UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
MIDLAND - ODESSA DIVISION

OZMO LICENSING LLC, Plaintiff, v. SONY GROUP CORPORATION, SONY CORPORATION, SONY CORPORATION OF AMERICA, SONY ELECTRONICS INC., Defendants.	Civil Action No. 7:25-cv-0048 JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff, Ozmo Licensing LLC ("Ozmo Licensing"), as and for its Complaint against defendants Sony Group Corporation, Sony Corporation, Sony Corporation of America, and Sony Electronics Inc., hereby alleges as follows:

THE PARTIES

1. Ozmo Licensing is a Texas limited liability company having its principal place of business located at 1000 Heritage Center Circle, Suite 508, Round Rock, Texas 78664.

2. Defendant Sony Group Corporation is a corporation organized and existing under the laws of Japan with its principal executive offices at 1-7-1 Konan Minato-ku, Tokyo, 108-0075 Japan.

3. On information and belief, Defendant Sony Corporation is a corporation organized and existing under the laws of Japan with its principal place of business at 1-7-1 Konan Minato-ku, Tokyo, 108-0075 Japan.

4. On information and belief, Sony Corporation of America ("SCA") is a subsidiary of Sony Group Corporation and is headquartered in New York, NY. *See* https://www.sony.com/content/sony/en/en_us/SCA/who-we-are/overview.html.

5. On information and belief, Sony Electronics Inc. ("SEI") is a subsidiary of SCA and is headquartered in San Diego, California. https://www.sony.com/content/sony/en/en_us/SCA/who-we-are/overview.html#electronics.

6. Sony Group Corporation, Sony Corporation, SCA, and SEI, are referred to hereinafter collectively as "Sony" or "Defendants," and each individually as a "Defendant." On information and belief, Defendants operate, together with other parents, subsidiaries, and affiliates, as part of a group of companies. *See, e.g.*, https://www.sony.com/en/SonyInfo/CorporateInfo/Data/organization.html; https://www.sony.com/en/SonyInfo/News/Press/202005/20-039E/.

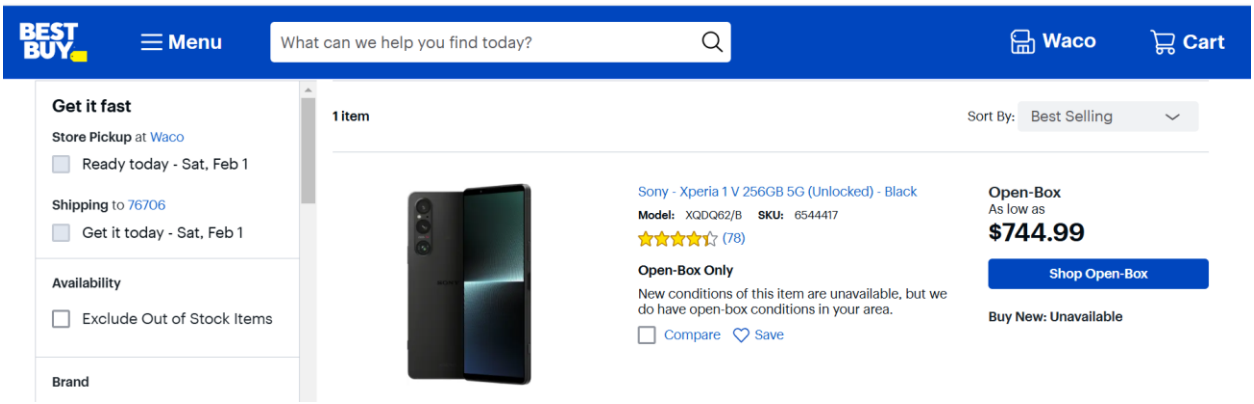
7. Sony has engaged, and continues to engage, in making, using, selling, offering for sale, and/or importing, and/or inducing its subsidiaries, affiliates, retail partners, and customers in the making, using, selling, offering for sale, and/or importing throughout the United States, including within this District, the products accused of infringement, such as mobile phones including Xperia 1 V phones. *See, e.g.*, https://electronics.sony.com/retailers (select "B"); https://www.bestbuy.com/site/sony-store/sony-cell-phones/pcmcat302400050019.c.

8. On information and belief, Sony has induced, and continues to induce, its subsidiaries, affiliates, retail partners, and customers in the past, present, and future making, using, selling, offering for sale, and/or importing throughout the United States, including within this District, the products accused of infringement. Sony provides a distribution channel for the products accused of infringement within this District and the U.S. nationally. On information

and belief, Sony purposefully directs the products accused of infringement into the established distribution channels within this District and the U.S. nationally.

9. On information and belief, Sony maintains a corporate presence in the United States via at least its U.S.-based subsidiaries including at least SCA and SEI.

https://electronics.sony.com/retailers (select "B").



https://www.bestbuy.com/site/sony-store/sony-cell-phones/pcmcat302400050019.c.

JURISDICTION AND VENUE

10. This is an action for patent infringement brought under the Patent Laws of the United States, 35 U.S.C. §§ 271, *et seq.* This Court has jurisdiction over the subject matter of this action under 28 U.S.C. §§ 1331 and 1338(a).

11. This Court has general and specific personal jurisdiction over Sony pursuant to due process and/or the Texas Long Arm Statute. Sony has sufficient minimum contacts with the forum because, *inter alia*, (i) Sony has done and continues to do business in Texas including in this District and (ii) Sony has, directly and through intermediaries committed and continues to commit acts of patent infringement in the State of Texas including in this District. For example, on information and belief, based on LinkedIn listings, Sony, and SEI in particular, has employees at locations throughout Texas, working in areas such as sales, management, etc.

12. Sony has committed acts of infringement and/or has induced infringement in this District by, among other things, making, using, offering to sell, selling (e.g., online and/or through authorized retailers (e.g., Best Buy Co., Inc.) in Texas including in this District, and/or importing, the products (including mobile phones), computers, and other devices that infringe the patents-in-suit (identified below), as alleged herein. Sony has placed, and continues to place, the products accused of infringement into the stream of commerce, via an established distribution channel, with the knowledge and/or understanding that such products are sold in Texas, including in this District.

13. Sony has authorized retailers that offer and sell the products accused of infringement throughout the State of Texas, including in this District, such as Best Buy, 2511 W. Loop 250 N, Midland, Texas 79705 and Best Buy, 6300 E Highway 191, Odessa, Texas 79762. Sony has derived substantial revenues from its infringing acts occurring within Texas and within this District. Sony has substantial business in this State and District, including: (A) at least part of its infringing activities alleged herein; and (B) regularly doing or soliciting business, engaging in other persistent conduct, and/or deriving substantial revenue from infringing goods offered for sale, sold, and imported, and services provided to Texas residents directed and/or through and/or

in concert with its alter egos, subsidiaries, intermediaries, agents, distributors, authorized retailers, importers, customers, and/or consumers.

14. This has given rise to this action and has established more than minimum contacts within this District, such that the exercise of jurisdiction over Sony in this Court would not offend traditional notions of fair play and substantial justice.

15. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391 at least because: (i) a substantial part of the acts of infringement by Defendants that gave rise to the claims in this Complaint have occurred and continue to occur in this District, and (ii) at least one Defendant is a foreign entity.

FACTUAL BACKGROUND

The Patents-in-Suit

16. On December 3, 2013, the United States Patent and Trademark Office (the "USPTO") issued United States Patent No. 8,599,814 ("the '814 patent") (Ex. A1), titled APPARATUS AND METHOD FOR INTEGRATING SHORT-RANGE WIRELESS PERSONAL AREA NETWORKS FOR A WIRELESS LOCAL AREA NETWORK INFRASTRUCTURE. The '814 patent is valid and enforceable.

17. Ozmo Licensing is the owner and assignee of all rights, title and interest in and to the '814 patent and holds all substantial rights therein, including the right to grant licenses, to exclude others, and to enforce and recover past damages for infringement of the '814 patent.

18. On February 16, 2016, the USPTO issued United States Patent No. 9,264,991 ("the '991 patent") (Ex. A2), titled APPARATUS AND METHOD FOR INTEGRATING SHORT-RANGE WIRELESS PERSONAL AREA NETWORKS FOR A WIRELESS LOCAL AREA NETWORK INFRASTRUCTURE. The '991 patent is valid and enforceable.

19. Ozmo Licensing is the owner and assignee of all rights, title and interest in and to the ’991 patent and holds all substantial rights therein, including the right to grant licenses, to exclude others, and to enforce and recover past damages for infringement of the ’991 patent.

20. On December 22, 2020, the USPTO issued United States Patent No. 10,873,906 (“the ’906 patent”) (Ex. A3), titled APPARATUS AND METHOD FOR INTEGRATING SHORT-RANGE WIRELESS PERSONAL AREA NETWORKS FOR A WIRELESS LOCAL AREA NETWORK INFRASTRUCTURE. The ’906 patent is valid and enforceable.

21. Ozmo Licensing is the owner and assignee of all rights, title and interest in and to the ’906 patent and holds all substantial rights therein, including the right to grant licenses, to exclude others, and to enforce and recover past damages for infringement of the ’906 patent.

The Inventors, Ozmo Devices, and Ozmo Licensing

22. The inventions of the ’814 patent, the ’991 patent, and the ’906 patent (the “Ozmo Devices patents” or the “patents-in-suit”) was conceived at Ozmo Devices. Founded in 2004 by spouses Katelijn Vleugels and Roel Peeters, Ozmo Devices was a leading provider of low-power Wi-Fi Personal Area Network (“WPAN”) products that may be deployed in proximity to Wi-Fi Local Area Networks (“WLAN”) products without severe interference arising between the two.

23. Named co-inventors of the patents-in-suit, Vleugels, with a Ph.D. in electrical engineering from Stanford University, and Peeters, with an MBA from The Wharton School, are responsible for inventing a solution to integrate WPAN and WLAN functionalities in a way that delivers cost savings to manufacturers, unprecedented performance to users, and solves the interoperability problems that plagued existing methods of attempted WPAN-WLAN integrations. This patented invention gave rise to what has since been promulgated by the Wi-Fi Alliance as the Wi-Fi Peer-to-Peer Technical Specification (“Wi-Fi Direct Standard,” also

known as "Wi-Fi P2P"), which specification Vleugels and Peeters helped draft. The Wi-Fi Alliance is headquartered in Austin, Texas. Vleugels and Peeters live in the greater Austin area of Texas.

24. The Ozmo Devices patents relate to an apparatus for a WPAN that is seamlessly integrated with a WLAN, and methods for using such, to enable a WPAN device that can connect with other WPAN devices without losing connectivity to a WLAN, thereby enabling extended communication with WPAN devices from anywhere within the range of a WLAN infrastructure.

25. Ozmo Licensing was founded in 2019. A significant aspect of Ozmo Licensing's business is widely and reasonably licensing its current patent portfolio, including the Ozmo Devices patents, with the support of the inventors.

Computer Networks, Protocols, and Wireless Communication Technology

26. A **computer network**[1] is a "collection of autonomous computers interconnected by a single technology." Andrew S. Tanenbaum and David J. Wetherall, Computer Networks ("Computer Networks") at 2 (Prentice Hall, 5th ed. 2011). Networks using different technologies, such as wired or wireless, broadcast or point-to-point, etc., can be interconnected to form a larger network called an internetwork. *Id*. at 28. An **overlay network** is a network that is "overlaid on [a] base network." *Id*. at 430; *see* Larry Peterson and Bruce Davie, Computer Networks: A System Approach at 461 (2019) (describing an overlay network as "a logical network implemented on top of some underlying network"), https://open.umn.edu/opentextbooks/textbooks/771. A "**protocol** is an agreement between the

[1] In this document, the **bold** typeface is used to show emphasized text; quoted claim language is *italicized*.

communicating parties on how communication is to proceed." Computer Networks at 29 (emphasis in original). In computer networks, a network protocol is a set of "rules and conventions" used in a network communication. *Id*.

27. The inventors of the patents-in-suit discovered a problem that is peculiar to wireless networks, and provided a novel solution that features an overlay protocol. Like an overlay network, an overlay protocol employs the concept of overlaying one thing on top of another. An overlay protocol is very different from an overlay network, however, because, as noted above, a network is a collection of interconnected computers. In contrast, a protocol is a set of rules and conventions of communication or data exchange. As such, an overlay protocol is not a new network structure. Rather, it is a set of **new rules** (and conventions) for data exchange that are overlaid on the rules and conventions of data exchange of an underlying protocol.

28. For example, inventors' U.S. Patent Application No. 11/376,753, which is incorporated by reference in each of the patents-in-suit, describes an overlay protocol as "a [secondary wireless network] protocol that has elements that are reuses of elements of a [primary wireless network] protocol." U.S. Patent Application Pub. No. 2006/0227753, ¶ [0057]. The "elements" of a primary wireless network protocol are the rules and conventions thereof. Because the overlay protocol is different from the underlaying protocol, one or more of the new rules of the overlay protocol are necessarily different from the rules and conventions of the underlying protocol. But the concept of overlaying also necessarily implies that the new rules are partially consistent with the rules and conventions of the underlying protocol.

29. In the field of wireless networks, significant accomplishments of the Internet era included standardization of various forms of wireless connectivity, including WLANs and WPANs. An example of a WLAN is an 802.11x (x = a, b, g, n, etc.) network, whose operation is

specified in a handful of versions of the Institute of Electrical and Electronics Engineers (IEEE) 802.11x Standard, including the IEEE Std. 802.11 ("IEEE 802.11-2012," "802.11x," or "IEEE 802.11x"). Since its adoption, the 802.11x standard, commonly known as "Wi-Fi,"[2] has been widely deployed for wireless connectivity in a variety of settings, including in homes, offices, and public establishments. 802.11x WLANs generally support two different modes: infrastructure mode and ad-hoc mode.

30. The Basic Service Set (BSS) is the basic building block of an 802.11x WLAN. In the infrastructure mode, a BSS comprises one or more mobile stations (STAs), such as tablet computers, mobile phones, printers, smart televisions, and the like, and an access point ("AP"), with which all STAs of a BSS are associated. The AP has a radio range that defines the BSS's coverage, within which the member STAs of the BSS may remain in communication with each other via the AP. In the infrastructure-mode BSS, the STAs communicate with one another through the AP, and also communicate with other nodes outside the BSS (including nodes in other adjacent BSSs, or potentially nodes anywhere on the Internet), through the AP.

31. In the ad hoc mode, a BSS comprises two or more STAs that each can all directly talk to one another. Such a BSS is referenced as an Independent BSS, or IBSS. Because this mode of IEEE 802.11x WLAN is often formed without preplanning, for only as long as the WLAN is needed, this mode of network is often referred to as an ad hoc network. The STAs of an IBSS have a collective radio range that defines the IBSS's coverage. By definition, a node in an IBSS according to the Standard does not communicate with nodes in other BSSs, or potentially nodes anywhere on the Internet.

[2] The Wi-Fi technology is promulgated by the Wi-Fi® Alliance, and adopts the IEEE 802.11x Standard. *See* https://www.wi-fi.org/who-we-are; https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-celebrates-25-years-of-wi-fi-innovation-and-impact.

32. An 802.11x WLAN STA, whether in the infrastructure mode (where an STA can also be an AP) or in the ad hoc mode, is less likely to interfere with any other 802.11x WLAN STA's transmissions. This is because all STAs and APs, regardless of whether they are in the same BSS/IBSS or different BSSs/IBSSs, access the wireless medium using the same fundamental method, known as carrier sense multiple access with collision avoidance (CSMA/CA). In CSMA/CA, for an STA or AP to transmit, it shall first listen to or sense the wireless medium to determine if another STA/AP is transmitting. If the wireless medium is not determined to be busy, the transmission may proceed. If the medium is determined to be busy, the STA/AP shall defer until the end of the current transmission.

33. Devices in a WPAN did not follow the CSMA/CA access method prior to the inventions of the Ozmo Devices patents. WPAN devices may communicate directly with each other without the need for an AP to provide connections between those WPAN devices. A well-known example of a WPAN is a Bluetooth connection/network formed between two or more Bluetooth-equipped devices. In order to minimize collisions between several Bluetooth-connected devices, instead of using CSMA/CA, Bluetooth employs a time-division duplex (TDD) scheme. In a TDD scheme, each device transmits only during its allotted time window. Both the range and the data transmission rates of a Bluetooth WPAN are far smaller than those of an 802.11x WLAN operating in infrastructure mode or ad hoc mode. An advantage of the smaller range and communication speed is that Bluetooth communications typically require less power than WLAN communications. Therefore, a Bluetooth network (an a WPAN, in general) can support small devices (e.g., a wireless mouse, wireless headphones, etc.) that have a small battery.

34. Bluetooth WPAN devices may operate in the same 2.4-GHz frequency band in which WLAN devices frequently operate. The co-existence of WPAN and WLAN communications in a single frequency band often results in severe interference due to their different methods of accessing the wireless medium and a lack of synchronization between WPAN and WLAN devices when accessing the wireless medium. Furthermore, a device that supports both Bluetooth WPAN and 802.11 WLAN often requires different hardware and software to support each standard, including different transceivers, and drivers for the transceivers and antennas, which can be functionally duplicative and thus wasteful of resources. While the disharmonious coexistence of Bluetooth WPANs and 802.11x WLANs had long been tolerated, there remained a need for a solution that could more seamlessly integrate WPAN and WLAN communications.

35. The "Background of the Invention" sections of the Ozmo Devices patents describe some of the problems pertaining to the previously contemplated integrations of WLANs and WPANs. Vleugels and Peeters addressed these problems through their inventions. For example, the Ozmo Devices patents describe the lack of synchronization that occurred with then-existing integrations of WLANs and WPANs, resulting in interference from such integrations. *See*, *e.g.*, Ex. A1 (the '814 patent) at 2:22-44.[3]

36. The Ozmo Devices patents note that prior art efforts to address these problems were insufficient. For example, one option was to simply implement WLAN protocols in WPAN devices. *Id.* at 2:45-62. This led to power dissipation and/or low transmission rate problems, and introduced undesirable amounts of latency in communications involving the WPAN devices.

[3] The relevant portions of the specification of the patents-in-suit are identical, and so citations are just to the '814 patent.

For example, the Ozmo Devices patents point out that though WLANs typically operate at relatively high-speed data rates compared to WPANs, they cannot be operated at those faster rates when integrated with WPANs. This is because communication between an AP and its associated STAs occurs at the slowest common data rate supported by any of those associated STAs, and because an STA adapted for a Bluetooth WPAN will typically support only low-speed data rates that are typical of Bluetooth devices. *Id*. at 2:63-3:28. There was thus a recognized need for seamless integration of WPAN into WLAN without the aforementioned problems one would encounter by then existing integrations. *Id*. at 3:29-33.

Overview of Claimed Inventions of Ozmo Devices Patents

37. The inventors of the Ozmo Devices patents determined that an effective way to facilitate a seamless integration between WPAN and WLAN was to provide a wireless device or hub that is a part of both a WLAN and a WPAN. *See* Ex. A1 (the ’814 patent) at Abstract, 3:37-54, 5:51-65, 10:59-11:6 (describing a “‘dual-net’” device). One advantage of such a dual-net device was that via the WLAN, the dual-net device could access not only the AP and other devices of the WLAN, but also any other network, including the Internet, that is connected to the WLAN. The dual-net device could then share the information / data obtained via its WLAN connection with other devices in a WPAN. Thus, though the dual-net device, the WPAN devices may access nodes and exchange data with nodes that are not part of the WPAN. *See id*. at 8:44-58, 11:59-12:12, FIG. 8.

38. The inventors of the Ozmo Devices patents further recognized that the communications between WLAN devices and WPAN devices, where the WLAN and WPAN are coupled through the hub, can occur effectively when the interference between these communications is minimized. An important aspect of minimizing such interference, the

inventors recognized, was to coordinate such communications, or coordinate access to the wireless medium. Via such coordination, two nodes, one on the WLAN and the other on the WPAN, are less likely to transmit simultaneously, resulting in a collision and loss of data. *See id*. at 9:65-10:7. To facilitate such coordination, the inventors of the Ozmo Devices patents invented an "an overlay protocol" (i.e., a protocol that is based on and can coordinate with the underlying protocol), "that is partially compatible with the WLAN protocol, but not entirely." *Id*. at 10:1-5. The use of the overlay protocol allows for power conservation, which is highly desirable for small battery operated devices, on the WPAN devices. *See e.g.*, *id*. at 10:27-38, 11:47-12:18.

The Inventions of the Patents-in-Suit Are Patent Eligible

39. The patents-in-suit addressed a peculiar technological problem. Before the priority date of March 14, 2005 of the patents-in-suit, the use of two different types of wireless networks, namely, WLAN and WPAN, was generally known. Ex. A1 (the '814 patent) at 1:33-39, FIG. 1. While the WLAN networks were typically based on the IEEE 802.11x standard, a unified standard did not exist for the WPAN. *Id*. at 1:40-2:35. The use of different methods of accessing the wireless medium by the different standards caused severe interference and made the co-existence of WLAN and WPAN difficult. *Id*. at 2:35-44. Using the WLAN protocols for WPAN could minimize the interference, but this created a different problem. The devices in a WPAN are typically small, battery operated, such as wireless headphones, wireless mice, etc. To avoid frequent battery replacement, these devices generally have substantial power constraints. The WLAN protocols, however, demand high power and usually cannot meet the power constraints of many WPAN devices. *Id*. at 2:45-3:38.

40. The inventions of the patents-in-suit represented a technical solution to the above-described unsolved technological problems, i.e., minimizing interference between WLAN and WPAN and minimizing the power consumption of WPAN communications. This solution is based on, in part, the ingenious concepts of "maintaining" two wireless network connections via a hub "simultaneously" using two different protocols, and an "overlay protocol" or a "WPAN protocol [that] uses a WLAN protocol frame." These innovative concepts are recited in claim 1 of the '814 patent, claim 1 of the '991 patent, and claims 4 of the '906 patent. The specification of the patents-in-suit describes in technical detail each of the limitations of the claims, allowing a person of ordinary skill in the art to understand what the limitations cover and how the combination of claim elements differed markedly from and enhanced the then existing technology of wireless communications. For example, the specification and incorporated references detail the inventors' novel approach to seamlessly integrating a WPAN into a WLAN infrastructure.

41. Certain exemplary claim limitations are listed below:

- "*a* [*first wireless network* / *first network* / *WLAN*] *protocol*" and "*a* [*second wireless network* / *second network* / *WPAN*] *protocol*" (claim 1 of the '814 patent, claim 1 of the '991 patent, and claim 4 of the '906 patent)
- an "*overlay protocol*" (claim 1 of the '814 patent, claim 1 of the '991 patent, and claim 4 of the '906 patent)
- "*maintaining*" two network connections "*simultaneously*" (claim 1 of the '814 patent, and claim 1 of the '991 patent); and
- providing for a network "*inactivity time*" (claim 4 of the '906 patent).

42. Various claimed features, including but not limited to those listed above, are neither laws of nature, nor mental processes, nor fundamental economic activities. Rather, they are directed to devices and a method to facilitate communications between WLAN and WPAN wireless devices without suffering substantially from one or more of the aforementioned problems. These claims are thus not directed to a result or effect that can be characterized as an abstract idea. These claim elements do not employ generic processes and/or machinery merely to implement an otherwise known or abstract idea.

43. Indeed, the elements claimed by the patents-in-suit, including but not limited to those listed above, taken alone or in combination, were also not well-understood, routine, or conventional to one of ordinary skill in the art at the time of the invention. Compared to the prior art, the claimed devices / method for integrating a WPAN into a WLAN is also cost effective, because communications using the second network / WPAN protocol are based on the first network / WLAN protocol, and hence, at least some of the hardware used for the first / WLAN network can also be used for the second / WPAN network.

44. Compared to the prior art, the claimed devices / method for integrating a WPAN into a WLAN allows the two networks to operate in the same frequency spectrum without causing excessive interference with each other, which allows for an efficient, improved use of the wireless spectrum. Compared to the prior art, the claimed devices / method for integrating a WPAN into a WLAN is also more energy efficient, which can extend the battery life of WPAN devices that are battery powered or otherwise enable power-hungry WPAN devices to enter power-save modes more readily. Compared to the prior art, the claimed devices / method for integrating a WPAN into a WLAN, also enables lower latency communication involving WPAN

devices, which enables a device serving as a hub between WLAN and WPAN devices to exchange data, e.g., via streaming, more effectively between the two devices.

45. Participants in the communications industry chose to incorporate a subset of the claimed devices / method into the Wi-Fi Direct Standard to enjoy at least some of their aforementioned advantages.

46. At least for these reasons, the claims of the patents-in-suit are patent eligible.

COUNT I

(Sony' Infringement of U.S. Patent No. 8,599,814)

47. Paragraphs 1-46 are incorporated by reference as if fully set forth herein.

48. Sony has infringed, and continue to infringe, the '814 patent by making, importing, using, offering for sale, and selling in the United States wireless devices, including at least Sony mobile phones and tablet computers that support Wi-Fi Direct™ feature, e.g., various Xperia™ mobile phones and tablets (i.e., the "Accused Products").

49. Claim 1 of the '814 patent is reproduced below:

Claim Element No.	Claim Limitation
1.pre	A network-enabled hub, usable for facilitating data communications between two or more wireless devices that are configured to communicate indirectly with each other via the network-enabled hub, comprising:
1.a	an interface to a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability;
1.b	logic for processing data received via the wireless radio circuit;
1.c	logic for generating data to be transmitted by the wireless radio circuit;
1.d.1	logic for initiating and maintaining wireless network connections with nodes of a wireless network external to the network-enabled hub,
1.d.2	maintaining at least a first wireless network connection using a first wireless network protocol and a second wireless network connection using a second wireless network protocol, that can be maintained, at times, simultaneously with each other in a common wireless space,

Claim Element No.	Claim Limitation
1.d.3	wherein the second wireless network protocol is an overlay protocol with respect to the first wireless network protocol in that communications using the second wireless network protocol are partially consistent with the first wireless network protocol and
1.d.4	at least some of the communications using the second wireless network protocol impinge on at least some antennae used for the first wireless network; and
1.e	data forwarding logic, implemented in the network-enabled hub using hardware and/or software, that forwards data between an originating node and a destination node, wherein the originating node is a node in one of the first and second wireless networks and the destination node is a node in the other of the first and second wireless networks.

A. Preamble of Claim 1 [1.pre]

50. Sony infringes claim 1 of the '814 patent because the Accused Products, e.g., an Xperia 1 V phone, comprise, *inter alia*, "[*a*] *network-enabled hub, usable for facilitating data communications between two or more wireless devices that are configured to communicate indirectly with each other via the network-enabled hub*." For example, an Xperia 1 V phone can be wirelessly connected to an access point (AP) of a wireless network at home or office. An Xperia 1 V phone can use Wi-Fi Direct to stream video or mirror the screen of the Xperia 1 V phone to another nearby[4] device, e.g., a Sony TV or a TV made by another entity that supports the Wi-Fi Direct feature.

51. Data (e.g., streaming video/audio, webpages, documents, images, etc.) is received by the Xperia 1 V phone from, e.g., the Internet, via the AP, and using Wi-Fi Direct, the received data is displayed on and/or delivered to another device, e.g., a TV, made by Sony or another manufacturer, that supports the Wi-Fi Direct feature (hereinafter, a "Wi-Fi-Direct Compatible TV"), etc. Thus, an Xperia 1 V phone is "*a network-enabled hub, usable for facilitating data*

[4] Within the wireless range of the Xperia 1 V phone.

communications between" an AP (and other networked devices accessible via the AP) and another device, e.g., a "Wi-Fi-Direct Compatible TV," etc. The AP (and networked devices connected thereto) and the other devices are "*two or more wireless devices that are configured to communicate indirectly with each other via*" the Xperia 1 V phone, i.e., "*the network-enabled hub*."

Xperia 1 V 256GB, factory unlocked smartphone, 6.5" 4K 120Hz display, 4K 120fps HDR, true optical zoom, 5G

https://electronics.sony.com/mobile/smartphone/all/p/xqdq62-b

‹ Sony Support | XPERIA 1 V 256GB

Specifications

Operating System	**VERSION** Android™ 13[25] / 2 upgrades of OS / 3 years of security updates
Processor	**CPU** Snapdragon® 8 Gen2 Mobile Platform[20]

Connectivity

OTHER FEATURES

Smart connectivity, Google Cast, NFC, Output video/image via Display Port support Type-C® Cable or Type-C® to HDMI Adapter Cable (Display port 4K/60 fps)[30]

WI-FI

IEEE802.11a/b/g/n/ac/ax, 2.4/5/6 GHz[31]

USB TYPE

Type-C®

USB VERSION

SuperSpeed USB 5 Gbps (USB 3.2)

BLUETOOTH

Bluetooth® 5.3 wireless technology, LE Audio

LOCATION

A-GPS, A-GLONASS, Beidou, Galileo, QZSS[32]

https://www.sony.com/electronics/support/mobile-phones-tablets-mobile-phones/xperia-1-v-256gb/specifications

Smartphone
Xperia 1 V XQ-DQ54/XQ-DQ62/XQ-DQ72

Wirelessly mirroring the screen of your device on a TV

If your TV or other large display supports mirroring, you can enjoy content from your device on the TV or display without using a cable connection.

Mirroring the screen of your device on a supported TV

You can use the Screen mirroring feature to mirror the screen of your device on a TV or other large display without using a cable connection.
Wi-Fi Direct® technology creates a wireless connection between the two devices, so you can sit back and enjoy your favorite photos from the comfort of your couch. You can also use this feature to listen to music from your device using the TV's speakers.

