Nokia 7750 Service Router

Release 15.1

The Nokia 7750 Service Router (SR) series of IP routers deliver high performance, intelligence and resiliency. Designed to stay ahead of the evolving service demands driven by the cloud, 5G and the Internet of Things (IoT), the Nokia 7750 SR product family consists of the Nokia 7750 SR series, the Nokia 7750 SR-s series, the Nokia 7750 SR-e series and the Nokia 7750 SR-a series.

Versatile and scalable

For service providers, the Nokia 7750 SR enables delivery of advanced residential, enterprise and mobile services. For webscale providers, the 7750 SR enables data center aggregation, gateway and interconnect, point of presence (PoP) edge, internet peering and backbone router functions. For enterprises, the 7750 SR provides high-performance networking for cloud, data center and branch office applications.

The 7750 SR delivers high-performance routing and an extensive range of IP functions and applications. Available in four variants, the 7750 SR scales system capacity from 2.4 Tb/s half duplex (HD) to 21.6 Tb/s HD and is equipped with high-density Gigabit Ethernet (GE), 10GE, 40GE and 100GE interfaces. At the heart of the 7750 SR is the highly programmable Nokia FP4 network processing (NP) silicon, an essential element in the quest for uncompromising high-speed intelligent services and applications that can adapt to evolving customer requirements.

7750 SR-12e

7750 SR-12

7750 SR-1

7750 SR-7

Deterministic performance

The Nokia 7750 SR leverages the latest generation of Nokia IP routing silicon, the 2.4 Tb/s FP4, which combines a multichip architecture and intelligent memory design to provide deterministic packet forwarding performance even when complex processing-intensive operations are required. With the FP4 traffic manager, buffering is always deterministic and does not degrade or cause control plane discards if the buffer rate increases.

Intelligent fan-in/fan-out

To cost effectively meet the most stringent high-density aggregation scenarios, the 7750 SR supports intelligent fan-in/fan-out capabilities. Intelligent fan-in/fan-out is a leading capability, with FP enabling the 7750 SR to handle more aggregation than capacity in an exceptionally smart way. It ensures packet priority is always respected and delivers leading ingress buffering and shaping in a fully deterministic way. As a result, with FP4-based systems, the 7750 SR-12e supports up to 43.2 Tb/s HD and the 7750 SR-1 supports up to 4.8 Tb/s HD.

Comprehensive features

With Nokia's feature-rich 64-bit Service Router Operating System (SR OS) and extensive QoS, IP/MPLS and segment routing capabilities, the 7750 SR has the intelligent and comprehensive features and tools to define and deliver the most stringent SLAs and end-user quality of experience (QoE) requirements. With specialized application processing, the 7750 SR leverages embedded subscriber, service and application intelligence to enable deeper levels of integrated service capabilities. It supports tens of thousands of IP flows and access control lists with high performance and scale even when multiple advanced features are enabled concurrently. These platforms support a leading number of statistics counts per packet, enabling comprehensive statistics for existing and future applications.

Full array of IP routing functions

The MEF CE 2.0-certified 7750 SR supports a full array of IP network functions and applications, including the following.

IP edge services

- Broadband Network Gateway (BNG) for residential services
- Provider edge (PE) router for enterprise VPN, internet access, and cloud and data center interconnect services
- Mobile applications, including as an aggregation router for 3G, LTE and LTE-A backhaul, a WLAN gateway for Wi-Fi® network aggregation, and a security gateway for securing backhaul networks
- Value-added services, including distributed denial of service (DDoS) mitigation, application assurance (AA) and carrier-grade Network Address Translation (NAT)

Infrastructure and networking

- Data center aggregation, gateway and interconnect, PoP edge, DDoS mitigation, internet peering and backbone router functions

Mobile gateway

- Supports SGW/PGW/GGSN and PCEF for 2G/3G/4G access and ePDG/TWAG for Wi-Fi access plus TDF and SSG for enhanced subscriber services

Enterprise private WANs

- High-performance IP routing, including connectivity to the data center, internet and branch offices

High availability

For always-on service delivery, the 7750 SR sets the benchmark for high availability. Moving beyond full system redundancy, the robust SR OS supports numerous features to maximize network stability, ensuring IP/MPLS protocols and services run without interruption. These features include innovative nonstop routing, nonstop services, in-service software upgrades (ISSUs) and multichassis resiliency mechanisms.

