ANNEXURE-1

Table-2: Network Layer 2 Access Switch 48 ports			
Sr. No.	IPR Specification	Compliance (Yes/No)	Remarks
1	**Architecture**		
1.1	The switch should have 48 100/1000 Base-TX, auto-negotiating and auto sensing ports.		
1.2	The switch should have atleast 2 nos. of Small Form-Factor, pluggable, 10G SFP+ uplink ports in addition to the above ports.		
1.3	The switch should have at least one console port having RJ-45 (with RS232 signalling) port for OS management (uploading, downloading and configuration).		
1.4	The switch should be rack mountable and should not take space more than 1 Rack Unit (RU).		
1.5	The switch architecture should be stackable with at least 8 switches in a single stack, having 2 at least additional stacking port supporting 10Gig or higher. Additional 2 Stacking module to be supplied if needed to support stacking.		
1.6	The switch Stack Architecture should allow the end user to stack 24/48 Port switch with 48 Port switch of the same model/family offering POE/POE+ and Non-POE models.		
1.7	The switch should be able to carry power savings mechanism wherein it should reduce the power consumption on ports not being used and should be EEE certified.		
1.8	The switch should support internal dual redundant power supply		
2	**Performance**		
2.1	The switch should have atleast 512 MB Flash and 2 Gbps of SDRAM.		
2.2	The switch should have latency in sub-millisecond order for 10 Gbps < 3 micro seconds.		
2.3	The switch should support Jumbo Frames		
2.4	The switch should support atleast 216 Gbps of switching bandwidth.		
2.5	The switch should have atleast 190 Mpps of forwarding rate.		
2.6	The switch should support atleast 10 Gbps dedicated stacking bandwidth using dedicated stacking ports		
2.7	The switch should support atleast 4000 Active VLAN ID's.		
2.8	The switch should support atleast 32K MAC Addresses.		
3	**Layer 2 and Layer 3 Features**		
3.1	The switch should be able to discover/support (on both IPv4 & IPv6 Network) the neighbouring device giving the details about the platform, IP Address, MAC address etc. and should be able to detect duplicate IP address.		

3.2	The switch hardware should be able to run both IPv4 & IPv6 (dual stack)simultaneously		
3.3	The switch should support OpenFlow 1.3 capabilities or higher to enable software-defined networking (SDN).		
3.4	The switch should have the capability to monitor link connectivity and shut down ports at both ends if uni-directional traffic is detected, preventing loops.		
3.5	The switch should support Link Aggregation Control Protocol (LACP) to allow creation of Ethernet channelling.		
3.6	The switch should support Internet Group Management Protocol (IGMP) snooping for IPv4 and IPv6.		
3.7	The switch should support Per-Port Broadcast, Multicast, and Unicast Storm Control.		
3.8	The switch should support Voice VLAN, Port based, Private, Dynamic Vlans		
3.9	The switch should support Bridge protocol data unit (BPDU) Guard, Root Guard or equivalent.		
3.10	The switch should support link redundancy & link load-balancing feature.		
3.11	The switch should support support Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP) to provide redundant links while preventing network loops.		
3.12	The switch should support Link Layer Discovery Protocol (LLDP).		
3.13	The switch should support DHCP client, DHCP relay enables DHCP operation across subnets.		
4	**Network Security Features**		
4.1	The switch should support Dynamic ARP inspection to ensure user integrity by preventing malicious users from exploiting the insecure nature of ARP.		
4.2	The switch should support L2 to L4 traffic filtering and support global ACL, VLAN ACL, port ACL and IPV6 ACL, Time based ACL		
4.3	Switch should support 802.1x, MAC based authentication per user ACLs, identity based VLAN assignments.		
4.4	The Switch should support secure encryption of all access methods (CLI, GUI, or MIB) through SSHv2, SSL, HTTPS and/or SNMPv3, SFTP and SCP		
4.5	The Switch should support Guest VLAN to provide a browser-based environment to authenticated clients that is similar to IEEE 802.1X		
4.6	The switch should support access to specific MAC addresses, configured by administrator		
4.7	The switch should support authentication feature like Terminal Access Controller Access Control System (TACACS) and/or Remote Authentication Dial-In User Service (RADIUS) or equivalent to facilitate centralized control of the switch and to restricts unauthorized users from altering the configuration.		

