UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

OZMO LICENSING LLC, Plaintiff, v. ACER INC. and ACER AMERICA CORPORATION, Defendants.	Civil Action No. 6:21-cv-01225 JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff, Ozmo Licensing LLC ("Ozmo Licensing"), as and for its Complaint against defendants, Acer Inc. and Acer America Corporation (together, "Acer" or "Defendants"), hereby alleges as follows:

THE PARTIES

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

2. Acer Inc. is a corporation organized under the laws of Taiwan, with a principal place of business at 1F, 88, Sec. 1, Xintai 5th Rd., Xizhi, New Taipei City 221, Taiwan. Acer Inc. offers its products and/or services, including those accused of infringement herein, to customers and potential customers located in this District.

3. Acer America Corporation is a California corporation that operates a regular and established place of business, including a repair and service facility, within this District at 1394 Eberhardt Road, Temple, Texas 76504 and commits acts of infringement within this judicial district. Acer America Corporation also maintains a place of business at 900 Guardians Way, Allen, Texas 75013. Acer America Corporation may be served with process through its registered

agent for service of process in Texas, CT Corp. System, located at 1999 Bryan Street, Suite 900, Dallas, Texas 75201.

JURISDICTION AND VENUE

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. Acer is subject to this Court's general and specific personal jurisdiction pursuant to due process and/or the Texas Long Arm Statute, Tex. Civ. Prac. & Rem. Code § 17.042, due at least to its substantial business conducted in this District, including: (i) having engaged in substantial and continuous business in the State of Texas, having transacted business within the State of Texas and having attempted to derive financial benefit from residents of the State of Texas in this District, including benefits directly related to the instant patent infringement causes of action set forth herein; (ii) having placed its products and services into the stream of commerce throughout Texas and the United States and having been actively engaged in transacting business in in this District, including repair and service, and (iii) having committed the complained of tortious acts of infringement in this District. This Court also has personal jurisdiction over Acer Inc. pursuant to Federal Rule of Civil Procedure 4(k)(2) based on Acer Inc.'s contacts with the United States as a whole.

6. Acer directly and/or through subsidiaries and agents (including distributors, retailers, and others), makes, imports, ships, distributes, offers for sale, sells, uses, and advertises (including offering products and services through its website, https://us-store.acer.com, as well as other retailers) its products and/or services in the United States, including within this District.

7. Venue is proper in this District as to Acer Inc. under 28 U.S.C. § 1391(c) because Acer Inc. is a foreign corporation and has committed acts of patent infringement in this District and Ozmo Licensing has suffered harm in this District.

8. Venue is proper in this District as to Acer America Corporation under 28 U.S.C. § 1400(b) because "any civil action for patent infringement may be brought in the judicial district where a defendant resides, or where the defendant has committed acts of infringement and has a regular and established place of business."

FACTUAL BACKGROUND

The Patents-in-Suit

9. On February 16, 2016, the United States Patent and Trademark Office ("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.

10. 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.

11. 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.

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.

17. On September 14, 2021, the PTO issued United States Patent No. 11,122,504 (“the ’504 patent”), titled APPARATUS AND METHOD FOR INTEGRATING SHORT-RANGE WIRELESS PERSONAL AREA NETWORKS FOR A WIRELESS LOCAL AREA NETWORK

INFRASTRUCTURE. The ’504 patent is valid and enforceable. A copy of the ’504 patent is attached as Exhibit E.

18. Ozmo Licensing is the owner and assignee of all rights, title and interest in and to the ’504 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 ’504 patent.

The Inventors, Ozmo Devices, and Ozmo Licensing

19. The inventions of the ’991 patent, the ’906 patent, the ’814 patent, the ’934 patent, and the ’504 patent (collectively, “the Ozmo Devices patents” or “the patents-in-suit”) were conceived at Ozmo Devices. Founded in 2004 by spouses Katelijn Vleugels and Roel Peeters, Ozmo Devices was a leading provider of low-power Wi-Fi Personal Area Network (“WPAN”) products that may be deployed in proximity to Wi-Fi Local Area Networks (“WLAN”) products without severe interference arising between the two.

20. 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 Vleugels and Peeters helped draft. The Wi-Fi Alliance is headquartered in Austin, Texas. Vleugels and Peeters live in the greater Austin area of Texas.

21. 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.

22. Ozmo Licensing was founded in 2019. A significant aspect of Ozmo Licensing's business is widely and reasonably licensing its current patent portfolio, including the Ozmo Devices patents, with the support of the inventors. Ozmo Licensing is pursuing related patent applications with the support of inventors Katelijn Vleugels and Roel Peeters.

Wireless Communication Technology

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

24. An example of a WLAN is an 802.11x (x = a, b, g, n, etc.) network, whose operation is specified in a handful of versions of the Institute of Electrical and Electronics Engineers (IEEE) 802.11x standard, including the IEEE Std. 802.11 ("IEEE 802.11-2012," "802.11x," or "IEEE 802.11x"). Since its adoption, the 802.11x standard, commonly known as "Wi-Fi," has been widely deployed for wireless connectivity in a variety of settings, including in homes, offices, and public establishments. 802.11x WLANs generally support two different configurations: infrastructure mode and ad-hoc mode.

25. An 802.11x 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, and they may be able to communicate with STAs of other WLANs, with all such communications being routed through APs.

26. Devices in a WPAN communicate directly with each other 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. Both the range and the data transmission rates of a Bluetooth WPAN are far smaller than those of an 802.11x WLAN.

27. Bluetooth WPAN devices may operate in the same 2.4-GHz frequency band in which WLAN devices frequently operate. The co-existence of WPAN and WLAN 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 when accessing the wireless medium. Furthermore, a device that supports both Bluetooth WPAN and 802.11 WLAN connections often requires different hardware and software such as transceivers, drivers for the transceivers and antennas, which can be functionally duplicative and thus wasteful of resources. While the disharmonious coexistence of Bluetooth WPANs and 802.11x WLANs has long been tolerated, there remained a need for a solution that could more seamlessly integrate WPAN and WLAN communication protocols.

28. The "Background of the Invention" sections of the Ozmo Devices patents describes some of the problems pertaining to then-contemplated integrations of WLANs and WPANs. Vleugels and Peeters addressed these problems with their inventions. For example, the Ozmo Devices patents describe the lack of synchronization and resulting interference that occurred with then-existing integrations of WLANs and WPANs. *See, e.g.*, Ex. A at 2:29-36.[1]

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

29. The Ozmo Devices patents note that the prior art efforts to address these issues were insufficient. For example, one option was to simply implement WLAN protocols in WPAN devices. *Id.* at 2:37-3:6. This led to power dissipation and/or low transmission rate problems, and introduces undesirable amounts of latency in communications involving the WPAN devices.

30. 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.

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

32. 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 802.11x WLAN network.

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

33. Paragraphs 1-32 are incorporated by reference as if fully set forth herein.

34. 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 a WPAN into a WLAN infrastructure.

35. 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.

36. 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 WPAN protocol impinge on at least some antennae used for communications using the first network WLAN protocol.

37. Compared to the prior art, the claimed 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.

38. Compared to the prior art, the claimed apparatus 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 a network-enabled

hub, which may be adapted to establish communication via an AP coupled to the Internet. This allows remote monitoring and control of a WPAN device such as a home security system, or an implanted or wearable medical device, over the Internet.

39. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more energy efficient, which can extend the battery life of WPAN devices that are battery powered or otherwise enable power-hungry WPAN devices to more readily enter power-save modes.

40. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN, also enables lower latency communication involving WPAN devices, which enables a device serving as a hub between a WPAN and WLAN to more effectively forward video streams between the two.

41. Acer 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 and projectors. Wi-Fi protocols allow such devices to act as network-enabled hubs (i.e., the "Accused Products") to receive, for example, video from an IEEE 802.11x AP and to forward such video to a second device using Wi-Fi Direct.

42. Examples of the Accused Products are Acer's Wi-Fi Direct and/or Miracast enabled laptop computers (including, but not limited to, ConceptD Laptops, Enduro Laptops, Nitro Gaming Laptops, Predator Gaming Laptops, Swift Laptops, Spin Laptops, and Aspire Laptops); desktop computers (including, but not limited to, ConceptD Desktops, Aspire TC Desktops, Veriton Desktops, Nitro Desktops, and Predator Orion Desktops); tablets (including, but not limited to, Enduro tables); projectors (including, but not limited to, the Acer H6535i projector), and all other Acer products that include Wi-Fi Direct and/or Miracast functionality.

43. For the avoidance of doubt, all of Acer'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 with respect to the '991 patent are equally applicable to all Accused Products.

44. 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.

45. The Accused Products were designed by Acer 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.

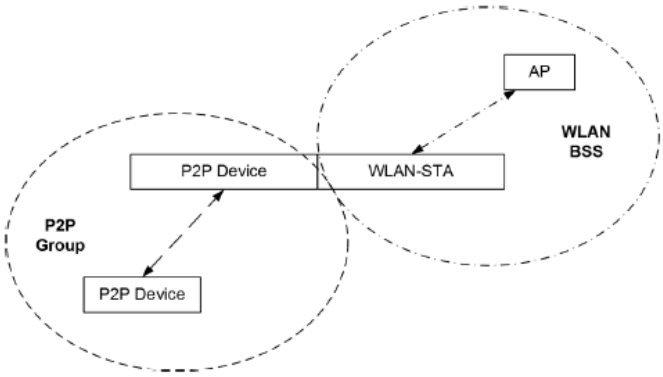
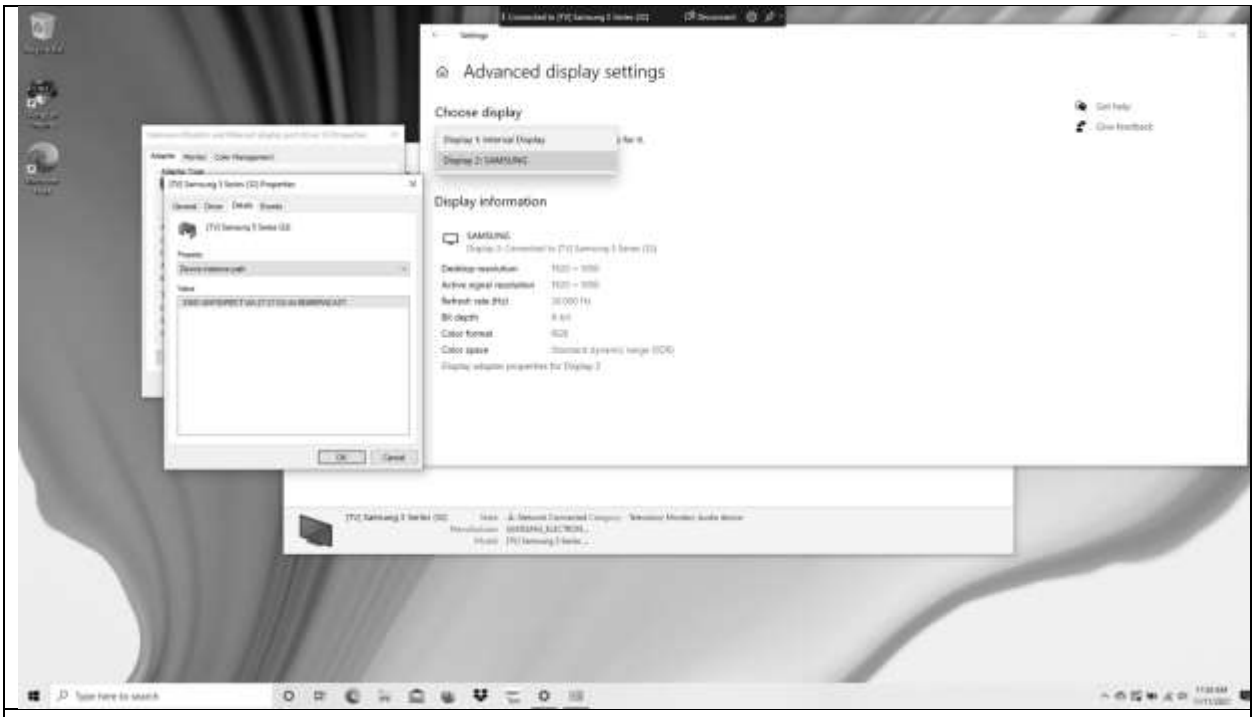


Figure 4—P2P Concurrent device

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



Source: Acer Aspire 3 Laptop Product Testing

46. For example, the Aspire 3 Laptop (A317-52-565S) ("Aspire 3 Laptop") is an Accused Product (a network-enabled hub) designed and manufactured by Acer 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 considered to provide "Screen Mirroring" functionality, is based on operating Wi-Fi Direct connections between devices:

Standards-based Miracast advances life without wires

Miracast is an industry-wide solution, allowing technology to work across device types and vendors. Connections are easy to set up and use since Miracast devices choose the appropriate settings automatically. Miracast can connect two devices using network infrastructure or **Wi-Fi Direct®**. When content to be shared is stored on a Miracast-certified device, such as a smartphone to an automobile infotainment display, a Wi-Fi network connection is not required.

Only devices marked Wi-Fi CERTIFIED Miracast have been certified by Wi-Fi Alliance® to work well with other Wi-Fi CERTIFIED™ devices, employ the latest security protections, and deliver a high-quality user experience.

Source: https://www.wi-fi.org/discover-wi-fi/miracast

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

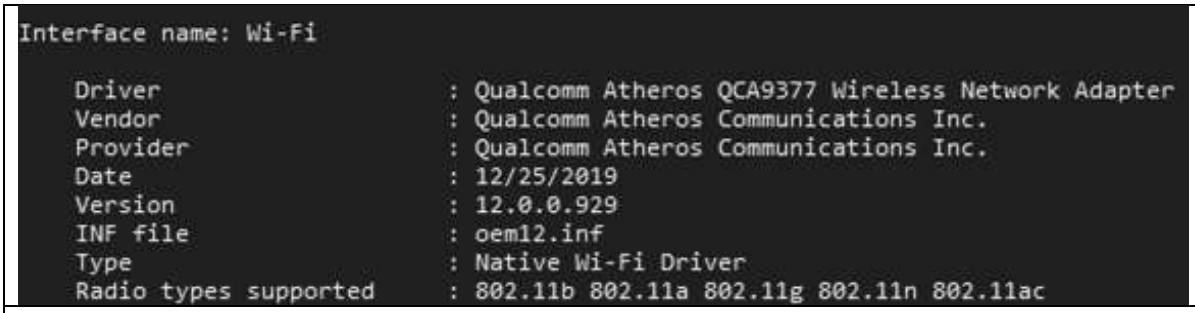
Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
      Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
            Language: English (Regional Setting: English)
   System Manufacturer: Acer
         System Model: Aspire A317-52
               BIOS: V1.18 (type: UEFI)
          Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
             Memory: 8192MB RAM
   Available OS Memory: 7982MB RAM
          Page File: 4219MB used, 5681MB available
        Windows Dir: C:\Windows
     DirectX Version: DirectX 12
   DX Setup Parameters: Not found
    User DPI Setting: 96 DPI (100 percent)
   System DPI Setting: 96 DPI (100 percent)
     DWM DPI Scaling: Disabled
          Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
 DirectX Database Version: 1.0.8
       DxDiag Version: 10.00.19041.0546 64bit Unicode
```

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)

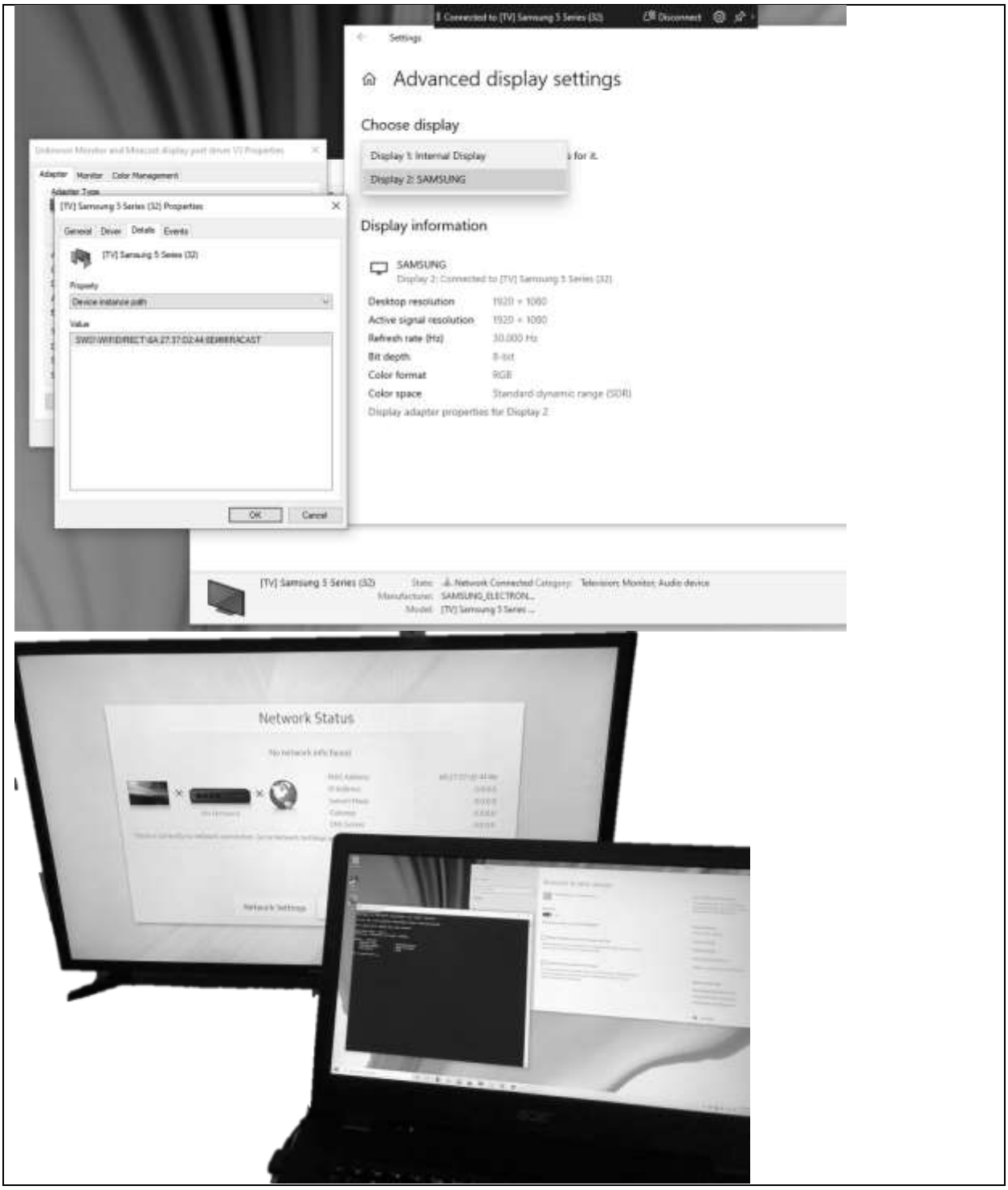
Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point

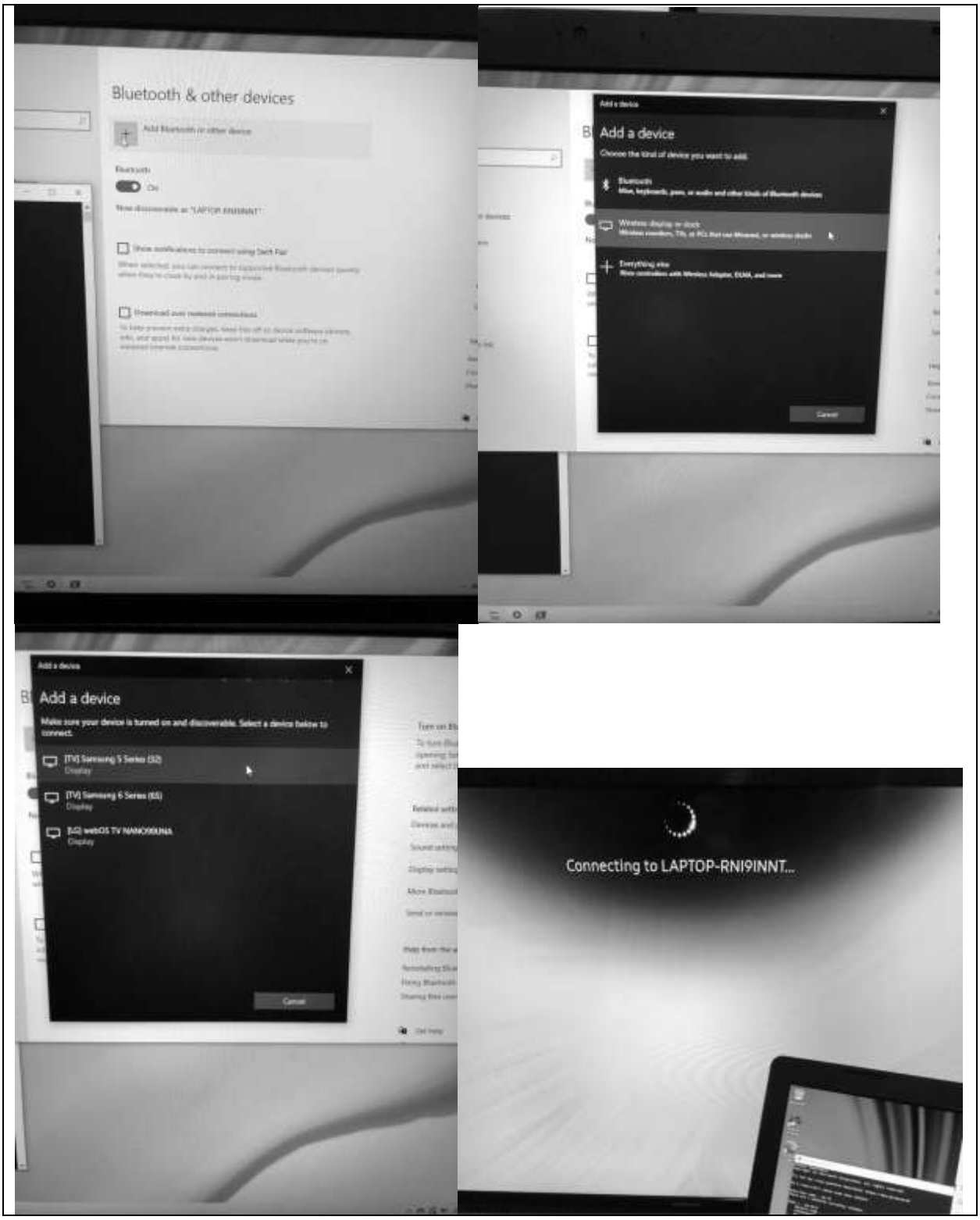
Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless- projection-receiver-manufacturers



Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Source: https://www.qualcomm.com/products/qca9377


Settings
Advanced display settings
Choose display
Display 1: Internal Display
Display 2: SAMSUNG
Display information
SAMSUNG
Desktop resolution
Active signal resolution
Refresh rate (Hz)
Bit depth
Color format
Color space
Display adapter properties for Display 2
[TV] Samsung 5 Series (32) Properties
General
Driver
Details
Events
Property
Value
OK
Cancel
[TV] Samsung 5 Series (32)
Network Status


Bluetooth & other devices
Add a device
Add a device
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

47. 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 Aspire 3 Laptop, designed and manufactured by Acer, includes the Qualcomm Atheros QCA9377 wireless network adapter (wireless radio circuit that can send and receive data wirelessly), which includes Wi-Fi and Bluetooth functionality (bi-directional wireless data communications). The Aspire 3 Laptop can serve as the claimed hub when, for example, a video is streamed from the Internet to the Aspire 3, and Miracast / Wi-Fi Direct are used to mirror the Internet-video to a second device, such as a wireless display:

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                     : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                     : Qualcomm Atheros Communications Inc.
    Provider                   : Qualcomm Atheros Communications Inc.
    Date                       : 12/25/2019
    Version                    : 12.0.0.929
    INF file                   : oem12.inf
    Type                       : Native Wi-Fi Driver
    Radio types supported      : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Specifications

Wi-Fi

Peak Speed: 433 Mbps

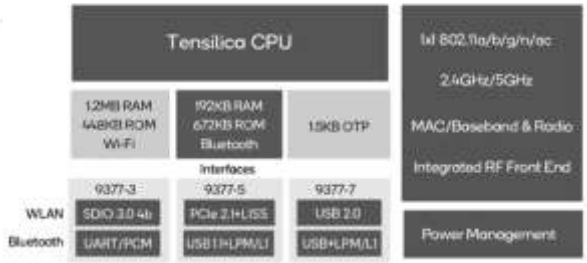
Standards: 802.11ac Wave 2, 802.11a/b/g, 802.11n

Wi-Fi Spectral Bands: 2.4 GHz, 5 GHz

Wi-Fi Features: MU-MIMO

Channel Utilization: 20/40/80 MHz

MIMO Configuration: 1x1 (1-stream)



Source: https://www.qualcomm.com/products/qca9377

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

Source: Acer Aspire 3 Laptop Product Testing

48. The Accused Products include a processor. For example, the Aspire 3 Laptop includes the Intel Core i5-1035G1 system processor, as well as the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes a processor (for example, "Tensilica CPU," as shown below):

Aspire 3 Laptop - A317-52-565S

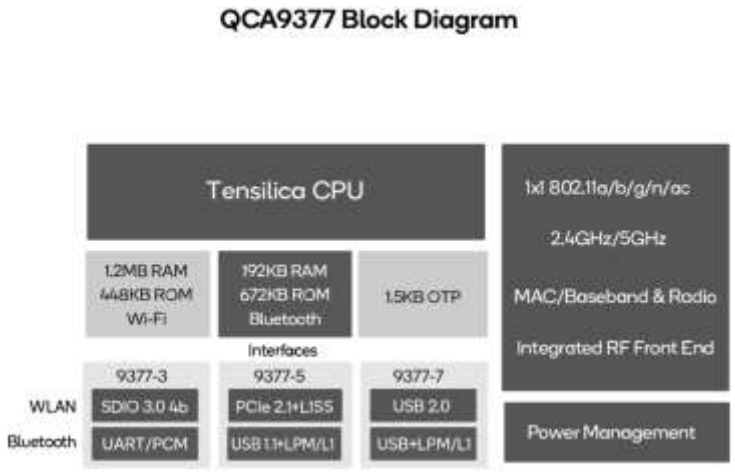
Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                     : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                     : Qualcomm Atheros Communications Inc.
    Provider                   : Qualcomm Atheros Communications Inc.
    Date                       : 12/25/2019
    Version                    : 12.0.0.929
    INF file                   : oem12.inf
    Type                       : Native Wi-Fi Driver
    Radio types supported      : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

49. The processor in the Accused Products is configured to process data received via the wireless radio circuit. For example, the Aspire 3 Laptop includes the Intel Core i5-1035G1 system processor, as well as the Tensilica CPU, which is configured to receive data received via the wireless radio circuit:

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Aspire 3 Laptop - A317-52-565S

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

50. The processor in the Accused Products is configured to generate data to be transmitted by the wireless radio circuit. For example, the Aspire 3 Laptop includes the Intel Core i5-1035G1 system processor, as well as the Tensilica CPU, which is configured to generate data to be transmitted by the wireless radio circuit:

Aspire 3 Laptop - A317-52-565S

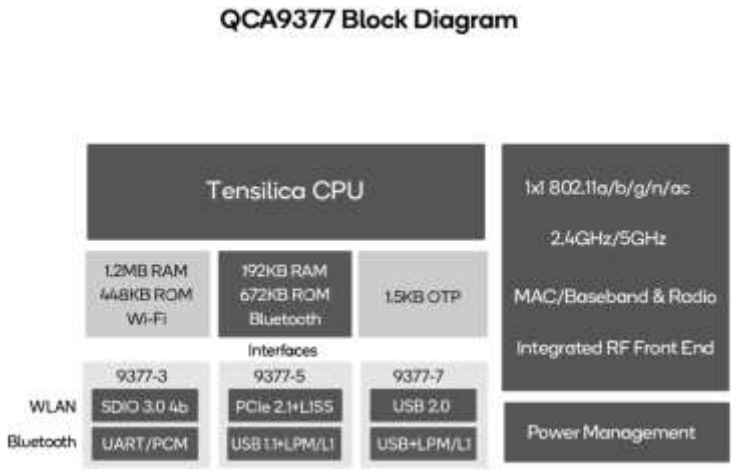
Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                     : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                     : Qualcomm Atheros Communications Inc.
    Provider                   : Qualcomm Atheros Communications Inc.
    Date                       : 12/25/2019
    Version                    : 12.0.0.929
    INF file                   : oem12.inf
    Type                       : Native Wi-Fi Driver
    Radio types supported      : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



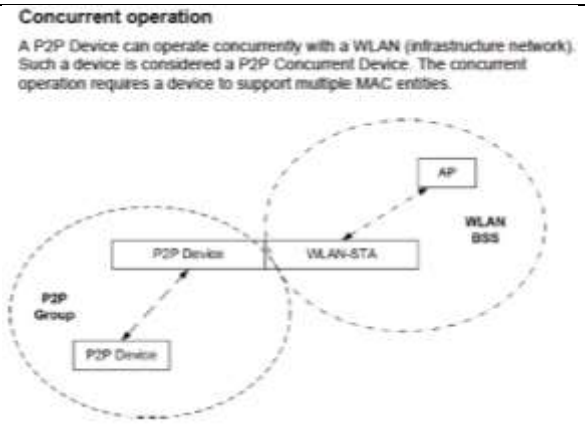
Source: https://www.qualcomm.com/products/qca9377

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

51. 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 Aspire 3 Laptop (network-enabled hub) may initiate and maintain a connection (network connection) with an AP, or devices accessible over the Internet via the AP:



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

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

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

