
# Samsung's Massive MIMO Radios for an Outstanding 5G Experience

Moving towards a sustainable future

# Massive MIMO Radio, the Pivotal Player for Network Enhancement

The radios and antennas in modern cellular networks have always been distinct components. However, advancements in technologies have allowed for smaller components and the move to higher frequency bands, leading to smaller antennas. In turn, the active antenna has emerged, combining the antenna and radio into one unit. Samsung has improved on it further, adding beamforming and higher MIMO layers for increased spectral density and performance. Meet the massive MIMO radio.

Massive MIMO radio revenues are 60~70% of the total 5G mobile communications market in 2021, per Dell'Oro's RAN market forecast.

As the market for massive MIMO radios increases, multiple versions will be needed, based on the frequency and site characteristics in the operators' network. Samsung provides a diverse and advanced massive MIMO radio portfolio to meet market needs.

## How to solve telcos' challenges with the massive MIMO radio

1. **Increasing traffic demand and number of mobile devices**
   Reduce cell congestion with various MIMO modes, including MU-MIMO.

2. **Rising interference due to increased cell density**
   Minimize interference with beamforming technology.

3. **Crowded cell site due to existing antennas and radio units**
   Upgrade site with integrated radio and antenna solution.

4. **Limited coverage expansion from existing radio and infrastructure**
   Extend service coverage including a wider vertical range for high-rise buildings with array antenna gain.

# Samsung's Massive MIMO Radios Span the Full Range

## 1 Higher performance, longer, and wider coverage solution for dense urban environments: 64T64R Massive MIMO Radio

As wireless traffic usage soars and the number of mobile devices continues to rise, user's expectations continue to increase. Samsung's 64T64R massive MIMO radio maximizes 5G performance in the mid-band. The 64T64R supports maximum performance through Multi-user MIMO(MU-MIMO) perfect for congested cells with high population densities and perfectly suited for dense urban areas with high rise buildings by supporting a wide vertical coverage range.

# Samsung's Massive MIMO Radios Span the Full Range

## 2 Optimal performance with slim form factor for urban areas: 32T32R Massive MIMO Radio

When upgrading existing sites with new hardware, space constraints are essential to consider. Samsung's 32T32R massive MIMO radio is compact and easy to install while providing maximum performance and coverage. Samsung has developed the slimmest 32T32R massive MIMO radio in the industry less than 300mm width.

# Samsung's Massive MIMO Radios Span the Full Range

## 3 Flexible solution for multi-band spectrum: FDD Dual-band Massive MIMO Radio

Advanced techniques such as beamforming have been challenging to design in FDD spectrum due to asymmetry of downlink and uplink. Samsung has overcome this challenge to make FDD massive MIMO radio by R&D expertise and experience.

Samsung's FDD dual-band massive MIMO radio enables operators to save on TCO by offering dual-band operations in one unit. And it also provides flexible operations for both LTE and 5G in each band. It offers maximum performance by bi-sector mode when the load is increased. Cell congestion is reduced without the need for a hardware change.

