

SOLUTION BRIEF

Energy-efficient wireless transport solutions with Nokia Wavence

Optimizing network energy
consumption with AI for more
sustainable future

NOKIA



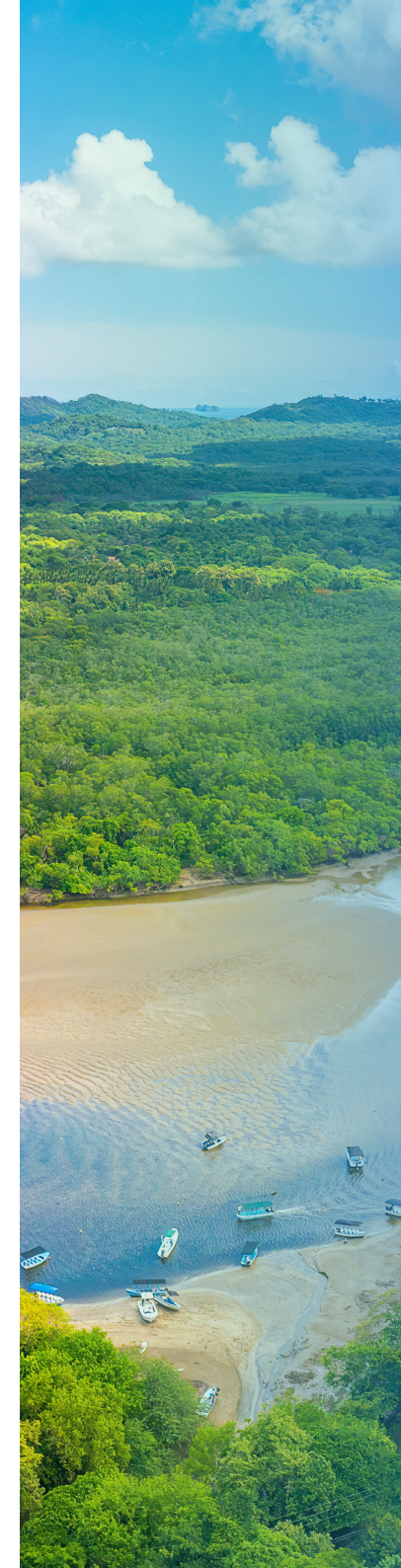
Growing demand for sustainable energy solutions

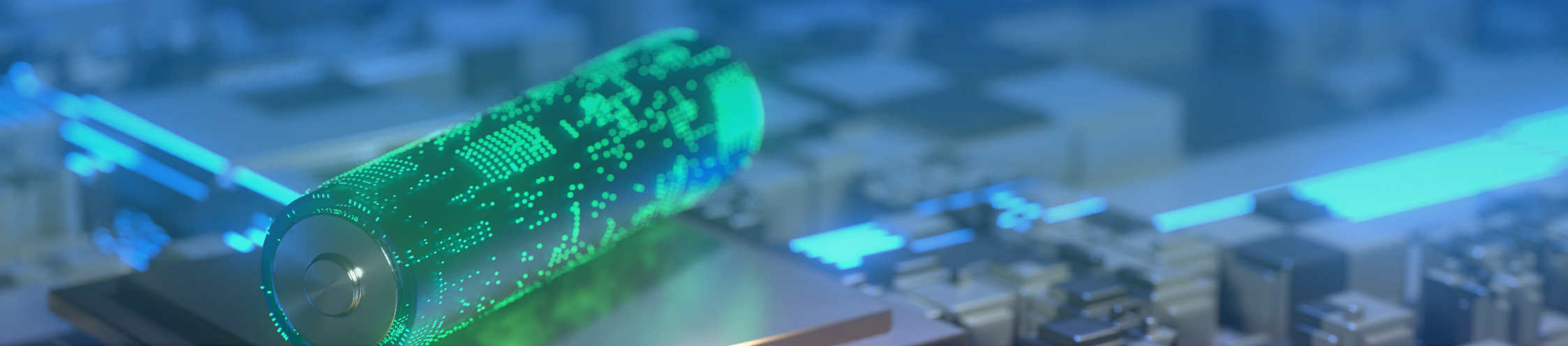
Minimizing carbon emissions throughout the product lifecycle has become essential in the telecommunications industry, especially in radio networks where the majority of energy—around 80%—is consumed at cell sites (base stations and site infrastructure), with the remaining 20% used by the core network and transport systems. Since most of the CO₂ emissions in the networks come from the use during operation, **improving energy efficiency is essential for both cutting costs and reducing environmental impact**. Reducing these emissions not only supports environmental responsibility but also drives operational efficiency and lowers expenses, as energy consumption is a major contributor to overall costs.

