

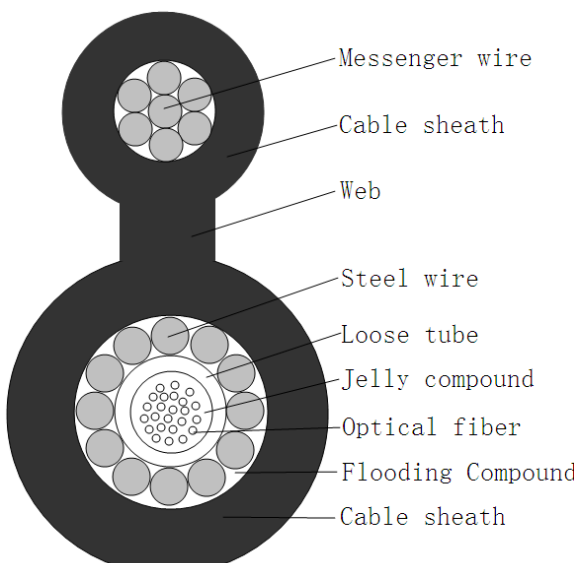
Annex-5

Technical Specifications

The Applicant shall install Broadband Network as specified in Request for Application. The successful Applicant shall develop optical fiber network, wireless and/or VSAT to use or rented/leased services from any other existing operators as applicable.

The purpose of broadband network is to provide broadband connectivity service with minimum of 512Kbps symmetric and dedicated bandwidth in each Rural Municipality (Gaun Palika), Wada Offices, health centers/health posts and public educational institutions (colleges and high schools) and residential household in the vicinity.

This Annex is prepared to provide minimum technical specification of different types of Access technology and media to provide broadband network. Each successful Applicant shall meet minimum of all the availability or key indicating parameters as listed in this Annex.

Clause No.	Particulars of Technical Requirements																																																																																																																				
1.0	Figure 8 Fiber specification																																																																																																																				
1.1	12 Core G.652D Armored fiber shall be used to connect OLT GPON interfaces with Master Splitters																																																																																																																				
1.2	6 core G.657A1 Armored shall be used to connect Master splitters to Distribution splitters																																																																																																																				
1.3	Fiber cross section 																																																																																																																				
1.4	<table border="1"> <thead> <tr> <th colspan="2">No. of cores</th> <th colspan="2">6</th> <th colspan="2">12</th> </tr> <tr> <th colspan="2">Fiber Specification</th> <th colspan="4">6 core - G.657A1, 12 - G.652D</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Loose Tube</td> <td>Material</td> <td colspan="4">Polybutylene Terephthalate (PBT)</td> </tr> <tr> <td>Diameter (±0.06) mm</td> <td></td> <td>2.0</td> <td>2.2</td> <td></td> </tr> <tr> <td>Thickness (±0.03) mm</td> <td></td> <td>0.32</td> <td>0.32</td> <td></td> </tr> <tr> <td>The Max.Core NO./Tube</td> <td></td> <td>6</td> <td>12</td> <td></td> </tr> <tr> <td colspan="2">Water Blocking Layer(Material)</td> <td colspan="4">Flooding Compound</td> </tr> <tr> <td rowspan="2">Messenger wire</td> <td>Material</td> <td colspan="4">Galvanized steel strand</td> </tr> <tr> <td>Thickness (±0.2) mm</td> <td colspan="4">2.1(0.7mm*7)</td> </tr> <tr> <td rowspan="2">Armoring</td> <td>Material</td> <td colspan="4">steel wire</td> </tr> <tr> <td>Diameter*NO mm</td> <td>0.7*12</td> <td>0.7*12</td> <td>0.8*12</td> <td>0.9*12</td> </tr> <tr> <td rowspan="2">Messenger Outer Sheath</td> <td>Material</td> <td colspan="4">Medium Density Polyethylene (MDPE)</td> </tr> <tr> <td>Thickness (±0.2) mm</td> <td colspan="4">1.3</td> </tr> <tr> <td rowspan="2">Cable Outer Sheath</td> <td>Material</td> <td colspan="4">MDPE</td> </tr> <tr> <td>Thickness (±0.2) mm</td> <td colspan="4">1.5</td> </tr> <tr> <td rowspan="2">Web</td> <td>Material</td> <td colspan="4">MDPE</td> </tr> <tr> <td>Size (±0.5) mm</td> <td colspan="4">3.0*2.0</td> </tr> <tr> <td colspan="2">Cable Diameter (±0.5) mm (W×H)</td> <td>6.4*13.1</td> <td>6.4*13.1</td> <td>6.8*13.5</td> <td>7.6*14.3</td> </tr> <tr> <td colspan="2">Cable Weight (±10) kg/km</td> <td>110</td> <td>110</td> <td>124</td> <td>144</td> </tr> <tr> <td>Attenuation</td> <td>1310nm</td> <td colspan="4">0.35dB/ km</td> </tr> </tbody> </table>					No. of cores		6		12		Fiber Specification		6 core - G.657A1, 12 - G.652D				Loose Tube	Material	Polybutylene Terephthalate (PBT)				Diameter (±0.06) mm		2.0	2.2		Thickness (±0.03) mm		0.32	0.32		The Max.Core NO./Tube		6	12		Water Blocking Layer(Material)		Flooding Compound				Messenger wire	Material	Galvanized steel strand				Thickness (±0.2) mm	2.1(0.7mm*7)				Armoring	Material	steel wire				Diameter*NO mm	0.7*12	0.7*12	0.8*12	0.9*12	Messenger Outer Sheath	Material	Medium Density Polyethylene (MDPE)				Thickness (±0.2) mm	1.3				Cable Outer Sheath	Material	MDPE				Thickness (±0.2) mm	1.5				Web	Material	MDPE				Size (±0.5) mm	3.0*2.0				Cable Diameter (±0.5) mm (W×H)		6.4*13.1	6.4*13.1	6.8*13.5	7.6*14.3	Cable Weight (±10) kg/km		110	110	124	144	Attenuation	1310nm	0.35dB/ km			
No. of cores		6		12																																																																																																																	
Fiber Specification		6 core - G.657A1, 12 - G.652D																																																																																																																			
Loose Tube	Material	Polybutylene Terephthalate (PBT)																																																																																																																			
	Diameter (±0.06) mm		2.0	2.2																																																																																																																	
	Thickness (±0.03) mm		0.32	0.32																																																																																																																	
	The Max.Core NO./Tube		6	12																																																																																																																	
Water Blocking Layer(Material)		Flooding Compound																																																																																																																			
Messenger wire	Material	Galvanized steel strand																																																																																																																			
	Thickness (±0.2) mm	2.1(0.7mm*7)																																																																																																																			
Armoring	Material	steel wire																																																																																																																			
	Diameter*NO mm	0.7*12	0.7*12	0.8*12	0.9*12																																																																																																																
Messenger Outer Sheath	Material	Medium Density Polyethylene (MDPE)																																																																																																																			
	Thickness (±0.2) mm	1.3																																																																																																																			
Cable Outer Sheath	Material	MDPE																																																																																																																			
	Thickness (±0.2) mm	1.5																																																																																																																			
Web	Material	MDPE																																																																																																																			
	Size (±0.5) mm	3.0*2.0																																																																																																																			
Cable Diameter (±0.5) mm (W×H)		6.4*13.1	6.4*13.1	6.8*13.5	7.6*14.3																																																																																																																
Cable Weight (±10) kg/km		110	110	124	144																																																																																																																
Attenuation	1310nm	0.35dB/ km																																																																																																																			

