

U.S. Patent No. 8,594,698 (“’698 Patent”)

Accused Instrumentalities

Samsung products, including without limitation Galaxy SmartTag devices, including, but not limited to the SmartTag, SmartTag+, and all variations or iterations thereof; Galaxy Tab tablet devices, including, but not limited to the S9, S9+, S9 Ultra, S8, S8+, S8 Ultra, S6 Lite 2022, S7 FE, S6 Lite, S6 5G, S7+ 5G, S7+, S7 5G, S7, S5e, S6, S4, S3, and all variations or iterations thereof; Galaxy mobile phone devices, including, but not limited to the S8, S8+, S8 Active, S9, S9+, S10, S10+, S10 5G, S10 Lite, S10e, S20, S20+, S20+ BTS Edition, S20 Ultra, S20 FE, S20, S21, S21+, S21 Ultra, S21 FE, S22, S22+, S22 Ultra, S23, S23+, S23 Ultra, Z Fold 5, Z Fold 4, Z Fold 3, Z Fold 2, Fold, Z Flip 5, Z Flip 4, Z Flip 3, Z Flip, A3, A5, A6, A6+, A7, A8, A8+, A8 Star, A9, A2 Core, A10e, A10, A10s, A20, A20s, A30, A30s, A40, A40s, A50, A50s, A60, A70, A70s, A80, A90, A01 Core, A01, A11, A21, A21s, A31, A41, A51, A71, A51 5G, A71 5G, A52s 5G, A73 5G, A23 5G, A02, A02s, A12, A22, A22 5G, A32, A32 5G, A42 5G, A52, A52 5G, A52s 5G, A72, A03 Core, A03, A03s, A13, A13 5G, A23, A23 5G, A33 5G, A53 5G, A73 5G, A04e, A04, A04s, A14, A14 5G, A24, A34 5G, A54 5G, Note 8, Note 9, Note 10, Note 10+, Note 10 Lite, Note 20, Note 20 Ultra, and all variations or iterations thereof (“Accused Products”), infringe at least Claims 1-7, 11-13, and 15-16 of the ’698 Patent.

Each Accused Product infringes the claims in substantially the same way, and the evidence shown in this chart is similarly applicable to each Accused Product. Each claim limitation is literally infringed by each Accused Product. However, to the extent any claim limitation is not met literally, it is nonetheless met under the doctrine of equivalents because the differences between the claim limitation and each Accused Product would be insubstantial, and each Accused Product performs substantially the same function, in substantially the same way, to achieve the same result as the claimed invention. Notably, Samsung has not yet articulated which, if any, particular claim limitations it believes are not met by the Accused Products.

Claim 1

Claim 1	Accused Products
[1pre]. A location-determining method, operable by a first portable RF communications device, the method comprising:	To the extent the preamble is limiting, each Accused Product performs a location-determining method, operable by a first portable RF communications device. For example, the Galaxy S22 contains both cellular and WiFi antennas, which are used to determine the geographic location of the phone as described below. <i>See, e.g.:</i>

Claim 1	Accused Products
	Samsung Galaxy S22 5G  - Released 2022, February 25 167g / 168g (mmWave), 7.6mm thickness <> Android 12, One UI 4.1.1 128GB/256GB storage, no card slot  6.1" 1080x2340 pixels  50MP 4320p https://www.gsmarena.com/samsung_galaxy_s22_5g-11253.php

	NETWORK	Technology	GSM / CDMA / HSPA / EVDO / LTE / 5G	COLLAPSE ▲
		2G bands	GSM 850 / 900 / 1800 / 1900 - SIM 1 & SIM 2 (Dual SIM model only) CDMA 800 / 1900 & TD-SCDMA	
		3G bands	HSDPA 850 / 900 / 1700(AWS) / 1900 / 2100 CDMA2000 1xEV-DO	
		4G bands	1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 18, 19, 20, 25, 26, 28, 32, 38, 39, 40, 41, 66 - International 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 18, 19, 20, 25, 26, 28, 29, 30, 38, 39, 40, 41, 46, 48, 66, 71 - USA	
		5G bands	1, 2, 3, 5, 7, 8, 12, 20, 25, 28, 38, 40, 41, 66, 75, 77, 78 SA/NSA/Sub6 - International 1, 3, 5, 7, 8, 20, 28, 38, 41, 66, 71, 260, 261 SA/NSA/Sub6/mmWave - USA	
		Speed	HSPA 42.2/5.76 Mbps, LTE-A (7CA) Cat20 2000/200 Mbps, 5G (5+ Gbps DL)	
	DISPLAY	Type	Dynamic AMOLED 2X, 120Hz, HDR10+, 1300 nits (peak)	
		Size	6.1 inches, 90.1 cm ² (~87.4% screen-to-body ratio)	
		Resolution	1080 x 2340 pixels, 19.5:9 ratio (~425 ppi density)	
		Protection	Corning Gorilla Glass Victus+	
			Always-on display	
	PLATFORM	OS	Android 12, One UI 4.1.1	
		Chipset	Exynos 2200 (4 nm) - Europe Qualcomm SM8450 Snapdragon 8 Gen 1 (4 nm) - ROW	
		CPU	Octa-core (1x2.8 GHz Cortex-X2 & 3x2.50 GHz Cortex-A710 & 4x1.8 GHz Cortex-A510) - Europe Octa-core (1x3.00 GHz Cortex-X2 & 3x2.50 GHz Cortex-A710 & 4x1.80 GHz Cortex-A510) - ROW	
		GPU	Xclipse 920 - Europe Adreno 730 - ROW	

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	COMMS <table> <tr> <td>WLAN</td><td>Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, Wi-Fi Direct, hotspot</td></tr> <tr> <td>Bluetooth</td><td>5.2, A2DP, LE</td></tr> <tr> <td>GPS</td><td>Yes, with A-GPS, GLONASS, BDS, GALILEO</td></tr> <tr> <td>NFC</td><td>Yes</td></tr> <tr> <td>Radio</td><td>No</td></tr> <tr> <td>USB</td><td>USB Type-C 3.2, USB On-The-Go</td></tr> </table> https://www.gsmarena.com/samsung_galaxy_s22_5g-11253.php  Find My Mobile Lost your phone? Don't panic. Find My Mobile will help you locate your phone or tablet and protect your data. You can even use it to unlock if you forget your pattern, PIN, or password. *To use this service, you must be signed in to your Samsung account on your device. https://findmymobile.samsung.com/	WLAN	Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, Wi-Fi Direct, hotspot	Bluetooth	5.2, A2DP, LE	GPS	Yes, with A-GPS, GLONASS, BDS, GALILEO	NFC	Yes	Radio	No	USB	USB Type-C 3.2, USB On-The-Go
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Bluetooth	5.2, A2DP, LE												
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Claim 1	Accused Products
	Find My Mobile Because many of us live a significant part of our lives through our Galaxy phones, Find My Mobile has become a necessary precaution. Use the Locate My Device function when you can't find your phone. When it's lost for sure, you have the option to remotely lock your device, block access to Samsung Pay, and even delete Samsung Pay or simply wipe data from the entire device. Requirements * To use the 'Find My Mobile' service, 1) You must have set up your Samsung account on your device. 2) You allow Google to collect your location information and agree to the 'Use wireless networks' term and conditions. https://www.samsung.com/us/support/owners/app/find-my-mobile How does Google know my location? Depending on the products you're using and settings you choose, you may provide Google with different types of location information that are critical to making some services work and making others more useful for you. Location can come from real-time signals, like your IP address or device location, and also your past activity on Google sites and services, to tailor experiences for your context. Below are the primary ways we may get information about your location. https://policies.google.com/technologies/location-data?hl=en-US