# Samsung's Massive MIMO Radios Span the Full Range

## 4 Consolidating multiple antennas with a massive MIMO radio solution: One Antenna Radio

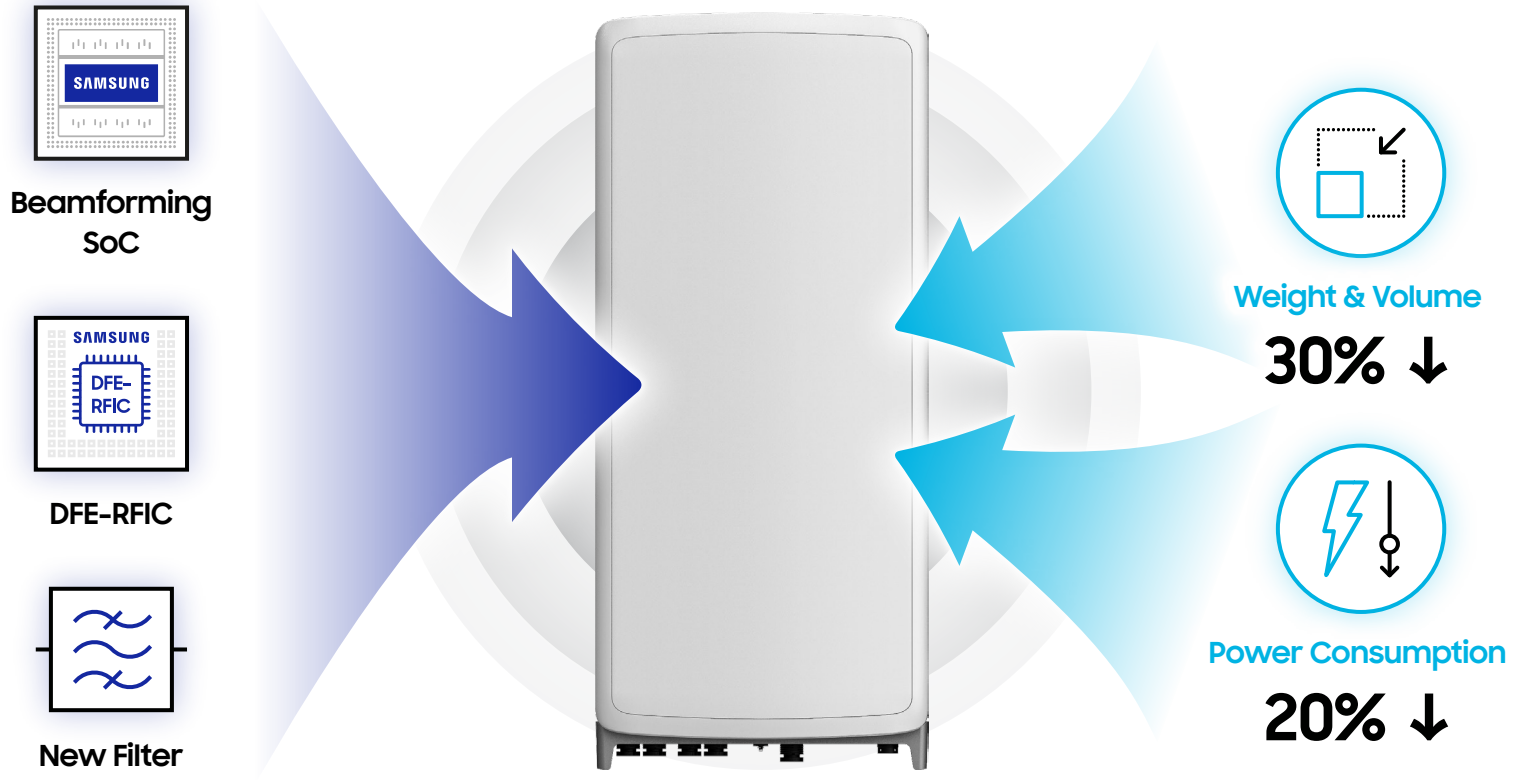
The One Antenna Radio is Samsung's innovative solution for cell sites with space restrictions. It combines a massive MIMO radio with low and mid-band antennas. So, it enables a simplified site upgrade on the low and mid-band 5G.

The One Antenna Radio helps to reduce operational and maintenance costs dramatically by integrating existing bands' antennas. Its interleaved solution between passive antennas and massive MIMO radio in addition to its mechanical integration help to reduce the dimensions of the overall solution.

# Driving Towards a Sustainable Future

## 1 Reduce power and size with in-house chipset and new innovative filter

Samsung's comprehensive portfolio of 5G products includes an in-house chipset designed for radios to increase their capacity and coverage while decreasing power consumption and size. By applying the beamforming SoC, Digital Front End (DFE)-RFIC and new innovative filter, the massive MIMO radio will be lower in size and weight by up to 30%, accompanied by an up to 20% reduction in power consumption compared to the previous generation.