4.8	The switch should support Multi level security on console access to prevent unauthorized users from altering the switch configuration.		
4.9	The switch should support Dynamic VLAN, Multi-Auth VLAN Assignment and MAC Based Filtering.		
4.10	The switch should support port security, DHCP snooping and IP source guard.		
4.11	The Switch should support Port isolation to secures and adds privacy, and prevents malicious attackers from obtaining user information		
4.12	The Switch should allow access only to specified MAC addresses, which can be learned or specified by the administrator		
5	**Quality of Service**		
5.1	The switch should support QoS to classifies traffic using L2, L3 and L4 information.		
5.2	The Switch should support Broadcast control to allow limitation of broadcast traffic rate to cut down on unwanted network broadcast traffic		
5.3	The switch should support access and line rate.		
6	**Manageability**		
6.1	The switch should support configuration and management through a secure web browser,CLI and SSH		
6.2	The switch support role based authorization on CLI and HTTPS		
6.3	The switch should support sFlow or equivalent.		
6.4	The switch should support authorization using RADIUS/HWTACACS and also provide audit trail		
6.5	The switch should support syslog		
6.6	The switch should support RMON		
6.7	The switch should support SNMPv1, v2c, and v3, MIB-II with traps, RADUIS authentication client MIB (RFC 2618)		
7	**Standards and Compliance**		
7.1	The switch should be compliant with IEEE compliance: IEEE 802.1W (RSTP), IEEE 802.1S (MSTP), IEEE 802.1D (Bridging, STP), IEEE 802.1P (L2 Prioritization), IEEE 802.1Q (VLAN Tagging, Double VLAN Tagging, GVRP), IEEE 802.1ab (LLDP), IEEE 802.3 (10 BASE-T specification), IEEE 802.3X (Flow Control), IEEE 802.3ab (Gigabit Ethernet (1000BASE-T) with QSA or breakout), IEEE 802.3ad (Link Aggregation with LACP), IEEE 802.3u (Fast Ethernet (100Base-TX) on mgmt ports), IEEE 802.3x (Flow Control), IEEE 802.3z (Gigabit Ethernet (1000Base-X) with QSA), RMON I and II, SNMP v1, SNMP v2c, and SNMP v3. Safety compliance EMI and EMC Compliance		

ANNEXURE-II

Sr. No.	IPR Specification	Compliance (Yes/No)	Remarks
	Table-2: Network Layer 3 Data Center Switch 48 ports		
1	**Architecture**		
1.1	48 ports of 10GBASE-T (10 Gbps RJ45) with at least 6 x QSFP28 100GbE ports.		
1.2	One serial console port		
1.3	Memory and processor - AT least 1GB flash; Packet buffer size: At least 12MB and at least 4GB SDRAM		
1.5	The switch should support 10 Gbps Latency - <1µs (64-byte packets)		
1.6	The switch should support Throughput –At least 1600 Mpps		
1.7	The switch should support Switching Capacity – At least 2150 Gbps		
1.8	The switch should support Routing Table Size – At least 128000 (For IPv4) and 64000(For IPv6) entries		
1.9	The switch should support MAC table size – At least 32K entries.		
1.10	The switch should support Power Supplies – Dual redundant hot swapable power supply (both power supply populated) with dual Fan tray populated (reversible air flow)		
1.11	The switch should have Rack Mount 1U		
1.12	The switch should support stacking with at least 8 switches		
2	**Data Centre Optimization**		
2.1	FCoE support - Provides support T11 standards-compliant FC-BB-5 Fibre Channel over Ethernet (FCoE), including FCoE Initialization Protocol (FIP), FCP, Fibre Channel enhanced port types VE, TE and VF, NPV, NPIV, Fabric Name Server, RSCN, Login Services, and name-server zoning, per-VSAN Fabric Services, FSPF, Standard Zoning, and Fibre Channel Ping.		
2.2	VXLAN support - VXLAN Layer 2 gateway support for up to 4k tunnels. Support for dynamic VXLAN configuration		
2.3	The switch should support Virtualization		
2.4	The switch should be SDN enabled, support openflow		
2.5	Data Center Bridging (DCB) protocols-Provides support for IEEE 802.1Qbb Priority Flow Control (PFC), Data Center Bridging Exchange (DCBX), IEEE 802.1Qaz Enhanced Transmission Selection (ETS), Explicit Congestion Notification (ECN) for converged FCoE, iSCSI, and RoCE environments.		
2.6	Redundant fans and power supplies - Internal redundant and hot-pluggable power supplies and dual fan trays enhance reliability and availability.		

