

# **Exhibit 6**

**EXHIBIT 6 – U.S. Patent No. 9,667,337**

Plaintiff asserts the following “Accused RAN Instrumentalities” infringe the Asserted Claims of U.S. 9,667,337:

- i) Massive MIMO Radio (e.g., 4T4R, 8T8R, 16T16R, 32T32R, 64T64R) for TDD, FDD, dual-band (AWS/PCS);
- ii) Citizens Broadband Radio Service (CBRS) Radio (e.g., 16T16R - C-Band/CBRS Dual-Band (Mid-Band Aggregation));
- iii) Compact Macro Radio (e.g., access unit); and
- iv) 5G Link Cell (e.g., Link Cell, Link HubPro, Link Hub).





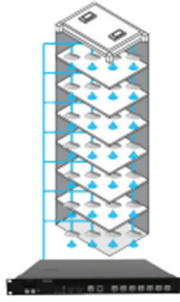
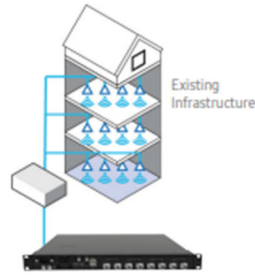
Claim 1	Accused RAN Instrumentalities <sup>1</sup>
<p>[1PRE] A broadband wireless repeater or relay, comprising:</p>	<p>The Accused RAN Instrumentalities act as a wireless repeater to broadcast received wireless signals to connected devices via, for example, a 5G cellular network, and to receive and forward wireless signals received from the connected devices to the Internet via a 5G cellular network.</p> <p>Samsung describes Accused RAN Instrumentalities as “a variety of multi-band Massive MIMO radios, including one that supports both CBRS and C-band, another that supports both low and mid-band frequencies, and another that supports multiple high bands. Samsung’s radios support both FDD and TDD bands, and its multi-band radios can support 2G, 4G and 5G. New to the lineup, is Samsung’s dual-band mmWave Compact Macro, which supports both 28GHz and 39GHz in a small, integrated form factor.”</p> <p>See <a href="https://www.samsung.com/global/business/networks/insights/blog/0822-the-power-of-multi-band-radios-unlocking-faster-speeds-better-coverage-and-a-smaller-footprint/">https://www.samsung.com/global/business/networks/insights/blog/0822-the-power-of-multi-band-radios-unlocking-faster-speeds-better-coverage-and-a-smaller-footprint/</a></p> <p>Massive MIMO Radio:</p>

<sup>1</sup> Unless indicated otherwise, the evidence cited in this table is representative of the operation of the Accused RAN Instrumentalities and upon information and belief, the Accused RAN Instrumentalities function in a substantially similar manner for purposes of this chart.

	<p><b>Massive MIMO Radio</b></p> <p>Samsung’s Massive MIMO Radios are a crucial part of 5G networks. With cutting-edge technologies our solution provides a vast level of coverage, capacity and performance with an optimal form factor.</p> <p>See <a href="http://www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/">www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/</a>; and <a href="https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/">https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/</a></p> <p>Citizens Broadband Radio Service (CBRS) Radios:</p> <p><b>CBRS</b></p> <p>Enterprises with access to CBRS have an efficient way to build private networks that can open up new business opportunities using the mid-band frequency.</p> <p>CBRS Radios enable communication of 150MHz of shared spectrum in Band 48 (otherwise known as the 3.5GHz C-Band).</p> <p>See <a href="https://insights.samsung.com/2022/11/04/what-is-cbrs-and-how-is-it-transforming-enterprise-networks-2/">https://insights.samsung.com/2022/11/04/what-is-cbrs-and-how-is-it-transforming-enterprise-networks-2/</a>; <a href="https://www.samsung.com/global/business/networks/products/radio-access/cbrs/">https://www.samsung.com/global/business/networks/products/radio-access/cbrs/</a>; and <a href="https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/">https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/</a></p> <p>Compact Macro:</p> <p><b>Compact Macro</b></p> <p>Samsung’s Compact Macro integrates mmWave 5G technical innovations into a single form factor. It supports all frequencies within the mmWave spectrum and boasts high performance, low power consumption, compact size and light weight.</p> <p>See <a href="https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/">https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/</a>; and <a href="https://www.samsung.com/global/business/networks/insights/brochures/1221-5g-fixed-wireless-access-a-powerful-">networks/insights/brochures/1221-5g-fixed-wireless-access-a-powerful-</a></p>
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alternative-to-fiber-to-the-home/5g-fixed-wireless-access-a-powerful-alternative-to-fiber-to-the-home.pdf

The Samsung 5G Link Cell products include at least the Link Cell, Link HubPro, and Link Hub.

