

EXHIBIT 12

US Patent No. 11,856,414, Claim 1 on Samsung's Galaxy S24 Ultra

U.S. Patent No. 11,856,414 issued on December 26, 2023. Claim 1 recites a method for improving the performance of a wireless networking device (*e.g.*, a smartphone, laptop, tablet or access point) having software and/or hardware that enables a “band aggregation” feature. Band aggregation occurs when a wireless networking device (WND) aggregates at least two portions of bandwidth from two different Wi-Fi bands (any two of 2.4 GHz, 5 GHz, and 6 GHz bands).

Samsung has infringed claim 1 of the '414 patent in the manner charted herein in manufacturing and/or testing in the United States all Samsung products (*e.g.*, smartphones, TVs, laptops and tablets) that share the features detailed below with reference to the Galaxy S24 Ultra smartphone. Specifically, the methods Samsung has used to manufacture and/or test all Samsung products that implement Multi-Link Operation (“MLO”) as specified in IEEE 802.11be Draft Standard for Information Technology—Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks—Specific Requirements (D7.0 Aug. 2024) (“Wi-Fi 7 Draft Standard”) using two or more transceivers infringe as set forth below. Additionally or alternatively, Samsung has infringed claim 1 of the '414 patent by importing into the United States, offering to sell, selling, and/or using in the United States all Samsung products made by the processes charted herein.

The Samsung Galaxy S24 Ultra has Wi-Fi 7 enabled, using a Qualcomm Snapdragon 8 Gen 3 processor,¹ including Qualcomm's FastConnect 7800 Mobile Connectivity System.² Qualcomm's FastConnect 7800 is Wi-Fi CERTIFIED™ having at least Certification ID WFA127693 that includes connectivity, optimization, security, and spectrum & regulatory features.³ Furthermore, Samsung's Galaxy S24 Ultra is Wi-Fi CERTIFIED™ having at least Certification ID WFA127969 that includes applications & services, connectivity, optimization, security, and spectrum & regulatory features.⁴ Optimization certifications include Wi-Fi Agile Multiband™.⁵

¹ [Samsung Galaxy S24 Ultra Specs](https://www.gsmarena.com/samsung_galaxy_s24_ultra-12771.php); https://www.gsmarena.com/samsung_galaxy_s24_ultra-12771.php.

² FastConnect 7800 Mobile Connectivity System described here: <https://www.qualcomm.com/products/technology/wi-fi/fastconnect/fastconnect-7800>. See also <https://www.qualcomm.com/snapdragon/news/wi-fi-7-unleashed-with-samsung-galaxy-s24-ultra>.

³ <https://api.cert.wi-fi.org/api/certificate/download/public?variantId=137093>.

⁴ <https://api.cert.wi-fi.org/api/certificate/download/public?variantId=129396>.

⁵ WiFi Alliance, Wi-Fi Agile Multiband Technical Specification, v1.5 (2020) (“Wi-Fi Agile Multiband Specification”).

Pursuant to the Wi-Fi 7 Draft Standard, a WND comprises at least a multi-link device (MLD), which may be an access point (AP) MLD or a non-AP MLD. The Galaxy S24 Ultra is configured to operate both as an AP MLD and as a non-AP MLD. As described in more detail in the following claim chart, the Galaxy S24 Ultra is enabled to perform the claimed link aggregation operations when operating as an AP MLD and when operating as a non-AP MLD.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
1. A method of improving the performance of a wireless networking device, comprising the steps of:	Samsung has practiced the claimed method of improving performance of a wireless networking device in the manner charted herein by manufacturing and/or testing the Samsung Galaxy S24 Ultra mobile phone (“Galaxy S24 Ultra”).⁶ The Galaxy S24 Ultra is a wireless networking device (WND). A WND comprises at least a multi-link device (MLD) as specified by IEEE 802.11be/D7.0 Draft Standard for Information Technology—Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks—Specific Requirements (Aug. 2024) (“Wi-Fi 7 Draft Standard”). An MLD may be an access point (AP) MLD or a non-AP MLD. multi-link device: [MLD] A logical entity that is capable of supporting more than one affiliated station (STA) and can operate using one or more affiliated STAs, and that presents one medium access control (MAC) data service and a single MAC service access point (MAC SAP) to the logical link control (LLC) sublayer. access point (AP) multi-link device (MLD): [AP MLD] An MLD, where each station (STA) affiliated with the MLD is an AP. non-access point (non-AP) multi-link device (MLD): [non-AP MLD] An MLD, where each station (STA) affiliated with the MLD is a non-access point (non-AP) station (non-AP STA). Wi-Fi 7 Draft Standard at 61, 62, 63. In this context, for example, a wireless terminal device or a network access device may comprise one or more MLDs. A wireless networking device may be, for example, a wireless

⁶ Additionally or alternatively, Samsung has imported into the United States, offered to sell, sold, or used within the United States the Galaxy S24 Ultra mobile phone, which is made by the claimed method. *See* 35 U.S.C. § 271(g).

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	station in a Wi-Fi 7 system, such as a stationary wireless AP or a mobile wireless AP, such as the Galaxy S24 Ultra, comprising an AP MLD. A WND may also be, for example, a mobile or fixed device comprising a non-AP MLD. Such devices may be, for example, mobile telephones or smartphones, such as the Galaxy S24 Ultra. In this regard, the Galaxy S24 Ultra is operable both as an AP MLD and as a non-AP MLD. For example, the Galaxy S24 Ultra is capable of operating as a mobile hotspot, thereby sharing its data connection with other devices. Mobile hotspot Mobile hotspot uses your data plan to create a Wi-Fi network that can be used by multiple devices. 1. From Settings, tap  Connections > Mobile hotspot and tethering > Mobile hotspot. 2. Tap  to turn on Mobile hotspot. 3. On the devices you want to connect, activate Wi-Fi, and select your device's Mobile hotspot. Enter the Mobile hotspot password to connect.  TIP Tap  QR code to connect another device to your Mobile hotspot by scanning a QR code instead of entering a password. Configure mobile hotspot settings You can customize your mobile hotspot's security and connection settings. 1. From Settings, tap  Connections > Mobile hotspot and tethering > Mobile hotspot. 2. Tap  to turn on Mobile hotspot, and then tap the following settings to change them:

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	<i>Samsung Galaxy S24, S24+, S24 Ultra User Guide</i>, Ver. U 14.1 (English(North America)) (Sep. 6, 2024) at 120. When operating as a mobile hotspot, the Galaxy S24 Ultra behaves as an AP for other devices. Otherwise, the Galaxy S24 Ultra operates as a non-AP MLD in communications with other devices.
[1.a] connecting an application interface to a processing interface, the application interface being associated with a first application, the first application providing, when the wireless networking device is being used, a first data stream and having a first wireless bandwidth requirement;	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has connected an application interface to a processing interface, the application interface being associated with a first application, the first application providing, when the wireless networking device is being used, a first data stream and having a first wireless bandwidth requirement. The Samsung Galaxy S24 Ultra has Wi-Fi 7 enabled, using a Qualcomm Snapdragon 8 Gen 3 processor, including Qualcomm's FastConnect 7800 Mobile Connectivity System. Wi-Fi Connectivity 802.11a/b/g/n/ac/ax/be 2.4GHz+5GHz+6GHz, EHT320, MIMO, 4096-QAM Samsung Galaxy S24 Ultra Specs.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	Samsung Galaxy S24 Ultra Featuring Snapdragon 8 Gen 3 for Galaxy. Introducing Samsung Galaxy S24 Ultra, now with many next-gen AI features and capabilities enabled by Snapdragon 8 Gen 3 for Galaxy. Powered with Galaxy AI, Galaxy S24 Ultra adapts to your passions and behaviors to make a new level of achievement possible. And, with Qualcomm FastConnect 7800 Mobile Connectivity System, you'll get the best possible connection and premium WiFi 7 connectivity. https://www.qualcomm.com/snapdragon/device-finder/samsung-galaxy-s24-ultra. The Galaxy S24 Ultra includes an application interface that allows the Wi-Fi module of the Galaxy S24 Ultra to interact with one or more applications having bandwidth requirements. The application interface comprises hardware and/or software engaging with software applications, such as internet browsers or video playback apps, having data streams when the wireless networking device is used. Each application data stream has a wireless bandwidth requirement. Additionally, the Galaxy S24 Ultra has a processing interface, with the application interface connected to the processing interface. The processing interface is provided by the Qualcomm Snapdragon 8 Gen 3 processor contained within the Galaxy S24 Ultra. The Wi-Fi 7 Draft Standard includes the reference model for an MLD shown below.

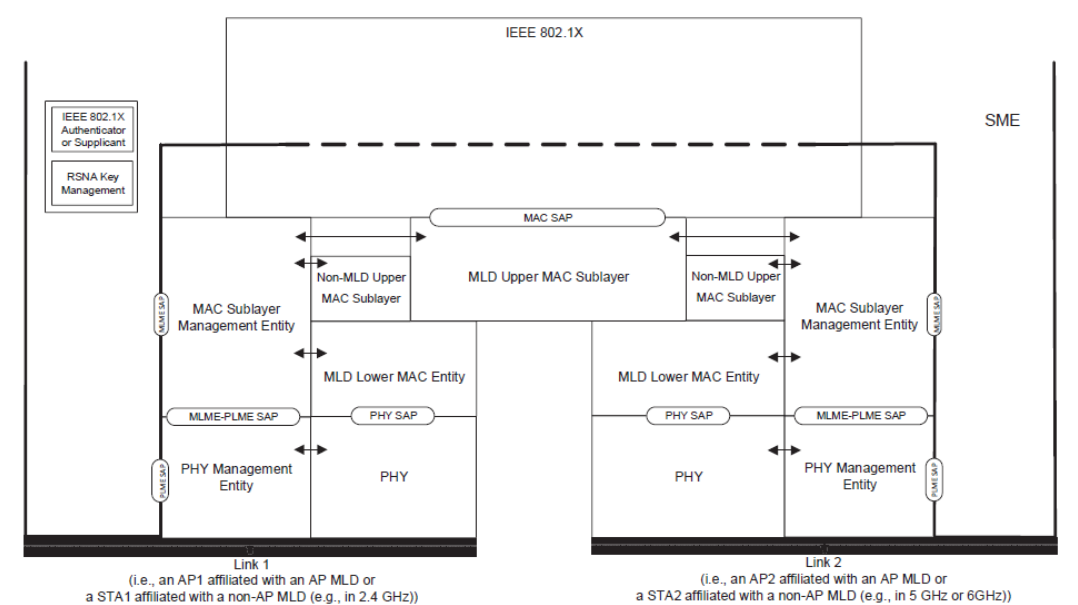
USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	 Figure 4-33b—Reference model for an MLD for two links

Figure 4-33b, Wi-Fi 7 Draft Standard at 78.

As shown in Figure 4-33b above, an MLD, such as in the Galaxy S24 Ultra, has a Station Management Entity (SME). The SME is in communication with a MAC Sublayer Management Entity (MLME), through an MLME SAP, and a PHY Management Entity (PLME), through a PLME SAP. Further, the MLME is in communication with the Upper MAC Sublayer (UMAC) and with each Lower MAC entity (LMAC).