		1550nm	0.21dB/ km
Min. bending radius		Without Tension	10.0×Cable-φ
		Under Maximum Tension	20.0×Cable-φ
Temperature range (°C)		Installation	-20~+60
		Transport & Storage	-40~+70
		Operation	-40~+70

1.5

Fiber core color codes:

No.	1	2	3	4	5	6
Color	Blue	Orange	Green	Brown	Gray	White
No.	7	8	9	10	11	12
Color	Red	Black	Yellow	Violet	Pink	Aqua
No.	13	14	15	16	17	18
Color	Blue+P	Orange+P	Green+P	Brown+P	Gray+P	White+P
No.	19	20	21	22	23	24
Color	Red+P	Natural+P	Yellow+P	Violet+P	Pink+P	Aqua+P

1.6

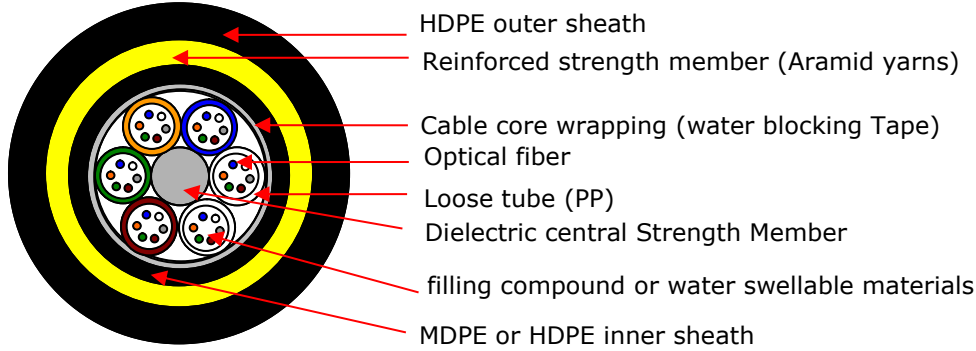
Item		Requirement
Allowable Tensile Strength	Short Term	3600 N
	Long Term	1500 N
Allowable Crush Resistance	Short Term	1500 (/100mm)
	Long Term	600 (/100mm)

1.7

Identification

Following information shall be embossed or printed or indented on the cable sheath at intervals of 1m throughout the whole length of the cable to enable the identification of cable. The embossed or printed or indented marking shall be distinct to naked eye from a distance of not less than 50 cm.

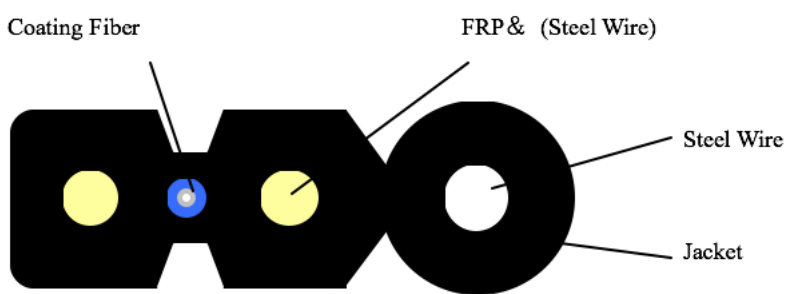
- (i) Type and size of cable
- (ii) Progressive length marking
- (iii) Year of manufacturing
- (iv) Manufacturer's name
- (v) NTA
- (vi) Laser symbol or text identifying the cable as optical fibre cables.