<b>Link Cell</b> Compact & Integrated Solution	<b>Link HubPro</b> Simple & Scalable Solution	<b>Link Hub</b> Fast & Easy Upgrade to 5G
		
 <p data-bbox="840 1079 1039 1104">Enterprise and Hotspot</p>	 <p data-bbox="1207 1079 1459 1128">Large and IT-friendly Building with Ethernet or Optic</p>	 <p data-bbox="1606 1079 1837 1128">Small to Medium Building with Existing DAS Solution</p>

<https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/brochures/bringing-5g-indoors-the-critical-next-step-in-5gs-evolution/Samsung-Link-Series.pdf>

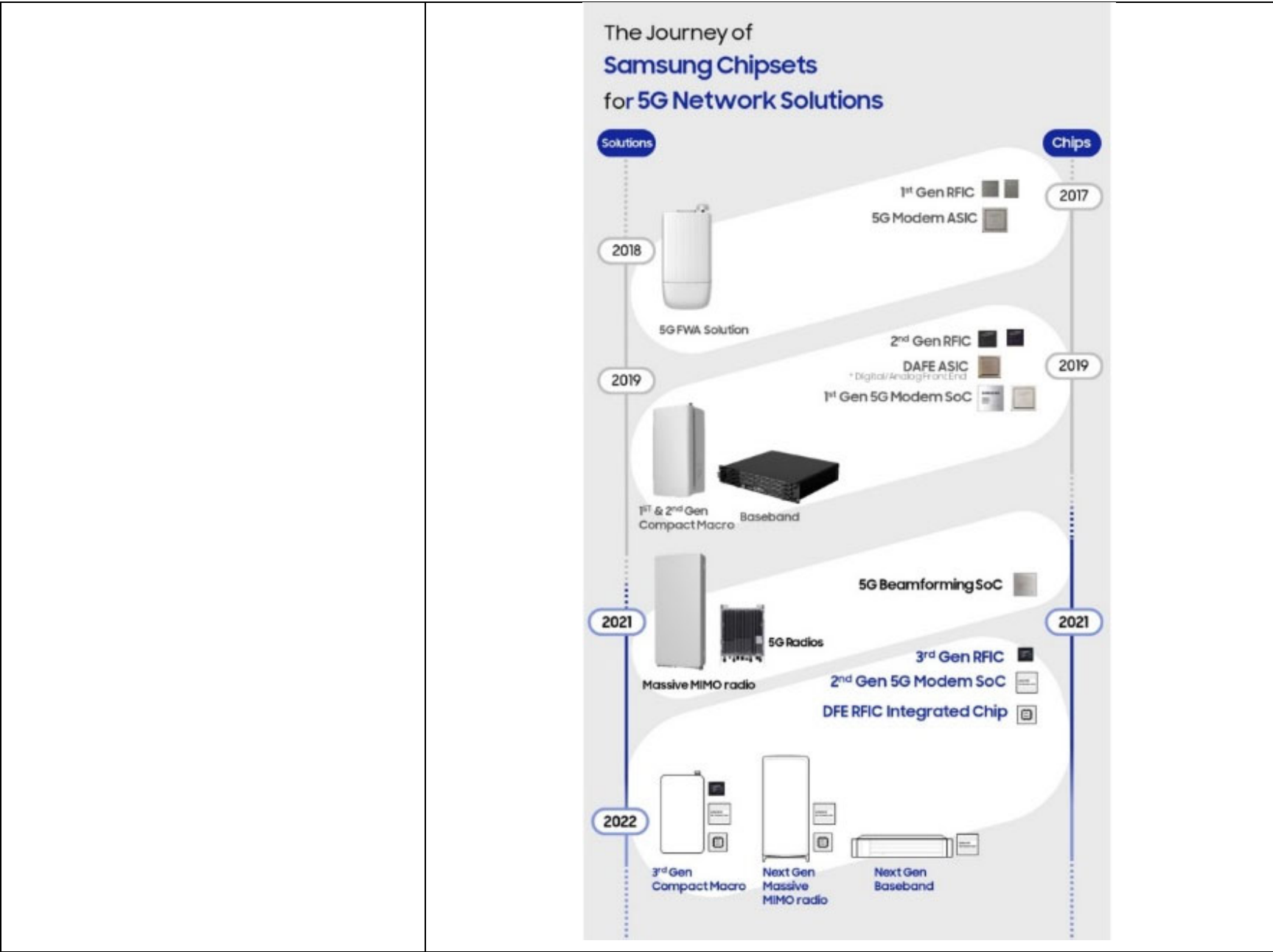
<https://news.samsung.com/us/5g-indoor-mmwave-small-cell/>

