UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

OZMO LICENSING LLC, Plaintiff, v. HP Inc., Defendant.	Civil Action No. 6:21-cv-00383-ADA **JURY TRIAL DEMANDED**

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff, Ozmo Licensing LLC ("Ozmo Licensing"), as and for its Complaint against defendant, HP Inc. ("HP"), hereby alleges as follows:

THE PARTIES

1. Ozmo Licensing LLC 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. Upon information and belief, HP is a Delaware corporation, having its principal place of business located at 1501 Page Mill Road, Palo Alto, California, 94304. HP maintains a regular and established place of business within this District located at 3800 Quick Hill Road, Suite 100, Austin, Texas 78728, and offers its products and/or services, including those accused of infringement herein, to customers and potential customers located in this District.

3. Defendant may be served with process by serving a copy of this Complaint on its agent for service of process: CT Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201.

JURISDICTION

4. Ozmo Licensing brings this action pursuant to the patent laws of the United States, 35 U.S.C. §§ 271 *et seq*. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

5. This Court has general jurisdiction over HP because HP is engaged in substantial and not isolated activity at its regular and established places of business within this judicial district. This Court has specific jurisdiction over HP because HP has committed acts of infringement giving rise to this action and has established more than minimum contacts within this judicial district, such that the exercise of jurisdiction over HP in this Court would not offend traditional notions of fair play and substantial justice.

6. Venue is proper in this district pursuant to 28 U.S.C. §§ 1391(b)-(c) and 1400(b) because HP maintains regular and established places of business and has committed acts of patent infringement within this judicial district.

FACTUAL BACKGROUND

The Patents-in-Suit

7. On February 16, 2016, the PTO issued United States Patent No. 9,264,991 ("the '991 patent"), 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. A copy of the '991 patent is attached as Exhibit A.

8. 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.

9. On December 22, 2020, the PTO issued United States Patent No. 10,873,906 ("the '906 patent"), 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. A copy of the '906 patent is attached as Exhibit B.

10. 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.

11. On December 3, 2013, the PTO issued United States Patent No. 8,599,814 ("the '814 patent"), 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. A copy of the '814 patent is attached as Exhibit C.

12. 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.

13. On May 18, 2021, the PTO issued United States Patent No. 11,012,934 ("the '934 patent"), titled APPARATUS AND METHOD FOR INTEGRATING SHORT-RANGE

WIRELESS PERSONAL AREA NETWORKS FOR A WIRELESS LOCAL AREA NETWORK INFRASTRUCTURE. The '934 patent is valid and enforceable. A copy of the '934 patent is attached as Exhibit D.

14. Ozmo Licensing is the owner and assignee of all rights, title and interest in and to the '934 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 '934 patent.

The Inventors, Ozmo Devices and Ozmo Licensing

15. The inventions of the '991 patent, the '906 patent, the 814 patent and the '934 patent (collectively, "the Ozmo Devices patents" or "the patents-in-suit") were conceived at Ozmo Devices. Founded in 2004 by Silicon Valley-based spouses, Katelijn Vleugels and Roel Peeters, Ozmo Devices was a leading provider of low-power Wi-Fi Personal Area Network ("WPAN") products, that could be deployed in proximity to Wi-Fi Local Area Networks ("WLAN") products without severe interference arising between the two.

16. 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. These patented inventions 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"), which specification they helped draft. The Wi-Fi Alliance is headquartered in Austin, Texas.

17. 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.

18. Ozmo Licensing was founded in 2019. A significant aspect of Ozmo Licensing's business is working to widely and reasonably license its current patent portfolio with the support of the inventors. Included are the Ozmo Devices patents. Ozmo Licensing is concomitantly pursuing related patent applications with the support of inventors Katelijn Vleugels and Roel Peeters, now residing in the Greater Austin area of Texas.

Wireless Communication Technology

19. Significant accomplishments of the Internet era included standardization for various forms of wireless connectivity including WLANs and WPANs.

20. An example of a WLAN is an 802.11x (x = a, b, g, n & etc.) network. The 802.11x standard, commonly known as "Wi-Fi," has been widely deployed for wireless connectivity since its adoption in any variety of settings including in homes, offices, and public establishments. It has been embodied in standards, such as the IEEE Std. 802.11-2012 ("IEEE 802.11-2012"). WLANs generally support two different configurations: infrastructure mode and ad-hoc mode.

21. A WLAN configuration in infrastructure mode requires a dedicated access point ("AP") to manage connections to the Internet or other WLANs. Additional 802.11x-compliant wireless circuits ("stations" or "STAs"), such as laptop computers, desktop computers, tablet computers, mobile phones, printers, smart televisions, and the like, may be capable of joining the WLANs to communicate with each other, or they may be able to communicate with STAs of other WLANs, with all such communications being routed through APs.

22. Devices in a WPAN communicate directly without the need for an intermediary device such as an AP to manage connections. The most common example of a WPAN is a Bluetooth connection/network formed between two Bluetooth-equipped devices. The range of a Bluetooth WPAN and the data transmission rates, are far smaller than those of an 802.11 WLAN.

23. Bluetooth WPAN devices operate in the same 2.4-GHz frequency band in which WLAN devices frequently operate. The co-existence of WPAN and WLAN communication protocols in a single frequency band often results in severe interference due to their varying methods of accessing the wireless medium and a lack of synchronization between how they operate. Furthermore, a device's ability to operate in a WLAN or a WPAN may be limited by the hardware and software it includes, as the Bluetooth WPAN and 802.11 WLAN often require different transceiver integrated circuits and may require different antennas. While the disharmonious coexistence of Bluetooth WPANs and 802.11 WLANs has long been tolerated, there remained a need for a solution that could seamlessly integrate WPAN and WLAN communication protocols.

24. The "Background of the Invention" sections of the '991, '906, '814 and '934 patents describe some of the problems pertaining to then-contemplated integrations of WLANs and WPANs that Vleugels and Peeters addressed with their invention. For example, the Ozmo Devices patents describe the lack of synchronization and resulting interference problems with then-existing networks. *See* Ex. A at 2:29-36.[1]

25. The Ozmo Devices patents note that the prior art efforts to address these issues were insufficient. For example, one option was to use WLAN protocols in WPAN devices. *Id.* at 2:37-

[1] The relevant portions of the specification of the patents-in-suit are identical, and so citations are just to the '991 patent.

3:6. But this led to power dissipation and/or low transmission rate problems, and could introduce undesirable amounts of latency in communications involving the WPAN devices.

26. The Ozmo Devices patents further describe noise, linearity and/or overhead protocol problems with integrating then-existing WPAN and WLAN networks. *Id.* at 3:6-19. WLANs typically operate at relatively high data rates compared to WPANs. It is thus undesirable to have a STA associated with a Bluetooth WPAN for example, to be included in a WLAN, since communication between an AP and its associated STAs occurs at the lowest common data rate supported by all STAs connected to that AP.

27. Also, although the 802.11x standard specifies power save modes that allow forms of power savings, there was still a need to different enable power save modes better optimized to meet the needs of WPAN devices.

28. There was, thus, a recognized need for seamless integration of WPAN into WLAN infrastructure, without the aforementioned problems one would encounter by for example integrating a Bluetooth WPAN device into an 802.11 WLAN network.

COUNT I
(HP's Infringement of U.S. Patent No. 9,264,991)

29. Paragraphs 1-28 are reincorporated by reference as if fully set forth herein.

30. The invention of the '991 patent represented a technical solution to an unsolved technological problem. The written description of the '991 patent 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 improved upon what may have been considered conventional or generic. For example, the specification and incorporated references detail the inventors' novel approach to seamlessly integrating WPAN into WLAN infrastructure.

31. The elements claimed by the ’991 patent, taken alone or in combination, were not well-understood, routine or conventional to one of ordinary skill in the art at the time of the invention. Rather, the ’991 patent claims and teaches, *inter alia*, an improved network-enabled hub to facilitate communications between WLAN and WPAN wireless devices. The invention improved upon existing wireless communications, which were unable to integrate a WPAN into a WLAN infrastructure without suffering from one or more of the aforementioned problems, by allowing the network-enabled hub to initiate and maintain connections with nodes of an external wireless network via a first network connection using a first network WLAN protocol and, a second network connection using a second network WPAN protocol that is an overlay protocol with respect to the first network protocol, and that is partially consistent with the first network protocol.

32. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more cost effective to design, since the communications using the second network protocol impinge on at least some antennae used for communications using the first network protocol.

33. Compared to the prior art, the claimed wireless apparatus for integrating a WPAN into a WLAN allows the two to operate in the same frequency spectrum without causing excessive interference with each other.

34. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more beneficial as it allows for remote monitoring and controlling of a WPAN device, since the WPAN device may be connected to a Wi-Fi infrastructure, via the network-enabled hub, which may be adapted to established communication via the Internet

coupled to the AP. This allows remote monitoring and controlling of a WPAN device such as a home security system, or an implanted or wearable medical device.

35. Compared to the prior art, the claimed wireless infrastructure 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.

36. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN, also enables lower latency communication involving WPAN devices.

37. HP has infringed, and continues to infringe, the '991 patent by making, importing, using, offering for sale and selling in the United States numerous wireless devices, including laptop computers, desktop computers, printers and monitors. Wi-Fi protocols allow such devices to act as a hub to receive, for example, video images from an IEEE 802.11 access point and to forward such images to a second device using Wi-Fi Direct (together, "Accused Products").

38. Examples of the Accused Products are HP's Wi-Fi Direct enabled laptop computers (including but not limited to Chromebook, ENVY, Elite, EliteBook, Essential, Mobile Thin Client, OMEN, Pavilion, ProBook, Spectre and ZBook); desktop computers (including but not limited to Chromebox, Collaboration Solutions, ENVY, EliteDesk, EliteOne, Essential, Flexible, OMEN, P-Series, Pavilion, ProDesk, ProOne, Z and Zero); printers (including but not limited to DesignJet, DeskJet, ENVY, LaserJet, Neverstop, OfficeJet, PageWide, ScanJet, Smart Tank and Tango); monitors (including but not limited to HP U27 4K Wireless Monitor, and OMEN X Emperium Gaming Monitor), and all other products that include Wi-Fi Direct functionality.

39. For the avoidance of doubt, all of HP's products made, used, sold and/or offered for sale in, or imported into, the United States during the life of the '991 patent that provide(d) the foregoing functionality during the life of the '991 patent are included within the definition of

Accused Products. The examples and evidence provided below are equally applicable to all Accused Products.

40. Claim 1 of the '991 patent is reproduced below:

> 1. 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:
>
> an interface to a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability;
>
> a processor configured to:
>
> process data received via the wireless radio circuit;
>
> generate data to be transmitted by the wireless radio circuit;
>
> initiate and maintain network connections with nodes of a wireless network external to the network-enabled hub, 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, 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 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
>
> 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.

41. The Accused Products were designed by HP and include, *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, the Accused Products implement Miracast functionality, which includes Wi-FI Direct,

and under which a device can act as a network enabled hub that concurrently operates with a WLAN and WPAN.

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.

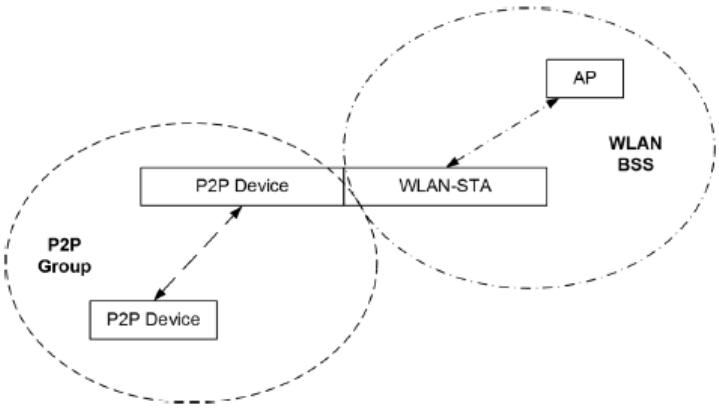

Figure 4—P2P Concurrent device

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3, Fig. 4

42. For example, the Spectre x360 13-ap0046nr notebook is an Accused Product (a network-enabled hub) designed and manufactured by HP which implements the Wi-Fi Direct standard and includes Miracast functionality (which involves data communications between two or more wireless devices that are configured to communicate indirectly with each other). Miracast is a technology standard, adopted by the Wi-Fi Alliance, that allows a user to project a video image received from a Wi-Fi access point, from one screen (such as from an Accused Product) onto another screen or projector (including, but not limited to, other Accused Products). Miracast, commonly alternatively referred to as "Screen Mirroring" functionality, is built on Wi-Fi Direct connections between devices.

HP Spectre x360 - 13-ap0046nr

- Windows 10 Home 64

HP PCs - Sharing Your Screen Using Miracast (Windows 10)

This document is for HP computers with Windows 10.

Miracast is a wireless technology that projects the image from your computer screen onto another monitor, TV screen, projector, or streaming media player that also supports Miracast. You can use this to share what you're doing on your computer, present a slide show, or even play your favorite game on a larger screen.

Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

Specification	Wi-Fi Direct
Computer or device can connect to both printer and Internet simultaneously	Android devices and Windows 10 or 8.1 computers

Source: https://support.hp.com/us-en/document/c04577030

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless- projection-receiver-manufacturers

It seems that the ScreenBeam product can stream content from most Intel WiDi, and WiFi Miracast enabled devices. It does not seem that it guarantees every device. Based on your model, HP Spectre x360 notebooks are Miracast compatible.

Source: https://support.hp.com/us-en/document/c05189396

INTEL® WIRELESS-AC 9560 TECHNICAL SPECIFICATIONS

Wi-Fi CERTIFIED* a/b/g/n/ac with wave 2 features, WMM*, WMM-PS*, WPA2*, WPA3*, WPS2*, Protected Management Frames, and Wi-Fi Direct (For Microsoft Windows* only)

Source: https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/dualband-wireless-ac-9560-brief.pdf

Discovering and connecting to Miracast-compatible wireless displays (select products only)

To discover and connect to Miracast-compatible wireless displays without leaving your current apps, follow the steps below.

To open Miracast:

- Type `project` in the taskbar search box, and then click **Project to a second screen**. Click **Connect to a wireless display**, and then follow the on-screen instructions.

Source: http://h10032.www1.hp.com/ctg/Manual/c06672444

43. The Accused Products include 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, the Spectre x360 13-ap0046nr, designed and manufactured by HP, includes the Intel Wireless-AC 9560 1216 LTE SKU wireless radio chip (wireless radio circuit that can send and receive data wirelessly), which includes Wi-Fi and Bluetooth functionality (bi-directional wireless data communications). The Spectre x360 13-ap0046nr can serve as the claimed hub when, for example, a video is streamed from the Internet to the Spectre x360, and Miracast / Wi-Fi Direct are used to mirror the Internet-video to a second device, such as a wireless display.

HP Spectre x360 - 13-ap0046nr

- Windows 10 Home 64

Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 5 combo[10,11]

Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

Intel® Wireless-AC 9560 1216 LTE SKU supports Wi-Fi/Bluetooth® and LTE coexistence that improves wireless performance and user experience while both Intel® Wireless-AC 9560 and an Intel LTE modem are being used in the same platform.

Source: https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/dual-band-wireless-ac-9560-brief.pdf

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.1

Product Name	HP Spectre x360 13 Convertible PC
	Model: 13-ap0xxx, 13t-ap000
	Integrated wireless local area network (WLAN) options by way of on-board wireless module
	Two built-in WLAN antennas
	Supports the following WLAN modules:
	Intel 9560 ac 2×2 + Bluetooth 5 M.2 1216 non-vPro PCI-e+USB world-wide with 2 antennas

Source: http://h10032.www1.hp.com/ctg/Manual/c06155404

44. The Accused Products include a processor. For example, the Spectre x360 13-ap0046nr includes the Intel Core i7-8565U processor.

HP Spectre x360 - 13-ap0046nr

Intel® Core™ i7-8565U (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 8 MB L3 cache, 4 cores)[17,18]

Elevate your every day with the most stunning Spectre yet—featuring the latest Quad-Core 8th Generation Intel® Core™ i7 processor for top-of-the-line efficiency and speed.

Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

45. The processor in the Accused Products is configured to process data received via the wireless radio circuit. For example, the Spectre x360 13-ap0046nr includes the Intel Core i7-8565U processor which receives data from the wireless radio circuit.

CPU Specifications

# of Cores	4
# of Threads	8

Source: https://ark.intel.com/content/www/us/en/ark/products/149091/intel-core-i7-8565u-processor-8m-cache-up-to-4-60-ghz.html

Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 5 combo[10,11]
Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

Integrated wireless local area network (WLAN) options by way of on-board wireless module
Two built-in WLAN antennas
Supports the following WLAN modules:
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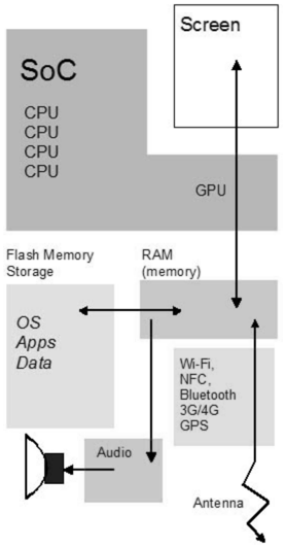
Source: http://h10032.www1.hp.com/ctg/Manual/c06155404



Source: https://www.pcmag.com/encyclopedia/term/51603/soc

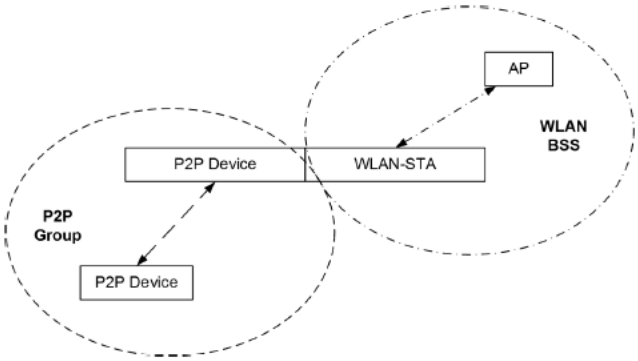
46. The processor in the Accused Products is configured to generate data to be transmitted by the wireless radio circuit. For example, the Spectre x360 13-ap0046nr includes the Intel Core i7-8565U processor which generates data to be transmitted by the wireless radio circuit.

Data is exchanged between the P2P Group Owner and each connected Client. Both the Group Owner and the Client may employ power savings techniques, so each shall use the appropriate data delivery mechanisms as described in Section 3.3.

The P2P Group Owner may provide a data distribution service between all connected Clients in the P2P Group. A P2P Group Owner that provides such a service shall set the Intra-BSS Distribution bit to 1 in the Group Capability Bitmap field that it sends describing its own capabilities.

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.



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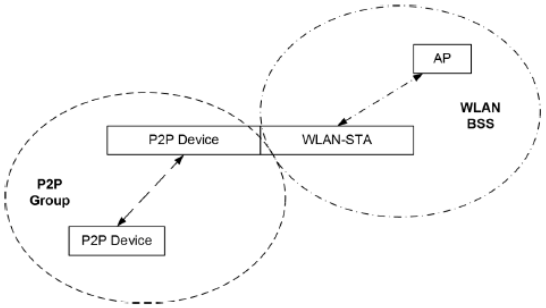
As an example, Figure 4 shows a P2P Concurrent Device that has one MAC entity operating as a WLAN-STA and the second MAC entity operating as a P2P Device. The dual MAC functionality can be provided via two separate physical MAC entities each associated with its own PHY entity, two virtual MAC entities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

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.2.6.1, 2.3, Fig. 4

47. The processor in the Accused Products is configured to initiate and maintain network connections with nodes of a wireless network external to the network-enabled hub. For example, the Spectre x360 13-ap0046nr (network-enabled hub) may initiate and maintain a Miracast connection (network connection) with other devices, such as peripherals (nodes of the wireless network), while maintaining a Wi-Fi internet (wireless external network) connection.

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.



Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3

Specification	Wi-Fi Direct
Computer or device can connect to both printer and Internet simultaneously	Android devices and Windows 10 or 8.1 computers

Source: https://support.hp.com/us-en/document/c04577030

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

and providing added security. Miracast also allows for devices to remain connected to an existing Wi-Fi network while simultaneously connected to a display directly, ensuring network services are always available for presentations or content viewing.

Source: https://www.screenbeam.com/solutions/miracast/

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

3.2.7 Disconnecting from a P2P Group

A P2P Client shall, when possible, indicate intent to disconnect from a P2P Group by using either:

— the deauthentication procedure in Section 10.3.4.4 of IEEE 802.11-2012 [1] to send a Deauthentication frame to the P2P Group Owner if the P2P Group was established outside DMG, or

— the STA disassociation procedure in Section 10.3.5.6 of IEEE 802.11-2012 [1] to send a Disassociation frame to the P2P Group Owner if operating outside DMG, or the STA disassociation procedure in Section 11.3.5.6 of IEEE 802.11-REVmc [11] to send a Disassociation frame to the P2P Group Owner when operating within DMG.

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.2.2, 3.2.3 & 3.2.7.

48. The processor in the Accused Products is configured to maintain 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. For example, the Spectre x360 13-ap0046nr connects to an access point via 802.11x Wi-Fi (first network connection using a first network protocol) and to the Miracast receiver screen (second network connection) using Wi-Fi Direct (second network protocol).

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

With the **Anniversary update** (Build 14393.0) for Windows 10, which was rolled out globally on Aug 2,2016, Microsoft brought an interesting new feature to the deck. To put it simply, ANY PC can act as a wireless receiver for Miracast. Miracast tech or screen mirroring, lets you view the display of a Windows Phone, another Windows PC, an Android phone or a tablet. I am not sure about iOS, though.