1.8	All Dielectric Self-Supporting Cable, (ADSS) Construction	
	<p>Design of cable from core to skin shall be as follows:</p> <ol style="list-style-type: none"> Center strength member (CSM) shall be made from non-metallic materials. Loose buffer tube filling compound to protect the fibers in the loose tube against water ingress and vibration, this compound must enable optical fibers move easily in the tube. Loose buffer tube shall be made from Polypropylene (PP) or Polybutylene Terephthalate (PBT), colored distinguished between loose buffer tubes and filled by filling compound or water swellable materials. Fillers and Loose tubes shall be arranged round CSM according to the reverse lay method (SZ). Fillers with neuter color shall be used to distinguish with loose buffer tubes. After application of fillers, at least one helical or longitudinal application of non-hygroscopic and non-wicking water blocking tape shall be applied over the cable core. The inner jacket shall be of MDPE or HDPE as per the latest relevant BS standards. Peripheral strength member shall be made from aramide yarns with high straining intensity and low stretching capacity. HDPE outer jacket shall be able to sustain high electric field. 	
1.9	The Cable structure shall be as follows:	
	<p>Cable Types</p>  <p>The diagram shows a circular cross-section of the cable. From the outside in, the layers are: a thick black outer sheath (HDPE), a yellow reinforced strength member (Aramid yarns), a thin white layer (Cable core wrapping), a central grey dielectric strength member, several loose tubes (PP) containing optical fibers, and an inner white sheath (MDPE or HDPE). Red arrows point from text labels to each of these components.</p>	
	a) ADSS cable for 11/33KV 100m span 24 core	
	Description	Technical Requirement
	ADSS cable	
	Span length	100m
	Lifetime	≥ 30 years
	Dielectric central strength member diameter	≥ 2.0 mm
	Minimum Quantity (or Amount) of Aramid Yarn	> 34,000 den
	Rated Tensile Strength	≥ 9 kN
	Maximum allowable Tension	≥ 3.6 kN
	Every day Stress	≥ 2.25 kN

	Applied Load Crush Resistance	≥ 2 kN/100mm
	Allowed Bending Radius	20 times of diameter of cable
	Inner jacket thickness Outer jacket thickness	≥ 1.0 mm ≥ 1.5 mm
	Cable weight	120 -160 kg/km
	Fiber length in the cable compared to the cable length	$\geq 1\%$
(b) ADSS cable for 11/33KV 200m span 24 core		
	Description	Technical Requirement
	ADSS cable	
	Span length	200m
	Lifetime	≥ 30 years
	Dielectric central strength member diameter	≥ 2.0 mm
	Minimum Quantity (or Amount) of Aramid Yarn	$> 79,600$ den
	Rated Tensile Strength	≥ 15 kN
	Maximum allowable Tension	≥ 6 kN
	Every day Stress	≥ 3.5 kN
	Applied Load Crush Resistance	≥ 2 kN/100mm
	Allowed Bending Radius	20 times of cable diameter
	Inner jacket thickness Outer jacket thickness	≥ 1.0 mm ≥ 1.5 mm
	Cable weight	140 -180 kg/km
	Fiber length in the cable compare with the cable length	$\geq 1\%$
(c) ADSS cable for 11/33KV 300m span 24 core		
	Description	Technical Requirement
	ADSS cable	
	Span length	300m
	Lifetime	≥ 30 years
	Dielectric central strength member diameter	≥ 2.0 mm
	Minimum Quantity (or Amount) of Aramid Yarn	$> 137,600$ den
	Rated Tensile Strength	≥ 18 kN
	Maximum allowable Tension	≥ 7 kN
	Every day Stress	≥ 4.5 kN
	Applied Load Crush Resistance	≥ 2 kN/100mm

	Allowed Bending Radius	20 times of cable diameter
	Inner jacket thickness	≥ 1.0 mm
	Outer jacket thickness	≥ 1.5 mm
	Cable weight	150 -190 kg/km
	Fiber length in the cable compare with the cable length	$\geq 1\%$

