

# **Exhibit 3**

**EXHIBIT 3 – U.S. Patent No. 8,923,754**

Plaintiff asserts the following “Accused Hotspot Instrumentalities” infringe the Asserted Claims of U.S. 8,923,754:

i) Smartphones:

Galaxy S20 (SM-G980, SM-G981); Galaxy S20+ (SM-G985, SM-G986); Galaxy S20 Ultra (SM-G988); Galaxy S20 FE (SM-G780, SM-G781); Galaxy S21 (SM-G991); Galaxy S21+ (SM-G996); Galaxy S21 Ultra (SM-G998); Galaxy S21 FE (SM-G990); Galaxy S22 (SM-S901); Galaxy S22+ (SM-S906); Galaxy S22 Ultra (SM-S908); Galaxy S23 (SM-S911); Galaxy S23+ (SM-S916); Galaxy S23 Ultra (SM-S918); Galaxy S23 FE (SM-S711); Galaxy S24 (SM-S921); Galaxy S24+ (SM-S926); Galaxy S24 Ultra (SM-S928); Galaxy S24 FE (SM-S821); Galaxy S25 (SM-S931); Galaxy S25+ (SM-S936); Galaxy S25 Ultra (SM-S938); Galaxy S25 Edge (SM-S935); Galaxy Z Flip 3 (SM-F711); Galaxy Z Flip 4 (SM-F721); Galaxy Z Flip 5 (SM-F731); Galaxy Z Flip 6 (SM-F741); Galaxy Z Fold 2 (SM-F916); Galaxy Z Fold 3 (SM-F926); Galaxy Z Fold 4 (SM-F936); Galaxy Z Fold 5 (SM-F946); Galaxy Z Fold 6 (SM-F956); Galaxy Note 20 (SM-N981); Galaxy Note 20 Ultra (SM-N986); Galaxy A32 5G (SM-A326); Galaxy A42 5G (SM-A426); Galaxy A12 (SM-A125); Galaxy A02s (SM-A025); Galaxy A54 5G (SM-A546); Galaxy A25 5G (SM-A256); Galaxy A26 5G (SM-A266); Galaxy A36 5G (SM-A366); Galaxy A16 5G (SM-A166); Galaxy A16 (SM-A165)

ii) Tablets:

Galaxy Tab S6 (SM-T860, SM-T865, SM-T866N); Galaxy Tab S6 5G (SM-T866N); Galaxy Tab S7 (SM-T870, SM-T875, SM-T878U); Galaxy Tab S7+ (SM-T970, SM-T976); Galaxy Tab S7 FE (SM-T730, SM-T736B); Galaxy Tab S8 (SM-X700, SM-X706); Galaxy Tab S8+ (SM-X800, SM-X806); Galaxy Tab S8 Ultra (SM-X900, SM-X906); Galaxy Tab S9 (SM-X710, SM-X716); Galaxy Tab S9+ (SM-X810, SM-X816); Galaxy Tab S9 Ultra (SM-X910, SM-X916); Galaxy Tab S10 FE (SM-X520, SM-X526); Galaxy Tab S10 FE+ (SM-X620); Galaxy Tab S10+ (SM-X826); Galaxy Tab S10 Ultra (SM-X920); Active4 Pro (SM-T636); Active5 (SM-X591B); Active5 Tactical Edition (SM-X591B); Active5 Pro (SM-X596)

iii) Personal Computers/ Laptops:

Galaxy Book S (SM-W767); Galaxy Book Go 5G (SM-X100); Galaxy Book Flex 2 Alpha (SM-X420); Galaxy Book Pro (SM-X50x); Galaxy Book Pro 360 (SM-X360); Galaxy Book2 360 (SM-X20x); Galaxy Book2 Pro (SM-X30x); Galaxy Book2 Pro 360 (SM-X360); Galaxy Book2 Pro 360 5G (SM-X366); Galaxy Book3 360 (SM-X40x); Galaxy Book3 Pro (SM-X50x); Galaxy Book3 Pro 360 (SM-X60x); Galaxy Book3 Pro 360 5G (SM-X66x); Galaxy Book4 (SM-X70x); Galaxy Book4 Ultra (SM-X7Ux); Galaxy Book4 Pro (SM-X7Px); Galaxy Book4 Pro 360 (SM-X7Mx);

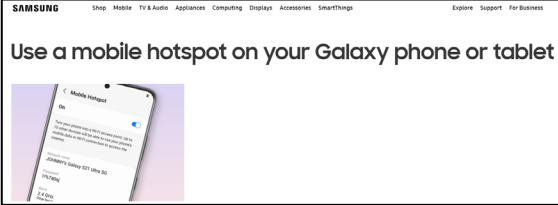
Galaxy Book4 Edge (SM-X8Ex); Galaxy Book5 360 (SM-X90x); Galaxy Book5 Pro (SM-X91x); Galaxy Book5 Pro 360 (SM-X93x); Galaxy Book5 Pro 360 5G (SM-X936)

iv) Hospitality TVs:

Crystal UHD Smart Hospitality TV (HGxxHBU800); Smart Hospitality TV (HGxxHQ60A); 4K Hospitality TV (HGxxCU708); Crystal UHD Smart Hospitality TV (HGxxHAU800); 690 Series Hospitality TV (HGxxNx690); 890 Series Hospitality TV (HGxxNx890)

v) Smart Hubs:

SmartThings Hub (STH-ETH-250); Connect Home Pro (ET-WV530); Connect Home (ET-WV520); SmartThings Wi-Fi (ET-WV525KWEKUS); SmartThings Hub (2018) (GP-U999SJVLGDA); SmartThings Hub (GP-U999SJVLGDB)

Claim 1	Accused Hotspot Instrumentalities <sup>1</sup>
<p>[1PRE] A broadband wireless repeater or relay, comprising:</p>	<p>Accused Hotspot Instrumentalities can serve as a broadband wireless repeater when in a mode to operate as a mobile hotspot. So configured, the Accused Hotspot Devices connect one or more mobile devices via a Wi-Fi network to the Internet or via a cellular network to the Internet.</p> <p>See Samsung website (<a href="http://www.samsung.com/us/support/answer/ANS00079036/">www.samsung.com/us/support/answer/ANS00079036/</a>) explaining how to use a mobile hotspot on a Galaxy phone or tablet.</p> 

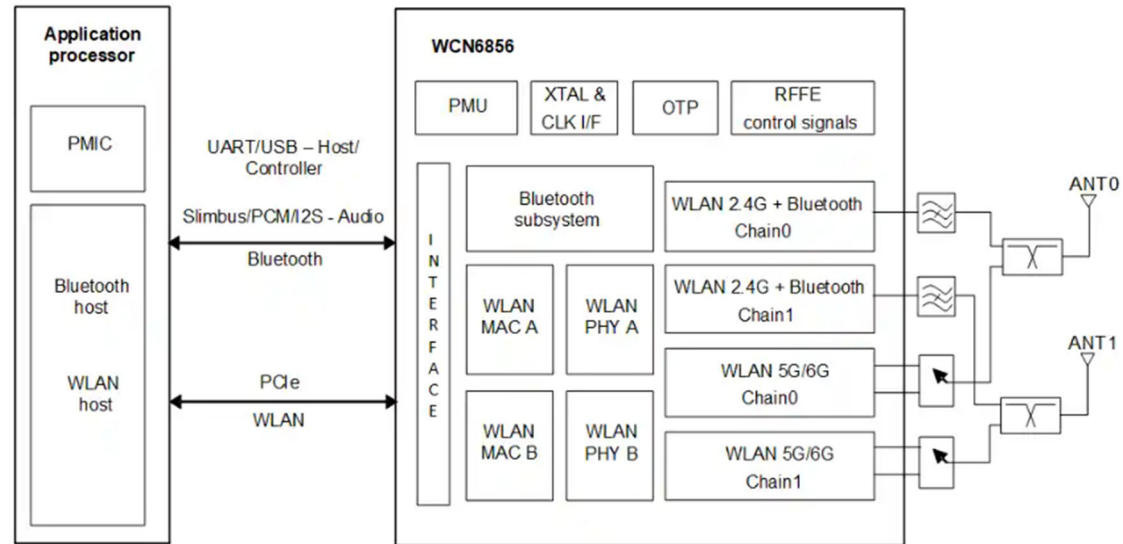
<sup>1</sup> Unless indicated otherwise, the evidence cited in this table is representative of the operation of the Accused Hotspot Instrumentalities and upon information and belief, the Accused Hotspot Instrumentalities function in a substantially similar manner for purposes of this chart.

[1A] at least one receiver or transceiver for signal or data reception from one or more devices;

The Accused Hotspot Instrumentalities include a receiver or transceiver for signal or data reception from a device (“connected device”) that is connected wirelessly to the Accused Hotspot Device via Wi-Fi 5/6/6E, 4G-LTE, and/or 5G.