Carrier SDN integration

The 7750 SR and the SR OS enable multivendor software-defined networking (SDN) control integration, which is enabled through OpenFlow, Path Computation Element Protocol (PCEP), Border Gateway Protocol with Link State (BGP-LS) and NETCONF/YANG interfaces. In combination with the Nokia Network Services Platform (NSP), the 7750 SR can be deployed as part of a Carrier SDN solution, supporting unified service automation and network optimization across IP, MPLS, Ethernet and optical transport layers.

IP/optical integration

Tunable 10G and integrated 100G coherent PM-QPSK tunable dense wavelength division multiplexing (DWDM) optics enable the 7750 SR to interface directly with the photonic transport layer without requiring optical transponders. A standards-based Generalized Multiprotocol Label Switching (GMPLS) user network interface (UNI) enables the 7750 SR to efficiently coordinate IP routing and transport requirements across administrative boundaries and dynamically provision optical segments and end-to-end transport connections.

Network management

The 7750 SR is fully managed by the Nokia NSP, resulting in integrated network management across the network infrastructure of the service provider, webscale operator and enterprise.

Hardware overview

The 7750 SR is available in four chassis variants: the 7750 SR-12e, 7750 SR-12, 7750 SR-7 and 7750 SR-1, supporting a wide range of interface adapters, integrated service adapters (ISAs) and common system modules optimized to address various network and application requirements. For details on the 7750 SR-s series, 7750 SR-e series and 7750 SR-a series, refer to the respective data sheets.

Switch Fabric Module (SFM6-12e)

The SFM6-12e enables 1.2 Tb/s full duplex (FD) connectivity between all slots of the 7750 SR-12e chassis. The fabric cards are 3+1 redundant with active-active load-sharing design and are hot-swappable. Two full-height SFM6-12e modules provide the switching functions for the system as well as house the pluggable Control Processor Module 5 (CPM5). There are also two half-height Mini SFM6-12e modules providing exclusive switching functions for the system.

Switch Fabric Module (SFM5-12 and SFM5-7)

The SFM5-12 and SFM5-7 enable 200 Gb/s (redundant) line rate connectivity between all slots of the 7750 SR-12 and SR-7 chassis. The fabric cards are 1+1 redundant with active-active load-sharing design and are hot-swappable. The SFM5-12 and SFM5-7 are full-height cards that are modular and house the pluggable CPM5 for investment protection.

Control Processor Module (CPM5)

The CPM5 is a pluggable, hot-swappable module housed in the SFM6-12e, SFM5-12e, SFM5-12 and SFM5-7. The CPM5 provides the management, security and control plane processing for the 7750 SR-12e, SR-12 and SR-7. Redundant CPMs operate in a hitless, stateful, failover mode. Central processing and memory are intentionally separated from the forwarding function on the interface modules to ensure system resiliency. Face plate interfaces include an RJ-45 BITS port, a 1PPS port and a 10/100/1000BASE (RJ-45) management interface port.

Integrated Media Module (IMM)

IMMs are line cards providing integrated processing and physical interfaces on a single module. IMMs are hot-swappable and provide high-capacity Ethernet interfaces, including variants with integrated tunable DWDM optics, and deliver up to 400 Gb/s FD per-slot performance. For synchronization requirements, they also support ITU-T Synchronous Ethernet (Sync-E) and IEEE 1588v2.

Input/Output Module (IOM)

IOMs are available in three hot-swappable types and are optimized for versatility in deploying a variety of Ethernet and multiservice applications.