1. **TV**: Follow the instructions in the User guide of your TV to turn on the Screen mirroring function.
2. **Your device**: Find and tap [Settings] > [Device connection] > [Connection preferences] > [Screen mirroring].
3. Tap [START].
4. Tap [OK] and select a device.

Note

- This function can be used with TVs that support the Screen mirroring feature.
- When using Screen mirroring, do not cover the Wi-Fi antenna area of your device.
- When using Screen mirroring, the image quality may sometimes be negatively impacted if there is interference from other Wi-Fi networks.

https://helpguide.sony.net/mobile/xperia-1m5/v1/en/print.pdf

‹ Sony Support

Article ID : 00127499 / Last Modified : 01/05/2023

What is the Wi-Fi Direct feature?

Applicable Products and Categories of This Article

Wi-Fi Direct is a feature that allows audio and video content to be played back from a personal media player or mobile phone directly to a compatible TV without the need for a home network connection. Using a computer, wireless access point, or cable is not necessary. It is a great way to share movies, pictures, and music when friends and family come over using the big, beautiful BRAVIA TV screen, instead of having everyone pass around or crowd around a smaller portable device.

https://www.sony-asia.com/electronics/support/articles/00013745

B. Claim Element 1[a]

52. The Accused Products, e.g., an Xperia 1 V phone, also include, *inter alia*, "*an interface to a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability*." For example, an Xperia 1 V phone supports concurrent: (i) WLAN communication (using the infrastructure mode of the IEEE 802.11x Standard), with an access point (AP), and (ii) peer-to-peer communication with another device that is also based on the IEEE 802.11x Standard (e.g., Wi-Fi-Direct Compatible TV). In particular, an Xperia 1 V phone creates or joins a Wi-Fi Direct P2P network (a peer-to-peer network) while maintaining the infrastructure-mode WLAN connection. Wi-Fi Direct, which is also based on the IEEE 802.11x Standard, is used for the Wi-Fi Direct P2P network. Thus, the WLAN and Wi-Fi Direct communications in an Xperia 1 V phone are both based IEEE 802.11x Standard.

Xperia 1 V 256GB, factory unlocked smartphone, 6.5" 4K 120Hz display, 4K 120fps HDR, true optical zoom, 5G

https://electronics.sony.com/mobile/smartphone/all/p/xqdq62-b

‹ Sony Support | XPERIA 1 V 256GB

Specifications

Operating System	VERSION	Android™ 13[25] / 2 upgrades of OS / 3 years of security updates
Processor	CPU	Snapdragon® 8 Gen2 Mobile Platform[20]

Connectivity	OTHER FEATURES	Smart connectivity, Google Cast, NFC, Output video/image via Display Port support Type-C® Cable or Type-C® to HDMI Adapter Cable (Display port 4K/60 fps)[30]	USB VERSION: SuperSpeed USB 5 Gbps (USB 3.2) BLUETOOTH: Bluetooth® 5.3 wireless technology, LE Audio LOCATION: A-GPS, A-GLONASS, Beidou, Galileo, QZSS[32]
	WI-FI	IEEE802.11a/b/g/n/ac/ax, 2.4/5/6 GHz[31]	
	USB TYPE	Type-C®	

https://www.sony.com/electronics/support/mobile-phones-tablets-mobile-phones/xperia-1-v-256gb/specifications

Smartphone
Xperia 1 V XQ-DQ54/XQ-DQ62/XQ-DQ72

Wirelessly mirroring the screen of your device on a TV

If your TV or other large display supports mirroring, you can enjoy content from your device on the TV or display without using a cable connection.

Mirroring the screen of your device on a supported TV

You can use the Screen mirroring feature to mirror the screen of your device on a TV or other large display without using a cable connection.
Wi-Fi Direct® technology creates a wireless connection between the two devices, so you can sit back and enjoy your favorite photos from the comfort of your couch. You can also use this feature to listen to music from your device using the TV's speakers.

1. **TV**: Follow the instructions in the User guide of your TV to turn on the Screen mirroring function.
2. **Your device**: Find and tap [Settings] > [Device connection] > [Connection preferences] > [Screen mirroring].
3. Tap [START].
4. Tap [OK] and select a device.

Note

- This function can be used with TVs that support the Screen mirroring feature.
- When using Screen mirroring, do not cover the Wi-Fi antenna area of your device.
- When using Screen mirroring, the image quality may sometimes be negatively impacted if there is interference from other Wi-Fi networks.

https://helpguide.sony.net/mobile/xperia-1m5/v1/en/print.pdf

‹ Sony Support

Article ID : 00127499 / Last Modified : 01/05/2023

What is the Wi-Fi Direct feature?

Applicable Products and Categories of This Article

Wi-Fi Direct is a feature that allows audio and video content to be played back from a personal media player or mobile phone directly to a compatible TV without the need for a home network connection. Using a computer, wireless access point, or cable is not necessary. It is a great way to share movies, pictures, and music when friends and family come over using the big, beautiful BRAVIA TV screen, instead of having everyone pass around or crowd around a smaller portable device.

https://www.sony-asia.com/electronics/support/articles/00013745

Wi-Fi Peer-to-Peer (P2P)
Technical Specification
Version 1.7

This document is the specification for the Wi-Fi Alliance Wi-Fi CERTIFIED Wi-Fi Direct® program, which allows Wi-Fi client devices to connect directly without the use of an access point.

Ex. B (Wi-Fi Peer-to-Peer (P2P) Technical Specification Version 1.7) (hereinafter "Wi-Fi-Direct-Spec"), cover page.

1.1 Overview

This document is the Technical Specification for Wi-Fi P2P, a solution for Wi-Fi® device-to-device connectivity. This Specification defines an architecture and set of protocols that facilitate Wi-Fi P2P operation and that are backward compatible with existing Wi-Fi CERTIFIED™ devices when these devices operate outside DMG. For devices operating within DMG, there are no

1.4 Definitions

Directional Multi-Gigabit (DMG): A frequency band wherein the operating channel center frequency is above 45 GHz.

2 Architectural overview

2.1 P2P components

The P2P architecture consists of components that interact to support device-to-device communication.

P2P Device:

— Supports both P2P Group Owner and P2P Client roles.
— Negotiates P2P Group Owner or P2P Client role.
— Supports WSC and P2P Discovery mechanism.
— May support WLAN and P2P concurrent operation.

P2P Group Owner role:

— “AP-like” entity that provides BSS functionality and services for associated Clients (P2P Clients or Legacy Clients) when not operating within DMG, or

2.3 Concurrent operation

A P2P Device can operate concurrently with a WLAN (infrastructure network). Such a device is considered a P2P Concurrent Device. The concurrent operation requires a device to support multiple MAC entities.

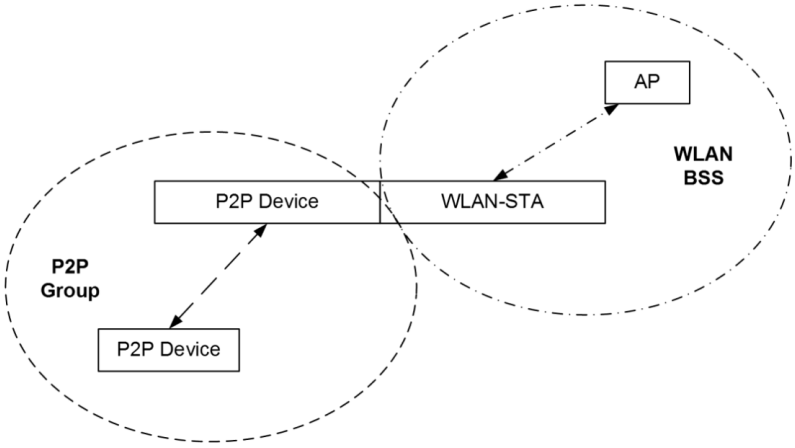


Figure 4—P2P Concurrent device

As an example, Figure 4 shows a P2P Concurrent Device that has one MAC entity operating as a WLAN-STA and the second MAC entity operating as a P2P Device. The dual MAC functionality can be provided via two separate physical MAC entities each associated with its own PHY entity, two virtual MAC entities over one PHY entity, or any other approach. Implementation of multiple MAC functionality is out of scope of this specification.

2.4 Functions and services

2.4.1 Basic functions and services

For P2P operation outside the DMG, this specification assumes that the following STA functions and services are implemented in P2P Devices:

- IEEE 802.11g or newer 2.4 GHz PHY [1]
- IEEE 802.11i (AES-CCMP) [1]
- Wi-Fi Simple Configuration [2]
- Wi-Fi Multimedia [3]

2.4.2 P2P specific functions and services

In addition to the assumed functions listed in Section 2.4.1, a P2P Device supports the following P2P specific functions:

- **P2P Discovery** provides a set of functions to allow a device to easily and quickly identify and connect to another P2P Device and its services in its vicinity.
- **P2P Group Operation** resembles infrastructure BSS operation as defined in IEEE 802.11-2012 [1] when operating outside DMG and PBSS

Ex. B (Wi-Fi-Direct-Spec) at 13-14, 19, 21-23.

53. To support both types of communication, an Xperia 1 V phone includes 802.11 circuitry, referred to as referred to as a "Wi-Fi module," e.g., LBEE5WV2GF provided by Murata Manufacturing Co. Ltd. (hereinafter "Murata").

Report Information	
Report Publish Date	12/28/2023
ItemID / Report Code	426083 / DDT-2309-819
Product Description	
Product Type	Smartphone
Brand	Sony
Device Name	Xperia 1 V
Device Model #	XQ-DQ54
Official Release Date	7/28/2023
Country of Purchase	Poland
Retail Price	$1,399.00
Weight (grams)	188
Device Dimensions (mm)	164.75 x 70.9 x 10.3
Product Features	
Operating System	Android 13
Processor Spec	Octa-Core Qualcomm Snapdragon 8 Gen 2
RAM Support	12 GB Mobile LPDDR5X SDRAM
Communications	Quad-Band GSM/EDGE, W-CDMA(800/850/900/1700/1900/2100MHz), LTE(700/800/850/900/1500/1700/1800/1900/2100/2600MHz), TD-LTE(1900/2000/2300/2500/2600/5500MHz), 5G NR(700/800/850/900/1800/2100/2600MHz), 5G TD-NR(2300/2500/2600/3500/3700MHz).
Connectivity	WiFi 6e, Bluetooth 5.3, GPS, NFC, USB Type-C (USB 3.2, DisplayPort)
User Interface	Capacitive Touchscreen, Side Buttons

Deep Dive Teardown

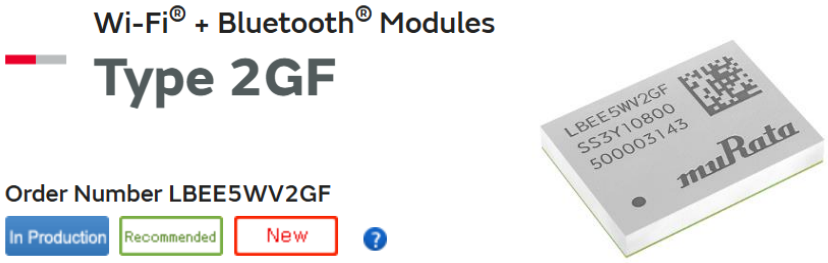
Device Summary - Design notes

Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

The Sony Xperia 1 V is a typical Qualcomm based design, using well-known components: Qualcomm SM8550-AB Snapdragon Processor and Qualcomm SDR735 RF Transceiver with matching power managements, SK Hynix's RAM, and flash.

The RF design is highly integrated, and most filtering occurs inside modules. There is little filtering directly on PCB, except for some diplexer signal splitting. The biggest integration appeared in WiFi design. In high-end smartphones the signal is typically split into 2.4 and 5 GHz frequencies and passed to four WiFi Front-End modules and then delivered to WiFi Module. In the Sony Xperia 1 V the signal from the antennas is initially filtered and then fed directly to Murata's WiFi LBEE5??2GH Module which consists of two NXP 2.4 GHz WiFi Front-End, two NXP 5 to 7.2 GHz WiFi Front-End and Qualcomm Wi-Fi 7/Bluetooth 5.3 dies.

https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents



https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

54. Each of the WLAN and Wi-Fi Direct communications comprises "*bi-directional wireless data communication*," at least, e.g., to exchange information required to establish the respective corresponding networks. Thus, the Wi-Fi module comprises "*a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability*." Moreover, at least some of these Wi-Fi modules are based on the CYW43022 chipset that uses "WLAN interface: [secure digital input output] SDIO 3.0 and SDIO 3.0" to provide both the Wi-Fi based infrastructure-mode communication and the Wi-Fi based peer-to-peer communication. Accordingly, the Wi-Fi module comprises "*an interface to a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability*."

1 Scope

This specification characterizes the IEEE 802.11a/b/g/n/ac WLAN + Bluetooth 5.4 combo module.

2 Key Features

- Infineon CYW43022 inside
- Supports IEEE 802.11a/b/g/n/ac specification: Dual band 2.4 GHz and 5 GHz
- Supports MCS8 (256-QAM) for 20MHz channels enabling data rates up to 78 Mbps.
- Supports Bluetooth specification version 5.4.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0

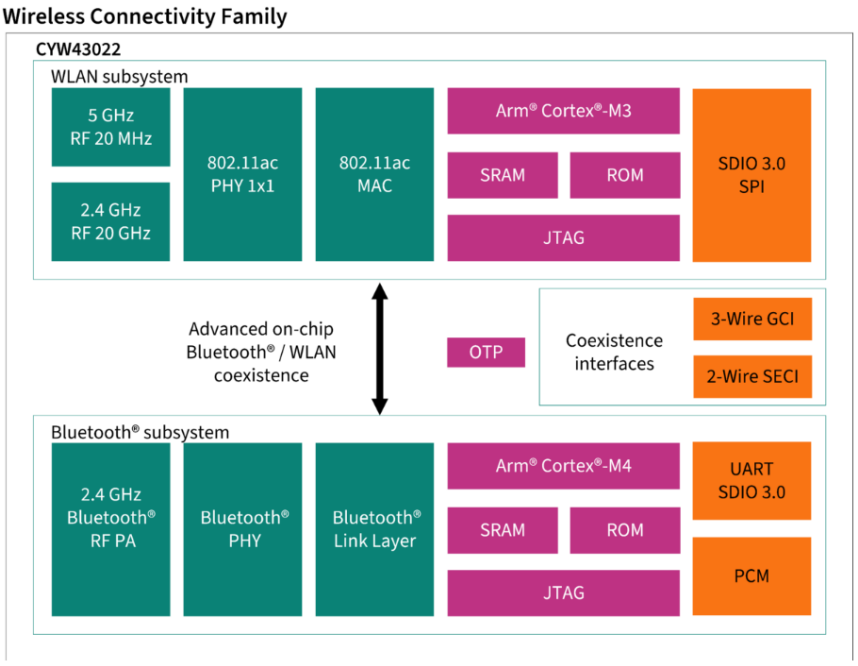
https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

Ultra-low Power 1x1 Dual-band Wi-Fi 5 (802.11ac) + Bluetooth® 5.4 combo

Infineon's AIROC™ CYW43022 an ultra-low power single-chip, combo device features 1x1 dual-band 2.4 GHz and 5 GHz Wi-Fi 5 (802.11ac) and Bluetooth® 5.4. With a low-power architecture, the CYW43022 is ideal for battery powered applications where best-in-class power consumption is critical. An embedded Bluetooth stack and Wi-Fi networking offloads allow the CYW43022 to maintain connectivity activity even while a host processor is in low-power sleep mode. The CYW43022 supports 256-QAM enabling data rates up to 78 Mbps. On-chip power amplifier and low-noise amplifiers are included for both the 2.4 and 5GHz bands plus an internal +20dBm Bluetooth power amplifier.

— General Features

- Best-in-class power consumption in active and power saving modes with MCU network offload and embedded Bluetooth ® stack
- SPI and SDIO v2.0 / v3.0 for WiFi - optional shared SDIO host interface for Wi-Fi and Bluetooth®
- UART/PCM host interface for Bluetooth®
- Support for both RTOS and Linux/Android (A-Class) host designs
- 40 GPIOs



https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/

C. Claim Element [1.b]

55. Moreover, the Accused Products, e.g., an Xperia 1 V phone, includes, *inter alia*, "*logic for processing data received via the wireless radio circuit*." For example, the Wi-Fi modules that Murata provides, and that is included in an Xperia 1 V phone supports "256-QAM" and includes the CYW43022 chipset. In order to transmit / receive Wi-Fi data, the Wi-Fi module / the CYW43022 chipset perform quadrature amplitude modulation and demodulation (QAM), e.g., "256-QAM." To perform such baseband operations, the CYW43022 chipset includes an ARM Cortex® processor, which comprises "*logic for processing data received via the wireless radio circuit*."

1 Scope

This specification characterizes the IEEE 802.11a/b/g/n/ac WLAN + Bluetooth 5.4 combo module.

2 Key Features

- Infineon CYW43022 inside
- Supports IEEE 802.11a/b/g/n/ac specification: Dual band 2.4 GHz and 5 GHz
- Supports MCS8 (256-QAM) for 20MHz channels enabling data rates up to 78 Mbps.
- Supports Bluetooth specification version 5.4.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0

https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

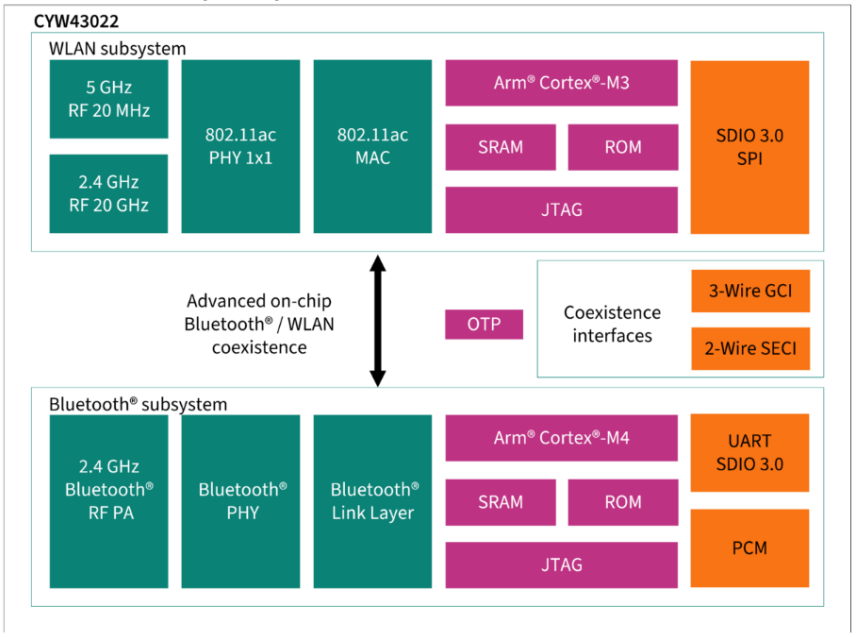
Ultra-low Power 1x1 Dual-band Wi-Fi 5 (802.11ac) + Bluetooth® 5.4 combo

Infineon's AIROC™ CYW43022 an ultra-low power single-chip, combo device features 1x1 dual-band 2.4 GHz and 5 GHz Wi-Fi 5 (802.11ac) and Bluetooth® 5.4. With a low-power architecture, the CYW43022 is ideal for battery powered applications where best-in-class power consumption is critical. An embedded Bluetooth stack and Wi-Fi networking offloads allow the CYW43022 to maintain connectivity activity even while a host processor is in low-power sleep mode. The CYW43022 supports 256-QAM enabling data rates up to 78 Mbps. On-chip power amplifier and low-noise amplifiers are included for both the 2.4 and 5GHz bands plus an internal +20dBm Bluetooth power amplifier.

— Wi-Fi Features

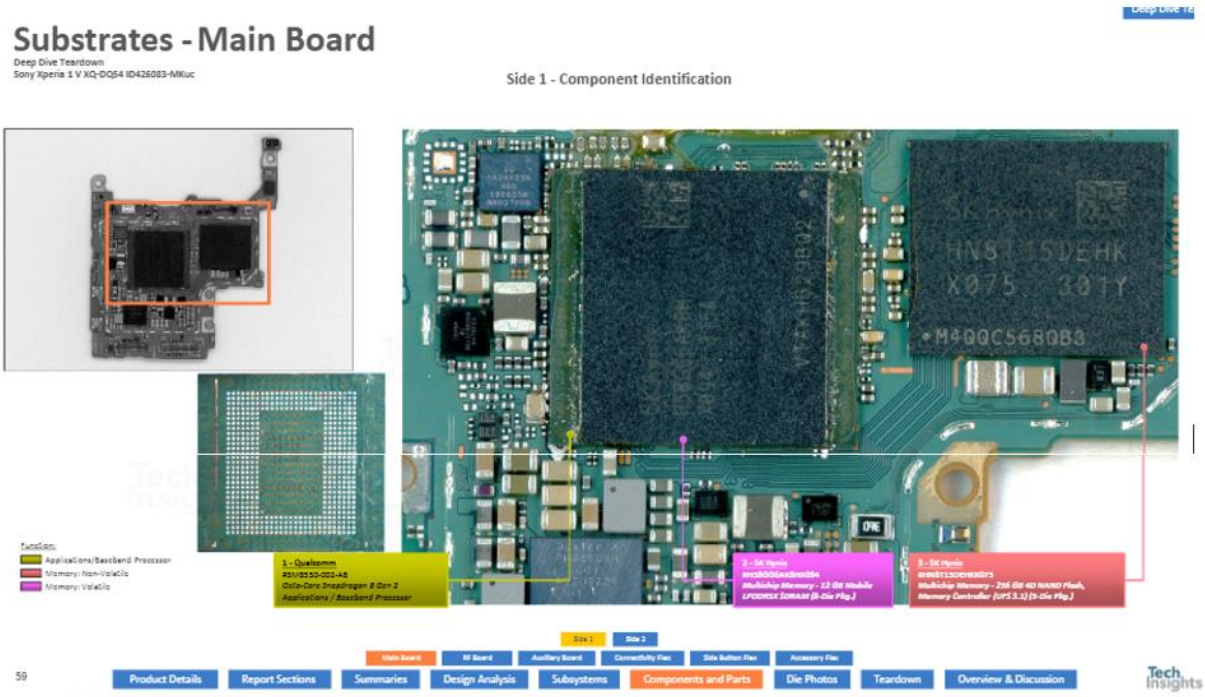
- Wi-Fi 5 (802.11ac) Dual-band (2.4/5 GHz)
- 1x1 SISO
- MCS8 (256-QAM) for 20MHz channels, up to 78Mbps PHY data rate
- Internal PA and LNA for both bands

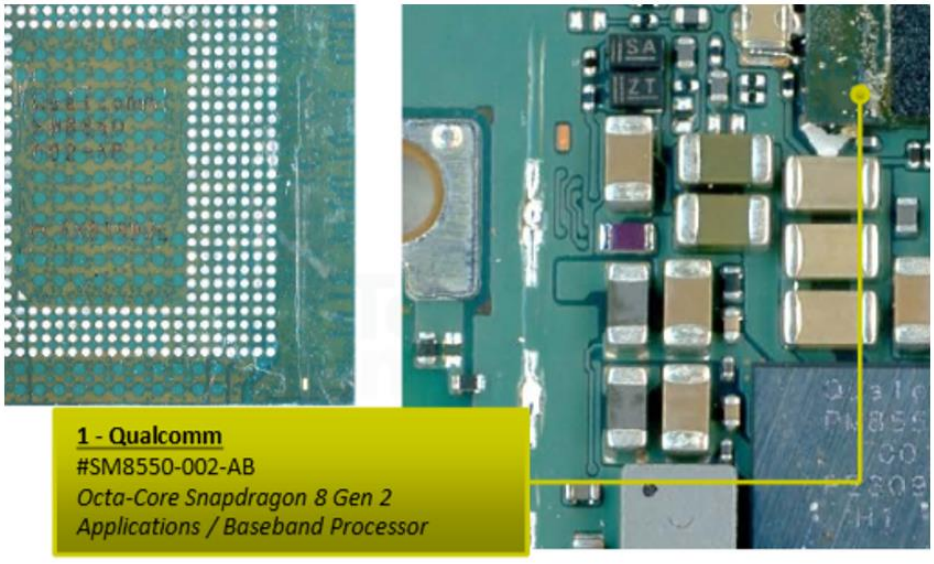
Wireless Connectivity Family



https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/

56. In addition, an Xperia 1 V phone includes a Qualcomm™ "Octa-Core Snapdragon[™] 8 Gen 2 Applications / Baseband Processor" (hereinafter "Snapdragon processor." The Snapdragon processor also comprises "*logic for processing data received via the wireless radio circuit*."





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D. Claim Element [1.c]

57. The Accused Products, e.g., an Xperia 1 V phone, further includes, *inter alia*, "*logic for generating data to be transmitted by the wireless radio circuit*." For example, the

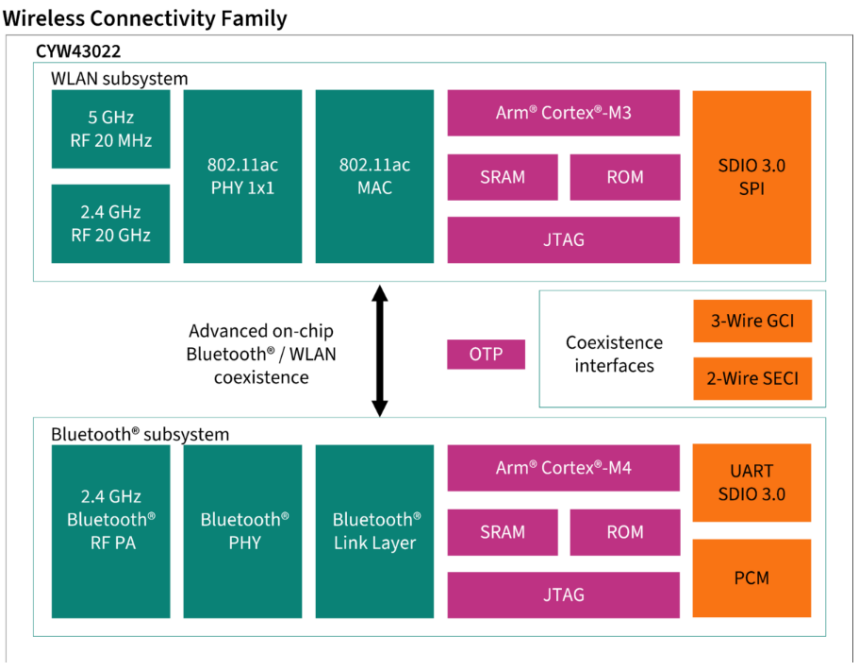
ARM Cortex® processor included in a CYW43022 chipset included in a Wi-Fi module that is included in an Xperia 1 V phone, *see supra*, ¶55, also modulates data for transmission, e.g., using 256 QAM modulation. The ARM Cortex® processor, therefore, comprises "*logic for generating data to be transmitted by the wireless radio circuit*." In addition, the Snapdragon processor included in an Xperia 1 V phone, *see supra*, ¶56, also generates data for transmission, and thus comprises "*logic for generating data to be transmitted by the wireless radio circuit*."

Ultra-low Power 1x1 Dual-band Wi-Fi 5 (802.11ac) + Bluetooth® 5.4 combo

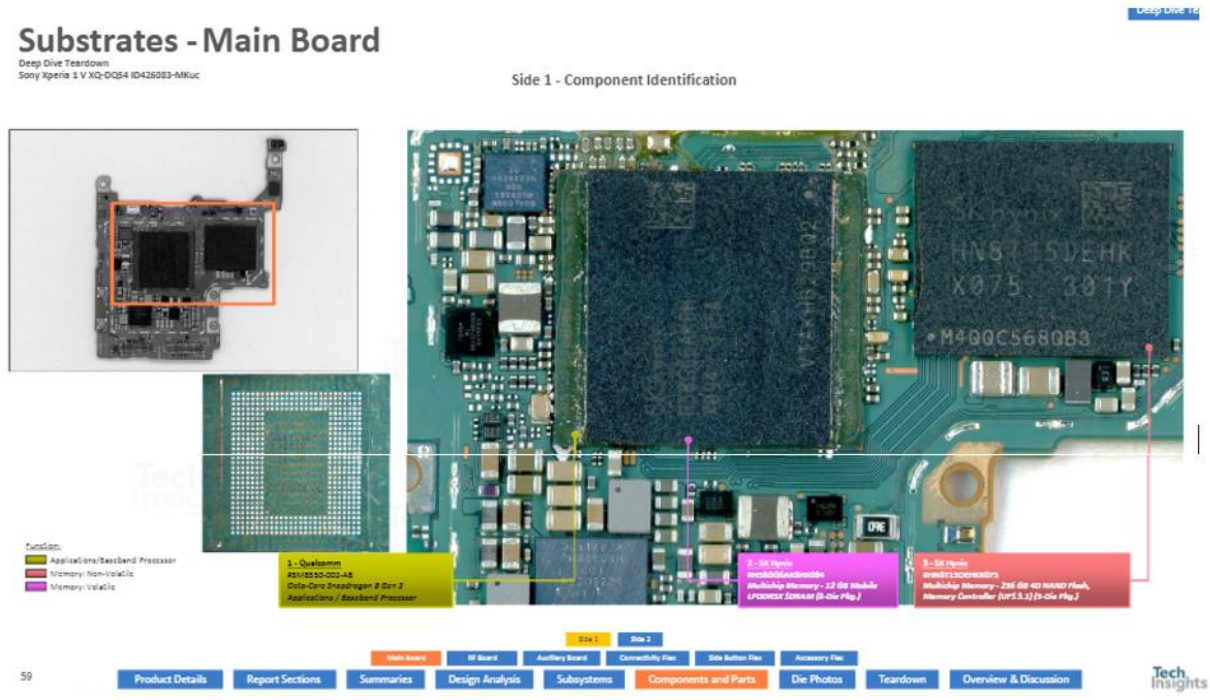
Infineon's AIROC™ CYW43022 an ultra-low power single-chip, combo device features 1x1 dual-band 2.4 GHz and 5 GHz Wi-Fi 5 (802.11ac) and Bluetooth® 5.4. With a low-power architecture, the CYW43022 is ideal for battery powered applications where best-in-class power consumption is critical. An embedded Bluetooth stack and Wi-Fi networking offloads allow the CYW43022 to maintain connectivity activity even while a host processor is in low-power sleep mode. The CYW43022 supports 256-QAM enabling data rates up to 78 Mbps. On-chip power amplifier and low-noise amplifiers are included for both the 2.4 and 5GHz bands plus an internal +20dBm Bluetooth power amplifier.

