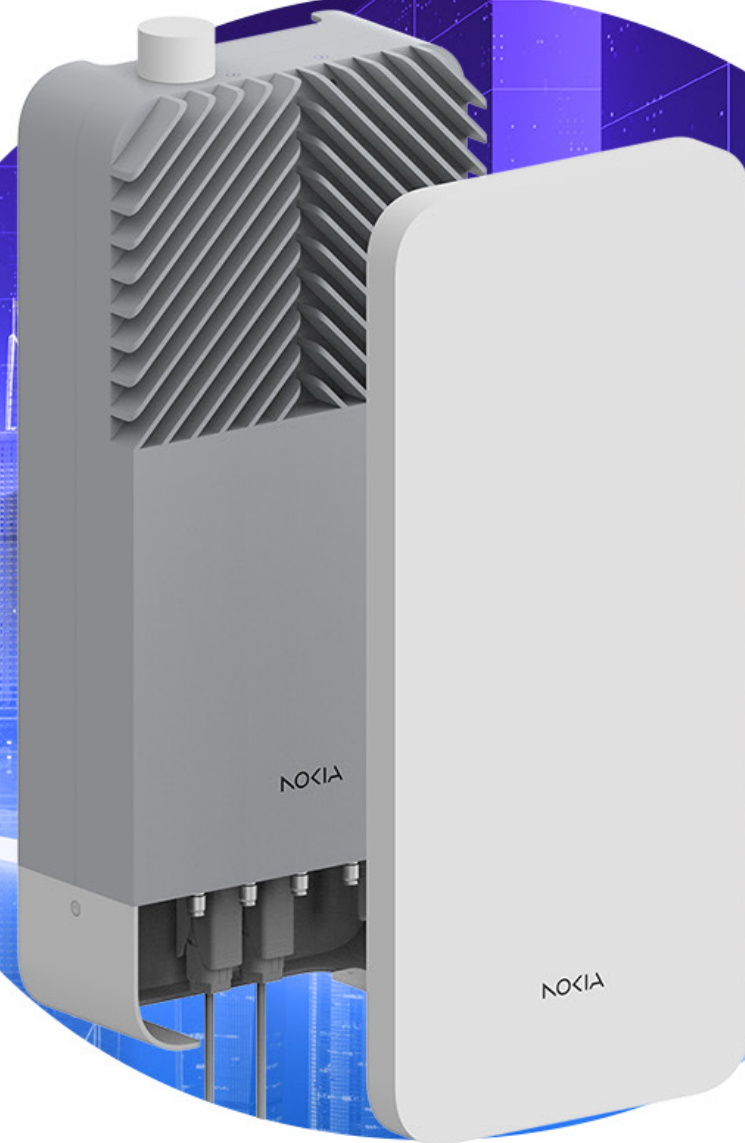


## SOLUTION BRIEF

# Maximizing network connectivity with small cells

Optimizing network performance, cost efficiency and business opportunities for CSPs and Enterprises

# NOKIA



# Nokia small cells for CSPs and Enterprises

Even as mobile network connectivity improves, coverage gaps remain a key issue for Communication Service Providers (CSPs) and Enterprises alike, especially in challenging environments such as street corridors, narrow streets, deep valleys and areas obstructed by geographical features. In campuses, industrial zones or remote areas beyond the reach of macro cells, coverage and performance may suffer. Enterprises also require high-performance, secure and reliable connectivity, especially in business-critical environments.

