

ALCATEL-LUCENT 7705 SERVICE AGGREGATION ROUTER RELEASE 6.1

The Alcatel-Lucent 7705 Service Aggregation Router (SAR) portfolio delivers industry-leading IP/MPLS and pseudowire capabilities in compact platforms that can reliably and securely aggregate multiple media, service and transport protocols on an economical packet transport infrastructure.



7705 SAR-18



7705 SAR-8



7705 SAR-H



7705 SAR-M



7705 SAR-A



7705 SAR-F



7705 SAR-W



7705 SAR-Wx



7705 SAR-Hc

The Alcatel-Lucent 7705 SAR portfolio is optimized for multiservice adaptation, aggregation and routing, especially on a modern Ethernet and IP/MPLS infrastructure. Leveraging the powerful Alcatel-Lucent Service Router Operating System (SR OS) and the 5620 Service Aware Manager (SAM), the 7705 SAR is available in compact, low-power-consumption indoor and outdoor platforms that deliver highly available services over resilient and flexible network topologies.

The Alcatel-Lucent 7705 SAR is well suited to the aggregation and backhaul of mobile traffic, including 2G, 3G, Long Term Evolution (LTE), LTE Advanced, Land Mobile Radio (LMR) and Private Mobile Radio (PMR). This provides cost-effective scaling and supports the transformation to IP/MPLS networking. Business services modernization is supported in the transition from legacy to consolidated, packet-based operation. Significant reductions in equipment footprint are achievable, along with reduced energy costs. Power utilities, public safety agencies and transportation operators, and government organizations can deploy the Alcatel-Lucent 7705 SAR for reliable and secure support of legacy and modern IP and Ethernet-based services.

FEATURES

Service aggregation and networking

The Alcatel-Lucent 7705 SAR can employ pseudowire encapsulation methods to map services end to end. This helps ensure that the key attributes of each service are maintained, while using a cost-effective packet environment to aggregate services. IP routing and forwarding and Virtual Private LAN Service (VPLS) are also supported.

The Alcatel-Lucent 7705 SAR portfolio provides support for Asynchronous Transfer Mode (ATM), inverse multiplexing over ATM (IMA), MC MLPPP, Ethernet, Frame Relay, HDLC and TDM traffic. Support for IP VPNs allows the separation of Layer 3 traffic among different groups of users or organizations. Analog voice encoding and transport are available on the Alcatel-Lucent 7705 SAR-8 and the 7705 SAR-18. Voiceband analog traffic can be carried over IP/MPLS network infrastructure between two analog devices that are using traditional T1/E1 network interfaces or over Ethernet or MLPPP interfaces.



Highly flexible network infrastructure options

For maximum deployment flexibility, the Alcatel-Lucent 7705 SAR portfolio supports a broad range of integrated media including fiber, copper and microwave. Tunneling options include the use of MPLS, IP or Generic Routing Encapsulation (GRE) for aggregated traffic. Efficient LDP-based dynamic signaling, static provisioning of MPLS tunnels, and pseudowires are also supported. GRE and IP tunneling allow low-cost, ubiquitous IP networks to be used for backhauling; for example, for the transport of High Speed Packet Access (HSPA) off-loaded traffic using DSL access media. The Alcatel-Lucent 7705 SAR can be configured as either a Label Edge Router (LER) or a Label Switched Router (LSR). The 7705 SAR includes a strong suite of traffic-engineering and resiliency capabilities, using functions such as Constraint-based Shortest Path First (CSPF) routing, Fast Reroute (FRR), primary and secondary LSPs, and redundant pseudowires.