With increasing regulatory mandates for sustainability, Communications Service Providers (CSPs), enterprises and government bodies face growing pressure to meet these requirements while managing rising energy demands. Reducing emissions and improving efficiency are crucial for achieving global net-zero targets and maintaining competitiveness as energy prices and capacity demands increase.

Nokia's **Wavence portfolio** addresses these challenges by offering industry-leading energy efficiency and lifecycle management. Designed to minimize emissions across use, manufacturing and disposal stages, Wavence helps CSPs and enterprises reduce costs while ensuring compliance with environmental regulations. Additionally, Nokia's Wavence solution uses 93% of its energy during operation, with only 6% used in production and 1% in logistics, emphasizing the need for efficiency during its use phase. As part of Nokia's commitment to Environmental, Social, and Governance (ESG) principles, we continue to advance energy efficiency, knowing more can be achieved in the future.

By adopting Nokia's Wavence, businesses can future-proof networks, enhance sustainability and progress toward carbon reduction goals. This solution brief outlines how **Wavence supports CSPs and enterprises in reducing carbon emissions** across the product lifecycle, helping to attain sustainability goals while still delivering high-performing networks. By adopting Wavence, businesses can meet ESG targets and stay competitive in an increasingly eco-conscious market, where energy efficiency plays a vital, if not primary, role in decision-making.





Unlocking business value with Nokia Wavence

Nokia's Wavence portfolio reflects our commitment to energy efficiency, offering significant business opportunities across three key levers: **product efficiency, site solutions, and power-saving features through different levels of automation.** By adopting a holistic approach to energy optimization across all network domains, including wireless transport, companies can unlock remarkable cost savings and sustainability benefits.

Although wireless transport solutions account for a smaller portion of total site energy consumption, their extensive deployment makes even small energy reductions highly impactful at scale. For example, a seemingly minor reduction of just 100W per node can result in an aggregate annual savings of 876 MWh when applied across 1,000 nodes. Given that networks often consist of hundreds or thousands of links with varying traffic patterns, it is crucial to leverage artificial intelligence and machine learning (AI/ML)-assisted automation, which not only understands

historical patterns and traffic but can also predict future demands. This highlights the potential for considerable efficiency gains that translate directly into cost reductions.

The benefits extend beyond mobile backhaul. Wireless transport, supported by Nokia Wavence, is also widely used in enterprise sectors such as public safety and utilities, providing opportunities for organizations in these industries to reduce operational costs and improve sustainability. As businesses face rising energy prices and increased regulatory pressures, optimizing energy consumption through solutions such as Nokia's can help maintain competitiveness and meet environmental goals.

By investing in energy-efficient wireless transport solutions, enterprises can achieve long-term savings, enhance their sustainability profile, and capitalize on growing demand for greener, more cost-effective network infrastructure.



Key use cases for Wavence portfolio

The Nokia Wavence portfolio offers a range of microwave solutions designed to meet the connectivity needs of various industries and address both geographical and operational challenges. Built for high capacity and low latency, Wavence solutions help close connectivity gaps in urban areas and remote, infrastructure-limited regions. With applications across public safety, enterprise, energy, transportation and defense, Wavence supports critical operations and digital transformation efforts.

Key use cases include:

- **Urban boost for 5G deployments:** Wavence offers compact and high-power solutions ideal for dense urban and suburban environments, accelerating 5G rollouts and enhancing connectivity.
- **Rural broadband expansion:** With high-speed, scalable technologies and optimized long-distance capabilities, Wavence solutions extend broadband services to remote and underserved rural areas, supporting 5G reach where alternative infrastructure is lacking.
- **Enterprise applications:** Wavence microwave solutions ensure connectivity across challenging terrains and locations with limited infrastructure. Industries such as energy, transportation, public safety, and oil and gas benefit from secure, high-capacity networks for mission-critical applications. Additionally, microwave transport technology plays an important role in extending transport backbones in areas where deploying fiber is impractical or cost prohibitive.