Source: https://thewincentral.com/how-turn-windows-10-pc-miracast/

INTEL® WIRELESS-AC 9560 TECHNICAL SPECIFICATIONS

Wi-Fi CERTIFIED* a/b/g/n/ac with wave 2 features, WMM*, WMM-PS*, WPA2*, WPA3*, WPS2*, Protected Management Frames, and Wi-Fi Direct (For Microsoft Windows* only)

Source: https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/dual-band-wireless-ac-9560-brief.pdf

Figure 2. Wi-Fi Direct Concurrent Mode

Source: https://arxiv.org/ftp/arxiv/papers/1810/1810.06964.pdf

Specification	Wi-Fi Direct
Computer or device can connect to both printer and Internet simultaneously	Android devices and Windows 10 or 8.1 computers

Source: https://support.hp.com/us-en/document/c04577030

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.

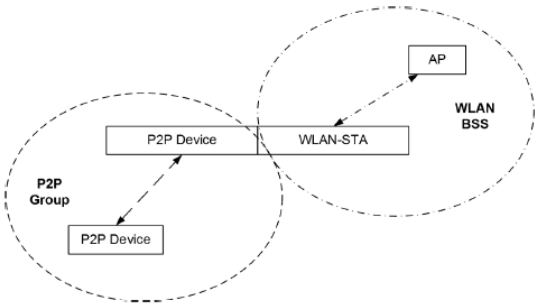


Figure 4—P2P Concurrent device

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.

A P2P Group may operate in the same or different operating class and channel as a concurrently operating WLAN BSS. For example, a WLAN BSS may

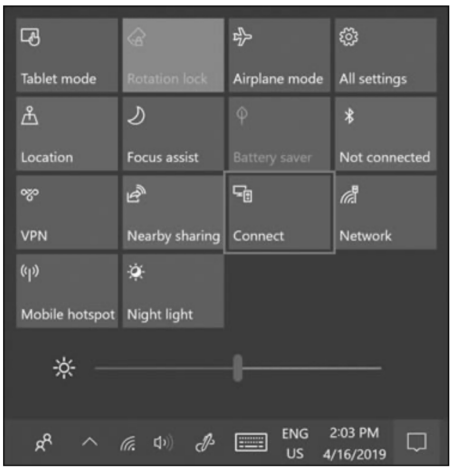
Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3

49. The following instructions from HP's website teach how to set up a Miracast connection, to duplicate a display for example, on a Spectre x360 13-ap0046nr:

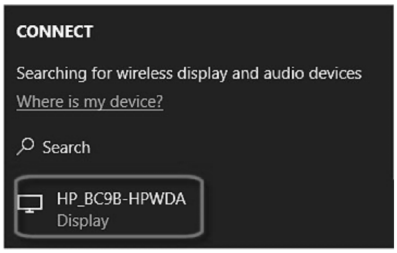
Step 2: Projecting your screen

When you have determined that both your computer and wireless display support Miracast, project your screen.

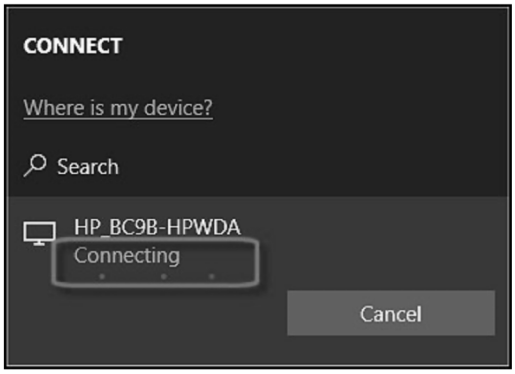
1. Make sure your computer is connected to a network and the display you want to connect to is turned on.
2. In Windows, click the **Action Center** icon on the taskbar, and then click **Connect**.



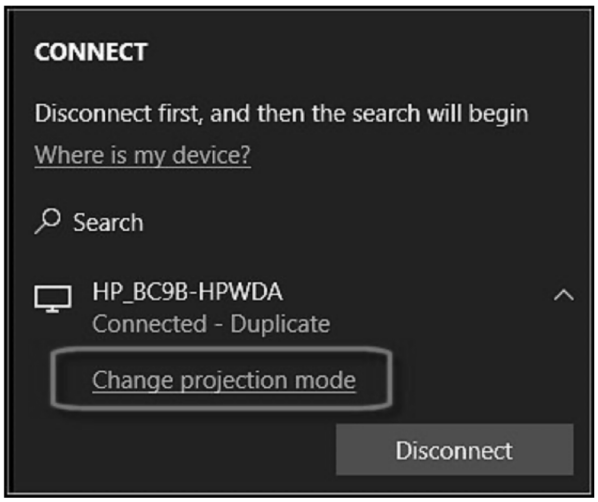
3. Wait while the computer searches for wireless display devices, and then select the wireless display you want from the search results.



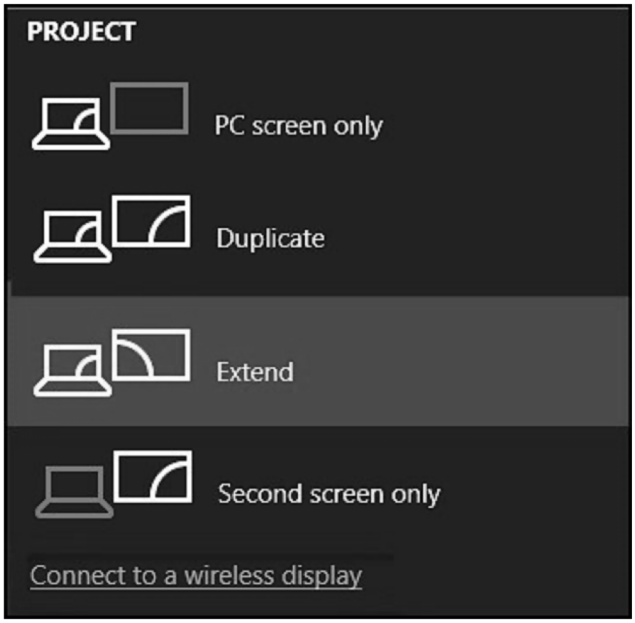
4. Wait while Windows connects the display.



5. When the connection is complete, Windows shows the projection mode. If you want to change this setting, select **Change projection mode**.



6. On the Project screen display, select the projection mode you want.



Source: https://support.hp.com/us-en/document/c05189396

The following modes are available when projecting from a computer to an external display.

- PC screen only
  Everything displays on your main screen, the connected screen remains blank.

  NOTE: When you are connected to a wireless projector, this option changes to **Disconnect**.
- Duplicate
  The same image displays on both screens. This is also called mirroring.
- Extend
  The image is spread over both screens, and you can drag and move items between both screens.
- Second screen only
  Everything displays on the connected screen. Your main screen is blank.

Source: https://support.hp.com/us-en/document/c05189396

50. In further detail, the Accused Products maintain at least a first network connection using a first network protocol. For example, the Spectre x360 13-ap0046nr does so since it complies with at least the IEEE 802.11-2012 standard.

10.1.3 Maintaining synchronization

10.1.3.1 General

Each STA shall maintain a TSF timer with modulus 2^{64} counting in increments of microseconds. STAs expect to receive Beacon frames at a nominal rate. The interval between Beacon frames is defined by the dot11BeaconPeriod parameter of the STA. A STA sending a Beacon frame shall set the value of the Beacon frame's timestamp so that it equals the value of the STA's TSF timer at the time that the data symbol containing the first bit of the timestamp is transmitted to the PHY plus the transmitting STA's delays through its local PHY from the MAC-PHY interface to its interface with the WM [e.g., antenna, light-emitting diode (LED) emission surface].

Source: IEEE 802.11-2012, Section 10.1.3.1

10.3.5 Association, reassociation, and disassociation

10.3.5.1 General

Subclause 10.3.5 describes the procedures used for IEEE 802.11 association, reassociation and disassociation.

The states used in this description are defined in 10.3.1.

Successful association enables a STA to exchange Class 3 frames. Successful association sets the STA's state to State 3 or State 4.

Successful reassociation enables a STA to exchange Class 3 frames. Unsuccessful reassociation when not in State 1 leaves the STA's state unchanged (with respect to the AP that was sent the Reassociation Request (which may be the current STA)). Successful reassociation sets the STA's state to State 3 or State 4 (with respect to the AP that was sent the Reassociation Request). Successful reassociation when not in State 1 sets the STA's state to State 2 (with respect to the current AP, if this is not the AP that was sent the Reassociation Request). Reassociation shall be performed only if the originating STA is already associated in the same ESS.

Disassociation notification when not in State 1 sets the STA's state to State 2. The STA shall become associated again prior to sending Class 3 frames. A STA may disassociate a peer STA at any time, for any reason.

Source: IEEE 802.11-2012, Section 10.3.5.1

51. In further detail, the Accused Products maintain a second network connection using a second network protocol. For example, the Spectre x360 13-ap0046nr does so since it also complies with the Wi-Fi Direct Standard.

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.3

52. In the Accused Products, the second network protocol is an overlay protocol with respect to the first network protocol. For example, Wi-Fi Direct frames (802.11 management frames with a P2P IE) are based on 802.11x frames, with some P2P attributes added in the vendor specific field of an 802.11 management frame. For example, the Wi-Fi Direct protocol includes adaptations to the standard power management mechanisms of the 802.11x protocol, in the form of a Notice of Absence field and CTWindow field to implement the Wi-Fi Direct Notice of Absence and Opportunistic Power Save procedures. Network-enabled hub nodes following the Wi-Fi Direct protocol can interoperate with regular 802.11 STAs, while supporting Wi-Fi Direct

Notice of Absence and Opportunistic Power Save procedures using the data in the vendor specific field of an 802.11 management frame, meaning the Wi-Fi Direct protocol can be considered an "overlay protocol."

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 Std 802.11-2012 [1] with the WFA OUI and an OUI Type indicating P2P. A number of P2P attributes are defined; a single P2P IE carries one or more P2P attributes.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4

8.3.3 Management frames

8.3.3.1 Format of management frames

The format of a management frame is defined in Figure 8-34. The Frame Control, Duration, Address 1, Address 2, Address 3, and Sequence Control fields are present in all management frame subtypes. The maximum unencrypted MMPDU size, excluding the MAC header and FCS, is 2304 octets.

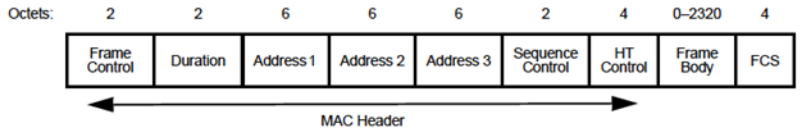


Figure 8-34—Management frame format

The HT Control field is defined in 8.2.4.6. The presence of the HT Control field is determined by the Order subfield of the Frame Control field, as specified in 8.2.4.1.10.

The frame body consists of the fields followed by the elements defined for each management frame subtype. All fields and elements are mandatory unless stated otherwise and appear in the specified, relative order. STAs that encounter an element ID they do not recognize in the frame body of a received management frame ignore that element and continue to parse the remainder of the management frame body (if any) for additional elements with recognizable element IDs. See 9.24.7. Unused element ID codes are reserved.

Gaps may exist in the ordering of fields and elements within frames. The order that remains is ascending.

8.3.3.2 Beacon frame format

The frame body of a management frame of subtype Beacon contains the information shown in Table 8-20.

Table 8-20—Beacon frame body

Source: IEEE 802.11-2012, Section 8.3.3.1

8.4 Management frame body components

8.4.1 Fields that are not information elements

8.4.2 Information elements

8.4.2.1 General

Elements are defined to have a common general format consisting of a 1 octet Element ID field, a 1 octet Length field, and a variable-length element-specific Information field. Each element is assigned a unique Element ID as defined in this standard. The Length field specifies the number of octets in the Information field. See Figure 8-81.

	Element ID	Length	Information
Octets:	1	1	variable

Figure 8-81—Element format

The set of valid elements is defined in Table 8-54.

Table 8-54—Element IDs

Element	Element ID	Length of indicated element (in octets)	Extensible
SSID (see 8.4.2.2)	0	2 to 34	
Supported rates (see 8.4.2.3)	1	3 to 10	

Table 8-54—Element IDs *(continued)*

Element	Element ID	Length of indicated element (in octets)	Extensible
U-APSD Coexistence (see 8.4.2.93)	142	14 to 257	Subelements
Reserved	143–173		
MCCAOP Advertisement Overview (see 8.4.2.110)	174	8	Yes
Reserved	175–220		
Vendor Specific (see 8.4.2.28)	221	3 to 257	
Reserved	222–255		

Source: IEEE 802.11-2012, Section 8.4

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.

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.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.1.14

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.2.10.2

3.3 P2P Power Management

3.3.1 Introduction

P2P power management supports power save mechanisms for P2P Group Owners and P2P Clients. The approach 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

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.

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.

CTWindow is also used for P2P Group Owner Opportunistic Power Save as described in Section 3.3.3.1. It should be noted that it may take a number of DTIM intervals to successfully communicate new, updated or cancelled CTWindow timing to all P2P Clients in a P2P Group.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Sections as identified above.

53. The Wi-Fi Direct protocol (second network protocol) is an overlay protocol with respect to 802.11x (first network protocol), in that Wi-Fi Direct uses 802.11x management frames with new arrangements in the 802.11 vendor specific information field for *inter alia*, Wi-Fi Direct power saving mechanisms, as seen from the Wi-Fi Direct Specification.

P2P PS	IEEE802.11 Power Save adapted for P2P operation
P2P WMM-PS	WMM-PS adapted for P2P operation

Source: Wi-Fi Direct Standard, v. 1.7, Section 1.7

54. In the Accused Products, communications using the second network protocol are partially consistent with the first network protocol. For example, Wi-Fi Direct is only partially consistent with 802.11 Wi-Fi. For example, Wi-Fi Direct (second network protocol) calls for modifications to the 802.11x responses (first network protocol) to Probe Request frames.

A P2P Group Owner shall respond to Probe Request frames following the rules in IEEE Std 802.11-2012 [1], with the following modifications:

- The P2P Wildcard SSID shall be treated the same as the Wildcard SSID for the purposes of deciding to transmit a response (i.e. in IEEE Std 802.11-2012 [1], Clause Section 11.1.3.2.1, change "The SSID in the probe request is the wildcard SSID or the specific SSID of the STA" to "The SSID in the probe request is the wildcard SSID, the P2P wildcard SSID, or the specific SSID of the STA,")
- When a P2P Group Owner responds to a Probe Request frame containing the P2P IE it shall include the P2P Group Info attribute in the P2P IE in the Probe Response frame. The P2P IE shall include the P2P Group Info attribute unless there are zero connected P2P Clients. A P2P Group Owner shall not include a P2P IE in the Probe Response frame if the received Probe Request frame does not contain a P2P IE.
- If one or more Requested Device Type attributes are present in the Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if it has one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values, or if it has a connected P2P Client with one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values. The P2P Group Owner may filter the P2P Group Information returned in the Probe Response frame to include only devices with matching Primary or Secondary Device Type values.
- If a Device ID attribute is present in the P2P IE in a Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if its Device Address, or the Device Address of a connected P2P Client matches that in the Device Address field in the Device ID attribute.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

55. In the Accused Products, 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. For example, Wi-Fi Direct (second network protocol) uses the same antennae as 802.11x Wi-Fi (first network protocol). For example, the Spectre x360 13-ap0046nr uses

Windows 10 Home 64, which includes the standard Wi-Fi Direct functionality, and the products use the same antennae for communications for both Wi-Fi Direct and 802.11x Wi-Fi.

About the Wi-Fi Direct feature

05/31/2018 • 2 minutes to read •

In this article

Related topics

The Native Wifi API contains a set of functions that support the use of Wi-Fi Direct for desktop apps. Starting on Windows 8 and Windows Server 2012, Wi-Fi Direct functions were added to the Native Wifi API.

Source: https://docs.microsoft.com/en-us/windows/win32/nativewifi/about-the-wi-fi-direct-api

All devices certified under the Wi-Fi Direct program allow the user to connect to an infrastructure or a Wi-Fi Direct-certified network. Some devices certified under the Wi-Fi Direct program support connections to both an infrastructure network and Wi-Fi Direct-certified group at the same time (e.g. a laptop may support an infrastructure connection while also belonging to a Wi-Fi Direct-certified group). Simultaneous connection to a Wi-Fi Direct-certified group and an infrastructure network is an optional feature.

Source: https://www.wi-fi.org/knowledge-center/faq/can-a-device-simultaneously-connect-to-a-regular-wi-fi-network-and-a-group-of

Figure 2. Wi-Fi Direct Concurrent Mode

Source: https://arxiv.org/ftp/arxiv/papers/1810/1810.06964.pdf

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

- Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2)[19a] Wi-Fi® and Bluetooth® 5 combo[26]
- MU-MIMO supported

Source: https://www8.hp.com/h20195/v2/GetDocument.aspx?docname=4aa7-8019enuc

Advanced 802.11ac features such as MU-MIMO and TX Beamformee to increase network capacity, as well as maximal likelihood (ML) decoding, low-density parity check (LDPC), maximum ratio combining (MRC) for robust link connection.

Source: https://www.qualcomm.com/media/documents/files/qca6174a-product-brief.pdf

56. The processor in the Accused Products is configured to 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. For example, the Spectre x360 13-ap0046nr (a network-enabled hub) uses Windows 10 Home 64, which includes the standard Miracast (also known as "screen mirroring") (data forwarding logic) functionality, with data from the Wi-Fi access point (originating node in the first (802.11x) network) being forwarded to the destination screen (destination node in the second (Wi-Fi Direct) network).

Figure 2. Wi-Fi Direct Concurrent Mode

Source: https://arxiv.org/ftp/arxiv/papers/1810/1810.06964.pdf

Wireless connectivity

- Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2)[19a] Wi-Fi® and Bluetooth® 5 combo[26]
- MU-MIMO supported

Source: https://www8.hp.com/h20195/v2/GetDocument.aspx?docname=4aa7-8019enuc

To mirror the information from your Windows 10 desktop or laptop, do the following:

1. Click on **Settings** from the **Start Menu**
2. Open the application
3. Choose **System**, then **Display Settings**
4. Scroll down to **Multiple Displays**
5. Click **Connect to a wireless display**
6. Wait for your device to appear
7. Click to connect
8. Follow any prompts to complete the connection, including passwords, PINS, or conformation codes between devices

Source: https://store.hp.com/us/en/tech-takes/what-is-screen-mirroring

What is the difference between screen mirroring and casting?

You may hear these terms used interchangeably, but they're not exactly the same. While mirroring shows the audio and video you are sharing on both screens at the same time, casting shifts the display functionality from one device to another, so you only see it on one screen at a time.

Can you screen mirror without WiFi?

Most of the mirroring tech used today needs a wireless network to send the information. Does that mean that you can't do it without WiFi? While it's not impossible, using WiFi is preferred. Some mirroring and casting devices on the market can use

Source: https://store.hp.com/us/en/tech-takes/what-is-screen-mirroring

With ***Miracast on Windows 10,*** you can conveniently mirror the content from your computer to any other display, be it a TV, a projector or a set-top box. The best part of the Miracast is that it does not need your home network to work since it creates its own network.

Source: https://www.technorms.com/68339/miracast-windows-10

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

57. As set forth above, HP 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.

58. HP intentionally designed and incorporated the IEEE 802.11/Wi-Fi Direct features and functionalities described above into the Accused Products, and advertises its products as complying with those features and functionalities.

59. HP provides instructions to its customers, encouraging and directing the customers to use the Accused Products in an infringing manner as described above to implement, as HP intends, the IEEE 802.11/Wi-Fi Direct functionality. For example, HP provides user manuals, operating instructions and the like for the Accused Products, including the citations above, as well as at the following:

- https://support.hp.com/us-en/document/c04228016
- https://store.hp.com/us/en/tech-takes/what-is-screen-mirroring
- https://www.hp.com/us-en/shop/tech-takes/what-is-screen-mirroring
- https://support.hp.com/us-en/document/c05189396
- https://support.hp.com/us-en/document/c06299203

60. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11/Wi-Fi Direct features described above, HP has induced its customers to infringe the '991 patent. HP's customers who use the Accused Products as described above directly infringe the '991 patent. HP has had knowledge or was willfully blind of the '991 patent since at least as early as November 17, 2020, as a result of the following communications from Ozmo to HP. More specifically, on March 23, 2020, Christian Dubuc, Chief Executive Officer of Ozmo Licensing, wrote to Kim Rivera, Chief Legal Officer and General Counsel of HP, regarding the HP Accused Products and Ozmo Licensing's patent portfolio, including Ozmo's position that HP requires a license. Subsequently, on November 10, 2020, Ozmo followed up with HP via email providing more specificity regarding the '991 patent and offering to provide claim charts. On November 17,

2020, Ozmo provided HP with detailed claim charts illustrating how the Accused Products infringe each element of exemplary claims of the '991 patent. Therefore, HP has had actual and express knowledge of the '991 patent and Ozmo's infringement allegations since at the latest November 17, 2020, and additionally, by the service upon it of the Original Complaint and this Amended Complaint. HP also induces such infringement by failing to remove the infringing features from the Accused Products.

61. By offering for sale, selling, commercially distributing and importing the Accused Products, HP has also contributed to its customers' infringement of the '991 patent. The Accused Products are used by HP's customers to practice the inventions claimed in the '991 patent. The IEEE 802.11/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the '991 patent. HP knows or was willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by HP solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. HP also knows or was 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 HP. HP has had knowledge since at least as early as November 17, 2020—described above—that its customers were infringing the '991 patent.

62. By the time of trial, HP will have known and intended that its continued actions would directly infringe, and would induce and contribute to the infringement by its customers of, at least claim 1 of the '991 patent.

63. Ozmo Licensing has been damaged by HP's past and ongoing direct and indirect infringement of the '991 patent.

64. With knowledge of the allegations set forth herein, HP continues to incorporate the infringing functionalities in the Accused Products, and has failed to compensate Ozmo Licensing for the use of such features. HP's unlawful activities described above have continued despite HP's receipt of the numerous correspondence described above, including exemplary element-by-element claim charts no later than November 17, 2020. HP's infringement will continue unabated unless and until HP is ordered to pay a reasonable royalty for a license to the '991 patent.