Quality of service (QoS) and traffic management

Traffic flows with different QoS requirements are identified at the access and marked in-line with the appropriate QoS metrics. Traffic classification and marking are based on a wide range of categories at Layer 1, Layer 2, Layer 2.5 and Layer 3. To ensure fairness, the Alcatel-Lucent 7705 SAR's traffic management policies use detailed classification and hierarchical scheduling mechanisms including: minimum/maximum, queue type-based weighted round robin, and strict priority and profiled scheduling, as well as multi-tier policing to differentiate and prioritize individual services and flows. Bursty ingress flows can be selectively shaped as needed to improve application throughput and optimize resource usage.

Operations, administration and maintenance (OAM)

To promote rapid deployment and high service availability, the Alcatel-Lucent 7705 SAR portfolio has a full set of OAM features including:

- LSP ping
- LSP traceroute
- Service distribution path (SDP) ping
- Virtual circuit connectivity verification (VCCV)

- Ethernet OAM functions, such as:
 - 802.3ah: Ethernet in the First Mile
 - 802.1ag: Connectivity Fault Management
 - Y.1731: Ethernet OAM mechanisms for fault and performance management
- IP OAM functions using Two-Way Active Measurement Protocol (TWAMP)

These features, when used in conjunction with the Alcatel-Lucent 5620 Service Aware Manager (SAM) portfolio, ensure rapid fault detection, as well as efficient troubleshooting. In particular, SLAs can be proactively monitored by the Service Aware Agent (SAA). For example, high-accuracy, one-way delay measurements can be used to closely assess ongoing network latency. This powerful SAA capability allows the specification of test suites, policies and schedules. The tests are then auto-created, and the test results are automatically compared to predefined SLA metrics. Any problems detected are automatically reported through the SAA to operations staff. An auto-discovery protocol (ADP) can provide rapid automated commissioning of remote devices.

Synchronization

The Alcatel-Lucent 7705 SAR portfolio supports external reference timing, line timing, adaptive clock recovery (ACR) and differential clock recovery (DCR) timing, synchronous Ethernet, and timing distribution using 1588v2. The 1588v2 Master Clock and Boundary Clock functions are also supported. In addition, the 7705 SAR-M, 7705 SAR-W, 7705 SAR-Wx, 7705 SAR-H, 7705 SAR-Hc and 7705 SAR-A support Transparent Clock and Time of Day capabilities. The 7705 SAR-H also supports synchronization output according to IRIG-B (B000/B127). The 7705 SAR-H and certain 7705 SAR-Wx variants include integrated Global Positioning System (GPS) receiver capability. This can allow 1588v2 grandmasters to be enabled for frequency, phase and time distribution.

Timing accuracy and high performance over packet solutions are enabled with a combination of built-in architectural features, Bell Labs' algorithms and powerful QoS mechanisms, which minimize the delay and delay variation experienced by synchronization traffic. A built-in Stratum-3 clock is provided to assist with synchronization maintenance if a primary source is unavailable.

Security

The Alcatel-Lucent 7705 SAR portfolio incorporates security features to maintain network integrity in the face of cyber-attacks. Access control lists, filters and authentication of signaling messages provide mechanisms to protect management, control and data planes, helping to prevent session hijacking, spoofing, denial of service attacks and other malicious behaviors. Strong access security is provided by Simple Network Management Protocol (SNMP) v3 confidentiality, integrity features and Secure Shell (SSH) and IPsec encryption. Network address translation (NAT) capabilities allow private networking schemes to be carried across a public infrastructure. IPsec on the Gigabit Ethernet adapter cards provides the ability to establish highly secure traffic streams. IPsec and NAT functionality provide the flexibility to backhaul traffic over the public internet for example. Dynamic Host Configuration Protocol (DHCP) server can be used to facilitate the automatic configuration of aggregated small cell sites.

These security features enable the 7705 SAR portfolio to be part of a North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) compliant network.