```
      Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
            Language: English (Regional Setting: English)
   System Manufacturer: Acer
        System Model: Aspire A317-52
              BIOS: V1.18 (type: UEFI)
         Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
            Memory: 8192MB RAM
   Available OS Memory: 7982MB RAM
          Page File: 4219MB used, 5681MB available
        Windows Dir: C:\Windows
     DirectX Version: DirectX 12
   DX Setup Parameters: Not found
     User DPI Setting: 96 DPI (100 percent)
    System DPI Setting: 96 DPI (100 percent)
      DWM DPI Scaling: Disabled
           Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
 DirectX Database Version: 1.0.8
       DxDiag Version: 10.00.19041.0546 64bit Unicode
```

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)

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.

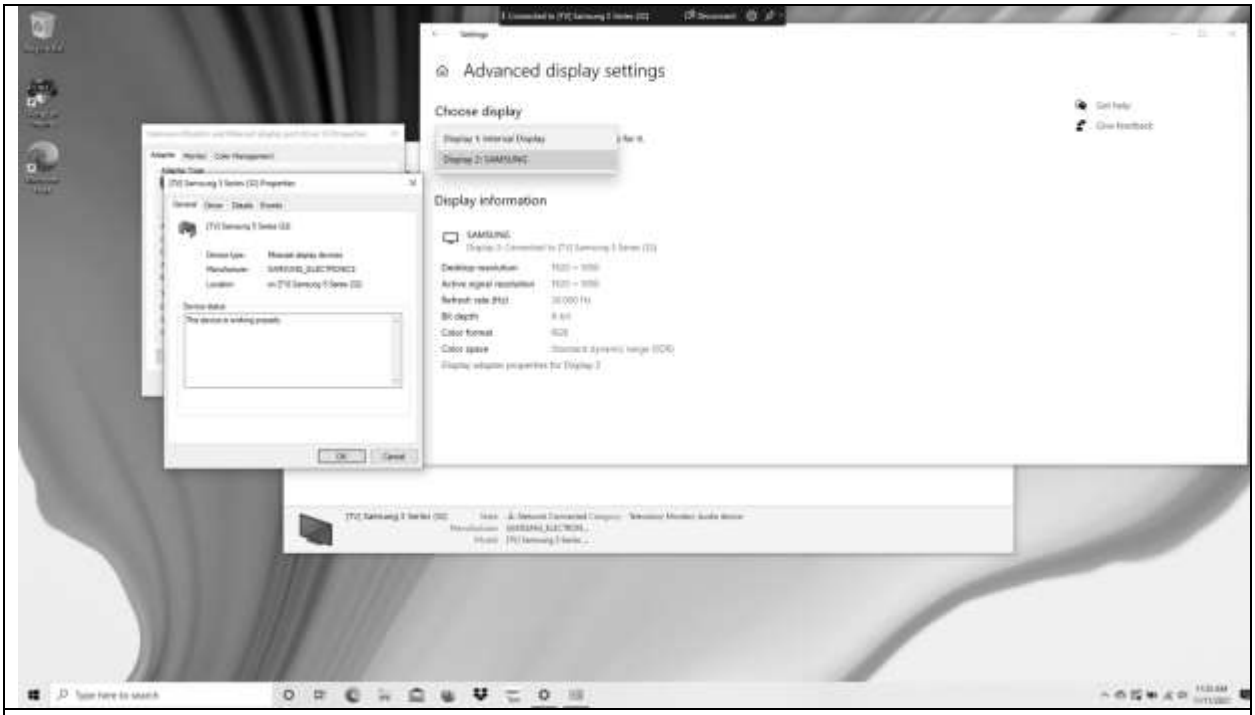
3.2.7 Disconnecting from a P2P Group

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.



Source: Acer Aspire 3 Laptop Product Testing

52. 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 simultaneously with each other. For example, the Aspire 3 Laptop connects to an access point via 802.11x Wi-Fi (first network connection using a first network protocol) and to a Miracast receiver screen (second network connection) using Wi-Fi Direct (second network protocol):

Source: Acer Aspire 3 Laptop Product Testing

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/

Figure 2. Wi-Fi Direct Concurrent Mode

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

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.

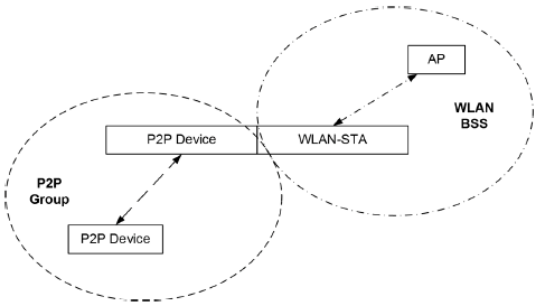


Figure 4—P2P Concurrent device

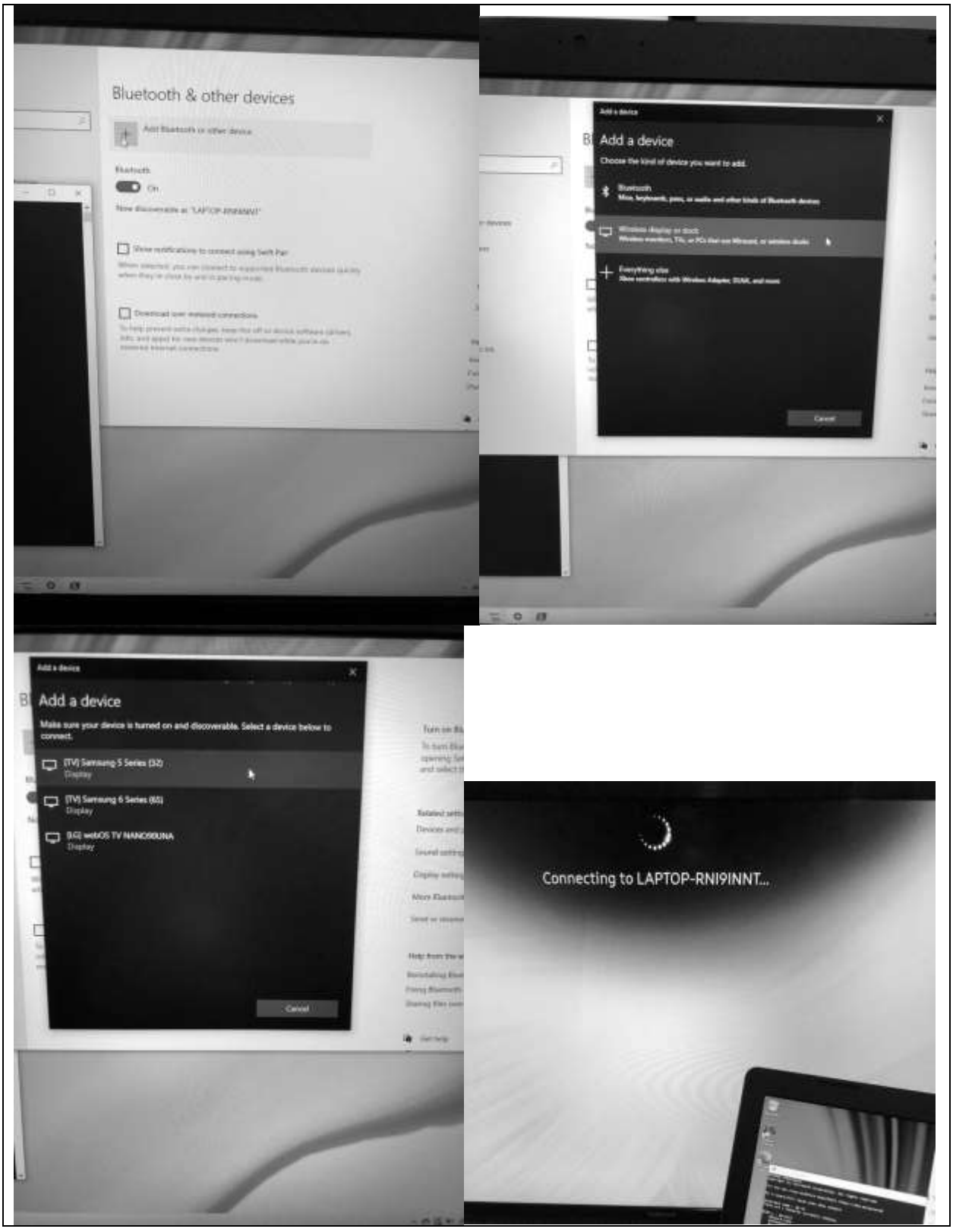
As an example, Figure 4 shows a P2P Concurrent Device that has one MAC entity operating as a WLAN-STA and the second MAC entity operating as a P2P Device. The dual MAC functionality can be provided via two separate physical MAC entities each associated with its own PHY entity, two virtual MAC entities 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

53. The following user interface prompts, as provided in Acer's Accused Products, provide step-by-step instructions and teach how to set up a Miracast connection to mirror a display, for example, on an Aspire 3 Laptop:


Network Status
No network info found.
Network Settings


Bluetooth & other devices
Add a device
Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

54. In further detail, the Accused Products maintain at least a first network connection using a first network protocol. For example, the Aspire 3 Laptop maintains association and synchronization in providing connections compliant with IEEE 802.11x:

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.

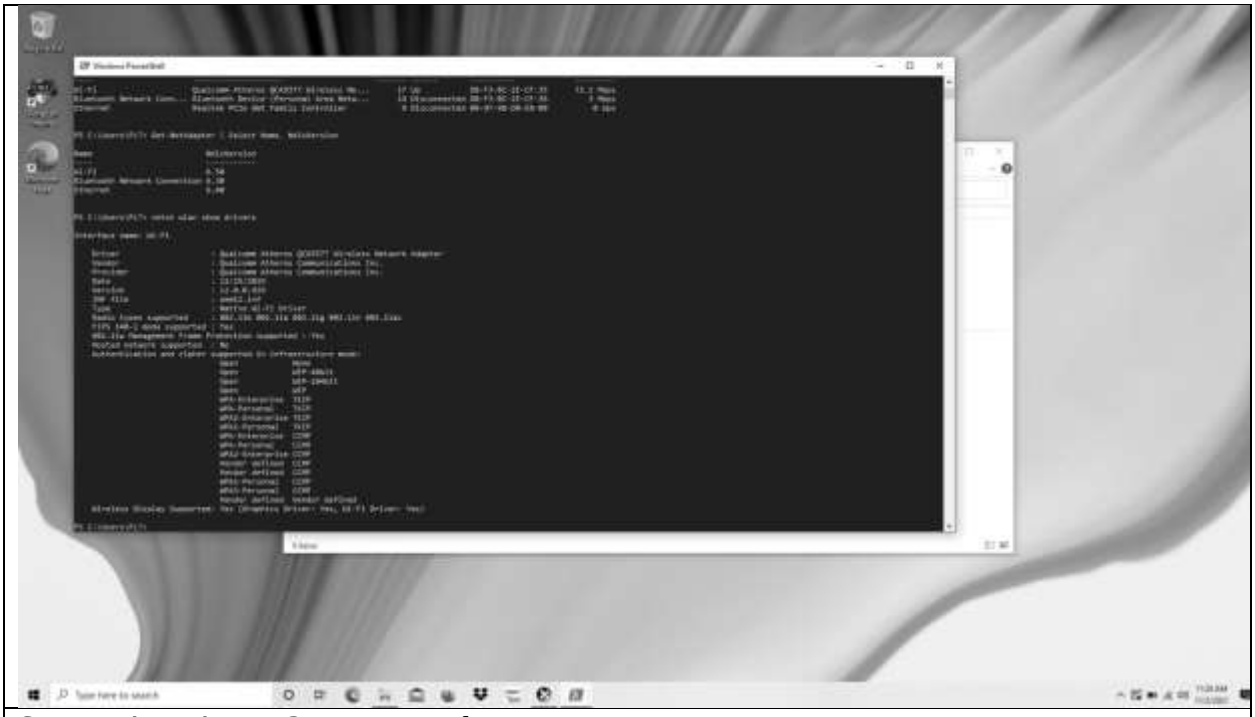
The states used in this description are defined in 10.3.1.

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



Source: Acer Aspire 3 Laptop Product Testing

55. In further detail, the Accused Products maintain a second network connection using a second network protocol. For example, the Aspire 3 Laptop maintains association and synchronization in providing connections compliant with the Wi-Fi Direct Standard:

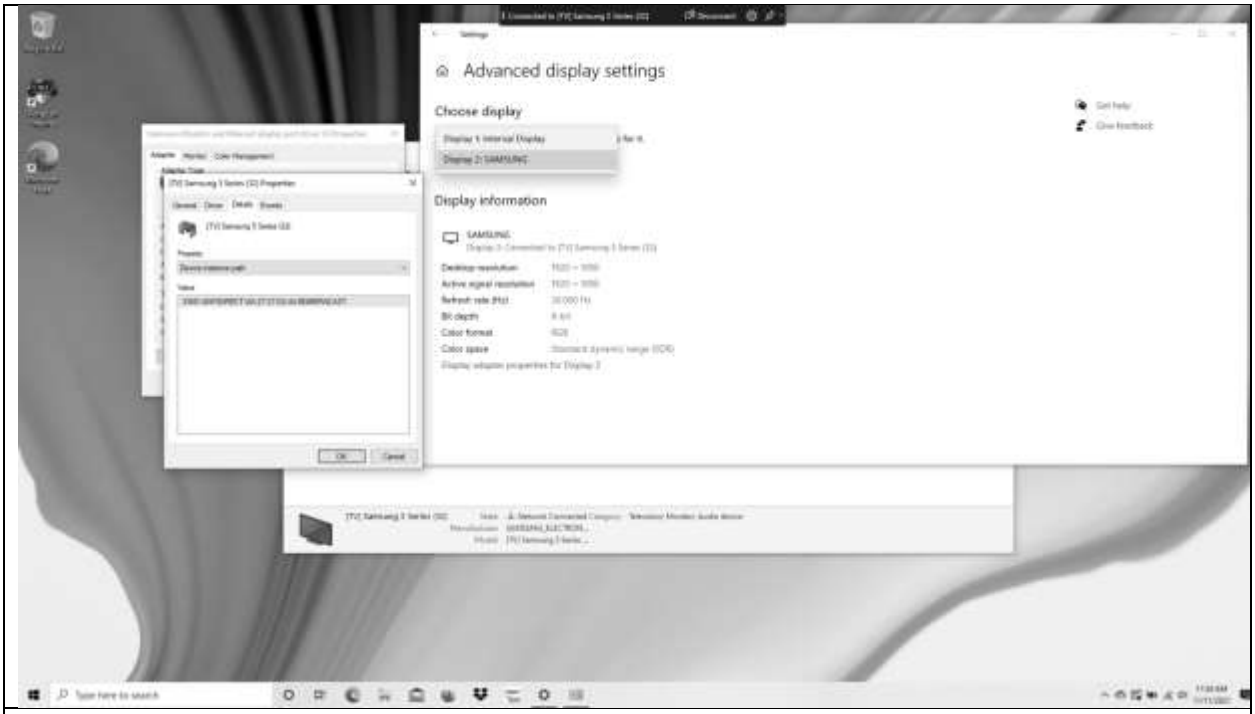
3.2.2 Starting and maintaining a P2P Group session

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



Source: Acer Aspire 3 Laptop Product Testing

56. 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 (802.11x management frames with a P2P IE) are based on 802.11x frames. For example, some Wi-Fi Direct frames are created by placing P2P attributes inside the vendor specific field of an 802.11x management frame. The Wi-Fi Direct protocol, for example, specifies power management behaviors over a Wi-Fi Direct connection using Notice of Absence and CTWindow P2P attributes that are placed inside the vendor specific field of an 802.11x management frame and that help implement the Wi-Fi Direct Notice of Absence and Opportunistic Power Save procedures. Network-enabled hub nodes following the Wi-Fi Direct protocol, for example, can interoperate with WLAN nodes using frames and procedures defined in the 802.11x standard, while supporting Wi-Fi Direct Notice of Absence and Opportunistic Power Save procedures using the data in the vendor specific field of an 802.11x 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.

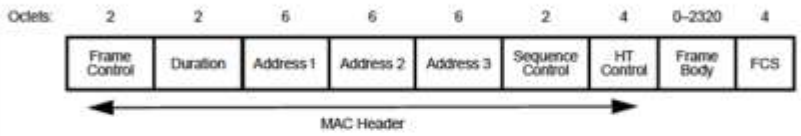


Figure 8-34—Management frame format

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.

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

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

58. 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 802.11x 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

59. 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, the Aspire 3 Laptop uses Windows 10 Home 64, which includes support for 802.11x Wi-Fi (first network protocol) and Wi-Fi Direct (second network protocol)

functionality and uses the same antennae for both Wi-Fi Direct and 802.11x Wi-Fi communications.

60. 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 Aspire 3 Laptop (a network-enabled hub) uses Windows 10 Home 64, which includes the standard Miracast (also known as "screen mirroring") functionality (i.e., data forwarding logic), 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):


Network Status
No network info found.
Network Settings
Add a device
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

Figure 2. Wi-Fi Direct Concurrent Mode

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

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

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

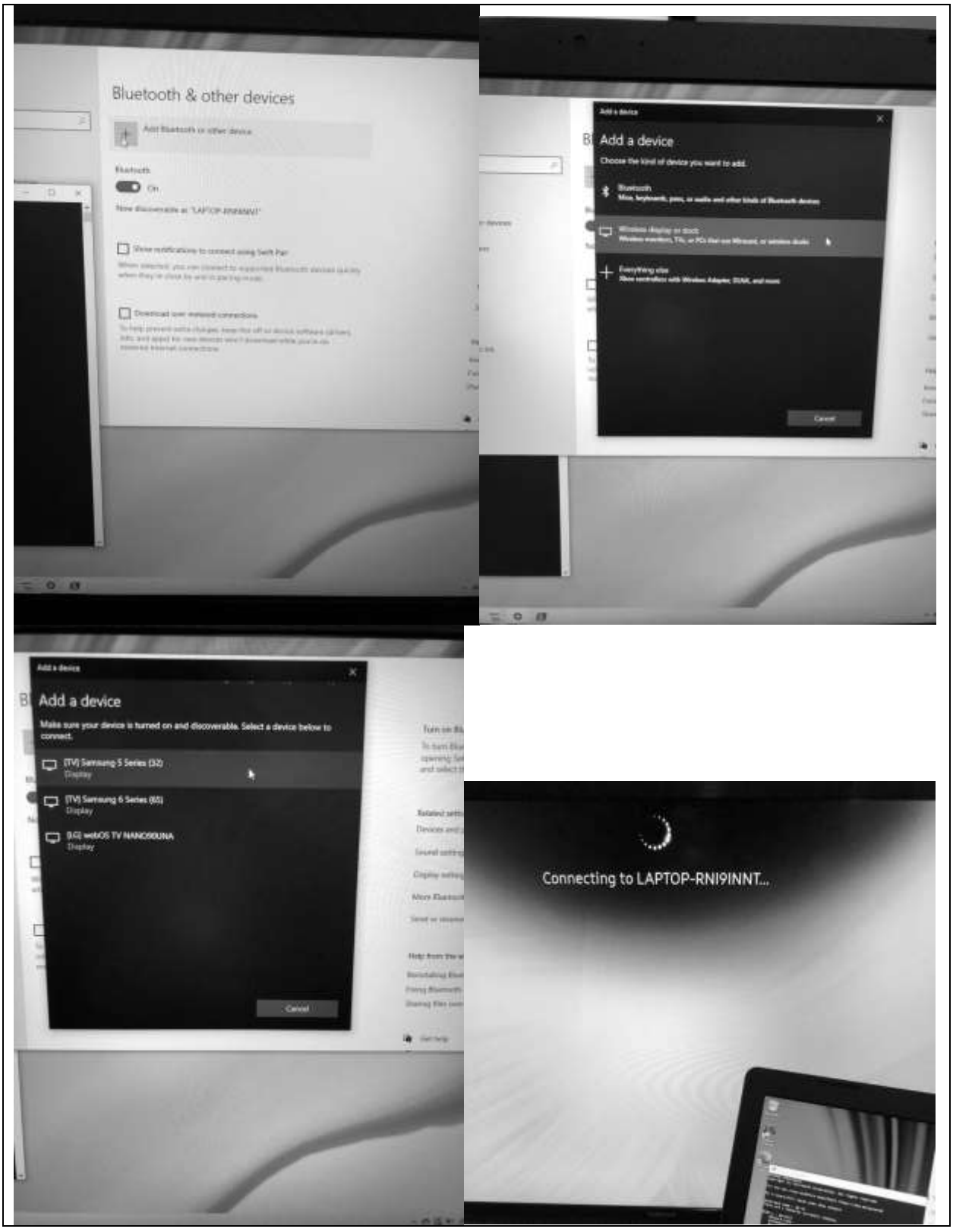
Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

61. As set forth above, Acer 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.

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

63. Acer provides instructions (in the form of at least user interface prompts) to its customers, encouraging and directing the customers to use the Accused Products in an infringing manner as described above to implement the IEEE 802.11x/Wi-Fi Direct functionality, as intended by Acer. For example, Acer provides operating instructions and the like for the Accused Products, including the citations above:


Network Status
No network info found.
Network Settings


Bluetooth & other devices
Add a device
Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

64. By its instructions, including those set forth above, and with intent that its customers use the IEEE 802.11x/Wi-Fi Direct features described above, Acer has induced its customers to infringe the '991 patent. Acer's customers who use the Accused Products as described above directly infringe the '991 patent. Acer has had knowledge of (or has been willfully blind to) the '991 patent since at least April 2, 2020, as a result of the below described communications between Ozmo Licensing and Acer. Specifically, on April 2, 2020, Christian Dubuc, Chief Executive Officer of Ozmo Licensing, wrote to Peggy Yo, Legal Supervisor at Acer, regarding Ozmo Licensing's patent portfolio and the Accused Acer Products, informing Acer that it required a license to the '991 patent. Acer responded to Ozmo Licensing's initial letter on April 15, 2020. Subsequently, on April 29, 2020, Ozmo Licensing followed up with Acer via email, providing more specificity (including additional Acer products requiring a license), and indicating an intent to provide illustrative claim charts. On May 14, 2020, Ozmo Licensing provided Acer with detailed claim charts illustrating how the Accused Products infringe each element of exemplary claims of the '991 patent. Ozmo Licensing and Acer have had no fewer than 24 interactions since Ozmo Licensing sent its initial notice letter in April 2020. Acer has therefore had actual and express knowledge of the '991 patent and Ozmo Licensing's infringement allegations since, at the latest, May 14, 2020, and additionally, by service upon Acer of this Complaint. Acer also induces such direct infringement by its customers by failing to remove the infringing features from the Accused Products.

65. By offering for sale, selling, commercially distributing and importing the Accused Products, Acer has also contributed to its customers' infringement of the '991 patent. The Accused Products are used by Acer's customers to practice the inventions claimed in the '991 patent. The IEEE 802.11x/Wi-Fi Direct features as performed by the Accused Products as described above

constitute material parts of the claimed inventions of the '991 patent. Acer knows or was willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by Acer solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. Acer 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 Acer. As described above, Acer has had knowledge since at least as early as April 2020 that its customers were infringing the '991 patent.

66. By the time of trial, Acer 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.

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

68. With knowledge of the allegations set forth herein, Acer continues to incorporate the infringing functionalities in the Accused Products, and has failed to compensate Ozmo Licensing for the use of such features. Acer's unlawful activities described above have continued despite Acer's receipt of the numerous correspondence described above, including exemplary element-by-element claim charts no later than May 14, 2020. Acer's infringement will continue unabated unless and until Acer is enjoined or ordered to pay a reasonable royalty for a license to the '991 patent.

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

69. Paragraphs 1-68 are incorporated by reference as if fully set forth herein.

70. 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 a WPAN into a WLAN infrastructure where the WPAN protocol is an overlay protocol that is only partially compliant with the WLAN protocol.

71. 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.

72. 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.

73. Compared to the prior art, the claimed apparatus 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.

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

75. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more energy efficient, thereby extending the battery life of the devices that are battery powered or otherwise enable power-hungry WPAN devices to more readily enter power-save modes.

76. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN also enables lower latency communication involving WPAN devices, which enables a device serving as a hub between a WPAN and a WLAN to more effectively forward video streams between the two.

77. Acer 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, and other peripherals that include Wi-Fi Direct functionality (together, "Accused Products"). The same Accused Products that infringe the '991 patent infringe the '906 patent.

78. Examples of the Accused Products are Acer's Wi-Fi Direct and/or Miracast enabled laptop computers (including, but not limited to, ConceptD Laptops, Enduro Laptops, Nitro Gaming Laptops, Predator Gaming Laptops, Swift Laptops, Spin Laptops, and Aspire Laptops); desktop computers (including, but not limited to, ConceptD Desktops, Aspire TC Desktops, Veriton Desktops, Nitro Desktops, and Predator Orion Desktops); tablets (including, but not limited to, Enduro tables); projectors (including, but not limited to, the Acer H6535i projector), and all other Acer products that include Wi-Fi Direct and/or Miracast functionality. These products use Wi-Fi Direct in substantially the same way.

79. For the avoidance of doubt, all of Acer'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.

80. Claim 4 of the '906 patent is reproduced below:

> 4. A first wireless device for connecting to 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;

associate, via the wireless radio circuit, with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon associating, the first wireless device is configured to become a member of a WPAN network; and

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 data exchanges with the second wireless device via the wireless connection following a start of the inactivity time, wherein the disabling is such that less power per unit time is consumed by the wireless radio circuit relative to a power per unit time consumed by the wireless radio circuit when the data exchanges are not disabled.

81. 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.

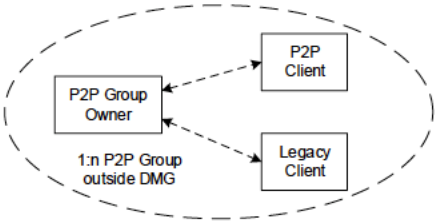
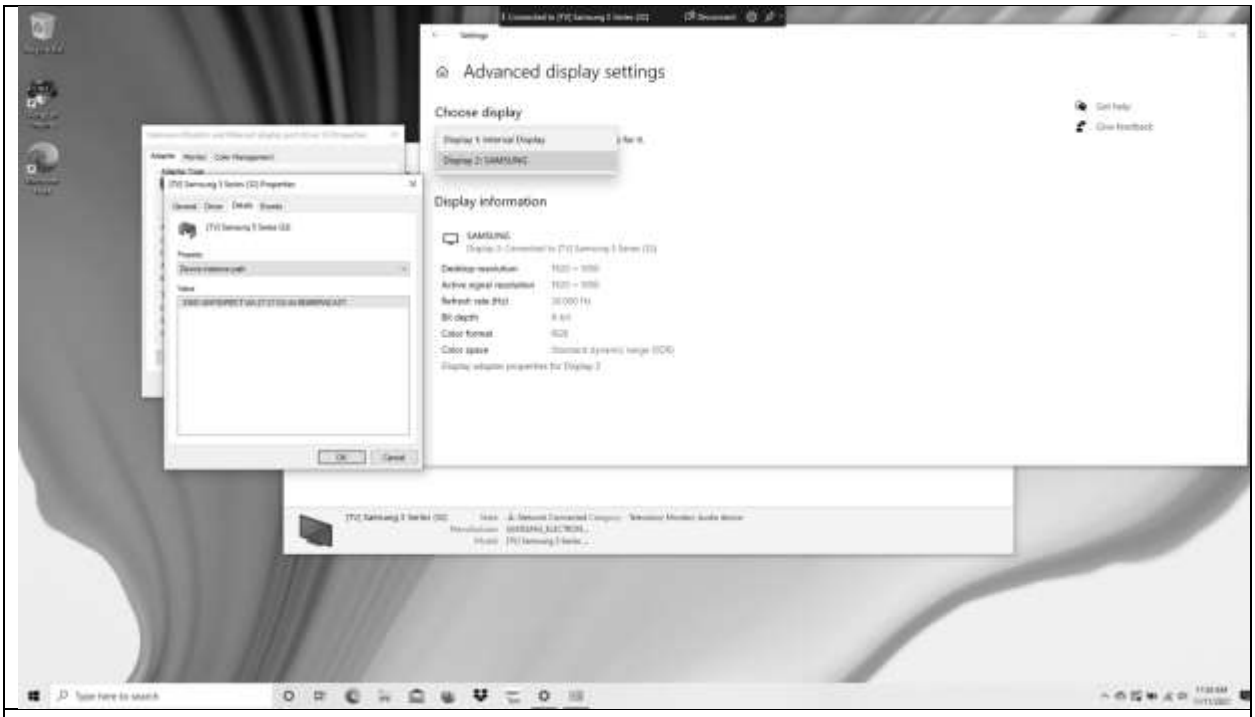


Figure 1—P2P components and topology when operating outside DMG

Source: Wi-Fi Direct Standard, v. 1.7, Section 2.1, Fig. 1



Source: Acer Aspire 3 Laptop Product Testing

82. For example, the Acer Aspire 3 Laptop (a first wireless device), designed and manufactured by Acer, can connect to a Wi-Fi Direct network (a WPAN) via a wireless connection to another device, such as a television or other peripheral (including, but not limited to, other

Accused Products) (a second wireless device), and is also capable of communications using an 802.11x WLAN protocol:

Standards-based Miracast advances life without wires

Miracast is an industry-wide solution, allowing technology to work across device types and vendors. Connections are easy to set up and use since Miracast devices choose the appropriate settings automatically. Miracast can connect two devices using network infrastructure or **Wi-Fi Direct®**. When content to be shared is stored on a Miracast-certified device, such as a smartphone to an automobile infotainment display, a Wi-Fi network connection is not required.

Only devices marked Wi-Fi CERTIFIED Miracast have been certified by Wi-Fi Alliance® to work well with other Wi-Fi CERTIFIED™ devices, employ the latest security protections, and deliver a high-quality user experience.

Source: https://www.wi-fi.org/discover-wi-fi/miracast

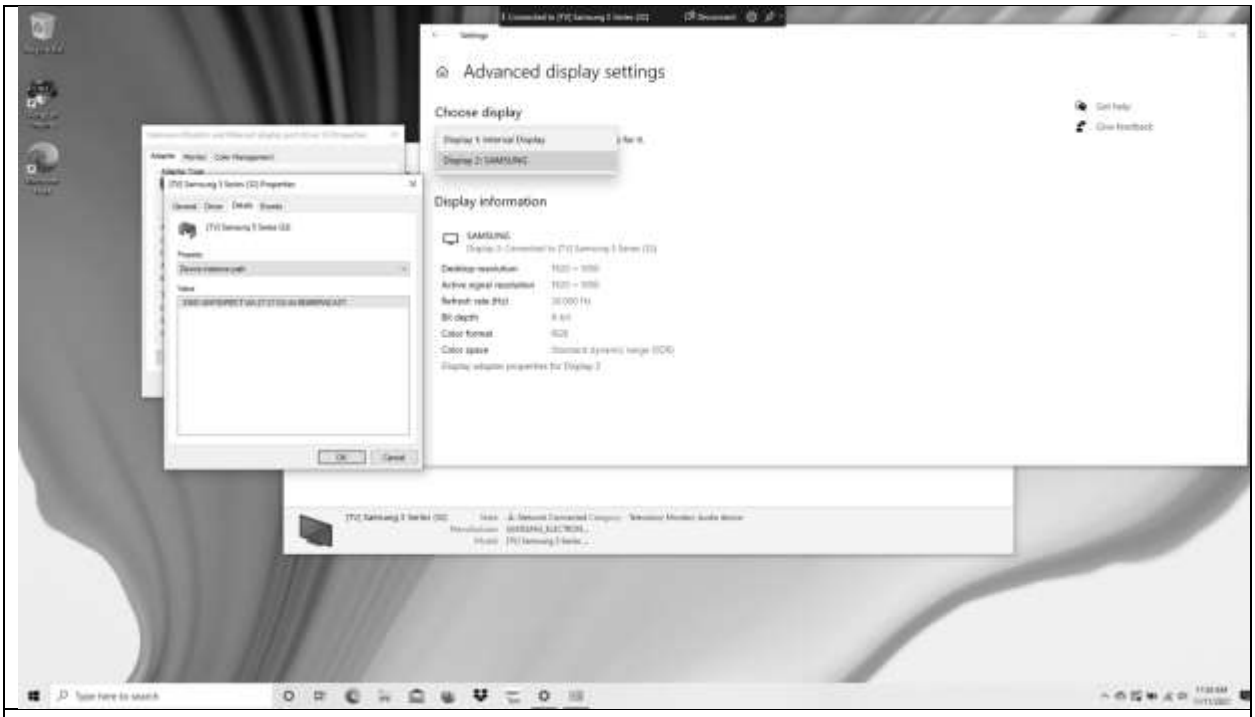
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
      Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
            Language: English (Regional Setting: English)
  System Manufacturer: Acer
       System Model: Aspire A317-52
             BIOS: V1.18 (type: UEFI)
          Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
             Memory: 8192MB RAM
Available OS Memory: 7982MB RAM
          Page File: 4219MB used, 5681MB available
        Windows Dir: C:\Windows
     DirectX Version: DirectX 12
DX Setup Parameters: Not found
     User DPI Setting: 96 DPI (100 percent)
   System DPI Setting: 96 DPI (100 percent)
      DWM DPI Scaling: Disabled
           Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
 DirectX Database Version: 1.0.8
        DxDiag Version: 10.00.19041.0546 64bit Unicode
```

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)



Source: Acer Aspire 3 Laptop Product Testing

83. 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 Acer Aspire 3 Laptop (first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (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:

Aspire 3 Laptop - A317-52-565S	
Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Source: https://www.qualcomm.com/products/qca9377

84. The Accused Products are first wireless devices comprising a memory. For example, the Acer Aspire 3 Laptop includes system memory and the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes memory (for example, Wi-Fi "RAM" and "ROM"), as seen below:

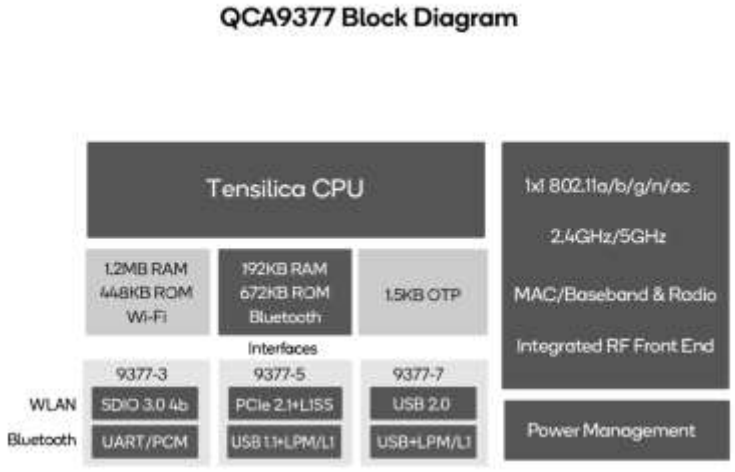
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

85. The Accused Products are first wireless devices comprising at least one processor coupled to the wireless radio circuit and the memory. For example, the Acer Aspire 3 Laptop includes the Intel Core i5-1035G1 processor and system memory, as well as the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes memory (for example, Wi-Fi "RAM" and "ROM") and at least one processor (for example, "Tensilica CPU") coupled to the wireless radio circuit and the memory, as seen below:

Aspire 3 Laptop - A317-52-565S

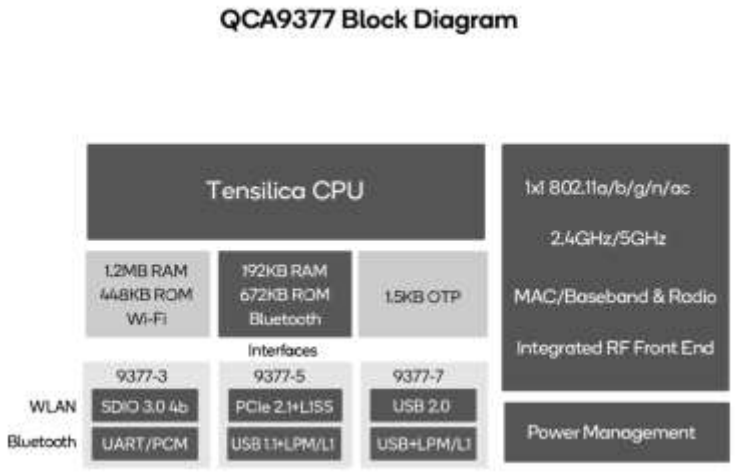
Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

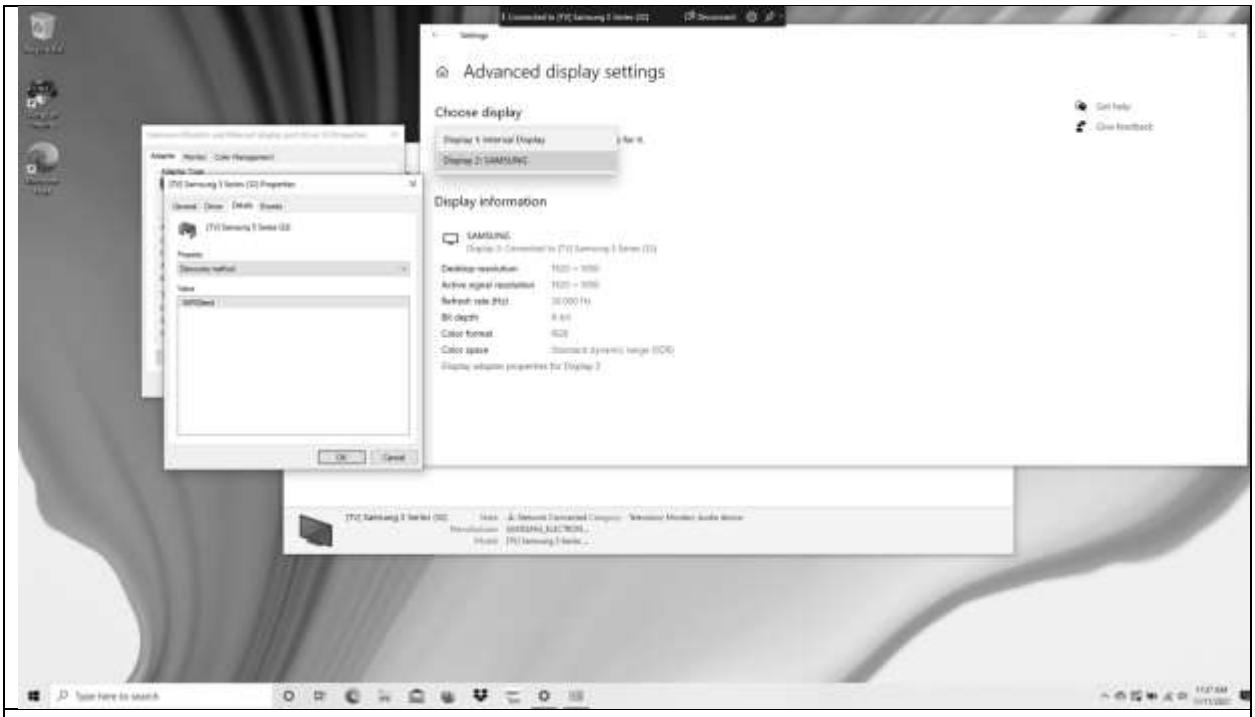
```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

86. 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 Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, discovering a second wireless device, such as a television or other peripheral (including, but not limited to, other Accused Products), using Wi-Fi Direct (a WPAN protocol):



Source: Acer Aspire 3 Laptop Product Testing

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.

3.1.2.2 P2P Device discovering a P2P Device that is in a P2P Group

A searching P2P Device discovers a P2P Group Owner in the Scan Phase through received Beacon, DMG Beacon, SSW, or Probe Response frames. The searching P2P Device will also discover other P2P Devices that are associated to that P2P Group Owner from Group Information Advertisement (see Section 3.2.4) or, when operating within DMG, through a STA Availability element or Information Response frame (see Section 11.30.1 of IEEE 802.11-REVmc [11]).

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.1.1 & 3.1.2.2

87. The Accused Products are first wireless devices comprising at least one processor configured to associate, via the wireless radio circuit, with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon

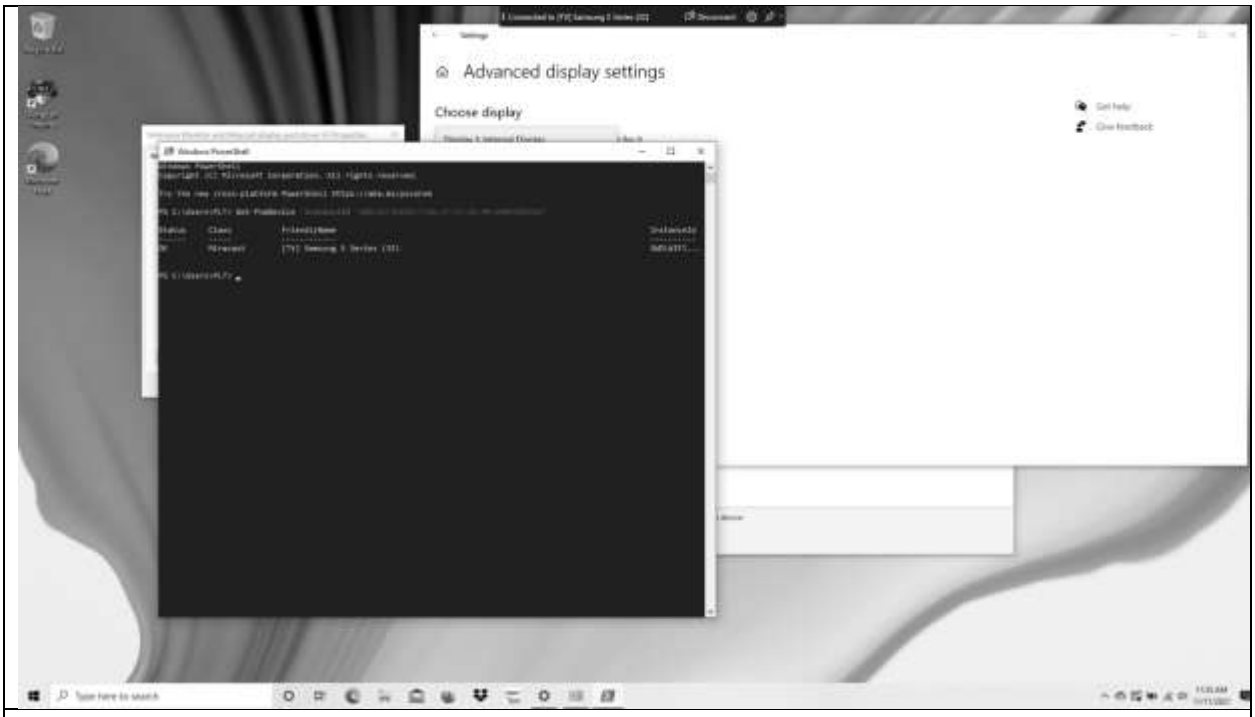
associating, the first wireless device is configured to become a member of a WPAN network. For example, the Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, establishing a Wi-Fi Direct connection (a wireless connection using a WPAN protocol) with a second wireless device, such as a television or other peripheral (including, but not limited to, other Accused Products), wherein, upon associating, the Acer Aspire 3 Laptop and the second wireless device are members of the Wi-Fi Direct network (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.

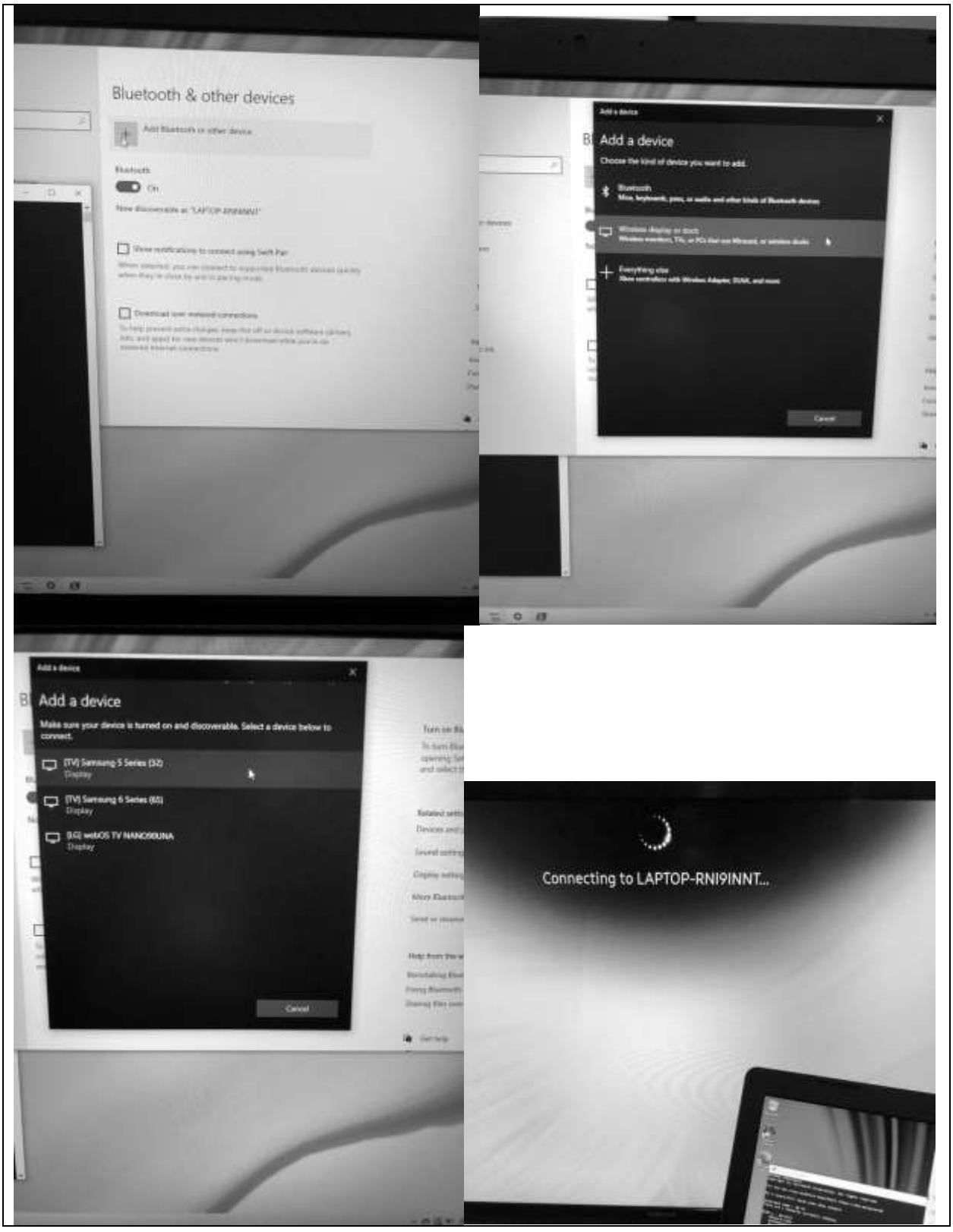
When a P2P Client associates with a P2P Group Owner, it provides its Device Name, Primary Device Type, and optionally Secondary Device Type List information to the P2P Group Owner by including the P2P Device Info attribute (see Section 4.1.15) and the P2P Capability attribute (see Section 4.1.4) in the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

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



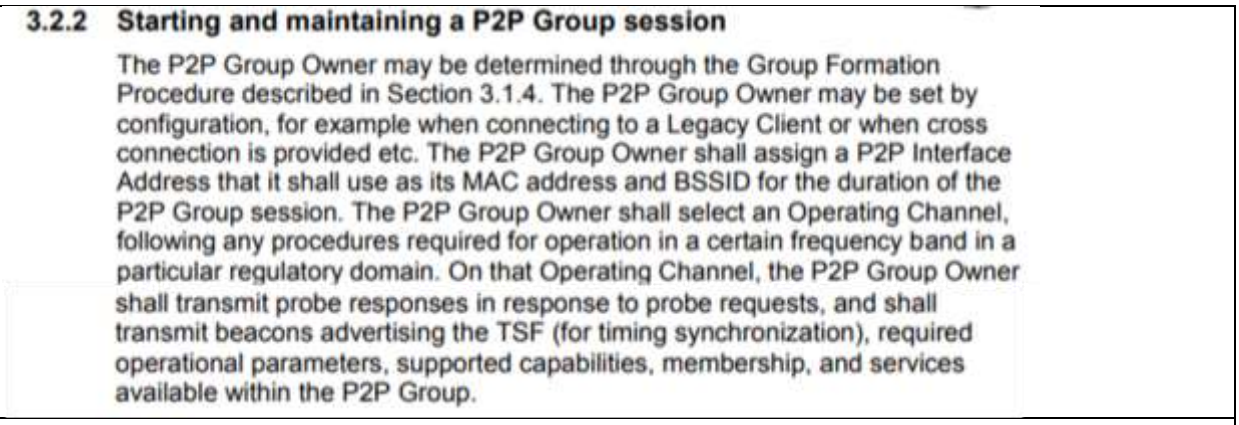
Source: Acer Aspire 3 Laptop Product Testing


Network Status
No network info found.
Network Settings


Bluetooth & other devices
Add a device
Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

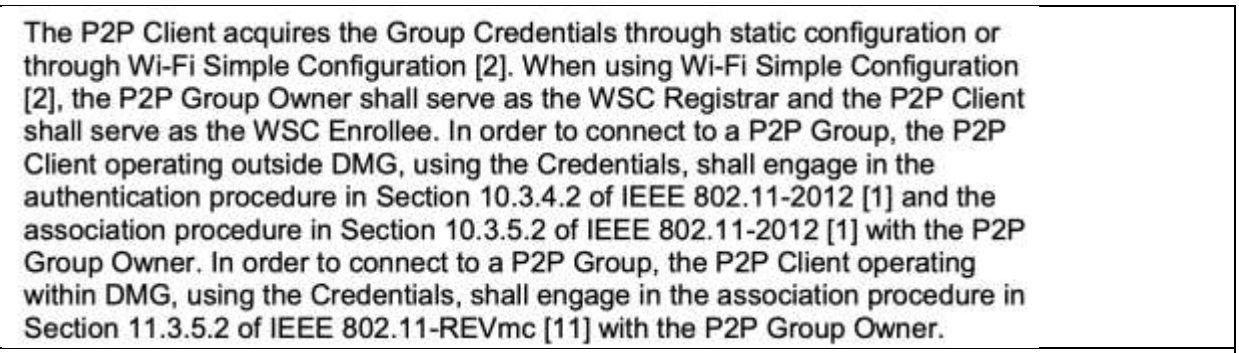
88. The Accused Products are first wireless devices comprising at least one processor configured to maintain, via the wireless radio circuit, the association with the second wireless device over the wireless connection using the WPAN protocol. For example, the Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, maintaining the association with the second wireless device, such as a television or other peripheral (including, but not limited to, other Accused Products), in providing connections compliant with the Wi-Fi Direct Standard (a WPAN protocol):



3.2.2 Starting and maintaining a P2P Group session

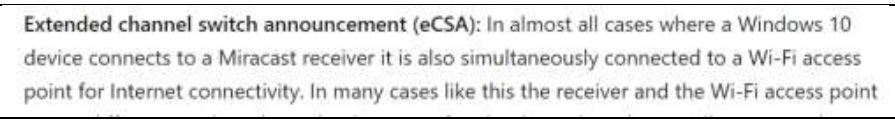
The P2P Group Owner may be determined through the Group Formation Procedure described in Section 3.1.4. The P2P Group Owner may be set by configuration, for example when connecting to a Legacy Client or when cross connection is provided etc. The P2P Group Owner shall assign a P2P Interface Address that 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



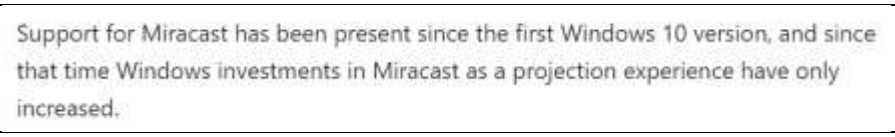
The P2P Client acquires the Group Credentials through static configuration or through Wi-Fi Simple Configuration [2]. When using Wi-Fi Simple Configuration [2], the P2P Group Owner shall serve as the WSC Registrar and the P2P Client shall serve as the WSC Enrollee. In order to connect to a P2P Group, 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



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



Support for Miracast has been present since the first Windows 10 version, and since that time Windows investments in Miracast as a projection experience have only increased.

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

Source: Acer Aspire 3 Laptop Product Testing

89. In the Accused Products, the WPAN protocol is an overlay protocol with respect to the WLAN protocol. For example, Wi-Fi Direct frames are based on 802.11x frames and use the vendor specific field of an 802.11x management frame:

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.

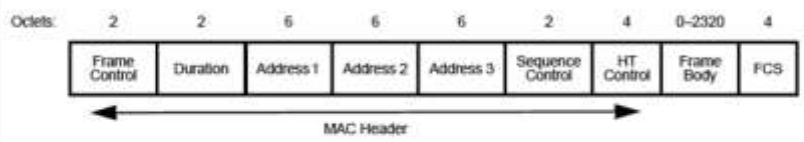


Figure 8-34—Management frame format

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.

8.5.6 Vendor-specific action details

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

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

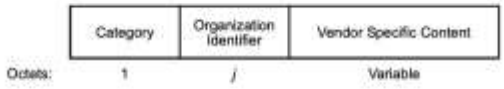


Figure 8-437—Vendor Specific Action frame Action field format

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

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, Sections 8.3.3.1 & 8.5.6

90. In the Accused Products, the WPAN protocol is an overlay protocol with respect to the WLAN protocol, such that the WPAN protocol uses a WLAN protocol frame adapted to support a WPAN protocol power-saving procedure that is different as compared to a power-saving protocol supported by the WLAN 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 (a WLAN protocol frame) to carry information not defined by the IEEE 802.11x Standard so that interoperability operations that are not part of the 802.11x standard can be implemented, 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 a P2P Group Owner (one of the first or second wireless devices corresponding to a WPAN) to take on a role similar to that of an AP in IEEE 802.11x 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). For example, 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.

* * *

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

91. In the Accused Products, the WPAN protocol is an overlay protocol that is partially compliant with respect to the WLAN protocol. For example, the Wi-Fi Direct protocol does not fully comply with the 802.11x protocol as set out below:

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

92. 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 Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor), including a wireless radio circuit that operates in both the 2.4 and 5 GHz frequency bands:

Aspire 3 Laptop - A317-52-565S	
Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
PS C:\Users\PLT> netsh wlan show drivers

Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Specifications

Wi-Fi	**Peak Speed:** 433 Mbps
	Standards: 802.11ac Wave 2, 802.11a/b/g, 802.11n
	Wi-Fi Spectral Bands: 2.4 GHz, 5 GHz
	Wi-Fi Features: MU-MIMO
	Channel Utilization: 20/40/80 MHz
	MIMO Configuration: 1x1 (1-stream)

Source: https://www.qualcomm.com/products/qca9377

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

93. 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 802.11x Standard 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 attributes used in this manner may, for example, enable a power-saving protocol that allows the P2P Group Owner (the second 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 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 communicatipn 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

94. 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). For example, per IEEE 802.11x, management frames are used by stations (STAs) to join and leave a Basic Service Set (BSS). By adapting a WLAN protocol management frame to specify, for example, 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

95. 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 second 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 first 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. According to the Wi-Fi Direct

Standard, for example, 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.

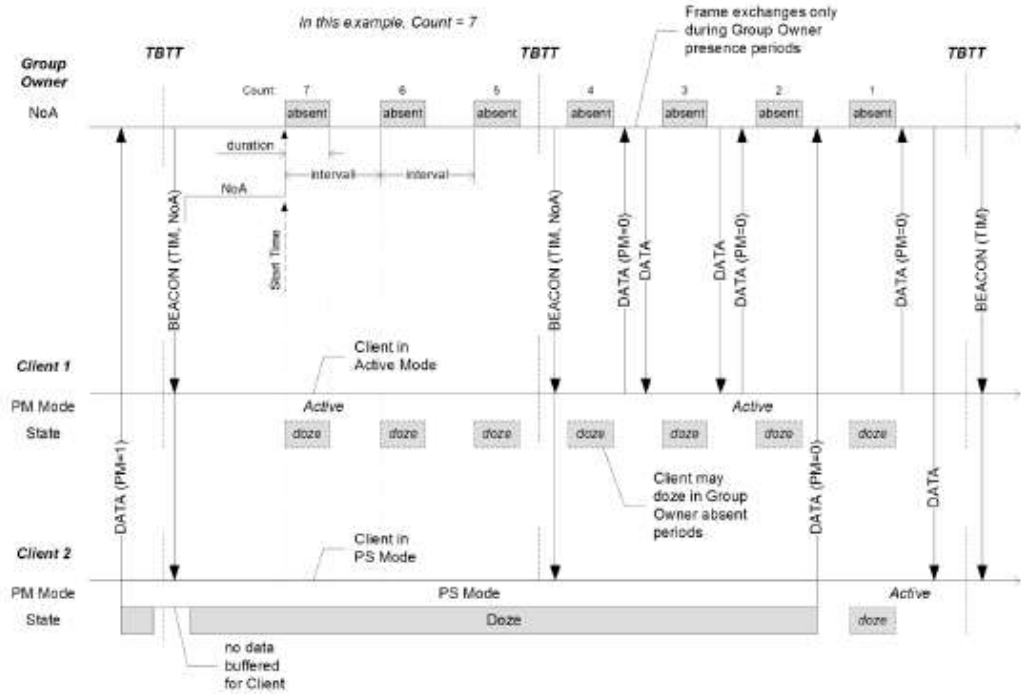


Figure 15—P2P Group Owner Notice of Absence

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

* * *

3.3.4.4 Signaling of Client service requirements

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

96. 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.

3.3.4.4 Signaling of Client service requirements

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.

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, 3.3.4.4, 4.2.10.2 & 4.2.10.3

97. In the Accused Products, the first wireless device is configured to disable data exchanges with the second wireless device via the wireless connection following a start of the inactivity time, wherein the disabling is such that less power per unit time is consumed by the wireless radio circuit relative to a power per unit time consumed by the wireless radio circuit when the data exchanges are not disabled, such as can be seen in the following:

3.3.4.1 P2P Client operation with P2P Group Owner Power Management

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

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

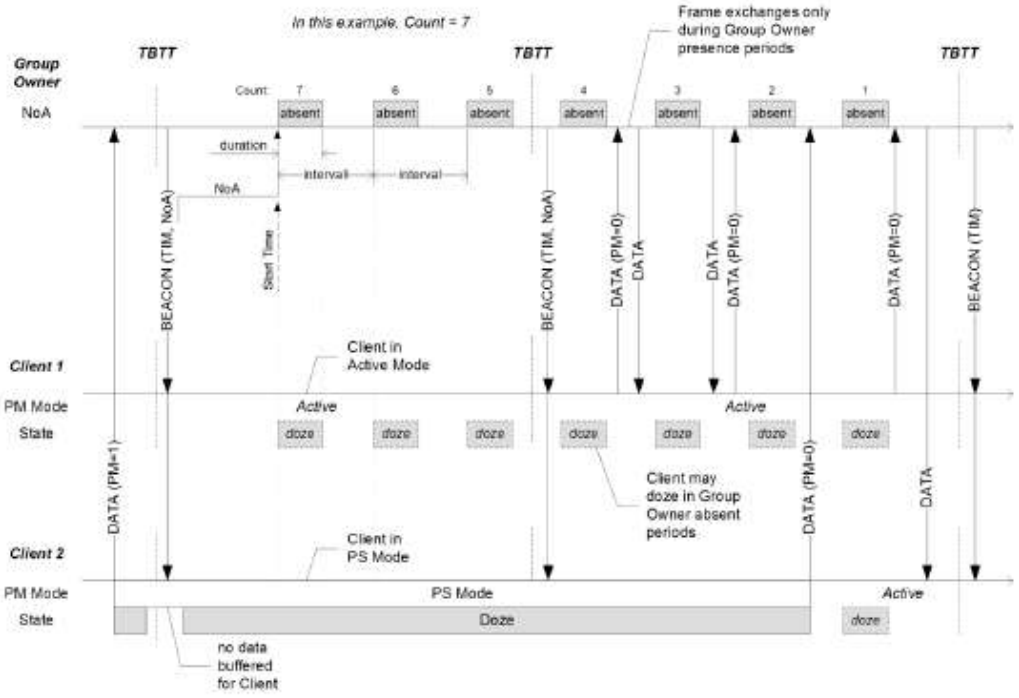


Figure 15—P2P Group Owner Notice of Absence

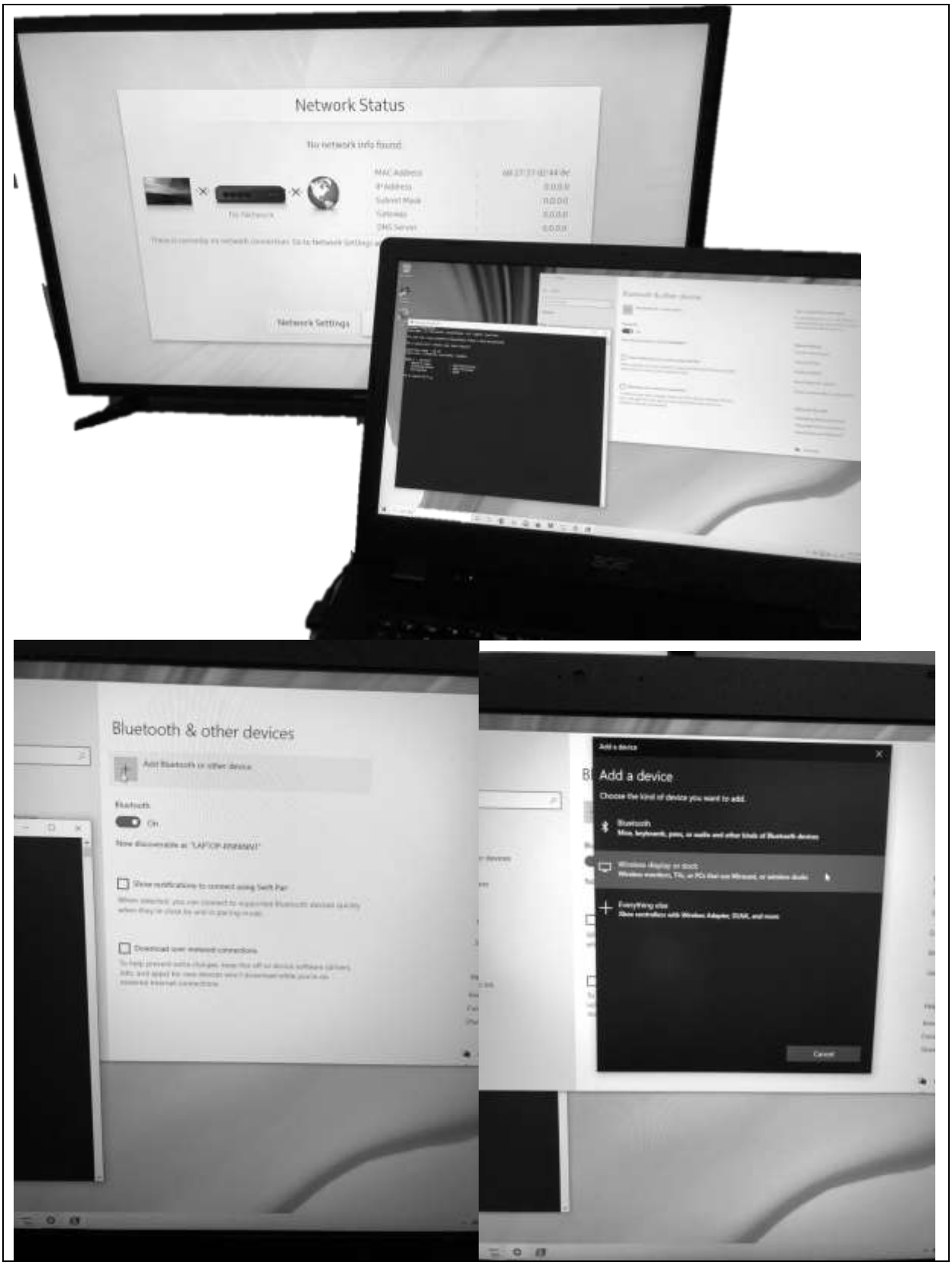
Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.4.1 & Figure 15

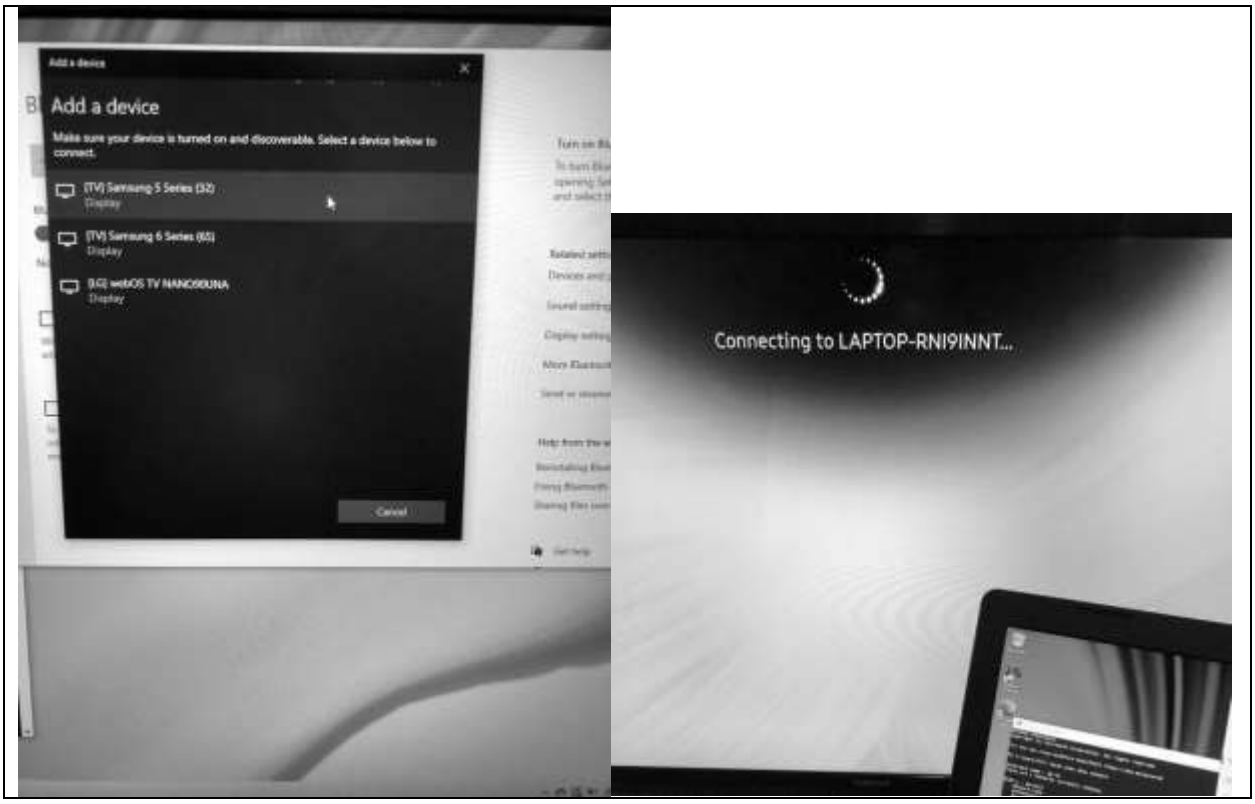
98. As set forth above, Acer has directly infringed at least claim 4 of the '906 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

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

100. Acer 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 Acer intends, the IEEE 802.11x/Wi-Fi Direct functionality. For example, Acer provides user / operating instructions (including at least user interface prompts) and the like for the Accused Products, including the citations above:


Network Status
No network info found.
Network Settings
Bluetooth & other devices
Add a device
Choose the kind of device you want to add.
Bluetooth
Cancel


Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
[TV] Samsung 5 Series (32)
Display
[TV] Samsung 6 Series (65)
Display
(LG) webOS TV NANO90UNA
Display
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

101. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11x/Wi-Fi Direct features described above, Acer has induced its customers to infringe the '906 patent. Acer's customers who use the Accused Products as described above directly infringe the '906 patent. Acer has had knowledge, or was willfully blind of the '906 patent since at least as early as April 2, 2020, or alternatively, not later than November 24, 2020, as a result of the following communications between Ozmo and Acer. Specifically, on April 2, 2020, Christian Dubuc, Chief Executive Officer of Ozmo Licensing, wrote to Peggy Yo, Legal Supervisor of Acer, regarding the Acer Accused Products and Ozmo Licensing's patent portfolio, including Ozmo Licensing's position that Acer requires a license. After numerous communications between Ozmo Licensing and Acer, on November 24, 2020, Acer requested, and Ozmo Licensing provided, a document containing a then-current listing of patents belonging to the Ozmo Licensing portfolio, including U.S. Patent Application No. 16/912,262. Subsequently, on December 22, 2020, Ozmo Licensing followed up with Acer via email providing more specificity regarding Application No. 16/912,262, which issued on that date as the '906 patent, and offering to provide claim charts mapping the claims of such issued patent to the Accused Products, as well as indicating that additional patents were expected and forthcoming. Therefore, Acer has had actual and express knowledge of the '906 patent and Ozmo Licensing's infringement allegations since April 2, 2020, or alternatively, at the latest, November 24, 2020, and additionally, by the service upon it of this Complaint. Acer also induces such infringement by failing to remove the infringing features from the Accused Products.

102. By offering for sale, selling, commercially distributing and importing the Accused Products, Acer has also contributed to its customers' infringement of the '906 patent. The Accused Products are used by Acer's customers to practice the inventions claimed in the '906 patent. The

IEEE 802.11x/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the '906 patent. Acer 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 Acer solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. Acer 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 Acer, since no later than November 24, 2020, via Ozmo Licensing's letters, emails and presentations detailed above that its customers were infringing the '906 patent.

103. By the time of trial, Acer 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 4 of the '906 patent.

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

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

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

106. Paragraphs 1-105 are incorporated by reference as if fully set forth herein.

107. 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 a WPAN into a WLAN infrastructure.

108. 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.

109. 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 WPAN protocol impinge on at least some antennae used for communications using the first network WLAN protocol.

110. Compared to the prior art, the claimed 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.

111. Compared to the prior art, the claimed apparatus 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 a network-enabled hub, which may be adapted to establish communication via an AP coupled to the Internet. This allows remote monitoring and control of a WPAN device such as a home security system, or an implanted or wearable medical device, over the Internet.

112. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more energy efficient, which can extend the battery life of WPAN devices that are battery powered or otherwise enable power-hungry WPAN devices to more readily enter power-save modes.

113. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN, also enables lower latency communication involving WPAN devices, which enables a device serving as a hub between a WPAN and a WLAN to more effectively forward video streams between the two.

114. Acer 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 and projectors (i.e., the "Accused Products"). Wi-Fi protocols allow such devices to act as a hub to receive, for example, video from an IEEE 802.11x access point and to forward such video to a second device using Wi-Fi Direct.

115. Examples of the Accused Products are Acer's and/or Miracast enabled laptop computers (including, but not limited to, ConceptD Laptops, Enduro Laptops, Nitro Gaming Laptops, Predator Gaming Laptops, Swift Laptops, Spin Laptops, and Aspire Laptops); desktop computers (including, but not limited to, ConceptD Desktops, Aspire TC Desktops, Veriton Desktops, Nitro Desktops, and Predator Orion Desktops); tablets (including, but not limited to, Enduro tables); projectors (including, but not limited to, the Acer H6535i projector), and all other Acer products that include Wi-Fi Direct and/or Miracast functionality.

116. For the avoidance of doubt, all of Acer'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.

117. 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.

118. The Accused Products were designed by Acer 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:

Source: https://www.wi-fi.org/discover-wi-fi/miracast

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.

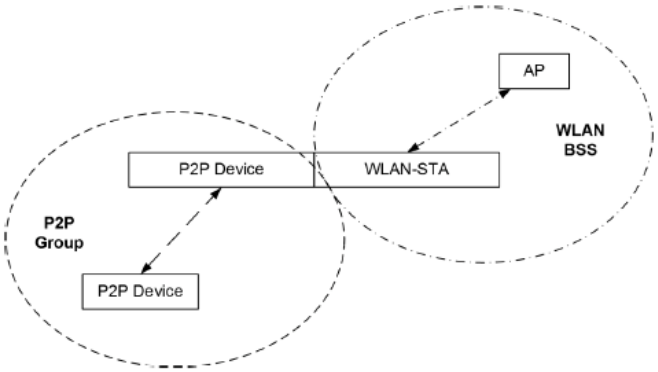
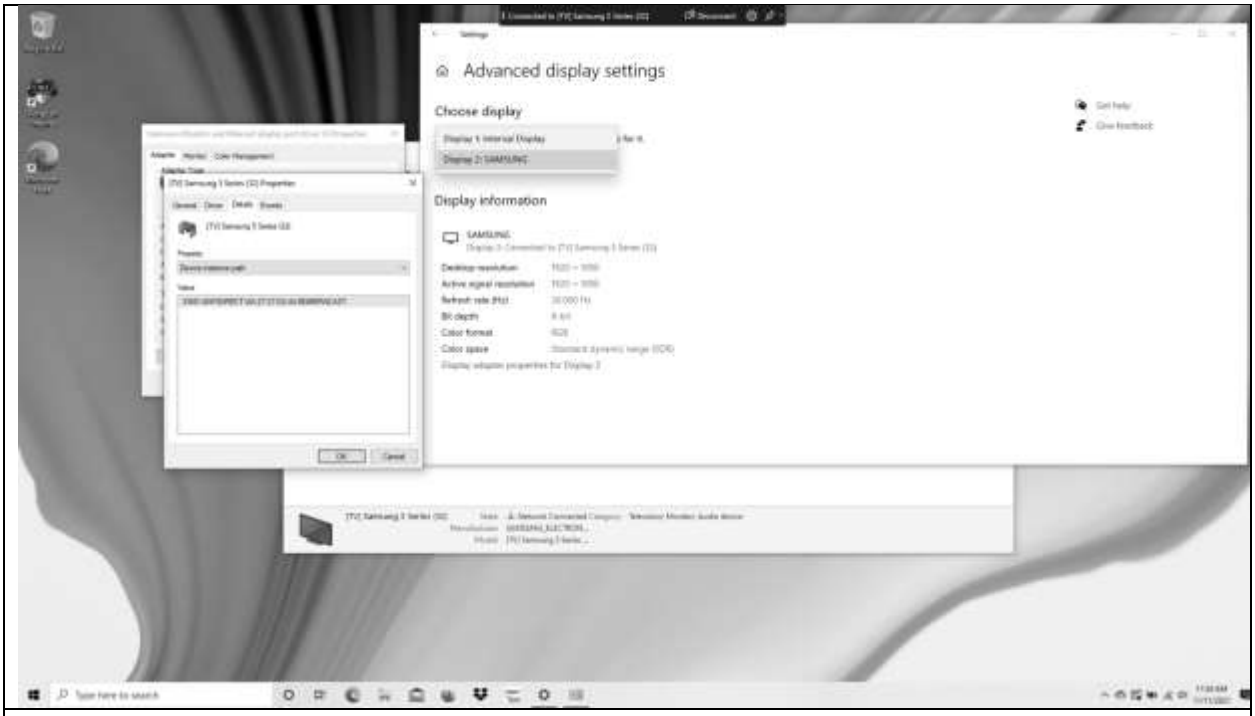


Figure 4—P2P Concurrent device

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



Source: Acer Aspire 3 Laptop Product Testing

119. For example, the Aspire 3 Laptop is an Accused Product (a network-enabled hub) designed and manufactured by Acer 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 considered to provide "Screen Mirroring" functionality, is based on operating Wi-Fi Direct connections between devices, as can be seen below:

Standards-based Miracast advances life without wires

Miracast is an industry-wide solution, allowing technology to work across device types and vendors. Connections are easy to set up and use since Miracast devices choose the appropriate settings automatically. Miracast can connect two devices using network infrastructure or **Wi-Fi Direct®**. When content to be shared is stored on a Miracast-certified device, such as a smartphone to an automobile infotainment display, a Wi-Fi network connection is not required.

Only devices marked Wi-Fi CERTIFIED Miracast have been certified by Wi-Fi Alliance® to work well with other Wi-Fi CERTIFIED™ devices, employ the latest security protections, and deliver a high-quality user experience.

Source: https://www.wi-fi.org/discover-wi-fi/miracast

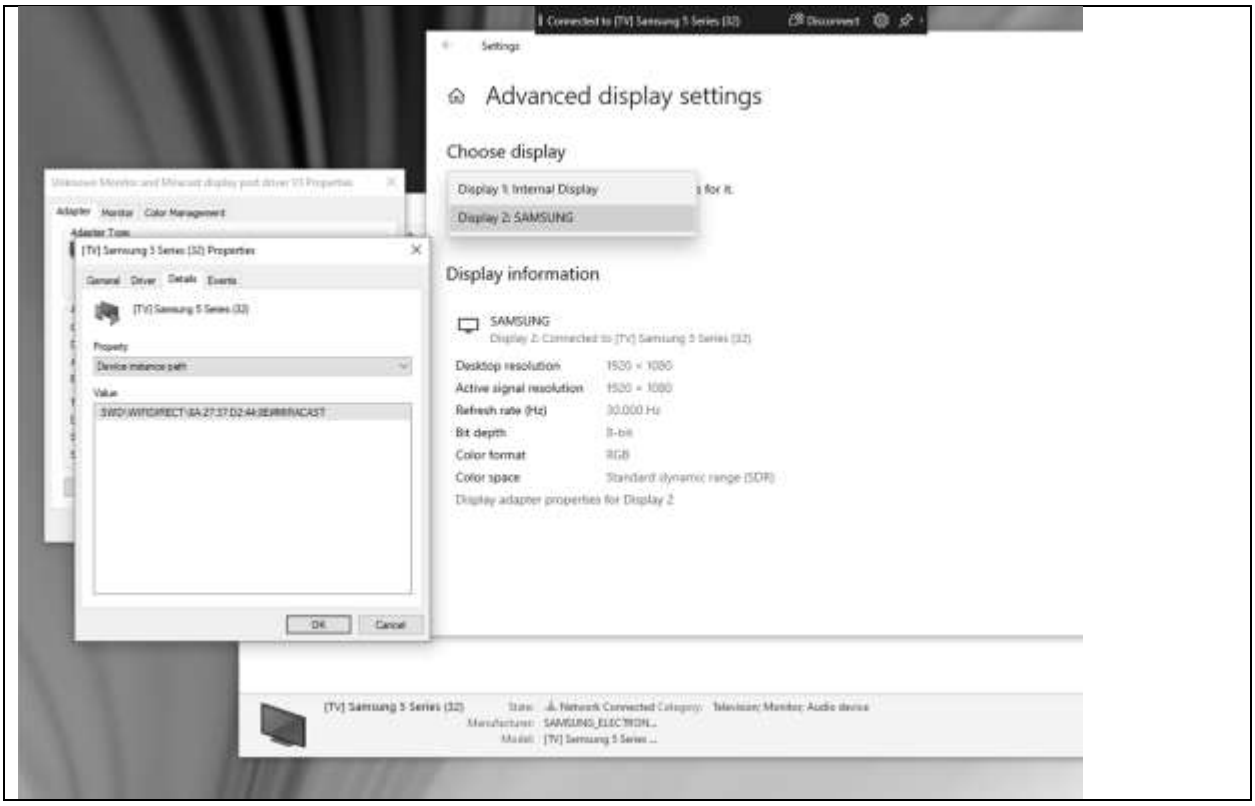
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

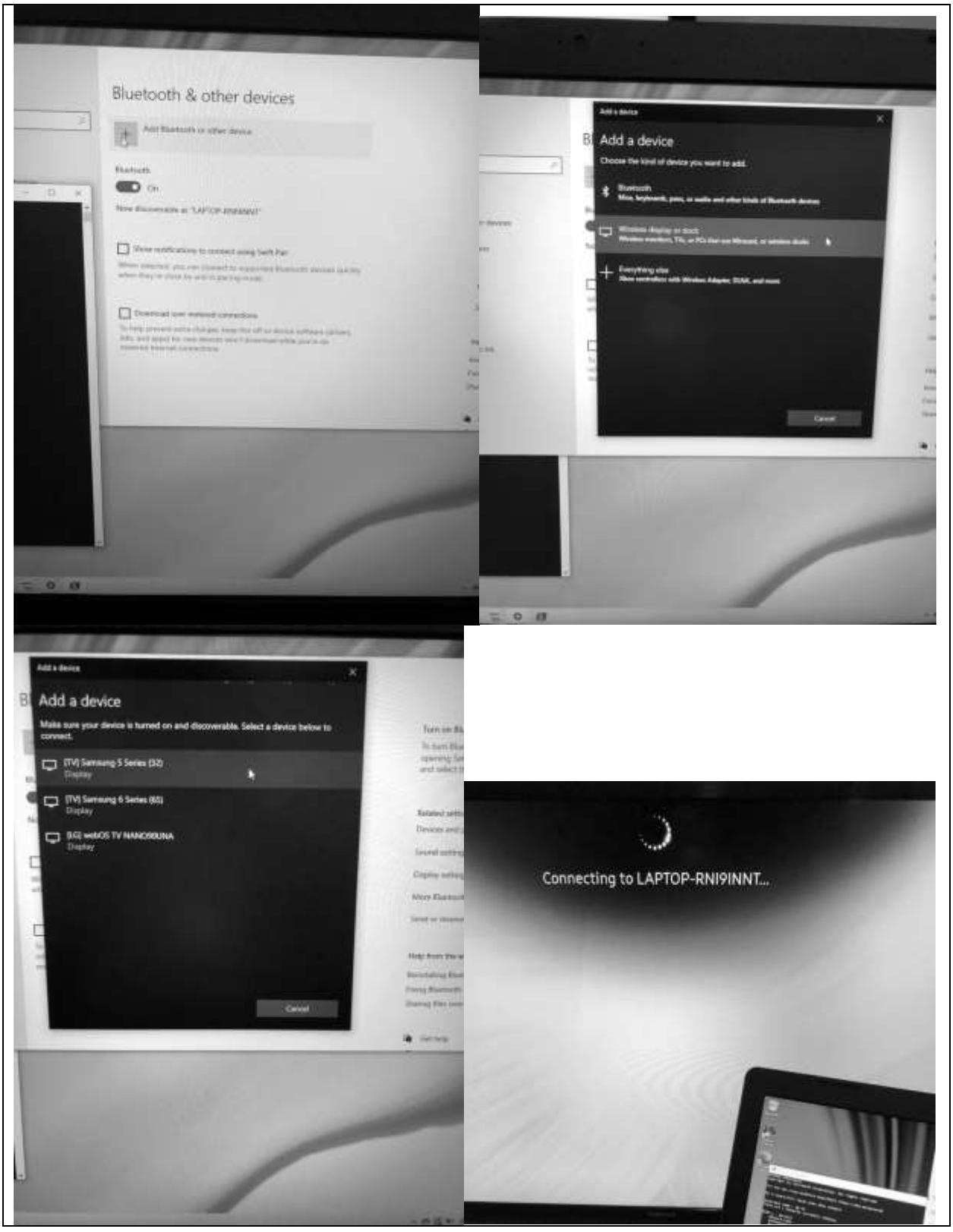
Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406) Language: English (Regional Setting: English) System Manufacturer: Acer System Model: Aspire A317-52 BIOS: V1.18 (type: UEFI) Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz Memory: 8192MB RAM Available OS Memory: 7982MB RAM Page File: 4219MB used, 5681MB available Windows Dir: C:\Windows DirectX Version: DirectX 12 DX Setup Parameters: Not found User DPI Setting: 96 DPI (100 percent) System DPI Setting: 96 DPI (100 percent) DWM DPI Scaling: Disabled Miracast: Available, with HDCP Microsoft Graphics Hybrid: Not Supported DirectX Database Version: 1.0.8 DxDiag Version: 10.00.19041.0546 64bit Unicode
Source: Acer Aspire 3 Laptop Product Testing (DxDiag)

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


Settings
Advanced display settings
Choose display
Display 1: Internal Display
Display 2: SAMSUNG
Display information
SAMSUNG
Desktop resolution
Active signal resolution
Refresh rate (Hz)
Bit depth
Color format
Color space
Display adapter properties for Display 2
[TV] Samsung 5 Series (32) Properties
General
Driver
Details
Events
Property
Value
OK
Cancel


Network Status
No network info found.
Network Settings


Bluetooth & other devices
Add a device
Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

120. 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 Aspire 3 Laptop, designed and manufactured by Acer, includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (wireless radio circuit that can send and receive data wirelessly), which includes Wi-Fi and Bluetooth functionality (bi-directional wireless data communications). The Aspire 3 Laptop can serve as the claimed hub when, for example, a video is streamed from the Internet to the Aspire 3 Laptop, and Miracast / Wi-Fi Direct are used to mirror the Internet-video to a second device, such as a wireless display:

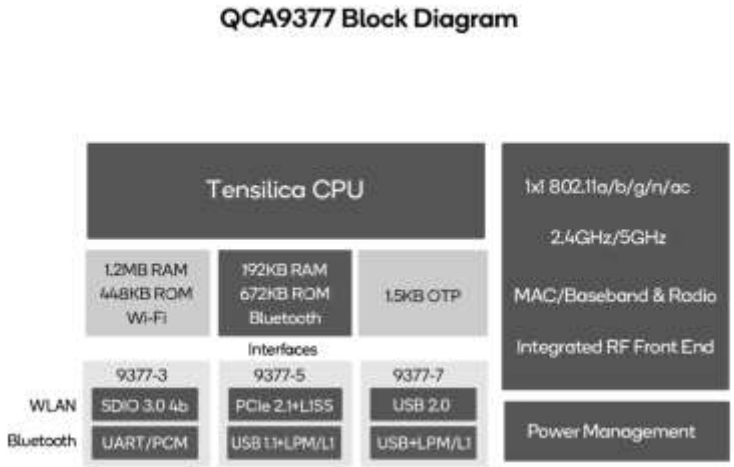
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                     : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                     : Qualcomm Atheros Communications Inc.
    Provider                   : Qualcomm Atheros Communications Inc.
    Date                       : 12/25/2019
    Version                    : 12.0.0.929
    INF file                   : oem12.inf
    Type                       : Native Wi-Fi Driver
    Radio types supported      : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

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

Source: Acer Aspire 3 Laptop Product Testing

121. The Accused Products include a processor with logic. For example, the Aspire 3 Laptop includes the Intel Core i5-1035G1 system processor, as well as the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes a processor (for example, "Tensilica CPU," as shown below):

Aspire 3 Laptop - A317-52-565S

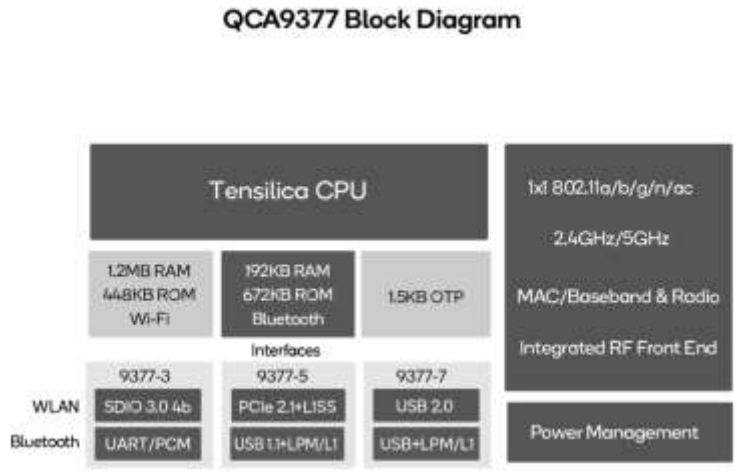
Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

122. The Accused Products include logic for processing data received via the wireless radio circuit. For example, the Aspire 3 Laptop includes the Intel Core i5-1035G1 system processor, as well as the Tensilica CPU, which receives and processes data from the wireless radio circuit:

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

123. The Accused Products include logic for generating data to be transmitted by the wireless radio circuit. For example, the Aspire 3 Laptop includes the Intel Core i5-1035G1 system processor, as well as the Tensilica CPU, which generates data to be transmitted by the wireless radio circuit:

Aspire 3 Laptop - A317-52-565S

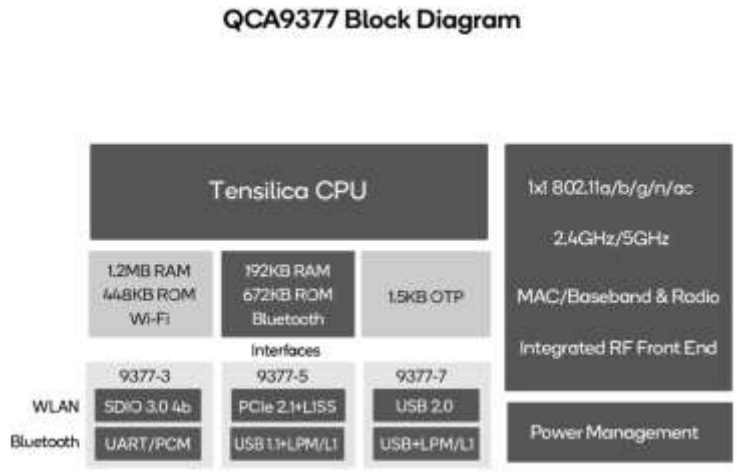
Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



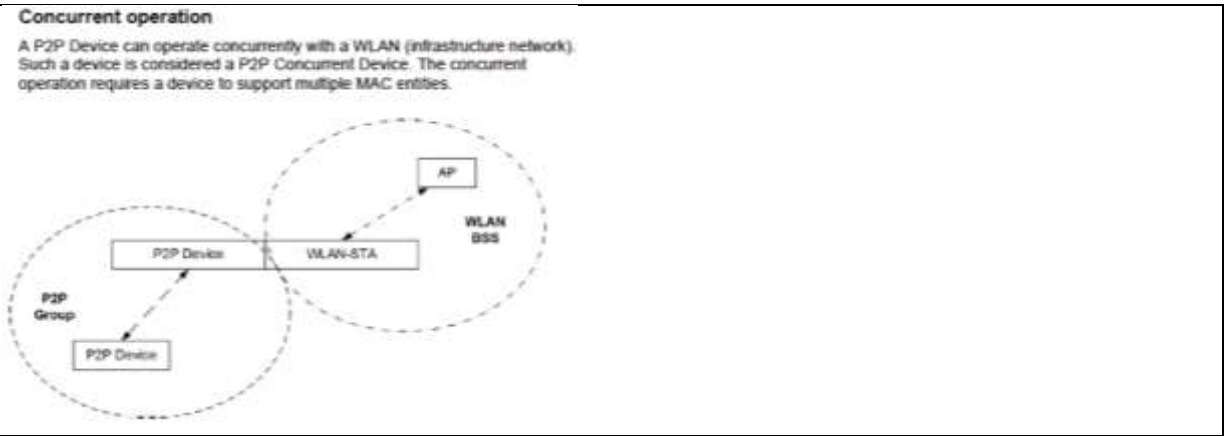
Source: https://www.qualcomm.com/products/qca9377

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

124. 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 Aspire 3 Laptop (network-enabled hub) may initiate and maintain a connection (network connection) with an AP, or devices accessible over the Internet via the AP:



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

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

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