Claim 1	Accused Products
	From your devices Many devices, like phones or computers, can work out their precise location. You can allow Google and other apps to provide you with useful features based on where your device is located. For example, if you're running late to meet your friends, you'll probably want to use a navigation app to know the quickest way to get to your destination. To get turn-by-turn directions, you may need to turn on your device's location and give the app the permission to access it. Or for some searches like "coffee shop", "bus stop" or "atm", results will usually be more helpful when precise location is available. On your Android device, if you choose to turn on your device location, you can use features like navigation, giving an app access to your current location, or find your phone. You can also choose which apps have permission to use your device's location with simple controls that let you turn the permission on or off for individual apps. On Android, you can see when an app is requesting to use your phone's GPS-based location when the top of your screen shows Location . Learn more https://policies.google.com/technologies/location-data?hl=en-US

Claim 1	Accused Products
	Google Location Services On most Android devices, Google, as the network location provider, provides a location service called Google Location Services (GLS), known in Android 9 and above as Google Location Accuracy. This service aims to provide a more accurate device location and generally improve location accuracy. Most mobile phones are equipped with GPS, which uses signals from satellites to determine a device's location – however, with Google Location Services, additional information from nearby Wi-Fi, mobile networks, and device sensors can be collected to determine your device's location. It does this by periodically collecting location data from your device and using it in an anonymous way to improve location accuracy. You can disable Google Location Services at any time in your device's location settings. Your device's location will continue to work even if GLS is turned off, but the device will rely only on GPS to estimate device location for apps with the necessary permission. Google Location Services is distinct from your device's location setting. Learn more https://policies.google.com/technologies/location-data?hl=en-US
[1a] (a) the first portable RF communications device monitoring its location by (i)	In each Accused Product, the first portable RF communications device monitors its location by (i) receiving communications signals from a first plurality of fixed-location service-area antenna stations capable of RF communication with the first portable RF communications device wherein

Claim 1	Accused Products
receiving communications signals from a first plurality of fixed-location service-area antenna stations capable of RF communication with the first portable RF communications device wherein the antenna stations are substantially continuously operating, (ii) identifying at least one ID within at least one of the received communications signals, and (iii) measuring a varying signal characteristic other than ID, which signal characteristic is associated with a received communications signal from each of the first plurality of antenna stations; and	the antenna stations are substantially continuously operating, (ii) identifying at least one ID within at least one of the received communications signals, and (iii) measuring a varying signal characteristic other than ID, which signal characteristic is associated with a received communications signal from each of the first plurality of antenna stations. For example, the Galaxy S22 receives communication signals from a plurality of Wi-Fi network stations and/or a plurality of mobile network stations, each of which is generally in a fixed location and operating continuously (Wi-Fi access point, cell phone tower, etc.). On information and belief, based on the availability of public documentation for Google Location Services and for related Android APIs, the Galaxy S22 determines signal strengths, round-trip times, and other signal characteristics, and uses these to determine its location. <i>See, e.g.:</i>  Find My Mobile Lost your phone? Don't panic. Find My Mobile will help you locate your phone or tablet and protect your data. You can even use it to unlock if you forget your pattern, PIN, or password. *To use this service, you must be signed in to your Samsung account on your device. https://findmymobile.samsung.com/

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Claim 1	Accused Products
	From your devices Many devices, like phones or computers, can work out their precise location. You can allow Google and other apps to provide you with useful features based on where your device is located. For example, if you're running late to meet your friends, you'll probably want to use a navigation app to know the quickest way to get to your destination. To get turn-by-turn directions, you may need to turn on your device's location and give the app the permission to access it. Or for some searches like "coffee shop", "bus stop" or "atm", results will usually be more helpful when precise location is available. On your Android device, if you choose to turn on your device location, you can use features like navigation, giving an app access to your current location, or find your phone. You can also choose which apps have permission to use your device's location with simple controls that let you turn the permission on or off for individual apps. On Android, you can see when an app is requesting to use your phone's GPS-based location when the top of your screen shows Location . Learn more https://policies.google.com/technologies/location-data?hl=en-US

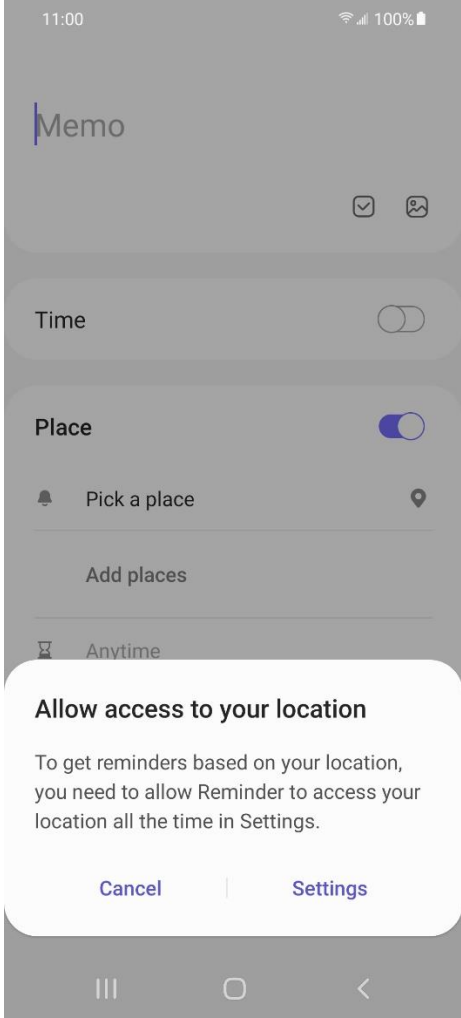
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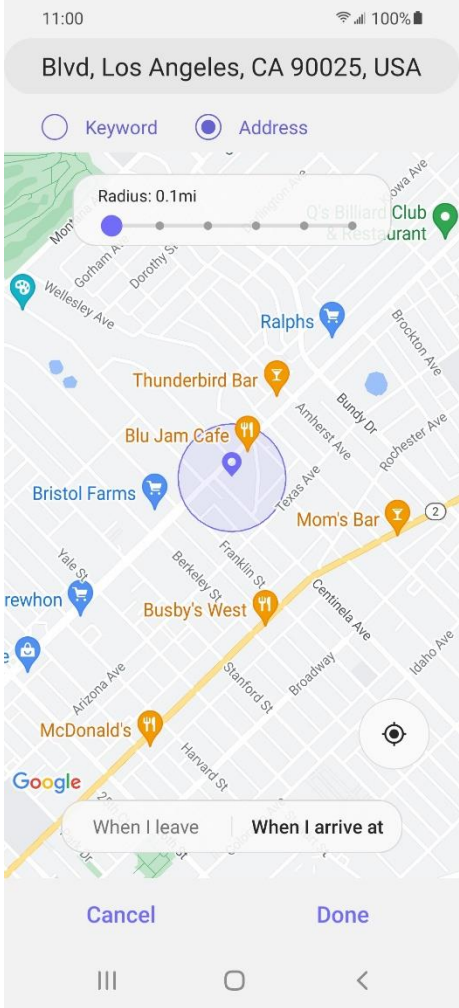
Claim 1	Accused Products
	Wi-Fi location: ranging with RTT  You can use the Wi-Fi location functionality provided by the Wi-Fi RTT (Round-Trip-Time) API to measure the distance to nearby RTT-capable Wi-Fi access points and peer Wi-Fi Aware devices. If you measure the distance to three or more access points, you can use a multilateration algorithm to estimate the device position that best fits those measurements. The result is typically accurate within 1-2 meters. https://developer.android.com/guide/topics/connectivity/wifi-rtt Introduction The Geolocation API returns a location and accuracy radius based on information about cell towers and WiFi nodes that the mobile client can detect. This document describes the protocol used to send this data to the server and to return a response to the client. ... Cell tower objects ..