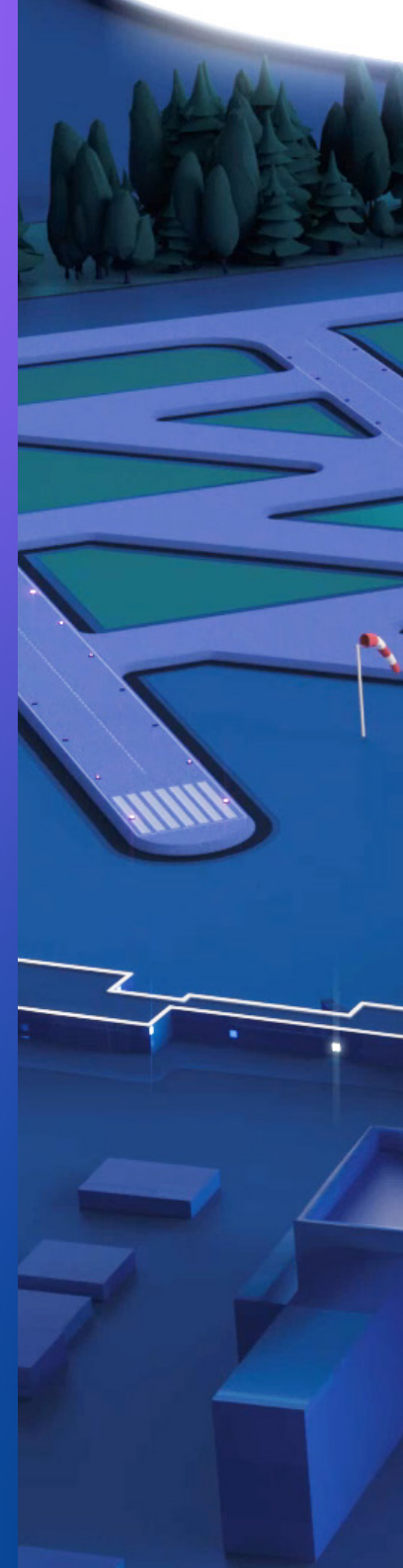
Small cell solutions provide the answer to these challenges by filling coverage gaps, enhancing network performance and enabling new business opportunities. These solutions not only address capacity and coverage issues but also offer energy-efficient features, such as micro-Discontinuous Transmission ( $\mu$ DTX) and dynamic radio switching, which improve both operational efficiency and sustainability.

## **Small cells' impact on network capacity in the 5G era**

Small cells have played a crucial role in mobile network deployments since the early days of 2G, and their importance has only grown in the 5G era. While early generations primarily focused on coverage, the current focus of small cell solutions is on capacity, for both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) deployments. CSPs continue to request support for simultaneous 4G and 5G operations in a single product, ensuring backward compatibility while meeting future demands.

## **Flexible backhaul solutions for growing network demands**

Not only is there an increasing demand across networks for technology flexibility, but also for network sharing and neutral hosting, driven by multi-operator scenarios. To aid this issue, small cells offer higher output power—distributed between operators—along with broadband and bandwidth capabilities to support growing traffic and coverage needs. While fiber or copper Ethernet remains the backbone of small cell backhauling, locations without these options can rely on microwave transport solutions which are optimized for small cell use.



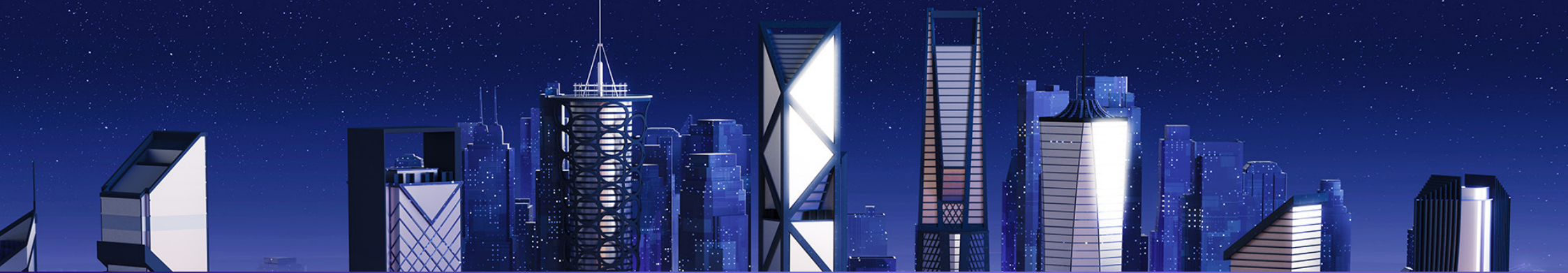
# Creating new business potential with small cells

As the need for quick and reliable network connectivity increases, the deployment of small cells has become critical for both CSPs and Enterprise. 5G is gaining traction and the deployment of small cell solutions offers advantages that create significant business opportunities for CSPs while addressing the key challenges of network expansion, cost efficiency and user experience.