```
      Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
            Language: English (Regional Setting: English)
  System Manufacturer: Acer
       System Model: Aspire A317-52
             BIOS: V1.18 (type: UEFI)
        Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
          Memory: 8192MB RAM
Available OS Memory: 7982MB RAM
         Page File: 4219MB used, 5681MB available
       Windows Dir: C:\Windows
    DirectX Version: DirectX 12
DX Setup Parameters: Not found
     User DPI Setting: 96 DPI (100 percent)
   System DPI Setting: 96 DPI (100 percent)
      DWM DPI Scaling: Disabled
           Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
DirectX Database Version: 1.0.8
      DxDiag Version: 10.00.19041.0546 64bit Unicode
```

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)

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.

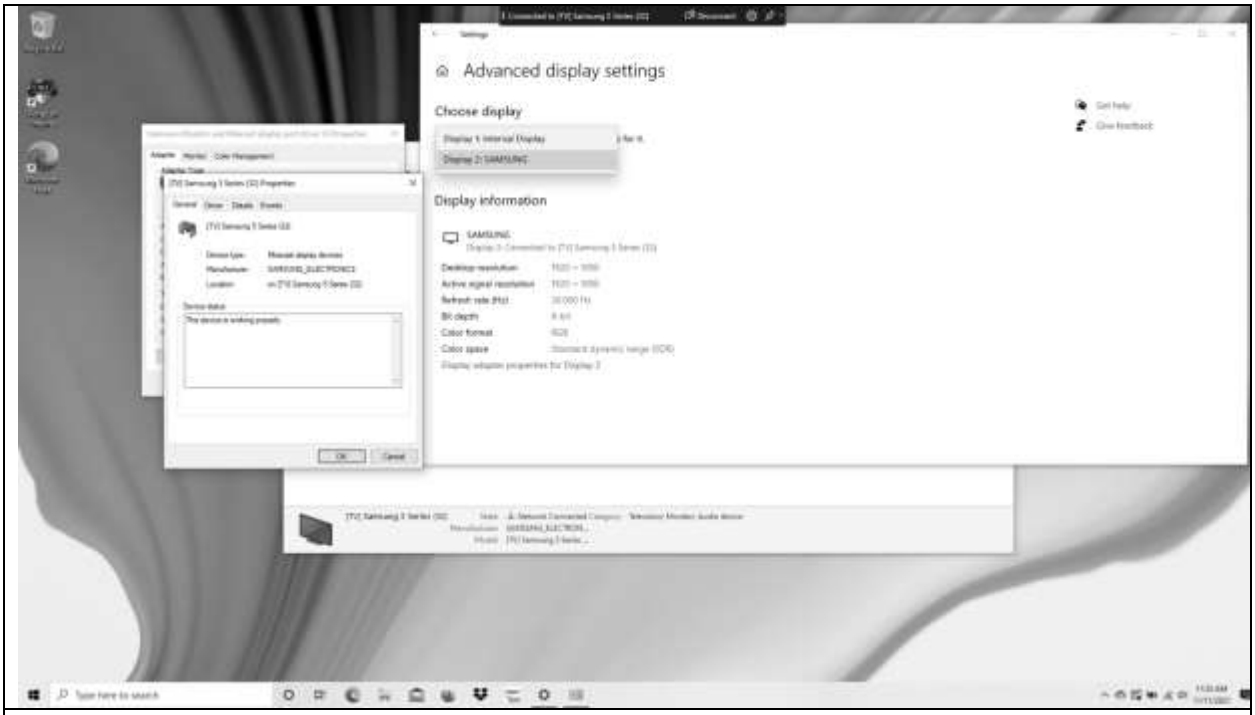
3.2.7 Disconnecting from a P2P Group

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.



Source: Acer Aspire 3 Laptop Product Testing

125. 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 Aspire 3 Laptop connects to an access point via 802.11x Wi-Fi (first wireless network connection using a first wireless network protocol) and to a 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:

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/

Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
Language: English (Regional Setting: English)
System Manufacturer: Acer
System Model: Aspire A317-52
BIOS: V1.18 (type: UEFI)
Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
Memory: 8192MB RAM
Available OS Memory: 7982MB RAM
Page File: 4219MB used, 5681MB available
Windows Dir: C:\Windows
DirectX Version: DirectX 12
DX Setup Parameters: Not found
User DPI Setting: 96 DPI (100 percent)
System DPI Setting: 96 DPI (100 percent)
DWM DPI Scaling: Disabled
Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
DirectX Database Version: 1.0.8
DxDiag Version: 10.00.19041.0546 64bit Unicode

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)

Figure 2. Wi-Fi Direct Concurrent Mode

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

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.

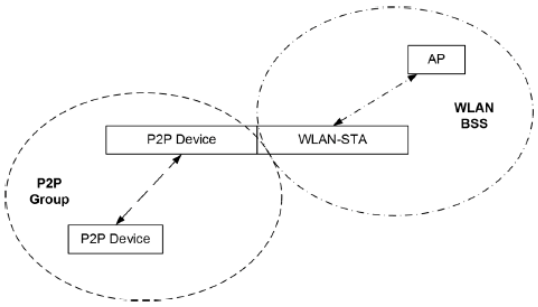
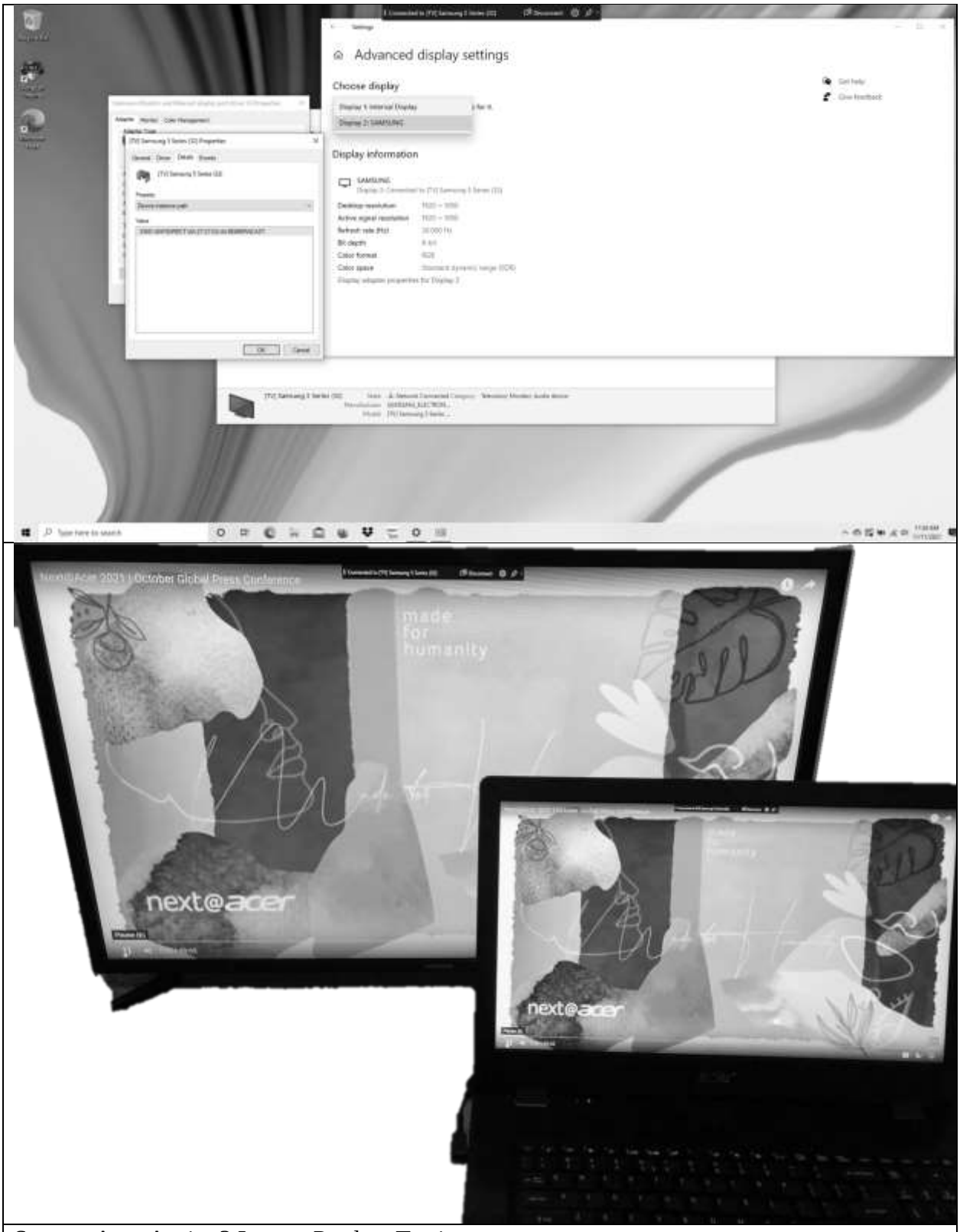


Figure 4—P2P Concurrent device

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



Source: Acer Aspire 3 Laptop Product Testing

126. In further detail, the Accused Products maintain at least a first wireless network connection using a first wireless network protocol. For example, the Aspire 3 Laptop maintains the first network connection with an AP in providing connections compliant with IEEE 802.11x:

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.

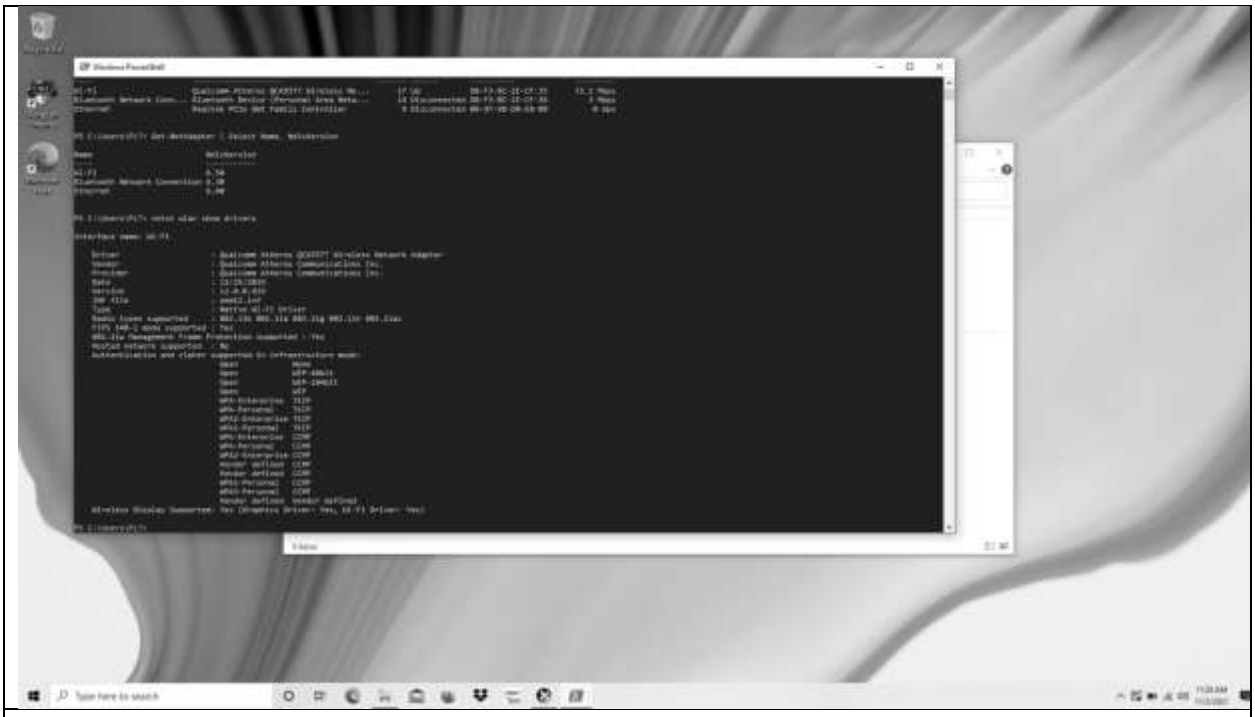
The states used in this description are defined in 10.3.1.

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



Source: Acer Aspire 3 Laptop Product Testing

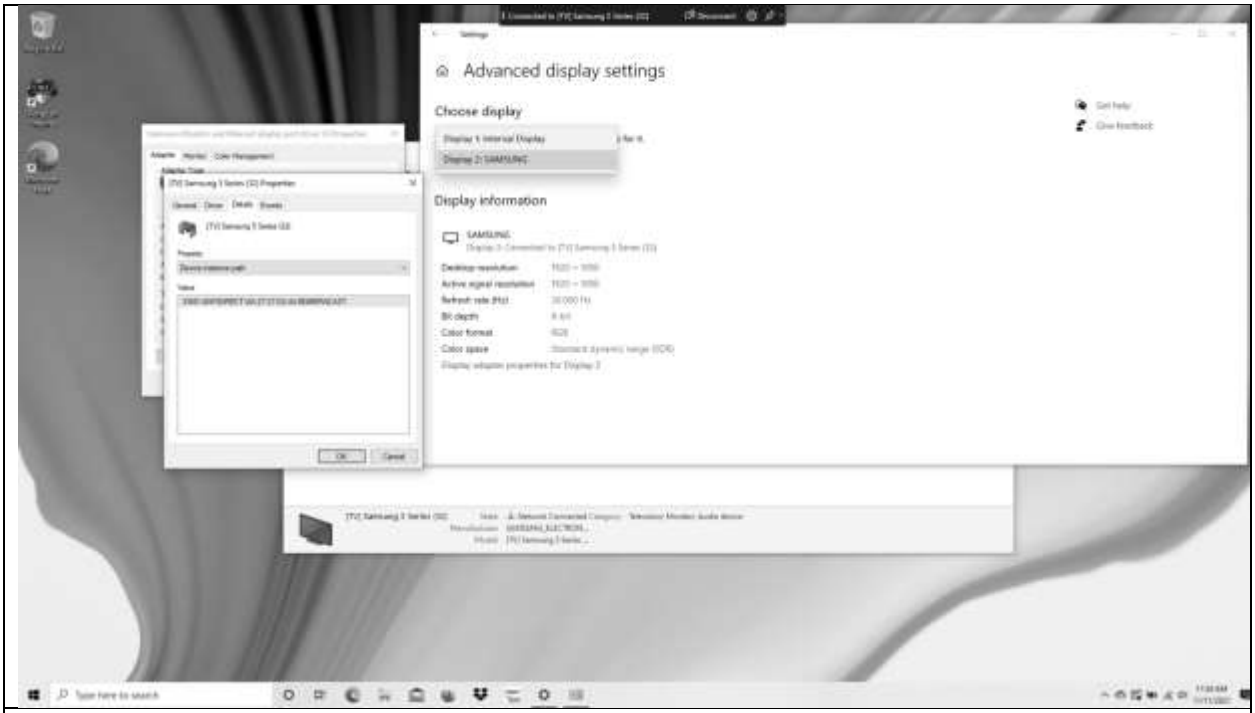
127. In further detail, the Accused Products maintain a second wireless network connection using a second wireless network protocol. For example, the Aspire 3 Laptop maintains the second connection with a second wireless device in providing connections compliant with the Wi-Fi Direct Standard:

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



Source: Acer Aspire 3 Laptop Product Testing

128. 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 Aspire 3 Laptop 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 via concurrent operation, as explained herein and in the Wi-Fi Direct Standard:

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

129. 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 (802.11x management frames with a P2P IE) are based on 802.11x frames. For example, some Wi-Fi Direct frames are created by placing P2P attributes inside the vendor specific field of an 802.11x management frame. The Wi-Fi Direct protocol, for example, specifies power management behaviors over a Wi-Fi Direct connection using Notice of Absence and CTWindow P2P attributes that are placed inside the vendor specific field of an 802.11x management frame and that help implement the Wi-Fi Direct Notice of Absence and Opportunistic Power Save

procedures. Network-enabled hub nodes following the Wi-Fi Direct protocol, for example, can interoperate with WLAN nodes using frames and procedures defined in the 802.11x standard, while supporting Wi-Fi Direct Notice of Absence and Opportunistic Power Save procedures using the data in the vendor specific field of an 802.11x 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.

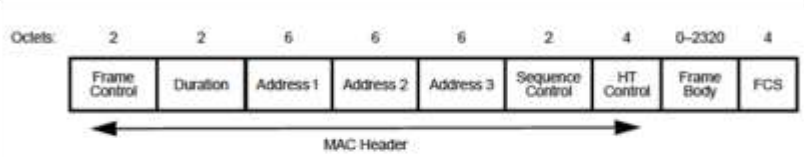


Figure 8-34—Management frame format

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 3.3.1, 3.3.3.2, 3.3.2 & 3.3.3.1

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

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

131. 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 802.11x Wi-Fi. For example, Wi-Fi Direct (second wireless network protocol) calls for modifications to the 802.11x responses (first wireless 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

132. 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 wireless network protocol) uses the same antennae as 802.11x

Wi-Fi (first wireless network protocol). For example, the Aspire 3 Laptop uses Windows 10 Home 64, which includes support for the standard Wi-Fi Direct functionality, and the products use the same antennae for both Wi-Fi Direct and 802.11x Wi-Fi communications.

133. 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 Aspire 3 Laptop (a network-enabled hub) uses Windows 10 Home 64, which includes support for 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 a second device, such as a television screen (destination node in the second (Wi-Fi Direct) network):


Network Status
No network info found.
Network Settings
Add a device
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

Figure 2. Wi-Fi Direct Concurrent Mode

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

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
      Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
            Language: English (Regional Setting: English)
  System Manufacturer: Acer
       System Model: Aspire A317-52
             BIOS: V1.18 (type: UEFI)
         Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
           Memory: 8192MB RAM
Available OS Memory: 7982MB RAM
         Page File: 4219MB used, 5681MB available
       Windows Dir: C:\Windows
    DirectX Version: DirectX 12
DX Setup Parameters: Not found
     User DPI Setting: 96 DPI (100 percent)
   System DPI Setting: 96 DPI (100 percent)
      DWM DPI Scaling: Disabled
          Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
DirectX Database Version: 1.0.8
      DxDiag Version: 10.00.19041.0546 64bit Unicode
```