FEATURES AND BENEFITS

FEATURES	BENEFITS
Extension of dynamic service routing IP/MPLS capabilities to the remote site, hubs and network edge in compact form factors with low power consumption.	Modular, flexible architecture alleviates the burden of complex pre-engineering and future scenario planning. Compact, rugged form factors allow deployment in remote sites including outdoor installation.
Dense adaptation of multiple converged services onto an efficient, economical packet infrastructure with appropriate QoS treatment	Energy-efficient platforms carrying multiple traffic types reduce power and cooling costs. Powerful QoS improves the user experience.
Powerful, service-aware OAM capabilities, complemented by the Alcatel-Lucent 5620 SAM portfolio, for GUI-based network and element configuration, provisioning, and fault and performance management	Rapid fault detection and powerful commissioning and troubleshooting tools can improve operations staff's productivity and reduce network downtime, helping to reduce operations costs and improve end-user satisfaction.
Cost-effective migration from TDM-based backhaul to economical and flexible IP/MPLS-based aggregation and routing, leveraging a wide range of first-mile media	Transition from TDM-based connectivity to modern Ethernet and/or IP-based networking infrastructures can reduce recurring operating expenditures such as line lease costs.
Resiliency and redundancy, including hitless control and switch module failover (Alcatel-Lucent 7705 SAR-8 and 7705 SAR-18), synchronization redundancy, network uplink resiliency and redundancy of power feeds, plus temperature hardening (except Alcatel-Lucent 7705 SAR-18)	Advanced resiliency features can improve network uptime, enhancing customer retention and increasing revenues for critical services.
Breadth of synchronization solutions with flexible operation, redundancy and independent validation of accuracy	Accurate synchronization allows cost-effective deployment over packet infrastructure and improves the user experience (for example, less data loss and fewer dropped calls in mobile applications).

HARDWARE OVERVIEW

The Alcatel-Lucent 7705 SAR is available in a range of chassis types to suit a broad range of applications. Tables 1, 2 and 3 provide a summary of the technical specifications for each platform within the portfolio. The 7705 SAR product line supports an extensive range of adapter cards and modules, optimized to address different network and service requirements.

Select 7705 SAR products are also available with conformal coating as an orderable option to provide added protection against environmental contaminants.

Alcatel-Lucent 7705 SAR adapter cards

Each of the six adapter card slots in the 7705 SAR-8, or the twelve adapter card slots in the right side of the 7705 SAR-18, can be used to house the following adapter card types:

- 4-port OC-3/STM-1 clear channel adapter card, supporting ATM, POS and IP services with ports configurable for SONET or SDH operation
- 2-port OC-3/STM-1 channelized adapter card, supporting ATM, ATM IMA, TDM, PPP/MLPPP and IP services with ports configurable for SONET or SDH operation
- 16-port ASAP T1/E1 adapter card supporting ATM, ATM IMA, TDM, multiclass PPP/MLPPP and IP services
- 32-port ASAP T1/E1 adapter card supporting ATM, ATM IMA, TDM, multiclass PPP/MLPPP and IP services
- 8-port Ethernet adapter card supporting six ports of auto-sensing 10/100BASE-TX ports, plus two extra ports supporting 10/100/1000BASE Ethernet with SFP connectors
- 4-port DS3/E3 adapter card supporting clear channel and channelized (on DS3 only) PPP and ATM service (on DS3 only)
- 6-port E&M adapter card supporting selectable μ -Law or A-Law encoding
- 12-port Serial Data Interface (SDI) card, which can be configured for RS-232, V.35 or X.21 operation
- An auxiliary alarm card with 24 digital alarm inputs, 2 analog inputs and 8 output relays
- A range of CWDM passive optical adapter cards. Add/drop cards are available with selected wavelengths.
- 8-port Gigabit Ethernet (GigE) adapter card with SFP connectors
- Microwave power injector card
- Packet microwave card with microwave-aware Ethernet ports
- Voice and teleprotection card supporting 2 FXS and 2 FXO ports for analog voice, 2 G.703 co-directional ports and 2 C37.94 optical teleprotection ports for low-latency teleprotection
- 8-port FXO voice adapter card
- 6-port FXS voice adapter card
- 2-port 10GBASE Ethernet ring adapter card with XFP connectors
- 4-port OC3/STM1 adaptor card
- Integrated Services adapter card (Multi-Drop Data Bridging application – Mddb)

