

SOLUTION BRIEF

Maximize the
business potential
of your network
with modernization

NOKIA

Content

Why is network modernization essential?

Benefit from a holistic approach to modernization with Nokia

RAN modernization

- Dense urban sites
- Urban capacity and coverage sites
- Rural coverage sites
- Results from a live customer deployment
- Future-proof performance foundation
- Small cells
- RAN modernization results
- Harnessing the power of AI for RAN

Transport network modernization

- Future-proof mobile backhaul
- Backhaul for urban and 5G Massive MIMO sites
- Backhaul for rural and 5G small cell sites

Modernize for energy efficiency

Making deployments easy and sustainable

Why Nokia?

Why is network modernization essential?

Telecommunications networks serve an increasing number of subscribers and traffic volumes, and mobile users expect a seamless experience throughout the network. Over time, existing network deployments become less efficient and cannot meet the growing demand for high-performance connectivity and coverage with cost efficiency.

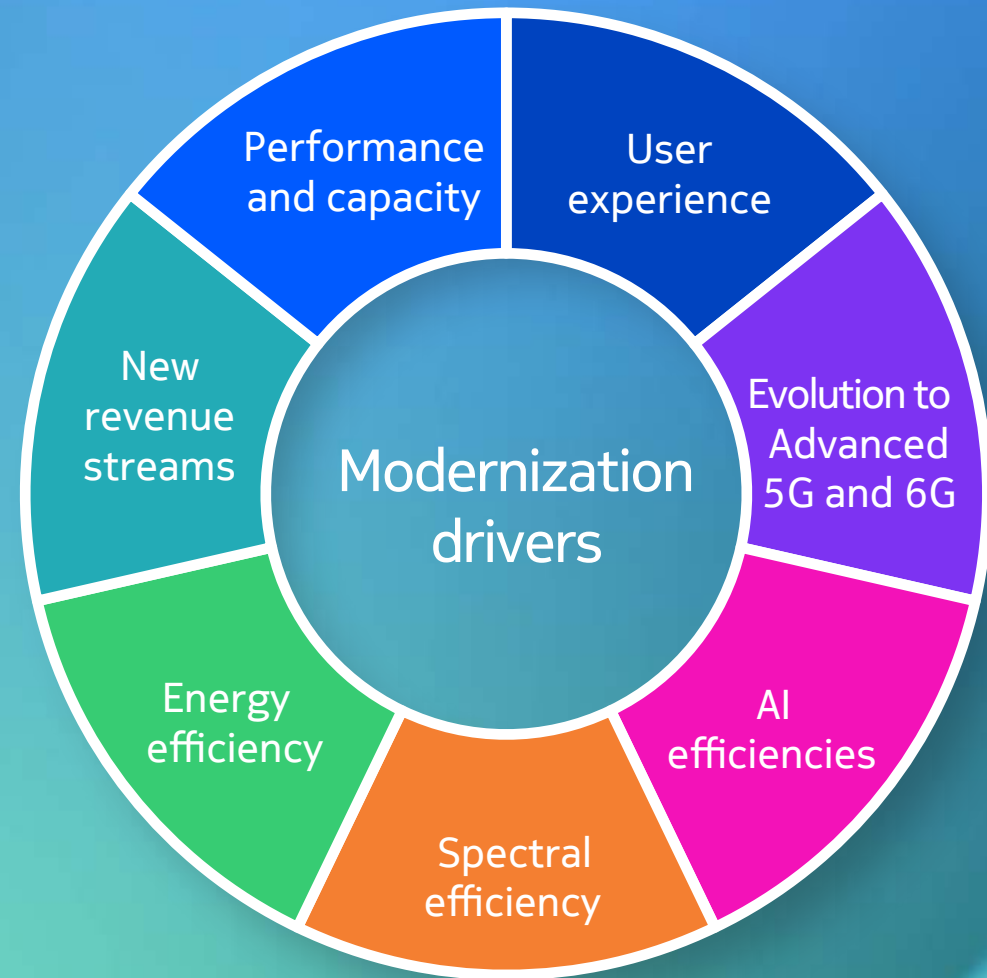
To stay competitive in this evolving landscape, the modernization of network hardware and software is essential.

