




**SPECIFICATION FOR
ICT NETWORKING
SYSTEM
(L-S38)**


JKR 20300-0106-22

CKE.LS.03.38.(00).2020


CAWANGAN KEJURUTERAAN ELEKTRIK

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: i of iii


SECTION	CONTENT	PAGE
1.0	General	S1/1 – S1/1
1.1	Scope	1
1.2	Standards	1
1.3	Technical Particulars	1
1.4	Guarantees	1
1.5	Electrical System Requirement	1
2.0	Installation, Configuration and Workmanship	S2/1 – S2/1
2.1	Description	1
2.2	Certified Installer	1
2.3	Certified Network Engineer	1
3.0	Network Equipment	S3/1 – S3/12
3.1	Description	1
3.2	Firewall	2
3.3	Network Switches	5
3.4	Server	9
3.5	Storage	10
3.6	Wireless Access Point (Wi-Fi AP) System	11
3.7	Network Management System	12
4.0	User Equipment	S4/1 – S4/8
4.1	Description	1
4.2	Desktop Computer & Desktop Workstation	1
4.3	Laptop	4
4.4	Telepresence System	7
4.5	Medical Display Monitor	8
5.0	Equipment Rack	S5/1 – S5/3
5.1	Description	1
5.2	Network Rack	2
5.3	Server Rack	3

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: ii of iii

SECTION	CONTENT	PAGE
6.0	Facilities for Data Centre, Server Room & Telecommunication Closet Room (TCR)	S6/1 – S6/11
6.1	Description	1
6.2	Precision Air Conditioner (PAC)	3
6.3	Uninterruptible Power Supply (UPS)	4
6.4	Early Warning Smoke Detection System	5
6.5	Fire Suppression System	6
6.6	Water Leak Detection System	6
6.7	Environment Monitoring System (EMS)	7
6.8	Telecommunication Earthing System	8
6.9	Signal Reference Grid (SRG)	10
7.0	System of Cabling	S7/1 – S7/14
7.1	Structured Cabling System	1
7.2	Type of Cables & Accessories	2
7.3	Singlemode Fibre Optic Cable	3
7.4	Multimode Fibre Optic Cable	5
7.5	Fibre Optic Cable Accessories	7
7.6	Twisted Pair Copper Cable	9
7.7	RJ45 Modular Jack	9
7.8	RJ45 Patch Panel	10
7.9	RJ45 Patch Cord	10
7.10	Modular Plug Terminated Link (MPTL)	11
7.11	Faceplate	11
7.12	Multi-user Telecommunications Outlet Assembly (MUTOA)	12
7.13	Cabling in Conduit, Trunking, Cable Tray and Cable Ladder (Surface/ Concealed/ Suspended)	12
7.14	Cabling in Cable Basket and Fibre Raceway	13
7.15	Cabling in Underground Ducting and Manhole	14
7.16	Conduits and Trunking Space Factor	14
7.17	Identification of Services	14
7.18	Mounting Heights	14

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: iii of iii

SECTION	CONTENT	PAGE
8.0	Labelling	S8/1 – S8/6
8.1	Description	1
8.2	Equipment Rack Labelling	1
8.3	Network Switches, UPS and Other Equipment Labelling	2
8.4	Fibre Patch Panel and Fibre Patch Cord Labelling	3
8.5	UTP Patch Panel and UTP Patch Cord labelling	4
8.6	Data/ Voice Faceplates and Wireless Access Point (Wi-Fi AP) Labelling	5
9.0	Testing and Commissioning	S9/1 – S9/4
9.1	Test Instruments	1
9.2	Test and Test Certificates	1
9.3	Structured Cabling System Test	2
9.4	Network Equipment Test	3
10.0	Warranty and Support	S10/1 – S10/1
10.1	Description	1
10.2	Warranty	1
11.0	Shop Drawings and As-Built Documents	S11/1 – S11/3
11.1	Shop Drawings	1
11.2	As Built Documents	2
12.0	List of Standards	S12/1 – S12/2
13.0	Abbreviations	S13/1 – S13/3

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S1 - 1 of 1

1.0 GENERAL

1.1 SCOPE

- 1.1.1 This section of the Specifications describes and specifies requirements for the supply, delivery, installation, testing, commissioning, handing over in approved working order and maintenance during the Defects Liability Period of the whole Information and Communication Technology (ICT) installation in accordance to the Specification, Bill of Quantities, Conditions of Contract, Drawings etc.

1.2 STANDARDS

- 1.2.1 The material, equipment and installation shall conform to the principles of the latest standards and its addendums laid down by the Malaysian Standards (MS), Suruhanjaya Komunikasi & Multimedia Malaysia (SKMM), International Organisation for Standardisation (ISO), Institute of Electrical and Electronics Engineers (IEEE), American National Standards Institute (ANSI), Telecommunications Industry Association (TIA) and International Electrotechnical Commission (IEC).

1.3 TECHNICAL PARTICULARS


- 1.3.1 The Contractor shall submit at the time of tendering all catalogues, detailed technical particulars, name of manufacturers, brand, model numbers and guarantees in respect of the equipment offered, which shall be binding. No departure from these technical particulars and guarantees will be permitted except with the written approval of the Superintendent Officer (S.O.) or S.O.'s Representative.

1.4 GUARANTEES

- 1.4.1 The Contractor shall guarantee the equipment to be supplied under this contract against faulty design, materials and workmanship at the manufacturer's works within the DLP.

1.5 ELECTRICAL SYSTEM REQUIREMENT

- 1.5.1 All equipment shall be rated for operation on a 230/400V (within the tolerance as defined in MS IEC 60038; 230/400 V, +10%, -6%), 3-phase, 4 wire, 50Hz system with solidly earthed neutral.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S2 - 1 of 1

2.0 INSTALLATION, CONFIGURATION AND WORKMANSHIP

2.1 DESCRIPTION


- 2.1.1 All works shall comply with the specification and shall be of best engineering practices and shall be carried out and supervised by qualified, competent and skilled personnel.
- 2.1.2 The Contractor shall responsible for all related works which involve earthwork, hacking and making good or any civil work for the installation. All labour, material and tools necessary during the works shall be supplied or executed at the Contractor's cost. The Contractor shall ensure the site is in a good condition after the installation completed.

2.2 CERTIFIED INSTALLER

- 2.2.1 The work of installation, termination, testing and commissioning of the structured cabling system shall be conducted and carried out by a Certified Installer. The Certified Installer shall be a competent person and certified by related cable manufacturer. The Contractor shall submit the list of on-site Certified Installer complete with valid certificates to the S.O. or S.O.'s Representative at least two (2) weeks prior to the installation.

2.3 CERTIFIED NETWORK ENGINEER

- 2.3.1 The work of configuration, testing and commissioning of the network equipment installed shall be conducted and carried out by a Certified Network Engineer. The Certified Network Engineer shall be a competent person and certified by related network equipment manufacturer. The Contractor shall submit the list of on-site Certified Network Engineer complete with valid certificates to the S.O. or S.O.'s Representative at least two (2) weeks prior to the installation.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 1 of 12

3.0 NETWORK EQUIPMENT

3.1 DESCRIPTION

3.1.1 The network equipment including its software for network infrastructure e.g. Local Area Network (LAN) generally consists of the following components: -


- 3.1.1.1 Firewall
- 3.1.1.2 Network Switches
- 3.1.1.3 Server
- 3.1.1.4 Storage
- 3.1.1.5 Wireless LAN Access Point (Wi-Fi)
- 3.1.1.6 Network Management Software

3.1.2 All network equipment shall comply with the IPv4 and IPv6 requirement. It shall also comply with IEC 61000 and CISPR 22 standards pertaining to Electromagnetic Compatibility (EMC).

3.1.3 All network equipment shall be configured as per required such as VLANs, security policies and IP Addressing of the network which suit to the requirement. Information of numbers of VLANs, port assignments, permissions, security policies etc. shall be submitted to S.O. or S.O.'s Representative for approval.

3.1.4 The size of network shall be categorised based on the following criteria:

- 3.1.4.1 Small network – network ports ≤ 200
- 3.1.4.2 Medium network – $200 < \text{network ports} \leq 1000$
- 3.1.4.3 Large network – network ports > 1000

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 2 of 12


3.2 FIREWALL

3.2.1 The Firewall and its features shall be of the following types: -

- 3.2.1.1 Firewall with basic features suitable for small size of network.
- 3.2.1.2 Firewall with standard features suitable for medium size of network.
- 3.2.1.3 Firewall with comprehensive features suitable for large size of network.


3.2.2 The firewall with basic features shall comply with the following minimum technical specifications: -

Firewall Throughput	:	5.0 Gbps
Firewall IMIX	:	2.0 Gbps
VPN Tunnel /Throughput	:	2 nos / 1.5 Gbps
IPS Throughput	:	1.5 Gbps
Antivirus Throughput	:	1.0 Gbps
Concurrent connections	:	3,000,000
New connections/sec	:	30,000
Storage	:	Solid State Technology
Power Supply	:	Optional redundant power supply unit
Gigabit Ethernet Port	:	Support 4 x 1 GbE port (min.)
Management ports	:	2 x USB 3.0 and 1 x RJ45
General Management	:	Trouble shoot in graphical user interface (GUI), automated firmware update, backup and restore configuration by on demand, daily, weekly or monthly. Default zones for LAN, WAN, DMZ, VPN and Wi-Fi
Network Protection	:	Stateful inspection firewall, Intrusion Prevention System (IPS) and Virtual Private Network (VPN)

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 3 of 12


3.2.3 The firewall with standard features shall comply with the following minimum technical specifications: -

Firewall Throughput	:	10.0 Gbps
Firewall IMIX	:	5.0 Gbps
VPN Tunnel/Throughput	:	10 nos / 3.0 Gbps
IPS Throughput	:	5.0 Gbps
NGFW Throughput	:	4.0 Gbps
Antivirus Throughput	:	2.0 Gbps
Concurrent Connections	:	4,000,000
New Connections/sec	:	100,000
Storage	:	Solid State Technology
Power Supply	:	Redundant power supply unit
Gigabit Ethernet Port	:	4 x 1 GbE port, 2 x 10 GbE port (min.)
Expansion Slot	:	Copper/fibre/SFP/SFP+ module/port
Management Ports	:	2 x USB 3.0 and 1 x RJ45
High Availability	:	Support active-active and active-passive configuration
General Management	:	Trouble shoot in graphical user interface (GUI), automated firmware update, backup and restore configuration by on demand, daily, weekly or monthly. Default zones for LAN, WAN, DMZ, VPN and Wi-Fi.
Reporting	:	Support on-board and central management
Network Protection	:	Intrusion Prevention System (IPS), Advanced Threat Protection, Web protection and control, Web Application Firewall and Virtual Private Network (VPN).

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 4 of 12

3.2.4 The firewall with comprehensive features shall comply with the following minimum technical specifications: -

Firewall Throughput	:	20.0 Gbps
Firewall IMIX	:	8.0 Gbps
VPN Tunnel/Throughput	:	Unlimited nos / 5.0 Gbps
IPS Throughput	:	10.0 Gbps
NGFW Throughput	:	10.0 Gbps
Antivirus Throughput	:	10.0 Gbps
Concurrent Connections	:	10,000,000
New Connections/sec	:	150,000
Storage	:	Solid State Technology
Power Supply	:	Redundant power supply, hot swappable
Gigabit Ethernet Port	:	4 x 1 GbE port, 4 x 10 GbE port (min.)
Expansion Slot	:	Copper/fibre/SFP/SFP+ module/port
Management Ports	:	2 x USB 3.0 and 1 x RJ45
High Availability	:	Active – active configuration
General Management	:	Trouble shoot in graphical user interface (GUI), automated firmware update, backup and restore configuration by on demand, daily, weekly or monthly. Default zones for LAN, WAN, DMZ, VPN and Wi-Fi.
Reporting	:	Support on-board and central management
Network Protection	:	Intrusion Prevention System (IPS), Advanced Threat Protection, Web protection and control, Web Application Firewall (WAF) and Virtual Private Network (VPN).

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 5 of 12

3.3 NETWORK SWITCHES

3.3.1 All network switches shall comply with IEEE 802.3 with latest Ethernet technology and the communication shall be based on Transmission Control Protocol /Internet Protocol (TCP/IP).


3.3.2 The types of network switches shall be of the following types: -

- 3.3.2.1 Core Switch – used to interconnects the Distribution Switch and/or Access Switch in the network.
- 3.3.2.2 Distribution Switch – used to interconnects the Access Switch located at different building to the Core Switch in the network.
- 3.3.2.3 Access Switch – used to interconnects the end user devices (e.g. PC, printers, telephones, Wi-Fi AP) to the network.
- 3.3.2.4 Server Farm Switch – used to interconnects several numbers of Servers to the Core Switch in the Server Room.

