

## Nokia 7250 IXR-R Interconnect Routers

Release 21

The Nokia 7250 Interconnect Router R-series (IXR-R-series)<sup>1</sup> offers high port density in compact, modular, extended-temperature form factors. Routers in this series are ideal for IP anyhaul, aggregation, fixed-mobile convergence and mission-critical applications.

There are two platforms in the R-series: the 7250 IXR-R6 and the IXR-R4. Using these routers, service providers can rapidly create and deploy new services while extending the lifetime of their existing infrastructure investment. Public and private enterprises can efficiently expand their aggregation networks.

### New service opportunities

The 7250 IXR-R series supports new 5G transport requirements. It delivers low latency for fronthaul, Internet of Things (IoT) and mission-critical applications while providing a large buffer memory for less delay-sensitive applications.

Per-service queuing features support differentiated quality of service (QoS), which is ideal for any-G aggregation and fixed-mobile network convergence. These features also help industrial enterprises attain IT/OT convergence by simultaneously carrying both their business and operational traffic.

Network operators who upgrade to the 7250 IXR-R series today will be ready to meet new service demands for many years to come.



7250 IXR-R6



7250 IXR-R4

### Automation

The 7250 IXR-R series uses the Nokia Service Router Operating System (SR OS) and is managed by the Nokia Network Services Platform (NSP). The NSP offers a rich set of service management features that automates new service delivery and reduces operating cost.

Standards-based software-defined networking (SDN) interfaces enable best-path computation to be offloaded to SDN controllers such as the Nokia NSP. 7250 IXR-R-series routers, operating as path computation clients (PCCs), collect and report

<sup>1</sup> The 7250 IXR-R-series is part of the 7250 IXR product family. Additional data sheets are available for other models in this product family.

per-link and per-service delay, jitter and loss metrics together with port utilization levels, for efficient path computation by a path computation element (PCE) function in the SDN controller.

## Network longevity

The modular architecture used by routers in the 7250 IXR-R series supports a variety of deployment options. High-density 1GE/10GE/25GE/40GE/100GE media-dependent adapter (MDA) cards accommodate future growth. CFP2 DCO optics provide high bandwidth over extended distances, lowering the total cost of operations. Legacy interface cards support transport over existing TDM interfaces and allow for seamless migration to a next-generation IP/MPLS infrastructure.

Side-to-side airflow with a fan filter and redundant fans increases system lifetime and reduces maintenance costs. Side-to-side airflow also guarantees compatibility with 300 mm ETSI-compliant cabinets. This capability is typically not available with front-to-back cooled systems.

## High performance

The 7250 IXR-R series offers industry-leading control-plane performance using a multi-tasking, multi-priority operating system to take full advantage of multi-core processors combined with symmetrical multiprocessing (SMP). Network operators benefit from faster convergence times and powerful operations, administration and maintenance (OAM) and security features.

## Accurate timing

The 7250 IXR-R series provides precise timing and accurate synchronization to meet the stringent requirements of 4G/5G mobile base stations and other networks. It improves timing accuracy over packet networks by combining built-in architectural features with Global Navigation Satellite System (GNSS) capabilities, ITU-T Synchronous Ethernet (SyncE) and the Nokia Bell Labs IEEE 1588v2 algorithm. Powerful QoS mechanisms deliver best-in-class performance by minimizing the delay and delay variation experienced by packet synchronization technologies. Port-based timestamping delivers consistently accurate IEEE 1588v2 performance.

## Reliable service delivery

Granular, in-depth and scalable per-service monitoring offers visibility into packet flows. The 7250 IXR-R series provides comprehensive reporting on key performance indicators such as packet discard and forward counters. These capabilities improve reliability and help service providers fulfil service-level guarantees. Industry, enterprise and public sector operators can ensure that their critical operations traffic is receiving the required treatment.

The 7250 IXR-R series provides excellent protection against link or equipment failures through control and datapath redundancy options. It quickly reroutes traffic and re-converges networks using a robust set of dynamic routing and recovery capabilities. Superior network resiliency reduces network downtime and improves the overall productivity of network operations. With a highly resilient network, network operators can reduce operating costs, improve end-user satisfaction and offer higher-value SLAs.

## For harsh environments

The 7250 IXR-R series, with its extended temperature range, mechanical hardening and robust EMC design, meets the IEEE 1613, IEC 61850-3 and EN 50121-4 standards for power substation and railway environments.

## Software features

The 7250 IXR-R series supports, but is not limited to, the following features.

