

The Samsung logo is positioned in the top right corner of the slide. It consists of the word "SAMSUNG" in a bold, white, sans-serif font. The background of the entire slide is a dark, abstract pattern of glowing teal and blue lines that curve and converge towards the center, creating a sense of depth and movement, reminiscent of a data visualization or a futuristic network.

Delivering the Promises of 5G Today

with Samsung's Radio Network Solutions

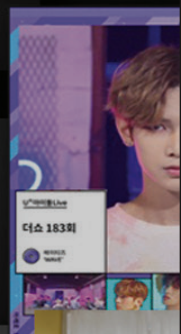
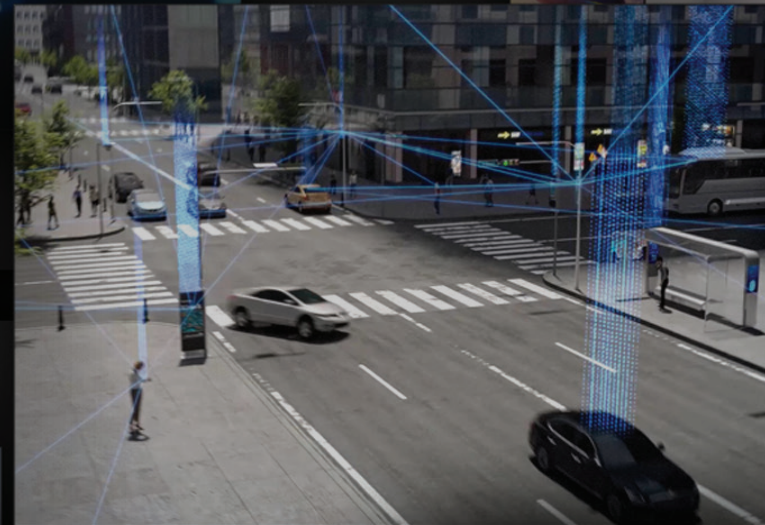
5G Growth Increases the Demand for 5G Innovation

Mobile network operators are now truly experiencing the value of 5G and they are continuing to expand their 5G networks by increasing coverage and optimizing capacity. And, with the higher levels of throughput, operators are enabling new services for consumer as well as enterprise businesses.

Consumers are interested in enhanced entertainment and communication services like UHD video, Virtual Reality (VR), and Augmented Reality (AR), the drivers for B2B opportunities are smart factories, smart cities, smart offices, etc. Overall, new 5G business opportunities are being created around the globe.

While network operators are excited about the growth, they are also intrigued by the challenges that 5G brings. In many cases, building new sites or increasing capacity at existing sites are not simple tasks. These challenges arise from the fact that it is hard to build new sites in urban area and existing sites are already saturated with previous generations of network equipment. Therefore, new Radio Access Network (RAN) equipment must offer performance improvements that meet the coverage and capacity needs in as small of a footprint as possible.

Samsung is leading the industry in 5G innovation. Building on industry-leading designs and leveraging 5G deployment expertise from first-to-deploy experiences, we continue to develop 5G radios and baseband units to offer solutions that meet the demands of mobile network operators.



Samsung Radio Access Network

Peak Performance



Flexible Scalability to Maximize Capacity



Efficient Energy Saving and Cooling Solutions



Easy Installation and Management



Cutting Edge Innovative Technology

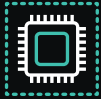


Today's 5G RAN for Tomorrow's Needs

The RAN is the most crucial part of the 5G network. Today's 5G RAN from Samsung provides maximum performance and capacity to enhance user experiences by incorporating cutting-edge technologies such as massive MIMO and mmWave, which offers beamforming at various frequencies. These components have to consider various size and installation environments while accelerating time to market. Samsung's 5G RAN portfolio delivers the promise of a 5G experience that meets the market demands for the foreseeable future.