The IOM5-e delivers up to 1.2 Tb/s FD per-slot performance and is supported in the 7750 SR-12e. The IOM5-e will be supported on the SR-12 and SR-7 in a future release. The IOM5-e offers a pay-as-you-grow licensing model with hardware capability-level and functional-level licensing options; upgrade options are enabled through software.

The IOM4-e delivers up to 200 Gb/s FD per-slot performance and the IOM3-XP supports up to 50 Gb/s FD per-slot performance. Both are supported on the 7750 SR-12e, SR-12 and SR-7.

7750 SR-1 compact system

Providing full SR OS capabilities in a compact 2RU form factor, the 2.4 Tb/s HD 7750 SR-1 has one integrated CPM and an integrated IOM5-e based on the Nokia FP4 NP silicon. It supports up to two MDA-e-XPs and supports up to 4.8 Tb/s HD capacity with 2:1 intelligent fan-in/fan-out. It provides full synchronization and Nokia 7210 Service Access Switch-S series (SAS-S) satellite system support for Ethernet port expansion. The SR-1 offers pay-as-you-grow hardware functional-level licenses, with upgrade options enabled through software.

The AC variant has two rear-mounted modular power supplies, and the DC variant comes with integrated dual feeds at the rear of the system. Both systems have modular rear-mounted fans.

Media Dependent Adapter (MDA)

MDAs are available in four hot-swappable types. They provide modular interface connectivity along with a variety of interface types and density configurations. Ethernet types support ITU-T Sync-E and IEEE 1588v2 for synchronization requirements.

The MDA-e-XP provides up to 600 Gb/s FD throughput, supports QSFP28/QSFP+ optics and is supported by the IOM5-e in the SR-12e and by the integrated IOM5-e of the SR-1. The MDA-e-XP will be supported by the IOM5-e in the SR-12 and SR-7 in a future release.

The MDA-e provides up to 100 Gb/s FD throughput. It is supported by the IOM4-e, IOM4e-B and IOM4-e-HS in the 7750 SR-12e, SR-12 and SR-7, and by the IOM-e in the 7750 SR-e series. The MDA-e supports a full range of SFP, cSFP, SFP+, CFP2, CFP4 and QSFP28 /QSFP+ optics. Optical transport network (OTN) support includes ITU-T G.709 and FEC.

The MDA-XP and MDA provide up to 25 Gb/s and 10 Gb/s respectively and support Ethernet and multiservice interfaces. They are supported in the 7750 SR-12e, SR-12 and SR-7 and are available in a variety of interface and density configurations.

Multiservice Integrated Service Module (MS-ISM)

The MS-ISMs are hot-swappable, full-height resource modules. They provide specialized processing and buffering for deeper levels of integrated services and advanced applications. They leverage two embedded ISA2 general-purpose multicore processors and support up to 80 Gb/s of processing. Combination IMMs support Ethernet ports and an embedded ISA2, which supports up to 40 Gb/s of processing.

Multiservice Integrated Service Adapter 2 (MS-ISA2)

The MS-ISA2s, common with the SR-12e, SR-12, and SR-7 and the 7750 SR-e series, are hot-swappable, half-height resource adapters. They provide specialized processing and buffering for deeper levels of integrated services and advanced applications. They deliver up to 40 Gb/s of processing and are supported by the IOM4-e.

Integrated Service Module - Mobile Gateway (ISM-MG)

ISM-MGs are hot-swappable, full-height modules that fit into any 7750 SR I/O slot and provide the bearer functions for 2G/3G/4G and Wi-Fi access networks.

Advanced Power Equalization Modules (APEQs)

APEQs provide power for the 7750 SR-12e. The low-voltage DC APEQs deliver up to 2800 W each. The high-voltage DC APEQs take 260-400 V and provide 3000 W each. AC APEQs take 200-240 V single phase and deliver 3000 W each. APEQs support cost-effective modular expansion as required.