Among these advantages include:

- **Enhanced user experience and reduced churn:** With small cells, CSPs can significantly reduce churn by offering better network coverage, especially in areas where macro cell signals struggle to reach, such as street corridors, industrial sites or deep within commercial buildings.
- **Expanded service offerings and higher revenue streams:** By leveraging small cells' extra network capacity, CSPs can offer premium services like enhanced mobile broadband, ultra-reliable low-latency communication and massive IoT deployments. This flexibility unlocks new revenue streams and keeps CSPs competitive in a saturated market. The Service Provider as a Partner (SPaaS) model also enables CSPs to expand into the Enterprise market, delivering tailored solutions for industries such as manufacturing and public safety.
- **Neutral hosting:** These have become essential strategies for CSPs and Enterprises to expand networks while cutting costs. By using a third-party to manage infrastructure, providers can purchase capacity as a service, reducing both capital and deployment complexity. This approach is particularly useful in space-constrained areas like commercial buildings and campuses, with government support accelerating adoption to help bridge the digital divide.
- **Network sharing:** With small cells, multiple operators can share hardware while maintaining separate networks and spectrum, reducing equipment cost and installation complexity. This model minimizes visual clutter by using fewer access points and antennas, addressing space limitations and fostering collaboration between CSPs to provide reliable coverage in hard-to-reach areas, all while keeping costs in check.





For Enterprises, small cells provide on-demand coverage exactly where it is needed, whether on industrial sites, exploration platforms, such as for oil and gas, or even future-facing environments like Moon and Mars exploration bases. The simplicity and plug-and-play approach offered by small cell solutions make them especially attractive to enterprises looking for high-performance, secure and reliable connectivity with minimal complexity in deployment. Other business advantages for Enterprises include:

- **Enhanced productivity and operational efficiency:** Small cells offer reliable, low-latency communication, essential for industries such as manufacturing and healthcare. They enable automation, reduce downtime and ensure smooth operations, boosting overall productivity.
- **Customizable and scalable network solutions:** Small cells provide flexible, on-demand coverage, whether for remote sites or private networks. Their scalability allows businesses to start smaller, and expand as needed, ensuring networks grow with business demands.
- **Improved data security and privacy:** Private small cell networks enhance data security by keeping sensitive information within the organization. This is paramount for sectors such as finance and healthcare where data privacy is a top priority.
- **Cost-efficient infrastructure and easy deployment:** With a plug-and-play design, small cells offer cost-effective solutions, allowing for quick deployment and reduced infrastructure costs. This minimizes both capital and operational expenses while simplifying network expansion.
- **Enabling IoT and digital transformation:** Small cells support IoT deployments by providing the connectivity needed for smart factories, healthcare and more. They help businesses implement new technologies, driving growth and competitive advantages.
- **Futureproofing with 5G:** Small cells facilitate smooth 5G connectivity, preparing Enterprises for future technologies such as artificial intelligence and augmented reality. This ensures businesses stay innovative and future ready.

Nokia's small cells portfolio offers tailored solutions for CSPs and Enterprises of all sizes, from small offices to large campuses and outdoor areas.

### Small-scale deployments

Kolibri radios: Ideal for small-scale setups like enterprises, offices or campuses, Kolibri indoor and outdoor radios come with integrated baseband, supporting even single, easily deployable access points.

AirScale indoor (ASiR) solution with Shikra Pico: Perfect for deployments leveraging existing baseband and fronthaul infrastructure.