Alcatel-Lucent 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:

- 1-port 10 Gb/s /10-port 1 Gb/s card, configurable to operate in one of the following modes:
 - 10-port 1GigE SFP
 - 1-port 10GigE SFP+

Alcatel-Lucent 7705 SAR-M Modules

The expansion module slot, provided on two of the 7705 SAR-M variants, can support one of the following plug-in modules:

- Integrated GPON ONT
- DSL Combo Module (DCM) supporting four pairs of G.SHDSL, plus two pairs of ADSL2+/VDSL2 with ATM/PTM bonding
- xDSL module supporting up to eight pairs of PTM bonding over ADSL2/ADSL2+/VDSL2
- Integrated CWDM Optical Add-Drop Mux (OADM) module
- 2-port 10GBASE ring module

Alcatel-Lucent 7705 SAR-H Modules

The two expansion module slots, provided on the 7705 SAR-H, can support the following plug-in modules:

- Combination T1/E1/RS-232 module with 2 T1/E1 ports and 2 RS-232 asynchronous serial ports
- GPS receiver module

Table 1. Alcatel-Lucent 7705 SAR portfolio chassis-dependent specifications (part 1)

	7705 SAR-F	7705 SAR-M*	7705 SAR-8	7705 SAR-18
Capacity for adapter cards/modules per chassis	-	Certain 7705 SAR-M variants have one expansion module slot*	Six adapter card slots	12 (2.5 Gb/s full duplex) adapter card slots + 4 (10 Gb/s full duplex) XMDA adapter card slots
Built-in service/ network interfaces	16 x T1/E1 ASAP ports, 6 x 10/100BASE-TX auto-sensing Ethernet, 2 x 10/100/1000BASE SFP ports	*	-	-
Redundancy and resiliency	Synchronization, uplinks, MPLS tunnels, pseudowires, power feeds, cooling fans	Synchronization, uplinks, MPLS tunnels, pseudowires, power feeds, cooling fans*	Control, fabric, synchronization, uplinks, MPLS tunnels, pseudowires, power feeds, cooling fans	Control, fabric, synchronization, uplinks, MPLS tunnels, pseudowires, power feeds, cooling fans
Physical dimensions	<ul style="list-style-type: none"> Height: 1 RU 4.45 cm (1.75 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) 	<ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Two feeds: -48/-60 V DC, or two feeds: +24 V DC AC power solutions available: 100 V AC to 240 V AC , 50/60 Hz 	<ul style="list-style-type: none"> Two feeds: -48/-60 V DC, or two feeds: +24V DC AC power solutions available: 100 VAC to 240 V AC , 50/60 Hz 	<ul style="list-style-type: none"> Two feeds: -48/-60 V DC, or two feeds: +24 V DC AC power solutions available: 100 VAC to 240 V AC , 50/60 Hz 	<ul style="list-style-type: none"> Two feeds: -48/-60 V DC AC power solutions available: 100 V AC to 240 V AC , 50/60 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
Operating environment	<ul style="list-style-type: none"> Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained Normal humidity: 5% to 95%, non-condensing 	<ul style="list-style-type: none"> Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained Normal humidity: 5% to 95%, non-condensing 	<ul style="list-style-type: none"> Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained Normal humidity: 5% to 95%, non-condensing 	<ul style="list-style-type: none"> Normal operating temperature range: -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 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)

* See Table 4, "Alcatel-Lucent 7705 SAR-M chassis variants" for details on 7705 SAR-M chassis option characteristics.

** Only 7705 SAR-M variants with active cooling have fans and fan redundancy. Passively cooled 7705 SAR-M variants have no fans.