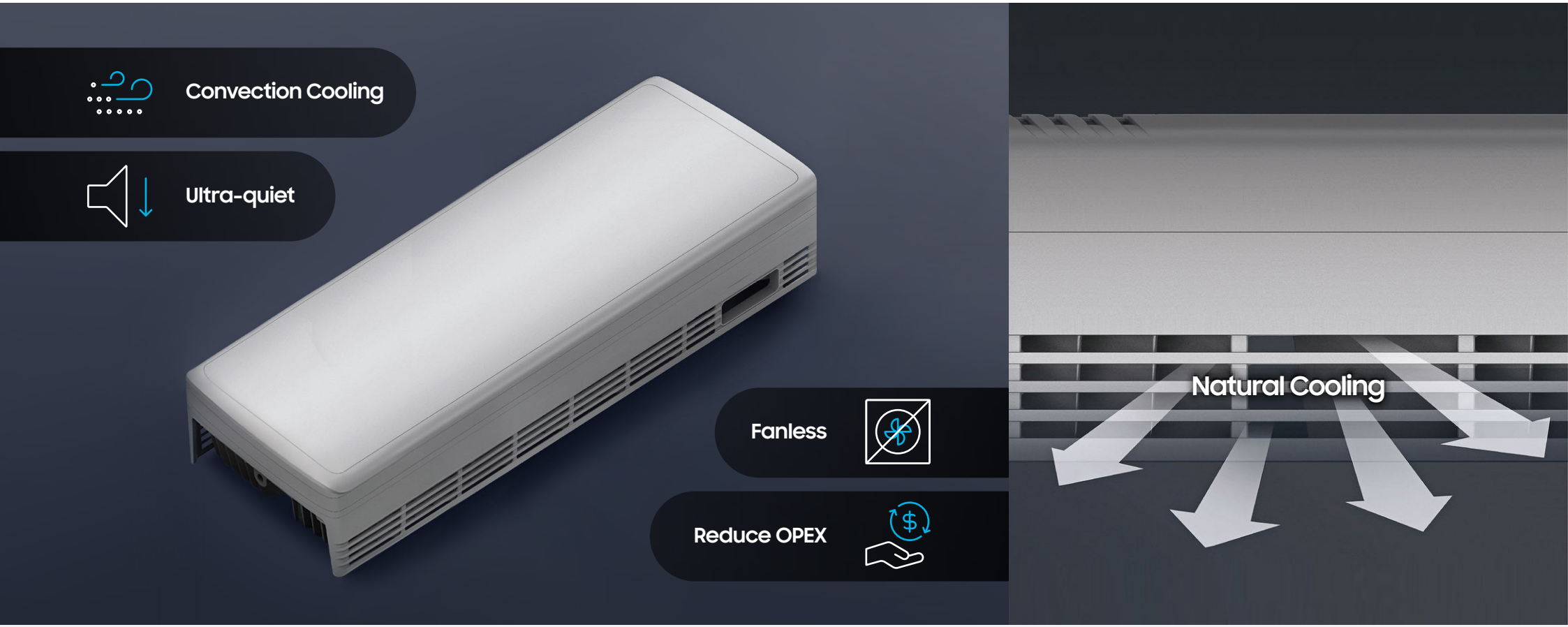


# Driving Towards a Sustainable Future

## 2 Natural convection cooling reduces site visits and maintenance costs

Samsung's massive MIMO radio provides natural convection cooling without the need for a fan, reducing power requirements. The advanced heat dissipation technology also helps reduce the size and weight of the massive MIMO radio.