Femto Smart Node: An excellent solution for small offices and home environments. Please note, this is not limited to just small-scale deployments.

### Medium- to large-scale deployments

AirScale indoor (ASiR) solution with Shikra Pico radios: Delivers reliable coverage for medium-sized indoor buildings.

Shikra micro-RRHs: Addresses outdoor coverage gaps and enhances capacity.

Distributed Antenna Systems (DAS): Provides seamless indoor coverage by utilizing existing infrastructure.

### Medium- to very large-scale deployments

Shikra micro-RRHs and Shikra mmWave radios: Address outdoor coverage gaps and enhance capacity, perfect for areas like street corridors or locations lacking macro coverage.

Shikra mmWave radios for FWA: Ideal for delivering high-performance connectivity for Fixed Wireless Access (FWA) business applications.

Nokia's Kolibri Strand Mount: A perfect fit for cable operators who are looking to expand their business into wireless services using the CBRS band, leveraging existing DOCSIS infrastructure for efficient backhauling.

Nokia's AirScale solutions: The AirScale baseband, with plugin cards or the compact Tuuli baseband, combined with Shikra micro-RRHs or Shikra pico-radios, offers a powerful yet compact solution for small to medium venues and areas requiring high-performance coverage.



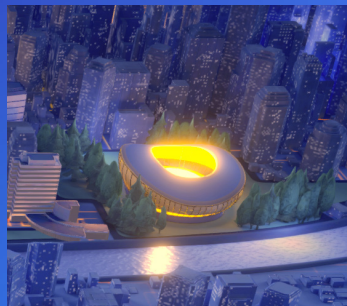
# Successful customer use cases

Nokia's **small cells portfolio** has delivered impressive network improvements across a variety of sectors globally:



**Corporate sector:** In North America, small cells were implemented to enhance coverage and capacity in corporate headquarters, providing effective 4G and 5G indoor connectivity with peak data rates of over 1.7 Gbps. The solution combined LTE and 5G technologies under a

shared baseband unit, simplifying deployment through Ethernet-based power and data transmission. This setup met the high demands of corporate environments, ensuring consistent performance for both employees and visitors.

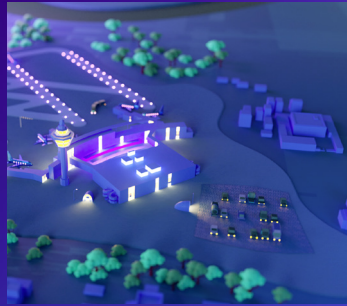


**Sports and events:** In Europe, Nokia's small cells were deployed in sports stadiums and event venues to significantly boost network capacity during major events. For example, installations in stadiums across the United Kingdom and Italy supported

high data throughput rates, exceeding 1 Gbps even under dense user conditions. By utilizing multi-band configurations and advanced MIMO techniques, these deployments effectively handled large volumes of simultaneous traffic, ensuring a smooth experience for spectators and event staff.



**Retail sector:** In Finland and Taiwan, Nokia's solutions were rolled out in shopping centers to enhance indoor coverage. These deployments achieved peak data rates of over 1.5 Gbps, enabling retailers to support advanced applications such as augmented reality and in-store digital services. The solution also helped boost 5G device sales by providing shoppers with a first-hand 5G experience.



**Transportation hubs:** In Asia, transportation hubs such as subway stations in China and airports in Saudi Arabia benefited from Nokia's multi-RAT small cell solutions. These deployments provided reliable 4G and 5G coverage across expansive areas, utilizing a single baseband unit to

optimize total cost of ownership. In subway stations, Nokia's small cells improved network coverage for commuters, achieving peak data rates around 1 Gbps and maintaining stable connectivity across multiple stations.



**Special events:** For large-scale events, such as ski championships in Austria and high-profile demonstrations in Finland, Nokia's small cells enabled rapid, temporary network deployments. These solutions supported record-setting data rates, including an 8 Gbps peak throughput

using mmWave technology at a flagship store in Finland, showcasing the potential of 5G for ultra-high-speed applications like virtual reality and live video streaming.