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)

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

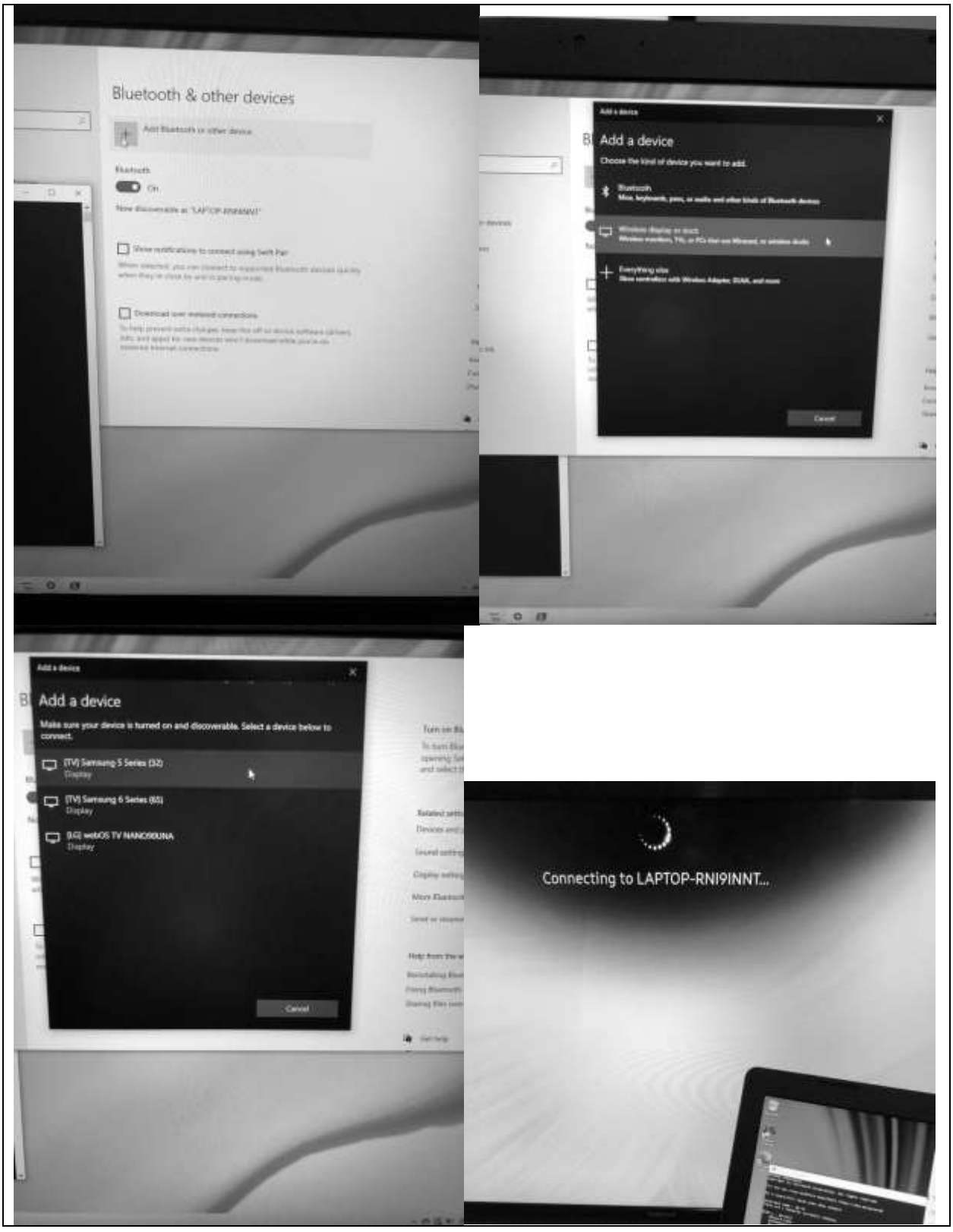
Extended channel switch announcement (eCSA): In almost all cases where a Windows 10 device connects to a Miracast receiver it is also simultaneously connected to a Wi-Fi access point for Internet connectivity. In many cases like this the receiver and the Wi-Fi access point
Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-receiver-manufacturers

134. As set forth above, Acer 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.

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

136. Acer provides instructions (in the form of at least user interface prompts) to its customers, encouraging and directing the customers to use the Accused Products in an infringing manner as described above to implement, as Acer intends, the IEEE 802.11x/Wi-Fi Direct functionality. For further example, Acer provides operating instructions and the like for the Accused Products, including the citations above:


Network Status
No network info found.
Network Settings


Bluetooth & other devices
Add a device
Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

137. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11x/Wi-Fi Direct features described above, Acer has induced its customers to infringe the '814 patent. Acer's customers who use the Accused Products as described above directly infringe the '814 patent. Acer has had knowledge or has been willfully blind of the '814 patent since at least as early as April 2, 2020, as a result of the following communications from Ozmo Licensing to Acer. Specifically, on April 2, 2020, Christian Dubuc, Chief Executive Officer of Ozmo Licensing, wrote to Peggy Yo, Legal Supervisor at Acer, regarding Ozmo Licensing's patent portfolio and the Accused Acer Products, informing Acer that it required a license. Acer responded to Ozmo Licensing's initial letter on April 15, 2020. Subsequently, on April 29, 2020, Ozmo Licensing followed up with Acer via email, providing more specificity (including additional Acer products requiring a license), and indicating an intent to provide illustrative claim charts. On May 14, 2020, Ozmo Licensing provided Acer with detailed claim charts illustrating how the Accused Products infringe each element of exemplary claims of certain patents in Ozmo Licensing's portfolio, including the '991 patent (the child of the '814 patent). After numerous communications between Ozmo Licensing and Acer, on November 24, 2020, Acer requested, and Ozmo Licensing provided, a document containing a then-current listing of patents belonging to the Ozmo Licensing portfolio, including the '814 patent. Acer has therefore had actual and express knowledge of the '814 patent and Ozmo Licensing's infringement allegations since, at the latest, November 24, 2020, and additionally, by service upon Acer of this Complaint. Acer also induces such infringement by failing to remove the infringing features from the Accused Products.

138. By offering for sale, selling, commercially distributing and importing the Accused Products, Acer has also contributed to its customers' infringement of the '814 patent. The Accused Products are used by Acer's customers to practice the inventions claimed in the '814 patent. The

IEEE 802.11x/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the '814 patent. Acer knows or was willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by Acer solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. Acer 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 Acer. Acer has had knowledge since at least as early as April 2, 2020—described above—that its customers were infringing the '814 patent.

139. By the time of trial, Acer 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.

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

141. With knowledge of the allegations set forth herein, Acer continues to incorporate the infringing functionalities in the Accused Products, and has failed to compensate Ozmo Licensing for the use of such features. Acer's unlawful activities described above have continued despite Acer's receipt of the numerous correspondence described above. Acer's infringement will continue unabated unless and until Acer is enjoined or ordered to pay a reasonable royalty for a license to the '814 patent.

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

142. Paragraphs 1-141 are incorporated by reference as if fully set forth herein.

143. 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 a WPAN into a WLAN wherein the WPAN protocol is an overlay protocol that is only partially compliant with the WLAN protocol, and wherein a wireless device can establish and maintain association and synchronization with a WPAN.

144. 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-saving procedures. 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.

145. 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.

146. Compared to the prior art, the claimed apparatus 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.

147. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more beneficial as it allows for remote monitoring and control 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 establish communication via an AP coupled to the Internet. 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 control of a WPAN device such as a home security system, or an implanted or wearable medical device, over the Internet.

148. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more energy efficient, thereby extending the battery life of the devices or otherwise enable power-hungry WPAN devices to more readily enter power-save modes.

149. Compared to the prior art, the claimed apparatus 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.

150. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN also enables lower latency communication involving WPAN devices, which enables a device serving as a hub between a WPAN and a WLAN to more effectively forward video streams between the two.

151. Acer 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, monitors, and peripheral devices that include Wi-Fi Direct and/or Miracast functionality (together, “Accused Products”). The same Accused Products that infringe the ’991,’906, and ’814 patents infringe the ’934 patent, and vice versa.

152. Examples of the Accused Products are Acer’s Wi-Fi enabled laptop computers (including, but not limited to, ConceptD Laptops, Enduro Laptops, Nitro Gaming Laptops, Predator Gaming Laptops, Swift Laptops, Spin Laptops, and Aspire Laptops); desktop computers (including, but not limited to, ConceptD Desktops, Aspire TC Desktops, Veriton Desktops, Nitro Desktops, and Predator Orion Desktops); tablets (including, but not limited to, Enduro tables); projectors (including, but not limited to, the Acer H6535i projector), and all other Acer products that include Wi-Fi Direct and/or Miracast functionality. These products use Wi-Fi Direct in substantially the same way.

153. For the avoidance of doubt, all of Acer’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.

154. Claim 4 of the ’934 patent is reproduced below:

> 4. A first wireless device for connecting to 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 an association and synchronization, via the wireless radio circuit, with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon establishing such association and synchronization, the first wireless device is configured to become a member of the WPAN;
>
> maintain, via the wireless radio circuit, such 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.

155. The Accused Products are first wireless devices for connecting to 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.

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

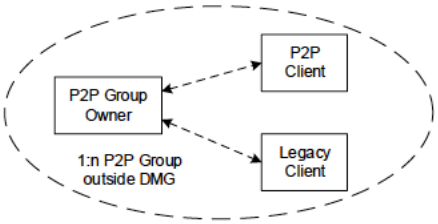
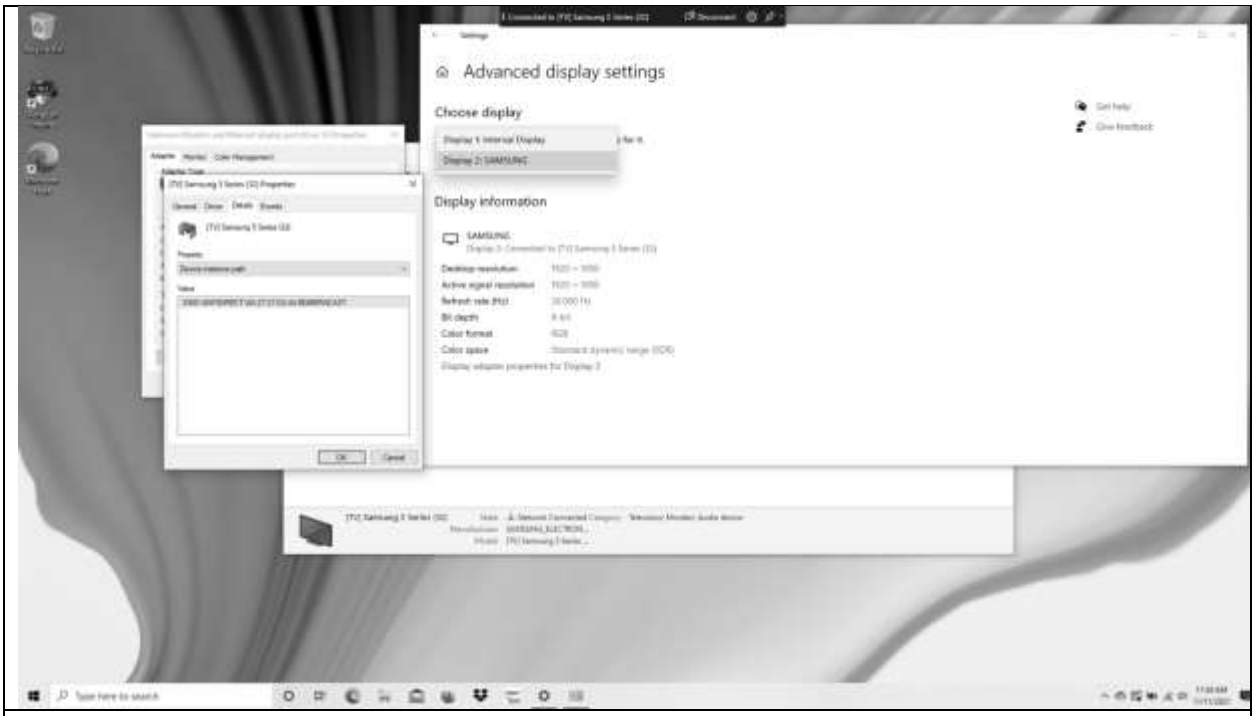


Figure 1—P2P components and topology when operating outside DMG

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



Source: Acer Aspire 3 Laptop Product Testing

156. For example, the Acer Aspire 3 Laptop (a first wireless device), designed and manufactured by Acer, can connect to a Wi-Fi Direct network (a WPAN) via a wireless connection to another device, such as a television or other peripheral (including, but not limited to, other Accused Products) (a second wireless device). The first wireless device is also capable of communications using an 802.11x WLAN protocol:

Standards-based Miracast advances life without wires

Miracast is an industry-wide solution, allowing technology to work across device types and vendors. Connections are easy to set up and use since Miracast devices choose the appropriate settings automatically. Miracast can connect two devices using network infrastructure or **Wi-Fi Direct®**. When content to be shared is stored on a Miracast-certified device, such as a smartphone to an automobile infotainment display, a Wi-Fi network connection is not required.

Only devices marked Wi-Fi CERTIFIED Miracast have been certified by Wi-Fi Alliance® to work well with other Wi-Fi CERTIFIED™ devices, employ the latest security protections, and deliver a high-quality user experience.

Source: https://www.wi-fi.org/discover-wi-fi/miracast

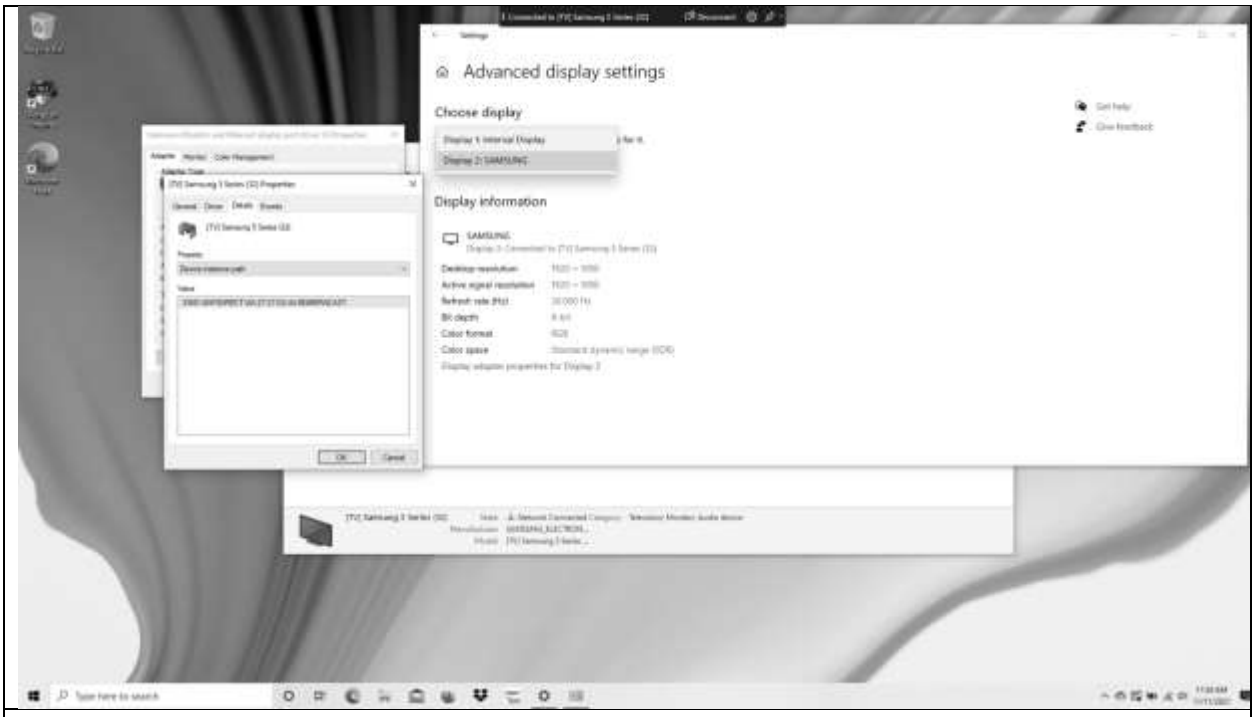
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
      Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
            Language: English (Regional Setting: English)
   System Manufacturer: Acer
         System Model: Aspire A317-52
               BIOS: V1.18 (type: UEFI)
          Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
             Memory: 8192MB RAM
Available OS Memory: 7982MB RAM
          Page File: 4219MB used, 5681MB available
        Windows Dir: C:\Windows
     DirectX Version: DirectX 12
DX Setup Parameters: Not found
   User DPI Setting: 96 DPI (100 percent)
 System DPI Setting: 96 DPI (100 percent)
      DWM DPI Scaling: Disabled
           Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
DirectX Database Version: 1.0.8
       DxDiag Version: 10.00.19041.0546 64bit Unicode
```

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)



Source: Acer Aspire 3 Laptop Product Testing

157. 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 Acer Aspire 3 Laptop (first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (wireless radio circuit configured to communicate over a wireless medium), which includes a wireless radio circuit with 802.11x capabilities (802.11x WLAN protocol), as seen below:

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
PS C:\Users\PLT> netsh wlan show drivers

Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Source: https://www.qualcomm.com/products/qca9377

158. The Accused Products are first wireless devices comprising a memory. For example, the Acer Aspire 3 Laptop includes system memory, and the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes memory (for example, Wi-Fi "RAM" and "ROM"), as seen below:

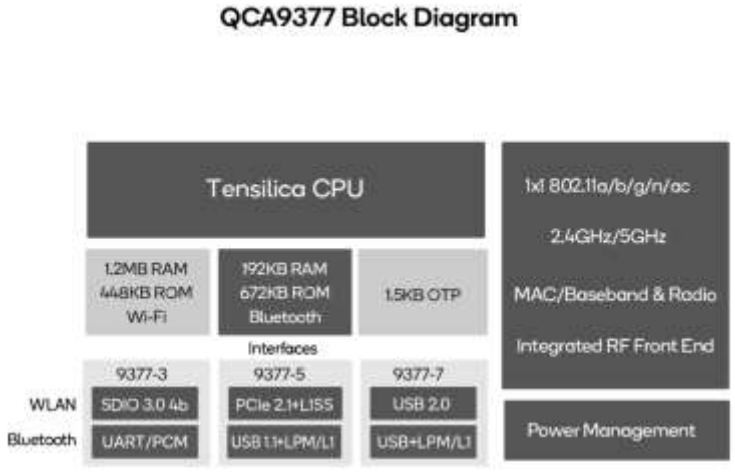
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

159. The Accused Products are first wireless devices comprising at least one processor coupled to the wireless radio circuit and the memory. For example, the Acer Aspire 3 Laptop includes the Intel Core i5-1035G1 processor and system memory, as well as the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes memory (for example, Wi-Fi "RAM" and "ROM") and at least one processor (for example, "Tensilica CPU") coupled to the wireless radio circuit and the memory, as seen below:

Aspire 3 Laptop - A317-52-565S

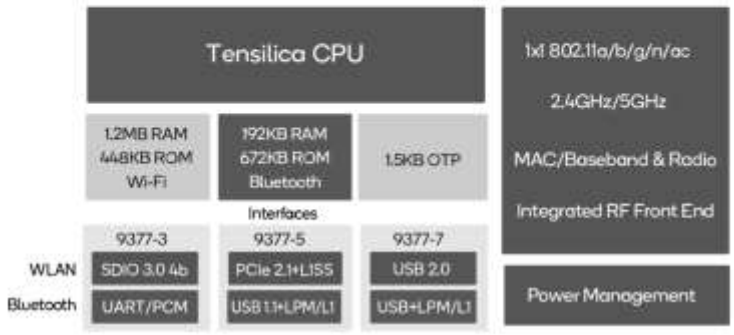
Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

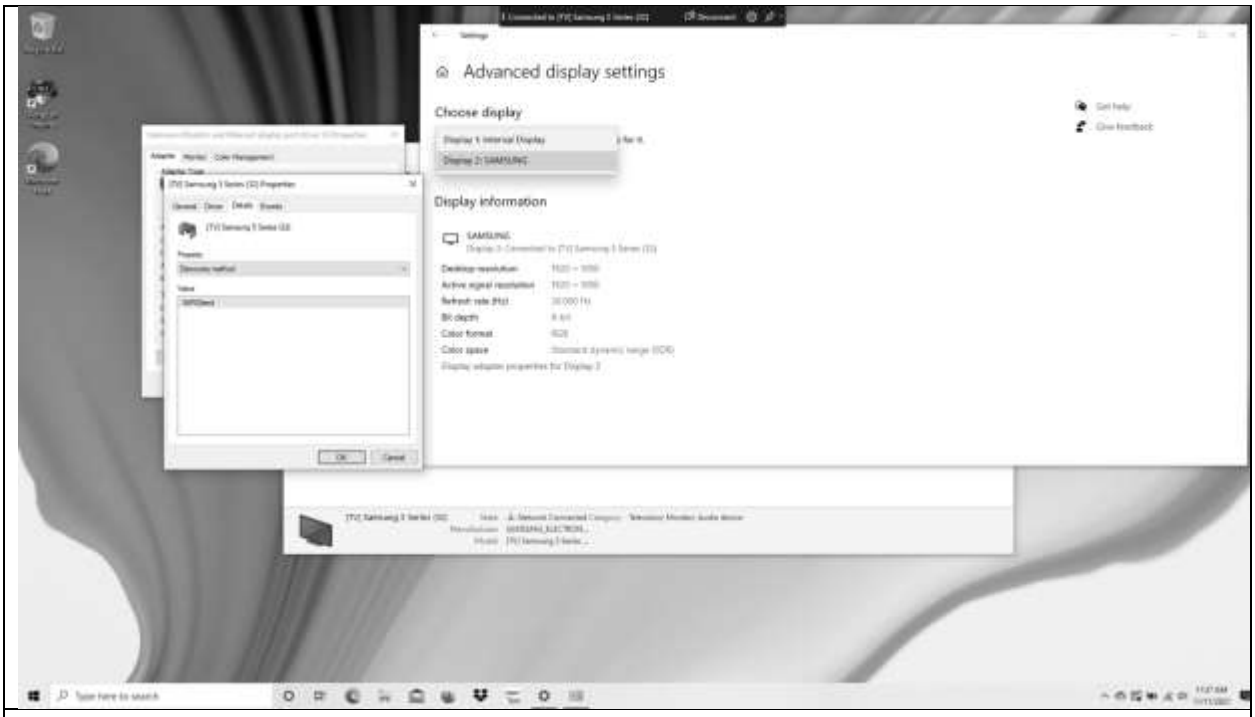
```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

160. 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 Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, discovering a second wireless device, such as a television or other peripheral (including, but not limited to, other Accused Products), using Wi-Fi Direct (a WPAN protocol):



Source: Acer Aspire 3 Laptop Product Testing

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.

