Nokia 7210 SAS

Release 26

The Nokia 7210 SAS product portfolio provides telecommunication providers with IP routing and Carrier Ethernet demarcation, access, and aggregation capabilities for mobile backhaul and business and residential service delivery. In mission-critical enterprise networking environments, the 7210 SAS meets stringent requirements for network resiliency, deterministic performance, and scalability.

As a member of the Service Router (SR) product portfolio, the Nokia 7210 SAS leverages the proven Nokia Service Router Operating System (SR OS) and the Nokia Network Services Platform (NSP) for service and operational consistency across the network. It is Mplify Carrier Ethernet for Business certified, delivering advanced Hierarchical Quality of Service (H-QoS) and comprehensive Operations, Administration, and Maintenance (OAM) capabilities. It provides deployment flexibility, service richness, and operational simplicity to extend IP/MPLS and Carrier Ethernet services throughout the network.



7210 SAS-Sx 10/100GE



7210 SAS-K30 ETR



7210 SAS-Sx 1/10GE



7210 SAS-K12 ETR



7210 SAS-S 1/10GE



7210 SAS-K12



7210 SAS-Dxp



7210 SAS-K5



7210 SAS-Dxp-24p



7210 SAS-Dxp-16p

Benefits

Support for differentiated services

Service providers want to unlock new revenue streams. Enterprise and mission-critical network operators need to fulfil the specific requirements of each of their various applications. To meet these needs, the 7210 SAS offers differentiated services, including Carrier Ethernet, IP VPN, and enhanced internet services coupled with per-service QoS, and bandwidth guarantees. Service providers can create tiered service models with flexible billing options, tailoring service packages based on the performance and availability requirements of their customers. Enterprise and mission-critical

network operators can provide customized QoS and traffic profiles to assure the delivery of individual applications and essential business communications.

Customer satisfaction and application delivery assurance

The plug-and-play capabilities of the Nokia 7210 SAS along with the NSP deliver rapid service turn-up without truck rolls, expediting in-service deadlines and time-to-revenue while minimizing the chance of operator error. The ability to continuously monitor and measure traffic from end to end and troubleshoot proactively enables network problems to be found and resolved before they affect end users.

Monitoring, performance measurement of service metrics, prediction of threshold violations, reporting of test results and accurate billing provide a superior level of service to end users. These features also increase the reliability of mission-critical applications.

For service providers, self-service customer portals with customized on-demand management capabilities improve the overall quality of experience for their customers.

Cost reduction through operational simplicity

Cost savings can be realized by transitioning from separate legacy networks onto a single platform where multiple services are converged onto one uplink and each application can be supported by a full range of Carrier Ethernet and IP/MPLS services. With a variety of compact form factors and features, the 7210 SAS cost effectively scales to support current and future customer and application requirements. It provides savings through advanced QoS, end-to-end OAM, optical integration, streamlined network upgrades, reduced training, testing cycles and operations support system (OSS) integration costs.

Hardware overview

Table 1. Nokia 7210 SAS-S series models

The Nokia 7210 SAS-S series IP/MPLS platforms may be used in standalone mode to function the same as other 7210 SAS models. The 7210 SAS-S series IP/MPLS platforms may be used in standalone mode to function the same as other 7210 SAS models. Alternatively, they can be used in satellite mode as port extenders for the 7750 Service Router. For more information on their satellite capabilities, please see **Nokia Ethernet satellites** data sheet.

The 7210 SAS Sx 1/10 GE model is similar to the 7210 SAS S but it is fully NEBS compliant with side-to-back airflow. It has two modular power supplies, supporting DC and AC at the same time, and has additional timing capabilities.

The 7210 Sx/S 1/10GE models use stacking ports to provide a virtual chassis capability. This provides a cost-effective solution for modular growth and redundant control.