Nokia's **Smart Node solutions for indoor coverage** have delivered significant improvements across various sectors by enhancing coverage and boosting network performance in challenging environments:



**Retail sector:** In a European supermarket chain, Nokia deployed over 2,000 femtocells to improve in-store mobile coverage. These Smart Node solutions addressed low macro signal penetration, significantly enhancing data quality and call performance for both customers and

employees. This resulted in high customer satisfaction and secured multi-year enterprise contracts. The flexibility to install multiple Smart Nodes allowed for tailored coverage solutions across different areas, such as the main shopping floor and staff offices.



**Healthcare sector:** In the healthcare sector, Nokia's Smart Node technology was used to upgrade connectivity in a large hospital, overcoming coverage issues posed by the concrete and brick structure. The deployment included 38 access points to ensure comprehensive 4G service throughout

the facility, improving signal quality and data speeds for both staff and visitors. The Smart Node's plug-and-play capabilities, along with automatic cell optimization, made the deployment cost-effective and efficient, providing consistent connectivity in critical areas of the hospital.



# The role of 5G-Advanced in small cell technology evolution

The evolution of small cell technology, driven by 5G-Advanced, is transforming telecommunications, particularly in industries requiring ultra-reliable, low-latency and precise communication. Advances in positioning accuracy, time-sensitive networking (TSN) and AI-native interfaces are enabling small cells to meet the demands of applications across sectors like Industrial IoT, logistics and transportation.

## **Enhancing industry applications with precise indoor positioning**

A major breakthrough is the integration of indoor positioning capabilities in 5G-Advanced, achieving centimeter-level accuracy. This is critical for asset tracking, workflow automation and operational efficiency in logistics and Industrial IoT. Key 3GPP advancements include Release 16's precise positioning for IoT and logistics, Release 17's sub-100 ms latency for real-time use, and Release 18's improved accuracy for asset tracking and smart cities.

## **AI-native interfaces for optimized network performance**

AI-native interfaces further optimize network performance by enabling real-time resource management, interference mitigation and energy efficiency. AI-driven adjustments to network parameters enhance reliability and resilience, especially in dynamic environments like enterprise and industrial networks. This intelligent approach also enables faster and more efficient decision-making and troubleshooting, ensuring higher levels of network reliability and resilience in complex, data-sensitive scenarios.



## Outdoor Solutions for High-Capacity Coverage

Nokia's outdoor small cell solutions are designed to handle even the most challenging environments, ensuring high performance even in dense urban areas and high-traffic venues:

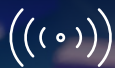
### Shikra mmWave radio

Delivering extreme 5G capacity and performance

Ideal for hotspots, venues, and Fixed Wireless Access (FWA) applications, the Shikra mmWave supports all mmWave frequencies. Its high RF output power and integrated antenna ensure superior coverage and performance, making it a perfect fit for high-capacity areas.