	<p>Samsung describes the Link Cell as supporting “strong 5G performance in the mmWave spectrum for indoor applications. The product has integrated the baseband, radio and antenna into a single unit, connecting back to the network via fiber. Despite its small form factor, Samsung’s Link Cell provides Gbps data throughput and is suitable for hotspots and high traffic areas, where high capacity and low latency are a necessity.” See <a href="https://www.samsung.com/global/business/networks/products/radio-access/indoor-solutions/">https://www.samsung.com/global/business/networks/products/radio-access/indoor-solutions/</a></p> <p>Samsung describes the Link HubPro as providing “scalable indoor deployment for both LTE and 5G. The solution is comprised of indoor radio units and a radio hub connected through PoE which enables easier installation as the indoor radio doesn’t require extra power cables. Moreover, operators can design the number of indoor radios and hubs to be linked. Furthermore, the multiple indoor radios can act as single cell to widen 5G coverage, and later they can be used as individual cells to secure performance and coverage for hotspot areas. Therefore Link HubPro can be a coverage expansion solution for large venues such as office buildings or subway stations at early deployment stage and later a capacity solution to adapt increasing traffic demands.” See <i>id.</i></p> <p>Samsung further describes the Link Hub as “a radio interface unit that bridges the baseband unit and the passive DAS headend, converting data traffic into radio signals for the DAS system. It supports both LTE and 5G with dual-band or single-band options for low and mid-band spectrums. If a building already has an existing DAS system, operators can easily upgrade their indoor network to 5G and reuse legacy infrastructure to save both time and cost.” See <i>id.</i></p>
<p>[1A] at least one receiver or transceiver for signal or data reception from one or more devices;</p>	<p>The Accused RAN Instrumentalities include a receiver or transceiver for signal or data reception from one or more devices.</p> <p>For example, the Accused RAN Instrumentalities comprise a mmWave Radio Frequency Integrated Circuit (RFIC) chipsets, which comprise at least one receiver or transceiver for signal or data reception from a connected device, over a 5G cellular network.</p>

**SEOUL, Korea – June 22, 2021** – Samsung Electronics. Co., Ltd. today unveiled a range of new chipsets that will be embedded into the company's next generation 5G solutions. The new 3GPP Rel.16 compliant chipsets consist of a third generation mmWave Radio Frequency Integrated Circuit (RFIC) chip, a second generation 5G modem System-on-Chip (SoC), and a Digital Front End (DFE)-RFIC integrated chip. The company's latest chips will power Samsung's next-generation products for 5G build out, including the next generation 5G Compact Macro, Massive MIMO radios, and baseband units, which will all be commercially available in 2022.

See [www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/](http://www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/)

An integrated circuit package (e.g., 5G system-on-a-chip) may comprise a plurality of functionalities within a single IC package such as signal encoding/decoding by a modem, frequency tuning by a front-end module, and/or transmitter/receiver by a transceiver. The IC is in communication with one or more antennas or an antenna array to wirelessly transmit and receive wireless data over a cellular network.