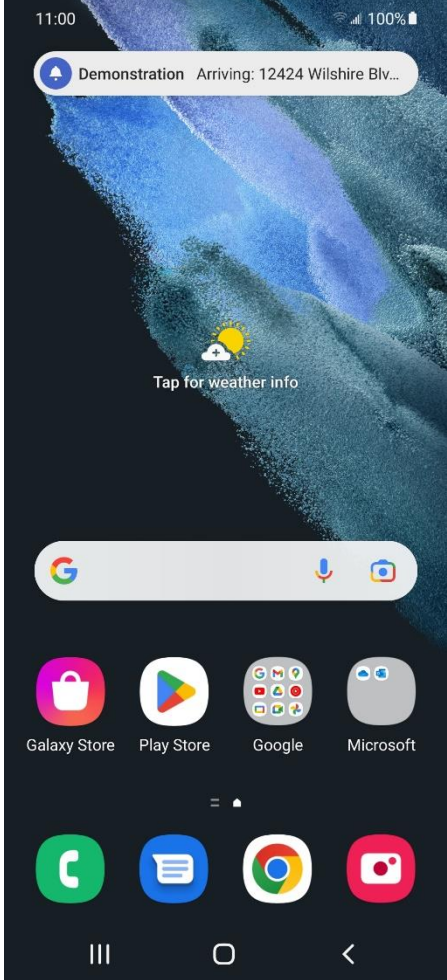
Claim 1	Accused Products																
	The following optional fields are not currently used, but may be included if values are available. <table><tr><th>Field</th><th>JSON type</th><th>Description</th><th>Notes</th></tr><tr><td>age</td><td>number (uint32)</td><td>The number of milliseconds since this cell was primary.</td><td>If age is 0, the <code>cellId</code> or <code>newRadioCellId</code> represents a current measurement.</td></tr><tr><td>signalStrength</td><td>number (double)</td><td>Radio signal strength measured in dBm.</td><td></td></tr><tr><td>timingAdvance</td><td>number (double)</td><td>The timing advance  value.</td><td></td></tr></table> .. WiFi access point objects	Field	JSON type	Description	Notes	age	number (uint32)	The number of milliseconds since this cell was primary.	If age is 0, the <code>cellId</code> or <code>newRadioCellId</code> represents a current measurement.	signalStrength	number (double)	Radio signal strength measured in dBm.		timingAdvance	number (double)	The timing advance  value.	
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	WiFi access point objects The request body's <code>wifiAccessPoints</code> array must contain two or more WiFi access point objects. <code>macAddress</code> is required; all other fields are optional. <table><tr><th>Field</th><th>JSON type</th><th>Description</th><th>Notes</th></tr><tr><td><code>macAddress</code></td><td><code>string</code></td><td>The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.</td><td><i>Required.</i> : (colon) separated hexadecimal string.</td></tr><tr><td><code>signalStrength</code></td><td><code>number (double)</code></td><td>The current signal strength measured in dBm.</td><td>For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.</td></tr><tr><td><code>age</code></td><td><code>number (uint32)</code></td><td>The number of milliseconds since this access point was detected.</td><td></td></tr><tr><td><code>channel</code></td><td><code>number (uint32)</code></td><td>The channel over which the client is communicating with the access point.</td><td></td></tr><tr><td><code>signalToNoiseRatio</code></td><td><code>number (double)</code></td><td>The current signal to noise ratio measured in dB.</td><td></td></tr></table> https://developers.google.com/maps/documentation/geolocation/overview	Field	JSON type	Description	Notes	<code>macAddress</code>	<code>string</code>	The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.	<i>Required.</i> : (colon) separated hexadecimal string.	<code>signalStrength</code>	<code>number (double)</code>	The current signal strength measured in dBm.	For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.	<code>age</code>	<code>number (uint32)</code>	The number of milliseconds since this access point was detected.		<code>channel</code>	<code>number (uint32)</code>	The channel over which the client is communicating with the access point.		<code>signalToNoiseRatio</code>	<code>number (double)</code>	The current signal to noise ratio measured in dB.	
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[1b] (b) the first portable RF communications device determining if a first monitored location, monitored in accordance with part (a), is within proximity of a location chosen by a user of the first portable RF communications device, as a result of	Each Accused Product determines if a first monitored location, monitored in accordance with part (a), is within proximity of a location chosen by a user of the first portable RF communications device, as a result of electronically comparing (i) the at least one ID at the first monitored location with at least one ID at the location chosen by the user and (ii) at least one number based on the varying signal characteristic of the communications signals from each of the first plurality of antenna stations at the first monitored location with at least one number based on corresponding varying signal characteristics of the communications signals from each of the first plurality of antenna stations at the location chosen by the user.																								

Claim 1	Accused Products
electronically comparing (i) the at least one ID at the first monitored location with at least one ID at the location chosen by the user and (ii) at least one number based on the varying signal characteristic of the communications signals from each of the first plurality of antenna stations at the first monitored location with at least one number based on corresponding varying signal characteristics of the communications signals from each of the first plurality of antenna stations at the location chosen by the user.	For example, using the Samsung Reminder app included with the Galaxy S22, a user can specify a location by creating a location-based reminder. This functionality uses the Google Location Services functionality, as shown by the necessity of providing Location permissions to the Reminder app. The phone then uses signal strength, round-trip time, and other network information from nearby Wi-Fi and/or mobile communications signals, based on antennas identified as being within range of the specified location, to determine whether or not the phone is in the same location as the location chosen by the user. Similar reminders can also be created through Samsung's Bixby service. For another example, Samsung's SmartThings Find, Search Nearby, and/or Find My systems, when used on a Galaxy S22 or other Samsung Accused Product, enable locating, and navigating to the location of, a user's SmartTag, SmartThings, and/or Android devices. On information and belief, these processes use the same or similar techniques as described in other Samsung and Google documentation, including comparing varying signal characteristics in order to determine if the Accused Product is within proximity of the chosen location. <i>See, e.g.:</i>

Claim 1	Accused Products
	 The screenshot shows the Samsung Reminder app interface. At the top, the status bar displays 11:00, signal strength, and 100% battery. The app has a 'Memo' title bar with a blue vertical line. Below the title bar are icons for a checklist and a photo. The main content area includes a 'Time' section with a toggle switch, a 'Place' section with a toggle switch and a 'Pick a place' button, and an 'Add places' button. At the bottom, there is an 'Anytime' section. A white dialog box is overlaid on the screen, titled 'Allow access to your location'. The dialog contains the text: 'To get reminders based on your location, you need to allow Reminder to access your location all the time in Settings.' Below the text are two buttons: 'Cancel' and 'Settings'. Screenshot from Samsung Reminder app showing that the app uses Google Services based location determination.