2.7	High-performance switching - Cut-through and non-blocking architecture delivers low latency (1 microsecond for 10GbE) for very demanding enterprise applications		
3	**Quality of Service (QoS)**		
3.1	Flexible queue scheduling including Strict Priority (SP), WRR, WDRR, WFQ, SP+WRR, SP+WDRR, SP+WFQ, Configurable Buffer, Time range, Queue Shaping.		
3.2	Packet filtering at Layer 2 (L2) through Layer 4 (L4); flow classification based on source MAC address, destination MAC address, source IP (IPv4/IPv6) address, destination IP (IPv4/IPv6) address, port, protocol, and VLAN.		
3.3	Jumbo frames-frame sizes of up to 10,000 bytes on Gigabit Ethernet and 10 Gigabit ports, high-performance remote backup and disaster-recovery services are enabled.		
4	**Manageability**		
4.1	Full-featured console - complete control of the switch with a command-line interface (CLI).		
4.2	Troubleshooting- Ingress and egress port monitoring, Traceroute and ping		
4.3	Multiple configuration files to be stored to a flash image.		
4.4	Wire-speed traffic accounting and monitoring via sFLOW		
4.5	Facilitate centralized discovery, monitoring, and secure management of networking devices via SNMPv1, v2c, and v3.		
4.6	Isolates management traffic from user data plane traffic for complete isolation and total reachability		
4.7	Remote configuration and management over SSH and Configuration Rollback and multiple configurations on the flash provide ease of operation; remote visibility is provided with sFlow and SNMPv1/v2/v3 and is fully supported in the HP Intelligent Management Center (IMC).		
4.8	Provides automatic confguration via DHCP autoconfguration.		
4.9	NTP, SNTP, and PTP Support.		
4.10	Provides local and remote logging of events via SNMP (v2c and v3) and syslog; and provides log throttling and log filtering to reduce the number of log events generated.		
5	**Resiliency and high availability**		
5.1	Supports stacking technology/similar.		
5.2	IEEE 802.1w Rapid Convergence Spanning Tree Protocol.		
5.3	IEEE 802.1s Multiple Spanning Tree -Provides high link availability in multiple VLAN environments by allowing multiple spanning trees.		

5.4	Support Virtual Router Redundancy Protocol (VRRP).		
5.5	Device Link Detection Protocol (DLDP) - Monitors link connectivity and shuts down ports at both ends if unidirectional traffic is detected, helping prevent loops in STP-based networks.		
6	**L2 and L3 services**		
6.1	MAC-based VLAN-Provides granular control and security; and uses RADIUS to map a MAC address/user to specific VLANs.		
6.2	Address Resolution Protocol (ARP) - Supports static, dynamic, and reverse ARP and ARP proxy.		
6.3	IEEE 802.3x Flow Control.		
6.4	Ethernet Link Aggregation - Provides IEEE 802.3ad Link Aggregation of up to 128 groups of 16 ports; and support for LACP,LACP Local Forwarding First, and LACP Short-time provides a fast, resilient environment that is ideal for the data center usage.		
6.5	Supports STP (IEEE 802.1D), Rapid STP (RSTP, IEEE 802.1w), and Multiple STP (MSTP, IEEE 802.1s).		
6.6	VLAN support - support for 4,096 VLANs based on the port, MAC address, IPv4 subnet, protocol, and guest VLAN; and supports VLAN mapping.		
6.7	IGMP support- support for IGMP Snooping, Fast-Leave, and Group-Policy; IPv6 IGMP Snooping provides L2 optimization of multicast traffic.		
6.8	DHCP support at L2 - full DHCP Snooping support for DHCP Snooping Option 82, DHCP Relay Option 82, DHCP Snooping Trust, and DHCP Snooping Item Backup.		
6.9	Operations, administration and maintenance (OAM) support - Provides support for Connectivity Fault Management (IEEE 802.1AG) and Ethernet in the First Mile (IEEE 802.3AH); and provides additional monitoring that can be used for fast fault detection and recovery.		
6.10	DHCP management of large IP networks and supports client and server; DHCP Relay enables DHCP operation across subnets.		
6.11	Virtual Router Redundancy Protocol (VRRP) and VRRP Extended.		
6.12	Makes routing decisions, based on policies.		
6.13	Enables multiple equal-cost links in a routing environment to increase link redundancy and scale bandwidth.		
6.14	Provides routing of IPv4 at media speeds; and supports static routes, RIP and RIPv2, OSPF, BGP, and IS-IS.		
6.15	Routing Information Protocol next generation (RIPng). Extends RIPv2 to support IPv6 addressing		
6.16	Dual IP stack-Maintains separate stacks for IPv4 and IPv6 to ease the transition from an IPv4-only network to an IPv6-only network design		

7	Security		
7.1	Provide IP Layer 3 filtering based on source/destination IP address/subnet and source/destination TCP/UDP port number.		
7.2	RADIUS/TACACS+ - Eases switch management security administration by using a password authentication server.		
7.3	IEEE 802.1X and RADIUS network logins-Controls port-based access for authentication and accountability		
7.4	Port security-Allows access only to specified MAC addresses		
7.5	The switch should support Dynamic ARP inspection to ensure user integrity by preventing malicious users from exploiting the insecure nature of ARP.		
7.6	The switch should support L2 to L4 traffic filtering and support global ACL, VLAN ACL, port ACL and IPV6 ACL, Time based ACL		

ANNEXURE-III

Sr. No.	IPR Specification	Compliance (Yes/No)	Remarks
	10G BASE SFP+ LR Module		
1	Should be 10G base SFP+ LR 1310nm SMF module.		
2	Should support 10GBASE Ethernet in accordance with IEEE 802.3ae.		
3	Should be from the same OEM of the quoted core switch and access switch.		
4	Should be hot-swappable (no need to power down the switch while installing/replacing), for the core switch.		
5	The module should support transmission on link length of atleast 10 Km on standard single-mode fibre.		