GADVASU Tender No: LIB/CNW/2015-484 Dated 13-3-2015

Instructions and Technical Specifications for Implementation of Wi-Fi in GADVASU Boys Hostels

Guru Angad Dev Veterinary and Animal Sciences University
Ferozepur Road, Ludhiana, Punjab- 141004

Schedule of Requirements and Scope of the Work

The scope of work shall consist of preparation of design, supply, installation, drawings, testing and commission of Wi Fi system complete in all respects and its maintenance during warranty period to the following (to be extended as per requirement):

1. Supply and installation of switches, indoor/outdoor access points, Wireless LAN controllers, other related accessories and software as per the specifications outlined in this document.
2. All the proposed solution should be manageable from a centralized location.
3. Solution must support Zero IT Configuration for wireless on end-user device.
4. The System Integrator / Tenderer shall provide complete end to end solution, configuration, administration and operational documentation, implementation instructions. Network Documentation along with Labelling of Cables, I/Os, Jack Panel, Switches and Access Points. OTDR to be done from both sides of OFC. Civil work related to implementation of the project shall be taken up by the successful bidder.
5. The digging for laying the fibre cable should be along the roadside / pavement only. No diagonal crossing of roads, lawns, grounds will be allowed. In case of any damages occurred to University property due to such digging, laying etc. in the campus the same will be repaired by the supplier else the supplier will be liable to pay the expenses for such repairs.
6. In hostels area, Wi- Fi must cover all rooms, mess, and common area.
7. Design of multiple VLANs and IP addressing scheme for the wireless network and configuration of the wireless network to implement the design be provided.
8. Design and Implementation of Wireless LAN security and authentication system for providing secure access to students, faculty and staff.
9. Supplier will make sure that the network installed is in sync with existing infrastructure (network, hardware, software).
10. Proper physical protection to be given to all the access points.
11. The firm shall be responsible to draw and supply complete site plan and network layout in the form of diagram or chart of work done and the equipment installed at the site.
12. The system proposed by the supplier should be scalable for future expansion without any performance constraints.
13. The system should be able to provide network and internet access to any device which is Wi-Fi enabled. The user can access the internet on any of their internet ready devices such as Smart Phones, Laptops and Tablets etc. regardless of software browser and operating system.
14. Testing may also be carried out at the discretion of the University, from the lot of finished product brought at site by the supplier. In case such tests have been carried out by the principal manufacturer at its testing facility, the same will be provided by the supplier for consideration. Also provide any certification carried out on the cabling.
15. Penta-scanning should be done at minimum 250 MHz, report less than 250MHz should not be considered and component should not be accepted. The report should be submitted in PDF format.
16. The quantities mentioned for Wi-Fi Solution is as per our design and survey. Bidders are requested to survey the campus and give their own solution for wireless. The no of POE Switches will be changed as per the bidder design. The payments will be on actual quantities quoted as per bidder design.

BILL OF MATERIAL:- AS PER PROPOSED PLAN

Sr. No.	DESCRIPTION	UoM	Quantity	Unit Price	Total
ACTIVE COMPONENTS					
1	POE Switch (POE) as per the specifications (Tentative)	Nos.	8		
2	Indoor Access Point as per the specifications (Tentative)	Nos.	50		
3	Outdoor Access Point as per the specifications (Tentative)	Nos.	6		
4	Wireless Controller with Security features AP License as per proposed Access Point by bidder. (Number of licenses in controller should be Number of APs bided + 50 licenses)	Nos.	1		
5	Hardware Firewall with security features as per specification	Nos.	1		
PASSIVE COMPONENTS - COPPER					
6	Cat 6 UTP cable 305m (Tentative) as per the specifications	Box	10		
7	Cat 6 24 port Jack Panel with rear cable manager (Tentative) as per the specifications	Nos.	7		
8	Cat 6 Information outlet (Tentative) as per the specifications	Nos.	50		
9	Cat 6 Patch Cords 1.0 mtrs (Tentative) as per the specifications	Nos.	50		
10	Cat 6 Patch Cords 2.0 mtrs as per (Tentative) as per the specifications	Nos.	50		
11	Face Plate with Back Box 3x3 (Tentative) as per the specifications	Nos.	50		
FIBER MATERIAL SM OS2					
12	Fiber cable SM OS2 6 core (Tentative) as per Specifications. (Bidder to quote as per their design.)	Mtrs.	500		
13	Fiber patch panels - rack mount 06 Port unloaded tray as per Specifications.	Nos.	5		
14	Patch Cords SC-LC SM OS2 3 mtrs as per specifications	Nos.	20		