- **Public safety and disaster recovery:** Wavence supports emergency and mission-critical networks, providing rapid deployment, resiliency against natural disasters and secure communications for first responders and public safety agencies.
- **Utilities and power management:** For transmission and distribution operators, Wavence offers solutions for differential protection, time synchronization and connectivity from offshore installations, ensuring reliability, efficient grid management and integration of renewable sources.
- **Oil and gas, and mining operations:** In remote and rugged environments, Wavence enables backhaul connectivity along pipelines and within open pit mining areas, facilitating real-time data transfer, autonomous systems and reliable communication networks for operation centers.
- **Defense and government networks:** Secure, high-capacity microwave solutions provide resilient connectivity for tactical communications, border surveillance and other critical government functions, with robust infrastructure supporting mobility and secure information transfer.

These use cases demonstrate the flexibility and strength of the Wavence portfolio in meeting the connectivity demands of both densely populated urban centers and remote, challenging environments across various sectors.

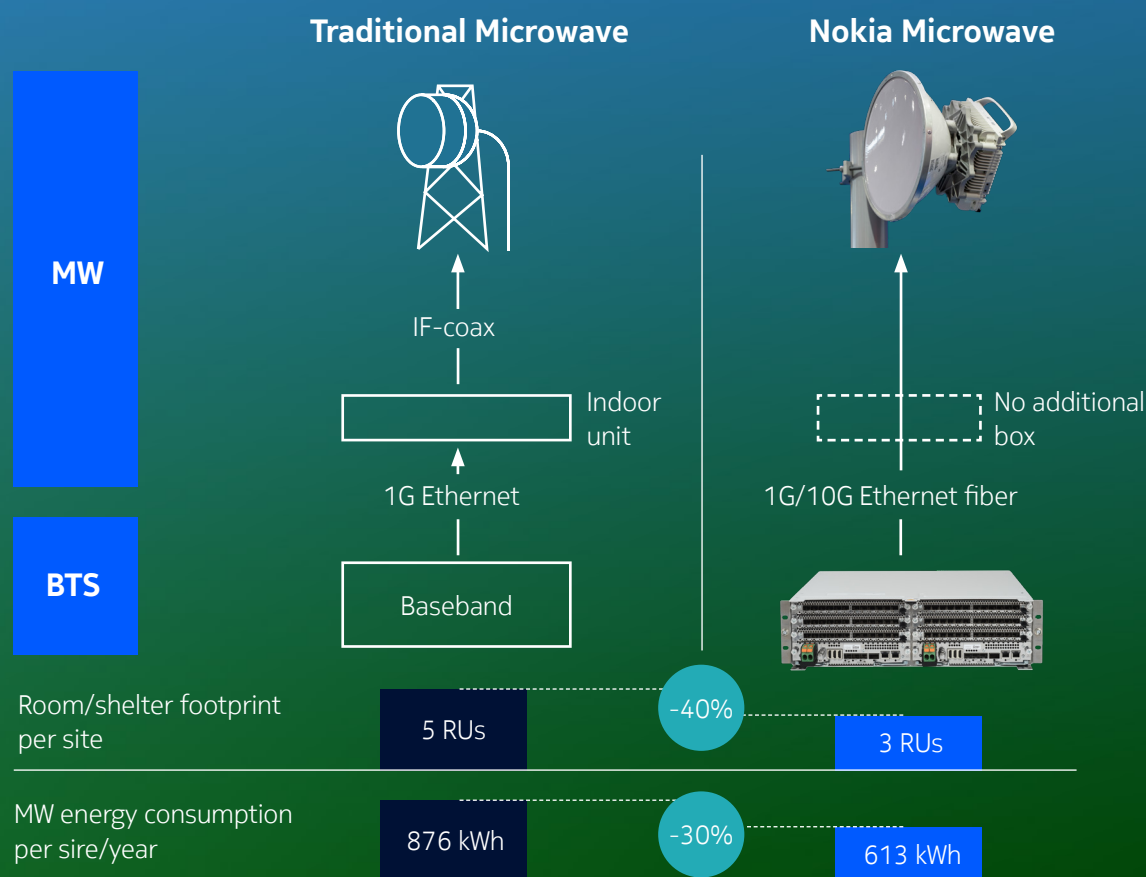
Nokia Wavence portfolio

Nokia's Wavence portfolio offers a comprehensive range of point-to-point wireless connectivity products, encompassing both hardware and software solutions designed to deliver superior performance and energy efficiency across various deployment scenarios. Wavence's innovative architecture allows radio units to operate in flexible configurations, either with a networking unit (in split-mount or full indoor deployment models) or as stand-alone units. By eliminating the need for indoor equipment, Wavence simplifies deployments and delivers savings on capital expenditures (CAPEX) and energy consumption.

Simplified RAN Transport (SRT)

Wavence combines Radio Access Network (RAN) and wireless transport into a singular site solution known as Simplified RAN Transport (SRT). This configuration allows stand-alone Microwave radios to connect directly to Nokia basebands using standard Ethernet connections, eliminating the need for indoor units. By leveraging Nokia Airscale's advanced management and networking features, SRT reduces both physical footprint and power consumption.

For sites that require a cell site router, the Wavence UBT pairs with Nokia IP to create the Simplified Microwave Router (SMR) solution. This setup further reduces indoor footprint requirements while optimizing energy use, providing a compact and efficient solution for modern network needs.





Compact and energy efficient deployments

The Wavence portfolio includes Nokia's latest outdoor deployment solution, which combines the Wavence UBT-mU – the most compact E-band radio in the market – with the Tuuli 6 outdoor baseband. This combination further reduces the need for external power-consuming arrangements and significantly optimizes energy efficiency.

As mobile networks continue to evolve, the need for scalable, high-performance and environmentally conscious solutions is more critical than ever.

In deployments the indoor footprint is reduced, microwave site energy consumption can drop by an estimated 30% annually. In more complex setups with multiple co-located devices, energy savings may exceed this estimate, showcasing the efficiency potential of Wavence solutions.