The SME is responsible for coordinating the MLD and each of the affiliated STAs used to establish links between devices. It operates at least by communicating with the MLME SAP and the PLME SAP to manage the MAC and PHY interfaces affiliated with

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	each link. The communicating may include, for example, messaging, signaling, or shared memory access. An MLD supports multiple MAC functions, with synchronization across the MAC functions as needed via the MLD synchronization service (see 35.3.25 (MLD synchronization service)) and otherwise coordinated by the SME. Each affiliated STA is enumerated with a Link ID (for example, as Link 1 and Link 2 in Figure 4-33b (Reference model for an MLD for two links)) and MLME primitives are invoked through an MLME SAP. The SME maintains the authentication and association states. The Authenticator and the MAC-SAP of the AP MLD are identified by the same AP MLD MAC address. The Supplicant and the MAC-SAP of the non-AP MLD are identified by the same non-AP MLD MAC address. The SME is responsible for coordinating the MLD and each of the affiliated STAs through the MLME, and to maintain an RSNA key management entity and IEEE 802.1X Authenticator or Supplicant, for MLO. Wi-Fi 7 Draft Standard at 78. 36.1.3.2 PHY management entity (PLME) The PLME performs management of the local PHY functions in conjunction with the MLME. Wi-Fi 7 Draft Standard at 707. Accordingly, the processing interface comprises at least a portion of the SME and MLME. The processing interface may also include at least a portion of the MLME SAP and PLME SAP by which the SME communicates with other management layers. Additionally, the processing interface may include at least some functionality of the UMAC. As shown above in Figure 4-33b, the MLD has a MAC layer that is divided into an LMAC corresponding to each STA, and a single UMAC managing common operations for all STAs.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	The LMACs perform certain link-specific MAC functions while the UMAC is responsible for MAC functions common to the multiple links. 5.1.5.1a MLD MAC sublayer functions The MLD upper MAC sublayer functions include: — Authentication, association, and reassociation (between an AP MLD and a non-AP MLD) — Security association (e.g., PMKSA, PTKSA) and distribution of GTK/IGTK/BIGTK — SN/PN assignment for frames to be encrypted by PTK for individually addressed frames — SN assignment for group addressed MSDUs — Power save buffering of individually addressed frames (only on AP MLD) — Encryption/decryption using PTK for individually addressed frames — Selection of the MLD lower MAC entity for transmission (TID-to-link mapping (see 35.3.7.2 (TID-To-Link Mapping (TTLM)))) — Merging reception of MPDUs from two or more links — Reordering of packets to ensure in-order delivery per each Block Ack session — Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD lower MAC entities). Optionally, the MLD upper MAC sublayer delivers successful status records of MPDUs and/or scoreboard context control information on Block Ack scoreboarding at one of the setup links to other setup links (see 35.3.8 (Block ack procedures in MLO)) — MLD level management information exchange/indication via the MLD lower MAC entity — Each affiliated STA selects its own EDCA parameters (for a non-AP STA it comes from the peer AP on that link). Wi-Fi 7 Draft Standard at 84.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	The MLD lower MAC entity functions include: — Link specific control information exchange/indication (e.g., RTS/CTS, acknowledgements, NDP, etc.) — Power save state and mode — MAC address filtering for frame reception — Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD upper MAC sublayer). Optionally, the MLD lower MAC entity receives the successful status records of the MPDUs and/or scoreboard context control information of the Block Ack agreement from the MLD upper MAC sublayer) (see 35.3.8 (Block ack procedures in MLO)) Wi-Fi 7 Draft Standard at 84-85. Operations performed by the UMAC include, for example, TID-to-Link Mapping and authentication, association, and reassociation between an AP MLD and a non-AP MLD. The processing interface may therefore include at least some functionality of the UMAC. The processing interface is located below other layers of the MLD, such as the data link layer. The application interface is connected to the processing interface. The processing interface is responsible for AP MLD and non-AP MLD multi-link operation (MLO) processes that allow the Galaxy S24 Ultra to discover, authenticate, associate, and set up links with other MLDs for meeting bandwidth requirements. Bandwidth information is exchanged between the application interface and the processing interface. For example, in order to perform TID-to-Link Mapping and other MLO operations for exchanging frames across links, the processing interface is connected to the application interface. MLO is defined for an EHT STA in 35.3 (Multi-link operation (MLO)). MLO allows an AP MLD and a non-AP MLD to set up multiple links between them. A reference model for MLO is described in 4.9.6 (Reference model for multi-link operation (MLO)). Wi-Fi 7 Draft Standard at 523.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	4.9.6 Reference model for multi-link operation (MLO) MLO defines a set of procedures allowing communication over one or more links between MLDs. An MLD manages such communication over one or more links. Communication over links using different channels on different frequency bands or the same frequency band can occur simultaneously or not depending on the capabilities of both the AP MLD and the non-AP MLD (see 35.3.16.3 (Simultaneous transmit and receive (STR) operation) and 35.3.16.4 (Nonsimultaneous transmit and receive (NSTR) operation)). The MLO procedures (see 35.3 (Multi-link operation (MLO))) allow a pair of MLDs to discover, synchronize, (de)authenticate, (re)associate, disassociate, and manage links and other resources with each other on any common bands or channels that are supported by both MLDs. Wi-Fi 7 Draft Standard at 76. For example, the processing interface performs TID-to-Link mapping procedures to determine how data frames will be assigned for transmission. 35.3.7.2 TID-To-Link Mapping (TTLM) 35.3.7.2.1 General The TTLM mechanism allows an AP MLD and a non-AP MLD that performed or are performing ML setup to determine how Data frames belonging to TIDs 0–7 and Management frames will be assigned for transmission, on the setup links between the two MLDs in DL and UL. Wi-Fi 7 Draft Standard at 565. The SME is responsible for coordinating the MLD and each of the affiliated STAs through the MLME, and to maintain an RSNA key management entity and IEEE 802.1X Authenticator or Supplicant, for MLO. Wi-Fi 7 Draft Standard at 78.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	As shown above in Figure 4-33b, the processing interface engages with other layers within the Galaxy S24 Ultra through a MAC SAP. Information regarding data streams from the application interface may be communicated to the processing interface through the MAC SAP. Thus, the processing interface of the Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, comprises at least portions of the MAC SAP, UMAC, MLME, and SME in providing data streams and meeting bandwidth requirements. Where the application that needs to transmit and/or receive data interacts with the UMAC through the MAC SAP, the UMAC passes data to the MLME, which is responsible for managing the MAC layer functions. The MLME communicates with the SME to request channel allocation, link selection, and other resources necessary for data transmission given the bandwidth requirements. The SME coordinates with the UMAC to determine the optimal links and channels for data transmission. Once the resources are allocated, the SME instructs the MLME to transmit/receive the data over the selected links.
[1.b] connecting first and second actual MAC interfaces to the processing interface;	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has connected first and second actual MAC interfaces to the processing interface. As shown below, the Wi-Fi 7 Draft Standard explains that an AP MLD or a non-AP MLD has multiple STAs that can each establish a link. Each link is associated with a frequency band (<i>e.g.</i>, 2.4 GHz, 5 GHz, or 6 GHz). The reference diagram below illustrates two STAs and associated links for simplicity; a Wi-Fi 7 MLD provides three STAs and thus may form three links—one for each of the 2.4 GHz, 5 GHz, and 6 GHz frequency bands.

USP 11,856,414, Claim 1

Evidence of Use in the Galaxy S24 Ultra

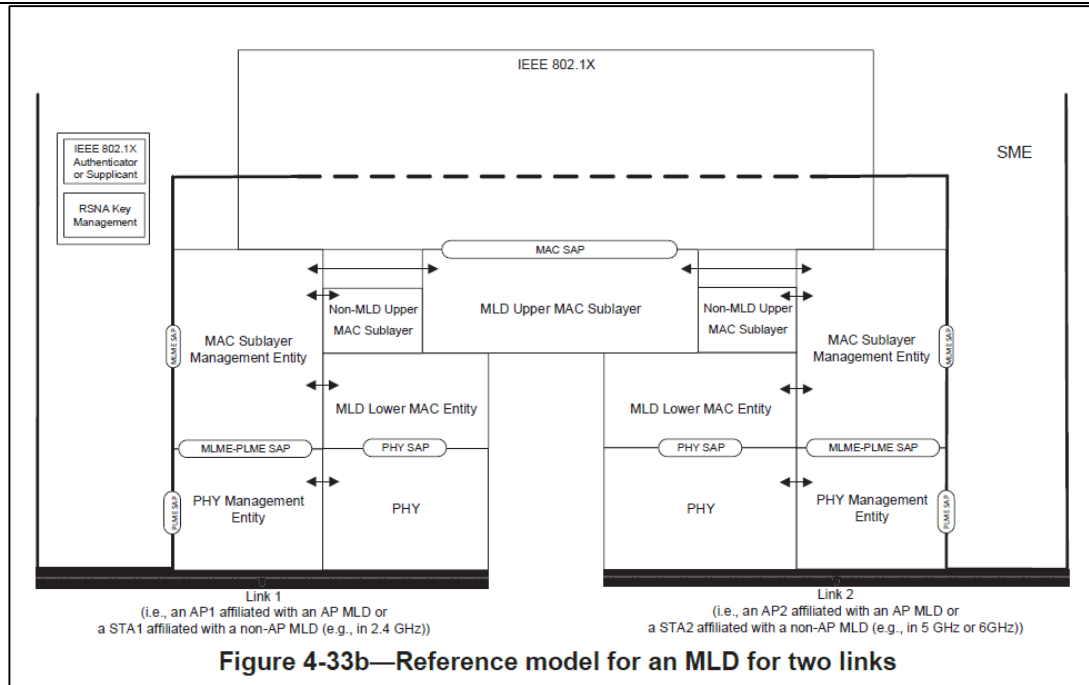


Figure 4-33b, Wi-Fi 7 Draft Standard at 78.

Each STA of the AP MLD or non-AP MLD has a PHY unique to that STA and associated with an affiliated link. Additionally, the MLD has a MAC layer that is divided into an LMAC corresponding to each STA and affiliated link, and a single UMAC managing common operations for all STAs and affiliated links. The LMACs perform certain link-specific MAC functions while the UMAC is responsible for MAC functions common to the multiple links.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	5.1.5.1a MLD MAC sublayer functions The MLD upper MAC sublayer functions include: — Authentication, association, and reassociation (between an AP MLD and a non-AP MLD) — Security association (e.g., PMKSA, PTKSA) and distribution of GTK/IGTK/BIGTK — SN/PN assignment for frames to be encrypted by PTK for individually addressed frames — SN assignment for group addressed MSDUs — Power save buffering of individually addressed frames (only on AP MLD) — Encryption/decryption using PTK for individually addressed frames — Selection of the MLD lower MAC entity for transmission (TID-to-link mapping (see 35.3.7.2 (TID-To-Link Mapping (TTLM)))) — Merging reception of MPDUs from two or more links — Reordering of packets to ensure in-order delivery per each Block Ack session — Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD lower MAC entities). Optionally, the MLD upper MAC sublayer delivers successful status records of MPDUs and/or scoreboard context control information on Block Ack scoreboarding at one of the setup links to other setup links (see 35.3.8 (Block ack procedures in MLO)) — MLD level management information exchange/indication via the MLD lower MAC entity — Each affiliated STA selects its own EDCA parameters (for a non-AP STA it comes from the peer AP on that link). Wi-Fi 7 Draft Standard at 84.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	The MLD lower MAC entity functions include: — Link specific control information exchange/indication (e.g., RTS/CTS, acknowledgements, NDP, etc.) — Power save state and mode — MAC address filtering for frame reception — Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD upper MAC sublayer). Optionally, the MLD lower MAC entity receives the successful status records of the MPDUs and/or scoreboard context control information of the Block Ack agreement from the MLD upper MAC sublayer) (see 35.3.8 (Block ack procedures in MLO)) Wi-Fi 7 Draft Standard at 84-85. The Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, has three wireless transceivers (or STAs) that communicate in the 2.4 GHz, 5 GHz and 6 GHz bands. Accordingly, and as discussed with respect to element 1.d, the Galaxy S24 Ultra has at least first and second wireless transceivers. Wi-Fi Connectivity 802.11a/b/g/n/ac/ax/be 2.4GHz+5GHz+6GHz, EHT320, MIMO, 4096-QAM Samsung Galaxy S24 Ultra Specs. In accordance with the Wi-Fi 7 Draft Standard, the Galaxy S24 Ultra has first and second actual MAC interfaces corresponding to its first and second STAs. Each MAC interface comprises, for each of the first and second transceivers, a corresponding LMAC. The first and second actual MAC interfaces are connected to the processing interface. As described above, the processing interface comprises at least a portion of the SME, MLME, MAC SAP, MLME SAP, and PLME SAP in combination with at least some

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	functionality of the UMAC. As shown in Figure 4-33b of the Wi-Fi 7 Draft Standard, the LMACs and the UMAC are in communication with the MLME. The MLME is further in communication with the SME via the MLME SAP. Figure 4-33b—Reference model for an MLD for two links
[1.c] connecting first and second actual PHY interfaces respectively to the first and second actual MAC interfaces;	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has connected first and second actual PHY interfaces respectively to the first and second actual MAC interfaces.

USP 11,856,414, Claim 1

Evidence of Use in the Galaxy S24 Ultra

As discussed with respect to element 1.b, the Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, has three transceivers that communicate in the 2.4 GHz, 5 GHz and 6 GHz frequency bands. In addition to an associated MAC interface, each of these transceivers has an associated PHY interface. As shown in Figure 4-33b below, the PHY for each STA is connected to the corresponding actual MAC interface for that STA via a PHY SAP. The PHYs corresponding to the first and second wireless transceivers of the Galaxy S24 Ultra comprise the first and second actual PHY interfaces.

