

Exhibit 1

EXHIBIT 1 – U.S. Patent No. 7,676,194

Plaintiff asserts that at least the following “Accused Hotspot Instrumentalities” infringe the Asserted Claims of U.S. 7,676,194:

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);

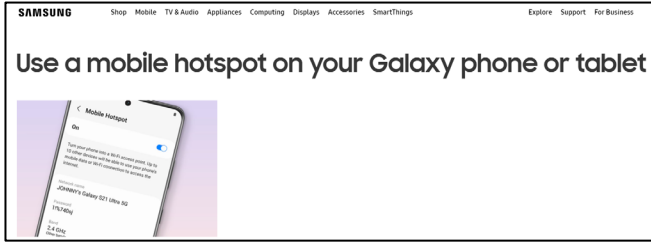
Galaxy Book4 Edge (SM-X8Ex); Galaxy Book5 360 (SM-X90x); Galaxy Book5 Pro (SM-X91x); Galaxy Book5 Pro 360 (SM-X93x); Galaxy Book5 Pro 360 5G (SM-X936)

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-WV525KWEUS); SmartThings Hub (2018) (GP-U999SJVLGDA); SmartThings Hub (GP-U999SJVLGDB)

Claim 1	Accused Hotspot Instrumentalities ¹
[1PRE] A broadband wireless repeater, comprising:	The 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 Instrumentalities connect one or more mobile devices via a Wi-Fi network to the Internet or via a cellular network to the Internet. For example, Samsung's website explains how to use a mobile hotspot on a Galaxy phone or tablet.  See https://www.samsung.com/us/support/answer/ANS00079036/

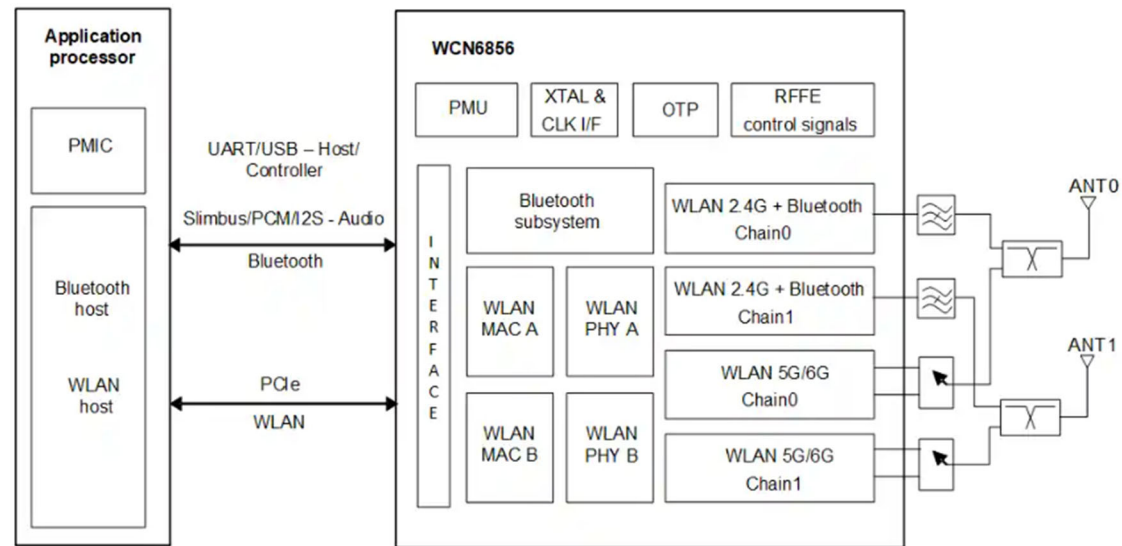
¹ Unless indicated otherwise, the evidence cited in this table is representative of the operation of the Accused Hotspot Instrumentalities and upon information and belief, the Accused Hotspot Instrumentalities function in a substantially similar manner for purposes of this chart.

[1A] at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband² wireless devices in a network, and

The Accused Hotspot Instrumentalities include a receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network.

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.

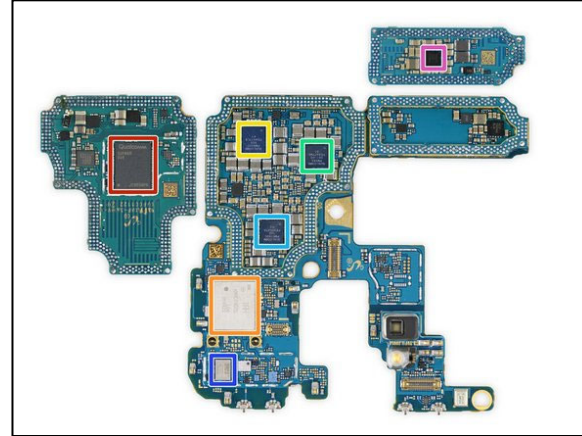


² “Ultrawideband” is defined in the ’194 Patent specifically as “any type of electromagnetic signal that have an instantaneous or overall occupied bandwidth of 100 MHz or more and that are used to communicate or to position-locate between two or more devices.” ’194 Patent at col. 3:57-60.

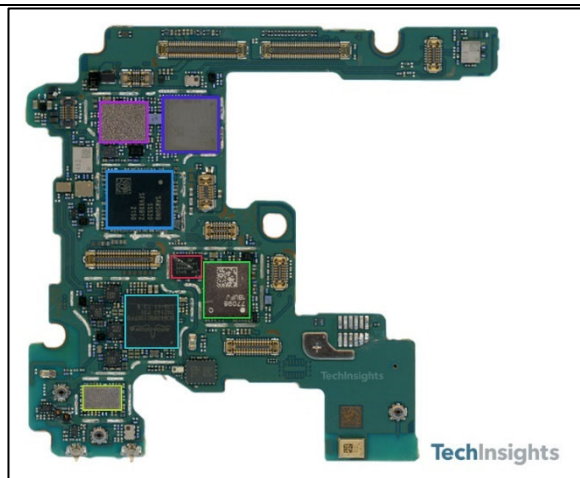
<https://docs.qualcomm.com/bundle/publicresource/topics/80-WL542-10/overview.html>

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

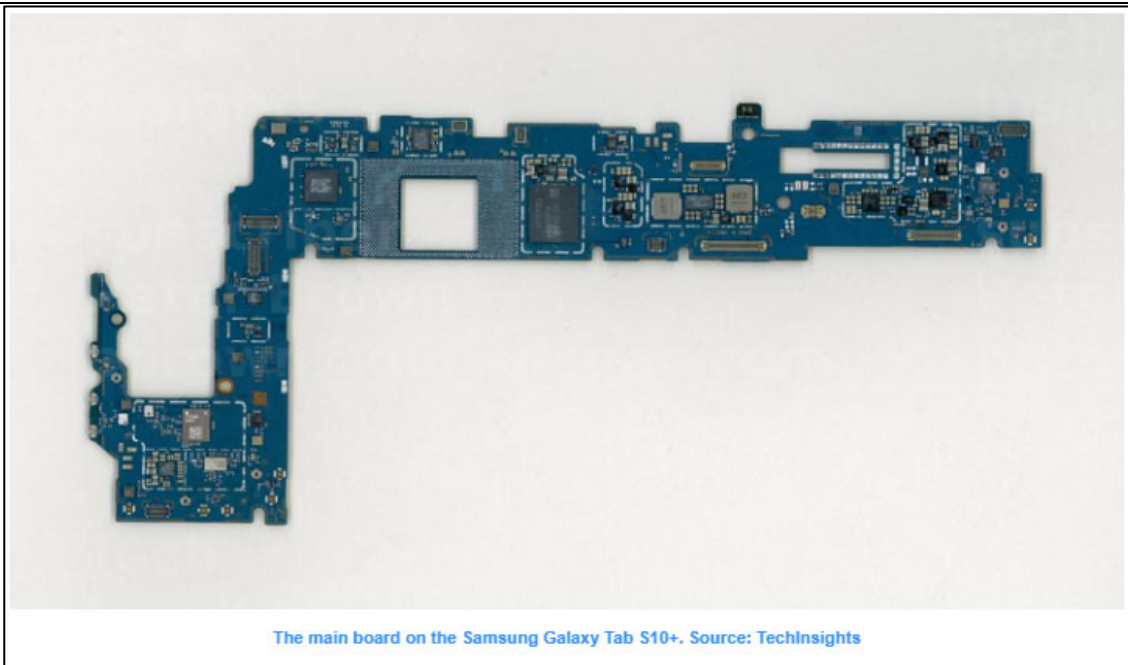
<https://semiconductor.samsung.com/news-events/tech-blog/exynos-rf-5500-and-exynos-sm-5800-chips-making-5g-wireless-communication-possible/> In one example, the image below shows a circuit board from the Galaxy S20 Ultra, identifying a Murata KM9D19075 Wi-Fi module, in the orange rectangle, which comprises “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?srsId=AfmBOorbKmG1FgZYkgqQsKc3mMYaHd6vA_c9nDDoDhWlkT_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



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 RGB/IR light sensor
- Cirrus Logic's Class-D audio amplifier
- Samsung's secure element chip

	See https://electronics360.globalspec.com/article/22285/techinsights-teardown-samsung-galaxy-tab-s10 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. Samsung LYNK™ Cloud Yes Hospitality Plug&Play (Easy Set-up) Yes Hotel Channel List Yes Mixed Channel List (ATSC, DVB-T/T2/C/S2, Analog) Yes Energy Saving Mode (BLU Control) Yes Clock Back Up Supply Yes Soft AP Yes Samsung LYNK™ DRM Yes Security Mode Yes
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See <https://www.samsung.com/ca/business/commercial-tvs/hotel-tv/hq60a-4k-qlcd-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.

