

Exhibit 12

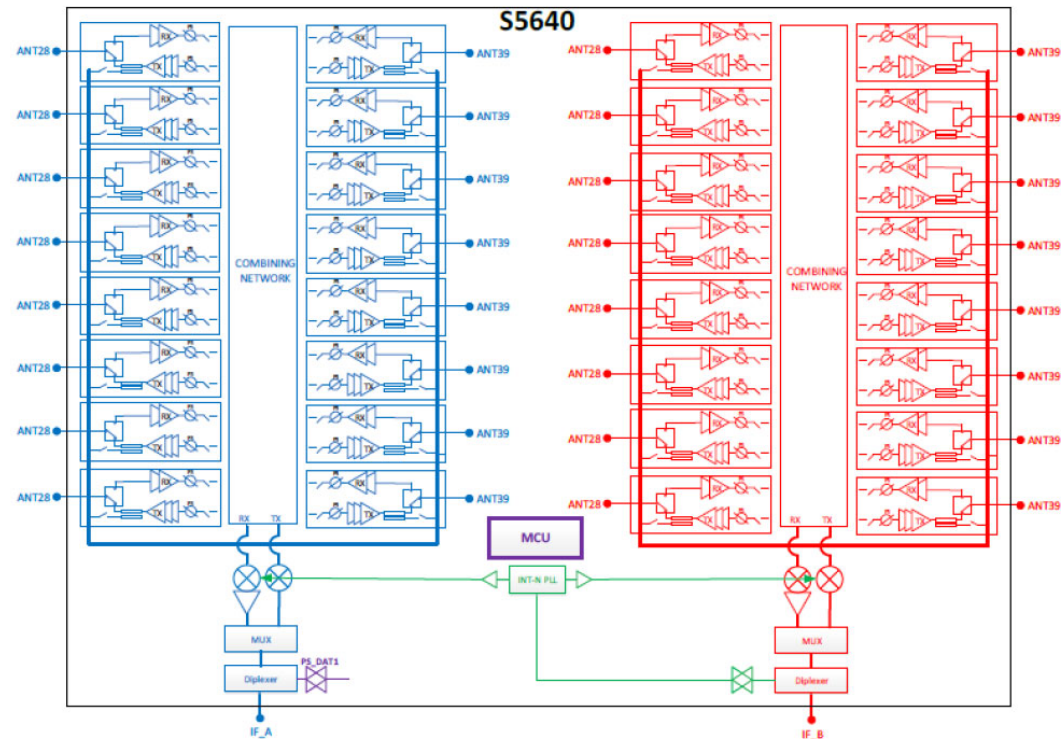
EXHIBIT 12 – U.S. Patent No. 11,876,548

Plaintiff asserts that at least the following products (“Accused Instrumentalities”) infringe the Asserted Claims of U.S. Patent No. 11,876,548: 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 3 (SM-F926); Galaxy Z Fold 4 (SM-F936); Galaxy Z Fold 5 (SM-F946); Galaxy Z Fold 6 (SM-F956); Galaxy A51 (SM-A516x); Galaxy A53 (SM-A536x); Galaxy A56 (SM-A566x); Galaxy A36 (SM-A366x); Galaxy A26 (SM-A266); Galaxy Note 20 (SM-N981); Galaxy Note 20 Ultra (SM-N986) model smartphones.

Claim 1	Correspondence in Accused Instrumentalities ¹
[1PRE] A wireless device configured for avoiding radiation of a user or structure, comprising the steps of:	The Accused Instrumentalities, which include smartphones, are wireless devices at least because they are WiFi, LTE and/or 5G compatible. The Accused Instrumentalities are configured to avoid radiation of a user or structure (e.g., an “obstacle”) as described below. The Accused Instrumentalities comprise at least one steerable antenna that includes an antenna array that consists of multiple individual antenna elements arranged in a specific geometric pattern. Each element radiates a signal, and the combination of these signals forms the overall radiation pattern of the array. Beam steering is achieved by controlling the phase of the signals fed to each individual antenna element in the array. According to an Operational Description for an Accused Instrumentality, the Accused Instrumentality includes a “mmW Antenna Module,” which includes “two separate phased array

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

chips (S5640).” Each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHz band.



See fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf (“A53 Operational Description”).

A teardown of a Galaxy S20 Ultra describes that this Accused Instrumentality includes “two Qualcomm RF ICs ... w/multilayer package substrate antenna array ...” See electronics360.globalspec.com/article/15093/teardown-samsung-galaxy-s20-ultra-5g

The “Criticality of 5G Modem to RF Integration; A look inside Samsung Galaxy S20 Ultra” article (<https://omdia.tech.informa.com/om006104/criticality-of-5g-modem-to-rf-integration-a>

look-inside-samsung-galaxy-s20-ultra) describes a teardown of the S20 Ultra, including that the Qualcomm RF ICs in the Galaxy S20 Ultra are QTM525 mmWave Antenna modules.

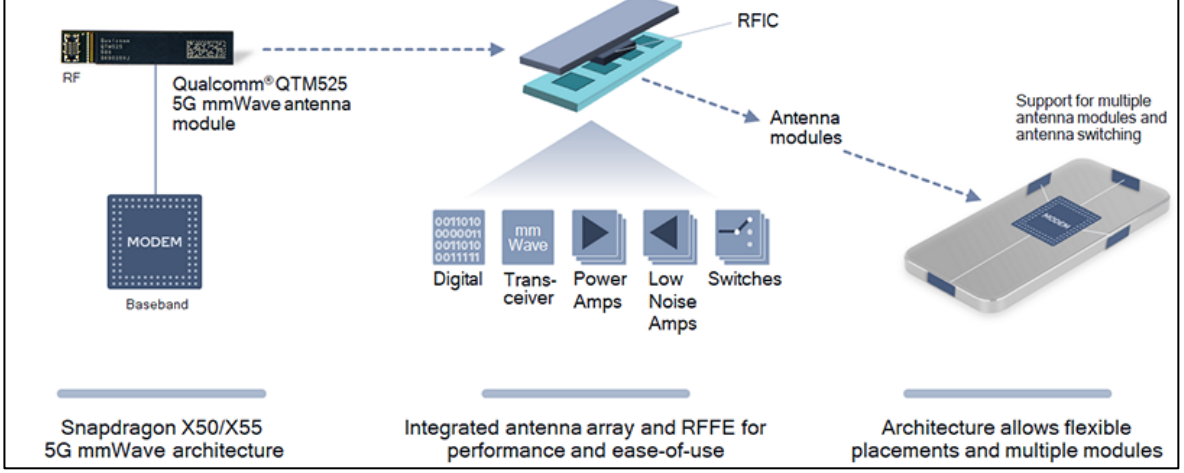
The Qualcomm article “5G Modems, RF and Antennas — Getting mmWave Data into the Device” describes the QTM525 mmWave antenna module as including an “array of tiny mmWave antenna elements” See www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device

The Qualcomm article further describes the QTM525 mmWave antenna module, in communication with the 5G modems (e.g., Snapdragon X50, X55, X60), as capable of beamforming and beam tracking to avoid obstructions. Such obstructions include the user (such as the head or hand when holding the phone) and nearby structures (such as walls or furniture), and the accused devices adjust their steerable antenna beams to avoid radiating in those direction.

mmWave technology works well in cities, where you can locate a small cell on top of a building and serve an entire block. In a dense, urban environment, the buildings would normally be an obstruction. But beamforming and beam tracking take advantage of them as an endless series of surfaces off of which the mmWaves can bounce.