15	LIU 12 PORT RACK MOUNT BLK with Splice Tray, Cable spool and Pig Tails, Loaded as per Specifications.	Nos.	5		
OTHER MISCELLANEOUS (Tentative)					
16	HDPE pipe with inside thread and accessories*	Mtrs.	500		
17	PVC Conduit Pipe 1.5" with accessories*	Mtrs.	200		
18	PVC Conduit Pipe 1" with accessories*	Mtrs.	200		
19	Steel Flexible Pipe 1.5" with accessories*	Mtrs.	200		
20	Steel Flexible Pipe 0.75" with accessories*	Mtrs.	200		
21	Rack 12U*	Nos.	8		
22	Rack 42U as per Specifications	Nos.	1		
23	Mast with Guy Wire Support including Cement Foundation*	Mtrs.	40		
SERVICE (Tentative)					
24	Erection and Installation of Guy Wire Mast*	Mtrs.	40		
25	Laying of UTP Cable*	Mtrs.	3050		
26	Laying of OFC Cable through HDPE Pipes*	Mtrs.	500		
27	Laying of HDPE Pipes*	Mtrs.	500		
28	Trenching Soft / Hard Soil*	Mtrs.	600		
29	Open Chamber*	Nos.	2		
30	Fixing , Installation of LIU*	Nos.	5		
31	Fusion Splicing of OFC Cores*	Nos.	50		
32	Laying of PVC Conduit Pipe with Flexible*	Mtrs.	800		
33	Termination , Installation , Fixing of Cat 6 I/O at User End*	Nos.	50		
34	Termination , Installation , Fixing of Cat 6 I/O at Patch Panel*	Nos.	50		
35	Installation , Fixing of Wall Mount Racks*	Nos.	5		
36	Pentscanning of Cat 6 Nodes*	Nos.	50		
37	OTDR Charges for OFC*	Nos.	50		
38	Project Documentation and Commissioning Charges	L/S	1		
39	Other charges, if any	Nos.	As per Actual		
40	Free of cost for Maintenance service of one year				

*** As per actual consumption/site conditions**

Technical Compliance Sheet - Switches

NOTE: All the Switches and OFC/Copper Module should be of same OEM

POE Switch

SN.	Description	Complied (Y/N)	Remarks
1	Switch should have wire-speed, non-blocking and distributed forwarding on all the ports.		
2	L2 PoE Switch - 20 x GE RJ45 ports (including 12 x PoE ports) (As per the bidder wireless design)		
3	Should have 4 x shared media pairs (including 4 x GE RJ45, 4 x GE SFP slots).		
4	Should have Capacity 48 Gbps		
5	Should support VLAN support up to 4000		
6	Total Link Aggregation Groups support Up to 8 ports		
7	Should have MAC Address Storage support for 16000		
8	Jumbo Frames and Auto-negotiation for port speed and duplex		
9	Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP)		
10	Should support 802.1Q VLAN Tagging, Port Fast, Private VLAN and 802.3ad Link Aggregation with LACP.		
11	Layer 3 Static Routing and Port Mirroring		
12	Dynamic Host Configuration Protocol (DHCP)		
13	Admin Authentication Via RADIUS and 802.1X authentication with auto VLAN assignment		
14	Should support Linking with Firewall for Secure Wired connection		
15	Should be quoted with 5 years direct OEM TAC support and next business day hardware shipment.		
16	Should support Telnet / SSH, HTTP / HTTPS, SNMP v1/v2c/v3 and SNTP.		
17	Support management using CLI, GUI, using Web interface. Additionally, management can also be done using NMS		