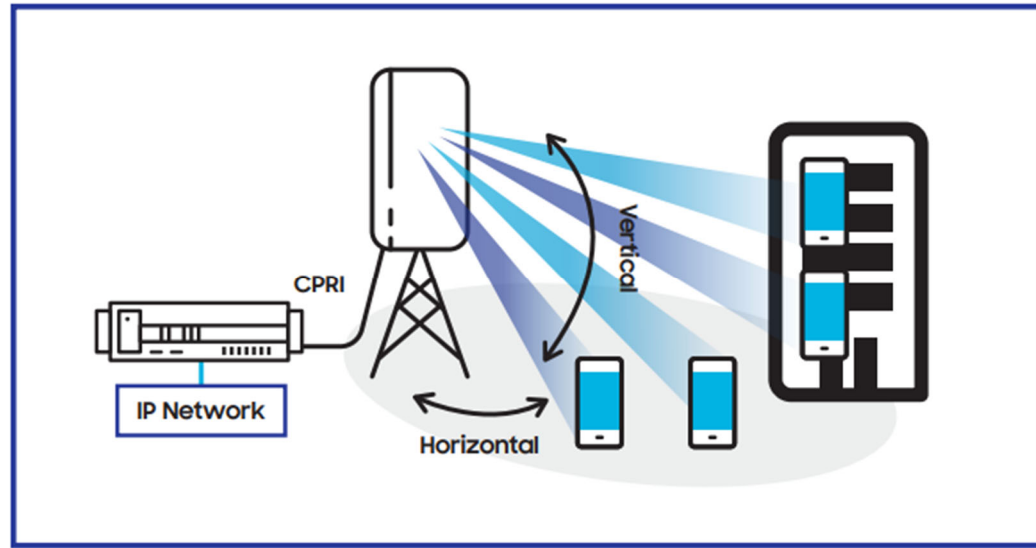
<p>[1B] at least one transmitter or transceiver for signal or data transmission to one or more devices, wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and</p>	<p>The Accused RAN Instrumentalities include a transmitter or transceiver for signal or data transmission to one or more devices.</p> <p>For example, the RFIC chipsets in the Accused RAN Instrumentalities include at least one transmitter or transceiver for signal or data transmission to the connected device.</p> <p>See <a href="http://www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/">www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/</a></p> <p>See claim element [1A] above.</p>
<p>[1C] a controller that is configured or configurable for operation in one or more wireless networks,</p>	<p>The Accused RAN Instrumentalities include a controller that is configured or configurable for operation in a cellular network (e.g., 4G LTE or 5G), which are wireless networks.</p> <p>The Accused RAN Instrumentalities include a controller (e.g., chipset, processor) configurable for operation in a cellular network (e.g., 4G-LTE, 5G). For example, the controller of the Accused RAN Instrumentalities is configured to support wireless communication in at least the 28GHz and 39GHz spectrum bands (i.e., mmWave).</p> <p>See <a href="https://www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/">https://www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/</a>; and <a href="https://www.ericsson.com/en/ran/massive-mimo">https://www.ericsson.com/en/ran/massive-mimo</a></p> <p>In another example, the controller in the Accused RAN Instrumentalities can be programmed with an ID for the connected device. The ID can be, for example, the IMEI (International Mobile Equipment Identity) number, the IMSI (International Mobile Subscriber Identity) number, the IP address, and/or the MAC address of the connected ultrawideband device. The Accused RAN Instrumentalities use the connected device’s ID in order to communicate with the connected device via 5G.</p> <p>See <a href="http://amit-khandelwal.medium.com/understanding-5g-eab4a660d3ab">amit-khandelwal.medium.com/understanding-5g-eab4a660d3ab</a>; and <a href="http://interlir.com/2024/08/01/the-impact-of-5g-on-ip-resource-management/">interlir.com/2024/08/01/the-impact-of-5g-on-ip-resource-management/</a></p> <p>See claim element [1C] below.</p>

<p>[1D] said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,</p>	<p>The controller in the Accused RAN Instrumentalities communicates with t the cellular module (e.g., 5G transceiver) for data reception and transmission via cellular networks. The controller communicates with the Wi-Fi module and/or the cellular module for signal processing, decoding, controlling application data, and signal I/O management.</p> <p>An integrated circuit package (e.g., 5G system-on-a-chip) may comprise a plurality of functionalities within a single IC package such as signal encoding/decoding by a modem, frequency tuning by a front-end module, and/or transmitter/receiver by a transceiver. The IC is in communication with one or more antennas or an antenna array to wirelessly transmit and receive wireless data over a cellular network.</p> <p>For example, Samsung describes their Compact Macro products as including “over 1,000 antenna elements in the product to supports wide coverage, creating precise sharp beams to better target mobile users. With these advancements, Samsung is able to overcome the perceived limitations of mmWave spectrum and offer mobile operators a path to provide stable mmWave 5G services.”</p> <p>See <a href="https://www.samsung.com/global/business/networks/products/radio-access/access-unit/">https://www.samsung.com/global/business/networks/products/radio-access/access-unit/</a></p> <p>See claim elements [1E], [1G], and [1H] below.</p>
<p>[1E] wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,</p>	<p>The receivers and transmitters of the Accused RAN Instrumentalities support 5G cellular networks, which has NR bands that have a bandwidth of 100 MHz or more (e.g., n41, n48, n77, n78, n79, n90, n257, n258, n259, n260, n261 bands).</p> <p>In one example, 5G mmWave Fixed Wireless Access (FWA) devices can achieve transmission speeds of up to 1.75 Gbps (e.g., a data transmission rate of 100 Mbps or more).</p> <p>See <a href="https://news.samsung.com/global/samsung-electronics-reaches-top-speeds-over-10km-distance-for-5g-mmwave-in-australia">https://news.samsung.com/global/samsung-electronics-reaches-top-speeds-over-10km-distance-for-5g-mmwave-in-australia</a></p> <p>In another example, Samsung’s website describes the Accused RAN Instrumentalities, for CBRS Radios, that “operate over the entire CBRS Spectrum of 150MHz and can simultaneously transmit a combination of contiguous or non-contiguous 10 or 20MHz carriers, across the entire CBRS Band for both PAL and GAA, up to 100MHz.”</p>