On the device, multiple mmWave antenna modules like the QTM052 and QTM525 are located in different places, as shown in the image below. The baseband modem switches among the antenna modules, depending on the source of the strongest signal. All of that takes place in real time in fractions of a millisecond.

See *id.*

	 See <i>id.</i>
[1A] one or more detectors selected from the group consisting of one or more cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, for detecting an orientation of said wireless device relative to either or both said user and said structure;	The Accused Instrumentalities include, among other things, proximity sensors for sensing proximity of an obstacle, such as a user body part, to the wireless device, and also for detecting an orientation of the wireless device. The sensor(s) used to detect the orientation of the device, such as proximity to an obstruction, include, but are not limited to, (i) a range finder embodied, in whole or in part, by the modem and RF front-end system of the Accused Instrumentalities, including the phased array module and associated transceiver, (ii) one or more capacitive sensors, (iii) one or more light detectors, and/or (iv) one or more gyroscopes. For example, the Accused Instrumentalities include infrared sources and detectors. Infrared is a form of light energy, so the Accused Instrumentalities include at least light detectors for sensing an orientation of the obstacle relative to the wireless device. <i>See</i> www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone. How does the proximity sensor work? A proximity sensor consists of a light-emitting and light-receiving component. Infrared rays from the light-emitting component analyze the light reflected from physical objects and measure the distance between the object and the device. The proximity sensor is installed under the display, on all the latest Galaxy smartphones and is now capable of detecting the angle of the device. Make a call and bring the phone close to your ear. The screen will turn off as you move the phone away, and the screen will wake up.

The Accused Instrumentalities also include one or more gyroscopes that enable them to perform orientation detection. For example, the “Samsung Galaxy S21 Ultra Teardown” and “Samsung Galaxy S22 Chip ID” articles describe ASICs used in the Samsung Galaxy S21 Ultra and S22 Ultra, including the STMicroelectronics LSM6DSO. The STMicroelectronics LSM6DSO is 3-axis accelerometer/gyroscope combination chip. *See* <https://www.ifixit.com/Guide/Samsung+Galaxy+S22+Chip+ID/148072>; <https://www.ifixit.com/Teardown/Samsung+Galaxy+S21+Ultra+Teardown/141188>.

Together, the gyroscopes/accelerometers (which detect device orientation in three-dimensional space) and the proximity, capacitive, and light sensors (which detect the presence and location of the user or nearby structures) determine the orientation of the wireless device relative to either or both the user and the structure. *See* www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone.

For example, the Accused Instrumentalities include accelerometers, capacitive sensors, gyroscopes, and proximity sensors in the form of ambient light sensors and/or infrared light sensor that can detect the presence of the user. The Accused Instrumentalities use one or more of these sensors to detect the location that the user of the Accused Instrumentalities is gripping the device. The sensors are located near antenna patch of the antenna arrays so that the corresponding antenna patch can be deactivated to avoid the user.

In another example, the A53 Operational Description describes a grip sensor configuration that determines the presence and location of the user with a smart capacitive sensor.

1.11 Grip Sensor : SX9380

1.11.1 General Description

The SX9380 is a smart capacitive sensor for SAR (Specific Absorption Rate).

The resulting detection is used in portable electronic devices to reduce and control radio-frequency (RF) emission power in the presence of a human body, enabling significant performance advantages for manufacturers of electronic devices with electro-magnetic radiation sources to meet stringent emission regulations' criteria and Specific Absorption Rate (SAR) standards.

Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative

	that the element is present under the doctrine of equivalents because any differences are insubstantial, the Accused Instrumentalities perform substantially the same function in substantially the same way to achieve substantially the same result, and/or the differences are otherwise insubstantial under controlling law.												
[1B] one or more processors for determining, based on information provided by said one or more detectors, zones or spans of directions in the three dimensional space corresponding with one or more directions of said user or structure relative to said at least one steerable antenna;	The Accused Instrumentalities comprise one or more processors communicatively coupled to said one or more sensors, configured to determine zones or spans of directions in the three-dimensional space corresponding with one or more directions of either or both said user and said structure relative to said at least one steerable antenna. For example, the table below shows certain Accused Instrumentalities comprising a variation of the Qualcomm Snapdragon processors. The Snapdragon processors are coupled to a plurality of sensors including an accelerometer, gyroscope, proximity sensor, infrared light sensor, and ambient light sensor to determine a location corresponding to a user or object. <table><tr><td>S20</td><td>S21</td><td>S22</td><td>S23</td><td>S24</td><td>S25</td></tr><tr><td>Snapdragon 865</td><td>Snapdragon 888</td><td>Snapdragon 8 Gen 1</td><td>Snapdragon 8 Gen 2</td><td>Snapdragon 8 Gen 3</td><td>Snapdragon 8 Elite</td></tr></table> See https://www.phonearena.com/phones/Samsung-Galaxy-S20_id11266 https://www.phonearena.com/phones/Samsung-Galaxy-S21_id11508 https://www.phonearena.com/phones/Samsung-Galaxy-S22_id11763 https://www.phonearena.com/phones/Samsung-Galaxy-S23_id11999 https://www.phonearena.com/phones/Samsung-Galaxy-S24_id12113 https://www.phonearena.com/phones/Samsung-Galaxy-S25_id12340 The A53 Operational Description document describes that an Accused Instrumentality includes one or more processors (see A53 Operational Description at sheet 13):	S20	S21	S22	S23	S24	S25	Snapdragon 865	Snapdragon 888	Snapdragon 8 Gen 1	Snapdragon 8 Gen 2	Snapdragon 8 Gen 3	Snapdragon 8 Elite
S20	S21	S22	S23	S24	S25								
Snapdragon 865	Snapdragon 888	Snapdragon 8 Gen 1	Snapdragon 8 Gen 2	Snapdragon 8 Gen 3	Snapdragon 8 Elite								

2.1 AP/CP : S5E8825 (EXYNOS1280)**1) Description**

S5E8825 is a System-on-Chip (SoC), which is based on a 64-bit RISC processor. It also contains a 5G communication processor (modem), which is compliant with 5G NR features and all legacy features. S5E8825 targets high-end smart phones and tablet products. S5E8825 is based on the 5 nm low-power process and it provides the following features:

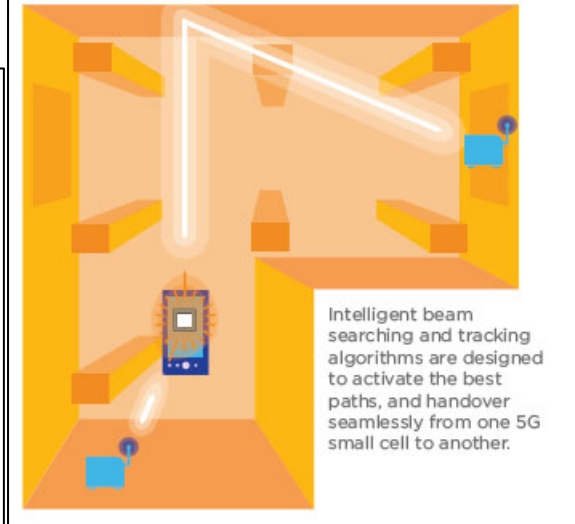
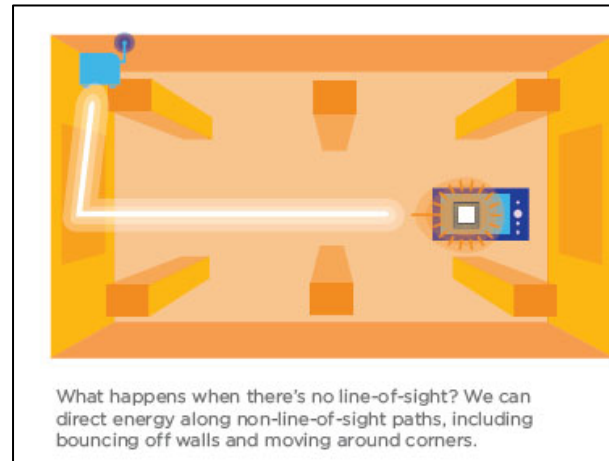
- ☐ Octa-core CPU (Dual-core ARM Cortex-A78 (Big CPU), and Hexa-cores ARM Cortex-A55 (Little CPU))
- ☐ 17.1 GB/s of LPDDR4 bandwidth
- ☐ WQHD embedded display
- ☐ 4K 30-frame video decoding (H.264/HEVC) and FHD 30-frame video decoding/encoding hardware (MPEG4/H.263/VP8)
- ☐ 3D graphics H/W
- ☐ Image Signal Processor (ISP)
- ☐ Neural Processing Unit (NPU)
- ☐ ABOX (Audio Sub-System)
- ☐ High-speed interfaces, such as UFS 2.2 and USB 2.0 DRD
- ☐ Embedded communication processor (5G NR FR1 FR2, 4G LTE, 3G FDD/TDD, 2G GSM/CDMA)
- ☐ GNSS and WiFi/BT
- ☐ Context HUB (CHUB)

Accordingly, the Accused Instrumentalities comprise one or more processors (e.g., Qualcomm Snapdragon or Samsung Exynos SoCs) communicatively coupled to one or more sensors (including at least accelerometers, gyroscopes, proximity sensors, infrared light sensors, and ambient light sensors). The one or more processors are for determining, based on information provided by said one or more detectors, zones or spans of directions in the three dimensional space corresponding with one or more directions of said user or structure relative to said at least one steerable antenna.

The wireless device comprises one or more steerable antennas as described in element [1C].

Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative

	that the element is present under the doctrine of equivalents because any differences are insubstantial, the Accused Instrumentalities perform substantially the same function in substantially the same way to achieve substantially the same result, and/or the differences are otherwise insubstantial under controlling law.
[1C] one or more steerable antennas which operate on one or multiple bands and radiates or receives at one or more frequencies in the range of 10 GHz to 500 GHz,	The Accused Instrumentalities adjust one or more radiation patterns from the steerable antenna to direct energy in zones or spans of directions where obstacles were not detected, while avoiding spans or directions where obstacles were detected. The Qualcomm article “5G Modems, RF and Antennas — Getting mmWave Data into the Device” describes the QTM525 mmWave antenna module, included in certain Accused Instrumentalities, that allows “[t]he device and the network exchange information constantly, directing beams in a way they can best reach each other.” <i>See</i> www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device In one example, the Qualcomm document below describes that the 5G modem available in certain Accused Instrumentalities as capable of avoiding obstructions in a direct line-of-sight transmission paths and selecting indirect transmission paths with lower signal attenuation. See https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf



At least by this manner, for example, the Accused Instrumentalities adjust the radiation patterns from the steerable antenna to direct energy in spans or directions where obstacles were not detected, while avoiding spans of directions where obstacles were detected. By steering beams away from obstructed directions, the phased-array antennas in the Accused Instrumentalities inherently place nulls or dead zones in those avoided directions, as required by the claim.

The A53 Operational Description describes that the Accused Instrumentality implements beamforming for 5G band n261.

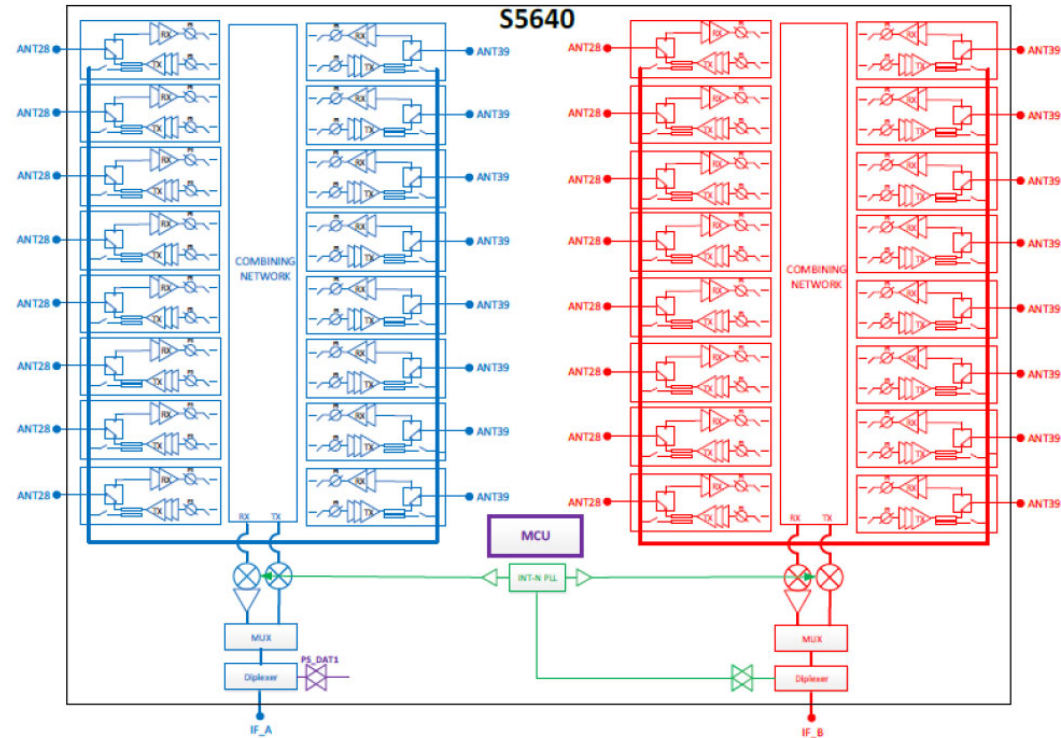
Beamforming| – n261

The mmWave operations in this device use beam-forming. The below beams are used in this device (no other beams or combinations of beams are supported.)

ANT L	Patch/Dipole	SISO/MIMO & Polarization	Beam ID	
	Patch	Single beam / V-pole	0	
			1	
			2	
			3	
			4	
			5	
			6	
		Single beam / H-pole		7
				8
				9
				10
				11
				12
				13
		Paired beam / MIMO	0	7
			1	8
			2	9
			3	10
			4	11
			5	12
			6	13