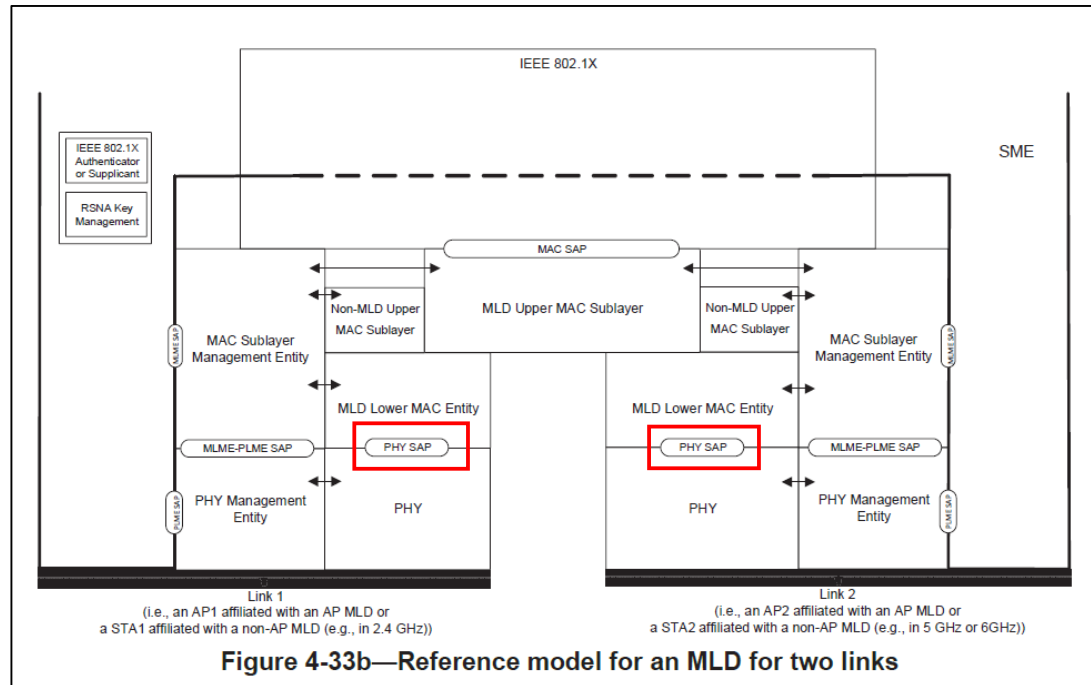


Figure 4-33b, Wi-Fi 7 Draft Standard at 78 (emphasis added).

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	Each PHY communicates with its corresponding MAC through the PHY SAP using certain vectors. 36.2 EHT PHY service interface 36.2.1 Introduction The EHT PHY provides an interface to the EHT MAC through an extension of the generic PHY service interface defined in 8.3.4 (Basic service and options). The interface includes TXVECTOR, RXVECTOR, PHYCONFIG_VECTOR, and TRIGVECTOR. The EHT MAC uses the TXVECTOR to supply the EHT PHY with per-PPDU transmit parameters. The EHT PHY uses the RXVECTOR to inform the EHT MAC of the received PPDU parameters. The EHT MAC uses the PHYCONFIG_VECTOR to configure the EHT PHY for operation that is independent of PPDU transmission or reception. The EHT MAC uses the TRIGVECTOR to configure the EHT PHY to receive EHT TB PPDU's over each assigned RU or MRU. Wi-Fi 7 Draft Standard at 708.
[1.d] respectively associating first and second wireless transceivers with the first and second actual PHY interfaces, wherein each one of the first and second wireless transceivers (i) is suitable for use in a wireless local area network, (ii) has a first and second bandwidth availability up to a first and second actual bandwidth, and (iii) is adapted to emit radio waves in first and second different bands of frequencies;	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has respectively associated first and second wireless transceivers with the first and second actual PHY interfaces, wherein each of the first and second wireless transceivers (i) is suitable for use in a wireless local area network, (ii) has a first and second bandwidth availability up to first and second actual bandwidth, and (iii) is adapted to emit radio waves in first and second different bands of frequencies. The Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, has three transceivers, including at least first and second wireless transceivers. Each transceiver is associated with an actual MAC interface and an actual PHY interface. Each of the three transceivers is suitable for use in a wireless local area network, such as a Wi-Fi network, shown below.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	Wi-Fi Connectivity 802.11a/b/g/n/ac/ax/be 2.4GHz+5GHz+6GHz, EHT320, MIMO, 4096-QAM Samsung Galaxy S24 Ultra Specs. The Wi-Fi 7 Draft Standard references that the transceivers are used in wireless local area networks that emit radio waves in frequency bands “ensuring backward compatibility and coexistence with legacy IEEE Std 802.11 compliant devices operating in the 2.4 GHz, 5 GHz, and 6 GHz bands.” Wi-Fi 7 Draft Standard at 2. Additionally, the first and second transceivers of the Galaxy S24 Ultra have first and second bandwidth availability up to first and second actual bandwidths. At any given time, each of the three transceivers associated with the 2.4, 5, and 6 GHz bands has a bandwidth availability representing a portion of an actual and/or total bandwidth for that band. As described in further detail below, the UMAC, in combination with the SME (both of the processing interface), uses the bandwidth availability of each transceiver to make resource allocation decisions. The first and second transceivers of the Galaxy S24 Ultra are adapted to emit radio waves in first and second different bands of frequencies. The first and second transceivers can be any two of the 2.4 GHz, 5 GHz, and 6 GHz transceivers of the Galaxy S24 Ultra.
[1.e] forming in the processing interface (i) at least one virtual MAC interface and	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has formed in the processing interface at least one virtual MAC interface. As described with respect to elements 1.a and 1.b, the processing interface of the Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, comprises at least a portion of the SME, MLME, MAC SAP, MLME SAP, and PLME SAP in combination with

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	the UMAC. The processing interface performs certain functions that correspond to and comprise a virtual MAC interface. When operating as an AP MLD or a non-AP MLD, the processing interface of the Galaxy S24 Ultra performs certain functions that correspond to and comprise a virtual MAC interface. For example, the processing interface, and particularly the SME, makes strategic decisions about resource allocation and/or link recommendations based on traffic demands and network conditions. Network condition information necessarily includes bandwidth availability information resulting from channel assessments directly or indirectly by way of, for example, at least trigger frames, management frames, and feedback messages. The Galaxy S24 Ultra complies with the Wi-Fi Agile Multiband Specification, which “is built on the fundamental premise that the APs and STAs each have information which can aid in making the most effective selection of the spectrum band in which the STA and AP should be communicating. By exchanging this information with each other, APs and STAs enable each other to make decisions that collectively drive the network towards more efficient use of the available spectrum.” Wi-Fi Agile Multiband Specification at § 3.1. 3 Wi-Fi Agile Multiband protocol 3.1 Introduction The goal of the Wi-Fi Agile Multiband certification program is to certify features that facilitate efficient use of multiple frequency bands/channels available to APs and the STAs. The program is built on the fundamental premise that the APs and STAs each have information which can aid in making the most effective selection of the spectrum band in which the STA and AP should be communicating. By exchanging this information with each other, APs and STAs enable each other to make decisions that collectively drive the network towards more efficient use of the available spectrum. The following sections describe the information exchanged and the mechanisms by which APs and STAs exchange the desired information. Where applicable, references to existing IEEE standards are provided. In instances where there is a need to go beyond what the IEEE standards specify, the corresponding functionality, protocols and constraints are defined. Wi-Fi Agile Multiband Specification at § 3.1.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	As a particular example, in accordance with the Wi-Fi 7 Draft Standard, the SME's understanding of traffic priorities, queue lengths, and real-time network status enables intelligent TID-to-link mapping in the Galaxy S24 Ultra. This mapping determines which traffic (identified by TID) should be directed to which links (<i>i.e.</i>, associated bandwidth resources). The SME, in combination with the UMAC, allocates appropriate RUs/MRUs (resource units / multiple resource units) based on the data requirements of the specific traffic type mapped to a link. The SME considers factors like the amount of data to be transmitted for a particular TID and the channel bandwidth available on the chosen link. It can choose to allocate a single RU for smaller data packets or low-priority traffic, or allocate multiple RUs combined into an MRU for larger data transfers or high-priority traffic requiring more bandwidth. Accordingly, the processing interface comprises at least one virtual MAC interface. The virtual MAC interface comprises the portions of the SME and MLME, in combination with functionality of the UMAC, that perform RU/MRU allocation and TID-to-Link mapping. The virtual MAC interface may additionally include a portion of the MLME SAP by which the SME communicates with the MLME. An MLD supports multiple MAC functions, with synchronization across the MAC functions as needed via the MLD synchronization service (see 35.3.25 (MLD synchronization service)) and otherwise coordinated by the SME. Each affiliated STA is enumerated with a Link ID (for example, as Link 1 and Link 2 in Figure 4-33b (Reference model for an MLD for two links)) and MLME primitives are invoked through an MLME SAP. The SME maintains the authentication and association states. The Authenticator and the MAC-SAP of the AP MLD are identified by the same AP MLD MAC address. The Supplicant and the MAC-SAP of the non-AP MLD are identified by the same non-AP MLD MAC address. The SME is responsible for coordinating the MLD and each of the affiliated STAs through the MLME, and to maintain an RSNA key management entity and IEEE 802.1X Authenticator or Supplicant, for MLO.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	Wi-Fi 7 Draft Standard at 78.
[1.f] (ii) first and second virtual PHY interfaces that, during operation of the wireless networking device, feed information regarding the bandwidth availabilities of the first and second wireless transceivers back to the at least one virtual MAC interface;	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has formed in the processing interface first and second virtual PHY interfaces that, during operation of the wireless networking device, feed information regarding the bandwidth availabilities of the first and second wireless transceivers back to the at least one virtual MAC interface. As described with respect to element 1.e, when operating as an AP MLD or a non-AP MLD, at least a first portion of the processing interface of the Galaxy S24 Ultra comprises a virtual MAC interface. The virtual MAC interface comprises portions of the SME and MLME, in combination with functionality of the UMAC, and makes strategic decisions about resource allocation and/or link recommendations. For example, the virtual MAC interface comprises the portions of the SME and MLME, in combination with functionality of the UMAC, that perform RU/MRU allocation and TID-to-Link mapping. The virtual MAC interface may additionally include a portion of the MLME SAP by which the SME communicates with the MLME. Additionally, in order for the processing interface to make strategic decisions about resource allocation and/or link recommendations, the SME must receive information regarding bandwidth availabilities of the transceivers. For example, to allocate RUs/MRUs to achieve the increased bandwidth utilization and efficiency objectives of the IEEE 802.11be standard and for multi-users, the SME must receive information regarding the bandwidth availabilities of the transceivers from which the RUs/MRUs may be assigned based at least on channel utilization and/or congestion. <i>See, e.g.,</i> Wi-Fi 7 Draft Standard at 629-637. Information regarding bandwidth availabilities of the transceivers may be or include information about the actual PHY itself. Information regarding bandwidth availabilities of the transceivers may additionally or alternatively include information received at the actual PHY from another device, such as an AP MLD device. In each case, information regarding bandwidth availabilities is communicated to the virtual MAC interface.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	As described in more detail below, the virtual PHY interfaces of the Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, comprise those portions of the SME that report information regarding bandwidth availabilities to the virtual MAC. Each virtual PHY interface may additionally include a portion of the MLME, where logic or pathways within the MLME are used in reporting information about bandwidth availabilities to the virtual MAC. Additionally, the path of communication by which information regarding bandwidth availabilities is fed to the virtual MAC may be or include portions of the MLME SAP and/or PLME SAP. Each virtual PHY interface may therefore additionally include a portion of the MLME SAP and/or the PLME SAP through which bandwidth information is directed to the virtual MAC. The Galaxy S24 Ultra has three STAs for its three transceivers, each with a corresponding actual PHY interface. In connection with each actual PHY interface, the Galaxy S24 Ultra has a virtual PHY interface responsible for feeding information regarding bandwidth availabilities about the corresponding actual PHY interface to the virtual MAC. The Galaxy S24 Ultra therefore has first and second virtual PHY interfaces corresponding to its first and second transceivers. The Wi-Fi Agile Multiband Specification provides examples of information regarding bandwidth availabilities that may be communicated by the virtual PHY interfaces. In accordance with the Wi-Fi Agile Multiband Specification, when operating as a non-AP MLD, for example, the Galaxy S24 Ultra provides “to a Wi-Fi Agile Multiband AP a list of channels and bands on which it prefers not to be associated,” including in each list entry: channel and band, preference value, and reason code. Wi-Fi Agile Multiband Specification at § 2.3.2.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	A Wi-Fi Agile Multiband STA shall support the following features: • Indicates whether or not it has a cellular data connection available (refer to section 4.2.3) • Provides to a Wi-Fi Agile Multiband AP a list of channels and bands on which it prefers not to be associated, including in each list entry: ▪ Channel and band ▪ Preference value ▪ Reason code Wi-Fi Agile Multiband Specification at § 2.3.2. Reason codes may include, for example, co-located interference, where an “unacceptable level of interference is being experienced by the Wi-Fi Agile Multiband STA in this channel,” and in-device interferer, where the “Agile Multiband STA has another active connection in this channel, or near enough to this channel to cause operating interference.” Wi-Fi Agile Multiband Specification at Table 10. “This information is communicated to the Wi-Fi Agile Multiband AP when the Wi-Fi Agile Multiband STA associates or reassociates, and when the information changes while the Wi-Fi Agile Multiband STA is associated.” Wi-Fi Agile Multiband Specification at §3.2. For a Wi-Fi Agile Multiband AP that supports MLO as defined in the Wi-Fi 7 Draft Standard, “this list of non-preferred channels” are indicated across all affiliated non-AP STAs. <i>Id.</i> In addition to the non-AP MLD communicating such channel and band information to an AP MLD, such channel and band information, including interference information, may be communicated from the Galaxy S24 Ultra’s virtual PHY interfaces to the virtual MAC. Information regarding bandwidth availabilities may be communicated by the virtual PHY interfaces to the virtual MAC through multiple operations. For example: <u>Multi-Link Beacon or Probe Response</u>

