

DEENDAYAL PORT AUTHORITY

(Erstwhile 'Kandla Port Trust')

Chief Mechanical Engineer (i/c) 2nd Floor, Annexxee, A. O. Building, Deendayal Port Authority, Gandhidham (Kutch) - 370 201 E-mail: cme@deendayalport.gov.in

Date - 11.06.2025

To,

Subject: IT System for Surveillance of Gopalpuri Colony, DPA - reg.

Sir,

Deendayal Port Authority (DPA) intends to commission IT System for Surveillance of Gopalpuri Colony, DPA. Please submit your Expression of Interest (EoI) with supporting documents in following format with sign and seal on each page, by 21.06.2025 to <u>cme@deendayalport.gov.in</u>:

Credentials of Firm:

Sr.	Description	Inputs to be filled in
1	Name of Firm	
2	GST No.	
3	Whether Similar Work has been executed?	
	If yes, please provide the details of:	
	(a) Details of completed Surveillance System	
	(b) Location and	
	(c) Employer of referred system.	
4	Please share the copy of Work Order / Completion	
	Certificate of referred work.	
5	The Firm shall furnish an Original Equipment Manufacturer	
	(OEM) Authorization Certificate along with a	
	comprehensive Compliance Statement, duly attested and	
	issued on the OEM's official letterhead, bearing the OEM's	
	seal and authorized signatory for following parts:	
	(1) Outdoor Security Radar	
	(2) All weather and light Thermal Camera	
	(3) Audio Communication Unit	
	(4) Network Paging Console	
	(5) Network Paging Console Microphone	
	(6) High-Performance Network-Based PTZ	
	(7) Control Board	
	(8) 5 MP IR Bullet cameras	
	(9) 2 MP IR Bullet cameras	
	(10) 4 x 5 MP multidirectional Panoramic Camera	
	(11) Dual sensor with 360° IR	
	(12) Integrated digital video storage & access management	
	(13) Monitoring Work Station	
	(14) Core Switch	
	(15) Outdoor Switches.	
	This authorization must explicitly certify that the firm is duly	

authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.	
The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to purchaser / DPA through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM- issued authorization and compliance documentation in the prescribed format shall be deemed non-compliant.	

Budgetary Offer:

Sr.	Details	Unit	Qty	Rate	Amount (Qty. X Rate)
	Supply of CCTV Components				
1	Supply, Installation, Testing and commissioning (SITC) of Security Radar, 24.05–24.25 GHz, FMCW, for wall mounting outdoor. Reliable 180 degrees horizontal field of detection 24/7 with built-in analytics including classification of humans and vehicles. Complement to video surveillance enables filtering on distance, customized detection zones, and auto- tracking for PTZ cameras. Trigger events to activate camera recording, audio notification or light source for deterrence. Open API for software integration, microSD/SDHC memory card slot for edge storage, 30W PoE out to power an additional device, 4 input/output ports, 24 V DC relay port. Powered by PoE+ (IEEE 802.3at, Type 2 Class 4) or DC 8-28V. IP66, IK08 and NEMA 4. Operating conditions -40°C to 60°C (-40°F to 140°F). (As per attached Compliances)	Nos	5		
2	Supply, Installation, Testing and commissioning (SITC) of Thermal Camera The imaging apparatus intended for deployment shall incorporate a minimum resolution thermal sensor based on an uncooled microbolometer focal plane array, having not less than 640 (horizontal) by 480 (vertical) discrete pixels, with a pixel pitch not exceeding a minimum of 17 μ m or better. The operative spectral sensitivity band of the said device shall minimally extend from 8 μ m to 14 μ m, inclusive, ensuring effective capture of thermal energy in the longwave infrared region. The lensing assembly integrated with the device must be configured for athermalized operation to maintain focus across a broad thermal range, and shall permit swappable configurations comprising a minimum of 10 mm focal length with a minimum F-number of F1.2, affording a minimum horizontal field of view not less than 63° and vertical field of view not below 46°. (As per attached Compliances)	Nos	15		
3	Supply, Installation, Testing and commissioning (SITC) of Audio Communication Unit The unit shall consist of a high- performance re- entrant horn loudspeaker integrated with a precision-matched compression driver designed to	Nos	20		

	deliver a maximum sound pressure level exceeding 121 dB. The effective acoustic response shall be within the range of 280 Hz to 12.5 kHz, with an optimized directional dispersion pattern providing approximately 70° horizontal by 100° vertical coverage at 2 kHz, enabling wide-area intelligibility. The enclosure shall incorporate a mechanically isolatable electret-type microphone with an operational frequency response between 50 Hz and 12 kHz, alongside an embedded speaker element. A built-in 7-watt Class D audio amplification module shall be provided to ensure high-efficiency signal reproduction. (As per attached Compliances)			
4	Supply, Installation, Testing and commissioning (SITC) of Network Paging Console The equipment to be provided shall be of a fully integrated nature enabling live paging functionality alongside capability to deliver pre-recorded message playback while ensuring full-duplex bi- directional communication with SIP-compatible devices and speaker endpoints. The system shall be able to navigate a minimum of multiple audio zones simultaneously and shall provide a built-in broadband speaker having a minimum diameter of 42 millimeters or better with a maximum sound pressure level not less than 80 decibels. The built-in microphone shall allow audio input functionality, and connectors must include minimum one XLR input compatible with TC6901 Gooseneck Microphone and one 3.5 mm audio input port supporting both 3-ring and 4-ring headsets. Network connectivity shall be achieved via an RJ45 connector. (As per attached Compliances)	Nos	1	
5	Supply, Installation, Testing and commissioning (SITC) of High- Performance Network-Based PTZ Camera The offered imaging device shall incorporate a minimum 1/2.8" progressive scan CMOS sensor or better, capable of capturing high-fidelity visual data under varied illumination conditions. The optical assembly must comprise a minimum varifocal lens configuration having a focal length range of minimum 4.3 mm to minimum 137.6 mm or better, with a minimum aperture range spanning from F1.4 to F4.0 or better, ensuring precision-controlled optical performance. Horizontal and vertical fields of view shall be not less than minimum 58.3° to minimum 2.4° and minimum 34.9° to minimum 1.3° respectively or better and must provide minimum auto-iris and autofocus functionalities or equivalent. (As per attached Compliances)	Nos	1	
6	Supply, Installation, Testing and commissioning (SITC) of Control Bord The control interface unit shall be a precision operator console comprising a three- hall-effect joystick and a programmable keypad module, intended for advanced PTZ (Pan-Tilt-Zoom) control within professional video surveillance command environments. The joystick component shall support X and Y movement for pan and tilt functionality, and a Z- rotary encoder for zoom control. Each shall have movement constrained by mechanical square delimiters, permitting precise control within ±15° for XY and ±25° for Z directions. The device shall support	Nos	10	

	a minimum of 16 programmable hotkeys, allowing			
	custom user-defined macros.			
	(As per attached Compliances)			
	Supply, Installation, Testing and commissioning (SITC) of			
	5 MP IR Bullet cameras The device proposed shall be			
	constructed employing a minimum 1/2 7" progressive scan			
	RGB CMOS sensor integrated within a ruggedized			
	minimum IP66/IP67 and IK10-rated polycarbonate-			
	aluminum blend enclosure conforming to NEMA Type 4X			
	standard with white finish compliant with NCS S 1002-B			
7	any repainting shall be governed under OEM warranty	Nos	10	
	stipulations. The imaging assembly shall incorporate a		-	
	varifocal lens mechanism spanning minimum focal lengths			
	of 2.8 mm to 8 mm or better, with minimum F1.3 aperture			
	or better and shall feature integrated remote zoom/focus			
	capabilities, inclusive of minimum P-iris control and IR			
	correction for optimized day/night fidelity.			
	(As per attached Compliances)			
	Supply, Installation, Testing and commissioning (SITC) of			
	2 MP IR Bullet cameras The imaging mechanism			
	incorporated within the proposed visual capture apparatus			
	shall be constructed upon a minimum 1/2.8" progressive			
	scan RGB CMOS sensor or better, with a pixel dimension			
	not less than 2.9 μm or superior. The optical subassembly			
8	must incorporate a minimum varifocal lens mechanism	Nos	10	
Ō	with provisions for remote operability inclusive of	1103	10	
	motorized focus and zoom functionalities, and it must be			
	equipped with minimum P-Iris control as well as IR-			
	corrected optics or equivalent. The system shall support			
	interchangeable lens configurations, including a minimum			
	3–9 mm varifocal assembly.			
	(As per attached Compliances)			
	Supply, Installation, Testing and commissioning (SITC) of			
	4X 5 MP multidirectional Panoramic Camera The device			
	intended for deployment in surveillance-critical zones shall			
	incorporate not rewer than four individual RGB CIVIOS			
	Imaging modules, each incorporating a minimum sensor			
	omploy a pixel pitch not loss than 2.0 micromotors to			
9	ensure precise imaging under various illumination regimes	Nos	10	
	The ontical subsystem must utilize a remote- configurable	1405	10	
	varifocal lens mechanism featuring a zoom range of			
	minimum 3.2 mm to 8.1 mm and an aperture variation from			
	F1.9 to F3.2, supporting a minimum horizontal coverage			
	not less than 99 degrees.			
	(As per attached Compliances)			
	Supply, Installation, Testing and commissioning (SITC) of			
	Dual sensor with 360° IR proposed network video			
1	surveillance device shall be equipped with a dual imaging			
	mechanism comprising minimum two progressive scan			
1	RGB CMOS sensors each not exceeding minimum 1/2.7"			
10	in dimension, enabling minimum image capture precision	Nos	5	
	and color rendition, capable of delivering synchronized			
	dual views across simultaneous fields of surveillance. The			
	optical assembly shall incorporate a motor-driven varifocal			
	lens system ranging from minimum 3.3 mm to minimum			
1	8.1 mm with a minimum aperture configuration of F1.9 to			

	F3.2, exhibiting a minimum horizontal angular coverage between minimum 98° to minimum 36°.			
11	(As per attached Compliances) Supply, Installation, Testing and commissioning (SITC) of integrated digital video storage and access management hardware appliance shall be inherently engineered to support and facilitate a system architecture accommodating minimum scalability thresholds equating to at least minimum 192 electronically secured portal nodes and a cumulative minimum sustained recording throughput capability no less than minimum 850 Megabits per second or better under optimized conditions. The system shall exhibit operational readiness to concurrently manage a video matrix comprising minimum 96 video acquisition channels configured at minimum 4 Megapixels resolution and a minimum capture frame frequency of 30 frames per second per stream. (As per attached Compliances)	Nos	1	
12	Supply, Installation, Testing and commissioning (SITC) of Monitoring Work Station desktop-grade client-side computing unit intended for high- definition surveillance live-view and forensic playback functions shall incorporate an embedded processing subsystem equipped with a multi- core central processing engine meeting or exceeding the minimum industry classification of Intel Core series processors or better, delivering sufficient compute throughput to support decoding and real-time rendering of multiple high-bitrate surveillance video streams. Integrated volatile system memory allocation shall not be less than minimum 16 GB capacity, populated using dual-channel architecture with minimum 2x 8 GB non-ECC DIMMs or equivalent, facilitating optimal parallel data access rates and enhanced performance. (As per attached Compliances)	Nos	1	
13	Supply, Installation, Testing and commissioning (SITC) of Mounting Hardware's The mounting assembly intended for variable-surface surveillance deployment shall incorporate a multifunctional attachment ensemble comprising components suitable for pendant, wall, and pole integration scenarios across a range of cylindrical and planar structural substrates. The primary assembly configuration shall support pendant mounting arrangements with adaptivity to pole diameters ranging from a minimum 50 mm to a maximum of 150 mm or better, utilizing tension- based clamping mechanisms and reinforced banding hardware to ensure axial stability. (As per attached Compliances)	Lot	1	
14	Supply, Installation, Testing and commissioning (SITC) of Core Switch shall be equipped with advanced functionalities including flow control, port mirroring, MAC address filtering, and robust support for IPv6 and IP address filtering. It shall incorporate stacking Technology, sFlow, and support for various spanning tree protocols including Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). VRRP support shall be mandatory for high availability. Additional features such as DHCP	Nos	2	

	snooping, Access Control List (ACL) support, Quality of Service (QoS), Class of Service (CoS), Equal-Cost Multipath (ECMP) routing, DHCP relay, GARP VLAN Registration Protocol (GVRP), and Err Disable Recovery. (As per attached Compliances)			
15	Supply, Installation, Testing and commissioning (SITC) of Outdoor switch device shall be an industrial-grade, minimum 10-port fully managed Gigabit Ethernet Layer-2+ switch solution, and shall incorporate a minimum of 8 (Eight) 10/100/1000BASE-TX RJ45 interfaces supporting IEEE 802.3at/af compliant Power over Ethernet Plus (PoE+), or better, alongside a minimum of 2 (Two) Gigabit SFP-based uplink slots for optical media connectivity or better. The switch shall operate over a minimum voltage input of 48 VDC, and the aggregate power output budget dedicated to powered devices (PDs) shall not be less than 240 Watts or better. All power interface connectivity shall be provided via a minimum 1 (One) 4-pin input, and a minimum 1 (One) 3-pin signalling contact interface shall be provided or better. (As per attached Compliances)	Nos	32	
16	Supply, Installation, Testing and commissioning (SITC) of DIN rail– mountable switching mode power supply unit conforming to industrial installation requirements and shall possess a minimum continuous rated direct current voltage of 48 volts DC or better, with a minimum rated output current capacity not below 5 amperes or better, and a minimum rated power output of 240 watts or better. The unit shall be equipped with internal mechanisms to ensure ripple and noise levels do not exceed a minimum of 150 millivolts peak-to-peak or better under standard full-load operation. The voltage trimming range should be minimum from 48V up to 55V or better, with line and load regulation not exceeding a minimum $\pm 0.5\%$ and $\pm 1.0\%$ or better respectively. (As per attached Compliances)	Nos	32	
17	Supply, Installation, Testing and commissioning (SITC) of Outdoor Rack Cabinet solution proposed for pole-mounted applications shall be of 9U vertical space configuration with a minimum footprint dimension of 600mm × 500mm (W×D) and shall strictly conform to DIN 41494 or equivalent globally recognized enclosure standards including but not limited to EIA, ISO, EN, and CEA norms. The basic structural framework must be constructed entirely of minimum cold-rolled steel with welded construction methodology to ensure ruggedized and vandal-resistant integrity suitable for harsh external deployment. (As per attached Compliances)	Nos	44	
18	Supply, Installation, Testing and commissioning (SITC) of 42U equipment rack enclosure shall be a free-standing, 42U capacity floor- mount type constructed from high- tensile cold-rolled steel of folded architecture, fabricated through continuous welded joint methodology to deliver superior structural integrity and resistance against mechanical deformation. The rack cabinet shall possess a physical footprint of not less than 600mm in width and	No	1	

	1000mm in depth, with static load handling capacity rated at a minimum of 1250 kilograms, uniformly distributed across the U-space, in full compliance with DIN 41494, or equivalent EIA/ISO/EN/CEA rack-mounting and equipment accommodation standards.			
19	(As per attached Compliances) Supply, Installation, Testing and commissioning (SITC) of Outdoor CAT 6 ANSI/TIA/EIA-568-C.2 standards for Category 6 performance, as well as to international cabling standards including ISO/IEC 11801 and IEC 61156-5. It shall be constructed using a solid conductor of 23 AWG size, fabricated from bare annealed copper with a nominal diameter of 0.58 mm, uniformly insulated with solid polyolefin compound engineered for thermal stability and dielectric performance. The core assembly shall be protected by a dual-sheath structure wherein the inner sheath shall comprise of Low Smoke Zero Halogen (LSOH) material to meet indoor fire and smoke safety norms. (As per attached Compliances)	Mtr	6000	
20	Supply, Installation, Testing and commissioning (SITC) of 24-port modular patch panel offered for structured cabling installations shall strictly conform to all applicable commercial standards, including ANSI/TIA-568.2-D-2018, ISO/IEC 11801-1:2017, FCC Part 68 Subpart F Section 68.5, and shall be UL listed to ensure regulatory compliance, safety, and interoperability within certified IT network environments. Each port of the panel shall be preloaded with RJ45 jack modules designed for minimum Category 6 performance and shall exhibit consistent termination integrity across the full operational lifecycle. (As per attached Compliances)	Mtr	32	
21	Supply, Installation, Testing and commissioning (SITC) of 2 Mtr Patch Chord Should be factory-fabricated, high- performance, shielded twisted-pair patch cord assemblies conforming to international commercial and performance standards, including ISO/IEC 11801 2nd Edition Amendment 1 Class EA, ANSI/TIA-568-C.2 Category 6A, UL 1863, and CSA C22.2, engineered for deployment in high-speed 10GBASE-T Ethernet networks with superior immunity to alien crosstalk and external interference. Each assembly shall incorporate stranded copper conductors of nominal 26 AWG gauge, precision-drawn and insulated, enclosed within an overall shield comprising laminated aluminum/polyester composite foil bonded to a continuous tinned copper drain conductor to ensure consistent 360° electromagnetic shielding performance.	Nos	100	
22	Supply, Installation, Testing and commissioning (SITC) of outdoor- grade optical fibre cable intended for use in structured backbone, campus, and telecom duct installations shall be of the six-core single mode type, featuring a loose tube armoured construction with medium-density polyethylene (MDPE) outer sheathing and designed in accordance with all applicable commercial and international performance standards including, but not limited to, ISO/IEC 11801, EN 50173, and IEC 60794-1 for optical cable architecture. The optical	Mtr	6000	

	fibre cores themselves shall conform to Category B.1.3 of IEC 60793-2-50 and Class B.1.3 of EN 60793-2-50, while also adhering to ITU-T recommendations G.652 A. (As per attached Compliances)			
23	Supply, Installation, Testing and commissioning (SITC) of Fiber Optic LIU (Light Interface Unit) shall be a factory- assembled, fully populated 48-port enclosure in a 19-inch rack-mountable form factor, constructed from high-grade cold rolled steel with ruggedized structural integrity and finished in electrostatically powder-coated graphite paint for corrosion resistance and long service life. The enclosure must support universal mounting standards suitable for both 19-inch EIA racks and optional wall- mount configurations to accommodate varied deployment environments such as isolated OT areas or integrated IT enclosures. (As per attached Compliances)	Each	2	
24	Supply, Installation, Testing and commissioning (SITC) of Fiber Optic LIU (Light Interface Unit) shall be a factory- assembled, fully populated 6-port enclosure in a 19-inch rack-mountable form factor, constructed from high-grade cold rolled steel with ruggedized structural integrity and finished in electrostatically powder-coated graphite paint for corrosion resistance and long service life. The enclosure must support universal mounting standards suitable for both 19-inch EIA racks and optional wall- mount configurations to accommodate varied deployment environments such as isolated OT areas or integrated IT enclosures. The unit shall be supplied fully loaded with factory-installed LC adapters (simplex or duplex, as per configuration), pre-terminated single-mode pigtails of G.652D. (As per attached Compliances)	Each	30	
25	Supply, Installation, Testing and commissioning (SITC) of 1 Mtr Fiber Patch Chord (SC to LC) 1 Mtr pre-terminated duplex optical fiber patch interconnect assemblies conforming to stringent international commercial cabling standards including but not limited to ISO/IEC 11801- 1:2017, ANSI/TIA-568.3-D, IEC 60794-1, ANSI/TIA/EIA- 492, TELECORDIA GR-409, ICEA S-596, and AS/CA S008:2020, suitable for structured cabling installations in enterprise-grade data, voice, and video networks. Each cord shall be terminated with factory-fitted, high-precision connector types comprising SC at one end and LC at the other, with insertion and return loss values within acceptable thresholds as defined in relevant fiber optic connector. (As per attached Compliances)	Nos	88	
26	Supply, Installation, Testing and commissioning (SITC) of 3 Mtr Fiber Patch Chord (SC to LC) 3 Mtr pre-terminated duplex optical fiber patch interconnect assemblies conforming to stringent international commercial cabling standards including but not limited to ISO/IEC 11801- 1:2017, ANSI/TIA-568.3-D, IEC 60794-1, ANSI/TIA/EIA- 492, TELECORDIA GR-409, ICEA S-596, and AS/CA S008:2020, suitable for structured cabling installations in enterprise-grade data, voice, and video networks. Each	Nos	30	