Claim 1	Accused Products
	 The screenshot shows a mobile application interface for selecting a location. At the top, the status bar displays '11:00', signal strength, and '100%' battery. Below the status bar, the address 'Blvd, Los Angeles, CA 90025, USA' is entered. There are two radio buttons: 'Keyword' (unselected) and 'Address' (selected). A map of Los Angeles is shown with a blue circle indicating a radius of 0.1 miles. Various locations are marked on the map, including 'Thunderbird Bar', 'Blu Jam Cafe', 'Mom's Bar', 'Busby's West', 'McDonald's', 'Bristol Farms', 'Ralphs', and 'O's Billiard Club & Restaurant'. At the bottom, there are two buttons: 'Cancel' and 'Done'. Below the map, there are two tabs: 'When I leave' and 'When I arrive at'. The bottom of the screen shows the Android navigation bar with three icons: a square, a circle, and a triangle. Screenshot from Samsung Reminder app showing selection of location for notification

Claim 1	Accused Products
	 Screenshot showing, at top, notification from Samsung Reminder app that the phone is in the same location as specified by the user

Claim 1	Accused Products
	Get reminded. When you create a new reminder with Bixby, you can set a specific time and location for delivery, so you'll get it when you need it.  https://www.samsung.com/global/galaxy/apps/bixby/reminder/

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Wi-Fi location: ranging with RTT

You can use the Wi-Fi location functionality provided by the [Wi-Fi RTT \(Round-Trip-Time\) API](#) to measure the distance to nearby RTT-capable Wi-Fi access points and peer [Wi-Fi Aware](#) devices.

If you measure the distance to three or more access points, you can use a multilateration algorithm to estimate the device position that best fits those measurements. The result is typically accurate within 1-2 meters.

With this accuracy, you can develop fine-grained location-based services, such as indoor navigation, disambiguated voice control (for example, "Turn on this light"), and location-based information (for example, "Are there special offers for this product?").

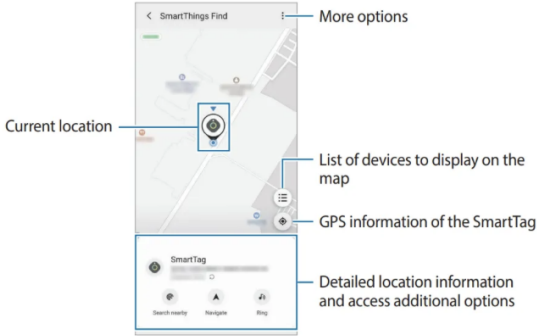
The requesting device doesn't need to connect to the access points to measure distance with Wi-Fi RTT. To maintain privacy, only the requesting device is able to determine the distance to the access point; the access points do not have this information. Wi-Fi RTT operations are unlimited for foreground apps but are throttled for background apps.

Wi-Fi RTT and the related *Fine-Time-Measurement* (FTM) capabilities are specified by the IEEE 802.11-2016 standard. Wi-Fi RTT requires the precise time measurement provided by FTM because it calculates the distance between two devices by measuring the time a packet takes to make a round trip between the devices and multiplying that time by the speed of light.

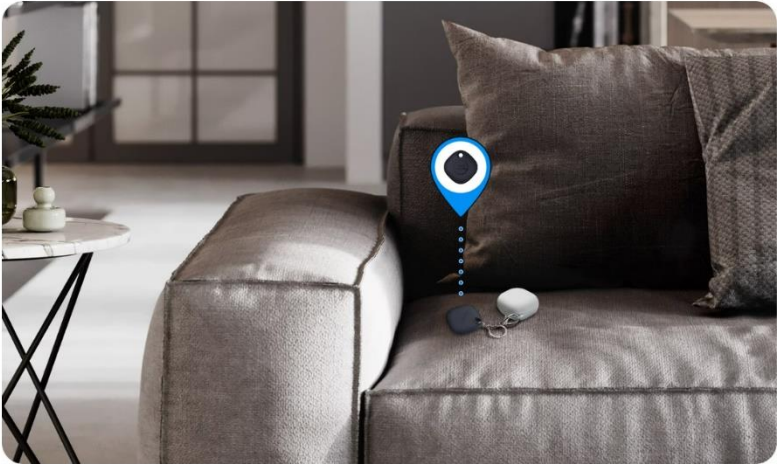
<https://developer.android.com/guide/topics/connectivity/wifi-rtt>

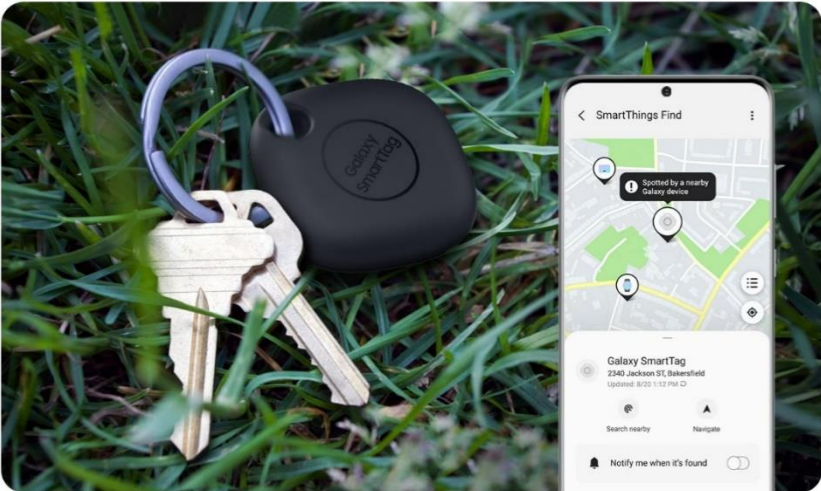
In a press release this evening, Samsung announced that the SmartThings Find network has effectively doubled in size over the last year, with 200 million "find nodes" out in the wild. A "find node" is a Galaxy smartphone or tablet that is registered to use SmartThings Find and can relay the location of a Galaxy SmartTag to the tag's owner.

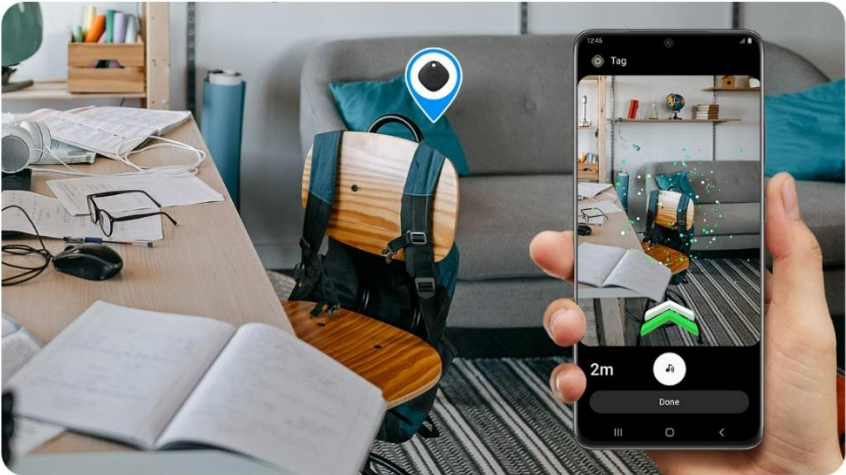
<https://9to5google.com/2022/07/13/samsung-smarthings-find-users/>