Wireless Controller

SN.	Description	Complied (Y/N)	Remarks
1	Should have at least 8 x 10/100/1000 GE interfaces & 2 x GbE SFP slots or 10/100/1000 Shared Interfaces, 2 nos. of 10/100/1000 Ethernet Ports and one Console port.		
2	Proposed Controller should be ready for supporting extra 50 Access Points from day one with scalability for 500 Access Points support in future without adding any new hardware. **(50 extra licenses means e.g. if as per bidder survey, number of Access Points is 50, then the bidder will be quoting controller with 100 Access Point Licenses.)**		
3	Appliance should have Optional Redundant Power Supply		
General Features			
4	Controller should support Spectrum Analysis feature to Detect interference from different sources. System Should provide real-time charts showing interference for access point, on a per-radio, per-channel basis.		
5	Ability to map SSID to VLAN and dynamic VLAN support for same SSID.		
6	Access points can discover controllers across Layer-3 network through DHCP or DNS option		
Security & Monitoring			
7	Controller should support following for Security & Authentication		
8	WIRELESS SECURITY: WEP, WPA-TKIP, WPA2-AES		
9	System should provide DOS attacks and Intrusion Detection and Prevention and Control for any Rough Access Points.		
10	Controller should support L2 Client Isolation so that End Users cannot access each other's devices. Isolation should have option to apply on Access Point or SSID's.		
11	IPv4 & IPv6 support from Day 1		
12	The Controller should support OS/Device identification and device type based policies i.e allow or deny, Bandwidth rate limit, VLAN mapping.		
13	Per SSID or dynamic Per user bandwidth Rate Limiting		
14	Support advanced multicast features and WMM support to provide best performance on Video applications.		

Client Management			
15	The controller should provide a Guest Login portal in order to authenticate users that are not part of the organization.		
16	The Controller should be able to provide a web-based application that allows non-technical staff to create Guest accounts with validity for fixed duration like hours or days.		
17	System should be able to send password direct through Email and SMS to the user.		
18	System should be able to generate one click password for single user, multiple users or single user multiple devices.		
19	System should support user management features like Rate limiting based on time based WLAN Access and User profile per WLAN etc.		
Regulatory			
20	Wi-Fi Alliance certified, FCC Part 15, CE Mark, UL/cUL, VCCI		

Hardware Firewall with Security features

SN.	Description	Complied (Y/N)	Remarks
1.	The Firewall should be Hardware based, Reliable, purpose-built security appliance with hardened operating system that eliminates the security risks associated with general-purpose operating systems		
2.	Firewall Throughput should be 16 Gbps		
3.	Firewall should have 3DES IPSec throughput of 8 Gbps		
4.	Firewall should support 2000 site-to-site VPN Tunnels.		
5.	Firewall should support 70,000 new sessions per second		
6.	Firewall should support 3 Million concurrent sessions		
7.	The Firewall solution should support NAT64, DNS64 & DHCPv6		
8.	The proposed system shall be able to operate on either Transparent (bridge) mode to minimize interruption to existing network infrastructure or NAT/Route mode. Both modes can also be available concurrently using Virtual Contexts.		
9.	The physical interface shall be capable of link aggregation, otherwise known as the IEEE 802.3ad standard, allows the grouping of interfaces into a larger bandwidth 'trunk'. It also allows for high availability (HA) by automatically redirecting traffic from a failed link in a trunk to the remaining links in that trunk.		