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Power Entry Modules (PEMs)

PEMs provide low-voltage DC power for the 7750 SR-12 and 7750 SR-7 and support cost-effective modular expansion as required.

Power Supply Units (PSUs)

PSUs provide modular, redundant AC power for the 7750 SR-1.

Technical specifications

Table 1. Hardware specifications for the 7750 SR series

	7750 SR-12e	7750 SR-12	7750 SR-7	7750 SR-1
System throughput	• 21.6 Tb/s (HD, redundant) • Per-slot throughput: 1.2 Tb/s (FD, redundant)	• 4 Tb/s (HD, redundant) • Per-slot throughput: 200 Gb/s (FD, redundant)	• 2 Tb/s (HD, redundant) • Per-slot throughput: 200 Gb/s (FD, redundant)	• 2.4 Tb/s (HD)
Number of MDA-e/MDA-e-XP/MDA/ISA2 adapters	18	20	10	2
Number of IOMs/IMMs/ISMs	9	10	5	1; integrated IOM
Common equipment redundancy	SFM6-12e, Mini-SFM6-12e, SFM5-12e, Mini-SFM5-12e, CPM5, SF/CPM, APEQs, enhanced fan tray (EFT)	SFM5-12, CPM5, SF/CPM, PEM, EFT	SFM5-7, CPM5, SF/CPM, PEM, EFT	Fan module, PSU
Hot-swappable modules	SFM6-12e, Mini-SFM6-12e, SFM5-12e, Mini-SFM5-12e, IOM5-e, MDA-e-XP, MDA-e, MDA-XP, MDA, IMM, ISM, ISA2, VSM, APEQ, EFT	SFM5-12, CPM5, SF/CPM, IOMs, IMM, ISM, MDA-e, MDA-XP, MDA, ISA2, VSM, EFT, PEM	SFM5-7, CPM5, SF/CPM, IOM, MDA-e, MDA-XP, MDA, IMM, ISM, ISA2, VSM, EFT, PEM	MDA-e-XP, fan module, PSU
Dimensions*	• Height: 97.8 cm (38.5 in), 22RU • Width: 44.5 cm (17.5 in) • Depth: 76.2 cm (30.0 in)	• Height: 62.2 cm (24.5 in), 14RU • Width: 44.5 cm (17.5 in) • Depth: 64.5 cm (25.4 in) (without cable management) • Depth: 76.5 cm (30.1 in) (with cable management)	• Height: 35.6 cm (14.0 in), 8RU • Width: 44.5 cm (17.5 in) • Depth: 64.8 cm (25.5 in)	• Height: 9.53 cm (3.5 in), 2RU • Width: 44.5 cm (17.5 in) • Depth: 62.5 cm (24.6 in)
Weight*	• Empty: 79.4 kg (175.0 lb) • Loaded: 249.5 kg (550.0 lb)	• Empty: 56.4 kg (124.3 lb) • Loaded: 155.7 kg (343.3 lb)	• Empty: 41 kg (90.4 lb) chassis weight with factory-installed fan tray and air filter • Loaded: 70.5 kg (155.4 lb)	**DC system** • Empty: 14.96 kg (33.0 lb) • Loaded: 20.1 kg (44.4 lb) **AC system** • Empty: 14.4 kg (31.7 lb) • Loaded: 21.9 kg (48.3 lb)

* Dimensions and weights are approximate and subject to change. Refer to the appropriate installation guide for the current dimensions and weights.