2.0 Underground Optical Fiber Cables

2.0	Last Mile Fiber Drop Wire Specification																																																																			
2.1	Two core G.647A1 outdoor black fiber should be used to provide last mile connection from Distribution splitter to ONT																																																																			
2.2	Fiber cross section: 																																																																			
2.3	<table border="1"> <thead> <tr> <th rowspan="2">Items</th> <th rowspan="2">Unit</th> <th>Specification</th> </tr> <tr> <th>G.657A1</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Mode Field Diameter</td> <td>1310nm</td> <td>9.0±0.4</td> </tr> <tr> <td>1550nm</td> <td>10.1±0.5</td> </tr> <tr> <td>Cladding Diameter</td> <td>μm</td> <td>124.8±0.7</td> </tr> <tr> <td>Cladding Non-Circularity</td> <td>%</td> <td>≤0.7</td> </tr> <tr> <td>Core-Cladding Concentricity Error</td> <td>μm</td> <td>≤0.5</td> </tr> <tr> <td>Coating Diameter</td> <td>μm</td> <td>245±5</td> </tr> <tr> <td>Coating Non-Circularity</td> <td>%</td> <td>≤6.0</td> </tr> <tr> <td>Cladding-Coating Concentricity Error</td> <td>μm</td> <td>≤12.0</td> </tr> <tr> <td>Cable Cutoff Wavelength</td> <td>nm</td> <td>$\lambda_{cc} \leq 1260$</td> </tr> <tr> <td>Tension (Long Term)</td> <td>N</td> <td>300</td> </tr> <tr> <td>Tension (Short Term)</td> <td>N</td> <td>600</td> </tr> <tr> <td>Crush (Long Term)</td> <td>N/10cm</td> <td>1000</td> </tr> <tr> <td>Crush (Short Term)</td> <td>N/10cm</td> <td>2200</td> </tr> <tr> <td>Min. Bend Radius (Dynamic)</td> <td>mm</td> <td>30</td> </tr> <tr> <td>Min. Bend Radius (Static)</td> <td>mm</td> <td>15</td> </tr> <tr> <td>Operating Temperature</td> <td>°C</td> <td>-20~+70</td> </tr> <tr> <td>Storage Temperature</td> <td>°C</td> <td>-20~+70</td> </tr> <tr> <td rowspan="2">Attenuation(max.)</td> <td>1310nm</td> <td>dB/km</td> <td>≤0.35</td> </tr> <tr> <td>1550nm</td> <td>dB/km</td> <td>≤0.21</td> </tr> <tr> <td>Macro-Bending Loss</td> <td>1turn×10mm radius @ 1550nm</td> <td>dB</td> <td>≤0.75</td> </tr> </tbody> </table>			Items	Unit	Specification	G.657A1	Mode Field Diameter	1310nm	9.0±0.4	1550nm	10.1±0.5	Cladding Diameter	μm	124.8±0.7	Cladding Non-Circularity	%	≤0.7	Core-Cladding Concentricity Error	μm	≤0.5	Coating Diameter	μm	245±5	Coating Non-Circularity	%	≤6.0	Cladding-Coating Concentricity Error	μm	≤12.0	Cable Cutoff Wavelength	nm	$\lambda_{cc} \leq 1260$	Tension (Long Term)	N	300	Tension (Short Term)	N	600	Crush (Long Term)	N/10cm	1000	Crush (Short Term)	N/10cm	2200	Min. Bend Radius (Dynamic)	mm	30	Min. Bend Radius (Static)	mm	15	Operating Temperature	°C	-20~+70	Storage Temperature	°C	-20~+70	Attenuation(max.)	1310nm	dB/km	≤0.35	1550nm	dB/km	≤0.21	Macro-Bending Loss	1turn×10mm radius @ 1550nm	dB	≤0.75
Items	Unit	Specification																																																																		
		G.657A1																																																																		
Mode Field Diameter	1310nm	9.0±0.4																																																																		
	1550nm	10.1±0.5																																																																		
Cladding Diameter	μm	124.8±0.7																																																																		
Cladding Non-Circularity	%	≤0.7																																																																		
Core-Cladding Concentricity Error	μm	≤0.5																																																																		
Coating Diameter	μm	245±5																																																																		
Coating Non-Circularity	%	≤6.0																																																																		
Cladding-Coating Concentricity Error	μm	≤12.0																																																																		
Cable Cutoff Wavelength	nm	$\lambda_{cc} \leq 1260$																																																																		
Tension (Long Term)	N	300																																																																		
Tension (Short Term)	N	600																																																																		
Crush (Long Term)	N/10cm	1000																																																																		
Crush (Short Term)	N/10cm	2200																																																																		
Min. Bend Radius (Dynamic)	mm	30																																																																		
Min. Bend Radius (Static)	mm	15																																																																		
Operating Temperature	°C	-20~+70																																																																		
Storage Temperature	°C	-20~+70																																																																		
Attenuation(max.)	1310nm	dB/km	≤0.35																																																																	
	1550nm	dB/km	≤0.21																																																																	
Macro-Bending Loss	1turn×10mm radius @ 1550nm	dB	≤0.75																																																																	

			1turn×10mm radius @1625nm	dB	≤1.5	
3.0	GPON Optical Line Terminal (OLT)					
3.1	OLT must comply with ITU-T recommendations G.984.1 , the G.984.2, G.984.5 and G.988.					
3.2	The GPON operating wavelengths shall be bidirectional 1490nm downstream and 1310nm upstream.					
3.3	The bitrate of the GPON system shall be 2488.32 Mbit downstream and 1244.16 Mbit/ upstream, as defined in G.984.2					
3.4	The optical power levels for the 2.4 Gbit/s downstream and 1.2 Gbit/s upstream system and the optical power budget shall be compliant to Class B+ and Class C+					
3.5	It should provide Optical Line Supervision capabilities as defined in G.984.2, with compliancy to measurement specifications G.984.2 like Transceiver temperature, voltage , Laser bias current , Optical transmit power and receive power					
3.6	The GTC parameters shall be compliant to support the following GPON system, as defined in G.984.3 with Logical split ratio of up to 1:128 or Higher and Fiber distance of up to 20km or Higher.					
3.7	The OLT shall automatically discovered ONT registration.					
3.8	The OLT MUST support the pre-provisioning of ONT serial numbers and registration IDs and their associated ONT IDs.					
3.9	The OLT must support DBA method and be capable of accommodating on the same PON a mix of status-reporting and non-status-reporting ONT.					
3.10	The proposed equipment shall support complete all T-CONT types according to ITU-T G.983.4					
3.11	Support Advanced Encryption Standard (AES),Forward error correction (FEC), Dynamic bandwidth allocation (DBA) & Configurable delay tolerance					
3.12	The proposed equipment must comply with the ITU-T G.988 ONT management and control interface specification (OMCI)					
3.13	OMCI transport mechanism compliance based on ITU-G 984.3.					
3.14	GEM Port IDs MUST be assigned automatically by the OLT					
3.15	The management specification must allow the OLT to establish and release connections across the ONT, manage the UNIs at the ONT, request configuration information and performance statistics and autonomously inform the system operator of an event (e.g. link failure)					
3.16	The proposed equipment shall be able to detect and isolate the rogue ONTs.					
3.17	The proposed OLT must have at least one year of commercial application.					
3.18	The vendor should implement his OMCI stack in accordance to OMCI Implementer's Study Guide, ITU-T G.988 for OMCI interoperability					
3.19	The proposed equipment must be compliant to ONT management and control protocol as defined in G.988					
3.20	The GPON OLT should be modular chassis based with small, medium and high-density various slots options					
3.21	The OLT optical connections to the GPON must be based on SC/UPC					
3.22	The same GPON service board should support mixing of B+ and C+ pluggable transceivers. There should be no restriction on the number of pluggable SFP of each flavor (B+ or C+) that could be inserted.					
3.23	The proposed product should support an operating temperature of -25C to +60C					