The A53 Operational Description for the Galaxy A53 5G (SM-A536V) confirms that the device implements beamforming for FR2 band n261 and n260, with multiple selectable beam indices and module configurations, such that one array is active at a time and other directions remain unenergized (i.e., nulls or dead zones). The same FCC filing further states that beam index and module selection affect power density and are considered in the device’s transmit antenna switching (TAS) algorithm, showing that the handset actively adjusts which beams to use based on operating conditions. In addition, the A53 Operational Description details the use of grip sensors, earpiece/receiver sensors, and earjack sensors, which trigger changes in transmit

	behavior when the user's hand or head is near the antenna. These sensor inputs, together with the device's beam index selection, result in beam radiation patterns that are directed away from zones occupied by the user or nearby structures, thereby avoiding said zones or spans of directions in the three-dimensional space. Qualcomm's technical publications describing the QTM525 and Snapdragon X50/X55/X60 modems likewise confirm that these mmWave modules support beamforming and beam tracking to avoid obstructions, further evidencing that the Accused Instrumentalities adjust their steerable antennas to radiate in permitted directions while providing nulls or dead zones in obstructed directions. See https://www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device; www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/5G-Whitepaper-mmWave_Antenna_Module_Placement-Qualcomm.pdf; www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf. Plaintiff contends that this element is literally present in the Accused Instrumentalities. The steerable antenna arrays in the Accused Instrumentalities are for 5G bands operating above 10 GHz and less than 500 GHz. According to the A53 Operational Description, each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHz band.
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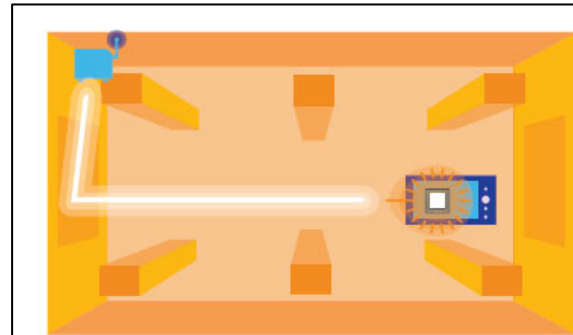
The A53 Operational Description describes that the Accused Instrumentality (e.g., SM-A536V model) implements beamforming for 5G band n261, which has a frequency of 27.5 - 28.35 GHz, which is in the range of 10 GHz to 500 GHz. In addition, 3GPP TS 38.101 defines Frequency Range 2 (FR2) as 24.25 GHz to 52.6 GHz, covering the 28 GHz and 39 GHz bands used by the Accused Instrumentalities.

Thus, the Accused Instrumentalities include at least one steerable antenna that operates on multiple bands (28 GHz and 39 GHz) and radiates at frequencies within the claimed range of 10 GHz to 500 GHz.

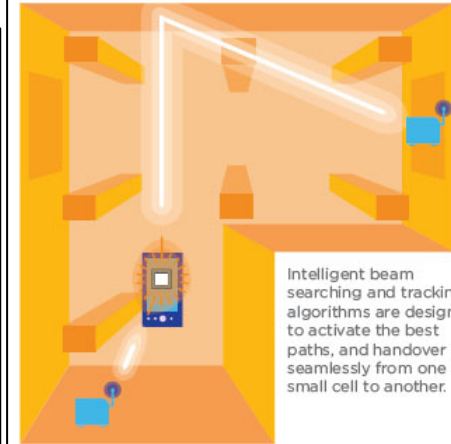
[1D] wherein one or more beams of said one or more steerable antennas is adjustable to

The one or more steerable antennas in the Accused Instrumentalities is adjustable to accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions in the three-dimensional space as determined by said one or more computational devices,

accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions in the three dimensional space as determined by said one or more computational devices, wherein said one or more steerable antennas are configured to steer or direct its radiation pattern in particular directions while attenuating the radiation pattern in other directions; and	wherein said one or more steerable antennas are configured to steer or direct its radiation pattern in particular directions while attenuating the radiation pattern in other directions. For example, the Accused Instrumentalities determines an area or location associated with an obstruction and deactivates a corresponding antenna in the antenna array. For example, the Accused Instrumentalities use one or more sensors to detect the location that the user of the Accused Instrumentalities is gripping the device and deactivates the corresponding antenna to avoid the user. These operations define zones or spans of directions in three-dimensional space that correspond to the directions of the user's body or surrounding structures relative to the steerable antenna. In another example, the Accused Instrumentalities can determine transmission areas associated with beams that are associated with high and low signal attenuation. The Qualcomm article “5G Modems, RF and Antennas — Getting mmWave Data into the Device” describes the QTM525 mmWave antenna module, included in certain Accused Instrumentalities, that allows “[t]he device and the network exchange information constantly, directing beams in a way they can best reach each other.” See www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device The images below, from the Qualcomm document, shows that the Snapdragon X50 5G modem can perform beam steering to avoid obstructions when direct line of sight transmission paths are not available.
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What happens when there's no line-of-sight? We can direct energy along non-line-of-sight paths, including bouncing off walls and moving around corners.



Intelligent beam searching and tracking algorithms are designed to activate the best paths, and handover seamlessly from one 5G small cell to another.

See <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf>

In another example, the A53 Operational Description describes that the Accused Instrumentality implements beamforming for 5G band n261.

Beamforming – n261

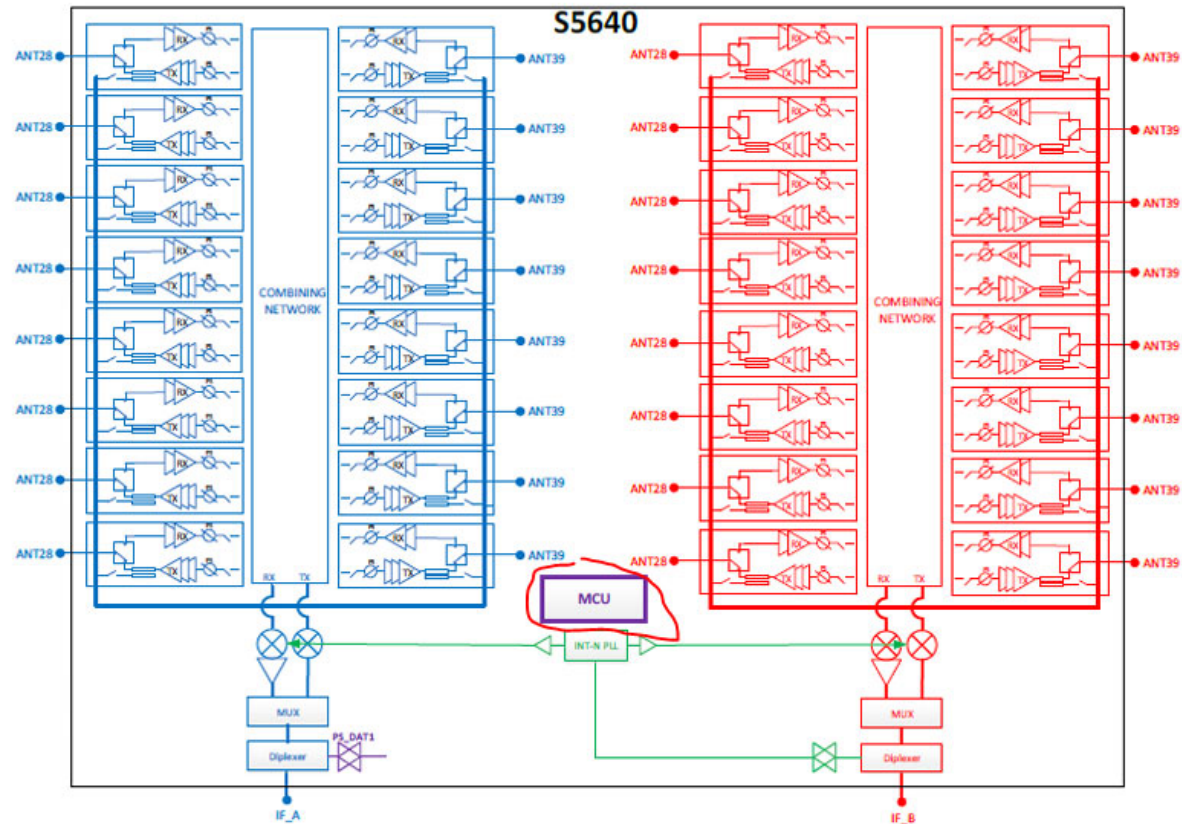
The mmWave operations in this device use beam-forming. The below beams are used in this device (no other beams or combinations of beams are supported.)