	<p>See <a href="https://www.samsung.com/global/business/networks/products/radio-access/cbrs/">https://www.samsung.com/global/business/networks/products/radio-access/cbrs/</a></p>
<p>[1F] wherein said broadband wireless repeater or relay is connected or connectable to one or more network backbones for connecting said one or more wireless networks with said one or more network backbones,</p>	<p>The controller in the Accused RAN Instrumentalities is connected or connectable to one or more network backbones for connecting said one or more wireless networks with said one or more network backbones.</p> <p>“one or more wireless networks” refer to cellular networks (e.g., 4G-LTE or 5G) provided by the Accused RAN Instrumentalities.</p> <p>“one or more network backbones” refer to computer networks connected and the 5G RAN via the wired connections.</p> <p>The Accused Hotspot Devices are connected to or connectable to a wide area network through a wired or wireless connection through a backend of a cellular network (e.g., 4G-LTE or 5G).</p> <p>See claims [2] and [3] below.</p>
<p>[1G] wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and</p>	<p>The Accused RAN Instrumentalities are at least used to support connectivity and/or position location capabilities by providing IP network connectivity for mobile devices connected via the 5G RAN via the cellular network provided by the Accused RAN Instrumentalities.</p> <p>For example, the Accused RAN Instrumentalities use Round Trip Time (RTT) (IEEE 802.11mc) to measure the latency between a connected device to the wireless access points by timing how long it takes for a signal to travel to the access point and back. RTT information is used to diagnose network connectivity issues and support QoS.</p> <p>See <a href="https://www.cmu.edu/scs/edgecomputing/articles/5g-network-article.html">https://www.cmu.edu/scs/edgecomputing/articles/5g-network-article.html</a></p> <p>In another example, the Accused RAN Instrumentalities use beamforming to support “fewer dropped sessions as they hand over to a new cell.”</p> <p>See <a href="https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/white-paper/samsung-delivers-the-promises-of-massive-mimo/white-paper_samsung-delivers-the-promises-of-massive-mimo.pdf">https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/white-paper/samsung-delivers-the-promises-of-massive-mimo/white-paper_samsung-delivers-the-promises-of-massive-mimo.pdf</a></p>

	<p>In another example, Samsung’s website states “Samsung’s Massive MIMO Radios are a crucial part of 5G networks. With cutting-edge technologies such as 3D beamforming and higher MIMO layers, our solutions provide a vast level of coverage, capacity and performance with an optimal form factor to support an easier installation process. Our diverse line-up of products are ready to meet the challenges of a complex 5G network like supporting the continuous growth of traffic and users.”</p> <p>See <a href="https://www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/">https://www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/</a></p> <p>Samsung’s website further states, “[t]o maximize 5G performance in the mid-band, Samsung’s 64T64R Massive MIMO Radios make full use of innovative technologies such as multi-user MIMO.” See <i>id.</i></p>
<p>[1H] wherein said controller is configured or configurable to perform or for performing at least one of:</p> <p>a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; and</p> <p>b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources.</p>	<p>The Accused RAN Instrumentalities include a controller that performs elements (a). The controller performs elements (a) by at least ignoring or filtering signals received by the connected device.</p> <p>The controller performs elements (a) by at least ignoring or filtering signals received from an undesired transmitters, users, networks, data sources, or noise sources.</p> <p>In one example, the controller of the Accused RAN Instrumentalities ignores and/or filters signals to filter noise sources and interference through beamforming and spatial filtering.</p>

LTE Advanced introduced advanced beamforming as a capability that helps massive MIMO antenna systems optimize spectral efficiency, support groups of users in an area, and reduce interference. Technically, radio resources operate in two dimensions – time and frequency, and beamforming adds a third – spatial filtering. With beamforming, a base station is now aiming what it is transmitting in a particular direction instead of broadcasting the signal across a much larger area. Early implementations focused beams in horizontal patterns, but Samsung’s solution creates a 3-dimensional beam by adjusting vertical and horizontal transmissions to aim the signal towards the users, similar to a focused beam of light created by a searchlight.