3.24	Field replaceable Fan Frame and Dust Filter
3.25	The Equipment should support redundant -48VDC power supply
3.26	Should support Redundant Controller Card
3.27	The offered product must provide a support for 10GPON in future
3.28	The OLT must support 1/10G SFP+ port for uplink connectivity towards network
3.29	IEEE 802.3ad Link Aggregation must be supported on OLT uplink network interfaces for link protection/redundancy
3.30	The SFP+ uplink interfaces on the OLT must support transceiver monitoring DDMI monitoring like temperature, voltage, laser bias current, RX and TX power
3.31	Out of Band Management support in the control card
3.32	Should Support L2, L3, IP/MPLS, VPWS, VPLS, Layer 3 routing protocols OSPF,IS-IS,BGP
3.33	Protection against malicious media access control (MAC) move, proxy ARP, IP spoofing, L2/L3/L4 ACL including MAC ACL and Traffic rates controls, DHCP snooping
3.34	Should support or have clear roadmap to support SDN and NFV
3.35	Support Frequency and timing protocol such as ToD, 1588v2, SyncE & BITS for mobile backhaul
3.36	The OLT should be able to support IEEE802.1Q Vlan 1-4094, QinQ tagging, Vlan translation, N:1 Vlan, S-Tag, C-Tag, 1:1 Vlan
3.37	Should support IGMPv2, IGMPv3 for multicast traffic with IGMP Snooping
3.38	Should support SNMP v1, 2 and 3
3.39	Minimum 2 x service slots or higher
3.40	1 x Control Card with provision to add another for redundancy in future
5.1	2 x 1/10Gbps or higher SFP+ uplink interfaces with optics based on proposed network design
5.2	The power card should be physically separated from control card;
6.0	GPON Service Interface Card
6.1	16 x GPON Ports with class B+ or C+ optics based on proposed network design
8.0	GPON Optical Network Terminal (ONT)
8.1	The ONT should belongs to proposed Vendor's of OLT
8.2	The ONT should support 4 x 10/100/1000 Mbps interface over RJ45
8.3	The ONT should support Wi-Fi capability such as b/g/n
8.4	Should support Bridge/Routed
8.5	IP-v4 and IP-v6 support
8.6	The throughput of the Ethernet port shall be wire speed for different frame size
8.7	The ONT should support Bridging of 802.1q tagged Ethernet frames between its LAN and WAN interfaces
8.8	The ONT should have local LAN DHCP server to provide IP assignment to end device
8.9	The ONT should support remote software download and upgrade
8.10	The ONT should support Bridging of 802.1q tagged Ethernet frames between its LAN and WAN interfaces
8.11	The ONT should support PPPoE over the encapsulated Ethernet , Bridge IP over Ethernet
8.12	Should support Multiple WAN interfaces for Internet, IPTV, including TR069 for Management
8.13	The ONT should support NAT/Firewall/DMZ with port forwarding
8.14	The ONT shall support smart public Wi-Fi hotspot for public usage over different VLAN, and invisible for family users (Hidden SSID).
8.15	The ONT should support Wi-Fi user security such as WPA-PSK/WPA2
8.16	The ONT should support IEEE 802.1q virtual LAN (VLAN)
8.17	The ONT should support Class of Service (CoS) based on VLAN-ID, IEEE 802.1p bit