3.3.3 CORE SWITCH

3.3.3.1 The Core Switch shall comply with the following minimum technical specifications: -

Layer Function	:	Layer 2/3/4 switching
Number of Port	:	As specified in the Drawing and/or Bill of Quantities
I/O Ports	:	Support 1/10 GbE (small network), Support 1/10/25/40 GbE (medium network), Support 1/10 GbE to 100 GbE (large network)
Port Performance	:	Wire speed, Non-blocking port (no over subscription of switching fabric)
Power Supply	:	Redundant power supply, hot swappable
IP Routing	:	IPv4 and IPv6 requirement
High Availability	:	Redundant supervisor and fabric (only for modular chassis type)

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 6 of 12

3.3.4 DISTRIBUTION SWITCH


3.3.4.1 The Distribution Switch shall comply with the following minimum technical specifications: -

Layer Function	:	Layer 2/3/4 switching
Number of Port	:	As specified in the Drawing and/or Bill of Quantities
I/O Ports	:	Support 1/10/25/40 GbE (medium network), Support 1/10 GbE to 100 GbE (large network)
Port Performance	:	Wire speed, Non-blocking port (no over subscription of switching fabric)
Power Supply	:	Redundant power supply unit, hot swappable
IP Routing	:	IPv4 and IPv6 requirement
High Availability	:	Redundant supervisor and fabric (only for modular chassis type)

3.3.5 ACCESS SWITCH

3.3.5.1 The Access Switch shall comply with the following minimum technical specifications: -

Layer Function	:	Layer 2/4 switching
Number of Ethernet Port	:	24 or 48 port 1000 Base-T Minimum 2 port 10 GbE
Stacking module/cable	:	10 Gbps speed (for stacking environment)
Port Performance	:	Wire speed, Non-blocking port (no over subscription of switching fabric)


	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 7 of 12

3.3.5.2 The Access Switch with Power Over Ethernet (PoE) shall comply with the following minimum technical specifications: -

Layer Function	:	Layer 2/4 switching
Number of Ethernet Port	:	Maximum 24-port 1000 Base-T Minimum 2 port 10 GbE
Stacking Module/Cable	:	10 Gbps speed (for stacking environment)
PoE Function	:	Power Sourcing Equipment (PSE) complies with IEEE 802.3af and 802.3at (PoE+)
Port Performance	:	Wire speed, Non-blocking port (no over subscription of switching fabric)

3.3.5.3 The Multi Gig or Multi Rate Switch shall comply with the following minimum technical specifications: -

Layer Function	:	Layer 2 switching
Number of Port	:	As specified in the Drawing and/or Bill of Quantities
Transceiver Speed	:	Support 10 Gbps uplink, 1/ 2.5/5.0 Gbps downlink
Stacking Module/Cable	:	10 Gbps speed (for stacking environment)
Power Supply	:	Dual power supply unit, hot swappable
PoE function	:	Power Sourcing Equipment (PSE) complies with IEEE 802.3af, 802.3at, 802.3bt(PoE++)
Port Performance	:	Wire speed, Non-blocking port (no over subscription of switching fabric)

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 8 of 12

3.3.6 SERVER FARM SWITCH

3.3.6.1 The Server Farm Switch shall have a Layer 2 and Layer 3 switching services and shall comply with the following minimum technical specifications: -

Number of Port	:	As specified in the Drawing and/or Bill of Quantities
Transceiver Speed	:	Support 1/10 Gbps
Power Supply	:	Dual power supply unit, hot swappable
Port Performance	:	Wire speed, Non-blocking port (no over subscription of switching fabric)


3.3.7 TRANSCEIVER MODULE

3.3.7.1 The Singlemode Transceiver Module shall comply with the following minimum technical specifications: -

Transceiver Speed	:	10 Gbps uplink or higher
Wavelength	:	1310 nm or 1550 nm

3.3.7.2 The Multimode Transceiver Module shall comply with the following minimum technical specifications: -

Transceiver Speed	:	10 Gbps uplink or higher
Wavelength	:	850 nm or 1300 nm

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 9 of 12

3.4 SERVER


3.4.1 The server shall be rack based type and shall be housed in the 19" equipment rack.

3.4.2 The server shall be able to support virtual environment solution and shall support redundancy and high availability (HA) configuration to prevent single engine failure.

3.4.3 The server shall be equipped with server management software and latest version of anti-virus software.

3.4.4 The server for network management shall comply with the following minimum technical specifications: -

Processor	:	Intel or AMD processor with latest generation
Processor sockets (CPU)	:	Dual processor
Number of core	:	4
Core speed	:	2.0 GHz
Cache per processor	:	11 MB
Memory	:	2 x 8 GB DDR4, minimum 8 DIMM slots,
Internal storage	:	Minimum 1TeraByte usable with at least RAID 1 configuration
RAID controllers	:	Support RAID 0/1/5/6
Drive bays (Hard disk)	:	Minimum 8 slots
PCIe I/O slots	:	Minimum 3
Network Interface Card	:	Minimum 1 card
Power Supply	:	Dual power supply unit, hot swappable
Operating System	:	Latest Version (e.g. Microsoft Windows/Linux/Unix or any Hypervisor)

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 10 of 12


3.4.5 The server for system application infrastructure shall comply with the following minimum technical specifications: -

Processor	:	Intel or AMD processor with latest generation
Processor sockets (CPU)	:	Dual processor
Number of core	:	8
Core speed	:	2.0 GHz
Cache per processor	:	11 MB
Memory	:	4 x 8 GB DDR4, minimum 24 DIMM slots,
Internal storage	:	Minimum 1TeraByte usable with at least RAID 1 configuration
RAID controllers	:	Support RAID 0/1/5/6
Drive bays (Hard disk)	:	Minimum 8 slots
PCIe I/O slots	:	Minimum 6
Network Interface Card	:	Minimum 2 card
Power Supply	:	Dual power supply unit, hot swappable
Operating System	:	Latest Version (e.g. Microsoft Windows/Linux/Unix or any Hypervisor)

3.5 STORAGE

3.5.1 The storage shall be of rack based type and shall be housed in the 19" equipment rack.

3.5.2 The size of the storage shall be calculated based on the current requirement and future expansion.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 11 of 12

3.6 WIRELESS ACCESS POINT (WI-FI AP) SYSTEM

3.6.1 The Wi-Fi AP system shall be equipped with wireless management system software and/or hardware and including the licenses.


3.6.2 The Wi-Fi AP shall comply with latest version of IEEE 802.11 standard and shall be compatible with the previous IEEE 802.11 a/b/g/n/ac standard.

3.6.2.1 The Wi-Fi AP shall comply with the following minimum technical specifications: -

Standard Compliance	:	IEEE 802.11 ax (Wi-Fi 6) or higher
Frequency Band	:	Support 2.4 GHz or 5 GHz
Modulation Technology	:	Support 1024 QAM and Orthogonal Frequency Division Multiple Access (OFDMA),
Antenna Technology	:	2x2 Multi User - MIMO or higher
Radio Technology	:	Support Triple Radio
Interface port	:	Support 0.1/1/2.5 GbE Base-T (RJ45 port)
LED Indicator	:	Indicates Power On, Running, Alarm and Fault
PoE Function	:	Support Power Over Ethernet (PoE) in compliance with IEEE 802.3af, 802.3at, 802.3bt

3.6.2.2 The Wireless Controller or Management System shall comply with the following minimum technical specifications: -


Platform	:	Appliance or Virtual
Number of Port	:	Minimum of 2 port Ethernet Base-T
Expansion slot	:	Support SFP/SFP+ module/port
Power Supply	:	Support redundant power supply
Security Features	:	Support WPA/WPA2/WPA3 authentication and encryption, Wireless IPS

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S3 - 12 of 12

3.7 NETWORK MANAGEMENT SYSTEM

3.7.1 The Network Management System (NMS) shall be able to support the following minimum technical specifications: -

- 3.7.1.1 To monitor and manage wired and wireless network devices and shall be able to detect, diagnose and resolve multi-vendor network performance issues.
- 3.7.1.2 To support cloud computing, software defined network and big data analytics environment. It shall be able to collect statistics on devices performance, alarm data, traps, user data and analyses the collected statistics to perform root cause analysis.
- 3.7.1.3 To provide unified management of small, medium and large size of networks and multiple branch of campus network.
- 3.7.1.4 To monitor and manage third-party devices such as switches, firewall, router, wireless access point and others in unified platform.
- 3.7.1.5 To provide configuration for batch import, export, modification, deletion, templates to deploy configuration on devices and configuration wizard at least for Layer 2 and Layer 3 networks, VLANs, DHCP, DNS, NAT, STP etc.
- 3.7.1.6 To allow network administrators to configure SSIDs, restrict access, allow access, enable isolation user terminals, enable or disable transmission of audio/video data, MAC address blacklist and whitelist, multiple security authentication methods including portal, PSK, PPSK or latest.
- 3.7.1.7 To provide network topology, reporting on the overall of network health status, log data in real-time with an interactive graphical user interface (GUI), chart and graph.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 1 of 8

4.0 USER EQUIPMENT


4.1 DESCRIPTION

- 4.1.1 The user equipment shall be originated from the manufacturer, not a clone product, shall be supplied with the software licenses, security software (e.g. Anti-virus) and warranty as stated in the contract.
- 4.1.2 The user equipment generally consists of desktop computer, desktop workstation, laptop, telepresence system, medical display monitor, etc.

4.2 DESKTOP COMPUTER AND DESKTOP WORKSTATION


- 4.2.1 The Desktop Computer for network administration usage shall comply with the following minimum technical specifications: -

Processor	:	Intel processor or AMD with latest generation
Processor sockets (CPU)	:	Core i5 or Ryzen 5
Number of core	:	6
Core speed (base frequency)	:	2.0 GHz
Memory	:	1 x 8GB DDR4 at 2666 MHz
Memory DIMM slot	:	2 slots
Hard Drive	:	256 GB Solid State Drive
Network Interface Card	:	1000 Base-T (RJ-45)
Port	:	4 x USB 3.0, 1 x DisplayPort
Chassis Form Factor	:	Micro
Power Supply	:	AC Adapter power supply unit
Operating System	:	Latest version (e.g. Microsoft or Linux)
Security Software	:	Anti-virus enterprise version
Accessories	:	English Keyboard, Optical Mouse, All-In One Mount or Stand (height adjustable) to be mounted behind monitor, etc.
Display Monitor	:	21.5 inch, Backlight LED, Full HD Resolution (1920 x 1080)
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 2 of 8


4.2.2 The Desktop Computer for standard office automation usage shall comply with the following minimum technical specifications: -

Processor	:	Intel processor or AMD with latest generation
Processor sockets (CPU)	:	Core i5 or Ryzen 5
Number of core	:	6
Core speed (base frequency):	:	2.0 GHz (min)
Memory	:	1 x 8 GB DDR4 at 2666 MHz
Memory DIMM slot	:	2 slots
Hard Drive	:	512 GB Solid State Drive
Network Interface Card	:	1000 Base-T (RJ-45)
Port	:	4 x USB 3.0, 1 x DisplayPort
Chassis Form Factor	:	Micro
Wireless	:	Integrated Intel Wi-Fi 6, dual band 802.11ax
Power Supply	:	AC Adapter power supply unit
Operating System	:	Latest version (e.g. Microsoft or Linux)
Accessories	:	English Keyboard, Optical Mouse, All-In-One Mount or Stand (height adjustable) to be mounted behind monitor, etc.
Display Monitor	:	21.5 inch, Backlight LED, Full HD Resolution (1920 x 1080)
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 3 of 8

4.2.3 The Desktop Workstation for high performance usage shall comply with the following minimum technical specifications: -


Processor	:	Intel Xeon processor with latest generation
Processor sockets (CPU)	:	Xeon W
Number of core	:	8
Core speed (base frequency):	:	3.4 GHz
Chipset	:	Intel W480
Memory	:	2 x 16 GB DDR4 at 2666 MHz with ECC
Memory DIMM slot	:	4 slots
Hard Drive	:	1TB Solid State Drive
Network Interface Card	:	1000 Base-T (RJ-45)
Graphic Card	:	8 GB NVidia Quadro RTX 4000
Port	:	4 x USB 3.0, 1 x DisplayPort
Chassis Form Factor	:	Full Tower
Power Supply	:	Energy Efficiency (80 plus gold rating)
Operating System	:	Latest version (e.g. Microsoft or Linux)
Accessories	:	Wired USB Keyboard (English), Optical Mouse, etc.
Display Monitor	:	27 inch, Backlight LED, QHD Resolution (2560 x 1440)
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 4 of 8

4.3 LAPTOP


4.3.1 The Laptop for standard office automation usage shall comply with the following minimum technical specifications: -

Processor	:	Intel or AMD processor with latest generation
Processor sockets (CPU)	:	Intel Core i5 or Ryzen 5
Number of core	:	4
Core speed (base frequency)	:	1.6 GHz
Boost speed	:	4.2 GHz
Cache per processor	:	6 MB
Memory	:	1 x 8 GB DDR4
DIMM slots	:	2 DIMM slots
Internal storage	:	512 GB Solid State Drive
Network Interface Card	:	Built-in RJ-45, Gigabit Ethernet
I/O ports	:	2 x USB 3.2 or latest generation ports, HDMI 1.4, Universal Audio Jack
Battery	:	Minimum 40 Whr with Fast Charge capability
Operating System	:	Latest version (e.g. Microsoft or Linux)
Adapter	:	AC Adapter
Keyboard	:	Backlit keyboard
Wireless	:	Integrated Intel Wi-Fi 6, dual band 802.11ax and Bluetooth 5.1
Display	:	14" HD (1366 x 768) Anti-glare Non-touch
Webcam	:	720p webcam with microphone
Weight	:	1.7 kg (maximum)
Accessories	:	Backpack, USB optical mouse etc.
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 5 of 8