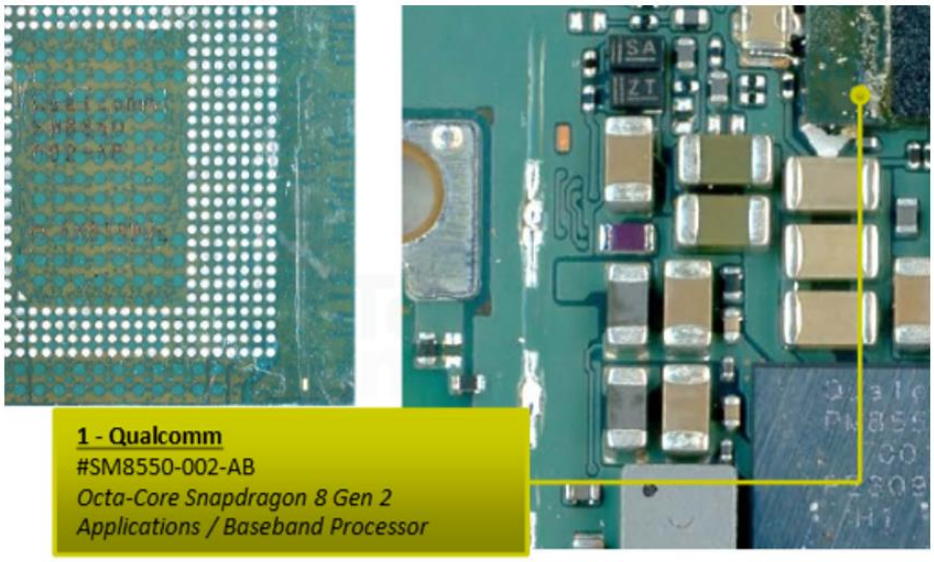
— Wi-Fi Features

- Wi-Fi 5 (802.11ac) Dual-band (2.4/5 GHz)
- 1x1 SISO
- MCS8 (256-QAM) for 20MHz channels, up to 78Mbps PHY data rate
- Internal PA and LNA for both bands



https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/





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E. Claim Element [1.d.1]

58. Additionally, the Accused Products, e.g., an Xperia 1 V phone, includes, *inter alia*, "*logic for initiating and maintaining wireless network connections with nodes of a wireless network external to the network-enabled hub*." For example, an Xperia 1 V phone is wirelessly connected to a WLAN, e.g., to an access point (AP). Additionally, that Xperia 1 V phone can also be connected concurrently in a Wi-Fi Direct P2P network, e.g., to facilitate mirroring, to another device, e.g., Wi-Fi-Direct Compatible TV. Thus, the Xperia 1 V phone is a "*network-enabled hub*" that is connected to both the AP of a WLAN and another device (e.g., a Wi-Fi-Direct Compatible TV). The AP and the other device comprise "*nodes of a wireless network external to the network-enabled hub*."

59. The Xperia 1 V phone initiates and maintains a WLAN BSS connection with the AP using the protocol for an infrastructure-mode BSS per the IEEE 802.11x Standard (hereinafter the "infrastructure-mode protocol") and using the Wi-Fi module included in the Xperia 1 V phone. *See supra*, ¶¶ 55-57 (claim elements [1.b], [1.c]). The Wi-Fi Direct P2P

connection is initiated and maintained concurrently with the WLAN connection using the Wi-Fi Direct protocol (referred to in the Wi-Fi Direct Standard as the "P2P protocol"). Ex. B (Wi-Fi-Direct-Spec) at 71, 89. The Wi-Fi Direct protocol is based on the IEEE 802.11 (i.e., Wi-Fi) Standard, and, thus, the Wi-Fi Direct protocol and the Wi-Fi Direct P2P connection also use the Wi-Fi module included in the Xperia 1 V phone. *see supra*, ¶¶ 55-57. Accordingly, the Wi-Fi module included in the Xperia 1 V phone comprises "*logic for initiating and maintaining wireless network connections with nodes of a wireless network external to the network-enabled hub*."

Xperia 1 V 256GB, factory unlocked smartphone, 6.5" 4K 120Hz display, 4K 120fps HDR, true optical zoom, 5G

https://electronics.sony.com/mobile/smartphone/all/p/xqdq62-b

‹ Sony Support | XPERIA 1 V 256GB

Specifications

Operating System

VERSION

Android™ 13[25] / 2 upgrades of OS / 3 years of security updates

Processor

CPU

Snapdragon® 8 Gen2 Mobile Platform[20]

Connectivity

OTHER FEATURES

Smart connectivity, Google Cast, NFC, Output video/image via Display Port support Type-C® Cable or Type-C® to HDMI Adapter Cable (Display port 4K/60 fps)[30]

WI-FI

IEEE802.11a/b/g/n/ac/ax, 2.4/5/6 GHz[31]

USB TYPE

Type-C®

USB VERSION

SuperSpeed USB 5 Gbps (USB 3.2)

BLUETOOTH

Bluetooth® 5.3 wireless technology, LE Audio

LOCATION

A-GPS, A-GLONASS, Beidou, Galileo, QZSS[32]

https://www.sony.com/electronics/support/mobile-phones-tablets-mobile-phones/xperia-1-v-256gb/specifications

‹ Sony Support

Article ID : SX043402 / Last Modified : 11/01/2024

Can't connect to the internet using a Wi-Fi connection

Applicable Products and Categories of This Article

Applicable Products

- Mobile Phones & Tablets
  - Mobile phones
    - Xperia 1
    - Xperia 1 II
    - Xperia 1 III
    - Xperia 1 IV 512GB
    - Xperia 1 V 256GB
    - Xperia 10

Try these actions one after the other. Verify whether the problem was solved after each step before trying the next one.

- Make sure your Wi-Fi® or router is on, and you are within range of it. Next, check the Wi-Fi signal strength in the status bar of your Xperia® device. If the signal is low or there is no signal, move closer to the router. If you're in a public place, move closer to the Wi-Fi hotspot, which provides the Wi-Fi network.
- Make sure your Wi-Fi is on in your Xperia device, and you can see your Wi-Fi network in **Settings**. If **Connected** appears under the network name, you're connected. If not, tap the network name to connect. For secured networks, enter the relevant password. Contact your Internet service provider or your organization's Wi-Fi network administrator if you need a password.
- If you are in a location with several Wi-Fi hotspots, make sure you have selected the correct hotspot.
- Some Wi-Fi networks require that you sign in to a web page before accessing the network. So, first, open the web browser on your device to sign in. Then, contact the Wi-Fi network administrator for more information.
- Don't cover the Wi-Fi antenna area of your device.
- Restart your device. Turn off Wi-Fi and then turn it on again.
- Android versions 4.3–5.1: Turn off Wi-Fi. Disable **Scanning always available** in Wi-Fi settings. Turn on the Wi-Fi again.

- Restart the router. Check that your router is Wi-Fi certified. Your device is Wi-Fi certified, so the devices may not communicate appropriately if the router isn't.
- Make sure that both the Xperia device and the router use the latest software versions.
  - Check the user guide or contact the manufacturer if you need help updating the router software.
- Check the router settings using your computer. If you need help changing the settings, check the router user guide and contact the manufacturer.
  - **Network mode/speed**: Change to **auto** or **mixed** mode instead of **b**, **g**, or **n**.
  - **SSID** and **password**: Make sure there are no special characters or characters not in the standard ASCII character set.
  - **DHCP**: Make sure it's turned on in the router. You could also set a static IP address in your Xperia device if you have problems accessing the Internet using your Wi-Fi connection. Contact your Internet service provider for information about the IP address settings.
  - **MAC filter**: Make sure it's turned off. Also, set your device as allowed by adding your device's MAC address to the MAC filtering table of the Wi-Fi router. Some routers require your MAC address. For instructions on adding the MAC address to the router's MAC filtering table, check the router's user guide or contact your router manufacturer.
  - **Channel**: Try using another channel, preferably 11 or lower. Check that your access point/router is not set to use channels 12 or 13. These channels are not supported in all markets.
  - Change the Wi-Fi network security of your router to different security encryption. Check the router user guide or contact your router manufacturer for instructions on changing the network security.
- On your Xperia device, set the Wi-Fi sleep policy to **Keep Wi-Fi on during sleep** to **Always**. The device stays connected to the current Wi-Fi network, even on standby.
- Often, Bluetooth® and Wi-Fi use the same frequency band, 2.4GHz. If available, set your device to use the Wi-Fi connection of the 5GHz frequency band. Alternatively, turn off Bluetooth if you don't need it.

https://www.sony.com/electronics/support/articles/SX043401

Smartphone
Xperia 1 V XQ-DQ54/XQ-DQ62/XQ-DQ72

Wirelessly mirroring the screen of your device on a TV

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4. Tap [OK] and select a device.

Note

- This function can be used with TVs that support the Screen mirroring feature.
- When using Screen mirroring, do not cover the Wi-Fi antenna area of your device.
- When using Screen mirroring, the image quality may sometimes be negatively impacted if there is interference from other Wi-Fi networks.

https://helpguide.sony.net/mobile/xperia-1m5/v1/en/print.pdf

2 Architectural overview

2.1 P2P components

The P2P architecture consists of components that interact to support device-to-device communication.

P2P Device:

— Supports both P2P Group Owner and P2P Client roles.
— Negotiates P2P Group Owner or P2P Client role.
— Supports WSC and P2P Discovery mechanism.
— May support WLAN and P2P concurrent operation.

P2P Group Owner role:

— “AP-like” entity that provides BSS functionality and services for associated Clients (P2P Clients or Legacy Clients) when not operating within DMG, or

2.3 Concurrent operation

A P2P Device can operate concurrently with a WLAN (infrastructure network). Such a device is considered a P2P Concurrent Device. The concurrent operation requires a device to support multiple MAC entities.

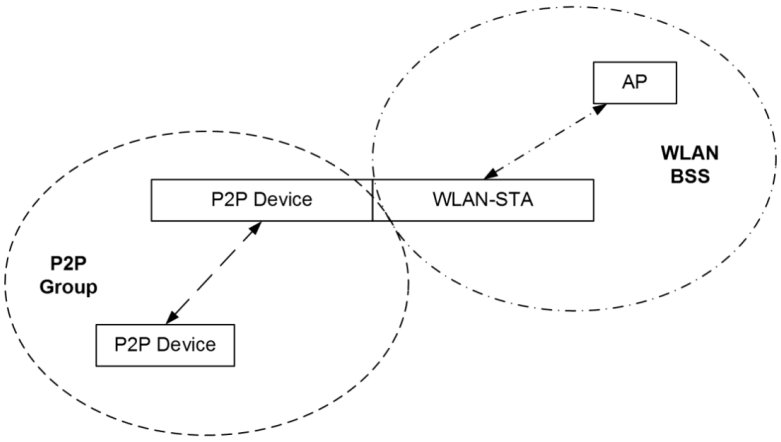


Figure 4—P2P Concurrent device

As an example, Figure 4 shows a P2P Concurrent Device that has one MAC entity operating as a WLAN-STA and the second MAC entity operating as a P2P Device. The dual MAC functionality can be provided via two separate physical MAC entities each associated with its own PHY entity, two virtual MAC entities over one PHY entity, or any other approach. Implementation of multiple MAC functionality is out of scope of this specification.

Ex. B (Wi-Fi-Direct-Spec) at 19, 21.

F. Claim Element [1.d.2]

60. The Accused Products, e.g., an Xperia 1 V phone, also includes, *inter alia*, "*logic for … maintaining at least a first wireless network connection using a first wireless network protocol and a second wireless network connection using a second wireless network protocol, that can be maintained, at times, simultaneously with each other in a common wireless space*." This is because an Xperia 1 V phone is wirelessly connected to a WLAN BSS, e.g., to an access point (AP), using the infrastructure-mode protocol. Thus, an Xperia 1 V phone "*maintain*[*s*] *at least* [a WLAN connection, i.e.,] *a first wireless network connection using* [the infrastructure-mode protocol, i.e.,] *a first wireless network protocol*." Additionally, to facilitate mirroring, the Xperia 1 V phone can also be connected concurrently in a Wi-Fi Direct P2P network to another device (e.g., a Wi-Fi Direct-Compatible TV) using the Wi-Fi Direct protocol. Thus, the Xperia 1 V phone also "*maintain*[*s*] … [a Wi-Fi Direct P2P connection, i.e.,] *a second wireless network connection using* [the Wi-Fi Direct protocol, i.e.] *a second wireless network protocol*."

61. The W-Fi Direct protocol is an IEEE 802.11 based wireless protocol that uses some of the same channels that the infrastructure-mode protocol uses, and a "P2P Device can operate **concurrently** with a WLAN (infrastructure network)" and "is considered a **P2P Concurrent Device**." Ex. B (Wi-Fi-Direct-Spec) at 21. Therefore, the Wi-Fi Direct protocol is "*a second wireless network protocol that can be maintained, at times, simultaneously with each other in a common wireless space*." Finally, the Wi-Fi module of an Xperia 1 V phone facilitates both the WLAN and the Wi-Fi Direct P2P connections. *See supra*, 52-55 (claim elements [1.a], [1.b]). Therefore, the logic used by the Wi-Fi module, including but not limited to the Wi-Fi driver, comprises "*logic for … maintaining at least a first wireless network*

connection using a first wireless network protocol and a second wireless network connection using a second wireless network protocol, that can be maintained, at times, simultaneously with each other in a common wireless space."

‹ Sony Support

Article ID : SX043402 / Last Modified : 11/01/2024

Can't connect to the internet using a Wi-Fi connection

Applicable Products and Categories of This Article

Applicable Products

- Mobile Phones & Tablets
  - Mobile phones
    - Xperia 1
    - Xperia 1 II
    - Xperia 1 III
    - Xperia 1 IV 512GB
    - Xperia 1 V 256GB
    - Xperia 10

Try these actions one after the other. Verify whether the problem was solved after each step before trying the next one.

- Make sure your Wi-Fi® or router is on, and you are within range of it. Next, check the Wi-Fi signal strength in the status bar of your Xperia® device. If the signal is low or there is no signal, move closer to the router. If you're in a public place, move closer to the Wi-Fi hotspot, which provides the Wi-Fi network.
- Make sure your Wi-Fi is on in your Xperia device, and you can see your Wi-Fi network in **Settings**. If **Connected** appears under the network name, you're connected. If not, tap the network name to connect. For secured networks, enter the relevant password. Contact your Internet service provider or your organization's Wi-Fi network administrator if you need a password.
- If you are in a location with several Wi-Fi hotspots, make sure you have selected the correct hotspot.
- Some Wi-Fi networks require that you sign in to a web page before accessing the network. So, first, open the web browser on your device to sign in. Then, contact the Wi-Fi network administrator for more information.
- Don't cover the Wi-Fi antenna area of your device.
- Restart your device. Turn off Wi-Fi and then turn it on again.
- Android versions 4.3–5.1: Turn off Wi-Fi. Disable **Scanning always available** in Wi-Fi settings. Turn on the Wi-Fi again.
- Restart the router. Check that your router is Wi-Fi certified. Your device is Wi-Fi certified, so the devices may not communicate appropriately if the router isn't.
- Make sure that both the Xperia device and the router use the latest software versions.
  - Check the user guide or contact the manufacturer if you need help updating the router software.
- Check the router settings using your computer. If you need help changing the settings, check the router user guide and contact the manufacturer.
  - **Network mode/speed**: Change to **auto** or **mixed** mode instead of **b**, **g**, or **n**.
  - **SSID** and **password**: Make sure there are no special characters or characters not in the standard ASCII character set.
  - **DHCP**: Make sure it's turned on in the router. You could also set a static IP address in your Xperia device if you have problems accessing the Internet using your Wi-Fi connection. Contact your Internet service provider for information about the IP address settings.
  - **MAC filter**: Make sure it's turned off. Also, set your device as allowed by adding your device's MAC address to the MAC filtering table of the Wi-Fi router. Some routers require your MAC address. For instructions on adding the MAC address to the router's MAC filtering table, check the router's user guide or contact your router manufacturer.
  - **Channel**: Try using another channel, preferably 11 or lower. Check that your access point/router is not set to use channels 12 or 13. These channels are not supported in all markets.
  - Change the Wi-Fi network security of your router to different security encryption. Check the router user guide or contact your router manufacturer for instructions on changing the network security.

- On your Xperia device, set the Wi-Fi sleep policy to **Keep Wi-Fi on during sleep** to **Always**. The device stays connected to the current Wi-Fi network, even on standby.
- Often, Bluetooth® and Wi-Fi use the same frequency band, 2.4GHz. If available, set your device to use the Wi-Fi connection of the 5GHz frequency band. Alternatively, turn off Bluetooth if you don't need it.

https://www.sony.com/electronics/support/articles/SX043401

Smartphone
Xperia 1 V XQ-DQ54/XQ-DQ62/XQ-DQ72

Wirelessly mirroring the screen of your device on a TV

If your TV or other large display supports mirroring, you can enjoy content from your device on the TV or display without using a cable connection.

Mirroring the screen of your device on a supported TV

You can use the Screen mirroring feature to mirror the screen of your device on a TV or other large display without using a cable connection.
Wi-Fi Direct® technology creates a wireless connection between the two devices, so you can sit back and enjoy your favorite photos from the comfort of your couch. You can also use this feature to listen to music from your device using the TV's speakers.

1. **TV**: Follow the instructions in the User guide of your TV to turn on the Screen mirroring function.
2. **Your device**: Find and tap [Settings] > [Device connection] > [Connection preferences] > [Screen mirroring].
3. Tap [START].
4. Tap [OK] and select a device.

Note

- This function can be used with TVs that support the Screen mirroring feature.
- When using Screen mirroring, do not cover the Wi-Fi antenna area of your device.
- When using Screen mirroring, the image quality may sometimes be negatively impacted if there is interference from other Wi-Fi networks.

https://helpguide.sony.net/mobile/xperia-1m5/v1/en/print.pdf

1.4 Definitions

Directional Multi-Gigabit (DMG): A frequency band wherein the operating channel center frequency is above 45 GHz.

In-band: Data transfer using the WLAN communication channel, including WLAN multiband devices (e.g. 2.4GHz, 5GHz, and 60GHz).

2 Architectural overview

2.1 P2P components

The P2P architecture consists of components that interact to support device-to-device communication.

P2P Device:

— Supports both P2P Group Owner and P2P Client roles.
— Negotiates P2P Group Owner or P2P Client role.
— Supports WSC and P2P Discovery mechanism.
— May support WLAN and P2P concurrent operation.

P2P Group Owner role:

— "AP-like" entity that provides BSS functionality and services for associated Clients (P2P Clients or Legacy Clients) when not operating within DMG, or

2.3 Concurrent operation

A P2P Device can operate concurrently with a WLAN (infrastructure network). Such a device is considered a P2P Concurrent Device. The concurrent operation requires a device to support multiple MAC entities.

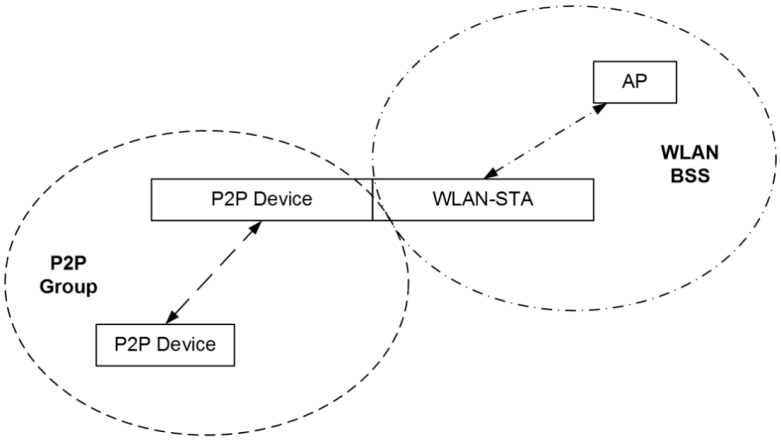


Figure 4—P2P Concurrent device

As an example, Figure 4 shows a P2P Concurrent Device that has one MAC entity operating as a WLAN-STA and the second MAC entity operating as a P2P Device. The dual MAC functionality can be provided via two separate physical MAC entities each associated with its own PHY entity, two virtual MAC entities over one PHY entity, or any other approach. Implementation of multiple MAC functionality is out of scope of this specification.

Ex. B (Wi-Fi-Direct-Spec) at 13-14, 19, 21.

G. Claim Element [1.d.3]

62. In the Accused Products, e.g., an Xperia 1 V phone, "*the second wireless network protocol is an overlay protocol with respect to the first wireless network protocol in that*

communications using the second wireless network protocol are partially consistent with the first wireless network protocol." This is because, as discussed for claim element [1.d.2] an Xperia 1 V phone uses the infrastructure-mode protocol per the IEEE 802.11x Standard, as the "*first wireless network protocol*" and the Wi-Fi Direct protocol, which is also based on the IEEE 802.11x Standard, as the "*second wireless network protocol*." *See supra*, ¶¶ 60-61. Specifically, the Wi-Fi Direct protocol uses frames defined by the IEEE 802.11x Standard, and hence, as further discussed below, is "*an overlay protocol with respect to the first wireless network protocol in that communications using the second wireless network protocol are partially consistent with the first wireless network protocol*."

63. In prior litigation, "*an overlay protocol*" has been construed as:

> a second wireless network protocol that has elements that are **reuses of elements of a first wireless protocol** to provide one or more advantages, e.g., ability to use some common hardware components for both networks, the ability to communicate in the second wireless network without having to disassociate with the first wireless network, the ability to signal in the SWN with signals that are understood by second wireless network devices but are such that they are, if not understood, are acted upon by first wireless network devices to provide desirable actions, etc.

(emphasis added).

64. The infrastructure-mode protocol uses frames defined by the IEEE 802.11 (i.e., Wi-Fi) Standard. *See infra*, ¶¶ 67-71. The Wi-Fi Direct protocol also uses at least some of these frames, e.g., Management frames, and the mandatory fields of these frames. Therefore, the Wi-Fi Direct protocol "*has elements that are **reuses of elements of*** [the infrastructure-mode protocol, i.e.,] ***first wireless protocol***."

65. It should be noted that the benefits of the "*overlay protocol*" listed in the prior construction are examples; none of the specifically listed benefits must necessarily be provided. Nevertheless, the Wi-Fi Direct protocol provides at least two of the listed benefits. First, the

reuses of the IEEE 802.11 frames and fields provide the benefits of at least partial reuse of the Wi-Fi module and the associated Wi-Fi driver, i.e., the "ability to use some common hardware components for both networks," per the prior construction. *See supra*, ¶¶ 55-61.

66. Second, as discussed for claim element [1.d.2], while using the Wi-Fi Direct protocol, a P2P Concurrent Device can operate **concurrently** with a WLAN (infrastructure network)" and the W-Fi Direct P2P network. Ex. B (Wi-Fi-Direct-Spec) at 21. Therefore, an Xperia 1 V phone can simultaneously remain connected to both the WLAN, i.e., the "*first wireless network*" and the Wi-Fi Direct P2P network, i.e., the "*second wireless network*." Thus, the Wi-Fi Direct protocol also provides the "ability to communicate in the second wireless network without having to disassociate with the first wireless network" per the prior construction. Accordingly, the Wi-Fi Direct protocol is "*an overlay protocol with respect to the first wireless network protocol*."

67. Furthermore, the "*communications using* [the Wi-Fi Direct protocol, i.e.,] *the second wireless network protocol are partially consistent with* [the infrastructure-mode protocol, i.e.,] *the first wireless network protocol*." This is at least because some of the Management frames used in communications based on the Wi-Fi Direct protocol have the same format and mandatory fields as the Management frames used in communications based on the infrastructure-mode protocol. Specifically, the IEEE 802.11x Standard defines medium access control (MAC) frames. Each frame has a number of fields, of which some are mandatory. For example, the "Frame Control" field is included in all frames. Some fields, e.g., the "HT Control" field and one of the four "Address" fields, may be omitted in some frames. Ex. C (IEEE Std 802.11™-2012, Part 11) at 380-81, and 413-14 and 417-18 (disclosing that Address 4 field is optional in both Data and Management frames).

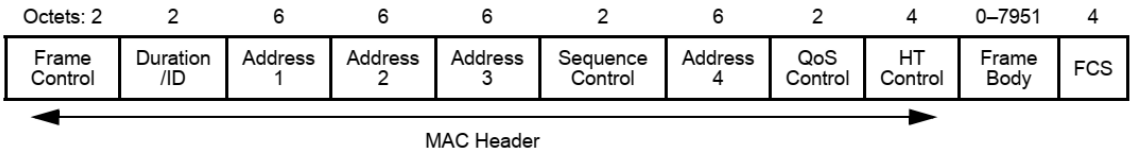


Figure 8-1—MAC frame format

Ex. C (IEEE Std 802.11™-2012, Part 11) at 381.

68. The "Frame Control" field includes the "Type" and "Subtype" fields that "identify the function of the frame. There are three frame types: control, data, and management."

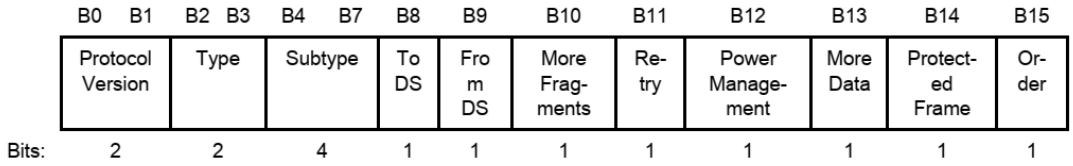


Figure 8-2—Frame Control field

Ex. C (IEEE Std 802.11™-2012, Part 11) at 382-83.

69. The four Address "fields are used to indicate the basic service set identifier (BSSID), source address (SA), destination address (DA), transmitting STA address (TA), and receiving STA address (RA). Certain frames may not contain some of the address fields." Ex. C (IEEE Std 802.11™-2012, Part 11) at 387. In particular, per the IEEE 802.11x Standard, a Management frame includes only three Address fields.

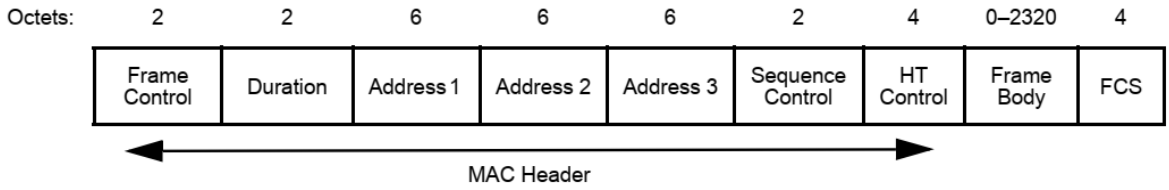


Figure 8-34—Management frame format

Ex. C (IEEE Std 802.11™-2012, Part 11) at 417-18. The "HT Control" field is optional. *Id.* at 380.

70. One particular Subtype of Management frames is Action frames, and a particular category of Action frames is Vendor Specific Action frames. Ex. C (IEEE Std 802.11™-2012, Part 11) at 382-83 (disclosing the Subtype Action), 436, 449-450 (disclosing the format and categories, including the "Vendor-specific" category, of Action frames).

8.5.6 Vendor-specific action details

The Vendor Specific Action frame is defined for vendor-specific signaling. The format of the Action field of the Vendor Specific Action frame is shown in Figure 8-437. An Organization Identifier, in the octet field immediately after the Category field, differentiates the vendors (see 8.4.1.31).

NOTE—If management frame protection is negotiated, then Vendor Specific Protected Action frames (see Table 8-38) are protected; otherwise they are unprotected.

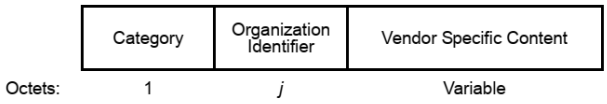


Figure 8-437—Vendor Specific Action frame Action field format

The Category field is set to the value indicating the vendor-specific category, as specified in Table 8-38.

Ex. C (IEEE Std 802.11™-2012, Part 11) at 737.

71. The communications within a BSS using the infrastructure-mode protocol, e.g., from an STA to an AP, comply with the IEEE 802.11x Standard. As such, these communications use Management frames having formats and at least the mandatory fields that are defined by the IEEE 802.11x Standard, such as, e.g., those that are discussed above. The Wi-Fi Direct protocol reuses these elements, e.g., at least some Management frames that have the same formats and mandatory fields, that are defined by the IEEE 802.11x Standard.

72. In particular, the "Wi-Fi Direct [protocol also] uses IEEE 802.11 vendor-specific AFs," i.e., Vendor-specific Action frames that are a subtype of Management frames. *See, e.g.*, Ex. B (Wi-Fi-Direct-Spec) at 89. These frames have the same format as the IEEE 802.11x Standard Management frames, and include, *inter alia*, the Type / Subtype fields and these Address fields that are mandatory for the IEEE 802.11x Standard Management frames.