COUNT II
(HP's Infringement of U.S. Patent No. 10,873,906)

65. Paragraphs 1-64 are reincorporated by reference as if fully set forth herein.

66. The invention of the '906 patent represented a technical solution to an unsolved technological problem. The written description of the '906 patent 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 improved upon what may have been considered conventional or generic. For example, the specification and incorporated references detail the inventors' novel approach to seamlessly integrating WPAN into WLAN where the WPAN protocol is an overlay protocol that is only partially consistent with the WLAN protocol.

67. The elements claimed by the '906 patent, taken alone or in combination, were not well-understood, routine or conventional to one of ordinary skill in the art at the time of the invention. Rather, the '906 patent claims and teaches, *inter alia*, an improved way to integrate two devices using WPAN and WLAN in an infrastructure using: a WPAN protocol that is partially compliant with the WLAN protocol, including frames adapted to support WPAN power-savings; either the 2.4 or 5 GHz frequency band; a WLAN protocol that is an 802.11x protocol using 802.11x frames; a WPAN protocol that uses WPAN-adapted frames including at least one field

frame defined by the 802.11x protocol; the WPAN-adapted frame is adapted from a WLAN protocol management frame; the WPAN protocol provides for inactivity time, during which the wireless devices agree on inactivity times in accordance with the WPAN protocol; and at least one of the devices disables functions during the inactivity time, such that less power-per-unit is consumed relative to when those functions are not disabled.

68. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more cost effective to design, since the communications using the second network protocol impinge on at least some antennae used for communications using the first network protocol.

69. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN extends the communication range of power-sensitive battery-operated devices and allows power-sensitive battery-operated devices to become part of the larger WLAN infrastructure, thus enabling monitoring and control from any location that is within the range covered by the WLAN.

70. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more beneficial as it allows for remote monitoring and controlling of a WPAN device, since the WPAN device may be connected to a Wi-Fi infrastructure, via the network-enabled hub, which may be adapted to established communication via the Internet coupled to the AP. This implementation may permit a user to poll information from a specific WPAN device while away from the infrastructure network in which the WPAN device is integrated. This allows remote monitoring and controlling of a WPAN device such as a home security system, or an implanted or wearable medical device.

71. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more energy efficient, thereby extending the battery life of the devices.

72. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN, also enables lower latency communication involving WPAN devices.

73. HP has infringed, and continues to infringe, the '906 patent by making, importing, using, offering for sale and selling in the United States numerous wireless devices, including laptop computers, desktop computers, printers and monitors that include Wi-Fi Direct functionality (together, "Accused Products"). The same Accused Products that infringe the '991 patent infringe the '906 patent, and vice versa.

74. Examples of the Accused Products are HP's Wi-Fi Direct enabled laptop computers (including but not limited to Chromebook, ENVY, Elite, EliteBook, Essential, Mobile Thin Client, OMEN, Pavilion, ProBook, Spectre and ZBook); desktop computers (including but not limited to Chromebox, Collaboration Solutions, ENVY, EliteDesk, EliteOne, Essential, Flexible, OMEN, P-Series, Pavilion, ProDesk, ProOne, Z and Zero); printers (including but not limited to DesignJet, DeskJet, ENVY, LaserJet, Neverstop, OfficeJet, PageWide, ScanJet, Smart Tank and Tango); monitors (including but not limited to HP U27 4K Wireless Monitor, and OMEN X Emperium Gaming Monitor), and all other products that include Wi-Fi Direct functionality. These products use Wi-Fi Direct in substantially the same way.

75. For the avoidance of doubt, all of HP's products made, used, sold and/or offered for sale in, or imported into, the United States during the life of the '906 patent that provide(d) the foregoing functionality during the life of the '906 patent are included within the definition of

Accused Products. The examples and evidence provided below are equally applicable to all Accused Products.

76. Claim 1 of the '906 patent is reproduced below:

1. A first wireless device for coordinating a wireless personal area network (WPAN), comprising:

a wireless radio circuit configured to communicate over a physical medium of a wireless local area network (WLAN) using a WLAN protocol;

a memory; and

at least one processor coupled to the wireless radio circuit and the memory, the at least one processor configured to:

discover, via the wireless radio circuit, a second wireless device using a WPAN protocol;

establish, via the wireless radio circuit, an association with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon establishment of the association, the first and second wireless devices are each a member of a WPAN network; and

maintain, via the wireless radio circuit, the association with the second wireless device over the wireless connection using the WPAN protocol;

wherein the WPAN protocol is an overlay protocol that is partially compliant with respect to the WLAN protocol 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;

wherein the wireless radio circuit is configured to operate in at least one of a 2.4 GHz or 5 GHz frequency band;

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;

wherein the WPAN-adapted frame is adapted from a WLAN protocol management frame;

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;

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

wherein the first wireless device is configured to disable at least a part of a coordination function of the first wireless device 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 at least part of said coordination function is not disabled.

77. The Accused Products are first wireless devices for coordinating a wireless personal area network (WPAN). For example, the Accused Products implement the Wi-Fi Direct protocol to connect to WPANs.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.1

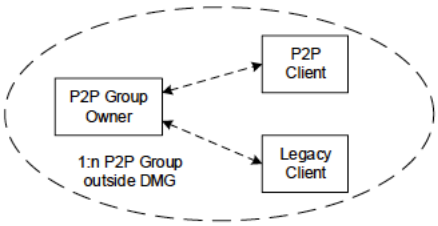


Figure 1—P2P components and topology when operating outside DMG

Source: Wi-Fi Direct Standard, v. 1.7, Figure 1

78. For example, the HP OfficeJet Pro 8035e All-in-One Printer (a first wireless device), designed and manufactured by HP, can coordinate via Wi-Fi Direct (WPAN) with another device, PC or laptop (including, but not limited to, other Accused Products) (a second wireless device), and is capable of communications via an 802.11x WLAN protocol.

HP OfficeJet Pro 8035e All-in-One Printer

Product # 1L0H6A#B1H

Source: https://store.hp.com/us/en/pdp/hp-officejet-pro-8035e-all-in-one-printer

Standard connectivity	1 USB 2.0; 1 Ethernet; 1 Wireless 802.11a/b/g/n; 1 RJ-11 Fax
Network capabilities	Yes, via built-in Ethernet; Wireless 802.11 a/b/g/n
Wireless capability	Yes, built-in WiFi 802.11 a/b/g/n
Mobile printing capability[4]	Apple AirPrint™; Wi-Fi® Direct Printing; Mopria™ Certified; HP Smart
Memory	Standard: 256 MB; Maximum: 256 MB DDR3 SDRAM
Processor speed	1.2 GHz

Source: https://h20195.www2.hp.com/v2/getpdf.aspx/4aa7-8767enuc.pdf

No network, no problem!

Even if you do not have a router or network to connect to, you can print directly from your mobile devices to many HP printers using secure Wi-Fi Direct, HP Wireless Direct, or NFC Touch to print.

Source: https://www8.hp.com/us/en/printers/mobility/wireless-directprinting.html?m802=1&tab=1

Product Specifications (1L0H6A)

* * *

Mobile printing capability

Mobile printing services	Apple AirPrint™; Wi-Fi® Direct Printing; Mopria™ Certified; HP Smart

Source: https://support.hp.com/us-en/product/hp-officejet-pro-8030e-all-in-one-printer-series/38023433/document/c06953402

Wi-Fi CERTIFIED™ Interoperability Certificate

This certificate lists the features that have successfully completed Wi-Fi Alliance interoperability testing.
Learn more: www.wi-fi.org/certification/programs

Certification ID: WFA101069

Date of Last Certification: 2020-07-30

Brand: HP Inc.

Product: HP OfficeJet Pro 8030 All-in-One series

Model Number: 1L0H6A-1L0H9A, 1L0J0A

Product Identifier(s): SKU: HP OfficeJet Pro 8034e All-in One Printer, SKU: HP OfficeJet Pro 8032e All-in One Printer, SKU: HP OfficeJet Pro 8035e All-in One Printer, SKU: HP OfficeJet Pro 8035 All-in One Printer, SKU: HP OfficeJet Pro 8028e All-in One Printer, SKU: HP OfficeJet 8022e All-in One Printer, SKU: HP OfficeJet Pro 8025 All-in One Printer, SKU: HP OfficeJet Pro 8025e All-in One Printer

Category: Printer/Multi-Function Printer/Print Server

Hardware Version: MP2

Firmware Version: 2030B

Operating System: Linux, version:3.0

Frequency Band(s): 2.4 GHz, 5 GHz

Summary of Certifications

CLASSIFICATION	PROGRAM
Connectivity	Wi-Fi CERTIFIED™ a
	Wi-Fi CERTIFIED™ b
	Wi-Fi CERTIFIED™ g
	Wi-Fi CERTIFIED™ n
	Wi-Fi Direct®
Security	WPA2™ - Personal
	WPA2™ - Enterprise
Optimization	WMM®
Access	Wi-Fi Protected Setup™

Source: http://certifications.prod.wi-fi.org/pdf/certificate/public/download?cid=WFA101069

79. The Accused Products are first wireless devices comprising a wireless radio circuit configured to communicate over a physical medium of a wireless local area network (WLAN) using a WLAN protocol. For example, the OfficeJet Pro 8035e All-in-One Printer (first wireless device) includes the VCVRA1712 Radio Module (wireless radio circuit configured to communicate over a physical medium), which includes a wireless radio circuit with 802.11x capabilities (802.11x WLAN protocol), as seen below.

DESCRIPTION:*	OPTION RMN:*
Product Derivatives: 3UC61B, 3UC60B, 4KJ66B, 1L0H6A, 1L0H67A, 1L0H8A, 1K7K3A, 1L0H6A, 1L0H7A, 1L0H8A, 1K7K3A, 1K7K6A, 1K7K6A, 1K7K7A, 229W7B, 229W8B, 229W9B, 229X1D, 229X2D, 229X3D, 257B9B	
Radio Module Number	**VCVRA-1712**
Power Supply (WW, excluding China and India)	**F0V63-60012**

Source: https://h20195.www2.hp.com/v2/getpdf.aspx/c06288530.pdf

fccid.io › HP Inc. › VCVRA1712 › External Photos

VCVRA1712 Module External Photos ... - FCC ID

Company: **Marvell** Semiconductors. Product Name: SP88W8977. Report No.: MARS11 - SP88W8977 External Photos. PHOTOS - EXTERNAL. Title: **Marvell** ...

Source: https://fccid.io/B94VCVRA1712/External-Photos/External-Photos-3712099.html

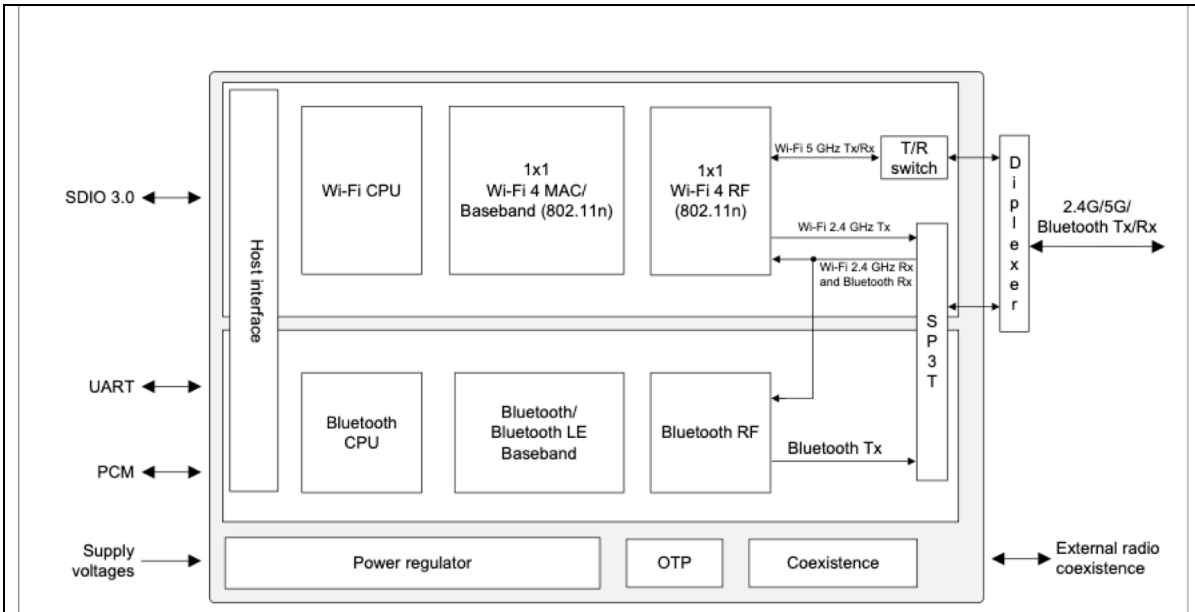


Figure 2. 88W8977 internal block diagram

Source: https://www.nxp.com/docs/en/data-sheet/88W8977DS.pdf

HP OfficeJet Pro 8035e All-in-One Printer Technical specifications

* * *

Standard connectivity	1 USB 2.0; 1 Ethernet; 1 Wireless 802.11a/b/g/n; 1 RJ-11 Fax
Network capabilities	Yes, via built-in Ethernet; Wireless 802.11 a/b/g/n
Wireless capability	Yes, built-in WiFi 802.11 a/b/g/n
Mobile printing capability[4]	Apple AirPrint™; Wi-Fi® Direct Printing; Mopria™ Certified; HP Smart
Memory	**Standard:** 256 MB; **Maximum:** 256 MB DDR3 SDRAM
Processor speed	1.2 GHz

Source: https://h20195.www2.hp.com/v2/getpdf.aspx/4aa7-8767enuc.pdf

80. The Accused Products are first wireless devices comprising a memory. For example, the OfficeJet Pro 8035e All-in-One Printer includes the VCVRA1712 Radio Module, which includes memory, as seen below.

HP OfficeJet Pro 8035e All-in-One Printer Technical specifications

* * *

Standard connectivity	1 USB 2.0; 1 Ethernet; 1 Wireless 802.11a/b/g/n; 1 RJ-11 Fax
Network capabilities	Yes, via built-in Ethernet; Wireless 802.11 a/b/g/n
Wireless capability	Yes, built-in WiFi 802.11 a/b/g/n
Mobile printing capability[4]	Apple AirPrint™; Wi-Fi® Direct Printing; Mopria™ Certified; HP Smart
Memory	Standard: 256 MB; Maximum: 256 MB DDR3 SDRAM
Processor speed	1.2 GHz

Source: https://h20195.www2.hp.com/v2/getpdf.aspx/4aa7-8767enuc.pdf

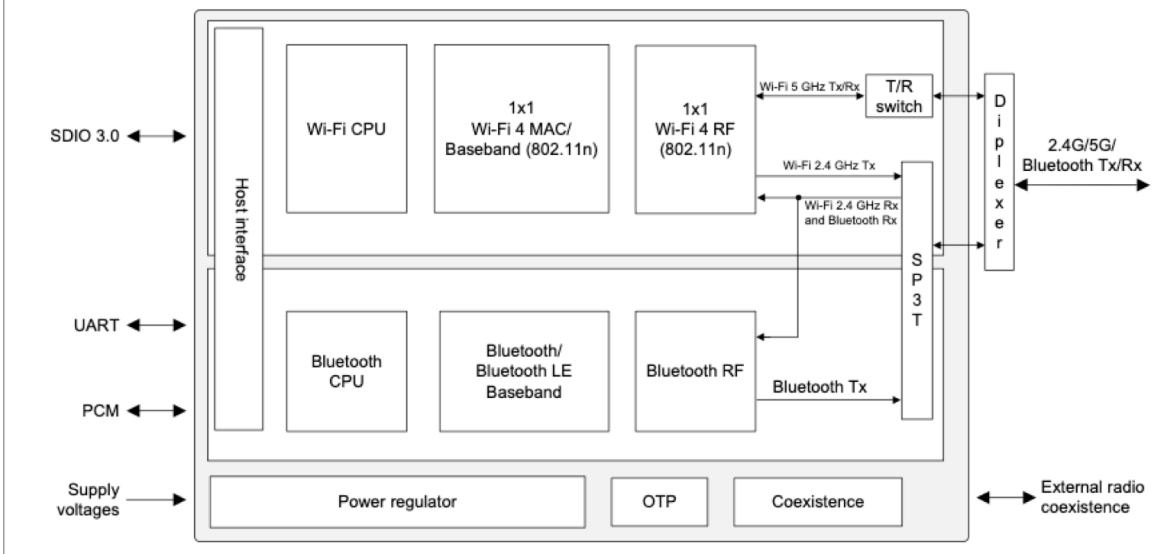


Figure 2. 88W8977 internal block diagram

Source: https://www.nxp.com/docs/en/data-sheet/88W8977DS.pdf

81. The Accused Products are first wireless devices comprising at least one processor coupled to the wireless radio circuit and the memory. For example, the OfficeJet Pro 8035e All-in-One Printer includes the VCVRA1712 Radio Module, which includes memory and at least one processor coupled to the wireless radio circuit and the memory, as seen below.

HP OfficeJet Pro 8035e All-in-One Printer Technical specifications

* * *

Standard connectivity	1 USB 2.0; 1 Ethernet; 1 Wireless 802.11a/b/g/n; 1 RJ-11 Fax
Network capabilities	Yes, via built-in Ethernet; Wireless 802.11 a/b/g/n
Wireless capability	Yes, built-in WiFi 802.11 a/b/g/n
Mobile printing capability[4]	Apple AirPrint™; Wi-Fi® Direct Printing; Mopria™ Certified; HP Smart
Memory	**Standard:** 256 MB; **Maximum:** 256 MB DDR3 SDRAM
Processor speed	1.2 GHz

Source: https://h20195.www2.hp.com/v2/getpdf.aspx/4aa7-8767enuc.pdf

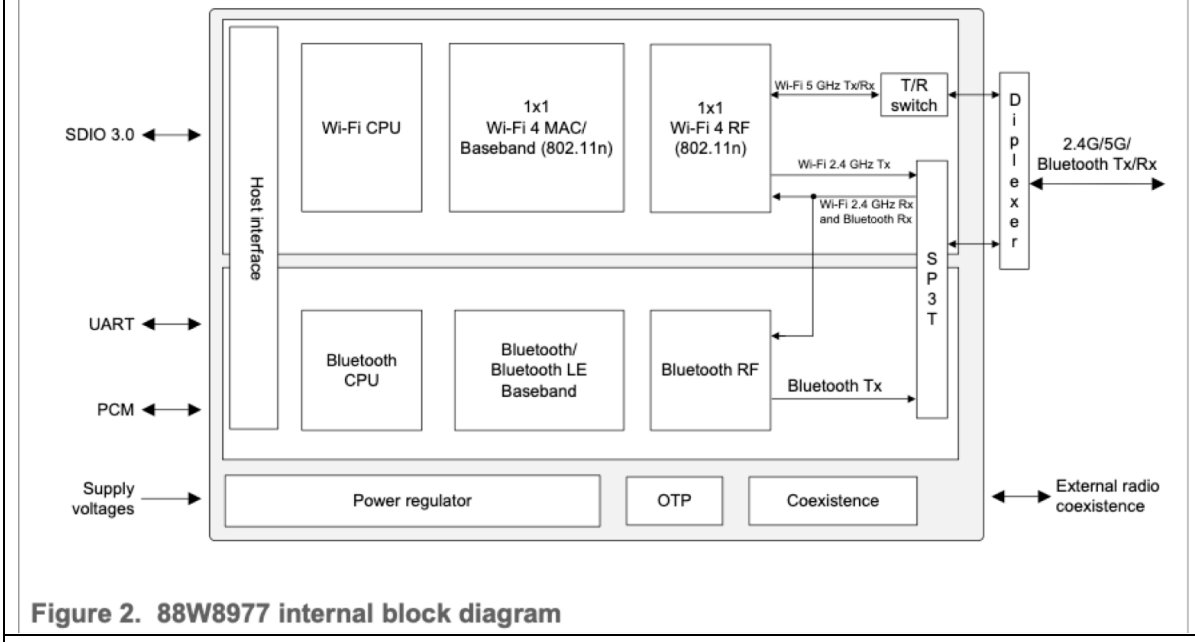


Figure 2. 88W8977 internal block diagram

Source: https://www.nxp.com/docs/en/data-sheet/88W8977DS.pdf

82. The Accused Products are first wireless devices comprising at least one processor configured to discover, via the wireless radio circuit, a second wireless device using a WPAN protocol. For example, the OfficeJet Pro 8035e All-in-One Printer (a first wireless devices) includes the VCVRA1712 Radio Module (a wireless radio circuit with a processor) configured to discover a second wireless device, such as a PC or laptop (including, but not limited to, other Accused Products), using Wi-Fi Direct (a WPAN protocol).

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.

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 (3.1.2.1)

3.1.2.4 Device Discovery procedures for a P2P Group Owner

A P2P Device that is already operating as a P2P Group Owner stays on the Operating Channel and waits for other devices to discover it. A P2P Group Owner may search on other channels to find desired devices or services.

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 Formation Procedure shall complete prior to entering the Group Formation Procedure with any other P2P Device. A P2P Device that is already in Group (3.1.4.1)

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.1.1, 3.1.2.1, 3.1.2.4, & 3.1.4.1

Certification ID: WFA101069

Date of Last Certification: 2020-07-30

Brand: HP Inc.