	Patch/Dipole	SISO/MIMO & Polarization	Beam ID	
ANT L	Patch	Single beam / V-pole	0	
			1	
			2	
			3	
			4	
			5	
			6	
		Single beam / H-pole		7
				8
				9
				10
				11
				12
				13
		Paired beam / MIMO	0	7
			1	8
			2	9
			3	10
			4	11
			5	12
			6	13

See fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf.

Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that the element is present under the doctrine of equivalents because any differences are insubstantial, the Accused Instrumentalities perform substantially the same function in

	substantially the same way to achieve substantially the same result, and/or the differences are otherwise insubstantial under controlling law.
[1E] a controller for adjusting the radiation pattern of the one or more steerable antennas to accentuate one or more of said particular directions while attenuating the radiation pattern for said zones or spans of directions in the three dimensional space.	The Accused Instrumentalities comprise a controller for adjusting the radiation pattern of the one or more steerable antennas to accentuate one or more of said particular directions while attenuating the radiation pattern for said zones or spans of directions in the three dimensional space. For example, the steerable antenna of an Accused Instrumentality is controlled by a microcontroller unit (“MCU”), as shown in the A53 Operational Description, and controlling the radiation pattern from the steerable antenna accentuates particular directions while attenuating other directions, e.g., the ones for the obstacles.



A teardown of a Galaxy S20 Ultra describes that this Accused Instrumentality includes “two Qualcomm RF ICs ... w/multilayer package substrate antenna array ...” See electronics360.globalspec.com/article/15093/teardown-samsung-galaxy-s20-ultra-5g

The “Criticality of 5G Modem to RF Integration; A look inside Samsung Galaxy S20 Ultra” article (<https://omdia.tech.informa.com/om006104/criticality-of-5g-modem-to-rf-integration-a-look-inside-samsung-galaxy-s20-ultra>) describes a teardown of the S20 Ultra, including that the Qualcomm RF ICs in the Galaxy S20 Ultra are QTM525 mmWave Antenna modules.

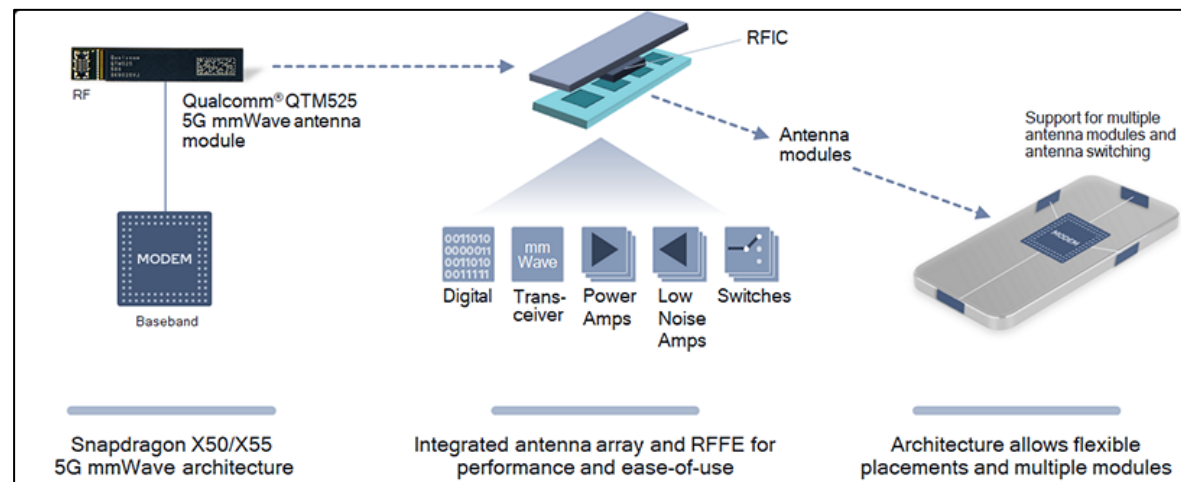
The Qualcomm article “5G Modems, RF and Antennas — Getting mmWave Data into the Device” describes the QTM525 mmWave antenna module as including an “array of tiny mmWave antenna elements” See www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device

The Qualcomm article further describes the QTM525 mmWave antenna module, in communication with the 5G modems (e.g., Snapdragon X50, X55, X60), as capable of beamforming and beam tracking to avoid obstructions.

mmWave technology works well in cities, where you can locate a small cell on top of a building and serve an entire block. In a dense, urban environment, the buildings would normally be an obstruction. But beamforming and beam tracking take advantage of them as an endless series of surfaces off of which the mmWaves can bounce.

On the device, multiple mmWave antenna modules like the QTM052 and QTM525 are located in different places, as shown in the image below. The baseband modem switches among the antenna modules, depending on the source of the strongest signal. All of that takes place in real time in fractions of a millisecond.