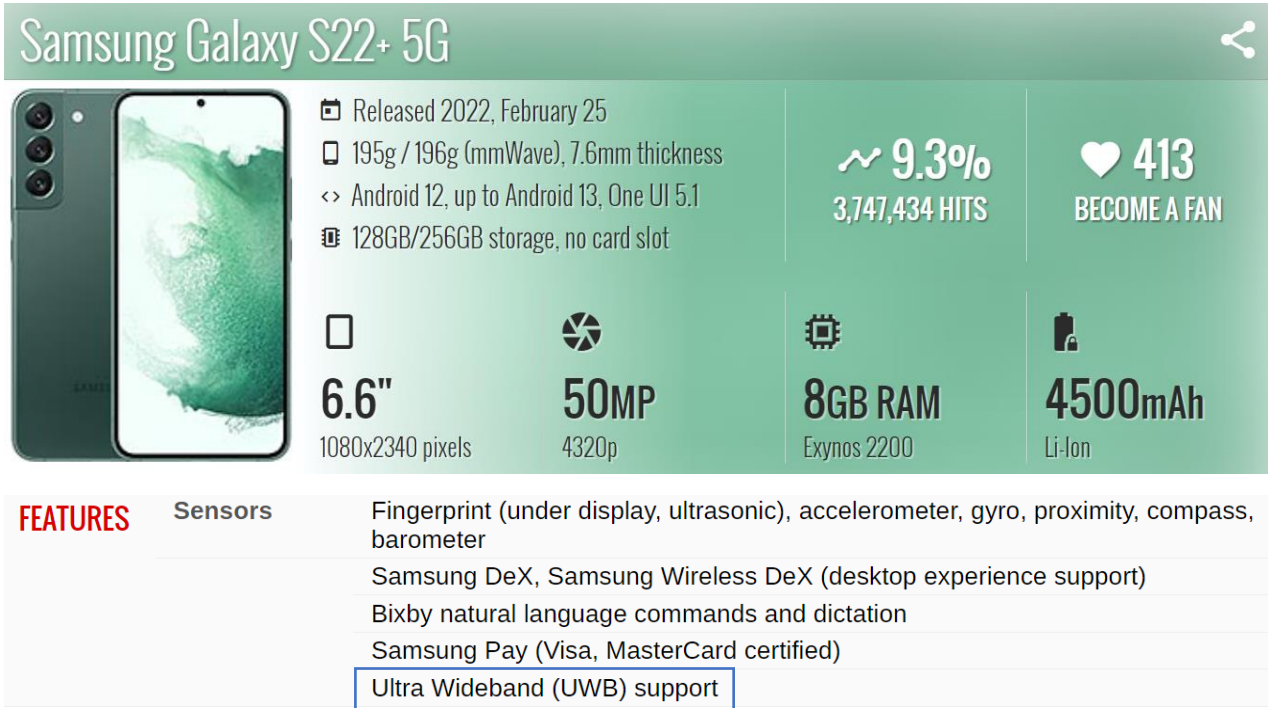
Claim 1	Accused Products
	Using the SmartTag Viewing a SmartTag's location You can remotely view your SmartTag's location from the SmartThings app on your mobile device and find its location by triggering a notification sound on the SmartTag. 1. Launch the SmartThings app on your mobile device. 2. Tap on your SmartTag card and tap View map. Alternatively, tap SmartThings Find. The current location of the device will be displayed on the map.  • <u>The location of the SmartTag is based on GPS and Wi-Fi positioning results of the mobile device connected to the SmartTag or the nearby Android mobile device, which may have some errors due to things like the surrounding environment or GPS failure</u> • If the current location of the SmartTag does not appear, the SmartTag's battery has been discharged or has not been discovered by an Android mobile device that can check the SmartTag's location information. Activate the related feature to get notifications of the SmartTag's location information. • The SmartTag's usage time may vary depending on the user's environment and the usage pattern. • The Ultra-Wideband (UWB) feature may not be available depending on the region. 

Claim 1	Accused Products
	1. Launch the SmartThings app on your mobile device. 2. Tap SmartThings → Find Navigate. <u>Directions to the place where the SmartTag is located will begin.</u>  If a supported navigation app is not installed on your mobile device, install the desired app from the list of supported navigation apps first and get directions. https://manuals.plus/samsung/galaxy-smarttagsmarttag-manual#axzz7g8yWgeln Searching for the SmartTag location by signal strength You can find the SmartTag's location by detecting its signal strength. 1. Launch the SmartThings app on your mobile device. 2. Tap SmartThings Find Search nearby. The signal screen of the SmartTag you are looking for will appear. The closer you are to the location of the SmartTag you are looking for, the stronger the signal strength indicated on the screen will be. https://manuals.plus/samsung/galaxy-smarttagsmarttag-manual#axzz7g8yWgeln <i>Comment: Samsung SmartTag product uses Bluetooth to communicate with mobile phones in its proximity, which will scan and find the SmartTag based on Bluetooth device ID and received signal strength</i>

Claim 1	Accused Products
	Finding the important things in your life Bluetooth powered SmartTags* attach easily to keys, bags, or even the family pet. If you think your lost item is nearby but can't quite find it, tap the ring button on your mobile and follow the familiar sound of your ringtone calling for you at the volume you set.  * Galaxy SmartTags have a Bluetooth range of up to 100m without obstacles. Actual performance may vary depending on the environment where they are used. Source: https://www.samsung.com/us/mobile-accessories/galaxy-smarttag-black-ei-t5300bbegus/ <i>Comment: Even when the Samsung SmartTag is out of the proximity of its owner's mobile phone, it can still broadcast Bluetooth beacons that will potentially be captured by anybody's mobile phone that is nearby, which will relay the beacon to Samsung's Find Network in order to be discovered by its owner:</i>

Claim 1	Accused Products
	Locate your things from far away Your tagged item is out of range? No problem! Even when offline, the Galaxy Find Network* can use scanned data to find it for you privately. You can also use other devices you own to locate your items.  * This feature is only available with Galaxy devices. Source: https://www.samsung.com/us/mobile-accessories/galaxy-smarttag-black-ei-t5300bbegus/ <i>Comment: Samsung SmartTag+ product further uses UWB to communicate with mobile phones, such as Samsung Galaxy S22 Plus, in its proximity, which will use more precise ranging technology with UWB to get cm level accuracy and step-by-step guide to lead to the tag.</i>

Claim 1	Accused Products
	AR Finding walks you step-by-step to lost items AR Finding gives you a uniquely visual way to locate a lost item with a SmartTag+ attached. It even lets you know you're close with a glimmering green light when you're at the destination. It shows you the way on your phone screen through the SmartThings app.  * For Galaxy SmartTag+, Samsung account log-in and registration on SmartThings Find is required. Galaxy SmartTag+ needs to be paired with ultra-wideband(UWB)-enabled Galaxy smartphones with Android 11 or higher to fully function. ** AR Finding works between devices that support UWB technology. UWB is supported on Galaxy S21 Ultra, Galaxy S21+, Galaxy Note20 Ultra and Galaxy Z Fold2. *** Accuracy may be reduced if there's an obstacle between you and the tag, such as when the tag is inside a drawer, behind a wall, or in a car. Source: https://www.samsung.com/us/mobile-accessories/galaxy-smarttag-plus-black-1-pack-eit7300bbegus/ Ultra-wideband (UWB) communication Ultra-wideband communication is a radio technology focused on precise ranging (measuring the location to an accuracy of 10 cm) between devices. This radio technology can use a low-energy density for short range measurements and perform high-bandwidth signaling over a large portion of the radio spectrum. UWB's bandwidth is greater than 500 MHz (or exceeding 20% fractional bandwidth).