Product: HP OfficeJet Pro 8030 All-in-One series

Model Number: 1L0H6A-1L0H9A, 1L0J0A

Product Identifier(s): SKU: HP OfficeJet Pro 8034e All-in One Printer, SKU: HP OfficeJet Pro 8032e All-in One Printer, SKU: HP OfficeJet Pro 8035e All-in One Printer, SKU: HP OfficeJet Pro 8035 All-in One Printer, SKU: HP OfficeJet Pro 8028e All-in One Printer, SKU: HP OfficeJet 8022e All-in One Printer, SKU: HP OfficeJet Pro 8025 All-in One Printer, SKU: HP OfficeJet Pro 8025e All-in One Printer

Category: Printer/Multi-Function Printer/Print Server

Hardware Version: MP2

Firmware Version: 2030B

Operating System: Linux, version:3.0

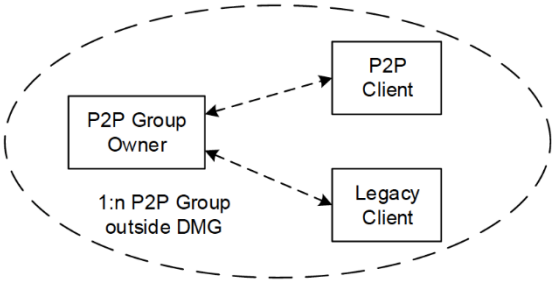
Frequency Band(s): 2.4 GHz, 5 GHz

Summary of Certifications

CLASSIFICATION	PROGRAM
Connectivity	Wi-Fi CERTIFIED™ a
	Wi-Fi CERTIFIED™ b
	Wi-Fi CERTIFIED™ g
	Wi-Fi CERTIFIED™ n
	Wi-Fi Direct®
Security	WPA2™ - Personal
	WPA2™ - Enterprise
Optimization	WMM®
Access	Wi-Fi Protected Setup™

Source: http://certifications.prod.wi-fi.org/pdf/certificate/public/download?cid=WFA101069

83. The Accused Products are first wireless devices comprising at least one processor configured to establish, via the wireless radio circuit, an association with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon establishment of the association, the first and second wireless devices are each a member of a WPAN network. For example, the OfficeJet Pro 8035e All-in-One Printer (a first wireless device) includes the VCVRA1712 Radio Module (a wireless radio circuit with a processor) configured to establish a Wi-Fi Direct connection (a wireless connection using a WPAN protocol) with such a second wireless device (including, but not limited to, other Accused Products), wherein, upon establishment of the association, the printer and other device are members of the Wi-Fi Direct network (WPAN network).



3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

3.2.3 Connecting to a P2P Group

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

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

Source: Wi-Fi Direct Standard, v. 1.7, Fig. 1, Sections 3.2.2 & 3.2.3

84. The Accused Products are first wireless devices comprising at least one processor configured to maintain, via the wireless radio circuit, the association with the second wireless device over the wireless connection using the WPAN protocol. For example, the OfficeJet Pro 8035e All-in-One Printer (a first wireless device) includes the VCVRA1712 Radio Module (a wireless radio circuit with a processor) configured to maintain the association with the second

wireless device, such as a PC or laptop (including, but not limited to, other Accused Products), using Wi-Fi Direct (a WPAN protocol).

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

A P2P Device shall not respond to Probe Request frames unless it is:

- a P2P Group Owner or
- in the Listen State, or
- in the Search State and the P2P Device operates within DMG, or
- a P2P Device associated with an infrastructure AP on the channel on which the Probe Request was sent — in which case the P2P Device may respond provided it is not already a member of a P2P Group, or
- a P2P Client supporting Peer-to-Peer services (P2Ps) [10], having a Service Advertiser with a Service Hash matching the hash value in the incoming Probe Request, as described in 3.4.3.2 (Advertise Service fields in Probe Response) of [10], on the operating channel of the P2P group that the client connected.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.1.2.1

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.3

Use Wi-Fi Direct

With Wi-Fi Direct, you can print wirelessly from a computer, smart phone, tablet, or other wireless-capable device—without connecting to an existing wireless network.

- Make sure Wi-Fi Direct for your printer is turned on.
- Up to five computers and mobile devices can use the same Wi-Fi Direct connection.
- Wi-Fi Direct can be used while the printer is also connected either to a computer using a USB cable or to a network using a wireless connection.

Source: http://h10032.www1.hp.com/ctg/Manual/c06291142 at 128

Specification	Wi-Fi Direct
Security	WPA2 password is required
Maximum simultaneous device connections	5
Printer name that displays when printing	DIRECT-xx-HP [your printer model name]
Wireless computer or device can automatically detect and connect to printer	Yes: Automatic or Manual (pushbutton/PIN)
Computer or device can connect to both printer and internet simultaneously	Yes

Source: https://support.hp.com/us-en/document/c04090221

85. In the Accused Products, the WPAN protocol is an overlay protocol that is partially compliant with respect to the WLAN protocol 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.

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.

A P2P Group Owner shall respond to Probe Request frames following the rules in IEEE Std 802.11-2012 [1], with the following modifications:

- The P2P Wildcard SSID shall be treated the same as the Wildcard SSID for the purposes of deciding to transmit a response (i.e. in IEEE Std 802.11-2012 [1], Clause Section 11.1.3.2.1, change "The SSID in the probe request is the wildcard SSID or the specific SSID of the STA" to "The SSID in the probe request is the wildcard SSID, the P2P wildcard SSID, or the specific SSID of the STA,")
- When a P2P Group Owner responds to a Probe Request frame containing the P2P IE it shall include the P2P Group Info attribute in the P2P IE in the Probe Response frame. The P2P IE shall include the P2P Group Info attribute unless there are zero connected P2P Clients. A P2P Group Owner shall not include a P2P IE in the Probe Response frame if the received Probe Request frame does not contain a P2P IE.
- If one or more Requested Device Type attributes are present in the Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if it has one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values, or if it has a connected P2P Client with one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values. The P2P Group Owner may filter the P2P Group Information returned in the Probe Response frame to include only devices with matching Primary or Secondary Device Type values.
- If a Device ID attribute is present in the P2P IE in a Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if its Device Address, or the Device Address of a connected P2P Client matches that in the Device Address field in the Device ID attribute.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.1 & 3.3.2

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4

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.

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 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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.1.14

86. In the Accused Products, the wireless radio circuit is configured to operate in at least one of a 2.4 GHz or 5 GHz frequency band. For example, the OfficeJet Pro 8035e All-in-One Printer (a first wireless device) includes the VCVRA1712 Radio Module (a wireless radio circuit with a processor), including a wireless radio circuit that operates in both the 2.4 and 5 GHz frequency bands.

The 88W8977 System-on-Chip (SoC) is a highly integrated single-chip solution that incorporates both Wi-Fi® (2.4/5 GHz) and Bluetooth® technology. The System-on-Chip (SoC) provides both simultaneous and independent operation of the following:

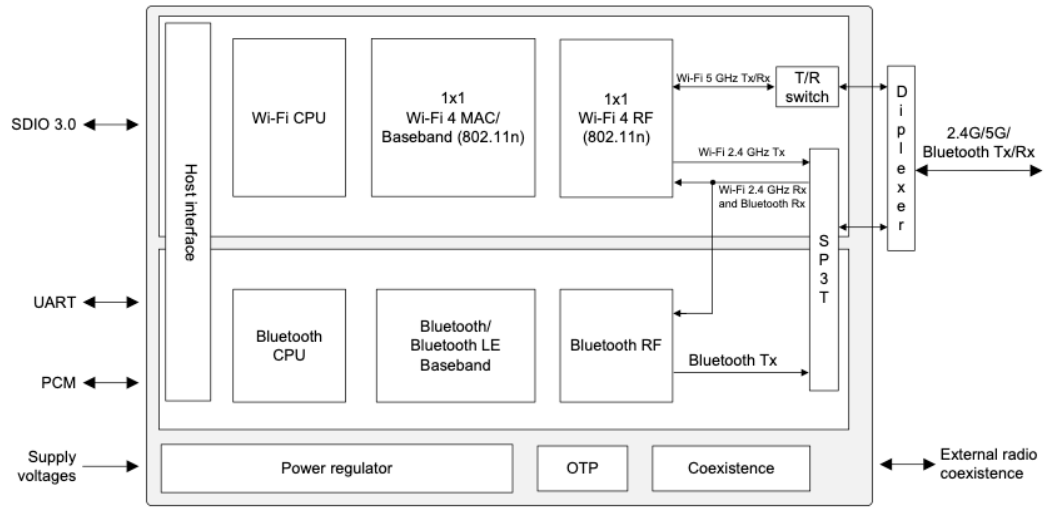


Figure 2. 88W8977 internal block diagram

Source: https://www.nxp.com/docs/en/data-sheet/88W8977DS.pdf

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

Source: Wi-Fi Direct Standard, v. 1.7, Section 1.4

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

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.1.2.1

87. In the Accused Products, 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. For example, in Wi-Fi Direct (the WPAN protocol) the WPAN-adapted frame may utilize the Vendor Specific Information Element (IE) of an 802.11x protocol frame to specify the organizationally unique identifier (OUI) as the Wi-Fi Alliance OUI and the type indicating P2P (an 802.11x protocol that uses a frame defined by the 802.11x protocol). The modified frame is used to carry information not defined by the IEEE 802.11-2012 Standard so that

interoperability is more easily achieved when implementing operations that are not part of the 802.11x standard, such as those required by the power save features defined by the Wi-Fi Direct Standard. P2P IEs used in this manner may, for example, enable a power-saving protocol that allows the P2P Group Owner (the first wireless device) to take on a role similar to that of an AP in an IEEE 802.11x network, while also implementing power management for a P2P Group, by for example allowing the P2P Group Owner to be absent for certain periods of time (using a WPAN-adapted frame in which at least one field of the frame defined by the 802.11x protocol, namely the aforementioned vendor-specific information field, is adapted to support the WPAN power-saving protocol). In the Wi-Fi Direct protocol, two of the P2P Group Owner's adapted power saving protocol schemes are Notice of Absence and Opportunistic Power Save.

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.
Source: Wi-Fi Direct Standard, v. 1.7, Section 4

P2P PS	IEEE802.11 Power Save adapted for P2P operation
P2P WMM-PS	WMM-PS adapted for P2P operation
Source: Wi-Fi Direct Standard, v. 1.7, Section 1.4	

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.

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 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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.1.14

88. In the Accused Products, the WPAN-adapted frame is adapted from a WLAN protocol management frame; *i.e.*, a WPAN-adapted MAC frame of type management (as defined by IEEE 802.11-2012 at Section 8.2.4.1). Per IEEE 802.11-2012, management frames are used by stations (STAs) to join and leave a Basic Service Set (BSS); management type frame subtypes include association request and/or response, probe request and/or response, timing advertisement, beacon, authentication and/or deauthentication. By adapting a WLAN protocol management frame to specify the Wi-Fi Alliance OUI and an OUI type indicating P2P, all devices in the P2P Group may communicate according to the Wi-Fi Direct Standard, however with reduced interference with Wi-Fi devices, and potentially at reduced power dissipation.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4

8.4 Management frame body components

8.4.1 Fields that are not information elements

8.4.2 Information elements

8.4.2.1 General

Elements are defined to have a common general format consisting of a 1 octet Element ID field, a 1 octet Length field, and a variable-length element-specific Information field. Each element is assigned a unique Element ID as defined in this standard. The Length field specifies the number of octets in the Information field. See Figure 8-81.

	Element ID	Length	Information
Octets:	1	1	variable

Figure 8-81—Element format

The set of valid elements is defined in Table 8-54.

Table 8-54—Element IDs

Element	Element ID	Length of indicated element (in octets)	Extensible
SSID (see 8.4.2.2)	0	2 to 34	
Supported rates (see 8.4.2.3)	1	3 to 10	

Table 8-54—Element IDs *(continued)*

Element	Element ID	Length of indicated element (in octets)	Extensible
U-APSD Coexistence (see 8.4.2.93)	142	14 to 257	Subelements
Reserved	143–173		
MCCAOP Advertisement Overview (see 8.4.2.110)	174	8	Yes
Reserved	175–220		
Vendor Specific (see 8.4.2.28)	221	3 to 257	
Reserved	222–255		

Source: IEEE 802.11-2012, Section 8.4

89. In the Accused Products, 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. For example, a P2P Group Owner (the first wireless device) utilizing the Notice of Absence procedure shall not send frames within the P2P Group during periods it has indicated it will be absent, and a P2P Client (the second wireless device) that received the Notice of Absence and that does not try modifying any of the periods using P2P Presence procedures, shall not send frames to a P2P Group Owner during the specified absence. During a P2P Group Owner's absence,

the P2P Client shall buffer frames until frame delivery may be attempted in a presence period, such that during the absence, the wireless connection between the P2P Group Owner and the P2P Client is partially disabled (an inactivity time during which the first and second wireless devices can agree to at least partially disable the wireless connection).

3.3.3.2 P2P Group Owner Notice of Absence procedure

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.

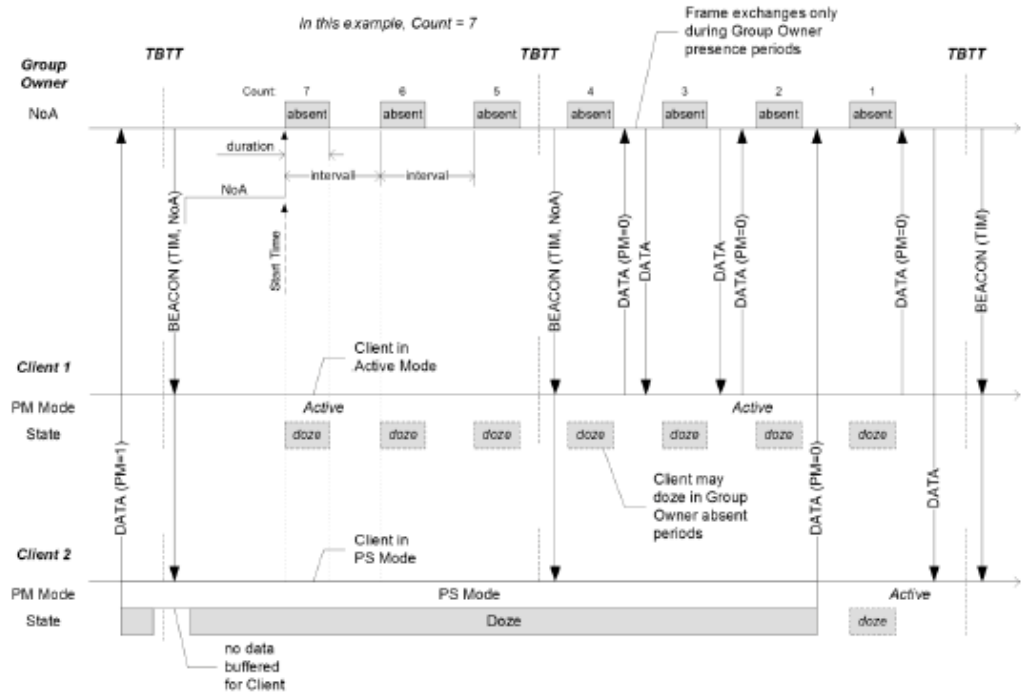


Figure 15—P2P Group Owner Notice of Absence

P2P Clients may submit a P2P Presence Request to the P2P Group Owner to influence P2P Group Owner power management timing. This mechanism may be used whenever the P2P Client has requirements on the interval between and/or duration of P2P Group Owner presence periods, e.g. where the P2P Client has WMM Traffic Stream (TS), or latency sensitive traffic.

On receipt of a P2P Presence Request, the P2P Group Owner shall determine whether to accept the request. If the P2P Group Owner accepts the P2P Presence Request, it shall respond with a P2P Presence Response action frame containing a Status attribute indicating success and a Notice of Absence attribute describing the Notice of Absence timing that it will use in response to the request. The P2P Group Owner may adopt revised Notice of Absence

* * *

If the Status element in the P2P Presence Response indicates failure, or if the Status element indicates success, but the timing indicated in the returned Notice of Absence attribute does not meet the requirements of the P2P Client, the P2P Client may:

— send a new P2P Presence Request with revised timing,
— use the timing indicated in the returned Notice of Absence attribute, or
— disconnect from the P2P Group.

A P2P Client may submit a request for revised P2P Group Owner presence, by submitting a new P2P Presence Request to the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.3.2, 3.3.4.4 and Figure 15

90. In the Accused Products, the first wireless device and the second wireless device are configured to agree on the inactivity time in accordance with the WPAN protocol as described above and reiterated below.

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.

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.

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.

4.2.10.3 P2P Presence Request frame

The P2P Presence Request action frame uses the P2P Action frame format and may be transmitted by a P2P Client to influence P2P Group Owner power management timing.

The Dialog Token field in a Client P2P action frame shall be set to a non-zero value selected by the P2P Client to identify the P2P Presence Request-Response transaction.

The Elements field in a P2P Presence Request action frame shall contain a P2P IE with a single Notice of Absence attribute describing the requested P2P Group Owner presence timing, see Section 3.3.4.4.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.3.2, 4.1.14, 4.2.10.2, & 4.2.10.3

91. In the Accused Products, the first wireless device is configured to disable at least a part of a coordination function of the first wireless device 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 at least part of said coordination function is not disabled.

3.3.3.2 P2P Group Owner Notice of Absence procedure

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.

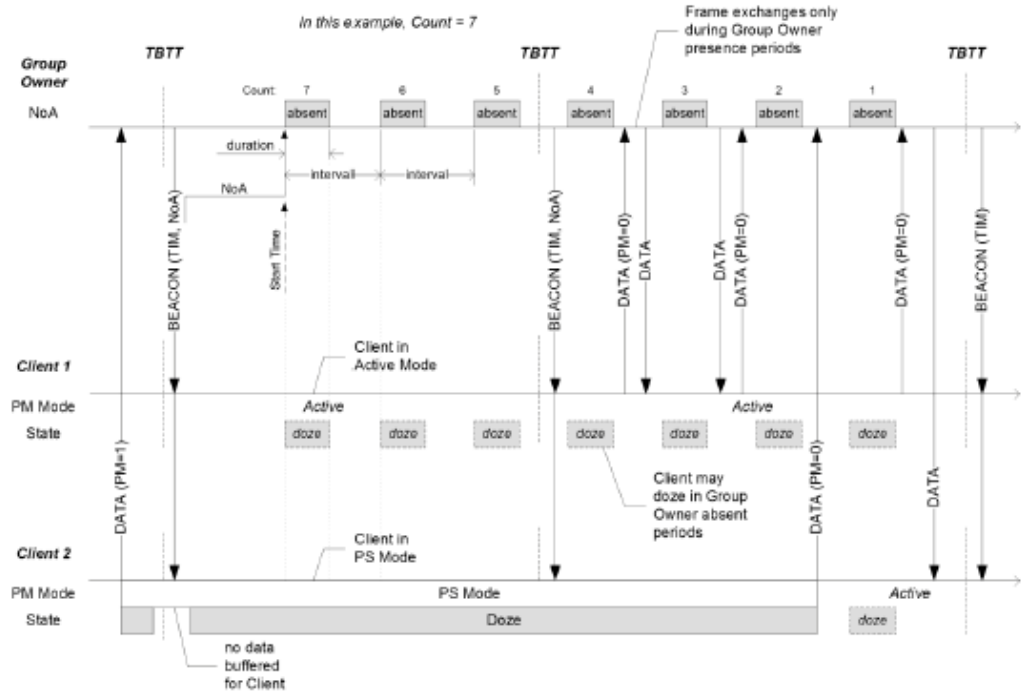


Figure 15—P2P Group Owner Notice of Absence

* * *

Power management for the P2P Group Owner consists of delivery mechanisms based on those defined for PS and WMM-PS, together with two methods that allow the P2P Group Owner to be absent for defined periods. These schemes are termed Opportunistic Power Save and Notice of Absence.

* * *

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.

* * *

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.
Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.3, 3.3.3.2, 3.3.3.3, and Figure 15

92. As set forth above, HP has directly infringed at least claim 1 of the '906 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

93. HP intentionally designed and incorporated the IEEE 802.11/Wi-Fi Direct features and functionalities described above into the Accused Products, and advertises its products as complying with those features and functionalities.

94. HP provides instructions to its customers, encouraging and directing the customers to use the Accused Products in an infringing manner as described above to implement, as HP intends, the IEEE 802.11/Wi-Fi Direct functionality. For example, HP provides user manuals, operating instructions and the like for the Accused Products, including the citations above, as well as at the following:

- https://support.hp.com/id-en/document/c04090221
- https://www8.hp.com/us/en/printers/mobility/wireless-direct-printing.html
- https://www.hpsmart.com/us/en/wireless-printing/wi-fi-direct-and-hp-wireless-direct/
- https://www.hpsmart.com/us/en/wireless-printing/wi-fi-direct-and-hp-wireless-direct/what-is-hp-wireless-direct-and-wi-fi-direct
- https://support.hp.com/us-en/document/ish_1841315-1637332-16
- https://youtu.be/YbLYfMCQ3WM

- https://youtu.be/Icoo7oQvhXs
- https://youtu.be/Camss6YiQcs
- https://youtu.be/aD01m8LxKAM
- https://youtu.be/WI8Kmad4uOM
- https://youtu.be/lGRE2b7K6Zw
- https://youtu.be/YlZHear3T0o
- https://youtu.be/aZNpjGBZiAg

95. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11/Wi-Fi Direct features described above, HP has induced its customers to infringe the '906 patent. HP's customers who use the Accused Products as described above directly infringe the '906 patent. HP has had knowledge, or was willfully blind of the '906 patent since at least as early as November 17, 2020, or alternatively, not later than December 22, 2020, as a result of the following communications from Ozmo to HP. More specifically, on March 23, 2020, Christian Dubuc, Chief Executive Officer of Ozmo Licensing, wrote to Kim Rivera, Chief Legal Officer and General Counsel of HP, regarding the HP Accused Products and Ozmo Licensing's patent portfolio, including Ozmo's position that HP requires a license. Subsequently, on November 10, 2020, Ozmo followed up with HP via email providing more specificity regarding Application No. 16/912262, which would soon issue as the '906 patent, and offering to provide claim charts mapping the claims of such application to the Accused Products. On November 17, 2020, Ozmo provided HP with detailed claim charts illustrating how the Accused Products infringe each element of exemplary claims of Application No. 16/912262. Finally, on December 22, 2020, the date that Application No. 16/912262 issued as the '906 patent, Ozmo informed HP by email of the issuance and its continued belief HP infringed the claims as set forth in the November 17th claim

charts. Therefore, HP has had actual and express knowledge of the '906 patent and Ozmo's infringement allegations since November 17, 2020, or alternatively, at the latest, December 22, 2020, and additionally, by the service upon it of the Original Complaint and this Amended Complaint. HP also induces such infringement by failing to remove the infringing features from the Accused Products.

