Nokia 7705 Service Aggregation Router

Adapter cards

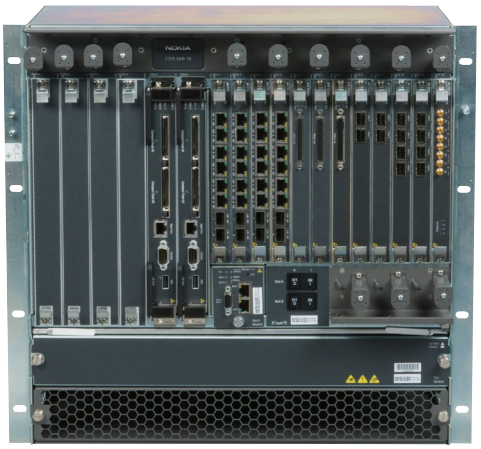
As communications networks and applications migrate to IP/MPLS and Ethernet infrastructures, many mission-critical and enterprise networks still have operational systems that rely on serial data and analog voice interfaces that must be supported. The network interfaces used in PDH and SONET/SDH networks (T1/E1, T3 and OC-n/STM-n) will remain in use for many years as networks transition to packet.

The Nokia 7705 Service Aggregation Router (SAR) supports a broad range of data and voice interfaces, allowing networks to be upgraded to IP/MPLS for advanced services delivery, while maintaining support for existing operational systems.

Cards are available with a variety of options including power, conformal coating and hardware-based encryption support.

Features and benefits

- Support for legacy and advanced services is provided over a single network with extensive network and service management capabilities.
- Legacy network interfaces simplify the transition from TDM-based PDH/SONET/SDH network infrastructures to IP/MPLS.
- Legacy voice and serial data interfaces integrated within the 7705 SAR system eliminate the need for a separate T1/E1 channel bank or multiplexer, providing capital and operational cost savings.
- Service interworking with IP, Frame Relay and High-Level Data Link Control (HDLC) pseudowires provides flexibility, as well as bandwidth and cost optimization for serial data interfaces.
- Nokia's patented Asymmetrical Delay Control (ADC) feature is used by electrical utilities to manage packet network asymmetry for proper operation of current differential teleprotection relays.
- The Nokia Network Services Platform (NSP) provides industry-leading network and service management for lower operational costs.
- Service Portal Express enables automatic controlled work order process and comprehensive report generation.



7705 SAR-18

7705 SAR-8

Ethernet

Ethernet cards provide 10/100 Mb/s, GE and 10GE interfaces and support ring, tree and point-to-point deployments. Both optical and electrical SFPs are supported.

10-port 10GE/GE X-Adapter

This card can be used in the 7705 SAR-18 only. It is user-configurable for either 1 x 10GE or 10 x 10/100/1000 Mb/s, with optical and electrical transceivers supported. It features optional hardware-based encryption.

6-port 10GE/GE

This card is equipped with two SFP+ ports and four SFP ports. All ports support both optical and electrical components. The SFP+ ports support 10 Gb/s. The SFP ports support 10/100/1000 Mb/s. It features optional hardware-based encryption.

8-port GE

This card is equipped with eight ports supporting 10/100/1000 Mb/s Ethernet optical or electrical SFPs. OC-3/STM-1 Transparent SONET/SDH over Packet (TSoP) SFPs are supported. It features optional hardware-based encryption.

Legacy network

Existing services can be transported over a new IP/MPLS network using the 7705 SAR-8/18 legacy network interface cards. Alternatively, these legacy network interface cards can be used to deliver new IP/MPLS services while using an existing PDH/SONET/SDH backbone for transport. They support TDM, ATM, Frame Relay, HDLC, as well as IP services.

32-port T1/E1 ASAP

This card provides standard T1/E1 ports capable of carrying multiple service types over IP/MPLS, as well as existing TDM networks.