Modernization gives an opportunity to fully benefit from the latest technology innovations to boost network performance, user experience, energy efficiency and spectral efficiency.

Network modernization is also necessary to harness the latest AI capabilities, unlock new monetization streams and prepare for Advanced 5G and 6G.

Nokia supports customers with all modernization needs.

This solution brief explores key modernization scenarios and related products. The stated capacity and performance figures can vary based on the specific site configuration and traffic model.



Benefit from a holistic approach to modernization with Nokia



Latest **Massive MIMO radios** for the best 5G experience



Latest **baseband** for the highest capacity and data-hungry services



Latest **software** for maximizing performance and efficiency



Compact **site solutions** for energy and OPEX savings



Small cell solutions for strategic indoor and outdoor deployments



Scalable mobile backhaul with **microwave transport**



Fast rollouts with AI-based **deployment services**



Focus on **energy efficiency** in products and services



Harnessing **artificial intelligence** throughout portfolio

Radio refresh: Deliver the best 5G experience with Habrok Massive MIMO

In dense urban environments, user and traffic volumes can grow exponentially, placing higher demands on throughput.

Radio modernization

Early Massive MIMO radios deployed for rapid 5G rollout are no longer sufficient to deliver the performance needed in these sites.

Modernization of dense urban sites with the latest Nokia Habrok Massive MIMO radios enables:

- Higher RF output power
- Better receiver performance
- Higher energy efficiency
- Enhanced capacity and efficiency

Habrok
Massive MIMO



Up to
400 MHz

oBW/iBW

Up to
30%

Throughput gain at cell edge*

Up to
40%

Less power consumption*

* field measurements

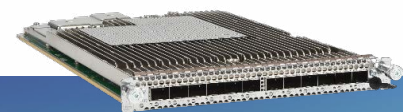
Baseband refresh: Deliver the highest capacity to support data-hungry services

Nokia AirScale baseband delivers next-generation processing power to support data-hungry and uplink-intensive services. The latest baseband capacity and control cards, Levante, Lodos and Ponente, provide double the cell capacity while reducing power consumption.

The AirScale indoor modular baseband features six capacity card slots and two control card slots, enabling seamless scaling of compute power. The outdoor modular baseband combines up to three high/ultra-capacity cards with one control card.

Baseband modernization provides:

- Incremental expansion and efficient scalability
- Double the cell capacity with the latest baseband cards compared to the previous generation
- Significantly enhanced throughput
- Minimized energy consumption
- Simplified maintenance and commissioning



▲ Levante



▲ Lodos



▲ Ponente

Up to
90%

lower energy consumption

Up to
100%

higher cell capacity



Site refresh: Boost coverage with enhanced spectral efficiency while reducing complexity