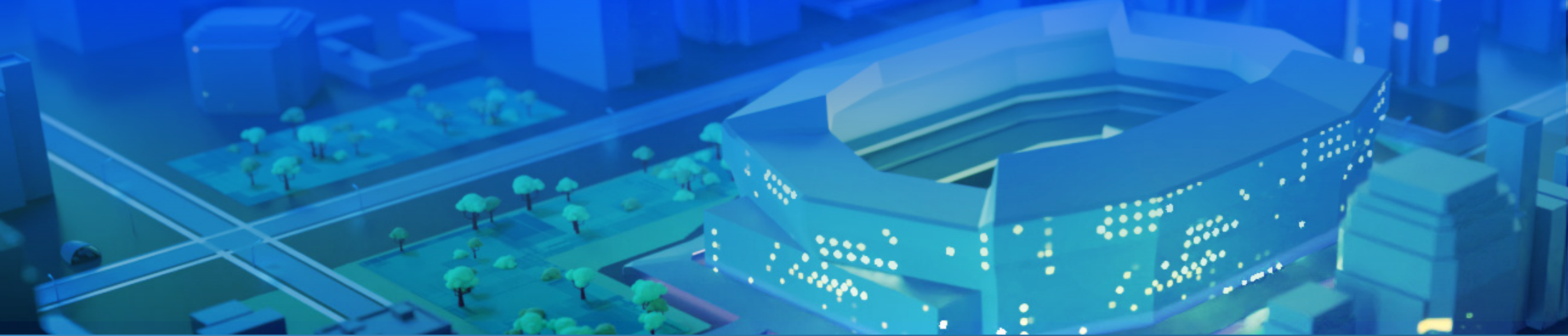
Nokia Wavence

Power and fiber
from the baseband

- ✓ Power saving
- ✓ TCO optimization
- ✓ Simplified operations

Nokia baseband and 5G radio





Automatic transmit (TX) power control

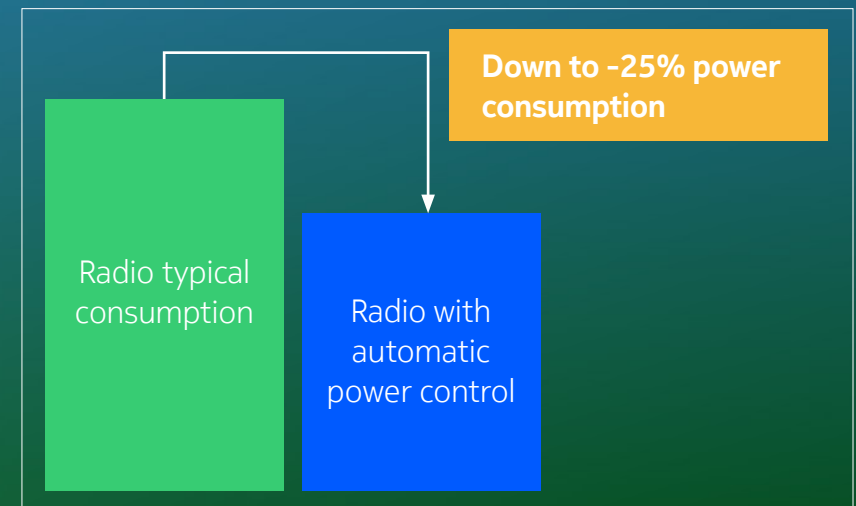
One of the core features of our Wavence portfolio is automatic transmit (TX) power control, which dynamically adjusts transmission power based on favorable propagation conditions. This adaptive reduction delivers energy savings of up to 25% in high-power Wavence UBT models while maintaining optimal network performance.

Energy efficiency optimization tool

