Nokia 7705 Service Aggregation Router–Hm series

The Nokia 7705 Service Aggregation Router–Hm (SAR-Hm) series extends IP/MPLS services over cellular and WLAN networks. Routers in the series are ideal for mission-critical and IoT applications in energy, public safety, mining, transportation, and government market segments.

The Nokia 7705 SAR-Hm series includes feature-rich IP/MPLS service routers in a ruggedized and compact platform. With these routers, operators are able to support IP VPN, VPLS, and VPWS services over wireless networks, enabling an end-to-end, seamless, IP/MPLS service offering between wireless and wired devices. This enables critical infrastructure operators to fully realize the promise of smart grids, smart cities, and public safety mobile broadband to enhance safety, efficiency and responsiveness. The 7705 SAR-Hm series can be used in fixed or mobile locations for a variety of applications, such as supervisory control and data acquisition (SCADA), security monitoring, workforce voice and data connectivity in offices or vehicles, mass transit, fleet management, and vehicle remote control and monitoring.

Using the Nokia Service Router Operating System (SR OS) software base, the 7705 SAR-Hm series offers the same IP/MPLS feature richness, reliability, manageability, flexibility and extensive quality of service (QoS) capabilities that are common across the service router portfolio. The 7705 SAR product line is widely used globally with a proven track record of overcoming diverse challenges in a variety of mission-critical networks. It is managed by the Nokia Network Services Platform (NSP) for seamless deployment and end-to-end management across a resilient IP/MPLS network from wireless access to core.

7705 SAR-Hm

7705 SAR-Hmc

Cellular

Routers in the 7705 SAR-Hm series have a cellular interface to connect to Long Term Evolution (LTE) and 3G networks. They support the most commonly used cellular frequency bands and are able to connect to most mobile network operators worldwide. The routers also support AT&T's WCS C/D bands to allow specific private LTE applications in the United States. The cellular interface supports 2x2 multi-in multi-out (MIMO) to provide better signal performance and higher data rates.

The routers in the SAR-Hm series support dual SIM applications. They can be equipped with two industrial 2FF mini-SIM cards to provide a primary and backup cellular connection to different service providers for better resiliency.

WLAN

The 7705 SAR-Hm model supports IEEE 802.11 b/g/n WLANs with the flexibility to act as both an access point (AP) and client concurrently[1]. When operating as an AP, the 7705 SAR-Hm provides WLAN connections between wireless and wired networks. Alternatively, it can be used as the center point of a stand-alone wireless network. With the 7705 SAR-Hm operating as an AP, client, or both, IP/MPLS services and routing can be delivered over a variety of WLAN topologies to increase connectivity and reach in mission-critical applications.

Built for harsh environmental conditions

With temperature, electromagnetic shock, and vibration hardening, the 7705 SAR-Hm series is ideally suited for use in remote environments, particularly smart grid distribution automation and field area networks or vehicle-mounted applications such as public safety, mining, or rolling stock. Fanless operation makes the 7705 SAR-Hm series more tolerant to dust and corrosive environments. The 7705 SAR-Hm series is compliant with IEEE 1613-Class 2 and IEC 61850-3 standards for power utility applications, and EN 50155 and IEC 61373 for rail applications. It is certified for hazardous locations (HazLoc) including Class 1, Division 2 and ATEX Zone 2.

Cyber security protection

The 7705 SAR-Hm series provides a robust set of security features to maintain network integrity in the face of threatening cyberattacks. Its encryption features, including Network Group Encryption (NGE) and IP Security (IPsec), that use advanced encryption and authentication algorithms, seamlessly protect confidentiality, integrity, and authenticity of communications from the IP/MPLS core to the wireless access locations without compromising performance. The 7705 SAR-Hm series supports a comprehensive set of security features for nodal protection, including management access controls, CPU protection, and login controls. Many types of access control lists are available for added security of services traffic over wireless networks.

Software features

The 7705 SAR-Hm series supports, but is not limited to, the following features:

Services

- Generic Routing Encapsulation (GRE) service distribution points over cellular supporting MPLS services
- Layer 2 virtual private network (VPN) services – virtual leased line (VLL), BGP Virtual Private Wire Service (BGP-VPWS) and virtual private LAN service (both VPLS, and BGP-VPLS)
- IPv4 VPN services, and IPv6 Provider Edge (6VPE) using MP-BGP based MPLS VPRNs
- Internet Enhanced Service (IES)
- Raw Socket IP transport for asynchronous RS-232 serial data over MPLS services
- Network Address Translation (NAT)/Port Address Translation (PAT) for VPRN and IES services.