Table 2. Alcatel-Lucent 7705 SAR portfolio chassis-dependent specifications (part 2)

	7705 SAR-H	7705 SAR-Hc	7705 SAR-A***
Capacity for adapter cards/modules per chassis	Two expansion module slots capable of housing 7705 SAR-H specific modules	-	-
Built-in service/ network interfaces	<ul style="list-style-type: none"> • 4 x 10/100/1000BASE-TX ports (PoE/PoE+ capable) • 2 x 100/1000BASE SFP ports • 2 x combo 100/1000 Ethernet ports (SFP/RJ45) 	<ul style="list-style-type: none"> • Two 10/100/1000BASE-TX Ethernet ports (PoE/PoE+ capable) • Two 10/100/1000BASE-TX Ethernet ports • Two 100/1000BASE ports (SFP) • Two RS-232 (async) ports 	***
Redundancy and resiliency	Synchronization, uplinks, MPLS tunnels, pseudowires	Synchronization, uplinks, MPLS tunnels, pseudowires	Synchronization, uplinks, MPLS tunnels, pseudowires
Physical dimensions	<ul style="list-style-type: none"> • 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 mount 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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)
Power	<ul style="list-style-type: none"> • Low voltage DC variant: two feeds: +24/-48 V DC • High voltage AC/DC variant: <ul style="list-style-type: none"> - Rated voltages: 110-250VDC, 100 to 240VAC, 50/60 Hz 	<ul style="list-style-type: none"> • +/-20VDC to 75 VDC • HV power solution available: 100 V AC to 240 V AC, 50/60 Hz; 88 to 300VDC 	<ul style="list-style-type: none"> • Two feeds: -48/-60 V DC • AC power solutions available: 100 to 240 V AC, 50/60 Hz
Cooling	Passively cooled	Passively cooled	Passively cooled
Operating environment	<ul style="list-style-type: none"> • Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained • Normal humidity: 5% to 95%, non-condensing 	<ul style="list-style-type: none"> • Normal operating temperature range: -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 • Normal humidity: 5% to 95%, non-condensing 	<ul style="list-style-type: none"> • Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained • Normal humidity: 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)

*** See Table 5, "Alcatel-Lucent 7705 SAR-A chassis variants" for details on 7705 SAR-A option characteristics

Table 3. Alcatel-Lucent 7705 SAR portfolio chassis-dependent specifications (part 3)

	7705 SAR-W	7705-SAR-WX****
Capacity for adapter cards/modules per chassis	-	-
Built-in service/ network interfaces	5 x Gigabit Ethernet ports: 3 are SFP and 2 are RJ45 combo ports. A GPON ONT SFP is available. The RJ45 ports optionally support power over Ethernet plus (PoE+)	****
Redundancy and resiliency	Synchronization, uplinks, MPLS tunnels, pseudowires	Synchronization, uplinks, MPLS tunnels, pseudowires
Physical dimensions	<ul style="list-style-type: none"> • Height: 6.6 cm (2.6 in.) • Depth: 25.4 cm (10 in.) • Width: 38.1 cm (15 in.) 	<ul style="list-style-type: none"> • Height: 9.7 cm (3.8 in.) • Depth: 16.5 cm (6.5 in.) • Width: 35.6 cm (14 in.)

Table 3. Alcatel-Lucent 7705 SAR portfolio chassis-dependent specifications (part 3) (continued)

	7705 SAR-W	7705-SAR-WX****
Power	<ul style="list-style-type: none"> Power IN <ul style="list-style-type: none"> Universal power (AC, AC with DC backup or DC) AC: 100 - 240 V AC, 50/60 Hz with 1s hold-up DC: +24/-48/-60 V DC with 1s hold-up Power OUT <ul style="list-style-type: none"> PoE+ with 1s hold-up on all RJ45 Ethernet ports 	****
Cooling	Passively cooled	Passively cooled
Operating environment	<ul style="list-style-type: none"> Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained Normal humidity: 2% to 100%, condensing Element-proof enclosure/connectivity 	<ul style="list-style-type: none"> Normal operating temperature range: -40°C to +55°C (-40°F to +131°F) sustained Normal humidity: 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)

**** See Table 6, "Alcatel-Lucent 7705 SAR-Wx chassis variants" for details on 7705 SAR-Wx option characteristics

There are four variants of the 7705 SAR-M. Each column in table 3 denotes the supported capabilities for one of these configurations.