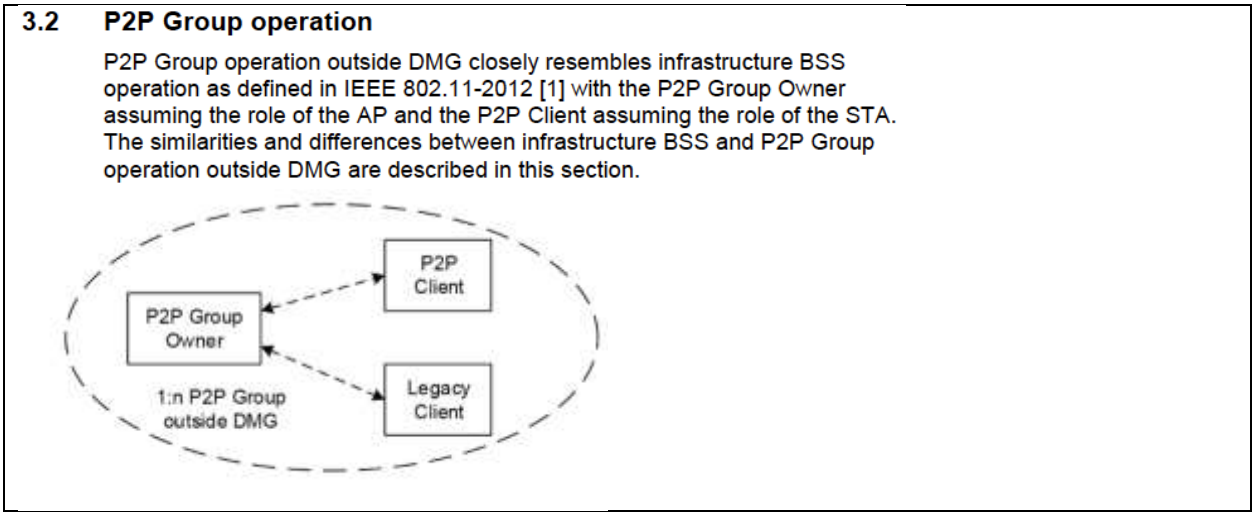
3.1.2.2 P2P Device discovering a P2P Device that is in a P2P Group

A searching P2P Device discovers a P2P Group Owner in the Scan Phase through received Beacon, DMG Beacon, SSW, or Probe Response frames. The searching P2P Device will also discover other P2P Devices that are associated to that P2P Group Owner from Group Information Advertisement (see Section 3.2.4) or, when operating within DMG, through a STA Availability element or Information Response frame (see Section 11.30.1 of IEEE 802.11-REVmc [11]).

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.1.1 & 3.1.2.2

161. 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 an association and synchronization, via the wireless radio

circuit, with the second wireless device to establish a wireless connection, the wireless connection using the WPAN protocol, wherein upon establishing such an association and synchronization, the first wireless device is configured to become a member of the WPAN. For example, the Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, establishing a Wi-Fi Direct connection (a wireless connection using a WPAN protocol) with a second wireless device, such as a television or other peripheral (including, but not limited to, other Accused Products), wherein, upon establishing such an association and synchronization, the Acer Aspire 3 Laptop and the second wireless device are members of the Wi-Fi Direct network (the 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, Figure 1, Sections 3.2, 3.2.2 & 3.2.3

10.1 Synchronization

10.1.2.1 TSF for infrastructure networks

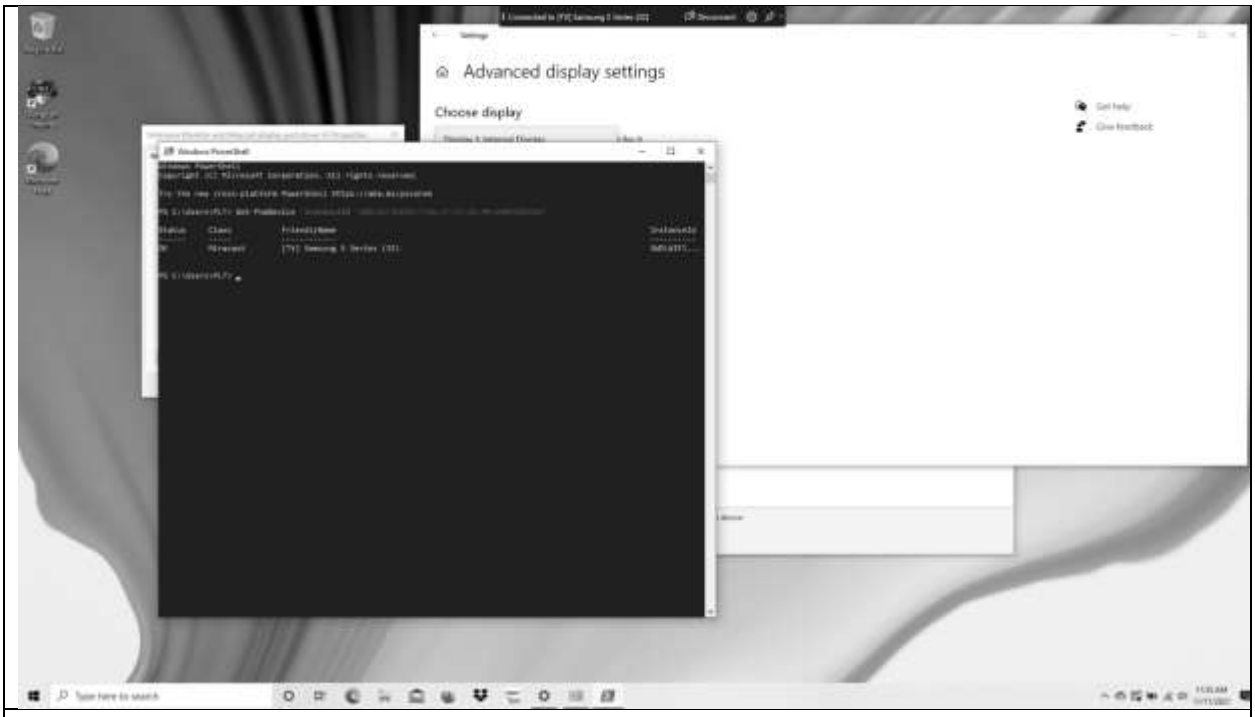
In an infrastructure BSS, the AP shall be the timing master for the TSF. The AP shall initialize its TSF timer independently of any simultaneously started APs in an effort to minimize the synchronization of the TSF timers of multiple APs. The AP shall periodically transmit special frames called *Beacon 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

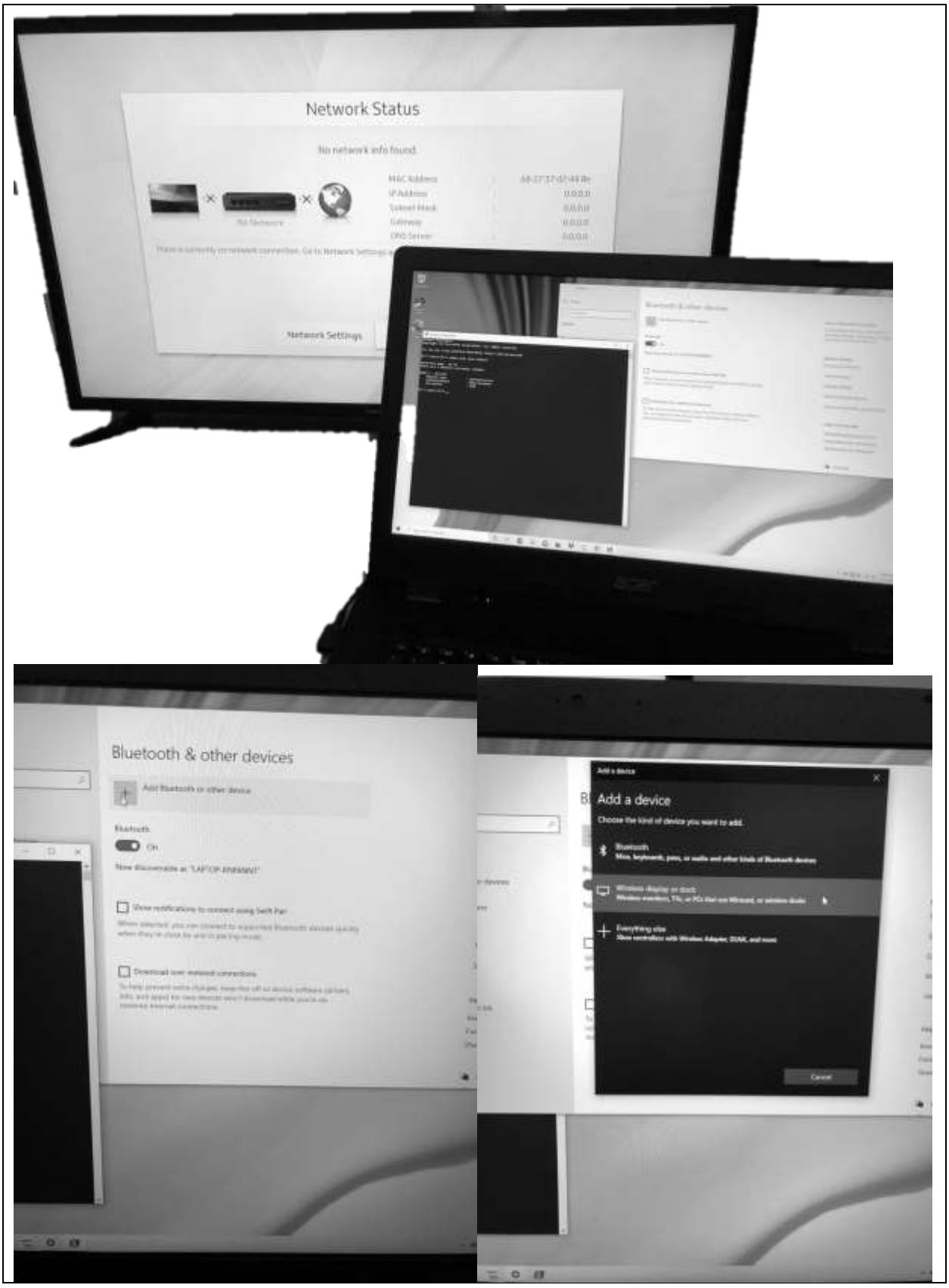
10.1.3.1 General

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



Source: Acer Aspire 3 Laptop Product Testing


Network Status
No network info found.
Network Settings
Bluetooth & other devices
Add a device
Choose the kind of device you want to add.
Bluetooth
Cancel

Source: Acer Aspire 3 Laptop Product Testing

162. The Accused Products are first wireless devices comprising at least one processor configured to maintain, via the wireless radio circuit, such association and synchronization with the second wireless device over the wireless connection using the WPAN protocol. For example, the Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, maintaining the association and synchronization with the second wireless device, such as a television or other peripheral (including, but not limited to, other Accused Products), in providing connections compliant with the Wi-Fi Direct Standard (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.

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, Sections 3.2.2 & 3.2.3

Source: Acer Aspire 3 Laptop Product Testing

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

Support for Miracast has been present since the first Windows 10 version, and since that time Windows investments in Miracast as a projection experience have only increased.
Source: https://docs.microsoft.com/en-us/windows-hardware/design/device-experiences/wireless-projection-understanding

163. 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 Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, participating in a coordination of usage of the wireless medium by the wireless connection 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

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.

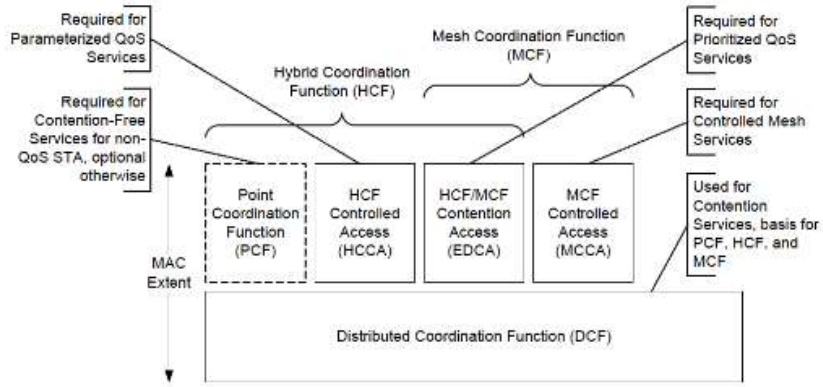


Figure 9-1—MAC architecture

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, Sections 9.2.1, 9.2.2 & 9.3.1

164. In the Accused Products, the WPAN protocol is an overlay protocol with respect to the WLAN protocol. For example, Wi-Fi Direct frames are based on 802.11x frames and use the vendor specific field of an 802.11x management frame:

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.

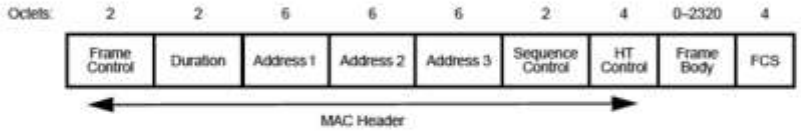


Figure 8-34—Management frame format

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.

8.5.6 Vendor-specific action details

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

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

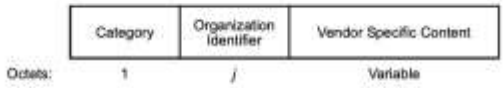


Figure 8-437—Vendor Specific Action frame Action field format

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

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, Sections 8.3.3.1 & 8.5.6

165. 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. 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 (a WLAN protocol frame) to carry information not defined by the IEEE 802.11x Standard so that interoperability operations that are not part of the 802.11x standard can be implemented, 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 a P2P Group Owner (one of the first or second wireless devices corresponding to a WPAN) to take on a role similar to that of an AP in IEEE 802.11x 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). For example, 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.

* * *

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

166. In the Accused Products, 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. For example, the Wi-Fi Direct protocol (the WPAN protocol) does not fully comply with the 802.11x protocol as set out below:

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.

* * *

In order to promote efficient wireless medium use when operating outside DMG:

- P2P Devices shall not use 11b rates (1, 2, 5.5, 11 Mbps) for data and management frames except:
  - Probe Request frames sent to both P2P Devices and non-P2P Devices.
- P2P Devices shall not respond to Probe Request frames that indicate support for 11b rates only.

Note 1 —This means that the P2P Group Owner transmits Beacon frames using OFDM.

Note 2 — This means that the P2P Group Owner transmits Probe Response frames using OFDM, including frames sent in response to Probe Requests received at 11b rates from non 11b-only devices.

Note 3 — P2P Devices shall not include 11b rates in the list of supported rates in Probe Request frame intended only for P2P Devices. 11b rates may be included in the list of supported rates in Probe Request frames intended for both P2P Devices and non-P2P Devices.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.2.2 & 2.4.1

are not already members of the BSSDescriptionSet. To actively scan, the STA shall transmit Probe request frames containing the desired SSID or one or more SSID List elements. When the SSID List element is pres-

8.3.3.9 Probe Request frame format

The frame body of a management frame of subtype Probe Request contains the information shown in Table 8-26.

Table 8-26—Probe Request frame body

Order	Information	Notes
1	SSID	If dot11MeshActivated is true, the SSID element is the wildcard value as described in 8.4.2.2.
2	Supported rates	
SupportedRates	Set of integers	2–127 inclusive (for each integer in the set)	The set of data rates (in units of 500 kb/s) that are supported by the STA that is requesting association.

Source: IEEE 802.11-2012 Standard, Section 8.3.3.9

167. 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 Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor), including a wireless radio circuit that operates in the 2.4 GHz or 5 GHz frequency bands:

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
PS C:\Users\PLT> netsh wlan show drivers

Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Source: https://www.qualcomm.com/products/qca9377

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

168. 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 802.11x Standard 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 attributes used in this manner may, for example, provide a power-saving protocol that allows the P2P Group Owner (the second wireless device) to take on a role similar to that of an AP in IEEE 802.11x 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

169. 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). For example, per IEEE 802.11x, management frames are used by stations (STAs) to join and leave a Basic Service Set (BSS). 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

170. 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 second 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 first 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. According to the Wi-Fi Direct

Standard, for example, 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.

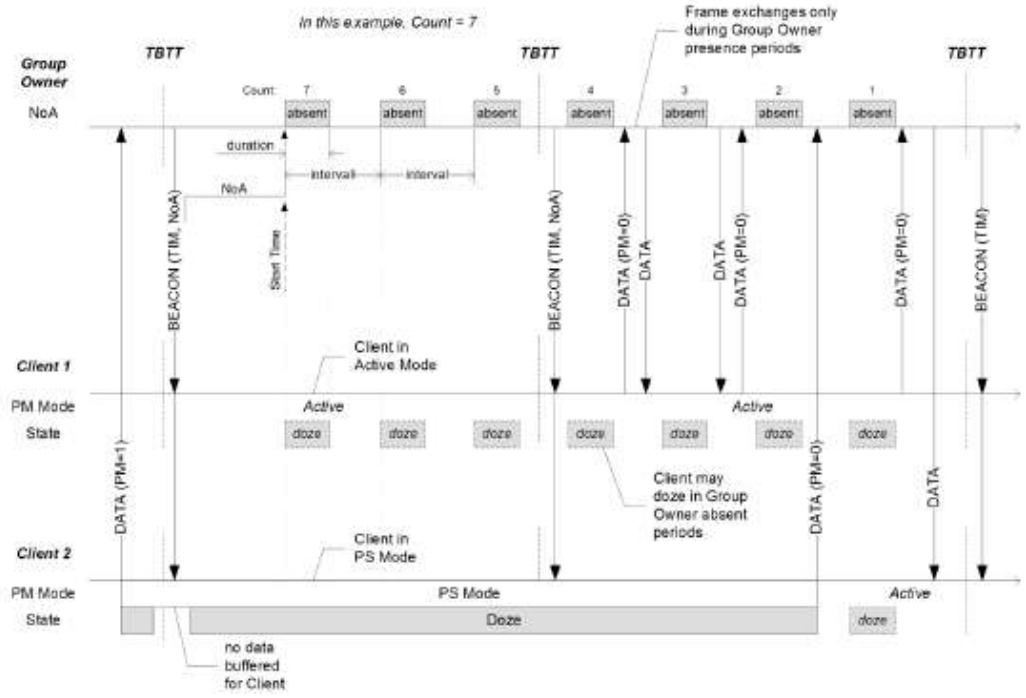


Figure 15—P2P Group Owner Notice of Absence

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

* * *

3.3.4.4 Signaling of Client service requirements

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

171. In the Accused Products, the WPAN protocol provides for the first wireless device and the second wireless device to agree on the inactivity time, for example, 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.

3.3.4.4 Signaling of Client service requirements

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.

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, 3.3.4.4, 4.2.10.2 & 4.2.10.3

172. 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, such as can be seen in the following:

3.3.4.1 P2P Client operation with P2P Group Owner Power Management

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

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

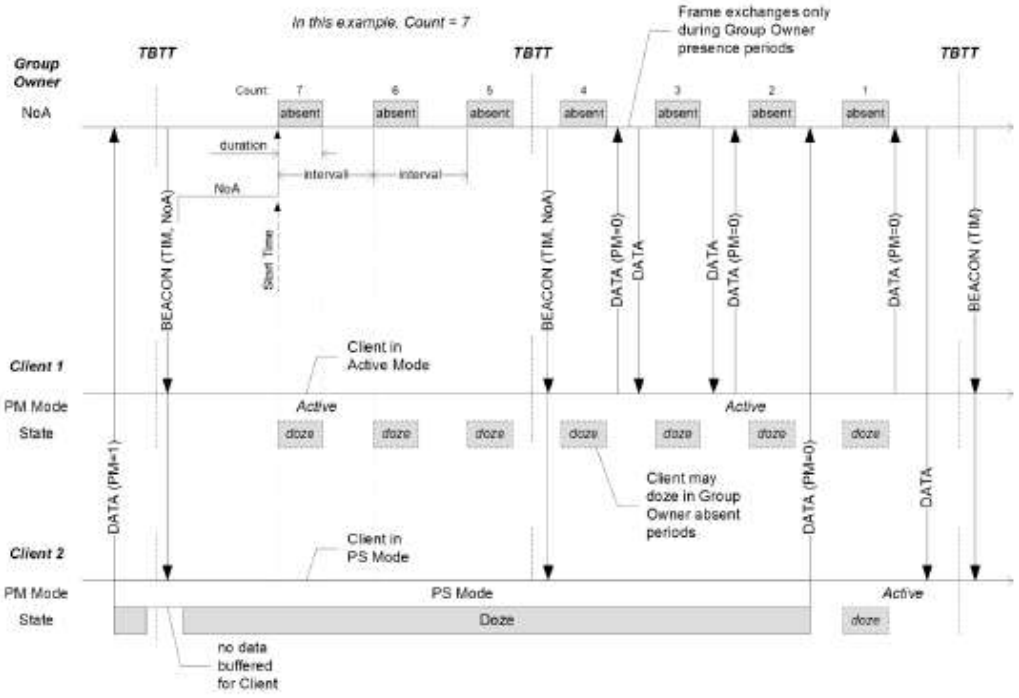


Figure 15—P2P Group Owner Notice of Absence

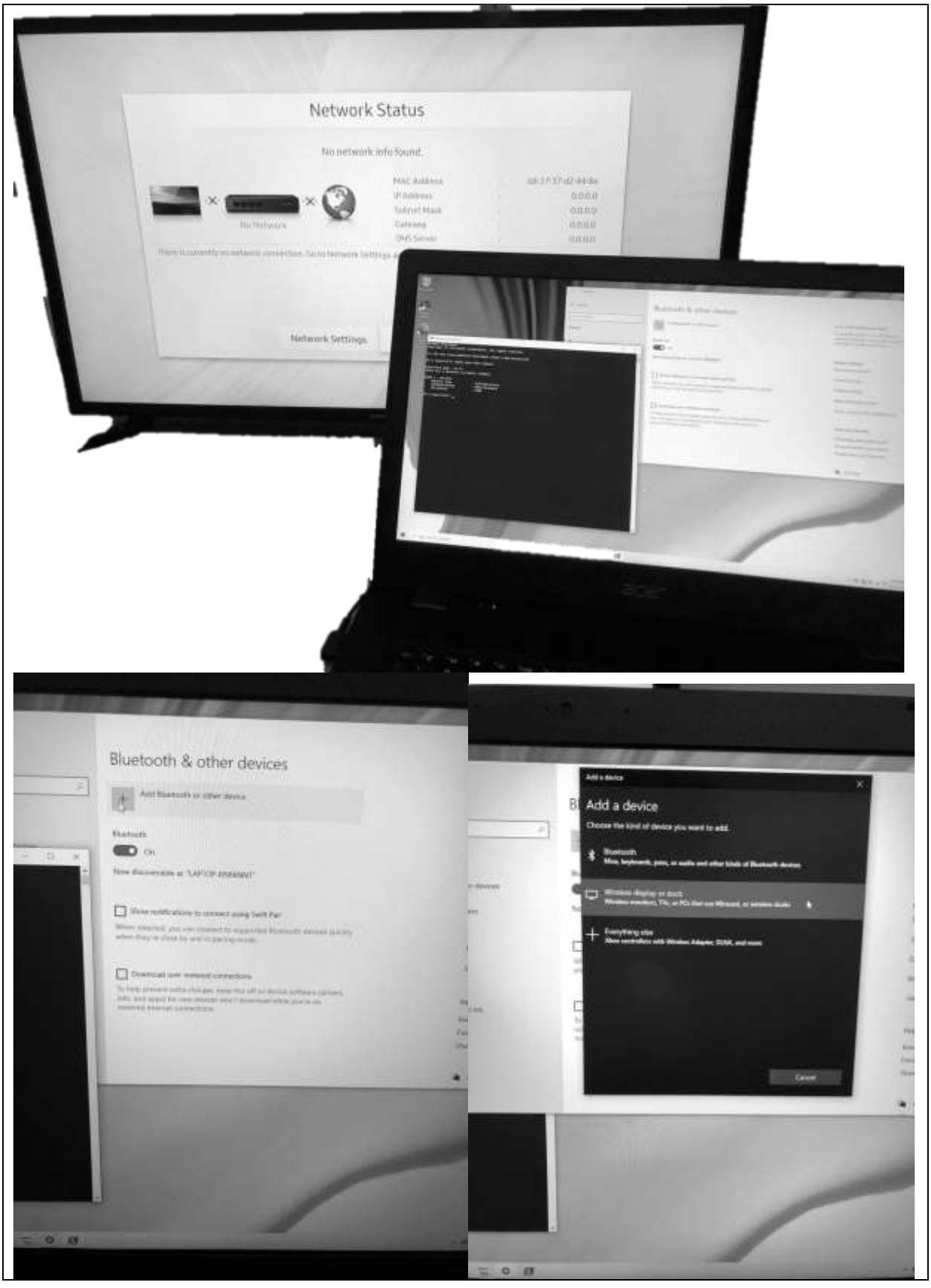
Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.3.4.1 & Figure 15

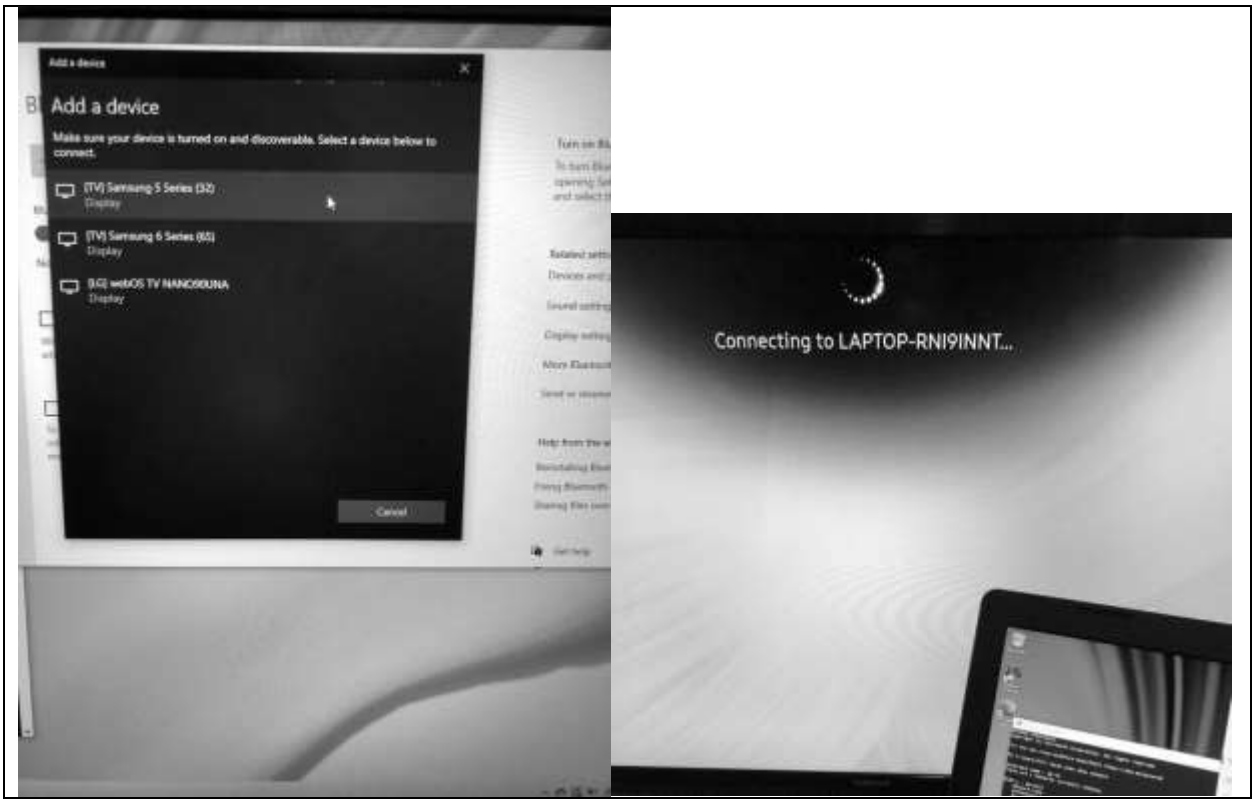
173. As set forth above, Acer has directly infringed at least claim 4 of the '934 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

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

175. Acer 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 Acer intends, the IEEE 802.11x/Wi-Fi Direct functionality. For example, Acer provides user / operating instructions (including at least user interface prompts) and the like for the Accused Products, including the following:


Network Status
No network info found.
Network Settings
Bluetooth & other devices
Add a device
Choose the kind of device you want to add.
Bluetooth
Everything else
Cancel


Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
[TV] Samsung 5 Series (32)
Display
[TV] Samsung 6 Series (65)
Display
[LG] webOS TV NANO90UNA
Display
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

176. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11x/Wi-Fi Direct features described above, Acer has induced its customers to infringe the '934 patent. Acer's customers who use the Accused Products as described above directly infringe the '934 patent. Upon information and belief, Acer has had knowledge or has been willfully blind of the '934 patent since at least April 2, 2020, but in no event later than May 3, 2021, as a result of the below described communications between Ozmo Licensing and Acer. Specifically, on April 2, 2020, Christian Dubuc, Chief Executive Officer of Ozmo Licensing, wrote to Peggy Yo, Legal Supervisor at Acer, regarding Ozmo Licensing's patent portfolio and the Accused Acer Products, informing Acer that it required a license. Acer responded to Ozmo Licensing's initial letter on April 15, 2020. Subsequently, on April 29, 2020, Ozmo Licensing followed up with Acer via email, providing more specificity (including additional Acer products requiring a license), and indicating an intent to provide illustrative claim charts. Ozmo Licensing and Acer have had no fewer than 24 interactions since Ozmo Licensing sent its initial notice letter in April 2020. Furthermore, on May 3, 2021, Ozmo Licensing wrote informing Acer that Ozmo Licensing was about to receive yet another patent, stemming from U.S. Patent Application No. 17/125,797 (another child of the '991 patent), which subsequently issued as the '934 patent. Acer has therefore had actual and express knowledge of the '934 patent and Ozmo Licensing's infringement allegations since, at the latest, May 18, 2021, and additionally, by service upon Acer of this Complaint. Acer also induces such infringement by failing to remove the infringing features from the Accused Products.