4.3.2 The Laptop for managerial purposes usage shall comply with the following minimum technical specifications: -

Processor	:	Intel or AMD processor with latest generation
Form Factor	:	2-in-1 (convertible/ support tablet)
Processor sockets (CPU)	:	Intel Core i7 or Ryzen 7
Number of core	:	4
Core speed (base frequency)	:	1.8 GHz
Boost speed	:	4.9 GHz
Cache per processor	:	8 MB
Memory	:	1 x 16 GB LPDDR3 at 2133 MHz
Internal storage	:	512 GB Solid State Drive
Network Interface Card	:	USB-C to RJ-45 adapter
I/O ports	:	2 x USB 3.2 or latest generation ports, HDMI 1.4, Universal Audio Jack
Battery	:	Minimum 52 Whr with Long-life battery
Operating System	:	Latest version (e.g. Microsoft or Linux)
Adapter	:	USB Type-C Adapter
Keyboard	:	Backlit keyboard
Wireless	:	Integrated Intel Wi-Fi 6, dual band 802.11ax and Bluetooth 5.1
Display	:	14" FHD (1920 x 1080) Anti-glare with capacitive touch screen
Webcam	:	720p webcam with microphone
Sensor	:	Proximity sensor
Weight	:	1.4 kg (maximum)
Accessories	:	Backpack, Wireless optical mouse etc.
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 6 of 8

4.3.3 The Laptop for mobile workstation usage shall comply with the following minimum technical specifications: -

Processor	:	Intel or AMD processor with latest generation
Form Factor	:	Mobile Workstation
Processor sockets (CPU)	:	Intel Core i5 (45W H-series)
Number of core	:	4
Core speed (base frequency)	:	2.6 GHz
Boost speed	:	4.6 GHz
Cache per processor	:	8 MB
Memory	:	2 x 8 GB DDR4 2933MHz
DIMM slots	:	4 DIMM slots
Internal storage	:	512 GB Solid State Drive
Network Interface Card	:	Integrated RJ-45, Gigabit Ethernet
I/O ports	:	2 x USB 3.2 or latest generation ports, HDMI 1.4, Universal Audio Jack
Graphic card	:	6 GB NVIDIA Quadro RTX 3000
Battery	:	Minimum 95 Whr with Long-life battery
Operating System	:	Latest version (e.g. Microsoft or Linux)
Adapter	:	180W AC Adapter
Keyboard	:	Backlit keyboard
Wireless	:	Intel Dual Band AX201 2x2 c/w Bluetooth 5.1
Display	:	15" Ultra HD (3840x2160) resolution, Anti-glare, 100 Adobe gamut and support High Dynamic Range (HDR)
Display brightness	:	500 nits
Webcam	:	720p webcam with microphone
Accessories	:	Backpack, USB optical mouse etc
External Monitor	:	24" Medical Display Monitor with HDMI input
Mobile cart	:	Mobile cart to fit proposed mobile workstation and external monitor
UPS battery	:	UPS battery to support External monitor and mobile workstation
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 7 of 8


4.4 TELEPRESENCE SYSTEM

4.4.1 The Telepresence System consists of integrated multi-codec, multi-monitor, multi-microphone and multi-channel speaker systems. It shall be able to present interactive audio and video in real-time at different locations.

4.4.2 The Telepresence System shall comply with the following minimum technical specifications:

-

Display System	:	Full HD video monitor display (1920 x 1080) resolution Support HDMI interface
Camera	:	Full HD camera, (1920 x 1080) resolution Locked PTZ position set and fixed focus
Video Requirement	:	Comply with H.264 and H.239 standards 1080 p per codec at 2 Mbps 16 x 9 aspect ratio
Audio Requirement	:	Comply with AAC-LD and AAC-LC standards 2 x digital microphone array pods 50Hz – 20kHz frequency response
Network Requirement	:	1 GbE Base-T (RJ-45 port), support IPv4, IPv6 requirement and latest application platform (e.g. Microsoft Office Communications Server integration, Microsoft ICE, Skype, Meet, Zoom etc.)
User Interface	:	Web based management, SNMP
Security	:	Media Encryption (H.323, SIP), AES-128, AES-256, Authenticated access to admin menus, web interface and telnet API
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S4 - 8 of 8


4.5 MEDICAL DISPLAY MONITOR

4.5.1 The Medical Display Monitor with 5.0 megapixel (MP) shall comply with the following minimum technical specifications: -

Screen Technology	:	LCD, dual monitor
Active Screen Size	:	21.3" diagonal
Resolution	:	2100 x 2800 pixels
Viewing Image	:	Color/ Gray
Bit depth	:	30 bit
Viewing angle	:	178 ⁰
Ambient Light Compensation	:	Provided
Sensor	:	Front Sensor
DICOM calibrated luminance	:	600 cd/m ²
Video Input Signal	:	DisplayPort
Screen Protection	:	Protective, anti-reflective glass cover
EMI compliance	:	Comply with IEC 60601-1-2
Support	:	24x7 Next Business Day

4.5.2 The Medical Display Monitor with 3.0 megapixel (MP) shall comply with the following minimum technical specifications: -

Screen Technology	:	LCD, dual monitor
Active Screen Size	:	21.3" diagonal
Resolution	:	2048 x 1536 pixels
Viewing Image	:	Color/ Gray
Bit depth	:	30 bit
Viewing angle	:	178 ⁰
Ambient Light Compensation	:	Provided
Sensor	:	Front Sensor
DICOM calibrated luminance	:	500 cd/m ²
Video Input Signal	:	DisplayPort
Screen Protection	:	Protective, anti-reflective glass cover
EMI compliance	:	Comply with IEC 60601-1-2
Support	:	24x7 Next Business Day

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S5 - 1 of 3

5.0 EQUIPMENT RACK

5.1 DESCRIPTION

5.1.1 The Equipment Rack shall be of a standard nineteen inch (19") factory fabricated rack and shall be of the following types:-

5.1.1.1 Network Rack shall house the equipment such as switches, fibre optic patch panel, UTP patch panel, firewall and others, suitable for floor standing or wall mounted type of installation.

5.1.1.2 Server Rack shall house the servers equipment, storage and accessories, suitable for floor standing type of installation in the Server Room.


5.1.2 The network rack shall preferably be located at a centrally located room within 70 meters radius of serving working station area with 90 meters of maximum cable length.

5.1.3 The rack type Power Distribution Unit (PDU) shall be equipped with power supply indicator and on/off switch. The PDU shall comply with IEC 60320 latest edition.

5.1.4 All fibre optic, twisted pair and power cable incoming to the equipment rack shall be of top-entry. A minimum of two (2) meters slack cable shall be allowed to give movement tolerance to the equipment rack.

5.1.5 The floor standing equipment racks shall be equipped with horizontal, vertical and slack cable management accessories to eliminate cable stress, to maintain a neat and organised cable route within a rack.

5.1.6 Velcro tie shall be used to bundle or manage all cables in the equipment rack in order to make it tidy and neat. The velcro tie shall be of heavy-duty type, able to fasten and unfastened repeatedly and reusable.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S5 - 2 of 3

5.2 NETWORK RACK


5.2.1 The Network Rack shall be of stamped metal plate with black epoxy coating finishes.

5.2.2 The Network Rack in TCR shall be rated for 1000kg static load and shall comply with the following minimum technical specifications: -

Rack Unit	:	42 U
Width / Depth	:	800 mm / 1000 mm
Frame / Panel Thickness	:	2 mm / 1.5 mm
Front / Rear Door	:	Double-leaf, lockable and perforated door
Top Entry Cable Slot	:	2 slots with air sealing and cable grommet
Vertical Cable Management	:	4 angle side
Rack PDU	:	16A socket outlet type C13
Earthing	:	Earthing connection for 1 x 16 sq.mm PVC green earth wire
Accessories	:	Lockable castor wheel and heavy-duty adjustable levelling feet

5.2.3 The Network Rack in Server Room shall be rated for 1500kg static load and shall comply with the following minimum technical specifications: -

Rack Unit	:	42 U
Width / Depth	:	800 mm / 1000 mm
Frame / Panel Thickness	:	2 mm / 1.5 mm
Front / Rear Door	:	Double leaf, lockable and perforated door
Top Entry Cable Slot	:	2 slots with air sealing and cable grommet
Vertical Cable Management	:	4 angle side
Rack PDU	:	16A socket outlet type C13 and 32A 3-pin Commando Plug
Earthing	:	Earthing connection for 25 mm x 3 mm copper tape rack bonding conductor
Blank Panel	:	1U, 2U or 5U
Accessories	:	Lockable castor wheel and heavy-duty adjustable levelling feet

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S5 - 3 of 3

5.2.4 The Wall Mounted Network Rack shall comply with the following minimum technical specifications: -


Rack Unit	:	9U / 15 U
Width / Depth	:	600 mm / 800 mm
Frame / Panel Thickness	:	1.5 mm / 1.2 mm
Front Door	:	Single leaf, lockable and perforated door
Top Entry Cable Slot	:	2 slots with air sealing and cable grommet
Trailing Socket	:	3 nos 13A 3-pin switched socket outlet
Earthing	:	Earthing connection for 1 x 6 sq.mm PVC green earth wire
Accessories	:	Heavy duty wall mounted bracket

5.3 SERVER RACK

5.3.1 The Server Rack shall be of stamped metal plate with black epoxy coating finishes. It shall be ready made or recommended by the server manufacturer.

5.3.2 The Servers Rack shall be rated for 1500kg static load and shall comply with the following minimum technical specifications: -


Rack Unit	:	42 U
Width / Depth	:	600 mm or 800 mm / 1000 mm
Frame / Panel Thickness	:	2 mm / 1.5 mm
Front / Rear Door	:	Double leaf, lockable and perforated door
Top Entry Cable Slot	:	2 slots with air sealing and cable grommet
Rack PDU	:	C13 and C19 socket outlet 32A 3-pin commando plug
Earthing	:	Earthing connection for 1 x 16 sq.mm PVC green earth wire in MTCR or 25 mm x 3 mm copper tape in Server Room
Blank Panel	:	1U, 2U or 5U
Accessories	:	Lockable castor wheel and heavy-duty adjustable levelling feet
Monitoring accessories	:	Keyboard/Video/Mouse (KVM) console switch

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 1 of 11

6.0 FACILITIES FOR DATA CENTRE, SERVER ROOM AND TELECOMMUNICATION CLOSET ROOM (TCR)

6.1 DESCRIPTION

- 6.1.1 The equipment rack shall be housed in a designated room which is either Data Centre or Server Room or TCR. The rooms shall comply with ISO/IEC 11801-5, ANSI/TIA-569.E and ANSI/TIA 942 B.
- 6.1.2 Data Centre is designed to house a number of critical servers, storage and database with 24x7 days operation which is required to be monitored, controlled and no compromise with any error in data integrity, security, losses or power failure. The Data Centre shall have its dedicated support rooms or areas as follows: -
- 6.1.2.1 Server Room to house the ICT network infrastructure e.g. switches, server, storage etc.
 - 6.1.2.2 Mechanical & Electrical (M&E) rooms for equipment e.g. centralised UPS, switchboard, chiller distribution unit (CDU), firefighting cylinder, etc.
 - 6.1.2.3 Network Operation Center (NOC) or Command Center for IT supporting staffs.
 - 6.1.2.4 Staging Area for ICT equipment to be inspected, configured and tested to ensure deployment readiness.
 - 6.1.2.5 Media Storage Area e.g. documentation, hard disk drives, tape drives, compact disc etc.
- 6.1.3 Server Room is designed to house servers or storages with 24x7 days operation and no compromise with any error in data integrity, security, losses or power failure. It shall accommodate several units of equipment racks.
- 6.1.4 A Main Telecommunication Closet Room (MTCR) is designed to house core or distribution switches, non-critical server or storage and shall accommodate more than two (2) units of equipment racks.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 2 of 11

6.1.5 A Telecommunication Closet Room (TCR) is designed to house access switches and shall accommodate not more than two (2) units of equipment racks.

6.1.6 Facilities for all related rooms are as follows:

Room \ Facilities	UPS	PAC	FSS	WLD	SD	EMS
Data Centre	Centralised	✓	✓	✓	✓	✓
Server Room	Centralised	✓	✓	✓	✓	✓
Main TCR	Rack type	X	X	X	X	X
TCR	Rack type	X	X	X	X	X


✓ - Provided

X - Not Provided

Table 6.1 Type of Room and Its Facilities

UPS	-	Uninterruptible Power Supply
PAC	-	Precision Air-Conditioner
FSS	-	Fire Suppression System
WLD	-	Water Leak Detection System
SD	-	Early Warning Smoke Detection System
EMS	-	Environment Monitoring System

Note : For MTCR and TCR, the air-conditioning unit and portable fire suppression system shall be provided by the Mechanical Contractor.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 3 of 11

6.2 PRECISION AIR-CONDITIONER (PAC)

6.2.1 The precision air-conditioner (PAC) system shall be of rack based type, support hot and/or cold aisle containment system and shall be able to eliminate hot/cold air mixing in order to maximise cooling efficiency to the network equipment.