	cord shall be terminated with factory-fitted, high-precision			
	connector types comprising SC at one end and LC at the			
	other, with insertion and return loss values within			
	acceptable thresholds as defined in relevant fiber ontic			
	connector			
	(As per attached Compliances)			
	Supply Installation Testing and commissioning (SITC) of			
	opping installation, resting and commissioning (orregot			
	oplical transceiver mouthe proposed shall be of the			
	pluggable SFP form factor, specifically engineered for			
	industrial-grade operational parameters and applicable			
	international interface standards. The transceiver shall			
	utilize a unidirectional single-fiber bidirectional (BiDi or BX)			
27	transmission mechanism, employing wavelength-division	Nos	44	
	multiplexing (WDM) with a specified transmit (Tx) center			
	wavelength of 1550 nm and receive (Rx) center			
	wavelength of 1310 nm, enabling duplex communication			
	over a single SM strand. This module shall adhere to			
	1000BASE-X Ethernet transmission protocols as			
	standardized under IEEE 802.3z.			
	(As per attached Compliances)			
	Supply, Installation, Testing and commissioning (SITC) of			
	CCTV pole infrastructure intended for deployment in			
	outdoor surveillance environments shall comprise a			
	vertically oriented cylindrical support member constructed			
	from a round-section steel tube with a uniform wall			
	thickness ranging between 5 mm and 10 mm, and an			
00	overall height extending from a minimum of 3500 mm to a		~~	
28	maximum of 7000 mm above finished ground level. The	INOS	39	
	main vertical shaft shall be of seamless or ERW round pipe			
	profile, engineered for high rigidity and wind load			
	resistance, and subjected to a comprehensive anti-			
	corrosive surface treatment process comprising hot-dip			
	galvanization.			
	(As per attached Compliances)			
	Supply, Installation, Testing and commissioning (SITC) of			
	Computing workstation shall be tower-form factor based.			
	equipped with a 13th Generation Intel® Core™ i7-13700			
	processor, incorporating 16 physical cores and 24			
	threads enabled via Intel's hybrid performance			
	architecture including performance and efficiency cores			
	The CPU shall operate at a base clock with dynamic			
	frequency scaling up to 5.2 GHz under Intel® Turbo Boost			
29	Technology 2.0 backed by a 30MB Intel Smart Cache	Nos	2	
20	(1.3) ensuring seamless multitasking and compute-	1100	-	
	intensive operations. The platform must be built upon the			
	Intel® 0670 chinset architecture ensuring full chinset			
[compatibility with enterprise-class features and advanced			
	I/O handling Memory configuration shall include 16 CR of			
	DDR4 RAM with 24" Monitor display completed with Key			
[board and Mouse			
	(As per attached Compliances)			
	Supply Installation Testing and commissioning (SITC) of			
	98" Display shall be equinned with a minimum or better			
30	active display diagonal measuring not less than 98 inches	Nos	1	
	(minimum or better 2158.8 mm horizontal x 1214 / mm	1103	•	
	vertical), constructed on In-Plane Switching (IPS) matrix			

	technology employing Direct-LED (DLED) backlight illumination architecture for uniform luminance distribution. The native visual resolution shall conform to a minimum or better 3840 × 2160 pixel matrix, ensuring full Ultra High Definition (UHD) output in a 16:9 aspect ratio format, maintaining a minimum or better refresh frequency of 60 Hz. Minimum brightness intensity shall not be less than 500 candela per square meter, with a minimum static contrast ratio of 1200:1 (typical), and a minimum dynamic contrast ratio of 40000:1. Minimum response latency shall not exceed 8 milliseconds under standard operating conditions. (As per attached Compliances)			
31	Supply, Installation, Testing and commissioning (SITC) of Control Command Center System Interconnect USB cables, Wall Mount Kit Fiber HDMI Cables and All Related Hardware	Lot	1	
32	32mm HDPE Conduit, ISI Mark flexible, underground- grade, Precision Layered Coextruded High-Density Polyethylene Duct (PLB-HDPE) conforming to telecom utility ducting applications, specifically designed for hosting armoured optical fibre cables in subsurface installations. The duct shall be manufactured from primary-origin virgin- grade thermoplastic polymeric compound, polyethylene (PE), explicitly classified under PE100 category for enhanced long-term hydrostatic strength, impact resistance, and environmental stress crack resistance. The product shall possess a minimum pressure rating of PN10, ensuring performance integrity under specified operating conditions	Mtr	5000	
33	25mm Nylon Flexible Pipe with supporting clamps 25mm nominal diameter flexible conduit piping system fabricated from high-performance Polyamide 6 material. It shall support continuous operating temperatures from -40°C to +105°C and withstand short-term surges up to +150°C. The system shall provide ingress protection rating of IP67 when installed with compatible conduit glands. All conduits shall be securely fastened using approved supporting clamps to ensure mechanical stability.			
	Metal Flexi Conduit (25mm) ISI with supporting clamps	Mtr	300	
34	Supply, transportation, storage, laying (Either in cable trench or in cable tray), & termination of 1100 V grade, Aluminium Conductor, PVC insulated and armoured cables per EIL standard specification No. 6- 51-0051 as per data sheets, specifications of this tender and directions of Engineer-in-Charge.			
	4C 25SQMM	Mtr	3000	
35	Supply, Installation, connection & testing of dust & vermin proof G.I. steel sheet (minimum 1.6mm thick) junction box WP type, INGRESS PROTECTION:IP65 with canopy suitable for outdoor installation with 3P+N bus for 4C 25sqmm cable termination (03 nos.) with 02 nos. 2P 6A MCB for outgoing 3C 10sqmm cable connection, Copper bus bar for RYBN inside, provision for 1 earthing inside: M6, Size, double earthing outside panel: M8, including supply of required size and number of terminals, PVC connectors, supply & fixing of cable glands as per	Each	44	

	approved drawings, specifications of this tender and			
	directions of Engineer-In-Charge. Junction box should be			
	provided with libor mounting arrangement.			
	Supply, installation, connection, testing and			
	INCRESS DROTECTION/IDEE with concerv suitable for			
	INGRESS PROTECTION. 1905 with canopy suitable for			
	outdoor installation including transportation from			
	store/yard to site at the place of installation, installation on			
	roundations of steel structures, aligning, leveling,			
	grouting, including an labour and materials, as per			
26	directions of Engineer in Charge Distribution Roard I/C	Fooh	4	
30	63A 3D+N MCB (AC 25 samm cable) Outgoing 32A AD	Laci	4	
	MCB-04 Nos (4C 25sqmm cable). Conner hus hars for			
	RYBN inside Indication Jamp R Y B at door, provision for 1			
	earthing inside: M6: SIZE Double earthing outside			
	panel M8 including supply of required size and number of			
	terminals PVC connectors supply & fixing of cable			
	glands. Junction box should be provided with floor			
	mounting arrangement.			
	ERC/ HDD for cable road crossing.			
	ERC for cable road crossing. Including supply & laying of			
07	RCC duct below road surface for cable crossing, cutting of	N 44-1	500	
31	road, repair of road after duct laying, end sealing of RCC	IVIT	500	
	duct. Thickness-150mm			
	HDD for cable road crossing, including supply & laying of			
38	HDPE duct of below road surface for cable crossing, end	Mtr	500	
	sealing of HDPE duct.			
	Supply, installation, testing and commissioning of GI earth			
	electrodes, complete with earth pit as per std. 7-51-0102			
	and all necessary materials including excavation of earth			
39	pit, filling with charcoal and salt, back filling, providing	Each	4	
	necessary brickwork, connections, including all labour and			
	materials, as per approved drawings, specifications of			
	this tender and directions of Engineer-in-Charge.			
	Supply, installation and connection of following GI earthing			
	sup along the cable trenches of cable trays of fixing to			
	anti corrective paint or hitumon and jute covering for			
40	wolded portion clamping and percessary bardware for			
	connecting etc. including all labour and materials as per			
	approved drawings specifications of this tender and			
	directions of Engineer-in- Charge.			
	40 x 5 mm	KG	250	
	20 x 3 mm	KG	250	
	Connecting individual equipment to the earth strip or earth			
	plate with following sizes of G.I. wire / G.I. wire rope			
	including the supply of G.I. wire /G.I. wire rope, lugs,			
41	conductors, connecting to the G.I. strip or earth plate and			
	necessary hardware for connection, including all labour			
	and materials, as per approved drawings, specifications			
	of this tender and directions of Engineer-in-Charge.			
	3/8" dia (10 mm) flexible rope.	Mtr	200	
	Supply and installation of following galvanised slotted			
42	channel trays of 2 mm thickness and 50 mm high for			
	supporting cables, including all labour and materials, as			
	per approved drawings, specifications of this tender and			

	directions of Engineer-in-Charge.				
	50 mm wide	Mtr	200		
43	Supply and installation of cable markers as per std. 7-51- 0301, for underground cable runs with 14 SWG enamelled steel plate with white lettering on jade green background inclusive of providing and fixing supports, including all labour and materials, as per approved drawings, specifications of this tender and directions of Engineer-in- Charge.	Each	50		
44	Painting and marking in letters of following sizes of applicable circuit nos. for identification with red/black/white paint for all outdoor equipment in safe areas viz. power panels, junction boxes etc. supply of all material such as stickers, enamel paints, stencil, etc including yellow background and black colour border, including intermittent spacing between letters, including supply of all labour, materials as per the specification of this tender and directions of Engineer-in-Charge.				
	Letter sizes of 25 mm	Each	100		
	Letter sizes of 50 mm	Each	100		
45	Supply and laying of following sizes of G.I. Pipes (medium) in required length fixed on steel, concrete or similar structure, laid in trenches, ready to be buried in concrete including cutting, threading, bending and similar works, supply of clamps, small iron structures, spacers and installation of seats, plugs, bushings etc., small civil works, including all labour and materials, as per approved drawings, specifications of this tender and directions of Engineer-in-Charge				
	80 mm NB	Mtr	2000		
46	Excavation and backfilling of trenches for cables in all types of soil except rock, for a maximum depth of 0.75 m and dewatering (if necessary), Supply and spreading of approved fine river sand/stone dust in cable trenches, Supply and spreading of approved second class bricks of 75 mm thickness in cable trenches for cable protection including consolidation and disposal of surplus earth up to a distance of 30 m, including all labour and materials, as per approved drawings, specifications of this tender and directions of Engineer-in-Charge. (Excavated trench dimensions shall be measured).	Cu Mtr	(As per actual)		
Total amount (in Rs.)					

Note: GST will be extra as per actual.

This EOI does not constitute a commitment to purchase, and DPA reserves the right to accept or reject any EOI without assigning any reason whatsoever.

Contractor's scope of work shall broadly consist of the following:

- Design, engineering, manufacture, assemble, test, FAT, supply, installation supervision and commissioning, SAT, training of entire offered surveillance IP CCTV system as per the tender specification including power supply required for cameras from owner's substation to CCTV camera's installation location.
- Supply of IP/IP type CCTV camera with suitable mounting brackets, nuts & bolts as

per the site requirement. Cameras shall be designed to be compatible with environment conditions. Necessary mounting arrangement shall be prepared to suit the conditions at site and supplied along with the camera. Suitable canopies/sunshade shall be supplied for the camera.

- Supply of min. 10 Mtr height CCTV Hot Dip Galvanized (GI) poles/structure support for the camera installation shall be in Contractor scope. Contractor shall provide the camera mounting arrangement drawing for the same. Also, removal of the existing poles and associated connections shall be in the scope of the contractor. On the southern boundary, CCTV camera pole shall have crash barrier for crash protection. Area around all the installed poles would be provided with 1m x 1 m either Paved or PCC pavements for maintenance purpose.
- Contractor shall be responsible for transportation of all materials from warehouse to site and the installation supervision of all the supplied components and commissioning of the system. The configuration (software and hardware) required to ensure the functioning of individual components as well as the system in totality shall be carried out by the Contractor.
- The Contractor shall carryout the installation of the field and control room components, cable laying, cable tray installation, cable glanding. The Contractor shall carryout termination job in field JBs and in control room cabinets. However, it shall be Contractor's responsibility to provide the necessary installation details & procedures and provide supervision during the installation of all supplied components, field test and commission the system.
- All FO cable splicing and termination along with OTDR shall be carried out by the Contractor. All the tools/tackles and connectors required for this activity other than supply of FO cable shall be in Contractor's scope All FO cables shall be laid in HDPE conduit of suitable size either in cable tray or underground.
- Contractor shall carryout the necessary configuration to integrate the system and establish communication between the camera and the video management system as per the approved system configuration drawing
- Contractor shall supply the mounting accessories to install the cameras, junction boxes (in field) and the cabinet and monitor in the existing security control room. The installation and commissioning of CCTV monitors with proper mounting brackets and support in security control room shall be in the scope of Contractor. The supply of power cable, HDMI cable, UTP cable for commissioning of monitors shall be in the scope of the Contractor. The Contractor should make site survey to determine the length of all types of cables and required conduits.
- Contractor shall demonstrate the functioning of the system. Monitoring and control shall be possible from the control room.
- The Contractor shall carryout system testing and commissioning at site. All commissioning spares and consumables necessary shall be supplied by the Contractor without any price or time implications. These shall be included in the base offer. All testing records shall be submitted by the Contractor to Engineer in- charge for his approval before the start of commissioning.
- Supply of system cabinet for housing the server PC with CCTV monitoring and

configuration software, Ethernet switch and other network components. The cabinet shall be supplied in completely assembled condition with all the components installed and wired inside the cabinet ready for site installation. Contractor shall provide cabinet base frame details during detail engineering. The system cabinets should be installed in space occupied by existing cabinets.

- Supply of workstation PC, LED video monitor, Ethernet switch, related network components and required interconnecting cables for monitoring and control functions from the Operator console. Supply of interconnecting cables and cable glands between the camera and the field junction boxes. All interconnecting cable between camera and field JB shall be armoured. Contractor shall indicate the different types of cables between the cameras and field junction boxes in their offer along with the network architecture drawing at the time of detail engineering.
- Connections/wiring between PC and network switches/converters, KVM (Keyboard, Video, and Mouse) extender, display monitor and inside the field junction box for network components shall be in Contractor's scope along with the supply of required quantity of various types of cables and connectors.
- All materials and consumables are in the scope of Contractor including sand, cement, rebar, paint, all consumables as per Contract etc.
- Arrangement of skilled/unskilled labours/operators, tools/ tackles, mobilization, demobilization, insurances, wages, overtime charges, lodging/ boarding, transportation, accommodations, food of labour etc. will be in contractor's scope. Hydra/crane, Manlifter, Rigger, helper, sling, belt, d-shackle etc. will be in scope of Contractor as per Contract.
- Deployment of adequate manpower, machineries and other resources shall be in scope of Contractor. The Contractor shall deploy adequate number of supervisors, skilled/ unskilled and auxiliary labour as required for the work and comply with instructions of the Engineer-in-Charge in the interest of satisfactory progress and completion of the work according to the schedule.
- Installation, termination and commissioning of entire CCTV setup, configuration, handover documentation, onsite training etc. will be in Contractor scope. The Contractor needs to provide all technical and functional documentation related to implementation of the project and for maintenance and operations. Documents to be provided:
- Design basis, High level and Low-level network design documents, Data sheet of each device, electrical wiring diagram, As built drawings, operation & maintenance manual and spare part list, other related drawings.
- The Contractor must provide User Manuals, including system instructions and how to run a program to perform specific task in the system with sample reports, screen formats etc. The Contractor must Conduct user acceptance / site acceptance test and associated trainings for hand-over the system.
- Contractor to note that the ratings and sizing for equipment's indicated are indicative and minimum requirement. The Contractor shall visit the site to understand the exact requirement and shall calculate the sizes/ratings of the equipment for the owner's approval. Additional switchboards, Distribution boards etc. if required during detail

engineering to meet power distribution of the installations shall be supplied and installed without any price and time implication to the Owner.

Minimum Technical Specifications:

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria.

Minimum Technical Specifications for Outdoor SECURITY RADAR

The proposed radar-based area and vehicular surveillance detection subsystem shall be a solid-state, FMCW (Frequency Modulated Continuous Wave) phased-array radar unit, designed for continuous operation under harsh environmental conditions and must be capable of detecting, tracking, and classifying multiple moving or stationary objects within a predefined perimeter zone, leveraging digital beamforming technologies. The system shall be fully capable of operating within the unlicensed and globally harmonized ISM frequency band and shall function within a designated transmission envelope of Minimum 24.05 GHz to Minimum 24.25 GHz or better, utilizing radio waves of nonharmful nature and emitting a total power not exceeding Minimum 100 mW (EIRP) or better, adhering to global RF safety and compliance mandates.

Mounting configuration shall be optimized for situational awareness and must be executed at a nominal elevation of Minimum 3.5 meters or better, ensuring unobstructed hemispherical field coverage. The detection performance profile shall incorporate differentiated presets for human and vehicular entities. For personnel detection under the Area Monitoring Profile, the device shall ensure identification and tracking capabilities in the range of Minimum 3 meters to Minimum 60 meters or better, and for vehicular recognition, Minimum 3 meters to Minimum 85 meters or better must be guaranteed. Under Road Monitoring configuration, the detection envelope shall not be less than Minimum 30 meters to Minimum 60 meters or better at object velocities up to Minimum 105 km/h or better.

The radar subsystem shall demonstrate object velocity resolution under the Area Monitoring Profile up to Minimum 55 km/h or better, while under Road Monitoring Profile, it shall support radial speed discrimination up to Minimum 105 km/h or better. Angular coverage must not fall below Minimum 180° horizontal field of view or better, with angular resolution limited to Maximum 1° or better, and distance estimation precision shall be no less accurate than Minimum ± 0.7 meters or better. Speed detection accuracy must maintain deviation within Maximum ± 2 km/h or better. The spatial discrimination threshold shall be Minimum 3 meters or better with temporal object tracking updates executed at a data refresh interval not exceeding Minimum 10 Hz or better.

Area coverage capabilities shall not be below Minimum 5600 m² for human detection or better, and Minimum 11300 m² for vehicular detection or better. The radar must operate efficiently within a frequency coexistence cluster zone of Minimum 350 meters radius or better, supporting simultaneous deployment of Minimum 6 radars or better without mutual interference. Classification logic shall be embedded to differentiate between humans, vehicles, and undefined (unknown) categories, with rule-based eventing possible based on directionality, velocity thresholds, and object type.