The receiver and/or transceiver is shown by the Wi-Fi module (e.g., Wi-Fi/Bluetooth combo chip) and/or cellular module (e.g., 4G-LTE tuner/transceiver, 5G tuner/transceiver) of the Accused Hotspot Instrumentalities. The Wi-Fi/Bluetooth combo chip (e.g., Qualcomm WCN6855 and WCN7851-101) includes a receiver or transceiver for signal or data reception from the connected device. See <https://devicehd.com/smartphones/en/product/64328d1550d90c8ad32d8f6b/>; <https://devicehd.com/smartphones/en/product/64295291e5917e62545296b9/>

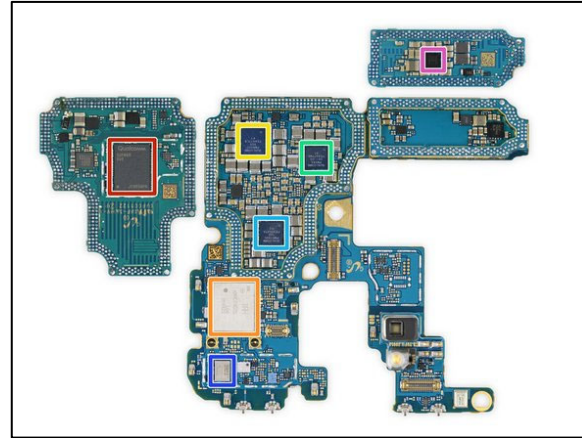
See the figure below showing the Qualcomm WCN6855 coupled to an application processor and antenna.



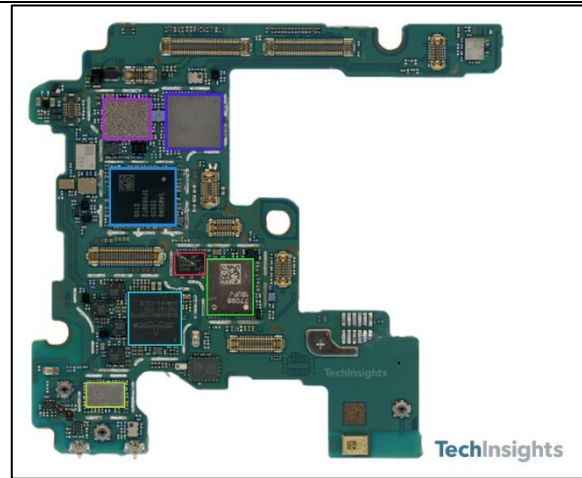
<https://docs.qualcomm.com/bundle/publicresource/topics/80-WL542-10/overview.html>

The cellular module (e.g., Exynos RF 5500) also comprises a receiver or transceiver for receiving signals via a cellular network.

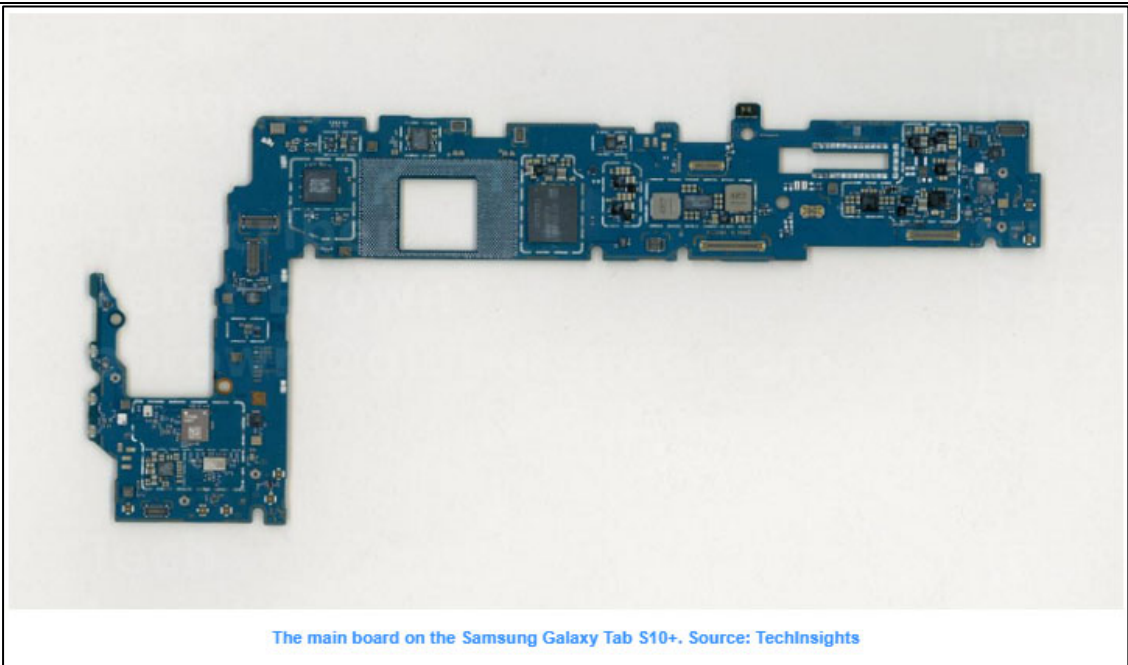
<https://semiconductor.samsung.com/news-events/tech-blog/exynos-rf-5500-and-exynos-sm-5800-chips-making-5g-wireless-communication-possible/>In one example, the image below shows a circuit board from the Galaxy S20 Ultra, identifying a Murata KM9D19075 Wi-Fi module, in the orange rectangle, which comprises “at least one receiver or transceiver for signal or data reception from one or more devices.” See [www.ifixit.com/Teardown/Samsung+Galaxy+S20+Ultra+Teardown/131607?srsltid=AfmBOorbKmG1FgZYkgqQsKc3mMYaHd6vA\\_c9nDDoDhWIkT\\_IkjlHRT-t](http://www.ifixit.com/Teardown/Samsung+Galaxy+S20+Ultra+Teardown/131607?srsltid=AfmBOorbKmG1FgZYkgqQsKc3mMYaHd6vA_c9nDDoDhWIkT_IkjlHRT-t)



As another example, below is an image of a Galaxy S22 Ultra circuit board a Broadcom Wi-Fi 6/6E chip, which comprises “at least one receiver or transceiver for signal or data reception from one or more devices.” See [www.techinsights.com/blog/samsung-galaxy-s22-ultra-teardown](http://www.techinsights.com/blog/samsung-galaxy-s22-ultra-teardown)



In another example, the image below shows a main circuit board from the Galaxy S10+, comprising a MediaTek 5G RF transceiver.

**Main board**

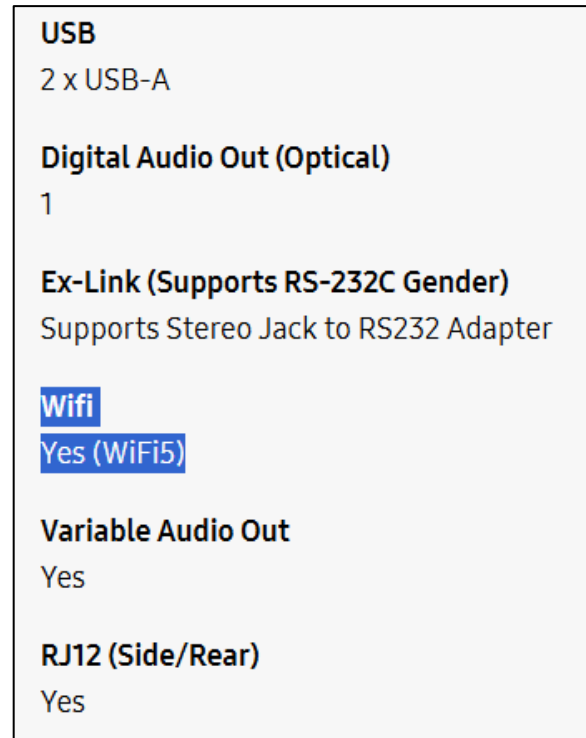
The main board of the Samsung Galaxy Tab S10+ includes the main memory and sensors for operation of the tablet. The electronic components found on the smart tablet include:

- ST Microelectronics' six-axis MEMS accelerometer
- [Texas Instruments'](#) 250 mA LDO regulator and 250 mA LDO regulator
- [Murata's](#) SAW filter, RxD front-end module,
- MediaTek's GPS receiver, clock buffer and 5G RF transceiver
- Diodes Inc.'s 300 mA/3.0 V LDO regulator
- [Qorvo's](#) RF antenna tuner and front-end module
- [Infineon's](#) SPDT RF switch
- Silergy's DC-DC converter
- Analog Devices' buck-boost regulator
- Vishay's RGBC/IR light sensor
- Cirrus Logic's Class-D audio amplifier
- Samsung's secure element chip

	<p>See <a href="https://electronics360.globalspec.com/article/22285/techinsights-teardown-samsung-galaxy-tab-s10">https://electronics360.globalspec.com/article/22285/techinsights-teardown-samsung-galaxy-tab-s10</a></p> <p>In another example, the Accused Hotspot Device comprises a Wi-Fi module configured to transmit and receive wireless signals, to perform the functionality of a SoftAP. Samsung’s website describes the specification of the HQ60A series hospitality TVs as including a software access point (SoftAP). The SoftAP feature allows the Hospitality TV to deploy a hotspot for the hotel guests to connect to the internet.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p><b>Samsung LYNK™ Cloud</b> Yes</p> <p><b>Hospitality Plug&amp;Play (Easy Set-up)</b> Yes</p> <p><b>Hotel Channel List</b> Yes</p> <p><b>Mixed Channel List (ATSC, DVB-T/T2/C/S2, Analog)</b> Yes</p> <p><b>Energy Saving Mode (BLU Control)</b> Yes</p> <p><b>Clock Back Up Supply</b> Yes</p> <p><b>Soft AP</b> Yes</p> <p><b>Samsung LYNK™ DRM</b> Yes</p> <p><b>Security Mode</b> Yes</p> </div>
--	--

See <https://www.samsung.com/ca/business/commercial-tvs/hotel-tv/hq60a-4k-qlled-hg65q60aanfxza/>

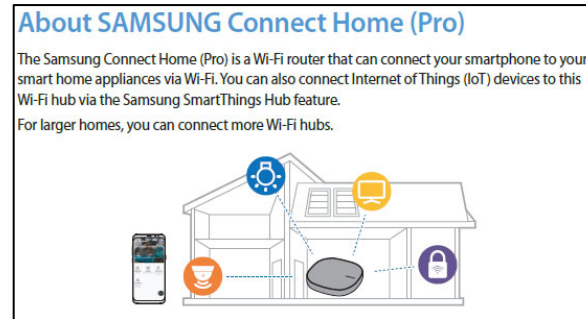
As shown in the image below, Samsung’s website describes the specifications of the HQ60A Series Hospitality TV as supporting the Wi-Fi 5 generation (i.e., IEEE 802.11ac). According to IEEE 802.11ac, the Accused Hotspot Device supports a channel width of up to 160 MHz and data transmission speeds of up to 6.93 Gbps.