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1   Client functionality is a future software deliverable.

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Network protocols

- MPLS Label Edge Router (LER)
- Open Shortest Path First (OSPFv2 and OSPFv3)
- Constraint-based Shortest Path First (CSPF)
- Routing Information Protocol (RIP)
- Border Gateway Protocol v4 (BGP) with multiprotocol extensions
- Dynamic Host Configuration Protocol (DHCP) server
- DHCP relay
- Network Time Protocol (NTP) client and server for v4 and v6
- Automatic discovery protocol (ADP) over LTE/3G for zero-touch provisioning

Quality of service and traffic management

- Deep buffering on all interfaces
- Ingress intelligent packet classification using Dot1p, DSCP v4/v6
- Ingress coloring and metering
- Egress per-port queuing of up to 8 queues
- Mapping of FC to egress per-port queues
- Per-queue priority congestion management
- LTE dedicated bearers and queues for cellular-based QoS

Operations, administration and maintenance

- Internet Control Message Protocol (ICMP) and ICMP v6
- IP/MPLS services diagnostics
- VLL and VPLS MAC diagnostics
- GPS for location tracking and monitoring

Resiliency

- Pseudowire redundancy for VLL services
- Dynamic IP protocol resiliency (OSPP, BGP)
- Dual SIM application support

Security

- User and control plane encryption and authentication algorithms AES-128, AES-256, HMA-SHA-256, HMAC-SHA-512
- Network Group Encryption (NGE) for IP/MPLS services and Layer 3 user traffic and control plane protocols
- IP Security (IPsec)
- Internet Key Exchange (IKE) v1 and v2
- Public Key Infrastructure (PKI) supporting X.509v3 certificates
- IEEE 802.1x on access ports
- IPv4 and IPv6 filters using access control lists (ACLs)
- Management access control filters
- User profile management, strict login controls and scope of command/control
- Remote Authentication Dial-In User Service (RADIUS) client
- Terminal Access Concentrator Access Control Server Plus (TACACS+)
- Simple Network Management Protocol (SNMP) v3
- Secure Shell v2 (SSHv2)
- WLAN security with WPA and WPA2

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Hardware features

Table 1. 7705 SAR-Hm series specifications

	7705 SAR-Hm	7705 SAR-Hmc

Fixed interfaces	• 6 x RJ-45 10/100 Mb/s
	• 2 x RS-232 (async)
	  (raw socket)
		• 3 x RJ-45 10/100 Mb/s
		• 2 x RS-232 (in 1 x RJ-45) (async)
		  (raw socket)

Cellular interface	• See Table 2
	• Dual SIM support
	  (2FF mini-SIM)
		• See Table 3
		• Dual SIM support
		  (2FF mini-SIM)

Wi-Fi specifications	• 802.11b/g/n • 2.4 or 5 GHz • Access and client support • Simultaneous access point/client mode	Does not have Wi-Fi
GNSS port	Global Navigation Satellite System (GNSS) receiver supporting GPS, GLONASS	Global Navigation Satellite System (GNSS) receiver supporting GPS, GLONASS
Physical dimensions and mounting	• Height: 15.2 cm (6 in) • Width: 6.7cm (2.7 in) • Depth: 14 cm (5.5 in) • DIN rail and desktop mountable • IP40; IP66/IP67 with custom enclosure	• Height: 14 cm (5.5 in) • Width: 3.9 cm (1.5 in) • Depth: 12.7 cm (5 in) • Wall/panel, shelf, and DIN rail mountable • IP40; IP66/IP67 with custom enclosure

Power	• +12/24 V DC
	• HV power solution available:
	  90 V AC to 264 V AC; 88 V DC to 300 V DC
		• +12/24/48 V DC
		• HV power solution available:
		  90 V AC to 264 V AC; 88 V DC to 300 V DC