USB

2 x USB-A

Digital Audio Out (Optical)

1

Ex-Link (Supports RS-232C Gender)

Supports Stereo Jack to RS232 Adapter

Wifi

Yes (WiFi5)

Variable Audio Out

Yes

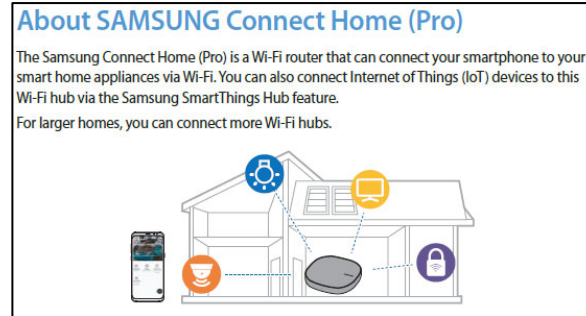
RJ12 (Side/Rear)

Yes

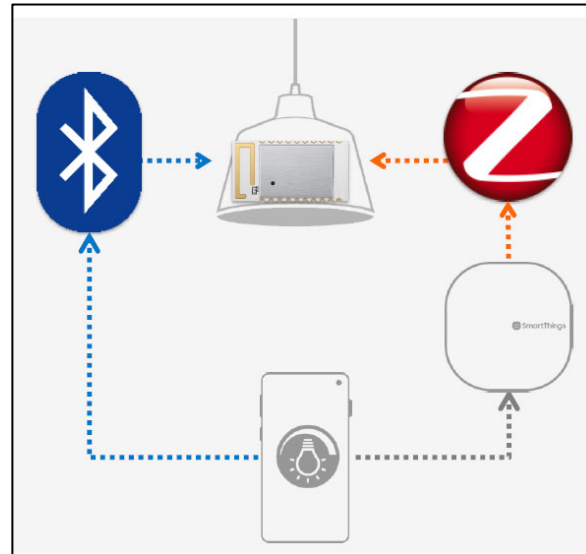
See *id.*

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)

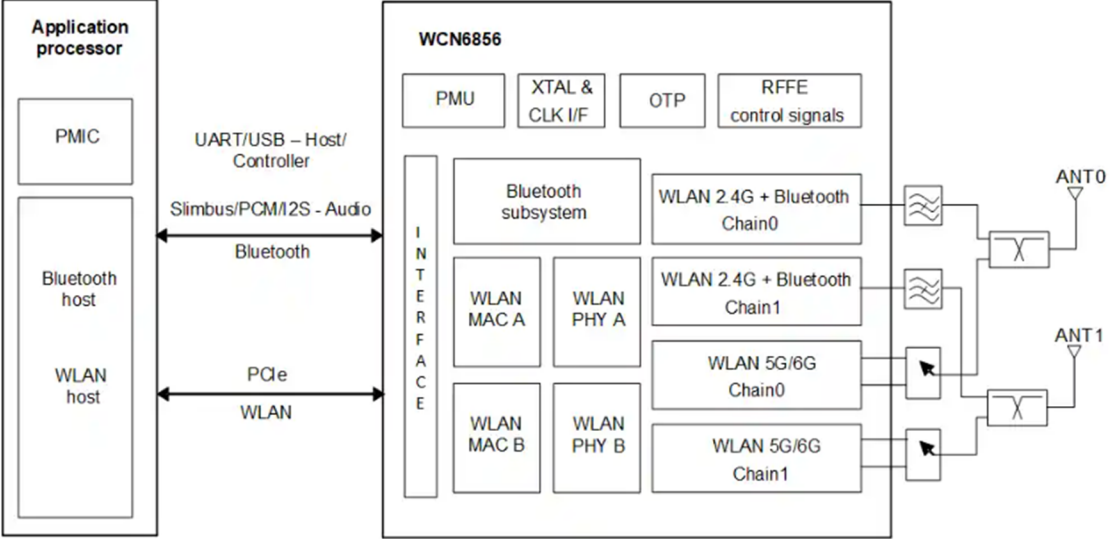


See <https://content.syndigo.com/asset/17adf894-afac-49a6-9e43-acc47d706188/original.pdf>

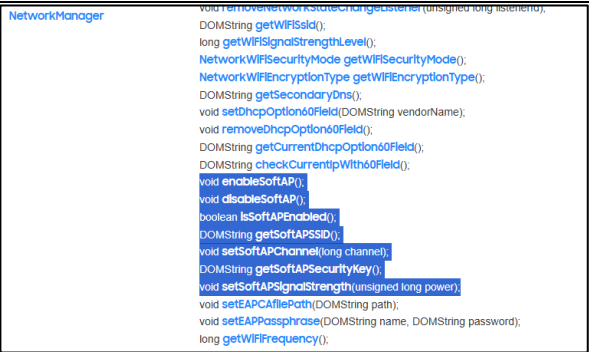


See
https://download.led.samsung.com/led/file/resource/2020/06/Smart_Lighting_Solution_0602.pdf

	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. See claim elements [1B] and [1C] below.
[1B] at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may function alternatively as a receiver and as a transmitter; and	The Accused Hotspot Instrumentalities include a transmitter or transceiver for transmitting received, modified, or stored electronic signals or data. 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 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.

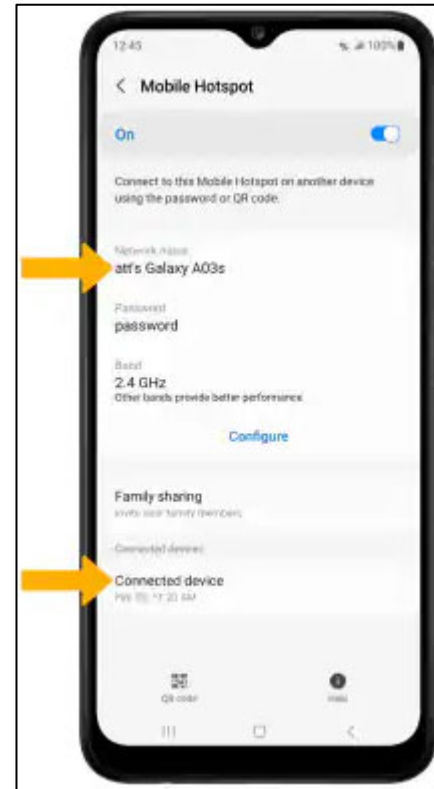
	 https://docs.qualcomm.com/bundle/publicresource/topics/80-WL542-10/overview.html The cellular module (e.g., Exynos RF 5500) also comprises a transmitter or transceiver for transmitting signals via a cellular network. See https://semiconductor.samsung.com/news-events/tech-blog/exynos-rf-5500-and-exynos-sm-5800-chips-making-5g-wireless-communication-possible/ See claim elements [1A] above and [1C] below.
[1C] a controller, which is either pre-programmed or programmable with network information which at least identifies said one or more ultrawideband wireless devices,	The Accused Hotspot Instrumentalities comprise a controller (e.g., processor) configured to identify an ultrawideband wireless device. The ultrawideband wireless devices are 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). 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.

	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. www.techinsights.com/blog/samsung-galaxy-s22-ultra-teardown 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., www.techtarget.com/searchnetworking/answer/What-is-the-difference-between-an-IP-address-and-a-physical-address/. The controller of the Accused Hotspot Instrumentalities also 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. See https://insights.samsung.com/2022/12/16/how-to-turn-your-galaxy-smartphone-into-a-hotspot-3/; and https://en.wikipedia.org/wiki/Wi-Fi_Protected_Access 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.
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	 The screenshot shows a list of methods for the <code>NetworkManager</code> class. The methods include: <code>void removeNetworkStateChangeListener()</code>, <code>DOMString getWiFiSsid()</code>, <code>long getWiFiSignalStrengthLevel()</code>, <code>NetworkWiFiSecurityMode getWiFiSecurityMode()</code>, <code>NetworkWiFiEncryptionType getWiFiEncryptionType()</code>, <code>DOMString getSecondaryDns()</code>, <code>void setDhcpOption60Field(DOMString vendorName)</code>, <code>void removeDhcpOption60Field()</code>, <code>DOMString getCurrentDhcpOption60Field()</code>, <code>DOMString checkCurrentPwWith60Field()</code>, <code>void enableSoftAP()</code>, <code>void disableSoftAP()</code>, <code>boolean isSoftAPEnabled()</code>, <code>DOMString getSoftAPSSID()</code>, <code>void setSoftAPChannel(long channel)</code>, <code>DOMString getSoftAPSecurityKey()</code>, <code>void setSoftAPSignalStrength(unsigned long power)</code>, <code>void setEAPCAFilePoth(DOMString path)</code>, <code>void setEAPPassphrase(DOMString name, DOMString password)</code>, and <code>long getWiFiFrequency()</code>. See https://developer.samsung.com/smarttv/develop/api-references/samsung-product-api-references/network-api.html 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 to identify an ultrawideband in a wireless local area network (WLAN) and wide area network (WAN).
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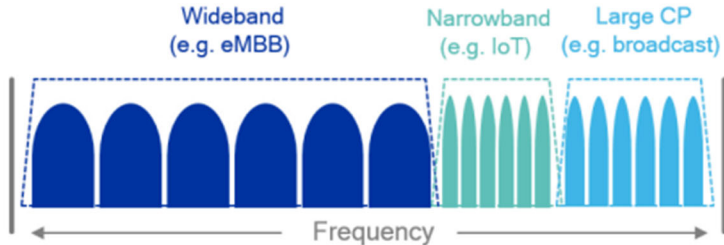
	Specifications Processor <table><tr><td>CPU Speed</td><td>CPU Type</td></tr><tr><td>716MHz</td><td>Quad-Core</td></tr></table> Memory <table><tr><td>RAM Size (MB)</td><td>Storage (GB)</td></tr><tr><td>512</td><td>8</td></tr></table> Connectivity <table><tr><td>Bluetooth Version</td><td>Wi-Fi Version</td><td>Wi-Fi Speed</td><td>Wi-Fi - Security</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> https://news.samsung.com/global/samsung-begins-mass-production-of-first-exynos-branded-iot-solution-the-exynos-i-t200; https://www.samsung.com/ca/smartthings/hub/smartthings-wi-fi-et-wv525bwegca/	CPU Speed	CPU Type	716MHz	Quad-Core	RAM Size (MB)	Storage (GB)	512	8	Bluetooth Version	Wi-Fi Version	Wi-Fi Speed	Wi-Fi - Security	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
CPU Speed	CPU Type																
716MHz	Quad-Core																
RAM Size (MB)	Storage (GB)																
512	8																
Bluetooth Version	Wi-Fi Version	Wi-Fi Speed	Wi-Fi - Security														
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														
[1D] which controls the screening of data received by said at least one receiver, and either passes, ignores, rejects, redirects, modifies, or kills received data	The controller in the Accused Hotspot Instrumentalities controls the screening of data received by said at least one receiver, and either passes, ignores, rejects, redirects, modifies, or kills received data. The received wireless communications can be passed, screened, filtered, or ignored based on MAC Address filtering, IP address filtering, DNS address filtering, port filtering, and/or quality of service (QoS). In network connection, the controller in the Accused Hotspot Instrumentalities use, for example, the IP and/or MAC address of the connected ultrawideband wireless device, to screen out transmissions to/from other devices.																