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Table 1. Hardware specifications for the 7750 SR series (continued)

	7750 SR-12e	7750 SR-12	7750 SR-7	7750 SR-1
Power	**DC power** • DC-40 V to -72 V, 60 A or 80 A per feed or • DC 260 to 400 V, 13 A per feed 4+1 redundancy	**DC power** • DC-40 to -72 V, 162 A max, 6,480 W or • DC-46 to -72V, 175 A max, 8,050 W or • DC-49 to -55 V, 175 A max, 8,575 W or • DC-50.5 to -72 V, 175 A max, 8,837.5 W • 1+1 redundancy **External AC power (option)** • Input voltage: 200 V AC to 240 V AC • Output voltage: 42 V DC to 56 V DC • Current: 50 A	**DC power** • DC-40 to -72 V, 100 A, 4,000 W max or • DC-46 to -72 V, 100 A, 4,600 W max • 1+1 redundancy **External AC power (option)** • Input voltage: 200 V AC to 240 V AC • Output voltage: 42 V DC to 56 V DC • Current: 50 A	**DC power** • DC input: -40 to -72 V, 40 A max • Power feed redundancy **AC power** • AC input: 90-127/200-264 V AC, 50/60 Hz, 12/10 A • 1+1 redundancy
Cooling	Front to back	Front to back	Side to back	Front to back

Table 2. Nokia 7750 SR MDA-e-XP and MDA-e summary

MDA-e type	Ports	Connector type	Maximum density			
			7750 SR-12e	7750 SR-12*	7750 SR-7*	7750 SR-1
MDA-e-XP						
100GBASE/40GBASE/10GBASE**	6	QSFP28/QSFP+	108/216/1,080	—	—	12/24/120
100GBASE/40GBASE/10GBASE**	12	QSFP28/QSFP+	216/432/2,160	—	—	24/48/240
MDA-e						
100GBASE	1, 2	CFP2, CFP4	18, 36	20, 40	10, 20	—
100GBASE/40GBASE	2	QSFP28/QSFP+	36	40	20	—
10GBASE	10, 6	SFP+	180, 108	200, 120	100, 60	—
10GBASE/1000BASE (MACsec)	12	SFP+/SFP	216	240	100	—
1000BASE	40	CSFP/SFP	720	800	400	—

* The MDA-e-XP will be supported on the 7750 SR-12 and 7750 SR-7 in a future release.
** Leverages intelligent fan-in/fan-out.

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Table 3. Nokia 7750 SR IMM summary

IMM type	Ports	Connector type	Maximum density		
			7750 SR-12e	7750 SR-12	7750 SR-7
10/100/1000BASE	160	CSFP/SFP	1,440	1,600	800
10/100/1000BASE	48	SFP	432	480	240
10GBASE	40	SFP+	360	—	—
10GBASE	12, 20	SFP+	108, 180	120, 200	60, 100
40GBASE	6	QSFP+	54	60	30
100GBASE	4	CXP and CFP4	36	—	—
100GBASE	1, 2	CFP	9, 18	10, 20	5, 10
100GBASE IMM (DWDM tunable optics)	1	LC	9	10	5
10GBASE + 100/1000BASE	10/20	SFP+/SFP	90/180	100/200	50/100
10GBASE + 7x50 ISA2	10	SFP+	90	100	50
40GBASE + 100/1000BASE	3/20	QSFP+/SFP	27/180	30/200	15/100
100GBASE + 10GBASE	1/10	CFP/SFP+	9/90	10/100	5/50
100GBASE + 7x50 ISA2	1	CFP	9	10	5

Table 4. Nokia 7750 SR MDA-XP and MDA summary

MDA type	Ports	Connector type	Maximum density		
			7750 SR-12e	7750 SR-12	7750 SR-7
Ethernet MDA-XP					
10/100/1000BASE-TX	48	8 x mini RJ-21	864	960	480
1000BASE	10, 12, 20	SFP	180, 216, 360	200, 240, 400	100, 120, 200
10GBASE (LAN/WAN PHY)	1, 2, 4	XFP	18, 36, 72	20, 40, 80	10, 20, 40
10GBASE + 1000BASE (LAN/WAN PHY)	2/12	XFP/SFP	36/216	40/240	20/120
Any Service Any Port (ASAP) MDA					
Channelized DS3/E3 ASAP	4, 12	1.0/2.3 connectors	72, 216	80, 240	40, 120
Channelized OC-3/STM-1 ASAP	4	SFP	72	80	40
Channelized OC-12/STM-4 ASAP	SFP	18	18	20	10
Other					
Versatile Service Module-XP	—	—	√	√	√

Table 5. Nokia 7750 SR ISA support summary

ISA type	7750 SR-12e	7750 SR-12	7750 SR-7
Multiservice Integrated Service Adapter 2 (MS-ISA2)	√	√	√
Multiservice Integrated Service Module (MS-ISM)	√	√	√
Integrated Service Module - Mobile Gateway (ISM-MG)*	—	√	√

* Consult the ISM-MG data sheet for details. Support requires SR OS-MG.