	7210 SAS-S 1/10GE (10 variants based on interfaces, PoE, and power supply)	**7210 SAS-Sx 1/10GE (6 variants based on interfaces and PoE)**	**7210 SAS-Sx 10/100GE (1 variant based on interface)**
System throughput Full duplex IMIX traffic	• 88 Gb/s on 48-port variants • 64 Gb/s on 24-port variants wire speed	• 88 Gb/s on 48-port variants • 64 Gb/s on 24-port variants wire speed	1.04 Tb/s wire speed
Network transport	IP/MPLS/segment routing/Ethernet	IP/MPLS/segment routing/Ethernet	IP/MPLS/segment routing/Ethernet
Interfaces	See table 2 for details on SAS-S series variants.		
Timing and synchronization	• ITU-T SyncE with ESMC • IEEE 1588v2 Transparent Clock (TC)[1]	• ITU-T SyncE with ESMC • IEEE 1588v2 - BC, OC-slave, TC - UDP/IP and Ethernet encapsulation - Profiles: IEEE 1588v2 default, ITU-T G.8265.1, ITU-T G.8275.1 (standalone mode) • 1PPS[1]	• ITU-T SyncE with ESMC • IEEE 1588v2 - BC, OC-Slave[1], TC - Ethernet encapsulation - Profiles: ITU-T G.8275.1 (standalone mode) • 1PPS[1]
Stacking ports	2	2	2[1]
POE/PoE+	See table 2 for details on SAS-S series variants.		
Dimensions	• Height: 4.32 cm (1.7 in) 1RU • Width: 44 cm (17.3 in) • Depth: 38.7 cm (15.2 in) • Fits in standard 19-in mounting rack	• Height: 4.37 cm (1.72 in) 1RU • Width: 43.94 cm (17.3 in) • Depth: 40.61 cm (15.99 in) • Fits in standard 19-in mounting rack	• Height: 6.6 cm (2.6 in) 1.5RU • Width: 44 cm (17.3 in) • Depth: 45 cm (17.7 in) • Fits in standard 19-in mounting rack
Power supply options	• Two feeds. One fixed internal supply and one optional modular supply • Hot swappable	• Two feeds. Modular AC and DC power supplies • Supports concurrent use of AC and DC power supplies • Hot-swappable	• Two feeds. Modular AC and DC power supplies • Supports concurrent use of AC and DC power supplies • Hot-swappable
Power requirements	• AC input: 100 V to 240 V, 50 Hz to 60 Hz • DC input: -40 V DC to -72 V DC	• AC input: 100 V to 240 V, 50 Hz to 60 Hz • DC input: -40 V DC to -72 V DC	• AC input: 100 V to 240 V, 50 Hz to 60 Hz • DC input: -40 V DC to -72 V DC
Cooling	Fan cooled with front-to-back airflow	• Fan cooled with side-to-back airflow • Air filters on both sides of the chassis	• Fan cooled with side-to-back airflow • Air filters on both sides of the chassis
Temperature operating range	0°C to 40°C (32°F to 104°F)	0°C to 50°C (32°F to 122°F)	0°C to 50°C (32°F to 122°F)

[1] Future software deliverable

Table 2. Nokia 7210 SAS-S series variants

The interface specifications and other orderable features for each SAS-S series variant are listed below.

Identifier	Interface	PoE
7210 SAS-S 1/10GE 48-port fiber AC	• 4 x SFP+ GE or 10GE • 48 x SFP 100/1000 Mb/s	
7210 SAS-S 1/10GE 48-port fiber DC	• 4 x SFP+ GE or 10GE • 48 x SFP 100/1000 Mb/s	
7210 SAS-S 1/10GE 24-port fiber AC	• 4 x SFP+ GE or 10GE • 24 x SFP 100/1000 Mb/s	
7210 SAS-S 1/10GE 24-port fiber DC	• 4 x SFP+ GE or 10GE • 24 x SFP 100/1000 Mb/s	
7210 SAS-S 1/10GE 48-port copper AC	• 4 x SFP+ GE or 10GE • 48 x RJ-45 10/100/1000 Mb/s	
7210 SAS-S 1/10GE 48-port copper AC PoE[1]	• 4 x SFP+ GE or 10GE • 48 x RJ-45 10/100/1000 Mb/s	720 W maximum
7210 SAS-S 1/10GE 48-port copper DC	• 4 x SFP+ GE or 10GE • 48 x RJ-45 10/100/1000 Mb/s	
7210 SAS-S 1/10GE 24-port copper AC	• 4 x SFP+ GE or 10GE • 24 x RJ-45 10/100/1000 Mb/s	
7210 SAS-S 1/10GE 24-port copper AC PoE[1]	• 4 x SFP+ GE or 10GE • 24 x RJ-45 10/100/1000 Mb/s	720 W maximum
7210 SAS-S 1/10GE 24-port copper DC	• 4 x SFP+ GE or 10GE • 24 x RJ-45 10/100/1000 Mb/s	
7210 SAS-Sx 1/10GE 48-port fiber	• 4 x SFP+ GE or 10GE • 46 x SFP 100/1000 Mb/s • 2 x combo SFP or RJ-45 10/100/1000 Mb/s	60 W maximum on combo RJ-45 ports
7210 SAS-Sx 1/10GE 24-port fiber	• 4 x SFP+ GE or 10GE • 22 x SFP 100/1000 Mb/s • 2 x combo SFP or RJ-45 10/100/1000 Mb/s	60 W maximum on combo RJ-45 ports
7210 SAS-Sx 1/10GE 48-port copper	• 4 x SFP+ GE or 10GE • 48 x RJ-45 10/100/1000 Mb/s	
7210 SAS-Sx 1/10GE 48-port copper PoE[1]	• 4 x SFP+ GE or 10GE • 48 x RJ-45 10/100/1000 Mb/s	720 W maximum
7210 SAS-Sx 1/10GE 24-port copper	• 4 x SFP+ GE or 10GE • 24 x RJ-45 10/100/1000 Mb/s	
7210 SAS-Sx 1/10GE 24-port copper PoE[1]	• 4 x SFP+ GE or 10GE • 24 x RJ-45 10/100/1000 Mb/s	720 W maximum
7210 SAS-Sx 10/100GE QSFP28	• 4 x QSFP28[2] • 64 x SFP+ GE or 10GE	