8.18	ONT must be manageable through Network Element manager of OLT
8.19	ONT must be zero touch auto provisioning through TR069 using DHCP options from ACS
8.20	Remotely software image download over OMCI, as well as activation and reboot/reset functionality along with auto re-provisioning in case of factory reset by customer
8.21	Should support the AES security mechanism defined in G.984.3
8.22	Fully manageable from NMS using OMCI from OLT
8.23	Must support L2 loop detection feature on the LAN side with auto port shut feature upon loop detection as an action
9.0	Routers
9.1	The router must have 2 or higher service slots
9.2	The router have 20x1Gbps Ethernet ports
9.3	The router have 4x10Gbps SFP+ Ethernet ports
9.4	
9.5	The Router should support 1 Million IPv4 and 512K IPv6 routes
9.6	Minimum Switching Capacity: 80Gbps
9.7	Packet Forwarding Capacity per service slot (at least): 50 Mpps
9.8	Packet Forwarding Performance for Chassis (at least): 500 Mpps
9.9	Router shall be equipped with redundant route processor card
9.10	Upgradation and down gradation of software in the standby processor should not affect traffic switching in the main processor.
9.11	Shall support on line hot insertion and removal of cards without service hit.
9.12	Should have redundant -48VDC power supply and 220VAC
9.13	Operating Temperature: -5°C to 40° C nominal
9.14	Should support all Metro and Carrier Ethernet Services and L2 protocols like 802.1Q VLAN, Q-in-Q, VLAN Translation, EFM, CFM, Link Aggregation
9.15	Should support all L3 functionality Static Route, RIP, OSPF, ISIS, BGP, GRE, MP-BGP, uRPF,
9.16	The router should support IP/MPLS features LDP based MPLS, BGP based MPLS, L2VPN (EoMPLS) , L3VPN, VPLS, EVPN, RSVP, RSVP-TE, MPLS-TE, MPLS-FRR, VRF.
9.17	Supports Multicasting PIM-DM, PIM-SM, IGMP v1, IGMP v2, IGMP Snooping, MLD, MSDP,
9.18	The router shall support the dual stack with all IPv6 related features

9.19	The proposed router shall support defend against TCP SYN flood attack
9.20	The router must support QoS features to allocate network resources on application needs and QoS priorities. Such ass, traffic shaping, queueing, Classifications for DiffServ, Marking, Round Robin, RED, WRED
9.21	Should support SNMP v1, v2 and v3 along with Radius, Tacacs+, SSH and Telnet
	Switch
	The manageable switch musth have minimum 8x100Mbps Ethernet and two Gigabit Ethernet port
10.1	Should operate in either -48VDC power supply and 220VAC
10.2	Operating Temperature: -5°C to 40° C nominal
10.3	Should support all Metro and Carrier Ethernet Services and L2 protocols like 802.1Q VLAN, Q-in-Q, VLAN Translation, EFM,Link Aggregation, STP, RSTP, MSTP, Port Loopback detection.
	Should support SNMP v1, v2 along with Radius, Tacacs+, SSH and Telnet
11.1	PLC Splitter is based on the Planar Waveguide Technology (Planar Lightwave Circuit Splitter)
11.2	Must be SC/APC connector
11.3	Splitter could be 1:2,1:4, 1:8, 1:16 or 1:32 based on network design
11.4	The splitter should have Low PDL, Insertion and high return loss
11.5	Should have uniform power splitting, wide operating wavelength
11.6	Should have compact design that can be easily fitted in the pole mount outdoor enclosures
11.7	Should be Qualified Under Telcordia GR-1221 and GR-1209
11.8	Excellent Environmental & Mechanical Stability
11.9	Marking and Labeling of individual ports

11.10	Parameter	Unit	Specification										
	Operation Wavelength	nm	1260~1650										
	Channel Number		1X2	1x3	1X4	1x6	1X8	1x12	1X16	1x24	1X32	1X64	1x128
	Insertion Loss (Max.)	dB	4.3	6.2	7.4	9.8	10.7	12.5	13.9	16.5	17.2	21.5	25.5
	Uniformity (Max.)	dB	0.5	0.6	0.8	0.8	1.0	1.0	1.4	1.5	1.6	2.0	2.6
	Polarization Dependent Loss	dB	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.8
	Return Loss	dB	≥50										
	Directivity	dB	≥50										
Connector IL Loss of 0.3dB on APC not included													
12.0	Outdoor Enclosures Specification												
12.1	The box should have International Protection rating : IP55												
12.2	The Material should be <i>sheet molding compound</i> (SMC)												
12.3	The Seal material should be Ethylene Propylene Diene Monomer (EPDM)												
12.4	The Sealing of the ports should be Rubber												
12.5	It should have key locks door												
12.6	Operating temperature - 40 degree to +70												
12.7	The installation type should be Pole mounted												
12.8	The clamps for mounting the splitters enclosures in the poles shall be made up of “stainless steel” for superior durability, corrosion and red rust resistance.												
12.9	The Box should have marking as below: Nepal Telecom Authority, Provider assigned Splitter name or number												
13.0	Power supply												
<ul style="list-style-type: none"> ▪ All the offered equipment shall work on -48V DC dual-power supply systems. ▪ All the offered equipment shall have 1+1 power supply redundancy protection mechanism. ▪ Adequate protective devices and alarms shall be provided to protect the system from any damage caused due to surge, high voltage, and high current or overheating. 													

14.0	Wireless	
14.1	Point-to-Multipoint Radio - Base station & CPE Specification	
14.2	Features	Description
	Frequency	Frequency supported should be according to unlicensed frequency band approved by WPC - 5.725 GHz to 5.875 GHz/2.4 GHz-2.4835 GHz
	Frequency Band Support	Should support multiband in 5 GHz - in case Govt. releases new frequency under unlicensed band in future, hardware should not be changed
	NLOS, nLOS operation	Should support <i>near Line of sight / Non Line of sight</i>
	Channel Bandwidth	5 MHz, 10 MHz, 20 MHz & 40 MHz
	Channel spacing	Should be 5 MHz or better
	Max Output Power at Antenna port	Should support 25 dBm or better; user configurable in 1 dBm steps
	Modulation	OFDM, MIMO supported with QPSK, 16-QAM, 64-QAM with Forward Error Correction (FEC)
		Should support automatic adaptive modulation
	Architecture	Base Station: 90° / 120° Dual polarized sectoral antenna
		Single CAT5e / CAT6 Cable between IDU & ODU
	Radio	Quoted Radio should be based on ITU standard/IEEE standards.
	Distance Coverage	Product should be capable of providing communication to minimum 15 KMs
	CPE supported per Base station	Should support at least 50 CPEs
	Transmit Power	Should support Automatic Transmit Power Control (ATPC) by Base Station
	Bandwidth restriction	Should support the MIR/CIR configuration to ensure SLA
	Ethernet Latency	Should be less than 20 ms
	DHCP	Should support DHCP client
	Protocol Filtering	System should support the protocol filtering based on interface

