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Nokia 7705 Service Aggregation Router

Release 8.0

The Nokia 7705 Service Aggregation Router (SAR) portfolio provides service adaptation, aggregation, and routing over an efficient, feature-rich Ethernet and IP/MPLS infrastructure. With interfaces supporting a wide range of access protocols, it is well suited for mobile backhaul, fixed-mobile convergence, mission-critical and enterprise applications.

Leveraging the powerful Nokia Service Router Operating System (SR OS) and the Nokia 5620 Service Aware Manager (SAM), the 7705 SAR delivers industry-leading IP/MPLS and pseudowire capabilities. It is available in compact, power-efficient, indoor and outdoor platforms that support highly available services and applications over flexible network topologies.

Unprecedented scalability

The 7705 SAR is distinguished by its IP and MPLS scale, giving network operators the greatest potential to grow their networks, adding unprecedented numbers of end users and applications, without having to make additional capital investment.

Deployment flexibility

The Nokia 7705 SAR portfolio is packaged in a wide range of form factors to accommodate the density and types of services required at any location. It provides both indoor and outdoor mounting solutions combined with extended temperature range and power-over-Ethernet (PoE) options. Fanless and conformal-coated variants allow the 7705 SAR to be used in harsh environmental conditions. The 7705 SAR portfolio accommodates fiber, copper and microwave uplinks with support for a full range of interfaces to accelerate deployment and reduce capital expense.

7705 SAR-18

7705 SAR-8

7705 SAR-X

7705 SAR-A

7705 SAR-Ax

7705 SAR-M

7705 SAR-H

7705 SAR-Hc

7705 SAR-W

7705 SAR-Wx

Reliable service delivery

SR OS software provides superior QoS on the 7705 SAR. The same level of deep buffering and support for ingress and egress shaping that is available on Nokia's edge and core routing platforms is also available on the 7705 SAR aggregation platform. Consistency of traffic engineering and shaping across the network provides higher packet routing performance overall with differentiated service treatment. This facilitates the convergence of fixed and mobile traffic for service providers as well as operational and business services traffic for mission-critical network operators. It allows for advanced service offerings, and delivers efficient network resource usage, customer satisfaction and retention.

The 7705 SAR provides excellent resiliency to link or equipment failures through redundancy and the ability to quickly reroute traffic. The 7705 SAR delivers network reconvergence in tens of milliseconds using a strong suite of dynamic routing and recovery capabilities. Superior network resiliency reduces network down time and improves operations staff's productivity, helping to reduce operating costs, improve end-user satisfaction, and allowing service providers to offer higher-value SLAs.

Precise timing and synchronization

The 7705 SAR provides microsecond timing and accurate synchronization to support mobile base station requirements and the migration of TDM-based services onto the packet network. Timing accuracy and performance over packet are enabled with a combination of built-in architectural features, integrated Global Navigation Satellite System (GNSS) receivers, Nokia Bell Labs algorithms, and powerful QoS mechanisms, which minimize the delay and delay variation experienced by synchronization traffic.

Wide-ranging security

The 7705 SAR provides a robust set of security features to maintain network integrity in the face of cyberattacks such as session hijacking, spoofing, and denial of service attacks. The 7705 SAR firewall is application-aware and mitigates attacks, such as Domain Name System (DNS)/Internet Control Message Protocol (ICMP) replay. It uses application-level gateways to ensure extra security for FTP/T-FTP connections. 7705 SAR hardware-based encryption features, including IPsec, Network Group Encryption (NGE) and advanced key exchange algorithms, prevent man-in-the-middle attacks. All 7705 SAR security features provide high throughput levels while minimizing latency. Operators can use the 7705 SAR to safeguard critical infrastructures and address regulatory requirements, such as North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection Version 5 (CIP V5).

Software features

7705 SAR models support, but are not limited to, the following features:

Services

- L2 virtual private network (VPN) services – virtual leased line (VLL) and virtual private LAN service (VPLS)
- IP (VPN) services (IPv4 and IPv6)
- Internet Enhanced Service (IES)
- Circuit Emulation Services (CES)
  - Structure Agnostic TDM over Packet (SAToP)
  - Circuit Emulation Service over Packet-Switched Network (CESoPSN)
  - Raw Socket IP transport for asynchronous RS232 serial data
  - MEF 8

Interfaces supported

- Ethernet
- Packet over SONET/SDH (POS)
- Asynchronous Transfer Mode (ATM), ATM-IMA
- Frame Relay (FR)
- High Level Data Link Control (HDLC)
- Point-to-Point Protocol (PPP), Multi-Class (MC) PPP, Multi-Link (ML) PPP
- TDM