The onboard firmware must allow rule-based configuration for zone-based alerts, including multiple simultaneous detection zones, bi-directional line crossing analytics,

configurable zone-based object exclusion using filters for temporal brevity, object size, object velocity, object classification, and tolerance for oscillating or rotating elements. Dynamic calibration via reference map overlay with scaling, panning, and zooming features shall be mandatory. Radar transmission enable/disable functionality must be provided, alongside environmental opacity mapping, color coding, object trail lifetime control, detection sensitivity modulation, and multiple filter configurations including BETA versions.

Integrated computing architecture shall be built upon the ARTPEC-7 SoC platform, with onboard volatile and non-volatile memory allocations of not less than Minimum 1024 MB RAM or better and Minimum 512 MB Flash or better. A video subsystem shall be embedded for visual streaming with compression formats including H.264 Baseline, Main, and High Profiles, H.265 Main Profile, and Motion JPEG. Video resolution range must support Minimum 1920x1080 HDTV 1080p down to Minimum 640x360 or better with Minimum 10 fps across all resolutions or better. Streams shall be individually configurable supporting H.264, H.265, and MJPEG formats with adjustable bitrate protocols including VBR, ABR, and MBR, and shall support corridor format rotation of 0°, 90°, 180°, and 270°.

Audio functionality must include streaming output via edge-to-edge integration and must support speaker pairing via system-level APIs. The network layer shall comply with IPv4/v6 stack and shall include protocols such as ICMP, HTTP/2, HTTPS, TLS, FTP, SFTP, CIFS/SMB, SMTP, mDNS, UPnP, SNMP v1/v2c/v3, DNS, DDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, DHCP, ARP, SSH, LLDP, CDP, MQTT v3.1.1, and Secure Syslog protocols per RFC3164/5424 specifications.

Integration capabilities shall incorporate full API support through VAPIX® and the Camera Application Platform (ACAP) for third-party module support. ONVIF® Profiles G, S, T, and M shall be fully supported. Real-time analytics shall allow motion detection, auto-tracking, and radar metadata streaming inclusive of GPS-referenced position and velocity. Event trigger conditions must support environmental thresholds (temperature, casing, fan, network, interference), I/O changes, MQTT stateless triggers, storage health, and operational state. Reaction logic must include toggling I/O states, LED signalling, MQTT publications, overlaying radar and text data, secure configuration erasure. SNMP trap dispatch, and data recording/export to FTP/SFTP/HTTP/HTTPS/NAS/Email. Installation support tools must include reference mapping, tilt sensing, and GPS coordination.

Compliance with environmental durability standards shall include IEC/EN/UL 62368-1, 60950-22 and testing per IEC 60068-2-1/2/6/14/27/78. Ingress and mechanical ratings shall not be lower than IP66 and IK08 per IEC/EN 60529 and 62262, with NEMA Type 4X equivalence. Cybersecurity protocols shall comply with ETSI EN 303 645, FIPS 140, and NIST SP500-267. Network security must include IEEE 802.1X (EAP-TLS, PEAP), MACsec (IEEE 802.1AE), HSTS, HTTPS, TLS v1.2/v1.3, NTS, and X.509 PKI. The embedded operating system shall support signed firmware, brute-force delay, digest authentication, OAuth 2.0, OpenID ADFS integration, and local password security.

The radar shall support IEEE 802.3at Type 2 Class 4 (PoE) with Minimum 11W typical and Minimum 15W peak or better. The unit shall support Minimum 30W PoE output or better to downstream devices using IEEE 802.3bt Type 3 Class 5 or approved 60W midspan injector. DC power input shall range from Minimum 8V to Minimum 28V or better, consuming Minimum 10W typical and Maximum 15W or better. Data and power interfaces must include RJ45 1000BASE-T (input/output), 2-pin terminal block relay, and

6-pin I/O with Minimum four configurable inputs/outputs or better. The relay shall support Minimum 5A at Minimum 24V DC or better, with operational lifespan of Minimum 25,000 operations or better. Storage capabilities shall include AES-XTS-Plain64 256-bit encryption and support for microSD/microSDHC/microSDXC cards with optional recording to networked NAS devices. Operating conditions must sustain from Minimum -40°C to Maximum 60°C or better at Minimum 10% to Maximum 100% RH (condensing). Storage conditions shall extend from Minimum -40°C to Maximum 65°C or better. The device casing shall be IP66-, NEMA 4X-, and IK08-rated, constructed from aluminum and polymer composites in color standard NCS S 1002-B. The design must be PVC-free and support long-term sustainability.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

High-resolution detection in all weather and light Thermal Camera

The imaging apparatus intended for deployment shall incorporate a minimum resolution thermal sensor based on an uncooled microbolometer focal plane array, having not less than 640 (horizontal) by 480 (vertical) discrete pixels, with a pixel pitch not exceeding a minimum of 17 µm or better. The operative spectral sensitivity band of the said device shall minimally extend from 8 µm to 14 µm, inclusive, ensuring effective capture of thermal energy in the longwave infrared region. The lensing assembly integrated with the device must be configured for athermalized operation to maintain focus across a broad thermal range, and shall permit swappable configurations comprising a minimum of 10 mm focal length with a minimum F- number of F1.2. affording a minimum horizontal field of view not less than 63° and vertical field of view not below 46°, with the minimum nearfocus distance no less than 2.8 meters; alternatively, configurations including a 19 mm lens of F1.0 minimum aperture yielding a minimum of 31° horizontal and 24° vertical FOV with a focusing threshold from not below 8.5 meters; a 25 mm lens (minimum F1.0) affording minimum FOV of 24° (H) and 18.5° (V) with not less than 18.5 meters nearfocus; and a 35 mm focal length variant (minimum F1.2) supporting a minimum 17° × 13° field coverage with a near object detection not less than 33 meters, shall be considered.

Thermal sensitivity (NETD) shall be no more than 20 millikelvin at ambient temperature of 25°C under minimum F1.0 configuration or better. The core computational engine embedded within the system shall integrate a system-on-chip architecture, leveraging a minimum of 2048 MB RAM and 8192 MB of flash storage, and must contain a dedicated deep learning processing module (DLPU) for onboard analytics execution. Video encoding

capabilities shall mandatorily support industry-compliant compression algorithms including H.264 (MPEG-4 Part 10/AVC) with Baseline, Main and High Profiles, H.265 (MPEG-H Part 2/HEVC) Main Profile, and Motion JPEG formats. The native resolution of the sensor shall be a minimum of 640 × 480, with system support for digital upscaling to a minimum of 800 × 600 (SVGA) or better. The frame capture rate shall support selectable options of 8.3 fps and 30 fps minimum. Simultaneous video stream outputs shall be configurable for a minimum of 20 unique streams, with dynamic adjustment via advanced compression and bit rate regulation techniques including VBR, ABR, and MBR across both H.264 and H.265 codecs, and shall include proprietary adaptive streaming optimizations.

Adjustable image parameters must encompass at minimum contrast, brightness, sharpness, exposure zoning, compression ratio, axis rotation (0°, 90°, 180°, 270°), corridor view format, mirror inversion, dynamic overlays (text and images), privacy masking using polygonal overlays, and electronic stabilization. A diverse thermal palette selection shall be made available. Audio subsystem shall support full duplex and half duplex modes, automatic gain control, visual spectrum analyzer, external microphone input (unbalanced, with optional 5V phantom supply), 10-band graphic equalizer, and audio output routed via externally paired speaker interface. Audio encoding protocols must include 24-bit LPCM, AAC-LC at selectable sampling rates (8/16/32/48 kHz), G.711 PCM 8 kHz, G.726 ADPCM 8 kHz, and Opus codec support for 8/16/48 kHz configurations.

Network interface shall be compliant with a comprehensive suite of protocols including, but not limited to, minimum support for IPv4 and IPv6 (USGv6), ICMP (v4 and v6), HTTP/HTTPS with TLS, HTTP/2, FTP/SFTP, CIFS/SMB, SMTP, mDNS, UPnP, SNMP v1/v2c/v3 (with MIB-II), DNS (v4/v6), DDNS, NTP with Network Time Security (NTS), RTSP, RTP/SRTP/RTSPS, TCP/UDP, IGMP v1/v2/v3, RTCP, DHCP (v4/v6), SSH, LLDP, CDP, MQTT v3.1.1, Secure Syslog (RFC 3164/5424 via UDP/TCP/TLS), and ZeroConf-based link-local addressing.

Application interface shall incorporate an open protocol API enabling seamless third-party software integration, with full compatibility to standard metadata access layers and proprietary application platforms. Minimum compliance with ONVIF Profile S, G, M, and T shall be ensured, and integration support with cloud and local VMS platforms should be provisioned, enabling compatibility with edge recording, media clip handling, privacy masking, EIS, and instream indicators.

Device analytics and event triggers must support a wide range of scenarios including but not limited to: acoustic event detection, audio clip activation, clip playback status, thermal tampering, bitrate degradation, casing breach, vibration/shock detection, fan failure, temperature thresholds (above, below, within), IP configuration anomalies, and storage faults including SD health warnings and write disruptions. System actions triggered by events must include output toggling, MQTT state publishing, HTTP/TCP/Email notifications, SNMP traps, dynamic overlays, video/image buffering (pre and post alarm), and file uploads via FTP/SFTP/HTTP/HTTPS/email.

Environmental resilience shall be tested to conform to minimum IEC 60068-2 series, encompassing temperature, vibration, shock, humidity, and other operating conditions as per IEC 60068-2-1/2/6/14/27/78, with ingress and impact resistance rated to minimum IP66/IP67 and IK10 standards respectively. Additional environmental compliance shall include adherence to NEMA 250 Type 4X, ISO 21207 Method B, and military-grade MIL-STD-810H (including but not limited to Methods 501.7 to 521.4).

Cybersecurity implementation must adhere to minimum requirements under ETSI EN 303 645, BSI IT security labelling, and FIPS-140-2 standards. Embedded hardware must incorporate a

certified TPM 2.0 secure element (minimum CC EAL4+ or higher), Trusted Execution Environment (TEE), Axis device ID management, secure keystore, encrypted filesystem (minimum AES-XTS-Plain64 256-bit), signed firmware enforcement, and secure bootloader functionality. Network-side protections shall include IEEE 802.1X (EAP-TLS/PEAP-MSCHAPv2), IEEE 802.1AE (MACsec), IEEE 802.1AR, PKI-based X.509 certificate exchange, host-based firewall, and secure HTTPS with HSTS support.

The mechanical housing of the unit shall be constructed using minimum aluminum and polycarbonate materials with an optical-grade germanium window. The enclosure must comply with minimum IP66/IP67 for dust and water ingress, IK10 for vandal protection, and NEMA 4X for corrosion resistance. Powering shall support PoE as per IEEE 802.3af/802.3at (Type 1, Class 3) and direct DC input in the range of 12–28 V, with power consumption capped at maximum 12.95 W, typical not exceeding 5.0 W (PoE) or 4.8 W (DC).

Physical interface connectivity shall comprise shielded RJ45 connector supporting 10/100/1000BASE-T for Ethernet/PoE, 3.5 mm audio jack for microphone/line-in, dedicated DC terminal block for power, and I/O terminal block for 1 supervised input and 1 output (max load 50 mA @12V DC). Local storage shall allow minimum support for microSD/microSDHC/microSDXC and also permit scheduled or event-based recording to NAS devices over network links. Camera Must Be Supplied with same OEM Lisance.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications for Audio Communication Unit

The unit shall consist of a high-performance re-entrant horn loudspeaker integrated with a precision-matched compression driver designed to deliver a maximum sound pressure level exceeding 121 dB. The effective acoustic response shall be within the range of 280 Hz to 12.5 kHz, with an optimized directional dispersion pattern providing approximately 70° horizontal by 100° vertical coverage at 2 kHz, enabling wide-area intelligibility. The enclosure shall incorporate a mechanically isolatable electret-type microphone with an operational frequency response between 50 Hz and 12 kHz, alongside an embedded speaker element. A built-in 7-watt Class D audio amplification module shall be provided to ensure high-efficiency signal reproduction.

The internal digital signal processing system shall be pre-configured to support advanced features such as multi-zone audio distribution with support for up to 200 addressable endpoints subdivided into a minimum of 20 independently managed zones. Functional capabilities shall include content scheduling (for music, live, and pre-recorded

announcements), content prioritization protocols to allow interruption of ongoing schedules for urgent messages, and remote health monitoring to detect anomalies across distributed devices. Additionally, access control mechanisms shall permit tiered user authorization to specific configuration or operational roles.

Compatibility shall be ensured with enterprise-grade unified communication platforms and SIP-based systems, including but not limited to softphones and PBX servers supporting standard SIP clients. Supported interoperability protocols shall include SIP over TLS, SRTP, SIPS, DTMF (per RFC 2976 and RFC 2833), NAT traversal (using ICE, STUN, and TURN), and compliance with RFC 3261 call signalling (INVITE, CANCEL, BYE, REGISTER, OPTIONS, INFO). SIP failover mechanisms using secondary servers and IPv6 compatibility shall be mandatory.

The system shall generate and respond to multiple event condition triggers, including audio playback state, speaker test feedback, VoIP call state changes, device status changes (e.g., IP conflict, live stream engagement, system readiness), I/O events (manual trigger, virtual input), MQTT subscribe events, and scheduled triggers. Actions triggered by these events shall include automated speaker testing, playback of preloaded clips, I/O toggling, activation of auxiliary alerts (light/siren), publication to MQTT brokers, notification via HTTP/HTTPS/TCP/email, audio recording initiation, SNMP trap message dispatch, and LED status indicator control.

Built-in functional diagnostics shall support automatic verification using a preconfigured test tone as well as real-time microphone-based monitoring of speaker functionality. The system shall be designed to comply with international EMC standards, including EN 55035, EN 55032 Class B, EN 50121-4, EN 61000-6-1, and EN 61000-6-2. Environmental durability shall be substantiated through adherence to IEC 60068 series tests for temperature, vibration, shock, and humidity, and protection rating shall meet or exceed IP66 per IEC/EN 60529, NEMA 250 Type 4X, and salt fog protection as defined by MIL-STD-810G/H methods.

Network communication protocols shall include dual-stack IPv4/v6 support, HTTP/HTTPS, SSL/TLS encryption, FTP/SFTP, CIFS/SMB, SMTP, SNMP v1/v2c/v3 (MIB-II), RTSP/RTP/RTCP streaming, IGMP v1/v2/v3, DHCP, DNS, DynDNS, NTP (including Network Time Security), SIP, ARP, SOCKS, and Bonjour/UPnP discovery. Comprehensive cybersecurity architecture shall include signed firmware, enforced password security, digest authentication, brute-force mitigation, secure keystore, secure boot, cryptographic protections in accordance with FIPS 140-2 Level 1, and device integrity assurance via a secure element validated to CC EAL 6+. Network-level defense shall include IEEE 802.1X authentication (EAP-TLS), IEEE 802.1AE MACsec (with PSK or EAP-TLS), HTTPS with HSTS, TLS v1.2/v1.3, and X.509-based PKI frameworks.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the

full duration of the contract and any applicable warranty period. Submissions without OEMissued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications Network Paging Console

The equipment to be provided shall be of a fully integrated nature enabling live paging functionality alongside capability to deliver pre-recorded message playback while ensuring full-duplex bi-directional communication with SIP-compatible devices and speaker endpoints. The system shall be able to navigate a minimum of multiple audio zones simultaneously and shall provide a built-in broadband speaker having a minimum diameter of 42 millimeters or better with a maximum sound pressure level not less than 80 decibels. The built-in microphone shall allow audio input functionality, and connectors must include minimum one XLR input compatible with TC6901 Gooseneck Microphone and one 3.5 mm audio input port supporting both 3-ring and 4-ring headsets. Network connectivity shall be achieved via an RJ45 connector supporting minimum 10BASE-T/100BASE-TX/1000BASE-T PoE standards and shall also provide minimum one 6-pin 2.5 mm terminal block allowing at least 2 configurable digital I/Os or better.

The device user interface must comprise configurable soft keys with RGB backlighting capable of being designated for paging, announcement, or calling functions, in addition to volume control keys for internal speaker and headset audio output. There shall be a push-to-talk button with RGB illumination and LED indicator for microphone status. A minimum 7-inch display with full-angle view capability and resolution not less than 1024 x 600 pixels must be included, equipped with an ambient light sensor for automatic backlight adjustment and a display sleep mode for energy optimization.

The solution shall incorporate built-in digital signal processing mechanisms including but not limited to echo cancellation, beam forming, and noise reduction. Audio encoding and streaming shall support two-way (full-duplex) interaction and must accommodate codecs including minimum AAC LC 8/16/32/48 kHz, G.711 PCM 8 kHz, G.726 ADPCM 8 kHz, µ-law 16 kHz, WAV, MP3, and Opus 8/16/48 kHz. MP3 decoding shall support mono or stereo playback at a minimum 64 kbps to 320 kbps constant or variable bit rate with minimum sampling frequencies ranging from 8 kHz to 48 kHz or better.

The system must be built on a System-on-Chip platform conforming to minimum i.MX 8M Mini architecture and shall incorporate minimum 1024 MB RAM and 1024 MB Flash memory. The network capabilities must support a broad protocol range including minimum IPv4 and IPv6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, SFTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMP v1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP v1/v2/v3, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, NTCIP. SIP VoIP integration shall be fully supported with compatibility for peer-to-peer and PBX-based systems, including Cisco and Asterisk. Minimum SIP features must include dual SIP server, IPv6, SRTP, SIPS, TLS, DTMF (RFC2976 and RFC2833), NAT traversal (ICE, STUN, TURN) and must support codecs including minimum PCMU, PCMA, Opus, L16/16000, L16/8000, Speex/8000, Speex/16000, G.726-32, and G.722 or better.

The system shall facilitate event-driven architecture allowing detection and action based on minimum triggers including audio clip playback, audio activity, call state transitions, device network events (e.g., IP blocked, removed, reassigned), edge storage anomalies or ongoing recording, manual or virtual input activations, MQTT stateless commands, and time-based schedules. Minimum allowable event responses must include audio clip management (play/stop/play while rule active), call handling (answer/make/end), I/O toggling (once or

persistent), LED flashing (status), MQTT publish actions, multi-protocol notifications (HTTP, HTTPS, TCP, email), SNMP trap messaging and audio recording actions (triggered or sustained while active).

Cybersecurity provisions shall comprise software-based protections inclusive of a signed OS, brute force delay mitigation, digest and OAuth 2.0 RFC6749 OpenID Authentication Code Flow, password protection, and FIPS 140-2 level 1-compliant Cryptographic Module. Hardware security shall incorporate Edge Vault platform and secure boot technology. Network security should support minimum IEEE 802.1X (EAP-TLS, PEAP-MSCHAPv2), IEEE 802.1AR, HTTPS with HSTS, TLS v1.2 and v1.3, Network Time Security (NTS), X.509 Certificate PKI, and host-based firewall implementation.

Powering of the system must conform to IEEE 802.3af/802.3at Type 1 Class 3 Power over Ethernet standards, with typical consumption not exceeding 6 Watts and maximum not exceeding 9.5 Watts. System reliability shall be designed for continuous 24/7 operation. Storage capabilities shall include support for microSD. This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications Network Paging Console Microphone

The microphone equipment intended for integration within audio infrastructure shall be exclusively compatible with minimum audio systems supporting XLR phantom power input and shall operate under the principle of condenser-based electret biasing technology. It shall exhibit a polar pattern that must be cardioid in nature and shall deliver minimum sensitivity measured at -33 dBV/Pa (equivalent to 17.8 mV), possessing a minimum output impedance rated at 200 Ohms with an active balanced output configuration or better. Under defined operational conditions (1 kHz, 1 k Ω load), the dynamic range shall not be less than 100 Db and must maintain a frequency response spanning a minimum of 40 Hz to 16 kHz, ensuring high-fidelity acoustic capture across standard vocal and ambient spectrums.