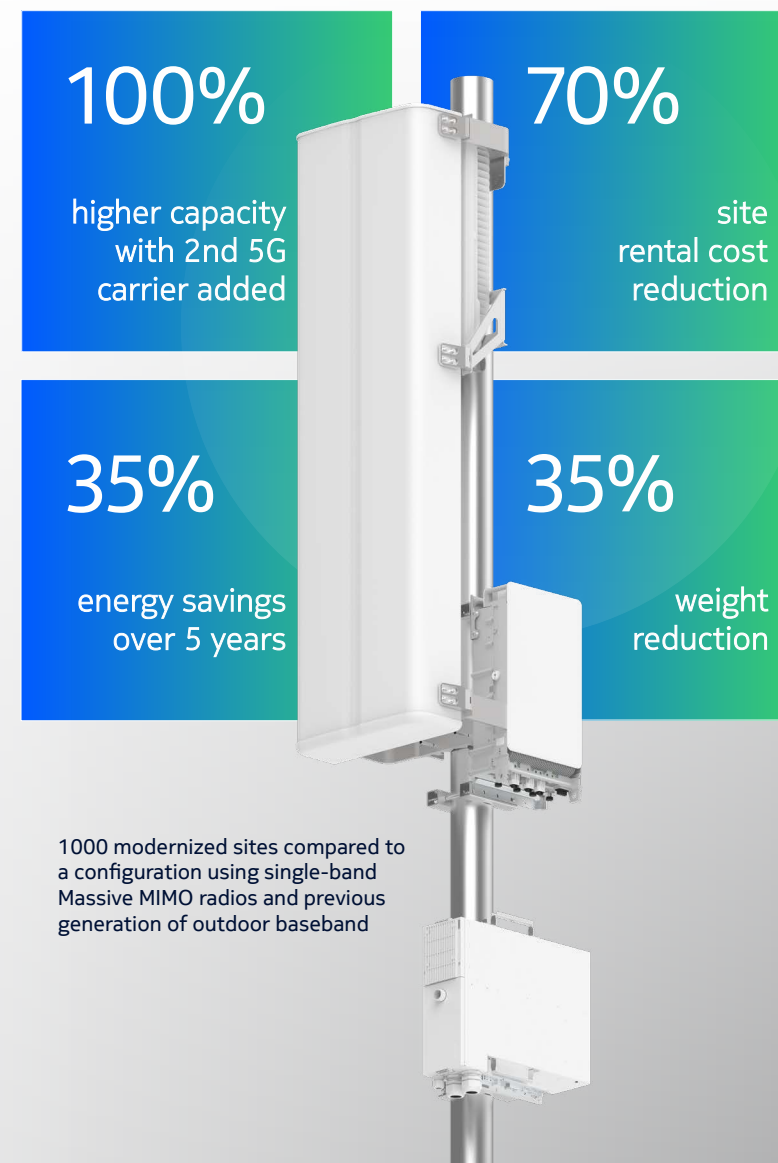
Telecommunications providers typically have multiple spectrum frequencies, while existing site deployments may still rely on single-band radios.

Nokia provides a simple modernization path with:

- Dual-band Habrok Massive MIMO radios
- Triple-band Pandion remote radio heads (RRH)
- Interleaved Passive Active Antenna (IPAA+) platform
- Outdoor modular baseband AMOE

The benefits include:

- Better spectral efficiency
- Enhanced coverage and performance
- No feeder losses when radios are installed next to antennas
- Lower energy consumption
- Readiness for easy and cost-effective addition of Massive MIMO radios



Baseband refresh: Boost cell capacity and throughput while reducing energy consumption

Tuuli 26e (supporting 2G, 3G, 4G and 5G) is Nokia's highest-capacity compact outdoor baseband solution. It is ideal for 4G and 5G urban capacity and coverage sites and enables seamless site upgrades via chaining multiple products, managed as a single entity.

Tuuli 26e leverages the latest generation of Nokia ReefShark System-on-Chip (SoC) technology for a perfect balance of performance and efficiency.

The AirScale outdoor modular baseband sub-rack AMOE enhances deployment flexibility and scalability by combining up to three high/ultra-capacity cards with one control card.



Tuuli 26e



2G, 3G, 4G, 5G

Up to
70%

energy savings*

* Field measurements in Flexi modernization case

Outdoor modular baseband AMOE

3x

capacity
cards

1x

control
card

Add capacity and extend the reach of 4G and 5G coverage in rural and remote areas

Radio refresh

Rural sites often have 2T2R remote radio heads installed in shelters or cell towers. Modernization can greatly benefit these sites.

Nokia's Pandion 4T4R RRH is the ideal choice for upgrading rural sites. In addition, the IPAA+ platform can be selected for multi-band deployments.

Baseband refresh

Compact, higher-efficiency solutions allow for broader coverage and lower energy consumption.

Tuuli 24 (supporting 4G and 5G) is Nokia's high-capacity compact outdoor baseband solution. It is an optimal choice for providing enhanced 4G and 5G network capacity and coverage in rural sites.

Tuuli 26e (supporting 2G, 3G, 4G and 5G) is the highest-capacity compact outdoor baseband solution. Its support for all radio technology generations allows seamless site modernization and simplifies network planning.