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	In accordance with the Wi-Fi Agile Multiband Specification, the Galaxy S24 Ultra “include[s] the MBO [Multiband Operation] Capability Indication attribute in Beacon and Probe Response frames on all links.” Wi-Fi Agile Multiband Specification at §3.8. 3.8 MBO Capability Indication attribute Wi-Fi Agile Multiband APs shall include the MBO Capability Indication attribute in Beacon frames, Probe Response frames and (Re)Association Response frames. This attribute indicates that the AP is a Wi-Fi Agile Multiband AP, and whether it is cellular data aware or not. A Wi-Fi Agile Multiband AP which supports MLO as defined in [2], shall include the MBO Capability Indication attribute in Beacon and Probe Response frames on all links. Wi-Fi Agile Multiband Specification at §3.8. Support for MBO attribute AP Beacon, Probe Response, and (Re)Association Response management frames is mandatory, as is support for non-preferred channel reports for the STA (Re)Association Request. Wi-Fi Agile Multiband Specification at Table 5. A non-AP MLD, such as the Galaxy S24 Ultra, obtains information regarding bandwidths from AP MLDs. Such information may be obtained, for example, during MLO discovery. For example, during MLO discovery and ML setup, a non-AP MLD discovers an AP MLD using either (1) passive or active scanning, or (2) transmission of a multi-link probe request. The non-AP MLD receives from the AP MLD either a beacon frame or a multi-link probe response frame.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	35.3.4.6 Frame exchange sequences during MLO discovery and ML setup A non-AP MLD is expected to discover an AP MLD and affiliated AP(s) of interest before initiating an ML setup with the AP MLD. The non-AP MLD can use one or a combination of the following methods for discovering the AP MLD and affiliated AP(s) of interest: — Through each of its affiliated STAs, perform passive scanning by following the procedure defined in 11.1.4.2 (Passive scanning) or active scanning by following the procedure defined in 11.1.4.3 (Active scanning and probing procedures). — Through one of its affiliated STAs, transmit a multi-link probe request on any link that the AP MLD is operating on, with the frame addressed to the affiliated AP operating on that link, to obtain information about the AP MLD and its affiliated AP(s) by following the procedure defined in 35.3.4.2 (Use of multi-link probe request and response). Wi-Fi 7 Draft Standard at 544.

USP 11,856,414, Claim 1

Evidence of Use in the Galaxy S24 Ultra

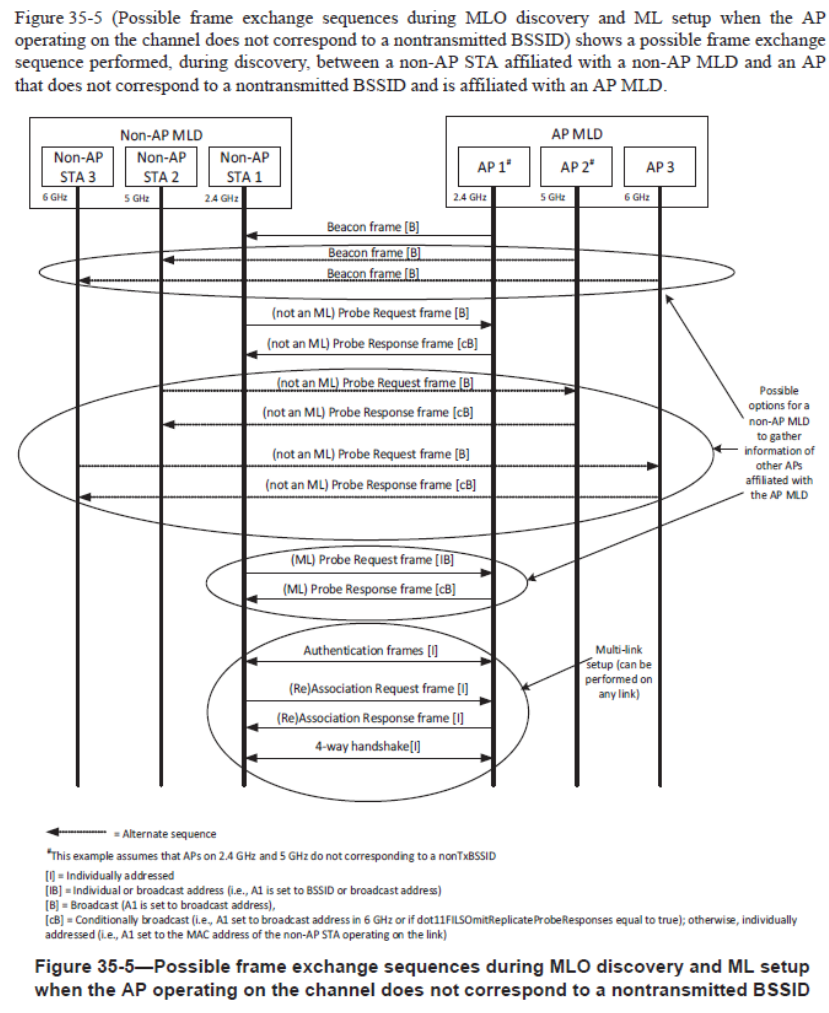


Fig. 35-5, Wi-Fi 7 Draft Standard at 545.

USP 11,856,414, Claim 1

Evidence of Use in the Galaxy S24 Ultra

The beacon frame and the multi-link probe response frame received by the non-AP MLD include information regarding bandwidth availabilities. In particular, both the beacon frame and the multi-link probe response frame include a multi-link traffic indication element, an EHT capabilities element, an EHT operation element, a TID-to-Link mapping element, and a channel usage element. Wi-Fi 7 Draft Standard at 183-84 (beacon frame), 190-91 (probe response frame). These elements include information regarding bandwidth availability, such as a per-link traffic indication list contained in the multi-link traffic indication element and PHY capabilities information contained in the EHT capabilities element. Wi-Fi 7 Draft Standard at 295-97 (Multi-Link Traffic Indication), 269-93 (EHT Capabilities).

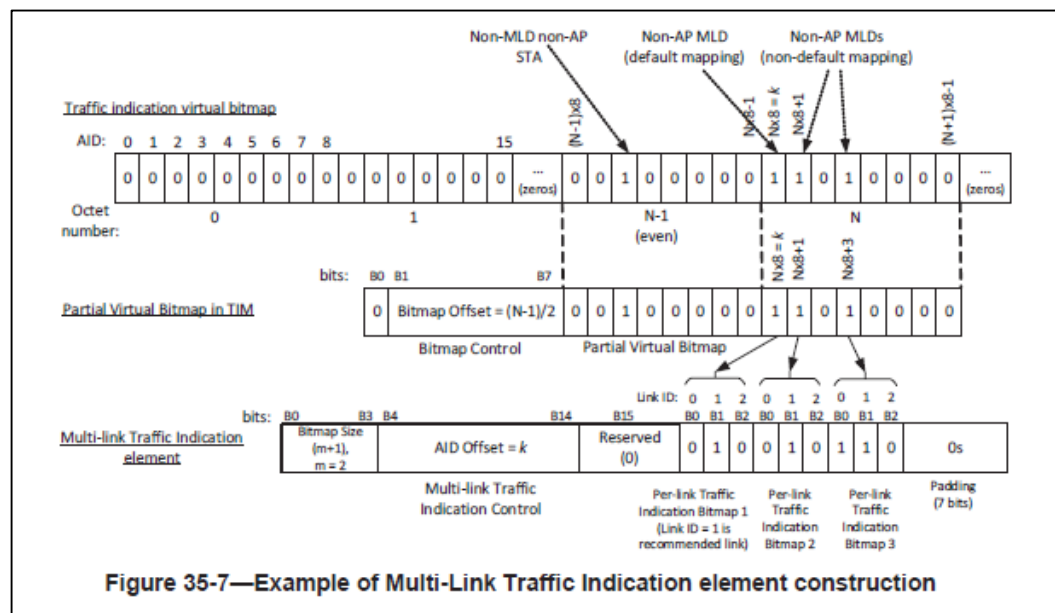


Fig. 35-7, Wi-Fi 7 Draft Standard at 587.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra												
	The beacon or multi-link probe response frame may additionally or alternatively include a Basic Multi-Link element, which includes a Per-STA Profile sub-element. Wi-Fi 7 Draft Standard at 248-61. The format of the Per-STA Profile subelement is defined in Figure 9-1001m (Per-STA Profile subelement format of the Basic Multi-Link element). <table><tr><td></td><td>Subelement ID</td><td>Length</td><td>STA Control</td><td>STA Info</td><td>STA Profile</td></tr><tr><td>Octets:</td><td>1</td><td>1</td><td>2</td><td>variable</td><td>variable</td></tr></table> Figure 9-1001m—Per-STA Profile subelement format of the Basic Multi-Link element Wi-Fi 7 Draft Standard at 259. Additionally, or alternatively, devices may transmit beacon frames on multiple channels simultaneously. By analyzing overlapping beacon frames from neighboring APs, the MLD can infer channel occupancy and recommend and/or allocate potential resources for its own transmissions. <u>Punctured Subchannels</u> Additionally, the Galaxy S24 Ultra, with Wi-Fi 7 enabled, is configured for preamble puncturing. The puncturing pattern, required of the standard, provides information regarding the first and second bandwidth availabilities to the virtual MAC interface. Preamble puncturing allows WNDs, such as the Galaxy S24 Ultra, to recognize and exclude unavailable subchannels from a transmission. For example, the Wi-Fi 7 Draft Standard describes the U-SIG field that carries the information necessary to interpret EHT PPDU, and that shows a puncturing pattern wherein RUs and MRUs are punctured. The puncturing pattern indicates what sub-portions of RUs or MRUs are not to be used for transmission or		Subelement ID	Length	STA Control	STA Info	STA Profile	Octets:	1	1	2	variable	variable
	Subelement ID	Length	STA Control	STA Info	STA Profile								
Octets:	1	1	2	variable	variable								

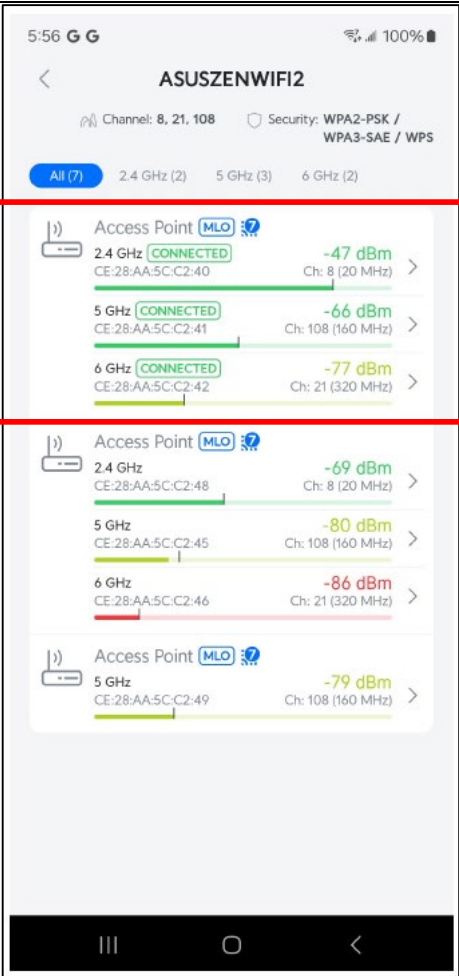
USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	reception purposes. Unavailable subchannels may be indicated, for example, in a Disabled Subchannel Bitmap. 36.3.12.11 EHT preamble of preamble punctured EHT MU PPDU 36.3.12.11.1 General Preamble puncturing refers to the transmission of a PPDU in which no signal is present in at least one of the 20 MHz subchannels within the PPDU bandwidth. Preamble puncturing might be the result of the unavailability of 20 MHz subchannel(s) within the PPDU bandwidth, such as a busy channel indicated by the CCA or the setting of the Disabled Subchannel Bitmap subfield in the EHT Operations element (see 9.4.2.321 (EHT Operation element)). Wi-Fi 7 Draft Standard at 867. Otherwise, an EHT STA may puncture other subchannels in addition to those indicated in the Disabled Subchannel Bitmap subfield in the EHT Operation element in an EHT MU PPDU or a non-HT duplicate PPDU. If an EHT AP punctures other subchannels in an EHT MU PPDU or a non-HT duplicate PPDU in addition to those indicated in the Disabled Subchannel Bitmap subfield and solicits a response to the PPDU, the EHT AP shall use a triggering frame to solicit the response in a TB PPDU and assign an RU or MRU within the nonpunctured subchannel set to a responding EHT STA. Wi-Fi 7 Draft Standard at 686. Regardless of the inclusion of the Disabled Subchannel Bitmap subfield in the EHT Operation element, an EHT STA may use EHT MU PPDU preamble puncturing modes as defined in 36.3.12.11 (EHT preamble of preamble punctured EHT MU PPDU) or EHT TB PPDU in which not all the 20 MHz subchannels are assigned. Wi-Fi 7 Draft Standard at 686. Unavailable subchannels (<i>i.e.</i>, punctured subchannels) may also be identified using TXVector parameters, as shown below.