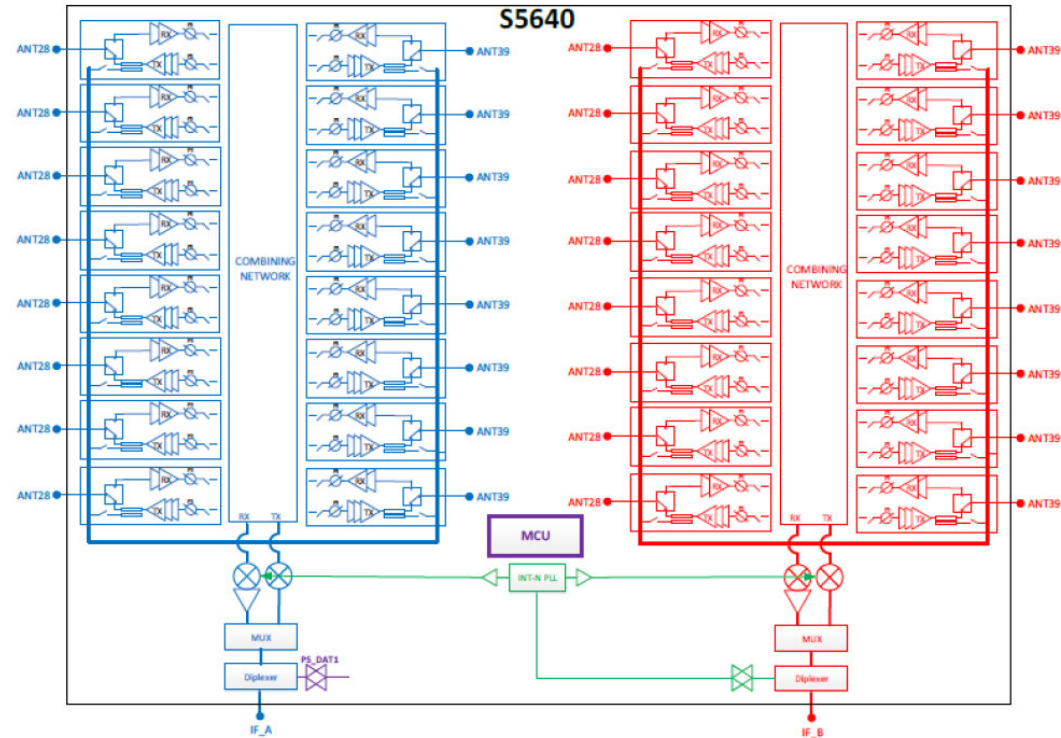
See *id.*



See *id.*

Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative

	that the element is present under the doctrine of equivalents because any differences are insubstantial, the Accused Instrumentalities perform substantially the same function in substantially the same way to achieve substantially the same result, and/or the differences are otherwise insubstantial under controlling law.
Claim 6	Correspondence in Accused Instrumentalities
[6] The wireless device of claim 1, wherein said at least one steerable antenna comprises a plurality of steerable antennas.	The Accused Instrumentalities comprise at least one steerable antenna that itself comprises a plurality of steerable antennas. Specifically, the Accused Instrumentalities include a mmWave Antenna Module (SGB5640X01-M040), which incorporates two separate phased array chips (S5640). Each phased array chip is a steerable antenna. Each S5640 chip includes 20 antenna ports, divided into 10 for the 28 GHz band and 10 for the 39 GHz band, enabling beam steering in FR2 frequency bands. The A53 Operational Description states: “It consists of one S5720, one modem chip (Pamir) and two separate phased array chips (S5640)... S5720 can connect to two phased array chips but only one phased array can work in the transmitter mode, and two can be operating concurrently in the receiver mode” A53 Operational Description at p. 8. Thus, the mmWave antenna module as a whole comprises a plurality of steerable antennas. The architectural block diagram of the S5640 chip, shown below, illustrates this structure. It depicts two independent antenna arrays (left for 28 GHz, right for 39 GHz), each with its own combining network and control paths, further demonstrating that the accused modules implement a plurality of steerable antennas:



See A53 Operational Description at p. 9.

Claim 7

Correspondence in Accused Instrumentalities

[7PRE] A method for avoiding or reducing radiation of a user or structure by a wireless device having at least one [steerable] antenna, comprising:

The Accused Instrumentalities are wireless devices at least because they are WiFi, LTE and/or 5G cellular compatible. The Accused Instrumentalities are configured for performing a method for avoiding or reducing radiation of a user or structure (e.g., an “obstacle”) as described herein. The Accused Instrumentalities comprise at least one steerable antenna as described in connection with claim element [1C] above.

See claim element [1PRE] above.

[7A] sensing with one or more sensors selected from the group consisting of cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, an orientation of said wireless device relative to either or both said user and said structure;	<i>See</i> claim element [1A] above. Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that the element is present under the doctrine of equivalents because any differences are insubstantial, the Accused Instrumentalities perform substantially the same function in substantially the same way to achieve substantially the same result, and/or the differences are otherwise insubstantial under controlling law.
[7B] receiving signals from said one or more sensors pertaining to said orientation in the three dimensional space;	The Accused Instrumentalities comprise a plurality of sensors including accelerometers, gyroscopes, and proximity sensors in the form of ambient light sensors and/or infrared light sensor that can communicate with the processor to determine the relative orientation of the device and three-dimensional spaces. <i>See</i> claim element [1B] above. Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that the element is present under the doctrine of equivalents because any differences are insubstantial, the Accused Instrumentalities perform substantially the same function in substantially the same way to achieve substantially the same result, and/or the differences are otherwise insubstantial under controlling law.
[7C] using said signals, computing zones or spans of directions corresponding with one or more directions of said user or structure relative to said at least one	The Accused Instrumentalities satisfy this limitation because they use sensor signals to compute zones or spans of directions corresponding to the position of the user or other structures relative to the device's steerable antennas. As set forth in claim element [1B] above, the Accused Instrumentalities incorporate proximity sensors, capacitive grip sensors, gyroscopes, cameras, and orientation-detection software. These

steerable antenna in the three dimensional space; and	sensors provide signals used by the device’s antenna management and beamforming subsystems to determine device orientation and user proximity in three-dimensional space. Samsung’s mmWave implementation (using Qualcomm QTM-series phased array modules) relies on beam management protocols defined by 3GPP for FR2, including beam acquisition, beam tracking, and beam switching. These protocols necessarily involve computing the spatial directions of viable beams relative to the device’s orientation and excluding or de-prioritizing directions blocked by the user’s head or hand. Samsung documentation further confirms that its devices perform “antenna selection and beam management to optimize performance when the user is holding the device,” demonstrating that the accused products compute directional spans to avoid blocked zones. Accordingly, the Accused Instrumentalities literally meet this claim limitation. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that it is present under the doctrine of equivalents, because any differences are insubstantial: the Accused Instrumentalities perform substantially the same function (computing zones relative to user position), in substantially the same way (using sensor signals to guide beam management), to achieve substantially the same result (avoiding blocked zones and directing energy toward open spans).
[7D] adjusting one or more beams of said at least one steerable antenna to accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions,	The Accused Instrumentalities satisfy this limitation because they adjust one or more beams of their steerable antennas to accentuate radiation in spans or directions that are not blocked by the user or other obstacles. The Qualcomm article “<i>5G Modems, RF and Antennas — Getting mmWave Data into the Device</i>” describes the QTM525 mmWave antenna module, included in certain Accused Instrumentalities, as enabling constant information exchange between the device and the network to direct beams “in a way they can best reach each other.” See https://www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device. Similarly, Qualcomm technical documentation explains that 5G modems available in the Accused Instrumentalities can avoid obstructions in direct line-of-sight transmission paths and instead select indirect transmission paths with lower attenuation. See www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf.

By steering beams away from obstructed zones and accentuating beams in unblocked spans, the phased-array antennas in the Accused Instrumentalities inherently create nulls or dead zones in obstructed directions while emphasizing viable paths, as required by the claim.

The A53 Operational Description for the Galaxy A53 5G (SM-A536V) confirms that the device implements beamforming for FR2 bands n260 and n261, with selectable beam indices and module configurations. Only one array is active in transmission at a time, while other directions remain unenergized (i.e., nulls or dead zones). The same filing explains that beam index and module selection affect power density and are considered in the device's transmit antenna switching (TAS) algorithm, showing that the handset dynamically adjusts its beams based on operating conditions.

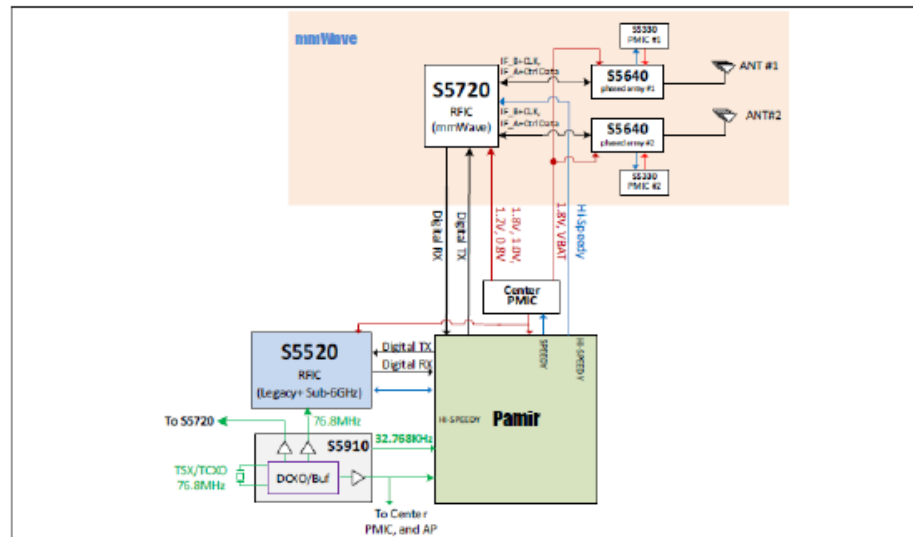
In addition, the A53 Operational Description details the use of grip sensors, earpiece/receiver sensors, and earjack sensors, which trigger changes in transmit behavior when the user's hand or head is near the antenna. These sensor inputs, together with beam index selection, cause the device to accentuate beam radiation patterns in open spans of directions while avoiding user-blocked zones.