Network protocols

- MPLS Label Edge Router (LER) and Label Switch Router (LSR) functions
- IP Routing
  - Intermediate System-to-Intermediate System (IS-IS) (IPv4, IPv6)
  - Open Shortest Path First (OSPFv2 and OSPFv3)
  - Constraint-based Shortest Path First (CSPF)
  - Routing Information Protocol (RIP)
  - Border Gateway Protocol (BGP) with multiprotocol extensions
  - RFC 3107-labeled routes
- IPv6
  - IPv6 VPN Provider Edge (6VPE) for MPLS and IPSec VPRN
  - Dynamic Host Configuration Protocol (DHCP) v6 server/relay
  - IPv6 over IPSecv4 tunnels
- Multicast functionality at L3 and L2
  - L2 multicasting via Internet Group Management Protocol (IGMP)/Multicast Listener Discovery (MLD) snooping in VPLS with traffic flow from L3 to L2
  - IGMP/MLD snooping translation into Protocol Independent Multicast (PIM) for Routed VPLS (RVPLS)
  - Protocol Independent Multicast – Source Specific Multicast (PIM-SSM) with both IGMPv1/2/3 and MLD v1/2 Label Distribution Protocol (LDP)

- PIM (SSM) stitching via L2 PIM snooping
- Next generation multicast VPNs with MP-BGP MVPN-IPv4 address family and dynamic MLDP PMSI tree
- Targeted LDP (T-LDP)
- Resource Reservation Protocol — Traffic Engineering (RSVP-TE)
  - RSVP-TE LSP shortcuts for IGP route resolution
- Generic Routing Encapsulation (GRE)

Timing and synchronization

- External reference and line timing
- Adaptive Clock Recovery (ACR) timing
- Differential Clock Recovery (DCR) timing
- Built-in Stratum-3 clock
- ITU-T Synchronous Ethernet (Sync-E)
- IEEE 1588v2
  - Master Clock (MC), Boundary Clock (BC), Slave Clock (SC)
  - User Datagram Protocol (UDP)/IP and Ethernet encapsulation
  - Default IEEE 1588v2 profile, ITU-T G.8265.1 and G.8275.1 profiles
- GNSS receiver (various models)
  - IEEE 1588v2 grandmaster
  - Frequency, phase and time distribution
- Transparent clock and time of day output
- RFC 1305, RFC 5905 Network Time Protocol (NTP)
- IRIG-B (B000/B12x) (7705 SAR-H)

Quality of service and traffic management

- Hierarchical QoS (H-QoS)
- Intelligent packet classification, policing, scheduling
- Deep buffering
- Ingress and egress shaping on per forwarding class, service access point (SAP) or VLAN, per customer multi-service site (MSS) and port basis

Operations, administration and maintenance

- IEEE 802.3ah: Ethernet in the first mile
- IEEE 802.1ag: Connectivity fault management
- ITU-T Y.1731: Fault and performance management
- Port mirroring (local/remote)

Two-Way Active Measurement Protocol (TWAMP), TWAMP light

- ITU-T Y.1564 (RFC 2544) test head
- Per-port and per SAP loopback with MAC swap
- 10 ms Bidirectional Forwarding Detection (BFD)
- Auto configuration (plug-and-play)

Resiliency

- IEEE 802.3.ad Link Aggregation Group (LAG) and multi-chassis (MC) LAG
- Pseudowire redundancy
- Primary and secondary LSPs
- Fast reroute (FRR)
  - BGP
  - IP (OSPF & ISIS)
  - LDP with loop-free alternate (LFA) policies
- RSVP-TE
- Automatic Protection Switching (APS) and MC APS for SONET/SDH
- IPv4 and LDP LSR equal-cost multi-path (ECMP)
- Virtual Router Redundancy Protocol (VRRP)

Security

- Simple Network Management Protocol (SNMP) v3
- Secure Shell (SSH)
- IP Security (IPSec) encryption over MPLS
- Network address translation (NAT)
- Stateful firewalls
- Network Group Encryption (NGE) for IP/MPLS services, L3 user and control traffic, and select L2 control traffic
- Public Key Infrastructure (PKI) supporting X.509v3 certificates, Certificate Management Protocol version 2 (CMPv2), Certificate Revocation List (CRL), Offensive Certified Security Professional (OCSP), RSA/DSA keys

Hardware features

The 7705 SAR is available in a range of models to suit a broad range of applications. Select 7705 SAR products are also available with conformal coating as an orderable option to provide added protection against environmental contaminants.