6.2.2 The PAC shall comply with the following minimum technical specifications: -

Performance	:	23°C ± 1 Rack inlet temperature comply with ASHRAE TC9.9
Type	:	Chilled Water or Air-Cooled type
Cooling Capacity	:	10kW to 50kW for each unit
Monitoring System	:	Built in monitoring and control system via TCP/IP

6.2.3 The Chilled Water type cooling system shall consist of the following components: -

6.2.3.1 In-row rack cooling unit complete with evaporators, chilled water piping (one length with no joint in between) come with closed-cell insulation, condensate pipe, 2-way valve, sockets, control system, overflow sensor, thermostat, cabling and control humidistat (if applicable).


6.2.3.2 The chilled water piping shall be installed in ring circuit method complete with tap off unit, isolation valve and required accessories.

6.2.4 The Air-Cooled type cooling system shall consist of the following components: -

6.2.4.1 In-row rack cooling unit complete with a set of refrigeration system, evaporators, copper piping complete with closed cell insulation, condensate pipe, valve, cable, control system and thermostat control.

6.2.4.2 The outdoor unit shall consist of condenser coil, copper piping complete with closed cell insulation, etc.

6.2.4.3 The compressor shall be variable speed or inverter type complete with rotalock valve for easy maintenance.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 4 of 11

6.2.5 IN-ROW RACK COOLING UNIT

6.2.5.1 The In-row rack cooling unit shall be of 42U height with horizontally air discharge patterns. The nominal input voltage shall be of 220-240V, 50Hz system.

6.2.5.2 The In-row rack cooling unit shall come with redundancy configuration and controllable temperature.

6.2.5.3 The In-row rack cooling unit shall be able to achieve rack inlet temperature at 0.1°C tolerance.

6.2.5.4 The fan shall be electronically commutated (EC) motor with variable speed and automatically regulated by microprocessor based controller through all modes of operation. The fan shall be of modular and hot swappable type.

6.2.5.5 The In-row rack cooling unit shall be integrated with air filtering system to reduce the concentration of dust. The filter shall be greater than 20% efficiency comply with ASHRAE 52.1 and ASHRAE 52.2.

6.2.5.6 The proposed solution by the contractor shall be of fully contain in-row system complete with power management unit, touch screen panel to monitor the system status, power usage effectiveness (PUE), etc.


6.2.5.7 The In-row rack cooling unit shall be able to send information status and integrate with EMS server through TCP/IP or SNMP protocol.

6.3 UNINTERRUPTIBLE POWER SUPPLY (UPS)

6.3.1 The Uninterruptible Power Supply (UPS) shall be of modular and scalable type.


6.3.2 For Data Centre or Server Room, the UPS power module and battery shall be of rack based and hot swappable type. The power modules shall have high availability or redundancy configuration (i.e. N+1) and the battery modules shall be provided with not less than thirty (30) minutes backup time.

6.3.3 The UPS shall be able to send information status and integrate with EMS server through TCP/IP or SNMP protocol.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 5 of 11

6.4 EARLY WARNING SMOKE DETECTION SYSTEM

- 6.4.1 The system shall consist of highly sensitive laser based smoke detector using aspirated air sampling connected to sampling pipes. The type of sampling pipes shall be copper.
- 6.4.2 The system shall be provided with a single or dual sample inlets with separate chamber for each inlet, internal thermal sensor flow monitoring, smoke detection and exhaust pipes.
- 6.4.3 The system shall comply with EN 54-20 and Jabatan Bomba dan Penyelamat Malaysia requirements. It shall have alarm level outputs as follows: -
- 6.4.3.1 A Pre-Signal Alarm shall activate the visual and audible alarm in the fire risk area.
 - 6.4.3.2 An Alarm Signal shall send signal to the EMS server through TCP/IP or SNMP protocol.
- 6.4.4 The system shall indicate the condition of the smoke sensors either dusty or dirty.
- 6.4.5 The system's detector, filter, aspirator and relay outputs shall be housed in an enclosure and shall be arranged in such a way that air is drawn from the fire risk area. The air sample is passed through an external filter and detector.
- 6.4.6 The system's detector shall be of laser based type and shall have an obscuration sensitivity range of 0.025 – 20% obscuration per metre.
- 6.4.7 The sampling pipe shall comply with latest BS 6266, smooth bore type with an internal diameter range between 19 to 21 mm. All joints in the sampling pipes shall be air tight using solvent cement.


	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 6 of 11

6.5 FIRE SUPPRESSION SYSTEM

- 6.5.1 The Fire Suppression System shall comply with NFPA and ISO 14520 on Clean Agent Fire Extinguishing System with zero ozone depleting and low global warming nitrogen inert gas system.
- 6.5.2 The clean agent gas shall electrically non-conduct in both the liquid and gaseous state. It shall be of equipment and human safe, leave no residue, colourless and odourless liquefied compressed gas type which is suitable to be used in the Data Centre or Server Room.
- 6.5.3 The fire suppression system shall able to send information status and integrate with EMS server through TCP/IP or SNMP protocol.


6.6 WATER LEAK DETECTION SYSTEM

- 6.6.1 The Water Leak Detection System shall consist of control panel, sensing cable and graphic monitoring display panel. The system shall simultaneously detect the presence of water at any point along the sensing cable and trigger the alarm system control panel.
- 6.6.2 The control panel shall capable of monitoring up to accumulated length of 150 metre. The precision distance to locate the leak location shall be less than 1 metre. The storage capacity shall support minimum of 800 time-stamped events which stored in non-volatile memory and in First-In-First-Out order.
- 6.6.3 The sound of alarm system e.g. buzzer shall be not more than 90 dB and equipped with silence button.
- 6.6.4 The sensing cable shall be able to detect the presence of water and any other conductive liquids. The cable shall consists of two or four wire served as liquid sensing and continuity wire. The cable shall made of non-flame propagating and self-extinguishing material.
- 6.6.5 The water leak detection system shall able to send information status and integrate with EMS server through TCP/IP or SNMP protocol.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 7 of 11

6.7 ENVIRONMENT MONITORING SYSTEM (EMS)

- 6.7.1 The Environment Monitoring System (EMS) shall be able to provide comprehensive management and monitoring of power, cooling, security and energy consumption in Data Centre or Server Room.
- 6.7.2 The EMS hardware and software shall comply with the following minimum technical specifications: -
- 6.7.2.1 Real-time monitoring, instant fault notification and accessible by multiple authorised users from anywhere on the network.
 - 6.7.2.2 Support multi-vendor environment for monitoring any devices from any manufacturer through TCP/IP or SNMP protocol.
 - 6.7.2.3 Integrate with building management system for information on the security, electrical and mechanical system in the Data Centre or Server Room.
 - 6.7.2.4 Graphical and custom reporting for ease of data collection, distribution and analysis. Centralised repository for ease of access to the historical alerts or data through one central database.
 - 6.7.2.5 User-friendly interface using any web browser and shall be able to send notification or alert signal via SMS e.g. WhatsApp or email.
 - 6.7.2.6 Provided with dual power supply, latest version of operating system, 2 GHz AMD/Intel processor, Full HD screen resolution and 1 TB data storage.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 8 of 11

6.8 TELECOMMUNICATION EARTHING SYSTEM


6.8.1 The telecommunication earthing system shall comply with basic safety requirements in accordance to IEC 30129, IEC 60364 and ANSI/TIA 607-C standards.

6.8.2 The generic telecommunication earthing infrastructure shall originate at the electrical main earthing bar and extended throughout the building. The infrastructure shall consists of the following components as shown in Figure 6.1: -

- 6.8.2.1 Primary Bonding Bar (PBB)
- 6.8.2.2 Secondary Bonding Bar (SBB)
- 6.8.2.3 Telecommunication Bonding Conductor (TBC)
- 6.8.2.4 Telecommunication Bonding Backbone (TBB)
- 6.8.2.5 Backbone Bonding Conductor (BBC)
- 6.8.2.6 Rack Bonding Conductor (RBC)
- 6.8.2.7 Rack Bonding Terminal (RBT)

6.8.3 The Primary Bonding Bar (PBB) shall be used as a connection point of telecommunication earthing infrastructure to the electrical main earthing bar and as a final attachment point for the SBB(s). The PBB shall comply with the following minimum technical specifications: -

Dimension	:	50 mm width x 6 mm thickness x 300 mm length
Material	:	Tinned Copper
Accessories	:	Bar mounted on porcelain insulator and provided with bolts, nuts, spring washer and jam nuts for copper tape connection.
Type	:	Ready made 6 way with M6 bolts and nuts
Location	:	SDF Room/MTCR/TCR

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020
		Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 9 of 11

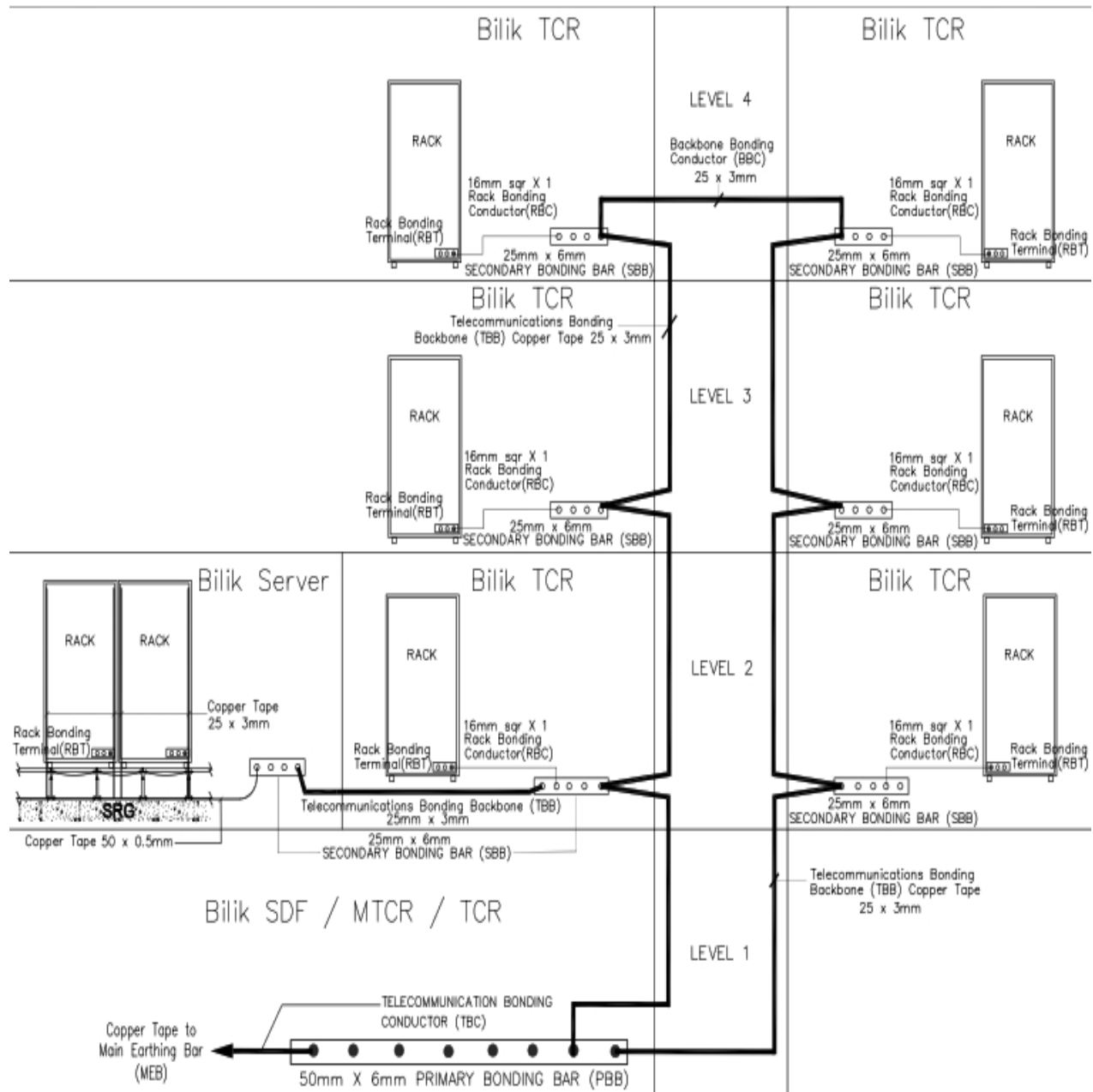



Figure 6.1: Illustrative diagram of Telecommunication Earthing System

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 10 of 11

6.8.4 The Secondary Bonding Bar (SBB) shall be used as a connection point for telecommunication equipment e.g. equipment rack, telephone vertical frame or DP, etc. The SBB shall comply with the following minimum technical specifications: -

Dimension	:	25 mm width x 6 mm thickness x 300 mm length
Material	:	Tinned Copper
Accessories	:	Bar mounted on porcelain insulator and provided with bolts, nuts, spring washer and jam nuts for copper tape connection.
Type	:	Ready made 6 way with M6 bolts and nuts
Location	:	MTCR, TCR or Server Room

6.8.5 The Telecommunication Bonding Conductor (TBC) of 25mm x 3mm copper tape shall connect the PBB to the electrical main earthing bar.