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.



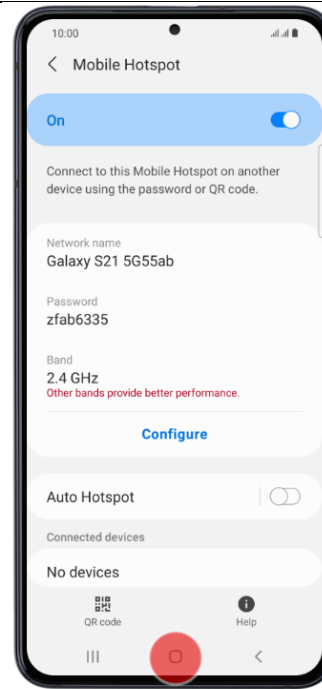
See <https://www.att.com/device-support/article/wireless/KM1472824/Samsung/SamsungSMA037U>; and

	devices.vodafone.com.au/samsung/galaxy-s21-5g-android-11-0/connectivity/use-your-phone-as-wi-fi-hotspot/ The Accused Hotspot Instrumentalities utilize WPA2 and/or WPA3 security protocols, which employ a handshake verification process that screens unwanted data from unauthorized devices attempting to join a WiFi mobile hotspot. See e.g., insights.samsung.com/2022/12/16/how-to-turn-your-galaxy-smartphone-into-a-hotspot-3/; en.wikipedia.org/wiki/Wi-Fi_Protected_Access In another example, 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 https://docs.tizen.org/application/native/api/common/latest/group__CAPI__NETWORK__SOFTAP__MODULE.html In another example, The Accused Hotspot Instrumentalities employ network security settings to ignore certain network communications. The document below shows hardware and firmware configuration of Accused Hotspot Instrumentalities, designed to protect wireless data communications. SmartThings is built from the ground up to protect the device and users’ data securely • Secure boot (SmartThings level 2 security) • H/W & F/W security (Protected external ports) • Protected storage / communication (AES-128 encryption) • Set-up mode / Proximity set-up • Compliance with CA SB-327
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	See https://download.led.samsung.com/led/file/resource/2020/06/Smart_Lighting_Solution_0602.pdf
[1E] said controller providing such data screening in order to differentiate between desired and undesired data for network security, network management, or interference mitigation purposes for said network,	The controller of the Accused Hotspot Instrumentalities provides such data screening in order to differentiate between desired and undesired data for network security, network management, or interference mitigation purposes for said network, In one example, 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

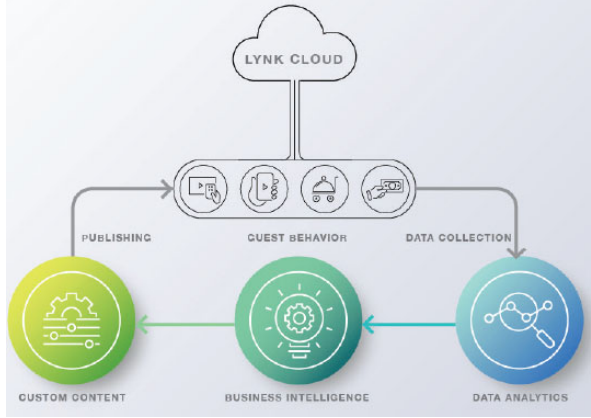
	.pdf; https://docs.qualcomm.com/bundle/publicresource/87-27161-1_REV_C_Snapdragon_X75_5G_Modem-RF_System_Product_Brief.pdf In another example, the controller of the Accused Hotspot Instrumentalities uses the ID of the connected ultrawideband device, e.g., its MAC and/or IP address, to screen out communications to or from the connected ultrawideband device for network security. The Accused Hotspot Devices 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. 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 https://docs.tizen.org/application/native/api/common/latest/group__CAPI_NETWORK_K_SOFTAP_MODULE.html See claim elements [1D]-[1F].
[1F] said controller controlling reception of electronic signals or data by said at least one receiver from said one or more ultrawideband wireless devices and transmission by said at least one transmitter to said one or more ultrawideband wireless devices,	The controller of the Accused Hotspot Instrumentalities controls the reception of electronic signals or data by said at least one receiver from said one or more ultrawideband wireless devices and the transmission by said at least one transmitter to said one or more ultrawideband wireless devices. For example, the controller of the Accused Hotspot Instrumentalities uses the ID of the connected ultrawideband device, e.g., its MAC and/or IP address, to control reception of signals or data from the connected ultrawideband device and transmission of signals to the connected ultrawideband device.

	In another example, 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. See claim elements [1D]-[1F].
[1G] said controller further providing for the collecting, reporting, or storing of network usage, network statistics, or network information for said network.	The controller of the Accused Hotspot Instrumentalities is configured for the collecting, reporting, or storing of network usage, network statistics, or network information for said network. For Example, the controller of the Accused Hotspot Instrumentalities, among other things, collects and stores the IDs of the connected ultrawideband wireless device, which is an example of “network information for said network.” The Accused Hotspot Instrumentalities show 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/



The Accused Hotspot Instrumentalities also track data usage for each connected device, when acting as a mobile hotspot. See gadgetmates.com/check-how-much-hotspot-bandwidth-you-have-left-on-android

	See https://4041669.fs1.hubspotusercontent-na1.net/hubfs/4041669/00_BlueStar%20Microsite%20Files/Samsung/PDF/HQ60A_SERIES.pdf In another example, the Accused Hotspot instrumentalities collect data analytics for the connected devices. See image below.
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	 See https://image-us.samsung.com/SamsungUS/samsungbusiness/tvs/hospitality/luxury/hq60a-series-43/HTV_HQ60A_SERIES.pdf See claim elements [1D]-[1F].
Claim 4	Accused Hotspot Instrumentalities
[4] The broadband repeater of claim 1 further comprising a buffer memory for storing received or to be transmitted electronic signals for processing by said controller.	The controller of the Accused Hotspot Instrumentalities include a buffer memory for storing received or to be transmitted electronic signals for processing by said controller. For example, the 5G modem in the Accused Hotspot Instrumentalities comprises a multilayer buffer (e.g., channel state feedback or channel state information) to manage traffic throughput and control for jitter, latency, and packet loss in real-time wireless communications.