[1] 7210 SAS-S and SAS-Sx 1/10GE 48-port and 24-port copper PoE variants must use AC power supplies.
[2] 1 x 100GE port is supported without the breakout option.

Table 3. Nokia 7210 SAS-K series models

The Nokia 7210 SAS-K uses Nokia silicon for programmability, industry-leading features and deep buffering. Programmability extends network longevity. Buffering of bursty customer traffic at demarcation and first aggregation sites enhances network throughput and customer experience.

	7210 SAS-K30 (ETR)	7210 SAS-K12 (2 variants: normal and ETR)	7210 SAS-K5 (2 variants: normal and ETR)
System throughput Full duplex, IMIX traffic	30 Gb/s wire speed	9 Gb/s wire speed	5 Gb/s wire speed
Network transport	IP/MPLS/segment routing/Ethernet	IP/MPLS/segment routing/Ethernet	Ethernet
Interfaces	• 3 x SFP+ 10GE • 8 x Combo SFP/RJ-45 10/100/1000 Mb/s	• 2 x SFP 100/1000 Mb/s • 4 x RJ-45 10/100/1000 Mb/s • 6 x Combo SFP or RJ-45 10/100/1000 Mb/s	• 2 x SFP 100/1000 Mb/s • 2 x RJ-45 10/100/1000 Mb/s • 1 x Combo SFP or RJ-45 10/100/1000 Mb/s
Timing and synchronization	• ITU-T SyncE with ESMC • IEEE 1588v2 – BC, OC-slave – UDP/IP and Ethernet encapsulation – Profiles: IEEE 1588v2 default, ITU-T G.8265.1, G.8275.1 • 1PPS	• ITU-T SyncE with ESMC • IEEE 1588v2 – BC, OC-slave – UDP/IP and Ethernet encapsulation – Profiles: IEEE 1588v2 default, ITU-T G.8265.1, G.8275.1 • 1PPS on ETR variant	• ITU-T SyncE with ESMC • IEEE 1588v2 – BC, OC-slave – UDP/IP encapsulation – Profiles: IEEE 1588v2 default, ITU-T G.8265.1
Port-based MACsec	Yes	ETR variant	No
Extended buffering and shaping	Ingress, egress 512 MB buffer	Ingress, egress 64 MB buffer	Ingress, egress 64 MB buffer
IP rating	IP20	7210 SAS-K12: IP50 7210 SAS-K12 ETR: IP20	IP50 (both variants)
Dimensions	• Height: 8.8 cm (3.5 in) 2RU • Width: 43.8 cm (17.2 in) • Depth: 25.2 cm (9.9 in) • Fits in standard 19-in mounting rack	7210 SAS-K12: • Height: 3.5 cm (1.4 in) 1RU • Width: 29.5 cm (11.6 in) • Depth: 21.8 cm (8.6 in) 7210 SAS-K12 ETR: • Height: 6.6cm (2.6 in) 1.5RU • Width: 33.9cm (13.35in) • Depth: 24.0cm (9.45in - ETSI)	7210 SAS-K5: • Height: 3.5 cm (1.4 in) 1RU • Width: 18.4 cm (7.2 in) • Depth: 21.8 cm (8.6 in) 7210 SAS-K5 (ETR): • Height: 4.1 cm (1.6 in) 1RU • Width: 18.4 cm (7.2 in) • Depth: 21.8 cm (8.6 in)
Power supply options	• The 7210 SAS-K30 (ETR) AC: Two fixed, internal AC power supply units (PSUs) with dual feeds • The 7210 SAS-K30 (ETR) DC: One fixed, internal DC PSU with dual feeds	• 7210 SAS-K12: One feed. External AC or DC power supply • 7210 SAS-K12 (ETR): Two feeds. External AC or DC power supplies. Supports concurrent use of AC and DC power • AC, -48 V DC and +24 V DC power supplies are available	• 7210 SAS-K5: One feed. External AC or DC power supply • 7210 SAS-K5 (ETR): Two feeds. External AC or DC power supplies. Supports concurrent use of AC and DC power supplies • AC, -48 V DC and +24 V DC power supplies are available for both variants.
Power requirements	• AC input: 100 V to 240 V, 50 Hz to 60 Hz • DC input: -20 V DC to -72 V DC	• AC input: 100 V to 240 V, 50 Hz to 60 Hz • DC input: -36 V DC to -75 V DC • DC input: 18 V DC to 36 V DC	• AC input: 100 V to 240 V, 50 Hz to 60 Hz • DC input: -36 V DC to -72 V DC • DC input: +20 V DC to +28 V DC
Cooling	Passive cooling	Passive cooling	Passive cooling
Temperature operating range	-40°C to +65°C (-40°F to +149°F)	• 7210 SAS-K12: 0°C to 40°C (32°F to 104°F) • 7210 SAS-K12 (ETR): -40°C to +65°C (-40°F to +149°F)	• 7210 SAS-K: 0°C to 40°C (32°F to 104°F) • 7210 SAS-K (ETR): -40°C to +65°C (-40°F to +149°F)