Qualcomm's broader technical publications regarding the QTM525 and Snapdragon modem platforms (X50, X55, X60) likewise confirm that these mmWave modules support beamforming and beam tracking to avoid obstructions and emphasize available beam directions. See <https://www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device>; www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/5G-Whitepaper-mmWave_Antenna_Module_Placement-Qualcomm.pdf; www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf.

Accordingly, the Accused Instrumentalities literally meet this claim limitation. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that the element is present under the doctrine of equivalents, because any differences are insubstantial: the Accused Instrumentalities perform substantially the same function (accentuating radiation in unblocked zones), in substantially the same way (using phased-array beam steering guided by sensor and beam management inputs), to achieve substantially the same result (directing energy toward open spans while avoiding blocked zones).

[7E] wherein said at least one steerable antenna radiates or receives said one or more beams based on signals from said one or more processors determined on execution of said executable instructions,	The Accused Instrumentalities satisfy this limitation because their steerable antennas radiate or receive beams based on control signals generated by processors executing software/firmware instructions. As shown in the A53 Operational Description, the Accused Instrumentalities incorporate a Pamir modem (S5520) and S5720 transceiver, which connect to two phased array chips (S5640). The processors within the modem and transceiver execute firmware and software instructions to determine beamforming parameters, including beam index selection, transmit power, and antenna module activation. These processors output control and intermediate frequency (IF) signals to the S5640 phased array chips, which in turn steer the beams accordingly. The A53 Operational Description explains: “It consists of one S5720, one modem chip (Pamir) and two separate phased array chips (S5640)... Inside the S5720 in the transmitter mode, these signals are filtered and up-converted to an intermediate frequency (IF) and sent via the four IF ports to the two phased array chips... These IF ports also allow control data and clock... S5720 can connect to two phased array chips but only one phase array can work in the transmitter mode, and two can be operating concurrently in the receiver mode.” A53 Operational Description at p. 11. This shows that the phased array antennas (S5640) radiate or receive beams based on signals from the modem/transceiver processors, which in turn are determined by execution of software/firmware instructions. The diagram below (A53 Operational Description §1.9.2) illustrates this architecture, showing how processor-generated control and IF signals are routed to the phased array chips to control beam radiation and reception.
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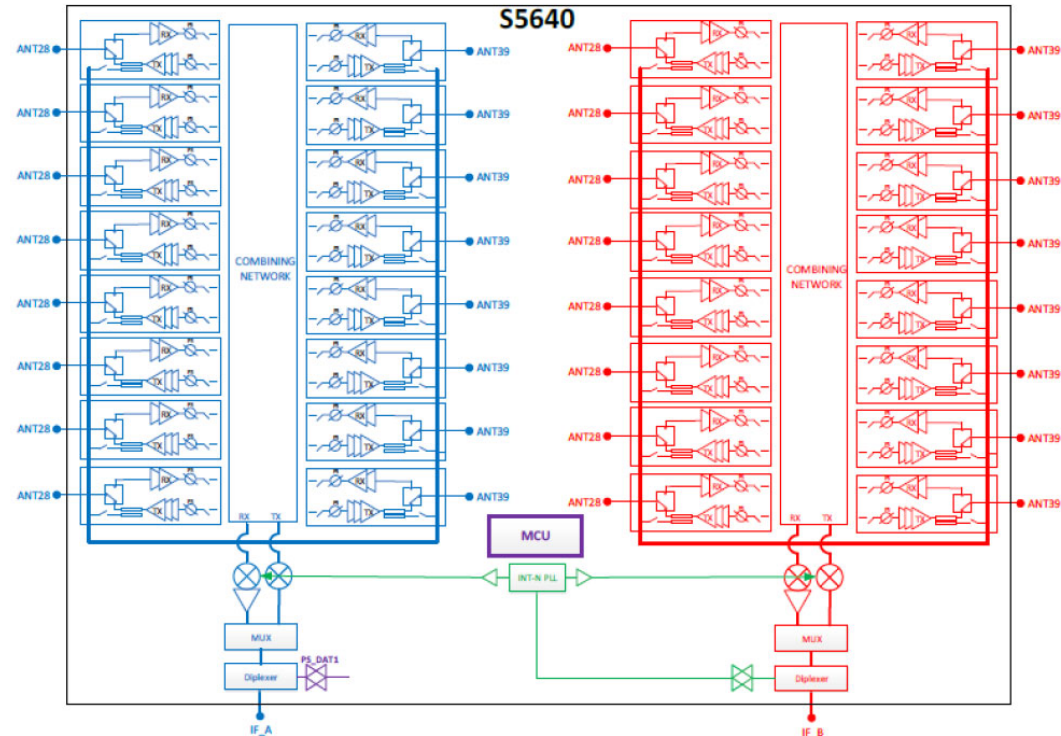
Figure 1-1 shows one 5G NR solution for cellular handsets. It consists of one S5720, one modem chip (Pamir) and two separate phased array chips (S5640). The modem uses digital interface for communication to S5720 (both receive and transmit). Inside the S5720 in the transmitter mode, these signals are filtered and up-converted to an intermediate frequency (IF) and sent via the four IF ports to the two phased array chips. These IF ports also allow control data and clock, and 560MHz reference clock to be sent from S5720 to the phased array chips. Note that the S5720-to-S5640 IF interconnection loss at the clock frequency must not exceed 1dB, so that the clock input power at the S5640 clock input is at least -8 dBm. S5720 can connect to two phased array chips but only one phase array can work in the transmitter mode, and two can be operating concurrently in the receiver mode. Note that S5640 supports two types of control interface: PSpeedy and HSpeedy. The configuration shows the use of PSpeedy, where both clock and data are multiplexed along with the IF signals.



See also claim element [1D] above.

Accordingly, the Accused Instrumentalities literally meet this claim limitation. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that it is present under the doctrine of equivalents, because any differences are insubstantial: the devices

	perform substantially the same function (processor-controlled beamforming), in substantially the same way (processors executing instructions to generate control signals for phased arrays), to achieve substantially the same result (steerable antenna beams directed according to processor instructions).
[7F] wherein said at least one steerable antenna operates on one or multiple bands, and	The steerable antenna arrays in the Accused Instrumentalities operate in 5G FR2 bands above 10 GHz and below 500 GHz. According to the A53 Operational Description, each S5640 phased array chip supports two frequency bands: 28 GHz (band n261) and 39 GHz (band n260/n262). Each phased array chip includes 20 antenna ports, divided into 10 for the 28 GHz band and 10 for the 39 GHz band. This demonstrates that the steerable antenna operates on multiple bands. The block diagram of the S5640 phased array chip, reproduced below, illustrates this dual-band configuration. The diagram shows the blue array (ANT28) for 28 GHz and the red array (ANT39) for 39 GHz, with separate combining networks and antenna ports for each band. This visual evidence further confirms that the steerable antenna arrays are explicitly configured to operate on more than one band:



See fcc.report/FCC-ID/A3LSMA536V/5651659.pdf (“Operational Description”).

See claim elements [1B] - [1D] above.

[7G] wherein said at least one steerable antenna radiates or receives at one or more frequencies in the range of 10 GHz to 500 GHz.

The Accused Instrumentalities satisfy this limitation because their steerable antennas radiate and receive at frequencies within the claimed range of 10 GHz to 500 GHz.

