Nokia 7705 Service Aggregation Router-Hmc

Certified and approved for use on FirstNet, the Nokia 7705 Service Aggregation Router-Hmc (SAR-Hmc) extends IP/MPLS services over cellular networks and wireless LANs (WLANs). It is ideal for mission-critical and IoT applications in energy, public safety, mining, transportation, and government market segments.

The 7705 SAR-Hmc is a feature-rich IP/MPLS service router that comes in a ruggedized and compact platform and provides an LTE interface. It allows operators to support IP virtual private network (VPN), virtual private LAN service (VPLS), and virtual private wire service (VPWS) over wireless networks to provide seamless, end-to-end IP/MPLS service offerings for wireless and wired devices. These service offerings enable 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-Hmc can be used for a variety of fixed and mobile applications, including supervisory control and data acquisition (SCADA), distribution automation, security monitoring, workforce voice and data connectivity for substations and feeder circuits, mass transit and railways, fleet management, and remote control and monitoring of vehicles.

The 7705 SAR-Hmc uses the Nokia Service Router Operating System (SR OS) software base to offer the IP/MPLS feature richness, reliability, manageability, flexibility and extensive quality of service (QoS) capabilities that are common across the Nokia service router portfolio. The 7705 SAR product

line is widely used globally and has 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) to enable seamless deployment and end-to-end management across a resilient IP/MPLS network from wireless access to core.

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Cellular interface

The 7705 SAR-Hmc has a cellular interface that supports connections to LTE networks. Certified and approved for use on the First Responder Network Authority (FirstNet), it supports Band 14 and other commercial bands on AT&T's LTE network, as well as private LTE spectrum bands such as CBRS and 900 MHz (B8). The cellular interface supports 2x2 multiple-input multiple-output (MIMO) to provide better signal performance and higher data rates.

The 7705 SAR-Hmc also supports dual SIM applications. It 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.

Suitability for harsh environments

With temperature, electromagnetic shock, and vibration hardening, the 7705 SAR-Hmc is ideally suited for use in remote environments, supporting smart grid distribution automation and field area networks or vehicle-mounted applications for public safety, mining, or rolling stock. Fanless operation makes the 7705 SAR-Hmc more tolerant to dust and corrosive environments. The 7705 SAR-Hmc complies with IEEE 1613-Class 2 and IEC 61850-3 standards for power utility applications, and with the EN 50155 and IEC 61373 standards 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-Hmc provides a robust set of security features to maintain network integrity in the face of threatening cyberattacks. Its encryption features, which include Network Group Encryption (NGE) and IP Security (IPsec), use advanced encryption and authentication algorithms to seamlessly protect the confidentiality, integrity, and authenticity of communications from the IP/MPLS core to the wireless access locations without compromising performance. The 7705 SAR-Hmc also supports a comprehensive set of security features for node protection, including management access controls, CPU protection, and login controls. Many types of access control lists are available to provide added security for service traffic over wireless networks.

Software features

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

Services

- Generic Routing Encapsulation (GRE) service distribution points over cellular supporting MPLS services
- Layer 2 VPN services — virtual leased line (VLL), Border Gateway Protocol VPWS (BGP-VPWS)
- LAN services — VPLS and BGP-VPLS
- IPv4 VPN services and IPv6 Provider Edge (6VPE) using Multiprotocol BGP-based MPLS virtual private routed networks (VPRNs)
- Internet Enhanced Service (IES)
- Raw socket IP transport for asynchronous RS-232 serial data over MPLS services for DNP3, IEC101/104 and other SCADA protocol transport
- Network Address Translation (NAT)/Port Address Translation (PAT) for VPRN and IES services

Network protocols

- MPLS Label Edge Router (LER)
- Open Shortest Path First (OSPFv2 and OSPFv3)
- Constraint-based Shortest Path First (CSPF)
- Routing Information Protocol (RIP)
- BGP v4 with multiprotocol extensions (MP-BGP4)
- 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

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Quality of service and traffic management

- Deep buffering on all interfaces
- Ingress intelligent packet classification using Dot1p and DSCP v4/v6
- Ingress coloring and metering
- Egress per-port queuing of up to 8 queues
- Mapping of forwarding class 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 service diagnostics
- VLL and VPLS media access control (MAC) diagnostics
- GPS for location tracking and monitoring

Resiliency

- Pseudowire redundancy for VLL services
- Dynamic IP protocol resiliency (OSPF, MP-BGP4)
- 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
- 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 Wi-Fi Protected Access (WPA) and Wi-Fi Protected Access 2 (WPA2)

Hardware features

Table 1. 7705 SAR-Hmc specifications

Fixed interfaces	• 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)
GNSS port	Global Navigation Satellite System (GNSS) receiver supporting GPS and GLONASS
Physical dimensions and mounting	• 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 compact enclosure
Power	• +12/24/48 V DC • HV power solution available: 90 V AC to 264 V AC; 88 V DC to 300 V DC
Power consumption	7 W typical; <8 W maximum
Cooling	Fanless, passively cooled
Operating temperature range	• –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)
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

Table 2. 7705 SAR-Hmc cellular radio specifications – USA and Canada

Air interface	LTE-FDD, LTE-TDD, P-LTE
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)
LTE user equipment category	4
Certifications	AT&T, FirstNet Ready™ PCS Type Certification Review Board (PTCRB) Global Certification Forum (GCF)* FCC Part 96 (CBRS EUD) Verizon Wireless*

* In progress

Technical specifications[1]

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 61000-3-2
- IEC 61000-3-3
- IEC 61000- 4-2
- IEC 61000- 4-3
- IEC 61000- 4-4
- IEC 61000- 4-5
- IEC 61000- 4-6
- IEC 61000- 4-8
- IEC 61000- 4-10
- IEC 61000- 4-11
- IEC 61000- 4-12
- IEC 61000- 4-16
- IEC 61000- 4-17
- IEC 61000- 4-18
- IEC 61000- 4-29
- IEC 61000-6-2
- IEC 61000-6-4
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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

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

- 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)
- FCC Part 90
- FCC Part 96 (CBRS)
- EN 301 908-1 (LTE/WCDMA)
- EN 301 908-13 (LTE)
- 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 2014/34/EU ATEX
- 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

A 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-Hmc 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.

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-Hmc router and an optional 35 W high-voltage power supply (HV-PS35)

Front

Top

Enclosure specifications

- 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)
- Used with the SAR-Hm/Hmc for hazardous locations

  Certification Marking:
  - II 3G
  - Ex ec nC IIA Gc
  - Class 1, Zone 2,AEx ec nC IIA Gc
  - Class 1, Division 2, Group D
  - Ta = -25°C ≤ Ta ≤ +46°C

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 in p-p displacement
  - 2.5 hours per axis

Hazardous locations

- UL/CSA/IEC/EN 60079-0
- UL/CSA/IEC/EN 60079-7
- UL/CSA/IEC/EN 60079-15

About Nokia

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

As a trusted partner for critical networks, we are committed to innovation and technology leadership across mobile, fixed and cloud networks. We create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Adhering to the highest standards of integrity and security, we help build the capabilities needed for a more productive, sustainable and inclusive world.

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