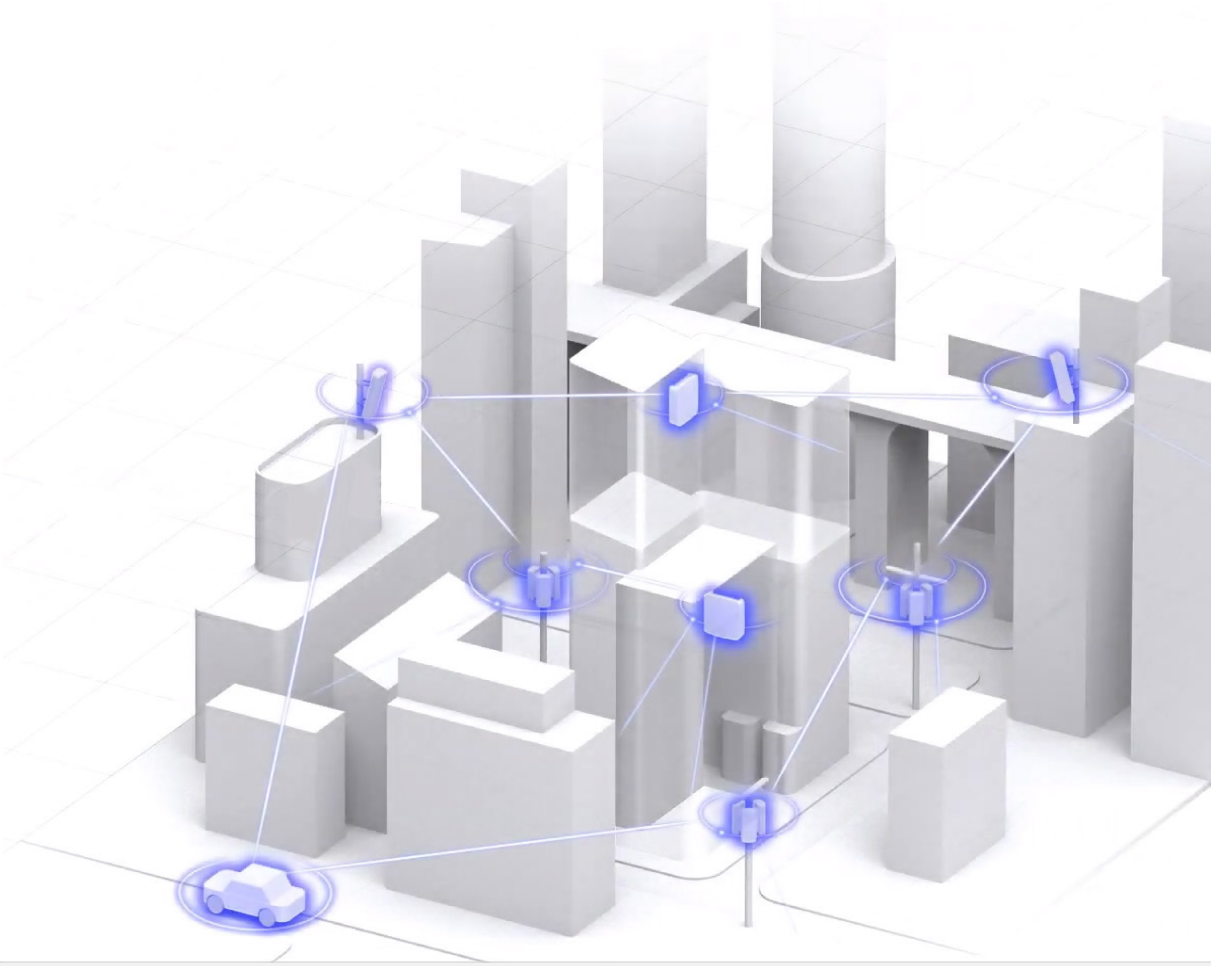
By removing the need for a fan, the ultra-quiet convection cooling system reduces the number of site visits needed for operation and maintenance, helping reduce OPEX.



# Driving Towards a Sustainable Future

## 3 A socially sustainable 5G network ecosystem: iF 2021 Design Award Win

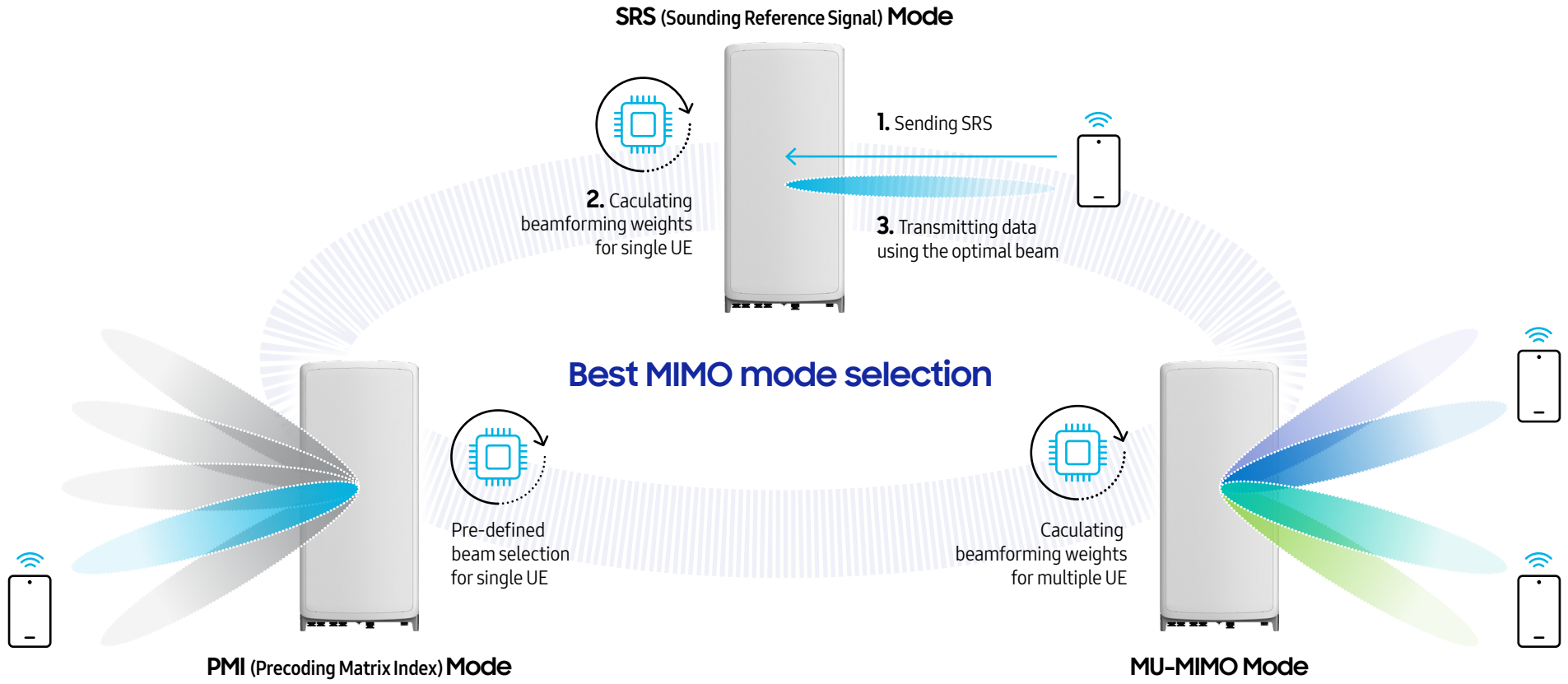
Samsung's 5G Network DI 3.0 (Design Identity 3.0), winner of an iF 2021 World Design Guide for Professional Concepts , solidifies the identity of Samsung network products and presents users with eco-friendly designs. DI 3.0 builds a sustainable 5G network eco with aesthetics and simple design by increasing production efficiency and extending product lifespan. Samsung's massive MIMO radio unified its brand identity with Samsung network products by applying DI 3.0.