	Features Qualcomm® 5G AI Suite Gen 2 includes: • Sensor-modem-RF solution for mmWave beam management • AI-enhanced channel state feedback (CSF) • AI-enhanced antenna tuning • AI-enhanced GNSS Location Gen 2 See https://docs.qualcomm.com/bundle/publicresource/87-27161-1_REV_C_Snapdragon_X75_5G_Modem-RF_System_Product_Brief.pdf
Claim 7	Accused Hotspot Instrumentalities
[7] The broadband repeater of claim 1 wherein said controller permits one or more network information to be modified and support of position location capabilities for use by a network.	The controller of the Accused Hotspot Instrumentalities permits one or more network information to be modified and support of position location capabilities for use by a network. For example, the Accused Hotspot Device can share emergency location information for E911 services with a connected device through the mobile hotspot. Additionally, the connected device can access GNSS information from the Accused Hotspot Device through the mobile hotspot. Features Qualcomm® 5G AI Suite Gen 2 includes: • Sensor-modem-RF solution for mmWave beam management • AI-enhanced channel state feedback (CSF) • AI-enhanced antenna tuning • AI-enhanced GNSS Location Gen 2 See https://docs.qualcomm.com/bundle/publicresource/87-27161-1_REV_C_Snapdragon_X75_5G_Modem-RF_System_Product_Brief.pdf

Claim 8	Accused Hotspot Instrumentalities
[8] The broadband repeater of claim 1 wherein said controller either or both a) uses adaptive or steerable antennas or MIMO technologies to control the direction or coverage zones or capacity or quality of transmissions or reception, and b) directs undesired user or intruder information to be passed to other components of a network from said at least one transmitter using either wireless or wired connectivity.	The controller of the Accused Hotspot Instrumentalities employs at least a) adaptive or steerable antenna technologies or MIMO technology to control the direction or coverage zones or capacity or quality of transmissions or reception. The Accused Hotspot Instrumentalities include transmitters and receivers to support at least 2x2 MIMO. In Wi-Fi networks, IEEE 802.11n (i.e., Wi-Fi 4) introduced 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 MIMO. In Cellular networks, 4G-LTE supports up to 4x4 MIMO and 5G supports up to 64x64 MIMO. 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. See https://docs.qualcomm.com/bundle/publicresource/87-27161-1_REV_C_Snapdragon_X75_5G_Modem-RF_System_Product_Brief.pdf See e.g., https://r2.community.samsung.com/t5/Tech-Talk/What-is-4-4-MIMO-and-Does-My-Smartphone-Need-It/td-p/4938055 See claim element [1H] above and claim [9] below.
Claim 9	Accused Hotspot Instrumentalities
[9] The broadband repeater of claim 1 where network provisioning information is passed to or pre-programmed with said controller, for purposes of network traffic provisioning,	The controller of the Accused Hotspot Instrumentalities is configured for provisioning information to prioritize either or both reception of data and transmission of data to or from said repeater.

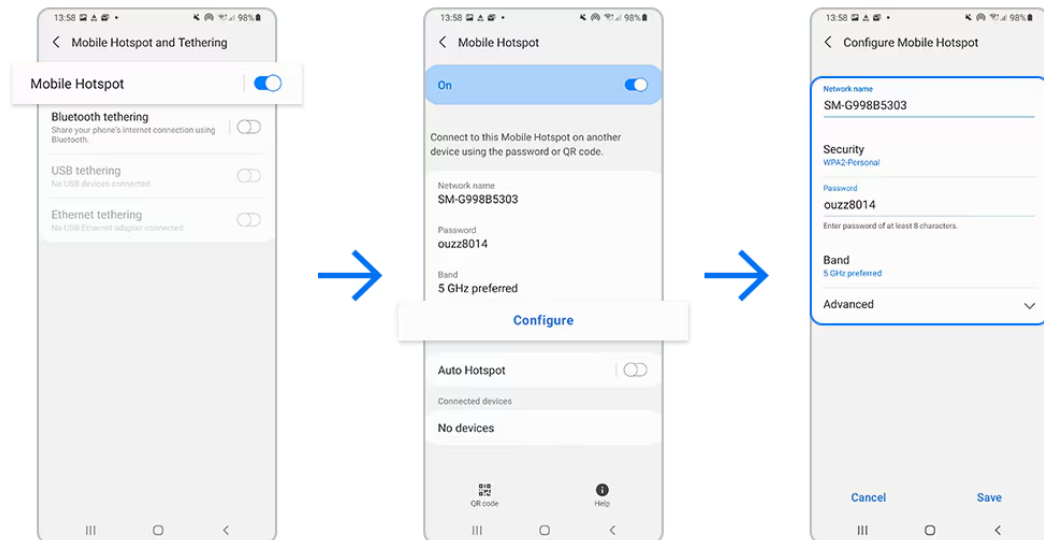
wherein said controller uses said provisioning information to prioritize either or both reception of data and transmission of data to or from said repeater.

For example, the Accused Hotspot Instrumentalities can reduce latency and jitter with traffic shaping and application prioritization. The Accused Hotspot Instrumentalities can also limit the amount of data consumed by consumed by connected devices.

Step 1. Tap Mobile Hotspot.

Step 2. Tap Configure.

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

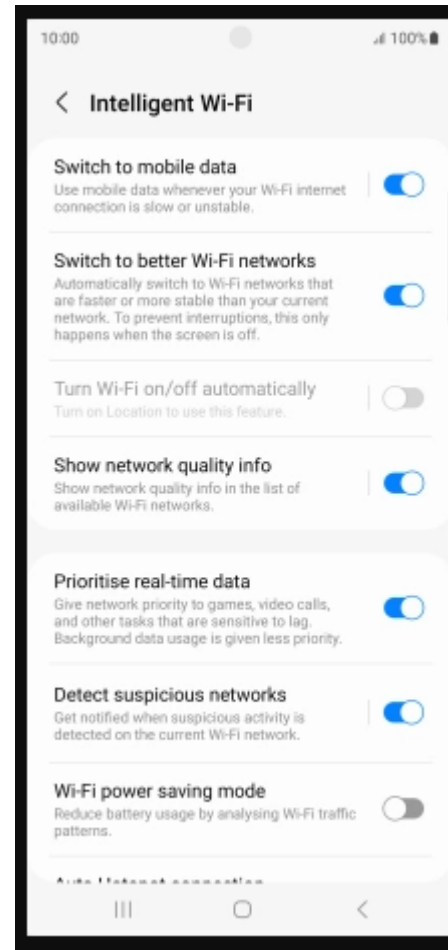


If the mobile hotspot is not found, on your device, tap **Configure** and set **Band** to **2.4 GHz**, tap **Advanced**, and then tap the **Hidden network** switch to deactivate it.

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 configured or configurable to manage intelligent Wi-Fi settings that are used to configure the network connections such as prioritizing real-time data detecting suspicious networks,

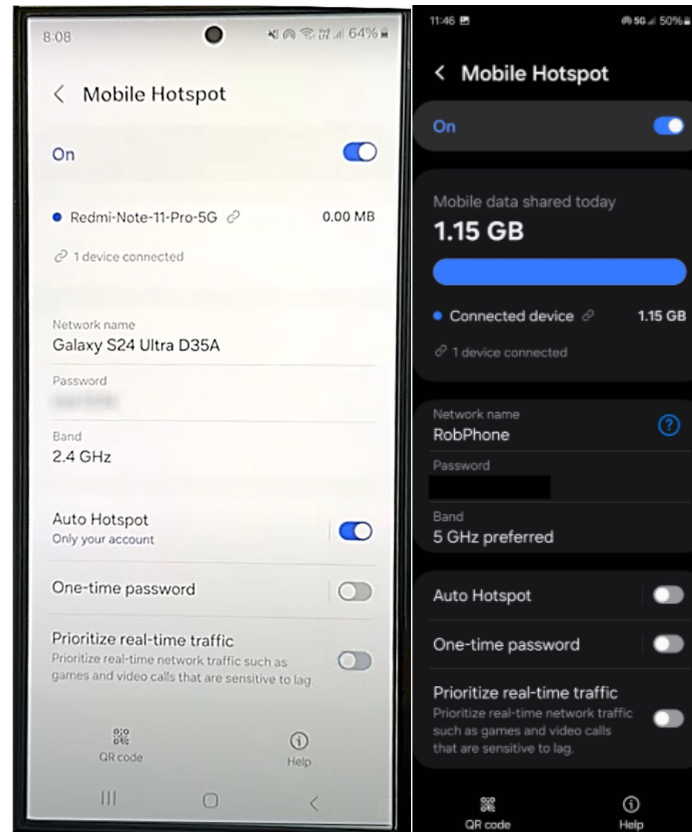
or reducing battery consumption by analyzing Wi-Fi traffic patterns. See the image of an Accused Hotspot Instrumentality below.



See <https://deviceguides.vodafone.co.uk/samsung/galaxy-s23-ultra-android-13/troubleshooting/connectivity/my-phone-uses-a-large-amount-of-mobile-data/196/>

In another example, the Accused Hotspot Instrumentalities are configurable to prioritize traffic for the Accused Hotspot Instrumentalities (e.g., smartphone or tablet)

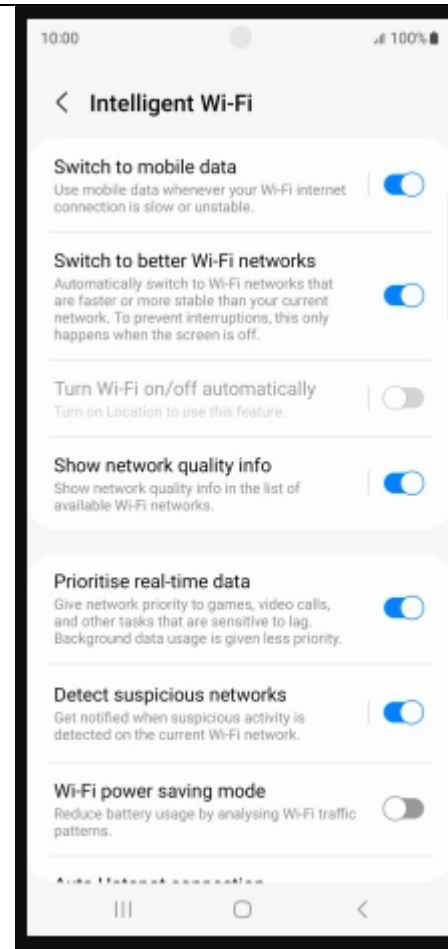
first, over communications for the wireless devices connected on the wireless hotspot (i.e., “prioritize real-time traffic” configuration option for the Mobile Hotspot). The prioritization may be based on application or traffic information.