Table 4. Alcatel-Lucent 7705 SAR-M chassis variants

ETHERNET PORTS BUILT-IN	7: 4 X 10/100/1000BASE WITH SFP 3 X 10/100/1000BASE-TX)	7: 4 X 10/100/1000BASE WITH SFP 3 X 10/100/1000BASE-TX)	7: 4 X 10/100/1000BASE WITH SFP 3 X 10/100/1000BASE-TX)	7: 4 X 10/100/1000BASE WITH SFP 3 X 10/100/1000BASE-TX)
T1/E1 ports built-in	16	0	16	0
Module slot support	Yes	Yes	No	No
Cooling	Active	Active	Passive	Passive

There are two variants of the 7705 SAR-A. Each column in table 5 denotes the supported capabilities for one of these configurations.

Table 5. Alcatel-Lucent 7705 SAR-A chassis variants

ETHERNET PORTS BUILT-IN	12: 4 X 10/100/1000 COMBO (RJ-45 OR SFP) 4 X 10/100/1000BASE SFP 4 X 10/100BASE-TX	12: 4 X 10/100/1000 COMBO (RJ-45 OR SFP) 4 X 10/100/1000BASE SFP 4 X 10/100BASE-TX
T1/E1 ports built-in	8	0
Module slot support	No	No
Cooling	Passive	Passive

There are six variants of the 7705 SAR-Wx. Each column in table 6 denotes the supported capabilities for one of these configurations.

Table 6. Alcatel-Lucent 7705 SAR-Wx chassis variants

ETHERNET PORTS BUILT-IN	3 X SFP, 2 X RJ45	3 X SFP, 2 X RJ45	3 X SFP, 1 X RJ45	3 X SFP, 1 X RJ45	3 X SFP, 2 X RJ45	3 X SFP, 2 X RJ45
DSL ports built-in	-	-	4 with bonding	4 with bonding	-	-
GPS support	No	Yes	No	Yes	No	Yes
Power	Power IN AC: 100 - 240 V AC, 50/60 Hz	Power IN AC: 100 - 240 V AC, 50/60 Hz	Power IN AC: 100 - 240 V AC, 50/60 Hz	Power IN AC: 100 - 240 V AC, 50/60 Hz	Power IN AC: 100 - 240 V AC, 50/60 Hz	Power IN AC: 100 - 240 V AC, 50/60 Hz Power OUT PoE+ on one RJ45 Ethernet port

A GPON ONT SFP is also available

Table 7. EMC Standards Compliance

EMC INDUSTRIAL STANDARDS COMPLIANCE											
STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	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 Performance Class 1 (Class 2 w/ Optics Interfaces only)		X Performance Class 2	X Performance Class 2		
IEEE Std C37.90	IEEE Standard for relays and relay systems associated with Electric Power Apparatus					X		X	X		
IEEE Std C37.90.1	Surge Withstand Capability (SWC) Tests					X		X	X		
IEEE Std C37.90.2	Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers					X		X	X		
IEEE Std C37.90.3	IEEE Standard Electrostatic Discharge Tests for Protective Relays					X		X	X		
EN 50121-4:2006	Electromagnetic Compatibility – Part 4: Emission and Immunity of the Signalling and Telecommunications Apparatus		X	X	X	X		X	X	X	X
IEC 62236-4:2008	Electromagnetic Compatibility – Part 4: Emission and Immunity of the Signalling and Telecommunications Apparatus		X	X	X	X		X	X	X	X
IEC 61000-6-2:2005	Generic standards – Immunity for industrial environments		X	X	X	X		X	X	X	X
IEC 61000-6-4:2006	Generic standards – Emissions standard for industrial environments		X	X	X	X		X	X	X	X
IEC TS 61000-6-5	Immunity for power station and substation environments					X		X	X		
IEC 61850-3	Communication networks and systems in substations - Part 3: General requirements					X		X	X		
IEC/AS 60870.2.1	Telecontrol equipment and systems. Operating conditions. Power supply and electromagnetic compatibility					X		X	X		