6.8.6 The Telecommunication Bonding Backbone (TBB) of 25mm x 3mm copper tape shall connect all SBBs with the PBB.


6.8.7 Whenever two or more TBBs are used within a multi-storey building, the TBBs shall be bounded together with a Backbone Bonding Conductor (BBC) at the top floor. The size of BBC is 25mm x 3mm copper tape.

6.8.8 The Rack Bonding Terminal (RBT) shall be installed in each Equipment Rack. The Rack Bonding Conductor (RBC) shall connect the RBT to the SBB. The size of RBC shall be a minimum of 6 sq.mm PVC green earth wire for wall mounted rack, 16 sq.mm PVC green earth wire for 42U rack in TCR or MTCR and 25mm x 3mm copper tape for 42U rack in Server Room or Data Centre.

6.9 SIGNAL REFERENCE GRID (SRG)

6.9.1 For Data Centre, a reliable signal reference shall be provided by an SRG dedicated at least to a functional unit or a system block i.e. SRG for Raised Flooring System. The SRG shall address the discharge of electrostatic energy as stated in ISO/IEC 14763-2.

6.9.2 The SRG shall be constructed using mesh bonding network of prefabricated copper strips as shown in figure 6.2. The size of copper strips shall be a minimum of 50mm width x 0.5mm thickness. All crossings and jointed sections shall employ exothermic welding.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S6 - 11 of 11

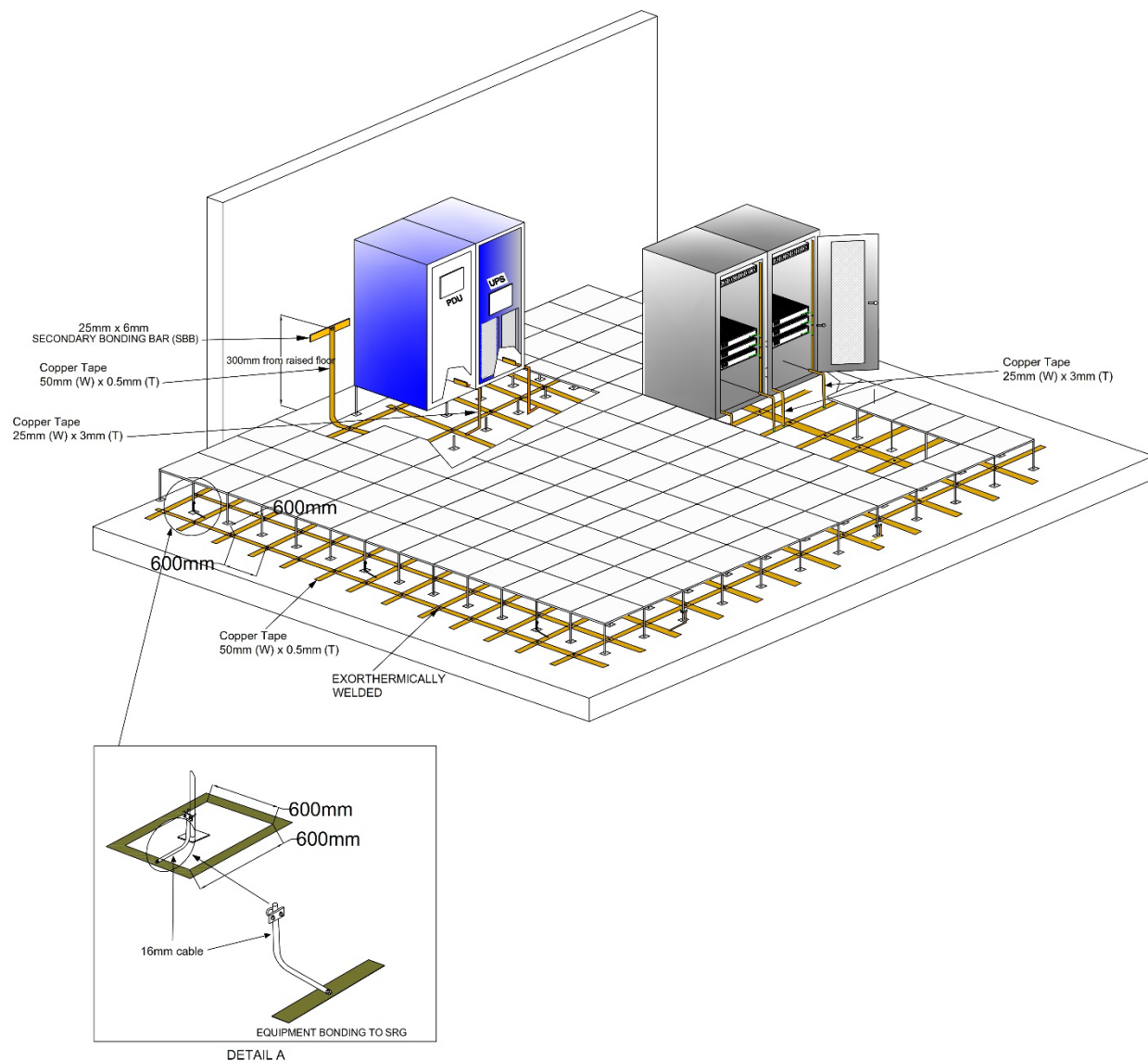



Figure 6.2: Typical Installation of SRG

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 1 of 14

7.0 SYSTEM OF CABLING

7.1 STRUCTURED CABLING SYSTEM

7.1.1 The structured cabling system shall consists of a combination of the following components:

7.1.1.1 Backbone cabling

7.1.1.2 Horizontal cabling


7.1.2 The external backbone cabling shall be of an interconnection between one equipment rack in Telecommunication Closet Room (TCR) to another in different buildings within the same campus network. The internal backbone cabling shall be of an interconnection between one equipment rack to another in the same building which can be in different or in the same floor. Singlemode or multimode fibre optic cable shall be used for the backbone cabling. The minimum bending radius for backbone cables shall be ten (10) times the overall cable diameter.

7.1.3 The horizontal cabling shall be of a cabling from patch panel in the equipment rack to the individual RJ45 faceplate using unshielded twisted pair (UTP) cable. For area where the horizontal cabling routed with high radiation or source of electromagnetic field (EMF) e.g. X-ray or MRI machine and operating theater, shielded twisted pair (STP) cable shall be used. The minimum bending radius for horizontal cables shall be four (4) times the overall cable diameter. The horizontal cable for PoE application shall be bundled up to a maximum of 24 cables per bundle.

7.1.4 The structured cabling system shall be able to support signal transmission for data, voice and video application. No cable jointing shall be allowed for the structured cabling system installation.

7.1.5 The internal backbone cabling and horizontal cabling shall be installed in separate trunking. They shall be routed parallel to the building wall and column, and shall be coordinated with other services.

7.1.6 The system shall be installed in accordance to the latest ANSI/TIA 568-D, ISO/IEC 11801 standard and manufacturer's cable installation guideline for 25 years product and

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 2 of 14

application warranty. All components shall be from single brand manufacturer and comply with end to end solutions requirement.


7.2 TYPES OF CABLES AND ACCESSORIES

7.2.1 The types of cables for backbone cabling shall be of the following type and complete with its accessories: -

- 7.2.1.1 Outdoor Singlemode Fibre Optic Cable
- 7.2.1.2 Indoor Singlemode Fibre Optic Cable
- 7.2.1.3 Singlemode Pigtail, Adapter and Patch Cord
- 7.2.1.4 Outdoor Multimode Fibre Optic Cable
- 7.2.1.5 Indoor Multimode Fibre Optic Cable
- 7.2.1.6 Multimode Pigtail, Adapter and Patch Cord
- 7.2.1.7 Fibre Optic Cable Splicing Cassette
- 7.2.1.8 Fibre Optic Patch Panel

7.2.2 The types of cables for horizontal cabling shall be of the following type and complete with its accessories: -


- 7.2.2.1 Unshielded Twisted Pair (UTP) Copper Cable
- 7.2.2.2 Shielded Twisted Pair (STP) Copper Cable
- 7.2.2.3 RJ-45 Modular Jack
- 7.2.2.4 RJ-45 Patch Panel
- 7.2.2.5 RJ-45 Patch Cord
- 7.2.3.6 Modular Plug Terminated Link (MPTL)
- 7.2.3.7 Faceplate

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 3 of 14

7.3 SINGLEMODE FIBRE OPTIC CABLE

7.3.1 Outdoor Singlemode Fibre Optic Cable shall comply with ANSI/TIA-568.3-D, ISO/IEC 11801-1, ANSI/ICEA S-87-640 and the following minimum technical specifications: -

Number of core	:	6 core
Fibre Class	:	Optical Singlemode 2 (OS 2) type
Core/Cladding diameter	:	$\leq 9 \mu\text{m} / 125 \mu\text{m}$
Cable Type	:	Loose Tube
Jacket Material	:	Polyethylene (PE)
Armour type	:	Corrugated Steel Armoured
Maximum attenuation	:	0.30 dB/km at 1550 nm 0.40 dB/km at 1310 nm
10 Gbps Ethernet distance	:	10 km at 1310 nm wavelength
10 GbE cable distance	:	Support up to 10km distance with less than 6.2 dB total insertion loss with maximum of 2 connections
25 GbE cable distance	:	Support up to 10km distance with less than 6.7 dB total insertion loss with maximum of 2 connections
40 GbE cable distance	:	Support up to 10km distance with less than 6.7 dB total insertion loss with maximum of 2 connections
100 GbE cable distance	:	Support up to 10km distance with less than 6.3 dB total insertion loss with maximum of 2 connections


	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 4 of 14

7.3.2 Indoor Singlemode Fibre Optic Cable shall comply with ANSI/TIA-568.3-D, ISO/IEC 11801-1. The method of flame test shall comply to IEC 60332-3, IEC 60754-2 and IEC 61034-2. It shall also comply to the following minimum technical specifications: -

Number of Core	:	6 core
Fibre Class	:	OS 2 type
Core/Cladding diameter	:	$\leq 9 \mu\text{m} / 125 \mu\text{m}$
Cable Type	:	Tight Buffer
Jacket Material	:	Low Smoke Zero Halogen (LSZH)
Maximum attenuation	:	0.50 dB/km at 1550 nm 0.50 dB/km at 1310 nm
10 Gbps Ethernet distance	:	10 km at 1310 nm wavelength
10 GbE cable distance	:	Support up to 10km distance with less than 6.2 dB total insertion loss with maximum of 2 connections
25 GbE cable distance	:	Support up to 10km distance with less than 6.7 dB total insertion loss with maximum of 2 connections
40 GbE cable distance	:	Support up to 10km distance with less than 6.7 dB total insertion loss with maximum of 2 connections
100 GbE cable distance	:	Support up to 10km distance with less than 6.3 dB total insertion loss with maximum of 2 connections

7.3.3 Singlemode Pigtail shall comply with ANSI/TIA-568.3-D and the following minimum technical specifications: -


Fibre Class	:	OS 2 type
Core/Cladding diameter	:	$\leq 9 \mu\text{m} / 125 \mu\text{m}$
Connector Type	:	LC
Jacket Material	:	Low Smoke Zero Halogen (LSZH) or PVC

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 5 of 14

7.4 MULTIMODE FIBRE OPTIC CABLE


7.4.1 Outdoor Multimode Fibre Optic Cable shall comply with ANSI/TIA-568.3-D, ISO/IEC 11801-1, ANSI/ICEA S-87-640 and the following minimum technical specifications: -

Number of Core	:	6 core
Fibre Class	:	Optical Multimode OM4 or OM5
Core/Cladding diameter	:	50 µm / 125 µm
Cable Type	:	Loose Tube
Jacket Material	:	Polyethylene (PE)
Armour type	:	Corrugated Steel Armoured
Maximum attenuation	:	3.00 dB/km at 850 nm 1.5 dB/km at 1300 nm (OM4) 1.5 dB/km at 1300 nm (OM5)
10 GbE cable distance	:	Support up to 500m distance at 850nm with less than 2.9 dB total insertion loss with maximum of 2 connections
25 GbE cable distance	:	Support up to 130m distance at 850nm with less than 1.3 dB total insertion loss with maximum of 2 connections
40 GbE cable distance	:	Support up to 150m distance at 850nm with less than 1.5 dB total insertion loss with maximum of 2 connections
100 GbE cable distance	:	Support up to 150m distance at 850nm with less than 1.5 dB total insertion loss with maximum of 2 connections

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 6 of 14

7.4.2 Indoor Multimode Fibre Optic Cable shall comply with ANSI/TIA-568.3-D and ISO/IEC 11801-1. The method of flame test shall comply to IEC 60332-3, IEC 60754-2 and IEC 61034-2. It shall also comply to the following minimum technical specifications: -