Table 4. Nokia 7210 SAS-Dxp

The Nokia 7210 SAS-Dxp is a cost-effective, Ethernet access device used for demarcation, business and wholesale services.

	7210 SAS-Dxp (2 variants: normal and ETR)
System throughput Full duplex, IMIX traffic	30 Gb/s wire speed
Network transport	Ethernet
Interfaces	• 2 x SFP+ 1/10GE • 4 x SFP 100/1000 Mb/s • 6 x RJ-45 10/100/1000 Mb/s
Timing and synchronization are available on the ETR variant	• ITU-T SyncE with ESMC • PTP Profiles – ITU-T G.8275.1 – IEEE 1588v2 Default • PTP Clock Types – Boundary clock – Ordinary clock (only timereceiver) • PTP Encapsulations – Ethernet encapsulation – UDP/IPv4 encapsulation
IP rating	IP50
Dimensions	• Height: 4.32 cm (1.70 in.) 1RU • Width: 26 cm (10.23 in.) • Depth: 23.5 cm (9.25 in.)
Power supply options	• 7210 SAS-Dxp: One feed. Fixed internal AC or DC power supply. • 7210 SAS-Dxp (ETR): Two feeds. One fixed internal AC or DC power supply and one external AC or DC power supply
Power requirements	• AC input: 100 V to 250 V, 50 Hz to 60 Hz • DC input (internal): -40 V DC to -72 V DC • DC input (external): -36 V DC to -75 V DC
Cooling	Fanless
Temperature operating range	• 7210 SAS-Dxp: 0°C to 40°C (32°F to 104°F) • 7210 SAS-Dxp (ETR): -40°C to 65°C (-40°F to 149°F)

Table 5. Nokia 7210 SAS-Dxp-16p/-24p

The Nokia 7210 SAS-Dxp-16p and 7210 SAS-Dxp-24p are feature-rich IP/Ethernet systems in a fanless, ruggedized, temperature hardened and compact form factor enabling enterprises and critical infrastructure operators to fully realize the promise of applications such as smart grids, smart cities, public safety and digital rail to name a few. The SAS-Dxp-16p and Dxp-24p DIN rail products offer high fan-out Power over Ethernet (PoE/PoE+/PoE++/HPoE) with 1+1 power redundancy.