See [images.samsung.com/is/content/samsung/assets/global/business/networks/insights/white-paper/samsung-delivers-the-promises-of-massive-mimo/white-paper\\_samsung-delivers-the-promises-of-massive-mimo.pdf](https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/white-paper/samsung-delivers-the-promises-of-massive-mimo/white-paper_samsung-delivers-the-promises-of-massive-mimo.pdf)

In another example, the Accused RAN Instrumentalities “incorporates zero-forcing beamforming (ZFBF) to minimize interference that would otherwise be caused by overlapping of signals of adjacent beams.” See <https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/case-study/samsung-16-layer-massive-mimo-increases-cell-capacity-in-commercial->

	<p>network/samsung-16-layer-massive-mimo-increases-cell-capacity-in-commercial-network.pdf</p> <p>See claim element [1G] above and claim [17] below.</p>
<b>Claim 2</b>	<b>Accused RAN Instrumentalities</b>
<p>2. The broadband wireless repeater or relay of claim 1, wherein at least one of said one or more network backbones to which said controller is connected or connectable is a wired backbone.</p>	<p>The Accused RAN Instrumentalities comprise physical connection interfaces (e.g., wired connections) for input and/or output connections.</p> <p>In one example, the physical connection interfaces allow the controller of the Accused RAN Instrumentalities to establish communication with the backbone through the backhaul of a RAN.</p> <p>See <a href="https://dgtlinfra.com/what-is-backhaul-wired-wireless-fiber-ethernet/">https://dgtlinfra.com/what-is-backhaul-wired-wireless-fiber-ethernet/</a></p>
<b>Claim 3</b>	<b>Accused RAN Instrumentalities</b>
<p>3. The broadband wireless repeater or relay of claim 2, wherein said wired backbone is selected from a group consisting of T1, T3, DSL, cable, cable modem, fiber, optical cable, copper lines, coax, phone, ethernet, and internet.</p>	<p>The Accused RAN Instrumentalities comprise physical connection interfaces for input and/or output connections through at least ethernet and optical fiber cables to connect to a wired backbone.</p> <p>See claim [2] above.</p>
<b>Claim 6</b>	<b>Accused RAN Instrumentalities</b>
<p>6. The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform a).</p>	<p>The controller of the Accused Hotspot Instrumentalities is configured or configurable to ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources, as described in a) of element [1H].</p> <p>See claim elements [1G] and [1H] above and claim [17] below.</p>

Claim 8	Accused RAN Instrumentalities
<p>8. The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform network provisioning or monitoring.</p>	<p>The controller of the Accused RAN Instrumentalities is configured or configurable to perform network provisioning or monitoring with one or more wireless devices.</p> <p>For example, the controller of the Accused RAN Instrumentalities is configured or configurable for network resource allocation by provisioning network bandwidth for multiple users in the same frequency and time slot.</p> <p>In another example, the Accused RAN Instrumentalities are configurable for network slicing to virtually partition network resources for certain applications or traffic types.</p> <p>See <a href="https://www.ericsson.com/en/blog/2023/10/network-slicing-for-5g-success">https://www.ericsson.com/en/blog/2023/10/network-slicing-for-5g-success</a></p> <p>See also claim [9] below.</p>
Claim 9	Accused RAN Instrumentalities
<p>9. The broadband wireless repeater or relay of claim 8, wherein the network provisioning or monitoring includes one or more of:</p> <p>i) bandwidth or delay provisioning of repeated or relayed transmissions,</p> <p>ii) application prioritization,</p> <p>iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and</p> <p>iv) monitoring or measuring traffic from one or more devices, users or networks.</p>	<p>The network provisioning and monitoring for the Accused RAN Instrumentalities includes one or more of: i) bandwidth or delay provisioning of repeated or relayed transmissions, ii) application prioritization, iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and iv) monitoring or measuring traffic from one or more devices, users or networks.</p> <p>For example, the Accused RAN Instrumentalities perform provisioning or monitoring of “i) bandwidth or delay provisioning of repeated or relayed transmissions,” through the use of traffic buffering (e.g., hybrid ARQ, packet queuing, and transmission scheduling).</p> <p>In another example, the Accused RAN Instrumentalities perform provisioning or monitoring with “ii) application prioritization” or “iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth,” through the use of traffic prioritization (e.g., 4G QoS class identifiers, 5G QoS indicators).</p> <p>In another example, the Accused RAN Instrumentalities perform “iv) monitoring or measuring traffic from one or more devices, users or network,” through the use of traffic shaping.</p>