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

IEEE 802.11x/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the ’934 patent. Acer knows or is willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by Acer solely to provide such functionality and that such features are not staple articles or commodities of commerce suitable for substantial non-infringing use. Acer also knows, via at least May 18, 2021 correspondence, 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 Acer.

178. By the time of trial, Acer 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 4 of the ’934 patent.

179. Ozmo Licensing has been damaged by Acer’s past and ongoing direct and indirect infringement of the ’934 patent.

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

COUNT V

(Acer’s Infringement of U.S. Patent No. 11,122,504)

181. Paragraphs 1-180 are incorporated by reference as if fully set forth herein.

182. The invention of the ’504 patent represented a technical solution to an unsolved technological problem. The written description of the ’504 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 a WPAN into a WLAN wherein the WPAN protocol is an overlay protocol that is only partially compliant with the WLAN protocol, and wherein a wireless device can establish and maintain association and synchronization with a WPAN.

183. The elements claimed by the '504 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 '504 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 another protocol that is a WLAN protocol using WLAN protocol frames. The WPAN protocol uses a WPAN-adapted frame in which at least one field of a WLAN 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 a part of the coordination function following the start of the inactivity time.

184. 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 WPAN protocol rely upon the same hardware used for communications using a WLAN protocol.

185. Compared to the prior art, the claimed apparatus 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.

186. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN is also more beneficial as it allows for remote monitoring and control of a WPAN device, since the WPAN device may be connected to a Wi-Fi infrastructure, via another wireless device capable of operating as a WPAN device in a WPAN and, at times, simultaneously operating as a WLAN station (WLAN STA) in an infrastructure network, which device may be adapted to establish communication via an AP coupled to the Internet coupled. 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 control of a WPAN device such as a home security system, or an implanted or wearable medical device, over the Internet.

187. Compared to the prior art, the claimed apparatus for integrated a WPAN into a WLAN is also more energy efficient, thereby extending the battery life of the devices or otherwise enable power-hungry WPAN devices to more readily enter power-save modes.

188. Compared to the prior art, the claimed apparatus 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-synchronizing the devices.

189. Compared to the prior art, the claimed apparatus for integrating a WPAN into a WLAN also enables lower latency communication involved WPAN devices, which enables a device serving as a hub between a WPAN and a WLAN to more effectively forward video streams between the two.

190. Acer has infringed, and continues to infringe, the ’504 patent by making, importing, using, offering for sale, and selling, in the United States, numerous wireless devices including laptop computers, desktop computers, and peripheral devices that include Wi-Fi Direct and/or Miracast functionality (together, “Accused Products”). The same Accused Products that infringe the ’991, ’906, ’814, and ’934 patents infringe the ’504 patent, and vice versa.

191. Examples of the Accused Products are Acer’s Wi-Fi enabled laptop computers (including, but not limited to, ConceptD Laptops, Enduro Laptops, Nitro Gaming Laptops, Predator Gaming Laptops, Swift Laptops, Spin Laptops, and Aspire Laptops); desktop computers (including, but not limited to, ConceptD Desktops, Aspire TC Desktops, Veriton Desktops, Nitro Desktops, and Predator Orion Desktops); tablets (including, but not limited to, Enduro tables); projectors (including, but not limited to, the Acer H6535i projector), and all other Acer products that include Wi-Fi Direct and/or Miracast functionality. These products use Wi-Fi Direct in substantially the same way.

192. For the avoidance of doubt, all of Acer’s products made, used, sold and/or offered for sale in, or imported into, the United States during the life of the ’504 patent that provide(d) the foregoing functionality during the life of the ’504 patent are included within the definition of

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

193. Claim 7 of the '504 patent is reproduced below:

> 7. A first wireless device for coordinating usage of a wireless medium comprising:
>
> a wireless radio circuit;
>
> a memory; and
>
> at least one processor coupled to the wireless radio circuit and the memory, said at least one processor configured to:
>
> maintain a first association and a first synchronization over the wireless medium with an access point of a wireless local area network (WLAN) over a first wireless connection via the wireless radio circuit, using a WLAN protocol;
>
> determine, via the wireless radio circuit, that a second wireless device corresponds to a wireless personal area network (WPAN) protocol;
>
> maintain, via the wireless radio circuit, a second association and a second synchronization over the wireless medium with the second wireless device over a second wireless connection via the wireless radio circuit using the WPAN protocol, while maintaining said first association and said first synchronization with the access point over the first wireless connection using the WLAN protocol;
>
> participate in a first coordination of a first usage of the wireless medium over the first wireless connection using the WLAN protocol; and
>
> participate in a second coordination of a second usage of the wireless medium over the second wireless connection using the WPAN protocol;
>
> wherein the WPAN protocol is an overlay protocol with respect to the WLAN protocol, such that the WPAN protocol uses a first WPAN protocol frame adapted to support a WPAN protocol power-saving procedure; and
>
> wherein the WPAN protocol is partially compliant with respect to the WLAN protocol, such that said second usage occurs

without interference from the WLAN, and such that the WPAN protocol uses a second WPAN protocol frame comprising a WLAN probe request protocol frame adapted to determine that the second wireless device corresponds to the WPAN protocol, and the second WPAN protocol frame comprises an SSID adapted to identify the WPAN protocol.

194. The Accused Products are first wireless devices for coordinating usage of a wireless medium. For example, the Accused Products implement the Wi-Fi Direct protocol to coordinate a WPAN in the same wireless space as a WLAN:

2.1 P2P components

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

P2P Device:

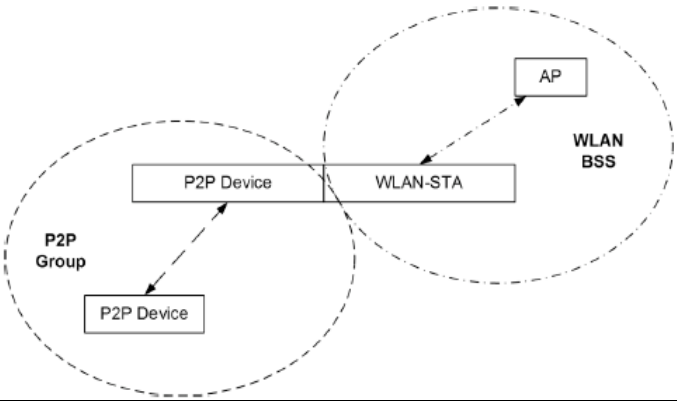
- Supports both P2P Group Owner and P2P Client roles.
- Negotiates P2P Group Owner or P2P Client role.
- Supports WSC and P2P Discovery mechanism.
- May support WLAN and P2P concurrent operation.

P2P Group Owner role:

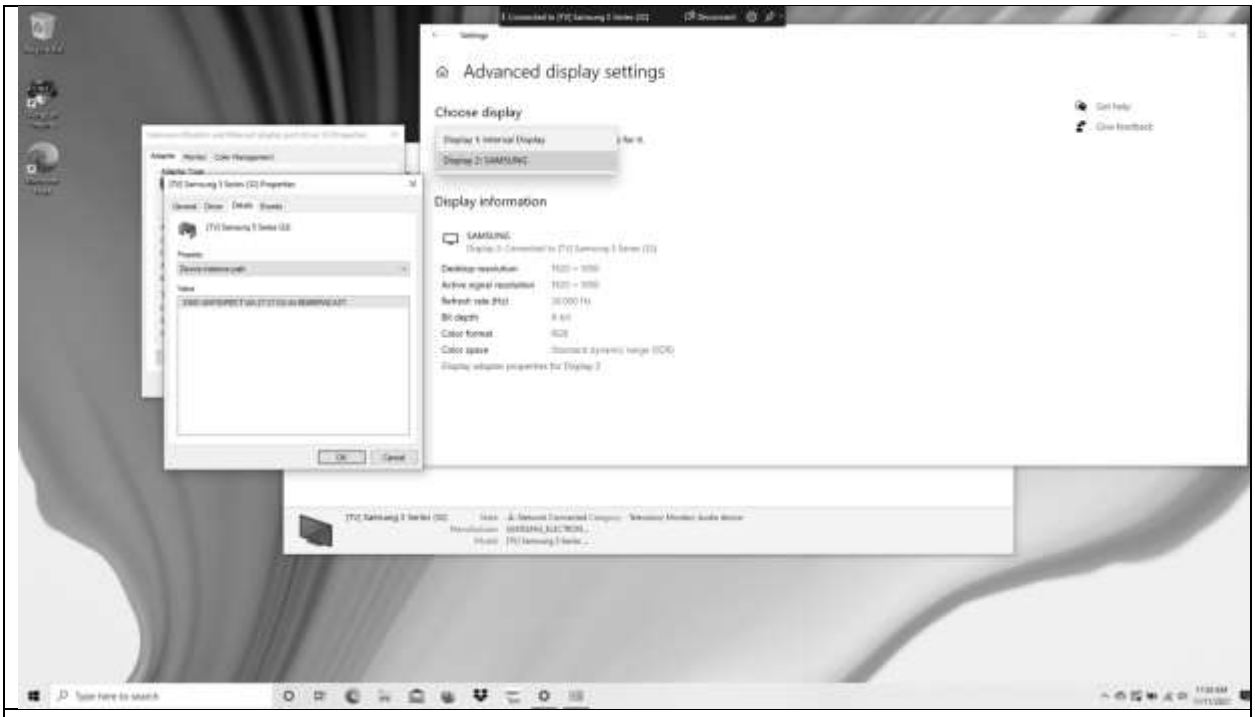
- "AP-like" entity that provides BSS functionality and services for associated Clients (P2P Clients or Legacy Clients) when not operating within DMG, or a PCP that provides PBSS functionality and services for Clients (P2P Clients) when operating within DMG.
- Provides WSC Internal Registrar functionality.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

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.



Source: Wi-Fi Direct Standard, v. 1.7, Sections 2.1, 2.3, Fig. 4



Source: Acer Aspire 3 Laptop Product Testing

195. For example, the Acer Aspire 3 Laptop (a first wireless device), designed and manufactured by Acer, can coordinate usage of a wireless medium by coordinating a Wi-Fi Direct network (WPAN) comprising a connection to a second wireless device in the same space in which the Acer Aspire 3 Laptop can coordinate an infrastructure network (WLAN) comprising a connection to an access point. For example, the Aspire 3 Laptop (the first wireless device) is capable of communications using a WPAN protocol and using an 802.11x WLAN protocol:

Standards-based Miracast advances life without wires

Miracast is an industry-wide solution, allowing technology to work across device types and vendors. Connections are easy to set up and use since Miracast devices choose the appropriate settings automatically. Miracast can connect two devices using network infrastructure or **Wi-Fi Direct®**. When content to be shared is stored on a Miracast-certified device, such as a smartphone to an automobile infotainment display, a Wi-Fi network connection is not required.

Only devices marked Wi-Fi CERTIFIED Miracast have been certified by Wi-Fi Alliance® to work well with other Wi-Fi CERTIFIED™ devices, employ the latest security protections, and deliver a high-quality user experience.

Source: https://www.wi-fi.org/discover-wi-fi/miracast

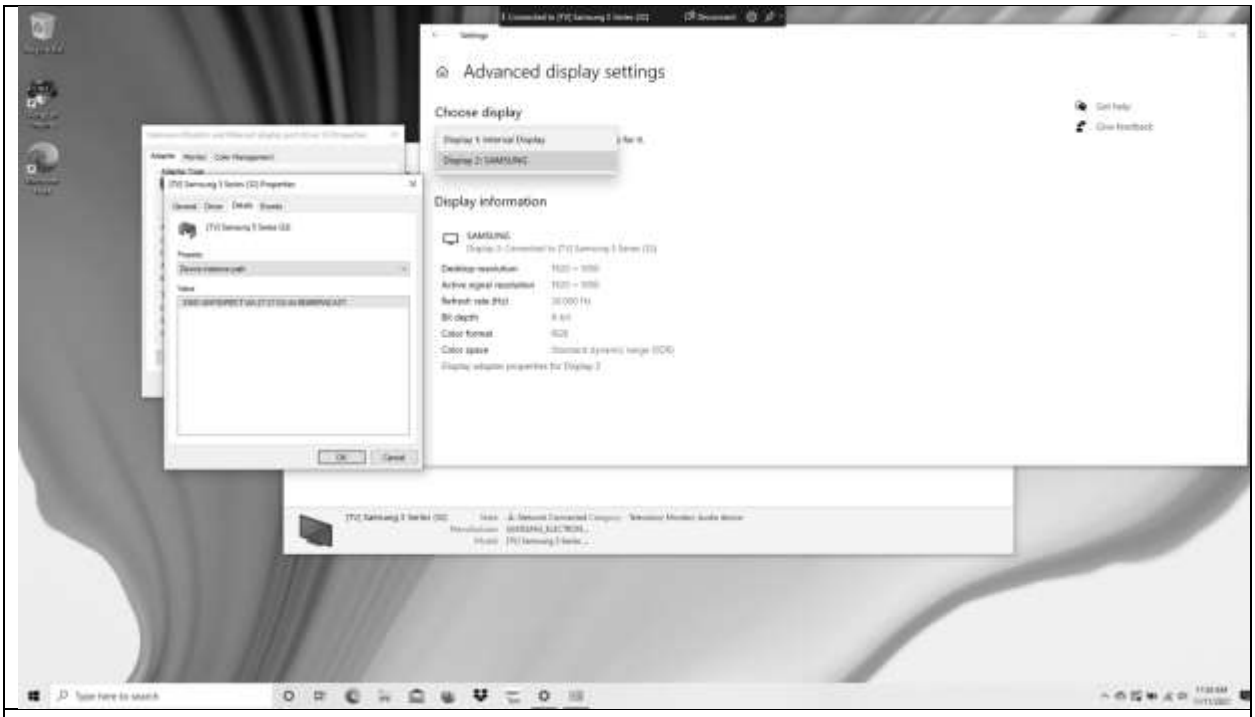
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
      Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
            Language: English (Regional Setting: English)
   System Manufacturer: Acer
         System Model: Aspire A317-52
               BIOS: V1.18 (type: UEFI)
           Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
             Memory: 8192MB RAM
Available OS Memory: 7982MB RAM
           Page File: 4219MB used, 5681MB available
         Windows Dir: C:\Windows
      DirectX Version: DirectX 12
   DX Setup Parameters: Not found
     User DPI Setting: 96 DPI (100 percent)
   System DPI Setting: 96 DPI (100 percent)
      DWM DPI Scaling: Disabled
           Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
 DirectX Database Version: 1.0.8
        DxDiag Version: 10.00.19041.0546 64bit Unicode
```

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)



Source: Acer Aspire 3 Laptop Product Testing

196. 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 Acer Aspire 3 Laptop (first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes a wireless radio circuit with 802.11x capabilities (a WLAN protocol), as seen below:

Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
PS C:\Users\PLT> netsh wlan show drivers

Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

Source: https://www.qualcomm.com/products/qca9377

197. The Accused Products are first wireless devices comprising a memory. For example, the Acer Aspire 3 Laptop includes system memory, as well as the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes memory (for example, Wi-Fi "RAM" and "ROM"), as seen below:

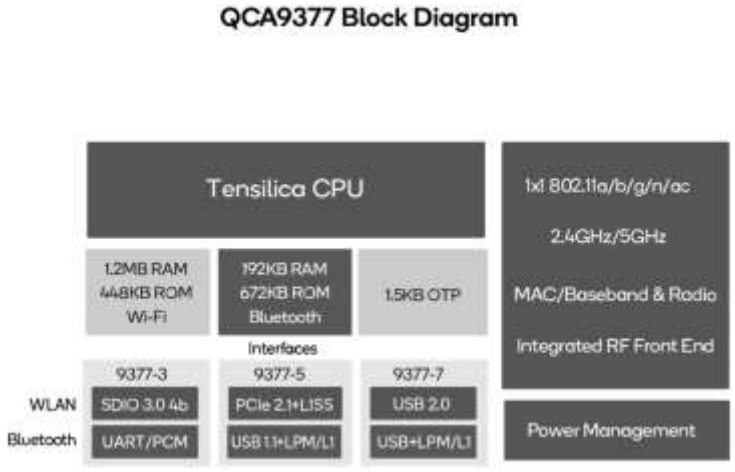
Aspire 3 Laptop - A317-52-565S

Operating System	Windows 10 Home
Operating System Architecture	64-bit
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)



Source: https://www.qualcomm.com/products/qca9377

198. The Accused Products are first wireless devices comprising at least one processor coupled to the wireless radio circuit and the memory. For example, the Acer Aspire 3 Laptop includes the Intel Core i5-1035G1 system processor, as well as the Qualcomm Atheros QCA9377 Wireless Network Adapter, which includes memory (for example, Wi-Fi "RAM" and "ROM") and at least one processor (for example, "Tensilica CPU") coupled to the wireless radio circuit and the memory, as seen below:

Aspire 3 Laptop - A317-52-565S

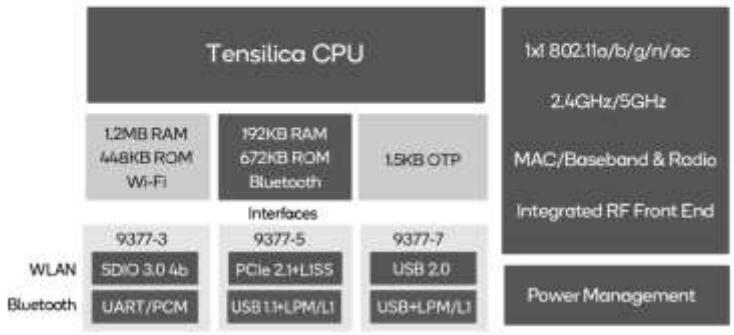
Operating System	Windows 10 Home
Operating System Architecture	64-bit

Network and Communication	
Wireless LAN	Yes
Wireless LAN Standard	IEEE 802.11a/b/g/n/ac
Memory	
Standard Memory	8 GB
Maximum Memory	12 GB
Memory Technology	DDR4 SDRAM
Processor and Chipset	
Processor Manufacturer	Intel®
Processor Type	Intel® Core™ i5
Processor Model	i5-1035G1
Processor Speed	1 GHz
Processor Speed (turbo)	3.60 GHz
Processor Core	Quad-core (4 Core™)

Source: https://store.acer.com/en-us/aspire-3-laptop-a317-52-565s