96. By offering for sale, selling, commercially distributing and importing the Accused Products, HP has also contributed to its customers' infringement of the '906 patent. The Accused Products are used by HP's customers to practice the inventions claimed in the '906 patent. The IEEE 802.11/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the '906 patent. HP knows, or was willfully blind to the fact (by among other things, continuing to engage in infringing conduct despite the numerous communications notifying it of the same described above), that portions of the hardware and software in the Accused Products were specifically made or adapted by HP solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. HP also knows that such combinations of hardware and software have no use other than to provide such functionality as intentionally designed into the Accused Products by HP, since no later than December 22, 2020, via Ozmo's letters, emails and claim charts detailed above that its customers were infringing the '906 patent.

97. By the time of trial, HP will have known and intended that its continued actions would directly infringe, and would induce and contribute to the infringement by its customers of, at least claim 1 of the '906 patent.

98. Ozmo Licensing has been damaged by HP's past and ongoing direct and indirect infringement of the '906 patent.

99. With knowledge of the allegations set forth herein, HP nonetheless refuses to remove the infringing functionalities from the Accused Products or to compensate Ozmo Licensing for the use of such features. HP's infringement described above will continue unabated unless and until HP is ordered to pay a reasonable royalty for a license to the '906 patent.

COUNT III
(HP's Infringement of U.S. Patent No. 8,599,814)

100. Paragraphs 1-99 are reincorporated by reference as if fully set forth herein.

101. The invention of the '814 patent represented a technical solution to an unsolved technological problem. The written description of the '814 patent 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 improved upon what may have been considered conventional or generic. For example, the specification and incorporated references detail the inventors' novel approach to seamlessly integrating WPAN into WLAN infrastructure.

102. The elements claimed by the '814 patent, taken alone or in combination, were not well-understood, routine or conventional to one of ordinary skill in the art at the time of the invention. Rather, the '814 patent claims and teaches, *inter alia*, an improved network-enabled hub to facilitate communications between WLAN and WPAN wireless devices. The invention improved upon existing wireless communications, which were unable to integrate a WPAN into a WLAN infrastructure without suffering from one or more of the aforementioned problems, by allowing the network-enabled hub to initiate and maintain connections with nodes of an external wireless network via a first network connection using a first network protocol and, a second network connection using a second network protocol that is an overlay protocol with respect to the first network protocol, and that is partially consistent with the first network protocol.

103. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more cost effective to design, since the communications using the second network protocol impinge on at least some antennae used for communications using the first network protocol.

104. Compared to the prior art, the claimed wireless apparatus for integrating a WPAN into a WLAN allows the two to operate in the same frequency spectrum without causing excessive interference with each other.

105. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more beneficial as it allows for remote monitoring and controlling of a WPAN device, since the WPAN device may be connected to a Wi-Fi infrastructure, via the network-enabled hub, which may be adapted to established communication via the Internet coupled to the AP. This allows remote monitoring and controlling of a WPAN device such as a home security system, or an implanted or wearable medical device.

106. Compared to the prior art, the claimed wireless infrastructure 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.

107. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN, also enables lower latency communication involving WPAN devices.

108. HP has infringed, and continues to infringe, the ’814 patent by making, importing, using, offering for sale and selling in the United States numerous wireless devices, including laptop computers, desktop computers, printers and monitors. Wi-Fi protocols allow such devices to act as a hub to receive, for example, video images from an IEEE 802.11 access point and to forward such images to a second device using Wi-Fi Direct (together, “Accused Products”).

109. Examples of the Accused Products are HP's Wi-Fi enabled laptop computers (including but not limited to Chromebook, ENVY, Elite, EliteBook, Essential, Mobile Thin Client, OMEN, Pavilion, ProBook, Spectre and ZBook); desktop computers (including but not limited to Chromebox, Collaboration Solutions, ENVY, EliteDesk, EliteOne, Essential, Flexible, OMEN, P-Series, Pavilion, ProDesk, ProOne, Z and Zero); printers (including but not limited to DesignJet, DeskJet, ENVY, LaserJet, Neverstop, OfficeJet, PageWide, ScanJet, Smart Tank and Tango); monitors (including but not limited to HP U27 4K Wireless Monitor, and OMEN X Emperium Gaming Monitor), and all other products that include Wi-Fi Direct functionality.

110. For the avoidance of doubt, all of HP's products made, used, sold and/or offered for sale in, or imported into, the United States during the life of the '814 patent that provide(d) the foregoing functionality during the life of the '814 patent are included within the definition of Accused Products. The examples and evidence provided below are equally applicable to all Accused Products.

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

> 1. 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:
>
> an interface to a wireless radio circuit that can send and receive data wirelessly, providing the hub with bi-directional wireless data communication capability;
>
> logic for processing data received via the wireless radio circuit;
>
> logic for generating data to be transmitted by the wireless radio circuit;
>
> logic for initiating and maintaining wireless network connections with nodes of a wireless network external to the network-enabled hub, 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, 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 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

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.

112. The Accused Products were designed by HP and include, *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, the Accused Products implement Wi-Fi Direct and include Miracast functionality.

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.

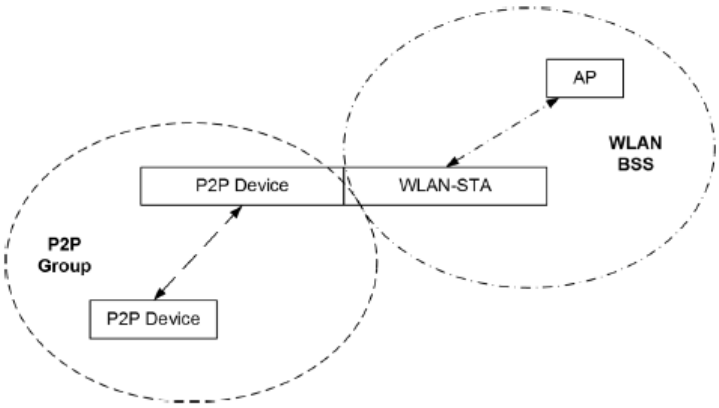


Figure 4—P2P Concurrent device

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3, Fig. 4

113. For example, the Spectre x360 13-ap0046nr notebook is an Accused Product (a network-enabled hub) designed and manufactured by HP which implements the Wi-Fi Direct

standard and includes Miracast functionality (which involves data communications between two or more wireless devices that are configured to communicate indirectly with each other). Miracast is a technology standard, adopted by the Wi-Fi Alliance, that allows a user to project a video image received from a Wi-Fi access point, from one screen (such as from an Accused Product) onto another screen or projector (including, but not limited to, other Accused Products). Miracast, commonly alternatively referred to as "Screen Mirroring" functionality, is built on Wi-Fi Direct connections between devices.

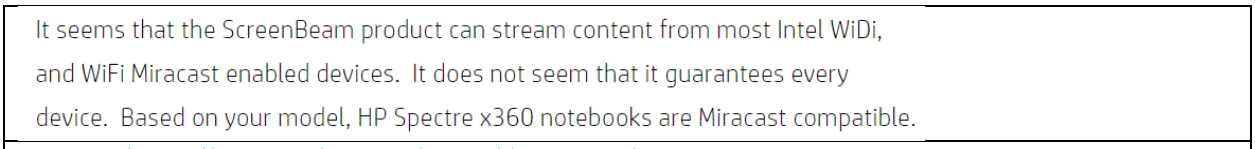
Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

Specification	Wi-Fi Direct
Computer or device can connect to both printer and Internet simultaneously	Android devices and Windows 10 or 8.1 computers

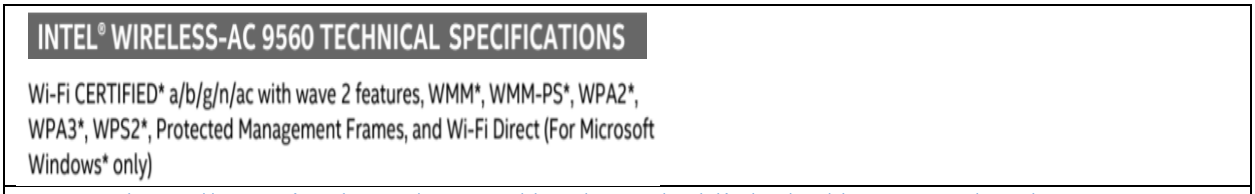
Source: https://support.hp.com/us-en/document/c04577030

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless- projection-receiver-manufacturers

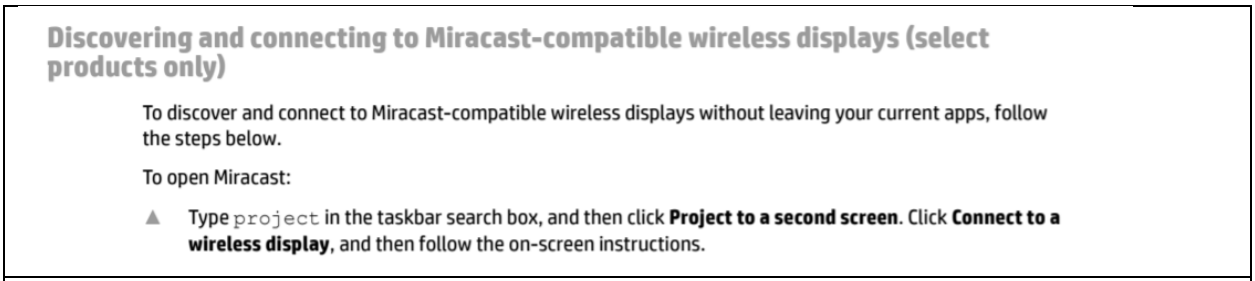

It seems that the ScreenBeam product can stream content from most Intel WiDi, and WiFi Miracast enabled devices. It does not seem that it guarantees every device. Based on your model, HP Spectre x360 notebooks are Miracast compatible.

Source: https://support.hp.com/us-en/document/c05189396


INTEL® WIRELESS-AC 9560 TECHNICAL SPECIFICATIONS

Wi-Fi CERTIFIED* a/b/g/n/ac with wave 2 features, WMM*, WMM-PS*, WPA2*, WPA3*, WPS2*, Protected Management Frames, and Wi-Fi Direct (For Microsoft Windows* only)

Source: https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/dualband-wireless-ac-9560-brief.pdf


Discovering and connecting to Miracast-compatible wireless displays (select products only)

To discover and connect to Miracast-compatible wireless displays without leaving your current apps, follow the steps below.

To open Miracast:

- Type `project` in the taskbar search box, and then click **Project to a second screen**. Click **Connect to a wireless display**, and then follow the on-screen instructions.

Source: http://h10032.www1.hp.com/ctg/Manual/c06672444

114. The Accused Products include 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, the Spectre x360 13-ap0046nr, designed and manufactured by HP, includes the Intel Wireless-AC 9560 1216 LTE SKU wireless radio chip (wireless radio circuit that can send and receive data wirelessly), which includes Wi-Fi and Bluetooth functionality (bi-directional wireless data communications). The Spectre x360 13-ap0046nr can serve as the claimed hub when, for example, a video is streamed from the Internet to the Spectre x360, and Miracast / Wi-Fi Direct are used to mirror the Internet-video to a second device, such as a wireless display.

HP Spectre x360 - 13-ap0046nr

- Windows 10 Home 64

Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 5 combo[10,11]

Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

Intel® Wireless-AC 9560 1216 LTE SKU supports Wi-Fi/Bluetooth® and LTE coexistence that improves wireless performance and user experience while both Intel® Wireless-AC 9560 and an Intel LTE modem are being used in the same platform.

Source: https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/dual-band-wireless-ac-9560-brief.pdf

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.1

Product Name	HP Spectre x360 13 Convertible PC
	Model: 13-ap0xxx, 13t-ap000
Integrated wireless local area network (WLAN) options by way of on-board wireless module	
Two built-in WLAN antennas	
Supports the following WLAN modules:	
Intel 9560 ac 2×2 + Bluetooth 5 M.2 1216 non-vPro PCI-e+USB world-wide with 2 antennas	

Source: http://h10032.www1.hp.com/ctg/Manual/c06155404

115. The Accused Products include a processor with logic. For example, the Spectre x360 13-ap0046nr includes the Intel Core i7-8565U processor.

HP Spectre x360 - 13-ap0046nr

Intel® Core™ i7-8565U (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 8 MB L3 cache, 4 cores)[17,18]

Elevate your every day with the most stunning Spectre yet—featuring the latest Quad-Core 8th Generation Intel® Core™ i7 processor for top-of-the-line efficiency and speed.

Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

116. The Accused Products include logic for processing data received via the wireless radio circuit. For example, the Spectre x360 13-ap0046nr includes the Intel Core i7-8565U processor which receives and processes data from the wireless radio circuit.

CPU Specifications

# of Cores	4
# of Threads	8

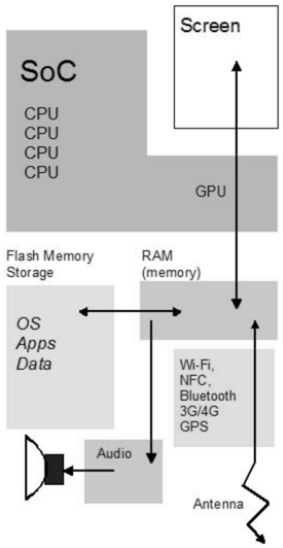
Source: https://ark.intel.com/content/www/us/en/ark/products/149091/intel-core-i7-8565u-processor-8m-cache-up-to-4-60-ghz.html

Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 5 combo[10,11]

Source: https://store.hp.com/us/en/pdp/hp-spectre-x360-13-ap0046nr

Integrated wireless local area network (WLAN) options by way of on-board wireless module
Two built-in WLAN antennas
Supports the following WLAN modules:
Intel 9560 ac 2×2 + Bluetooth 5 M.2 1216 non-vPro PCI-e+USB world-wide with 2 antennas

Source: http://h10032.www1.hp.com/ctg/Manual/c06155404



Source: https://www.pcmag.com/encyclopedia/term/51603/soc

117. The Accused Product includes logic for generating data to be transmitted by the wireless radio circuit. For example, the Spectre x360 13-ap0046nr includes the Intel Core i7-8565U processor which generates data to be transmitted by the wireless radio circuit.

> Data is exchanged between the P2P Group Owner and each connected Client. Both the Group Owner and the Client may employ power savings techniques, so each shall use the appropriate data delivery mechanisms as described in Section 3.3.
>
> The P2P Group Owner may provide a data distribution service between all connected Clients in the P2P Group. A P2P Group Owner that provides such a service shall set the Intra-BSS Distribution bit to 1 in the Group Capability Bitmap field that it sends describing its own capabilities.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.6.1

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.

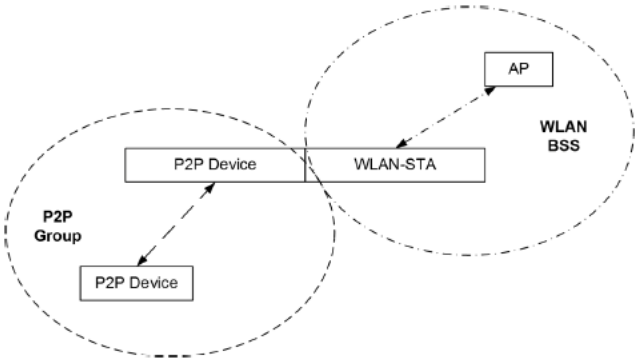


Figure 4—P2P Concurrent device

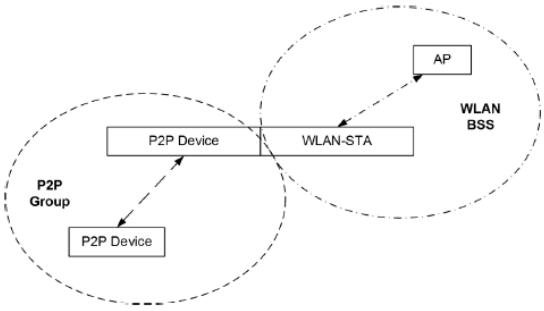
As an example, Figure 4 shows a P2P Concurrent Device that has one MAC entity operating as a WLAN-STA and the second MAC entity operating as a P2P Device. The dual MAC functionality can be provided via two separate physical MAC entities each associated with its own PHY entity, two virtual MAC entities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

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3

118. The Accused Products include logic for initiating and maintaining wireless network connections with nodes of a wireless network external to the network-enabled hub. For example, the Spectre x360 13-ap0046nr (network-enabled hub) may initiate and maintain a Miracast connection (network connection) with other devices, such as peripherals (nodes of the wireless network), while maintaining a Wi-Fi internet (wireless external network) connection.

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.



Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3

Specification	Wi-Fi Direct
Computer or device can connect to both printer and Internet simultaneously	Android devices and Windows 10 or 8.1 computers

Source: https://support.hp.com/us-en/document/c04577030

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

and providing added security. Miracast also allows for devices to remain connected to an existing Wi-Fi network while simultaneously connected to a display directly, ensuring network services are always available for presentations or content viewing.

Source: https://www.screenbeam.com/solutions/miracast/

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

3.2.7 Disconnecting from a P2P Group

A P2P Client shall, when possible, indicate intent to disconnect from a P2P Group by using either:

- the deauthentication procedure in Section 10.3.4.4 of IEEE 802.11-2012 [1] to send a Deauthentication frame to the P2P Group Owner if the P2P Group was established outside DMG, or
- the STA disassociation procedure in Section 10.3.5.6 of IEEE 802.11-2012 [1] to send a Disassociation frame to the P2P Group Owner if operating outside DMG, or the STA disassociation procedure in Section 11.3.5.6 of IEEE 802.11-REVmc [11] to send a Disassociation frame to the P2P Group Owner when operating within DMG.

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.2.2, 3.2.3 & 3.2.7.

119. The Accused Products include 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. For example, the Spectre x360 13-ap0046nr connects to an access point via 802.11x Wi-Fi (first wireless network connection using a first wireless network protocol) and to the Miracast receiver screen (second wireless network connection) using Wi-Fi

Direct (second wireless network protocol) that can be maintained, at times, simultaneously with each other in a common wireless space.

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.

A P2P Group may operate in the same or different operating class and channel as a concurrently operating WLAN BSS. For example, a WLAN BSS may operate in channel 36 in the 5.2 GHz band, while the P2P Group may operate in channel 6 in the 2.4 GHz band or in channel 2 in the 60 GHz band within DMG.

This specification does not preclude a P2P Device operating as a member of more than one P2P Group simultaneously, however, such operation is out of scope and therefore not described.

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

With the **Anniversary update** (Build 14393.0) for Windows 10, which was rolled out globally on Aug 2,2016, Microsoft brought an interesting new feature to the deck. To put it simply, ANY PC can act as a wireless receiver for Miracast. Miracast tech or screen mirroring, lets you view the display of a Windows Phone, another Windows PC, an Android phone or a tablet. I am not sure about iOS, though.

Source: https://thewincentral.com/how-turn-windows-10-pc-miracast/

INTEL® WIRELESS-AC 9560 TECHNICAL SPECIFICATIONS

Wi-Fi CERTIFIED* a/b/g/n/ac with wave 2 features, WMM*, WMM-PS*, WPA2*, WPA3*, WPS2*, Protected Management Frames, and Wi-Fi Direct (For Microsoft Windows* only)

Source: https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/dual-band-wireless-ac-9560-brief.pdf

Figure 2. Wi-Fi Direct Concurrent Mode

Source: https://arxiv.org/ftp/arxiv/papers/1810/1810.06964.pdf

Specification	Wi-Fi Direct
Computer or device can connect to both printer and Internet simultaneously	Android devices and Windows 10 or 8.1 computers

Source: https://support.hp.com/us-en/document/c04577030

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.

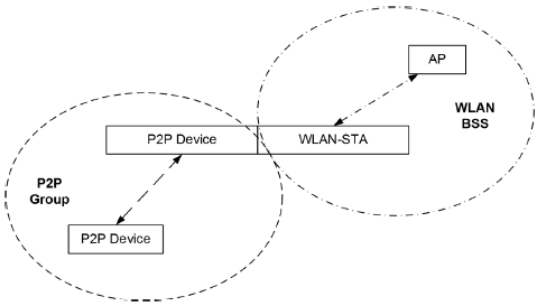


Figure 4—P2P Concurrent device

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.

A P2P Group may operate in the same or different operating class and channel as a concurrently operating WLAN BSS. For example, a WLAN BSS may

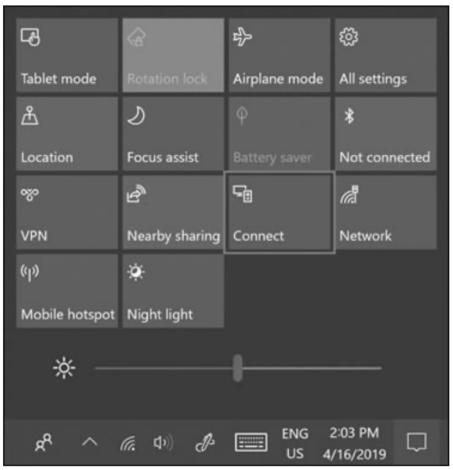
Source: Wi-Fi Direct Standard, v. 1.7, Section 2.3

120. The following instructions for how to set up a Miracast connection on a Spectre x360 13-ap0046nr are from HP's website:

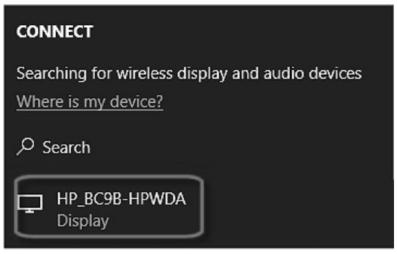
Step 2: Projecting your screen

When you have determined that both your computer and wireless display support Miracast, project your screen.