To maximize the impact of these features, Nokia offers advanced tools to help customers assess and finetune their return on investment:

- **Analytics:** These tools estimate potential energy savings by analyzing actual traffic patterns, enabling informed decision-making before deployment.
- **Simulation:** Digital twins allow customers to simulate potential savings and optimize power-saving configurations without impacting real network performance.

These tools allow businesses to optimize configurations and maximize energy savings.

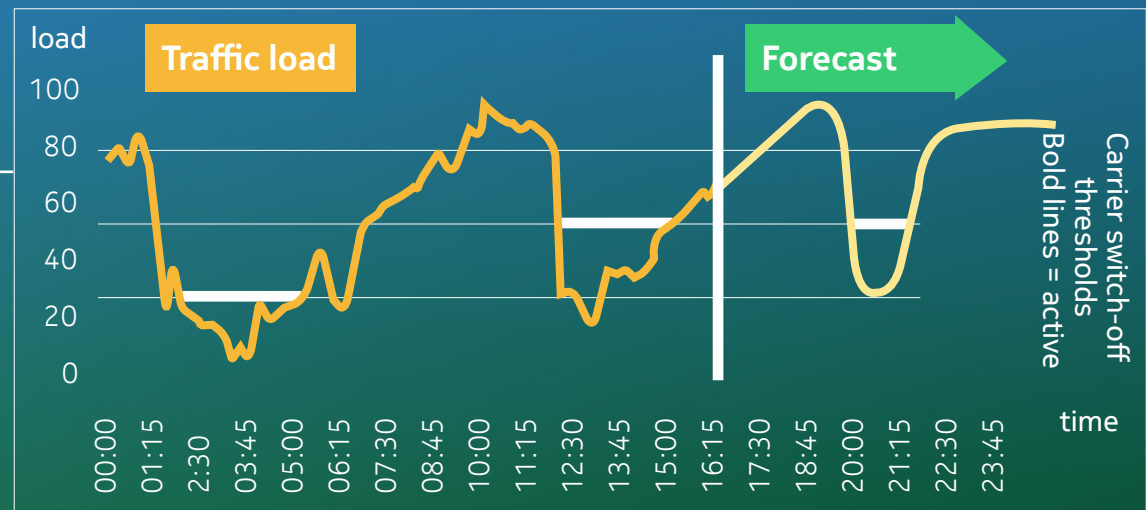
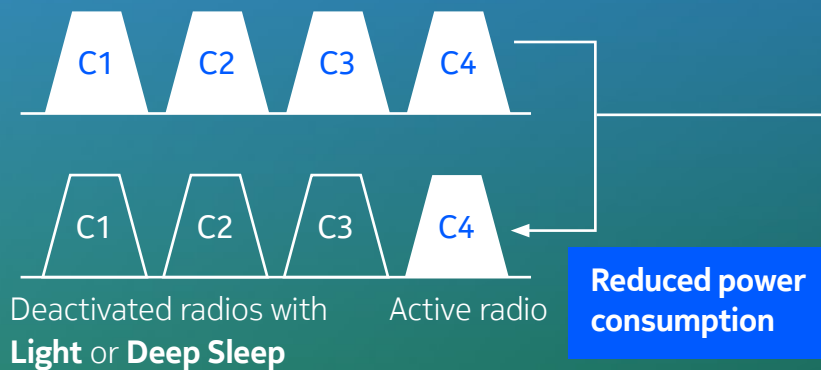