See <https://www.youtube.com/watch?v=yO0biK2PgcY>, and <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>

Claim 12	Accused Hotspot Instrumentalities
[12PRE] A broadband wireless repeater, comprising:	See claim element [1PRE] above.
[12A] at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network, and	See claim elements [1A] and [1B] above.
[12B] at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may function alternatively as a receiver and as a transmitter; and	See claim elements [1A] and [1B] above.
[12C] a controller which is either pre-programmed or programmable with provisioning information which at least identifies said one or more ultrawideband wireless devices for purposes of network traffic provisioning,	The controller of the Accused Hotspot Instrumentalities is pre-programmed or programmable with provisioning information which at least identifies said one or more ultrawideband wireless devices for purposes of network traffic provisioning. See claim element [1C] above and [12D] below.
[12D] wherein said controller uses said provisioning information to prioritize either or both reception of data by said at least one receiver and transmission of data	The controller of the Accused Hotspot Instrumentalities uses said provisioning information to prioritize either or both reception of data by said at least one receiver and transmission of data by said at least one transmitter to said one or more ultrawideband wireless devices.

by said at least one transmitter to said one or more ultrawideband wireless devices,	For example, the Accused Hotspot Instrumentalities are configured or configurable to deploy a hotspot (i.e., wireless local area network) for one or more wireless devices. By establishing a wireless connection between the one or more wireless devices with the WLAN, the Accused Hotspot Instrumentalities perform network provisioning. Additionally, the Accused Hotspot Instrumentalities monitor the data throughput shared with the one or more wireless devices. In another example, the Accused Hotspot Instrumentalities are configured or configurable to manage intelligent Wi-Fi settings that are used to configure the network connections such as prioritizing real-time data detecting suspicious networks, or reducing battery consumption by analyzing Wi-Fi traffic patterns. See the image of an Accused Hotspot Instrumentality below.
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See <https://deviceguides.vodafone.co.uk/samsung/galaxy-s23-ultra-android-13/troubleshooting/connectivity/my-phone-uses-a-large-amount-of-mobile-data/196/>

In another example, the Samsung developer documentation of the Accused Hotspot Instrumentalities (e.g., Hospitality TVs), 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

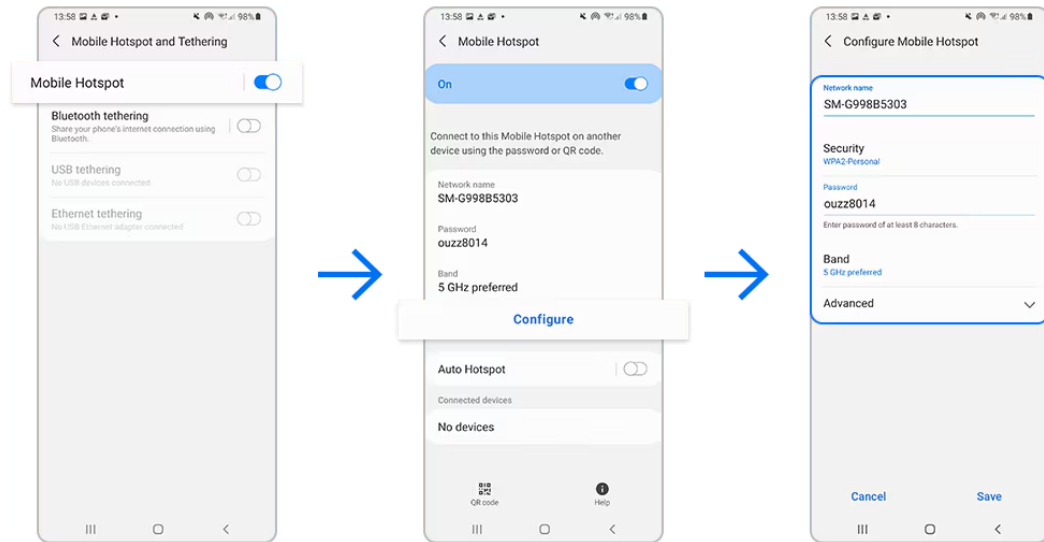
	security settings. It is primarily used in IoT environments to easily set up and maintain network access points.” See https://docs.tizen.org/application/native/api/common/latest/group__CAPI__NETWORK__SOFTAP__MODULE.html The SoftAP function is characterized in the industry as a software created wireless hotspot that can be deployed by a hospitality TV. See image below: Soft AP Software-enabled Access Point (SoftAP) is a "virtual" Wi-Fi feature that uses software to create a wireless hotspot. The current version supports Bridge Mode, which enables network managers to control connected devices See https://www.ggear.com.kh/information-display/55-smart-hotel-tv-ut660h-series/ In another example, the document below shows hardware and firmware configurations for Accused Hotspot Instrumentalities, designed to protect wireless data communications. SmartThings is built from the ground up to protect the device and users' data securely • Secure boot (SmartThings level 2 security) • H/W & F/W security (Protected external ports) • Protected storage / communication (AES-128 encryption) • Set-up mode / Proximity set-up • Compliance with CA SB-327 See https://download.led.samsung.com/led/file/resource/2020/06/Smart_Lighting_Solution_0602.pdf
[12E] said controller controlling reception of electronic signals or data by said at	See claim element [1F] above.

least one receiver and transmission of electronic signals or data by said at least one transmitter to said one or more ultrawideband wireless devices.	
Claim 13	Accused Hotspot Instrumentalities
[13] The broadband repeater of claim 12 wherein said provisioning information prioritizes by one or more of network user, type of data being received by said at least one receiver, type of data being transmitted by said at least one transmitter, and the particular type of application being used by one or more users of the network being transmitted by said at least one transmitter.	The controller of the Accused Hotspot Instrumentalities uses provisioning information to prioritizes transmitted or received data by one or more of network user, type of data being received by said at least one receiver, type of data being transmitted by said at least one transmitter, and the particular type of application being used by one or more users of the network being transmitted by said at least one transmitter. For example, the Accused Hotspot Instrumentalities can reduce latency and jitter with traffic shaping and application prioritization. The Accused Hotspot Instrumentalities can also limit the amount of data consumed by consumed by connected devices.

Step 1. Tap Mobile Hotspot.

Step 2. Tap Configure.

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



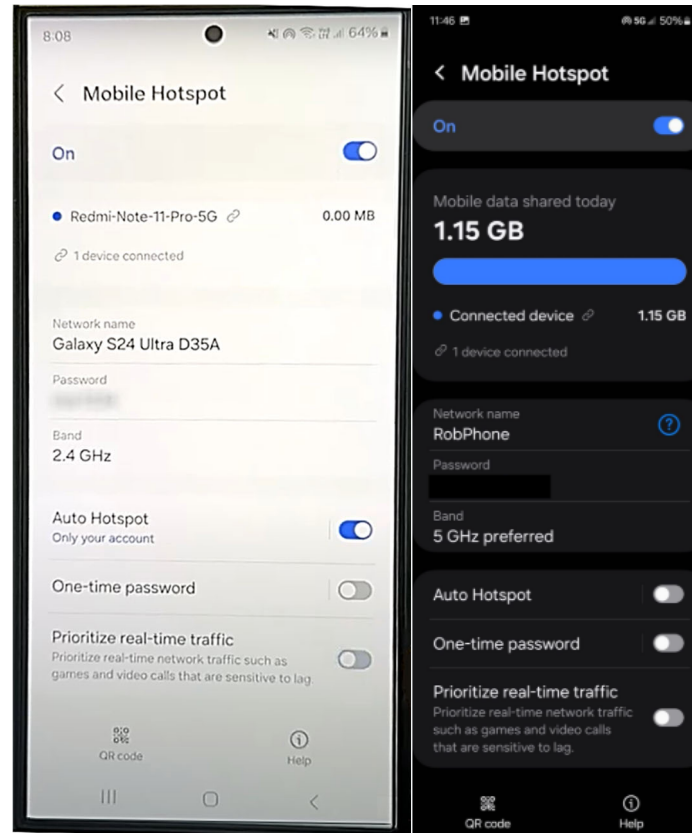
If the mobile hotspot is not found, on your device, tap **Configure** and set **Band** to **2.4 GHz**, tap **Advanced**, and then tap the **Hidden network** switch to deactivate it.

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 configured or configurable to manage intelligent Wi-Fi settings that are used to configure the network connections such as prioritizing real-time data detecting suspicious networks, or reducing battery consumption by analyzing Wi-Fi traffic patterns. See the image of an Accused Hotspot Instrumentality below.

	See https://deviceguides.vodafone.co.uk/samsung/galaxy-s23-ultra-android-13/troubleshooting/connectivity/my-phone-uses-a-large-amount-of-mobile-data/196/ 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
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(i.e., “prioritize real-time traffic” configuration option for the Mobile Hotspot). The prioritization may be based on application or traffic information.



See <https://www.youtube.com/watch?v=yO0biK2PgcY>, and <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>

Claim 14	Accused Hotspot Instrumentalities
[14] The broadband repeater of claim 12 further comprising a buffer memory for storing received or to be transmitted electronic signals or data for processing by said controller.	See claim [4] above.
Claim 17	Accused Hotspot Instrumentalities
[17] The broadband repeater of claim 12 wherein said controller permits one or more of provisioning information to be modified and support of position location capabilities for use by a network.	See claim [7] above.
Claim 20	Accused Hotspot Instrumentalities
[20] The broadband repeater of claim 12 wherein said controller either or both a) uses adaptive or steerable antennas or MIMO technologies to control the direction or coverage zones or capacity or quality of transmissions or reception, and b) directs undesired user or intruder information to be passed to other components of a network from said at least one transmitter using either wireless or wired connectivity.	See claim [8] above.