Flexi baseband modernization with easy 5G upgrade: Up to 70% energy savings

In recent customer deployments, we have replaced the existing Nokia Flexi baseband equipment with the energy-efficient Tuuli 26e compact outdoor baseband solution, which supports the earlier radio generations 2G and 3G in addition to 4G and 5G.

We have made Flexi baseband modernization easy and sustainable: the new Tuuli 26e baseband products are designed to fit perfectly in the existing indoor and outdoor Flexi casings.

Trial results with a major European telecommunications provider:

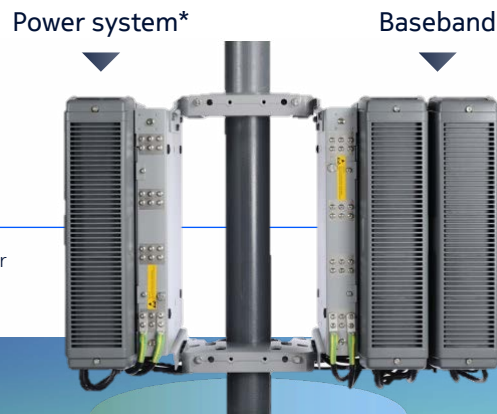
Up to **70%**

energy savings with Tuuli 26e

Tuuli 26e offers a simple upgrade to 5G with high capacity, the best performance-cost ratio and significant energy savings. It also facilitates spectrum refarming from 4G to 5G, which helps safeguard our customers' investments.

Flexi 2G,3G,4G site

Modernized 2G or 3G, 4G, 5G



*Additional TCO benefits with power system modernization with a Zero footprint product.





Maximize the performance potential of 5G Massive MIMO sites with Dual Boost

In modernized networks with the latest AirScale radio and baseband equipment, Dual Boost technology takes base station performance to the next level.

Dual Boost also enhances the energy efficiency of Massive MIMO sites by leveraging the Advanced Receivers and the optimized processing capabilities of ReefShark SoCs.

In addition, it enables a single baseband unit to manage up to twice as many 5G cells as before, which reduces energy use.

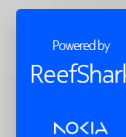
AirScale Dual Boost technology delivers:

- A substantial increase in 5G Massive MIMO uplink and downlink processing power, enabling high throughput and low latency, also in ultra-dense areas.
- Strong support for uplink-heavy services and real-time data transmission, such as HD video, immersive applications, gaming and video conferencing.
- A robust performance foundation for network evolution to Advanced 5G and toward 6G.

Up to
30%

higher average cell throughput in uplink

Latest AirScale portfolio & software



Uplink boost

Downlink boost

Complement macro network coverage and capacity with strategic small cell deployments

Shikra
pico-RRH



Kolibri all-in-one
indoor



Indoor locations

Previous connectivity solutions implemented with passive distributed antenna systems (DAS) are no longer sufficient to meet today's demands for indoor network capacity and performance.

Modernizing these sites with active systems based on AirScale baseband and Shikra pico RRHs or Kolibri all-in-one indoor solutions enables:

- Flexibility and scalability
- High capacity
- Enhanced energy efficiency

Shikra
mmWave



Shikra
RRH



Kolibri all-in-one
outdoor



Outdoor locations

Outdoor small cells are an ideal solution for complementing the macro network coverage and capacity, especially in dense urban environments.

Nokia offers Shikra RRHs, Shikra mmWave radios and Kolibri all-in-one outdoor solutions for outdoor use cases.

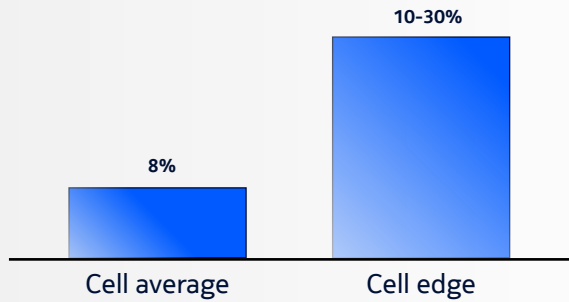
Network modernization with these solutions enables:

- Easy 5G densification
- Performance boost in focus areas
- Traffic offload at cell edge