### Services

- Point-to-point Ethernet pseudowires/virtual leased line (VLL)
- Ethernet Virtual Private Network (EVPN)
  - Virtual Private Wire Service (EVPN-VPWS)
  - Virtual Private LAN Services (EVPN-VPLS): IPv4 and IPv6 support, including Virtual Router Redundancy Protocol (VRRP)
  - Multihoming with single active or active/active modes

- Multipoint Ethernet VPN services with VPLS based on Targeted Label Distribution Protocol (T-LDP) and Border Gateway Protocol (BGP)
- Routed VPLS with Internet Enhanced Services (IES)/IP-VPN IPv4 and IPv6
- Ingress and egress VLAN manipulation for L2 services
- IP VPN Virtual Private Routed Network (VPRN), Inter-Autonomous System (Inter-AS) Option A, B and C
- IPv6 VPN Provider Edge (6VPE)
  - Protocol Independent Multicast – Sparse Mode (PIM-SM), Source Specific Multicast (SSM)
  - Multicast Listener Discovery (MLD)

## Network protocols

- Segment routing
  - Intermediate System-to-Intermediate System (SR-ISIS) and Open Shortest Path First (SR-OSPF)
  - Traffic engineering (SR-TE) IPv4, IPv6
- MPLS label edge router (LER) and label switching router (LSR) functions
  - LDP
  - Resource Reservation Protocol with traffic engineering (RSVP-TE)
- BGP Labeled Unicast (LU) (RFC 3107) route tunnels
- IP routing
  - Dual-stack Interior Gateway Protocol (IGP)
  - Multi-topology, multi-instance IS-IS
  - Multi-instance OSPF
  - Multiprotocol BGP (MP-BGP)
  - BGP-LU support in edge, area border router (ABR) and autonomous system boundary router (ASBR) roles
  - Usage-triggered download of BGP label routes to Label - Forwarding Information Base (L-FIB)
  - Accumulated IGP (AIGP) metric for BGP
  - BGP monitoring protocol (BMP)
  - BGP route-reflector for EVPN and IP-VPN with VPNv4 and VPNv6 address families (AFs)
  - BGP confederations
- Layer 3 Multicast – base routing
  - Internet Group Management Protocol (IGMP)

- Layer 3 Multicast - VPRN
  - Next-generation multicast VPNs (NG-MVPN)
  - SSM with multicast LDPv4 (mLDPv4)
  - IGMP/MLD
  - IGMP/MLD on Routed VPLS Interface
- Layer 2 Multicast
  - IGMP/MLD snooping

## SDN

- SR-TE LSPs, RSVP-TE LSPs
  - PCC initialized, PCC controlled
  - PCC initialized, PCE computed
  - PCC initialized, PCE controlled
- SR-TE LSPs: PCE initialized, PCE controlled
- Topology discovery: BGP-Link State (BGP-LS) IPv4 and IPv6
- Telemetry: streaming interface statistics, service delay and jitter metrics

## Load balancing and resiliency

- IEEE 802.3.ad Link Aggregation Group (LAG) and multi-chassis (MC) LAG
- Pseudowire and LSP redundancy
- Control plane high availability (HA)
- BGP Edge and Core Prefix Independent Convergence (BGP PIC)
- HA routing and forwarding (7250 IXR-R6)
- Fast reroute:
  - LDP with loop-free alternate (LFA) and remote loop-free alternate (rLFA) policies
  - RSVP-TE
  - Segment routing with rLFA and topology-independent LFA policies
- IP and MPLS load balancing by equal-cost multipath (ECMP)
- VRRP
- Ethernet Ring Protection Switching ITU-T G.8032v2

- Configurable polynomial and hash seed shift
- Entropy label (RFC-6790)
- In-service software upgrade (ISSU) (7250 IXR-R6)

## Platform

- Ethernet IEEE 802.1Q (VLAN) and 802.1ad (QinQ) with 9k jumbo frames
- Detailed forwarded and discarded counters for service access points (SAPs) and network interfaces in addition to port-based statistics
- High-scale, per-Virtual Output Queue (VoQ) packet and byte counters (7250 IXR-R6)
- High-scale, per-policer, detailed counters on a per-state basis
- VLAN range-based SAPs
- Dynamic Host Configuration Protocol (DHCP) server for IPv4 IES, VPNv4
- DHCP relay, IPv4 and IPv6, IES, IP-VPN, EVPN-VPLS
- Accounting records