The sensitivity characteristics shall reference a calibration at 1 kHz where an open-circuit voltage response to 94 dB SPL shall be established as the benchmark. The microphone shall withstand and reproduce input signals at maximum SPL up to 120 dB (ranging 50 Hz – 18 kHz) without exceeding 1% total harmonic distortion at 1 k Ω load. Signal-to-noise ratio must reference 94 dB SPL and provide a minimum threshold of 60 dB or better to ensure optimal acoustic clarity in professional environments.

Power shall be supplied via phantom voltage ranging between minimum 11 V and maximum 48 V, with a current draw strictly under 5 mA. The device shall conform to form factor

parameters with a minimum top width not less than 65 mm (0.54 in), bottom width not less than 19.3 mm (0.76 in), and a total device weight not exceeding 72 grams (0.16 lbs) or better.

Compliance and regulatory conformity shall be evidenced by approvals including EMC standards: CISPR 32:2015, CISPR 32:2015/AMD1:2019, CISPR 35:2016, IEC 61000-6-1:2016, and IEC 61000-6-2:2016, as well as FCC Part 15 Subpart B Class A for both STP and UTP structured cabling environments. Safety certifications shall include compliance with IEC/EN/UL 60950-1 and CE marking. Environmental conformity shall meet or exceed minimum requirements established in IEC/EN 60529 and EN 50581.

The unit must be designed for continuous operation under minimum 24/7 reliability parameters. Operating temperature conditions shall span from a minimum of -20 degrees Celsius to a maximum of 60 degrees Celsius (-4 °F to 140 °F), with relative humidity tolerance ranging from 0% to 75% non-condensing. Storage conditions shall be met between minimum -40 °C to maximum 70 °C (-40 °F to 158 °F) without performance degradation or material compromise.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications of High-Performance Network-Based PTZ

The offered imaging device shall incorporate a minimum 1/2.8" progressive scan CMOS sensor or better, capable of capturing high-fidelity visual data under varied illumination conditions. The optical assembly must comprise a minimum varifocal lens configuration having a focal length range of minimum 4.3 mm to minimum 137.6 mm or better, with a minimum aperture range spanning from F1.4 to F4.0 or better, ensuring precision-controlled optical performance. Horizontal and vertical fields of view shall be not less than minimum 58.3° to minimum 2.4° and minimum 34.9° to minimum 1.3° respectively or better and must provide minimum day/night operation facilitated via a mechanically removable infrared-cut filter mechanism or better, ensuring full-spectrum operability.

Under color-mode conditions, the device shall exhibit a minimum sensitivity of 0.06 lux at 30 IRE and 0.09 lux at 50 IRE, both at minimum F1.4 or better. For monochrome operation, the minimum sensitivity shall be 0.008 lux at 30 IRE and 0.01 lux at 50 IRE, at minimum F1.4, and a minimum of 0 lux with IR illumination activated or better. The integrated mechanical shutter shall offer an electronic exposure range from a minimum of 1/66500 seconds up to minimum 2 seconds or better. The PTZ mechanism shall incorporate a continuous 360° minimum endless pan range with a speed spectrum of minimum 0.05°/s to minimum 700°/s

or better. The tilt shall be operable from minimum +20° to minimum -90° at a velocity of minimum 0.05°/s to minimum 500°/s or better. The optical zoom must provide minimum 32x zoom capability, in conjunction with minimum 12x digital zoom functionality, yielding a minimum effective magnification of 384x or better.

PTZ features shall include but not be limited to nadir flip, minimum 256 preset positions, tour recording capabilities for a minimum of 10 sequences of up to 16 minutes each, and a minimum of 100 configurable guard tours or better. The system must support control queuing, on-screen directional indicators, orientation aids, adjustable zoom velocity, "speed dry" feature, and the ability to redefine the zero pan position. The processing architecture shall be based on a minimum ARTPEC-7 system-on-chip platform or better, with minimum 1024 MB RAM and minimum 512 MB flash storage capacity or better, incorporating a dedicated machine learning processing unit (MLPU) or equivalent.

The video subsystem shall support multiple simultaneous streams encoding formats inclusive of minimum H.264 Baseline/Main/High profiles, minimum H.265 Main Profile, and Motion JPEG or better. The supported resolution range shall extend from minimum 1920x1080p to minimum 320x180 or better, with a frame rate capability of up to minimum 50/60 fps under both 50 Hz and 60 Hz conditions or better. Streaming technologies must include frame-optimized bitrate algorithms such as Zipstream in both H.264 and H.265 formats, and shall support VBR, ABR, and MBR encoding modes with controllable bandwidth and frame rate parameters. Low-latency video streaming shall be supported natively.

Minimum video image settings should include compression, saturation, brightness, contrast, sharpness, local contrast enhancement, white balance, and exposure controls including selectable zones and defog functionality. A minimum Forensic WDR capability of up to 120 dB depending on scene content or better shall be provided. Further, image orientation must allow a minimum of 0° and 180° rotation, support for image freeze during PTZ operations, and overlay of text and graphics. A minimum of 32 individual polygonal privacy masks should be configurable or better. The image sensor system shall deliver a minimum signal-to-noise ratio of 55 dB or better and incorporate electronic image stabilization (EIS), tone mapping, and dynamic day/night shift calibration.

Audio interface must be implemented via port cast technology supporting minimum two-way audio with voice enhancement or better. Network stack compliance shall include support for IPv4 and IPv6 (USGv6), with minimum compatibility across protocols such as ICMP, HTTP/S1 and HTTP/2, TLS1, FTP, CIFS/SMB, SMTP, mDNS, UPnP, SNMP (v1/v2c/v3), DNS/DNSv6, DDNS, NTP, NTS, RTSP, RTP, SRTP/RTSPS, SFTP, TCP/UDP, IGMP (v1/v2/v3), RTCP, ARP, DHCP (v4/v6), SSH, NTCIP, LLDP, CDP, MQTT v3.1.1, and secure syslog over UDP/TCP/TLS or better. The unit must include support for Link-Local ZeroConf addressing.

Event management conditions must enable detection and reporting of status anomalies including over/under temperature thresholds, fan malfunctions, shock detection, storage disruptions, IP address change or loss, and system readiness confirmations. Events should also include PTZ faults, motion activity, auto tracking states, preset arrival notifications, guard tour activations, and scheduled tasks. MQTT protocol-based publish/subscribe mechanisms must be present. Event-based actions shall facilitate local or remote video recording (via microSD or NAS), with pre- and post-event buffers, FTP/SFTP/HTTP uploads, text overlays, WDR mode toggling, and day/night transitions or better.

Installation aids must include a pixel counter, levelling guide, and configuration assistants for angle and alignment. The onboard object analytics suite shall be capable of identifying humans and vehicles within defined scenarios such as line crossing, area entry/exit, duration-based monitoring, and crossline counting, supporting up to a minimum of 10 simultaneous

scenarios or better. The system shall enable perspective calibration and provide color-coded bounding boxes, trajectory visualization, and metadata export inclusive of object class, type, position, and confidence. Object types should include humans, vehicles (cars, trucks, buses, bikes), license plates, and faces or better.

The product shall comply with all relevant safety standards including minimum IEC/EN/UL 62368-1, IEC/EN/UL 60950-22, IEC/EN 62471 (risk group 2), and IS13252 or better. Environmental resistance ratings shall be minimum IK08 mechanical impact, IP66 dust/water ingress, and NEMA 4X outdoor enclosure specifications. Testing compliance should meet or exceed IEC 60068-2 standards (1, 2, 6, 14, 27, 30, 78), ISO 4892-2 UV resistance, and NEMA TS 2 (clauses 2.2.7–2.2.9). Cybersecurity provisions must meet a minimum of ETSI EN 303 645, BSI IT security labelling, FIPS 140, and NIST SP500-267 standards or better.

The casing material shall include an IK08 and IK10-rated aluminum housing with a clear polycarbonate dome (hard-coated), using Sharpdome technology, and must be paintable or better. Connectivity shall be provided via a minimum RJ45 interface supporting 10BASE-T/100BASE-TX PoE and an IP66-rated push-pull connector. Audio and I/O connectivity shall utilize port cast interface technology.

Integrated IR illumination shall utilize Optimized with minimum 850 nm wavelength, employing power-efficient, long-life LEDs. Using a minimum 30W midspan injector, IR reach shall be at least 190 meters, and using a 60W injector, a minimum of 250 meters or better depending on environmental scene variables. Storage capability must include support for encrypted microSD/microSDHC/microSDXC cards and network-attached storage with secure recording features or better.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document. The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications for Control Board

The control interface unit shall be a precision operator console comprising a three-hall-effect joystick and a programmable keypad module, intended for advanced PTZ (Pan-Tilt-Zoom) control within professional video surveillance command environments. The joystick component shall support X and Y movement for pan and tilt functionality, and a Z- rotary encoder for zoom control. Each shall have movement constrained by mechanical square delimiters, permitting precise control within ±15° for XY and ±25° for Z directions. The device shall support a minimum of 16 programmable hotkeys, allowing custom user-defined macros and operational shortcuts via a supported Software Development Kit (SDK), and the keypad shall provide a minimum of 26 customizable tactile keys, with a 2×20-character alphanumeric LCD display that can be dynamically updated based on control mode or connected device status.

The product shall operate over a USB interface, drawing all necessary power directly from the host system without requiring external power adaptors. The system shall expose at minimum one USB Type-C port integrated into the joystick body and one USB Type-A port, permitting flexible integration with host computers. The external casing shall be fabricated from high- impact Polycarbonate-ABS blend plastic, with an environmental protection rating of IP54 for the top enclosure and IP20 for the base, ensuring resistance to ingress of dust and water spray under routine command center conditions.

Environmental operating conditions shall include ambient temperatures between 0 °C and +60°C, with relative humidity tolerances of 10–85% non-condensing, and support safe storage in environments ranging from -40 °C to +70 °C at 5–95% RH, without performance degradation. The device shall be TAA (Trade Agreements Act) compliant, with full adherence to global electromagnetic compatibility (EMC) standards including EN 55035, EN 55032 Class B, EN 50121-4, RCM AS/NZS CISPR 32 Class B (Australia/NZ), ICES-003 Class B (Canada), VCCI Class B (Japan), KS C 9835/9832 Class B (Korea), and FCC Part 15 Subpart B Class B (USA). Safety compliance must include certifications under CAN/CSA C22.2 No. 62368-1 Ed. 3 and IEC/EN/UL 62368-1 Ed. 3, ensuring electrical and mechanical safety for Information and Communication Technology Equipment.

The system shall be compatible with USB 2.0 or higher ports and shall function with operating systems including Windows 7, 8, 10, and 11. External dimensions shall not exceed 312 mm (width) × 185 mm (length) × 122 mm (height), and the complete assembly shall weigh no more than 1.26 kg (2.8 lbs), allowing for desk-based or integrated console deployment. The system shall be supported by utility software such as product selectors, accessory designers, and site configurators, and the entire offering shall be backed by a minimum 5-year comprehensive warranty, with full compliance to RoHS Directive 2011/65/EU and documentation in accordance with EN 63000:2018 for environmental substance management.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications of 5 MP IR Bullet cameras

The device proposed shall be constructed employing a minimum 1/2.7" progressive scan RGB CMOS sensor, integrated within a ruggedized, minimum IP66/IP67 and IK10-rated polycarbonate-aluminum blend enclosure conforming to NEMA Type 4X standard, with white finish compliant with NCS S 1002-B; any repainting shall be governed under OEM warranty stipulations. The imaging assembly shall incorporate a varifocal lens mechanism spanning minimum focal lengths of 2.8 mm to 8 mm or

better, with minimum F1.3 aperture or better and shall feature integrated remote zoom/focus capabilities, inclusive of minimum P-iris control and IR correction for optimized day/night fidelity. The device must employ an auto-removable infrared-cut filter for true day/night switching. The illumination sensitivity, under WDR and Light finder operation, should permit minimum color visibility at 0.13 lux and monochrome at 0.03 lux at 50 IRE using minimum F1.3 or better, and shall support 0 lux operation when integrated IR is active, achieving a minimum illumination reach of 40 meters or more via optimized 850 nm IR LED array.

The electronic shutter mechanism must support a minimum range from 1/50000 s to 1/5 s or better. At its computational core, the unit must deploy a minimum ARTPEC-8 SoC enabling advanced edge analytics via integrated deep learning processing unit (DLPU). The memory configuration shall be minimum 2 GB RAM with 8 GB Flash or better. In the domain of video handling, it shall support a minimum resolution array from 2592x1944 (5 MP) down to 160x90, with capture modes enabling 25/30 fps for 5 MP mode and a minimum of 180 fps in 720p mode, with full support for H.264 Baseline/Main/High, H.265 Main, and Motion JPEG encoding formats, and include multiple simultaneous video streams individually configurable across codecs with Axis Zipstream optimization in both H.264 and H.265.

Frame rate control shall offer minimum VBR, ABR, and MBR mechanisms alongside a dedicated low-latency streaming mode. Streaming functionality must support minimum 8 individual cropped views through multi-view streaming, with user-defined ROI segmentation. Imaging parameters shall encompass saturation, sharpness, brightness, contrast, forensic WDR up to minimum 120 dB dynamic range depending on scene composition, white balance, exposure zones, tone mapping, motion-adaptive exposure, defog, barrel distortion correction, configurable orientation (0°, 90°, 180°, 270° including Corridor Format), polygonal privacy masking, text/image overlay, and selectable scene profiles such as forensic, vivid, and traffic overview.

The unit must support minimum digital PTZ with digital zoom, a minimum of 100-point guard tour, fixed orientation aid, and object-based scene metadata with classification for humans, vehicles including types (cars, buses, trucks, bikes), and license plates, with advanced detection attributes such as upper/lower clothing color, position, and confidence scoring. Scene metadata shall also support object attributes and tampering detection features including image redirection, blockage, blur, and underexposure validation with sensitivity configuration. The device shall be equipped with object analytics supporting up to minimum 10 configurable scenarios including line crossing, occupancy, and object-in-area with bounding box visualization and polygonal exclusion/inclusion areas.

Audio capabilities must include minimum simplex audio streaming and two-way communication via edge-to-edge technology, with encoding support for minimum 24bit LPCM, AAC-LC (8–48 kHz), G.711 PCM 8 kHz, G.726 ADPCM 8 kHz, and Opus (8/16/48 kHz) with configurable bitrates. Interface must support external mic/line input and digital audio input with ring power and network speaker pairing. The system shall comply with network protocols including but not limited to minimum IPv4/IPv6 (USGv6), ICMPv4/ICMPv6, HTTP/HTTPS1/HTTP2, TLS1, FTP, SFTP, CIFS/SMB, SMTP, SNMP v1/v2c/v3, mDNS, UPnP, DNS/DNSv6, DDNS, NTP/NTS, RTSP/RTCP/RTP/SRTP/RTSPS, TCP/UDP, IGMP v1/v2/v3, DHCP v4/v6, ARP, SSH, MQTT v3.1.1, LLDP, CDP, secure syslog, and link-local addressing. Network interface must be via shielded RJ45 supporting 10/100/1000BASE-T Ethernet. The camera shall be compatible with ONVIF profiles and provide a video streaming indicator.

Device event handling must incorporate minimum support for conditions such as thermal thresholds (above, below, within), IP change detection, system readiness, stream activity, storage anomalies, manual triggers, virtual inputs, MQTT subscriptions, digital signal validity, and ongoing recording events. Corresponding event actions shall include overlay text, mode switching (day-night/WDR), audio clip playback/control, I/O toggling, light activation. MQTT publish. HTTP/HTTPS/TCP/email notifications, and media uploads via FTP, SFTP, network shares, or email. Storage provisions must include support for minimum microSD/microSDHC/microSDXC with AES-XTS-Plain64 256-bit encryption, and recording to NAS.

Built-in installation aids must feature pixel counter, auto-rotation, and remote zoom/focus. Powering options must include minimum IEEE 802.3af/802.3at Type 1 Class 3 PoE (typical 5.8 W, max 12.95 W) and 10–28 V DC input (typical 5.2 W, max 12.95 W). Alarm interface should include minimum 1 supervised input and 1 output via terminal block, with 12 V DC output at 25 mA max.

The device must conform to environmental and safety standards including minimum IEC/EN 62368-1, IEC/EN 62471, IS 13252, IEC 60068 series (2-1/2-2/2-6/2-14/2-27/2-78), and cybersecurity regulations per ETSI EN 303 645, BSI IT Security Label, FIPS-140-2. It shall integrate Axis Edge Vault platform with secure element (CC EAL6+), TEE, device ID, secure keystore, signed video, secure boot, and encrypted filesystem. Network security shall include IEEE 802.1X, IEEE 802.1AE (MACsec), IEEE 802.1AR, HTTPS/HSTS, TLS v1.2/v1.3, Network Time Security (NTS), host-based firewall, and X.509 PKI with OpenID/OAuth 2.0 centralized account support.

Sustainability criteria mandate the use of PVC/BFR/CFR-free components. The unit must comply with NIST SP500-267 and NEMA TS 2 (2.2.7-2.2.9) for transportation environments. The system shall be classified as secure and conforming to international and national cybersecurity mandates with full device-to-network resilience ensured.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications of 2 MP IR Bullet cameras

The imaging mechanism incorporated within the proposed visual capture apparatus shall be constructed upon a minimum 1/2.8" progressive scan RGB CMOS sensor or better, with a pixel dimension not less than 2.9 µm or superior. The optical subassembly must incorporate a minimum varifocal lens mechanism with provisions for remote operability inclusive of motorized focus and zoom functionalities, and it must be equipped with minimum P-Iris control as well as IR-corrected optics or equivalent. The system shall support interchangeable lens configurations, including a minimum 3-9 mm varifocal assembly with an aperture range beginning at minimum F1.6 up to F3.3 or better, facilitating a horizontal field coverage no less than 117° to 37° and vertical visual field not below 59° to 20°. The closest allowable object focal convergence point for the aforementioned lens should be a minimum of 0.5 meters (or better). Alternatively, in extended focal mode, the apparatus shall accommodate a minimum 10.9–29 mm focal span with constant aperture specification minimum F1.7 or equivalent across zoom range, ensuring horizontal coverage not under 29° to 11° and vertical angularity no less than 16° to 6° with a minimum focus range not exceeding 2.5 meters or better.

Integrated into the spectral management regime shall be a minimum automatic IR-cut filter for day-night operability accompanied by a hybrid IR filter or similar spectral rejection mechanism. Minimum illumination thresholds shall not exceed 0 lux when IR subsystems are engaged. For 9 mm configuration, color sensitivity should be no greater than 0.06 lux at 50 IRE with F1.6 or superior, and black-and-white sensitivity must not exceed 0.01 lux at identical IRE level. For the extended 29 mm configuration, corresponding illumination thresholds shall remain equivalent, not surpassing minimum 0.06 lux (color) and 0.01 lux (B/W) at F1.7 or better.