Customer results

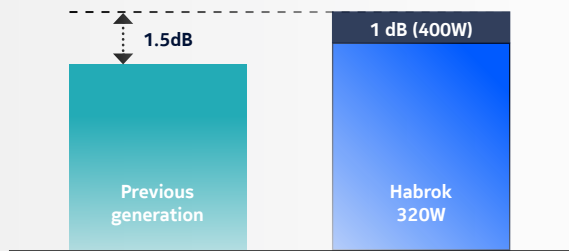
Throughput gain

Better end-user experience and efficiency



EIRP improvement

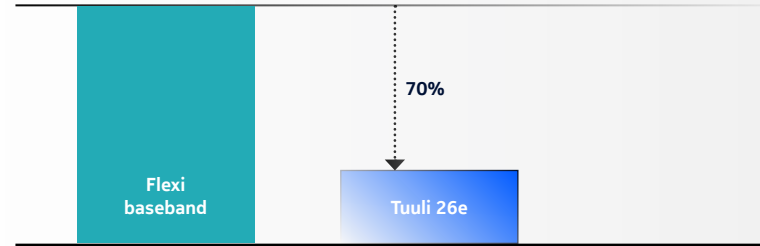
More coverage and capacity



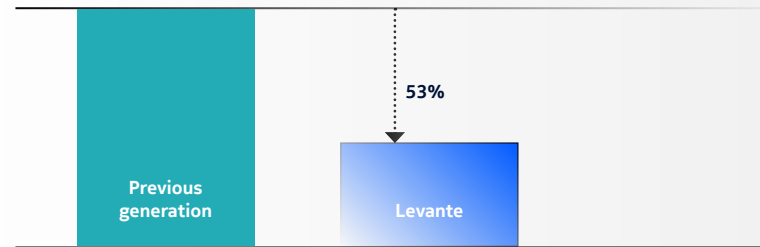
Energy efficiency

Reduced operational cost and CO₂ emissions

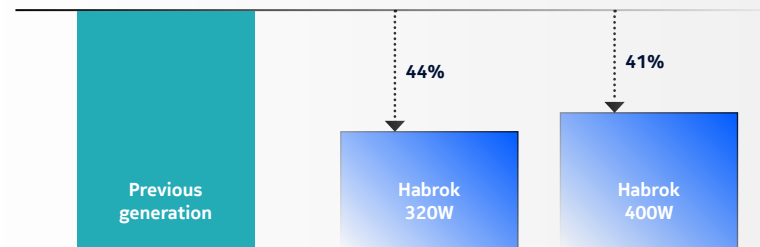
Baseband



Baseband



Habrok Massive MIMO



Results are based on field measurements from key customers in North America and Middle East