	7210 SAS-Dxp-16p (DIN rail and ETR)	**7210 SAS-Dxp-24p (DIN rail and ETR)**
System throughput Full duplex	34 Gb/s wire speed	42 Gb/s wire speed
Network transport	Ethernet	Ethernet
Interfaces	• 2 x SFP+ 1/10GE • 4 x SFP 1000 Mb/s • 10 x RJ45 10/100/1000 Mb/s PoE/+	• 2 x SFP+ 1/10GE • 6 x SFP 1000 Mb/s • 16 x RJ45 10/100/1000 Mb/ PoE/+ (MACsec on 4 ports: 2SFP+, 2SFP)
Timing and synchronization	• ITU-T SyncE with ESMC • PTP Profiles – ITU-T G.8275.1 – IEEE 1588v2 Default – Power Utility profile: IEC/IEEE 61850-9-3 and C37.238-2017 • PTP Clock Types – Boundary clock – Ordinary clock (only timereceiver) • PTP Encapsulations – Ethernet encapsulation – UDP/IPv4 encapsulation	• ITU-T SyncE with ESMC • PTP Profiles – ITU-T G.8275.1 – IEEE 1588v2 Default – Power Utility profile: IEC/IEEE 61850-9-3 and C37.238-2017 • PTP Clock Types – Boundary clock – Ordinary clock (only timereceiver) • PTP Encapsulations – Ethernet encapsulation – UDP/IPv4 encapsulation
IP rating (main unit)	IP50	IP50
PoE	• Up to 10 PoE (15W) / PoE+ (30W) • Up to 4 PoE++ (60W) / HPoE (90W)	• Up to 16 PoE (15W) / PoE+ (30W) • Up to 4 PoE++ (60W) / HPoE (90W)
Alarm inputs/outputs	Alarm input connector for monitoring device environment	Alarm input connector for monitoring device environment
Dimensions	• Height: 15.0 cm (5.9 in) • Width: 20.3 cm (8.0 in) • Depth: 13.2 cm (5.2 in)	• Height: 15.0 cm (5.9 in) • Width: 20.3 cm (8.0 in) • Depth: 13.2 cm (5.2 in)
Power supply options	• Two feeds. External AC and DC power supplies • 1+1 Power Redundancy	• Two feeds. External AC and DC power supplies • 1+1 Power Redundancy
Power requirements	• DC output: 54 V DC • Refer to table 6 for details	• DC output: 54 V DC • Refer to table 6 for details
Cooling	Fanless	Fanless
Mounting options	DIN rail, wall, 19” rack mount	DIN rail, wall, 19” rack mount
Temperature operating range	-40°C to 70°C (ETR) (-40°F to 158°F) up to 13K ft. 65°C still air, 70°C 1.52 m/s air flow	-40°C to 70°C (ETR) (-40°F to 158°F) up to 13K ft. 65°C still air, 65°C 1.52 m/s, 70°C 3.30 m/s air flow

Table 6. Nokia 7210 SAS-Dxp-16p/-24p power supplies

	100W AC PSU	290W DC PSU	480W AC PSU	960W AC PSU
Power source	Input voltage AC: 85-265 VAC or DC: 88-250 VDC	Input voltage DC: 18-60 VDC	Input voltage AC: 100-240 VAC	Input voltage AC: 100-240 VAC
Max power rating	100W	290W	480W	960W
IP rating	IP65	IP20	IP20	IP20
PoE standards support	PoE (15W), PoE+(30W)	PoE (15W), PoE+(30W), PoE++(60W), HPoE(90W)	PoE (15W), PoE+(30W), PoE++(60W), HPoE(90W)	PoE (15W), PoE+(30W), PoE++(60W), HPoE(90W)
Cooling	Fanless	Fanless	Fanless	Fanless
Dimensions (HxWxD)	40 x 67.5 x 226 mm	124 x 82 x 127 mm	121 x 144 x 118.6 mm	124 x 125 x 133.6 mm
Temperature operating range	-40 °C to +70 °C (-40 °F to 158 °F)	-40 °C to +70 °C (-40 °F to 158 °F)	-40 °C to +75 °C (-40 °F to 167 °F)	-40 °C to +70 °C (-40 °F to 158 °F)

Software features

Each product model supports, but is not limited to, a variation of the following features. Please refer to Nokia 7210 SAS technical documentation for the features supported on each product model.