- DIN-connector access with optional RJ-45 and BNC panels
- Synchronization options – loop, node, adaptive clock recovery (ACR)/Differential clock recovery (DCR)
- -48/+24 V DC
- MPLS pseudowire support:
  - TDM circuit emulation (Cpipe/Epipe)
  - Circuit Emulation Service over Packet-Switched Network (CESoPSN)
  - Structure Agnostic TDM over Packet (SAToP)
  - Metro Ethernet Forum (MEF) 8 to 64 kb/s level
  - Frame Relay (Fpipe)
  - HDLC (Hpipe)
  - IP (Ipipe)
- IP services

4-port DS3/E3

The DS3/E3 card provides standard DS3/E3 ports capable of carrying multiple service types over IP/MPLS, as well as existing TDM networks.

- 4 ports
- Configurable DS3 or E3 operation
- Access or network links
- Point-to-point Protocol (PPP) for network links
- Loop or node timing
- 1.0/2.3 coax connector access
- -48/-60 V DC
- MPLS pseudowire support:
  - TDM circuit emulation (Cpipe/Epipe)
  - CESoPSN, SAToP, MEF 8 to 64 kb/s level
  - Frame Relay (Fpipe)
  - HDLC (Hpipe)
  - IP (Ipipe)

SONET/SDH

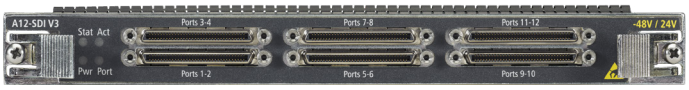
4-port OC-3/STM-1 or 1-port OC-12/STM-4

The SONET/SDH card provides TDM, Packet over SONET (PoS), and PPP/Multi-Link PPP (MLPPP) services.

- Configurable SONET or SDH operation
- SFP interface
- Loop or node timing
- -48/+24V DC
- 4-port OC-3/STM-1 or 1-port OC-12/STM-4 card
  - Configurable as 4-port OC-3/STM-1 or 1-port OC-12/STM-4
  - Channelized to T1/E1 with DCR for access or MLPPP for network applications
  - Clear channel PoS for network links
  - APS/MC-APS for TDM services, APS for PoS

Serial data and voice

12-port Serial Data Interface (SDI) (v3)



The SDI card provides 12 serial data ports configurable as RS-232, V.35, X.21 or RS-530/RS-422 interfaces, permitting transport of legacy services over an IP/MPLS network. Cables connect the SDI card to interface-specific panels for connector access.

- Typical applications for the SDI card include SCADA (RS-232, X.21), electrical utility teleprotection (RS-232, X.21), serial data encryption network interconnect (RS-232, RS-530) and remote router backhaul (V.35).
- Separate distribution panels/cables for port access:
  - RS-232 – DB-25 connectors
  - V.35 – M34 connectors
  - X.21 – DB-15 connectors
  - RS-530/RS-422 - DB-25 connectors
- Selectable data terminal equipment (DTE)/data circuit-terminating equipment (DCE) operation
- Multiple options for transporting serial data:
  - High Capacity Multiplexing (HCM) for TDM transport of sub-rate data within a 64 kb/s timeslot (CESoPSN)
  - Transparent mode (Tr) for n x 64 kb/s TDM traffic. This can be as standard TDM traffic or an IP/Frame Relay or HDLC pseudowire.
  - Raw Sockets (RS) for transport of asynchronous RS-232 data as an IP service
  - Serial SAToP (SS) for transport of additional speeds as well as supporting serial DCR