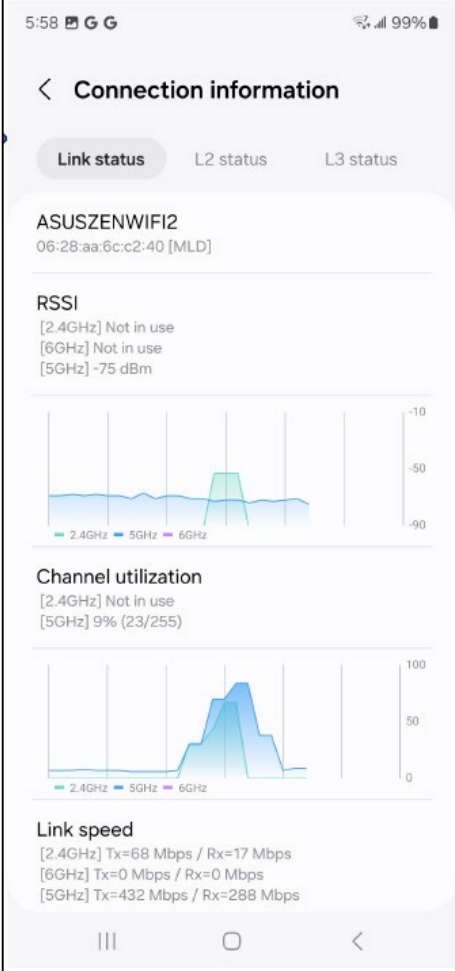
USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	35.11.5 INACTIVE_SUBCHANNELS An EHT STA shall not transmit on any 20 MHz subchannel that is punctured as indicated in the TXVECTOR parameter INACTIVE_SUBCHANNELS (see Table 36-1 (TXVECTOR and RXVECTOR parameters)). The indication of which subchannels are punctured in a non-HT duplicate PPDU or EHT PPDU is conveyed from the MAC to the PHY through the TXVECTOR parameter INACTIVE_SUBCHANNELS (see Table 36-1 (TXVECTOR and RXVECTOR parameters)). The parameter INACTIVE_SUBCHANNELS is present in the TXVECTOR of a non-HT duplicate PPDU or EHT PPDU when the conditions defined in 35.15.2 (Preamble puncturing operation) are satisfied. Wi-Fi 7 Draft Standard at 671. If a 20 MHz subchannel is indicated as a punctured subchannel in the most recently exchanged Disabled Subchannel Bitmap subfield in the EHT Operation element, the corresponding bit in the TXVECTOR parameter INACTIVE_SUBCHANNELS shall be set to 1 and the punctured 20 MHz subchannel shall not be used by the non-TB PPDU(s) that is transmitted during the time allocated by the associated AP. Wi-Fi 7 Draft Standard at 527. When operating as an AP MLD or a non-AP MLD, the virtual MAC interface of the Galaxy S24 Ultra evaluates the channel information, such as the puncturing pattern, to determine what portions of channels are unavailable, and therefore not to be recommended and/or used for transmission or reception purposes. <u>Bandwidth Signaling TA</u> As another example of information regarding bandwidth availabilities, a bandwidth signaling transmitter address (TA) indicates the presence of additional signaling related to the bandwidth to be used in a subsequent transmission. A bandwidth signaling TA may be communicated in connection with control frames such as an RTS frame, a PS-Poll frame, or a BlockAckReq frame.

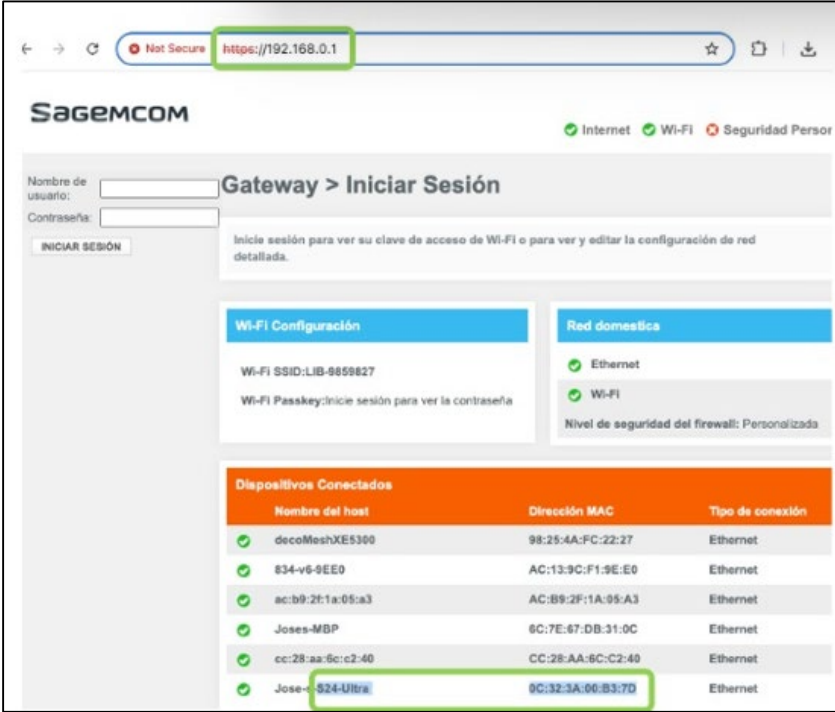
USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	35.2 EHT channel access 35.2.1 TXOP 35.2.1.1 Bandwidth signaling An EHT STA that is a STA 6G and is transmitting a Control frame in non-HT duplicate format with a bandwidth signaling TA addressed to an EHT STA shall set the TXVECTOR parameter CH_BANDWIDTH_IN_NON_HT signaled via the scrambling sequence and SERVICE field according to Table 36-1 (TXVECTOR and RXVECTOR parameters). An EHT STA that is a STA 6G and is transmitting a CTS frame in non-HT duplicate format in response to an RTS frame in non-HT duplicate format with a bandwidth signaling TA addressed to the EHT STA shall set the TXVECTOR parameter CH_BANDWIDTH_IN_NON_HT signaled via the scrambling sequence and SERVICE field according to Table 36-1 (TXVECTOR and RXVECTOR parameters). Wi-Fi 7 Draft Standard at 523. Additionally, multi-link enhancements in the use of management primitives, clear channel assessments, link monitoring, bandwidth query or link quality reports, and/or channel availability mechanisms may be used for communicating information about bandwidth availabilities to the virtual MAC interface. Thus, when operating as an AP MLD or a non-AP MLD, the SME of the Galaxy S24 Ultra makes decisions and/or recommendations about which channels to use for data transmission by collecting information about channel conditions, including noise levels, and selecting the channels that offer the best performance. To accomplish this, the MLME provides the SME with information about the available channels and their characteristics, such as channel utilization and interference levels. The PLME provides feedback to the MLME about channel conditions, which the MLME may then relay to the SME.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
[1.g] wherein the processing interface is configured to, when the wireless network device is being used, in a manner transparent to any layer of the wireless networking device above the processing interface,	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has configured the processing interface such that when the wireless network device is being used, the processing interface operates in a manner transparent to any layer of the wireless networking device above the processing interface. Layers between the processing interface and the application interface include, for example, a data link interface. As described with respect to elements 1.a and 1.b, when operating as an AP MLD or a non-AP MLD, the processing interface of the Galaxy S24 Ultra comprises at least a portion of the SME, MLME, MAC SAP, MLME SAP, and PLME SAP in combination with at least some functionality of the UMAC. The SME, MLME, PLME, MAC SAP, and UMAC exchange information and operate to make bandwidth allocation decisions and/or recommendations in a manner transparent to all layers of the wireless networking device above the processing interface such as the data link layer. 4.2.5 Interaction with other IEEE 802® layers IEEE Std 802.11 is required to appear to higher layers [logical link control (LLC) sublayer] as a general-purpose IEEE 802 LAN. This requires that the IEEE 802.11 network handle STA mobility within the MAC sublayer. To meet reliability assumptions (that LLC makes about lower layers), it is necessary for IEEE Std 802.11 to incorporate functionality that is untraditional for MAC sublayers. IEEE 802.11-2020 Standard for Information Technology—Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks—Specific Requirements (2020) at 219.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	An MLD supports multiple MAC functions, with synchronization across the MAC functions as needed via the MLD synchronization service (see 35.3.25 (MLD synchronization service)) and otherwise coordinated by the SME. Each affiliated STA is enumerated with a Link ID (for example, as Link 1 and Link 2 in Figure 4-33b (Reference model for an MLD for two links)) and MLME primitives are invoked through an MLME SAP. The SME maintains the authentication and association states. The Authenticator and the MAC-SAP of the AP MLD are identified by the same AP MLD MAC address. The Supplicant and the MAC-SAP of the non-AP MLD are identified by the same non-AP MLD MAC address. The SME is responsible for coordinating the MLD and each of the affiliated STAs through the MLME, and to maintain an RSNA key management entity and IEEE 802.1X Authenticator or Supplicant, for MLO. Wi-Fi 7 Draft Standard at 78. The SME maintains the authentication and association states. The same AP MLD MAC address and same non-AP MLD MAC address are used. Thus, when the Galaxy S24 Ultra is being used, operating as an AP MLD or a non-AP MLD, its processing interface operates in a manner transparent to any layer of the Galaxy S24 Ultra above the processing interface. Further, testing of the Galaxy S24 Ultra indicates that, when the Galaxy S24 Ultra is in use, its processing interface, including its virtual MAC interface, operates to make bandwidth allocation decisions and/or recommendations in a manner transparent to all layers of the wireless networking device above the processing interface such as the data link layer. For example, the screenshots below demonstrate that, in use, the processing interface of the Galaxy S24 Ultra operates to make, for example, bandwidth allocation decisions using each of the 2.4 GHz, 5 GHz, and 6 GHz bands.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	 WiFiman application screenshot taken on Galaxy S24 Ultra demonstrating connection with local access point (emphasis added).

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	 5:58 G G 99% < Connection information Link status L2 status L3 status ASUSZENWIFI2 06:28:aa:6c:c2:40 [MLD] RSSI [2.4GHz] Not in use [6GHz] Not in use [5GHz] -75 dBm Channel utilization [2.4GHz] Not in use [5GHz] 9% (23/255) Link speed [2.4GHz] Tx=68 Mbps / Rx=17 Mbps [6GHz] Tx=0 Mbps / Rx=0 Mbps [5GHz] Tx=432 Mbps / Rx=288 Mbps WiFiman application screenshot taken on Galaxy S24 Ultra demonstrating connection with local access point.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	As shown above, the processing interface's utilization of the available channels changes over time. Despite this, as shown below, in use, the Galaxy S24 Ultra is associated with only a single IP address and a single MAC address used to route Internet traffic to the Galaxy S24 Ultra.  Internet browser screenshot indicating connection between Sagemcom Internet Gateway router and Galaxy S24 Ultra (emphasis added).
[1.h] (a) request or create (i) a first association between a recipient and	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has configured the processing interface to request or create (i) a first association between a recipient and the first

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
the first actual MAC and PHY interfaces and (ii) a second association between the recipient and the second actual MAC and PHY interfaces, and	actual MAC and PHY interfaces and (ii) a second association between the recipient and the second actual MAC and PHY interfaces. MLO allows a non-AP MLD and an AP MLD to establish multiple links between their corresponding STAs. The Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, is configured to request or create associations between its STAs and those of another device. As described above, the Galaxy S24 Ultra has multiple STAs, each having a corresponding actual PHY interface and a corresponding actual MAC interface. Each station is associated with a frequency band, such as 2.4 GHz, 5 GHz, or 6 GHz. MLO is defined for an EHT STA in 35.3 (Multi-link operation (MLO)). MLO allows an AP MLD and a non-AP MLD to set up multiple links between them. A reference model for MLO is described in 4.9.6 (Reference model for multi-link operation (MLO)). Wi-Fi 7 Draft Standard at 523. 4.9.6 Reference model for multi-link operation (MLO) MLO defines a set of procedures allowing communication over one or more links between MLDs. An MLD manages such communication over one or more links. Communication over links using different channels on different frequency bands or the same frequency band can occur simultaneously or not depending on the capabilities of both the AP MLD and the non-AP MLD (see 35.3.16.3 (Simultaneous transmit and receive (STR) operation) and 35.3.16.4 (Nonsimultaneous transmit and receive (NSTR) operation)). The MLO procedures (see 35.3 (Multi-link operation (MLO))) allow a pair of MLDs to discover, synchronize, (de)authenticate, (re)associate, disassociate, and manage links and other resources with each other on any common bands or channels that are supported by both MLDs. Each MLD has a single MAC-SAP. Each STA affiliated with an MLD has a MAC address different from any other STA affiliated with the same MLD. Wi-Fi 7 Draft Standard at 76.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	When a link is established between a non-AP MLD and an AP MLD, an association is requested or created between the actual MAC and actual PHY interfaces of the non-AP MLD and the AP MLD.