Table 1. 7705 SAR platform specifications (part 1)

	7705 SAR-X (2 variants based on power supply)	7705 SAR-M[1] (2 variants based on port configuration)	7705 SAR-8[2]	7705 SAR-18[3]
System throughput	54 Gb/s half duplex (HD)	10 Gb/s (HD)	60 Gb/s (HD)	140 Gb/s (HD)
Capacity for adapter cards/modules per chassis	None	1 slot	• 2 x 10 Gb/s full duplex (FD) slots • 4 x 2.5 Gb/s (FD) slots	• 12 x 2.5 Gb/s (FD) slots • 4 x 10 Gb/s (FD) XMDA adapter card slots
Built-in interfaces	• 2 x SFP+ 10 Gb/s • 8 x SFP 10/100/1000 Mb/s • 4 x Combo SFP/RJ-45 10/100/1000 Mb/s • 8 x RJ-45 T1/E1	• 4 x SFP 10/100/1000 Mb/s • 3 x RJ-45 10/100/1000 Mb/s • Variant 1: additional 16 x RJ-45 T1/E1 • Variant 2: no additional ports	N/A	N/A
Timing ports	Sync in, ToD/1PPS out	Sync in, Sync out, ToD	Sync in, Sync out, ToD in, ToD out	2 BITS ports
Common equipment redundancy	Power feeds, cooling fans	Power feeds, cooling fans	Control, switch fabric, power feeds, cooling fans	Control, switch fabric, power feeds, cooling fans
Dimensions	• Height: 1 RU 4.37 cm (1.72 in) • Depth: 25.4 cm (10 in) • Width: 44.2 cm (17.4 in) • Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)	• Height: 1 RU 4.4 cm (1.73 in) • Depth: 24.1 cm (9.5 in) • Width: 44.1 cm (17.4 in) • Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)	• Height: 2 RU, 8.9 cm (3.5 in) • Depth: 26.4 cm (10.4 in) • Width: 44.5 cm (17.5 in) • Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)	• Height: 10 RU, 44.5 cm (17.5 in) • Depth: 30 cm (11.8 in) • Width: 43.9 cm (17.3 in) • Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)
Power	Variant 1: • Two feeds: -48 V DC/ - 60 V DC, or +24 V DC Variant 2: • One feed: 100 V AC to 240 V AC, 50 Hz to 60 Hz	• Two feeds: -48 V DC/ -60 V DC, or +24 V DC • AC power solutions available: 100 V AC to 240 V AC, 50 Hz/60 Hz	• Two feeds: -48 V DC/ -60 V DC, or +24 V DC • AC power solutions available: 100 V AC to 240 V AC, 50Hz/60 Hz	• Two feeds: -48 V DC/ -60 V DC • AC power solutions available: 200 V AC to 277 V AC, 50 Hz/60 Hz
Cooling	Built-in five-fan array with redundancy	Built-in five-fan array with redundancy	One tray of eight fans with redundancy	One tray of eight fans with redundancy
Normal operating temperature range	-40°C to +65°C (-40°F to +149°F) sustained	-40°C to +65°C (-40°F to +149°F) sustained	-40°C to +65°C (-40°F to +149°F) sustained	• -5°C to +45°C (23°F to 113°F) sustained • -5°C to +55°C (23°F to 131°F) extended (96 hours)
Normal humidity	5% to 95%, non-condensing	5% to 95%, non-condensing	5% to 95%, non-condensing	• 5% to 85%, non-condensing • Short-term (96 hours) extended humidity range: 5% to 95%, non-condensing
Shipping and storage temperature	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)

1　See Table 7 for SAR-M modules
2　See Table 5 for SAR-8 adapter cards
3　See Tables 5 and 6 for SAR-18 adapter cards

Table 2. 7705 SAR platform specifications (part 2)