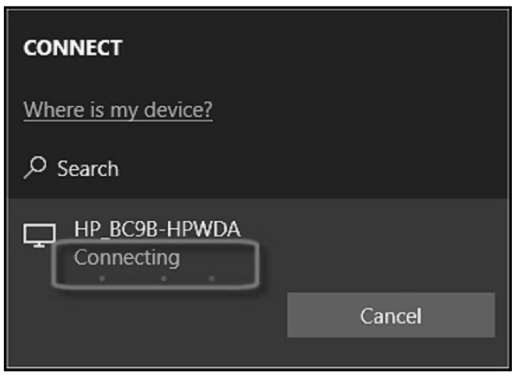
1. Make sure your computer is connected to a network and the display you want to connect to is turned on.
2. In Windows, click the **Action Center** icon on the taskbar, and then click **Connect**.



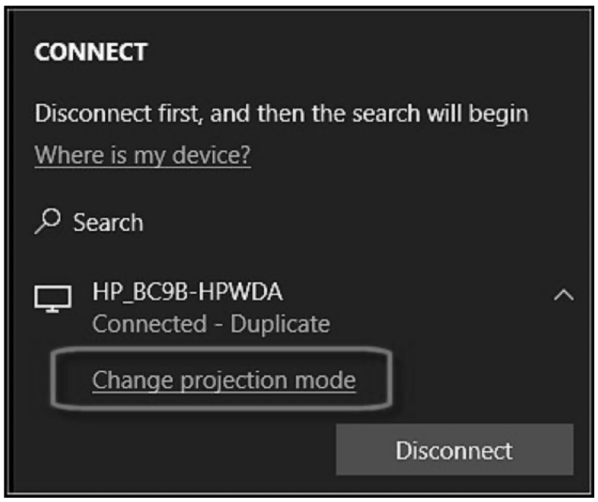
3. Wait while the computer searches for wireless display devices, and then select the wireless display you want from the search results.



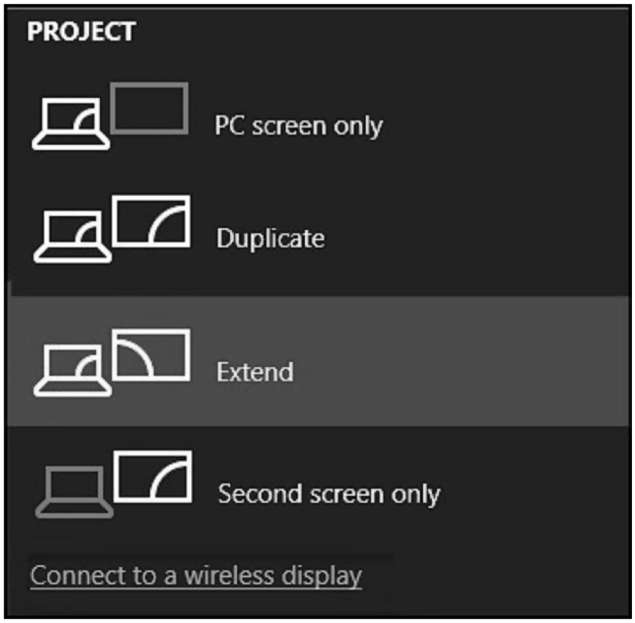
4. Wait while Windows connects the display.



5. When the connection is complete, Windows shows the projection mode. If you want to change this setting, select **Change projection mode**.



6. On the Project screen display, select the projection mode you want.



Source: https://support.hp.com/us-en/document/c05189396

The following modes are available when projecting from a computer to an external display.

- PC screen only
  Everything displays on your main screen, the connected screen remains blank.

  NOTE: When you are connected to a wireless projector, this option changes to Disconnect.
- Duplicate
  The same image displays on both screens. This is also called mirroring.
- Extend
  The image is spread over both screens, and you can drag and move items between both screens.
- Second screen only
  Everything displays on the connected screen. Your main screen is blank.

Source: https://support.hp.com/us-en/document/c05189396

121. In further detail, the Accused Products maintain at least a first wireless network connection using a first wireless network protocol. For example, the Spectre x360 13-ap0046nr since it complies with at least the IEEE 802.11-2012 standard.

10.1.3 Maintaining synchronization

10.1.3.1 General

Each STA shall maintain a TSF timer with modulus 2^{64} counting in increments of microseconds. STAs expect to receive Beacon frames at a nominal rate. The interval between Beacon frames is defined by the dot11BeaconPeriod parameter of the STA. A STA sending a Beacon frame shall set the value of the Beacon frame's timestamp so that it equals the value of the STA's TSF timer at the time that the data symbol containing the first bit of the timestamp is transmitted to the PHY plus the transmitting STA's delays through its local PHY from the MAC-PHY interface to its interface with the WM [e.g., antenna, light-emitting diode (LED) emission surface].

Source: IEEE 802.11-2012, Section 10.1.3.1

10.3.5 Association, reassociation, and disassociation

10.3.5.1 General

Subclause 10.3.5 describes the procedures used for IEEE 802.11 association, reassociation and disassociation.

The states used in this description are defined in 10.3.1.

Successful association enables a STA to exchange Class 3 frames. Successful association sets the STA's state to State 3 or State 4.

Successful reassociation enables a STA to exchange Class 3 frames. Unsuccessful reassociation when not in State 1 leaves the STA's state unchanged (with respect to the AP that was sent the Reassociation Request (which may be the current STA)). Successful reassociation sets the STA's state to State 3 or State 4 (with respect to the AP that was sent the Reassociation Request). Successful reassociation when not in State 1 sets the STA's state to State 2 (with respect to the current AP, if this is not the AP that was sent the Reassociation Request). Reassociation shall be performed only if the originating STA is already associated in the same ESS.

Disassociation notification when not in State 1 sets the STA's state to State 2. The STA shall become associated again prior to sending Class 3 frames. A STA may disassociate a peer STA at any time, for any reason.

Source: IEEE 802.11-2012, Section 10.3.5.1

122. In further detail, the Accused Products maintain a second wireless network connection using a second wireless network protocol. For example, the Spectre x360 13-ap0046nr since it complies with the Wi-Fi Direct Standard.

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.3

123. In further detail, the Accused Products can maintain the first wireless network connection and the second wireless network connection simultaneously with each other in a common wireless space. For example, the Spectre x360 13-ap0046nr can maintain its connection to an access point via 802.11x Wi-Fi (first wireless network connection using a first wireless network protocol) and to the Miracast receiver screen (second wireless network connection) using Wi-Fi Direct (second wireless network protocol), at times, simultaneously with each other in a common wireless space.

About the Wi-Fi Direct feature

05/31/2018 • 2 minutes to read •

In this article

Related topics

The Native Wifi API contains a set of functions that support the use of Wi-Fi Direct for desktop apps. Starting on Windows 8 and Windows Server 2012, Wi-Fi Direct functions were added to the Native Wifi API.

Source: https://docs.microsoft.com/en-us/windows/win32/nativewifi/about-the-wi-fi-direct-api

All devices certified under the Wi-Fi Direct program allow the user to connect to an infrastructure or a Wi-Fi Direct-certified network. Some devices certified under the Wi-Fi Direct program support connections to both an infrastructure network and Wi-Fi Direct-certified group at the same time (e.g. a laptop may support an infrastructure connection while also belonging to a Wi-Fi Direct-certified group). Simultaneous connection to a Wi-Fi Direct-certified group and an infrastructure network is an optional feature.

Source: https://www.wi-fi.org/knowledge-center/faq/can-a-device-simultaneously-connect-to-a-regular-wi-fi-network-and-a-group-of

Figure 2. Wi-Fi Direct Concurrent Mode

Source: https://arxiv.org/ftp/arxiv/papers/1810/1810.06964.pdf

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

- Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2)[19a] Wi-Fi® and Bluetooth® 5 combo[26]
- MU-MIMO supported

Source: https://www8.hp.com/h20195/v2/GetDocument.aspx?docname=4aa7-8019enuc

Advanced 802.11ac features such as MU-MIMO and TX Beamformee to increase network capacity, as well as maximal likelihood (ML) decoding, low-density parity check (LDPC), maximum ratio combining (MRC) for robust link connection.

Source: https://www.qualcomm.com/media/documents/files/qca6174a-product-brief.pdf

124. In the Accused Products, the second wireless network protocol is an overlay protocol with respect to the first wireless network protocol. For example, Wi-Fi Direct frames (802.11 management frames with a P2P IE) are based on 802.11x frames, with some P2P attributes added in the vendor specific field of an 802.11 management frame. For example, the Wi-Fi Direct protocol includes adaptations to the standard power management mechanisms of the 802.11x protocol, in the form of a Notice of Absence field and CTWindow field to implement the Wi-Fi Direct Notice of Absence and Opportunistic Power Save procedures. Network-enabled hub nodes following the Wi-Fi Direct protocol can interoperate with regular 802.11 STAs, while supporting Wi-Fi Direct Notice of Absence and Opportunistic Power Save procedures using the data in the vendor specific field of an 802.11 management frame, meaning the Wi-Fi Direct protocol can be considered an "overlay protocol."

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 Std 802.11-2012 [1] with the WFA OUI and an OUI Type indicating P2P. A number of P2P attributes are defined; a single P2P IE carries one or more P2P attributes.
Source: Wi-Fi Direct Standard, v. 1.7, Section 4

8.3.3 Management frames

8.3.3.1 Format of management frames

The format of a management frame is defined in Figure 8-34. The Frame Control, Duration, Address 1, Address 2, Address 3, and Sequence Control fields are present in all management frame subtypes. The maximum unencrypted MMPDU size, excluding the MAC header and FCS, is 2304 octets.

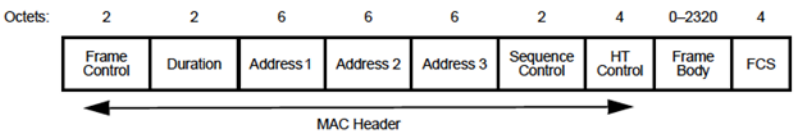


Figure 8-34—Management frame format

The HT Control field is defined in 8.2.4.6. The presence of the HT Control field is determined by the Order subfield of the Frame Control field, as specified in 8.2.4.1.10.

The frame body consists of the fields followed by the elements defined for each management frame subtype. All fields and elements are mandatory unless stated otherwise and appear in the specified, relative order. STAs that encounter an element ID they do not recognize in the frame body of a received management frame ignore that element and continue to parse the remainder of the management frame body (if any) for additional elements with recognizable element IDs. See 9.24.7. Unused element ID codes are reserved.

Gaps may exist in the ordering of fields and elements within frames. The order that remains is ascending.

8.3.3.2 Beacon frame format

The frame body of a management frame of subtype Beacon contains the information shown in Table 8-20.

Table 8-20—Beacon frame body

Source: IEEE 802.11-2012, Section 8.3.3.1

8.4 Management frame body components

8.4.1 Fields that are not information elements

8.4.2 Information elements

8.4.2.1 General

Elements are defined to have a common general format consisting of a 1 octet Element ID field, a 1 octet Length field, and a variable-length element-specific Information field. Each element is assigned a unique Element ID as defined in this standard. The Length field specifies the number of octets in the Information field. See Figure 8-81.

	Element ID	Length	Information
Octets:	1	1	variable

Figure 8-81—Element format

The set of valid elements is defined in Table 8-54.

Table 8-54—Element IDs

Element	Element ID	Length of indicated element (in octets)	Extensible
SSID (see 8.4.2.2)	0	2 to 34	
Supported rates (see 8.4.2.3)	1	3 to 10	

Table 8-54—Element IDs *(continued)*

Element	Element ID	Length of indicated element (in octets)	Extensible
U-APSD Coexistence (see 8.4.2.93)	142	14 to 257	Subelements
Reserved	143–173		
MCCAOP Advertisement Overview (see 8.4.2.110)	174	8	Yes
Reserved	175–220		
Vendor Specific (see 8.4.2.28)	221	3 to 257	
Reserved	222–255		

Source: IEEE 802.11-2012, Section 8.4

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.

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.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.1.14

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.2.10.2

3.3 P2P Power Management

3.3.1 Introduction

P2P power management supports power save mechanisms for P2P Group Owners and P2P Clients. The approach 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

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.

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.

CTWindow is also used for P2P Group Owner Opportunistic Power Save as described in Section 3.3.3.1. It should be noted that it may take a number of DTIM intervals to successfully communicate new, updated or cancelled CTWindow timing to all P2P Clients in a P2P Group.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Sections as identified above.

125. The Wi-Fi Direct protocol (second wireless network protocol) is an overlay protocol with respect to 802.11x (first wireless network protocol), in that Wi-Fi Direct uses 802.11x management frames with new arrangements in the 802.11 vendor specific information field for *inter alia*, Wi-Fi Direct power saving mechanisms, as seen from the Wi-Fi Direct Specification.

P2P PS	IEEE802.11 Power Save adapted for P2P operation
P2P WMM-PS	WMM-PS adapted for P2P operation

Source: Wi-Fi Direct Standard, v. 1.7, Section 1.7

126. In the Accused Products, communications using the second wireless network protocol are partially consistent with the first wireless network protocol. For example, Wi-Fi Direct is only partially consistent with 802.11 Wi-Fi. For example, Wi-Fi Direct (second network protocol) calls for modifications to the 802.11x responses (first network protocol) to Probe Request frames.

A P2P Group Owner shall respond to Probe Request frames following the rules in IEEE Std 802.11-2012 [1], with the following modifications:

- The P2P Wildcard SSID shall be treated the same as the Wildcard SSID for the purposes of deciding to transmit a response (i.e. in IEEE Std 802.11-2012 [1], Clause Section 11.1.3.2.1, change "The SSID in the probe request is the wildcard SSID or the specific SSID of the STA" to "The SSID in the probe request is the wildcard SSID, the P2P wildcard SSID, or the specific SSID of the STA,")
- When a P2P Group Owner responds to a Probe Request frame containing the P2P IE it shall include the P2P Group Info attribute in the P2P IE in the Probe Response frame. The P2P IE shall include the P2P Group Info attribute unless there are zero connected P2P Clients. A P2P Group Owner shall not include a P2P IE in the Probe Response frame if the received Probe Request frame does not contain a P2P IE.
- If one or more Requested Device Type attributes are present in the Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if it has one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values, or if it has a connected P2P Client with one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values. The P2P Group Owner may filter the P2P Group Information returned in the Probe Response frame to include only devices with matching Primary or Secondary Device Type values.
- If a Device ID attribute is present in the P2P IE in a Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if its Device Address, or the Device Address of a connected P2P Client matches that in the Device Address field in the Device ID attribute.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

127. In the Accused Products, at least some of the communications using the second wireless network protocol impinge on at least some antennae used for the first wireless network. For example, Wi-Fi Direct (second network protocol) uses the same antennae as 802.11x Wi-Fi

(first network protocol). For example, Spectre x360 13-ap0046nr uses Windows 10 Home 64, which includes the standard Wi-Fi Direct functionality, and the products use the same antennae for communications for both Wi-Fi Direct and 802.11x Wi-Fi.

About the Wi-Fi Direct feature

05/31/2018 • 2 minutes to read •

In this article

Related topics

The Native Wifi API contains a set of functions that support the use of Wi-Fi Direct for desktop apps. Starting on Windows 8 and Windows Server 2012, Wi-Fi Direct functions were added to the Native Wifi API.

Source: https://docs.microsoft.com/en-us/windows/win32/nativewifi/about-the-wi-fi-direct-api

All devices certified under the Wi-Fi Direct program allow the user to connect to an infrastructure or a Wi-Fi Direct-certified network. Some devices certified under the Wi-Fi Direct program support connections to both an infrastructure network and Wi-Fi Direct-certified group at the same time (e.g. a laptop may support an infrastructure connection while also belonging to a Wi-Fi Direct-certified group). Simultaneous connection to a Wi-Fi Direct-certified group and an infrastructure network is an optional feature.

Source: https://www.wi-fi.org/knowledge-center/faq/can-a-device-simultaneously-connect-to-a-regular-wi-fi-network-and-a-group-of

Figure 2. Wi-Fi Direct Concurrent Mode

Source: https://arxiv.org/ftp/arxiv/papers/1810/1810.06964.pdf

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

- Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2)[19a] Wi-Fi® and Bluetooth® 5 combo[26]
- MU-MIMO supported

Source: https://www8.hp.com/h20195/v2/GetDocument.aspx?docname=4aa7-8019enuc

Advanced 802.11ac features such as MU-MIMO and TX Beamformee to increase network capacity, as well as maximal likelihood (ML) decoding, low-density parity check (LDPC), maximum ratio combining (MRC) for robust link connection.

Source: https://www.qualcomm.com/media/documents/files/qca6174a-product-brief.pdf

128. The Accused Products include 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. For example, the Spectre x360 13-ap0046nr (a network-enabled hub) uses Windows 10 Home 64, which includes the standard Miracast (also known as "screen mirroring") (data forwarding logic) functionality, with data from the Wi-Fi access point (originating node in the first (802.11x) network) being forwarded to the destination screen (destination node in the second (Wi-Fi Direct) network).

Figure 2. Wi-Fi Direct Concurrent Mode

Source: https://arxiv.org/ftp/arxiv/papers/1810/1810.06964.pdf

Wireless connectivity

- Intel® Wireless-AC 9560 802.11 b/g/n/ac (2x2)[19a] Wi-Fi® and Bluetooth® 5 combo[26]
- MU-MIMO supported

Source: https://www8.hp.com/h20195/v2/GetDocument.aspx?docname=4aa7-8019enuc

To mirror the information from your Windows 10 desktop or laptop, do the following:

1. Click on **Settings** from the **Start Menu**
2. Open the application
3. Choose **System**, then **Display Settings**
4. Scroll down to **Multiple Displays**
5. Click **Connect to a wireless display**
6. Wait for your device to appear
7. Click to connect
8. Follow any prompts to complete the connection, including passwords, PINS, or conformation codes between devices

Source: https://store.hp.com/us/en/tech-takes/what-is-screen-mirroring

What is the difference between screen mirroring and casting?

You may hear these terms used interchangeably, but they're not exactly the same. While mirroring shows the audio and video you are sharing on both screens at the same time, casting shifts the display functionality from one device to another, so you only see it on one screen at a time.

Can you screen mirror without WiFi?

Most of the mirroring tech used today needs a wireless network to send the information. Does that mean that you can't do it without WiFi? While it's not impossible, using WiFi is preferred. Some mirroring and casting devices on the market can use

Source: https://store.hp.com/us/en/tech-takes/what-is-screen-mirroring

With ***Miracast on Windows 10,*** you can conveniently mirror the content from your computer to any other display, be it a TV, a projector or a set-top box. The best part of the Miracast is that it does not need your home network to work since it creates its own network.

Source: https://www.technorms.com/68339/miracast-windows-10

Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point

Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

129. As set forth above, HP 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.

130. HP intentionally designed and incorporated the IEEE 802.11/Wi-Fi Direct features and functionalities described above into the Accused Products, and advertises its products as complying with those features and functionalities.

131. HP provides instructions to its customers, encouraging and directing the customers to use the Accused Products in an infringing manner as described above to implement, as HP intends, the IEEE 802.11/Wi-Fi Direct functionality, such as seen above at Paragraph 120. For further example, HP provides user manuals, operating instructions and the like for the Accused Products, including the citations above, as well as at the following:

- https://support.hp.com/us-en/document/c04228016
- https://store.hp.com/us/en/tech-takes/what-is-screen-mirroring
- https://www.hp.com/us-en/shop/tech-takes/what-is-screen-mirroring
- https://support.hp.com/us-en/document/c05189396
- https://support.hp.com/us-en/document/c06299203

132. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11/Wi-Fi Direct features described above, HP has induced its customers to infringe the '814 patent. HP's customers who use the Accused Products as described above directly infringe the '814 patent. HP has had knowledge or was willfully blind of the '814 patent since at least as early as November 17, 2020, as a result of the following communications from Ozmo to HP. More specifically, on March 23, 2020, Christian Dubuc, Chief Executive Officer of Ozmo Licensing, wrote to Kim Rivera, Chief Legal Officer and General Counsel of HP, regarding the HP Accused Products and Ozmo Licensing's patent portfolio, including Ozmo's position that HP requires a license. Subsequently, on November 10, 2020, Ozmo followed up with HP via email providing more specificity regarding Ozmo's patent portfolio and offering to provide claim charts. On

November 17, 2020, Ozmo provided HP with detailed claim charts illustrating how the Accused Products infringe each element of exemplary claims of certain patents from Ozmo's patent portfolio, including claim charts with respect to the '991 patent, the child of the '814 patent. Additionally, on July 29, 2021 Mr. Dubuc sent HP a letter, including its contention that HP infringes the '814 patent and a list of infringing accused products. Therefore, HP has been on notice of Ozmo's infringement theories since at the latest July 29, 2021. HP also induces such infringement by failing to remove the infringing features from the Accused Products.

133. By offering for sale, selling, commercially distributing and importing the Accused Products, HP has also contributed to its customers' infringement of the '814 patent. The Accused Products are used by HP's customers to practice the inventions claimed in the '814 patent. The IEEE 802.11/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the '814 patent. HP knows or was willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by HP solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. HP also knows or was 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 HP. HP has had knowledge since at least as early as November 17, 2020—described above—that its customers were infringing the '814 patent.

134. By the time of trial, HP will have known and intended that its continued actions would directly infringe, and would induce and contribute to the infringement by its customers of, at least claim 1 of the '814 patent.

135. Ozmo Licensing has been damaged by HP's past and ongoing direct and indirect infringement of the '814 patent.

136. With knowledge of the allegations set forth herein, HP continues to incorporate the infringing functionalities in the Accused Products, and has failed to compensate Ozmo Licensing for the use of such features. HP's unlawful activities described above have continued despite HP's receipt of the numerous correspondence described above, including exemplary element-by-element claim charts no later than November 17, 2020. HP's infringement will continue unabated unless and until HP is ordered to pay a reasonable royalty for a license to the '814 patent.