Peak Performance

In-house Chipsets



Cutting-Edge Technology



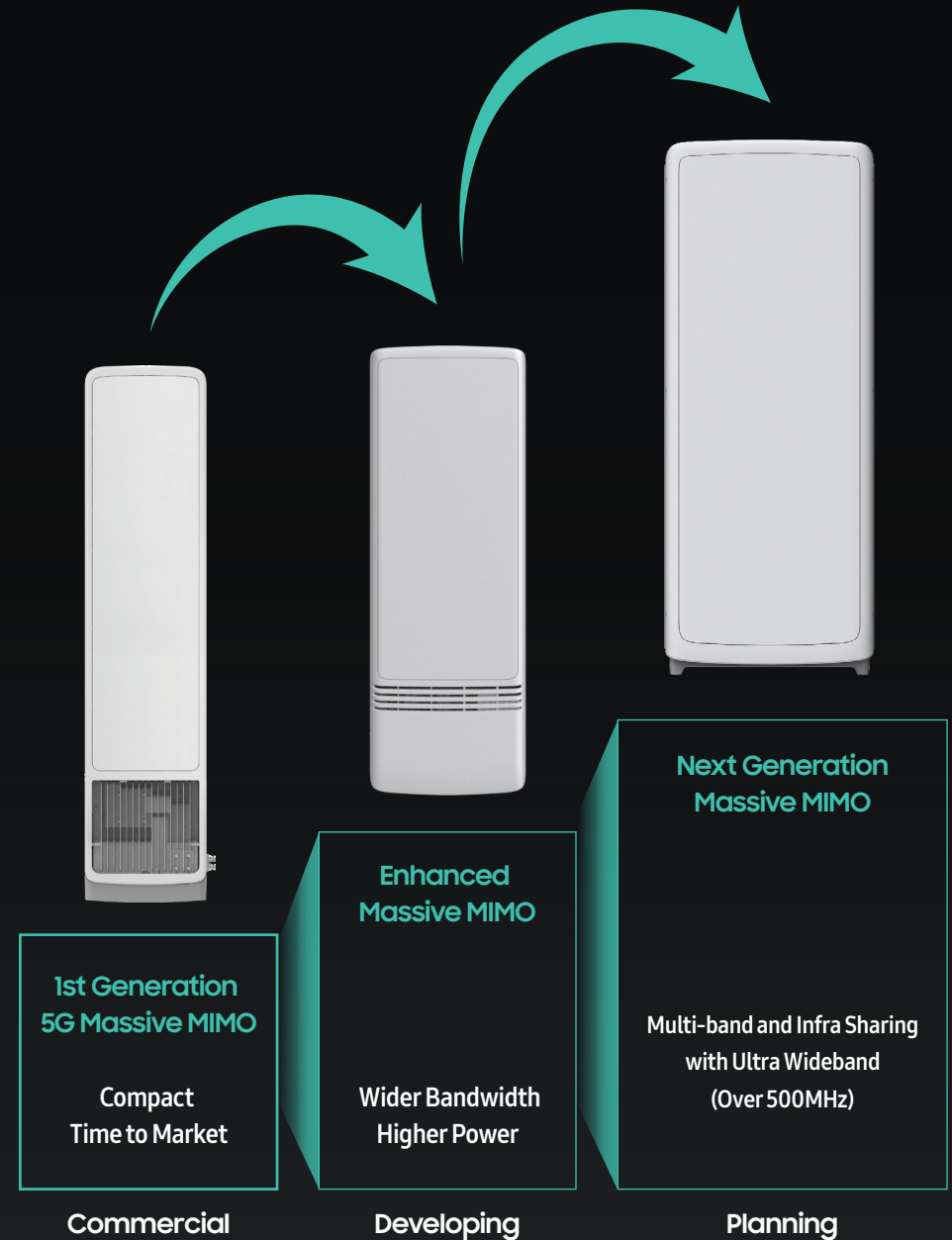
Wide bandwidth



Samsung's in-house chipset is one of the most significant advantages that comes in to play for 5G. Through creative design and technology leadership, Samsung's RAN portfolio provides a full range of products that meet the demanding capacities and varying installation needs required by leading network operators. One of our core competencies is to make our products powerful and compact, which comes from our ability to design and manufacture critical components in-house, including our modem and RFICs. With our SoC modem, the baseband can connect to a large number of radios, including massive MIMO and mmWave solutions, to expand cell capacity. Our in-house RFICs support various spectrum bands ranging, providing operators with the right solutions to meet their different deployment scenarios.

Massive MIMO radios are one of the primary solutions driving commercial 5G, which needs both high-capacity and extensive coverage. These radios use advanced antenna beamforming technologies to gain high throughput and provide broad vertical- and horizontal-oriented service areas. It also provides a flexible beam scan range for various topologies. Massive MIMO radios not only increase cell capacity, but they also leverage the benefits of beamforming gain to increase coverage. Through massive antenna arrays and MU-MIMO, wireless connections are possible to a large number of UEs.