USP 11,856,414, Claim 1

Evidence of Use in the Galaxy S24 Ultra

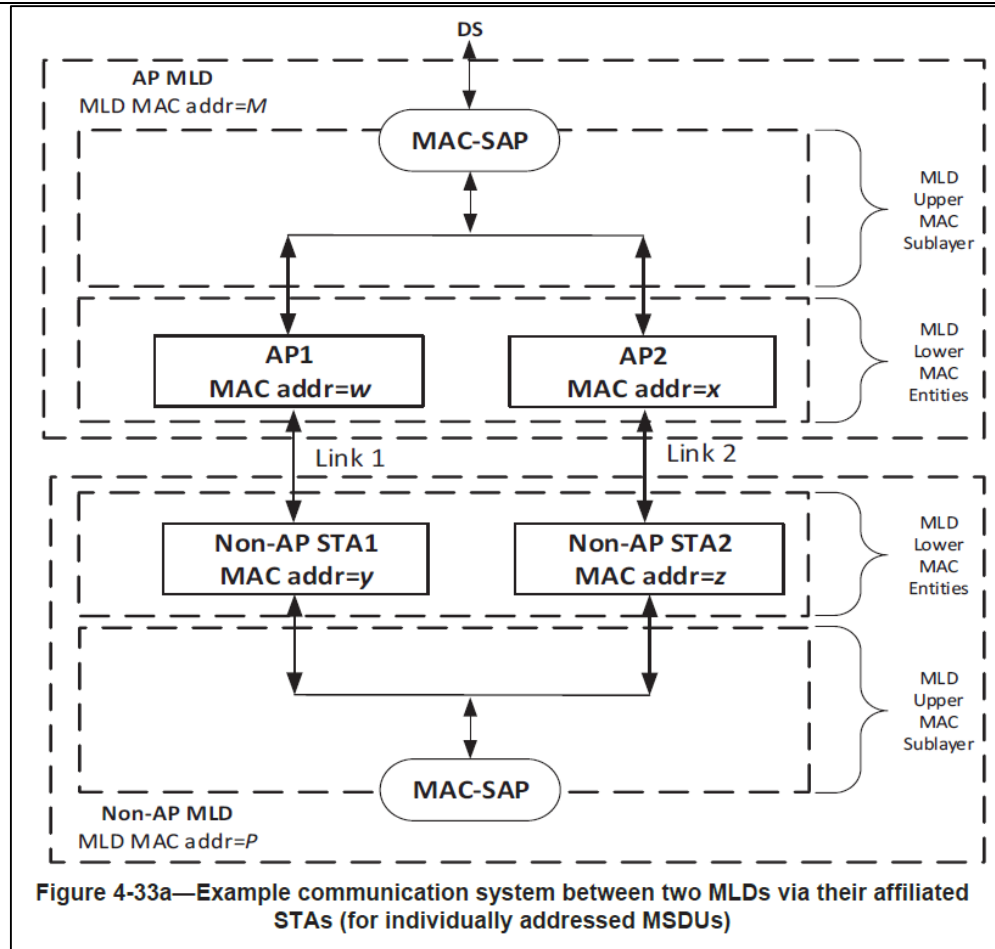


Fig. 4-33a, Wi-Fi 7 Draft Standard at 77.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	During MLO discovery and ML setup, a non-AP MLD may discover an AP MLD using either (1) passive or active scanning, or (2) transmission of a multi-link probe request. The non-AP MLD receives from the AP MLD either a beacon frame or a multi-link probe response frame. These exchanges of frames allow the non-AP MLD and the AP MLD (here, the recipient) to request or create an association between their STAs. Operating as an AP MLD, the Galaxy S24 Ultra may request or create associations between its actual MAC and PHY interfaces and a recipient, such as a non-AP MLD device. Additionally, when operating as a non-AP MLD, the Galaxy S24 Ultra may request or create associations between its actual MAC and PHY interfaces and a recipient, such as an AP MLD device. 35.3.4.6 Frame exchange sequences during MLO discovery and ML setup A non-AP MLD is expected to discover an AP MLD and affiliated AP(s) of interest before initiating an ML setup with the AP MLD. The non-AP MLD can use one or a combination of the following methods for discovering the AP MLD and affiliated AP(s) of interest: — Through each of its affiliated STAs, perform passive scanning by following the procedure defined in 11.1.4.2 (Passive scanning) or active scanning by following the procedure defined in 11.1.4.3 (Active scanning and probing procedures). — Through one of its affiliated STAs, transmit a multi-link probe request on any link that the AP MLD is operating on, with the frame addressed to the affiliated AP operating on that link, to obtain information about the AP MLD and its affiliated AP(s) by following the procedure defined in 35.3.4.2 (Use of multi-link probe request and response). Wi-Fi 7 Draft Standard at 544.

USP 11,856,414, Claim 1

Evidence of Use in the Galaxy S24 Ultra

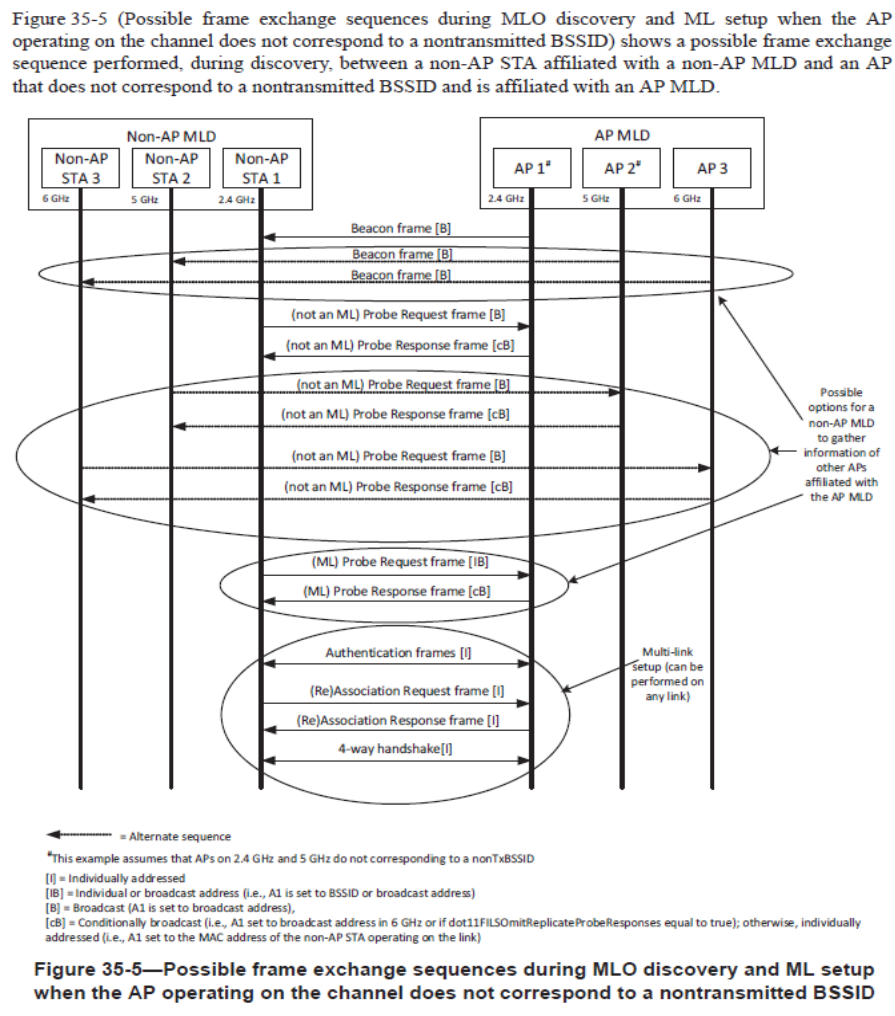
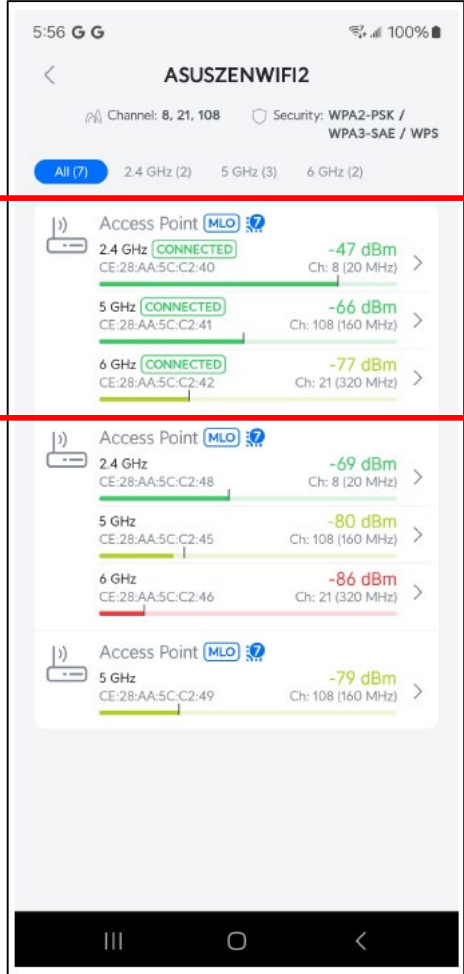


Fig. 35-5, Wi-Fi 7 Draft Standard at 545.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	As indicated above, the Galaxy S24 Ultra has three wireless transceivers, each having an associated actual PHY interface and an associated actual MAC interface. Thus, when operating as an AP MLD or a non-AP MLD, the Galaxy S24 Ultra may request or create an association between each of its actual PHY and MAC interfaces and a recipient. The first and second transceivers can be any two of the 2.4 GHz, the 5 GHz transceiver, and the 6 GHz transceiver of the Galaxy S24 Ultra. Further, testing of the Galaxy S24 Ultra indicates that, when the Galaxy S24 Ultra is in use, its processing interface operates to request or create associations between the Galaxy S24 Ultra and a recipient, such as an AP MLD, over multiple bands. For example, the screenshot below demonstrates that, in use, the Galaxy S24 Ultra may have an association between a recipient and each of its three transceivers.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	 WiFiman application screenshot taken on Galaxy S24 Ultra demonstrating connection with local access point (emphasis added).

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
[1.i] (b) (i) identify at least one portion of each one of the first and second bandwidth availabilities of the first and second wireless transceivers, and	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has configured the processing interface to identify at least one portion of each one of the first and second actual bandwidths of the first and second wireless transceivers that are available for communication. To achieve the increased bandwidth utilization and efficiency objectives of the Wi-Fi 7 Draft Standard and for MLO, when operating as an AP MLD or a non-AP MLD, the processing interface of the Galaxy S24 Ultra monitors and identifies portions of bandwidths for each of the device's three transceivers that are available for communication so that the processing interface can make resource allocations and/or recommendations based at least on channel utilization and/or congestion. <i>See, e.g.</i>, Wi-Fi 7 Draft Standard at 629-637. As described with respect to element 1.f, information regarding bandwidth availabilities is communicated to the virtual MAC using a variety of operations. Once received, the information regarding bandwidth availabilities allows the processing interface to identify at least one portion of each of the first, second, and third bandwidths of the first, second, and third transceivers that are available for communication. As a particular example, when operating as a non-AP MLD, the Galaxy S24 Ultra may operate in EMLMR mode. The Wi-Fi 7 Draft Standard states that EMLMR mode is an operating mode wherein a non-AP MLD like the Galaxy S24 Ultra aggregates some physical resources of its different radios used on different links (so-called EMLMR links) in order to transmit or receive data up to a pre-defined number of supported Rx/Tx spatial streams, which number may be greater than the number of supported Rx/Tx spatial streams of each radio.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	35.3.18 Enhanced multi-link multi-radio (EMLMR) operation The enhanced multi-link multi-radio (EMLMR) operation defined in this subclause allows a non-AP MLD with multiple radios on multiple links to listen a set of links as defined below for an initial frame sent by an AP affiliated with an AP MLD, followed by frame exchanges that satisfy the MCS and number of spatial streams (N_{SS}) capabilities in the EMLMR mode on the link on which the initial frame was received. Here initial frame is transmitted in a PPDU whose N_{SS} satisfies the receiving STA's capabilities. A non-AP MLD may operate in the EMLMR mode on a specified set of the enabled links as defined in 9.4.1.76 (EML Control field) between the non-AP MLD and its associated AP MLD. The specified set of the enabled links in which the EMLMR mode is applied is called EMLMR links. A non-AP STA affiliated with the non-AP MLD that is on an EMLMR link is an EMLMR STA. The EMLMR links shall be indicated in the EMLMR Link Bitmap subfield of the EML Control field of the EML Operating Mode Notification frame (see 9.6.38.8 (EML Operating Mode Notification frame details)) by setting the bit positions corresponding to the link IDs of these links in the EMLMR Link Bitmap subfield to 1. Wi-Fi 7 Draft Standard at 613. A portion of available bandwidth may comprise a single RU, a group of RUs or an MRU.
[1.j] (ii) evaluate the identified bandwidth availabilities of the first and second wireless transceivers with respect to the first bandwidth requirement of the first application;	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has configured the processing interface to evaluate the identified bandwidth availabilities of the first and second wireless transceivers with respect to the first bandwidth requirement of the first application. As described with respect to element 1.f, the Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, obtains information about bandwidth availabilities from other devices through, for example, beacon frames and multi-link response frames. For example, both the beacon frame and the multi-link probe response frame include a multi-link traffic indication element, an EHT capabilities element, an EHT operation element, a TID-to-Link mapping element, and a channel usage element. Wi-Fi 7 Draft Standard at 183-84 (beacon frame), 190-91 (probe response frame). These elements include information regarding bandwidth availability, such as a per-link traffic indication list contained in the multi-link