COUNT IV
(HP's Infringement of U.S. Patent No. 11,012,934)

137. Paragraphs 1-136 are reincorporated by reference as if fully set forth herein.

138. The invention of the '934 patent represented a technical solution to an unsolved technological problem. The written description of the '934 patent 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 improved upon what may have been considered conventional or generic. For example, the specification and incorporated references detail the inventors' novel approach to seamlessly integrating WPAN into WLAN wherein the WPAN protocol is an overlay protocol that is only partially consistent with the WLAN protocol, and wherein a wireless device can establish and maintain association and synchronization with a WPAN.

139. The elements claimed by the '934 patent, taken alone or in combination, were not well-understood, routine or conventional to one of ordinary skill in the art at the time of the invention. Rather, the '934 patent claims and teaches, *inter alia*, an improved way to associate and synchronize a wireless device with a WPAN, wherein a wireless device participates in a

coordination of usage of the wireless medium using the WPAN protocol, which WPAN protocol is partially compliant with a WLAN protocol, and includes frames adapted to support WPAN power-savings. A wireless circuit of the device operates in either the 2.4 or 5 GHz frequency band, and can also communicate using a WLAN protocol that is an 802.11x protocol using 802.11x frames. The WPAN protocol uses a WPAN-adapted frame in which at least one field of an 802.11x frame is adapted to support a WPAN power-saving protocol, and the WPAN-adapted frame is adapted from a WLAN protocol management frame. The WPAN protocol provides for an inactivity time, during which the wireless device agrees with a second wireless device to at least partially disable a wireless connection between them during an agreed upon inactivity time, in accordance with the WPAN protocol. The WPAN protocol provides for the wireless devices to disable at least part of the coordination following the start of inactivity time.

140. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more cost effective to design, since the communications using the second network protocol impinge on at least some antennae used for communications using the first network protocol.

141. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN extends the communication range of power-sensitive battery-operated devices and allows power-sensitive battery-operated devices to become part of the larger WLAN infrastructure, thus enabling monitoring and control from any location that is within the range covered by the WLAN.

142. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more beneficial as it allows for remote monitoring and controlling of a WPAN device, since the WPAN device may be connected to a Wi-Fi infrastructure, via the

network-enabled hub, which may be adapted to established communication via the Internet coupled to the AP. This implementation may permit a user to poll information from a specific WPAN device while away from the infrastructure network in which the WPAN device is integrated. This allows remote monitoring and controlling of a WPAN device such as a home security system, or an implanted or wearable medical device.

143. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more energy efficient, thereby extending the battery life of the devices.

144. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN is also more seamless, insofar as it facilitates association and synchronization across multiple devices, without the need to repeatedly engage in the time- and power-consuming processes of re-associating and re-resynchronizing the devices.

145. Compared to the prior art, the claimed wireless infrastructure for integrating a WPAN into a WLAN, also enables lower latency communication involving WPAN devices.

146. HP has infringed, and continues to infringe, the ’934 patent by making, importing, using, offering for sale and selling in the United States numerous wireless devices, including laptop computers, desktop computers, printers and monitors that include Wi-Fi Direct functionality (together, “Accused Products”). The same Accused Products that infringe the ’991 and ’906 patents infringe the ’934 patent, and vice versa.

147. Examples of the Accused Products are HP’s Wi-Fi enabled laptop computers (including but not limited to Chromebook, ENVY, Elite, EliteBook, Essential, Mobile Thin Client, OMEN, Pavilion, ProBook, Spectre and ZBook); desktop computers (including but not limited to Chromebox, Collaboration Solutions, ENVY, EliteDesk, EliteOne, Essential, Flexible, OMEN, P-

Series, Pavilion, ProDesk, ProOne, Z and Zero); printers (including but not limited to DesignJet, DeskJet, ENVY, LaserJet, Neverstop, OfficeJet, PageWide, ScanJet, Smart Tank and Tango); monitors (including but not limited to HP U27 4K Wireless Monitor, and OMEN X Emperium Gaming Monitor), and all other products that include Wi-Fi Direct functionality. These products use Wi-Fi Direct in substantially the same way.

148. For the avoidance of doubt, all of HP's products made, used, sold and/or offered for sale in, or imported into, the United States during the life of the '934 patent that provide(d) the foregoing functionality during the life of the '934 patent are included within the definition of Accused Products. The examples and evidence provided below are equally applicable to all Accused Products.

149. Claim 1 of the '934 patent is reproduced below:

> 1. A first wireless device for coordinating a wireless personal area network (WPAN), comprising:
>
> a wireless radio circuit configured to communicate over a wireless medium of a wireless local area network (WLAN) using a WLAN protocol;
>
> a memory; and
>
> at least one processor coupled to the wireless radio circuit and the memory, the at least one processor configured to:
>
> discover, via the wireless radio circuit, a second wireless device using a WPAN protocol;
>
> establish, via the wireless radio circuit, an association and synchronization with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon establishment of the association, the first and second wireless devices are each a member of the WPAN;
>
> maintain, via the wireless radio circuit, the association and the synchronization with the second wireless device over the wireless connection using the WPAN protocol; and

participate in a coordination of usage of the wireless medium by the wireless connection using the WPAN protocol;

wherein the WPAN protocol is an overlay protocol that is partially compliant with respect to the WLAN protocol such that said usage occurs without interference from the WLAN, and 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;

wherein the wireless radio circuit is configured to operate in at least one of a 2.4 Ghz or 5 GHz frequency band;

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;

wherein the WPAN-adapted frame is adapted from a WLAN protocol management frame;

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;

wherein the WPAN protocol provides for the first wireless device and the second wireless device to agree on the inactivity time; and,

wherein the WPAN protocol provides for the first wireless device to disable at least a part of said coordination following a start of the inactivity time.

150. The Accused Products are first wireless devices for coordinating a wireless personal area network (WPAN). For example, the Accused Products implement the Wi-Fi Direct protocol to coordinate a WPAN.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.1

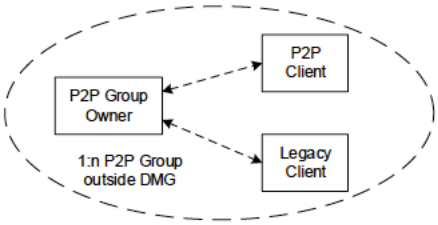


Figure 1—P2P components and topology when operating outside DMG

Source: Wi-Fi Direct Standard, v. 1.7, Figure 1

151. For example, the HP OfficeJet 200 Mobile Printer (a first wireless device), designed and manufactured by HP, can coordinate a Wi-Fi Direct (WPAN) comprising another device, PC or laptop (including, but not limited to, other Accused Products) (a second wireless device). The first wireless device is also capable of communications via an 802.11x WLAN protocol.

HP OfficeJet 200 Mobile Printer

Product # CZ993A#B1H

Source: https://www.hp.com/us-en/shop/pdp/hp-officejet-200-mobile-printer

Processor speed	525 MHz
Connectivity	**Standard:** 1 USB 2.0; Wi-Fi;
Wireless	Yes, via built-in wireless
Mobile printing capability	HP ePrint; Wireless Direct Printing
Network capabilities	Yes, via built-in wireless
Memory	**Standard:** 128 MB DDR3; **Maximum:** 128 MB

Source: https://www8.hp.com/h20195/V2/GetPDF.aspx/4aa6-4371eee

No network, no problem!

Even if you do not have a router or network to connect to, you can print directly from your mobile devices to many HP printers using secure Wi-Fi Direct, HP Wireless Direct, or NFC Touch to print.

Source: https://www8.hp.com/us/en/printers/mobility/wireless-directprinting.html?m802=1&tab=1

Wi-Fi CERTIFIED™ Interoperability Certificate

This certificate lists the features that have successfully completed Wi-Fi Alliance interoperability testing.
Learn more: www.wi-fi.org/certification/programs

CERTIFIED

Certification ID: WFA62138

Product Info

Date of Certification	March 2, 2016
Company	HP Inc.
Product Name	HP Officejet 200 Mobile Printer Series
Product Model Variant	2016-03-02 (WFA62138 - 3387299)
Model Number	200, 200C, 202, 202C
Category	Computers & Accessories
Sub-category	Printer/Multi-Function Printer/Print Server

Summary of Certifications

CLASSIFICATION	CERTIFICATION
Access	Wi-Fi Protected Setup™
Applications & Services	Wi-Fi Direct®
Connectivity	2.4 GHz Spectrum Capabilities Wi-Fi CERTIFIED™ b Wi-Fi CERTIFIED™ g Wi-Fi CERTIFIED™ n
Optimization	WMM®
Security	WPA2™-Personal WPA™-Personal

Source: https://api.cert.wi-fi.org/api/certificate/download/public?variantId=11405

152. The Accused Products are first wireless devices comprising a wireless radio circuit configured to communicate over a wireless medium of a wireless local area network (WLAN) using a WLAN protocol. For example, the OfficeJet 200 Mobile Printer (first wireless device) includes the SDGOB-1391 Radio Module (wireless radio circuit configured to communicate over a physical medium), which includes a wireless radio circuit with 802.11x capabilities (802.11x WLAN protocol), as seen below.

Product Name and Model:	HP OfficeJet 200 Mobile Printer HP OfficeJet 202 Mobile Printer HP OfficeJet 200C Mobile Printer HP OfficeJet 202C Mobile Printer
Regulatory Model Number: [1]	SDGOB-1601-01
Product Options:	All
Radio Module Number:	SDGOB-1391
Power Supply:	F0V63-60012 (World Wide) / F0V63-60013 (China and India Only)

Source: http://www.microline.hr/UploadedFilesmicpg/hp-oj-202-mobile__DoC%20OJ%20200_202_200c_202c.pdf

802.11 b/g/n WLAN Module
RMN: SDGOB-1391

WLAN module Overview

HPPN:	1150-7968 Right Angle Connector 1150-7967 Bottom Straight Connector 0960-3293Bottom Socket Connector 0960-3295 Bottom Straight Connector w/ Ext Ant2 option
Vendor:	Broadcom
CM:	Foxconn
Radio FW:	Thick MAC
WLAN tech:	1x1 802.11n 2.4 GHz
Chipset:	BCM943143EDU 56-QFN 7x7 2L

Module Features

Connectivity

- 802.11 b/g/n 2.4 GHz ISM radio
- USB 2.0 Interface.
- External Antenna- Yageo 0960-3467 (Ext RF connector option)
- Module (pin7) On/n_Off power control input.
- Module (pin8) Wake On Wireless (Optional FW support)

Source: https://fccid.io/ANATEL/01127-14-01130/Manual-atualizado-SDGOB-1391/715D885C-5EAA-4C70-AC5A-BCE9B0ECCD9A/PDF

Data sheet | HP OfficeJet 200 Mobile Printer

Technical specifications

Connectivity	**Standard:** 1 USB 2.0; Wi-Fi;
Wireless	Yes, via built-in wireless
Mobile printing capability	HP ePrint; Wireless Direct Printing
Network capabilities	Yes, via built-in wireless

Source: https://www8.hp.com/h20195/V2/GetPDF.aspx/4aa6-4371eee

153. The Accused Products are first wireless devices comprising a memory. For example, the OfficeJet 200 Mobile Printer includes the SDGOB-1391 Radio Module, which includes memory, as seen below.

Data sheet | HP OfficeJet 200 Mobile Printer

Technical specifications

Processor speed	525 MHz
Connectivity	**Standard:** 1 USB 2.0; Wi-Fi;
Wireless	Yes, via built-in wireless
Mobile printing capability	HP ePrint; Wireless Direct Printing
Network capabilities	Yes, via built-in wireless
Memory	**Standard:** 128 MB DDR3; **Maximum:** 128 MB

Source: https://www8.hp.com/h20195/V2/GetPDF.aspx/4aa6-4371eee

154. The Accused Products are first wireless devices comprising at least one processor coupled to the wireless radio circuit and the memory. For example, the OfficeJet 200 Mobile

includes the SDGOB-1391 Radio Module, which includes memory and at least one processor coupled to the wireless radio circuit and the memory, as seen below.

Data sheet | HP OfficeJet 200 Mobile Printer

Technical specifications

Processor speed	525 MHz
Connectivity	**Standard:** 1 USB 2.0; Wi-Fi;
Wireless	Yes, via built-in wireless
Mobile printing capability	HP ePrint; Wireless Direct Printing
Network capabilities	Yes, via built-in wireless
Memory	**Standard:** 128 MB DDR3; **Maximum:** 128 MB

Source: https://www8.hp.com/h20195/V2/GetPDF.aspx/4aa6-4371eee

155. The Accused Products are first wireless devices comprising at least one processor configured to discover, via the wireless radio circuit, a second wireless device using a WPAN protocol. For example, the OfficeJet 200 Mobile Printer (a first wireless devices) includes the SDGOB-1391 Radio Module (a wireless radio circuit with a processor) configured to discover a second wireless device, such as a PC or laptop (including, but not limited to, other Accused Products), using Wi-Fi Direct (a WPAN protocol).

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.

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 (3.1.2.1)

3.1.2.4 Device Discovery procedures for a P2P Group Owner

A P2P Device that is already operating as a P2P Group Owner stays on the Operating Channel and waits for other devices to discover it. A P2P Group Owner may search on other channels to find desired devices or services.

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 Formation Procedure shall complete prior to entering the Group Formation Procedure with any other P2P Device. A P2P Device that is already in Group (3.1.4.1)

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.1.1, 3.1.2.1, 3.1.2.4, & 3.1.4.1

Certification ID: WFA62138

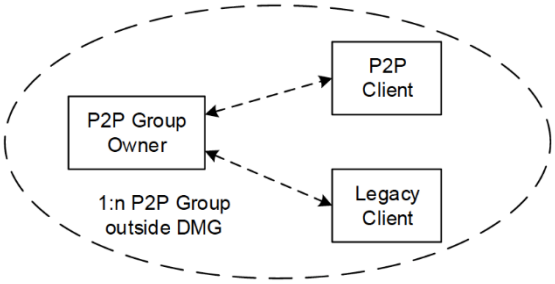
Product Info	
Date of Certification	March 2, 2016
Company	HP Inc.
Product Name	HP Officejet 200 Mobile Printer Series
Product Model Variant	2016-03-02 (WFA62138 - 3387299)
Model Number	200, 200C, 202, 202C
Category	Computers & Accessories
Sub-category	Printer/Multi-Function Printer/Print Server

Summary of Certifications	
CLASSIFICATION	CERTIFICATION
Access	Wi-Fi Protected Setup™
Applications & Services	Wi-Fi Direct®
Connectivity	2.4 GHz Spectrum Capabilities Wi-Fi CERTIFIED™ b Wi-Fi CERTIFIED™ g Wi-Fi CERTIFIED™ n
Optimization	WMM®
Security	WPA2™-Personal WPA™-Personal

Source: https://api.cert.wi-fi.org/api/certificate/download/public?variantId=11405

156. The Accused Products are first wireless devices comprising at least one processor configured to establish, via the wireless radio circuit, an association and synchronization with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon establishment of the association, the first and second wireless devices are each a member of the WPAN. For example, the OfficeJet 200 Mobile Printer (a first wireless devices) includes the SDGOB-1391 Radio Module (a wireless radio circuit with a processor)

configured to establish a Wi-Fi Direct connection (a wireless connection using a WPAN protocol) with such a second wireless device (including, but not limited to, other Accused Products), wherein, upon establishment of the association and synchronization, the printer and other device are members of the Wi-Fi Direct network (the WPAN network).



3.2.3 Connecting to a P2P Group

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

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

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

Source: Wi-Fi Direct Standard, v. 1.7, Figure 1, Sections 3.2.3 & 3.2.2

157. The Accused Products are first wireless devices comprising at least one processor configured to maintain, via the wireless radio circuit, the association and synchronization with the

second wireless device over the wireless connection using the WPAN protocol. For example, the OfficeJet 200 Mobile Printer (a first wireless devices) includes the SDGOB-1391 Radio Module (a wireless radio circuit with a processor) configured to maintain the association and synchronization with the second wireless device, such as a PC or laptop (including, but not limited to, other Accused Products), using Wi-Fi Direct (a WPAN protocol).

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

A P2P Device shall not respond to Probe Request frames unless it is:

- a P2P Group Owner or
- in the Listen State, or
- in the Search State and the P2P Device operates within DMG, or
- a P2P Device associated with an infrastructure AP on the channel on which the Probe Request was sent — in which case the P2P Device may respond provided it is not already a member of a P2P Group, or
- a P2P Client supporting Peer-to-Peer services (P2Ps) [10], having a Service Advertiser with a Service Hash matching the hash value in the incoming Probe Request, as described in 3.4.3.2 (Advertise Service fields in Probe Response) of [10], on the operating channel of the P2P group that the client connected.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.1.2.1

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 within DMG, using the Credentials, shall engage in the association procedure in Section 11.3.5.2 of IEEE 802.11-REVmc [11] with the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.3

Use Wi-Fi Direct

Wi-Fi Direct lets you print wirelessly from a computer or a wireless-capable mobile device without connecting to a wireless network.

- Make sure Wi-Fi Direct for your printer is turned on.
- Up to five computers and mobile devices can use the same Wi-Fi Direct connection.
- Wi-Fi Direct can be used while the printer is also connected either to a computer using a USB cable or to a network using a wireless connection.

Source: http://h10032.www1.hp.com/ctg/Manual/c05040380.pdf at 38

Specification	Wi-Fi Direct
Security	WPA2 password is required
Maximum simultaneous device connections	5
Printer name that displays when printing	DIRECT-xx-HP [your printer model name]
Wireless computer or device can automatically detect and connect to printer	Yes: Automatic or Manual (pushbutton/PIN)
Computer or device can connect to both printer and internet simultaneously	Yes

Source: https://support.hp.com/us-en/document/c04090221

3.2.2 Starting and maintaining a P2P Group session

The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that it shall use as its MAC address and BSSID for the duration of the P2P Group session. The P2P Group Owner shall select an Operating Channel, following any procedures required for operation in a certain frequency band in a particular regulatory domain. On that Operating Channel, the P2P Group Owner shall transmit probe responses in response to probe requests, and shall transmit beacons advertising the TSF (for timing synchronization), required operational parameters, supported capabilities, membership, and services available within the P2P Group.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

158. The Accused Products are first wireless devices comprising at least one processor configured to participate in a coordination of usage of the wireless medium by the wireless connection using the WPAN protocol. For example, the OfficeJet 200 Mobile Printer (a first

wireless devices) includes the SDGOB-1391 Radio Module (a wireless radio circuit with a processor) configured to participate in a coordination of usage of the wireless medium using Wi-Fi Direct (a WPAN protocol).

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]

3.2 P2P Group operation

P2P Group operation outside DMG closely resembles infrastructure BSS operation as defined in IEEE 802.11-2012 [1] with the P2P Group Owner assuming the role of the AP and the P2P Client assuming the role of the STA. The similarities and differences between infrastructure BSS and P2P Group operation outside DMG are described in this section.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 2.4.1 and 3.2

10.1 Synchronization

10.1.2.1 TSF for infrastructure networks

In an infrastructure BSS, the AP shall be the timing master for the TSF. The AP shall initialize its TSF timer independently of any simultaneously started APs in an effort to minimize the synchronization of the TSF timers of multiple APs. The AP shall periodically transmit special frames called *Beacon frames* that contain the value of its TSF timer in order to synchronize the TSF timers of other STAs in a BSS. A receiving STA shall accept the timing information in Beacon frames sent from the AP servicing its BSS. If a STA's TSF timer is different from the timestamp in the received Beacon frame, the receiving STA shall set its local TSF timer to the received timestamp value.

10.1.3 Maintaining synchronization

10.1.3.1 General

Each STA shall maintain a TSF timer with modulus 2^{64} counting in increments of microseconds. STAs expect to receive Beacon frames at a nominal rate. The interval between Beacon frames is defined by the dot11BeaconPeriod parameter of the STA. A STA sending a Beacon frame shall set the value of the Beacon frame's timestamp so that it equals the value of the STA's TSF timer at the time that the data symbol containing the first bit of the timestamp is transmitted to the PHY plus the transmitting STA's delays through its local PHY from the MAC-PHY interface to its interface with the WM [e.g., antenna, light-emitting diode (LED) emission surface].

Source: IEEE 802.11-2012, Sections 10.1.2.1, 10.1.3.1 and 10.3.5.2

159. In the Accused Products, the WPAN protocol is an overlay protocol with respect to the WLAN protocol.

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 Std 802.11-2012 [1] with the WFA OUI and an OUI Type indicating P2P. A number of P2P attributes are defined; a single P2P IE carries one or more P2P attributes.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4

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.

	Category	Organization Identifier	Vendor Specific Content
Octets:	1	*j*	Variable

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.

The Organization Identifier contains a public organizationally unique identifier assigned by the IEEE and is specified in 8.4.1.31. The order of the Organization Identifier field is described in 8.2.2.

The Vendor Specific Content contains vendor-specific field(s). The length of the Vendor Specific Content in a Vendor Specific Action frame is limited by the maximum allowed MMPDU size.

Source: IEEE 802.11-2012, Section 8.5.6

160. In the Accused Products, the WPAN protocol is an overlay protocol, 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.

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.

* * *

3.3 P2P Power Management

3.3.1 Introduction

P2P power management supports power save mechanisms for P2P Group Owners and P2P Clients. The approach 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

* * *

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.

CTWindow is also used for P2P Group Owner Opportunistic Power Save as described in Section 3.3.3.1. It should be noted that it may take a number of DTIM intervals to successfully communicate new, updated or cancelled CTWindow timing to all P2P Clients in a P2P Group.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 4, 3.3, 3.3.1, & 3.3.2

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.