Samsung's mmWave solutions, which maximize 5G capacity and beam scan range, use cutting-edge in-house chipset technology to set a new coverage benchmark with the industry's best-in-class 4x4 MIMO solution. Compact Macro, formerly known as our Access Unit (AU), is an outdoor integrated unit with the antenna, radio and the baseband. It provides hybrid beamforming, an evolved technology that supports both analog and digital beamforming to extend coverage and capacity in the mmWave spectrum with over 1,000 antenna elements.



※ Product Designs are subject to change.

Flexible Scalability to Maximize Capacity



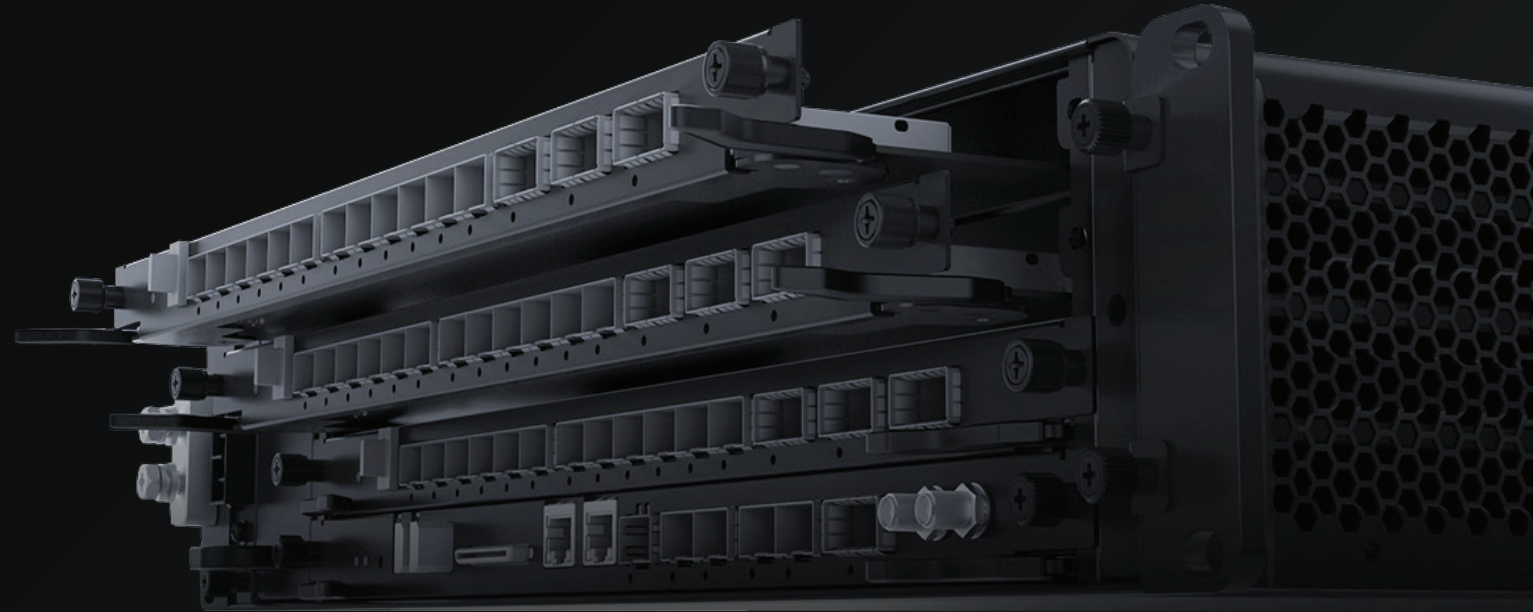
Boost in Capacity
6 times more capacity



Easy Expansion & Upgrade
Up to 3 Cards expandable



Simultaneous LTE/NR Operation
Dynamic Spectrum Sharing



With 5G's high density, flexible scalability is a crucial capability that will help network operators meet market capacity needs. Samsung's baseband can expand capacity within the existing HW platform footprint without the need for additional real estate space. In addition, existing 4G baseband products can upgrade to 5G without a service outage. Dynamic spectrum sharing is an enhanced frequency and time resource coordination feature in LTE and NR. Samsung's RAN supports slot-level spectrum sharing with an integrated scheduler to increase coverage and spectrum utilization. It can provide a smooth migration from LTE to NR for operators.

We continue to build a portfolio that includes multiple radio form factors to meet mobile network operators' coverage requirements. Samsung's radios support various output powers, antenna configurations and spectrum options to help operators deploy and extend their coverage. Particularly, we provide multi-band and wideband radios for site modernization and reducing OPEX.