## QoS and traffic management

- Hierarchical QoS (H-QoS)
  - Hierarchical egress schedulers and shapers per forwarding class, SAP, network interface or port
  - Port sub-rate
- Intelligent packet classification, including media access control (MAC), IPv4, IPv6 match-criteria-based classification
- Granular rate enforcement with up to 32 policers per SAP/VLAN including broadcast, unicast, multicast and unknown policers
- Hierarchical policing for aggregate rate enforcement
- Strict priority, weighted fair queuing schedulers
- Congestion management via weighted random early discard (WRED)
- Egress marking or re-marking

## System management

- Simple Network Management Protocol (SNMP)
- Model-driven (MD) management interfaces
  - NETCONF

- MD CLI
- Remote Procedure Call (gRPC)
- Comprehensive management with Nokia NSP

## Operations, administration and maintenance

- IEEE 802.1ag, ITU-T Y.1731: Ethernet Connectivity Fault Management (CFM) for both fault detection and performance monitoring, including delay, jitter, and loss tests
- Ethernet bandwidth notification (ETH-BN) with egress rate adjustment
- IEEE 802.3ah: Ethernet in the First Mile (EFM)
- Bidirectional Forwarding Detection (BFD) IPv4, IPv6
- Two-Way Active Measurement Protocol (TWAMP), TWAMP Light
- A full suite of MPLS OAM tools, including LSP and virtual circuit connectivity verification (VCCV) ping
- Service assurance agent
- Mirroring with slicing support
  - Port
  - VLAN
  - Filter output: MAC, IPv4/IPv6 filters
  - Local/remote
- Port loopback with MAC-swap
- Configuration rollback
- Zero Touch Provisioning (ZTP) capable

## Security

- Remote Authentication Dial-In User Service (RADIUS), Terminal Access Controller Access Control System Plus (TACACS+), and comprehensive control-plane protection capabilities
- MAC-, IPv4- and IPv6-based access control lists and criteria-based classifiers
- Per-port MAC security (MACsec)<sup>2</sup>
- IP security (IPsec)<sup>2</sup>
- Network address translation (NAT)<sup>3</sup>
- Firewall<sup>3</sup>
- Secure Shell (SSH)