Cooling	Fanless, passively cooled	Fanless, passively cooled
Power consumption	13-16 W typical; <19 W maximum	8 W typical; <10 W maximum
Operating temperature range	• -40°C to +65°C (-40°F to +149°F) in a still air environment • AT&T radio model (see Table 2): -30°C to +65°C (-22°F to +149°F) in a still air environment	• -40°C to +65°C (-40°F to +149°F) in a still air environment
Shipping and storage temperature	-40°C to +85°C (-40°F to +185°F)	• -40°C to +85°C (-40°F to +185°F)
Hazardous locations	• Class I, Division 2, Group A,B,C,D T4 • Ex ec IIC T4 Gc • Class I, Zone 2, AEx ec IIC, T4 Gc • -40°C ≤ Ta ≤ 65°C	• Class I, Division 2, Group A,B,C,D T4 • Ex ec IIC T4 Gc • Class I, Zone 2, AEx ec IIC, T4 Gc • -40°C ≤ Ta ≤ 65°C

Table 2. 7705 SAR-Hm cellular radio specifications

The 7705 SAR-Hm includes one of the following cellular radios:

	AT&T 2.3 GHz WCS C&D	Americas and EMEA	APAC and Rest of World
Air interface	LTE-FDD	LTE-FDD, LTE-TDD, HSPA+	LTE-FDD, LTE-TDD, HSPA+, TD-SCDMA
4G LTE bands – In MHz	**FDD Bands** 1900(B2), AWS 1700/2100(B4), 700(B12), 2300 (B125 AT&T)	**FDD Bands** 2100(B1), 1900(B2), 1800(B3), AWS 1700/2100(B4), 850(B5), 2600(B7), 900(B8), 700(B12), 700(B13), 700(B17), 800(B20), 1900(B25), 850(B26), 700(B29), 2300(B30) **TDD Bands** 2500(B41)	**FDD Bands** 2100(B1), 1800(B3), 850(B5), 2600(B7), 900(B8), 850(B18), 850(B19), 1500(B21), 700(B28) **TDD Bands** 2600(B38), 1900(B39), 2300(B40), 2500(B41)
3G UMTS(WCDMA)/ HSPA+ bands		2100(B1), 1900(B2), 1800(B3), AWS 1700/2100(B4), 850(B5), 900(B8)	2100(B1), 850(B5), 800(B6), 900(B8), 1700(B9), 850(B19)
TD-SCDMA	Not supported	Not supported	1900(B39)
LTE user equipment category	4	6	6

Table 3. 7705 SAR-Hmc cellular radio specifications

	USA and Canada	EMEA and CALA
Air interface	LTE-FDD, LTE-TDD, P-LTE	LTE-FDD, LTE-TDD
4G LTE bands – In MHz	**FDD Bands** 1900(B2), 1700(B4), 850(B5), 900(B8), 700(B12), 700(B13), 700(B14), 1900(B25), 850(B26), 1700(B66) **TDD Bands** 2500(B41), 3500(B42), 3700(B43), 3500(B48)	**FDD Bands** 1800(B3), 1700(B4), 2600(B7), 800(B20), 700(B28), 450(B31), 450(B72) **TDD Bands** 2600(B38), 3500 (B42), 3700 (B43)
LTE user equipment category	4	4
Certifications	PCS Type Certification Review Board (PTCRB) Global Certification Forum (GCF)* AT&T*, Verizon Wireless* FCC Part 96 (CBRS EUD)	GCF

*In progress

Technical specifications[2]

Safety

- UL/CSA 60950-1
- UL/CSA 62368-1
- IEC/EN 60950-1
- IEC/EN 62368-1
- AS/NZS 60950.1
- IEC 60529

Hazardous locations

- UL/CSA/IEC/EN 60079-0
- UL/CSA/IEC/EN 60079-7

Electromagnetic compatibility

- CISPR 32 (Class A)
- IC ICES-003 (Class A)
- FCC Part 15 (Class A)
- EN 55032 (Class A)
- AS/NZS CISPR 32 (Class A)
- VCCI V-3/2015 (Japan)
- KCC Notice Emission KN32 and Immunity KN35 (S. Korea)
- KN 301 489-1
- KN 301 489-7 (GSM)
- KN 301 489-17 (Wi-Fi)
- KN 301 489-52 (LTE)
- EN 301 489-1
- EN 301 489-7 (GSM)
- EN 301 489-17 (Wi-Fi)
- EN 301 489-19 (GNSS)
- EN 301 489-52 (LTE)
- IEC 61000-6-2
- IEC 61000-6-4
- IEC 61000-3-2
- IEC 61000-3-3