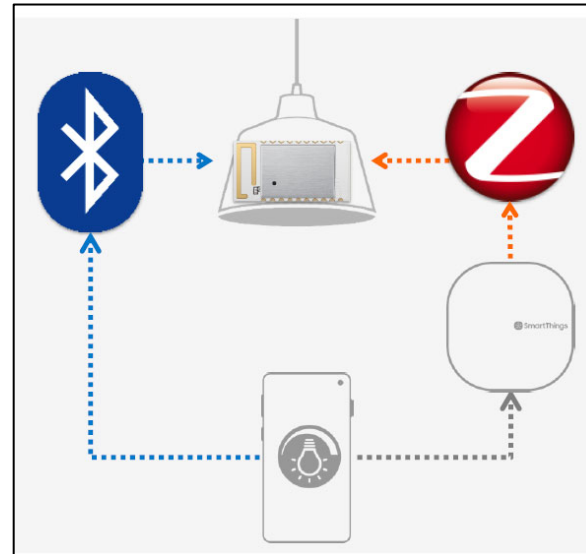
See *id.*

In another example, the Accused Hotspot Instrumentalities (e.g., Connect Home Pro) can connect a user mobile device to other smart devices through a Wi-Fi network (at least Wi-Fi 4 for speeds up to 600 Mbps). This allows a transceiver within the Accused

Hotspot Instrumentalities to send and receive wireless data over a Wi-Fi network. (See images below)



See <https://content.syndigo.com/asset/17adf894-afac-49a6-9e43-acc47d706188/original.pdf>



See [https://download.led.samsung.com/led/file/resource/2020/06/Smart\\_Lighting\\_Solution\\_0602.pdf](https://download.led.samsung.com/led/file/resource/2020/06/Smart_Lighting_Solution_0602.pdf)

	<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 Wi-Fi network or cellular network.</p> <p>See claim elements [1B] and [1C] below.</p>
<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 Hotspot Instrumentalities include a transmitter or transceiver for signal or data transmission to one or more devices (e.g., “connected device”) that is connected wirelessly to the Accused Hotspot Device via Wi-Fi 5/6/6E, 4G-LTE, and/or 5G.</p> <p>The transmitter and/or transceiver is provided by the Wi-Fi module (e.g., Wi-Fi/Bluetooth combo chip) and/or cellular module (e.g., 4G-LTE tuner/transceiver, 5G tuner/transceiver) of the Accused Hotspot Instrumentalities. The Wi-Fi/Bluetooth combo chip (e.g., Qualcomm WCN6855 and WCN7851-101) comprises a receiver or transceiver for signal or data transmission to the connected device. See <a href="https://devicehd.com/smartphones/en/product/64328d1550d90c8ad32d8f6b/">https://devicehd.com/smartphones/en/product/64328d1550d90c8ad32d8f6b/</a>; <a href="https://devicehd.com/smartphones/en/product/64295291e5917e62545296b9/">https://devicehd.com/smartphones/en/product/64295291e5917e62545296b9/</a></p> <p>See the figure below showing the Qualcomm WCN6855 coupled to an application processor and antenna.</p>

	<p><a href="https://docs.qualcomm.com/bundle/publicresource/topics/80-WL542-10/overview.html">https://docs.qualcomm.com/bundle/publicresource/topics/80-WL542-10/overview.html</a></p> <p>The cellular module (e.g., Exynos RF 5500) also comprises a transmitter or transceiver for transmitting signals via a cellular network. See <a href="https://semiconductor.samsung.com/news-events/tech-blog/exynos-rf-5500-and-exynos-sm-5800-chips-making-5g-wireless-communication-possible/">https://semiconductor.samsung.com/news-events/tech-blog/exynos-rf-5500-and-exynos-sm-5800-chips-making-5g-wireless-communication-possible/</a></p> <p>See claim elements [1A] above and [1C] below.</p>
<p>[1C] a controller that is configured or configurable for operation in one or more wireless networks,</p>	<p>The Accused Hotspot Instrumentalities include a controller that is configured or configurable for operation in a Wi-Fi network (e.g., Wi-Fi 5/802.11ac, Wi-Fi 6/802.11ax, or Wi-Fi 6E/ 802.11ax networks) and/or a cellular network (e.g., 4G LTE or 5G), which are wireless networks.</p> <p>For example, the Galaxy S20 Ultra comprises, among other things, a Qualcomm Snapdragon 865 processor in communication with a STMicroelectronics STM32G071EB 32-bit ARM microcontroller and a Qualcomm SDX55M 5G modem.</p>

[www.ifixit.com/Teardown/Samsung+Galaxy+S20+Ultra+Teardown/131607?srsId=AfmBOorbKmG1FgZykgqQsKc3mMYaHd6vA\\_c9nDDoDhWlKt\\_IkjlHRT-t](http://www.ifixit.com/Teardown/Samsung+Galaxy+S20+Ultra+Teardown/131607?srsId=AfmBOorbKmG1FgZykgqQsKc3mMYaHd6vA_c9nDDoDhWlKt_IkjlHRT-t)

In another example, the Galaxy S22 Ultra comprises, among other things, a Qualcomm Snapdragon 8 Gen 1 in communication with a Samsung RF Transceiver S5520, a Broadcom Front-End Module AFEM-9140, a Skyworks Front-End Module SKY58083-11, a Broadcom Wi-Fi 6/6E&BT 5.0 SoC BCM4389, and a Qorvo Front-End Module QM77098. See [www.techinsights.com/blog/samsung-galaxy-s22-ultra-teardown](http://www.techinsights.com/blog/samsung-galaxy-s22-ultra-teardown)

In another example, the Accused Hotspot Instrumentalities (e.g., Hospitality TVs) comprise a processor such as the Crystal Processor 4K, Quantum Processor Lite, NQ4 AI Gen2, NQ4 AI Gen3, NQ8 AI Gen3, RISC-V SoCs (e.g., SiFive P470) Processors. These processors communicate with the Wi-Fi modules (e.g., Realtek MT7668AUN, Broadcom BCM43143) for operation in a wireless network. See <https://manuals.plus/samsung/wcf734m-wi-fi-bluetooth-combo-module-manual>; <https://manualmachine.com/samsung/spwb43143u/11353954-user-manual/>

The image below shows a network configuration menu for the Samsung TV operating system, Tizen, which is executed by a controller of a Hospitality TVs. The operating system is programable through a network API, and causes the controller to configure the TVs network settings to identify wireless devices.

```

NetworkManager
void removeNetworkStateChangeListener(unsiged long listener);
DOMString getWiFiSSID();
long getWiFiSignalStrengthLevel();
NetworkWiFiSecurityMode getWiFiSecurityMode();
NetworkWiFiEncryptionType getWiFiEncryptionType();
DOMString getSecondaryDns();
void setDhcpOption6Field(DOMString vendorName);
void removeDhcpOption6Field();
DOMString getCurrentDhcpOption6Field();
DOMString checkCurrentIpWith6Field();
void enableSoftAP();
void disableSoftAP();
boolean isSoftAPEnabled();
DOMString getSoftAPSSID();
void setSoftAPChannel(long channel);
DOMString getSoftAPSecurityKey();
void setSoftAPSignalStrength(unsiged long power);
void setEAPCAFilePath(DOMString path);
void setEAPPassphrase(DOMString name, DOMString password);
long getWiFiFrequency();

```

See <https://developer.samsung.com/smarttv/develop/api-references/samsung-product-api-references/network-api.html>