	See also claim [8] above.
<b>Claim 11</b>	<b>Accused RAN Instrumentalities</b>
11. The broadband wireless repeater or relay of claim 1, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in half duplex.	The receiver and/or the transmitter of the Accused RAN Instrumentalities are configured to transmit or receive signals in half-duplex signal modulation through cellular networks (e.g., 4G-LTE or 5G).
<b>Claim 17</b>	<b>Accused RAN Instrumentalities</b>
[17] The broadband wireless repeater or relay of claim 1, wherein said repeater or relay employs MIMO or adaptive antenna technology.	<p>The Accused RAN Instrumentalities, including at least the Massive MIMO Radios, use MIMO technology and/or adaptive antenna technology.</p> <p>The Accused RAN Instrumentalities employs adaptive antenna technology through at least beamforming, antenna selection, and/or spatial filtering. For example, the Accused RAN Instrumentalities can use multiple antennas in MIMO technology to direct wireless RF signals in a specific direction based on information from the controller, select an antenna of multiple antennas to send or receive signals based on signal strength, or use multiple antennas to filter or ignore interference.</p> <p>In another example, Samsung’s website further states, “[t]o maximize 5G performance in the mid-band, Samsung’s 64T64R Massive MIMO Radios make full use of innovative technologies such as multi-user MIMO.” See <a href="http://www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/">www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/</a></p> <p>In another example, Samsung’s website describes that a “Massive MIMO Radio supports various beamforming modes including SRS (Sounding Reference Signal) mode, PMI (Precoding Matrix Index) mode and MU-MIMO mode, to deliver the best quality signals, no matter the mobile environment. For example, when a user device is located at the cell edge, Samsung’s Massive MIMO provides coordinated beamforming that adjusts the beam patterns of adjacent cells during SRS mode to decrease</p>

interference. To further enhance user performance in mobile environments, Samsung’s Mobility Enhancer combines AI and advanced signal processing technology to improve beamforming accuracy of a moving user.”

See *id.*

In another example, the Massive MIMO products are configured to split mode operation, Carrier aggregation, and multi-user MIMO.

**Samsung’s Massive MIMO Solution Benefits**

**Samsung Massive MIMO Unit (MMU):** The key product in the solution is the Samsung Massive MIMO Unit (MMU), which is operating in the 2.5 GHz and CBRS (3.5 GHz) spectrum bands. This product also supports the following RAN technologies:

- 4G LTE
- 5G NR
- Co-deploy 4G LTE and 5G NR.

A key differentiator of Samsung’s MMU is its ability to support LTE and 5G NR simultaneously. The “split mode” configuration allocates 32 of the 64 transmit-receiver pairs to each of the RAN technologies. This unique capability reduces the CAPEX spend by MNOs for co-deployment of LTE and 5G in those sites, as the existing equipment supports both technologies in the existing footprint.

**High-Density Antenna System with Integrated Radio Control:** The high-density antenna 64T64R option allows MNOs to reduce CAPEX as they now need fewer products to cover the same area. When operating in 2.5 GHz markets, the MMU leverages five 10 Gbps CPRI links, while the solution for CBRS markets uses four 10 Gbps CPRI links.

**Carrier Aggregation:** This MMU supports carrier aggregation and offers different options based on the deployment. For 2.5GHz, Carrier Aggregation supports up to three 20 MHz carriers, creating up to 60MHz of downlink bandwidth, while deployments in CBRS spectrum supports up to five 20MHz channels, offering up to 100 MHz of downlink bandwidth.

**MIMO and MU-MIMO:** In addition to supports 2x2 and 4x4 single-user MIMO, the MMU supports multi-user MIMO with by allowing up to 16 layers, or independent streams, of downlink transmission for up to 16 users. For 2.5 GHz deployments, the MMU supports up to 2 layers for uplink MU-MIMO transmissions for multi-user MIMO, while the CBRS solution in the 3.5 GHz spectrum allows up to 8 layers for uplink transmissions.