	7705 SAR-Ax	7705 SAR-A (2 variants based on port configuration)	7705 SAR-H[4] (2 variants based on power supply)	7705 SAR-Hc
System throughput	10 Gb/s (HD)	10 Gb/s (HD)	8 Gb/s (HD)	5 Gb/s (HD)
Capacity for modules per chassis			2 slots	
Built-in interfaces	• 4 x Combo SFP/RJ-45 10/100/1000 Mb/s • 8 x SFP 10/100/1000 Mb/s	• 4 x Combo SFP/RJ-45 10/100/1000 Mb/s • 4 x SFP 10/100/1000 Mb/s • 4 x RJ-45 10/100 Mb/s • Variant 1: additional 8 x RJ-45 T1/E1 • Variant 2: no additional ports	• 4 x RJ-45 10/100/1000 (PoE/PoE+ capable) • 2 x SFP 100/1000 Mb/s • 2 x Combo SFP/RJ-45 100/1000 Mb/s	• 2 x RJ-45 10/100/1000 (PoE/PoE+ capable) • 2 x RJ-45 10/100/1000 Mb/s • 2 x SFP 100/1000 Mb/s • 2 x RS-232 (async)
Timing ports	• Sync in, ToD/1PPS out, GNSS	• Sync in, ToD out	• Sync in, Sync out	
Dimensions	• Height: 1 RU 4.3 cm (1.7 in) • Depth: 20.1 cm (7.9 in) • Width: 43.79 cm (17.24 in) • Rack-mountable in a 48.2 cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)	• Height: 1 RU 4.4 cm (1.73 in) • Depth: 24.1 cm (9.5 in) • Width: 44.1 cm (17.4 in) • Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)	• Height: 1.7 RU 7.62 cm (3 in) • Depth: 25.4 cm (10 in) • Width: 43.9 cm (17.3 in) • Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth) • Wall/panel-mountable	• Height: 17.8 cm (7 in) • Width: 9.14 cm (3.6 in) • Depth: 15.24 cm (6 in) • DIN rail and wall/panel-mountable
Power	• Two feeds: -48 V DC/-60 V DC, or +24 V DC • AC power solutions available: 100 V AC to 240 V AC, 50 Hz/60 Hz	• Two feeds: -48 V DC/-60 V DC • AC power solutions available: 100 V AC to 240 V AC, 50/60 H	• Low voltage DC variant: Two feeds: -48 V DC/-60 V DC, or +24 V DC • High voltage AC/DC variant: – Rated voltages: 110 V DC to 250 V DC, 100 V AC to 240 V AC, 50/60 Hz	• ±20 V DC to 75 V DC • HV power solution available: 100 V AC to 240 V AC, 50/60 Hz; 88 V DC to 300 V DC
Cooling	Passively cooled	Passively cooled	Passively cooled	Passively cooled
Normal operating temperature range	• -40°C to +65°C (-40°F to +149°F) sustained with a minimum airflow rate of 0.5 m/s • -40°C to +60°C (-40°F to +140°F) in a still air environment	• -40°C to +65°C (-40°F to +149°F) sustained with a minimum airflow rate of 0.5 m/s • -40°C to +60°C (-40°F to +140°F) in a still air environment	-40°C to +65°C (-40°F to +149°F) sustained	• -40°C to +70°C (-40°F to +158°F) sustained with a minimum airflow rate of 0.5 m/s • -40°C to +65°C (-40°F to +149°F) in a still air environment
Shipping and storage temperature	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)

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4   See Table 8 for SAR-H modules

Table 3. 7705 SAR platform specifications (part 3)

	7705 SAR-W	7705 SAR-Wx [5]
System throughput	10 Gb/s (HD)	10 Gb/s (HD)
Built-in interfaces	• 3 x SFP 100/1000 Mb/s • 2 x Combo SFP/RJ-45 100/1000 Mb/s. The RJ-45 ports optionally support Power over Ethernet plus (PoE+)	See Table 8, fn1
Timing ports		• GNSS (some variants)
Dimensions and mounting options	• Height: 6.6 cm (2.6 in) • Depth: 25.4 cm (10 in) • Width: 38.1 cm (15 in) • Pole-, wall-, strand-mount brackets • Carrying kit • Weather-proof cable termination kits • Cosmetic wrap, paintable to meet municipal color codes • Rack/cabinet mounting kit	• Height: 9.7 cm (3.8 in) • Depth: 16.5 cm (6.5 in) • Width: 35.6 cm (14 in) • Pole-, wall-, strand-mount brackets • Carrying kit • Weather-proof cable termination kits
Power	Power IN • Universal power (AC, AC with DC backup or DC) • AC: 100 V AC to 240 V AC, 50/60 Hz with 1s hold-up • DC: +24 V DC/-48 V DC/-60 V DC with 1s hold-up Power OUT • PoE+ with 1s hold-up on all RJ-45 Ethernet ports	• AC: 100 V AC to 240 V AC, 50/60 Hz • Power over coaxial cable: 90 V AC, 50/60 Hz, quasi-square wave
Cooling	Passively cooled	Passively cooled
Normal operating temperature range	-40°C to +65°C (-40°F to +149°F) sustained	-40°C to +65°C (-40°F to +149°F) sustained
Normal humidity	• 2% to 100%, condensing • Element-proof enclosure/connectivity	• 2% to 100%, condensing • Element-proof enclosure/connectivity
Shipping and storage temperature	-40°C to +70°C (-40°F to +158°F)	40°C to +70°C (-40°F to +158°F)

7705 SAR-Wx variants

There are six variants of the 7705 SAR-Wx. Each column in Table 4 denotes the supported capabilities for one of these configurations.