	<p>In another example, a controller (e.g., Exynos i T200) in communication with a transceiver of the Accused Hotspot Instrumentalities (e.g., smart hub) is configured or configurable for operations with at least a wireless local area network (WLAN) and wide area network (WAN).</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <h3 style="text-align: center;">Specifications</h3> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="4" style="text-align: center;"><b>Processor</b></td> </tr> <tr> <td style="width: 25%;"><b>CPU Speed</b></td> <td style="width: 25%;"></td> <td style="width: 25%;"><b>CPU Type</b></td> <td style="width: 25%;"></td> </tr> <tr> <td>716MHz</td> <td></td> <td>Quad-Core</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: center;"><b>Memory</b></td> </tr> <tr> <td><b>RAM Size (MB)</b></td> <td></td> <td><b>Storage (GB)</b></td> <td></td> </tr> <tr> <td>512</td> <td></td> <td>8</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: center;"><b>Connectivity</b></td> </tr> <tr> <td><b>Bluetooth Version</b></td> <td><b>Wi-Fi Version</b></td> <td><b>Wi-Fi Speed</b></td> <td><b>Wi-Fi - Security</b></td> </tr> <tr> <td>Bluetooth v4.1</td> <td>802.11 a/b/g/n/ac, 2.4G+5GHz, VHT80 2x2 MU MIMO</td> <td>Up to 866Mbps@ 5GHz + 400Mbps @ 2.4 GHz (AC1300)</td> <td>WPA2, WPA2-PSK</td> </tr> </table> </div> <p><a href="https://news.samsung.com/global/samsung-begins-mass-production-of-first-exynos-branded-iot-solution-the-exynos-i-t200;">https://news.samsung.com/global/samsung-begins-mass-production-of-first-exynos-branded-iot-solution-the-exynos-i-t200;</a>  <a href="https://www.samsung.com/ca/smartthings/hub/smartthings-wi-fi-et-wv525bwegca/">https://www.samsung.com/ca/smartthings/hub/smartthings-wi-fi-et-wv525bwegca/</a></p> <p>See claim elements [1A] and [1B] above.</p>	<b>Processor</b>				<b>CPU Speed</b>		<b>CPU Type</b>		716MHz		Quad-Core		<b>Memory</b>				<b>RAM Size (MB)</b>		<b>Storage (GB)</b>		512		8		<b>Connectivity</b>				<b>Bluetooth Version</b>	<b>Wi-Fi Version</b>	<b>Wi-Fi Speed</b>	<b>Wi-Fi - Security</b>	Bluetooth v4.1	802.11 a/b/g/n/ac, 2.4G+5GHz, VHT80 2x2 MU MIMO	Up to 866Mbps@ 5GHz + 400Mbps @ 2.4 GHz (AC1300)	WPA2, WPA2-PSK
<b>Processor</b>																																					
<b>CPU Speed</b>		<b>CPU Type</b>																																			
716MHz		Quad-Core																																			
<b>Memory</b>																																					
<b>RAM Size (MB)</b>		<b>Storage (GB)</b>																																			
512		8																																			
<b>Connectivity</b>																																					
<b>Bluetooth Version</b>	<b>Wi-Fi Version</b>	<b>Wi-Fi Speed</b>	<b>Wi-Fi - Security</b>																																		
Bluetooth v4.1	802.11 a/b/g/n/ac, 2.4G+5GHz, VHT80 2x2 MU MIMO	Up to 866Mbps@ 5GHz + 400Mbps @ 2.4 GHz (AC1300)	WPA2, WPA2-PSK																																		
<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 Hotspot Instrumentalities communicates with the Wi-Fi module and/or the cellular module (e.g., 4G-LTE tuner/transceiver, 5G tuner/transceiver) for data reception and transmission via Wi-Fi and cellular networks. The controller communicates with and/or includes the Wi-Fi module and/or the cellular module for signal processing, decoding, controlling application data, and signal I/O management.</p>																																				

	<p>For example, the controller of the Accused Hotspot Instrumentalities communicates with and interfaces with the transmitters/receivers/transceivers to identify and communicate with connected devices through Wi-Fi protocols, such as Wi-Fi 5/6/6E. The controller uses the IP and/or MAC addresses to identify connected devices. See e.g., <a href="http://www.techtarget.com/searchnetworking/answer/What-is-the-difference-between-an-IP-address-and-a-physical-address/">www.techtarget.com/searchnetworking/answer/What-is-the-difference-between-an-IP-address-and-a-physical-address/</a>.</p> <p>In another example, the controller of the Accused Hotspot Instrumentalities utilizes WPA2 and/or WPA3 protocols to allow for secure broadcasting of a Wi-Fi hotspot, which employs a handshake sequence that requires identification via network information of devices requesting to join the mobile hotspot.</p> <p>See <a href="https://insights.samsung.com/2022/12/16/how-to-turn-your-galaxy-smartphone-into-a-hotspot-3/">https://insights.samsung.com/2022/12/16/how-to-turn-your-galaxy-smartphone-into-a-hotspot-3/</a>; and <a href="https://en.wikipedia.org/wiki/Wi-Fi_Protected_Access">https://en.wikipedia.org/wiki/Wi-Fi_Protected_Access</a>.</p> <p>See claim elements [1C] above and [1E] 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 Products support Wi-Fi 5/6/6E which have channels with an instantaneous or overall occupied bandwidth of 100 MHz or more. According to the IEEE 802.11 standards, the Wi-Fi generations Wi-Fi5 (802.11ac), Wi-Fi6 (802.11ax-2019), and Wi-Fi6E (802.11ax-2021), all provide 160 MHz channel widths.</p> <p>For example, IEEE 802.11ax (Wi-Fi 5) allows for data transmissions over a contiguous or non-contiguous 160 MHz bandwidth. The 160 MHz contiguous spectrum comprises 8 channels (20 MHz) that are bonded together. The 160 MHz non-contiguous spectrum comprises two 4 channels (20 MHz) that are bonded together and concatenated to form 160 MHz non-contiguous spectrum. The 160 MHz bandwidth supports data rates of up to 6.93 Gbps, but does not indicate a minimum or lower bound for the data rate.</p> <p>See e.g., <a href="http://help.keenetic.com/hc/en-us/articles/360012060379-Available-channels-on-the-5-GHz-Wireless-network">help.keenetic.com/hc/en-us/articles/360012060379-Available-channels-on-the-5-GHz-Wireless-network</a>, and <a href="http://help.keenetic.com/hc/en-us/articles/360010536300-What-you-need-to-know-about-Wi-Fi-6-IEEE-802-11ax">help.keenetic.com/hc/en-us/articles/360010536300-What-you-need-to-know-about-Wi-Fi-6-IEEE-802-11ax</a></p>

The Accused Hotspot Instrumentalities (e.g., smartphones, tablets, 5G notebooks) also transmit and receive communication via 4G LTE or 5G cellular networks, which have channels with an instantaneous or overall occupied bandwidth of 100 MHz or more.

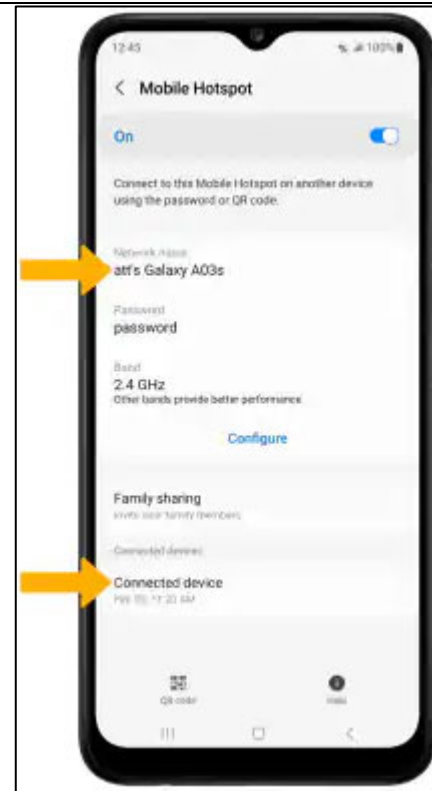
Aggregated 4G-LTE carrier channels, such as aggregated Band 41 channels, have a bandwidth of 100 MHz or more. 5G has several bands (including but not limited band n41, n48, n77, n78, n79, n90, n257, n258, n259, n260, n261) that have bandwidths of 100 MHz or more.

Additionally, the data rates for 4G-LTE and 5G cellular networks are capable of over 100 Mbps. See <https://www.qualcomm.com/news/releases/2022/05/qualcomm-unveils-new-features-snapdragon-x70-modem-rf-system>.

In another example, the Accused Hotspot Instrumentalities (e.g., smart hub) are configured to transmit or receive wireless signals or data at a data rate of 100 Mbps or more, based on Wi-Fi 5 (802.11ac). See image below.

<b>Specifications</b>			
<b>Processor</b>			
<b>CPU Speed</b>		<b>CPU Type</b>	
716MHz		Quad-Core	
<b>Memory</b>			
<b>RAM Size (MB)</b>		<b>Storage (GB)</b>	
512		8	
<b>Connectivity</b>			
<b>Bluetooth Version</b>	<b>Wi-Fi Version</b>	<b>Wi-Fi Speed</b>	<b>Wi-Fi - Security</b>
Bluetooth v4.1	802.11 a/b/g/n/ac, 2.4G+5GHz, VHT80 2x2 MU MIMO	Up to 866Mbps@ 5GHz + 400Mbps @ 2.4 GHz (AC1300)	WPA2, WPA2-PSK

	<p>See <a href="https://news.samsung.com/global/samsung-begins-mass-production-of-first-exynos-branded-iot-solution-the-exynos-i-t200">https://news.samsung.com/global/samsung-begins-mass-production-of-first-exynos-branded-iot-solution-the-exynos-i-t200</a>;  <a href="https://www.samsung.com/ca/smartthings/hub/smartthings-wi-fi-et-wv525bwegca/">https://www.samsung.com/ca/smartthings/hub/smartthings-wi-fi-et-wv525bwegca/</a></p>
<p>[1F] wherein said controller is configured or configurable to perform or for performing a plurality 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;</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; and</p> <p>c) network provisioning or monitoring.</p>	<p>The controller in the Accused Hotspot Devices perform at least (a) and (c). It performs (a) by filtering out signals from undesired transmitters based on the ID of the device with which the repeater/relay is in Wi-Fi communication. It monitors the network (c) by collecting network statistics.</p> <p>The controller performs element (a) by at least ignoring or filtering signals received from a wide area network and not providing the signal to a connected device. The wireless communications can be filtered or ignored based on MAC Address filtering, IP address filtering, DNS address filtering, port filtering, and/or quality of service (QoS).</p> <p>In one example, the Accused Hotspot Instrumentalities show the mobile user devices connected to the Wi-Fi network provided by the mobile hotspot. The user can select a connected device for a list of connected device and block the device from the network. The controller can configure network settings (e.g., blacklist, firewall settings) of the Accused Hotspot Instrumentalities to filter out wireless data transmissions (e.g., signals or data communication) based on blocked (blacklisted) MAC addresses or source IP addresses. This can prevent a previously connected device from establishing a connection to the mobile hotspots, based on a blacklisted MAC address of the device.</p>



See <https://www.att.com/device-support/article/wireless/KM1472824/Samsung/SamsungSMA037U>; and [devices.vodafone.com.au/samsung/galaxy-s21-5g-android-11-0/connectivity/use-your-phone-as-wi-fi-hotspot/](https://devices.vodafone.com.au/samsung/galaxy-s21-5g-android-11-0/connectivity/use-your-phone-as-wi-fi-hotspot/)

The Accused Hotspot Instrumentalities are configured with a 5G modem (e.g., Qualcomm x75) to filter or ignore noise sources through signal processing. For example, the Accused Hotspot Instrumentalities can filter waveforms in the frequency domain with OFDM to filter out signals in the same frequency domain.