Claim 22	Accused Hotspot Instrumentalities
[22PRE] A broadband wireless repeater, comprising:	See claim element [1PRE] above.
[22A] at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network, and	See claim elements [1A] and [1B] above.
[22B] at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may function alternatively as a receiver and as a transmitter; and	See claim elements [1A] and [1B] above.
[22C] a controller which is either pre-programmed or programmable to collect traffic information or security information related to received and transmitted data at least some of which is received from or sent to said one or more ultrawideband wireless devices in said network,	See claim elements [1C] and [1G] above.
[22D] said controller controlling reception of electronic signals or data by said at	See claim element [1F] above.

least one receiver and transmission by said at least one transmitter.	
Claim 23	Accused Hotspot Instrumentalities
[23] The broadband repeater of claim 22 further comprising one or more of a means for exporting traffic information or security information to one or more computer processors or devices, and a means for adjusting one or more operations of said controller based on said traffic information or security information.	See claims [9] and [13] above. The structure in the Accused Hotspot Instrumentalities that exports or transmits the traffic information or security information to one or more computer processors or devices is the transceiver. The structure in the Accused Hotspot Instrumentalities that adjusts the one or more operations of said controller based on said traffic information or security information is a hardware memory unit that stores instructions to adjust the operation of the controller.

Exhibit 2

EXHIBIT 2 – U.S. Patent No. 7,676,194

Plaintiff asserts the following “Accused RAN Instrumentalities” infringe the Asserted Claims of U.S. 7,676,194

- 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).

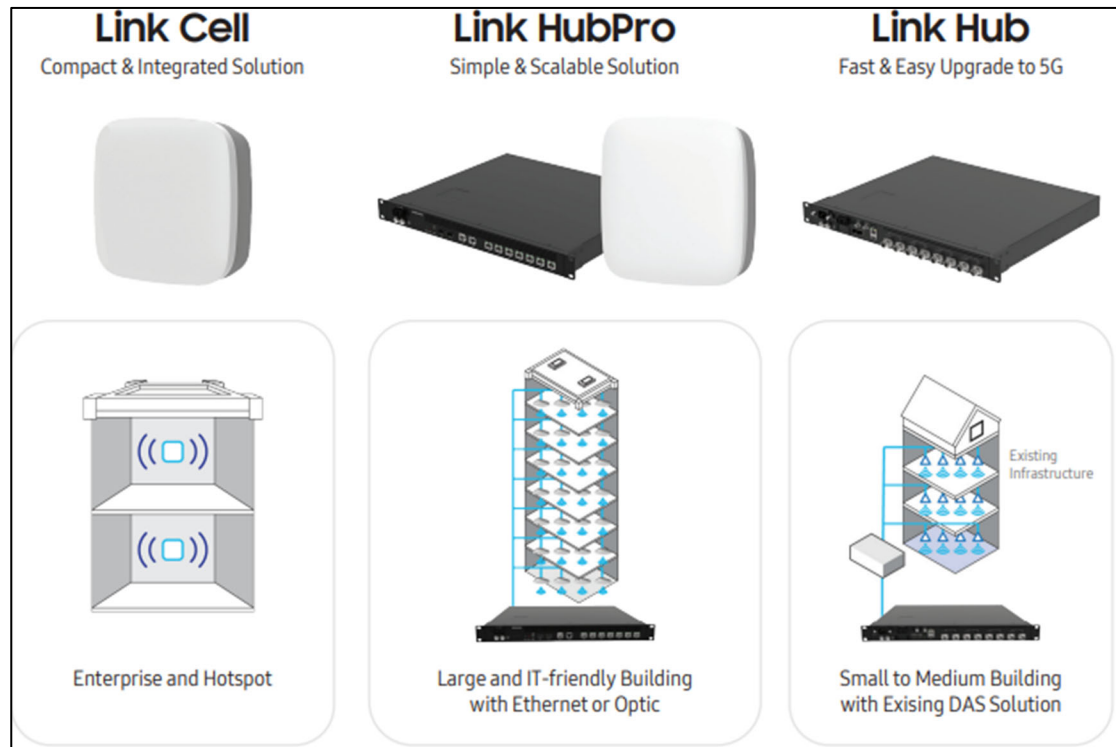
Claim 1	Accused RAN Instrumentalities ¹
[1PRE] A broadband wireless repeater, comprising:	The Accused RAN Instrumentalities act as a wireless repeater to broadcast received wireless signals to connected devices via, for example, a 5G cellular network, and to receive and forward wireless signals received from the connected devices to the Internet via a 5G cellular network. 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.” See 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/ Massive MIMO Radio:

¹ 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.

	Massive MIMO Radio 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. See www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/; and https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/ Citizens Broadband Radio Service (CBRS) Radios: CBRS 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. CBRS Radios enable communication of 150MHz of shared spectrum in Band 48 (otherwise known as the 3.5GHz C-Band). See https://insights.samsung.com/2022/11/04/what-is-cbrs-and-how-is-it-transforming-enterprise-networks-2/; https://www.samsung.com/global/business/networks/products/radio-access/cbrs/; and https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/ Compact Macro: Compact Macro 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.
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See <https://www.samsung.com/global/business/networks/products/radio-access/5g-ran/>; and [networks/insights/brochures/1221-5g-fixed-wireless-access-a-powerful-alternative-to-fiber-to-the-home/5g-fixed-wireless-access-a-powerful-alternative-to-fiber-to-the-home.pdf](https://www.samsung.com/global/business/networks/insights/brochures/1221-5g-fixed-wireless-access-a-powerful-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.

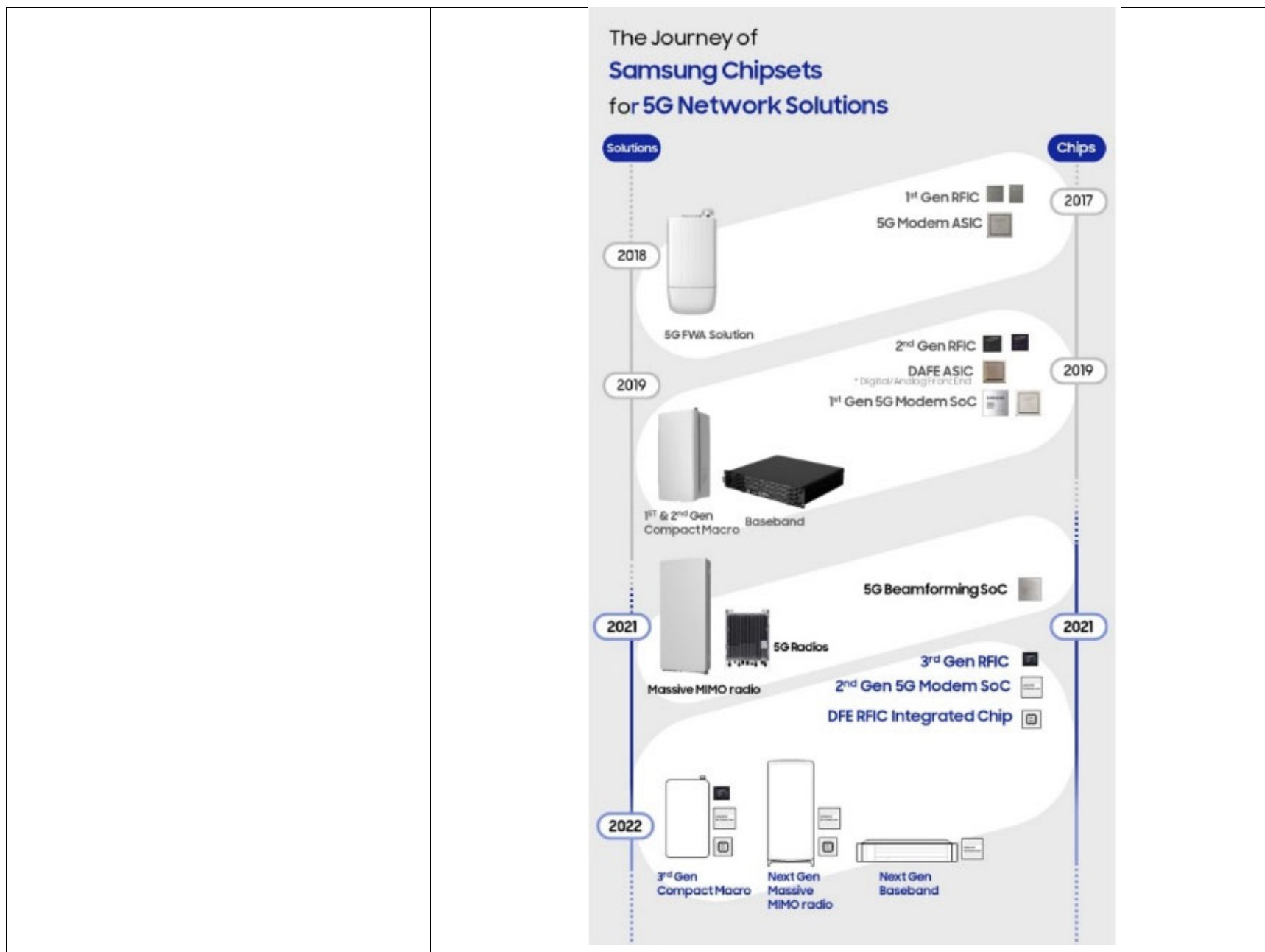


<https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/brochures/bringing-5g-indoors-the-critical-next-step-in-5gs-evolution/Samsung-Link-Series.pdf>

	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 https://www.samsung.com/global/business/networks/products/radio-access/indoor-solutions/ 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> 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>
[1A] at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband² wireless devices in a network, and	The Accused RAN Products include a receiver or transceiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network.