The temporal exposure matrix shall enable a minimum shutter speed operation of 1/37000 s up to 2 seconds in Forensic WDR mode, while permitting extension to a minimum 1/71500 s to 2 seconds in standard dynamic regime or equivalent. Processing core shall be constituted upon a minimum ARTPEC-8 SoC or better, with not less than 1024 MB RAM and minimum 8192 MB Flash storage capacity or higher, integrated with a dedicated DLPU (Deep Learning Processing Unit) for on-edge inference operations.

Compression capabilities shall include minimum support for H.264 across Baseline, Main, and High profiles, in addition to H.265 Main Profile, supplemented with Motion JPEG, all configurable under multi-profile encoding. Supported resolution envelopes shall span minimum 1920x1080 to 160x90 for 16:9, minimum 1280x800 to 160x100 for 16:10, and minimum 1280x960 to 160x120 for 4:3 aspect ratios. Frame delivery must attain a minimum 25/30 fps across all resolutions with WDR enabled and minimum 50/60 fps without WDR engaged or better. The device shall accommodate generation of minimum 20 independent video streams with configurable attributes using Zipstream in both H.264 and H.265, incorporating minimum VBR, ABR, and MBR control schemas, and including a low latency streaming mode or equivalent. Signal-to-noise ratio shall be no less than minimum 55 dB or higher. Forensic WDR capability must deliver dynamic range expansion up to minimum 120 dB or better depending on scene contrast levels.

Video outputs must support minimum 8 region-specific multi-view stream areas with digital PTZ and zoom capabilities. Integrated noise reduction shall be of both spatial (2D) and temporal (3D) types or superior, and configurable image parameters shall include, but not be limited to, minimum saturation, contrast, brightness, sharpness, white balance, day/night thresholds, selectable exposure modes/zones, anti-fog functionality, adjustable compression, image orientation including minimum 0°, 90°,

180°, 270° with corridor mode, mirroring, dynamic overlays (text/image), polygonal privacy zones, and barrel distortion correction. Preset imaging scenarios shall incorporate minimum forensic, vivid, and traffic profile modes, while 29 mm lens configuration must offer minimum electronic image stabilization or equivalent.

Integrated image enhancement must include Zipstream, Forensic WDR, Light finder 2.0, and Optimized subsystems. Audio architecture must accommodate AGC, network speaker pairing, and duplex-configurable audio streaming with support for minimum one-way, half duplex, and full duplex or better. Audio interface shall feature minimum 10-band graphic equalizer, unbalanced microphone input with minimum 5 VDC phantom power option, digital input with optional 12 V ring power, and unbalanced line input. Output must support network speaker pairing for playback. Encoding suite shall incorporate minimum 24-bit LPCM, AAC-LC (8/16/32/44.1/48 kHz), G.711 PCM 8 kHz, G.726 ADPCM 8 kHz, and Opus at 8/16/48 kHz with adjustable bitrate or better.

Networking protocol stack shall conform to IPv4/IPv6 USGv6, ICMPv4/v6, HTTP/2, HTTPS, TLS, QoS (DiffServ Layer 3), FTP/SFTP, CIFS/SMB, SMTP, mDNS, UPnP, SNMP v1/v2c/v3 (MIB-II), DNSv6, DDNS, NTP/NTS, RTSP/SRTP/RTSPS, TCP/UDP/IGMPv1/v2/v3, RTCP, ARP, SSH, LLDP, CDP, MQTT v3.1.1, secure syslog RFC3164/5424, and ZeroConf or better.

The unit shall include onscreen controls for autofocus, defogging, IR illumination management, WDR toggle, privacy masking, video stream indicator, and pixel counter. Embedded object analytics shall support minimum object classes including humans and vehicle types (cars, buses, trucks, bikes, others), with scenario templates such as line crossing, object presence, occupancy, and dwell time; supporting not fewer than 10 active rules, with visualizations using color-coded bounding overlays and trajectories. Inclusion/exclusion zoning and perspective configuration shall be supported.

Scene metadata must incorporate recognition of minimum object types (human, face, car, bus, truck, bike, license plate) with associated attributes like vehicle color, clothing color (upper/lower), position, and detection confidence. Image health diagnostics must detect image degradation states such as blocking, redirection, blurring, and underexposure, with customizable sensitivity and validation durations.

Environmental durability shall comply with minimum IEC 60068-2-1/2-2/2-6/2-14/2-27/2-78, IEC/EN 60529 IP66/IP67, IEC/EN 62262 IK10, NEMA Type 4X, and NEMA TS 2 (2.2.7-2.2.9) or equivalent. Cybersecurity conformance must adhere to ETSI EN 303 645, BSI IT Labelling, and minimum FIPS-140 or better. Software security must incorporate signed OS, brute-force delay, digest and OAuth 2.0 (RFC6749) support, centralized ADFS credential flow, SD card encryption via AES-XTS-Plain64 256-bit, and hardware-based secure elements certified to minimum CC EAL6+, TEE-based SoC security, secure keystore, Axis device ID, and secure boot. Network security compliance must include IEEE 802.1X (EAP-TLS/PEAP), IEEE 802.1AE (MACsec PSK/EAP-TLS), IEEE 802.1AR, TLS v1.2/1.3, HSTS, NTS, host-based firewall, and full X.509 PKI.

Connectivity must provide shielded RJ45 port compatible with minimum 10BASE-T/100BASE-TX/1000BASE-T, 3.5 mm mic/line in, terminal block I/O with minimum 1 input and 1 output (12 VDC, 25 mA max), and DC power input. IR subsystem shall feature Optimized 850 nm LEDs with minimum range of 40 meters for 9 mm configuration and minimum 80 meters for 29 mm or superior, conditional on scene reflectivity.

Storage interfaces shall permit microSD/SDHC/SDXC with extended NAS recording support. Physical enclosure shall be IP66/IP67, IK10, and NEMA 4X compliant, constructed using high- resilience polycarbonate-aluminium blend, with color matching minimum NCS S 1002-B. Power delivery must accommodate IEEE 802.3af/at (Type 1, Class 3), consuming minimum 7.9 W typical and 12.95 W max, with alternate support for 10–28 VDC power supply with minimum 7.2 W typical and maximum 12.95 W or better.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications of 4 x 5 MP multidirectional Panoramic Camera

The device intended for deployment in surveillance-critical zones shall incorporate not fewer than four individual RGB CMOS imaging modules, each incorporating a minimum sensor format of 1/2.7" progressive scan architecture and shall employ a pixel pitch not less than 2.0 micrometers to ensure precise imaging under various illumination regimes. The optical subsystem must utilize a remote-configurable varifocal lens mechanism featuring a zoom range of minimum 3.2 mm to 8.1 mm and an aperture variation from F1.9 to F3.2, supporting a minimum horizontal coverage not less than 99 degrees at wide end and narrowing to 37 degrees at the tele end, while the vertical field shall range from minimum 70 degrees to 28 degrees, diagonally covering not less than 134 degrees to 47 degrees respectively. The optical path must remain IR-corrected and incorporate a fixed iris assembly while enabling motorized focus and zoom adjustment.

The integrated mechanism shall deploy an automatically actuated IR-cut filtration element to support full-spectrum operation for both day and night visualization, while minimum scene illumination sensitivity must not exceed 0.19 lux at F1.9 (color mode, 50 IRE), with a threshold of 0 lux in monochrome mode when aided by infrared lighting, achieving absolute zero-lux operability under aided conditions. The shutter mechanism must offer a variable exposure range starting from 1/28000 s up to 1/5 s when operating in 5 MP mode with WDR active, and as fast as 1/33500 s in Quad HD WDR mode; in non-WDR operation, the lower threshold shall be minimum 1/50000 s. Mechanically, the device shall be adaptable in orientation with pan limits of $\pm 90^{\circ}$, tilt from +25° to +95°, rotational compensation from -5° to +95°, and twist flexibility not

less than ±20° to align with diverse mounting scenarios.

The core computational engine must be embedded within a system-on-chip configuration equivalent to modern architectures incorporating deep learning acceleration capability, with onboard memory comprising a minimum 4096 MB of volatile RAM and minimum 8192 MB of persistent flash storage to facilitate advanced local analytics and video buffering. The imaging pipeline shall support multi-codec compression including H.264 across Baseline, Main, and High Profiles, H.265 (Main Profile), and Motion JPEG, while simultaneously generating multiple independently configurable video streams incorporating dynamic bitrate control including VBR, ABR, and MBR profiles. The device shall support resolutions not less than 2592x1944 (5 MP per sensor) and 2560x1440 (Quad HD) down to 320x180 with a minimum frame delivery rate of 20/20 fps in 5 MP and 25/30 fps in Quad HD, respecting regional frequency standards (50/60 Hz). A low-latency transmission mode, real-time stream indicators, and dynamic frame adaptation must be included.

Integrated wide dynamic range processing, equivalent to forensic-grade implementations, shall achieve scene compensation up to minimum 120 dB. Video enhancement features must include both temporal (3D) and spatial (2D) noise filtering, and support for saturation, contrast, sharpness, white balance, local contrast enhancement, tone mapping, exposure metering with zonal segmentation, barrel distortion correction, text/image overlay (including dynamic content), privacy masking using polygon shapes, and rotation in 90° increments including corridor view shall be supported. The image processor shall enable intelligent scene optimization such as Light finder and Optimized IR functionalities.

Audio integration, when enabled through auxiliary interface modules, must permit bidirectional streaming in half or full duplex using IP speaker pairing mechanisms. Network interfacing shall be facilitated via an RJ45 connector supporting 10BASE-T/100BASE- TX/1000BASE-T with full PoE compliance to IEEE 802.3at Type 2, drawing a typical power of minimum 13.25 W with IR active and peaking at 23.30 W; in IR-deactivated state, the power envelope must reduce to typical 6.80 W and not exceed 12.32 W.

Communication protocols must encompass a broad stack, including IPv4/v6, ICMP, HTTP/HTTPS, TLS, FTP/SFTP, CIFS/SMB, SMTP, mDNS, UPnP, SNMP v1/v2c/v3, DNS, NTP, RTSP/RTP/RTCP/SRTP, TCP/UDP, IGMP v1/v2/v3, MQTT v3.1.1, Secure Syslog (RFC 3164/5424), SSH, LLDP, CDP, and ZeroConf among others. Full IEEE 802.1X (EAP-TLS), IEEE 802.1AR, and X.509-based PKI integration with FIPS-aligned cryptographic modules and secure keystore mechanisms shall be implemented to ensure cybersecurity resilience, with dedicated hardware elements such as TPM 2.0, secure boot, encrypted storage using AES-XTS-Plain64 (256-bit), and compliance with ETSI EN 303 645 and FIPS 140-2 Level 1 or better.

The environmental robustness must align with IEC and MIL standards including, but not limited to, IEC 60068 series (2-1, 2-2, 2-6, 2-14, 2-27, 2-78), IEC/EN 60529 IP66/IP67, IEC/EN 62262 IK09, ISO 21207 Method B, MIL-STD-810H methods (501.7 through 512.6), and VDMA 24364 classifications. Casing shall exhibit ingress and impact resistance not less than IP66, IP67, IK09, and must conform to NEMA 4X standards using an aluminum-polycarbonate hybrid enclosure with UV-resistant polycarbonate dome, finished in a shade similar to NCS S 1002- B.

IR subsystem must utilize Optimized architecture featuring 850 nm LEDs with a scene-

dependent reach not less than 15 m. The system shall support onboard recording via microSD/microSDHC/microSDXC cards with encrypted file handling, and network-based archival to NAS or FTP/SFTP targets.

Analytics capabilities shall encompass not fewer than four simultaneous intelligent analysis streams, supporting object detection across humans and vehicles (cars, buses, trucks, motorcycles, etc.), with predefined rules including line crossing, object in area, dwell time measurement, crossline counting, and area occupancy. Metadata tagging must include bounding boxes, object trajectories, and attribute classification such as vehicle color and clothing color, with confidence levels and position mapping. Perspective adjustment and inclusion/exclusion zoning must be programmable. Metadata must support ONVIF Motion Alarm eventing, Scene Data, and Event Conditions tied to device states, network status, thermal thresholds, IP changes, and storage disruptions. MQTT-based publish-subscribe communication shall also be configurable.

Installation assist tools shall provide remote optical adjustment, pixel dimension overlays, and distortion correction utilities. Events and alarms shall be managed with multi-modal triggers and actions such as HTTP/TCP notifications, overlay content, illumination control, video clip generation, SNMP trap dispatch, status LED behavior, and direct-to-share uploading using encrypted protocols.

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The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications of Dual sensor with 360° IR

proposed network video surveillance device shall be equipped with a dual imaging mechanism comprising minimum two progressive scan RGB CMOS sensors each not exceeding minimum 1/2.7" in dimension, enabling minimum image capture precision and color rendition, capable of delivering synchronized dual views across simultaneous fields of surveillance. The optical assembly shall incorporate a motor-driven varifocal lens system ranging from minimum 3.3 mm to minimum 8.1 mm with a minimum aperture configuration of F1.9 to F3.2, exhibiting a minimum horizontal angular coverage between minimum 98° to minimum 36°, a minimum vertical range spanning from minimum 133° to minimum 46°, with a minimum focal engagement distance of 0.5 meters or better. The optical configuration shall provide

an IR-corrected, fixed iris arrangement with integrated capabilities for remote zoom and precision focus control, incorporating a minimum automatically retractable IR-cut filter to facilitate seamless transition between minimum day and minimum night surveillance modes.

The device shall ensure minimum color sensitivity threshold of 0.19 lux at 50 IRE with F1.9, and minimum black-and-white visibility at 0 lux with IR illumination enabled, with configurable electronic exposure ranging from minimum 1/33500 second to minimum 1/5 second under 60/50 Hz mains frequency context. The device shall provide motorized adjustment for installation versatility including pan motion up to minimum $\pm 110^{\circ}$, tilt alignment of minimum $\pm 75^{\circ}$, and rotational displacement of minimum $\pm 170^{\circ}$, to suit diversified field deployments. Embedded computational hardware shall incorporate a system-on-chip architecture powered by a minimum DLPU (Deep Learning Processing Unit) with minimum 2048 MB of volatile memory and minimum 8192 MB of non-volatile flash storage ensuring real-time analytic processing at the edge.

Video encoding protocols supported shall minimally include H.264 (covering Baseline, Main, and High profiles), H.265 (Main Profile as per MPEG-H Part 2/HEVC) and Motion JPEG, offering configurable resolutions from minimum 2x 2592×1944 (4:3, minimum 5MP per sensor) to minimum 2x 640×480 and from minimum 2x 2560×1440 (16:9, Quad HD) down to minimum 2x 640×360, sustaining a minimum frame rate of 30/25 fps under both 60/50 Hz electrical standards. Multiple simultaneous and independently controlled video streams shall be supported in all three codecs with application of bandwidth control techniques including VBR, ABR, MBR and proprietary compression optimization technology using Zipstream in both H.264 and H.265 formats. A low-latency transmission mode shall be available. Image refinement and compensation parameters shall provide granular controls for saturation, contrast, sharpness, brightness, white balance, forensic-level wide dynamic range (WDR), tone mapping, exposure zoning, and distortion correction. The device shall also accommodate image rotation at minimum 0°, 90°, 180°, and 270° including corridor view format and allow dynamic text/image overlays along with polygon-shaped privacy masking.

The unit shall include audio features supporting minimum simplex input and edge-toedge bidirectional audio capabilities over IP, with minimum 3.5mm jack supporting mic/line-in, optional ring-power provisioning, and digital audio input with automatic gain control. Audio enhancements through portcast technology shall facilitate voice enhancer functionalities, and encoding shall comply with minimum 24-bit LPCM, AAC-LC at various sampling frequencies (8/16/32/44.1/48 kHz), legacy G.711 PCM, G.726 ADPCM at minimum 8 kHz, and Opus codec compatibility across minimum 8/16/48 kHz with adjustable bitrate configuration.

The device must support a comprehensive network protocol suite including minimum IPv4, IPv6 with USGv6 compliance, ICMPv4/v6, HTTP, HTTPS, HTTP/2, TLS, FTP, SFTP, CIFS/SMB, SMTP, mDNS, UPnP, SNMP (v1/v2c/v3), DNS/DNSv6, DDNS, NTP with NTS support, RTSP/RTCP/RTP and SRTP/RTSPS, TCP, UDP, IGMP (v1/v2/v3), DHCP (v4/v6), ARP, SSH, LLDP, CDP, MQTT v3.1.1, secure syslog (RFC 3164/5424, over UDP/TCP/TLS), and zero-configuration networking (link-local addressing). Event-triggered automation and command invocation shall support a wide condition matrix including system temperature breaches (above/below/within), IP status variations, power anomaly via ring power overcurrent notification, and casing integrity detection. Audio conditions such as detection and metadata validity, signal

anomalies, and digital audio synchronization integrity must also be detectable. Storage subsystem health, I/O status, live stream initiation, and virtual/manual triggers should be observable and actionable.

Advanced analytics capabilities shall include object classification distinguishing minimum human and vehicle types including cars, buses, trucks, and bikes, with configurable scenarios supporting minimum 10 use-cases such as line crossing, object-in-area, occupancy metrics, and duration-based presence evaluation. Visual representation of detected objects shall be rendered using minimum color-coded demarcations motion trajectories, bounding and inclusive of polygonal inclusion/exclusion zones and adjustable scene perspective alignment. Alarm handling must incorporate ONVIF motion event standards with extended scene metadata such as human presence, facial recognition, vehicle identification with license plate extraction, and attribute metadata including color categorization of vehicles and apparel (upper/lower), spatial coordinates, and object detection confidence scores.

Device shall adhere to minimum cybersecurity compliance benchmarks as per NIST SP500- 267, ETSI EN 303 645, and hold certifications equivalent to BSI IT Security and FIPS 140. Embedded edge security shall include a signed operating system, brute force login mitigation, OAuth 2.0 with centralized identity federation (e.g., ADFS), secured password controls, and certified cryptographic modules with minimum FIPS 140-2 level 1. Hardware security must integrate a secure element (minimum CC EAL 6+), system-on-chip with trusted execution environment (TEE), TPM 2.0 with minimum FIPS 140-2 Level 2 and CC EAL 4+, along with secure keystore management, device-specific identity modules, full disk encryption (AES- XTS-Plain64 256bit), secure boot process, signed video streams, and encrypted file systems.

The enclosure shall exhibit minimum ingress protection equivalent to IP66 and IP67, with impact resistance not less than IK10, suitable for outdoor exposure as per NEMA 4X compliance. Dome material shall be composed of hard-coated polycarbonate, and the housing shall utilize aluminum and engineered plastics, with integrated weathershield, available in white or black as per industry-recognized color references (NCS S 1002-B or NCS S 9000-N respectively). Environmental design shall support sustainable manufacturing with minimum 7% recycled plastics and 2% bioplastics, free of PVC and halogenated flame retardants (BFR/CFR).

Powering shall be through IEEE 802.3at Type 2 PoE, Class 4, consuming a minimum of 5.2 W (typical) and up to minimum 10.6 W (max) with IR off, and minimum 10.7 W (typical) up to minimum 17.5 W (max) with IR on. The device must provide an integrated RJ45 port supporting minimum 10/100/1000 Mbps Ethernet over shielded cabling, and must support a 3.5 mm audio interface. IR illumination shall be implemented through optimized IR technology using long-life minimum 850 nm LEDs with minimum reach of 15 m or better, contingent on scene reflectivity. The device shall support edge recording through integrated microSD/microSDHC/microSDXC interfaces with full support for SD card encryption (AES- XTS-Plain64 256bit) and capability for NAS-based recording on the network infrastructure.