Wide bandwidth  
up to 3200MHz



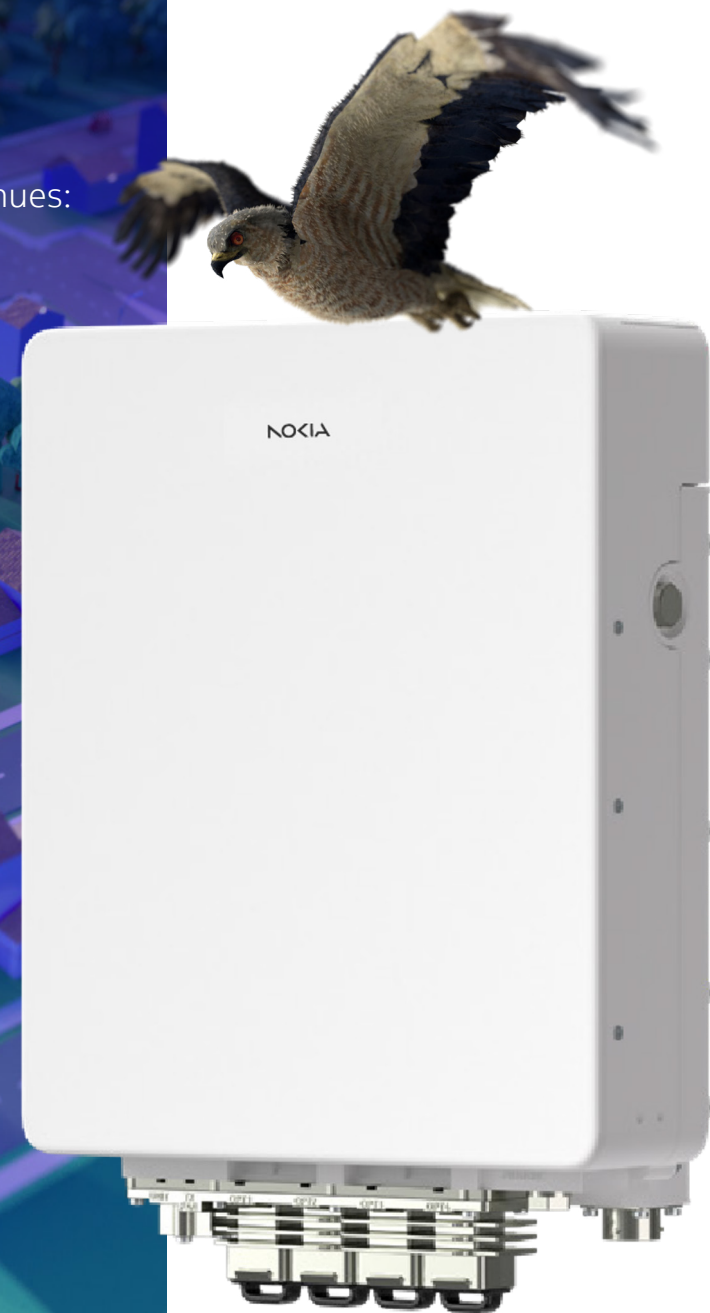
High output power  
66dBm



Compact  
8L / 10kg



Easy to install



## Outdoor Solutions for High-Capacity Coverage

Nokia's outdoor small cell solutions are designed to handle even the most challenging environments, ensuring high performance even in dense urban areas and high-traffic venues:



### Shikra remote radio heads

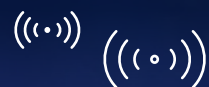
Enabling high performance across various locations



These RRHs offer a wide range of spectrum bands and bandwidth support, making them versatile for both small- and large-scale deployments. Their compact design allows for flexible installation while delivering efficient 5G coverage.



Multi-technology  
Multi-band



Single-band 4 x 20W  
Dual-band 2 x 4 x 20W



Compact  
<10L / 11kg



Easy to install

## Outdoor Solutions for High-Capacity Coverage

Nokia's outdoor small cell solutions are designed to handle even the most challenging environments, ensuring high performance even in dense urban areas and high-traffic venues:

### Kolibri outdoor small cells

Rapid 5G for the outdoor

For small to medium deployments, the Kolibri outdoor small cells offer high-bandwidth and high-capacity performance, with integrated baseband functionality simplifying 5G rollouts. These are ideal for urban and suburban environments where quick and efficient deployment is essential.