Services

- Layer-2 virtual private network (VPN) services – virtual leased line (VLL) and virtual private LAN service (VPLS)
- IP VPN services (IPv4 and IPv6)
- Ethernet VPN (EVPN)
  - VPLS
  - Multi-homing with single active and all-active options.
- Internet Enhanced Service (IPv4 and IPv6)
- Routed VPLS with IES and virtual private routed network (VPRN) IPv4 and IPv6 interfaces
- IPv4 multicast
- IPv4 VPN multicast (Next-generation multicast VPN)
- Dynamic VLAN (SAP) assignment using Dot1x RADIUS authentication with EHS

Network protocols

- IEEE 802.1Q (VLAN) and 802.1ad (QinQ)
- Provider Backbone Bridging (PBB), Backbone Edge Bridge (BEB) and Backbone Core Bridge (BCB) as defined in IEEE 802.1ah
- Segment routing
  - Intermediate System-to-Intermediate System (IS-IS) and Open Shortest Path First (OSPF)
  - Loop-free alternate (LFA) and remote LFA (RLFA)
- Path Computation Element Protocol (PCEP)
  - Resource Reservation Protocol (RSVP)
- MPLS Label Edge Router (LER) and LSR.
  - MPLS point to multi-point (P2MP) LSPs for NG-MVPN multicast.
  - MPLS-TP (based on IETF standards)
  - Label Distribution Protocol (LDP), LDPv6, LDP over RSVP, and Targeted LDP (T-LDP)
  - Resource Reservation Protocol — Traffic Engineering (RSVP-TE)

- IP routing
  - Intermediate System-to-Intermediate System (IS-IS) (IPv4 and IPv6), including traffic engineering (TE) support for IPv4
  - Open Shortest Path First (OSPFv2 and OSPFv3) with TE support for IPv4
  - IPv4 unnumbered with MPLS
  - Routing Information Protocol (RIP)
  - Border Gateway Protocol (BGP)
  - BGP label unicast routes as defined in RFC 3107 with next-hop-self and Accumulated Interior Gateway Protocol (AIGP) support.
  - BGP-AD for VPLS auto-discovery
  - BGP pseudowire routing for multi-segment pseudowires
  - BGP route-reflector server for VPRN IPv4 and IPv6 routes
  - BGP intra-AS option B for VPRN IPv4 and IPv6 routes
- Protocol Independent Multicast (PIM) – Sparse mode (SM), Source Specific Multicast (SSM) and IGMPv1/2/3
- IGMPv1/2/3 snooping

Load balancing and resiliency

- IEEE 802.3.ad Link Aggregation Group (LAG) and multi-chassis (MC) LAG
- Pseudowire redundancy
- Primary and Secondary LSPs
- Control plane redundancy
- BGP Prefix Independent Convergence (PIC)
- Fast reroute (FRR)
  - LDP with loop-free alternate (LFA) policies
  - RSVP
  - Segment routing with LFA and RLFA
- Equal-cost multi-path (ECMP) load balancing for LDP LSR/LER, IPv4 and L3 VPN tunnels
- Virtual Router Redundancy Protocol and VRRPv3 for IPv6
- Multi-chassis ITU-T G.8032v2
- IEEE Spanning Tree Protocol (STP)/Rapid Spanning Tree Protocol (RSTP)/Multiple Spanning Tree Protocol (MSTP)
- Hardware-based bidirectional forwarding detection (BFD) along with micro-BFD support for LAG with 10ms timer (IPV4 and IPv6)
- Shared Risk Link Group (SRLG) recovery
- Entropy (pseudowire hash) label
- Virtual chassis (stacking)
- Nonstop routing, nonstop services
- In-service software upgrade (ISSU)

Quality of service

- Service ingress packet classification based on MAC and IP criteria (IPv4 and IPv6), MPLS EXP on network ingress
- Service ingress packet classification based on IP DSCP and Dot1p with a large meter pool for higher SAP/service scaling
- Service egress reclassification based on IP DSCP, IP precedence, Dot1p
- Hierarchical per-service ingress and egress policing, queuing, and shaping
- Deep buffering
- RED slope
- Self-generated traffic marking
- Ethernet bandwidth notification (ETH-BN) for transport over microwave links

OAM

- IEEE 802.3ah Ethernet in the first mile with Dying Gasp support
- IEEE 802.1ag Ethernet OAM and ITU-T Y.1731 for fault and performance management
- MPLS OAM for in-service performance management (delay, jitter, and packet loss) and fault management
- MPLS-TP OAM
- Service mirroring (local/remote)
- Two-Way Active Measurement Protocol (TWAMP), TWAMP light