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	traffic indication element and PHY capabilities information contained in the EHT capabilities element. Wi-Fi 7 Draft Standard at 295-97 (Multi-Link Traffic Indication), 269-93 (EHT Capabilities). The Galaxy S24 Ultra, when operating as an AP MLD or a non-AP MLD, enables the use of TID-to-link mapping in accordance with the Wi-Fi 7 Draft Standard. For example, when operating as an AP MLD, the SME and UMAC (through a Resource Allocation Manager) may determine TID-to-link mapping and assign RUs/MRUs based on traffic needs and available resources on each link. Likewise, when operating as a non-AP MLD, the SME and UMAC may monitor and evaluate traffic needs and available resources to provide recommendation information to an AP MLD device assigning RUs/MRUs. Thus, the system architecture solves limitations of multi-band to enable MLO in IEEE 802.11be to be based on the processing interface's unique understanding of traffic priorities, queue lengths, and real-time network status enabling intelligent TID-to-link mapping. This mapping determines which traffic (<i>e.g.</i>, identified by TID) should be directed to which links (<i>i.e.</i>, associated bandwidth resources). As a particular example, when operating as an AP MLD, the SME and UMAC allocate appropriate RU(s)/MRU(s) based on the data requirements of the specific traffic type mapped to a link. The UMAC considers factors like the amount of data to be transmitted for a particular TID and the channel bandwidth available on the chosen link. It can choose to allocate a single RU for smaller data packets or low-priority traffic, or allocate multiple RUs combined into an MRU for larger data transfers or high-priority traffic requiring more bandwidth. Assigning RUs or MRUs is an integral part of TID-to-link mapping. In a survey paper published in IEEE Access and discussing MLO operations as presented in the Wi-Fi 7 Draft Standard, the authors describe that the processing interface of an MLD assigns traffic flows to channels based on channel availability and traffic needs.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	The motivation for MLO stems from its projected benefits across various dimensions [20]. Firstly, the introduction of the multi-link framework enables significantly improved coordinated operations across multiple links [34], [35]. Through unified and cooperative link management, Wi-Fi 7 can more easily accomplish additional throughput for data flows separated across links than earlier Wi-Fi technologies with separate and independent operations across multiple bands. Secondly, using several lines concurrently enhances the likelihood that a channel will be accessed, considerably reducing latency [36]. Thirdly, MLO permits duplication across numerous connections³ to guarantee the successful transmission of crucial data that demands extremely high reliability. Finally, depending on the application's requirements, MLO can be used to assign data flows to specific links to accomplish traffic separation [37]. Abdalhafid, Alsadg A., <i>et al.</i>, <i>Multi-Link Operation in IEEE802.11be Extremely High Throughput: A Survey</i>, 12 IEEE Access 46891, 46892 (2024) (emphasis added).

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	B. TID-TO-LINK MAPPING The IEEE 802.11 standard defines a Traffic Identifier (TID) as a four-bit value (ranging from 0 to 7) used to differentiate packets for QoS purposes [37]. There are $(2^4) = 16$ possible TID values; 8 identify Traffic Categories (TCs), and the other 8 identify parameterized Traffic Streams (TSs). The TID is assigned to an MSDU in the layers above the MAC () [76]. In MLO, TID is crucial in directing traffic with specific QoS requirements to the appropriate connections or channels. TID-to-link mapping associates each TID with a connection set, allowing any link within that set to transmit data frames associated with that TID. All established connections are initially linked to each TID, though this mapping can later be adjusted through negotiation processes [20], [77]. Abdalhafid, Alsadg A., <i>et al.</i>, <i>Multi-Link Operation in IEEE802.11be Extremely High Throughput: A Survey</i>, 12 IEEE Access 46891, 46895 (2024) (emphasis added). Thus, when the Galaxy S24 Ultra is operating as an AP MLD or a non-AP MLD, based on the information provided to the SME portions of the processing interface, the processing interface may evaluate the bandwidth availabilities of the wireless transceivers with respect to application bandwidth requirements.
[1.k] wherein, if the first bandwidth requirement is at least partially satisfied by the bandwidth availabilities of the first and second wireless transceivers, preparing the first data stream for simultaneous transmission to the recipient from both of the first and second wireless	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has configured it such that if the first bandwidth requirement is at least partially satisfied by the bandwidth availabilities of the first and second wireless transceivers, the Galaxy S24 Ultra prepares the first data stream for simultaneous transmission to the recipient from both of the first and second wireless transceivers using a specific subset of frequencies corresponding to the identified at least one portion of their available bandwidth.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
transceivers using a specific subset of frequencies corresponding to the identified at least one portions [sic] of their available bandwidth and	The processing interface of the Galaxy S24 Ultra receives a data stream from the application interface and prepares the data stream for simultaneous transmission by first packetizing it. Packets are then assigned to links for transmission in accordance with, for example, TID-to-Link mapping that is negotiated between an AP MLD and a non-AP MLD. 35.3.7.2 TID-To-Link Mapping (TTLM) 35.3.7.2.1 General The TTLM mechanism allows an AP MLD and a non-AP MLD that performed or are performing ML setup to determine how Data frames belonging to TIDs 0–7 and Management frames will be assigned for transmission, on the setup links between the two MLDs in DL and UL. Wi-Fi 7 Draft Standard at 565.

USP 11,856,414, Claim 1

Evidence of Use in the Galaxy S24 Ultra

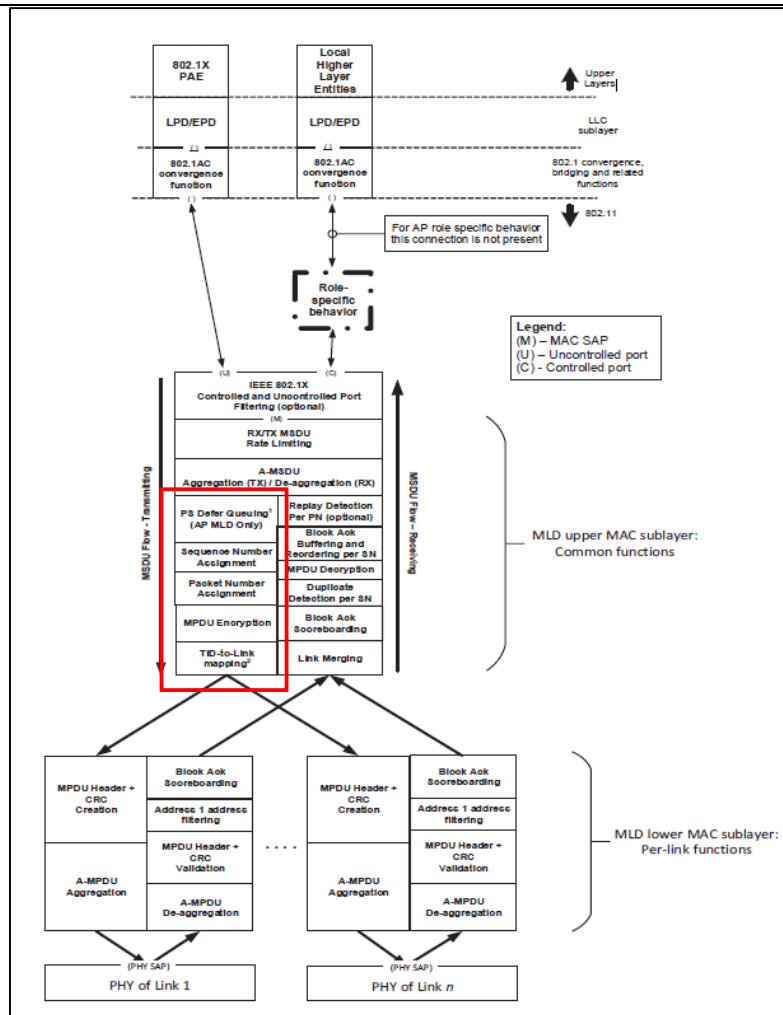


Fig. 5-2a, Wi-Fi 7 Draft Standard at 82 (emphasis added).

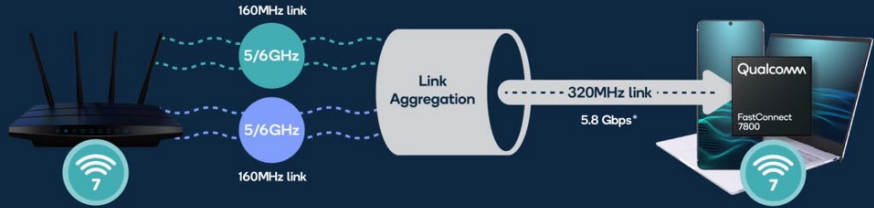
USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	Additionally, MLO allows a non-AP MLD to transmit data over multiple links with different frequencies simultaneously. The processing interface may prepare the data stream for simultaneous transmission to the recipient from two selected transceivers of the first, second, and third wireless transceivers using a subset of frequencies corresponding to their available bandwidths. With MLO procedures, the processing interface may assign some data packets to a first link and other data packets to a second link for simultaneous transmission. 4.9.6 Reference model for multi-link operation (MLO) MLO defines a set of procedures allowing communication over one or more links between MLDs. An MLD manages such communication over one or more links. Communication over links using different channels on different frequency bands or the same frequency band can occur simultaneously or not depending on the capabilities of both the AP MLD and the non-AP MLD (see 35.3.16.3 (Simultaneous transmit and receive (STR) operation) and 35.3.16.4 (Nonsimultaneous transmit and receive (NSTR) operation)). The MLO procedures (see 35.3 (Multi-link operation (MLO))) allow a pair of MLDs to discover, synchronize, (de)authenticate, (re)associate, disassociate, and manage links and other resources with each other on any common bands or channels that are supported by both MLDs. Each MLD has a single MAC-SAP. Each STA affiliated with an MLD has a MAC address different from any other STA affiliated with the same MLD. Wi-Fi 7 Draft Standard at 76. As a particular example operation, when operating as a non-AP MLD in enhanced multi-link multi-radio (EMLMR) mode, a Stream Classification Service (SCS) procedure is used by the Galaxy S24 Ultra to (1) request an EHT AP to classify incoming individually addressed MSDUs (MAC Service Data Units) based on parameters provided by the Galaxy S24 Ultra, and/or (2) describe its traffic characteristics to an EHT AP. The Galaxy S24 Ultra indicates the traffic latency requirement of the first application data stream to the AP MLD using the SCS procedure. Then, the AP MLD using a trigger frame allocates RUs/MRUs using puncturing across the links in the bandwidth allocated to the non-AP MLD's STAs. Wi-Fi 7 Draft Standard at 695-97.