Table 4. 7705 SAR-Wx chassis variants

	Variant 1	Variant 2	Variant 3	Variant 4	Variant 5	Variant 6
Ethernet ports built-in	• 3 x SFP 100/1000 Mb/s • 2 x RJ-45 100/1000 Mb/s	• 3 x SFP 100/1000 Mb/s • 2 x RJ-45 100/1000 Mb/s	• 3 x SFP 100/1000 Mb/s • 1 x RJ-45 100/1000 Mb/s	• 3 x SFP 100/1000 Mb/s • 1 x RJ-45 100/1000 Mb/s	• 3 x SFP 100/1000 Mb/s • 2 x RJ-45 100/1000 Mb/s • PoE+ on one RJ-45 Ethernet port	• 3 x SFP 100/1000 Mb/s • 2 x RJ-45 100/1000 Mb/s • PoE+ on one RJ-45 Ethernet port
ADSL2+/VDSL2 ports built-in			4 with bonding	4 with bonding		
GPS support	No	Yes	No	Yes	No	Yes

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5   See Table 4 for details on SAR-Wx variants

7705 SAR-8 and SAR-18 adapter cards

The 7705 SAR product line supports an extensive range of adapter cards and modules, optimized to address different network and service requirements. Each of the six adapter card slots in the 7705 SAR-8, or the 12 adapter card slots in the right side of the 7705 SAR-18, can be used to house the following adapter card types.

Table 5. SAR-8 and SAR-18 adapter cards

Card name	Details
6-port 10GE, GE	• 2 x SFP+ 10 Gb/s • 4 x SFP 100/1000 Mb/s
2-port 10GE ring	2 x XFP 10 Gb/s
8-port GE	8 x SFP 100/1000 Mb/s
8-port GE, Ethernet	• 2 x SFP 10/100/1000 Mb/s • 6 x RJ-45 10/100 Mb/s
4-port OC-3/STM-1 or 1-port OC-12/STM-4	• 4 x SFP configurable for SONET or SDH - configurable as 4 x OC-3/STM-1 or 1 x OC-12/STM-4 • Supports TDM and PPP/MLPPP in channelized mode and POS in clear channel mode
4-port OC-3/STM-1 clear channel	• 4 x SFP configurable for SONET or SDH • Supports ATM, POS and IP
2-port OC-3/STM-1 channelized	• 2 x SFP configurable for SONET or SDH • Supports ATM, ATM IMA, TDM, PPP/MLPPP and IP
16-port ASAP T1/E1	ATM, ATM IMA, TDM, FR, HDLC, MCPPP/MLPPP and IP
32-port ASAP T1/E1	ATM, ATM IMA, TDM, FR, HDLC, MCPPP/MLPPP and IP
4-port DS3/E3	• 4 sets (Tx/Rx) of DIN 1.0/2.3 connectors • Clear channel and channelized (on DS3 only) TDM, FR, PPP and ATM service (on DS3 only)
12-port Serial Data Interface (SDI)[6]	Can be configured for RS-232, RS-422/RS-530, V.35 or X.21 operation
6-port E&M[6]	6 x RJ-45
8-port voice and teleprotection[6]	• 2 x Foreign eXchange Subscriber (FXS) and 2 x Foreign eXchange Office (FXO) ports for analog voice • 2 x ITU-T G.703 co-directional ports • 2 x IEEE C37.94 optical teleprotection ports
6-port FXS voice[6]	3 x RJ-45, with 2 x FXS ports per connector - loop start/PLAR signaling
8-port FXO voice[6]	4 x RJ-45, with 2 x FXO ports per connector – loop start signaling
Integrated services[6]	Supports Multi-Drop Data Bridging (MDDB) and PCM multidrop bridging SCADA applications
GNSS receiver	1 x RF, receives frequency and time from a global navigation satellite system antenna
Auxiliary alarm	24 digital alarm inputs, 2 analog inputs and 8 output relays
Passive CWDM	Mux/demux and OADM variants available with selected wavelengths
Microwave interface	Interface to 9500 Microwave Packet Radio (MPR) • 2 x SFP 10/100/1000 Mb/s with microwave-aware Ethernet ports • 2 x RJ-45 10/100/1000 Mb/s with microwave-aware Ethernet ports • 4 x SFP 10/100/1000 Mb/s
Microwave power injector	• 2 x RJ-45 • Supplies power to Nokia 9500 Microwave Packet Radio (MPR)

6   See 7705 SAR Legacy Interface Adapter Cards datasheet for more details

7705 SAR-18 x-adapter cards

The four slots in the left side of the 7705 SAR-18 can be used to house the following x-adapter card:

Table 6. SAR-18 x-adapter card

Card name	Details
1-port 10 GE/ 10-port GE card	Configurable to operate in one of the following modes: • 10 x SFP 1 Gb/s • 1 x SFP+ 10 Gb/s

7705 SAR-M modules

The expansion module slot can support one of the following plug-in modules.

Table 7. SAR-M modules

Card name	Details
2-port 10 Gigabit Ethernet ring	2 x XFP 10GE
6-port Ethernet	• 2 x SFP 100 Mb/s • 2 x Combo SFP/RJ.5 100/1000 Mb/s • 2 x RJ.5 100/1000 Mb/s with 2 x PoE or 1 x PoE+
Passive CWDM	Mux/demux and optical add/drop multiplexer (OADM) variants available with selected wavelengths

7705 SAR-H modules

The two expansion module slots, provided on the 7705 SAR-H, can support the plug-in modules in Table 8.