Feature and protocol support highlights

Feature and protocol support within the 7750 SR series includes, but is not limited to, the following.

IP and MPLS routing features

- IP unicast routing: Routing Information Protocol (RIP), Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), Multiprotocol Border Gateway Protocol (MBGP), Unicast Reverse Path Forwarding (uRPF), comprehensive control plane protection features for security, and IPv4 and IPv6 feature parity
- IP multicast routing: Internet Group Management Protocol (IGMP), Multicast Listener Discovery (MLD), Protocol Independent Multicast (PIM), Multicast Source Discovery Protocol (MSDP), and IPv4 and IPv6 feature parity
- MPLS: Label edge router (LER) and label switch router (LSR) functions with support for seamless MPLS designs, MPLS-Transport Profile (MPLS-TP), Label Distribution Protocol (LDP) and Resource Reservation Protocol (RSVP) for MPLS signaling and traffic engineering, Point-to-Point (P2P) and Point-to-Multipoint (P2MP) label switched paths (LSPs) with Multicast LDP (MLDP), P2MP RSVP and weighted Equal-Cost Multi-Path (ECMP)
- Segment routing: Support in multiple instances of IS-IS and OSPF with shortest path tunnel and Segment Routing - Traffic Engineering (SR-TE) LSP. The implementation provides Loop-Free Alternate (LFA), remote LFA and Topology-Independent LFA (TI-LFA) protection for both types of tunnels. PCEP allows the delegation of the SR-TE LSP to the Nokia NSP or a third-party PCE function.

Layer 2 features

- Ethernet LAN (ELAN): BGP-VPLS (Virtual Private LAN Service), Provider Backbone Bridging for VPLS (PBB-VPLS), Ethernet VPN (EVPN) and PBB-EVPN
- E-Line: BGP-VPWS (Virtual Private Wire Service), EVPN-VPWS and PBB-EVPN
- E-Tree: EVPN and PBB
- EVPN: EVPN-VXLAN (Virtual eXtensible LAN) to VPLS/EVPN-MPLS gateway functions

Layer 3 features

- IP-VPN, enhanced internet services, EVPN for Layer 3 services with integrated routing and bridging (EVPN-IRB), and Multicast VPN (MVPN), which includes Inter-AS MVPN and Next Generation MVPN (NG-MVPN)
- Ethernet satellites: Port expansion through local or remote Nokia 7210 SAS-S series GE, 10GE, 100GE and SONET/SDH satellite variants, offering 24/48xGE ports, 64xGE/10GE ports or legacy SONET/SDH ports over GE, 10GE and 100GE uplinks[1]

System features

- OAM: Extensive fault and performance operations, administration and maintenance (OAM) includes Ethernet Connectivity Fault Management (CFM) (IEEE 802.1ag, ITU-T Y.1731), Ethernet in the First Mile (EFM) (IEEE 802.3ah), Bi-Directional Fault Detection (BFD), Cflowd, Two-Way Active Measurement Protocol (TWAMP), and a full suite of MPLS OAM tools, including GMPLS UNI
- Timing: ITU-T Synchronous Ethernet (SyncE), IEEE 1588v2, Network Time Protocol (NTP), BITS ports (T1, E1, 2M), and 1PPS
- QoS: Flexible intelligent packet classification; ingress and egress hierarchical QoS with multitiered shaping and two-tiered, class fair hierarchical policing; advanced, scalable network and service QoS, and end-to-end consistent QoS regardless of oversubscription or congestion
- High availability: Nonstop routing[2], nonstop services[2], in-service software upgrade (ISSU)[2], fast reroute for IP, RSVP, LDP and segment routing, pseudowire redundancy, ITU-T G.8031 and G.8032, weighted ECMP, and weighted, mixed-speed link aggregation