See

<https://images.samsung.com/is/content/samsung/assets/global/business/networks/insigh>

	<p><a href="https://www.samsung.com/global/white-paper/samsung-delivers-the-promises-of-massive-mimo/white-paper_samsung-delivers-the-promises-of-massive-mimo.pdf">ts/white-paper/samsung-delivers-the-promises-of-massive-mimo/white-paper_samsung-delivers-the-promises-of-massive-mimo.pdf</a></p> <p>See claim elements [1G] and [1H] above.</p>
<b>Claim 26</b>	<b>Accused RAN Instrumentalities</b>
<p>26. The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay.</p>	<p>The Accused RAN Instrumentalities are configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay.</p> <p>The Accused RAN Instrumentalities can be used for traffic buffering (e.g., hybrid ARQ, packet queuing, and transmission scheduling), traffic prioritization (e.g., 4G QoS class identifiers, 5G QoS indicators), traffic shaping.</p> <p>See claim [9] above.</p>
<b>Claim 29</b>	<b>Accused RAN Instrumentalities</b>
<p>[29PRE] A broadband wireless repeater or relay, comprising:</p>	<p>See claim element [1PRE] above.</p>
<p>[29A] at least one receiver or transceiver for signal or data reception from one or more devices;</p>	<p>See claim element [1A] above.</p>
<p>[29B] at least one transmitter or transceiver for signal or data transmission to one or more devices,</p> <p>wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and</p>	<p>See claim element [1B] above.</p>

<p>[29C] a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,</p>	<p>See claim elements [1C] and [1D] above.</p>
<p>[29D] wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,</p>	<p>See claim element [1E] above.</p>
<p>[29E] wherein said repeater or relay employs MIMO or adaptive antenna technology,</p>	<p>See claim [17] above.</p>
<p>[29F] wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and</p>	<p>See claim element [1G] above.</p>
<p>[29G] wherein said controller is configured or configurable to perform or for performing at least one of: a) ignore or filter out at least some signal or data transmissions from one or more</p>	<p>See claim element [1H] above.</p>

<p>undesired transmitters, users, networks, data sources, or noise sources; and</p> <p>b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources.</p>	
<p><b>Claim 30</b></p>	<p><b>Accused RAN Instrumentalities</b></p>
<p>30. The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform a).</p>	<p>See claim [6] above.</p>
<p><b>Claim 32</b></p>	<p><b>Accused RAN Instrumentalities</b></p>
<p>32. The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform network provisioning or monitoring.</p>	<p>See claim [8] above.</p>
<p><b>Claim 33</b></p>	<p><b>Accused RAN Instrumentalities</b></p>
<p>33. The broadband wireless repeater or relay of claim 32, wherein the network provisioning or monitoring includes one or more of:</p> <p>i) bandwidth or delay provisioning of repeated or relayed transmissions,</p> <p>ii) application prioritization,</p>	<p>See claim [9] above.</p>

<p>iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and iv) monitoring or measuring traffic from one or more devices, users or networks.</p>	
<p><b>Claim 35</b></p>	<p><b>Accused RAN Instrumentalities</b></p>
<p>35. The broadband wireless repeater or relay of claim 29, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in half duplex.</p>	<p>See claim [11] above.</p>
<p><b>Claim 48</b></p>	<p><b>Accused RAN Instrumentalities</b></p>
<p>48. The broadband wireless repeater or relay of claim 29, wherein one or more of said receiver or transceiver for signal or data reception, said transmitter or transceiver for signal or data transmission, and said controller is embedded in one or more integrated circuit chips.</p>	<p>The controller, transmitter, receiver, and/or transceiver of the Accused RAN Instrumentalities are embedded in one or more integrated circuit chips.</p> <p>For Example, the Accused RAN Instrumentalities use an RFIC for a 5G transceiver comprising a 5G modem SoC and digital front end.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><small>SEOUL, Korea – June 22, 2021 – Samsung Electronics. Co., Ltd. today unveiled a range of new chipsets that will be embedded into the company's next generation 5G solutions. The new 3GPP Rel.16 compliant chipsets consist of a third generation mmWave Radio Frequency Integrated Circuit (RFIC) chip, a second generation 5G modem System-on-Chip (SoC), and a Digital Front End (DFE)-RFIC integrated chip. The company's latest chips will power Samsung's next-generation products for 5G build out, including the next generation 5G Compact Macro, Massive MIMO radios, and baseband units, which will all be commercially available in 2022.</small></p> </div> <p>See <a href="http://www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/">www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/</a></p> <p>An integrated circuit package (e.g., 5G system-on-a-chip) may comprise a plurality of functionalities within a single IC package such as signal encoding/decoding by a modem, frequency tuning by a front-end module, and/or transmitter/receiver by a transceiver. The IC is in communication with one or more antennas or an antenna array to wirelessly transmit and receive wireless data over a cellular network.</p>

	See elements [1A] and [1C] above.
<b>Claim 49</b>	<b>Accused RAN Instrumentalities</b>
49. The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay.	See claim [26] above.