#### 4.1.2 Enabling efficient services multiplexing with windowed OFDM

In order to efficiently support multiplexing of 5G services, both in-band and out-of-band emissions must be kept to a minimum, so that services being transmitted on adjacent frequency channels do not interfere with one another. OFDM allows for waveform post-processing, such as windowing in the time domain or **filtering** in the frequency domain, to improve frequency localization. Figure 11 below showcases different 5G services, utilizing different 5G NR OFDM numerologies, multiplexed on the same frequency channel.

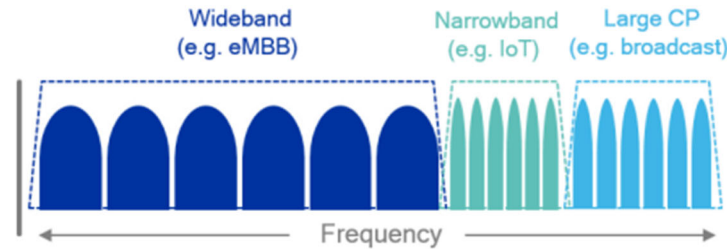
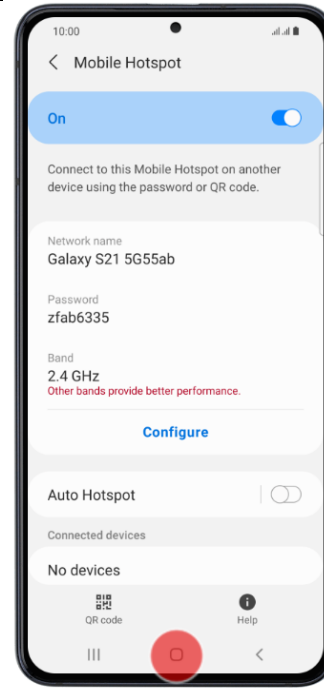


Figure 11: 5G NR will efficiently multiplex different services

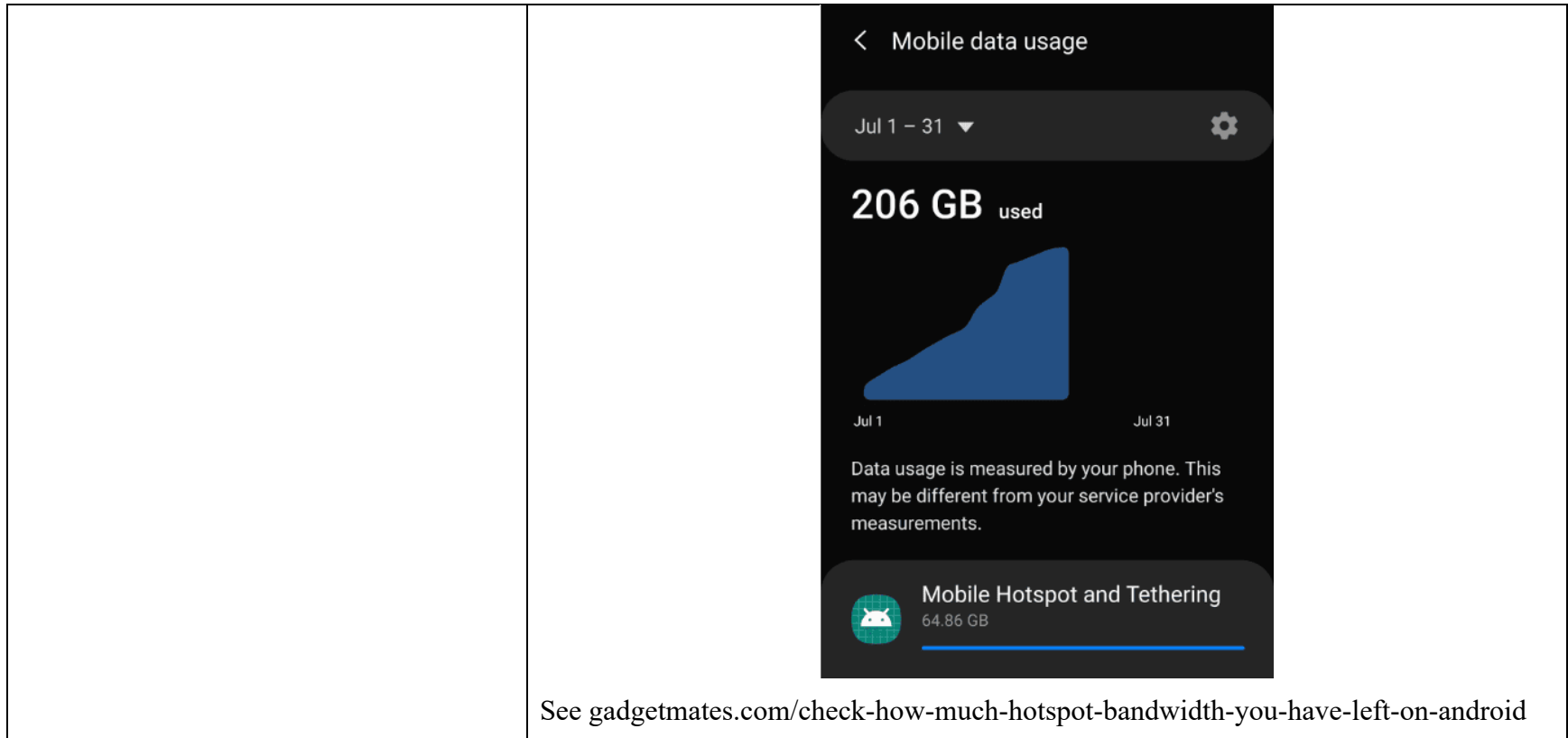
See [https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/draft\\_whitepaper\\_-\\_leading\\_the\\_technology\\_inventions\\_for\\_a\\_unified\\_more\\_capable\\_air\\_interface\\_v.1.0.pdf](https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/draft_whitepaper_-_leading_the_technology_inventions_for_a_unified_more_capable_air_interface_v.1.0.pdf); [https://docs.qualcomm.com/bundle/publicresource/87-27161-1\\_REV\\_C\\_Snapdragon\\_X75\\_5G\\_Modem-RF\\_System\\_Product\\_Brief.pdf](https://docs.qualcomm.com/bundle/publicresource/87-27161-1_REV_C_Snapdragon_X75_5G_Modem-RF_System_Product_Brief.pdf)

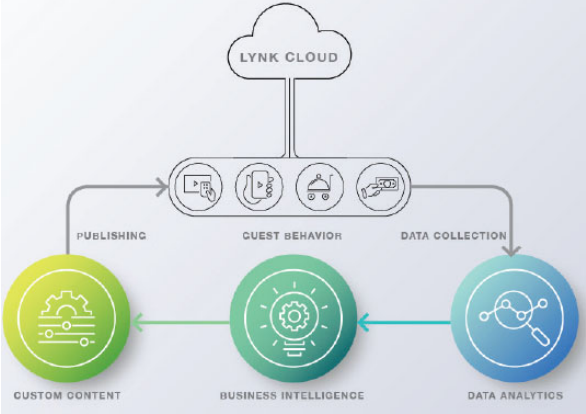
The Accused Hotspot Instrumentalities utilize, for example, the WPA2 or WPA3 protocols, which are network security protocols that screen undesired data to ensure network security and provides network management via preventing undesired connections from other devices.

In another example, the Accused Hotspot Instrumentalities perform element (c) by showing the devices connected to the Wi-Fi network provided by the mobile hotspot. See e.g., [devices.vodafone.com.au/samsung/galaxy-s21-5g-android-11-0/connectivity/use-your-phone-as-wi-fi-hotspot/](https://devices.vodafone.com.au/samsung/galaxy-s21-5g-android-11-0/connectivity/use-your-phone-as-wi-fi-hotspot/)



The Accused Hotspot Instrumentalities also track data usage (e.g., monitoring) when acting as a mobile hotspot.