Number of Core	:	6 core
Fibre Class	:	Optical Multimode OM4 or OM5
Core/Cladding diameter	:	50 µm / 125 µm
Cable Type	:	Tight Buffer
Jacket Material	:	Low Smoke Zero Halogen (LSZH)
Maximum attenuation	:	3.00 dB/km at 850 nm 1.5 dB/km at 1300 nm (OM4) 1.5 dB/km at 1300 nm (OM5)
10 GbE cable distance	:	Support up to 500m distance at 850nm with less than 2.9 dB total insertion loss with maximum of 2 connections
25 GbE cable distance	:	Support up to 130m distance at 850nm with less than 1.3 dB total insertion loss with maximum of 2 connections
40 GbE cable distance	:	Support up to 150m distance at 850nm with less than 1.5 dB total insertion loss with maximum of 2 connections
100 GbE cable distance	:	Support up to 150m distance at 850nm with less than 1.5 dB total insertion loss with maximum of 2 connections

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 7 of 14

7.4.3 Multimode Pigtail shall comply with ANSI/TIA-568.3-D and the following minimum technical specifications: -

Fibre Class	:	Optical Multimode OM4 or OM5
Core/Cladding diameter	:	50 µm / 125 µm
Connector Type	:	LC
Jacket Material	:	Low Smoke Zero Halogen (LSZH) or PVC


7.5 FIBRE OPTIC CABLE ACCESSORIES

7.5.1 Adapter shall comply with ANSI/TIA-568.3-D and the following minimum technical specifications: -

Connector Type	:	LC duplex
Fibre Type	:	Multimode or Singlemode
Colour	:	Shall be colour coded or marked as specified in ANSI/ TIA 598 :
		OM4 - Aqua/ Violet
		OM5 - Lime Green
		OS2 - Blue
Fastening Method	:	End cap snap-in
Sleeve Material	:	Ceramic

7.5.2 Fibre Optic Patch Cord shall comply with ANSI/TIA-568.3-D and the following minimum technical specifications: -

Connector Type	:	LC duplex and shall be factory terminated
Fibre Type	:	Multimode or Singlemode
Cable Type	:	Tight Buffer
Colour	:	Shall be colour coded or marked as specified in ANSI/ TIA 598 :
		OM4 - Aqua/ Violet
		OM5 - Lime Green
		OS2 - Blue
Connector Material	:	Ceramic


	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 8 of 14

7.5.3 Fibre optic cable splicing cassette shall be of 19" rack mounted type and consists of rear cable management to support the incoming cable. The maximum port of the patch panel shall be 48 duplex ports, 1U types, shall comply with ANSI/TIA-568.3-D and the following minimum technical specifications: -

Adapter Type	:	LC duplex with internal shutters
Fibre Type	:	Multimode or Singlemode
Fibre Ports	:	3 duplex ports
Fibre Panel Type	:	Accept four slot modular cassettes
Splice tray	:	Built-in/modular splice tray in cassette.

7.5.4 Fibre Optic Patch Panel shall comply with ANSI/TIA-568.3-D and the following minimum technical specifications: -

Fibre Patch Panel Type	:	Accept four slot modular cassettes
Panel Movement	:	Modular sliding trays.
Fibre Ports	:	Up to 48 duplex ports per RU
Splice tray	:	Built-in/modular splice tray in cassette.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 9 of 14

7.6 TWISTED PAIR COPPER CABLE

- 7.6.1 Unshielded Twisted Pair (UTP) Cable shall comply with ISO/IEC 11801, ANSI/TIA 568.2-D and IEEE 802.3 af/at/bt. The method of flame test shall comply to IEC 60332-3, IEC 60754-2 and IEC 61034-2. It shall also comply to the following minimum technical specifications: -


Conductor	:	4 pairs
Cable category	:	Cat. 6A
Conductor Size	:	23 AWG solid bare copper
Shielding	:	Unshielded U/UTP
Jacket Material	:	Low Smoke Zero Halogen (LSZH)
Frequency	:	500 MHz over 90m distance
Power Over Ethernet (PoE)	:	PoE++
Application	:	10GBase-T

- 7.6.2 Shielded Twisted Pair (STP) Cable shall comply with ISO/IEC 11801, ANSI/TIA 568.2-D and IEEE 802.3 af/at/bt. The method of flame test shall comply to IEC 60332-3, IEC 60754-2 and IEC 61034-2. It shall also comply to the following minimum technical specifications: -

Conductor	:	4 pairs
Cable category	:	Cat. 6A
Conductor Size	:	23 AWG solid bare copper
Shielding	:	Shielded F/UTP or U/FTP
Jacket Material	:	Low Smoke Zero Halogen (LSZH)
Frequency	:	500 MHz over 90m distance
Power Over Ethernet (PoE)	:	PoE++
Application	:	10GBase-T

7.7 RJ45 MODULAR JACK

- 7.7.1 The RJ45 modular jack shall comply with IEC 60603-7, ISO/IEC 11801 and ANSI/TIA 568.2-D standards, with 8 termination poles or 4 pair insulation displacement connection for 23 AWG. It shall be angle mounted in faceplate and support T568B cabling termination.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 10 of 14

7.7.2 For Power over Ethernet (PoE) applications, the modular jack shall comply with latest IEEE 802.3 af/at/bt and IEC 60512 standards.

7.7.3 The modular jack contact shall be of gold plated and comply with IEC 60603-7 and ANSI/TIA-1096-A standards. It also shall be rated for minimum of 750 mating cycles.

7.8 RJ45 PATCH PANEL

7.8.1 The patch panel shall be of 19" rack mounted type and consists of rear cable management to support and provide proper bending radius for the twisted pair cable. The maximum port of the patch panel shall be of twenty-four (24) 1U type.

7.8.2 For shielded patch panel, a minimum of one-hole lug using 6 sq.mm PVC green earth cable shall be provided for connections to the rack earthing system.

7.9 RJ45 PATCH CORD


7.9.1 The patch cord at patch panel or workstation/faceplate shall be a maximum of 5 meters length. The patch cord shall be of the same category Cat 6A with the horizontal twisted pair cable.

7.9.2 The patch cord shall be factory terminated, tested and comply with ISO/IEC 11801 and ANSI/TIA 568.2-D standard. It shall also comply with latest IEEE 802.3 af/at/bt standard for Power over Ethernet (PoE) applications.

7.9.3 The patch cord jacket shall be of LSZH. The plug contact shall be of gold plated and comply with IEC 60603-7 and ANSI/TIA-1096-A Standard. It also shall be rated for a minimum of 750 mating cycles.

7.9.4 The minimum bending radius for the patch cord shall be two (2) times of the overall cable diameter.

7.9.5 For identification purposes, the colour code for patch cord or tagging for different system or services shall be as shown in Table 7.1.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 11 of 14

System/ Services	Colour for Patch Cord or Tagging
Data (e.g. Network, Wi-Fi)	Blue
Voice (e.g. IP Telephony, Fax)	Green
ELV (e.g. IP CCTV, IP Door Access)	White

Table 7.1. Colour Code for Patch Cord or Tagging for different System/ Services

7.10 MODULAR PLUG TERMINATED LINK (MPTL)

7.10.1 The modular plug terminated link shall comply with ANSI/TIA-568.2-D, ISO/IEC 11801, IEEE 802.3 af/at/bt standards and the following minimum technical specifications: -


Connector type	:	RJ45
Cable category	:	Cat. 6A
Frequency	:	500 MHz
Power Over Ethernet (PoE)	:	PoE++
Application	:	10GBase-T

7.10.2 The connector shall be securely mounted to provide connection to the Wi-Fi access points or security IP cameras.

7.11 FACEPLATE

7.11.1 The faceplate material shall be from high-impact type, flame retardant, thermoplastic and UV resistant.

7.11.2 The faceplate shall be flush mounted type, support angle mounting and complete with shutter. The size shall be of 86 mm x 86 mm with a maximum number of two (2) port.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 12 of 14

7.11.3 The labelling area shall be large enough, covered with flip down or snap-in place on the top edge of the faceplate and allow labels to be easily viewed and installed. Manufacturer Brand name of the structured cabling system shall be embossed at the front of the faceplate.

7.11.4 For concealed installation, metalclad type back boxes shall be of galvanized sheet steel.

7.12 MULTI-USER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

7.12.1 The MUTOA shall be used for frequent changes in office layout. The MUTOA shall allow the horizontal cable to remain undisturbed while allowing office to do rearrangements. All workstation equipment shall be connected directly to the MUTOA using patch cord. It shall be from single brand manufacturer which support end to end solution.


7.12.2 It shall be located in an area where each furniture cluster is served by at least one (1) unit of MUTOA.

7.12.3 Each MUTOA shall serve a maximum of twelve (12) workstations. It shall be attached to a permanent part of the building and shall not be located in the ceiling or furniture, unless if part of the furniture is permanently affixed to the building.

7.13 CABLING IN CONDUIT, TRUNKING, CABLE TRAY AND CABLE LADDER (SURFACED/ CONCEALED/ SUSPENDED)

7.13.1 General system of cabling/ wiring in conduits, trunking, cable tray or cable ladder etc. shall be referred to the latest JKR Specification for Low Voltage Internal Electrical Installation (L-S1).

7.13.2 For horizontal cabling concealed in conduit, the conduits and fittings shall be of rigid high impact PVC grade Heavy Duty Code No 4421 and shall be under Product Specification Scheme. Cables above false ceiling shall run in conduit or trunking. Trunking shall be fabricated from electrogalvanised steel finished with epoxy oven baked powder coated or hot dipped galvanised steel. Other materials, components specification and method of installation shall be referred to the latest JKR Specification for Low Voltage Internal Electrical Installation (L-S1).

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 13 of 14

7.13.3 For backbone cabling in trunking, cable tray and cable ladder, they shall be referred to the latest JKR Specification for Low Voltage Internal Electrical Installation (L-S1).

7.13.4 All cabling shall be run neatly and in an orderly manner. They shall be routed parallel to building wall, column lines in a coordinated manner with other services and shall be arranged above the mechanical services and pipelines. Wherever the conduit, trunking, cable tray or cable ladder passes through a floor or a fire-resistant wall, fire resisting barrier shall be provided with non-hygroscopic fire resisting material of minimum two (2) hours fire rated and approved by Jabatan Bomba Dan Penyelamat Malaysia.

7.14 CABLING IN CABLE BASKET AND FIBRE RACEWAY


7.14.1 All horizontal and backbone cabling inside the MTCR or TCR and routing inside the Server Room or Data Centre, they shall be laid on cable basket and/or fibre raceway. Wherever the cable basket and fibre raceway connected to the trunking, cable tray or cable ladder on the fire-resistant wall, fire resisting barrier shall be provided with non-hygroscopic fire resisting material of minimum 2-hour fire rated and approved by Jabatan Bomba Dan Penyelamat Malaysia.

7.14.2 The cable basket and its fittings shall comply with MS IEC 61537 and the material shall be of stainless steel wire rod with 316 graded.

7.14.3 The fibre raceway and its fittings shall be of PVC type, self-extinguishing and halogen free material.

7.14.4 The cable basket and fibre raceway shall be supported by fixing brackets and hence they shall not be in contact with the walls or soffit slabs. The brackets shall be installed at intervals not greater than 1000 mm.

7.14.5 All cables running on the cable basket shall be bundled up securely using velcro cable tie at interval not more than 600 mm apart.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S7 - 14 of 14

7.15 CABLING IN UNDERGROUND DUCTING AND MANHOLE

7.15.1 All backbone cabling laid in underground ducting and manhole, they shall be referred to the latest JKR Specification for Telephone System (L-S16).

7.16 CONDUITS AND TRUNKING SPACE FACTOR

7.16.1 The number of cables drawn into the conduit or laid in trunking shall be such that the ratio of the sum of the overall cross-sectional areas of the cables (including insulation and any sheath) to the internal cross-sectional area of the conduit or trunking in which they are installed shall not exceed 40% for conduit and 45% for trunking respectively.

7.17 IDENTIFICATION OF SERVICES


7.17.1 The basic colour for the identification of ICT conduit, trunking and their cover shall follow the colour coding as specified in the latest JKR Specification for Low Voltage Internal Electrical Installation (L-S1).

7.18 MOUNTING HEIGHTS

7.18.1 Mounting heights listed below shall be measured from the underside of the fitting to the finished floor level. The heights of fitting shall be as shown in Table 7.2 below: -

Type of Fitting	Mounting Height (mm)
Wall mounted Equipment Rack	1450
Wall mounted Wi-Fi AP	300 below ceiling level
Network point	400

Table 7.2. Mounting Heights

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S8 - 1 of 6

8.0 LABELLING

8.1 DESCRIPTION

- 8.1.1 The labels shall be fitted on the outside of all equipment rack, network equipment, patch panels, patch cords, faceplates, Server Room or Data Centre facilities etc.
- 8.1.2 The labels shall allow easy identification of the equipment, heavy duty types, made of durable printed sticker and shall be able to securely stick or tied to the equipment.