Samsung's front-haul switch is an innovative future-proof solution in the RAN portfolio. A key feature of the front-haul switch is eCPRI to CPRI conversion. It supports legacy radios so operators can easily connect them with a new baseband based on eCPRI to support higher user bandwidth. Therefore, the front-haul switch helps operators use eCPRI cost-effectively without the need to change legacy radios.

Efficient Energy Saving and Cooling Solutions

Intelligent Energy Saving



Enhanced Cooling Solution



Reducing OPEX



Reducing OPEX is a primary challenge for operators. To provide high performance and comprehensive coverage, 5G requires high processing power and wide bandwidth, which means that saving energy is a significant challenge with 5G.

Samsung's 5G RAN includes an intelligent energy-saving mode that offers energy efficiency and OPEX savings. This mode minimizes the stand-by power of RF-transmit modules without any performance degradation. When the mobile traffic demand is significantly low at a multi-carrier site, Samsung's RAN operates only the minimum number of carriers needed to maintain the coverage. It turns other carriers off to eliminate unnecessary power consumption for both the baseband and radios, saving OPEX.

Samsung specifically designs radios to use natural convection cooling under all loading conditions. Our radios do not require power to maintain its temperature. Our radios operate within a safe temperature range without the use of noisy fans or powered cooling systems. With fan cooling, network operators may have to contend with permitting issues or incremental costs for sound-abatement solutions, and they must consider increased power and regular maintenance work into their operation costs. Moreover, our radios use cutting-edge liquid cooling solutions such as active fin and HCCS (Hyper Conductive Cooling System), which enables the radios to have a smaller form-factor and be more energy-efficient.