10.	The proposed system should have integrated Traffic Shaping functionality.		
11.	The Firewall should have integrated SSL VPN solution to cater to 5000 SSL VPN concurrent users.		
12.	The Firewall, IPSEC & SSL VPN module shall belong to product family which minimally attain Internet Computer Security Association (ICSA) Certification.		
13.	The proposed system should support IPSEC VPN, PPTP VPN, L2TP VPN, SSL VPN		
14.	The device shall utilize inbuilt hardware VPN acceleration: IPSEC (DES, 3DES, AES) encryption/decryption SSL encryption/decryption		
15.	The system shall support IPSEC site-to-site VPN and remote user VPN in transparent mode.		
16.	The system shall provide IPv6 IPSec feature to support for secure IPv6 traffic in an IPSec VPN.		
17.	The proposed solution should support Virtualization (Virtual Firewall, Security zones and VLAN). Minimum 10 Virtual Firewall license should be provided from day 1		
18.	The IPS capability shall minimally attain ICSA labs & NSS Certification		
19.	IPS throughput should be 4 Gbps		
20.	The IPS detection methodologies shall consist of: Signature based detection using real time updated database		
21.	The IPS should be able to inspect SSL sessions by decrypting the traffic.		
22.	The IPS system shall have at least 3,000 signatures		
23.	IPS Signatures can be updated in three different ways: manually, via pull technology or push technology. Administrator can schedule to check for new updates or if the device has a public IP address, updates can be pushed to the device each time an update is available		
24.	In event if IPS should cease to function, it will fail open by default and is configurable. This means that crucial network traffic will not be blocked and the Firewall will continue to operate while the problem is resolved		
25.	IPS solution should have capability to protect against Denial of Service (DOS) and DDOS attacks. Should have flexibility to configure threshold values for each of the Anomaly. DOS and DDOS protection should be applied and attacks stopped before firewall policy look-ups.		

26.	IPS signatures should have a configurable actions like terminate a TCP session by issuing TCP Reset packets to each end of the connection, or silently drop traffic in addition to sending a alert and logging the incident		
27.	Signatures should a severity level defined to it so that it helps the administrator to understand and decide which signatures to enable for what traffic (e.g. for severity level: high medium low)		
28.	Firewall should have 1.3 Gbps of Proxy based Aintivirus throughput. The Firewall should support flow based Antivirus throughput of 2.8 Gbps so that the solution can be deployed for less critical networks with higher Bandwidth.		
29.	The antivirus module shall belong to product family which minimally attain Internet Computer Security Association (ICSA) Certification.		
30.	The proposed system should be able to block, allow or monitor only using AV signatures and file blocking based on per firewall policy based or based on firewall authenticated user groups with configurable selection of the following services: HTTP, HTTPS, SMTP, SMTPS, POP3, POP3S, IMAP, IMAPS, FTP, FTPS		
31.	The proposed system should be able to block or allow oversize file based on configurable thresholds for each protocol types and per firewall policy.		
32.	A Firewall should support 1TB of internal logging or a dedicated appliance with the same capacity to be proposed with the solution for logging, analysis, and reporting into a single system, delivering increased knowledge of security events throughout the network for centralized security event analysis, forensic research and reporting.		
33.	Web Content Filtering		
34.	The proposed solution should be able to enable or disable Web Filtering per firewall policy or based on firewall authenticated user groups for both HTTP and HTTPS traffic.		
35.	The proposed system shall provide web content filtering features: a) which blocks web plug-ins such as ActiveX, Java Applet, and Cookies. b) Shall include Web URL block c) Shall include score based web keyword block d) Shall include Web Exempt List		

36.	The proposed system shall be able to queries a real time database of over 110 million + rated websites categorized into 70+ unique content categories.		
37.	Application Control		
38.	The proposed system shall have the ability to detect, log and take action against network traffic based on over 2000 application signatures		
39.	The application signatures shall be manual or automatically updated		
40.	The administrator shall be able to define application control list based on selectable application group and/or list and its corresponding actions		
41.	Data Leakage Prevention		
42.	The proposed system shall allow administrator to prevent sensitive data from leaving the network. Administrator shall be able to define sensitive data patterns, and data matching these patterns that will be blocked and/or logged when passing through the unit.		
43.	The proposed system shall have built-in high availability (HA) features without extra cost/license or hardware component		
44.	The device shall support stateful session maintenance in the event of a fail-over to a standby unit.		
45.	High Availability feature must be supported for either NAT/Route or Transparent mode		
46.	The proposed system shall support multiple heartbeat links		
47.	High Availability Configurations should support Active/Active, Active/ Passive & Clustering		