<sup>2</sup> Future software deliverable

<sup>3</sup> Future software deliverable on the 7250 IXR-R6

## Technical specifications

Table 1. 7250 IXR-R series specifications

Feature	7250 IXR-R6	7250 IXR-R4
System throughput Half duplex (HD) IMIX traffic	1.6 Tb/s with single or redundant active/standby control-processor input/output modules (CPIOMs)	600 Gb/s with single or redundant active/standby control processor modules (CPMs)
Card slot throughput	160 Gb/s full duplex (FD) per slot	160 Gb/s FD per slot
Card slots	Six	Four
Service interfaces	None	<ul style="list-style-type: none"> <li>2 x SFP+/SFP 10GE</li> <li>10 x SFP 100/1000 Mb/s (on the IOM card)</li> </ul>
Control interfaces*	<ul style="list-style-type: none"> <li>Console, management, SyncE/1588, BITS, Bluetooth, USB, GNSS in, 1PPS out, Optical Management Connection (OMC), SD slot</li> </ul>	<ul style="list-style-type: none"> <li>Console, management, SyncE/1588, BITS, USB, 1PPS out, SD slot</li> </ul>
Timing and synchronization	<ul style="list-style-type: none"> <li>Includes Stratum 3E oscillator</li> <li>ITU-T SyncE</li> <li>IEEE 1588v2                             <ul style="list-style-type: none"> <li>Grandmaster clock (GMC), master clock (MC), boundary clock (BC), slave clock (SC)</li> <li>Profiles: IEEE 1588v2 default, G.8265.1, G.8275.1</li> </ul> </li> <li>UDP/IPV4 and Ethernet encapsulations</li> <li>Nokia Bell Labs IEEE 1588v2 algorithm</li> <li>ITU-T G.8273.2 Class B**</li> <li>RFC 5905 Network Time Protocol (NTP)</li> <li>Building Integrated Timing Supply (BITS) port (T1, E1, 2M) and pulse-per-second (1PPS) timing</li> <li>Integrated, redundant GNSS receivers</li> <li>Support for GNSS SFP</li> </ul>	<ul style="list-style-type: none"> <li>Includes Stratum 3E oscillator</li> <li>ITU-T SyncE</li> <li>IEEE 1588v2                             <ul style="list-style-type: none"> <li>MC, BC, SC</li> <li>Profiles: IEEE 1588v2 default, G.8265.1, G.8275.1</li> </ul> </li> <li>UDP/IPV4 and Ethernet encapsulations</li> <li>Nokia Bell Labs IEEE 1588v2 algorithm</li> <li>NTP</li> <li>BITS port (T1, E1, 2M) and 1PPS timing</li> <li>Support for GNSS SFP</li> </ul>
Common connectors/indicators (on the fan tray)	<ul style="list-style-type: none"> <li>Alarm input/output</li> <li>Alarm cutoff/lamp test (ACO/LT) button</li> <li>Power status (A &amp; B), fan and alarm LEDs</li> </ul>	<ul style="list-style-type: none"> <li>Alarm input/output</li> <li>Alarm cutoff/lamp test (ACO/LT) button</li> <li>Power status (A &amp; B), fan and alarm LEDs</li> </ul>
Memory buffer size	8 GB	3 GB
Enhanced statistics collection	Full-scale	Standard
Common equipment redundancy	Control, switch, power feeds, cooling fans	Control, power feeds, cooling fans
Dimensions	<ul style="list-style-type: none"> <li>Height: 3RU, 13.3 cm (5.25 in)</li> <li>Width: 44.5 cm (17.5 in)</li> <li>Depth: 26.5 cm (10.4 in)</li> <li>Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)</li> </ul>	<ul style="list-style-type: none"> <li>Height: 2RU, 8.9 cm (3.5 in)</li> <li>Width: 44.5 cm (17.5 in)</li> <li>Depth: 26.5 cm (10.4 in)</li> <li>Rack-mountable in a 48.2-cm rack, 30-cm depth (standard 19-in equipment rack, 12-in depth)</li> </ul>
Power	<ul style="list-style-type: none"> <li>DC input (two feeds, rated): -48 V DC/-60 V DC</li> <li>AC power solutions available: 100 V AC to 240 V AC, 50 Hz/60 Hz</li> </ul>	<ul style="list-style-type: none"> <li>DC input (two feeds, rated): -48 V DC/-60 V DC</li> <li>AC power solutions available: 100 V AC to 240 V AC, 50 Hz/60 Hz</li> </ul>
Cooling	<ul style="list-style-type: none"> <li>One tray of six ultra-quiet fans with redundancy</li> <li>Safety electronic breaks on removal</li> <li>Right-to-left airflow</li> <li>Front-to-back airflow (optional with add-on ancillaries)</li> <li>Fan filter</li> </ul>	<ul style="list-style-type: none"> <li>One tray of eight ultra-quiet fans with redundancy</li> <li>Safety electronic breaks on removal</li> <li>Right-to-left airflow</li> <li>Front-to-back airflow (optional with add-on ancillaries)</li> <li>Fan filter</li> </ul>
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
Shipping and storage temperature	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)
Normal humidity	5% to 95%, non-condensing	5% to 95%, non-condensing

\* Some control processor port features are future software deliverables.







\*\* For noise generation only

Optical breakout solutions available on QSFP28/QSFP+ ports: 4 x 10GE and 4 x 25GE.

High-density MDA cards provide flexibility with breakout options and multiprotocol ports. Legacy TDM interfaces are also supported on the 7250 IXR-R6.

The 7250 IXR-R4 input/output module (IOM) has two SFP+/SFP 10GE ports and ten SFP GE ports providing an initial service configuration before any MDA cards are installed.

Table 2. 7250 IXR-R-series MDA cards

Card name	Details	
1-port 100GE + 6-port 10GE	<ul style="list-style-type: none"> <li>1 x QSFP28/QSFP+ 100/40GE</li> <li>6 x SFP+/SFP 10/1GE</li> </ul>	
1-port 100GE + 4-port 10GE	<ul style="list-style-type: none"> <li>1 x CFP2 DCO 100GE</li> <li>4 x SFP+/SFP 10/1GE</li> </ul>	
4-port 25GE + 6-port 10GE	<ul style="list-style-type: none"> <li>4 x SFP28/SFP+ 25/10GE</li> <li>6 x SFP+/SFP 10/1GE</li> </ul>	
10-port 10GE	<ul style="list-style-type: none"> <li>10 x SFP+/SFP 10/1GE</li> </ul>	
20-port GE	<ul style="list-style-type: none"> <li>20 x cSFP 1GE (also accepts SFPs)</li> </ul>	
32-port ASAP E1*	<ul style="list-style-type: none"> <li>TDM services</li> </ul>	

\* Supported on the 7250 IXR-R6. Compatible with 7705 SAR-8/SAR-18. See the 7705 SAR data sheets for more details