4 Frame formats

This section describes the information elements (see Section 4.1) and frame formats (see Section 4.2) in support of the capabilities described in clause P2P specific functions and services (see Section 2.4).

P2P protocol communication is based on the use of P2P Information Element (P2P IE), P2P Action frame and P2P Public Action frame formats. These utilize the Vendor Specific Information Element and Vendor Specific Action frame formats in IEEE 802.11-2012 [1] for operation outside DMG and in IEEE 802.11-REVmc [11] for operation within DMG, with the Wi-Fi Alliance OUI and an OUI Type indicating P2P. A number of P2P attributes are defined; a single P2P IE carries one or more P2P attributes.

4.1 P2P Information Element

4.1.1 P2P IE format

The Vendor Specific information element format (as defined in IEEE 802.11-2012 [1] for operation outside DMG and in IEEE 802.11-REVmc [11] for operation within DMG) is used to define the P2P information element (P2P IE) in this specification. The format of the P2P IE is shown in Table 4.

Table 4—P2P IE format

Field	Size (octets)	Value (Hexadecimal)	Description
Element ID	1	0xDD	IEEE 802.11 vendor specific usage.
Length	1	variable	Length of the following fields in the IE in octets. The Length field is a variable, and set to 4 plus the total length of P2P attributes.
OUI	3	50 6F 9A	Wi-Fi Alliance specific OUI.
OUI Type	1	0x09 (to be assigned)	Identifying the type or version of P2P IE. Setting to 0x09 indicates Wi-Fi Alliance P2P v1.0.
P2P Attributes	variable		One of more P2P attributes appear in the P2P IE.

4.2.1 Beacon frame format

One or more P2P IEs and the WSC IE shall be inserted after other information elements in the Beacon frames transmitted by a P2P Group Owner. P2P attributes for a P2P IE that is included in the Beacon frame are shown in Table 48.

Table 48—P2P attributes in the Beacon frame

Attributes	Attribute ID	Note
P2P Capability	2	The P2P Capability attribute shall be present in the P2P IE.
P2P Device ID	3	The P2P Device ID attribute shall be present in the P2P IE.

Attributes	Attribute ID	Note
Notice of Absence	12	The Notice of Absence attribute shall be present in the P2P IE in the Beacon frames transmitted by a P2P Group Owner when a Notice of Absence schedule is being advertised (see Section 3.3.3.2), or when the CTWindow is non-zero (see Section 3.3.2).

4.2.9 P2P public action frames

4.2.9.1 General format

The Public Action frame format (as defined in IEEE 802.11-2012 [1]) is used to define the P2P public action frames in this specification. The general format of the P2P public action frames is shown in Table 60.

Table 60—General format of P2P public action frame

Field	Size (octets)	Value (Hexadecimal)	Description
Category	1	0x04	IEEE 802.11 public action usage.
Action field	1	0x09	IEEE 802.11 vendor specific usage.
OUI	3	50 6F 9A	Wi-Fi Alliance specific OUI.
OUI type	1	0x09 (to be assigned)	Identifying the type or version of action frame. Setting to 09 indicates Wi-Fi Alliance P2P v1.0.
OUI Subtype	1		Identifying the type of P2P public action frame. The specific value is defined in Table 61.
Dialog Token	1		Set to a nonzero value to identify the request/response transaction.
Elements	variable		Including P2P IE or any information elements defined in IEEE 802.11-2012 [1].

Table 61—P2P public action frame type

Type	Notes
0	GO Negotiation Request

Type	Notes
1	GO Negotiation Response
2	GO Negotiation Confirmation
3	P2P Invitation Request
4	P2P Invitation Response
5	Device Discoverability Request
6	Device Discoverability Response
7	Provision Discovery Request
8	Provision Discovery Response
9 – 255	Reserved

4.2.10 P2P action frames

4.2.10.1 General format

The Vendor Specific action frame format (as defined in IEEE 802.11-2012 [1]) is used to define the P2P action frames in this specification. The general format of the P2P action frames is shown in Table 74.

The Notice of Absence, P2P Presence Request, and P2P Presence Response frames shall not be transmitted when operating within DMG.

Table 74—General format of P2P action frame

Field	Size (octets)	Value (Hexadecimal)	Description
Category	1	0x7F	IEEE 802.11 vendor specific usage (IEEE 802.11-2012 [1] Table 7-24).
OUI	3	50 6F 9A	Wi-Fi Alliance specific OUI.
OUI type	1	0x09 (to be assigned)	Identifying the type or version of action frame. Setting to 09 indicates Wi-Fi P2P v1.0.
OUI Subtype	1		Identifying the type of P2P action frame. The specific value is defined in Table 75.
Dialog Token	1		When set to a nonzero value, used to identify the request/response transaction.
Elements	variable		Including P2P IE or any information elements defined in IEEE 802.11-2012 [1].

Table 75—P2P action frame type

Type	Notes
0	Notice of Absence
1	P2P Presence Request
2	P2P Presence Response
3	GO Discoverability Request
4 – 255	Reserved

Ex. B (Wi-Fi-Direct-Spec) at 89, 116, 122-23, 132.

73. Thus, the Wi-Fi Direct protocol has elements that are reuses of certain elements of the infrastructure-mode protocol, e.g., at least some Management frames, their respective formats, and their respective mandatory fields. Hence, the Wi-Fi Direct protocol, i.e., "*the second wireless network protocol*[,] *is an overlay protocol with respect to [*the infrastructure-mode protocol, i.e.,*] the first wireless network protocol*." Moreover, because the Wi-Fi Direct and infrastructure-mode protocols both use at least some Management frames having the same

formats and the same mandatory fields, the Wi-Fi Direct protocol is at least partially compliant with the infrastructure-mode protocol, and the respective communications according to these two protocols are consistent with each other, at least to some extent.

74. The Wi-Fi Direct protocol is not entirely complaint with the infrastructure-mode protocol, however, and their respective communications are also not entirely consistent. For example, in the infrastructure-mode protocol only a non-AP STA can enter the power save (PS) mode but not an AP; the "Power Management field" of the MAC frames "is reserved in all frames transmitted by the AP," and the "Power Management bit shall be ignored in frame exchanges initiated by the AP." Ex. C (IEEE Std 802.11™-2012, Part 11) at 384, 985.

8.2.4.1.7 Power Management field

The Power Management field is 1 bit in length and is used to indicate the power management mode of a STA. The value of this field is either reserved (as defined below) or remains constant in each frame from a particular STA within a frame exchange sequence (see Annex G). The value indicates the mode of the STA after the successful completion of the frame exchange sequence.

In an infrastructure BSS, the following applies:

- The Power Management field is reserved in all management frames that are not bufferable management frames.
- The Power Management field is reserved in all management frames transmitted by a STA to an AP with which it is not associated.
- The Power Management field is reserved in all frames transmitted by the AP.
- Otherwise, a value of 1 indicates that the STA will be in PS mode. A value of 0 indicates that the STA will be in active mode.

BSS." Ex. C (IEEE Std 802.11™-2012, Part 11) at 384.

The Power Management mode of a STA is selected by the PowerManagementMode parameter of the MLME-POWERMGT.request primitive. Once the STA updates its Power Management mode, the MLME shall issue an MLME-POWERMGT.confirm primitive indicating the success of the operation.

To change Power Management modes, a STA shall inform the AP through a successful frame exchange as described in Annex G initiated by the STA and that includes an ACK frame or a BlockAck frame from the AP. The Power Management subfield(s) in the Frame Control field of the frame(s) sent by the STA in this exchange indicates the Power Management mode that the STA shall adopt upon successful completion of the entire frame exchange, except where it is reserved (see 8.2.4.1.7). The Power Management bit shall be ignored in frame exchanges initiated by the AP. A non-AP STA shall not change power management mode using a frame exchange that does not receive an ACK or BlockAck from the AP, or using a BlockAckReq frame.

Id. at 985.

75. In contrast, according to the Wi-Fi Direct protocol a "P2P Group Owner" is an "'AP-like' entity … that may provide and use connectivity between Clients."

1.4 Definitions

The following definitions and terms are used in this document:

Alternative Carrier: The Wi-Fi communication technology that can be used for data transfers between an NFC Handover Requester and an NFC Handover Selector.

Config Methods: The Wi-Fi Simple Configuration methods supported, as defined in the Wi-Fi Simple Configuration Specification [2].

Client: A P2P Client or a Legacy Client that is connected to a P2P Group Owner.

Credentials: The information that is required to join a P2P Group as defined in the Wi-Fi Simple Configuration Specification [2].

Device Password ID: The Wi-Fi Simple Configuration method currently in use, as defined in the Wi-Fi Simple Configuration Specification [2].

Directional Multi-Gigabit (DMG): A frequency band wherein the operating channel center frequency is above 45 GHz.

Discovery DMG Beacon: A DMG Beacon with the Discovery Mode field equal to 1.

Find Phase: A phase in P2P Discovery that is used to ensure that two simultaneously searching P2P Devices arrive on a common channel to enable communication.

In-band: Data transfer using the WLAN communication channel, including WLAN multiband devices (e.g. 2.4GHz, 5GHz, and 60GHz).

Legacy Client: A STA that is Wi-Fi CERTIFIED, but not P2P compliant.

P2P Client: A P2P Device that is connected to a P2P Group Owner.

P2P Coexistence Parameters: A combination of Primary P2P Coexistence Parameters and Secondary P2P Coexistence Parameters.

P2P Concurrent Device: A P2P Device that can concurrently operate as a WLAN STA in WLAN.

P2P Device: Wi-Fi P2P device that is capable of acting as both a P2P Group Owner and a P2P Client.

P2P Device Address: An identifier used to uniquely reference a P2P Device.

P2P Discovery: A capability that provides a set of functions to allow a device to easily and quickly identify and connect to a device and its services in its vicinity.

P2P Group: A set of devices consisting of one P2P Group Owner and zero or more Clients.

P2P Group Address: An identifier used to uniquely reference the P2P Device Address field of the P2P Group ID attribute.

P2P Group ID: An identifier used to indicate the presence of a specific P2P Group.

P2P Group Owner: An “AP-like” entity, when not operating within DMG, or PCP, when operating within DMG, that may provide and use connectivity between Clients.

2.1 P2P components

The P2P architecture consists of components that interact to support device-to-device communication.

P2P Device:

- Supports both P2P Group Owner and P2P Client roles.
- Negotiates P2P Group Owner or P2P Client role.
- Supports WSC and P2P Discovery mechanism.
- May support WLAN and P2P concurrent operation.

P2P Group Owner role:

- "AP-like" entity that provides BSS functionality and services for associated Clients (P2P Clients or Legacy Clients) when not operating within DMG, or a PCP that provides PBSS functionality and services for Clients (P2P Clients) when operating within DMG.
- Provides WSC Internal Registrar functionality.
- May provide communication between associated Clients.
- May provide access to a simultaneous WLAN connection for its associated Clients.

P2P Client role:

- Implements non-AP STA functionality.
- Provides WSC Enrollee functionality.

3.3 P2P Power Management

3.3.1 Introduction

P2P power management supports power save mechanisms for P2P Group Owners and P2P Clients when the P2P Group operates outside DMG. If the

The P2P power management approach for operation outside DMG is based on existing PS and WMM-PS power management delivery mechanisms with two new procedures that allow the P2P Group Owner to be absent for defined periods; Opportunistic Power Save and Notice of Absence. Small adaptations to PS and WMM-PS protocols at the P2P Client are necessary to allow for P2P Group Owner absence periods. The adapted protocols are termed P2P PS and P2P WMM-PS to differentiate them from the existing schemes on which they are based. These mechanisms are available in a P2P Group in which only P2P Devices are associated.

Legacy Clients do not understand the P2P protocol and consider the P2P Group Owner to be an AP. Legacy Clients expect an AP to be available all of the time and any mechanism that alters availability may result in undesirable consequences, e.g. needless consumption of spectrum due to multiple retries, or disassociation by the Legacy Client.

Ex. B (Wi-Fi-Direct-Spec) at 14-15, 19, 70-71.

76. Thus, according to the infrastructure-mode protocol, an AP cannot enter the power save mode but according to the Wi-Fi Direct protocol an "AP-like" P2P Group owner can. Thus, the Wi-Fi Direct protocol is only partially and not entirely compliant with the infrastructure-mode protocol, and their respective communications are consistent substantially but not entirely. Accordingly, the "*communications using* [the Wi-Fi Direct protocol, i.e.,] *the second wireless network protocol are partially consistent with* [the infrastructure-mode protocol, i.e.,] *the first wireless network protocol*."

H. Claim Element [1.d.4]

77. Moreover, in the Accused Products, e.g., an Xperia 1 V phone, "*at least some of the communications using the second wireless network protocol impinge on at least some antennae used for the first wireless network*." This is because, as discussed for claim element [1.d.3], an Xperia 1 V phone uses frames according to the IEEE 802.11x Standard for communications based on the infrastructure-mode protocol ("*first wireless network protocol*") in the WLAN ("*the first wireless network*"), and also for communications based on the Wi-Fi Direct protocol ("*the second wireless network protocol*." *See supra*, ¶¶ 72-73. Accordingly, and as discussed for claim elements [1.b] through [1.d.2], these communications use the same Wi-Fi module included in an Xperia 1 V phone. *See supra*, ¶¶ 55-61.

78. The Xperia 1 V phone includes an antenna for Wi-Fi (and Bluetooth and GPS) communications.[5] One type of Wi-Fi module supports a single antenna for single-input, single-output (SISO) operation supported by various IEEE 802.11 Standards. Some Accused Products, e.g., an Xperia 1 V phone, support the IEEE 802.11ax Standard per which the communications

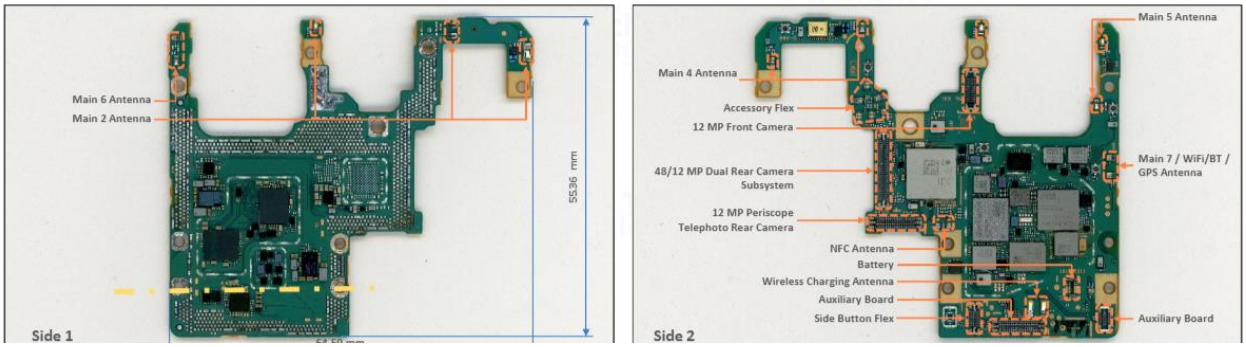
[5] In MIMO, each antenna in the antenna set transmits respective copies of the same signal, where each copy is cyclically shifted. *See, e.g.*, Ex. C (IEEE Std 802.11™-2012, Part 11) at 16, 56, 1684-85.

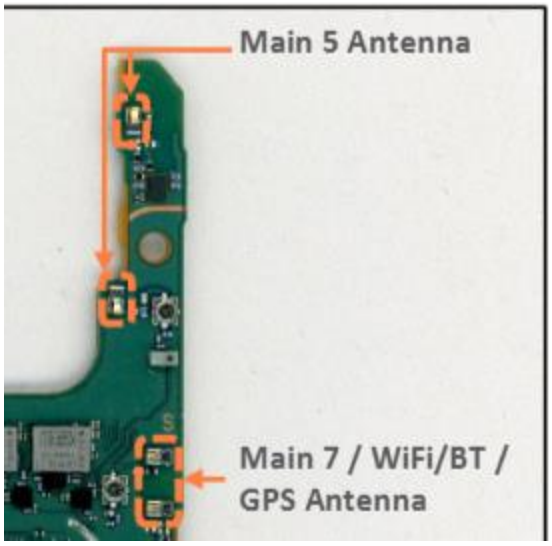
may employ the multiple input multiple output (MIMO) system. In a MIMO system, an antenna set is used, where each antenna in the set transmits respective copies of the same signal, where each copy is cyclically shifted, respectively. *See, e.g.*, Ex. C (IEEE Std 802.11™-2012, Part 11) at 16, 56, 1684-85. The same antennas that are used for communications based on the infrastructure-mode protocol ("*first wireless network protocol*") in the WLAN ("*the first wireless network*") are also used for communications based on the Wi-Fi Direct protocol ("*the second wireless network protocol*." Therefore, in an Xperia 1 V phone, whether using the SISO or MIMO system, "*at least some of the communications using* [the Wi-Fi Direct protocol, i.e.,] *the second wireless network protocol*" that use the Wi-Fi module that also facilitates the WLAN communications, "*impinge on at least some antennae used for* [the WLAN, i.e.,] *the first wireless network*."

Substrates - RF Board Details

Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

General Area	Assembly Name	Substrate Area (sq.cm)	Metal Layers	Circuit Area (sq.cm)	Routing Density (cm of routing per sq.cm of substrate)	Number of Components	Number of Connections	Component Density (Components/sq.cm)	Connection Density (Connections/sq.cm)	Avg. Pin Count	Assembly Weight (grams)
Main Electronics	RF Board	17.51	10	175.1	87.6	771	3392	44.0	193.7	4.4	5.23





https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents

Ultra-low Power 1x1 Dual-band Wi-Fi 5 (802.11ac) + Bluetooth® 5.4 combo

Infineon's AIROC™ CYW43022 an ultra-low power single-chip, combo device features 1x1 dual-band 2.4 GHz and 5 GHz Wi-Fi 5 (802.11ac) and Bluetooth® 5.4. With a low-power architecture, the CYW43022 is ideal for battery powered applications where best-in-class power consumption is critical. An embedded Bluetooth stack and Wi-Fi networking offloads allow the CYW43022 to maintain connectivity activity even while a host processor is in low-power sleep mode. The CYW43022 supports 256-QAM enabling data rates up to 78 Mbps. On-chip power amplifier and low-noise amplifiers are included for both the 2.4 and 5GHz bands plus an internal +20dBm Bluetooth power amplifier.

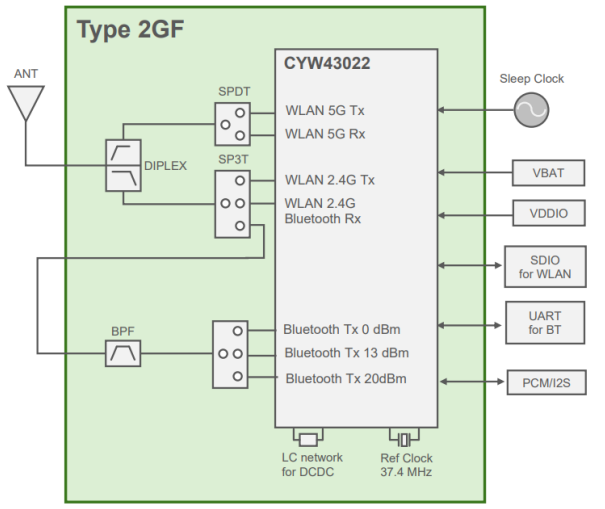
— Wi-Fi Features

- Wi-Fi 5 (802.11ac) Dual-band (2.4/5 GHz)
- 1x1 SISO
- MCS8 (256-QAM) for 20MHz channels, up to 78Mbps PHY data rate
- Internal PA and LNA for both bands

https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/

Figure 1 shows the Type 2GF block diagram.

Figure 1: Block Diagram



https://www.infineon.com/dgdl/Infineon-AIROC_CYW43022_Wi-Fi_5_Bluetooth_5-ProductBrief-v06_00-EN.pdf?fileId=8ac78c8c869190210186a14ce9be3186

I. Claim Element [1.e]

79. Finally, the Accused Products, e.g., an Xperia 1 V phone, include, *inter alia*, "*data forwarding logic, implemented in the network-enabled hub using hardware and/or software, that forwards data between an originating node and a destination node, wherein the originating node is a node in one of the first and second wireless networks and the destination node is a node in the other of the first and second wireless networks*." This is because the Wi-Fi Direct protocol supports the IPv6 protocol for routing data frames, and employs logic for IPv4 address resolution, i.e., "*data forwarding logic*" as claimed.

80. As discussed for the preamble of claim 1, [1.pre], and claim element [1.a], an Xperia 1 V phone supports the screen mirroring feature. *See supra*, ¶¶ 50-54. This entails receiving at an Xperia 1 V phone data from an Internet source via an AP of WLAN and forwarding that data to another device, e.g., a Wi-Fi Direct Compatible TV, etc. Thus, the Xperia 1 V phone e.g., "*forwards data between* [the AP, i.e.,] *an originating node and* [another device, i.e.,] *a destination node*." The AP is wirelessly connected to the Xperia 1 V phone via a

WLAN, and thus, the AP, i.e., "*the originating node is a node in* [the WLAN, i.e.,] *the first* [] *wireless network*." The other device is connected to the Xperia 1 V phone via the Wi-Fi Direct network, and thus, the other device i.e., "*the destination node is a node in* [the Wi-Fi Direct network, i.e.,] *the second wireless network*."

81. To facilitate mirroring, which entails forwarding of data from the AP to the other device through the Xperia 1 V phone, the Wi-Fi Direct protocol executed by the Xperia 1 V phone uses the IPv4 protocol and addressing scheme. The IPv4 address may be generated and/or used for forwarding data by the Snapdragon processor and/or ARM Cortex® processor in the Wi-Fi module. *See supra*, ¶¶ 55-56 Therefore, these processors, individually or in combination, comprise a "*data forwarding logic*." As such, an Xperia 1 V phone includes "*data forwarding logic, implemented in the network-enabled hub using hardware and/or software, that forwards data between an originating node and a destination node, wherein the originating node is a node in one of the first and second wireless networks and the destination node is a node in the other of the first and second wireless networks*."

3.2.6 Communication in a P2P Group

> Higher-layer data services may use IP. The P2P Group Owner shall act as a DHCP server to provide IP addresses to the connected P2P Clients that use IP. The DHCP Server shall at a minimum support Internet Protocol version 4 (IPv4) and assignment of an IP address, subnet mask and should not include the default gateway unless the P2P Device is providing Cross Connect. If P2Ps [10] is supported, the default gateway shall not be included unless the P2P GO is providing Cross Connect. A P2P Client that uses IP shall be capable of acting as a DHCP Client.

Ex. B (Wi-Fi-Direct-Spec) at 201.

4.2.8 IP Address Allocation in EAPOL-Key Frames (4-Way Handshake)

An IPv4 address may be allocated to a P2P Client in a secure manner by using vendor specific KDEs (Wi-Fi Alliance OUI: 50 6F 9A) in EAPOL-Key frames 2 and 3 during the 4-way EAPOL-Key Handshake.

If a P2P Client supports IP address allocation via EAPOL-Key frames, and the Group Owner to which it is associating advertises support for IP Address Allocation in its Group Capability Bitmap field, the P2P Client may request an IPv4 address allocation from the P2P Group Owner by adding an IP Address Request KDE to EAPOL-Key frame 2. If not advertised by the GO, the P2P Client shall not send the request.

If a P2P Group Owner supports IP address allocation via EAPOL-Key frames it shall set the IP Address Allocation field in its Group Capability Bitmap field to 1 and, on receipt of an IP Address Request KDE in a successful EAPOL-Key frame 2, provide an IP address to the P2P Client through the IP Allocation KDE in EAPOL-Key frame 3.

The structure of the IP address Request KDE (Data Type:4) and IP Allocation KDE (Data Type: 5) are shown in Table 58 and Table 59.

Table 58—IP Address Request KDE in the EAPOL-Key frame 2

	Request IP Address
Size (octet)	1

— The Request IP Address shall be set to 1 to indicate an IP address allocation request to the P2P Group Owner.

— A supplicant should not encrypt the IP Address Request KDE in EAPOL-Key msg 2/4.

Table 59—IP Allocation KDE in the EAPOL-Key frame 3

	Client IP Address	Subnet Mask	Group Owner IP Address
Size (octet)	4	4	4

— The Client IP Address shall be set to the address allocated by the P2P Group Owner. The allocated IP address shall be valid throughout the duration of the association between the P2P Group Owner and P2P Client.

— The Subnet Mask shall be set to provide the value of the subnet that the P2P Group Owner is using.

— The Group Owner IP Address shall be set to the address of the P2P Group Owner.

Refer to IEEE802.11-2012 [1] Section 11.6.2 for further details on EAPOL Key frames and Figure 11-30 for the KDE format.

Id. at 121-22.

82. As set forth above, Sony has directly infringed at least claim 1 of the ’814 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

83. Sony has also contributed to the infringement of at least claim 1 of the ’814 patent by Sony’s customers and/or has induced such infringement by its customers, as set forth below in paragraphs ¶¶ 152-160, that are incorporated by reference as if fully set forth herein.

COUNT II

(Sony’s Infringement of U.S. Patent No. 9,264,991)

84. Paragraphs 1-83 are incorporated by reference as if fully set forth herein.

85. Claim 1 of the ’991 patent is reproduced below:

Claim Element No.	Claim Limitation
1.pre	A network-enabled hub, usable for facilitating data communications between two or more wireless devices that are configured to communicate indirectly with each other via the network-enabled hub, comprising:

Claim Element No.	Claim Limitation
1.a	an interface to a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability;
1.b	a processor configured to:
1.b.1	process data received via the wireless radio circuit;
1.b.2	generate data to be transmitted by the wireless radio circuit;
1.b.3.1	initiate and maintain network connections with nodes of a wireless network external to the network-enabled hub,
1.b.3.2	maintaining at least a first network connection using a first network protocol and a second network connection using a second network protocol, that can be maintained, at times, simultaneously with each other,
1.c	wherein the second network protocol is an overlay protocol with respect to the first network protocol in that communications using the second network protocol are partially consistent with the first network protocol and
1.d	wherein at least some of the communications using the second network protocol impinge on at least some antennae used for communications using the first network protocol; and
1.e	implement data forwarding logic, implemented in a network-enabled hub using hardware and/or software, that forwards data between an originating node and a destination node, wherein the originating node is a node in one of the first and second networks and the destination node is a node in the other of the first and second networks.

A. Preamble of Claim 1 [1.pre]

86. Sony infringes claim 1 of the ’991 patent because the Accused Products, e.g., an Xperia 1 V phone, comprise, *inter alia*, “[*a*] *network-enabled hub, usable for facilitating data communications between two or more wireless devices that are configured to communicate indirectly with each other via the network-enabled hub*.”

87. Referring to Count I, the preamble of claim 1, [1.pre], of the ’991 patent is identical to the preamble of claim 1, [1.pre], of the ’814 patent. Therefore, as discussed for the preamble of claim 1 of the ’814 patent, an Xperia 1 V phone comprises the limitations recited in the preamble of claim 1 of the ’991 patent. *See supra*, ¶¶ 50-51.

B. Claim Element [1.a]

88. The Accused Products, e.g., an Xperia 1 V phone, also include, *inter alia*, "*an interface to a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability*." Referring to Count I, claim element [1.a] of the '991 patent is identical to claim element [1.a] of the '814 patent. Therefore, as discussed for claim element [1.a] of the '814 patent, an Xperia 1 V phone comprises the limitations recited in claim element [1.a] of the '991 patent. *See supra*, ¶.

C. Claim Element [1.b]

89. Additionally, the Accused Products, e.g., an Xperia 1 V phone, include, *inter alia*, "*a processor*." For example, an Xperia 1 V phone includes the Snapdragon processor, which includes a RAM, is provided on a board that also includes the Wi-Fi module used to provide Wi-Fi, i.e., IEEE 802.11 based wireless connections, as discussed for claim element [1.a]. https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents; *see supra*, ¶ 52.

90. In addition, at least some of these Wi-Fi modules are based on the CYW43022 chipset. https://www.murata.com/products/productdata/8824592302110/type2gf.pdf. This chipset includes an ARM Cortex® processor coupled to SRAM and ROM and Wi-Fi circuitry including the 802.11ac PHY and MAC modules. https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/. Accordingly, the Snapdragon processor and/or the ARM Cortex® processor (hereinafter referred to as "Snapdragon / ARM processors") of an Xperia 1 V,

individually or in combination, comprise "*a processor*" that may be used to execute communication-related tasks, together with the Wi Fi module.