² “Ultrawideband” is defined in the ’194 Patent specifically as “any type of electromagnetic signal that have an instantaneous or overall occupied bandwidth of 100 MHz or more and that are used to communicate or to position-locate between two or more devices.” ’194 Patent at col. 3:57-60.

	For example, the accused products 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. 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/ 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.
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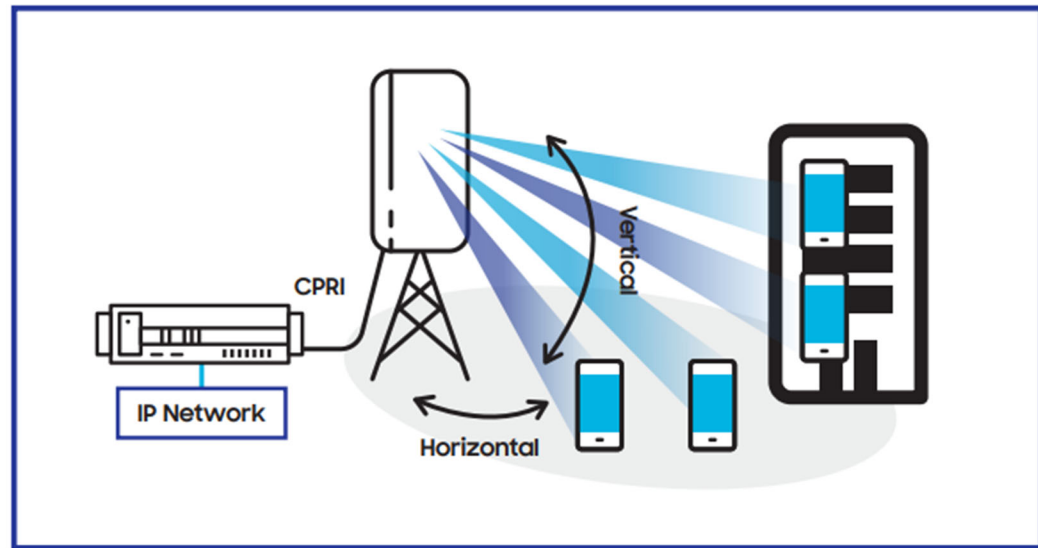


[1B] at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may function alternatively as a receiver and as a transmitter; and	The Accused RAN Products include a transmitter or transceiver for transmitting received, modified, or stored electronic signals or data to one or more devices. For example, the RFIC chipsets in the Accused RAN Products include at least one transmitter or transceiver for signal or data transmission to the connected device. See www.samsung.com/global/business/networks/insights/press-release/0621-samsung-unveils-new-chipsets-to-enhance-next-generation-5g-ran-portfolio/ See claim element [1A] above.
[1C] a controller, which is either pre-programmed or programmable with network information which at least identifies said one or more ultrawideband wireless devices,	The Accused RAN Instrumentalities comprise a controller, which is either pre-programmed or programmable with network information which at least identifies said one or more ultrawideband wireless devices. For example, the controller (e.g., processor) in the Accused RAN Instrumentalities can be programmed with an ID for the connected ultrawideband device, which is an example of “network information which at least identifies” the connected ultrawideband 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 need the connected device’s ID in order to communicate with the connected device via 5G. See amitkhandelwal.medium.com/understanding-5g-eab4a660d3ab; interlir.com/2024/08/01/the-impact-of-5g-on-ip-resource-management/
[1D] which controls the screening of data received by said at least one receiver, and	The controller in the Accused RAN Instrumentalities is configured to control screening of data received by said at least one receiver, and either passes, ignores, rejects, redirects, modifies, or kills received data.

either passes, ignores, rejects, redirects, modifies, or kills received data

In one example, the controller of the Accused RAN Instrumentalities ignores and/or filters signals to filter interference from receive signals by beamforming and spatial filtering.

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

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-network/samsung-16-layer-massive-mimo-increases-cell-capacity-in-commercial-network.pdf
[1E] said controller providing such data screening in order to differentiate between desired and undesired data for network security, network management, or interference mitigation purposes for said network,	The controller of the Accused RAN Instrumentalities provides such data screening in order to differentiate between desired and undesired data for network security, network management, or interference mitigation purposes for said network. For 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-network/samsung-16-layer-massive-mimo-increases-cell-capacity-in-commercial-network.pdf See claim element [1D] above.
[1F] said controller controlling reception of electronic signals or data by said at least one receiver from said one or more ultrawideband wireless devices and transmission by said at least one transmitter to said one or more ultrawideband wireless devices,	The controller of the Accused RAN Instrumentalities controls reception of electronic signals or data by said at least one receiver from said one or more ultrawideband wireless devices and transmission by said at least one transmitter to said one or more ultrawideband wireless devices. See claim element [1D], [1E] above and [1G] below.
[1G] said controller further providing for the collecting, reporting, or storing of network usage, network statistics, or network information for said network.	The controller of the Accused RAN Instrumentalities, among other things, stores the IDs of the connected ultrawideband wireless device, which is an example of “network information for said network.” Additionally, the Accused RAN Instrumentalities adaptively improve 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 Products need to know where uses are located, which is an example of network information.																														
Claim 4	Accused RAN Instrumentalities																														
[4] The broadband repeater of claim 1 further comprising a buffer memory for storing received or to be transmitted electronic signals for processing by said controller.	The Accused RAN Instrumentalities comprise a buffer memory for storing received or to be transmitted electronic signals for processing by said controller. For example, the Accused RAN Instrumentalities comprise an intelligent scheduler buffers information and chooses an optimal group of users to serve on resource blocks to maximize the collective data rate, while ensuring fairness for all users. See https://images.samsung.com/is/content/samsung/p5/global/business/networks/insights/white-papers/1208_massive-mimo-for-new-radio/MassiveMIMOforNRTechnicalWhitePaper-v1.2.0.pdf Table 2. Parameters for system level simulation <table><tr><th>Category</th><th>Parameter</th><th>Value</th></tr><tr><td rowspan="2">System configuration</td><td>Carrier frequency</td><td>3.5 GHz</td></tr><tr><td>Channel bandwidth</td><td>100 MHz</td></tr><tr><td rowspan="6">Spatial channel model</td><td>Channel model</td><td>3D Urban Macro</td></tr><tr><td>Inter-site distance</td><td>500 m</td></tr><tr><td>Base station antenna height</td><td>25 m</td></tr><tr><td>UE antenna configuration</td><td>4 Rx with cross-polarization (+/-45°)</td></tr><tr><td>UE antenna height</td><td>1.5 m ~ 22.5 m for indoor UE (80%) 1.5 m for outdoor UE (20%)</td></tr><tr><td>Base-station Transmit power</td><td>100 Watt for all types of radios</td></tr><tr><td rowspan="4">User configuration</td><td>Velocity</td><td>3 km/h</td></tr><tr><td>SRS periodicity</td><td>40 msec to hop over the entire bandwidth</td></tr><tr><td>PMI feedback</td><td>Wideband PMI with 40 msec periodicity</td></tr><tr><td>DL traffic model</td><td>Full buffer traffic</td></tr></table>	Category	Parameter	Value	System configuration	Carrier frequency	3.5 GHz	Channel bandwidth	100 MHz	Spatial channel model	Channel model	3D Urban Macro	Inter-site distance	500 m	Base station antenna height	25 m	UE antenna configuration	4 Rx with cross-polarization (+/-45°)	UE antenna height	1.5 m ~ 22.5 m for indoor UE (80%) 1.5 m for outdoor UE (20%)	Base-station Transmit power	100 Watt for all types of radios	User configuration	Velocity	3 km/h	SRS periodicity	40 msec to hop over the entire bandwidth	PMI feedback	Wideband PMI with 40 msec periodicity	DL traffic model	Full buffer traffic
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	See id.																														

Claim 7	Accused RAN Instrumentalities
[7] The broadband repeater of claim 1 wherein said controller permits one or more network information to be modified and support of position location capabilities for use by a network.	The controller of the Accused RAN Instrumentalities permits one or more network information to be modified and support of position location capabilities for use by a network. The controller of the Accused RAN Instrumentalities is configured to modify the transmission of the downlink signal to the user based on the position location of the user. (“Pin-pointing the focused beam to a particular user located in the cell edge can improve the quality of received DL signal and increase cell coverage. Furthermore, because the signal power is highly focused on the user, it can reduce the level of interference toward other users in the same cell and the adjacent cells”) https://images.samsung.com/is/content/samsung/p5/global/business/networks/insights/white-papers/1208_massive-mimo-for-new-radio/MassiveMIMOforNRTechnicalWhitePaper-v1.2.0.pdf
Claim 8	Accused RAN Instrumentalities
[8] The broadband repeater of claim 1 wherein said controller either or both a) uses adaptive or steerable antennas or MIMO technologies to control the direction or coverage zones or capacity or quality of transmissions or reception, and b) directs undesired user or intruder information to be passed to other components of a network from said at least one transmitter using either wireless or wired connectivity.	The controller of the Accused RAN Instrumentalities employs at least a) adaptive or steerable antenna technologies or MIMO technology to control the direction or coverage zones or capacity or quality of transmissions or reception. The Accused RAN Instrumentalities control the direction or coverage zones or capacity or quality of transmissions or reception through adaptive antenna technology by 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. 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

	www.samsung.com/global/business/networks/products/radio-access/massive-mimo-radio/ 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.” See <i>id</i>; In another example, the Massive MIMO products are configured to split mode operation, Carrier aggregation, and multi-user MIMO.
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	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/insights/white-paper/samsung-delivers-the-promises-of-massive-mimo/white-paper_samsung-delivers-the-promises-of-massive-mimo.pdf See claim element [1H] above and claim [9] below.
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Claim 9	Accused RAN Instrumentalities
[9] The broadband repeater of claim 1 where network provisioning information is passed to or pre-programmed with said controller, for purposes of network traffic provisioning, wherein said controller uses said provisioning information to prioritize either or both reception of data and transmission of data to or from said repeater.	The controller of the Accused RAN Instrumentalities is configured for provisioning information to prioritize either or both reception of data and transmission of data to or from said repeater. The controller of the Accused RAN Instrumentalities is configured to receive CSI measurements from the user device for PMI. The controller calculates beamforming weights from PMI feedback to allocated multiple layers (e.g., network traffic provisioning) to the same user.