Indoor Access Points

SN.	Description	Complied (Y/N)	Remarks
1	The Access Point should have minimum 1 Port 10/100/1000Mb POE Uplink port.		
2	802.11n Access Point should be able to power up using standards 802.3af POE input, and at the same time operate in full MIMO mode. It must have option to power through 12 VDC power Adaptor also.		
3	AP should have Dual Radios to support 2.4 GHz & 5Ghz concurrent users with 802.11 a/b/g/n capability. AP Must support 2x2 MIMO.		
4	AP should be able to handle 200 or more Concurrent users.		
5	AP should provide minimum 20 dBm Transmit power for 2.4Ghz and 22 dBm for 5Ghz. EIRP should be limited as per govt. regulation for indoor AP's).		
6	AP should have -96 dB or better Receiver Sensitivity		
7	Access Points can perform encryption / decryption on itself so as not to bottleneck the controller		
8	SSID support : 16 BSSID (8 BSSID per Radio)		
9	AP should support 6.5Mbps – 130Mbps (20MHz), upto 300Mbps (40MHz) data rates in 802.11n.		
10	The access point should support 802.1q VLAN tagging		
11	Antenna: Integrated omni-directional, with min 3 dB Gain for 2.4Ghz and 5Ghz both.		
12	Implement Wi-Fi alliance standards WMM		
13	AP Must support spectrum Analysis to detect RF interference in indoor area.		
14	AP should have technique to provide better reception for hard to hear clients and consistent performance while clients change their orientation i.e. beamforming/polarization.		
15	Should support the operating temp 0° to 45° C and Humidity: 15 to 95% non-condensing.		
16	The access point should support following security mechanism: WEP, WPA-PSK, WPA-TKIP, WPA2 AES, 802.11i.		
17	System should support Authentication via 802.1X, Local (controller based) authentication database, support for RADIUS and Active Directory.		
18	Access points should have antitheft locking mechanism.		
19	Web User Interface (HTTP/S),CLI (Telnet/SSH)		
20	Should be managed by Controller		
21	WEEE/RoHS compliance, Wi-Fi Alliance certified		
22	Should be WPC approved; ETA certificate to be enclosed		

Outdoor Access Point (AP)

SN.	Description	Complied (Y/N)	Remarks
1	The Access Point should have minimum 1 Port 10/100/1000Mb POE in Ethernet port.		
2	802.11n Access Point should be able to power up using standards 802.3af/at POE input, and at the same time operate in full MIMO mode. It must have option to power through 12 VDC power Adaptor.		
3	AP should have Dual Radios to support 2.4 GHz and 5Ghz concurrent users with 802.11 a/b/g/n capability. AP Must support 3x3 or 2x3 or 2x2 MIMO with 2 Radio Chain		
4	AP should be able to handle minimum 200 Concurrent users.		
5	AP should provide minimum transmission power of 23 dBm in 2.4Ghz and 20 dBm in 5Ghz.		
6	Wireless Interface: Dual radio; 802.11a/b/g/n/ac; 2.4Ghz and 5GHz		
7	SSID support : 16 BSSID (8 BSSID per Radio)		
8	AP should support 6.5Mbps – 130Mbps (20MHz), upto 300Mbps (40MHz) datarates in 802.11n.		
9	The access point should support 802.1q VLAN tagging		
10	Antenna: Integrated/External for Sectorial/Omni-directional (as specified in BOQ) coverage, with min 3 dB Gain for 2.4Ghz and 5Ghz both.		
11	AP should support the operating temp -10° to 55° C and Humidity: 15 to 95% non-condensing.		
12	AP Must be IP67 certified for outdoor deployment. AP must be outdoor rated and no AP will be accepted which is indoor and installed in outdoor casing.		
13	The access point should support following security mechanism: WEP, WPA-PSK, WPA-TKIP, WPA2 AES, 802.11i.		
14	System should support Authentication via 802.1X, Local (controller based) authentication database, support for RADIUS and Active Directory.		
15	Web User Interface (HTTP/S) ,CLI (Telnet/SSH)		
16	AP should be managed by Controller		
17	WEEE/RoHS compliance ; Wi-Fi Alliance certified		
18	AP should be WPC approved; ETA certificate to be enclosed		