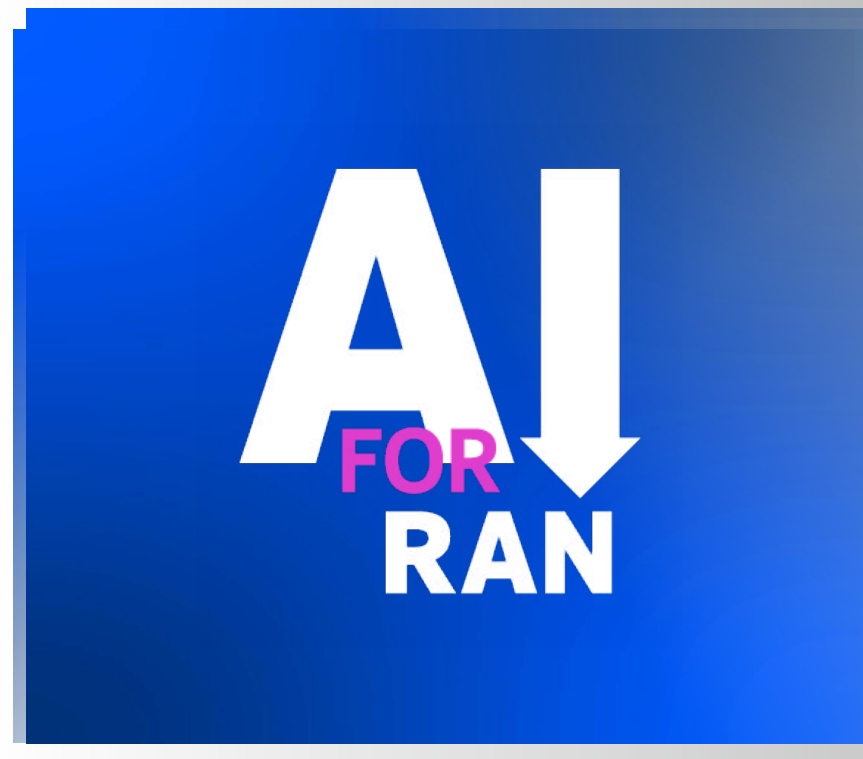


Benefit from the built-in AI capabilities and support extended AI workloads

The convergence of AI and RAN and the deeper integration of AI into mobile services for consumers and enterprises are taking telecommunications networks beyond their initial purpose, opening the door for new business opportunities.

AirScale base stations are ready for the AI supercycle. They leverage Nokia's ReefShark SoCs with advanced AI engines, enabling the use of base station computing capabilities for AI workloads. This helps unlock new revenue streams.

As the number and complexity of AI processing workloads continue to grow, the modular design of AirScale baseband enables meeting the evolving demands by seamlessly scaling capacity and AI computing power.



Build a robust backhaul with microwave transport to support evolution to Advanced 5G and 6G

As telecommunications networks evolve to meet the growing requirements for throughput, capacity and reliability, the mobile backhauling solution must deliver on the same expectations.

Today, telecommunications providers boost network performance with 5G Massive MIMO and make strategic decisions to introduce Advanced 5G and prepare for 6G.

Nokia Wavence microwave transport solutions provide matching backhaul capacity with cost efficiency, supporting all deployment scenarios from dense urban to rural environments.

Microwave transport helps extend the reach of 5G to areas where fiber backhaul would be impossible or too expensive to deploy and enables future-proof evolution.

Nokia Wavence microwave transport portfolio delivers:

- Industry-leading switching capacity and throughput
- Wider bandwidths and support for multi-band aggregation
- Enhanced energy efficiency
- Simplified, cost-efficient site solutions



Leverage the flexibility and scalability of microwave transport backhaul in all deployment scenarios

Urban boost and 5G massive MIMO sites

Nokia Wavence E-Band radios, such as the UBT-m XP with extreme high +24dBm output power, are an ideal option for dense urban sites with the latest 5G Massive MIMO radios. They provide high output power, leading to enhanced throughput with low latency.

Combined with the self-stabilizing SteadEband antennas, these radios significantly boost backhaul performance and availability.

Results from field measurements with SteadEband self-stabilization:

Up to **30%** higher link performance

Up to **20%** better throughput



Flexibility and scalability in all deployments

Wavence Microwave Service Switch (MSS) portfolio provides high-capacity transport and multi-band aggregation capabilities with hardened security. MSS portfolio product options scale from cost-optimized tail sites to heavy-lifting aggregation and trunking nodes.

4x

Switching capacity

2.5x

Multi-band capacity per link direction

Microwave Service Switch



Leverage the flexibility and scalability of microwave transport backhaul in all deployment scenarios

Rural 5G and bridging the digital divide

The extremely high-power Wavence UBT-T XP family provides optimal throughput and reach for rural sites and remote locations such as islands.

The capabilities contributing to high throughput and cost efficiency for longer hop distances include:

- High system gain
- High-order modulation schemes
- Multi-band configurations requiring just one parabolic antenna



UBT-T XP

+7dB

System gain

Easy outdoor small cell sites

The lightweight, fully integrated Wavence UBT-m Urban E-Band radio provides easy backhaul deployments for street-level and hotspot small cell sites, where fiber availability is typically limited.

UBT-mU is an ideal backhauling product for the small cells deployments with Tuuli 6 compact baseband and Shikra radios.