	Broadcast Rate Limit	System must be able to limit broadcast rate
	Link Test Utility	Should support the inbuilt link test utility to calculate the throughput and efficiency of link
	Security	Should support 128 bit AES encryption
		Should support Layer 2 firewall to allow/deny based on VLAN, Ethertype, Source and Destination MAC address in wireless/Ethernet port
		Should support Layer 3 firewall to allow/deny based on IP address, Network and DSCP/TOS.
		System should have option to use RADIUS authentication for better security and protection from intruder
	Throughput	Should provide up to 200 Mbps aggregate Ethernet throughput
	Spectral Efficiency	Minimum 5 bps/Hz or better
	Bandwidth allocation	System should be able to configure symmetric & asymmetric bandwidth
	Interference mitigation techniques	System should have dynamic filters to block adjacent / alternate channels to help mitigate interference
		System should support beamforming to avoid co-channel interference to improve the performance - Enabling Beamforming feature may be optional, wherever required it should be enabled by attaching the beamforming antenna
		System should support GPS synchronization technique to eliminate interference in colocated scenario
Interfaces	Should support 100/1000Base(T) Full Duplex, rate auto negotiated, 802.3at compliant	
Management	System should have support of protocols: IPv4, UDP, TCP, IP, ICMP, SSH, SNMPv2c, HTTPs, FTP, IGMP Snooping, LLDP, DHCP, RADIUS, NTP	
	System should have support of Network Management with HTTPs, SSH, SNMPv2c	

	VLAN	System should have the support of VLAN based on IEEE 802.1Q with 802.1p priority	
	Priority Management	System should provide option to define priority for management and data traffic	
	QoS	Should support at least 3 queues or better with packet classification by DSCP, COS, VLAN ID, IP & MAC address, Broadcast, Multicast and CPE Priority	
	Error Correction	Forward Error Correction coding and ARQ should be supported	
	Performance Statistics	System should provide detailed statistics of Wireless and LAN Interface	
		System should have the option of uploading syslog data to Syslog Server	
	Tools	Should support Spectrum scanner / monitor to analyze the interference	
		Should have inbuilt tools like Ping, Traceroute to get help in troubleshooting	
	Power Consumption	Should not exceed 20W	
	Surge Suppression	Should have inbuilt surge protection	
	Operation Temperature	-25°c to 55°C	
	Enclosure	IP55 or better	
	WPC Approval	System must be approved from WPC - ETA certificate to be submitted	
	Point-to-Point Radio Specification		
	1	Frequency	Radio should operate in ISM Band (5.8GHz/2.4GHz) as per WPC Regulation
	2	Band Support	Radio Must support 5.8GHz/2.4GHz Multi-Band
	3	NLOS, nLOS operation	Must support 512 subcarrier to support superior performance in NLOS ,nLOS conditions
	4	Channel Bandwidth	5 / 10 / 15 / 20 / 30 or 40 MHz with 2.5 MHz steps
	5	Max Output Power at Antenna port	Subscriber Module: up to 27 dBm automatically adjustable by ATPC controlled by AP
	6	Modulation	QPSK, 16-QAM, 64-QAM, 256-QAM, MIMO-B, with Forward Error Correction (FEC)

		Should support automatic adaptive modulation, separated per CPE per direction for maximum performance
7	Architecture	Quoted Radio should not be based on ITU/IEEE standards. Integrated, minimum 23 dBi, Must support H and V polarization patch or Connectorized Single Cable between IDU & ODU
8	Distance Coverage	Minimum 15 Km with suitable antenna
9	Transmit Power	Automatic transmit power control (ATPC)
10	MIR/CIR	Should support the MIR/CIR configuration to ensure SLA
11	Maximum Burst Size	System must support the Bursting of more than 2 Gbits to maintain Voice/Video/Data Quality
12	Ethernet Latency	Average latency of a heavily loaded (85% of link capacity) one way trip must not exceed 7 ms (regardless of packet size)
13	DHCP	System should be able to serve as DHCP Server and DHCP client
14	Protocol Filtering	System should support the protocol filtering based on port
15	Broadcast Rate Limit	System must be able to limit broadcast rate
16	AAA Authentication	System should have the support for AAA authentication support for better security and protect from intruder
17	Support feature like NAT,L2TP,PPPoE,DHCP option 82	System should support features like NAT and L2TP, DHCP option 82 to enhance security and prevent broadcast
18	Management of Video Traffic	Please describe how your radio system is designed to accommodate traffic of burst nature, such as real time video surveillance traffic
19	Link Test Utility	Should support the inbuilt link test utility to calculate the throughput and efficiency of link
20	VLAN Support	VLAN support based on IEEE 802.1Q
21	Security	128 bit AES authentication, accepted by NIST and passed the CAVP & CMVP testing
22	Throughput	Should support 300 Mbps aggregate Ethernet throughput