8.2 EQUIPMENT RACK LABELLING

- 8.2.1 The equipment rack shall be named and labelled according to a specific labelling convention which allow easy identification of the equipment including type and location as shown in Figure 8.1.
- 8.2.2 The equipment rack labelling convention is as follows:-

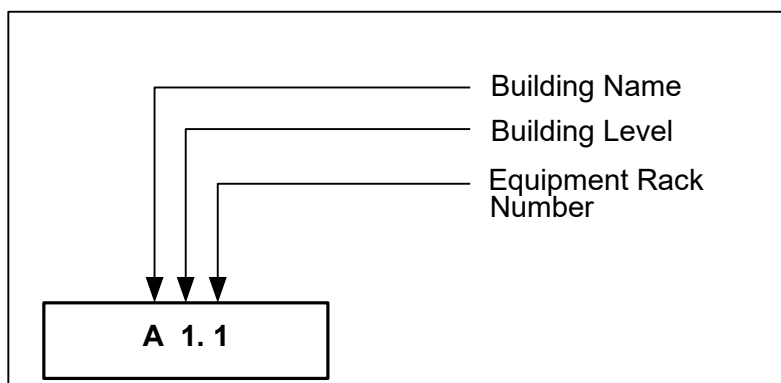



Figure 8.1. Labelling Convention for Equipment Rack

Where,

- “A” is building name e.g. Blok A.
- “1” is building level e.g. Level 1.
- “1” is equipment rack number on that particular floor e.g. Equipment Rack Number 1.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S8 - 2 of 6

8.3 NETWORK SWITCHES, UPS AND OTHER EQUIPMENT LABELLING

8.3.1 The network switches, UPS and other equipment shall be named and labelled according to the specific labelling convention which allow easy identification of the equipment including type and location as shown in Figure 8.2.

8.3.2 The switches, UPS and other equipment labelling convention is as follows:

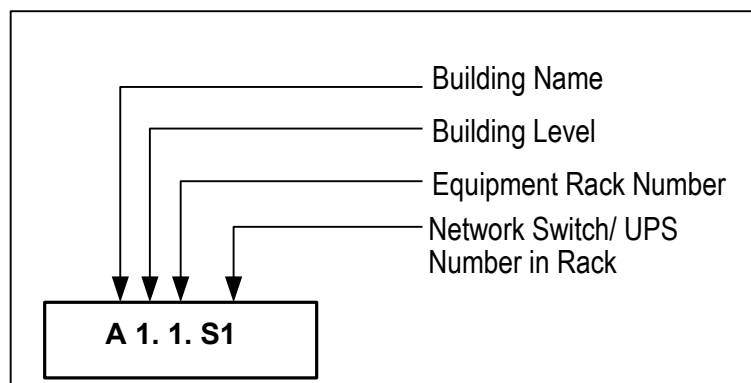



Figure 8.2: Labelling Convention For Switches and UPS

Where,

- “A” is building name e.g. Blok A.
- “1” is building level e.g. Level 1.
- “1” is equipment rack number on that particular floor e.g. Equipment Rack Number 1.
- “S1” is the 1st Network Switch in that particular equipment rack e.g. Network Switch Number 1.
- “UPS1” is the 1st UPS in that particular equipment rack e.g. UPS Number 1.
- Other equipment labelling shall be decided on site with S.O. or S.O.’s Representative approval.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S8 - 3 of 6

8.4 FIBRE PATCH PANEL AND FIBRE PATCH CORD LABELLING

- 8.4.1 The fibre patch panel and patch cord shall be named and labelled according to the specific labelling convention which allow easy identification of the equipment including type and location as shown in Figure 8.3
- 8.4.2 The fibre patch panel top part of the ports shall be labelled with the Building Level, Equipment Rack Number where the fibre cable originates from and shall be labelled in pair. For example: if the fibre cable on port 1-2 and 3-4 originates from Block A, TCR Level 1, Equipment Rack Number 1 then the top part shall be labelled "A1.1".
- 8.4.3 The bottom part of the ports on the fibre patch panel in the same rack shall be labelled continuously, in sequence. For example: For Fibre Patch Panel #1 shall have alphabet 'A' and has core pair numbers from 1, 2 and so on, then Fibre Patch Panel #2 shall have alphabet 'B' and has core pair numbers 1, 2 and so on.

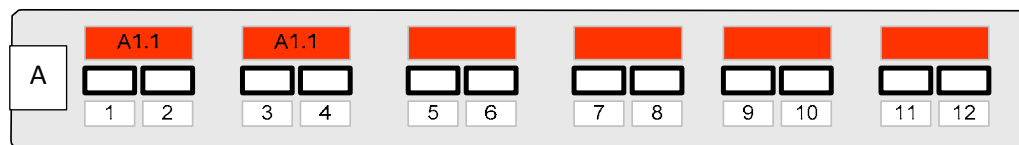



Figure 8.3: Labelling Convention For Fibre Patch Panel

- 8.4.4 The fibre patch cord in the same rack shall be labelled at both end with the same labelling of port it is connected. For example: If fibre patch cord on Fibre Patch Panel #1 is connected to port A1.1.34, then fibre patch cord shall be labelled as A1.1.34 at both end and so forth. Label holder shall be made of durable plastic and shall be securely tied to the fibre patch cord.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S8 - 4 of 6

8.5 UTP PATCH PANEL AND UTP PATCH CORD LABELLING

- 8.5.1 The UTP patch panel and patch cord shall be named and labelled according to the specific labelling convention which allow easy identification of the equipment including type and location as shown in Figure 8.4.
- 8.5.2 The UTP patch panel in the same rack shall be labelled continuously, in sequence. For example: If UTP Patch Panel #1 labelled as A, then UTP Patch Panel #2 shall be labelled as B and so on.

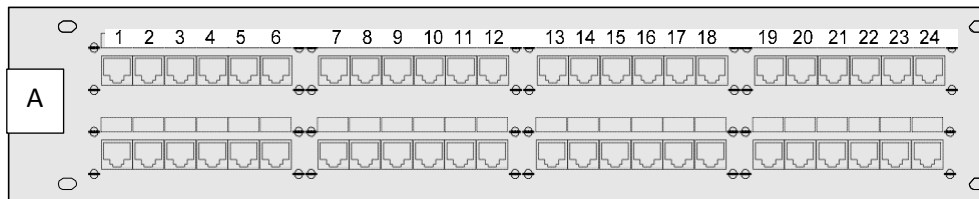



Figure 8.4: Labelling Convention for UTP Patch Panel

- 8.5.3 The UTP patch cord in the same rack shall be labelled continuously at both ends, in sequence. For example: If UTP Patch Cords on Patch Panel #1 labelled as A1 to A24, then UTP Patch Cords on Patch Panel #2 shall be labelled as B1 to B24 and so forth. Label holder shall be made of durable plastic and shall be securely tied to the UTP patch cord .

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S8 - 5 of 6

8.6 DATA/ VOICE FACEPLATES AND WI-FI AP LABELLING

8.6.1 The Data/ Voice faceplates and Wi-Fi AP shall be named and labelled according to a specific labelling convention which allow easy identification of the structured cabling including type and location as shown in Figure 8.5 and 8.6.

8.6.2 The Data faceplates labelling convention is as follows:

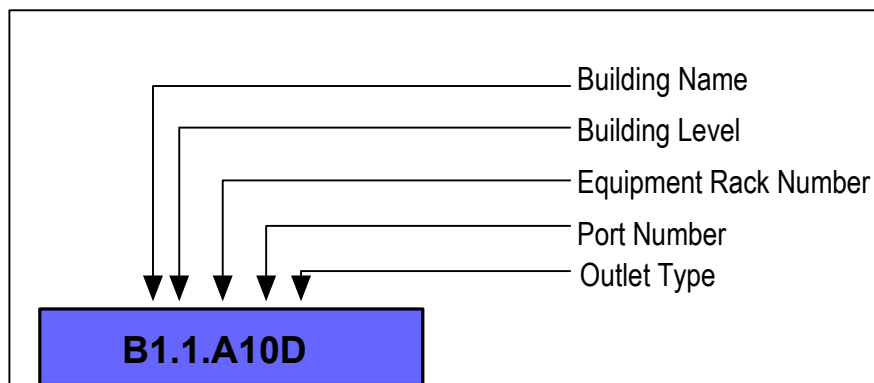



Figure 8.5: Labelling Convention for Data Faceplate

Where,

- “B” is building name e.g. Blok B.
- “1” is building level e.g. Level 1.
- “1” is equipment rack number on that particular floor e.g. Equipment Rack Number 1.
- “A10” is port Number 10 on patch panel A e.g. Port Number A10.
- “D” is for Data Outlet Type or “AP” is for Wi-Fi Outlet Type.
- Colour: BLUE for Data.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S8 - 6 of 6

8.6.3 The voice faceplates labelling convention is as follows:

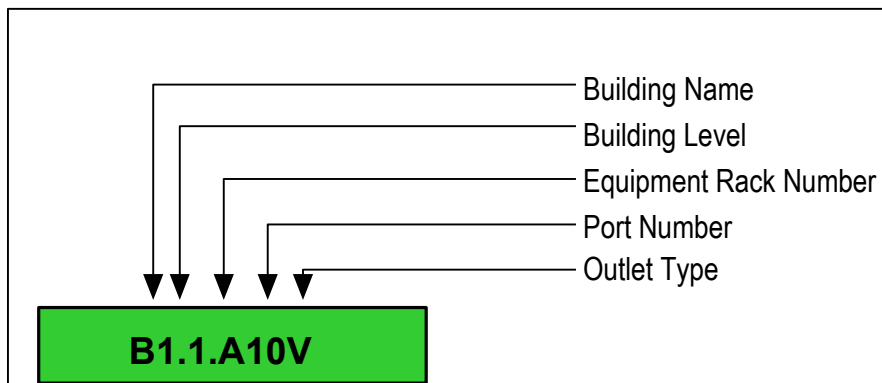



Figure 8.6: Labelling Convention for Voice Faceplate

Where,

- “B” is building name e.g. Blok B.
- “1” is building level e.g. Level 1.
- “1” is equipment rack number on that particular floor e.g. Equipment Rack Number 1.
- “A10” is port Number 10 on patch panel A e.g. Port Number A10.
- “V” is for Voice Outlet Type.
- Colour: GREEN for Voice

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S9 - 1 of 4


9.0 TESTING AND COMMISSIONING

9.1 TEST INSTRUMENTS

- 9.1.1 All measuring and test instruments used for testing and commissioning of the installations shall be regularly tested and calibrated by the manufacturers or accredited calibration laboratories for their functionality and accuracy. Test and Calibration Reports or Certificates for the measuring and test instruments issued by the calibration laboratory shall be valid for two (2) years from the date of issuance.
- 9.1.2 The instruments and their Test and Calibration Reports or Certificates shall be submitted to S.O. or S.O's Representative for verification two (2) weeks before testing of the installations being carried out. No test on the installation shall be carried out without prior approval of the S.O or S.O's Representative. Notwithstanding the validity of the aforesaid Reports or Certificates, the measuring and test instruments shall be recalibrated if so required by the S.O or S.O's Representative after any mechanical or electrical mishandling. Fee required for the testing and calibrating of the measuring and test instruments is deemed to be included in the Contract.
- 9.1.3 The Contractor shall provide adequate equipment or tools for the whole testing and commissioning works.


9.2 TEST AND TEST CERTIFICATES

- 9.2.1 After the installation work has been completed and before Certificate of Practical Completion is issued, the whole ICT networking system shall be tested for compliance, performance and manufacturer's testing and commissioning guideline.
- 9.2.2 The S.O or S.O's Representative reserves the right to be present at all tests and the Contractor shall give at least one (1) week notice in writing to the S.O or S.O's Representative for this purpose. In any case, no test shall be carried out without prior approval of the S.O or S.O's Representative. A copy of test results certified by competent person shall be submitted to the S.O or S.O's Representative. Copies of all the test certificates together with As Installed Drawings properly bound and titled shall be submitted to the S.O or S.O's Representative within one (1) week after the completion of the testing.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S9 - 2 of 4

9.3 STRUCTURED CABLING SYSTEM TEST


- 9.3.1 The testing shall be performed using a valid version of cable tester or analyzer e.g. Fluke Field Tester, Softing, Viavi or similar with the latest updated firmware and software. The work of testing and commissioning of the structured cabling system installed shall be conducted and carried out by a Certified Installer.
- 9.3.2 The testing shall be carried out on each cable installed only after all cables are fully bundled, tidied-up and patched into the network equipment. The same bundled patch cord shall be tested with the RJ45 plug on equipment side as per Channel Link Test requirement.
- 9.3.3 The Twisted Pair copper cable installation shall be tested and certified to the latest ANSI/TIA 568.2D, ISO/IEC 11801-1 standards and cable manufacturer's warranty requirement. The following tests shall be carried out:
- 9.3.3.1 Channel Link Test which includes the continuity, presence of electrical parameters and performance characteristics such as return loss, insertion loss (attenuation), pair to pair near end crosstalk (NEXT). Any reading indicated a marginal pass shall not be accepted.
 - 9.3.3.2 The MPTL Test shall be conducted with TIA Cat 6A MPTL test limit, Permanent Link Adapter and Patch Cord Adapter for Category 6A testing on the Far End or Remote Test Equipment (for MPTL termination).
- 9.3.4 The fibre optic cable installation shall be tested and certified to the latest ANSI/TIA-568. 3-D, ISO/IEC 14763-3 standards and cable manufacturer's warranty requirement. The following tests shall be carried out:
- 9.3.4.1 Tier 1 test (Optical Loss Test Set) shall include the bi-directional end to end test with 1 jumper reference methods, total link loss attenuation, channel length and polarity of the fibre channel. The cable shall be tested at both wavelengths 850 nm and 1300 nm for multimode fibre optic cable and 1310 nm and 1550 nm for singlemode fibre optic cable. The insertion loss for each mated optical fibre connection shall not exceed 0.3dB for multimode fibre optic cable and 0.5dB for singlemode fibre optic cable.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S9 - 3 of 4


- 9.3.5 Test results shall be printed directly from test unit or from a downloaded file using an application software from test equipment manufacturer.
- 9.3.6 The Contractor shall take such action as are necessary to remedy the non compliance or non quality installation and recertify again. The test results and other related documents shall be submitted to the cable manufacturer for the purpose of structured cabling system warranty certificate issuance.
- 9.3.7 The Contractor shall submit the test results and warranty certificate to the S.O. or S.O's Representative at least two (2) weeks before on-site verification. The testing and commissioning works shall not be considered completed until warranty certificate has been issued and on-site verification tests have been carried out.
- 9.3.8 The testing and commissioning works of the structured cabling system shall be completed at least two (2) weeks prior to network equipment testing.