Table 1. SDIv3 interface speeds/transport options

SDI v3							
Speed (kb/s)	**RS-232**		**V.35**	**X.21**		**RS-530**	
	Sync	**Async**	**Sync**	**Sync**	**Async**	**Sync**	**Async**
0.6	HCM, SS	HCM, RS				HCM, SS	HCM
1.2	HCM, SS	HCM, RS		HCM	HCM	HCM, SS	HCM
2.4	HCM, SS	HCM, RS		HCM	HCM	HCM, SS	HCM
4.8	HCM, SS	HCM, RS		HCM	HCM	HCM, SS	HCM
8	HCM, SS					HCM, SS	
9.6	HCM, SS	HCM, RS		HCM	HCM	HCM, SS	HCM
14.4	HCM, SS					HCM, SS	
16	HCM, SS					HCM, SS	
19.2	HCM, SS	HCM, RS		HCM	HCM	HCM, SS	HCM
24	HCM, SS						
32	HCM, SS					HCM, SS	
38.4	HCM, SS	HCM, RS		HCM	HCM	HCM, SS	HCM
56	HCM, SS		TR	HCM		HCM, SS	
57.6		RS					
64	TR, SS		TR	TR		TR, SS	
115.2		RS					
128			TR	TR		TR, SS	
192			TR			TR, SS	
256			TR	TR		TR, SS	
288						TR, SS	
336						TR, SS	
384			TR	TR		TR, SS	
512			TR	TR		TR, SS	
640			TR	TR		TR, SS	
704						TR, SS	
768			TR	TR		TR, SS	
896			TR	TR		TR, SS	
1024			TR	TR		TR, SS	
1152			TR	TR		TR, SS	
1280			TR	TR		TR, SS	
1344			TR			TR, SS	
1408			TR	TR		TR, SS	
1536			TR	TR		TR, SS	
1664			TR	TR		TR, SS	
1792			TR	TR		TR, SS	
1920			TR	TR		TR, SS	
2048			TR	TR		TR, SS	
4096, 5120, 7168			TR				
3072 - 16384 every 1024 kb/s						SS	

- MPLS pseudowire support:
  - CESoPSN/SAToP (Cpipe)
  - Frame Relay (Fpipe) – V.35, X.21, RS-530/ RS-422 n x 64 kb/s only
  - HDLC (Hpipe) – V.35, X.21, RS-530/ RS-422 n x 64 kb/s only
  - IP (Ipipe) – V.35, X.21, RS-530/R S-422 n x 64 kb/s only
- Multiple timing/synchronization options:
  - Asynchronous
  - Synchronous
  - Slave
  - External
  - Terminal Timing
  - Serial DCR to provide serial timing across MPLS networks
- RS-232, X.21 and RS-530/RS-422 MDDB SCADA support using the 7705 Integrated Services Card
- -48 V DC/+24 V DC

6-port E&M

The E&M card provides six analog interfaces that are used to deliver capabilities, such as SCADA, tone-based teleprotection, and Land Mobile Radio (LMR) base station backhaul. The E&M card utilizes CESoPSN TDM pseudowires (Cpipes) for transport across the IP/MPLS network.

- Six ports
- 2-wire or 4-wire operation
- 600Ω impedance
- Selectable µ-law or A-law companding for worldwide use
- E&M signaling Type I, Type II, and Type V supported
- ABCD signaling bit support: Option for no signaling for transmission-only applications
- Multiple multi-frame option minimizes network bandwidth utilization
- Designed for short reach, on-premise use (200Ω maximum loop length)
- RJ-45 connector access on faceplate
- PCM multi-drop SCADA and voice conference bridging support using the Integrated Services Card
- -48 V DC

8-port C37.94 teleprotection

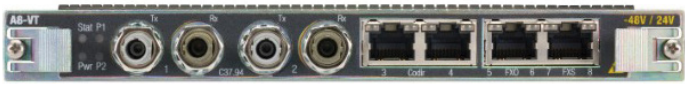
The 8-port C37.94 teleprotection card provides up to eight multimode fiber (MMF) or single-mode fiber (SMF) optical interfaces to connect TDM teleprotection relays across an electrical utility's IP/MPLS network using CESoPSN TDM pseudowires (Cpipes).