010110  
101100  
010111



Integrated  
baseband



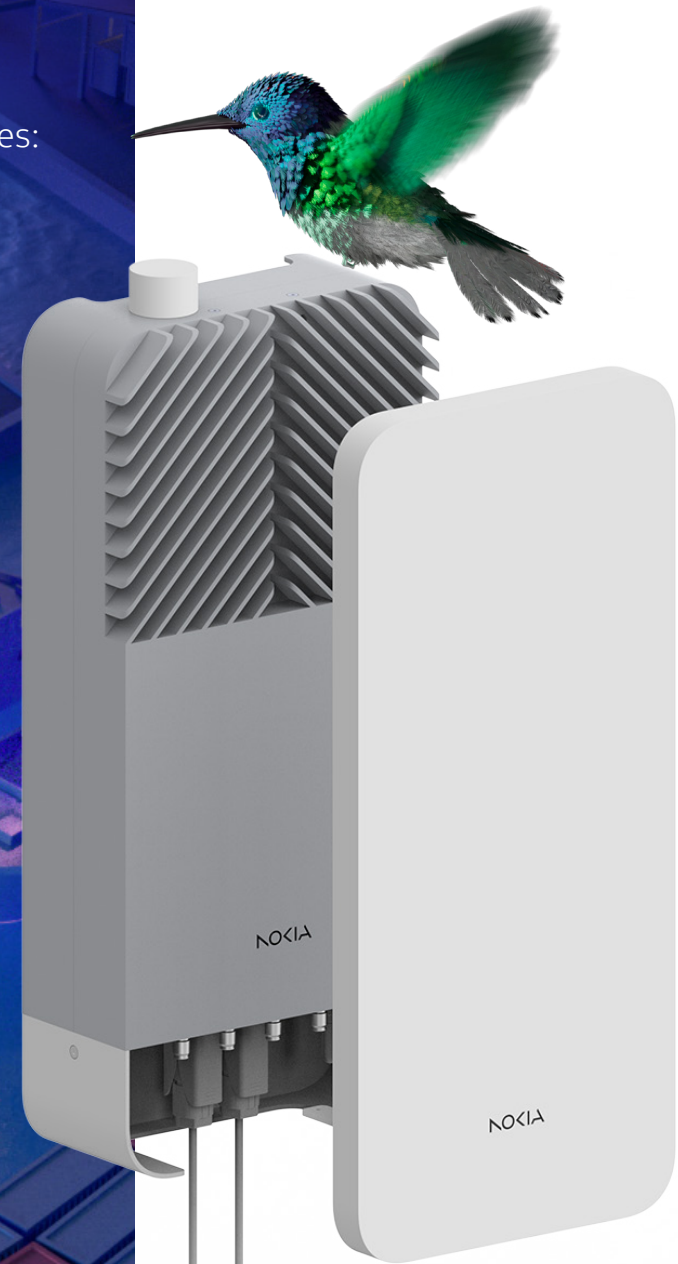
4 x 5W  
128 users



Compact  
12L / 15kg



Plug and play



## Outdoor Solutions for High-Capacity Coverage

Nokia's outdoor small cell solutions are designed to handle even the most challenging environments, ensuring high performance even in dense urban areas and high-traffic venues:

### Kolibri strand mount 5G small cell

Easy CBRS built for outdoors

For cable operators, the **Kolibri strand mount** is tailored specifically for MSOs in the U.S., particularly those using the CBRS band. This solution provides high capacity with 360° coverage, making it a reliable and easy-to-deploy option for expanding 5G services over existing infrastructure.

010110  
101100  
010111



CBRS radio with  
integrated baseband



360° coverage  
4T4R 42dBm



19 x 11.5 x 11.4 in  
33.9lbs



Integrated DOCSIS



## Indoor Solutions for Seamless Coverage

Nokia's indoor small cell solutions are designed to provide seamless, high-performance coverage across a wide range of venues, from enterprise buildings to shopping malls:

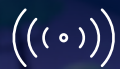
### AirScale indoor radio system with Shikra pico radio (ASiR)

Simplify indoor coverage and capacity

This solution supports a wide range of frequency bands and bandwidths, making it suitable for both small and large indoor environments. Paired with Nokia's AirScale baseband, it offers macro-level performance for indoor deployments.