1 Requires CPM5, an appropriate chassis mode and an uplink via an FP2-based IOM/IMM at a minimum.

2 Requires redundant CPMs.

Management features

- Management via CLI, SNMP, NETCONF/YANG and telemetry; comprehensive network and node management through the Nokia NSP
- Multivendor SDN control integration through OpenFlow, PCEP and BGP-LS interface support

Specifications, safety standards and compliance agency certifications[3]

Environmental specifications

- Operating temperature: 5°C to 40°C (41°F to 104°F)
- Operating relative humidity:
  - 5% to 85% (SR-12e, SR-12, SR-7)
  - 5% to 95% (non-condensing) (SR-1)
  - Operating altitude: Up to 4,000 m (13,123 ft) at 30°C (86°F)

Safety

- AS/NZS 60950.1
- IEC/EN 60825-1
- IEC/EN 60825-2
- IEC/EN/UL/CSA60950-1 Ed2 Am2

EMC emission

- AS/NZS CISPR 32 (Class A)
- EN 55032 (Class A)
- FCC Part 15 (Class A)
- ICES-003 (Class A)
- IEC 61000-6-4
- IEC CISPR 32 (Class A)
- KN 32 (Class A)
- VCCI (Class A)

EMC immunity

- BT GS-7
- EN 300 386
- EN 55024
- IEC 61000-6-2
- KN 35

EMC radio

- EN 301 489-1
- EN 301 489-19 (GPS/GNSS)

Telecom standards

- ANSI T1.105.03
- ANSI T1.105.06
- ANSI T1.105.09
- ANSI T1.404, DS3
- ITU-T G.703
- ITU-T G.707
- ITU-T G.813
- ITU-T G.823
- ITU-T G.824
- ITU-T G.825
- ITU-T G.957
- Telcordia GR-253-CORE

Environmental

- ETS 300 019-2-1 Storage Tests (Class 1.2)
- ETS 300 019-2-2 Transportation Tests (Class 2.3)
- ETS 300 019-2-3 Operational Tests (Class 3.2)
- ETS 300 019-2-4, pr A 1 Seismic
- ETSI EN 300 132-2 Power Supply Interface
- ETSI EN 300 132-3 AC Systems
- ETSI 300 753 Acoustic Noise

3 Specification listing does not imply full compliance as some specifications may include omissions. For protocol standards support, refer to product documentation.

Directives, regional approvals and certifications

- CE Mark - Common Europe EU Directive 2011/65/EU Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (Recast) Directive (RoHS)
- EU Directive 2012/19/EU Waste Electrical and Electronic Equipment (WEEE)
- EU Directive 2014/30/EU Electromagnetic Compatibility (EMC)
- EU Directive 2014/35/EU Low Voltage Directive (LVD)
- EU Directive 2014/53/EU Radio Equipment Directive (RED)
- KC Mark - South Korea
- NEBS Level 3
- RCM Mark - Australia
- VCCI Mark - Japan

Network Equipment Building System (NEBS)

- ATIS-0600010.03
- ATIS-0600015
- ATIS-0600015.03
- ATIS-0600019
- ATIS-0600020
- ATT-TP-76200
- GR-63-CORE
- GR-1089-CORE
- VZ.TPR.9205 TEEER
- VZ.TPR.9305
- VZ.TPR-9307

MEF certifications

- CE 1.0 (MEF 9 and MEF 14)
- CE 2.0
- Certified (on E-LAN, E-Line, E-Tree and E-Access MEF service types)
- 100G certified (on E-Line and E-Access MEF service types)

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