Deep Dive Teardown

Sony Xperia 1 V XQ-DQ54

Report Information	
Report Publish Date	12/28/2023
ItemID / Report Code	426083 / DDT-2309-819
Product Description	
Product Type	Smartphone
Brand	Sony
Device Name	Xperia 1 V
Device Model #	XQ-DQ54
Official Release Date	7/28/2023
Country of Purchase	Poland
Retail Price	$1,399.00
Weight (grams)	188
Device Dimensions (mm)	164.75 x 70.9 x 10.3

Product Features	
Operating System	Android 13
Processor Spec	Octa-Core Qualcomm Snapdragon 8 Gen 2
RAM Support	12 GB Mobile LPDDR5X SDRAM
Communications	Quad-Band GSM/EDGE, W-CDMA(800/850/900/1700/1900/2100MHz), LTE(700/800/850/900/1500/1700/1800/1900/2100/2600MHz), TD-LTE(1900/2000/2300/2500/2600/5500MHz), 5G NR(700/800/850/900/1800/2100/2600MHz), 5G TD-NR(2300/2500/2600/3500/3700MHz).
Connectivity	WiFi 6e, Bluetooth 5.3, GPS, NFC, USB Type-C (USB 3.2, DisplayPort)
User Interface	Capacitive Touchscreen, Side Buttons

Deep Dive Teardown

Device Summary - Design notes

Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

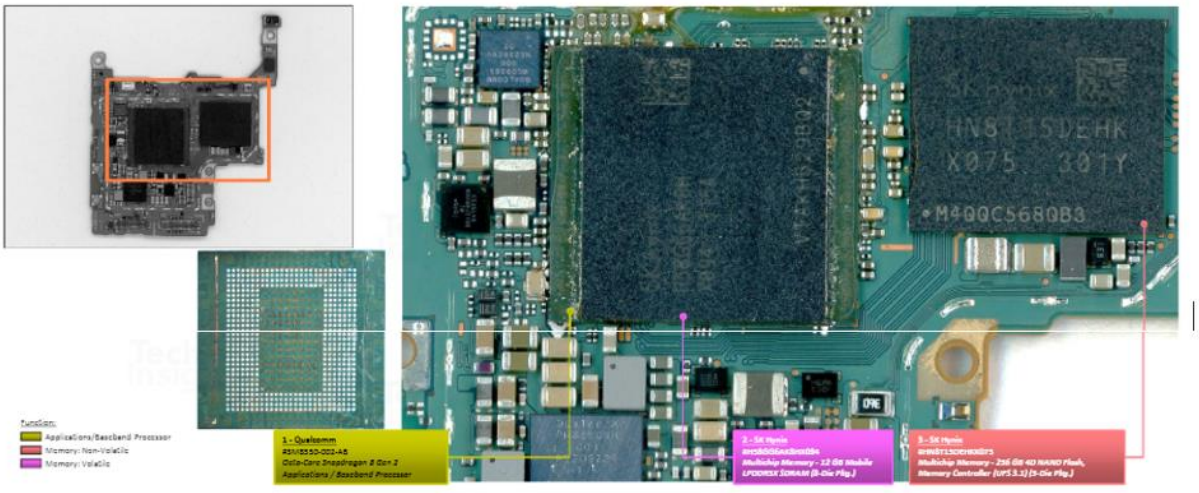
The Sony Xperia 1 V is a typical Qualcomm based design, using well-known components: Qualcomm SM8550-AB Snapdragon Processor and Qualcomm SDR735 RF Transceiver with matching power managements, SK Hynix's RAM, and flash.

The RF design is highly integrated, and most filtering occurs inside modules. There is little filtering directly on PCB, except for some diplexer signal splitting. The biggest integration appeared in WiFi design. In high-end smartphones the signal is typically split into 2.4 and 5 GHz frequencies and passed to four WiFi Front-End modules and then delivered to WiFi Module. In the Sony Xperia 1 V the signal from the antennas is initially filtered and then fed directly to Murata's WiFi LBEE5??2GH Module which consists of two NXP 2.4 GHz WiFi Front-End, two NXP 5 to 7.2 GHz WiFi Front-End and Qualcomm Wi-Fi 7/Bluetooth 5.3 dies.

Substrates - Main Board

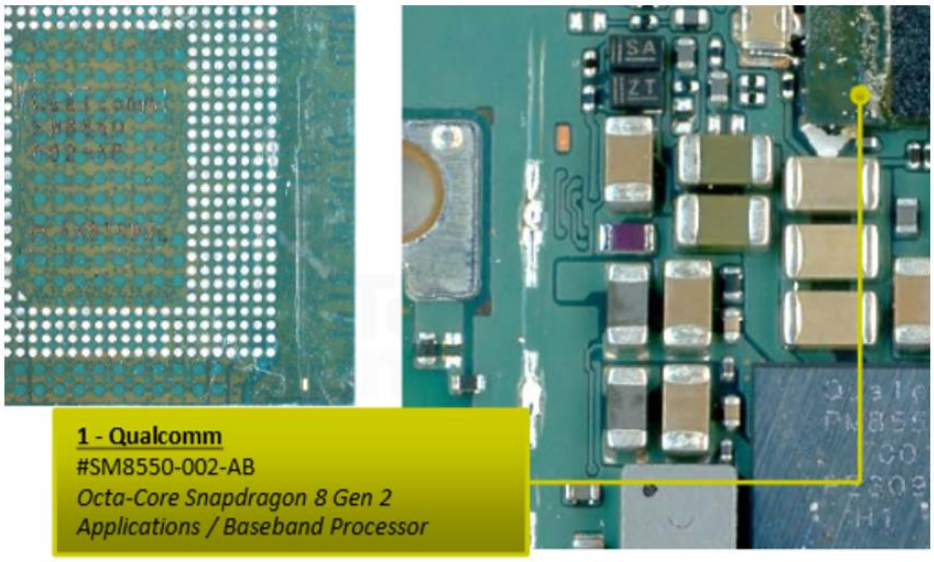
Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

Side 1 - Component Identification



59

Product Details | Report Sections | Summaries | Design Analysis | Subsystems | Components and Parts | Die Photos | Teardown | Overview & Discussion



https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents

https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

1 Scope

This specification characterizes the IEEE 802.11a/b/g/n/ac WLAN + Bluetooth 5.4 combo module.

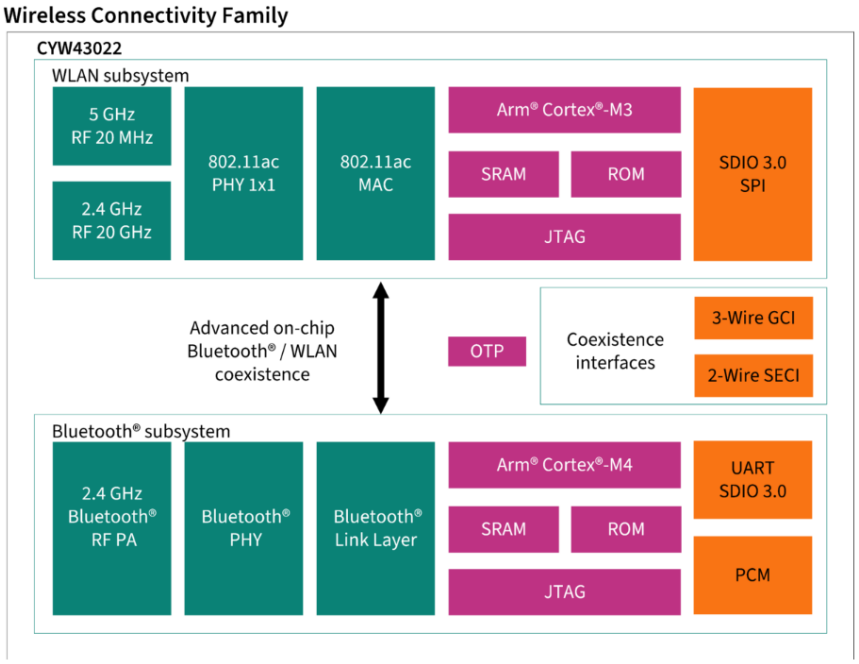
2 Key Features

- Infineon CYW43022 inside
- Supports IEEE 802.11a/b/g/n/ac specification: Dual band 2.4 GHz and 5 GHz
- Supports MCS8 (256-QAM) for 20MHz channels enabling data rates up to 78 Mbps.
- Supports Bluetooth specification version 5.4.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0

https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

— Wi-Fi Features

- Wi-Fi 5 (802.11ac) Dual-band (2.4/5 GHz)
- 1x1 SISO
- MCS8 (256-QAM) for 20MHz channels, up to 78Mbps PHY data rate
- Internal PA and LNA for both bands



https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/

91. The Snapdragon / ARM processors of an Xperia 1 V phone, individually or in combination, i.e., "*a processor*" is "*configured to*" perform various claimed operations, as discussed below.

D. Claim Element [1.b.1]

92. In the Accused Products, e.g., an Xperia 1 V phone, the Snapdragon / ARM processors, individually or in combination (the "*processor*"), is configured to, *inter alia*, "*process data received via the wireless radio circuit*." Referring to Count I, the difference

between claim element [1.b.1] of the '991 patent and claim element [1.b] of the '814 patent is set forth below.

~~logic for processing~~process data received via the wireless radio circuit[6]

93. The "*logic for processing*" that claim element [1.b] of the '814 patent recites, comprises the Snapdragon / ARM processors, i.e., individually or in combination (the "*processor*"). Therefore, as discussed for claim element [1.b] of the '814 patent, the Snapdragon / ARM processors, i.e., individually or in combination (the "*processor*") is configured to "*process data received via the wireless radio circuit*." *See supra*, ¶¶ 55-56.

E. Claim Element [1.b.2]

94. In the Accused Products, e.g., an Xperia 1 V, the Snapdragon / ARM processors, individually or in combination (the "*processor*"), is configured to, *inter alia*, "*generate data to be transmitted by the wireless radio circuit*." Referring to Count I, the difference between claim element [1.b.2] of the '991 patent and claim element [1.c] of the '814 patent is set forth below.

~~logic for generating~~generate data to be transmitted by the wireless radio circuit

95. The "*logic for generating*" that claim element [1.c] of the '814 patent recites, comprises the Snapdragon / ARM processors, i.e., individually or in combination (the "*processor*"). Therefore, as discussed for claim element [1.c] of the '814 patent, the Snapdragon / ARM processors, i.e., individually or in combination (the "*processor*") is configured to "*generate data to be transmitted by the wireless radio circuit*." *See supra*, ¶ 57.

[6] Throughout this document, while comparing two claim elements, the additions to a base or reference claim are shown using blue, underlined text; the omissions from the base / reference claim are shown using red text having a strikethrough line; and the unmodified, common text is shown using black text.

F. Claim Element [1.b.3.1]

96. In the Accused Products, e.g., an Xperia V phone, the Snapdragon / ARM processors, individually or in combination (the "*processor*"), is configured to, *inter alia*, "*initiate and maintain network connections with nodes of a wireless network external to the network-enabled hub*." Referring to Count I, the difference between claim element [1.b.3.1] of the '991 patent and claim element [1.d.1] of the '814 patent is set forth below.

> ~~logic for initiating and maintaining wireless~~initiate and maintain network connections with nodes of a wireless network external to the network-enabled hub

97. The "*logic for initiating and maintaining*" that claim element [1.d.1] of the '814 patent recites, comprises the Snapdragon / ARM processors, i.e., individually or in combination (the "*processor*"). Therefore, as discussed for claim element [1.d.1] of the '814 patent, the Snapdragon / ARM processors, i.e., individually or in combination (the "*processor*") is configured to "*initiate and maintain network connections with nodes of a wireless network external to the network-enabled hub*." *See supra*, ¶¶ 58-59.

G. Claim Element [1.b.3.2]

98. The Accused Products, e.g., an Xperia 1 V phone, also include, *inter alia*, "*maintaining at least a first network connection using a first network protocol and a second network connection using a second network protocol, that can be maintained, at times, simultaneously with each other*."

99. Referring to Count I, the differences between claim element [1.b.3.3] of the '991 patent and claim element [1.d.2] of the '814 patent are insubstantial, as set forth below.

> maintaining at least a first ~~wireless~~ network connection using a first ~~wireless~~ network protocol and a second ~~wireless~~ network connection

using a second ~~wireless~~ network protocol, that can be maintained, at times, simultaneously with each other ~~in a common wireless space~~

100. The "*wireless network connection*[*s*]" recited in claim element [1.d.2] of the '814 patent are also the "*network connection*[*s*]" recited in claim element [1.b.3.2] of the '991 patent. Likewise, the network connections "*that can be maintained, at times, simultaneously with each other in a common wireless space*," as claim element [1.d.2] of the '814 patent recites are also network connections "*that can be maintained, at times, simultaneously with each other*," as claim element [1.b.3.1] of the '991 patent recites.

101. Furthermore, as discussed for claim element [1.d.2] of the '814 patent, the logic used by the Wi-Fi module, including but not limited to the Wi-Fi driver, comprises "*logic for … maintaining*" recited in claim element [1.d.2] of the '814 patent. *See supra*, ¶ 60. The logic used by the Wi-Fi module, and that of the Wi-Fi driver in particular, which is a software implementation, are executed by the Snapdragon / ARM processors, i.e., individually or in combination (the "*processor*"). Therefore, as discussed for claim element [1.d.2] of the '814 patent, the Xperia 1 V phone practices the limitations recited in claim element [1.b.3.2] of the '991 patent. *See supra*, ¶ 60.

H. Claim Element [1.c]

102. In the Accused Products, e.g., an Xperia 1 V phone, "*the second network protocol is an overlay protocol with respect to the first network protocol in that communications using the second network protocol are partially consistent with the first network protocol*."

103. Referring to Count I, the differences between claim element [1.c] of the '991 patent and claim element [1.d.3] of the '814 patent are insubstantial, as set forth below.

> wherein the second ~~wireless~~ network protocol is an overlay protocol with respect to the first ~~wireless~~ network protocol in that communications using the second ~~wireless~~ network protocol are partially consistent with the first ~~wireless~~ network protocol and

104. The "*wireless network protocol*[*s*]" recited in claim element [1.d.3] of the '814 patent are also the "*network protocol*[*s*]" recited in claim element [1.c] of the '991 patent. Therefore, as discussed for claim element [1.d.3] of the '814 patent, the Xperia 1 V phone comprises the limitations recited in claim element [1.c] of the '991 patent. *See supra,* ¶¶ 62-75.

I. Claim Element [1.d]

105. Moreover, in the Accused Products, e.g., an Xperia 1 V phone, "*at least some of the communications using the second network protocol impinge on at least some antennae used for communications using the first network protocol*."

106. Referring to Count I, the differences between claim element [1.c] of the '991 patent and claim element [1.d.4] of the '814 patent are insubstantial, as set forth below.

> wherein at least some of the communications using the second ~~wireless~~ network protocol impinge on at least some antennae used for communications using the first ~~wireless~~ network protocol; and

107. The "*second wireless network protocol*" recited in claim element [1.d.3] of the '814 patent is also the "*second network protocol*" recited in claim element [1.c] of the '991 patent. Furthermore, one or more "*antennae used for the first wireless network*," as claim element [1.d.3] of the '814 patent recites is "*used for communications using the first network protocol*," as claim element [1.c] of the '991 patent recites. Therefore, as discussed for claim element [1.d.3] of the '814 patent, the Xperia 1 V phone comprises the limitations recited in claim element [1.c] of the '991 patent. *See supra,* ¶¶ 62-75.

J. Claim Element [1.e]

108. Finally, the Accused Products, e.g., an Xperia 1 V phone, include, *inter alia*, "*implement data forwarding logic, implemented in a network-enabled hub using hardware and/or software, that forwards data between an originating node and a destination node, wherein the originating node is a node in one of the first and second networks and the destination node is a node in the other of the first and second networks*."

109. Referring to Count I, the differences between claim element [1.e] of the '991 patent and claim element [1.e] of the '814 patent are insubstantial, as set forth below.

> implement data forwarding logic, implemented in ~~the~~a network-enabled hub using hardware and/or software, that forwards data between an originating node and a destination node, wherein the originating node is a node in one of the first and second ~~wireless~~ networks and the destination node is a node in the other of the first and second ~~wireless~~ networks

110. As discussed for claim element [1.e] of the '814 patent, the Snapdragon / ARM processors, individually or in combination, comprise a "*data forwarding logic*." *See supra*, ¶¶ 79-81. Therefore, the Snapdragon / ARM processors, individually or in combination, "*implement*" the data forwarding logic. Moreover, the "*first and second wireless networks*" recited in claim element [1.e] of the '814 patent are also the "*first and second networks*" recited in claim element [1.e] of the '991 patent. Therefore, as discussed for claim element [1.e] of the '814 patent, the Xperia 1 V phone comprises the limitations recited in claim element [1.e] of the '991 patent. *See supra*, ¶¶ 79-81.

111. As set forth above, Sony has directly infringed at least claim 1 of the '991 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

112. Sony has also contributed to the infringement of at least claim 1 of the ’991 patent by Sony’s customers and/or has induced such infringement by its customers, as set forth below in paragraphs ¶¶ 152-160, that are incorporated by reference as if fully set forth herein.

COUNT III

(Sony’s Infringement of U.S. Patent No. 10,873,906)

113. Paragraphs 1-112 are incorporated by reference as if fully set forth herein.

114. Claim 4 of the ’906 patent is reproduced below:

Claim Element No.	Claim Limitation
4.pre	A first wireless device for connecting to a wireless personal area network (WPAN), comprising:
4.a	a wireless radio circuit configured to communicate over a physical medium of a wireless local area network (WLAN) using a WLAN protocol;
4.b	a memory; and
4.c	at least one processor coupled to the wireless radio circuit and the memory, the at least one processor configured to:
4.c.1	discover, via the wireless radio circuit, a second wireless device using a WPAN protocol;
4.c.2	associate, via the wireless radio circuit, with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein, upon associating, the first wireless device is configured to become a member of a WPAN network; and
4.c.3	maintain, via the wireless radio circuit, the association with the second wireless device over the wireless connection using the WPAN protocol;
4.d.1	wherein the WPAN protocol is an overlay protocol that is partially compliant with respect to the WLAN protocol
4.d.2	such that the WPAN protocol uses a WLAN protocol frame adapted to support a WPAN power-saving protocol that is different as compared to a power-saving protocol supported by the WLAN protocol;
4.e	wherein the wireless radio circuit is configured to operate in at least one of a 2.4 GHz or 5 GHz frequency band;
4.f	wherein the WLAN protocol is an 802.11x protocol that uses a frame defined by the 802.11x protocol, and the WPAN protocol uses a WPAN-adapted frame in which at least one field of the frame defined by the 802.11x protocol is adapted to support the WPAN power-saving protocol;
4.g	wherein the WPAN-adapted frame is adapted from a WLAN protocol management frame;

Claim Element No.	Claim Limitation
4.h	wherein the WPAN protocol provides for an inactivity time during which the first and second wireless devices can agree to at least partially disable the wireless connection;
4.i	wherein the first wireless device and the second wireless device are configured to agree on the inactivity time in accordance with the WPAN protocol; and
4.j	wherein the first wireless device is configured to disable data exchanges with the second wireless device via the wireless connection following a start of the inactivity time, wherein the disabling is such that less power per unit time is consumed by the wireless radio circuit relative to a power per unit time consumed by the wireless radio circuit when the data exchanges are not disabled.

A. Preamble of Claim 4 [4.pre]

115. Sony infringes claim 4 of the '906 patent because the Accused Products, e.g., an Xperia 1 V phone, comprise, *inter alia*, "[*a*] *first wireless device for connecting to a wireless personal area network (WPAN)*." For example, an Xperia 1 V phone can be wirelessly connected to an access point (AP) of a wireless network at home or office. In addition, an Xperia 1 V phone can mirror its screen to another nearby[7] device, e.g., a Wi-Fi Direct Compatible TV, etc. To mirror its screen and to display content on another device, the Xperia 1 V phone may create and/ or join a Wi-Fi Direct P2P network (a peer-to-peer network) over which the Xperia 1 V phone and the other device can communicate. The Wi-Fi Direct P2P network comprises "*a wireless personal area network (WPAN)*." The Xperia 1 V phone facilitates the peer-to-peer communication via the Wi-Fi Direct protocol. Accordingly, the Xperia 1 V phone comprises a "*first wireless device for connecting to a wireless personal area network (WPAN)*."

Xperia 1 V 256GB, factory unlocked smartphone, 6.5" 4K 120Hz display, 4K 120fps HDR, true optical zoom, 5G

[7] Within the wireless range of the Xperia 1 V phone.

https://electronics.sony.com/mobile/smartphone/all/p/xqdq62-b

‹ Sony Support | XPERIA 1 V 256GB

Specifications

Operating System

VERSION

Android™ 13[25] / 2 upgrades of OS / 3 years of security updates

Processor

CPU

Snapdragon® 8 Gen2 Mobile Platform[20]

Memory & Storage

EXTERNAL MEMORY

microSDXC support (up to 1 TB)[21]

INTERNAL MEMORY

256 GB UFS[22]

RAM

12 GB

Connectivity

OTHER FEATURES

Smart connectivity, Google Cast, NFC, Output video/image via Display Port support Type-C® Cable or Type-C® to HDMI Adapter Cable (Display port 4K/60 fps)[30]

WI-FI

IEEE802.11a/b/g/n/ac/ax, 2.4/5/6 GHz[31]

USB TYPE

Type-C®

USB VERSION

SuperSpeed USB 5 Gbps (USB 3.2)

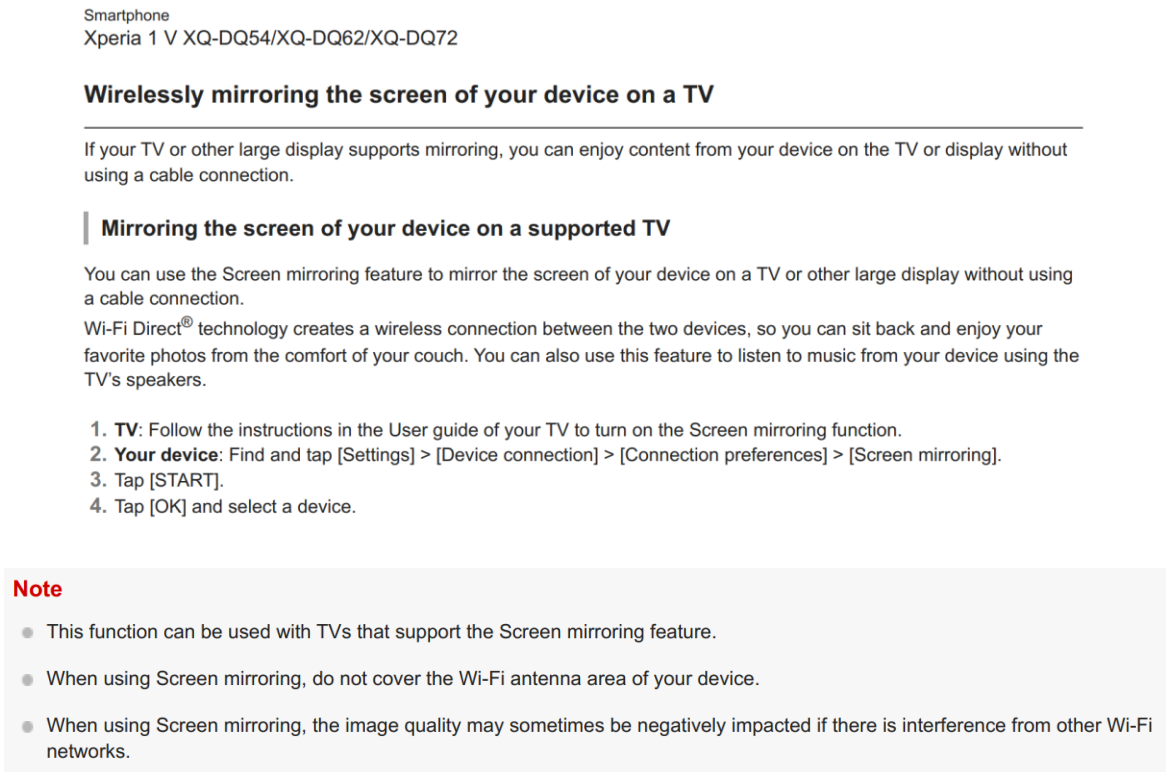
BLUETOOTH

Bluetooth® 5.3 wireless technology, LE Audio

LOCATION

A-GPS, A-GLONASS, Beidou, Galileo, QZSS[32]

https://www.sony.com/electronics/support/mobile-phones-tablets-mobile-phones/xperia-1-v-256gb/specifications



Smartphone
Xperia 1 V XQ-DQ54/XQ-DQ62/XQ-DQ72

Wirelessly mirroring the screen of your device on a TV

If your TV or other large display supports mirroring, you can enjoy content from your device on the TV or display without using a cable connection.

Mirroring the screen of your device on a supported TV

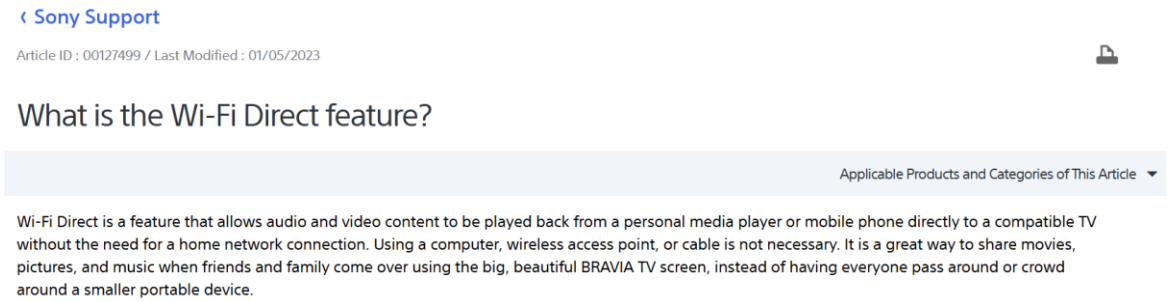
You can use the Screen mirroring feature to mirror the screen of your device on a TV or other large display without using a cable connection.
Wi-Fi Direct® technology creates a wireless connection between the two devices, so you can sit back and enjoy your favorite photos from the comfort of your couch. You can also use this feature to listen to music from your device using the TV's speakers.

1. **TV**: Follow the instructions in the User guide of your TV to turn on the Screen mirroring function.
2. **Your device**: Find and tap [Settings] > [Device connection] > [Connection preferences] > [Screen mirroring].
3. Tap [START].
4. Tap [OK] and select a device.

Note

- This function can be used with TVs that support the Screen mirroring feature.
- When using Screen mirroring, do not cover the Wi-Fi antenna area of your device.
- When using Screen mirroring, the image quality may sometimes be negatively impacted if there is interference from other Wi-Fi networks.

https://helpguide.sony.net/mobile/xperia-1m5/v1/en/print.pdf



‹ Sony Support

Article ID : 00127499 / Last Modified : 01/05/2023

What is the Wi-Fi Direct feature?

Applicable Products and Categories of This Article

Wi-Fi Direct is a feature that allows audio and video content to be played back from a personal media player or mobile phone directly to a compatible TV without the need for a home network connection. Using a computer, wireless access point, or cable is not necessary. It is a great way to share movies, pictures, and music when friends and family come over using the big, beautiful BRAVIA TV screen, instead of having everyone pass around or crowd around a smaller portable device.

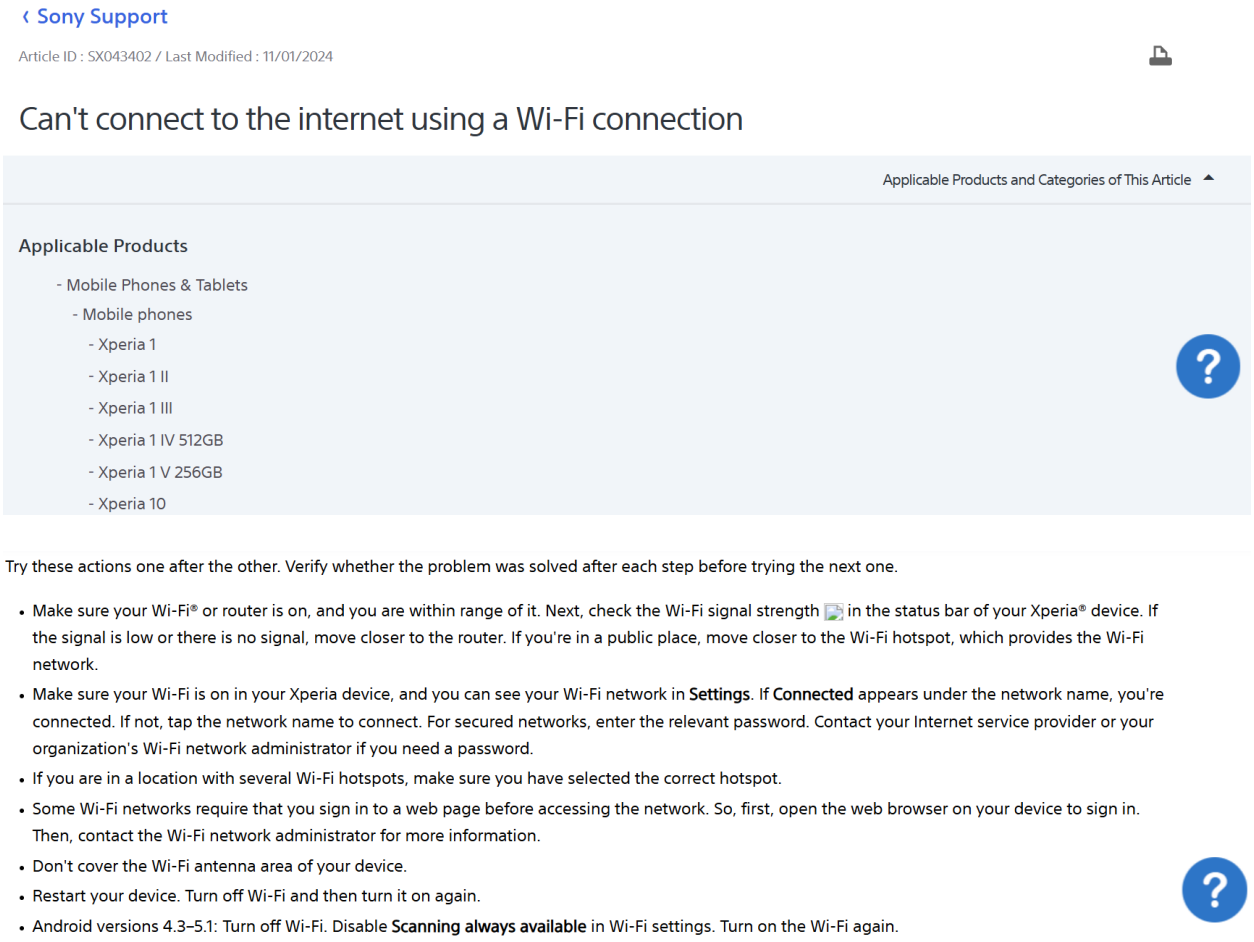
https://www.sony-asia.com/electronics/support/articles/00013745

B. Claim Element [4.a]

116. The Accused Products, e.g., an Xperia 1 V phone, also include, *inter alia*, "*a wireless radio circuit configured to communicate over a physical medium of a wireless local area network (WLAN) using a WLAN protocol*." For example, an Xperia 1 V phone can be wirelessly connected to an access point (AP) of a Wi-Fi network at home or office. Per the IEEE

802.11x Standard, a wireless connection between the Xperia 1 V phone (a mobile wireless station or STA) and the AP is "*a wireless local area network (WLAN)*" connection over, e.g., airspace, i.e., "*a physical medium of* [*the*] *WLAN*." The protocol used to connect the Xperia 1 V phone (a "*first wireless device*), to the AP is the infrastructure-mode protocol, i.e., "*a WLAN protocol*."