- Compliant with IEEE C37.94-2017
- n x 64 kb/s optical interface
- 50/62.5 micron MMF
- SMF or MMF SFP ports
- LC optical connectors (ST connectors via adapter cable)
- Low latency for teleprotection applications
- -48 V/+24 V DC

Distance:

- Short reach: 2 km (9/13 dB link budget)
- Long reach: 20 km (13 dB link budget)

8-port Voice and Teleprotection (VT)



The VT card is a multipurpose device with several interfaces for applications that require analog voice and specific digital interfaces needed for electrical utility teleprotection applications. All interfaces utilize CESoPSN TDM pseudowires for transport across the MPLS network. The physical interfaces are:

- 2-port Foreign eXchange – Subscriber (FXS) for connection to telephone sets
- 2-port Foreign eXchange – Office (FXO) for connection to the central office/PBX

- 2-port ITU-T G.703 co-directional 64 kb/s digital interface for teleprotection relay interconnect
- 2-port IEEE C37.94 Optical Teleprotection Interface (TPIF)
- -48 V/+24 V DC

FXS/FXO features:

- 600Ω impedance
- Selectable µ-law or A-law companding for worldwide use
- Loop Start (LS) signaling for Off-Premises eXtension (OPX) applications and Private Line Automatic Ringdown (PLAR) signaling (FXS-only) for direct site-to-site hot-line options
- On-card ringing support with multiple frequency options (FXS)
- ITU-T G.712 transmission performance
- Programmable Transmission Level Points (TLPs)
- Designed for short-reach, on-premise use (200Ω maximum loop length)
- RJ-45 connector access (two FXS or FXO ports/ connector)

G.703 co-directional features:

- Single 64-kb/s channel over G.703 bi-polar encoded signal
- 4-wire physical interface
- Low-latency capability for teleprotection applications
- RJ-45 connector access

C37.94 Optical TPIF features:

- Compliant with IEEE C37.94
- n x 64 kb/s optical interface
- 50/62.5 micron MMF
- 2-km reach (9/13 dB link budget)
- ST optical connectors
- Low latency for teleprotection applications

8-port FXO

The FXO card provides eight FXO interfaces for high-density connection to a central PBX/switch. The FXO card utilizes CESoPSN TDM pseudowires (Cpipes) for transport across the IP/MPLS network.

- 600Ω impedance
- Selectable µ-law or A-law companding for worldwide use
- LS signaling
- ITU-T G.712 transmission performance
- Programmable TLPs
- Designed for short-reach, on-premise use (200Ω maximum loop length)
- RJ-45 connector access (two FXS ports/ connector)
- -48 V/+24 V DC

6-port FXS

The FXS card provides six FXS interfaces for high-density connection to remote telephone sets (OPX). The FXS card utilizes CESoPSN TDM pseudowires (Cpipes) for transport across the IP/ MPLS network.

- 600Ω impedance
- Selectable µ-law or A-law companding for worldwide use
- LS and PLAR signaling
- ITU-T G.712 transmission performance
- Programmable TLPs
- Designed for short-reach, on-premise use (200Ω maximum loop length)
- RJ-45 connector access (two FXS ports/connector)
- -48 V/+24 V DC

Integrated Services Card (ISC)

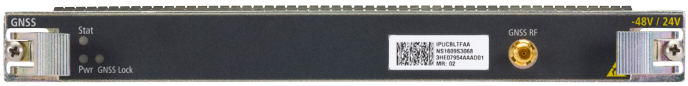
Applications running on the ISC card allow legacy TDM SCADA applications to be carried over an IP/MPLS network, deferring the need to upgrade the application to IP. These applications provide the ability for the SCADA master to broadcast to multiple remote terminal units (RTUs) and only receive data from an active RTU. Support for redundant SCADA masters is provided (manual and automatic switchover).

Applications supported on the ISC are:

- MDDB: MDDB allows a central SCADA master to communicate with multiple RTUs using RS-232 serial links.
- PCM multidrop bridging: PCM bridging is the same as MDDB except the RTUs use 4-wire E&M analog modems at the RTUs.
- Voice Conference Bridging (VCB): 64-kb/s PCM voice conference bridging for LMR backhaul, multi-terminal teleprotection and maintenance bridges. Requires 4W analog inputs.