Table 8. EMC Standards Compliance (continued)

EMC REGULATORY AND CUSTOMER STANDARDS COMPLIANCE											
STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
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
IEC61000-4-4	Electrical fast transient/ burst immunity test	X	X	X	X	X	X	X	X	X	X
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
IEC61000-4-8	Power frequency magnetic field immunity test					X		X	X		
IEC61000-4-9	Pulse Magnetic field immunity test					X		X	X		
IEC 61000-4-10	Damped Oscillatory Magnetic Field					X		X	X		
IEC 61000-4-11	Voltage dips, short interruptions and voltage variations immunity tests	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X	X w/ external AC/DC PS	X	X
IEC 61000-4-12	Oscillatory wave immunity test					X		X	X		
IEC 61000-4-16	Conducted immunity 0 Hz - 150 kHz					X		X	X		
IEC61000-4-17	Ripple on d.c. input power port immunity test					X		X	X		
IEC 61000-4-18	Damped oscillatory wave immunity test					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		
IEC 61000-3-2	Limits for harmonic current emissions (equipment input current <16A per phase)	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X	X w/ external AC/DC PS	X	X
IEC 61000-3-3	Limits for voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <16A	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X w/ external AC/DC PS	X	X w/ external AC/DC PS	X	X

EMC REGULATORY AND CUSTOMER STANDARDS COMPLIANCE

STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
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		
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	
EN300 386	Telecommunication network equipment; ElectroMagnetic Compatibility (EMC)	X	X	X	X	X	X	X	X	X	X
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 Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class B	X Class B
FCC Part 15, Subpart B	Radio Frequency devices- Unintentional Radiators (Radiated & Conducted Emissions)	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class B	X Class B
ICES-003	Information Technology Equipment (ITE) – Limits and methods of measurement	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class B	X Class B
EN 55022	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class B	X Class B
CISPR 22	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class A	X Class B	X Class B
KC Notice Emission (KN22) and Immunity (KN24) (South Korea)	EMS standard: NRRA notice		X	X	X	X	X	X	X		

Table 9. Environmental Regulations Compliance

ENVIRONMENTAL STANDARDS COMPLIANCE											
STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	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 (note 1)		X	X		
IEC 61850-3	Communication networks and systems in substations – Part 3: General requirements					X (note 2)		X (note 2)	X (note 2)		
IEC60068-2-1	Environmental testing – Part 2-1: Tests – Test A: Cold	X	X	X	X	X	X	X	X	X	X
IEC60068-2-2	Environmental testing – Part 2-2: Tests – Test B: Dry heat	X	X	X	X	X	X	X	X	X	X
IEC60068-2-30	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
IEC60255-21-2	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		
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 weatherprotected 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-weatherprotected locations									X	X
Telcordia GR-950-CORE	Generic Requirements for Optical Network Unit (ONU) Closures and ONU									X	X

ENVIRONMENTAL STANDARDS COMPLIANCE											
STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-WX
Telcordia GR-3108-CORE	Generic Requirements for Network Equipment in the Outside Plant (OSP)	X Class 2	X Class 2	X Class 2	X Class 2	X Class 2		X Class 2	X Class 2	X Class 4	X Class 4
"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 (Note 3)			X		X		X	X		

Note 1: Forced air system, uses fans
Note 2: Aerosols (Oils in air and Sea-Salt Mist) exempted
Note 3: Conformal coating is available as an orderable option.