SPECIFICATIONS FOR PASSIVE AND OTHER MISCELLANEOUS ITEMS

	ITEM WISE SPECIFICATION		
SN.	**Description**	**Complied (Y/N)**	**Remarks**
A	**Category 6 UTP Roll of 305 Mtrs**		
1	Category 6 Unshielded Twisted Pair 4 pair 100W cable shall be compliant with ANSI/TIA/EIA-568-C.2 Additional Transmission Performance Specifications for 4-pair 100W Category 6Cabling. Tested upto 600 MHZ		
2	Category 6 UTP cables shall extend between the work area location and its associated telecommunications closet and consist of 4 pair, 23 AWG, UTP.		
3	The 4 pair Unshielded Twisted Pair cable shall be ULÒ Listed		
All Category 6 cables shall meet or exceed the following characteristics:			
4	Construction: 4 twisted pairs separated by internal X shaped, 4 channel, polymer spine / full separator. Half shall not be accepted.		
5	Conductor Solid bare Copper		
6	Conductor Diameter 0.56±0.005mm (23 AWG)		
7	Insulation :High Density Polyethylene		
8	Jacket FR PVC		
9	Outer Diameter 6.1 mm nominal		
10	Temperature Range -20° to +70°C		
11	ERTL Certified		

B	**FACE PLATE**		
1	Single & DUAL square plate, Quad in Rectangular shape		
2	Write on labels in transparent plastic window – supplied with plate		
3	Screw hole covers – to be supplied with plate		
4	Face Plate with shutter		

C	**INFORMATION OUTLET**		
1	Category 6, TIA568 C.2		
2	All information outlets for 100 W, 22-26 AWG copper cable shall:		
3	Use insulation displacement connectors (IDC)		
4	Allow for a minimum of 200 re-terminations without signal degradation below standards compliance limits.		

5	Be constructed of high impact, flame-retardant thermoplastic with color and icon options for better visual identification.		
6	Shutter is on face plate		
7	Insertion force: 20N max (IEC 60603-7-4)		
8	IDC : Housing PC + glass fiber , UL 94 V-2		
9	568A/B configuration		
10	Information outlet (RJ45 jack) should be covered under ETL Verification program for compliance with TIA568.C.2		
11	Operation Temp: -10 C to 60 C		
12	Plastic Housing: Polycarbonate, UL94V-0 rated or equivalent		
13	Operating Life: Minimum 750 insertion cycles		
14	Contact Material: Copper alloy		
15	Contact Plating: 50 µinches gold on plug contact area		
16	Plastic Housing: Polycarbonate + glass fiber UL94V-2 rated		
17	Operating Life: Minimum 200 Re-terminations		
18	IDC Contact Plating: Phosphor bronze with tin plated		

D	**24 PORT JACK PANEL**		
1	Patch panel with straight frame with angular positioned IO's. This should be mounted in closed racks.		
2	Allow for a minimum of 200 re-terminations without signal degradation below standards compliance limit.		
3	Have port identification numbers on the front of the panel.		
4	Should have self-adhesive, clear label holders (transparent plastic window type) and white designation labels with the panel, with optional color labels / icons.		
5	IDC: Suitable for 22-26 AWG stranded and solid wire compatible with both 110 & Krone punch down tools		
6	Each port / jack on the panel should be individually removable on field from the panel.		
7	Improved cable management with optional cable management bar		
8	The Cat-6 transmission performance is in compliance with the ANSI/TIA/EIA 568C.2 standard		
9	Plastic Housing: ABS , UL94V-0 rated		

10	Operating Life: Minimum 750 insertion cycles		
11	Contact Material: Copper Alloy		
12	Contact Plating: 50μ" Gold plated on plug contact area		
13	Contact Force: 20N max (IEC 60603-7-4)		
14	Plug Retention Force: 15 lb.		
15	Plastic Housing: Polycarbonate, UL94V-0 rated or equivalent		
16	IDC cap : ABS, UL 94V -0		
17	Contact Material: Copper Alloy		
18	IDC Contact Plating: Phosphor bronze with tin plated		
19	Insertion Force: 20N max (IEC 60603-7-4)		
20	Wire Accommodation: 22-26 AWG solid		