```
Interface name: Wi-Fi

    Driver                    : Qualcomm Atheros QCA9377 Wireless Network Adapter
    Vendor                    : Qualcomm Atheros Communications Inc.
    Provider                  : Qualcomm Atheros Communications Inc.
    Date                      : 12/25/2019
    Version                   : 12.0.0.929
    INF file                  : oem12.inf
    Type                      : Native Wi-Fi Driver
    Radio types supported     : 802.11b 802.11a 802.11g 802.11n 802.11ac
```

Source: Acer Aspire 3 Laptop Product Testing (Windows PowerShell)

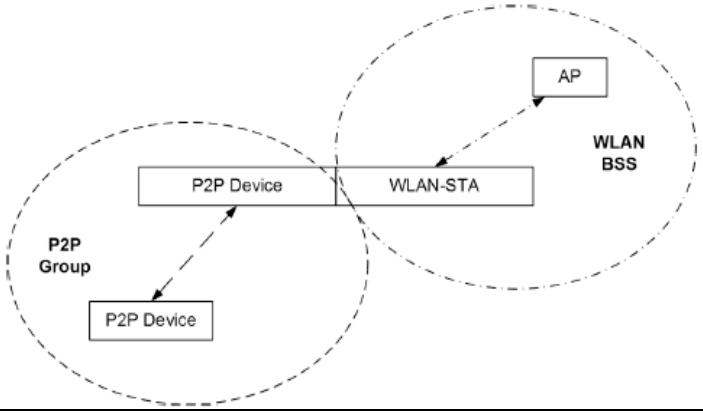


Source: https://www.qualcomm.com/products/qca9377

199. The Accused Products are first wireless devices comprising at least one processor configured to maintain a first association and a first synchronization over the wireless medium with an access point of a wireless local area network (WLAN) over a first wireless connection via the wireless radio circuit, using a WLAN protocol. For example, the Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the 802.11x WLAN protocol and the Wi-Fi Direct protocol (as shown above) by, for example, establishing a first wireless connection to an access point (AP) of an 802.11x network (a WLAN), and to maintain the Acer Aspire 3 Laptop's association and synchronization with the AP over the wireless medium using an 802.11x WLAN protocol:

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.



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

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,

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, 10.1.3.1, 10.3.5 & 10.3.5.1

200. The Accused Products are first wireless devices comprising at least one processor configured to determine, via the wireless radio circuit, that a second wireless device corresponds to a wireless personal area network (WPAN) protocol. For example, the Acer Aspire 3 Laptop (a

first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, determining that a second wireless device, such as a television or other peripheral device (including, but not limited to, other Accused Products), corresponds to a Wi-Fi Direct Network (WPAN) using Wi-Fi Direct and/or Miracast (a WPAN protocol):

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.

4 Frame formats

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

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

P2P Devices in the Search State shall transmit one or more Probe Request or Discovery DMG Beacon frames on each of the Social Channels supported by the P2P Device. All Probe Request frames transmitted by P2P Devices in the Search State shall:

- Include the P2P IE.
- Include the WSC IE, with Device Name, Primary Device Type, and Device Password ID as required attributes. Secondary Device Type List shall be an optional attribute. A P2P Device that uses PushButton configuration method shall indicate when it is in active PBC mode (i.e. during the 120 second walk time after the user has pressed the push button) by setting the Device Password ID value to PushButton.
- Have the SSID field set to the P2P Wildcard SSID.
- Have the BSSID field set to the Wildcard BSSID.

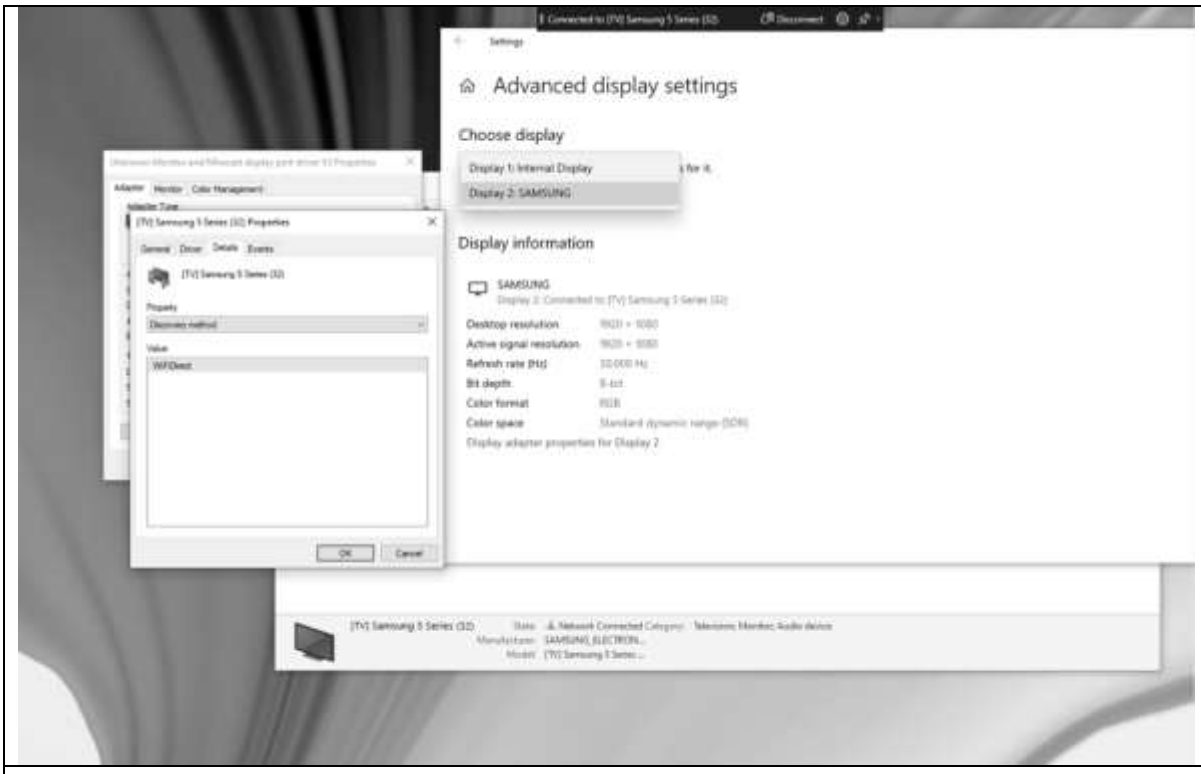
Probe Request frames sent by P2P devices in the Search State may include either one of the following:

- Requested Device Type attribute in the WSC IE. This attribute has the same format as the Primary Device Type attribute in the WSC specification.
- P2P Device ID attribute in the P2P IE.

Source: Wi-Fi Direct Standard, v. 1.7, Sections 2.1, 4 & 3.1.2.1.3

Operating System: Windows 10 Home 64-bit (10.0, Build 19041) (19041.vb_release.191206-1406)
Language: English (Regional Setting: English)
System Manufacturer: Acer
System Model: Aspire A317-52
BIOS: V1.18 (type: UEFI)
Processor: Intel(R) Core(TM) i5-1035G1 CPU @ 1.00GHz (8 CPUs), ~1.2GHz
Memory: 8192MB RAM
Available OS Memory: 7982MB RAM
Page File: 4219MB used, 5681MB available
Windows Dir: C:\Windows
DirectX Version: DirectX 12
DX Setup Parameters: Not found
User DPI Setting: 96 DPI (100 percent)
System DPI Setting: 96 DPI (100 percent)
DWM DPI Scaling: Disabled
Miracast: Available, with HDCP
Microsoft Graphics Hybrid: Not Supported
DirectX Database Version: 1.0.8
DxDiag Version: 10.00.19041.0546 64bit Unicode

Source: Acer Aspire 3 Laptop Product Testing (DxDiag)



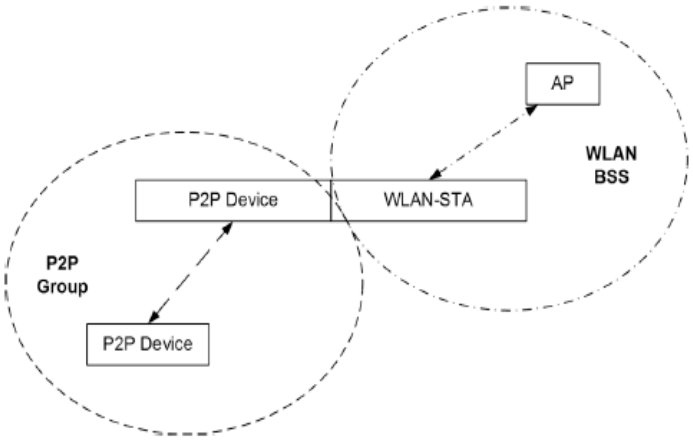
Source: Acer Aspire 3 Laptop Product Testing

201. The Accused Products are first wireless devices comprising at least one processor configured to maintain, via the wireless radio circuit, a second association and a second synchronization over the wireless medium with the second wireless device over a second wireless connection using the WPAN protocol. For example, the Acer Aspire 3 Laptop (a first wireless

device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, maintaining a second association and a second synchronization over the wireless medium to a second wireless device, such as a television or other peripheral device (including, but not limited to, other Accused Products), over a second wireless connection between the Acer Aspire 3 Laptop and the second wireless device, using the Wi-Fi Direct and/or Miracast protocol (a WPAN protocol). Furthermore, in accordance with the Wi-Fi Direct protocol, the Accused Products maintain this second association and second synchronization with a second wireless device over a second wireless connection while maintaining the first association and first synchronization with an AP of a WLAN over the first wireless connection using an 802.11x protocol (a WLAN protocol):

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.



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.

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, Sections 2.3, Fig. 4, 3.2, 3.2.2 & 3.2.3

10.1.2.1 TSF for infrastructure networks

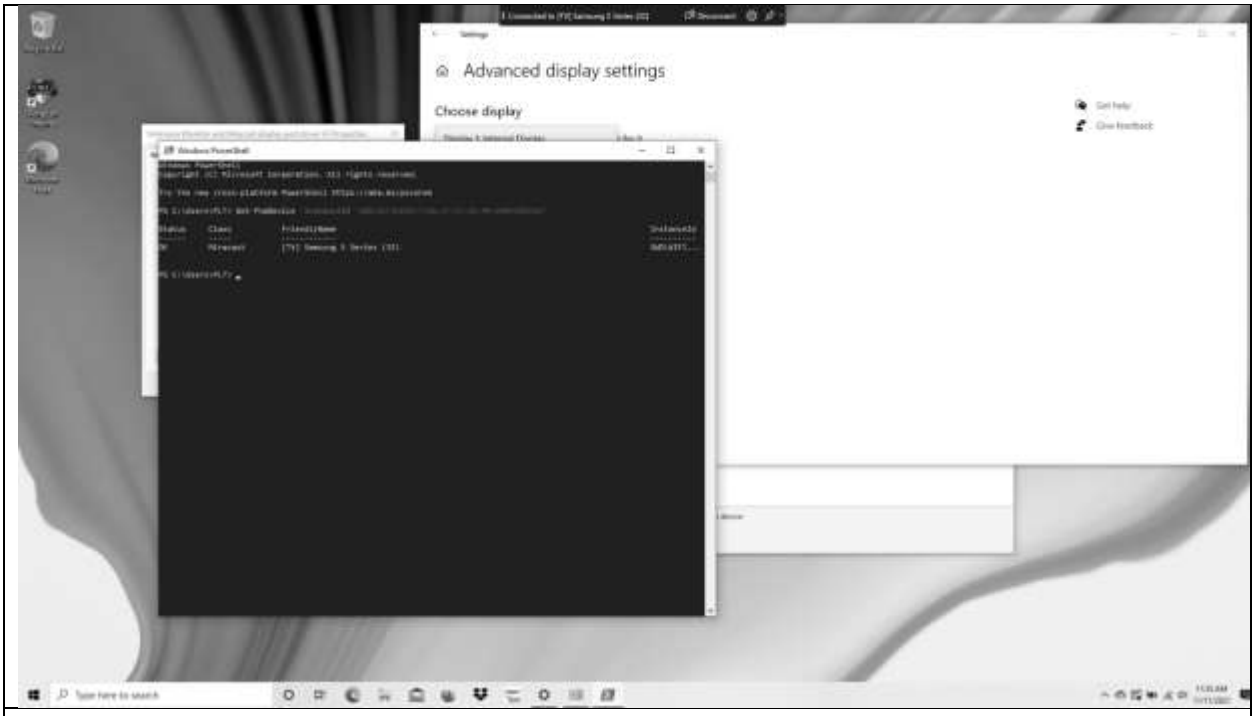
In an infrastructure BSS, the AP shall be the timing master for the TSF. The AP shall initialize its TSF timer independently of any simultaneously started APs in an effort to minimize the synchronization of the TSF timers of multiple APs. The AP shall periodically transmit special frames called *Beacon 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].

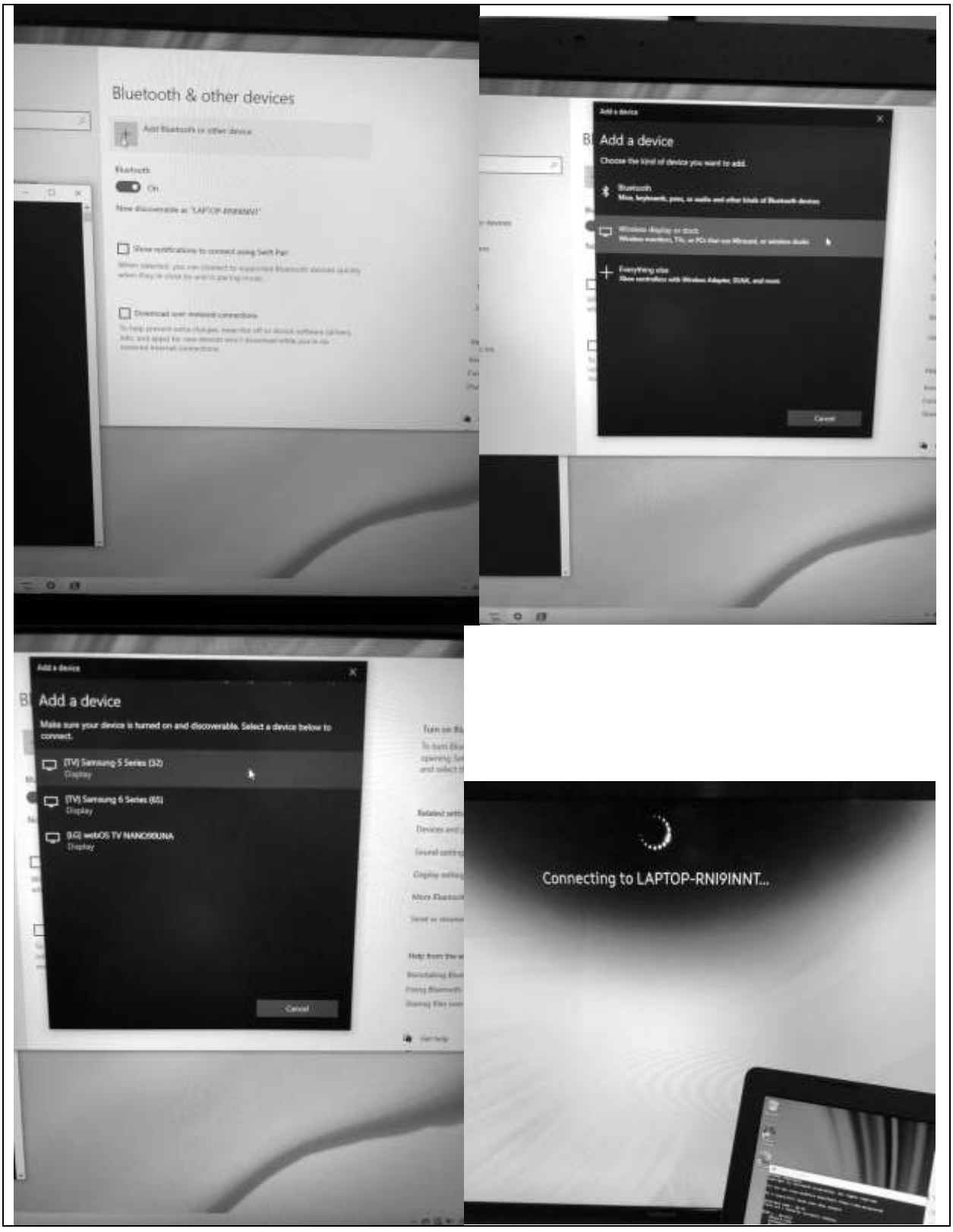
Source: IEEE 802.11-2012, Sections 10.1.2.1 & 10.1.3.1



Source: Acer Aspire 3 Laptop Product Testing

202. The Accused Products are first wireless devices comprising at least one processor configured to participate in a first coordination of a first usage of the wireless medium over the first wireless connection using the WLAN protocol. For example, the Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the 802.11x WLAN protocol and the Wi-Fi Direct protocol (as shown above) by, for example, participating in a first coordination of a first usage of the wireless medium over the first wireless connection to an AP of a WLAN using an 802.11x protocol (a WLAN protocol):


Network Status
No network info found.
Network Settings


Bluetooth & other devices
Add a device
Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
Cancel
Connecting to LAPTOP-RNI9INNT...

Source: Acer Aspire 3 Laptop Product Testing

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.

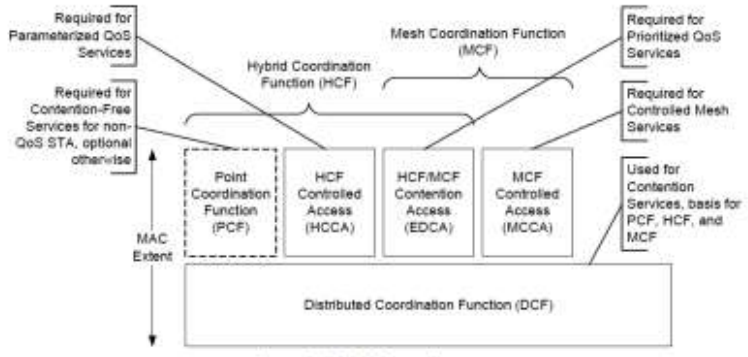


Figure 9-1—MAC architecture

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, Sections 9.2, 9.2.1, 9.2.2 & 9.2.3

203. The Accused Products are first wireless devices comprising at least one processor configured to participate in a second coordination of a second usage of the wireless medium over the second wireless connection using the WPAN protocol. For example, the Acer Aspire 3 Laptop (a first wireless device) includes the Qualcomm Atheros QCA9377 Wireless Network Adapter (a wireless radio circuit with a processor) configured to support the Wi-Fi Direct protocol (as shown above) by, for example, participating in a second coordination of a second usage of the wireless medium over the second wireless connection using the Wi-Fi Direct and/or Miracast protocol (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

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.

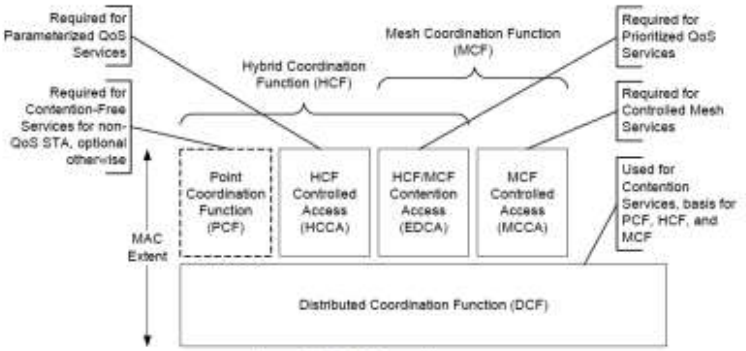


Figure 9-1—MAC architecture

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, Sections 9.2, 9.2.1, 9.2.2 & 9.2.3

204. In the Accused Products, the WPAN protocol is an overlay protocol with respect to the WLAN protocol. For example, Wi-Fi Direct frames are based on 802.11x frames and use the vendor specific field of an 802.11x management frame:

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.

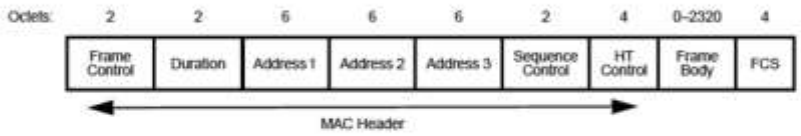


Figure 8-34—Management frame format

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.

8.5.6 Vendor-specific action details

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

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

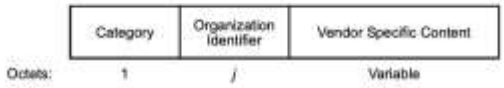


Figure 8-437—Vendor Specific Action frame Action field format

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

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, Sections 8.3.3.1 & 8.5.6

205. In the Accused Products, the WPAN protocol is an overlay protocol with respect to the WLAN protocol, such that the WPAN protocol uses a first WPAN protocol frame comprising a WLAN protocol frame adapted to support a WPAN protocol power-saving procedure. 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 (a WLAN protocol frame) to carry information not defined by the IEEE 802.11x Standard so that interoperability operations that are not part of the 802.11x standard can be implemented, 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 a P2P Group Owner (one of the first or second wireless devices corresponding to a WPAN) to take on a role similar to that of an AP in IEEE 802.11x 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). For example, 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.

* * *

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

206. In the Accused Products, the WPAN protocol is partially compliant with respect to the WLAN protocol. For example, the Wi-Fi Direct protocol (the WPAN protocol) calls for modifications to the 802.11x (the WLAN protocol) responses to Probe Request frames, as set out below:

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

207. In the Accused Products, the WPAN protocol is partially compliant with respect to the WLAN protocol, such that said second usage occurs without interference from the WLAN, such as can be seen below:

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]

In order to promote efficient wireless medium use when operating outside DMG:

- P2P Devices shall not use 11b rates (1, 2, 5.5, 11 Mbps) for data and management frames except:
  - Probe Request frames sent to both P2P Devices and non-P2P Devices.
- P2P Devices shall not respond to Probe Request frames that indicate support for 11b rates only.

Note 1 —This means that the P2P Group Owner transmits Beacon frames using OFDM.

Note 2 — This means that the P2P Group Owner transmits Probe Response frames using OFDM, including frames sent in response to Probe Requests received at 11b rates from non 11b-only devices.

Note 3 — P2P Devices shall not include 11b rates in the list of supported rates in Probe Request frame intended only for P2P Devices. 11b rates may be included in the list of supported rates in Probe Request frames intended for both P2P Devices and non-P2P Devices.

* * *

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 & 3.2

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.

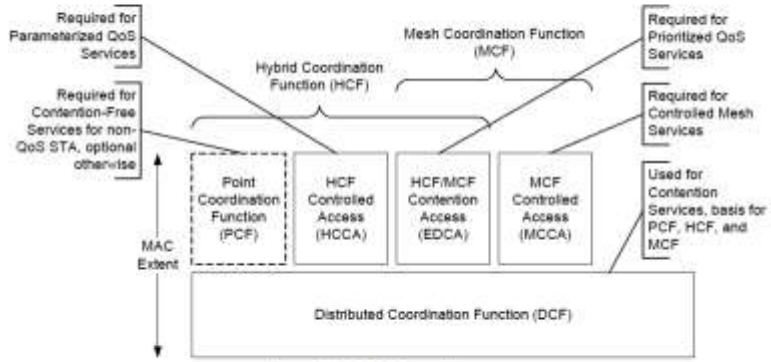


Figure 9-1—MAC architecture

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.

* * *

are not already members of the BSSDescriptionSet. To actively scan, the STA shall transmit Probe request frames containing the desired SSID or one or more SSID List elements. When the SSID List element is pres-

8.3.3.9 Probe Request frame format

The frame body of a management frame of subtype Probe Request contains the information shown in Table 8-26.

Table 8-26—Probe Request frame body

Order	Information	Notes
1	SSID	If dot11MeshActivated is true, the SSID element is the wildcard value as described in 8.4.2.2.
2	Supported rates	
SupportedRates	Set of integers	2–127 inclusive (for each integer in the set)	The set of data rates (in units of 500 kb/s) that are supported by the STA that is requesting association.

Source: IEEE 802.11-2012 Standard, Sections 9.2, 9.2.1, 9.2.2, 9.3 & 8.3.3.9

208. In the Accused Products, the WPAN protocol uses a second WPAN protocol frame comprising a WLAN probe request frame adapted to determine that the second wireless device corresponds to the WPAN protocol. For example, in Wi-Fi Direct (the WPAN protocol) the second WPAN-adapted frame may utilize the Vendor Specific Information Element (IE) field of an 802.11x probe request protocol frame to specify one or more P2P IEs and/or WSC IEs (Wi-Fi Simple Configuration Information Elements; the WLAN protocol may alternatively be the WSC protocol, which leverages the 802.11x protocol). The WPAN-adapted probe request frame containing one or more P2P IEs, specifies P2P attributes including P2P Capability, P2P Device ID, Listen Channel, P2P Device Info, and other information such that, for example, an Accused Product (a first wireless device) could determine that a second wireless device corresponds to the Wi-Fi Direct protocol (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.
- **P2P Invitation** is used to invoke a Persistent P2P Group or invite a P2P Device to join an existing P2P Group.

* * *

3.1.2 Device Discovery procedures

3.1.2.1 Basic mechanisms of Device Discovery

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

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

* * *

3.1.2.1.1 Listen State

A P2P Device in the Listen State shall only reply to Probe Request frames that contain the P2P IE, the P2P Wildcard SSID element, a Wildcard BSSID, and a Destination Address that is either the broadcast address or its P2P Device Address. If one or more Requested Device Type attributes are present in the WSC IE in the Probe Request frame, the P2P Device in the Listen State shall only respond with a Probe Response frame if it has a Primary Device Type or Secondary Device Type value identical to any of the Requested Device Type values. If a Device ID attribute is present in the P2P IE in the Probe Request frame, the P2P Device in the Listen State shall only respond with a Probe Response frame if its Device Address matches that in the Device Address field in the Device ID attribute.

* * *

4.2.2 Probe Request frame format

The Probe Request frames can be transmitted by any P2P Device.

One or more P2P IEs and the WSC IE shall be inserted after other information elements in the Probe Request frames transmitted by a P2P Device as shown in Table 49.

Table 49—Probe Request frame format

Order	Information Element	Note
	WSC IE	The WSC IE shall be present in the frames transmitted by a P2P Device.
Last	P2P IE	The P2P IE shall be present in the frames transmitted by a P2P Device.

Additional attributes shall be inserted in the WSC IE that is included in the Probe Request frame as shown in Table 50.

Table 50—Additional attributes in WSC IE in the Probe Request frame

Attributes	Required/ Optional	Note
Device Name	Required	The Device Name attribute shall be present in WSC IE in the Probe Request frame that is transmitted by a P2P Device.
Requested Device Type	Optional	The Requested Device Type attribute may be present in WSC IE in the Probe Request frame that is transmitted by a P2P Device.

P2P attributes for a P2P IE that is included in the Probe Request frame are shown in Table 51.

Table 51—P2P attributes in the Probe Request frame

Attributes	Attribute ID	Note
P2P Capability	2	The P2P Capability attribute shall be present in the P2P IE.
P2P Device ID	3	The P2P Device ID attribute may be present in the Probe Request frame when using the discovery protocol to find a P2P Device with a specific Device Address.
Listen Channel	6	The Listen Channel attribute shall be present in the P2P IE indicating the operating class and channel number on which the P2P Device is in the Listen State. If the P2P Device has not selected a Listen Channel, the Listen Channel attribute shall be omitted.
Extended Listen Timing	8	The Extended Listen Timing attribute may be present in the P2P IE to advertise Listen State availability of the P2P Device sending the Probe Request.
P2P Device Info	13	For operation within DMG, the P2P Device Info attribute shall be present in the P2P IE to indicate the P2P Device information.
Operating Channel	17	The Operating Channel attribute shall only be present in the P2P IE if the P2P Device is an operating P2P Group Owner and indicates the operating class and channel number on which the P2P Device is operating as P2P Group Owner.
Service Hash	21	The Service Hash attribute may be present in the P2P IE if P2Ps is supported. The usage of this attribute is defined in the Wi-Fi Peer-to-Peer Services specification [10].

* * *

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.

WLAN	Wireless Local Area Network
WMM®	Wi-Fi Multimedia™
WPA2™	Wi-Fi Protected Access® 2
WMM-PS	Wireless Multimedia Power Save
WSC	Wi-Fi Simple Configuration

1.3 References

[1] IEEE 802.11-2012 IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications

[2] Wi-Fi Simple Configuration Specification, Wi-Fi Alliance, http://www.wi-fi.org

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.1.1, 3.1.2.1, 3.1.2.1.1, 3.1.2.1.2, 4.2.2, Table 51, & 1.3, 1.4, 2.1

8.3.3.9 Probe Request frame format

The frame body of a management frame of subtype Probe Request contains the information shown in Table 8-26.

Table 8-26—Probe Request frame body

Order	Information	Notes
1	SSID	If dot11MeshActivated is true, the SSID element is the wildcard value as described in 8.4.2.2.
2	Supported rates	
3	Request information	The Request element is optionally present if dot11MultiDomainCapabilityActivated is true.
4	Extended Supported Rates	The Extended Supported Rates element is present if there are more than eight supported rates, and is optionally present otherwise.

Table 8-26—Probe Request frame body *(continued)*

Order	Information	Notes
5	DSSS Parameter Set	The DSSS Parameter Set element is present within Probe Request frames generated by STAs using Clause 16, Clause 17, or Clause 19 PHYs if dot11RadioMeasurementActivated is true. The DSSS Parameter Set element is present within Probe Request frames generated by STAs using a Clause 20 PHY in the 2.4 GHz band if dot11RadioMeasurementActivated is true. The DSSS Parameter Set element is optionally present within Probe Request frames generated by STAs using Clause 16, Clause 17, or Clause 19 PHYs if dot11RadioMeasurementActivated is false. The DSSS Parameter Set element is optionally present within Probe Request frames generated by STAs using a Clause 20 PHY in the 2.4 GHz band if dot11RadioMeasurementActivated is false.
6	Supported Operating Classes	The Supported Operating Classes element is present if dot11ExtendedChannelSwitchActivated is true.
7	HT Capabilities	The HT Capabilities element is present when dot11HighThroughputOptionImplemented attribute is true.
8	20/40 BSS Coexistence	The 20/40 BSS Coexistence element is optionally present when the dot112040BSSCoexistenceManagementSupport attribute is true.
9	Extended Capabilities	The Extended Capabilities element is optionally present if any of the fields in this element are nonzero.
10	SSID List	The SSID List element is optionally present if dot11MgmtOptionSSIDListActivated is true.
11	Channel Usage	The Channel Usage element is optionally present if dot11MgmtOptionChannelUsageActivated is true.
12	Interworking	The Interworking element is present if dot11InterworkingServiceActivated is true.
13	Mesh ID	The Mesh ID element is present if dot11MeshActivated is true.
Last	Vendor Specific	One or more vendor-specific elements are optionally present. These elements follow all other elements.

Source: IEEE 802.11-2012 Standard, Section 8.3.3.9

8.2.4 Probe Request (D-E or D-R)

If the station intends to use Wi-Fi Simple Configuration protocol, the Wi-Fi Simple Configuration Information Element shall be included in a probe request, and contain the following device attributes (Enrollee or Registrar):

Table 6 – Attributes in WSC IE in the Probe Request frame

Attribute	R/O/C	Notes
Version	R	Deprecated. Always set to 0x10 for backwards compatibility. See Version2 for current version negotiation mechanism.
Request Type	R	
Configuration Methods	R	
UUID-(E or R)	R	
Primary Device Type	R	
RF Bands	R	Specific RF band used for this message.
Association State	R	
Configuration Error	R	
Device Password ID	R	If the device is in PBC mode this value shall be 0x0004 (Pushbutton).
Manufacturer	C	Shall be included in protocol version 2.0 and higher.
Model Name	C	Shall be included in protocol version 2.0 and higher.
Model Number	C	Shall be included in protocol version 2.0 and higher.
Device Name	C	User-friendly description of device. Shall be included in protocol version 2.0 and higher.

Attribute	R/O/C	Notes
Version2 (inside WFA Vendor Extension)	C	0x20 = version 2.0, 0x21 = version 2.1, etc. Shall be included in protocol version 2.0 and higher.
Request to Enroll (inside WFA Vendor Extension)	O	Indicates the desire to enroll in the network. If the Registrar gets this attribute it can use this as a trigger that a device wants to enroll.
Requested Device Type	O	When a device receives a Probe Request containing a WSC IE with the Requested Device Type attribute it will only respond with a Probe Response if the devices Primary Device Type or Secondary Device Type matches the Requested Device Type contained in the Probe Request.
<other...>	O	Multiple attributes are permitted.

Source: WSC Specification, v.2.0.7, Section 8.2.4

209. In addition, the second WPAN protocol frame comprises an SSID adapted to identify the WPAN protocol. For example, in the Accused Products, the second WPAN-adapted frame uses a modified 802.11x probe request frame (a WLAN protocol probe request frame). For example, besides Wi-Fi Direct calling for the use the of the Vendor Specific IE field of the 802.11x protocol probe request frame to indicate that a wireless device corresponds to the Wi-Fi Direct protocol, as discussed above, Wi-Fi Direct also calls for the SSID element in the 802.11x probe request frame be adapted to identify the Wi-Fi Direct protocol (the WPAN protocol) via setting the SSID element to the P2P Wildcard SSID:

3.1.2.1.2 Scan Phase

be an optional attribute. A P2P Device may send a Probe Request frame containing the P2P IE and the Wildcard SSID to elicit Probe Response frames from both legacy networks and P2P Group Owners. Inclusion of the P2P IE in the Probe Request frame is required to enable the P2P Group Owner to include the P2P Group Info attribute in the Probe Response frame. P2P Clients shall not reply to Probe Request frames so they can only be discovered by the Probe Response frame from the P2P Group Owner containing the P2P Group Info attribute, as described in Section 3.2.4.

A P2P Device may limit its Scan to P2P Devices and Groups. A Probe Request frame intended only for P2P Devices shall include the P2P IE and shall have the SSID element set to the P2P Wildcard SSID.

Note — There is a very low probability of a legacy network that has the P2P Wildcard SSID as its SSID; such a Probe Response frame may be identified by the lack of the P2P IE.

* * *

Each SSID shall begin with the ASCII characters "DIRECT-". This SSID requirement may enable users of Legacy Clients to differentiate between a P2P Group and an infrastructure network. Following "DIRECT-" the SSID shall contain two ASCII characters "xy", randomly selected with a uniform distribution from the following character set: upper case letters, lower case letters and numbers. This SSID requirement makes the probability low that a Legacy Client encounters two P2P Groups with the same SSID and mistakenly attempt to roam between them. Any byte values allowed for an SSID according to IEEE802.11-2012 [1] may be included after the string "DIRECT-xy" (including none).

Source: Wi-Fi Direct Standard, v. 1.7, Sections 3.1.2.1.2 & 3.2.1

8.3.3.9 Probe Request frame format

The frame body of a management frame of subtype Probe Request contains the information shown in Table 8-26.

Table 8-26—Probe Request frame body

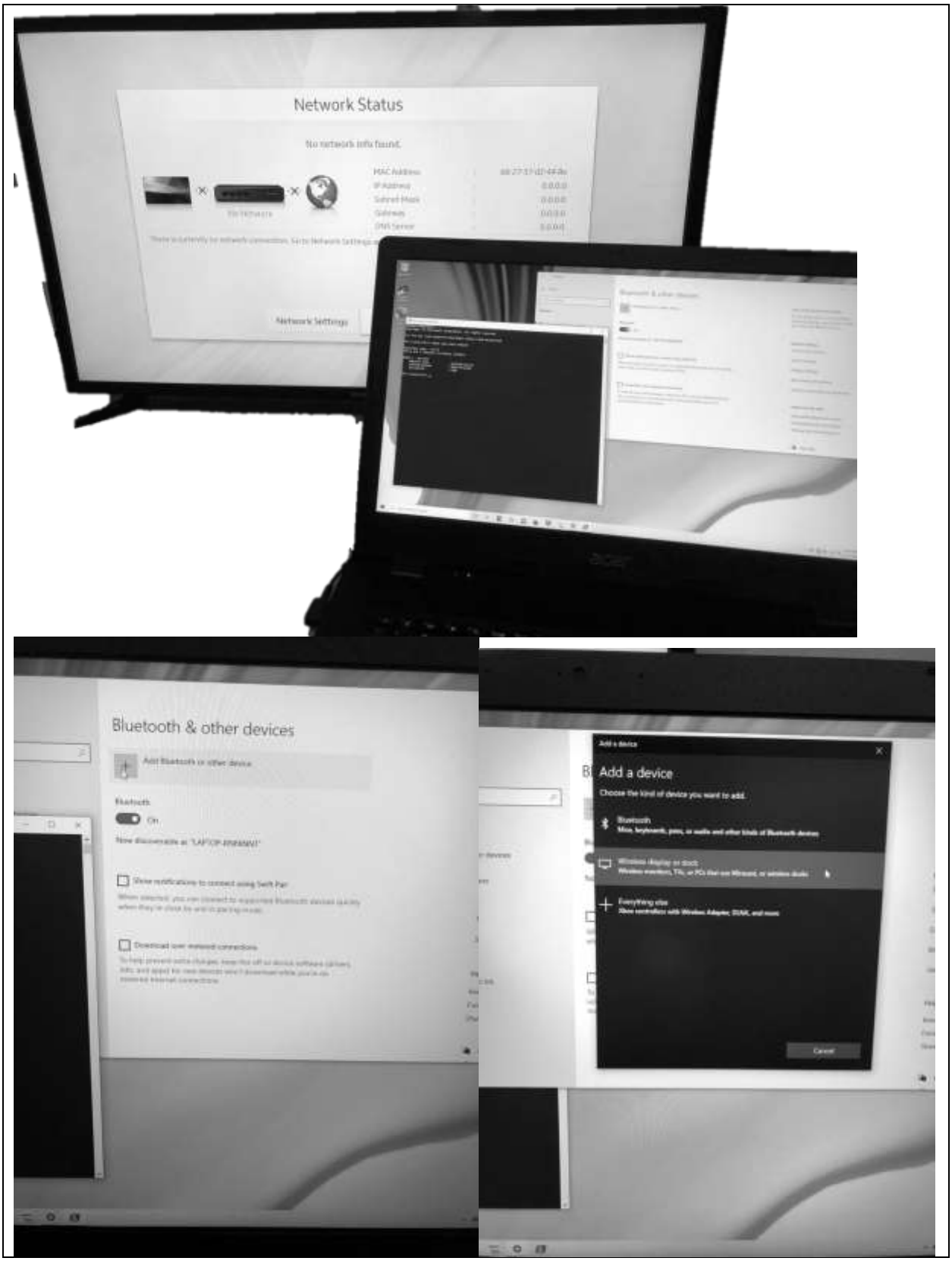
Order	Information	Notes
1	SSID	If dot11MeshActivated is true, the SSID element is the wildcard value as described in 8.4.2.2.
2	Supported rates	
3	Request information	The Request element is optionally present if dot11MultiDomainCapabilityActivated is true.
4	Extended Supported Rates	The Extended Supported Rates element is present if there are more than eight supported rates, and is optionally present otherwise.

Source: IEEE 802.11-2012 Standard, Section 8.3.3.9

210. As set forth above, Acer has directly infringed at least claim 7 of the '504 patent by making, importing, using, offering for sale and/or selling the Accused Products into or in the United States.

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

212. Acer 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 Acer intends, the IEEE 802.11x/Wi-Fi Direct functionality. For example, Acer provides user / operating instructions (including at least user interface prompts) and the like for the Accused Products, including the following:


Network Status
No network info found.
Network Settings
Bluetooth & other devices
Add a device
Choose the kind of device you want to add.
Bluetooth
Everything else
Cancel


Add a device
Make sure your device is turned on and discoverable. Select a device below to connect.
[TV] Samsung 5 Series (32)
Display
[TV] Samsung 6 Series (65)
Display
[LG] webOS TV NANO99UNA
Display
Cancel
Connecting to LAPTOP-RNI9INNT...
Your device is ready to go!

Source: Acer Aspire 3 Laptop Product Testing

213. By its instructions, including those set forth above, and with intent that they use the IEEE 802.11x/Wi-Fi Direct features described above, Acer has induced its customers to infringe the '504 patent. Acer's customers who use the Accused Products as described above directly infringe the '504 patent. Upon information and belief, Acer has had knowledge or has been willfully blind of the '504 patent since at least as early as the day the '504 patent issued, September 14, 2021, but no later than the date of service upon it of this Complaint.

214. By offering for sale, selling, commercially distributing and importing the Accused Products, Acer has also contributed to its customers' infringement of the '504 patent. The Accused Products are used by Acer's customers to practice the inventions claimed in the '504 patent. The IEEE 802.11x/Wi-Fi Direct features as performed by the Accused Products as described above constitute material parts of the claimed inventions of the '504 patent. Acer knows or is willfully blind that portions of the hardware and software in the Accused Products were specifically made or adapted by Acer solely to provide such functionality and that such features are not staple articles

or commodities of commerce suitable for substantial non-infringing use. Acer also knows, via at least the aforementioned communications with Ozmo Licensing, 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 Acer.

215. By the time of trial, Acer 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 7 of the '504 patent.

216. Ozmo Licensing has been damaged by Acer's past and ongoing direct and indirect infringement of the '504 patent.

217. With knowledge of the allegations set forth herein, Acer nonetheless refuses to remove the infringing functionalities from the Accused Products or to compensate Ozmo Licensing for the use of such features. Acer's infringement described above will continue unabated unless and until Acer is enjoined or ordered to pay a reasonable royalty for a license to the '504 patent.

PRAYER FOR RELIEF

Ozmo Licensing requests that the Court enter judgment against Acer as follows:

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

C. ordering Acer to pay Ozmo Licensing an ongoing royalty for Acer's future infringement of the patents-in-suit or, in the alternative, enjoining from the remaining life of the patents-in-suit any further acts of infringement by Acer, its

officers, directors, agents, consultants, contractors, affiliates and all others acting in privity and/or in concert with Acer;

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

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

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

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

DEMAND FOR JURY TRIAL

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

Date: November 24, 2021

Respectfully submitted,

/s/ Derek Gilliland

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