Table 10. Safety Standards Compliance

SAFETY STANDARDS COMPLIANCE											
STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	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
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

SAFETY STANDARDS COMPLIANCE

STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-Wx
IEC/EN 60950-22	Information technology equipment. SafetyEquipment installed outdoors									X	X
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)	X	X	X	X	X	X	X	X	X	X

Table 11. Telecom Regulations Compliance

TELECOM INTERFACE COMPLIANCE

STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	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	X			
ACTA TIA-968-B	Telecommunications - Telephone Terminal Equipment - Technical Requirements for Connection of Terminal Equipment to the Telephone Network	X	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	X			
ATIS-06000403	Network and Customer Installation Interfaces- DS1 Electrical Interfaces	X	X	X	X	X	X	X			
ANSI/TIA/EIA-422-B (RS422)	Electrical Characteristics for balanced voltage digital interfaces circuits					X	X				
ITU-T G.813	Timing characteristics of SDH equipment slave clock (SEC)	X	X	X	X	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	X			

TELECOM INTERFACE COMPLIANCE

STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-WX
ITU-T G.712 (E&M)	Transmission performance characteristics of pulse code modulation channels					X	X				
ITU-T G.957	Optical interfaces for equipments and systems relating to the synchronous digital hierarchy					X	X				
ITU-T V.24 (RS232)	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 (V35)	Electrical characteristics for unbalanced double-current interchange circuits					X	X				
ITU-T V.36 (V35)	Modems for synchronous data transmission using 60-108 kHz group band circuits					X	X				
ITU-T V.11 / X.27 (RS422)	Electrical characteristics for balanced double current interchange circuits operating at data signalling rates up to 10 Mbit/s					X	X				
ITU-T X.21 (RS422)	Interface between Data Terminal Equipment and Data Circuit-terminating Equipment for synchronous operation on public data networks					X	X				
ITU-T 8262 (Synch E)	Timing characteristics of synchronous Ethernet equipment slave clock (EEC)		X	X	X	X	X	X	X	X	X
IEEE 802.3ab (Ethernet)	Physical Layer Parameters and Specifications for 1000 Mb/s Operation Over 4-Pair of Category 5 Balanced Copper Cabling, Type 1000BASE-T	X	X	X	X	X	X	X	X	X	X
IEEE 802.3at (POE)	Data Terminal Equipment Power via the Media Dependent Interfaces Enhancements							X	X	X	X

Table 12. Directives, Regional Approvals and Certifications Compliance

DIRECTIVES, REGIONAL APPROVALS AND CERTIFICATIONS COMPLIANCE											
STANDARD	TITLE	7705 SAR-F	7705 SAR-A	7705 SAR-M	7705 SAR-M FANLESS	7705 SAR-8	7705 SAR-18	7705 SAR-H	7705 SAR-Hc	7705 SAR-W	7705 SAR-WX
EU Directive 1999/5/EC R&TTE	Radio and Telecommunication Terminal Equipment (R&TTE) OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL	X	X	X	X	X	X	X	X	X	X
EU Directive 2004/108/EC EMC	Electromagnetic Compatibility (EMC)	X	X	X	X	X	X	X	X	X	X
EU Directive 2006/95/EC LVD	Low Voltage Directive (LVD)	X	X	X	X	X	X	X	X	X	X
EU Directive 2002/96/EC WEEE	Waste Electrical and Electronic Equipment (WEEE)	X	X	X	X	X	X	X	X	X	X
EU Directive 2002/95/EC RoHS	Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)	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 (RoHS2)	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	
South Korea (KC Mark)			X	X	X	X	X	X	X		
Australia (RCM Mark)		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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