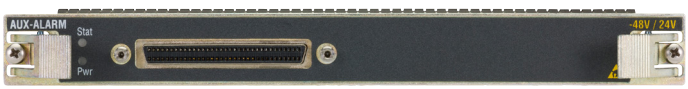
Other cards

GNSS Receiver



The GNSS Receiver card provides frequency, time of day, phase and location allowing 7705 SAR routers to act as IEEE 1588v2 grandmasters. Both GPS and Global Navigation Satellite System (GLONASS) are supported.

Auxiliary Alarm



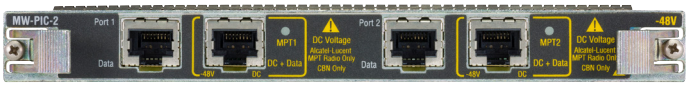
The Auxiliary Alarm card provides alarm relays for security, telecommunications, and building systems, triggering local visual or audible alarms on external alarm equipment and monitoring DC battery levels.

- Uses a single 68-pin AMP (SCSI-2 form factor) connector
- 24 dry contact alarm inputs for security (door/window), HVAC and telecom systems
- 8 dry contact alarm outputs to external audible/visual/telecom equipment
- 2 analog inputs provide voltage reading from 0 to 75V. These are ideal for backup battery monitoring.
- Alarm control and status are accessible on the 7705 SAR-8 using CLI commands, or remotely using the NSP.
- Ultra-wide support of -48 V/-60 V DC and +24 V DC power on the 7705 SAR-8 and -48 V/-60 V DC on the 7705 SAR-18.

Packet Microwave

The 7705 SAR microwave awareness (MWA) capability allows subtending microwave systems to be managed as a part of a 7705 SAR system with a single IP address. It also provides enhanced end-to-end Ethernet and reliability features. The packet microwave adapter card supports the MWA capability on ports 1-4 and IP/MPLS networking on all eight ports. All ports provide 10/100/1000 Mb/s, but when connecting to an MPR-e radio they are always in GE mode. It has 2 x RJ-45 and 6 x SFP ports. The card supports an ultra-wide power range of –48 V/ –60 V DC to +24 V DC.

Microwave Power Injector



The Microwave Power Injector card delivers power and data or power only to an MPR-e radio. The card draws its power from the backplane of a 7705 SAR chassis and provides p ower feed redundancy when it is provisioned on the chassis. The card operates at -48 VDC ± 20%.

The faceplate has two sets of RJ-45 electrical connectors labelled Data and DC+Data. The Data connector can connect to the following ports in order to receive data:

- a copper SFP or RJ-45 port on a Packet Microwave Adapter card
- a copper SFP port on an 8-port Ethernet Adapter card v2
- a copper SFP port on an 8-port Gigabit Ethernet Adapter card (v1 and v2)

The DC+Data connector takes that data and transmits it along with DC power to an MPR-e radio.

Physical specifications (all cards)

Adapter cards can be inserted into any one of the six adapter card slots in the 7705 SAR-8, or in any one of the 12 adapter card slots on the right-hand side of the 7705 SAR-18. The X-Adapter card can be inserted into one of the four card slots on the left-hand side of the 7705 SAR-18.

Dimensions and weight

Adapter cards

- Height: 17.0 cm (6.7 in)
- Width: 2.29 cm (0.9 in)
- Depth: 22.0 cm (8.7 in)
- Weight: 0.38 kg (0.86 lb)

X-Adapter card

- Height: 26 cm (10.2 in)
- Width: 2.9 cm (1.1 in)
- Depth: 23.3 cm (9.2 in)
- Weight: 0.72 – 0.74 kg (1.6 – 1.63 lb)

Temperature range

- Operating temperature: -40°C to 65°C (-40°F to 149°F)