117. To support the WLAN (and the peer-to-peer connection as well), the Xperia 1 V phone includes 802.11ac Wi-Fi circuitry / chip (collectively referred to as the "Wi-Fi module"), e.g., LBEE5WV2GF provided by Murata. The Wi-Fi modules comprises "*a wireless radio circuit configured to communicate over a physical medium of a wireless local area network (WLAN) using a WLAN protocol*."



- Restart the router. Check that your router is Wi-Fi certified. Your device is Wi-Fi certified, so the devices may not communicate appropriately if the router isn't.
- Make sure that both the Xperia device and the router use the latest software versions.
  - Check the user guide or contact the manufacturer if you need help updating the router software.
- Check the router settings using your computer. If you need help changing the settings, check the router user guide and contact the manufacturer.
  - **Network mode/speed**: Change to **auto** or **mixed** mode instead of **b**, **g**, or **n**.
  - **SSID** and **password**: Make sure there are no special characters or characters not in the standard ASCII character set.
  - **DHCP**: Make sure it's turned on in the router. You could also set a static IP address in your Xperia device if you have problems accessing the Internet using your Wi-Fi connection. Contact your Internet service provider for information about the IP address settings.
  - **MAC filter**: Make sure it's turned off. Also, set your device as allowed by adding your device's MAC address to the MAC filtering table of the Wi-Fi router. Some routers require your MAC address. For instructions on adding the MAC address to the router's MAC filtering table, check the router's user guide or contact your router manufacturer.
  - **Channel**: Try using another channel, preferably 11 or lower. Check that your access point/router is not set to use channels 12 or 13. These channels are not supported in all markets.
  - Change the Wi-Fi network security of your router to different security encryption. Check the router user guide or contact your router manufacturer for instructions on changing the network security.

- On your Xperia device, set the Wi-Fi sleep policy to **Keep Wi-Fi on during sleep** to **Always**. The device stays connected to the current Wi-Fi network, even on standby.
- Often, Bluetooth® and Wi-Fi use the same frequency band, 2.4GHz. If available, set your device to use the Wi-Fi connection of the 5GHz frequency band. Alternatively, turn off Bluetooth if you don't need it.

https://www.sony.com/electronics/support/articles/SX043401

infrastructure: The infrastructure includes the distribution system medium (DSM), access point (AP), and portal entities. It is also the logical location of distribution and integration service functions of an extended service set (ESS). An infrastructure contains one or more APs and zero or more portals in addition to the distribution system (DS).

Ex. C (IEEE Std 802.11™-2012, Part 11) at 13.

4.3 Components of the IEEE 802.11 architecture

4.3.1 General

The IEEE 802.11 architecture consists of several components that interact to provide a WLAN that supports STA mobility transparently to upper layers.

The basic service set (BSS) is the basic building block of an IEEE 802.11 LAN. Figure 4-1 shows two BSSs, each of which has two STAs that are members of the BSS.

It is useful to think of the ovals used to depict a BSS as the coverage area within which the member STAs of the BSS may remain in communication. (The concept of area, while not precise, is often good enough.) This

area is called the Basic Service Area (BSA). If a STA moves out of its BSA, it can no longer directly communicate with other STAs present in the BSA.

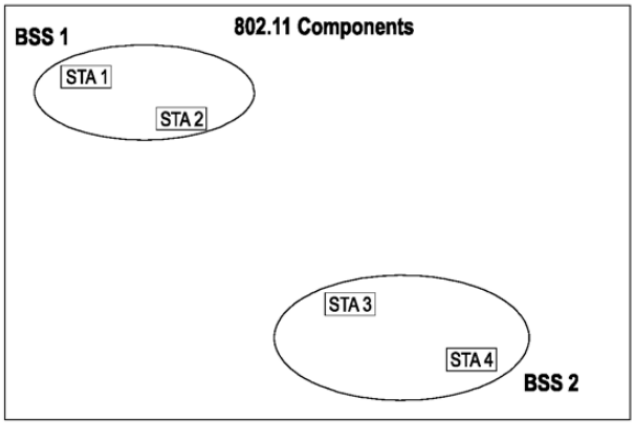


Figure 4-1—BSSs

4.3.4 Distribution system (DS) concepts

4.3.4.1 Overview

PHY limitations determine the direct station-to-station distance that may be supported. For some networks this distance is sufficient; for other networks, increased coverage is required.

Instead of existing independently, an infrastructure BSS may also form a component of an extended form of network that is built with multiple BSSs. The architectural component used to interconnect infrastructure BSSs is the DS.

IEEE Std 802.11 logically separates the WM from the distribution system medium (DSM). Each logical medium is used for different purposes, by a different component of the architecture. The IEEE 802.11 definitions neither preclude, nor demand, that the multiple media be either the same or different.

Recognizing that the multiple media are *logically* different is key to understanding the flexibility of the architecture. The IEEE 802.11 LAN architecture is specified independently of the physical characteristics of any specific implementation.

The DS enables mobile device support by providing the logical services necessary to handle address to destination mapping and seamless integration of multiple BSSs.

An access point (AP) is any entity that has STA functionality and enables access to the DS, via the WM for associated STAs.

Figure 4-2 adds the DS, DSM and AP components to the IEEE 802.11 architecture picture.

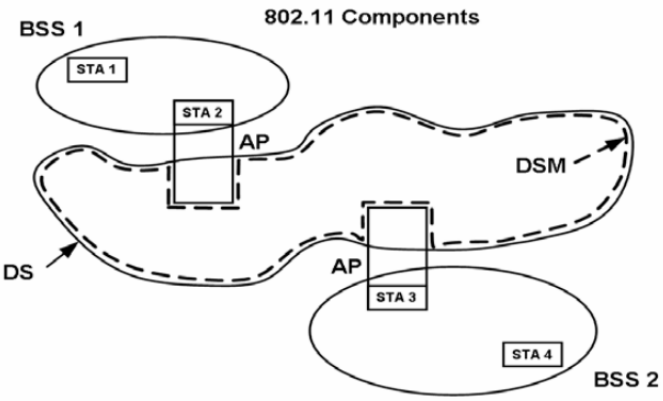


Figure 4-2—DSs and APs

Data move between a BSS and the DS via an AP. Note that all APs are also STAs; thus they are addressable entities. The addresses used by an AP for communication on the WM and on the DSM are not necessarily the same.

Data sent to the AP's STA address by one of the STAs associated with it are always received at the uncontrolled port for processing by the IEEE 802.1X port access entity. In addition, if the controlled port is authorized, these frames conceptually transit the DS.

Ex. C (IEEE Std 802.11™-2012, Part 11) at 45-47.

Report Information	
Report Publish Date	12/28/2023
ItemID / Report Code	426083 / DDT-2309-819
Product Description	
Product Type	Smartphone
Brand	Sony
Device Name	Xperia 1 V
Device Model #	XQ-DQ54
Official Release Date	7/28/2023
Country of Purchase	Poland
Retail Price	$1,399.00
Weight (grams)	188
Device Dimensions (mm)	164.75 x 70.9 x 10.3

Product Features	
Operating System	Android 13
Processor Spec	Octa-Core Qualcomm Snapdragon 8 Gen 2
RAM Support	12 GB Mobile LPDDR5X SDRAM
Communications	Quad-Band GSM/EDGE, W-CDMA(800/850/900/1700/1900/2100MHz), LTE(700/800/850/900/1500/1700/1800/1900/2100/2600MHz), TD-LTE(1900/2000/2300/2500/2600/5500MHz), 5G NR(700/800/850/900/1800/2100/2600MHz), 5G TD-NR(2300/2500/2600/3500/3700MHz).
Connectivity	WiFi 6e, Bluetooth 5.3, GPS, NFC, USB Type-C (USB 3.2, DisplayPort)
User Interface	Capacitive Touchscreen, Side Buttons

Deep Dive Teardown

Device Summary - Design notes

Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

The Sony Xperia 1 V is a typical Qualcomm based design, using well-known components: Qualcomm SM8550-AB Snapdragon Processor and Qualcomm SDR735 RF Transceiver with matching power managements, SK Hynix's RAM, and flash.

The RF design is highly integrated, and most filtering occurs inside modules. There is little filtering directly on PCB, except for some diplexer signal splitting. The biggest integration appeared in WiFi design. In high-end smartphones the signal is typically split into 2.4 and 5 GHz frequencies and passed to four WiFi Front-End modules and then delivered to WiFi Module. In the Sony Xperia 1 V the signal from the antennas is initially filtered and then fed directly to Murata's WiFi LBEE5??2GH Module which consists of two NXP 2.4 GHz WiFi Front-End, two NXP 5 to 7.2 GHz WiFi Front-End and Qualcomm Wi-Fi 7/Bluetooth 5.3 dies.

https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents

Wi-Fi® + Bluetooth® Modules

Type 2GF

Order Number LBEE5WV2GF

In Production | Recommended | New

https://www.murata.com/en-us/products/connectivitymodule/wi-fi-bluetooth/overview/lineup/type2gf

1 Scope

This specification characterizes the IEEE 802.11a/b/g/n/ac WLAN + Bluetooth 5.4 combo module.

2 Key Features

- Infineon CYW43022 inside
- Supports IEEE 802.11a/b/g/n/ac specification: Dual band 2.4 GHz and 5 GHz
- Supports MCS8 (256-QAM) for 20MHz channels enabling data rates up to 78 Mbps.
- Supports Bluetooth specification version 5.4.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0

https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

Ultra-low Power 1x1 Dual-band Wi-Fi 5 (802.11ac) + Bluetooth® 5.4 combo

Infineon's AIROC™ CYW43022 an ultra-low power single-chip, combo device features 1x1 dual-band 2.4 GHz and 5 GHz Wi-Fi 5 (802.11ac) and Bluetooth® 5.4. With a low-power architecture, the CYW43022 is ideal for battery powered applications where best-in-class power consumption is critical. An embedded Bluetooth stack and Wi-Fi networking offloads allow the CYW43022 to maintain connectivity activity even while a host processor is in low-power sleep mode. The CYW43022 supports 256-QAM enabling data rates up to 78 Mbps. On-chip power amplifier and low-noise amplifiers are included for both the 2.4 and 5GHz bands plus an internal +20dBm Bluetooth power amplifier.

Wi-Fi Features

- Wi-Fi 5 (802.11ac) Dual-band (2.4/5 GHz)
- 1x1 SISO
- MCS8 (256-QAM) for 20MHz channels, up to 78Mbps PHY data rate
- Internal PA and LNA for both bands

https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/

C. Claim Element [4.b]

118. The Accused Products, e.g., an Xperia 1 V phone, additionally include, *inter alia*, "*a memory*." The Xperia 1 V phone includes storage, e.g., a "12 GB Mobile LPDDR5X SDRAM," i.e., "*memory*." https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents.

119. Moreover, as discussed for claim element [4.a], an Xperia 1 V phone includes a Wi-Fi module. *See supra*, ¶¶ 116-117. The Wi-Fi module is based on the CYW43022 chipset. https://www.murata.com/products/productdata/8824592302110/type2gf.pdf. This chipset includes SRAM and ROM (i.e., "memory") used by the 802.11ac PHY and MAC modules and an ARM Cortex® processor. https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/.

Xperia 1 V 256GB, factory unlocked smartphone, 6.5" 4K 120Hz display, 4K 120fps HDR, true optical zoom, 5G

https://electronics.sony.com/mobile/smartphone/all/p/xqdq62-b

‹ Sony Support | XPERIA 1 V 256GB

Specifications

Operating System

VERSION

Android™ 13[25] / 2 upgrades of OS / 3 years of security updates

Processor

CPU

Snapdragon® 8 Gen2 Mobile Platform[20]

Memory & Storage

EXTERNAL MEMORY

microSDXC support (up to 1 TB)[21]

RAM

12 GB

INTERNAL MEMORY

256 GB UFS[22]

Connectivity

OTHER FEATURES

Smart connectivity, Google Cast, NFC, Output video/image via Display Port support Type-C® Cable or Type-C® to HDMI Adapter Cable (Display port 4K/60 fps)[30]

WI-FI

IEEE802.11a/b/g/n/ac/ax, 2.4/5/6 GHz[31]

USB TYPE

Type-C®

USB VERSION

SuperSpeed USB 5 Gbps (USB 3.2)

BLUETOOTH

Bluetooth® 5.3 wireless technology, LE Audio

LOCATION

A-GPS, A-GLONASS, Beidou, Galileo, QZSS[32]

https://www.sony.com/electronics/support/mobile-phones-tablets-mobile-phones/xperia-1-v-256gb/specifications

RAM Size	12GB
RAM Type	LPDDR5X
ROM Size	256GB
ROM Type	UFS
EXTERNAL MEMORY	microSDXC support (up to 1 TB)

https://electronics.sony.com/mobile/smartphone/all/p/xqdq62-b

Deep Dive Teardown

Sony Xperia 1 V XQ-DQ54

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https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents

Wi-Fi® + Bluetooth® Modules

Type 2GF

Order Number LBEE5WV2GF

In Production | Recommended | New

https://www.murata.com/en-us/products/connectivitymodule/wi-fi-bluetooth/overview/lineup/type2gf

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- Supports Bluetooth specification version 5.4.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0

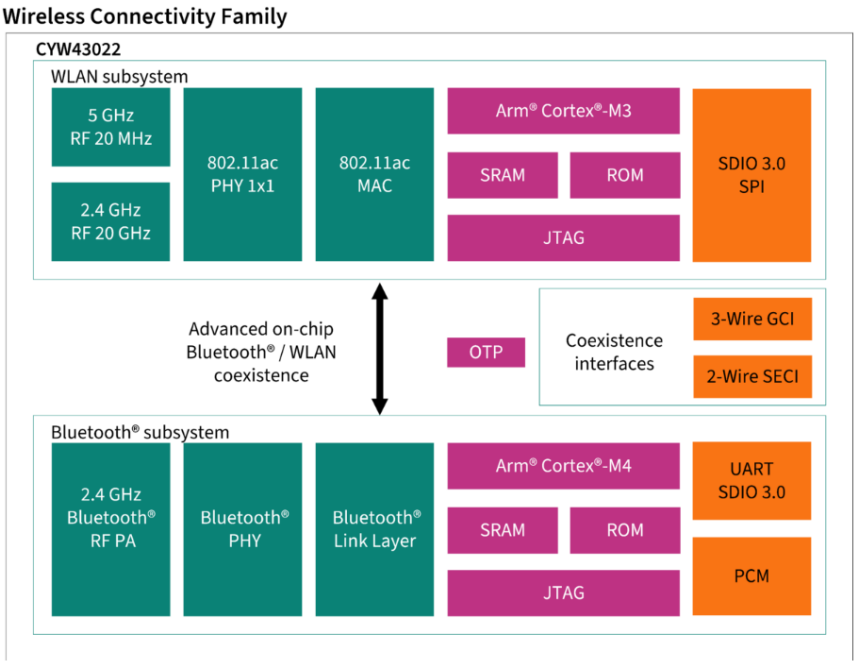
https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

Ultra-low Power 1x1 Dual-band Wi-Fi 5 (802.11ac) + Bluetooth® 5.4 combo

Infineon's AIROC™ CYW43022 an ultra-low power single-chip, combo device features 1x1 dual-band 2.4 GHz and 5 GHz Wi-Fi 5 (802.11ac) and Bluetooth® 5.4. With a low-power architecture, the CYW43022 is ideal for battery powered applications where best-in-class power consumption is critical. An embedded Bluetooth stack and Wi-Fi networking offloads allow the CYW43022 to maintain connectivity activity even while a host processor is in low-power sleep mode. The CYW43022 supports 256-QAM enabling data rates up to 78 Mbps. On-chip power amplifier and low-noise amplifiers are included for both the 2.4 and 5GHz bands plus an internal +20dBm Bluetooth power amplifier.

— Wi-Fi Features

- Wi-Fi 5 (802.11ac) Dual-band (2.4/5 GHz)
- 1x1 SISO
- MCS8 (256-QAM) for 20MHz channels, up to 78Mbps PHY data rate
- Internal PA and LNA for both bands



https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/

D. Claim Element [4.c]

120. Moreover, the Accused Products, e.g., an Xperia 1 V phone, include, *inter alia*, "*at least one processor coupled to the wireless radio circuit and the memory*." For example, an Xperia 1 V phone includes the Snapdragon processor, coupled to a RAM, is provided on a board that also includes the Wi-Fi module used to provide Wi-Fi, i.e., IEEE 802.11 based wireless connections, as discussed for claim element [4.a]. https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents; *see supra*, ¶¶ 116-117.

121. In addition, the Wi-Fi module is based on the CYW43022 chipset. https://www.murata.com/products/productdata/8824592302110/type2gf.pdf. This chipset includes an ARM Cortex® processor coupled to SRAM and ROM and Wi-Fi circuitry including

the 802.11ac PHY and MAC modules. https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/. Accordingly, the Snapdragon processor and/or the ARM Cortex® processor (referred to hereinafter as "Snapdragon / ARM processors") of the Xperia 1 V phone, individually or in combination, comprise "*at least one processor coupled to the wireless radio circuit and the memory*."

Deep Dive Teardown

Sony Xperia 1 V XQ-DQ54

Report Information	
Report Publish Date	12/28/2023
ItemID / Report Code	426083 / DDT-2309-819
Product Description	
Product Type	Smartphone
Brand	Sony
Device Name	Xperia 1 V
Device Model #	XQ-DQ54
Official Release Date	7/28/2023
Country of Purchase	Poland
Retail Price	$1,399.00
Weight (grams)	188
Device Dimensions (mm)	164.75 x 70.9 x 10.3

Product Features	
Operating System	Android 13
Processor Spec	Octa-Core Qualcomm Snapdragon 8 Gen 2
RAM Support	12 GB Mobile LPDDR5X SDRAM
Communications	Quad-Band GSM/EDGE, W-CDMA(800/850/900/1700/1900/2100MHz), LTE(700/800/850/900/1500/1700/1800/1900/2100/2600MHz), TD-LTE(1900/2000/2300/2500/2600/5500MHz), 5G NR(700/800/850/900/1800/2100/2600MHz), 5G TD-NR(2300/2500/2600/3500/3700MHz).
Connectivity	WiFi 6e, Bluetooth 5.3, GPS, NFC, USB Type-C (USB 3.2, DisplayPort)
User Interface	Capacitive Touchscreen, Side Buttons

Deep Dive Teardown

Device Summary - Design notes

Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

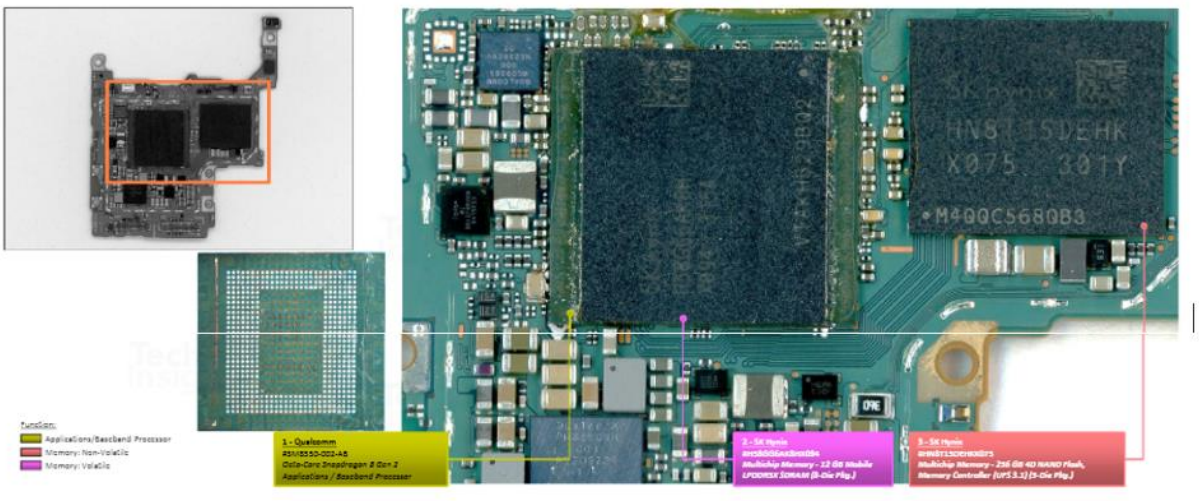
The Sony Xperia 1 V is a typical Qualcomm based design, using well-known components: Qualcomm SM8550-AB Snapdragon Processor and Qualcomm SDR735 RF Transceiver with matching power managements, SK Hynix's RAM, and flash.

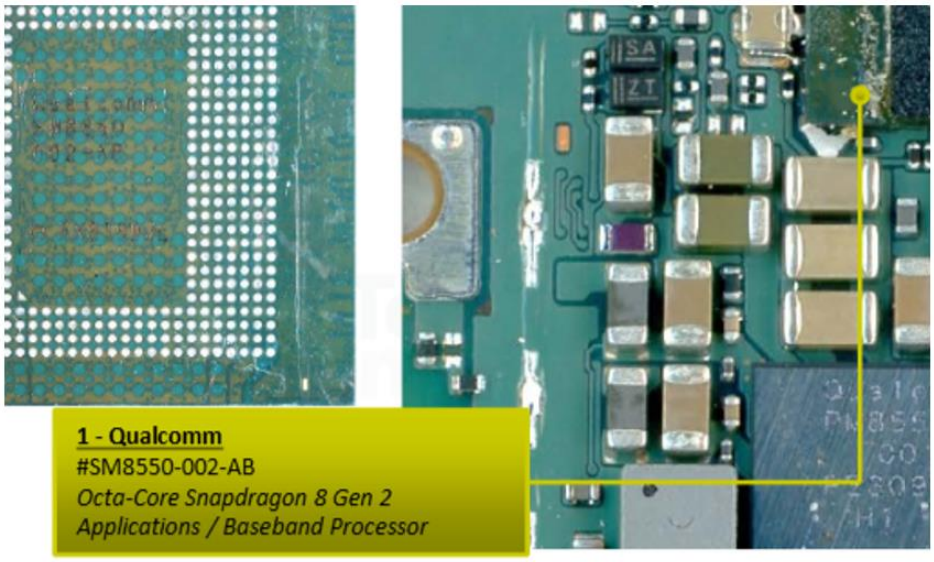
The RF design is highly integrated, and most filtering occurs inside modules. There is little filtering directly on PCB, except for some diplexer signal splitting. The biggest integration appeared in WiFi design. In high-end smartphones the signal is typically split into 2.4 and 5 GHz frequencies and passed to four WiFi Front-End modules and then delivered to WiFi Module. In the Sony Xperia 1 V the signal from the antennas is initially filtered and then fed directly to Murata's WiFi LBEE5??2GH Module which consists of two NXP 2.4 GHz WiFi Front-End, two NXP 5 to 7.2 GHz WiFi Front-End and Qualcomm Wi-Fi 7/Bluetooth 5.3 dies.

Substrates - Main Board

Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

Side 1 - Component Identification





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https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

1 Scope

This specification characterizes the IEEE 802.11a/b/g/n/ac WLAN + Bluetooth 5.4 combo module.

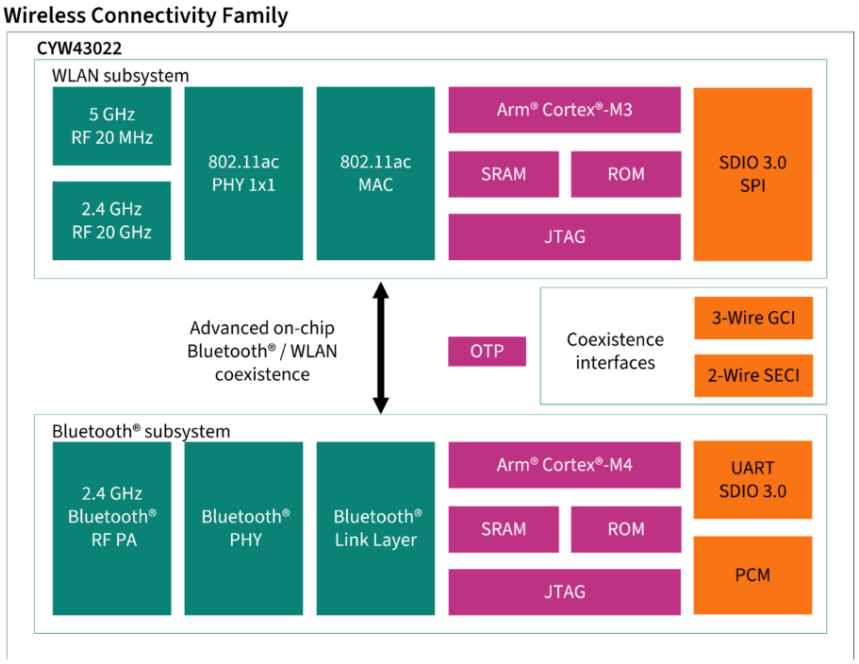
2 Key Features

- Infineon CYW43022 inside
- Supports IEEE 802.11a/b/g/n/ac specification: Dual band 2.4 GHz and 5 GHz
- Supports MCS8 (256-QAM) for 20MHz channels enabling data rates up to 78 Mbps.
- Supports Bluetooth specification version 5.4.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0

https://www.murata.com/products/productdata/8824592302110/type2gf.pdf

— Wi-Fi Features

- Wi-Fi 5 (802.11ac) Dual-band (2.4/5 GHz)
- 1x1 SISO
- MCS8 (256-QAM) for 20MHz channels, up to 78Mbps PHY data rate
- Internal PA and LNA for both bands



https://www.infineon.com/cms/en/product/wireless-connectivity/airoc-wi-fi-plus-bluetooth-combos/wi-fi-5-802.11ac/cyw43022/

122. The Snapdragon / ARM processors of an Xperia 1 V phone, individually or in combination, i.e., "*the at least one processor*" is "*configured to*" perform various claimed operations, as discussed below.

E. Claim Element [4.c.1]

123. In the Accused Products, e.g., an Xperia 1 V phone, the Snapdragon / ARM processors, individually or in combination ("*the at least one processor*") is configured to, *inter alia*, "*discover, via the wireless radio circuit, a second wireless device using a WPAN protocol*."

This is because, as discussed for the preamble of claim 4, [4.pre], to mirror its screen on to another device (e.g., a Wi-Fi Direct Compatible TV), an Xperia 1 V phone establishes a Wi-Fi Direct P2P network (i.e., the "*WPAN*") to which the other device is connected. *See supra*, ¶¶ 115-115. A wireless connection between the Xperia 1 V phone and the other device is established using the Wi-Fi Direct protocol that is based on the IEEE 802.11x Standard (Wi-Fi). Accordingly, the Wi-Fi Direct protocol comprises "*a WPAN protocol*."

124. Establishing the connection using the Wi-Fi Direct protocol entails "P2P Discovery" and "Pairing." The Wi-Fi Direct protocol is used by both the Xperia 1 V phone, i.e., the "*first wireless device*," and the other device. Therefore, the other device comprises "*a second wireless device using a WPAN protocol*." Moreover, as part of creating and/or joining the Wi-Fi Direct P2P network, a device using the Wi-Fi Direct protocol looks for another device via "P2P Discovery." Ex. B (Wi-Fi-Direct-Spec) at 13, 15, 19, 23, 25.

125. As discussed for claim element [4.a], an Xperia 1 V phone includes a Wi-Fi module that facilitates communications in a "*WLAN*." *See supra*, ¶¶ 116-117. Because the Wi-Fi Direct P2P network and the Wi-Fi Direct protocol used for its operation are both Wi-Fi based, the Wi-Fi module of an Xperia 1 V phone also supports the Wi-Fi Direct P2P network and the Wi-Fi Direct protocol (the "*WPAN protocol*"). As discussed for claim element [4.c], the Wi-Fi module is coupled to the Snapdragon / ARM processors. *See supra*, ¶¶ 120-122. At least some software / firmware based operations of the Wi-Fi module, e.g., the Wi-Fi driver operations, are performed by these processors. Thus, in an Xperia 1 V phone, the Snapdragon / ARM processors, individually or in combination ("*the at least one processor*") is configured to, *inter alia*, "*discover, via the wireless radio circuit, a second wireless device using a WPAN protocol*."