Energy Efficiency



OPEX Saving



Intelligent Energy Saving Mode

Dynamic Switch of Power Amplifier

Transmit Paths Sleep

Carrier Switch for Multi-Carrier Site

Easy Installation and Management

Compact Size



Light Weight



Push-pull Connector

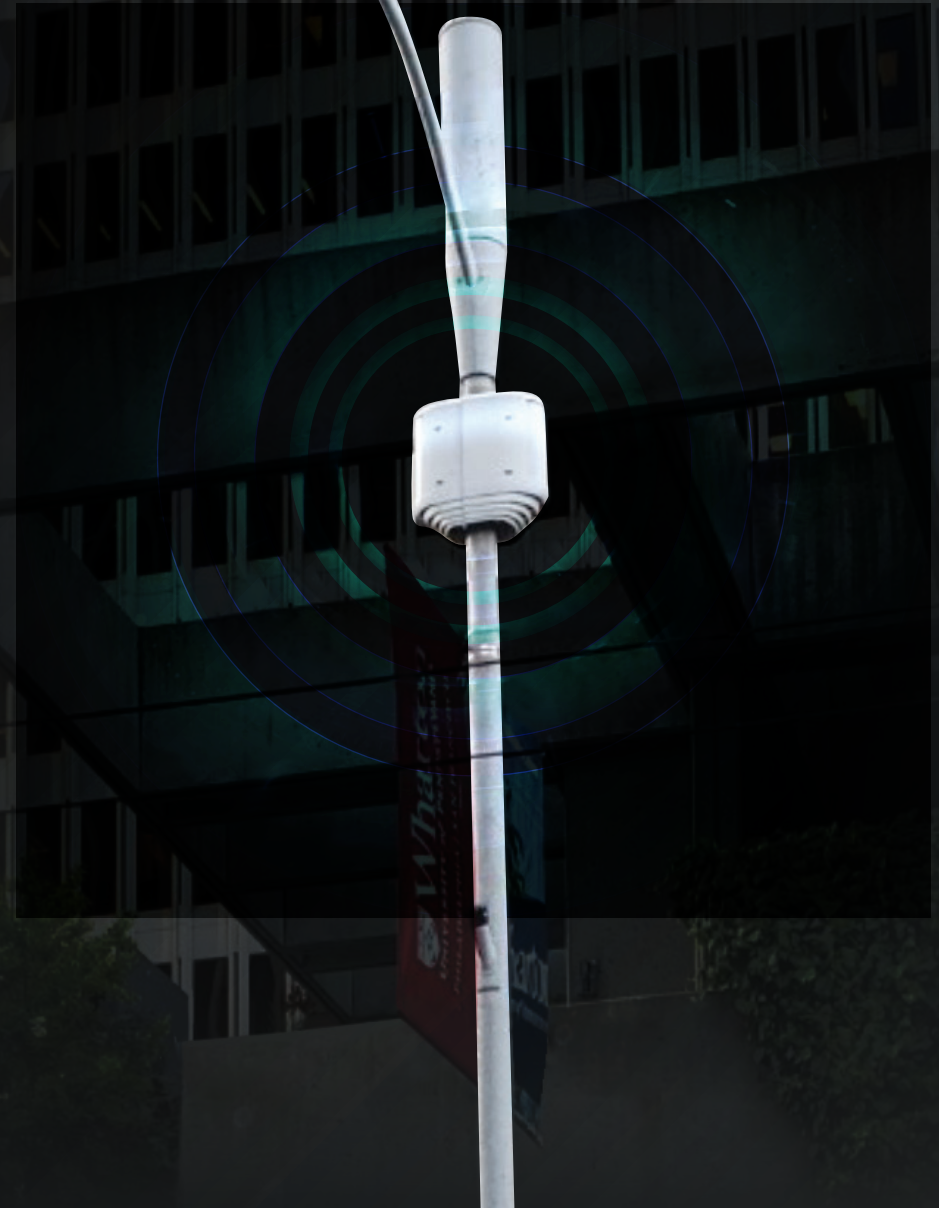


Samsung ensures that quick and easy installation is available for all of our 5G products. Network operators can expedite 5G rollouts with compact and light radios that can be carried by a single technician. Samsung's radios also use easy push-pull connectors to facilitate quick connections, reducing the time needed by the field engineer to complete the installation.

Compact Macro brings together the antenna, radio, and baseband into one compact box to further simplify installation. These sites provide lower TCO by eliminating fiber-based front-haul costs and removing the infrastructure for the baseband. Moreover, it reduces the extra costs for cabling between a baseband, radios, and antennas.

Samsung's mmWave radios are compact and lightweight and designed to blend into the surrounding environment. Coming with a shroud that covers the product, helps it aesthetically blend into the city environment when installed on a streetlamp or utility pole. With two radios mounted together, the solution provides a full 360-degrees of coverage that can effectively offload high data traffic in hotspots and high-traffic areas.

Our centralized operation and management system helps from installation to operation the network easily. We provide user-friendly and work-flow based GUI for automated work process. Thus, network operators can benefit from easy installation and fast deployment as well as lower operation costs.



Cutting Edge Innovative Technology

Dynamic



Efficient



Flexible



Samsung's vRAN solutions provide a new option for mobile operators seeking improved efficiencies and management benefits, gained by deploying a software-based 5G radio infrastructure. Samsung's 5G vRAN consists of a virtualized Central Unit (vCU), a virtualized Distributed Unit (vDU), and a wide range of radios to enable a smooth migration to 5G. By replacing the dedicated baseband hardware used in a traditional RAN architecture with software elements on a general-purpose computing platform, mobile operators can scale 5G capacity and performance with ease, add new features quickly, and have the flexibility to support multiple architectures. In many cases, network operators can introduce new capabilities and increase network capacity without additional changes to the existing hardware. With convenient hardware maintenance and maximized lifecycles, vRAN enables operating their network more efficiently.

vRAN also reduces maintenance costs by moving to an x86 COTS (commercial off-the-shelf) server while matching the reliability of a traditional RAN. COTS servers are standard and readily available computing elements from a vast supplier ecosystem. Real-time processing performance is a guarantee with Samsung's vRAN by adopting various virtualization techniques. To cope with high computational complexity, operators may also choose to add hardware-based baseband function acceleration on an x86 server. The basic fault recovery and redundancy features commonly achievable in the IT domain are not sufficient to meet telco-grade reliability needed in mobile networks. Samsung's vRAN applies enhanced and newly-designed health checks, fault recovery, and geo-redundancy techniques to minimize service outages.

Samsung continues to lead in advancements in the telecommunications industry and next-generation technologies through partnerships with mobile network operators around the world. Building on the first commercial deployments, we drive innovative 5G solutions that comply with the published 3GPP standards.

Mobile network operators can find lucrative opportunities with Samsung's innovative 5G technology. Through numerous collaborations with mobile network operators, to deliver cutting-edge RAN solutions, Samsung has demonstrated its commitment to developing products that will provide efficient and robust solutions for network operators.

At Samsung, we continue to providing valuable solutions to our customers, we are helping them improve their business value. We continue to strive to deliver the promises of the 5G experience to everyone **with Samsung's RAN.**

About Samsung Electronics Co., Ltd.

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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