# Continuously Evolving Performance

## 1 Optimizing user experience with Samsung's best MIMO mode selection

A user's mobile environment changes rapidly due to obstacles between the user's device and the network as well as the movement of the user, whether the user is stationary, walking, or in a car. These constant changes need to be analyzed continually to provide optimized service to the user.

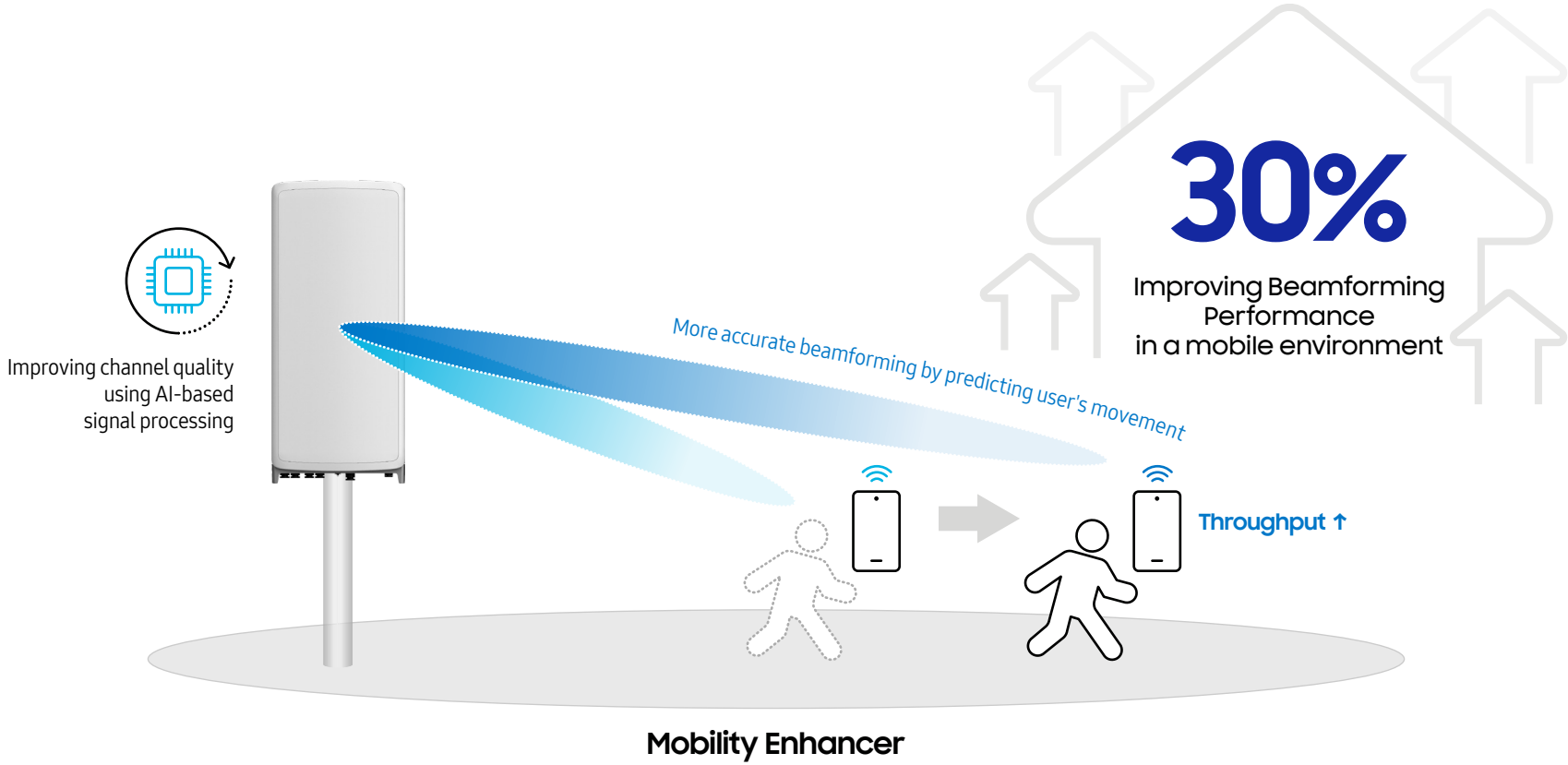