23	Bandwidth	System should be able to configure symmetric & asymmetric bandwidth. Upload and download percentage should be user configurable
24	MIMO-B	System must have the support for 2 x 2 MIMO-B technology to increase the throughput
25	Avoid Collision	System should support scheduled access rather than CSMA to avoid collision
26	Interference mitigation	System should have dynamic filters to mitigate interference from alternate frequency channels
		System carry small Radio data packet to combat interference without impacting performance
27	Interfaces	LAN Interface: System must have 100/1000Base(T) Full Duplex, rate auto negotiated (802.3 compliant)
		Should have POE Output interface in the ODU to power up camera, WiFi Hotspot or other POE directly
28	Management	System should have support of IPv4, UDP, TCP, IP, ICMP, Telnet, SNMP, HTTP, FTP
		System should have support of Network Management with HTTP, Telnet, FTP, SNMP v2c
29	Management VLAN	System should have the support of VLAN 802.1ad (DVLAN Q-in-Q), 802.1Q with 802.1p priority, dynamic port VID
30	QoS	Must support 802.1P and Diffserve QoS
31	Error Correction	3/4 Reed Solomon Forward Error Correction coding and ARQ
32	Alignment	SNR bar or beeper based alignment option on outdoor radio unit for antenna alignment
33	Antenna Gain	Should support integrated 23 dBi gain flat panel antenna or connectorized to use with external antenna
34	Antenna Beamwidth	Antenna Beam width should be at least 10° azimuth
35	Input Voltage	802.3at compliant
36	Surge Suppression	EN61000-4-5: 1.2us/50us, 500 V voltage waveform
37	Operation Temp.	40°C to 60°C Outdoor

		20°C to 40°C Indoor
	38	Protection IP66 & IP67
	39	WPC Approval System must be approved from WPC
15.0	Aggregation Wireless Backhaul	
	An all outdoor radio offering point to point backhaul solution shall be carrier grade and robust performance with a highly efficient operation and having excellent QoS	
15.1	Radio Capacity: 250Mbps or Higher	
15.2	Latency: 5ms Max	
15.3	Modulation: to 256QAM, MIMO, OFDM	
15.4	Synchronization: GPS with frequency reuse and scalability	
15.5	Channel Width: 5Mhz up to 40Mhz	
15.6	<u>Configuration: PTP or P2M</u>	
15.7	Security: AES, HTTPS, SNMP, Radius Authentication	
15.8	Reliability: MTBF 25yrs of higher	
15.9	Interfaces: Gigabit Ethernet	
15.10	Power Supply: 48VDC/ 220VAC or POE	
15.11	Ruggedized: IP66/67,IEC60529, ESD Higher than 8kV contact / 15kV air ESD discharges per EN61000	
15.12	Operating Temperature: -30°C to +55°C	
<u>Very Small Aperture Terminal (VSAT)</u>		
15.13	Capacity of each terminal port: 512Kbps to 2 Mbps or higher Symmetric and Dedicated	
15.14	Bands: Ku or Ka or other available bands	
15.15	Antenna: 0.6m to 1.2m or Higher	
15.16	LNB: up to 500 MHz range	
15.17	BUC: up to 1 W or higher	
15.18	Satellite location: Any	
	WiFi Router	
15.19	Wireless: 5dB External Antenna	
15.20	Ports: 4 x 10/100 Ethernet LAN and 1 x 10/100 WAN	

15.21	Standard: 802.11a/b/g/n, 2x2 MIMO 300Mbps
15.22	Protocols: NAT, DHCP/PPPOE,DNS, VLAN, QoS, TFTP/HTTP/TR069 Firmware upload and Remote Management
15.23	Security: WEP/AES, WEP, WPA2, WDS,WPS
15.24	SSID: 4 with Hidden SSID support
15.25	Power Supply System (PSS)
	<p>The Applicant shall provide complete power systems for all the stations of the network having two types:</p> <p>a)Site with AC power supply system: City Supply with 48 hours of battery backup b)Site without AC power supply system: Solar power system with 76 hours of battery backup All power systems must have IP remote management capability</p> <p>Earthing, Lighting and Surge Suppression System:</p> <p>The Applicant shall provide the complete earthing system for each site under this project. Suitable design and materials shall be used to maintain the Earth Resistance to less than 5 ohms even in dry season for the supplied earthing system.</p> <p>The Application shall provide complete details of Lighting protection system of each sites. All equipment must be installed with surge suppression system</p>
16.0	FTTH Guidelines
16.1	Operators are free to rollout the network using any split ratio and combination of splitter however it is advised to use max two level split as per standard industry practice for class B+ and max three level split if class C+ or C++ optics used
16.2	The max attenuation at ONT GPON port should not be higher 26dB for Class B+ optics and 29dB for Class C+ and 31 dB for Class C++ optics keeping safety margin of 2-3dB at each site.
16.3	ADSS/UG 24 Core fiber should be used to connect The Routers and interconnection of OLT
16.4	12 core Fiber should be used to connect OLT with 1 st level Master splitters
16.5	6 core fiber should be used to connect 2 nd level Distribution splitters with Master splitter
16.6	All necessary subscription Licenses, Support and comprehensive Warranty for 2 years should be backed by proposed OEM along with manufacture authorization letter