The FCC Operational Description confirms that the Accused mmWave products implement beamforming for 5G FR2 band n261 (27.5–28.35 GHz) and band n260/n262 (37–40 GHz). Both frequency ranges fall squarely within the 10–500 GHz range recited in the claim.

The S5640 phased array chips in the Accused Instrumentalities each include 20 antenna ports: 10 for the 28 GHz band and 10 for the 39 GHz band. These ports enable steerable beam

	radiation and reception at the specified frequencies, thereby directly meeting the claim limitation. See FCC ID A3LSMA536V, Operational Description (Main Part R4). See also claim element [1(c)] above.
Claim 12	Correspondence in Accused Instrumentalities
[12PRE] A method for avoiding radiation of a user or structure by a wireless device with a steerable antenna system, comprising:	See claim element [7PRE] above.
[12A] detecting in a three dimensional space with one or more sensors selected from the group consisting of one or more cameras, microphones, audio sensors or transducers, ultrasound sensors, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, an orientation of said wireless device relative to either or both said user and said structure;	The Accused Instrumentalities satisfy this limitation because they include multiple types of sensors that detect orientation of the device in three-dimensional space relative to the user and surrounding structures. For example: • Proximity and infrared sensors (light detectors): Samsung smartphones incorporate proximity sensors that use infrared light to detect nearby objects, such as the user's head or hand. These sensors measure distance and orientation of the device relative to the user. See Samsung Support: <i>What is this proximity sensor on your Samsung smartphone</i> (https://www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone/). • Gyroscopes and accelerometers: These sensors detect the device's spatial orientation in three dimensions, providing orientation data used in antenna management. • Capacitive touch/grip sensors: As described in the FCC Operational Description, Samsung devices detect when the user's hand is covering an antenna and adjust operation accordingly. Thus, the Accused Instrumentalities include at least one sensor selected from the group recited in the claim (e.g., light detectors, gyroscopes, capacitive sensors), and use those sensors to detect the orientation of the wireless device relative to the user and/or external structures.

	See also claim elements [1A] and [7A]. Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that the element is present under the doctrine of equivalents, because any differences are insubstantial: the Accused Instrumentalities perform substantially the same function (detecting orientation relative to the user), in substantially the same way (using onboard sensors), to achieve substantially the same result (adjusting device operation based on orientation).
[12B] computing, with a computation module communicatively coupled to said one or more sensors, zones or spans of directions in the three dimensional space;	The Accused Instrumentalities satisfy this limitation because they include a plurality of sensors (including accelerometers, gyroscopes, and proximity sensors such as ambient light and/or infrared light sensors) that communicate with an onboard processor. The processor functions as the claimed “computation module” and is communicatively coupled to the sensors to determine the relative orientation of the device in three-dimensional space. The processor executes software that uses these sensor inputs to compute zones or spans of directions for beam management. For example, when user proximity or device orientation is detected, the processor computes which directional spans are available for radiation and communicates those results to the steerable antenna module, which then adjusts its beams accordingly. Thus, a processor of the wireless device that communicates with the steerable antenna constitutes the claimed “computation module.” See claim element [1B] above. DOE fallback: Plaintiff contends that this element is literally present in the Accused Instrumentalities. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that the element is present under the doctrine of equivalents, because any differences are insubstantial: the Accused Instrumentalities perform substantially the same function (computing directional zones), in substantially the same way (using processors coupled to sensors), to achieve substantially the same result (beam steering in non-blocked zones).
[12C] adjusting at least one steerable antenna that operates on one or multiple bands, which radiates or receives at one or more frequencies in the range of 10 GHz	The Accused Instrumentalities satisfy this limitation as follows: • Steerable antenna on one or multiple bands: As explained in claim element [7F], the S5640 phased array chips in the Accused Instrumentalities operate on two frequency bands (28 GHz and 39 GHz).

to 500 GHz, and that is communicatively coupled to said computation module, so that the at least one steerable antenna radiates or receives one or more beams in one or more directions while attenuating its radiation pattern in said zones or spans of directions in the three dimensional space,	• Frequencies between 10 GHz and 500 GHz: As described in claim element [7G], both 28 GHz and 39 GHz fall within the claimed range. • Coupling to computation module: As described in claim element [12B], the Qualcomm modem/processor functions as the computation module, communicating with the phased array antennas to control beamforming. • Beam adjustment/attenuation: As explained in claim element [7D], the phased array chips adjust their beam radiation patterns to direct energy in open spans of directions while avoiding or attenuating radiation in blocked zones (e.g., due to hand/head proximity). This is achieved through beam index selection and transmit antenna switching (TAS) algorithms described in the FCC Operational Description for the Galaxy A53 5G (SM-A536V). Thus, the accused devices literally perform the claimed “adjusting” step: they adjust their steerable antennas to radiate beams in permitted directions while attenuating radiation in zones of obstruction, consistent with 3GPP beam management protocols. See also claim elements [7D]–[7G] above. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that it is present under the doctrine of equivalents, because any differences are insubstantial: the Accused Instrumentalities perform substantially the same function (beam adjustment with attenuation), in substantially the same way (processor-controlled phased array beamforming), to achieve substantially the same result (radiating in viable spans while attenuating blocked directions).
[12D] wherein said zones or spans of directions correspond with one or more directions or locations of said user or structure relative to said at least one steerable antenna in the three dimensional space,	The Accused Instrumentalities satisfy this limitation because the zones or spans of directions computed by the devices correspond to the user’s location relative to the steerable antennas. As described in claim element [1B], the devices incorporate proximity sensors, grip sensors, and gyroscopes, which provide signals indicating the presence and location of the user’s hand or head relative to the antenna modules. These signals are processed by the computation module to determine whether particular spans of directions are obstructed. Samsung’s FCC Operational Description confirms that the Accused Instrumentalities use grip and proximity sensors to detect when the user’s hand or head is near the antenna and adjust

	operation accordingly. In this way, the zones/spans of directions used in beam management directly correspond to user-relative directions or locations in three-dimensional space. Thus, the Accused Instrumentalities literally meet this limitation. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that it is present under the doctrine of equivalents, because any differences are insubstantial: the devices determine zones corresponding to the user's relative location in substantially the same way to achieve substantially the same result.
[12E] wherein said at least one steerable antenna is adjusted in the adjusting step to steer or direct its radiation pattern in particular directions while attenuating the radiation pattern in other directions in the three dimensional space.	The Accused Instrumentalities satisfy this limitation because their steerable antennas are adjusted to direct energy in permitted directions while attenuating radiation in other directions. As described in claim elements [1C]–[1E], the Accused Instrumentalities' phased array antennas support beamforming and beam steering in 5G FR2 bands. The Qualcomm QTM-series modules used in Samsung devices perform beam index selection and beam switching, which cause the antenna to direct radiation toward viable paths while placing nulls or reduced radiation in obstructed directions. The FCC Operational Description for the Galaxy A53 5G further states that beam index and module selection affect power density and are considered in the device's transmit antenna switching (TAS) algorithm, demonstrating that the handset actively directs beams in particular directions while leaving other spans unenergized. This satisfies the requirement of steering or directing the radiation pattern in certain directions while attenuating it in others. Thus, the Accused Instrumentalities literally meet this limitation. To the extent that this element is found not to be literally present, Plaintiff contends in the alternative that it is present under the doctrine of equivalents, because any differences are insubstantial: the devices perform substantially the same function (steering radiation to certain directions), in substantially the same way (beam index selection and phased array control), to achieve substantially the same result (attenuated patterns in obstructed spans).