Table 3. Maximum platform density per port speed

Port speed	7250 IXR-R6	7250 IXR-R4
• 100/40GE	• 6 x 100/40GE + 36 x 10/1GE	• 4 x 100/40GE + 26 x 10/1GE + 10 x GE
• 25GE	• 24 x 25GE + 36 x 10/1GE	• 16 x 25GE + 26 x 10/1GE + 10 x GE
• 10GE	• 60 x 10GE	• 42 x 10GE + 10 x GE
• GE	• 80 x GE	• 2 x 10GE + 80 x GE
		• Above configurations include Ethernet ports on the IOM card

## Standards compliance<sup>4</sup>

### Environmental specifications

- ATIS-0600015.03
- ATT-TP-76200
- ETSI EN 300 019-2-1; Storage Tests, Class 1.2
- ETSI EN 300 019-2-2; Transportation Tests, Class 2.3
- ETSI EN 300 019-2-3; Operational Tests, Class 3.2
- ETSI EN 300 753 Acoustic Noise Class 3.2
- GR-63-CORE
- GR-3108-CORE
- VZ-TPR-9205
- VZ.TPR.9203 (CO)

### Safety

- AS/NZS 60950.1/62368.1
- IEC/EN 60825-1
- IEC/EN 60825-2
- IEC/EN/UL/CSA 60950-1 Ed2
- IEC/EN/UL/CSA 62368-1 Ed2

### Electromagnetic compatibility

- AS/NZS CISPR 32 Class A
- ATIS-0600315.2013
- BSMI CNS13438 Class A
- BT GS-7
- EN 300 386
- EN 301 489-1 (7250 IXR-R6)
- EN 301 489-17 (Bluetooth) (7250 IXR-R6)
- EN 301 489-19 (GNSS) (7250 IXR-R6)
- EN 55032 Class A
- EN 55024

- ES 201 468
- ETSI EN 300 132-2
- FCC Part 15 Class A
- GR-1089-CORE
- ICES-003 Class A
- IEC 61000-6-2
- IEC 61000-6-4
- IEC CISPR 24
- IEC CISPR 32 Class A
- IEC/EN 61000-4-2 ESD
- IEC/EN 61000-4-3 Radiated Immunity
- IEC/EN 61000-4-4 EFT
- IEC/EN 61000-4-5 Surge
- IEC/EN 61000-4-6 Conducted Immunity
- IEC/EN 61000-4-11 Voltage Interruptions
- IEC/EN 61000-6-2 Immunity for industrial environments
- IEC/EN 61000-6-4
- KCC Korea-Emissions & Immunity (in accordance KN32/35)
- KN 301 489-1 (7250 IXR-R6)
- KN 301 489-17 (Bluetooth) (7250 IXR-R6)
- VCCI Class A

### Radio (7250 IXR-R6 only)

- EN 303 413 (GNSS)
- EN 300 328 ( Bluetooth)
- FCC Part 15 Subpart C (Bluetooth)
- RSS-GEN
- RSS-247 (Bluetooth)

<sup>4</sup> System design intent is according to standards listing. Refer to product documentation for detailed compliance status.

## Directives, regional approvals and certifications

- EU Directive 2011/65/EU Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (Recast) Directive (including Commission Delegated Directive (EU) 2015/863)
- DIRECTIVE 2012/19/EU Waste Electrical and Electronic Equipment (WEEE)
- DIRECTIVE 2014/30/EU Electromagnetic Compatibility (EMC)
- DIRECTIVE 2014/35/EU Low Voltage Directive (LVD)
- DIRECTIVE 2014/53/EU Radio Equipment Directive (RED)
- MEF CE 3.0 certified
- NEBS Level 3:
  - Australia: RCM Mark
  - China RoHS: CRoHS
  - Europe: CE Mark
  - Japan: VCCI Mark
  - South Korea: KC Mark
  - Taiwan: BSMI Mark

## Power utility substations

- IEEE 1613 (exception, forced air system)
- IEEE 1613.1
- IEC 61000-6-5
- IEC 61850-3 (normal environmental conditions)
- IEC/AS 60870.2.1

## Railway

- EN 50121-4
- IEC 62236-4

## About Nokia

We create the critical networks and technologies to bring together the world's intelligence, across businesses, cities, supply chains and societies.

With our commitment to innovation and technology leadership, driven by the award-winning Nokia Bell Labs, we deliver networks at the limits of science across mobile, infrastructure, cloud, and enabling technologies.

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

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Nokia Oyj  
Karakaari 7  
02610 Espoo  
Finland  
Tel. +358 (0) 10 44 88 000

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