# Continuously Evolving Performance

## 2 Boosting mobile performance with Mobility Enhancer

Samsung recently developed a new technology called "Mobility Enhancer" to improve user performance in mobile environments.

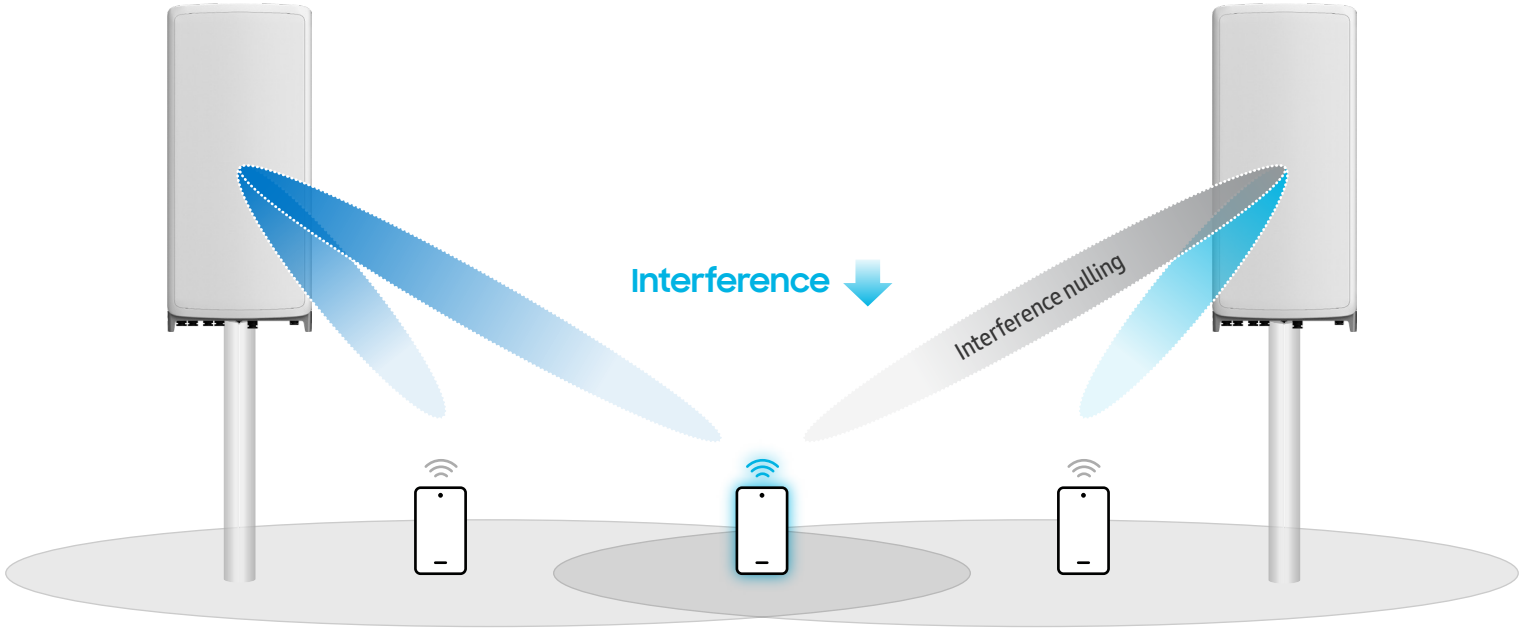
Mobility Enhancer, powered by Samsung's AI and advanced signal processing technology, will enable its massive MIMO radios to improve beamforming accuracy towards a moving user, maximizing the 5G experience. Mobility Enhancer can improve the beamforming performance of massive MIMO radios up to 30 percent for pedestrians.