	 <p>See <a href="https://4041669.fs1.hubspotusercontent-na1.net/hubfs/4041669/00_BlueStar%20Microsite%20Files/Samsung/PDF/HQ60A_SERIES.pdf">https://4041669.fs1.hubspotusercontent-na1.net/hubfs/4041669/00_BlueStar%20Microsite%20Files/Samsung/PDF/HQ60A_SERIES.pdf</a></p> <p>In another example, the accused instrumentalities provision network resources by configuring network settings. The Samsung developer documentation, for the Tizen Operating system, states “[t]he SoftAP module allows a device to act as a Soft Access Point (SoftAP), enabling other devices to connect to the network it creates. Applications can use this module to configure and monitor the SoftAP’s status, manage network connectivity, and adjust security settings. It is primarily used in IoT environments to easily set up and maintain network access points.” See <a href="https://docs.tizen.org/application/native/api/common/latest/group__CAPI__NETWORK__SOFTAP__MODULE.html">https://docs.tizen.org/application/native/api/common/latest/group__CAPI__NETWORK__SOFTAP__MODULE.html</a></p> <p>See claim [24] below.</p>
<b>Claim 2</b>	<b>Accused Hotspot Devices</b>
<p>[2] The broadband wireless repeater or relay of claim 1 wherein said controller performs a).</p>	<p>The Accused Hotspot Instrumentalities 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 [1F].</p>

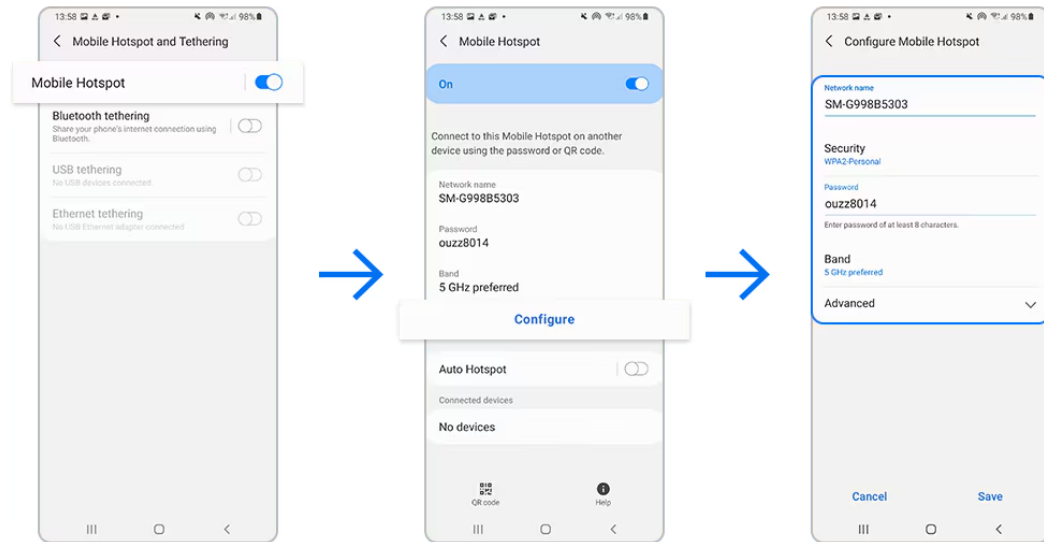
	See claim elements [1F] above.
<b>Claim 3</b>	<b>Accused Hotspot Devices</b>
[3] The broadband wireless repeater or relay of claim 1 wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in half duplex	The receiver and/or the transmitter of the Accused Hotspot Instrumentalities are configured to transmit or receive signals in half-duplex signal modulation through Wi-Fi networks (e.g., Wi-Fi 5/802.11ac, Wi-Fi 6/802.11ax, or Wi-Fi 6E/ 802.11ax networks) and/or cellular networks (e.g., 4G LTE or 5G).
<b>Claim 14</b>	<b>Accused Hotspot Devices</b>
[14] The broadband wireless repeater or relay of claim 1, wherein said repeater or relay employs MIMO or adaptive antenna technology.	<p>The Accused Hotspot Instrumentalities employ MIMO technology and/or adaptive antenna technology for cellular connections and/or Wi-Fi connections. See e.g., <a href="https://r2.community.samsung.com/t5/Tech-Talk/What-is-4-4-MIMO-and-Does-My-Smartphone-Need-It/td-p/4938055">https://r2.community.samsung.com/t5/Tech-Talk/What-is-4-4-MIMO-and-Does-My-Smartphone-Need-It/td-p/4938055</a></p> <p>The Accused Hotspot Instrumentalities include transmitters and receivers to support at least 2x2 SU-MIMO (single user). In Wi-Fi networks, IEEE 802.11n (i.e., Wi-Fi 4) introduced SU-MIMO support for up to 4x4 MIMO, while both 802.11ac (i.e., Wi-Fi 5) and 802.11ax (i.e., Wi-Fi 6/6E) support up to 8x8 SU-MIMO. In Cellular networks, 4G-LTE supports up to 4x4 SU-MIMO and 5G supports up to 4x4 SU-MIMO /64x64 MU-MIMO.</p> <p>The Accused Hotspot Instrumentalities can employ adaptive antenna technology through at least beamforming, antenna selection, and/or spatial filtering. For example, the Accused Hotspot 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>See <a href="https://docs.qualcomm.com/bundle/publicresource/87-27161-1_REV_C_Snapdragon_X75_5G_Modem-RF_System_Product_Brief.pdf">https://docs.qualcomm.com/bundle/publicresource/87-27161-1_REV_C_Snapdragon_X75_5G_Modem-RF_System_Product_Brief.pdf</a></p>

Claim 23	Accused Hotspot Instrumentalities
<p>[23] The broadband wireless repeater or relay of claim 1 wherein said controller performs c).</p>	<p>The Accused Hotspot Instrumentalities 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 [1F].</p> <p>See claim elements [1F] above, and claim [24] below.</p>
Claim 24	Accused Hotspot Instrumentalities
<p>[24] The broadband wireless repeater or relay of claim 1 wherein in c) includes one or more of:</p> <ul style="list-style-type: none"> <li>i) bandwidth or delay provisioning of repeated or relayed transmissions,</li> <li>ii) application prioritization,</li> <li>iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and</li> <li>iv) monitoring or measuring traffic from one or more devices, users or networks.</li> </ul>	<p>The network provisioning and monitoring for the Accused Hotspot 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>In one example, the Accused Hotspot Instrumentalities include a battery saver mode that throttles bandwidth for connected wireless devices. This mode reduces network performance of the connected wireless devices and conserve power for the Accused Hotspot Instrumentalities.</p> <p>In another example, the Accused Hotspot Instrumentalities are configured or configurable to select or dynamically select the WLAN frequency (e.g., 2.4GHz, 5 GHz) which provides a tradeoff between higher bandwidth but lower connectivity distance, or wider connectivity distance but lower bandwidth.</p>

**Step 1. Tap Mobile Hotspot.**

**Step 2. Tap Configure.**

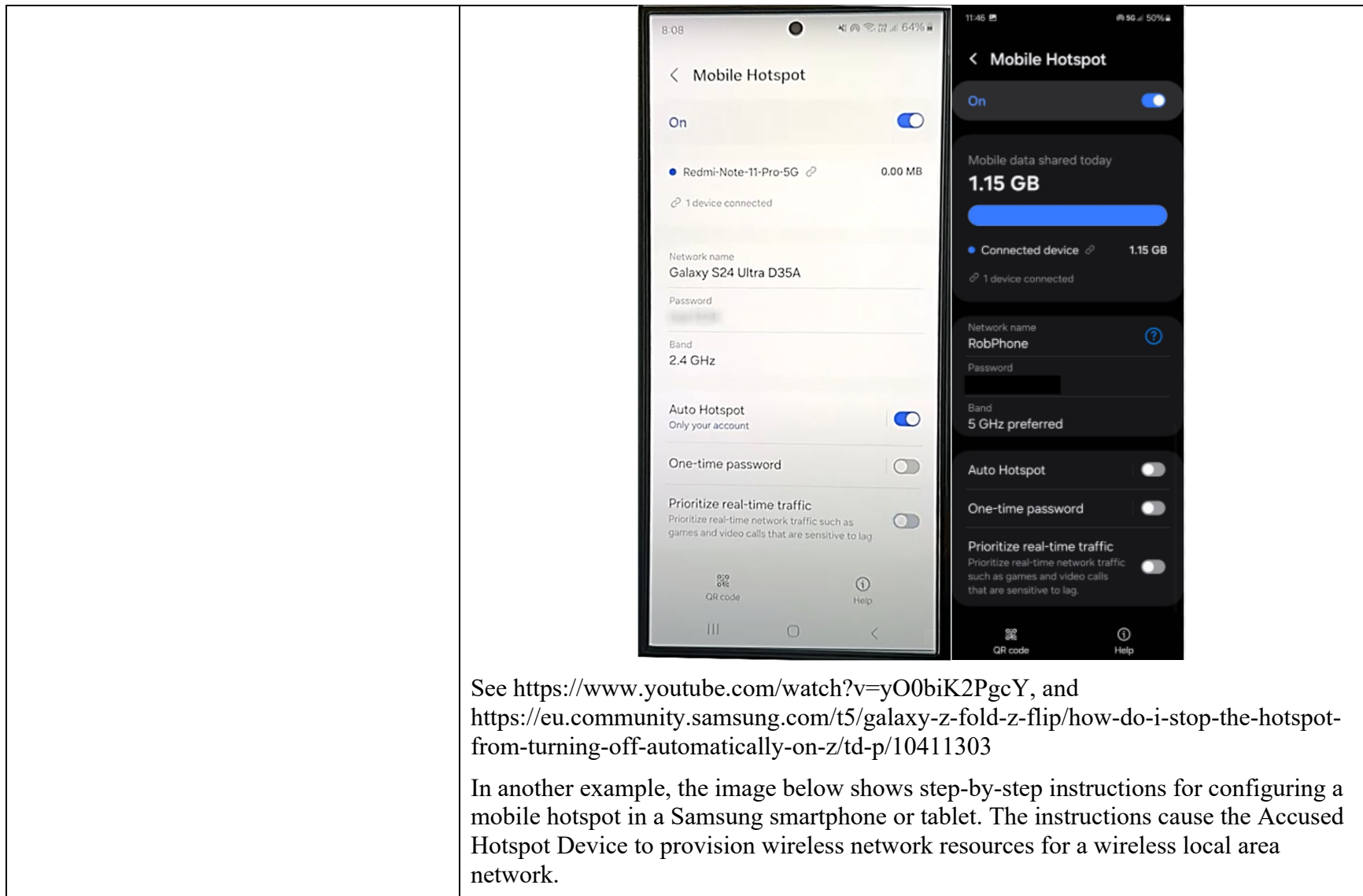
**Step 3. Set the Network name, Security, Password, or Band.**




If the mobile hotspot is not found, on your device, tap **Configure** and set **Band** to 2.4 GHz, tap **Advanced**, and then tap the **Hidden network** switch to deactivate it.