Table 8. SAR-H modules

Card name	Details
4-port Ethernet	4 x RJ-45 10/100 Mb/s
Combination T1/E1/RS-232	• 2 x RJ-45 T1/E1 • 2 x RS-232
GPS receiver	1 RF port - GPS

Standards compliance

Tables 9 through 13 provide information on how the 7705 SAR variants comply with international regulatory and telecom standards.

Table 9. EMC industrial, regulatory and customer standards compliance

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
IEEE 1613:2009 + A1:2011	IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations	X[1]		X[1]		X[2]	X[1]	X[3]	X[3]		
IEEE 1613. 1-2013	IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Transmission and Distribution Facilities	X[4]		X[4]		X[5]	X[6]	X[7]	X[7]		
IEEE Std C37.90	IEEE Standard for relays and relay systems associated with Electric Power Apparatus	X		X		X	X	X	X		
IEEE Std C37.90.1	Surge Withstand Capability (SWC) Tests	X		X		X	X	X	X		
IEEE Std C37.90.2	Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers	X		X		X	X	X	X		
IEEE Std C37.90.3	IEEE Standard Electrostatic Discharge Tests for Protective Relays	X		X		X	X	X	X		
EN 50121-4	Electromagnetic Compatibility – Part 4: Emission and Immunity of the Signalling and Telecommunications Apparatus	X	X	X	X	X	X	X	X	X	X
IEC 62236-4	Electromagnetic Compatibility – Part 4: Emission and Immunity of the Signalling and Telecommunications Apparatus	X	X	X	X	X	X	X	X	X	X
IEC 61000-6-2	Generic standards – Immunity for industrial environments	X	X	X	X	X	X	X	X	X	X
IEC 61000-6-4	Generic standards – Emissions standard for industrial environments	X	X	X	X	X	X	X	X	X	X
IEC 61000-6-5	Generic standards – Immunity for equipment used in power station and substation environment	X		X		X	X	X	X		
IEC 61850-3	Communication networks and systems for power utility automation - Part 3: General requirements	X		X		X	X[8]	X	X		
IEC/AS 60870.2.1	Telecontrol equipment and systems. Operating conditions. Power supply and electromagnetic compatibility	X		X		X	X	X	X		
IEC 61000-4-2	Electrostatic discharge immunity test	X	X	X	X	X	X	X	X	X	X
IEC 61000-4-3	Radiated electromagnetic field immunity test	X	X	X	X	X	X	X	X	X	X
IEC 61000-4-4	Electrical fast transient/burst immunity test	X	X	X	X	X	X	X	X	X	X

Table 9. EMC industrial, regulatory and customer standards compliance

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
IEC 61000-4-5	Surge immunity test	X	X	X	X	X	X	X	X	X	X
IEC 61000-4-6	Immunity to conducted disturbances	X	X	X	X	X	X	X	X	X	X
IEC 61000-4-8	Power frequency magnetic field immunity test	X		X		X	X	X	X		
IEC 61000-4-9	Pulse Magnetic field immunity test	X		X		X	X	X	X		
IEC 61000-4-10	Damped Oscillatory Magnetic Field	X		X		X	X	X	X		
IEC 61000-4-11	Voltage dips, short interruptions and voltage variations immunity tests	X	X[9]	X[9]	X[9]	X[9]	X[9]	X	X[9]	X	X
IEC 61000-4-12	Oscillatory wave immunity test	X		X		X	X	X	X		
IEC 61000-4-16	Conducted immunity 0 Hz - 150 kHz	X		X		X	X	X	X		
IEC 61000-4-17	Ripple on d.c. input power port immunity test	X		X		X	X	X	X		
IEC 61000-4-18	Damped oscillatory wave immunity test	X		X		X	X	X	X		
IEC 61000-4-29	Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests	X		X		X	X	X	X		
IEC 61000-3-2	Limits for harmonic current emissions (equipment input current <16A per phase)	X	X[9]	X[9]	X[9]	X[9]	X[9]	X	X[9]	X	X
IEC 61000-3-3	Limits for voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <16A	X	X[9]	X[9]	X[9]	X[9]	X[9]	X	X[9]	X	X
ITU-T K.20 (DC Ports)	Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents	X	X	X	X	X	X	X	X		
ETSI 300 132-2	Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (dc)	X	X	X	X	X	X	X	X	X	
ETSI 300-132-3	Power supply interface at the input to telecommunications equipment; Part 3: Operated by rectified current source, alternating current source or direct current source up to 400V	X	X[9]	X[9]	X[9]			X	X[9]	X	X
EN 300 386	Telecommunication network equipment; ElectroMagnetic Compatibility (EMC)	X	X	X	X	X	X	X	X	X	X
ES 201 468	Electromagnetic compatibility and Radio spectrum matters (ERM); Additional ElectroMagnetic Compatibility (EMC) requirements and resistibility requirements for telecommunications equipment for enhanced availability of service in specific applications	X		X	X	X	X				X
EN 55024	Information technology equipment - Immunity characteristics - Limits and methods of measurements	X	X	X	X	X	X	X	X	X	X