1 Introduction

1.1 Overview

This document is the Technical Specification for Wi-Fi P2P, a solution for Wi-Fi® device-to-device connectivity. This Specification defines an architecture and set of protocols that facilitate Wi-Fi P2P operation and that are backward compatible with existing Wi-Fi CERTIFIED™ devices when these devices operate outside DMG. For devices operating within DMG, there are no requirements on backward compatibility with existing Wi-Fi CERTIFIED™ devices.

1.2 Scope

The scope of the feature requirements is limited to that defined in this specification. The content of this specification is designed to address the solution requirement areas including:

- Discovery (Device Discovery and Service Discovery),
- Pairing (including Group Formation and P2P Invitation),
- Connectivity,
- Power Management when operating outside DMG,
- Group Management,
- Coexistence when operating outside DMG, and
- Legacy for operation outside DMG.

1.4 Definitions

The following definitions and terms are used in this document:

P2P Client: A P2P Device that is connected to a P2P Group Owner.

P2P Coexistence Parameters: A combination of Primary P2P Coexistence Parameters and Secondary P2P Coexistence Parameters.

P2P Concurrent Device: A P2P Device that can concurrently operate as a WLAN STA in WLAN.

P2P Device: Wi-Fi P2P device that is capable of acting as both a P2P Group Owner and a P2P Client.

P2P Device Address: An identifier used to uniquely reference a P2P Device.

P2P Discovery: A capability that provides a set of functions to allow a device to easily and quickly identify and connect to a device and its services in its vicinity.

P2P Group: A set of devices consisting of one P2P Group Owner and zero or more Clients.

2 Architectural overview

2.1 P2P components

The P2P architecture consists of components that interact to support device-to-device communication.

P2P Device:

- Supports both P2P Group Owner and P2P Client roles.
- Negotiates P2P Group Owner or P2P Client role.
- Supports WSC and P2P Discovery mechanism.
- May support WLAN and P2P concurrent operation.

P2P Group Owner role:

- "AP-like" entity that provides BSS functionality and services for associated Clients (P2P Clients or Legacy Clients) when not operating within DMG, or a PCP that provides PBSS functionality and services for Clients (P2P Clients) when operating within DMG.
- Provides WSC Internal Registrar functionality.
- May provide communication between associated Clients.
- May provide access to a simultaneous WLAN connection for its associated Clients.

P2P Client role:

- Implements non-AP STA functionality.
- Provides WSC Enrollee functionality.

2.4 Functions and services

2.4.1 Basic functions and services

For P2P operation outside the DMG, this specification assumes that the following STA functions and services are implemented in P2P Devices:

- IEEE 802.11g or newer 2.4 GHz PHY [1]
- IEEE 802.11i (AES-CCMP) [1]
- Wi-Fi Simple Configuration [2]
- Wi-Fi Multimedia [3]

2.4.2 P2P specific functions and services

In addition to the assumed functions listed in Section 2.4.1, a P2P Device supports the following P2P specific functions:

— **P2P Discovery** provides a set of functions to allow a device to easily and quickly identify and connect to another P2P Device and its services in its vicinity.

3.1 P2P discovery

3.1.1 Introduction

P2P Discovery enables P2P Devices to quickly find each other and form a connection.

P2P Discovery consists of the following major components:

— **Device Discovery** facilitates two P2P Devices arriving on a common channel and exchanging device information (e.g. device name and device type).

— **Service Discovery** is an optional feature that allows a P2P Device to discover available higher-layer services prior to forming a connection.

— **Group Formation** is used to determine which device will be the P2P Group Owner and form a new P2P Group.

— **P2P Invitation** is used to invoke a Persistent P2P Group or invite a P2P Device to join an existing P2P Group.

Note – During P2P Discovery, a DMG STA can ignore P2P public action frames received outside of a beacon interval if it does not know how to respond to such frames.

3.1.2 Device Discovery procedures

3.1.2.1 Basic mechanisms of Device Discovery

The objective of P2P Device Discovery is to find P2P Devices and quickly determine the P2P Device to which a connection will be attempted. In-band P2P Device Discovery consists of two major phases: Scan and Find, which are described in detail in the following sections. Alternatively, if two P2P Devices support NFC, the user may specify the target device by touching the P2P Device's NFC Interface to the corresponding device's NFC Interface. Such NFC Out-of-Band Device Discovery is defined in Section 3.1.2.7.

In-band Device Discovery uses Probe Request and Probe Response frames to exchange device information. When operating outside DMG, the P2P Devices in a P2P Group are discovered via a Probe Response frame from the P2P Group Owner. When operating within DMG, P2P Devices in a P2P Group are normally discovered via an SSW frame received in response to a DMG Beacon transmission as described in Section 11.1.4.3 of IEEE 802.11-REVmc [11]; Probe Request and Probe Response frames are subsequently used to exchange device information. Alternatively, Probe Request and Probe Response frames may be used instead of SSW frames for devices that do not use beamforming.

Ex. B (Wi-Fi-Direct-Spec) at 13-15, 19, 22, 23, 25.

F. Claim Element [4.c.2]

126. In the Accused Products, e.g., an Xperia 1 V phone, the Snapdragon / ARM processors, individually or in combination ("*the at least one processor*") is also configured to, *inter alia*, "*associate, via the wireless radio circuit, with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein, upon associating, the first wireless device is configured to become a member of a WPAN network*."

127. This is because, establishing a Wi-Fi Direct P2P connection between the Xperia 1 V phone and another device, e.g., a Wi-Fi Direct Compatible TV, protocol entails "Pairing," which includes forming a P2P Group and connecting to the P2P Group. The connect to the P2P Group, a P2P Device (e.g., an Xperia 1 V phone or another device) associates with the P2P

Group Owner (e.g., the other device or the Xperia 1 V phone), and thus, the P2P Group Owner associates with the P2P Client.

128. As discussed for claim element [4.c.1], the Snapdragon / ARM processors use the Wi-Fi module and the Wi-Fi Direct protocol for the Wi-Fi Direct P2P communication. *See supra*, ¶ 123. Accordingly, the Snapdragon / ARM processors (*the at least one processor*) is configured to "*associate* [the Xperia 1 V phone,] *via* [the Wi-Fi module, i.e.,] *the wireless radio circuit, with* [the other device, i.e.,] *the second wireless device to establish a wireless connection, the wireless connection using* [the Wi-Fi Direct protocol, i.e.,] *the WPAN protocol, wherein, upon associating,* [the Xperia 1 V phone, i.e.,] *the first wireless device is configured to become a member of* [the P2P Group of the Wi-Fi Direct P2P network, i.e.,] *a WPAN network*."

1 Introduction

1.1 Overview

This document is the Technical Specification for Wi-Fi P2P, a solution for Wi-Fi® device-to-device connectivity. This Specification defines an architecture and set of protocols that facilitate Wi-Fi P2P operation and that are backward compatible with existing Wi-Fi CERTIFIED™ devices when these devices operate outside DMG. For devices operating within DMG, there are no requirements on backward compatibility with existing Wi-Fi CERTIFIED™ devices.

1.2 Scope

The scope of the feature requirements is limited to that defined in this specification. The content of this specification is designed to address the solution requirement areas including:

- Discovery (Device Discovery and Service Discovery),
- Pairing (including Group Formation and P2P Invitation),
- Connectivity,
- Power Management when operating outside DMG,
- Group Management,
- Coexistence when operating outside DMG, and
- Legacy for operation outside DMG.

3.1 P2P discovery

3.1.1 Introduction

P2P Discovery enables P2P Devices to quickly find each other and form a connection.

P2P Discovery consists of the following major components:

- **Device Discovery** facilitates two P2P Devices arriving on a common channel and exchanging device information (e.g. device name and device type).
- **Service Discovery** is an optional feature that allows a P2P Device to discover available higher-layer services prior to forming a connection.
- **Group Formation** is used to determine which device will be the P2P Group Owner and form a new P2P Group.
- **P2P Invitation** is used to invoke a Persistent P2P Group or invite a P2P Device to join an existing P2P Group.

Note – During P2P Discovery, a DMG STA can ignore P2P public action frames received outside of a beacon interval if it does not know how to respond to such frames.

3.1.4 Group Formation procedure

3.1.4.1 General procedures

A P2P Device may autonomously start a P2P Group by becoming a P2P Group Owner as described in Section 3.2.2. A P2P Device may use the Group Formation Procedure to form a new P2P Group. Group Formation is used to determine which device shall be the P2P Group Owner, exchange Credentials for the P2P Group and determine its characteristics e.g. whether it shall be a Persistent P2P Group or a Temporary P2P Group. Group Formation Procedure consists of Group Owner Negotiation and Provisioning, as described in the following sections.

When a P2P Device discovers another P2P Device with which it intends to connect, it may start the Group Formation Procedure. A P2P Device shall conduct the Group Formation Procedure with one other P2P Device. The Group

3.2.3 Connecting to a P2P Group

A P2P Device discovers a P2P Group or another P2P Device using the Device Discovery procedure described in 3.1.2.

The P2P Client acquires the Group Credentials through static configuration or through Wi-Fi Simple Configuration [2]. When using Wi-Fi Simple Configuration [2], the P2P Group Owner shall serve as the WSC Registrar and the P2P Client shall serve as the WSC Enrollee. In order to connect to a P2P Group, the P2P Client operating outside DMG, using the Credentials, shall engage in the authentication procedure in Section 10.3.4.2 of IEEE 802.11-2012 [1] and the association procedure in Section 10.3.5.2 of IEEE 802.11-2012 [1] with the P2P Group Owner. In order to connect to a P2P Group, the P2P Client operating

When a P2P Client associates with a P2P Group Owner, it provides its Device Name, Primary Device Type, and optionally Secondary Device Type List information to the P2P Group Owner by including the P2P Device Info attribute (see Section 4.1.15) and the P2P Capability attribute (see Section 4.1.4) in the P2P IE in the Association Request frame. This information shall be used by the P2P Group Owner for Group Information Advertisement.

4.2.4 Association/Reassociation Request frame format

One or more P2P IEs shall be inserted after other information elements in the Association Request or Reassociation Request frame transmitted by a P2P Device.

P2P attributes for a P2P IE that is included in the Association Request or Reassociation Request frame Response frames sent to a P2P Device are shown in Table 53.

Table 53—P2P attributes in the Association/Reassociation Request frame

Attributes	Attribute ID	Note
P2P Capability	2	The P2P Capability attribute shall be present in the P2P IE.
Extended Listen Timing	8	The Extended Listen Timing attribute may be present in the P2P IE in Association Request or Reassociation Request frames transmitted by a P2P Client.
P2P Device Info	13	The P2P Device Info attribute shall be present in the P2P IE.

4.2.5 Association/Reassociation Response frame format

One or more P2P IEs shall be inserted after other information elements in the Association Response or Reassociation Response frame transmitted by a P2P Device. P2P attributes for a P2P IE that is included in the Association Response or Reassociation Response frames are shown in Table 55.

Table 55—P2P attributes in the Association/Reassociation Response frame

Attributes	Attribute ID	Note
Status	0	The Status attribute shall be present in the P2P IE to provide status information when a (Re) association Request frame is denied.
Extended Listen Timing	8	The Extended Listen Timing attribute may be present in the P2P IE in Association Response or Reassociation Response frames transmitted by a P2P Group Owner.

Ex. B (Wi-Fi Direct Spec) at 13, 25, 44, 46, 61-62, 119-120

G. Claim Element [4.c.3]

129. In addition, in the Accused Products, e.g., an Xperia 1 V phone, the Snapdragon / ARM processors ("*the at least one processor*") is configured to, *inter alia*, "*maintain, via the wireless radio circuit, the association with the second wireless device over the wireless connection using the WPAN protocol*." This is because, as discussed for claim element [4.c.1], the Snapdragon / ARM processors use the Wi-Fi module and the Wi-Fi Direct protocol for the Wi-Fi Direct P2P network communication. *See supra*, ¶ 123. As discussed for claim element [4.c.2], the Wi-Fi Direct protocol provides for an "*association*" between peers, e.g., the Xperia 1 V phone and another device, e.g., a Wi-Fi Direct Compatible TV. *See supra*, ¶¶ 126-128.

130. The Wi-Fi Direct protocol "*maintain*[*s*]" this "*association*" once established, simultaneously with another connection involving a peer, e.g., a WLAN connection between the Xperia 1 V phone and an AP of the WLAN. Accordingly, the Snapdragon / ARM processors (*the at least one processor*) is configured to "*maintain, via* [the Wi-Fi module, i.e.,] *the wireless*

radio circuit, the association with [another device, i.e.,] *the second wireless device over the wireless connection using* [the Wi-Fi Direct protocol, i.e.,] *the WPAN protocol*."

Wi-Fi Peer-to-Peer (P2P) Technical Specification

Version 1.7

This document is the specification for the Wi-Fi Alliance Wi-Fi CERTIFIED Wi-Fi Direct® program, which allows Wi-Fi client devices to connect directly without the use of an access point.

1.1 Overview

This document is the Technical Specification for Wi-Fi P2P, a solution for Wi-Fi® device-to-device connectivity. This Specification defines an architecture and set of protocols that facilitate Wi-Fi P2P operation and that are backward compatible with existing Wi-Fi CERTIFIED™ devices when these devices operate outside DMG. For devices operating within DMG, there are no

1.4 Definitions

Directional Multi-Gigabit (DMG): A frequency band wherein the operating channel center frequency is above 45 GHz.

In-band: Data transfer using the WLAN communication channel, including WLAN multiband devices (e.g. 2.4GHz, 5GHz, and 60GHz).

2 Architectural overview

2.1 P2P components

The P2P architecture consists of components that interact to support device-to-device communication.

P2P Device:

- Supports both P2P Group Owner and P2P Client roles.
- Negotiates P2P Group Owner or P2P Client role.
- Supports WSC and P2P Discovery mechanism.
- May support WLAN and P2P concurrent operation.

P2P Group Owner role:

- "AP-like" entity that provides BSS functionality and services for associated Clients (P2P Clients or Legacy Clients) when not operating within DMG, or

2.3 Concurrent operation

A P2P Device can operate concurrently with a WLAN (infrastructure network). Such a device is considered a P2P Concurrent Device. The concurrent operation requires a device to support multiple MAC entities.

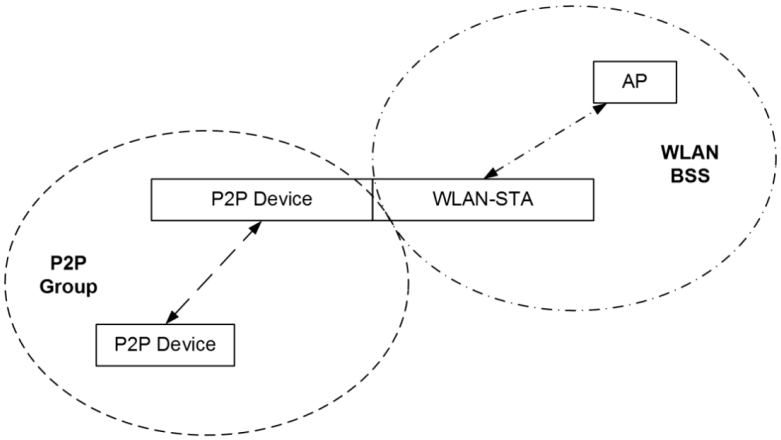


Figure 4—P2P Concurrent device

As an example, Figure 4 shows a P2P Concurrent Device that has one MAC entity operating as a WLAN-STA and the second MAC entity operating as a P2P Device. The dual MAC functionality can be provided via two separate physical MAC entities each associated with its own PHY entity, two virtual MAC entities over one PHY entity, or any other approach. Implementation of multiple MAC functionality is out of scope of this specification.

Ex. B (Wi-Fi-Direct-Spec) at cover page, 13-14, 19, 21.

H. Claim Element [4.d.1]

131. The Accused Products, e.g., an Xperia 1 V phone, practice this claim element because the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *is an overlay protocol that is partially compliant with respect to the WLAN protocol*." In particular, it is discussed for claim elements [4.a] and [4.c.1] that, respectively, the infrastructure-mode protocol comprises "*the WLAN protocol*" and the Wi-Fi Direct protocol comprises the "*WPAN protocol*." *See supra*, ¶¶ 116-117, 123-**Error! Reference source not found.**. Referring to Count I, claim element [1.d.3] o f the '814 patent, it was discussed that the Wi-Fi Direct protocol is an "*overlay protocol*" with respect to the infrastructure mode protocol. *See supra,* ¶¶ 62-75. It was also discussed that the

Wi-Fi Direct protocol is only partially and not entirely compliant with the infrastructure-mode protocol, and that their respective communications are consistent substantially but not entirely. *See id*. Therefore, the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *is an overlay protocol that is partially compliant with respect to* [the infrastructure-mode protocol, i.e.,] *the WLAN protocol*."

I. Claim Element [4.d.2]

132. The Accused Products, e.g., an Xperia 1 V phone, practice this claim element because the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *uses a WLAN protocol frame adapted to support a WPAN power-saving protocol that is different as compared to a power-saving protocol supported by the WLAN protocol*.

133. As discussed for Count I, claim element [1.d.3] of the '814 patent, the Wi-Fi Direct protocol uses Vendor-specific Action frames (AFs). *See supra*, ¶¶ 62-75. Vendor-specific AFs are defined by the IEEE 802.11x Standard and can be used by the infrastructure-mode protocol and are therefore "*WLAN protocol frame*[*s*]." The Vendor-specific AFs used by the Wi-Fi Direct protocol (hereinafter, Wi-Fi Direct AFs) include **customized Wi-Fi Direct-specific** fields and values to coordinate data exchanges among peers that are using the Wi-Fi Direct protocol. One or more Wi-Fi Direct-specific fields (e.g., "Notice of Absence," "CTWindow," "OppPS,") and their values in an Wi-Fi Direct AF define the Wi-Fi Direct power-saving rule set, i.e., "*a WPAN power-saving protocol*," for a Wi-Fi Direct P2P network using the Wi-Fi Direct protocol. Therefore, the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *uses* [a customized Vendor-specific AF, i.e.,] *a WLAN protocol frame adapted to support a WPAN power-saving protocol."*

134. The Wi-Fi Direct power-saving rule set, i.e., the "*WPAN power-saving protocol*," is different from the rules provided by the IEEE 802.11x Standard for power saving in an infrastructure-mode BSS, i.e., "*a power-saving protocol supported by the WLAN protocol*," in at least one significant way. According to the Wi-Fi Direct power-saving rule set, any peer in a Wi-Fi Direct P2P network using the Wi-Fi Direct protocol, including the P2P Group Owner that operates in an "'AP-like'" manner can disable a part of the communication with the other peers while in the power-save / absence state. In contrast, according to the infrastructure-mode protocol of the IEEE 802.11x Standard, only the non-AP STAs in an infrastructure-mode BSS can use the power-saving mode; the AP of the infrastructure-mode BSS cannot use the power-saving mode and must always remain awake.

135. Accordingly, the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *uses* [a customized Vendor-specific AF, i.e.,] *a WLAN protocol frame adapted to support a WPAN power-saving protocol that is different as compared to a power-saving protocol supported by* [the infrastructure-mode protocol, i.e.,] *the WLAN protocol.*"

8.2.3 General frame format

The MAC frame format comprises a set of fields that occur in a fixed order in all frames. Figure 8-1 depicts the general MAC frame format. The first three fields (Frame Control, Duration/ID, and Address 1) and the last field (FCS) in Figure 8-1 constitute the minimal frame format and are present in all frames, including reserved types and subtypes. The fields Address 2, Address 3, Sequence Control, Address 4, QoS Control, HT Control, and Frame Body are present only in certain frame types and subtypes. Each field is defined in 8.2.4. The format of each of the individual subtypes of each frame type is defined in 8.3. The components of management frame bodies are defined in 8.4. The formats of management frames of subtype Action are defined in 8.5.

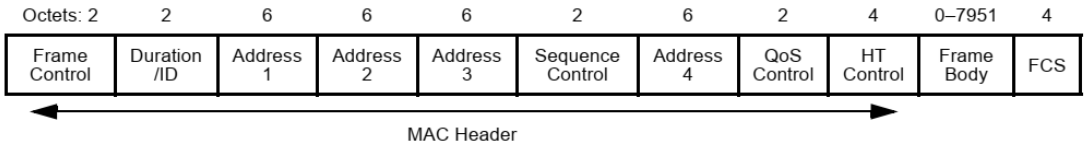


Figure 8-1—MAC frame format

8.2.4.1.1 General

The Frame Control field consists of the following subfields: Protocol Version, Type, Subtype, To DS, From DS, More Fragments, Retry, Power Management, More Data, Protected Frame, and Order. The format of the Frame Control field is illustrated in Figure 8-2.

	B0 B1	B2 B3	B4 B7	B8	B9	B10	B11	B12	B13	B14	B15
	Protocol Version	Type	Subtype	To DS	From DS	More Frag-ments	Re-try	Power Manage-ment	More Data	Protect-ed Frame	Or-der
Bits:	2	2	4	1	1	1	1	1	1	1	1

Figure 8-2—Frame Control field

Ex. C (IEEE Std 802.11™-2012, Part 11) at 381-83.

8.2.4.1.7 Power Management field

The Power Management field is 1 bit in length and is used to indicate the power management mode of a STA. The value of this field is either reserved (as defined below) or remains constant in each frame from a particular STA within a frame exchange sequence (see Annex G). The value indicates the mode of the STA after the successful completion of the frame exchange sequence.

In an infrastructure BSS, the following applies:

— The Power Management field is reserved in all management frames that are not bufferable management frames.

— The Power Management field is reserved in all management frames transmitted by a STA to an AP with which it is not associated.

— The Power Management field is reserved in all frames transmitted by the AP.

— Otherwise, a value of 1 indicates that the STA will be in PS mode. A value of 0 indicates that the STA will be in active mode.

Ex. C (IEEE Std 802.11™-2012, Part 11) at 384.

4.3.13.22 WNM-Sleep mode

WNM-Sleep mode is an extended power save mode for non-AP STAs in which a non-AP STA need not listen for every DTIM Beacon frame, and need not perform GTK/IGTK updates. WNM-Sleep mode enables a non-AP STA to signal to an AP that it will be sleeping for a specified length of time. This enables a non-AP STA to reduce power consumption and remain associated while the non-AP STA has no traffic to send to or receive from the AP.

Ex. C (IEEE Std 802.11™-2012, Part 11) at 60.

10.2 Power management

10.2.1 Power management in an infrastructure network

10.2.1.1 General

STAs changing Power Management mode shall inform the AP of this fact using the Power Management bits within the Frame Control field of transmitted frames. A STA shall remain in its current Power Management mode until it informs the AP of a Power Management mode change via a frame exchange that includes an acknowledgment from the AP. Power Management mode shall not change during any single frame exchange sequence, as described in Annex G.

NOTE—This means the Power Management bit is the same for all MPDUs in an A-MPDU.

The AP shall buffer individually addressed BUs addressed to STAs operating in a PS mode. These buffered BUs shall be transmitted only at designated times.

If any STA in its BSS is in PS mode, the AP shall buffer all group addressed BUs and deliver them to all STAs immediately following the next Beacon frame containing a DTIM transmission.

The STAs that currently have buffered BUs within the AP are identified in a TIM, which shall be included as an element within all Beacon frames generated by the AP. A STA shall determine that a BU is buffered for it by receiving and interpreting a TIM.

STAs operating in PS modes shall periodically listen for Beacon frames, as determined by the STA's ListenInterval and the ReceiveDTIMs parameter in the MLME-POWERMGT.request primitive.

In a BSS operating under the DCF, or during the CP of a BSS using the PCF, upon determining that a BU is currently buffered in the AP, a STA operating in the PS mode shall transmit a short PS-Poll frame to the AP, which shall respond with the corresponding buffered BU immediately, or acknowledge the PS-Poll and respond with the corresponding BU at a later time. If the TIM indicating the buffered BU is sent during a CFP, a CF-Pollable STA operating in the PS mode does not send a PS-Poll frame, but remains active until the buffered BU is received (or the CFP ends).

A non-AP QoS STA may be in PS mode before the setup of DLS or Block Ack. Once DLS is set up, both of the QoS STAs associated with a DLS link suspend the PS mode and shall be awake. When a STA enters normal (non-APSD) PS mode, any downlink Block Ack agreement without an associated schedule is suspended for the duration of this PS mode. BUs for a TID without a schedule are sent using Normal Ack following a PS-poll as described in rest of 10.2.1. Uplink Block Ack, Block Acks for any TID with a schedule, and any Block Acks to APSD STA continue to operate normally.

A STA may use both WNM-Sleep mode and PS mode simultaneously.

Ex. C (IEEE Std 802.11™-2012, Part 11) at 984.

3.3 P2P Power Management

3.3.1 Introduction

P2P power management supports power save mechanisms for P2P Group Owners and P2P Clients when the P2P Group operates outside DMG. If the

The P2P power management approach for operation outside DMG is based on existing PS and WMM-PS power management delivery mechanisms with two new procedures that allow the P2P Group Owner to be absent for defined periods; Opportunistic Power Save and Notice of Absence. Small adaptations to PS and WMM-PS protocols at the P2P Client are necessary to allow for P2P Group Owner absence periods. The adapted protocols are termed P2P PS and P2P WMM-PS to differentiate them from the existing schemes on which they are based. These mechanisms are available in a P2P Group in which only P2P Devices are associated.

3.3.2 Power Management and discovery

P2P Power Management reduces P2P Device availability and therefore impacts the discoverability of that P2P Device. For this reason, the P2P Power Management protocol defines an availability period, called the CTWindow, to assist in maintaining P2P Device discoverability. The CTWindow is a period during which a P2P Group Owner is present.

The P2P Group Owner is responsible for selecting an appropriate value for CTWindow. The CTWindow shall be an integral number of TU and shall always be less than the beacon interval. For a P2P Group Owner that desires to be discoverable, the CTWindow should be at least 10 TU. A CTWindow shall start at each TBTT and extend for the chosen duration. During this time window the P2P Group Owner shall be in the active state subject to the P2P Group Owner power save state precedence rules in Section 3.3.3.2. A P2P Group Owner shall complete any active frame exchange sequence prior to ending the CTWindow.

3.3.3.1 P2P Group Owner Opportunistic Power Save procedure

P2P Group Owner Opportunistic Power Save is a power management scheme that allows a P2P Group Owner to gain additional power savings on an opportunistic basis.

Opportunistic Power Save uses the CTWindow described in Section 3.3.2. The P2P Group Owner shall indicate that Opportunistic Power Save is enabled by setting the OppPS bit to 1 in the CTWindow and OppPS Parameters field of the Notice of Absence attribute. The CTWindow field shall be set to a non-zero value if the OppPS bit is set to 1.

At any time after the end of each CTWindow, if all of the connected P2P Clients are determined to be in Doze state by the P2P Group Owner, the P2P Group Owner may enter Doze state from that time until the next TBTT. After a DTIM, the P2P Group Owner shall complete delivery of all queued broadcast/multicast frames prior to entering Doze state, even if the total time taken to send these frames exceeds the CTWindow. Delivery of queued broadcast/multicast frames that is interrupted by a NoA absence period, shall continue after the absence period has ended.

As long as any Client is determined to be in Awake state, the P2P Group Owner shall remain in Awake state subject to any advertised Notice of Absence schedule. A P2P Group Owner shall determine that a P2P Client is in the Awake state if it is in the Active mode or if it is in the Power Save mode and has a WMM Unscheduled Service Period (USP) in progress or an unanswered PS-Poll. Figure 14 illustrates an example of P2P Group Owner Opportunistic Power Save with two connected P2P Clients, both using P2P PS.

This scheme creates opportunities for P2P Group Owner power save at the expense of increased latency in P2P Client transmissions, including transitions from Doze state to Awake state. This increased latency means that there is comparable latency for upstream and downstream traffic when a P2P Group Owner uses this mechanism.

Opportunistic Power Save may be used by the P2P Group Owner when connected P2P Clients are using the P2P PS procedures defined in Section

3.3.4.2, or the P2P WMM-PS procedures defined in Section 3.3.4.3. A P2P

3.3.3.2 P2P Group Owner Notice of Absence procedure

A P2P Group Owner establishing a Notice of Absence schedule shall include a P2P Notice of Absence attribute describing the planned absence timing within transmitted Beacon and Probe Response frames.

A P2P Group Owner may indicate Notice of Absence timing directly to a P2P Client using a Notice of Absence Action frame.

There shall be no more than one Notice of Absence attribute in a Beacon, Probe Response, or Notice of Absence Action frame.

Notice of Absence timing is specified by the values of the combination of Start Time, Interval, Duration and Count fields in the Notice of Absence attribute — see Table 26. The Start Time field shall indicate the start time of the timing schedule. The Interval field shall indicate the absence interval. The Duration field shall indicate the length of each absence. The Count field shall indicate the number of absences.

Note — Where Notice of Absence is used in connection with concurrent operation, operational parameters should be chosen, as far as is practical, to balance the needs of both the WLAN and P2P Group. Such operational parameters include Notice of Absence timing and any setting that places requirements on presence on either network, e.g. setting appropriate Max SP Length when using WMM-PS.

3.3.3.3 P2P Group Owner Power Save delivery

A P2P Group Owner shall not send frames within the P2P Group during periods that the P2P Group Owner has indicated it will be absent, subject to the power save state precedence rules above. A P2P Device should not initiate a frame exchange sequence that cannot be completed prior to the start of an absence period. Frames transmitted within the frame exchange sequence need not be received or acknowledged by the receiving P2P Device.

The procedures for data delivery from the P2P Group Owner to Clients using PS mode are as specified for an AP in Section 10.2.1.6 of IEEE 802.11-2012 [1].

The procedures for data delivery from the P2P Group Owner to Clients using WMM-PS power save mode are as specified for an Access Point in Section 3.6.0 and Section 3.6.1 of the WMM-PS Specification [3]. An example of WMM-PS operation with P2P Group Owner NoA is illustrated in Figure 18.