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Minimum Technical Specifications of integrated digital video storage and access management hardware

Integrated digital video storage and access management hardware appliance shall be inherently engineered to support and facilitate a system architecture accommodating minimum scalability thresholds equating to at least minimum 192 electronically secured portal nodes and a cumulative minimum sustained recording throughput capability no less than minimum 850 Megabits per second or better under optimized conditions. The system shall exhibit operational readiness to concurrently manage a video matrix comprising minimum 96 video acquisition channels configured at minimum 4 Megapixels resolution and a minimum capture frame frequency of 30 frames per second per stream, particularly in retail-centric deployment paradigms. Storage estimation and planning parameters shall be dynamically evaluated through industry-standard system design utilities.

The appliance shall have been subjected to rigorous validation protocols wherein concurrent client-side load distribution shall include simultaneous engagement from minimum 20 live visual monitoring terminals along with a minimum of 3 distinct client workstations performing high-density video retrieval operations, including frame scrubbing and continuous reverse play navigation. Processing core infrastructure shall be constructed around a minimum Intel Xeon Silver multi-core processor configuration with advanced instruction pipeline suitable for compute-intensive VMS workloads. Memory allocation shall incorporate dual-module dynamic memory constructs providing minimum 2x16 GB or better of error-correcting ECC RAM to ensure data integrity in volatile operational cycles. Local persistent data storage must utilize hotswappable enterprise-class rotational disk assemblies, with a total internal drive bay capacity not less than minimum 12 physical HDD insertion slots, of which a minimum 4 bays shall remain unoccupied for scalability. RAID redundancy shall be delivered via factory- integrated RAID controller configured to minimum RAID Level 5 and supporting minimum additional redundancy levels including RAID 0, RAID 1, RAID 6, and RAID 10. The device shall permit field modification of RAID configuration to match specific project resiliency goals.

Power delivery infrastructure shall incorporate minimum two independently operable hot- pluggable power supply modules each rated at minimum 800 Watts, supporting global voltage standards ranging from minimum 100 to minimum 240 Volts AC with a current draw profile of minimum 9.2 to minimum 4.7 Amperes across the 50/60 Hertz frequency envelope. Front- panel interface architecture shall comprise minimum one USB 2.0 interface port, one legacy analog video output VGA port, and one system management direct-access port compatible with embedded device lifecycle management modules. Rear-panel input/output interface shall provide a combination

of minimum one USB 2.0, minimum one USB 3.0, one duplicate VGA output port, one dedicated Ethernet-based remote controller access port for out-of-band diagnostics and BIOS-level interaction, and minimum dual 1 Gbps RJ45 Ethernet uplink ports for network redundancy or link aggregation.

The internal system image and application stack shall operate on a preinstalled minimum Microsoft Windows 10 IoT Enterprise operating system version consistent with LTSC 2021 release protocols. Operating system resilience shall be embedded through integrated recovery partition and secured firmware-level rollback mechanisms. System boot and OS shall be hosted on a high-speed minimum 480 GB solid-state disk (SSD) serving as the primary system volume, secured by hardware-based encryption. Remote server governance shall be facilitated via integrated out-of-band management infrastructure licensed under minimum express-level credentials of the server's embedded control module.

The appliance shall include built-in security capabilities supporting cryptographically enforced data protection on both the primary system boot volume and the dedicated video archival drives, with mandatory incorporation of hardware cryptographic modules certified to minimum FIPS 140-2 Level 2 compliance. In addition, the unit must support trusted execution verification through Trusted Platform Module (TPM) technology conforming to TPM 2.0 specifications. Component authenticity and tamper resistance shall be assured via secure verification protocols implemented through Secure Component Verification (SCV) at the hardware provisioning stage.

Environmental operational range shall allow functional performance within ambient temperature limits from minimum 10 degrees Celsius to minimum 35 degrees Celsius (minimum 50°F to minimum 95°F), with non-condensing humidity operation certified between minimum 20% to minimum 80% relative humidity. Non-operational storage condition tolerances shall extend from minimum -40 degrees Celsius to minimum +65 degrees Celsius (minimum -40°F to minimum 149°F), ensuring equipment survivability under extreme logistics conditions. Physical construction shall utilize a 2U rack-mountable chassis form factor with physical envelope dimensions not less than 721.62 mm in width, 482 mm in depth, and 87 mm in vertical height (or minimum 28.42 x 19 x 3.43 inches), excluding any front bezel or extended cable fixtures.

Mounting solution shall employ sliding rail mechanisms designed for rack deployment, with a minimum rail-mounting depth of 719 mm (minimum 28.31 inches) and a squarehole rack compatibility range adjustable between minimum 631 mm and minimum 868 mm (minimum 24.85 to minimum 34.18 inches), conforming to enterprise data center equipment rack standards as published in recognized compatibility matrices. Recording Server should preloaded Licenses and VMS Software From Same OEM as per design This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

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Minimum Technical Specifications Monitoring Work Station

Desktop-grade client-side computing unit intended for high-definition surveillance liveview and forensic playback functions shall incorporate an embedded processing subsystem equipped with a multi-core central processing engine meeting or exceeding the minimum industry classification of Intel Core series processors or better, delivering sufficient compute throughput to support decoding and real-time rendering of multiple high-bitrate surveillance video streams. Integrated volatile system memory allocation shall not be less than minimum 16 GB capacity, populated using dual-channel architecture with minimum 2x 8 GB non-ECC DIMMs or equivalent, facilitating optimal parallel data access rates and enhanced performance in multi-windowed video viewing environments. Visual output shall be natively managed through a minimum integrated Intel UHD graphics processor or equivalent embedded GPU solution, ensuring compatibility with modern H.265 decoding requirements and concurrent display across multiple ultra-high-definition monitor interfaces.

The power supply architecture shall be configured for energy-efficient operation through a minimum 300 Watt high-efficiency rated power converter compliant with minimum 80 Plus Platinum certification standards, capable of auto-switching across international voltage tolerances from minimum 100 Volts to minimum 240 Volts AC with an input current profile not exceeding minimum 4.2 Amperes across the 50/60 Hertz nominal power frequency spectrum. The system shall include both front and rear input/output connectivity zones, with the front- panel interface consisting of minimum one universal audio input/output combination jack, a minimum of two USB 2.0 ports for low-speed peripherals, one USB 3.2 Gen 1 port, and minimum one USB 3.2 Gen 2x2 Type-C reversible interface supporting high-speed data and video throughput. Rear-panel I/O array shall offer minimum one duplicate universal audio jack, minimum one DisplayPort output conforming to version 1.4a specification, a header connector for integration with remote power activation switches, minimum four USB 3.2 ports, two additional USB 2.0 ports, minimum one RJ45 Ethernet port with Gigabit capability, and minimum three Mini DisplayPort outputs compliant with version 1.4 protocol, enabling multi- monitor video output.

Real-time video decoding and live display capabilities shall accommodate minimum stream configurations including a single full-frame 4K resolution feed at minimum 30 frames per second, or alternatively, simultaneous quadrants of four 1080p feeds each at minimum 30 fps, or a non-overlapping matrix of minimum nine 720p streams at 30 fps, or larger grid layouts of minimum sixteen, twenty-five, or thirty-six feeds at 360p resolution, each operating at minimum 15 frames per second. The system shall be capable of rendering any valid combination of these display configurations across up to four physically connected 4K resolution monitor outputs, with a limiting condition whereby no more than two displays shall simultaneously render streams at the maximum 30 fps rate due to decoding bandwidth constraints. Playback capabilities must mirror live-view grid capacities while maintaining stream stability, although higher-than-real-time playback or accelerated seeking operations may result in reduced visual performance depending on processing load.

The base software platform shall operate on an embedded, license-authenticated operating system conforming to Microsoft Windows 10 IoT Enterprise standards consistent with the Long-Term Servicing Channel (LTSC) 2021 release cycle, preloaded onto a system volume drive utilizing non-mechanical solid-state storage technology with minimum 256 GB capacity, designed for high-speed boot and application loading performance. The OS environment shall feature an embedded recovery partition or mechanism enabling secure restoration of the default system state in the event of operational corruption.

Integrated security features shall include encrypted boot drive support natively recognized by the operating system without requiring third-party software, and hardware-based trusted computing mechanisms utilizing a cryptographic security module certified to minimum FIPS 140-2 Level 2 standards. The system shall incorporate a Trusted Platform Module adhering to minimum TPM 2.0 specifications to ensure secure key storage, hardware-based identity verification, and platform integrity validation at the firmware and bootloader level.

The product shall conform to internationally recognized safety standards including but not limited to minimum compliance with IEC/EN/UL 62368-1 for audio/video/ICT equipment safety, EN 62311 for human exposure to electromagnetic fields, and regulatory frameworks such as NOM-019-SCFI-1998 or better for electrical safety in computing appliances. The workstation should be from same OEM.

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Minimum Technical Specifications of Mounting Hardwares

The mounting assembly intended for variable-surface surveillance deployment shall incorporate a multifunctional attachment ensemble comprising components suitable for pendant, wall, and pole integration scenarios across a range of cylindrical and planar structural substrates. The primary assembly configuration shall support pendant mounting arrangements with adaptivity to pole diameters ranging from a minimum 50 mm to a maximum of 150 mm or better, utilizing tension-based clamping mechanisms and reinforced banding hardware to ensure axial stability under sustained outdoor operational conditions. The unit shall include a dual-purpose wall-and-pole adaptable mount, constructed from corrosion- resistant materials such as galvanized steel or treated aluminum alloy, capable of supporting extended operational lifespan in

environmental zones subject to high humidity, UV exposure, or corrosive particulates. The pole-mount accessory shall provide an expanded compatibility envelope, allowing affixation to pole with a nominal diameter spanning a minimum of 65 mm to a maximum of 165 mm, with the mechanical interface mediated through stainless steel banding straps engineered for high tensile load-bearing capacity and vibration dampening. The mounting arm extension shall be not less than 1450 mm in length, allowing for optimal field-of-view clearance and spatial separation from wall obstructions or pole curvature. Complete hardware ensemble shall be inclusive of bolts, washers, tension locks, and bracket components as per OEM- recommended installation methodology. All Hardware Should be Supplied from OEM Part number of Each Hardware Should be Mention on Required on following Document No 3rd part Mounting hardware will be accepted.

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Minimum Technical Specifications of Core Switch

Core Switch shall be equipped with advanced functionalities including flow control, port mirroring, MAC address filtering, and robust support for IPv6 and IP address filtering. It shall incorporate stacking Technology, sFlow, and support for various spanning tree protocols including Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). VRRP support shall be mandatory for high availability. Additional features such as DHCP snooping, Access Control List (ACL) support, Quality of Service (QoS), Class of Service (CoS), Equal-Cost Multipath (ECMP) routing, DHCP relay, GARP VLAN Registration Protocol (GVRP), and Err Disable Recovery are required switch must also include One Network (ZON) for simplified management, CPU protection, IP source guard, ARP inspection, Network Timing Protocol (NTP), and advanced security protocols like Loop Guard and Smart Connect. Guest VLAN support is necessary for secure access management. The switch shall support flexible Multi-Gigabit connections, ranging from 100M to 10G speeds, and should include a console port (DB9).

It shall come with a minimum of three fans to ensure proper cooling. The switch should deliver non blocking wire-speed performance with a minimum switching capacity of 560 Gbps and a forwarding rate of 416 Mpps Memory and storage requirements include support for a minimum of 32K MAC addresses, 4K VLANs, a 4M on-chip packet buffer (both Egress and Ingress), dual flash storage (64 MB), and 8GB of RAM. The switch

should handle 12K byte jumbo frames and comply with the EEE (802.3az) standard for energy efficiency, minimizing power consumption. Dual software image support is required for reliability during upgrades. Power management should include support for an optional external redundant power supply and removable fans, with an acoustic noise level of 58 dBA or better. It must comply with IEEE standards including IEEE 802.3, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3z, IEEE 802.3x, IEEE 802.1p, IEEE 802.1X, and IEEE 802.3ad for traffic management and aggregation For traffic management and QoS, the switch must support rate limiting with 64 kbps granularity, port-based egress traffic shaping, and broadcast storm control. It should support IEEE 802.1p with 8 priority queues per port and various scheduling algorithms like WRR, SPQ, and WFQ It must also support DSCP and DSCP to 802.1p priority mapping, along with IGMP snooping for versions v1, v2, and v3, with congestion control on all ports.VLAN capabilities should include port-based, protocol-based, and private VLANs, 802.1ad VLAN stacking (Q-in-Q), and automatic VLAN member registration (GVRP). The switch shall support static and dynamic VLANs, with at least 1K static VLANs and up to 4K dynamic VLANs. The switch must provide high bandwidth with true physical stacking capability, supporting up to 4 units for redundancy and resilience. It must support a total port density of 28 or more, including 4 ports compatible with 100M/1G/2.5G/5G/10G speeds. It should include 16 SFP+ (10Giga Fiber) ports and 8 additional 10Giga Ethernet ports for high-speed uplink and connectivity advanced security, management, and Layer-3 capabilities for robust network performance and manageability. It supports port-based VLANs and VLAN isolation, enhancing segmentation within the network. For security, it features an intrusion lock along with static and dynamic MAC binding, ensuring that only authorized devices can connect.

The switch supports specific MAC forwarding per port, which allows only designated MAC addresses to access the network, thereby enhancing security through strict access controls. Additionally, it supports a limited MAC number per port with configurable MAC aging times, IP source guard, and loop guard. It also incorporates RADIUS for MAC login, IP filtering, TCP/UDP socket filtering, and BPDU transparency. The switch implements 802.1X port-based authentication, allowing compensated assignment over VLANs and bandwidth for valid access, alongside support for TACACS+ and password encryption.

Network administration security is reinforced through username/password requirements for web, Telnet, and local console access, two-level security by specific SNMP read/write community, and multiple login sessions with varying access permissions. The switch supports SSH v1/v2, SSL, IPv6 over Ethernet, and various IPv6 addressing features, including dual- stack and Neighbor discovery Layer-3 capabilities include VRRP for redundancy, ECMP for multipath routing, and static routing with a minimum of 1,000 entries for both IPv4 and IPv6.

It features a management software suite for centralized control of multiple switches, supports a clustering of at least 20 switches under a single IP address, and offers webbased management, Telnet CLI, SNMP v1, v2c, v3, and RS-232c local console access. The switch includes IP management options for static IP or DHCP clients, RMON for enhanced traffic management, port mirroring capabilities, and intelligent ACLs based on various criteria, including MAC address, VLAN, IP address, protocol type, and TCP/UDP type. Overall, the Core Switch is built to meet rigorous standards for performance, security, and flexibility in a modern networking environment Core Switch complies with industry standards and specifications, including support for RFC 1643 Ethernet MIB, RFC 2358 Ethernet-like MIB, and RFC 1757 RMON groups 1, 2, 3, and 9, along with RFC 2819 and 2925 for remote management.

It adheres to various regulatory certifications such as LVD, SNMI, FCC Part 15 (Class A), CE EMC (Class A), BSMI ENC, and RoHS (Level A). The OEM brand must possess valid ISO 9000, ISO 14000, and ISO 50001 certificates to ensure quality and environmental compliance. The operating temperature range for the switch is between 0°C to 50°C, with a storage temperature of -40°C to 70°C, and it operates efficiently in humidity levels of 10% to 95% (non-condensing) features an internal dual AC power supply and boasts a Mean Time Between Failures (MTBF) of 65,620 hours or better.

The switch is equipped with auto-detection capabilities to identify connected devices, providing information such as model, firmware version, MAC address, IP address, and system name on a web-based management interface. Users can access web redirection to connected devices and reset them to factory defaults if necessary. A centralized management utility is available to facilitate the discovery and configuration of network devices, simplifying network maintenance.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications of Outdoor Switches

Switch device shall be an industrial-grade, minimum 10-port fully managed Gigabit Ethernet Layer-2+ switch solution, and shall incorporate a minimum of 8 (Eight) 10/100/1000BASE-TX RJ45 interfaces supporting IEEE 802.3at/af compliant Power over Ethernet Plus (PoE+), or better, alongside a minimum of 2 (Two) Gigabit SFP-based uplink slots for optical media connectivity or better. The switch shall operate over a minimum voltage input of 48 VDC, and the aggregate power output budget dedicated to powered devices (PDs) shall not be less than 240 Watts or better. All power interface connectivity shall be provided via a minimum 1 (One) 4-pin input, and a minimum 1 (One) 3-pin signalling contact interface shall be provisioned for alarm or event signalling requirements, or better. For local device management, a minimum 1 (One) RJ45 serial console interface compliant with RS-232 (115200bps, 8-N-1) shall be provided or better.

Device must support deployment in line, star, and ring topologies or better. Configuration and management functions shall be made available via minimum serial CLI, web-based GUI interface accessible via HTTP and HTTPS, and shall additionally

support Telnet and SSH protocols, or better. Full support shall be provided for SNMP versions 1, 2c, and 3 including trap generation; LLDP and LLDP-MED functionality shall be natively supported or better. Diagnostics and monitoring mechanisms shall include but not be limited to minimum LED- based port status indicators, Syslog, port mirroring (1:1 and N:1), RMON (groups 1, 2, 3, 9), loop protection mechanisms, and sFlow traffic sampling or better. The switch shall allow configuration via command line interface through serial console and telnet, as well as through a graphical web interface. It must feature a fully featured MIB structure supporting both IPv4 and IPv6 stacks, and shall offer DHCPv4 support in client/server/snooping/relay modes, alongside DHCPv6 client mode Security features shall include minimum user authentication via password protection, privilege-level authorization, IEEE 802.1x Network Access Control (NAS), Access Control Lists (ACLs), IP source guard, ARP inspection, and support for centralized AAA authentication via RADIUS and TACACS+ protocols or better. Redundancy mechanisms shall incorporate full compliance to IEEE 802.1D (STP), IEEE 802.1w (RSTP), IEEE 802.1s (MSTP) standards, and must support G.8032 Ethernet Ring Protection Switching (ERPS), Static Link Aggregation and LACP (IEEE 802.3ad) or better. Traffic classification and control functions shall include support for minimum 4 classes of Quality of Service (QoS), prioritization based on Class of Service (CoS), DSCP/TOS markings, port-based priority (IEEE 802.1p), along with comprehensive VLAN capabilities per IEEE 802.1Q standard. Multicast control features shall include IGMP snooping and MLD snooping.

Storm control functionality must be present or better. Time synchronization of the device shall be maintained using SNTP client capabilities or better. PoE+ functionalities shall support dynamic device power checking, diagnostics, and management adhering to IEEE 802.3at/af standards, or better. The switch construction shall be of compact form factor measuring a minimum of 44 mm (W) x 145 mm (H) x 131 mm (D), DIN rail mountable, with a minimum Ingress Protection of IP30 or better. The device must operate Fanless under industrial ambient conditions ranging between minimum -40°C to +70°C during operation, and minimum -40°C to +85°C during storage or transportation. It shall maintain functionality within a non- condensing humidity range of minimum 5% to 95% RH or better. The equipment shall comply with EMC immunity standards including minimum EN 61000-4-2 for electrostatic discharge (minimum 6 kV contact, 8 kV air), EN 61000-4-3 for radiated electromagnetic field immunity (minimum 10 V/m across 80-1000 MHz), EN 61000-4-4 for fast transient bursts (minimum 2 kV power line, 1 kV data line), EN 61000-4-5 for surge protection (minimum 2 kV line-to-earth, 1 kV line-to-line on power lines, and 1 kV on data lines), and EN 61000-4-6 conducted immunity (minimum 10 V in 150 kHz to 80 MHz band). Emission standards shall conform to FCC CFR47 Part 15 Class A and EN 55032 Class A or better.