Environmental

- ETSI EN 300 019-2-1; Storage, Class 1.2
- ETSI EN 300 019-2-2; Transportation, Class 2.3
- ETSI EN 300 019-2-3; Operational, Class 3.2
- IEC 60255-21-1/2/3

Railway

- EN 50121-4
- IEC 62236-4
- EN 50155
- IEC/EN 61373 (Category 1; Class B)

Power utility substations

- IEEE 1613 – Class 2
- IEEE 1613.1 – Zone A; Class 2
- IEC 61850-3
- IEC/AS 60870.2.1
- IEC 61000-6-5

Radio

- RSS - GEN
- RSS-130 (Band 12 and 13)
- RSS-132 (Band 5)
- RSS-133 (Band 2)
- RSS-139 (Band 4)
- RSS-199 (Band 7)
- RSS-210 (Wi-Fi)
- RSS-102 (RF Exposure)
- FCC OET Bulletin 65 (RF Exposure)
- FCC Part 22
- FCC Part 24
- FCC Part 27 (WCS)
- FCC Part 15 Subpart C (Wi-Fi)
- EN 301 908-1 (LTE/WCDMA)
- EN 301 908-13 (LTE)

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2   System design intent is according to the listed standards.
     Refer to product documentation for detailed compliance status.

- EN 301 511 (GSM)
- EN 300 328 (2.4 GHz Wi-Fi)
- EN 301 893 (5 GHz Wi-Fi)
- EN 62311 (RF Exposure)

Directives, regional approvals and certifications

- DIRECTIVE ATEX 2014/34/EU HazLoc
- DIRECTIVE 2014/53/EU RED
- DIRECTIVE 2014/30/EU EMC
- DIRECTIVE 2014/35/EU LVD
- DIRECTIVE 2012/19/EU WEEE
- DIRECTIVE 2011/65/EU RoHS2
- China RoHS
- Australia: RCM Mark
- South Korea: KC Mark
- Japan: VCCI Mark
- Europe: CE Mark

Telecom interoperability

- IEEE 802.3 (Ethernet)
- ANSI/TIA/EIA-232-C (RS-232)
- ITU-T V.24 Feb 2000 (RS-232)
- IEEE 802.11 (Wi-Fi)

Enclosure system

The 7705 SAR-Hm series compact, outdoor enclosure provides full weather and security access protection for deployment in power substations, rail transport, mining trucks and other harsh environmental locations. The enclosure's thermally optimized design meets extended temperature and solar loading requirements. The enclosure system is IP66/IP67 tested to ensure dust and water protection, and it allows the 7705 SAR-Hm series routers to be mounted on a vertical surface, pole or wall. Security measures include a door open sensor as well as provisions for hasp-style locks. Accessory kits are available for Wi-Fi and GNSS connection.

Front

Top

Features

- IP66/IP67 rated
- Internal moisture control venting
- Extended temperature operation compliant with Telcordia GR-487 solar loading conditions based on an integrated heatsink design
- Sustains 30 g,11 ms shock, 8.9 g vibration
- Certified for hazardous locations (HazLoc)
- Compact, UV-stabilized, durable, light grey polycarbonate construction
- Accommodates a 7705 SAR-Hm-series router and an optional 35 W high-voltage power supply (HV-PS35)

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Enclosure specifications

- 3HE12311AA: two 4.3-10 female LTE ports, plus two optional N-type connectors for Wi-Fi and GPS antenna termination

- 3HE12311BA: two N-type female LTE ports, plus two optional N-type connectors for Wi-Fi and GPS antenna termination

- 3HE12555BA for 7705 SAR-Hmc: two N-type female LTE ports, plus two optional N-type connectors for Wi-Fi and GPS antenna termination

- Three ¾-in NPT conduit ports for Ethernet, serial data, power and alarm connections

- Dimensions:
    - Height: 31.5 cm (12.4 in)
    - Width: 28.4 cm (11.2 in)
    - Depth: 15.7 cm (6.2 in)

Compliance

- IEC 60529 IP66/IP67

- IEC 60255-21-1/2/3 (shock & vibration)

- EN50155/EN 61373 (railway shock & random vibration)

- Mining vehicle-operational sinusoidal vibration:
    - 8.9 g; 5 to 200 Hz
    - 1"p-p displacement
    - 2.5 hours per axis