If a user supports SRS TAS (e.g., T1R4), in DL MU-MIMO, it is possible for the user to be allocated with multiple layers or for a user-specific precoding to be applied as to maximize the receive performance of the user. With this assumption, the channel matrix size increases as $(4K \times M)$. The number of layers per user and the BF weights are determined to minimize the interference to the other users and to maximize the MIMO capacity to the desired user.

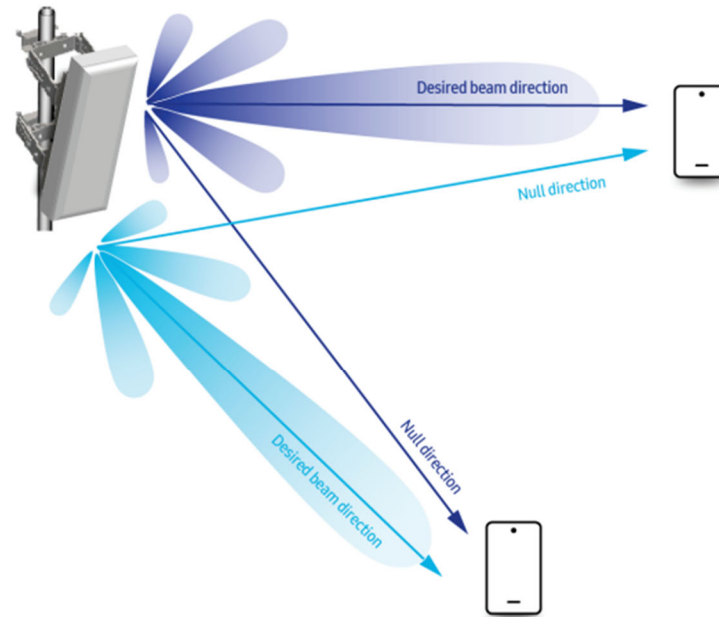


Figure 10. Beam Relation for DL MU-MIMO

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

Claim 12

Accused RAN Instrumentalities

[12PRE] A broadband wireless repeater, comprising:

See claim element [1PRE] above.

[12A] at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network, and	See claim elements [1A] and [1B] above.
[12B] at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may function alternatively as a receiver and as a transmitter; and	See claim elements [1A] and [1B] above.
[12C] a controller which is either pre-programmed or programmable with provisioning information which at least identifies said one or more ultrawideband wireless devices for purposes of network traffic provisioning,	The controller of the Accused Hotspot Instrumentalities is pre-programmed or programmable with provisioning information which at least identifies said one or more ultrawideband wireless devices for purposes of network traffic provisioning. See claim element [1C] above and [12D] below.
[12D] wherein said controller uses said provisioning information to prioritize either or both reception of data by said at least one receiver and transmission of data by said at least one transmitter to said one or more ultrawideband wireless devices,	See claim [9] above.
[12E] said controller controlling reception of electronic signals or data by said at	See claim element [1F] above.

least one receiver and transmission of electronic signals or data by said at least one transmitter to said one or more ultrawideband wireless devices.	
Claim 13	Accused RAN Instrumentalities
[13] The broadband repeater of claim 12 wherein said provisioning information prioritizes by one or more of network user, type of data being received by said at least one receiver, type of data being transmitted by said at least one transmitter, and the particular type of application being used by one or more users of the network being transmitted by said at least one transmitter.	The controller of the Accused RAN Instrumentalities prioritizes by one or more of network user, type of data being received by said at least one receiver, type of data being transmitted by said at least one transmitter, and the particular type of application being used by one or more users of the network being transmitted by said at least one transmitter. The controller of the Accused RAN Instrumentalities is configured to receive CSI measurements from the user device for PMI. The controller calculates beamforming weights from PMI feedback to allocated multiple layers (e.g., network traffic provisioning) to the same user.

If a user supports SRS TAS (e.g., T1R4), in DL MU-MIMO, it is possible for the user to be allocated with multiple layers or for a user-specific precoding to be applied as to maximize the receive performance of the user. With this assumption, the channel matrix size increases as $(4K \times M)$. The number of layers per user and the BF weights are determined to minimize the interference to the other users and to maximize the MIMO capacity to the desired user.

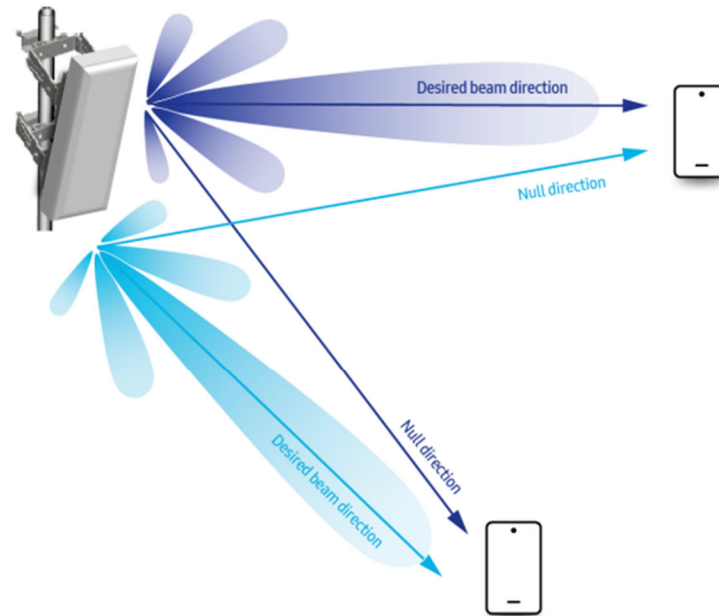


Figure 10. Beam Relation for DL MU-MIMO

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

In another example, controller of the Accused RAN Instrumentalities is configured to use dynamic spectrum sharing to prioritize certain types of application traffic.

	Radio Access Network (RAN) QoS Capabilities TS 38.300 defines the New Radio (NR) interface, which includes QoS mechanisms specifically for the 5G RAN. NR introduces support for ultra-reliable low-latency communication (URLLC) and advanced radio resource management. Features like Dynamic Spectrum Sharing, Massive MIMO, and beamforming are standardised to improve network efficiency and ensure QoS at the radio layer. This enables 5G networks to meet the stringent requirements of real-time applications, such as factory automation and V2X (vehicle-to-everything) communications. https://emblasoft.com/blog/understanding-5g-qos-how-5g-qos-mechanisms-relate-to-3gpp-standards
Claim 14	Accused RAN Instrumentalities
[14] The broadband repeater of claim 12 further comprising a buffer memory for storing received or to be transmitted electronic signals or data for processing by said controller.	See claim [4] above.
Claim 17	Accused RAN Instrumentalities
[17] The broadband repeater of claim 12 wherein said controller permits one or more of provisioning information to be modified and support of position location capabilities for use by a network.	See claim [7] above.
Claim 20	Accused RAN Instrumentalities
[20] The broadband repeater of claim 12 wherein said controller either or both	See claim [8] above.

a) uses adaptive or steerable antennas or MIMO technologies to control the direction or coverage zones or capacity or quality of transmissions or reception, and b) directs undesired user or intruder information to be passed to other components of a network from said at least one transmitter using either wireless or wired connectivity.	
Claim 22	Accused RAN Instrumentalities
[22PRE] A broadband wireless repeater, comprising:	See claim element [1PRE] above.
[22A] at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network, and	See claim elements [1A] and [1B] above. The radio chipset in the Accused RAN Products receives electronic signals from, and transmits electronic signals to, a connected ultrawideband device via, for example, at least 5G cellular.
[22B] at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may function alternatively as a receiver and as a transmitter; and	See claim elements [1A] and [1B] above.

[22C] a controller which is either pre-programmed or programmable to collect traffic information or security information related to received and transmitted data at least some of which is received from or sent to said one or more ultrawideband wireless devices in said network,	See claim elements [1C] and [1G] above.
[22D] said controller controlling reception of electronic signals or data by said at least one receiver and transmission by said at least one transmitter.	See claim element [1F] above.
Claim 23	Accused RAN Instrumentalities
[23] The broadband repeater of claim 22 further comprising one or more of a means for exporting traffic information or security information to one or more computer processors or devices, and a means for adjusting one or more operations of said controller based on said traffic information or security information.	See claims [9] and [13] above. The structure in the Accused Hotspot Instrumentalities that exports or transmits the traffic information or security information to one or more computer processors or devices is the transceiver. The structure in the Accused Hotspot Instrumentalities that adjusts the one or more operations of said controller based on said traffic information or security information is a hardware memory unit that stores instructions to adjust the operation of the controller.