Claim 1	Accused Products						
	UWB-enabled mobile devices As of April 2023, these devices support the Android UWB Jetpack library: <table> <tr> <td>Vendor</td><td>Device Model</td></tr> <tr> <td>Google</td><td>Pixel 6 Pro, Pixel 7 Pro</td></tr> <tr> <td>Samsung</td><td>Galaxy Note 20, S21+, S22+, Z Fold 2, 3, 4</td></tr> </table> https://developer.android.com/guide/topics/connectivity/uwb  The screenshot displays the Samsung Galaxy S22+ 5G product page. It includes a list of specifications: Released 2022, February 25; 195g / 196g (mmWave), 7.6mm thickness; Android 12, up to Android 13, One UI 5.1; 128GB/256GB storage, no card slot. Performance metrics show a 9.3% increase in hits (3,747,434) and 413 fans. Key specs include a 6.6" 1080x2340 pixel display, 50MP camera, 8GB RAM with Exynos 2200 processor, and a 4500mAh Li-Ion battery. The features section lists sensors (Fingerprint, accelerometer, gyro, proximity, compass, barometer), Samsung DeX, Bixby, Samsung Pay, and Ultra Wideband (UWB) support. Source: https://www.gsmarena.com/samsung_galaxy_s22_ultra_5g-11251.php	Vendor	Device Model	Google	Pixel 6 Pro, Pixel 7 Pro	Samsung	Galaxy Note 20, S21+, S22+, Z Fold 2, 3, 4
Vendor	Device Model						
Google	Pixel 6 Pro, Pixel 7 Pro						
Samsung	Galaxy Note 20, S21+, S22+, Z Fold 2, 3, 4						

Claim 2

Claim 2	Accused Products
2. The method of claim 1 wherein the characteristic is the communications signal's strength, which varies over a range of an antenna station.	Each Accused Product performs the method of claim 1 wherein the characteristic is the communications signal's strength, which varies over a range of an antenna station. For example, the location system uses signal strengths, which vary over the range of an antenna station due to fading effects, in its location determinations. <i>See, e.g.:</i> To provide this more accurate location, when turned on, GLA periodically collects location information from your Android device—including GPS and information about Wi-Fi access points, mobile networks and device sensors—using a temporary rotating device identifier that is not associated with any specific person. GLA uses this information to improve location accuracy and provide location-based services, including by building crowdsourced maps of Wi-Fi access points and mobile network towers. Source: https://policies.google.com/technologies/location-data?hl=en-US <pre>{ "macAddress": "9c:1c:12:b0:45:f1", "signalStrength": -43, "signalToNoiseRatio": 0, "channel": 11, "age": 0 }</pre>

Claim 2	Accused Products			
	Field	JSON type	Description	Notes
	macAddress	string	The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.	<i>Required.</i> Colon-separated (:) hexadecimal string. Only universally-administered MAC addresses ☒ can be located via the API. Other MAC addresses are silently dropped and may lead to an API request becoming effectively empty. For details, see Dropping useless Wifi access points .
	signalStrength	number (double)	The current signal strength measured in dBm.	For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.
	Source: https://developers.google.com/maps/documentation/geolocation/requests-geolocation#cell_tower_object			

Claim 3

Claim 3	Accused Products
3. The method of claim 2 wherein the chosen location signal strengths were measured by the first portable RF communication device.	Each Accused Product performs the method of claim 2 wherein the chosen location signal strengths were measured by the first portable RF communication device. For example, the geolocation system in each Accused Product includes periodic collection of location information from the first portable RF communication device. <i>See, e.g.:</i> To provide this more accurate location, when turned on, GLA periodically collects location information from your Android device—including GPS and information about Wi-Fi access points, mobile networks and device sensors—using a temporary rotating device identifier that is not associated with any specific person. GLA uses this information to improve location accuracy and provide location-based services, including by building crowdsourced maps of Wi-Fi access points and mobile network towers. Source: https://policies.google.com/technologies/location-data?hl=en-US <pre>{ "macAddress": "9c:1c:12:b0:45:f1", "signalStrength": -43, "signalToNoiseRatio": 0, "channel": 11, "age": 0 }</pre>

Claim 3	Accused Products			
	Field	JSON type	Description	Notes
	macAddress	string	The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.	<i>Required.</i> Colon-separated (:) hexadecimal string. Only universally-administered MAC addresses ☒ can be located via the API. Other MAC addresses are silently dropped and may lead to an API request becoming effectively empty. For details, see Dropping useless Wifi access points .
	signalStrength	number (double)	The current signal strength measured in dBm.	For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.
Source: https://developers.google.com/maps/documentation/geolocation/requests-geolocation#cell_tower_object				

Claim 4

Claim 4	Accused Products
4. The method of claim 2 wherein the chosen location signal strengths were measured by a second portable RF communication device.	Each Accused Product performs the method of claim 2 wherein the chosen location signal strengths were measured by a second portable RF communication device. For example, the geolocation system in each Accused Product includes periodic collection of location information from the other (“crowdsourced”) communication devices. <i>See, e.g.:</i> To provide this more accurate location, when turned on, GLA periodically collects location information from your Android device—including GPS and information about Wi-Fi access points, mobile networks and device sensors—using a temporary rotating device identifier that is not associated with any specific person. GLA uses this information to improve location accuracy and provide location-based services, including by building <u>crowdsourced maps</u> of Wi-Fi access points and mobile network towers. Source: https://policies.google.com/technologies/location-data?hl=en-US <pre>{ "macAddress": "9c:1c:12:b0:45:f1", "signalStrength": -43, "signalToNoiseRatio": 0, "channel": 11, "age": 0 }</pre>

Claim 4	Accused Products			
	Field	JSON type	Description	Notes
	macAddress	string	The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.	<i>Required.</i> Colon-separated (:) hexadecimal string. Only universally-administered MAC addresses  can be located via the API. Other MAC addresses are silently dropped and may lead to an API request becoming effectively empty. For details, see Dropping useless Wifi access points .
	signalStrength	number (double)	The current signal strength measured in dBm.	For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.
Source: https://developers.google.com/maps/documentation/geolocation/requests-geolocation#cell_tower_object				

Claim 5

Claim 5	Accused Products
5. The method of claim 2 wherein the chosen location signal strengths and the at least one ID originated from a database of geographic locations and corresponding signal strengths and IDs.	Each Accused Product performs the method of claim 2 wherein the chosen location signal strengths and the at least one ID originated from a database of geographic locations and corresponding signal strengths and IDs. For example, the geolocation system in each Accused Product uses “crowdsourced maps of Wi-Fi access points and mobile network towers” to determine the chosen location signal strengths and IDs. This database contains, for example, MAC addresses and signal strengths. <i>See, e.g.:</i> To provide this more accurate location, when turned on, GLA periodically collects location information from your Android device—including GPS and information about Wi-Fi access points, mobile networks and device sensors—using a temporary rotating device identifier that is not associated with any specific person. GLA uses this information to improve location accuracy and provide location-based services, including by building crowdsourced maps of Wi-Fi access points and mobile network towers. Source: https://policies.google.com/technologies/location-data?hl=en-US