# Continuously Evolving Performance

## 3 Performance enhancement in the cell boundary using coordinated beamforming

The performance and connection of a mobile user's device are affected by the interference between adjacent cells, particularly in the cell boundary. Samsung's massive MIMO radio supports coordinated beamforming between different cells, dramatically improving devices' performance in the cell boundary.

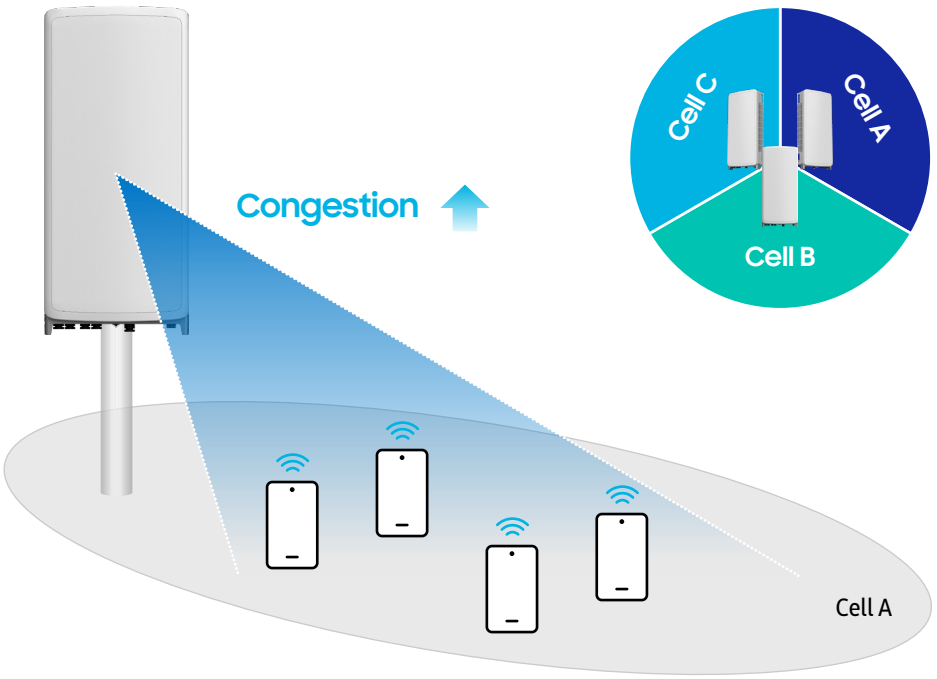



**Coordinated Beamforming**

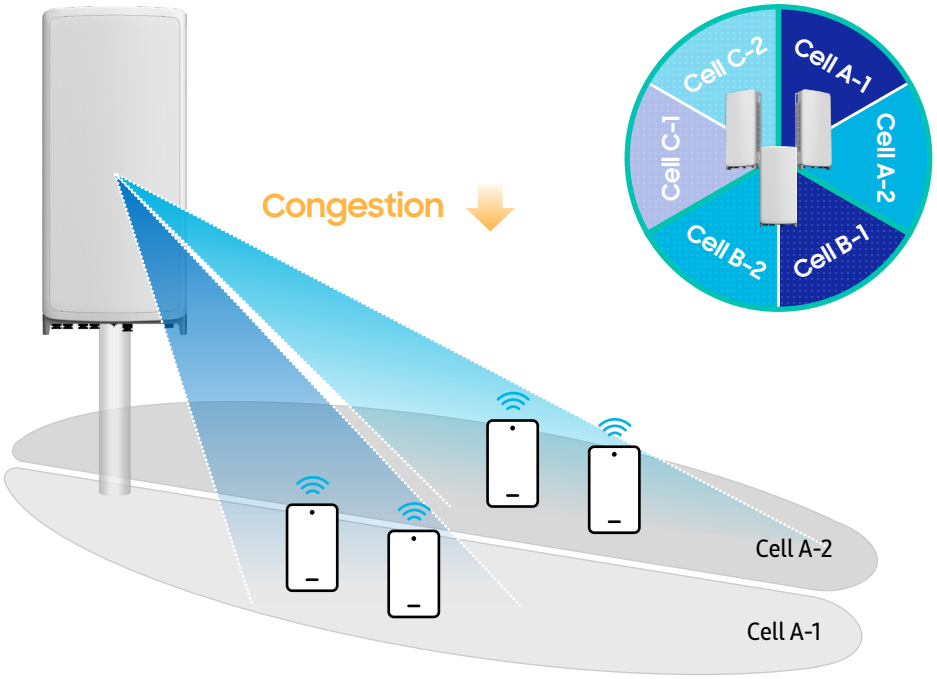
# Continuously Evolving Performance

## 4 Bi-sector mode for reducing cell congestion without hardware change

High traffic cells often require additional equipment in the site. Samsung's FDD massive MIMO radio provides bi-sector mode, reducing congestion without the need for new hardware. The new sectorized cells can re-use radio resources and improve the overall performance of the radio access network.




**Single sector mode**




**Bi-sector mode**

Samsung first developed massive MIMO technology for LTE in 2017 and has provided massive MIMO radios for 5G commercial service since 2018. Samsung provides massive MIMO radios to leading mobile markets, including Korea, the US, and Japan.

It has been succefully commercialized with advanced architecture and competitive features for an outstanding experience.

# Samsung's massive MIMO radio works with its virtual RAN (vRAN) solution an industry first and key milestone in virtualization technology.

# Samsung continues to devote efforts to improving the massive MIMO radio to advance the full 5G ecosystem.

# For more information about Samsung's massive MIMO radios offering, please see the links below:

## Press release:

- **Samsung to Bring Open RAN to Europe with Vodafone UK ('21.6)**
  https://www.samsung.com/global/business/networks/insights/press-release/0611_samsung-to-bring-open-ran-to-europe-with-vodafone-uk/

- **Samsung Achieves Industry First : Expands vRAN Capability to Support C-Band Massive ('21.6)**
  https://www.samsung.com/global/business/networks/insights/press-release/0608_samsung-achieves-industry-first-expands-vran-capability-to-support-c-band-massive-mimo-radio/

- **Samsung Develops New 5G Radio Technology for Efficient 5G Deployments in Mid-Band Spectrum ('21.4)**
  https://www.samsung.com/global/business/networks/insights/press-release/0331_samsung-develops-new-5g-radio-technology-for-efficient-5g-deployments-in-mid-band-spectrum/

- **Samsung and Marvell Unveil New System-on-a-Chip to Advance 5G Networks ('21.3)**
  https://www.samsung.com/global/business/networks/insights/press-release/samsung-and-marvell-unveil-new-system-on-a-chip-to-advance-5g-networks/

- **Samsung Boosts the Performance of Massive MIMO('21.2)**
  https://www.samsung.com/global/business/networks/insights/press-release/0223_samsung-boosts-the-performance-of-massive-mimo/

## Video:

- **Samsung's complete C-band solution portfolio**
  https://youtu.be/3_qvjn-n9b0

- **Samsung's CBRS Family is Providing Proven Quality, Interoperability and Security**
  https://youtu.be/AgKQ6inNojg

- **Powerful Mid-Band 5G Solutions for C-band & CBRS**
  https://youtu.be/HlPysXG_Vj0

## Whitepaper:

- **Massive MIMO for New Radio**
  https://images.samsung.com/is/content/samsung/p5/global/business/networks/insights/white-papers/1208_massive-mimo-for-new-radio/MassiveMIMOforNRTechnicalWhitePaper-v1.2.0.pdf

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Samsung inspires the world and shapes the future with transformative ideas and technologies. The company is redefining the worlds of TVs, smartphones, wearable devices, tablets, digital appliances, network systems, and memory, system LSI, foundry and LED solutions.

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