Table 9. EMC industrial, regulatory and customer standards compliance

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
Telcordia GR-1089-CORE	EMC and Electrical Safety – Generic Criteria for Network Telecommunications Equipment	X	X	X	X	X	X	X	X	X	X
AS/NZS CISPR 22	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[11]	X[11]
FCC Part 15, Subpart B	Radio Frequency devices- Unintentional Radiators (Radiated & Conducted Emissions)	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[11]	X[11]
ICES-003	Information Technology Equipment (ITE) — Limits and methods of measurement	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[11]	X[11]
EN 55022	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[11]	X[11]
EN 55032	Electromagnetic compatibility of multimedia equipment - Emission requirements	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[11]	X[11]
CISPR 22	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[11]	X[11]
CISPR 32	Electromagnetic compatibility of multimedia equipment - Emission requirements	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[10]	X[11]	X[11]
GS7 EMC	Electromagnetic Standard Compatibility (BT standard)	X		X	X	X	X	X			X
KC Notice Emission (KN22) and Immunity (KN24) (South Korea)	EMS standard: NRRA notice	X	X		X	X	X	X	X		
KC Notice Emission (KN32) and Immunity (KN35) (South Korea)	EMS standard: NRRA notice			X							

1 Performance Class 1
2 Performance Class 1 (Class 2 with optics interfaces only)
3 Performance Class 2
4 Zone A; Performance Class 1
5 Zone A; Performance Class 1 (Class 2 with optics interfaces only)
6 Zone B; Performance Class 1
7 Zone A; Performance Class 2
8 With the exception of DC surges
9 With external AC/DC power supply
10 Class A
11 Class B

Table 10. Environmental standards compliance

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
IEEE 1613:2009 + A1:2011	Environmental and Testing Requirements for Communications Networking Devices	X[1]		X[1]		X[1]	X[1]	X	X		
IEC 61850-3	Communication networks and systems for power utility automation - Part 3: General requirements	X[2]		X[2]		X[2]	X[2]	X[2]	X[2]		
IEC 60068-2-1	Environmental testing – Part 2-1: Tests – Test A: Cold	X	X	X	X	X	X	X	X	X	X
IEC 60068-2-2	Environmental testing – Part 2-2: Tests - Test B: Dry heat	X	X	X	X	X	X	X	X	X	X
IEC 60068-2-30	Environmental testing – Part 2: Tests. Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)	X	X	X	X	X	X	X	X	X	X
IEC 60255-21-2	Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section Two: Shock and bump tests	X		X		X	X	X	X		
ETSI 300 753 Class 3.2	Acoustic noise emitted by telecommunications equipment	X	X	X	X	X	X	X	X	X	X
Telcordia GR-63-CORE	NEBS Requirements: Physical Protection	X	X	X	X	X	X	X	X	X	X
ETSI EN 300 019-2-1 v2.1.2, Class 1.2	Specification of environmental tests; Storage	X	X	X	X	X	X	X	X	X	X
ETSI EN 300 019-2-2 V2.1.2, class 2.3	Specification of environmental tests; Transportation	X	X	X	X	X	X	X	X	X	X
ETSI EN 300 019-2-3 V2.2.2, class 3.2	Specification of environmental tests; Stationary use at weather protected locations	X	X	X	X	X	X	X	X		
ETSI EN 300 019-2-4 v2.2.2 class T4.1	Specification of environmental tests; Stationary use at non-weather protected locations									X	X
Telcordia GR-3108-CORE	Generic Requirements for Network Equipment in the Outside Plant (OSP)	X[3]	X[3]	X[3]	X[3]	X[3]		X[3]	X[3]	X[4]	X[4]
Telcordia GR-950-CORE	Generic Requirements for ONU Closures and ONU Systems									X	X
GR-3108 Class 3 Section 6.2 IEC 60068-2-52 - Severity 3 MIL-STD-810G Method 509.5 EN 60721-3-3 Class 3C4 EN 60068-2-11: Salt Mist EN50155 Class ST4.	Conformal coating[5]	X			X	X		X	X		

1   Forced air system, uses fans
2   Normal environmental conditions as per IEC61850-3 ed.2
3   Class 2
4   Class 4
5   Conformal coating is available as an orderable option.