Traffic-aware energy savings for Carrier Aggregation (CA)

Algorithms monitor and analyze traffic patterns in real time, ensuring optimal carrier activity based on utilization. When demand is high, all carriers remain active to meet capacity requirements, but during off-peak periods with lower utilization, unnecessary carriers are transitioned to Light or Deep Sleep modes.

Nokia's traffic-aware energy savings for Carrier Aggregation can reduce power consumption by 20-30% in Light Sleep and up to 50% in Deep Sleep, depending on the setup, optimizing energy efficiency without compromising performance.

MW link with 4 radio channels



Future-proof technologies with AI/ML

Nokia's Wavence solutions are evolving to meet the demands of increasingly dynamic and efficient mobile networks, leveraging AI/ML traffic predictions to enhance energy-saving policies. By using advanced algorithms based on traffic forecasts, Nokia enables the implementation of more precise and adaptive power-saving policies. These AI-driven optimizations ensure that network resources are utilized efficiently, reducing energy consumption while maintaining peak performance.

Why Nokia?

Nokia stands out as a leader in delivering high-performance wireless transport solutions with a focus on energy efficiency. The Wavence portfolio, designed for both CSPs and enterprises, exemplifies Nokia's commitment to optimizing product efficiency without compromising on throughput or features. Transporting more capacity with fewer radios, Nokia not only reduces energy consumption but also cuts operational costs.

Nokia's key innovations include:

- **Increased spectral efficiency:** By maximizing the use of available spectrum, Nokia enables the transport of more data with fewer radios, significantly lowering power consumption.
- **Larger radio channel sizes:** By utilizing wider spectrum portions, multiple devices can be replaced with high-speed radios, reducing the need for extensive infrastructure.
- **Higher carrier density:** Supporting two channels in a single radio allows for considerable energy savings by halving the number of radios needed.
- **Enhanced transmit power and receiver sensitivity:** While it may seem counterintuitive, increasing output power improves the reliability and availability of throughput, ensuring robust performance without needing to deploy multiple radios at lower modulation rates.
- **Carrier muting and deep sleep energy efficiency features:** Nokia's Wavence portfolio is equipped with intelligent software features that adapt to network conditions. During low-traffic periods, channels can be automatically powered down or adjusted to optimize energy use.
- **AI/ML assisted automation:** Nokia's network design, planning and optimization services guarantee that businesses achieve the best balance between performance and energy efficiency. Each network cell is configured for optimal power use, supported by advanced analytics that maintain peak performance without compromise. Other benefits include:
 - Operational cost savings by omitting manual configurations and reducing the risk of human error
 - Optimal utilization of energy efficiency features across the network, reducing electricity costs and lowering CO₂ emissions
 - AI/ML-powered features that enable seamless energy optimization without affecting key performance **indicators**.

Looking ahead, Nokia continues to invest in enhancing the energy efficiency of its microwave transport solutions, providing businesses with future-proof technology that supports both high performance and sustainability.

Nokia OYJ
Karakaari 7
02610 Espoo
Finland

Tel. +358 (0) 10 44 88 000

CID: 214475

nokia.com

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.

With truly open architectures that seamlessly integrate into any ecosystem, our high-performance networks create new opportunities for monetization and scale. 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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