See <https://www.samsung.com/ph/support/mobile-devices/how-to-use-and-configure-a-mobile-hotspot-on-your-galaxy-phone/>

In another example, the Accused Hotspot Instrumentalities are configurable to prioritize traffic for the Accused Hotspot Instrumentalities (e.g., smartphone or tablet) first, over communications for the wireless devices connected on the wireless hotspot (i.e., “prioritize real-time traffic” configuration option for the Mobile Hotspot). The prioritization may be based on application or traffic information.

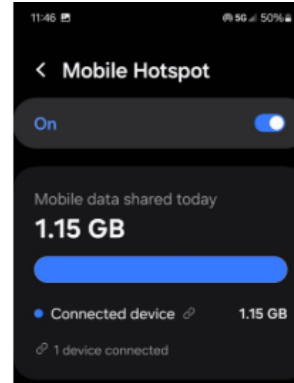


	 <h2>Connection options for your Galaxy phone or tablet</h2> <p><b>Mobile Hotspot</b> Use your device to create a Wi-Fi network, enabling other devices to connect and access the internet using your mobile data or Wi-Fi connection.</p> <ol style="list-style-type: none"><li>1 Swipe down from the top of the screen, and then tap the <b>Settings</b> icon.</li><li>2 Tap <b>Connections</b>, and then tap <b>Mobile Hotspot and Tethering</b>.</li><li>3 Tap <b>Mobile Hotspots</b>, and then turn on the <b>switch</b> at the top of the screen.</li><li>4 Tap the Network name, and then customize your desired information. The following options will now be available:<ul style="list-style-type: none"><li>• <b>Network name:</b> View and change the name of your hotspot.</li><li>• <b>Password:</b> View and change the password for your hotspot.</li><li>• <b>Band:</b> Set the radio band for the hotspot. <b>2.4 Ghz</b> is compatible with more devices, and <b>5 Ghz</b> will provide better performance.</li><li>• <b>Security:</b> Select the hotspot's security level.</li><li>• You can also tap <b>Advanced</b> to edit additional settings, such as MAC address type, Hidden network, Power saving mode, Wi-Fi sharing, and more.</li></ul></li><li>5 Tap <b>Save</b> to apply your changes.</li><li>6 Now, on the device you want to connect, open the Wi-Fi settings, and then search for and tap the mobile hotspot network name you set up. Enter the password, and then tap <b>Connect</b>.</li></ol> <p><b>Note:</b> If the Mobile hotspot is set to Hidden, tap <b>Add network</b> at the bottom of the Wi-Fi menu first, and then enter the network information</p>
--	---

**7** To ensure the connection is working, open the browser or an app that requires internet access on the receiving device.

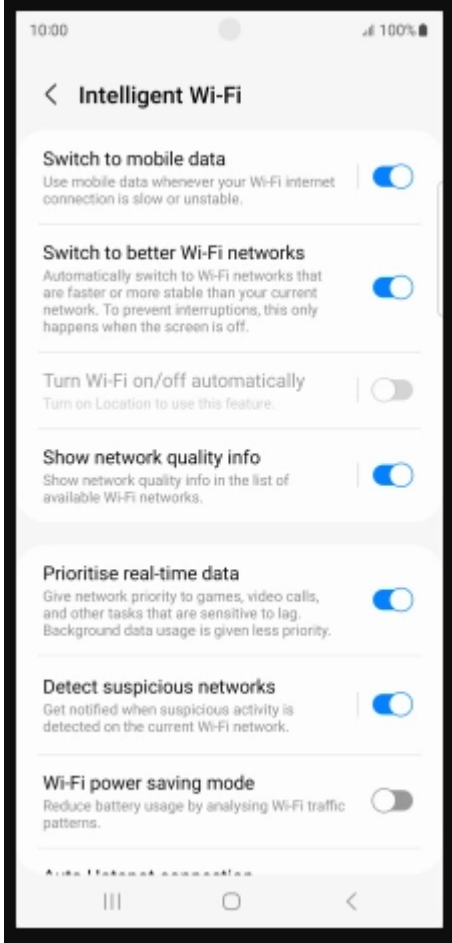
See <https://www.samsung.com/us/support/answer/ANS10002546/>

In another example, the Accused Hotspot Instrumentalities can monitor and measure the amount of data shared with the connected wireless device. The image below shows the measured traffic throughput for the connected device by the Accused Hotspot Device.



See <https://eu.community.samsung.com/t5/galaxy-z-fold-z-flip/how-do-i-stop-the-hotspot-from-turning-off-automatically-on-z/td-p/10411303>

The Accused Hotspot Instrumentalities can use the intelligent Wi-Fi feature to perform provisioning and monitoring of bandwidth through traffic shaping (e.g., prioritize real-time data and Wi-Fi power saving mode to restrict data usage) and delay provisioning of relayed transmissions (e.g., Wi-Fi power saving mode buffer packets for batch transmissions) For example, the prioritize real-time data mode can prioritize video call applications to reduce jitter and improve call or video clarity. See the image of an Accused Hotspot Instrumentality below.

	 <p>See <a href="https://deviceguides.vodafone.co.uk/samsung/galaxy-s23-ultra-android-13/troubleshooting/connectivity/my-phone-uses-a-large-amount-of-mobile-data/196/">https://deviceguides.vodafone.co.uk/samsung/galaxy-s23-ultra-android-13/troubleshooting/connectivity/my-phone-uses-a-large-amount-of-mobile-data/196/</a></p>
<p><b>Claim 25</b></p>	<p><b>Accused Hotspot Instrumentalities</b></p>

<p>[25] 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 Hotspot 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>See claim element [1f], and claims [23], [24] above.</p>
--	--

# **Exhibit 4**

**EXHIBIT 4 – U.S. Patent No. 8,923,754**

Plaintiff asserts the following “Accused RAN Instrumentalities” infringe the Asserted Claims of U.S. 8,923,754:

- 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).

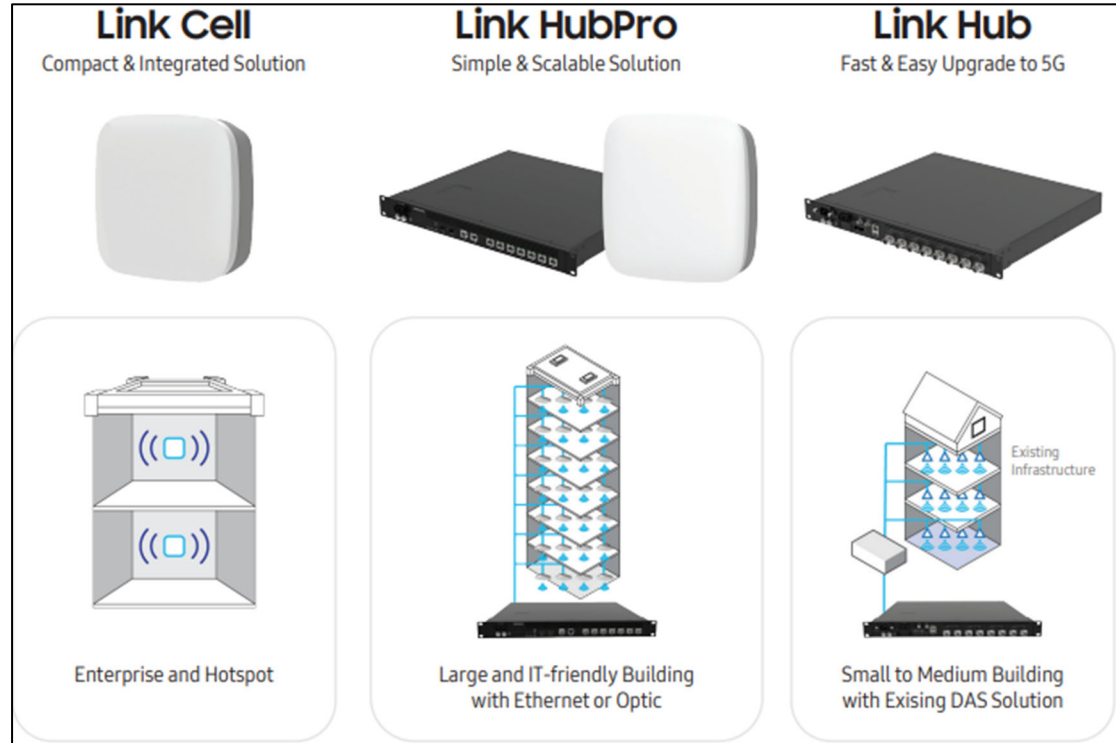
Claim 1	Accused RAN Instrumentalities <sup>1</sup>
<p>[1PRE] A broadband wireless repeater or relay, comprising:</p>	<p>The Accused RAN Instrumentalities act as a wireless repeater to broadcast received wireless signals to connected devices via, for example, a 5G cellular network, and to receive and 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>
--	---

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.