Ordering information

Part number	Part name	Description
3HE06153AA	1-port 10GE/10-port 1GE X-Adapter	Used in 7705 SAR-18 only User-configurable to support 1 x 10GE or 10 x 1GE 1 x SFP+ 10GE 10 x SFP 10/100/1000 Mb/s Optical or electrical
3HE06153AC	1-port 10GE/10-port 1GE X-Adapter Hardware-based IPsec, NGE	
3HE07943AB	6-port 10GE, GE v2	2 x SFP+ 10 Gb/s and 4 x SFP 10/100/1000 Mb/s Optical or electrical Hardware-based IPsec, NGE MACsec available on v2 models
3HE07943BB	6-port 10GE, GE v2 with conformal coating	
3HE07943AA	6-port 10GE, GE	
3HE07943BA	6-port 10GE, GE with conformal coating	
3HE06151AC	8-port GE SFP v3 large tables	8 x SFP 10/100/1000 Mb/s Optical or electrical OC-3/STM-1 TSoP SFPs are supported Hardware-based IPsec, NGE on v3 models
3HE06151BC	8-port GE SFP v3 large tables, with conformal coating	
3HE06151AA	8-port GE SFP v1 (-48 V/+24 V DC)	
3HE06151BA	8-port GE SFP v1 (-48 V/+24 V DC)	
3HE02781AA	32-port T1/E1 ASAP v2 (-48 V/+24 V DC)	32 T1 or E1 ports capable of providing TDM, IP, ATM, Frame Relay and HDLC transport
3HE04962AB	4-port DS3/E3 v2 (-48/-60 V DC)	Four-port DS3 or E3, clear channel and channelized (on DS3 only) TDM, FR, PPP and ATM service (on DS3 only)
3HE07938AA	4-port OC-3/STM-1, 1-port OC-12/STM-4	Four OC-3/STM-1 or one OC-12/STM-4 ports

Part number	Part name	Description
3HE03391AC	12-port Serial Data Interface v3 (SDIv3)	12 serial ports can be configured as RS-232, V.35, X.21, and RS-422/RS-530 interfaces for TDM, FR, HDLC and IP (TDM-only for RS-232) with additional speeds, synchronization functionality, and maintenance capability
3HE03391BC	12-port Serial Data Interface v3 (SDIv3) with conformal coating	
3HE03126AA	6-port E&M	Six analog interfaces used to deliver capabilities such as SCADA, tone-based teleprotection, Land Mobile Radio (LMR) base-station backhaul
3HE03126BA	6-port E&M with conformal coating	
3HE12504AA	8-port C37.94 teleprotection	Eight C37.94-compliant SMF or MMF LC SFP ports for electrical utility teleprotection applications.
3HE06006AA	8-port Voice and Teleprotection (VT)	A multipurpose device with a number of interfaces for applications that require analog voice and specific digital interfaces needed for electrical utility teleprotection applications
3HE06006BA	8-port VT with conformal coating	
3HE06794AA	8-port FXO	Eight analog FXO interfaces to a central PBX
3HE06794BA	8-port FXO with conformal coat	
3HE02780AA	6-port FXS	Six analog FXS subscriber interfaces from local telephone set
3HE02780BA	6-port FXS with conformal coating	
3HE07942AA	Integrated Services	Application resource card providing serial Multi-Drop Data Bridging (MDDB), analog PCM multidrop and voice conference bridging capabilities
3HE07954AA	GNSS Receiver	One x RF, receives frequency and time from a GNSS antenna
3HE02772AA	Auxiliary Alarm (-48 V/+24 V DC)	24 digital alarm inputs, 2 analog inputs and 8 output relays
3HE02772BA	Auxiliary Alarm (-48 V/+24 V DC) with conformal coating	
3HE02782AA	Packet Microwave interface	Interface to Nokia Wavence microwave transport supporting the microwave awareness capability. Eight Ethernet ports support 10/100/1000 Mb/s.
3HE02782BA	Packet Microwave interface with conformal coating	
3HE07152AA	Microwave Power Injector	Two pairs of RJ-45 ports supply power and data or power alone to Nokia Wavence microwave platforms

About Nokia

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

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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Document code: 1147154 (November) CID174425