Multi-technology  
Multi-band



4 x 250mW



Small formfactor  
~2kg / 2L



Scalable with  
baseband options



## Indoor Solutions for Seamless Coverage

Nokia's indoor small cell solutions are designed to provide seamless, high-performance coverage across a wide range of venues, from enterprise buildings to shopping malls:

### Kolibri indoor small cells

Indoor 5G made easy

Perfect for smaller indoor spaces, these small cells provide high-bandwidth, high-capacity 5G connectivity. Their plug-and-play design with Ethernet connectivity ensures quick and easy deployment.

010110  
101100  
010111



Integrated  
baseband



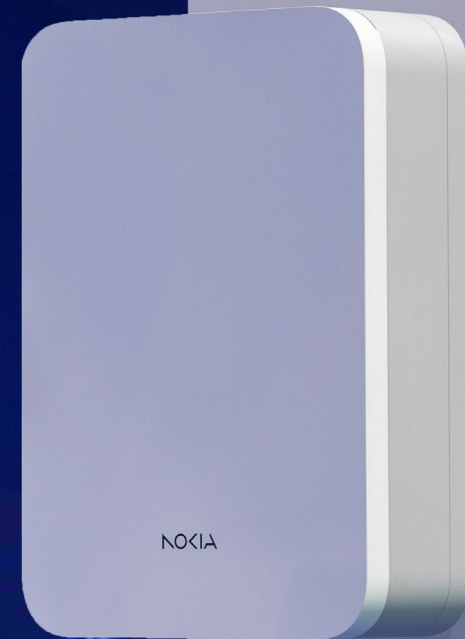
4 x 250mW  
128 users



Easy to install  
4L / 3.5Kg



Plug and play



## Indoor Solutions for Seamless Coverage

Nokia's indoor small cell solutions are designed to provide seamless, high-performance coverage across a wide range of venues, from enterprise buildings to shopping malls:

### Smart Node and Femtocells

Deliver superior and unified indoor service

For small businesses and residential users, these solutions offer reliable 4G/5G connectivity. With modular architecture and plug-and-play installation, they are ideal for smaller-scale deployments that still require robust wireless performance.



High capacity  
64 LTE users /  
32 5G users



Up to 250mW



4.4L / 3.5kg



4G + 5G NSA, SA





## Why Nokia?

Nokia combines extensive experience with its flexible, integrated small cell portfolio, tailored to address the needs of both CSPs and Enterprises. Offering a range of solutions, Nokia simplifies deployment for both indoor and outdoor environments. These solutions ensure efficient management and seamless integration across networks, making them a practical choice for organizations looking to expand or optimize their infrastructure. Nokia stands out for four reasons:

- **Industry-leading deployment experience:** Top analyst companies, such as GlobalData PLC, have recognized Nokia as a leader in their **Small Cells Competitive Landscape**. Nokia has also been acknowledged as the only vendor to have an outdoor all-in-one small cells solution, the Kolibri platform.
- **Comprehensive and diverse solutions:** Nokia provides comprehensive frequency coverage, addressing the demands of high-capacity areas like urban centers and industrial zones. These solutions are designed to handle both single- and dual-band frequencies, offering CSPs the flexibility needed to manage diverse network requirements.
- **Superior flexibility and scalability:** Nokia's focus on flexibility and scalability, including solutions for smaller deployments, allows CSPs and Enterprises to address a wide variety of network challenges while keeping costs manageable. By offering solutions that balance performance, energy efficiency and ease of deployment, Nokia enables businesses to future-proof their networks without sacrificing reliability.
- **Industry-specific expertise for Enterprises:** Nokia has proven success in deploying small cell solutions across multiple industries, including manufacturing, healthcare and logistics, meaning it can be trusted to deliver reliable, customized solutions. This deep industry knowledge ensures Nokia is a trusted partner for Enterprises seeking secure and scalable network deployments tailored to their specific requirements.

With Nokia, both CSPs and Enterprises gain access to competitive small cell solutions that ensure high performance and smooth deployment, helping them to stay competitive and future-ready in the evolving market and landscape.

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# 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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