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 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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.1.14

161. In the Accused Products, the WPAN protocol is partially compliant with respect to the WLAN protocol.

A P2P Group Owner shall respond to Probe Request frames following the rules in IEEE 802.11-2012 [1] for operation outside DMG and the rules in IEEE 802.11-REVmc [11] for operation within DMG, with the following modifications:

- The P2P Wildcard SSID shall be treated the same as the Wildcard SSID for the purposes of deciding to transmit a response (i.e. in IEEE 802.11-2012 [1], Clause Section 11.1.3.2.1, change "The SSID in the probe request is the wildcard SSID or the specific SSID of the STA" to "The SSID in the probe request is the wildcard SSID, the P2P wildcard SSID, or the specific SSID of the STA,")
- When a P2P Group Owner responds to a Probe Request frame containing the P2P IE it shall include the P2P Group Info attribute in the P2P IE in the Probe Response frame. The P2P IE shall include the P2P Group Info attribute unless there are zero connected P2P Clients. A P2P Group Owner shall not include a P2P IE in the Probe Response frame if the received Probe Request frame does not contain a P2P IE.
- If one or more Requested Device Type attributes are present in the Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if it has one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values, or if it has a connected P2P Client with one or more Primary or Secondary Device Type values identical to any of the Requested Device Type values. The P2P Group Owner may filter the P2P Group Information returned in the Probe Response frame to include only devices with matching Primary or Secondary Device Type values.
- If a Device ID attribute is present in the P2P IE in a Probe Request frame, a P2P Group Owner shall only respond with a Probe Response frame if its Device Address, or the Device Address of a connected P2P Client matches that in the Device Address field in the Device ID attribute.

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.2.2

162. In the Accused Products, the WPAN protocol is partially compliant with respect to the WLAN protocol, such that usage of the wireless medium by the wireless connection using the WPAN protocol occurs without interference from the WLAN.

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]

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.4.1

9.2 MAC architecture

9.2.1 General

A representation of the MAC architecture is shown in Figure 9-1 in which the PCF and HCF services are provided using the services of the DCF. Note that in a non-QoS STA, HCF is not present. In a QoS STA implementation, both DCF and HCF are present. PCF is optional in all STAs.

Due to the distributed nature of the MBSS, only the MCF is present in a mesh STA.

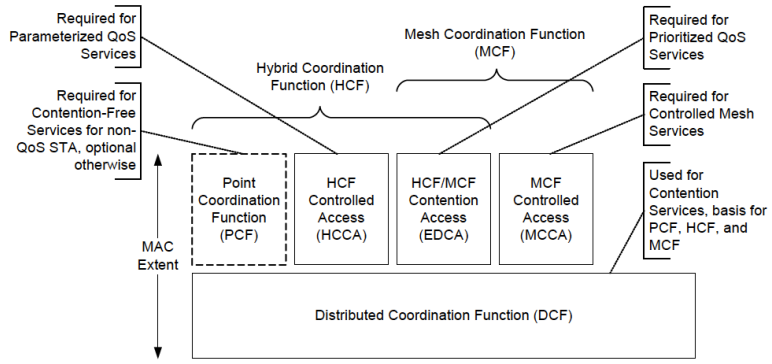


Figure 9-1—MAC architecture

9.2.2 DCF

The fundamental access method of the IEEE 802.11 MAC is a DCF known as *carrier sense multiple access with collision avoidance* (CSMA/CA). The DCF shall be implemented in all STAs.

9.3 DCF

9.3.1 General

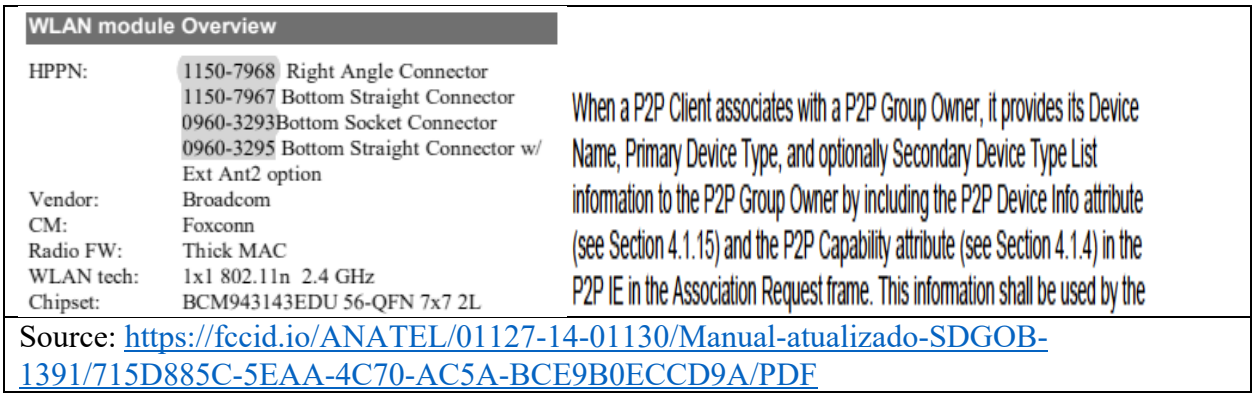
The basic medium access protocol is a DCF that allows for automatic medium sharing between compatible PHYs through the use of CSMA/CA and a random backoff time following a busy medium condition. In addition, all individually addressed traffic uses immediate positive acknowledgment (ACK frame) where retransmission is scheduled by the sender if no ACK is received.

The CSMA/CA protocol is designed to reduce the collision probability between multiple STAs accessing a medium, at the point where collisions would most likely occur. Just after the medium becomes idle following a busy medium (as indicated by the CS function) is when the highest probability of a collision exists. This is because multiple STAs could have been waiting for the medium to become available again. This is the situation that necessitates a random backoff procedure to resolve medium contention conflicts.

Source: IEEE 802.11-2012 Standard, Sections 9.2, 9.2.1, 9.2.2, & 9.3

163. In the Accused Products, the wireless radio circuit is configured to operate in at least one of a 2.4 GHz or 5 GHz frequency band. For example, the OfficeJet 200 Mobile Printer (a first wireless devices) includes the SDGOB-1391 Radio Module (a wireless radio circuit with a processor), including a wireless radio circuit that operates in the 2.4 GHz or 5 GHz frequency bands.

802.11 b/g/n WLAN Module
RMN: SDGOB-1391



WLAN module Overview

HPPN:	1150-7968 Right Angle Connector 1150-7967 Bottom Straight Connector 0960-3293Bottom Socket Connector 0960-3295 Bottom Straight Connector w/ Ext Ant2 option
Vendor:	Broadcom
CM:	Foxconn
Radio FW:	Thick MAC
WLAN tech:	1x1 802.11n 2.4 GHz
Chipset:	BCM943143EDU 56-QFN 7x7 2L

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

Source: https://fccid.io/ANATEL/01127-14-01130/Manual-atualizado-SDGOB-1391/715D885C-5EAA-4C70-AC5A-BCE9B0ECCD9A/PDF

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

Source: Wi-Fi Direct Standard, v. 1.7, Section 1.4

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

Source: Wi-Fi Direct Standard, v. 1.7, Section 3.1.2.1

164. In the Accused Products, 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. For example, in Wi-Fi Direct (the WPAN protocol) the WPAN-adapted frame may utilize the Vendor Specific Information Element (IE) field of an 802.11x protocol frame to specify the organizationally unique identifier (OUI) as the Wi-Fi Alliance OUI and the type indicating P2P (an 802.11x protocol that uses a frame defined by the 802.11x protocol). The modified frame is used to carry information not defined by the IEEE 802.11-2012 Standard so that interoperability is more easily achieved when implementing operations that are not part of the 802.11x standard, such as those required by the power save features defined by the Wi-Fi Direct Standard. P2P IEs used in this manner may, for example, provide a power-saving protocol that allows the P2P Group Owner (the first wireless device) to take on a role similar to

that of an AP in IEEE 802.11-2012 so that it may maintain power management for a P2P Group, but it is modified to additionally allow the P2P Group Owner to be absent for certain periods of time (using a WPAN-adapted frame in which at least one field of the frame defined by the 802.11x protocol, namely the aforementioned vendor-specific information field, is adapted to support the WPAN power-saving protocol). In Wi-Fi Direct, two of the P2P Group Owner's adapted power saving protocol schemes are Notice of Absence and Opportunistic Power Save.

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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4

P2P PS	IEEE802.11 Power Save adapted for P2P operation
P2P WMM-PS	WMM-PS adapted for P2P operation

Source: Wi-Fi Direct Standard, v. 1.7, Section 1.4

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.

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 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.

Source: Wi-Fi Direct Standard, v. 1.7, Section 4.1.14

165. In the Accused Products, the WPAN-adapted frame is adapted from a WLAN protocol management frame; *i.e.*, a WPAN-adapted MAC frame of type management (as defined

by IEEE 802.11-2012 at Section 8.2.4.1). Per IEEE 802.11-2012, management frames are used by stations (STAs) to join and leave a Basic Service Set (BSS); management type frame subtypes include association request and/or response, probe request and/or response, timing advertisement, beacon, authentication and/or deauthentication. By adapting a WLAN protocol management frame to specify the Wi-Fi Alliance OUI and an OUI type indicating P2P, all devices in the P2P Group may communicate according to the Wi-Fi Direct Standard, however with reduced interference with Wi-Fi devices, and potentially at reduced power dissipation.

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.
Source: Wi-Fi Direct Standard, v. 1.7, Section 4

8.4 Management frame body components

8.4.1 Fields that are not information elements

8.4.2 Information elements

8.4.2.1 General

Elements are defined to have a common general format consisting of a 1 octet Element ID field, a 1 octet Length field, and a variable-length element-specific Information field. Each element is assigned a unique Element ID as defined in this standard. The Length field specifies the number of octets in the Information field. See Figure 8-81.

	Element ID	Length	Information
Octets:	1	1	variable

Figure 8-81—Element format

The set of valid elements is defined in Table 8-54.

Table 8-54—Element IDs

Element	Element ID	Length of indicated element (in octets)	Extensible
SSID (see 8.4.2.2)	0	2 to 34	
Supported rates (see 8.4.2.3)	1	3 to 10	

Table 8-54—Element IDs *(continued)*

Element	Element ID	Length of indicated element (in octets)	Extensible
U-APSD Coexistence (see 8.4.2.93)	142	14 to 257	Subelements
Reserved	143–173		
MCCAOP Advertisement Overview (see 8.4.2.110)	174	8	Yes
Reserved	175–220		
Vendor Specific (see 8.4.2.28)	221	3 to 257	
Reserved	222–255		

Source: IEEE 802.11-2012, Section 8.4

166. In the Accused Products, 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. For example, a P2P Group Owner (the first wireless device) utilizing the Notice of Absence procedure shall not send frames within the P2P Group during periods it has indicated it will be absent, and a P2P Client (the second wireless device) that received the Notice of Absence and that does not try modifying any of the periods using P2P Presence procedures, shall not send frames to a P2P Group Owner during the specified absence. During a P2P Group Owner's absence,

the P2P Client shall buffer frames until frame delivery may be attempted in a presence period, such that during the absence, the wireless connection between the P2P Group Owner and the P2P Client is partially disabled (an inactivity time during which the first and second wireless devices can agree to at least partially disable the wireless connection).

3.3.3.2 P2P Group Owner Notice of Absence procedure

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.

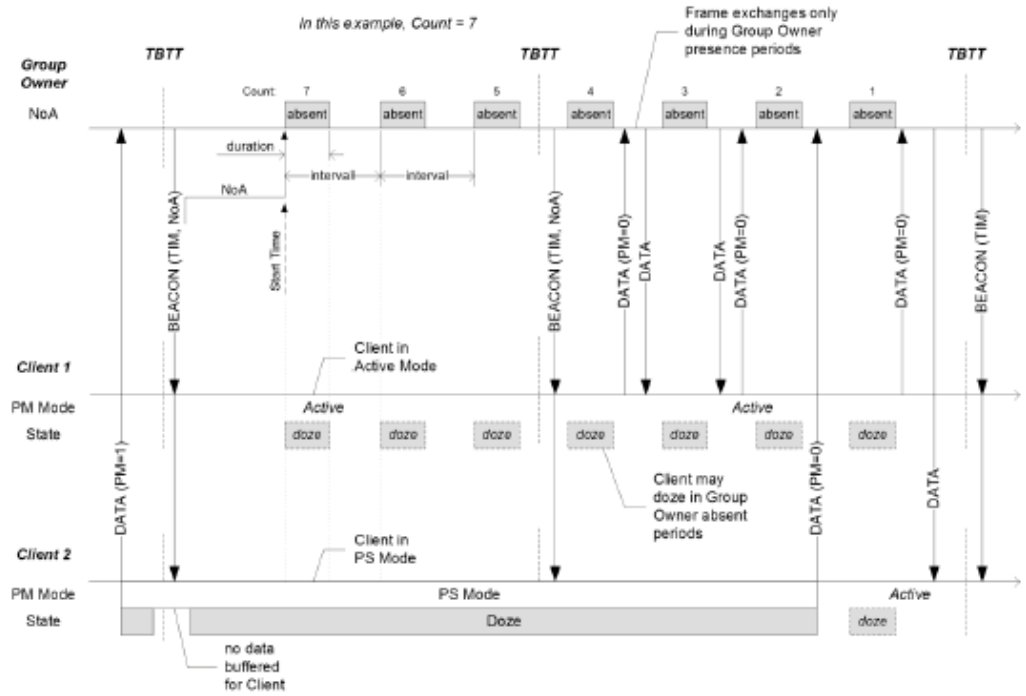


Figure 15—P2P Group Owner Notice of Absence

P2P Clients may submit a P2P Presence Request to the P2P Group Owner to influence P2P Group Owner power management timing. This mechanism may be used whenever the P2P Client has requirements on the interval between and/or duration of P2P Group Owner presence periods, e.g. where the P2P Client has WMM Traffic Stream (TS), or latency sensitive traffic.

On receipt of a P2P Presence Request, the P2P Group Owner shall determine whether to accept the request. If the P2P Group Owner accepts the P2P Presence Request, it shall respond with a P2P Presence Response action frame containing a Status attribute indicating success and a Notice of Absence attribute describing the Notice of Absence timing that it will use in response to the request. The P2P Group Owner may adopt revised Notice of Absence

* * *

If the Status element in the P2P Presence Response indicates failure, or if the Status element indicates success, but the timing indicated in the returned Notice of Absence attribute does not meet the requirements of the P2P Client, the P2P Client may:

- send a new P2P Presence Request with revised timing,
- use the timing indicated in the returned Notice of Absence attribute, or
- disconnect from the P2P Group.

A P2P Client may submit a request for revised P2P Group Owner presence, by submitting a new P2P Presence Request to the P2P Group Owner.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.3.2, 3.3.4.4, and Figure 15

167. In the Accused Products, the WPAN protocol provides for the first wireless device and the second wireless device to agree on the inactivity time as described above and reiterated below.

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.

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.

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.

4.2.10.3 P2P Presence Request frame

The P2P Presence Request action frame uses the P2P Action frame format and may be transmitted by a P2P Client to influence P2P Group Owner power management timing.

The Dialog Token field in a Client P2P action frame shall be set to a non-zero value selected by the P2P Client to identify the P2P Presence Request-Response transaction.

The Elements field in a P2P Presence Request action frame shall contain a P2P IE with a single Notice of Absence attribute describing the requested P2P Group Owner presence timing, see Section 3.3.4.4.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.3.2, 4.1.14, 4.2.10.2, & 4.2.10.3

168. In the Accused Products, the WPAN protocol provides for the first wireless device to disable at least a part of the coordination following a start of the inactivity time.

3.3.3.2 P2P Group Owner Notice of Absence procedure

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.

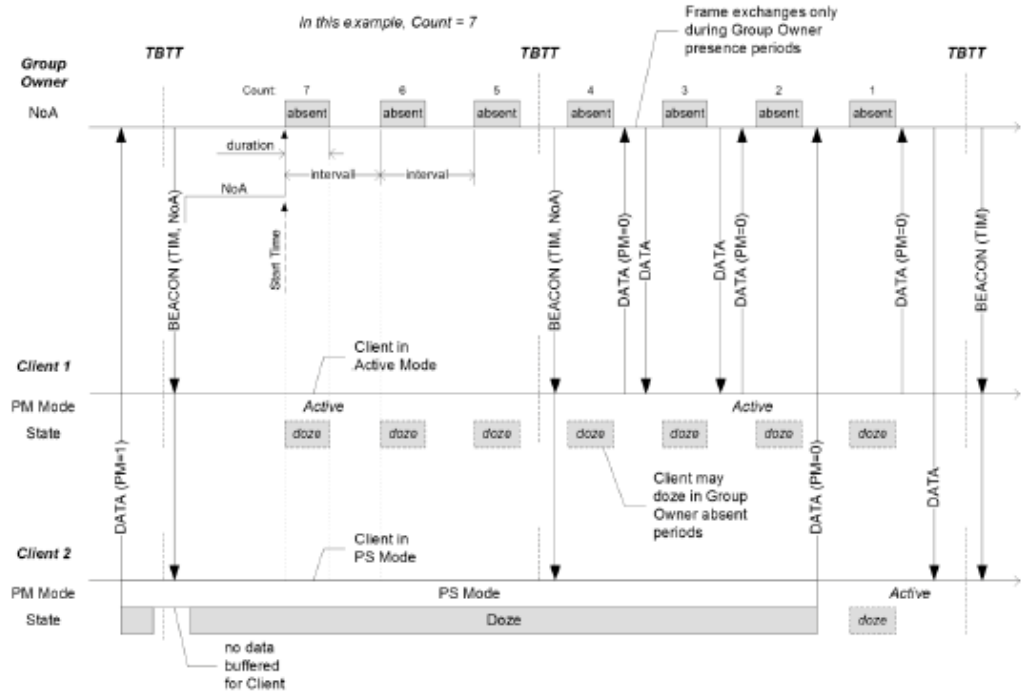


Figure 15—P2P Group Owner Notice of Absence

* * *

Power management for the P2P Group Owner consists of delivery mechanisms based on those defined for PS and WMM-PS, together with two methods that allow the P2P Group Owner to be absent for defined periods. These schemes are termed Opportunistic Power Save and Notice of Absence.

* * *

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.

* * *

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.
Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.3, 3.3.3.2, 3.3.3.3, and Figure 15

169. As set forth above, HP has directly infringed at least claim 1 of the '934 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

170. HP intentionally designed and incorporated the IEEE 802.11/Wi-Fi Direct features and functionalities described above into the Accused Products, and advertises its products as complying with those features and functionalities.

171. HP provides instructions to its customers, encouraging and directing the customers to use the Accused Products in an infringing manner as described above to implement, as HP intends, the IEEE 802.11/Wi-Fi Direct functionality. For example, HP provides user manuals, operating instructions and the like for the Accused Products, including the citations above, as well as at the following:

- https://support.hp.com/id-en/document/c04090221
- https://www8.hp.com/us/en/printers/mobility/wireless-direct-printing.html
- https://www.hpsmart.com/us/en/wireless-printing/wi-fi-direct-and-hp-wireless-direct/
- https://www.hpsmart.com/us/en/wireless-printing/wi-fi-direct-and-hp-wireless-direct/what-is-hp-wireless-direct-and-wi-fi-direct
- https://support.hp.com/us-en/document/ish_1841315-1637332-16
- https://youtu.be/YbLYfMCQ3WM

- https://youtu.be/Icoo7oQvhXs
- https://youtu.be/Camss6YiQcs
- https://youtu.be/aD01m8LxKAM
- https://youtu.be/WI8Kmad4uOM
- https://youtu.be/lGRE2b7K6Zw
- https://youtu.be/YlZHear3T0o
- https://youtu.be/aZNpjGBZiAg

172. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11/Wi-Fi Direct features described above, HP has induced its customers to infringe the '934 patent. HP's customers who use the Accused Products as described above directly infringe the '934 patent. Upon information and belief, HP has had knowledge or has been willfully blind of the '934 patent since at least as early as the day the '934 patent issued, May 18, 2021, based upon service upon it of the Original Complaint. The Original Complaint stated at Paragraph 14 that Ozmo Licensing was "pursuing related patent applications," and so HP was at least willfully blind to the issuance of any subsequently issued patents. HP has had knowledge or has been willfully blind of the '934 patent no later than July 29, 2021, due to a letter sent by Ozmo informing HP of the '934 patent and its infringement allegations regarding the same. Additionally, HP has had knowledge of the '934 patent not later than the service upon it of this Amended Complaint. HP also induces such infringement by failing to remove the infringing features from the Accused Products.

173. By offering for sale, selling, commercially distributing and importing the Accused Products, HP has also contributed to its customers' infringement of the '934 patent. The Accused Products are used by HP's customers to practice the inventions claimed in the '934 patent. The

IEEE 802.11/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the '934 patent. HP knows or is willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by HP solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. HP also knows, via at least the aforementioned July 29, 2021, letter, 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 HP.

174. By the time of trial, HP will have known and intended that its continued actions would directly infringe, and would induce and contribute to the infringement by its customers of, at least claim 1 of the '934 patent.

175. Ozmo Licensing has been damaged by HP's past and ongoing direct and indirect infringement of the '934 patent.

176. With knowledge of the allegations set forth herein, HP nonetheless refuses to remove the infringing functionalities from the Accused Products or to compensate Ozmo Licensing for the use of such features. HP's infringement described above will continue unabated unless and until HP is ordered to pay a reasonable royalty for a license to the '934 patent.

PRAYER FOR RELIEF

Plaintiff requests that the Court enter judgment against HP:

A. that HP has 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. awarding damages sufficient to compensate Plaintiff for HP's infringement under 35 U.S.C. § 284;

C. ordering HP to pay Plaintiff a royalty for HP's future infringement;

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

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

F. awarding Plaintiff prejudgment and post-judgment interest; and

G. granting Plaintiff such further relief as the Court deems just and appropriate.

DEMAND FOR JURY TRIAL

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

Date: July 30, 2021

Respectfully submitted,

/s/Derek Gilliland
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COUNSEL for PLAINTIFF

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the above foregoing document has been delivered to all counsel of record through the Court's CM/ECF service on this 30th day of July, 2021.

/s/Derek Gilliland
DEREK GILLILAND