3.3.4 Power Management at a P2P Client

3.3.4.1 P2P Client operation with P2P Group Owner Power Management

A P2P Client that receives a Notice of Absence descriptor shall assume the specified Notice of Absence timing will commence at the indicated Start Time.

The P2P Client shall not send frames to a P2P Group Owner during periods that the P2P Group Owner has indicated it will be absent, subject to the power save state precedence rules above. P2P Clients shall buffer frames until frame delivery can be attempted in a presence period. A P2P Device should not initiate a frame exchange sequence that cannot be completed prior to the start of an absence period. Frames transmitted within the frame exchange sequence need not be received or acknowledged by the receiving P2P Device.

A P2P Client determines that a P2P Group Owner has Opportunistic Power Save enabled by the OppPS bit being set to 1 in the CTWindow and OppPS Parameters field of received Notice of Absence attributes. In this case, a P2P Client in Power Save mode shall only send frames to a P2P Group Owner during the CTWindow, subject to any non-periodic NoA, and with the exception that the P2P Client shall respond to frames received after the end of the CTWindow in relation to an incomplete WMM Unscheduled Service Period (USP), or outstanding PS-Poll.

A P2P Client that has requirements on the P2P Group Owner presence periods may submit a P2P Presence Request to the P2P Group Owner to influence P2P Group Owner power management timing, see Section 3.3.4.4.

A P2P Client shall use P2P PS, or P2P WMM-PS protocols if it uses power save operation.

3.3.4.2 Procedures for P2P Power Save at a P2P Client

The procedures for the operation of a P2P Client using P2P power save are as specified for a non-AP STA in PS mode in Section 10.2.1.8 of IEEE 802.11-2012 [1].

3.3.4.3 Procedures for P2P WMM-PS at a P2P Client

The procedures for the operation of the P2P Client using P2P WMM-PS are as specified for a non-AP STA using U-APSD in Section 3.6.0 and Section 3.6.2 of the WMM-PS Specification [3]. An example of P2P WMM-PS operation with

Ex. B (Wi-Fi-Direct-Spec) at 70-73, 75-76, 78-80

4 Frame formats

This section describes the information elements (see Section 4.1) and frame formats (see Section 4.2) in support of the capabilities described in clause P2P specific functions and services (see Section 2.4).

P2P protocol communication is based on the use of P2P Information Element (P2P IE), P2P Action frame and P2P Public Action frame formats. These utilize the Vendor Specific Information Element and Vendor Specific Action frame formats in IEEE 802.11-2012 [1] for operation outside DMG and in IEEE

4.1 P2P Information Element

4.1.1 P2P IE format

The Vendor Specific information element format (as defined in IEEE 802.11-2012 [1] for operation outside DMG and in IEEE 802.11-REVmc [11] for operation within DMG) is used to define the P2P information element (P2P IE) in this specification. The format of the P2P IE is shown in Table 4.

Table 4—P2P IE format

Field	Size (octets)	Value (Hexadecimal)	Description
Element ID	1	0xDD	IEEE 802.11 vendor specific usage.
Length	1	variable	Length of the following fields in the IE in octets. The Length field is a variable, and set to 4 plus the total length of P2P attributes.
OUI	3	50 6F 9A	Wi-Fi Alliance specific OUI.
OUI Type	1	0x09 (to be assigned)	Identifying the type or version of P2P IE. Setting to 0x09 indicates Wi-Fi Alliance P2P v1.0.
P2P Attributes	variable		One of more P2P attributes appear in the P2P IE.

The P2P attributes are defined to have a common general format consisting of a 1 octet P2P Attribute ID field, a 2 octet Length field and variable-length attribute-specific information fields, as shown in Table 5.

Table 5—General format of P2P attribute

Field	Size (octets)	Value (Hexadecimal)	Description
Attribute ID	1	variable	Identifying the type of P2P attribute. The specific value is defined in Table 6.
Length	2	variable	Length of the following fields in the attribute.
Attributes body field	variable		Attribute-specific information fields.

Table 6—P2P Attribute ID definitions

Attribute ID	Notes
0	Status
1	Minor Reason Code
2	P2P Capability
3	P2P Device ID
[illegible]	[illegible]
10	P2P Manageability
11	Channel List
12	Notice of Absence
13	P2P Device Info
14	P2P Group Info
15	P2P Group ID
16	P2P Interface

4.1.14 Notice of Absence attribute

The Notice of Absence attribute is used by the P2P Group Owner to signal its absence due to power save timing, concurrent operation, or off-channel scanning. It is also used in the P2P Presence Request-Response mechanism. The format of the Notice of Absence attribute is shown in Table 26.

When operating within DMG, if the Notice of Absence attribute is transmitted it shall be ignored upon receipt.

Table 26—Notice of Absence attribute format

Field Name	Size (octets)	Value	Description
Attribute ID	1	12	Identifying the type of P2P attribute. The specific value is defined in Table 6.
Length	2	n*(13)+2	Length of the P2P Notice of Absence attribute body in octets
Index	1	0 – 255	Identifies an instance of Notice of Absence timing.
CTWindow and OppPS Parameters	1	—	Parameters indicating P2P Group Owner's availability window and opportunistic power save capability – see Table 27.
Notice of Absence Descriptor(s)	n*13	—	Zero or more Notice of Absence Descriptors each defining a Notice of Absence timing schedule – see Table 28.

The format of the CTWindow and OppPS Parameters field is described in Table 27.

Table 27— CTWindow and OppPS Parameters field format

Bit	Subfield	Notes
7	OppPS	Set to 1 to indicate that the P2P Group Owner is using opportunistic power save. Set to 0 if opportunistic power save is disabled. The CTWindow field shall be non-zero when the OppPS bit is set to 1. Set to 0 in Notice of Absence attributes transmitted by a P2P Client in a P2P Presence Request frame.
0-6	CTWindow	Client Traffic Window (CTWindow). A period of time in TU after a TBTT during which the P2P Group Owner is present. 0 indicates that there shall be no CTWindow. Set to 0 in Notice of Absence attributes transmitted by a P2P Client in a P2P Presence Request frame.

The format of the Notice of Absence Descriptor is shown in Table 28.

Table 28—Notice of Absence Descriptor format

Field Name	Size (octets)	Value	Description
Count/Type	1	1 – 255	Count in Notice of Absence Descriptors sent by a P2P Group Owner; indicates the number of absence intervals. 255 shall mean a continuous schedule; 0 is reserved and shall not be used. Type in Notice of Absence Descriptors sent by a P2P Client in a P2P Presence Request; qualifies the Duration and Interval fields. A Type value of 1 shall indicate preferred values, a Type value of 2 shall indicate acceptable limits.
Duration	4	—	In Notice of Absence Descriptors sent by a P2P Group Owner; indicates the maximum duration in units of microseconds that the P2P Group Owner can remain absent following the start of a Notice of Absence interval. In Notice of Absence Descriptors sent by a P2P Client in a P2P Presence Request; indicates a preferred, or minimum acceptable presence period duration.
Interval	4	—	In Notice of Absence Descriptors sent by a P2P Group Owner; indicates the length of the Notice of Absence interval in units of microseconds. In Notice of Absence Descriptors sent by a P2P Client in a P2P Presence Request; indicates a preferred, or maximum acceptable interval between presence periods.
Start Time	4	—	The start time for the schedule expressed in terms of the lower 4 bytes of the TSF timer. The Start Time field is reserved and shall be set to 0 on transmission and ignored on reception in Notice of Absence attributes transmitted by a P2P Client.

The Notice of Absence attribute shall be present in the P2P IE in the Beacon frames and Probe Response frames transmitted by a P2P Group Owner when a Notice of Absence schedule is being advertised or when the CTWindow is non-zero, as described in Section 4.2.1 and Section 4.2.3. If there is neither a Notice of Absence schedule nor a CTWindow, the GO may omit the Notice of Absence attribute from Beacon and Probe Response frames. The Notice of Absence shall be also present in Notice of Absence frames, as described in Section 4.2.10.2, P2P Presence Request frames, as described in Section 4.2.10.3, and P2P Presence Response frames, as described in Section 4.2.10.4.

4.2.1 Beacon frame format

One or more P2P IEs and the WSC IE shall be inserted after other information elements in the Beacon frames transmitted by a P2P Group Owner. P2P attributes for a P2P IE that is included in the Beacon frame are shown in Table 48.

Table 48—P2P attributes in the Beacon frame

Attributes	Attribute ID	Note
P2P Capability	2	The P2P Capability attribute shall be present in the P2P IE.
P2P Device ID	3	The P2P Device ID attribute shall be present in the P2P IE.

Attributes	Attribute ID	Note
Notice of Absence	12	The Notice of Absence attribute shall be present in the P2P IE in the Beacon frames transmitted by a P2P Group Owner when a Notice of Absence schedule is being advertised (see Section 3.3.3.2), or when the CTWindow is non-zero (see Section 3.3.2).

4.2.10.2 Notice of Absence frame

The Notice of Absence P2P action frame uses the P2P Specific Action frame format and may be transmitted by a P2P Group Owner to advertise a Notice of Absence schedule.

The Dialog Token field in a Notice of Absence P2P action frame shall be set to 0 on transmission and ignored on reception.

The Elements field in a Notice of Absence action frame shall contain a P2P IE with a single Notice of Absence attribute.

Ex. B (Wi-Fi-Direct-Spec) at 89-90, 103-05, 116-17, 133

J. Claim Element [4.e]

136. In the Accused Products, e.g., an Xperia 1 V phone, "*the wireless radio circuit is configured to operate in at least one of a 2.4 GHz or 5 GHz frequency band*."

‹ Sony Support | XPERIA 1 V 256GB

Specifications

Operating System

VERSION

Android™ 13[25] / 2 upgrades of OS / 3 years of security updates

Processor

CPU

Snapdragon® 8 Gen2 Mobile Platform[20]

Memory & Storage

EXTERNAL MEMORY

microSDXC support (up to 1 TB)[21]

INTERNAL MEMORY

256 GB UFS[22]

RAM

12 GB

Connectivity

OTHER FEATURES

Smart connectivity, Google Cast, NFC, Output video/image via Display Port support Type-C® Cable or Type-C® to HDMI Adapter Cable (Display port 4K/60 fps)[30]

WI-FI

IEEE802.11a/b/g/n/ac/ax, 2.4/5/6 GHz[31]

USB TYPE

Type-C®

USB VERSION

SuperSpeed USB 5 Gbps (USB 3.2)

BLUETOOTH

Bluetooth® 5.3 wireless technology, LE Audio

LOCATION

A-GPS, A-GLONASS, Beidou, Galileo, QZSS[32]

https://www.sony.com/electronics/support/mobile-phones-tablets-mobile-phones/xperia-1-v-256gb/specifications

Deep Dive Teardown

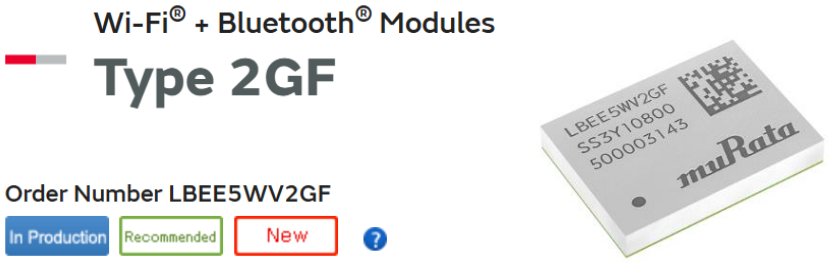
Device Summary - Design notes

Deep Dive Teardown
Sony Xperia 1 V XQ-DQ54 ID426083-MKuc

The Sony Xperia 1 V is a typical Qualcomm based design, using well-known components: Qualcomm SM8550-AB Snapdragon Processor and Qualcomm SDR735 RF Transceiver with matching power managements, SK Hynix's RAM, and flash.

The RF design is highly integrated, and most filtering occurs inside modules. There is little filtering directly on PCB, except for some diplexer signal splitting. The biggest integration appeared in WiFi design. In high-end smartphones the signal is typically split into 2.4 and 5 GHz frequencies and passed to four WiFi Front-End modules and then delivered to WiFi Module. In the Sony Xperia 1 V the signal from the antennas is initially filtered and then fed directly to Murata's WiFi LBEE5??2GH Module which consists of two NXP 2.4 GHz WiFi Front-End, two NXP 5 to 7.2 GHz WiFi Front-End and Qualcomm Wi-Fi 7/Bluetooth 5.3 dies.

https://library.techinsights.com/reverse-engineering/analysis-view/DDT-2309-819?size=50&page=1#pdfId=d30f67d9c4bd461a92d802d5e32f1148&activeTab=documents



https://www.murata.com/en-us/products/connectivitymodule/wi-fi-bluetooth/overview/lineup/type2gf

1 Scope

This specification characterizes the IEEE 802.11a/b/g/n/ac WLAN + Bluetooth 5.4 combo module.

2 Key Features

- Infineon CYW43022 inside
- Supports IEEE 802.11a/b/g/n/ac specification: Dual band 2.4 GHz and 5 GHz
- Supports MCS8 (256-QAM) for 20MHz channels enabling data rates up to 78 Mbps.
- Supports Bluetooth specification version 5.4.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0

https://www.murata.com/products/productdata/8824592302110/type2gf.pdf.

K. Claim Element [4.f]

137. The Accused Products, e.g., an Xperia 1 V phone, practice this claim element because the infrastructure-mode protocol, i.e., "*the WLAN protocol*[,] *is an 802.11x protocol that uses a frame defined by the 802.11x protocol, and* [the *Wi-Fi Direct protocol, i.e.,*] *the WPAN protocol uses a WPAN-adapted frame in which at least one field of the frame defined by the 802.11x protocol is adapted to support the WPAN power-saving protocol*."

138. It is discussed for claim elements [4.a] and [4.c.1] that, respectively, the infrastructure-mode protocol comprises "*the WLAN protocol*" and the Wi-Fi Direct protocol comprises the "*WPAN protocol*." *See supra*, ¶¶ 116-117, 123-**Error! Reference source not f**

ound.. Referring to Count I, claim element [1.d.3] of the '814 patent and claim element [4.d.2] of this Count, it is discussed that both the infrastructure-mode protocol and the Wi-Fi Direct protocol are based on the IEEE 802.11x Standard. *See supra*, ¶¶ 62-75, 132-135. It is further described that the infrastructure-mode protocol can use the Vendor-specific Action frames (AFs) defined by the IEEE 802.11x Standard. *See id*. A Vendor-specific AF is a Management Frame per the IEEE 802.11x Standard, that has the Subtype "Action" and the category "Vendor-specific." *See id*.; *see also*, Ex. C (IEEE Std 802.11™-2012, Part 11) at 381-83, 417-18, 436, 449-450, 737. Thus, the infrastructure-mode protocol, i.e., "*the WLAN protocol*[,] *is an 802.11x protocol that uses [] a frame defined by the 802.11x protocol*."

139. It is discussed for claim element [4.d.2] that the Wi-Fi Direct protocol uses Wi-Fi Direct AFs to facilitate power saving, where a Wi-Fi Direct AF is a Vendor-specific AF having customized fields and values. *See supra*, ¶¶ 132-135. Accordingly, the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *uses* [a Wi-Fi Direct AF, i.e.,] *a WPAN-adapted frame in which at least one field of the frame defined by the 802.11x protocol is adapted to support the WPAN power-saving protocol*."

L. Claim Element [4.g]

140. The Accused Products, e.g., an Xperia 1 V phone, practice this claim element because the Vendor-specific Action frame of the Wi-Fi Direct protocol, i.e., "*the WPAN-adapted frame*[,] *is adapted from a WLAN protocol management frame*."

141. It is discussed for claim element [4.f.1] that a Wi-Fi Direct AF comprises "the WPAN-adapted frame." *See supra*, ¶¶ 137-139. It is discussed for claim elements [4.a] and [4.c.1] that, respectively, the infrastructure-mode protocol comprises "*the WLAN protocol*" and the Wi-Fi Direct protocol comprises the "*WPAN protocol*." *See supra*, ¶¶ 116-117, 123-**Error! R**

eference source not found.. Referring to Count I, claim element [1.d.3] of the '814 patent and claim element [4.d.2] of this Count, it is discussed that both the infrastructure-mode protocol and the Wi-Fi Direct protocol are based on the IEEE 802.11x Standard. *See supra*, ¶¶ 62-75, 132-135.

142. It is also discussed that the Wi-Fi Direct AFs comprise the Vendor-specific Action frames (AFs) defined by the IEEE 802.11x Standard, where these frames are customized and adapted to include certain Wi-Fi Direct-specific fields and values. *See supra*, ¶¶ 62-75, 132-135. A Vendor-specific AF is a Management Frame per the IEEE 802.11x Standard, that has the Subtype "Action" and the category "Vendor-specific." *See id.*; *see also*, Ex. C (IEEE Std 802.11™-2012, Part 11) at 381-83, 417-18, 436, 449-450, 737. Thus, the Wi-Fi Direct AF, i.e., "*the WPAN-adapted frame*[,] *is adapted from a WLAN protocol management frame*."

M. Claim Element [4.h]

143. The Accused Products, e.g., an Xperia 1 V phone, practice this claim element because the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *provides for an inactivity time during which the first and second wireless devices can agree to at least partially disable the wireless connection*." In particular, a P2P Group Owner (e.g., the Xperia 1 V phone or another device connected thereto in a Wi-Fi Direct P2P network) can use the "P2P Notice of Absence attribute [to] describe[e] the planned absence timing." Ex. B (Wi-Fi-Direct-Spec) at 73. "Notice of Absence timing is specified by the values of the combination of Start Time, Interval, Duration and Count fields in the Notice of Absence attribute." *Id.*

144. As such, the Wi-Fi Direct protocol, i.e., "*the WPAN protocol*[,] *provides for* [a power-save / absence state, i.e.,] *an inactivity time during which* [the Xperia 1 V phone and

another device, i.e.,] *the first and second wireless devices*[,] *can agree to* [suspend exchange of data / communications, i.e.,] *at least partially disable the wireless connection*."

3.3.3.2 P2P Group Owner Notice of Absence procedure

A P2P Group Owner establishing a Notice of Absence schedule shall include a P2P Notice of Absence attribute describing the planned absence timing within transmitted Beacon and Probe Response frames.

A P2P Group Owner may indicate Notice of Absence timing directly to a P2P Client using a Notice of Absence Action frame.

There shall be no more than one Notice of Absence attribute in a Beacon, Probe Response, or Notice of Absence Action frame.

Notice of Absence timing is specified by the values of the combination of Start Time, Interval, Duration and Count fields in the Notice of Absence attribute — see Table 26. The Start Time field shall indicate the start time of the timing schedule. The Interval field shall indicate the absence interval. The Duration field shall indicate the length of each absence. The Count field shall indicate the number of absences.

4.1.14 Notice of Absence attribute

The Notice of Absence attribute is used by the P2P Group Owner to signal its absence due to power save timing, concurrent operation, or off-channel scanning. It is also used in the P2P Presence Request-Response mechanism. The format of the Notice of Absence attribute is shown in Table 26.

When operating within DMG, if the Notice of Absence attribute is transmitted it shall be ignored upon receipt.

Table 26—Notice of Absence attribute format

Field Name	Size (octets)	Value	Description
Attribute ID	1	12	Identifying the type of P2P attribute. The specific value is defined in Table 6.
Length	2	n*(13)+2	Length of the P2P Notice of Absence attribute body in octets
Index	1	0 – 255	Identifies an instance of Notice of Absence timing.
CTWindow and OppPS Parameters	1	—	Parameters indicating P2P Group Owner's availability window and opportunistic power save capability – see Table 27.
Notice of Absence Descriptor(s)	n*13	—	Zero or more Notice of Absence Descriptors each defining a Notice of Absence timing schedule – see Table 28.

The format of the CTWindow and OppPS Parameters field is described in Table 27.

Table 27— CTWindow and OppPS Parameters field format

Bit	Subfield	Notes
7	OppPS	Set to 1 to indicate that the P2P Group Owner is using opportunistic power save. Set to 0 if opportunistic power save is disabled. The CTWindow field shall be non-zero when the OppPS bit is set to 1. Set to 0 in Notice of Absence attributes transmitted by a P2P Client in a P2P Presence Request frame.
0-6	CTWindow	Client Traffic Window (CTWindow). A period of time in TU after a TBTT during which the P2P Group Owner is present. 0 indicates that there shall be no CTWindow. Set to 0 in Notice of Absence attributes transmitted by a P2P Client in a P2P Presence Request frame.

The format of the Notice of Absence Descriptor is shown in Table 28.

Table 28—Notice of Absence Descriptor format

Field Name	Size (octets)	Value	Description
Count/Type	1	1 – 255	Count in Notice of Absence Descriptors sent by a P2P Group Owner; indicates the number of absence intervals. 255 shall mean a continuous schedule; 0 is reserved and shall not be used. Type in Notice of Absence Descriptors sent by a P2P Client in a P2P Presence Request; qualifies the Duration and Interval fields. A Type value of 1 shall indicate preferred values, a Type value of 2 shall indicate acceptable limits.
Duration	4	—	In Notice of Absence Descriptors sent by a P2P Group Owner; indicates the maximum duration in units of microseconds that the P2P Group Owner can remain absent following the start of a Notice of Absence interval. In Notice of Absence Descriptors sent by a P2P Client in a P2P Presence Request; indicates a preferred, or minimum acceptable presence period duration.
Interval	4	—	In Notice of Absence Descriptors sent by a P2P Group Owner; indicates the length of the Notice of Absence interval in units of microseconds. In Notice of Absence Descriptors sent by a P2P Client in a P2P Presence Request; indicates a preferred, or maximum acceptable interval between presence periods.
Start Time	4	—	The start time for the schedule expressed in terms of the lower 4 bytes of the TSF timer. The Start Time field is reserved and shall be set to 0 on transmission and ignored on reception in Notice of Absence attributes transmitted by a P2P Client.

Ex. B (Wi-Fi-Direct-Spec) at 73, 103-04.

N. Claim Element [4.i]

145. The Accused Products, e.g., an Xperia 1 V phone, practice this claim element because the Xperia 1 V, i.e., "*the first wireless device*[,] *and* [*anther device, i.e.,*] *the second wireless device*[,] *are configured to agree on the inactivity time in accordance with the WPAN protocol*."

146. Claim element [4.h] recites: "*the WPAN protocol provides for an inactivity time during which the first and second wireless devices can agree to at least partially disable the wireless connection*." As discussed for claim element [4.h], the Wi-Fi Direct protocol practices the limitations recited in claim element [4.i]. *See supra*, ¶¶ 143-144. Specifically, the two peers communicating using the Wi-Fi Direct protocol, e.g., an Xperia 1 V phone and another device, "*can agree*" using the Wi-Fi Direct protocol "*to at least partially disable the wireless connection*" "*during*" the power-save / absence state of the P2P Group Owner and/or another P2P Device, either of which can be the Xperia 1 V phone or the other device to which the Xperia 1 V phone's screen is mirrored. Therefore, the Xperia 1 V phone, i.e., "*the first wireless device*[,] *and* [*anther device, i.e.,*] *the second wireless device*[,] *are configured to agree on the inactivity time in accordance with the WPAN protocol*."

O. Claim Element [4.j]

147. The Accused Products, e.g., an Xperia 1 V phone, practice this claim element because the Xperia 1 V phone, i.e., "*the first wireless device*[,] *is configured to disable data exchanges with the second wireless device via the wireless connection following a start of the inactivity time, wherein the disabling is such that less power per unit time is consumed by the wireless radio circuit relative to a power per unit time consumed by the wireless radio circuit when the data exchanges are not disabled*."

148. As discussed for claim element [4.h], an Xperia 1 V phone using the Wi-Fi Direct protocol is configured to suspend the exchange of data during the power-save / absence state. *See supra*, ¶¶ 143-143. Thus, the Xperia 1 V phone, i.e., "*the first wireless device*[,] *is configured to disable data exchanges with* [another device, i.e.,] *the second wireless device via the wireless connection following a start of* [the idle AWs, i.e.,] *the inactivity time*."

149. During the power-save / absence state, the Xperia 1 V phone can but may not completely turn off the radio, i.e., the W-Fi module. *See supra*, ¶¶ 116-117 (claim element [4.a]). Nevertheless, by suspending at least the exchange of data / Data frames, the power consumption of the Wi-Fi module of the Xperia 1 V phone is reduced compared to when the Data frames are transmitted, e.g., because the generation of data packets, and conversion thereof into radio-frequency (RF) signals by the Wi-Fi module are suspended during the power-save / absence state. As such, the suspension of the transmission of Data frames during the power-save / absence state, i.e., "*the disabling*[,] *is such that less power per unit time is consumed by* [the Wi-Fi module, i.e.,] *the wireless radio circuit*[,] *relative to a power per unit time consumed by the wireless radio circuit when* [the exchanges of Data frames, i.e.,] *the data exchanges are not disabled*."

150. As set forth above, Sony has directly infringed at least claim 4 of the '506 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

151. Sony has also contributed to the infringement of at least claim 4 of the '506 patent by Sony's customers and/or has induced such infringement by its customers, as set forth below in paragraphs ¶¶ 152-160, that are incorporated by reference as if fully set forth herein.

CONTRIBUTORY INFRINGEMENT AND INDUCEMENT OF INFRINGEMENT

152. In summary, as set forth above in paragraphs ¶¶ 47-151, Sony has directly infringed at least one claim of each patent from the patents-in-suit, e.g., claim 1 of the '814 patent, claim 1 of the '991 patent, and claim 4 of the '906 patent, by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

153. Sony intentionally designed and incorporated the IEEE 802.11x and the Wi-Fi Direct features and functionalities described above into the Accused Products.

154. Sony provides instructions (in the form of at least user interface prompts and customer support instructions) to its customers, advertising, encouraging and directing the customers to use the Accused Products in an infringing manner as described above to implement the IEEE 802.11x/Wi-Fi Direct functionality, as intended by Sony. For example, Sony provides operating instructions and the like for the Accused Products, including, but not limited to, those cited above and those listed below:

- https://helpguide.sony.net/mobile/xperia-1m5/v1/en/print.pdf
- https://www.sony-asia.com/electronics/support/articles/00013745

155. By its instructions, including those set forth above, and with intent that their customers use the IEEE 802.11x/Wi-Fi Direct features described above, Sony has induced its customers to infringe the patents-in-suit. Sony's customers who use the Accused Products as described above directly infringe the patents-in-suit. On information and belief, as a result of attempts by Ozmo to license its patents to Sony starting around July 2020, with the last exchange occurring around November 2023, Sony has been aware of Ozmo's Vleugels patent portfolio and of Ozmo's attempts to have Sony take a license thereto. In light of the correspondence from Ozmo Licensing, as well as the size of the portfolio, Sony was, at least, willfully blind to the existence of the patents-in-suit, in the event that it did not have actual knowledge thereof. In any

event, Sony has been aware of the patents-in-suit since at least as early as the service of this Complaint. Sony also induces such direct infringement by their customers by failing to remove the infringing features from the Accused Products.

156. By its instructions, including those set forth above, as well as by offering for sale, selling, commercially distributing and importing the Accused Products, Sony has also contributed to its customers' infringement of and/or induced its customers to infringe the patents-in-suit. The Accused Products are used by Sony's customers to practice the inventions claimed in the patents-in-suit. The IEEE 802.11x/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the patents-in-suit. Sony knows or was willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by them solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. Sony also knows or is willfully blind that such combinations of hardware and software have no use other than to provide such functionality as intentionally designed into the Accused Products by Sony. As described above, Sony has had knowledge since July 2020 and, at the latest, upon service of this Complaint, that its customers were infringing the patents-in-suit.

157. By the time of trial, Sony will have known and intended that its continued actions would directly infringe, and would induce and contribute to the infringement by Sony's customers of at least one claim of each of the patents-in-suit.

158. Ozmo Licensing has been damaged by Sony's past and ongoing direct and indirect infringement of the patents-in-suit.

159. With knowledge of the allegations set forth herein, Sony continues to incorporate the infringing functionalities in the Accused Products, and has failed to compensate Ozmo Licensing for the use of such features.

160. Sony's unlawful activities described above have continued despite their receipt of the correspondence described above. Sony's infringement will continue unabated unless and until Sony is enjoined or ordered to pay a reasonable royalty for a license to the patents-in-suit.

PRAYER FOR RELIEF

161. Ozmo Licensing requests that the Court enter judgment against Sony as follows:

A. Sony infringed one or more claims of each of the above patents-in-suit, directly and/or indirectly, literally and/or under the doctrine of equivalents;

B. award damages sufficient to compensate Ozmo Licensing for Sony's infringement under 35 U.S.C. § 284;

C. ordering Sony to pay Ozmo Licensing an ongoing royalty for their future infringement of the patents-in-suit or, in the alternative, enjoining from the remaining life of the patents-in-suit any further acts of infringement by Sony, its officers, directors, agents, consultants, contractors, affiliates and all others acting in privity and/or in concert with them;

D. finding this case exceptional under 35 U.S.C. § 285 and awarding Ozmo Licensing enhanced damages and its reasonable attorneys' fees;

E. awarding Ozmo Licensing its costs and expenses incurred in this action;

F. awarding Ozmo Licensing prejudgment and post-judgment interest; and

G. granting Ozmo Licensing such other and further relief as the Court deems just and appropriate.

DEMAND FOR JURY TRIAL

162. Ozmo Licensing demands trial by jury on all issues so triable under, inter *alia*, Fed. R. Civ. P. 38.

Date: February 3, 2025

Respectfully submitted,

/s/ Karl Rupp

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