Claim 5	Accused Products												
	<pre>{ "cellTowers": [{ "cellId": 170402199, "locationAreaCode": 35632, "mobileCountryCode": 310, "mobileNetworkCode": 410, "age": 0, "signalStrength": -60, "timingAdvance": 15 }] } { "macAddress": "9c:1c:12:b0:45:f1", "signalStrength": -43, "signalToNoiseRatio": 0, "channel": 11, "age": 0 }</pre> Source: https://developers.google.com/maps/documentation/geolocation/requests-geolocation#cell_tower_object <table><tr><th>Field</th><th>JSON type</th><th>Description</th><th>Notes</th></tr><tr><td>macAddress</td><td>string</td><td>The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.</td><td><i>Required.</i> Colon-separated (:) hexadecimal string. Only universally-administered MAC addresses ↗ can be located via the API. Other MAC addresses are silently dropped and may lead to an API request becoming effectively empty. For details, see Dropping useless Wifi access points.</td></tr><tr><td>signalStrength</td><td>number (double)</td><td>The current signal strength measured in dBm.</td><td>For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.</td></tr></table>	Field	JSON type	Description	Notes	macAddress	string	The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.	<i>Required.</i> Colon-separated (:) hexadecimal string. Only universally-administered MAC addresses ↗ can be located via the API. Other MAC addresses are silently dropped and may lead to an API request becoming effectively empty. For details, see Dropping useless Wifi access points .	signalStrength	number (double)	The current signal strength measured in dBm.	For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.
Field	JSON type	Description	Notes										
macAddress	string	The MAC address of the WiFi node. It's typically called a BSS, BSSID or MAC address.	<i>Required.</i> Colon-separated (:) hexadecimal string. Only universally-administered MAC addresses ↗ can be located via the API. Other MAC addresses are silently dropped and may lead to an API request becoming effectively empty. For details, see Dropping useless Wifi access points .										
signalStrength	number (double)	The current signal strength measured in dBm.	For WiFi access points, dBm values are typically -35 or lower and range from -128 to -10 dBm. Be sure to include the minus sign.										

Claim 5	Accused Products
	Source: https://developers.google.com/maps/documentation/geolocation/requests-geolocation#cell_tower_object

Claim 6

Claim 6	Accused Products
6. The method of claim 5 wherein the database is stored remotely from the first portable RF communications device.	Each Accused Product performs the method of claim 5 wherein the database is stored remotely from the first portable RF communications device. For example, each Accused Product uses an HTTPS connection with a remote server to access the database. <i>See, e.g.:</i> The Geolocation API is a service that accepts an HTTPS request with the cell tower and WiFi access points that a mobile client can detect. Source: https://developers.google.com/maps/documentation/geolocation/overview

Claim 7

Claim 7	Accused Products
7. The method of claim 5 wherein the database is built by a service provider.	Each Accused Product performs the method of claim 5 wherein the database is built by a service provider. For example, the claimed database is built by a service provider associated with Google. <i>See, e.g.:</i> The Geolocation API is a service that accepts an HTTPS request with the cell tower and Wi-Fi access points that a mobile client can detect. Source: https://developers.google.com/maps/documentation/geolocation/overview

Claim 7	Accused Products
	Google Maps Platform web services are an interface for requesting Maps API data from external services and using the data within your Maps applications. These services are designed to be used in conjunction with a map, as per the License Restrictions in the Google Maps Platform Terms of Service. Geolocation requests are sent using POST to the following URL: https://www.googleapis.com/geolocation/v1/geolocate?key=YOUR_API_KEY Source: https://developers.google.com/maps/documentation/geolocation/web-service-best-practices

Claim 11

Claim 11	Accused Products
11. The method of claim 1 wherein the signal characteristic is the signal's arrival time.	Each Accused Product performs the method of claim 1 wherein the signal characteristic is the signal's arrival time. For example, both IEEE 802.11 (Wi-Fi RTT) and 3GPP (cellular positioning) standards specify positioning technologies based on difference of arrival time. <i>See, e.g.:</i> Wi-Fi location: ranging with RTT You can use the Wi-Fi location functionality provided by the Wi-Fi RTT (Round-Trip-Time) API to measure the distance to nearby RTT-capable Wi-Fi access points and peer Wi-Fi Aware devices. If you measure the distance to three or more access points, you can use a multilateration algorithm to estimate the device position that best fits those measurements. The result is typically accurate within 1-2 meters.

Claim 11	Accused Products
	With this accuracy, you can develop fine-grained location-based services, such as indoor navigation, disambiguated voice control (for example, "Turn on this light"), and location-based information (for example, "Are there special offers for this product?"). The requesting device doesn't need to connect to the access points to measure distance with Wi-Fi RTT. To maintain privacy, only the requesting device is able to determine the distance to the access point; the access points do not have this information. Wi-Fi RTT operations are unlimited for foreground apps but are throttled for background apps. Wi-Fi RTT and the related Fine-Time-Measurement (FTM) capabilities are specified by the IEEE 802.11-2016 standard. Wi-Fi RTT requires the precise time measurement provided by FTM because it calculates the distance between two devices by measuring the time a packet takes to make a round trip between the devices and multiplying that time by the speed of light. Source: https://developer.android.com/guide/topics/connectivity/wifi-rtt 4.3.3 OTDOA positioning The Observed Time Difference of Arrival (OTDOA) positioning method makes use of the measured timing of downlink signals received from multiple TPs, comprising eNBs, ng-eNBs and PRS-only TPs, at the UE. The UE measures the timing of the received signals using assistance data received from the positioning server, and the resulting measurements are used to locate the UE in relation to the neighbouring TPs. Source: https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/Specifications/201906_final_specs_after_RAN_84/38305-f40.docx