This specification must be strictly adhered to with no deviations, substitutions, or omissions, unless an equivalent or superior solution is demonstrably provided and duly certified to meet or exceed all minimum criteria. The Contractor shall furnish an Original Equipment Manufacturer (OEM) Authorization Certificate along with a comprehensive Compliance Statement, duly attested and issued on the OEM's official letterhead, bearing the OEM's seal and authorized signatory. This authorization must explicitly certify that the Contractor is duly authorized to quote, supply, install, and support the specified product(s), and that the offered equipment, model numbers, and specifications are fully compliant with the technical parameters laid out in the tender document.

The OEM shall further confirm that full technical, warranty, and after-sales support for

the quoted equipment shall be extended directly to the purchaser through the Contractor for the full duration of the contract and any applicable warranty period. Submissions without OEM-issued authorization and compliance documentation in the prescribed format shall be deemed non- compliant and liable for outright rejection at the Technical Evaluation stage.

Minimum Technical Specifications of Power Supply

DIN rail-mountable switching mode power supply unit conforming to industrial installation requirements and shall possess a minimum continuous rated direct current voltage of 48 volts DC or better, with a minimum rated output current capacity not below 5 amperes or better, and a minimum rated power output of 240 watts or better. The unit shall be equipped with internal mechanisms to ensure ripple and noise levels do not exceed a minimum of 150 millivolts peak- to-peak or better under standard full-load operation. The voltage trimming range should be minimum from 48V up to 55V or better, with line and load regulation not exceeding a minimum ±0.5% and ±1.0% or better respectively. Voltage tolerance shall be constrained within a minimum ±1.0% or better. Output shall be stabilized within a setup time of minimum 3000 milliseconds and rise time not exceeding minimum 100 milliseconds at 115VAC under full-load operational conditions or better. Hold-up duration must be provided with a minimum of 22 milliseconds at 115VAC under full load or better to prevent premature shutdown during brief input interruptions. The input acceptance window shall extend from a minimum 90 volts AC to a maximum of 264 volts AC or better, or minimum 127 volts DC up to 370 volts DC or better, supporting alternating frequency in the range of minimum 47 to 63 hertz or better. The minimum power factor correction at 230 volts AC input at full load shall be no less than 0.95 or better, and minimum energy efficiency shall not be lower than 90% or better. The device shall sustain minimum input current not exceeding 2.5 amperes at 115VAC and 1.3 amperes at 230VAC or better. The inrush current experienced at startup should not exceed a minimum 35 amperes at 230VAC or better, with leakage current limited to a maximum of minimum 1 milliampere at 240VAC. The internal overload protection mechanism shall operate within a minimum range of 105% to 130% of rated output power or better, incorporating a constant current limiting function that shall automatically recover upon clearance of fault. The over-voltage shutdown threshold shall initiate at a minimum 56 volts and shall not exceed minimum 65 volts or better, requiring power reset to recover normal operation. Over-temperature protection shall automatically shut down the output when critical limits are breached and shall autonomously resume operation upon temperature normalization. Operating ambient temperature range must be a minimum of - 20°C to +70°C or better, with non-condensing humidity tolerance spanning a minimum of 20% to 95% relative humidity or better. Storage environment shall support temperature ranging from minimum -40°C up to minimum +85°C and relative humidity of minimum 10% up to 95% or better. Temperature coefficient shall not exceed minimum ±0.03% per degree Celsius in the 0–50°C range or better. Equipment shall withstand mechanical vibration compliance with IEC60068-2-6 across all X, Y, Z axes with minimum vibration frequency range 10Hz-500Hz at 2G acceleration for 10 minutes per axis or better. The device shall be certified in accordance with minimum safety compliance standards including but not limited to UL508, TUV BS EN62368-1, EAC TP TC 004, BSMI CNS14336-1, BIS IS13252 (Part1):2010/IEC60950-1:2005 (Note 8), KC K60950-1 (for 48V variant only), and shall meet the minimum safety requirements of BS EN/EN60204- 1 or better. Electrical withstand voltage between input and output must be rated at a minimum of 3KVAC, between input and frame ground at minimum 2KVAC, and between output and frame ground at minimum 0.5KVAC or better.

Insulation resistance for all combinations (I/P-O/P, I/P-FG, O/P-FG) shall be a minimum of 100M ohms measured at 500VDC under 25°C and 70% RH conditions or better. Electromagnetic compatibility emissions shall comply with minimum requirements of CISPR32, BS EN/EN61204-3 Class B, BS EN/EN61000-3-2, BS EN/EN61000-3-3, EAC TP TC 020, CNS13438, and KSC 9832 (specific to 48V model only), or better. Immunity standards must meet minimum compliance to BS EN/EN55035, EN/EN61000-4-2,3,4,5,6,8,11, BS BS EN/EN61000-6-2 (BS EN/EN50082-2), EN61000-6-4 for heavy industrial applications, EAC TP TC 020, and KSC 9835 (specific to 48V model only), or better. The unit shall demonstrate a minimum Mean Time Between Failure (MTBF) of 230,200 hours as calculated under MIL- HDBK-217F at 25°C or better, confirming long-term reliability for critical infrastructure deployment.

Minimum Technical Specifications of 9U Pole Mount Outdoor Rack

Outdoor Rack Cabinet solution proposed for pole-mounted applications shall be of 9U vertical space configuration with a minimum footprint dimension of 600mm × 500mm (W×D) and shall strictly conform to DIN 41494 or equivalent globally recognized enclosure standards including but not limited to EIA, ISO, EN, and CEA norms. The basic structural framework must be constructed entirely of minimum cold-rolled steel with welded construction methodology to ensure ruggedized and vandal-resistant integrity suitable for harsh external deployment. The rack enclosure shall incorporate a lockable plain metal door on the frontal face, while both the top and bottom covers must be mandatorily welded to the frame structure with provision for cable ingress and egress via pre-punched cut-out patterns. The vertical mounting rails shall be no fewer than two in number, factory-fitted with adjustable depth mechanisms, fabricated from formed steel, and equipped with a 19" mounting format supporting minimum DIN standard 10mm square punched slots. Further, the rails shall support a universal alternating hole pattern of 12.7mm - 15.875mm - 15.875mm to offer maximum compatibility across varied mounting hardware and ensure increased usable mounting space for all standardized equipment types.

All mechanical fabrication shall be undertaken through industry-certified precision manufacturing processes to ensure optimal structural alignment, long-term rigidity, and guaranteed dimensional tolerance conformity. It must be categorically stated that the enclosure shall offer 100% compatibility with all equipment modules conforming to DIN 41494 mounting norms and equivalents. The finish applied shall be a minimum of dual-layer powder coating processed through a seven-tank chemical pre-treatment line conforming to ASTM corrosion resistance standards, ensuring high endurance performance in outdoor installations exposed to thermal, saline, or humid environments. Grounding and bonding options shall be inherently supported through provided earthing studs and metallic continuity assurance within the cabinet body, to facilitate compliance with best practices in lightning protection and ESD mitigation. The rack system shall be capable of withstanding a minimum uniformly distributed static load of 30 kilograms or better across the total vertical U-space, and not less than 2 kilograms per individual U-mounting unit. The offered system must be available in a minimum of Grey, Off-White, or Black finish, and all fastening elements shall comply with relevant ISO threading and torgue specifications. The design should explicitly address ingress protection and shall be suitable for pole-mount outdoor telecom, surveillance, and industrial IT infrastructure deployment.

Minimum Technical Specifications of 42U Rack

equipment rack enclosure shall be a free-standing, 42U capacity floor-mount type constructed from high-tensile cold-rolled steel of folded architecture, fabricated through continuous welded joint methodology to deliver superior structural integrity and resistance against mechanical deformation. The rack cabinet shall possess a physical footprint of not less than 600mm in width and 1000mm in depth, with static load handling capacity rated at a minimum of 1250 kilograms, uniformly distributed across the U-space, in full compliance with DIN 41494, or equivalent EIA/ISO/EN/CEA rackmounting and equipment accommodation standards. The base frame shall be of steel construction supporting either a heavy-duty plinth-mount or optionally a dualconfiguration arrangement using industrial-grade casters combined with levelling feet to ensure stability on uneven surfaces. The top and bottom panels must be rigidly welded to the main chassis with adequate provisions to allow cable ingress and egress, while the 19" vertical mounting rails shall be no fewer than four (4) in number and shall be adjustable in-depth across the internal axis to support varied equipment formfactors. Each vertical post shall be punched with standard 10mm square holes following DIN conventions, and shall adhere to the universal alternating hole pitch of 12.7mm–15.875mm–15.875mm to maximize flexibility for rack-mount devices. All verticals shall be clearly labeled with numbered U positions etched or silk-screened to assist in accurate equipment alignment and configuration. The rack-mounting angles shall be formed from precision-bent steel with corrosion-inhibiting coating for enhanced mechanical endurance.

The enclosure finish shall consist of a multi-stage surface treatment process involving a minimum seven-tank degreasing and phosphating pretreatment, followed by a special-grade thermoset powder coating of black color, conforming to ASTM environmental and corrosion resistance standards. All exposed metallic surfaces shall be protected against rust, and the coating must demonstrate resistance to chipping, peeling, and UV degradation. he cabinet shall provide built-in grounding and bonding features compliant with relevant industry norms to support electrical continuity across all structural members. The design must support seamless integration with grounding systems to allow dissipation of stray voltages and compatibility with surge protection and ESD control frameworks. The equipment rack must guarantee 100% compatibility with any equipment conforming to DIN 41494 or equivalent standard and shall be manufactured using state-of-the-art automated fabrication techniques ensuring high dimensional tolerance, repeatable precision, and accelerated delivery schedules. All components and mounting accessories shall conform to global standards of interoperability, mechanical strength, and thermal ventilation as applicable to highdensity IT, AV, and control system deployments.

Minimum Technical Specifications of Outdoor CAT6

Conform in entirety to ANSI/TIA/EIA-568-C.2 standards for Category 6 performance, as well as to international cabling standards including ISO/IEC 11801 and IEC 61156-5. It shall be constructed using a solid conductor of 23 AWG size, fabricated from bare annealed copper with a nominal diameter of 0.58 mm, uniformly insulated with solid polyolefin compound engineered for thermal stability and dielectric performance. The core assembly shall be protected by a dual-sheath structure wherein the inner sheath shall comprise of Low Smoke Zero Halogen (LS0H) material to meet indoor fire and smoke safety norms, while the outermost layer shall be of heavy-duty UV-resistant polyvinyl chloride (PVC) suited for direct outdoor deployment and long-term exposure to solar radiation and atmospheric corrosion. The overall cable diameter shall not exceed approximately 10.3 mm, with the inner sheath measured at 0.6 mm thickness

and the outer sheath no less than 1.8 mm. The cable shall be suitable for deployment in a temperature range from -40 degrees Celsius to +60 degrees Celsius, shall demonstrate mechanical durability with a maximum pulling tension threshold not exceeding 100 Newtons. The electrical characteristics of the cable must ensure superior return loss, low attenuation, and strong crosstalk rejection over the frequency band extending up to 250 MHz. At a test frequency of 4 MHz, the return loss shall not fall below 23 dB, with attenuation limited to 3.8 dB per 100 meters, while near-end electrical characteristics of the cable must ensure superior return loss, low attenuation, and strong crosstalk rejection over the frequency band extending up to 250 MHz. At a test frequency of 4 MHz, the return loss shall not fall below 23 dB, with attenuation limited to 3.8 dB per 100 meters, while near-end crosstalk (NEXT) shall be maintained above 65.3 dB and power-sum NEXT (PS-NEXT) above 63.3 dB. At 10 MHz, the return loss shall be at least 25 dB, with attenuation not exceeding 6.0 dB, NEXT not less than 59.3 dB, and PS-NEXT not below 57.3 dB. The far-end crosstalk (ELFEXT) and its power-sum variant (PS-ELFEXT) shall be 47.8 dB and 44.8 dB respectively. As the frequency increases, performance shall degrade minimally such that at 100 MHz, return loss shall not fall below 20.1 dB, attenuation shall remain within 19.8 dB per 100 meters, NEXT shall stay above 44.3 dB, and PS-NEXT shall be retained at no less than 42.3 dB. At this frequency range, ELFEXT shall be no less than 27.8 dB, and PS-ELFEXT shall not fall below 24.8 dB. The cable shall sustain acceptable performance even at higher operating frequencies, such that at 200 MHz, the attenuation shall not exceed 29.0 dB and the NEXT and PS-NEXT shall remain above 39.8 dB and 37.8 dB respectively. At the upper limit of 250 MHz, the return loss shall be held at or above 18 dB, attenuation shall be confined to 32.0 dB per 100 meters, with NEXT no lower than 38.3 dB and PS-NEXT not below 36.3 dB. Corresponding ELFEXT and PS-ELFEXT values at this frequency shall be at least 19.8 dB and 16.8 dB respectively. The nominal velocity of propagation (NVP) across the operational bandwidth shall range between 65 to 69 percent, ensuring minimal phase delay, which shall not exceed 570 ns per 100 meters at 1 MHz and shall progressively reduce to approximately 536 ns per 100 meters at 250 MHz. The characteristic impedance shall lie within a tightly controlled window, maintaining an upper bound (Zu) up to 131.5 ohms and a lower bound (ZI) not below 22.2 ohms depending on frequency, ensuring compatibility with balanced high-speed transmission requirements. The offered product must be fully compliant with third-party certification norms and accompanied by factory test reports validating conformity to all stated mechanical, thermal, and electrical parameters.

Minimum Technical Specifications of Modular patch Panel

24-port modular patch panel offered for structured cabling installations shall strictly conform to all applicable commercial standards, including ANSI/TIA-568.2-D-2018, ISO/IEC 11801- 1:2017, FCC Part 68 Subpart F Section 68.5, and shall be UL listed to ensure regulatory compliance, safety, and interoperability within certified IT network environments. Each port of the panel shall be preloaded with RJ45 jack modules designed for minimum Category 6 performance and shall exhibit consistent termination integrity across the full operational lifecycle. The jack connectors shall be constructed from high impact.

flame-retardant polycarbonate material conforming to UL94V-0 flammability rating or an equivalent, ensuring durability and enhanced thermal resistance during operation and installation. Each jack must sustain a minimum of 750 insertion cycles without degradation in contact performance, and the internal contact components shall be formed using high- conductivity copper alloy electroplated with a minimum of 1.27 micrometres of gold over nickel to maintain a low-resistance signal path and provide corrosion resistance. A minimum contact force of 100 grams shall be maintained under full mated conditions, while the plug retention strength shall not be less than 15 pounds, ensuring secure coupling under mechanical stress.

The insulation displacement connectors (IDC) shall likewise be housed in polycarbonate material compliant with UL94V-0 specifications and must support a minimum of 200 re- termination cycles for field flexibility. IDC contact elements shall be made from copper alloy with a matte tin finish to ensure clean, low-resistance terminations. The IDC interface must support solid conductors within the gauge range of 22 AWG to 24 AWG, enabling compatibility with all industry-standard structured cabling cores. Contact engagement force within the IDC mechanism shall not fall below 100 grams to ensure reliable insulation penetration and electrical continuity across terminations. The base frame of the patch panel shall be fabricated using cold rolled steel (CRS) of a minimum thickness of 0.060 inches or 1.52 millimetres, providing adequate structural rigidity to prevent deflection or deformation under mechanical stress. The surface shall be coated with a durable black powder-coat finish, electrostatically applied and oven-cured, to resist chipping, oxidation, and chemical corrosion throughout its operational lifespan in indoor telecom enclosures or rack environments. The electrical characteristics.

panel must comply with high-speed data transmission requirements, maintaining an interface resistance not exceeding 20 milliohms under standard operating conditions. The initial contact resistance between mated conductors shall be limited to 2.5 milliohms, ensuring signal integrity and minimal attenuation at point-to-point connections. Additionally, the insulation resistance across terminals shall be greater than 100 megaohms under normal environmental exposure, ensuring safety, leakage isolation, and dielectric strength as required for high- performance Ethernet networks.

Minimum Technical Specifications of Modular patch Chord

Factory-Terminated Category 6A S/FTP Shielded Patch Cords, with a nominal length of 1 meter, specifically designed to support high-speed data communication networks including 10- Gigabit Ethernet (10GBASE-T) as defined under IEEE 802.3an, and fully compliant with ANSI/TIA-568-C.2, ISO/IEC 11801 Amendment 1.1, FCC Subpart F 68.5, IEC-603-7, UL-1863 and CSA C22.2 standards. The patch cord construction shall comprise 4 twisted pairs of 26 AWG stranded bare copper conductors, individually wrapped in aluminum/polyester foil forming an S/FTP configuration to provide optimal protection against internal and external electromagnetic interference (EMI) and radio frequency interference (RFI), with a longitudinally applied tinned copper drain wire ensuring 360° continuity of shielding. The plug housing shall be constructed from clear, high-impact.

flame-retardant polycarbonate, engineered to withstand mechanical stress and environmental factors. The contact blades shall be formed from high-grade copper alloy and plated with a minimum of 1.25 microns of gold over nickel (Au/Ni), ensuring low contact resistance and high mating durability, with a guaranteed operational life of no less than 750 insertion cycles. Each patch cord shall be terminated with factory-crimped modular plugs (RJ45 type) and individually tested for NEXT, FEXT, Return Loss, and Delay Skew at 500 MHz bandwidth as per channel- level requirements.

The shielded patch cords shall operate reliably under environmental conditions with an operating temperature range of -40°C to +85°C, supporting a maximum voltage rating of 150 VAC and current capacity of 1.5A at ambient 25°C. Patch cords must be

RoHS and ELV compliant and manufactured using non-halogenated, lead-free materials that conform to applicable environmental directives. Patch cords shall be ETL-certified and come with a 25- year manufacturer-backed component warranty when used as part of an end-to-end certified channel. Each unit must include factory labelling with unique serial or batch number for traceability. Patch cords shall be supplied in anti-static sealed pouches and must be available in various colors for identification (subject to consultant approval), with snag less boots or latch guards to prevent accidental disconnection.

The shielded patch cords shall operate reliably under environmental conditions with an operating temperature range of -40°C to +85°C, supporting a maximum voltage rating of 150 VAC and current capacity of 1.5A at ambient 25°C. Patch cords must be RoHS and ELV compliant and manufactured using non-halogenated, lead-free materials that conform to applicable environmental directives. Patch cords shall be ETL-certified and come with a 25- year manufacturer-backed component warranty when used as part of an end-to-end certified channel. Each unit must include factory labeling with unique serial or batch number for traceability. Patch cords shall be supplied in anti-static sealed pouches and must be available in various colors for identification (subject to consultant approval), with snagless boots or latch guards to prevent accidental disconnection. Only original OEM factory-terminated patch cords from approved makes shall be accepted. On-site assembly, field-terminated cords, or third- party labeled variants are strictly disallowed.