E	**MOUNTING CORDS (1 and 2 METER)**		
1	Category 6 Equipment cords		
2	The work area equipment cords shall, at a minimum comply with proposed ANSI/TIA/EIA-568-C.2 Commercial Building Cabling Standards Transmission Performance Specifications for 4 pair 100W Category 6 Cabling.		
3	Equipped with modular 8-position modular plugs on both ends, wired straight through with standards compliant wiring.		
4	Should have 50 micro inches of gold plating over nickel contacts.		
5	Should be covered by ETL verification program for compliance with TIA 568.C.2		
6	Conductor size: 24 AWG stranded bare copper		
7	Max O.D.: 5.6mm (.22")		
8	Jacket: PVC UL-94V-O		
9	Temperature range: -10oC to +80oC		
10	Operating life: Minimum 750 insertion cycles		
11	Contact blade: Phosphor bronze		
12	Contact plating: 50μ" Gold		
13	Plug dimensions & tolerances compliant with FCC Part 68.500 and IEC 60603-7		
14	Approvals: UL 444 for copper conductor		
15	Operating life: Minimum 750 insertion cycles		
16	Standing voltage :500 V AC		
17	Insolation résistance : 35 M Ohm (Max)		
18	Operating temperature: -10oC to 80oC		

F	**OPTICAL FIBER CABLE ARMORED SINGLE MODE 6 CORE - OS2**		
1	Should be ISO.IEC 11801-2nd Edition, type OS2 and ITU-T REC G 652D		
2	Tube Identification : Single tube		
3	Fiber protection (Tube): Polybutylene Terepthalate (PBT)		
4	Water Blocking : Thixotropic Gel (Tube) and Petroleum Jelly (Interstices)		
5	Core Wrapping : Polyethylene Terephthalate		
6	Armouring : Corrugated Steel Tape Armour (ECCS		
7	Peripheral Strength Member : Two Steel wires/Two FRP rods		
8	Sheath: UV Stabilized Polyethylene (HDPE)		
9	Minimum . Tensile Strength - Short Team : 1800N		

G	**FIBER PATCH PANELS – RACK MOUNT 6 PORT UNLOADED**		
1	Sufficient slots to accommodate Duplex Adaptors		
2	Fiber management provision inside		
3	Earthing lugs and other accessories		
4	Provide self-adhesive, clear label holders for labelling		
5	Rack mountable 1U		
6	Separate Splice holder		
7	Made of Cold Rolled Steel		
8	Sufficient slots to accommodate Duplex Adaptors		

H	**OPTICAL FIBER PIGTAILS SINGLE MODE OS2, 1 MTR**		
1	Precision ferrule end face geometry		
2	Factory polished, tested and serialized		
3	Buffer Diameter: 900um tight buffer		
4	Minimum bend radius install: 30mm		
5	Retention Strength : 100N		
6	Cable : 900um Buffered		

I	**OPTICAL FIBER EQUIPMENT CORDS**		
1	**(MINIMUM 3 METER)**		
2	All optical fiber patch leads shall comprise of Single mode 9/125µm OS2 fiber SC -LC		
3	Jacket should be LSZH sheath		
4	Connector: Zirconia ceramic ferrule		
5	Cable: 9/125, SM OS 2 Strength member: Aramid Yarn		

J	**RACK 42U Enclosure Frame-600X1000-STEEL**		
1	Casters Set of 4		
2	Adjustable Levellers set of 4		
3	Glass Door-600-42U		
4	Hexagonal Perforated Door-42-600		
5	Side Panels-1000-42U-Vented		
6	Mounting Hardware-(Pack of 20)		
7	FHU with 4 FAN 360CFM		
8	Vertical Power Distribution Unit with 12 x 5/15 sockets Round Pin, 230 Volts AC, 32 Amp with Plug		
9	Vertical Cable Manager-42U-Loop		
10	Horz. Cable Manager-1U-Loop		
11	Shelf-1000		
12	Key Board Tray -1000		