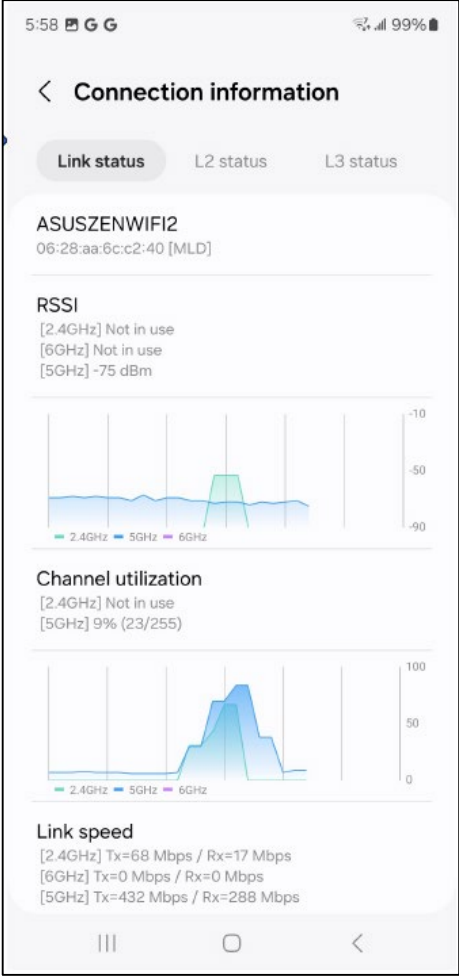
USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	As shown below, Abdalhafid <i>et al.</i> describe the processing interface's ability to satisfy the requirements of a traffic flow using multiple links with simultaneous transmission. C. MULTI-LINK CHANNEL ACCESS MLO offers a distinct advantage over a single wide channel by facilitating asynchronous channel access and data transmission across multiple links. This enables simultaneous transmission and reception in separate frequency bands [40], Abdalhafid, Alsadg A., <i>et al.</i>, <i>Multi-Link Operation in IEEE802.11be Extremely High Throughput: A Survey</i>, 12 IEEE Access 46891, 46896 (2024) (emphasis added). The motivation for MLO stems from its projected benefits across various dimensions [20]. Firstly, the introduction of the multi-link framework enables significantly improved coordinated operations across multiple links [34], [35]. Through unified and cooperative link management, Wi-Fi 7 can more easily accomplish additional throughput for data flows separated across links than earlier Wi-Fi technologies with separate and independent operations across multiple bands. Secondly, using several lines concurrently enhances the likelihood that a channel will be accessed, considerably reducing latency [36]. Thirdly, MLO permits duplication across numerous connections³ to guarantee the successful transmission of crucial data that demands extremely high reliability. Finally, depending on the application's requirements, MLO can be used to assign data flows to specific links to accomplish traffic separation [37]. Abdalhafid, Alsadg A., <i>et al.</i>, <i>Multi-Link Operation in IEEE802.11be Extremely High Throughput: A Survey</i>, 12 IEEE Access 46891, 46892 (2024) (emphasis added).

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	2) 1-TO-M TID-TO-LINK MAPPING, WHICH COMES IN AT NUMBER (PACKET-LEVEL AGGREGATION) This mapping enables traffic associated with a particular TID to travel via any link within a designated set. This strategy accelerates the resolution of congested TID queues, enhancing traffic handling capacity. UMAC manages TID-specific packet routing on the transmitter's end. However, this approach introduces packet reordering, requiring the receiver's UMAC to temporarily store data and orderly transmit packets to the LLC layer [20]. In other words UMAC serves as a shared component within the MAC sub-layer across all interfaces. Within the UMAC, operations that re independent of specific links are carried out. Examples include the assignment of sequence numbers and the aggregation/de-aggregation of MAC service data units (MSDUs). It is crucial to note that the assignment of sequence numbers is specifically conducted at the UMAC, as packets from the same traffic flow may undergo fragmentation and transmission across different links. This approach facilitates the reordering of packets at the receiver's end. Furthermore, this layer is responsible for executing common management functions applicable to all links, such as setup, association, and authentication [71]. Abdalhafid, Alsadg A., <i>et al.</i>, <i>Multi-Link Operation in IEEE802.11be Extremely High Throughput: A Survey</i>, 12 IEEE Access 46891, 46895-6 (2024) (emphasis added). As a particular example, when operating as a non-AP MLD, the Galaxy S24 Ultra may operate in EMLMR mode. The Wi-Fi 7 Draft Standard states that EMLMR mode is an operating mode wherein a non-AP MLD like the Galaxy S24 Ultra aggregates some physical resources of its different radios used on different links (so-called EMLMR links) in order to

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	transmit or receive data up to a pre-defined number of supported Rx/Tx spatial streams, which number may be greater than the number of supported Rx/Tx spatial streams of each radio. To operate in EMLMR mode, the Galaxy S24 Ultra makes allocation decisions that involve use of at least some of the first and second bandwidth availabilities. 35.3.18 Enhanced multi-link multi-radio (EMLMR) operation The enhanced multi-link multi-radio (EMLMR) operation defined in this subclause allows a non-AP MLD with multiple radios on multiple links to listen a set of links as defined below for an initial frame sent by an AP affiliated with an AP MLD, followed by frame exchanges that satisfy the MCS and number of spatial streams (N_{SS}) capabilities in the EMLMR mode on the link on which the initial frame was received. Here initial frame is transmitted in a PPDU whose N_{SS} satisfies the receiving STA's capabilities. A non-AP MLD may operate in the EMLMR mode on a specified set of the enabled links as defined in 9.4.1.76 (EML Control field) between the non-AP MLD and its associated AP MLD. The specified set of the enabled links in which the EMLMR mode is applied is called EMLMR links. A non-AP STA affiliated with the non-AP MLD that is on an EMLMR link is an EMLMR STA. The EMLMR links shall be indicated in the EMLMR Link Bitmap subfield of the EML Control field of the EML Operating Mode Notification frame (see 9.6.38.8 (EML Operating Mode Notification frame details)) by setting the bit positions corresponding to the link IDs of these links in the EMLMR Link Bitmap subfield to 1. Wi-Fi 7 Draft Standard at 613. As described with respect to element 1.a of claim 1, the Galaxy S24 Ultra's processing interface is provided by the Qualcomm Snapdragon 8 Gen 3 System on a Chip processor that includes the FastConnect 7800 connectivity system contained within the Galaxy S24 Ultra. The Qualcomm FastConnect 7800 connectivity system is compliant with Wi-Fi 7 standards.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	Leading Wi-Fi 7, premium Wi-Fi 6/6E, and advanced Bluetooth audio come together in this powerful and versatile connectivity system to unlock extreme performance for mobile, compute, and XR experiences. The Qualcomm® FastConnect™ 7800 Mobile Connectivity System is an advanced 14nm Wi-Fi and Bluetooth® Connectivity system delivering ultra-high speeds (up to 5.8 Gbps*), sustained low latency (2 ms), and premium Bluetooth audio. While maintaining compliance with the latest Wi-Fi 6/6E and Wi-Fi 7 standards, FastConnect 7800 is packed with sophisticated innovation that goes beyond standard benchmarks. High Band Simultaneous Multi-Link Wi-Fi technology uniquely harnesses the potential of 5 and 6GHz bands for multiple links of high band performance for throughput hungry and latency sensitive applications, eliminating dependence on comparatively narrow and congested 2.4GHz band. https://www.qualcomm.com/products/technology/wi-fi/fastconnect/fastconnect-7800. As demonstrated below, the Qualcomm FastConnect 7800 connectivity system allows the Galaxy S24 Ultra to aggregate resources from multiple links.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	With Wi-Fi 7 HBS Multi-Link 320MHz becomes even more achievable  delivering the fastest and lowest-latency Wi-Fi 7 performance *Speed claims refer to maximum physical layer (PHY) rate https://www.qualcomm.com/products/technology/wi-fi/fastconnect/fastconnect-7800. This evidences that devices, such as the S24 Ultra phone, for example, can aggregate a 160 MHz channel in the 5 GHz band with a 160 MHz channel in the 6 GHz band. Testing of the Galaxy S24 Ultra indicates that, when the Galaxy S24 Ultra is in use, it operates in EMLMR mode to aggregate resources from multiple links. For example, the screenshot below illustrates the Galaxy S24 Ultra’s aggregation of the 2.4 GHz and the 5 GHz bands.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	 WiFiman application screenshot taken on Galaxy S24 Ultra demonstrating connection with local access point.

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
[1.1] causing the prepared first data stream to be transmitted from the first and second wireless transceivers to thereby at least partially satisfy the first wireless bandwidth requirement of the first application; and	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has configured it such that it causes the prepared first data stream to be transmitted from the first and second wireless transceivers to thereby at least partially satisfy the first wireless bandwidth requirement of the first application. When the Galaxy S24 Ultra operates as an AP MLD or a non-AP MLD, its processing interface instructs the actual MAC and actual PHY to transmit the data packets using primitives. These instructions specify the chosen link and may specify the allocated RU/MRU configuration. Based on the instructions, the actual PHY layer segments data packets into units, modulates the data units using appropriate techniques for transmission over the designated link, and transmits the modulated data units using the allocated radio frequencies on the chosen transceiver. For example, the processing interface uses certain vectors, including TXVECTOR, RXVECTOR, PHYCONFIG_VECTOR, and TRIG_VECTOR to instruct the PHY. 36.2 EHT PHY service interface 36.2.1 Introduction The EHT PHY provides an interface to the EHT MAC through an extension of the generic PHY service interface defined in 8.3.4 (Basic service and options). The interface includes TXVECTOR, RXVECTOR, PHYCONFIG_VECTOR, and TRIGVECTOR. The EHT MAC uses the TXVECTOR to supply the EHT PHY with per-PPDU transmit parameters. The EHT PHY uses the RXVECTOR to inform the EHT MAC of the received PPDU parameters. The EHT MAC uses the PHYCONFIG_VECTOR to configure the EHT PHY for operation that is independent of PPDU transmission or reception. The EHT MAC uses the TRIGVECTOR to configure the EHT PHY to receive EHT TB PPDU's over each assigned RU or MRU. Wi-Fi 7 Draft Standard at 708, 709-23 (listing TXVECTOR and RXVECTOR parameters).

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	In all options, in order to transmit data, the MAC generates a PHY-TXSTART.request primitive, which causes the PHY entity to respond with a PHY-TXSTART.confirm primitive and enter the transmit state. Further, the PHY is set to operate at the appropriate frequency through station management via the PLME, as specified in 36.4 (EHT PLME). Other transmit parameters, such as EHT-MCS, coding types, and transmit power, are set via the PHY-SAP using the PHY-TXSTART.request primitive (containing TXVECTOR), as described in 36.2.2 (TXVECTOR and RXVECTOR parameters). After transmitting a PPDU that carries a Trigger frame, the MAC sublayer issues a PHY-TRIGGER.request with a TRIGVECTOR parameter that provides the PHY entity with the information needed to demodulate the expected EHT TB PPDU response. The remainder of the subclause applies to the first two paths. Wi-Fi 7 Draft Standard at 940. Thus, when operating as an AP MLD or a non-AP MLD, the processing interface of the Galaxy S24 Ultra is configured to cause the prepared first data stream to be transmitted from the first and second wireless transceivers to thereby at least partially satisfy the first wireless bandwidth requirement of the first application.
[1.m] wherein the wireless networking device's utilization of the available bandwidth of the first and second wireless transceivers does not prevent other wireless networking devices from utilizing a range of frequencies corresponding to the remaining portion of the bandwidth availability of the first and second wireless transceivers for data transmission purposes at the same time that processed data is being sent from the first and second wireless transceivers.	In manufacturing and/or testing the Galaxy S24 Ultra, Samsung has configured it such that its utilization of the available bandwidth of the first and second wireless transceivers does not prevent other wireless networking devices from utilizing a range of frequencies corresponding to the remaining portion of the bandwidth availability of the first and second wireless transceivers for data transmission purposes at the same time that processed data is being sent from the first and second wireless transceivers. As described in the Wi-Fi 7 Draft Standard, an AP or non-AP MLD like the Galaxy S24 Ultra will use each of the first and second wireless transceivers to communicate via channels and RUs/MRUs that have been respectively assigned. The Galaxy S24 Ultra is configured for Multi-user Multiple Input Multiple Output (MU-MIMO) procedures, as well as Orthogonal Frequency Division Multiple Access (OFDMA) procedures.

The EHT PHY provides support for DL OFDMA, UL OFDMA, DL MU-MIMO, and UL MU-MIMO. Both DL MU-MIMO and UL MU-MIMO transmissions are supported on both the entire PPDU bandwidth and portions of the PPDU bandwidth, with the assigned resource unit of size greater than or equal to 242 tones. On a resource unit utilizing MU-MIMO transmission, there is support for up to 8 users with up to 4 spatial streams per user with the total number of spatial streams across all users not exceeding 8. The EHT PHY also supports preamble puncturing of an EHT MU PPDU for both OFDMA and non-OFDMA.

Wi-Fi 7 Draft Standard at 701.

Wi-Fi CERTIFIED 7™ (continued)

MCS 8-9 Rx
MCS 8-9 Tx
MCS 10-11 Rx
MCS 10-11 Tx
MCS 12-13 Rx
MCS 12-13 Tx
Multi-link reconfiguration – AP removal
Multi-link reconfiguration – AP restart
Multi-RU
Operating mode indication
 Operating mode indication for 320 MHz
Static puncturing
STR (Simultaneous Transmit and Receive)
SU-MIMO
Triggered uplink access optimization
UL MU-MIMO
UL OFDMA

Wi-Fi CERTIFIED Certificate for Qualcomm FastConnect 7800 Mobile Connectivity System, Cert. I.D. WFA127693 (2024) (emphasis added).

Thus, when operating as an AP MLD or a non-AP MLD, the Galaxy S24 Ultra is configured such that the wireless networking device's utilization of the available bandwidth of the first and second wireless transceivers does not prevent other wireless networking devices from utilizing a range of frequencies corresponding to the remaining portion of the

USP 11,856,414, Claim 1	Evidence of Use in the Galaxy S24 Ultra
	bandwidth availability of the first and second wireless transceivers for data transmission purposes at the same time that processed data is being sent from the first and second wireless transceivers.