Minimum Technical Specifications of Outdoor Fiber

Outdoor-grade optical fibre cable intended for use in structured backbone, campus, and telecom duct installations shall be of the six-core single mode type, featuring a loose tube armoured construction with medium-density polyethylene (MDPE) outer sheathing and designed in accordance with all applicable commercial and international performance standards including, but not limited to, ISO/IEC 11801, EN 50173, and IEC 60794-1 for optical cable architecture. The optical fibre cores themselves shall conform to Category B.1.3 of IEC 60793-2-50 and Class B.1.3 of EN 60793-2-50, while also adhering to ITU-T recommendations G.652 A through D variants to ensure low attenuation and dispersion performance across all key transmission wavelengths. The product shall be compliant with EN 50173-1:2007 categories OS1 and OS2, ISO/IEC 11801:2002 OS1 category.

ISO/IEC 24702:2006 OS1 and OS2 categories and meet requirements for IEEE 802.3-2002 Ethernet performance over optical medium. The cable core shall incorporate a single, centrally located loose tube with a nominal diameter of 2.8 mm for 2 to 16 fibre constructions, or 3.5 mm for configurations containing up to 24 fibres. The tube shall be filled with a thixotropic gel compound that ensures water-blocking and mechanical cushioning, providing long-term protection against ingress and vibration-induced microlending losses.

Mechanical reinforcement shall be provided through E-glass yarns helically wound as primary strength members, offering both tensile integrity and rodent deterrence. Further protection shall be achieved through the application of a longitudinally corrugated steel tape armouring with a nominal thickness of 0.15 mm, providing enhanced resistance against compression, impact, and mechanical stress arising from installation or buried environments. Over this armoured layer, a UV-resistant black MDPE outer sheath with a uniform thickness of 1.5 mm shall be extruded, designed for high durability in external temperature extremes and long-term exposure.

The nominal overall cable diameter shall be maintained at approximately 8.5 mm for assemblies containing 2 to 16 fibres, and shall not exceed 9.5 mm for those comprising 18 to 24 fibre configurations. The approximate linear weight of the cable shall be 75 kg/km for up to 16-core configurations and 80 kg/km for higher core counts. Tensile load bearing capacity under installation pull conditions shall not be less than 1000 Newtons, and compressive strength resistance shall be rated at 2000 Newtons without permanent deformation. The minimum bend radius for static conditions shall be restricted to 55 mm whereas under tensile loading during installation, the minimum dynamic bending radius shall not be less than 110 mm. The operating thermal envelope of the cable shall support ambient ranges from -40°C to +70°C, both during storage and during active deployment. With respect to transmission characteristics, the fibre cores shall exhibit optical attenuation not exceeding 0.39 dB per kilometre over the extended wavelength window spanning from 1310 nm to 1625 nm, while the attenuation at 1550 nm shall be further limited to a maximum of 0.25 dB/km. The group index of refraction used for optical time domain reflectometry and length calculations shall be declared as 1.467 for 1310 nm, and 1.468 for both 1550 nm and 1625 nm operating bands, ensuring accuracy in link budget and dispersion compensation calculations for all high-speed and long-haul single mode applications.

Minimum Technical Specifications of Light Interface Unit 48 Port

Fiber Optic LIU (Light Interface Unit) shall be a factory-assembled, fully populated 48port enclosure in a 19-inch rack-mountable form factor, constructed from high-grade cold rolled steel with ruggedized structural integrity and finished in electrostatically powder-coated graphite paint for corrosion resistance and long service life. The enclosure must support universal mounting standards suitable for both 19-inch EIA racks and optional wall-mount configurations to accommodate varied deployment environments such as isolated OT areas or integrated IT enclosures. The unit shall be supplied fully loaded with factory-installed LC adapters (simplex or duplex, as per configuration), pre-terminated single-mode pigtails of G.652D-compliant optical fiber. and protective fusion splice sleeves, with each port terminated and labeled for traceability and ease of administration. The internal layout shall feature an integrated splice management architecture including a high-density 48-fiber splice tray fabricated from flame-retardant, molded ABS polymer material, conforming to standard fiber routing guidelines and bend radius control. The LIU must feature a sliding drawer mechanism on industrial-grade ball bearing rails, designed for smooth extension and retraction, enabling front access to terminations, splices, and slack storage without removing the unit from the rack. The drawer shall incorporate a locking feature to prevent unauthorized access, ensuring physical security of critical infrastructure links. Front faceplate design shall be modular and field- LIU interchangeable, allowing adapter plates to be removed or upgraded to accommodate various connector formats including LC, SC, or hybrid types as per evolving network requirements. The unit shall support optional adapter plate configurations, facilitating future expansion or retrofitting of port types without modification to the enclosure chassis. All fiber termination points shall be housed behind a secured front lockable cover.

and a comprehensive front cable management bar must be pre-installed for organized routing of patch cords, ensuring proper strain relief and compliance with minimum bend radius standards. Rear, side, and base cable entry access points with knockout provisions must be available to support flexible cable routing practices for both incoming and outgoing fibers. Internal cable management shall include pre-installed cable guide rings and cordage retention channels to accommodate buffer tubes and patch cords while maintaining defined bend radius to prevent optical signal degradation. The sliding panel cover must be removable or slide-out type to enable swift maintenance operations without disturbing existing fiber runs. The LIU must conform to best practices of fiber enclosure design per ISO/IEC 11801, TIA-568-C.3, and GR-449-CORE, and shall be compliant with RoHS directives and standard.

Minimum Technical Specifications of Light Interface Unit 6 Port

Fiber Optic LIU (Light Interface Unit) shall be a factory-assembled, fully populated 6port enclosure in a 19-inch rack-mountable form factor, constructed from high-grade cold rolled steel with ruggedized structural integrity and finished in electrostatically powder-coated graphite paint for corrosion resistance and long service life. The enclosure must support universal mounting standards suitable for both 19-inch EIA racks and optional wall-mount configurations to accommodate varied deployment environments such as isolated OT areas or integrated IT enclosures. The unit shall be supplied fully loaded with factory-installed LC adapters (simplex or duplex, as per configuration), pre-terminated single-mode pigtails of G.652D-compliant optical fiber, and protective fusion splice sleeves.

with each port terminated and labeled for traceability and ease of administration. The internal layout shall feature an integrated splice management architecture including a high-density 6- fiber splice tray fabricated from flame-retardant, molded ABS polymer material, conforming to standard fiber routing guidelines and bend radius control. The LIU must feature a sliding drawer mechanism on industrial-grade ball bearing rails, designed for smooth extension and retraction, enabling front access to terminations, splices, and slack storage without removing the unit from the rack.

The drawer shall incorporate a locking feature to prevent unauthorized access, ensuring physical security of critical infrastructure links. Front faceplate design shall be modular and field-interchangeable, allowing adapter plates to be removed or upgraded to accommodate various connector formats including LC, SC, or hybrid types as per evolving network requirements. The unit shall support optional adapter plate configurations, facilitating future expansion or retrofitting of port types without modification to the enclosure chassis.

All fiber termination points shall be housed behind a secured front lockable cover, and a comprehensive front cable management bar must be pre-installed for organized routing of patch cords, ensuring proper strain relief and compliance with minimum bend radius standards. Rear, side, and base cable entry access points with knockout provisions must be available to support flexible cable routing practices for both incoming and outgoing fibers.

Internal cable management shall include pre-installed cable guide rings and cordage retention channels to accommodate buffer tubes and patch cords while maintaining defined bend radius to prevent optical signal degradation. The sliding panel cover must be removable or slide-out type to enable swift maintenance operations without disturbing existing fiber runs. The LIU must conform to best practices of fiber enclosure design per ISO/IEC 11801, TIA-568-C.3, and GR-449-CORE, and shall be compliant with RoHS directives and standard.

Minimum Technical Specifications of Fiber Patch Chord (SC to LC) 3 Mtr and 2 Mtr

In compliance with prevailing international commercial standards, including but not

restricted to ISO/IEC 11801-1:2017, ANSI/TIA-568.3-D, IEC 60794-1, ANSI/TIA/EIA-492, TELECORDIA GR-409, ICEA-596, and AS/CA S008:2020, the composite fiber optic cordage utilized for structured cabling infrastructure shall be of duplex construction, conforming to a dimensional envelope of minimum 2.0mm \pm 0.1mm x 4.1mm \pm 0.2mm or better, ensuring mechanical resilience and consistent signal integrity over extended operational durations. The optical buffer coating diameter shall not be less than 900µm, over a primary coating dimension of minimum 245µm, while the internal strength reinforcement must be constituted using aramid yarn or better with sufficient tensile resilience for both installation and in-service load scenarios.

The external sheath shall be manufactured from LS0H material conforming to IEC 61034-1 & 2, IEC-60332-1, IEC-60754-1 & 2, and may optionally comply with PVC: UL1685 & UL1666 or OFNR-LS standards as per IEC-60332-3, UL1666, and UL1685 to meet rigorous flame propagation and smoke density constraints. Bend radius tolerances shall allow for a minimum dynamic (installation) bend of 3.0 cm and a minimum static (long-term) bend of 2.0 cm without performance degradation.

The operational ambient temperature range must extend from - 40°C to +85°C minimum. The single mode fiber shall comply with ITU-T G.657A2/OS2 classifications, possessing cladding dimensions of $125 \pm 0.7 \mu m$, mode field diameter of $9.2 \mu m \pm 0.4 \mu m$ @1310nm, and 10.4µm ±0.5µm @1550nm. Maximum attenuation values must remain within 0.33-0.35 dB/km @1310nm, 0.31-0.35 dB/km @1383nm, and 0.19-0.23 dB/km across the 1550–1625nm spectral window. Cut-off wavelength shall not exceed 1260nm, with chromatic dispersion values limited to a maximum of 18 ps/nm/km @1550nm and 22 ps/nm/km @1625nm. Zero- dispersion shall occur within the 1300-1324nm window. Connectorization shall meet maximum permissible optical interconnection thresholds, where insertion loss shall not exceed 0.15 dB for SC/LC/FC/APC or SC/LC/FC/ST interfaces. Return loss shall meet a minimum of 65 dB for APC-polished interfaces and 55 dB for UPC configurations. For specialized multi-mode or mixed connectors such as E-2000 or MTRJ, insertion loss and back reflection parameters shall adhere to respective maxima of 0.30-0.50 dB and minimum return losses between -30.0 dB to -65.0 dB based on connector and polish type, in strict accordance with designated interface limits.

Minimum Technical Specifications of optical transceiver module

Optical transceiver module proposed shall be of the pluggable SFP form factor, specifically engineered for single mode fiber transmission with full compliance to industrial-grade operational parameters and applicable international interface standards. The transceiver shall utilize a unidirectional single-fiber bidirectional (BiDi or BX) transmission mechanism, employing wavelength-division multiplexing (WDM) with a specified transmit (Tx) center wavelength of 1550 nm and receive (Rx) center wavelength of 1310 nm, enabling duplex communication over a single SM strand.

This module shall adhere to 1000BASE-X Ethernet transmission protocols as standardized under IEEE 802.3z and must further conform to the mechanical and functional specifications defined in INF-8074 (SFP Transceiver Multi-Source Agreement) and SFF-8472 (Digital Diagnostic Monitoring Interface). The maximum supported optical transmission distance shall be 20 kilometres over ITU-T G.652D compliant single mode fiber, with total optical link loss tolerance not exceeding 10 dB, and shall utilize a single LC connector interface to achieve minimum footprint and field compatibility.

The unit must be capable of delivering full 1Gbps throughput over standard SFP ports and must draw electrical power directly from the host SFP slot with an operating voltage of 3.3VDC, consuming no more than 1 watt during full load operation, with heat dissipation not exceeding 3 BTU/hr under maximum conditions. The Mean Time Between Failure (MTBF) for the transceiver module shall not be less than 250,000 hours, ensuring high reliability for mission- critical infrastructure.

In terms of ruggedization and field applicability, the SFP transceiver shall carry an ingress protection rating of IP40, be fully classified under the "Industrial Grade" category, and shall operate reliably across a temperature envelope ranging from -40°C to +85°C, including equivalent storage conditions. The product shall meet or exceed laser safety compliance standards including FDA 21CFR 1040.10, FDA 21CFR 1040.11, EN/IEC 60825-1, and EN/IEC 60825-2. For regulatory and project eligibility, the unit shall be NDAA (National Defense Authorization Act) compliant, TAA (Trade Agreements Act) compliant, and certified for deployment in intelligent transportation systems adhering to NEMA TS2 environmental and electrical requirements.

The transceiver shall be backed by a manufacturer-declared and must be supported by diagnostic monitoring capabilities, ensuring real-time parameter reporting for optical power, temperature, voltage, and laser bias current as per DDM standards. This specification ensures full interoperability within industrial networking environments, including long-range IP surveillance, backbone uplinks, and secure infrastructure communication systems.

Minimum Technical Specifications of Computing workstation

Computing workstation shall be tower-form factor based, equipped with a 13th Generation Intel® Core [™] i7-13700 processor, incorporating 16 physical cores and 24 threads enabled via Intel's hybrid performance architecture, including performance and efficiency cores. The CPU shall operate at a base clock with dynamic frequency scaling up to 5.2 GHz under Intel® Turbo Boost Technology 2.0, backed by a 30MB Intel Smart Cache (L3), ensuring seamless multitasking and compute-intensive operations. The platform must be built upon the Intel® Q670 chipset architecture, ensuring full chipset compatibility with enterprise-class features and advanced I/O handling. Memory configuration shall include 16 GB of DDR4 RAM operating at 3200 MT/s, non-ECC unbuffered, with single-module (1x16GB) population, supporting future upgradability via two DIMM slots.

Storage architecture shall comprise a minimum of one 512 GB NVMe SSD, interfacing over an M.2 2280 slot for high-speed access and boot performance, with support for additional storage expansion through two internal 3.5" HDD bays. The unit must incorporate at least one additional M.2 2230 slot for optional wireless or SSD integration, and offer expansion via one PCIe x1 slot, one legacy PCI slot, and one PCIe Gen4 x16 slot for dedicated graphics or accelerator cards.

Integrated display handling shall be facilitated through Intel® UHD Graphics 770 embedded within the processor die, capable of supporting multiple monitors with simultaneous output via rear panel I/O consisting of one HDMI 1.4 port and one DisplayPort[™] 1.4. The front I/O panel must provide a headphone/microphone combo jack, one SuperSpeed USB Type-C® port supporting 10 Gbps signalling rate, and three SuperSpeed USB Type-A ports with matching 10 Gbps throughput. The rear I/O panel shall host an additional three USB Type-A ports with 5 Gbps signalling.

two USB Type-A ports rated at 480 Mbps, one RJ-45 Gigabit Ethernet port, one audioout port, and a standard power connector. The system must support industrial-grade thermal management and be preconfigured for BIOS-level support of secure boot and hardware-level virtualization extensions. Operating system licensing shall be explicitly excluded from the current specification unless otherwise stated. The overall desktop solution shall be compliant with standard OEM manufacturing norms for businessgrade reliability, upgradeability, and long-term deployment in institutional or enterprise IT infrastructure settings.

Minimum Technical Specifications of Computing workstation

The 98" Ultra High Definition (UHD) commercial-grade display panel incorporates advanced IPS (In-Plane Switching) technology combined with a Direct LED (DLED) backlight system, offering a native resolution of 3840 x 2160 in a 16:9 aspect ratio. The panel delivers a typical brightness level of 500 cd/m² and a native contrast ratio of 1200:1, enhanced further by a dynamic contrast ratio of 40,000:1. With a minimum operational lifespan of 30,000 hours and a response time of 8ms (typical), this display ensures reliable indoor usage under extended operational cycles of up to 16 hours per day.

The active display area measures 2158.8 mm (H) by 1214.4 mm (V), supporting a wide 178° horizontal and vertical viewing angle with consistent performance (CR>10). The panel reproduces 1.07 billion colors using an 8-bit + FRC configuration and covers 72% of the NTSC color gamut. The surface treatment includes a 25% haze level to minimize reflections in commercial indoor environments. The refresh rate is fixed at 60 Hz, and the display is intended for landscape orientation only.

The mainboard model 17MB400VS integrates an Android 9 operating system supported by 2 GB DDR4 RAM and 16 GB eMMC internal storage, expandable via MicroSD up to 1TB. Processing is handled by a Quad-Core ARM Cortex-A55 CPU and an ARM Mali-G31 MP2 GPU, enabling HTML5 browser compatibility through the Vewd browser, Miracast wireless display support, and content management system (CMS) features.

The connectivity suite includes 4x HDMI 2.0 inputs, 1x HDMI 2.0 output, USB-A ports (3.0 and 2.0), internal USB, micro-USB, RS232 (3.5mm jack), RJ45 Fast Ethernet with IEEE 802.1X authentication, RJ12 service port, and support for external sensor control via RJ12. Wireless communication is supported via external USB dongles for WiFi 5 (802.11 a/b/g/n/ac) and Bluetooth 5.1. Audio output includes a headphone jack and optical SPDIF, while internal audio is provided by two integrated 12W speakers.

Additional features include HTML5/Android CMS launchers, USB-autoplay, content scheduling, HDMI-CEC and wake-up, automatic source failover, panel and OSD lock, video rotation, no signal power-off, pixel shift, and SNMP-based remote management. Mechanical enhancements comprise a joystick, rocker switch, detachable power cable and logo, and a lockable internal USB cover. The VESA mount pattern is 1000 x 400 mm using M8 screws. Operating conditions range from 0–40°C with 10–90% relative humidity. The power input supports 110–240V AC at 50/60Hz with a deep standby mode of \leq 0.5W. Supplied accessories include QSG, instruction booklet, power cord, IR remote control with batteries, mounting kit, and IR extender. The display is certified for CE and EMC compliance.

Minimum Technical Specifications of CCTV pole infrastructure

CCTV pole infrastructure intended for deployment in outdoor surveillance environments shall comprise a vertically oriented cylindrical support member constructed from a round-section steel tube with a uniform wall thickness ranging between 5 mm and 10 mm, and an overall height extending from a minimum of 3500 mm to a maximum of 7000 mm above finished ground level. The main vertical shaft shall be of seamless or ERW round pipe profile, engineered for high rigidity and wind load resistance, and subjected to a comprehensive anti- corrosive surface treatment.

process comprising hot-dip galvanization to ensure a minimum rust-free operational lifespan of 20 years under standard atmospheric exposure, as per IS/ASTM standards for outdoor structural metallic elements. The pole body may optionally include post-process exterior finishing by way of industrial-grade electrostatic spray coating, with color selection determined as per client or architectural integration requirements. The upper termination of the pole may be optionally fitted with a circular surface shield or plate with diameter options of Φ 200 mm, Φ 300 mm, or Φ 400 mm to accommodate various mounting brackets or lighting/shielding elements. These are designed for optical accessories or accessory housings were applicable.

Enclosure and terminal housing configurations shall conform to ingress protection classification IP55 or superior, ensuring resistance to dust ingress and projected water under field conditions. The base foundation shall be provided as per structural engineering design, including anchor bolt templates and reinforced concrete pedestal specifications suitable for the pole height and environmental loading. The pole shall be rated for sustained operation in outdoor environments and suitable for the mounting of static box cameras, PTZ domes, or integrated multi-sensor systems as per site requirements.

Sign & Seal of Firm

*-sd-*Chief Mechanical Engineer (i/c) Deendayal Port Authority