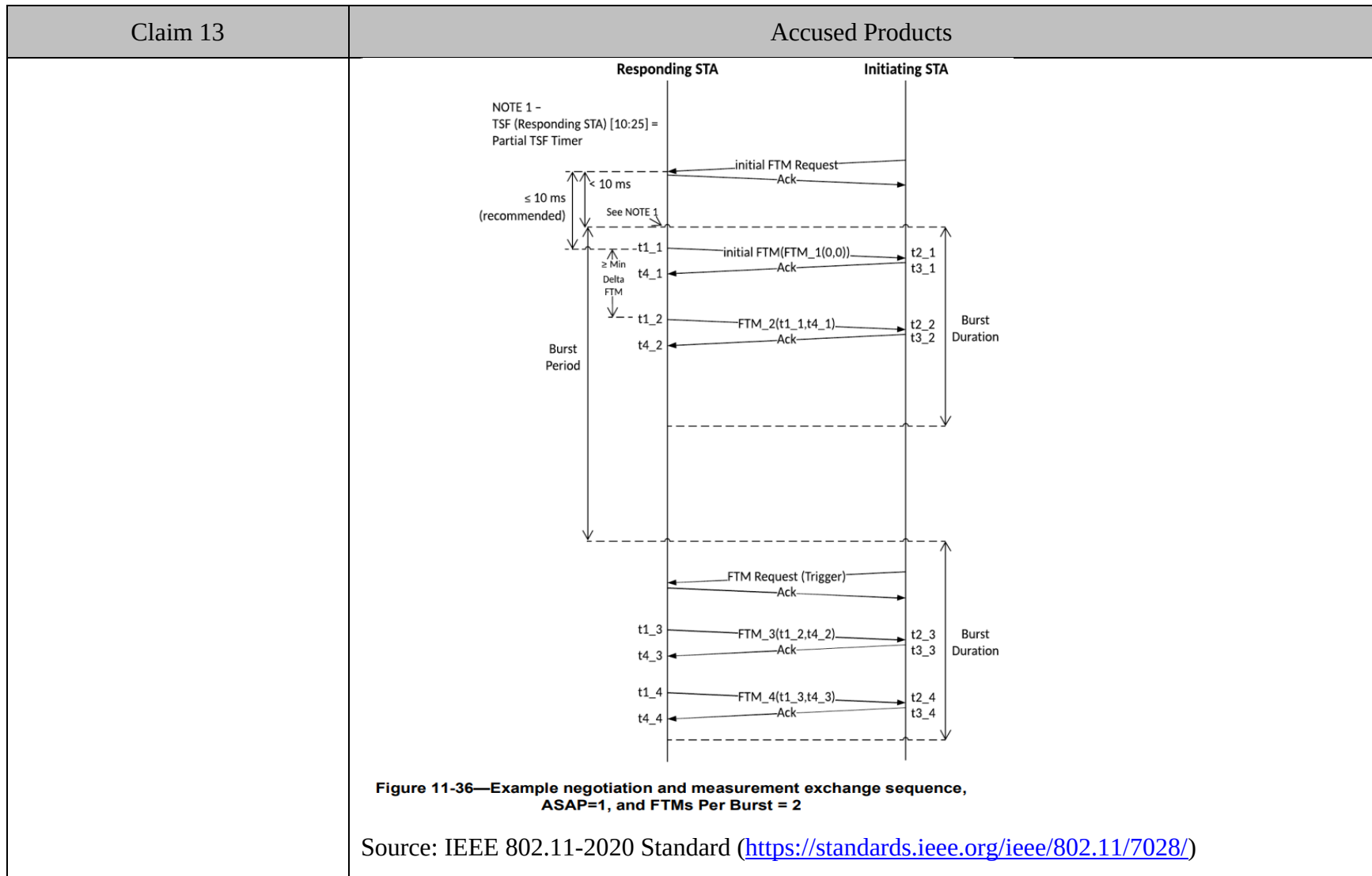
Claim 12

Claim 12	Accused Products
12. The method of claim 1 wherein the signal	Each Accused Product performs the method of claim 1 wherein the signal characteristic is the signal's phase.

Claim 12	Accused Products
characteristic is the signal's phase.	For example, phase shift between two arriving signal waves can be derived from the arrival time difference and the wave frequency, and vice versa. Therefore, arrival time and phase can be used interchangeably for ranging and positioning. <i>See, e.g.:</i> Phase Shift = $360 * (\text{Time Difference}) / (\text{Wave Period})$ Source: https://sciencing.com/calculate-phase-angles-5972010.html

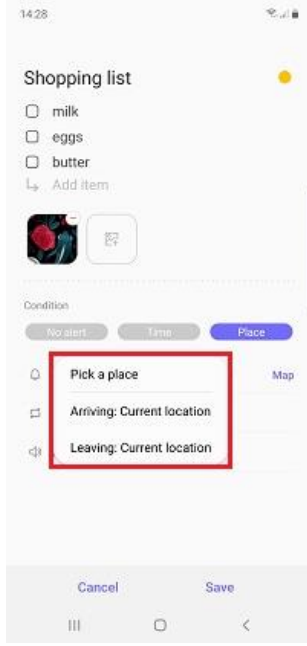
Claim 13

Claim 13	Accused Products
13. The method of claim 1 wherein part (a) is performed iteratively, with a predetermined time delay between successive iterations.	Each Accused Product performs the method of claim 1 wherein part (a) is performed iteratively, with a predetermined time delay between successive iterations. For example, in the IEEE 802.11 standard for Wi-Fi RTT Fine Time Measurement (FTM), there are typically multiple iterations of round trip FTM measurements grouped in bursts, and there is defined time delay between two consecutive rounds of FTM measurements and between two consecutive bursts. <i>See, e.g.:</i>



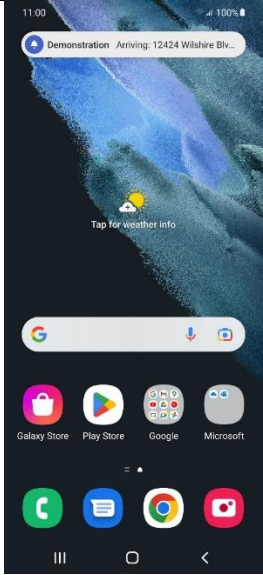
Claim 15

Claim 15	Accused Products
15. The method of claim 1 further comprising passing an indicia to a computer program application running on the first portable RF communications device indicating that the device is one of: (i) at the chosen location, or (ii) no longer at the chosen location.	Each Accused Product performs the method of claim 1 further comprising passing an indicia to a computer program application running on the first portable RF communications device indicating that the device is one of: (i) at the chosen location, or (ii) no longer at the chosen location. For example, the Samsung Reminder app allows a user to specify a location while creating a location-based reminder. The phone then uses signal strength and other network information from nearby Wi-Fi and/or mobile communications signals, based on antennas identified as being within range of the specified location, to determine whether the phone is arriving or leaving the location chosen by the user. For another example, any Android based mobile device can call a generic geofencing API to detect and notify applications when the device enters the vicinity of a defined location. <i>See, e.g.:</i>

Claim 15	Accused Products
	 Source: https://www.samsung.com/uk/support/mobile-devices/how-do-i-use-the-samsung-reminder-app/ Sometimes users want to use a particular app when they are in a specific type of location, such as an airport, or a supermarket. However, users have to navigate to that app and then take a specific action within it while they are near the area of interest. The geofencing API allows you to define perimeters, also referred to as geofences, which surround the areas of interest. Your app gets a notification when the device crosses a geofence, which allows you to provide a useful experience when users are in the vicinity. Source: https://developers.google.com/location-context/geofencing/

Claim 16

Claim 16	Accused Products
16. The method of claim 1 further comprising launching a computer program application on the first portable RF communications device when the device is at the chosen location.	Each Accused Product performs the method of claim 1 further comprising launching a computer program application on the first portable RF communications device when the device is at the chosen location. For example, the Samsung Reminder app allows a user to specify a location while creating a location-based reminder. The phone then uses signal strength and other network information from nearby Wi-Fi and/or mobile communications signals, based on antennas identified as being within range of the specified location, to determine whether the phone is arriving or leaving the location chosen by the user. Based on this determination, the phone launches the Samsung Reminder app. For another example, any Android based mobile device can call a generic geofencing API to detect and notify applications, including launching applications as appropriate, when the device enters the vicinity of a defined location. <i>See, e.g.:</i>

Claim 16	Accused Products
	 Screenshot showing, at top, notification from Samsung Reminder app that the phone arriving at the location as specified by the user.