- ITU-T Y.1564 test head with multiple streams (with EMIX/IMIX frame-size) and service performance measurement
- Per-port and per-service loopback with MAC-swap
- Loopback on SAP ingress
- Link Layer Discovery Protocol (LLDP)
- LLDP Media Endpoint Discovery (MED)
- NETCONF/YANG
- cflowd
- SNMPv1, v2c, v3
- IPv6 for management
- Ethernet and IP tools for performance monitoring with Mplify (formerly MEF 35)-based binning and availability
- PTP-based timestamps for service level agreement measurements
- Remote SR OS upgrade
- Auto-configuration (plug-and-play)
- Configuration roll-back
- Event Handling System (EHS)

Security

- Secure boot
- Secure Shell (SSH) v4 and v6 for management
- SSH with public key infrastructure (PKI)
- Transport layer security (TLS) for RADIUS and syslog
- IEEE 802.1x on access ports, MAC and VLAN authentication.
- Control plane security
- Management access filters
- Remote Authentication Dial-In User Service (RADIUS) client
- Terminal Access Concentrator Access Control Server Plus (TACACS+)
- User profile management
- VPLS security
- Access control lists
- Per-port MAC security (MACsec)
- Strict unicast Reverse Path Forwarding (uRPF)

Standards compliance[1]

Environmental specifications

- ATT-TP-76200[2]
- ETSI EN 300 019-2-1 Storage[2]
- ETSI EN 300 019-2-2 Transportation[2]
- ETSI EN 300 019-2-3 Operational
- ETSI EN 300 753 Acoustic Noise[2]
- GR-63-CORE[2]
- VZ.TPR.9205[2]
- RoHS 6/6 design

Safety

- IEC/EN 60825-1
- IEC/EN 60825-2
- AS/NZS 60950-1
- IEC/EN/UL/CSA 60950-1 Ed2
- AS/NZS 62368-1
- IEC/EN/UL/CSA 62368-1 Ed2

Electromagnetic compatibility

- AS/NZS CISPR 32 Class A
- BSMI CNS13438 Class A[2]
- BSMI CNS15936 Class A[2]
- BT GS-7[2]
- EN 55024
- EN 55032 Class A
- EN 55035 Class A[2]
- ETSI EN 300 132-2 (LVDC)[2]
- ETSI EN 300 132-3 (AC)[2]
- ETSI EN 300 386
- ETSI ES 201 468[2]
- FCC Part 15 Class A
- GR-1089-CORE[2]

[1] System design intent is according to the listed standards. Certifications vary on different models. Certifications applicable to only one or two models are noted. Refer to product documentation for detailed compliance status.
[2] Applicable to specific models

- ICES-003 Class A
- IEC CISPR 24
- IEC CISPR 32 Class A
- IEC CISPR 35[2]
- IEC/EN 61000-3-2 Power line harmonics[2]
- IEC/EN 61000-3-3 Voltage fluctuations[2]
- IEC/EN 61000-4-2 ESD
- IEC/EN 61000-4-3 Radiated Immunity
- IEC/EN 61000-4-4 EFT
- IEC/EN 61000-4-5 Surge
- IEC/EN 61000-4-6 Conducted Immunity
- IEC/EN 61000-4-11 Voltage Interruptions
- IEC/EN 61000-6-2 Industrial
- IEC/EN 61000-6-4
- KCC Korea-Emission & Immunity (in accordance with KN32/KN35)
- KCC Korea-Emission & Immunity (in accordance with KS C 9832/KS C 9835) (SAS-Dxp 16/24p)
- VCCI Class A

Power utility substations[2]

- IEC 61850-3
- IEEE 1613

Railway[2]

- EN 50121-4
- IEC 62236-4

Directives, regional approvals and certifications

- DIRECTIVE 2011/65/EU RoHS
- DIRECTIVE 2012/19/EU WEEE
- DIRECTIVE 2014/30/EU EMC
- DIRECTIVE 2014/35/EU LVD
- DIRECTIVE 2014/53/EU RED (7210 SAS-Sx 1/10GE, SAS-Sx 10/100GE)
- NEBS Level 3[2]
- Mplify Carrier Ethernet For Business Certified
- Australia - RCM Mark
- China RoHS – CRoHS
- Europe – CE Mark
- Japan – VCCI Mark
- South Korea – KC Mark

2 Applicable to specific models

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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