<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>

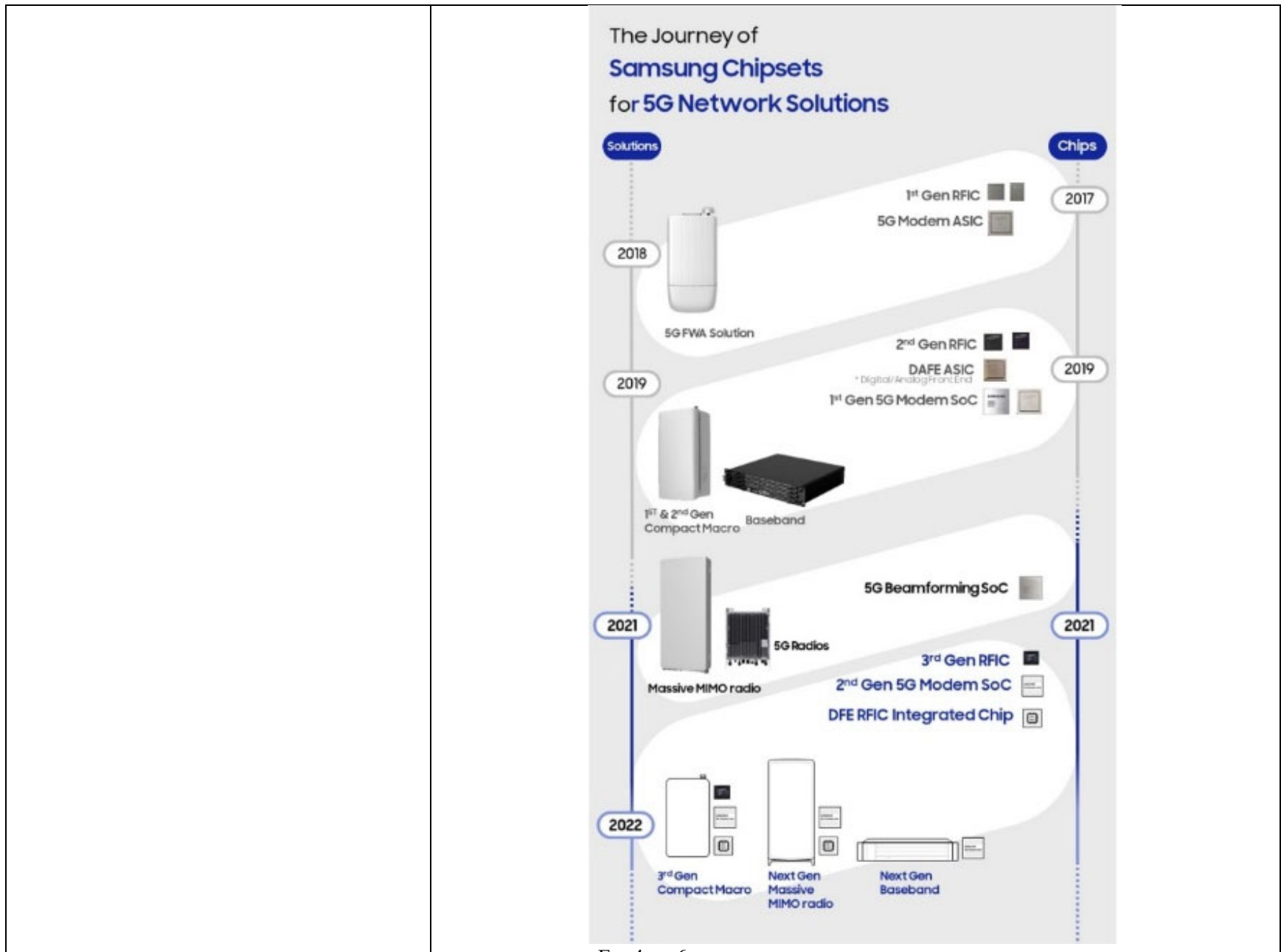
<https://news.samsung.com/us/5g-indoor-mmwave-small-cell/>

	<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.



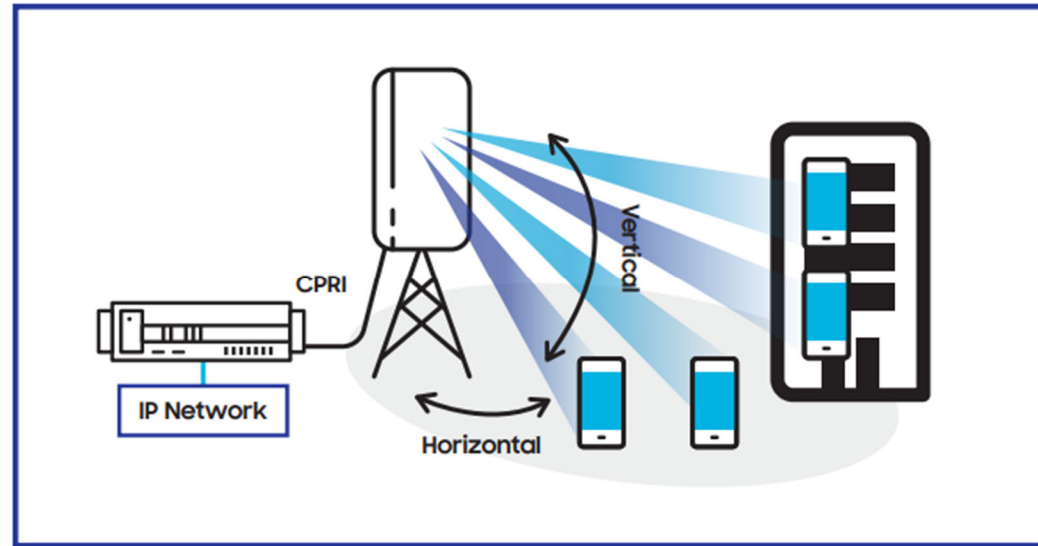
Ex. 4, p. 6

<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 [1C] above and [1E] 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>

	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>[1F] wherein said controller is configured or configurable to perform or for performing a plurality 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;</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; and</p> <p>c) network provisioning or monitoring.</p>	<p>The Accused RAN Instrumentalities include a controller that performs elements (a) and (c). The controller performs element (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

[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)

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>The controller in the Accused RAN Instrumentalities at least (c) monitors the network, such as by adaptively improving beamforming based on users. See brochures/0804_samsungs-massive-mimo-radios-for-an-outstanding-5g-experience/0804_samsungs-massive-mimo-radios-for-an-outstanding-5g-experience_r2.pdf. To adaptively beamform, the Accused RAN Instrumentalities need to know where uses are located, which is an example of network monitoring.</p> <p>In another 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. 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>
<b>Claim 2</b>	<b>Accused RAN Instrumentalities</b>
<p>[2] The broadband wireless repeater or relay of claim 1 wherein said controller performs a).</p>	<p>The controller of the Accused RAN 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 [1F].</p> <p>See claim elements [1F] above.</p>
<b>Claim 3</b>	<b>Accused RAN Instrumentalities</b>
<p>[3] 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</p>	<p>The receiver and/or the transmitter of the Accused Hotspot Instrumentalities are configured to transmit or receive signals in half-duplex signal modulation through cellular networks (e.g., 4G LTE or 5G).</p>

<p>transmitter or transceiver for transmitting signals or data operate in half duplex</p>	
<p><b>Claim 14</b></p>	<p><b>Accused RAN Instrumentalities</b></p>
<p>[14] The broadband wireless repeater or relay of claim 1, wherein said repeater or relay employs MIMO or adaptive antenna technology.</p>	<p>The Accused RAN Instrumentalities is configured to employ at least the Massive MIMO Radios that uses 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 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.”</p> <p>See <i>id</i>;</p> <p>In another example, the Massive MIMO products are configured to split mode operation, Carrier aggregation, and multi-user MIMO.</p>

	<p><b>Samsung's Massive MIMO Solution Benefits</b></p> <p><b>Samsung Massive MIMO Unit (MMU):</b> 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:</p> <ul style="list-style-type: none"> <li>• 4G LTE</li> <li>• 5G NR</li> <li>• Co-deploy 4G LTE and 5G NR.</li> </ul> <p>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.</p> <p><b>High-Density Antenna System with Integrated Radio Control:</b> 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.</p> <p><b>Carrier Aggregation:</b> 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.</p> <p><b>MIMO and MU-MIMO:</b> 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.</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>See claim elements [1PRE], [1D]-[1F] above.</p>
--	--

Claim 23	Accused RAN Instrumentalities
<p>[23] The broadband wireless repeater or relay of claim 1 wherein said controller performs c).</p>	<p>The Accused RAN Instrumentalities 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 [1F].</p> <p>See claim elements [1F] above, and claim [24] below.</p>
Claim 24	Accused RAN Instrumentalities
<p>[24] The broadband wireless repeater or relay of claim 1 wherein in c) includes one or more of:</p> <ul style="list-style-type: none"> <li>i) bandwidth or delay provisioning of repeated or relayed transmissions,</li> <li>ii) application prioritization,</li> <li>iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and</li> <li>iv) monitoring or measuring traffic from one or more devices, users or networks.</li> </ul>	<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> <p>In another 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>

	In another example, the Accused RAN Instrumentalities are configurable for network slicing to virtually partition network resources for certain applications or traffic types. 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>
<b>Claim 25</b>	<b>Accused RAN Instrumentalities</b>
[25] 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>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>See claim element [1f], and claims [23], [24] above.</p>