9.4 NETWORK EQUIPMENT TEST

- 9.4.1 The Contractor shall arrange with the Certified Network Engineer registered with the equipment's manufacturer to conduct and carry out the work of testing and commissioning of the network equipment.
- 9.4.2 The tests to be carried out according to the equipment manufacturer's warranty and as per stated in Inspection and Testing Procedure provided by the Contractor. The tests shall include but not limited to:-
- 9.4.2.1 Visual inspection to ensure the network equipment shall properly mounted/installed according to the manual, free from dust and physically in good condition without any scratch or crack.
- 9.4.2.2 Configuration test to check the administrator login ability into the equipment web browser, IP addresses configuration as per network topology designed, signal strength of the Wi-Fi system, security configuration as per client's policy, the equipment appears in NMS and indicates error-free status.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S9 - 4 of 4

- 9.4.2.3 Functionality test to ensure the equipment/system meets the functional requirement and performance specified.
- 9.4.2.4 Final Acceptance Test to ensure the whole installation of the equipment/material complies with the requirements as mentioned in the Contract. The test shall be conducted with the presence of S.O. or S.O's Representative and User's/ Client's Representative.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S10 - 1 of 1

10.0 WARRANTY AND SUPPORT

10.1 DESCRIPTION


10.1.1 During the Defects Liability Period (DLP), the Contractor shall be responsible for the warranty and support for the complete installation. All rectification works on defects shall be carried out by Certified Installer or Certified Network Engineer. All labour, materials, tools and parts necessary to rectify the defect due to manufacturing or installation faults shall be supplied and executed at the Contractor's cost.

10.2 WARRANTY

10.2.1 The Contractor shall guarantee the equipment, application system and software are free from defective or faulty of design, manufacture fabrication and installation work after DLP as specified in the Contract.

10.2.2 For structured cabling system a minimum twenty-five (25) years mandatory warranty shall be provided. The certificate of warranty from cable manufacturer shall be submitted to the S.O. or S.O.'s Representative for verification.

10.2.3 All information and communication technology-based systems and all interfacing, integration and connection systems shall free from software error.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S11 - 1 of 3

11.0 SHOP DRAWINGS AND AS BUILT DOCUMENTS

11.1 SHOP DRAWINGS

11.1.1 Two (2) sets of prints of shop drawings for construction and/or installation shall be submitted to the S.O. or S.O.'s Representative for approval. The Contractor shall prepare and submit shop drawings for the whole work or parts of the work at least two weeks before the work begins. If the shop drawings submitted are not acceptable by the S.O. or S.O.'s Representative, the Contractor shall amend and re-submit the shop drawings within two weeks from the date of return of the shop drawings. No work shall be carried out without the shop drawings being approved by the S.O. or S.O.'s Representative. The shop drawings shall include and show the following: -

11.1.1.1 Coordinated dimensioned general arrangements, layouts and positions of ICT equipment, cabling accessories such as network point faceplate, equipment racks, Wi-Fi and all others necessary for the complete of ICT installation;

11.1.1.2 The dimensioned layouts and positions of all holes and cut-through in the walls and floors for the horizontal dan backbone cabling;

11.1.1.3 The dimensioned general arrangements, layouts, routes and positions of all horizontal dan backbone cabling;

11.1.1.4 Coordinated routes for all cables laid external of the building, laid underground, in ducts, manholes and trenches;


11.1.1.5 Coordinated routes for all cables laid in the trunking, cable tray, cable ladder, cable basket, fibre raceway etc.;

11.1.1.6 The dimensioned general arrangements and layout of telecommunication earthing system including routes for bonding/backbone conductor to the main earthing bar;

11.1.1.7 Schematic drawings, network topology, VLAN and IP address topology;

11.1.1.8 Rack population drawing.

11.1.2 The cost for all these shop drawings is deemed to be included in the Contract.

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S11 - 2 of 3

11.2 AS BUILT DOCUMENTS


11.2.1 As built documents shall consist of but not limited to the as-installed drawings, manuals, certificates, catalogues, inventories and parts lists.

11.2.2 The as installed drawings or documents shall comprise of: -

- 11.2.2.1 Site plan and cable routes;
- 11.2.2.2 Schematic drawing, network topology, VLAN and IP address topology;
- 11.2.2.3 Layout plan (conduit/ trunking, cable tray, cable ladder, cable basket, fibre raceway route and location of network points);
- 11.2.2.4 Telecommunication earthing system;
- 11.2.2.5 Rack population and arrangement of equipment in Server Room/ Data Centre, MTCR and TCR;
- 11.2.2.6 Setting parameters, configurations, IP addressing and VLAN on each related equipment;
- 11.2.2.7 Source code of the application systems or software developed;
- 11.2.2.8 Test result on structured cabling system, network equipment and each related equipment;
- 11.2.2.9 Checklist or format reporting flow during Defect Liability Period;
- 11.2.2.10 The certificate of warranty from cable manufacturer and equipment.

11.2.3 These drawings shall be labelled at the lower right hand corner with the Contractor's name and address, date of commissioning, scale, drawing number (the drawing number to be obtained from the S.O or S.O's Representative), title and following particulars:-

JABATAN KERJA RAYA
CAWANGAN KEJURUTERAAN ELEKTRIK
CONTRACT NO.:

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S11 - 3 of 3

11.2.4 If the drawings or documents submitted are not according to the actual installation at site and/or not acceptable to the S.O. or S.O.'s Representative, the Contractor shall amend and re-submit the drawings or documents within two (2) weeks from the date of return of the drawings or documents.

11.2.5 The manuals shall comprise of: -

11.2.5.1 Installation manual.

11.2.5.2 Operation manual, Service and Maintenance manual.

11.2.5.3 Inventory list, product data, catalogue and product test certificates.


11.2.6 The certified softcopy of as built documents shall be compiled on web based format. The hardcopy of as built document shall be labelled at the lower right hand corner with the Contractor's name and address, date of commissioning, document number (the document number to be obtained from the S.O. or S.O.'s Representative), title and following particulars: -

JABATAN KERJA RAYA
CAWANGAN KEJURUTERAAN ELEKTRIK
CONTRACT NO.:

11.2.7 Each of the as built documents shall be bound together with hard cover and submitted in minimum four (4) sets upon issuance of Certificate of Practical Completion of the project.


11.2.8 In addition, one (1) set of the as installed drawing shall be submitted in the form of original document, and four (4) sets in physical digital storage.

11.2.9 The cost of all these documents, prints, manuals, tools etc. whether or not provided in the Bill of Quantities, is deemed to be included in the Contract.


	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S12 - 1 of 2

12.0 LIST OF STANDARDS

STANDARD	DESCRIPTION
IEEE 802.3	Ethernet Networks
IEEE 802.11	Wireless Local Area Networks
MS IEC 60038	IEC Standard Voltages
MS IEC 60364	Electrical Installations of Buildings
IEC 61000	Electromagnetic Compatibility
CISPR 22	Electromagnetic Compatibility within Europe for Information Technology Equipment
EN 54-20	Fire Detection and Fire Alarm Systems - Aspirating Smoke Detectors
ISO 14520	Gaseous Fire-Extinguishing Systems - Physical Properties and System Design
BS 6266:2011	Fire Protection for Electronic Equipment Installations. Code of Practice
ISO/IEC 30129:2015	Information Technology - Telecommunications Bonding Networks for Buildings and Other Structures
ISO/IEC 14763-2	Information Technology - Implementation and Operation of Customer Premises Cabling - Planning and Installation
ISO/IEC 11801-1	Generic Cabling for Customer Premises
ISO/IEC 11801-5	Generic Cabling for Customer Premises : Data Centres
ISO/IEC 18598	Information Technology - Automated Infrastructure Management (AIM) systems - Requirements, Data Exchange and Applications
ANSI/TIA-568.0-D	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568.1.D	Commercial Building Telecommunications Cabling Standard
ANSI/TIA-568.2-D	Balanced Twisted-Pair Telecommunication Cabling
ANSI/TIA-568.3-D	Optical Fibre Cabling and Components Standard


	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S12 - 2 of 2

STANDARD	DESCRIPTION
ANSI/TIA-569-E	Standard for Telecommunications Pathways and Spaces
ANSI/TIA-606-C	Administration Standard for Commercial Telecommunications
ANSI/TIA-862-B	Structured Cabling Infrastructure Standard for Intelligent Building Systems
ANSI/TIA-942-B	Telecommunications Infrastructure Standard for Data Centres
ANSI/ICEA S-87-640	Optical Fibre Outside Plant Communications Cable Standard
ANSI/ TIA 598	Optical Fibre Cable Color Coding
IEC 60332-3	Tests on Electric and Optical Fibre Cables under Fire Conditions - Test for Vertical Flame Spread of Vertically-Mounted Bunched Wires or Cables
IEC 60754-2	Test on Gases Evolved During Combustion of Materials from Cables
IEC 61034-2	Measurement of Smoke Density of Cables Burning under Defined Conditions
IEC 60603-7	Connectors for Electronic Equipment - Detail Specification for 8-way, Unshielded, Free and Fixed Connectors
IEC 60512	Connectors for Electrical and Electronic Equipment
ANSI/TIA-1096-A	Telecommunications Telephone Terminal Equipment Connector Requirements for Connection of Terminal Equipment to the Telephone Network
MS IEC 61537	Cable Management - Cable Tray Systems and Cable Ladder Systems
IEC 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use
IEC 61557-1	Electrical Safety in Low Voltage Distribution Systems up to 1000 VAC and 1500 VDC
ISO/IEC 14763-3	Information technology - Implementation and Operation of Customer Premises Cabling - Testing of Optical Fibre Cabling
ISO/IEC 60320	Appliance Couplers For Household And Similar General Purposes


	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S13 - 1 of 3

13.0 ABBREVIATIONS

ANSI	American National Standards Institute
AMD	Advanced Micro Devices
API	Application Programming Interface
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BICSI	Building Industry Consulting Service International
CMR	Communications Multipurpose Cable Riser
DDR	Double Data Rate
DIMM	Dual In-Line Memory Module
DHCP	Dynamic Host Configuration Protocol
DMZ	Demilitarised Zone
DNS	Domain Name Server
EMC	Electromagnetic Compatibility
FHD	Full High Definition
FTP	Foiled Twisted Pair
GB	Gigabyte
GbE	Gigabit Ethernet
Gbps	Gigabit per second
GHz	Giga Hertz
HDMI	High-Definition Multimedia Interface
HDR	High Dynamic Range
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S13 - 2 of 3

IMIX	Internet Mix
I/O	Input Output
IP	Internet Protocol
IPS	Intrusion Prevention System
ISO	International Organization for Standardization
LSZH	Low Smoke Zero Halogen
LPDDR	Low Power Double Data Rate
MAC	Media Access Control
MB	Megabyte
MIMO	Multiple Input Multiple Output
MPTL	Modular Plug Terminated Link
MUTOA	Multi-user Telecommunications Outlet Assembly
NAT	Network Address Translation
NFPA	National Fire Protection Association
NGFW	Next Generation Firewall
nm	Nanometer
OFDMA	Orthogonal Frequency Division Multiple Access
OM4/ OM5	Optical Multimode (OM) - Levels are for Multimode Fibre
OS2	Optical Singlemode (OS) - Levels are for Singlemode Fibre
PCIe	Peripheral Component Interconnect Express
PSK	Pre-Shared Key
PPSK	Private Pre-Shared Key
PVC	Polyvinyl chloride
QAM	Quadrature Amplitude Modulation
QHD	Quad High Definition

	SPECIFICATION FOR ICT NETWORKING SYSTEM (L-S38)	CKE.LS.03.38.(00).2020 Date Issued: June 2022
		Revision: 0
		Date: June 2022
		Page: S13 - 3 of 3

RAID	Redundant Array of Independent Disks
RJ-45	Registered Jack 45
SDF	Subscriber Distribution Frame
SFP	Small Form-Factor Pluggable
SMS	TBShort Message Service
SNMP	Simple Network Management Protocol
SSID	Service Set Identifier
STP	Spanning Tree Protocol
TB	Terabyte
TCP/IP	Transmission Control Protocol/ Internet Protocol
TIA	Telecommunications Industry Association
USB	Universal Serial Bus
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
WAN	Wide Area Network
WPA	Wi-Fi Protected Access