Table 11. Safety standards compliance

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
UL/CSA 60950-1	Information technology equipment - Safety - Part 1: General requirements	X	X	X	X	X	X	X	X	X	X
IEC/EN 60950-1	Information technology equipment - Safety - Part 1: General requirements	X	X	X	X	X	X	X	X	X	X
UL/CSA 62368-1	Audio/video, information and communication technology equipment - Part 1: Safety requirements			X							
IEC/EN 62368-1	Audio/video, information and communication technology equipment - Part 1: Safety requirements			X							
AS/NZS 60950-1	Information technology equipment - Safety - Part 1: General requirements	X	X	X	X	X	X	X	X	X	X
IEC/EN 60825-1 and 2	Safety of laser products - Part 1: Equipment classification and requirements Part 2: Safety of optical fibre communication systems (OFCS)	X	X	X	X	X	X	X	X	X	X
FDA CDRH 21-CFR 1040	PART 1040 Performance Standards for Light-Emitting Products	X	X	X	X	X	X	X	X	X	X
UL/CSA 60950-22	Information Technology Equipment - Safety - Part 22: Equipment to be Installed Outdoors									X	X
CSA–C22.2 No.94	Special Purpose Enclosures									X	X
UL50	Enclosures for Electrical Equipment, Non-Environmental Considerations									X	X
IEC/EN 60950-22	Information technology equipment. Safety Equipment installed outdoors									X	X
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)	X IP20	X IP40	X IP40	X IP20	X IP20	X IP20	X IP40	X IP40	X IP65	X IP65

Table 12. Telecom interface compliance

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
IC CS-03 Issue 9	Compliance Specification for Terminal Equipment, Terminal Systems, Network Protection Devices, Connection Arrangements and Hearing Aids Compatibility	X	X		X	X	X	X			
IACTA TIA-968-B	Telecommunications - Telephone Terminal Equipment - Technical Requirements for Connection of Terminal Equipment to the Telephone Network	X	X		X	X	X	X			
AS/ACIF S016 (Australia)	Requirements for Customer Equipment for connection to hierarchical digital interfaces	X	X		X	X	X	X			
ATIS-06000403	Network and Customer Installation Interfaces-DS1 Electrical Interfaces	X	X		X	X	X	X			
ANSI/TIA/ EIA-422-B (RS-422)	Electrical Characteristics for balanced voltage digital interfaces circuits					X	X				
ITU-T G.825	The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)					X	X				
ITU-T G.703	Physical/electrical characteristics of hierarchical digital interfaces	X	X		X	X	X	X			
ITU-T G.712 (E&M)	Transmission performance characteristics of pulse code modulation channels					X	X				

Table 12. Telecom interface compliance

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
ITU-T G.957	Optical interfaces for equipments and systems relating to the synchronous digital hierarchy					X	X				
ITU-T V.24 (RS-232)	List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)					X	X	X	X		
ITU-T V.28 (V.35)	Electrical characteristics for unbalanced double-current interchange circuits					X	X				
ITU-T V.36 (V.35)	Modems for synchronous data transmission using 60-108 kHz group band circuits					X	X				
ITU-T V.11/X.27 (RS-422)	Electrical characteristics for balanced double current interchange circuits operating at data signalling rates up to 10 Mb/s					X	X				
ITU-T X.21 (RS-422)	Interface between Data Terminal Equipment and Data Circuit-terminating Equipment for synchronous operation on public data networks					X	X				
IEEE 802.3at (POE)	Data Terminal Equipment Power via the Media Dependent Interfaces Enhancements				X			X	X	X	X

Table 13. Directives, regional approvals and certifications

Standard	Title	7705 SAR-X	7705 SAR-A	7705 SAR-Ax	7705 SAR-M	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
EU Directive 2014/30/EU (EMC) (formerly 2004/108/EC)	Electromagnetic Compatibility (EMC)	X	X	X	X	X	X	X	X	X	X
EU Directive 2014/35/EU (LVD) (formerly 2006/95/EC)	Low Voltage Directive (LVD)	X	X	X	X	X	X	X	X	X	X
EU Directive 2012/19/EU WEEE	Waste Electrical and Electronic Equipment (WEEE)	X	X	X	X	X	X	X	X	X	X
EU Directive 2011/65/EU RoHS2	Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (Recast)	X	X	X	X	X	X	X	X	X	X
CE Mark		X	X	X	X	X	X	X	X	X	X
CRoHS Logo; Ministry of Information Industry order No.39		X	X	X	X	X	X	X	X	X	X
China (MII NAL) Network Access License			X		X	X	X	X		X	
South Korea (KC Mark)		X	X	X	X	X	X	X	X		
Australia (RCM Mark)		X	X	X	X	X	X	X	X	X	X
Japan (VCCI Mark)		X	X	X	X	X	X	X			
NEBS Level 3		X	X	X	X	X	X	X	X	X	X
TL9000 certified		X	X	X	X	X	X	X	X	X	X
ISO 14001 certified		X	X	X	X	X	X	X	X	X	X
ISO 9001:2008 certified		X	X	X	X	X	X	X	X	X	X

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