10 Gbps

Easy small cells backhauling

UBT-mU



Minimize network energy consumption and related costs with intelligent RAN site solutions

Energy-efficient cooling - Nokia can provide an entire radio access network and microwave transport solution without the need for air cooling, which is a major contributor to the energy consumption in networks.

MantaRay NM - Nokia MantaRay NM is an AI-powered system for remote monitoring and management, integrated in our site solutions.

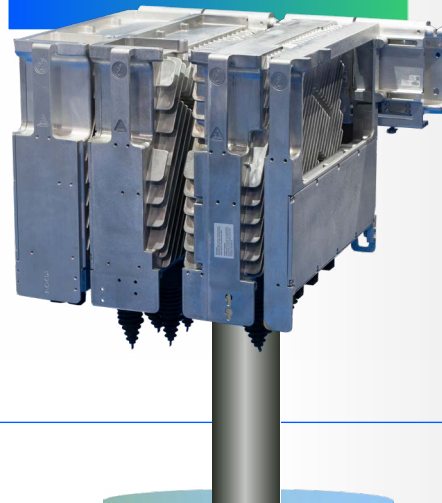
Zero-footprint site solution

The zero-footprint site solutions significantly enhance energy efficiency:

- Incorporates baseband units, highly efficient power rectifiers and long-lasting lithium batteries in a compact form factor.
- Can be installed directly on an outdoor mast, pole or building wall, eliminating the need for air conditioning.
- Enables power system modernization with a solar system and smart power management.

Up to
30%

site energy savings at zero-footprint sites*



Outdoor All-in-one cabinets

The outdoor All-in-one cabinets allow the pre-integration of baseband units, the most advanced cooling solutions, the latest high-performance rectifiers and batteries into just one cabinet. They provide future-proof capacity scaling and simplified operations.

Up to
24%

site energy savings with All-in-one cabinets*



* Compared with traditional indoor



Accelerate rollouts and optimize results with fully digital, AI-based deployment services

When considering network modernization, telecommunications providers may have concerns about cost, timelines and operational disruption.

At Nokia, we understand these challenges. Our fully digital, AI-enhanced approach removes complexity, enhances sustainability and delivers 30% faster rollouts.



Deployment challenges

Roll-out delays

Cost overruns

Fragmented processes

Resource-heavy

Insufficient quality control

Nokia approach

Reliability and efficient orchestration

Site delivery automation

Fully transparent deployment process

Sustainability

Enhanced quality and safety

Results

30%

Faster rollouts

2/3

Site visits eliminated

Quality

First-time right

Why Nokia?



Holistic approach to modernization

- We can help you plan and implement a comprehensive modernization of your RAN and transport network, optimizing the return on investment (ROI).
- Our solutions power the world's leading telecommunications networks globally.

Superior network performance

- We ensure reliable, high-performance connectivity and enhanced spectral efficiency.
- Our flexible, scalable product design allows customers to expand capacity as needed while reusing existing assets and supporting a smooth evolution to future technologies.

Commitment to sustainability

- Our innovative solutions significantly reduce energy consumption, helping the telecommunications industry meet its global ESG targets while enhancing network capacity and performance.

Latest technology innovations

- Our AirScale Dual Boost performance innovation maximizes base station potential. It enhances 5G Massive MIMO capabilities, providing considerable gains in both uplink and downlink processing power.

All-encompassing AI capabilities

- AI is built into AirScale base stations, our software solutions and services portfolio. Our customers have already achieved significant business outcomes with our AI-based solutions.

Safe investments with a future-proof evolution path to 6G

- Our AirScale platform with AI capabilities and scalable processing power paves a seamless path to Advanced 5G and toward 6G. Our Wavence solutions provide a 6G-ready microwave transport solution.

Nokia OYJ
Karakaari 7
02610 Espoo
Finland

Tel. +358 (0) 10 44 88 000

CID: 215184

nokia.com

NOKIA

Nokia is a global leader in connectivity for the AI era. With expertise across fixed, mobile, and transport networks, powered by the innovation of Nokia Bell Labs, we're advancing connectivity to secure a brighter world.

© 2025 Nokia