

**UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

KREATOSPHERE LLC,

Plaintiff,

v.

MICROSOFT CORPORATION,

Defendant.

C.A. No. 2:26-cv-00646

JURY TRIAL DEMANDED

PATENT CASE

ORIGINAL COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Kreatosphere LLC files this Original Complaint for Patent Infringement against Microsoft Corporation and would respectfully show the Court as follows:

I. THE PARTIES

1. Plaintiff Kreatosphere LLC (“Plaintiff”) is a Texas limited liability company with a principal place of business located at 2701D West 15th Street, #572, Plano, Texas 75075.

2. On information and belief, Defendant Microsoft Corporation (“Defendant”) is a limited liability company organized and existing under the laws of Washington with authorized retailers at 5514 S Broadway Ave, Tyler, TX 75703. Defendant has a registered agent Corporation Service Company at 211 E. 7th Street, Suite 620, Austin, Texas 78701.

II. JURISDICTION AND VENUE

3. This action arises under the patent laws of the United States, Title 35 of the United States Code. This Court has subject matter jurisdiction of such action under 28 U.S.C. §§ 1331 and 1338(a).

4. On information and belief, Defendant is subject to this Court’s specific and general personal jurisdiction, pursuant to due process and the Texas Long-Arm Statute, due at least to its business in this forum, including at least a portion of the infringements alleged herein.

Furthermore, Defendant is subject to this Court's specific and general personal jurisdiction because Defendant authorized sellers and sales representatives offer, sell, and distribute products accused of infringing Plaintiff's patents to consumers in this judicial district. Microsoft operates Microsoft Windows Stores in Best Buy retail locations within this district, including 5514 S Broadway Ave, Tyler, TX 75703 (<https://stores.bestbuy.com/tx/tyler/5514-s-broadway-ave-246.html>) (last visited 7/25/2026), 422 W Loop 281 Ste 100, Longview, TX 75605 (<https://stores.bestbuy.com/tx/longview/422-w-loop-281-594.html>) (last visited 7/25/2026), and 3333 Preston Rd, Frisco, TX 75034 (<https://stores.bestbuy.com/tx/frisco/3333-preston-rd-180.html>) (last visited 7/25/2026). Microsoft leases the spaces for these Windows Stores from Best Buy and controls its own pricing and merchandise selection. Microsoft also maintains millions of dollars in property, including at data centers, within this District:

The screenshot shows the Collin CAD Property Search interface. The search results are displayed in a table with the following columns: Property ID, Geo ID, Type, Owner Name, Owner ID, Situs Address, Legal Description, and Appraised. The results show five properties owned by Microsoft Corporation, all with Owner ID 758841. The properties are located in Plano, Frisco, and Allen, Texas, and are used for various purposes including data centers and retail stores.

Property ID	Geo ID	Type	Owner Name	Owner ID	Situs Address	Legal Description	Appraised
2716796	P-9000-215-3426-1	P	MICROSOFT CORPORATION	758841	2800 CENTRAL EXPY, PLANO TX 75074	BPP AT 2800 CENTRAL EXPY	\$43,169
2717892	P-9000-215-3502-1	P	MICROSOFT CORPORATION	758841	3333 PRESTON RD 00200, FRISCO TX 75034	BPP AT 3333 PRESTON RD	\$10,141
2734151	P-9000-216-1140-1	P	MICROSOFT CORPORATION	758841	1751 N CENTRAL EXPY 0000C, MCKINNEY TX 75070	BPP AT 1751 N CENTRAL EXPY	\$10,592
2734152	P-9000-216-1141-1	P	MICROSOFT CORPORATION	758841	190 E STACY RD 03000, ALLEN TX 75002	BPP AT 190 E STACY RD	\$6,480
2827989	P-9000-221-1449-1	P	MICROSOFT CORPORATION	758841	2800 SUMMIT AVE, PLANO TX 75074	BPP AT ALIGNED DATA CENTER	\$2,419,446

(<https://esearch.collincad.org/search/result?keywords=OwnerName%3Amicrosoft%20Year%3A2026%20&searchSessionToken=wwCb9%2FIAEh0XwYpPcR9W3fQZlz%2FhUeVZyxTDYDGCHuw%3D%7C2026-07-25T16%3A48%3A11.8719156Z>) (search performed 7/25/2026).

5. Without limitation, on information and belief, within this state and this District, Defendant has used the patented inventions thereby committing, and continuing to commit, acts of patent infringement alleged herein. In addition, on information and belief, Defendant has derived revenues from its infringing acts occurring within Texas and this District. Further, on information and belief, Defendant is subject to the Court's general jurisdiction, including from regularly doing or soliciting business, engaging in other persistent courses of conduct, and deriving substantial revenue from services provided to persons or entities in Texas and this District. Further, on information and belief, Defendant is subject to the Court's personal jurisdiction at least due to its providing services within Texas and this District. Defendant has committed such purposeful acts and/or transactions in Texas and this District such that it reasonably should know and expect that it could be haled into this Court as a consequence of such activity.

6. Venue is proper in this district under 28 U.S.C. § 1400(b). On information and belief, Defendant maintains a places of business at 5514 S Broadway Ave, Tyler, TX 75703 (<https://stores.bestbuy.com/tx/tyler/5514-s-broadway-ave-246.html>) (last visited 7/25/2026), 422 W Loop 281 Ste 100, Longview, TX 75605 (<https://stores.bestbuy.com/tx/longview/422-w-loop-281-594.html>) (last visited 7/25/2026), and 3333 Preston Rd, Frisco, TX 75034 (<https://stores.bestbuy.com/tx/frisco/3333-preston-rd-180.html>) (last visited 7/25/2026). On information and belief, from and within this District Defendant has committed at least a portion of the infringements at issue in this case.

7. For these reasons, personal jurisdiction exists and venue is proper in this Court under 28 U.S.C. § 1400(b).

III. UNITED STATES PATENT NO. 8,265,575

8. Plaintiff incorporates the above paragraphs herein by reference.

9. On September 11, 2012, United States Patent No. 8,265,575 (“the ‘575 Patent”) was duly and legally issued by the United States Patent and Trademark Office. The ‘575 Patent is titled “Methods for Handling a Transmitting Process and Communication Apparatuses Utilizing the Same.” A true and correct copy of the ‘575 Patent is attached hereto as Exhibit 1 and incorporated herein by reference.

10. Kreatosphere LLC is the assignee of all right, title, and interest in the ‘575 Patent, including all rights to enforce and bring actions for infringement and to collect damages for all relevant times against infringers of the ‘575 Patent. Accordingly, Kreatosphere LLC possesses the exclusive right and standing to bring the present action for infringement of the ‘575 Patent by Defendant.

11. The invention in the ‘575 Patent relates to a method for handling a transmitting process of a communication apparatus, and more particularly to a method for handling a transmitting process with reduced power consumption. (Ex. 1 at 1:9-12). The goal of the ‘575 Patent is to improve the power usage of communication devices utilizing Orthogonal Frequency Division Multiple Access (“OFDMA”) using a method that more efficiently handles the transmitting process. (*Id.* at 1:14-35). To do this, the ‘575 Patent discloses a communication apparatus with a power amplifier that amplifies a plurality of up-link messages before the up-link messages are transmitted by an antenna. (*Id.* at 2:10-13). The communication apparatus receives a bit stream comprising information indicating corresponding transmitting time and a sub-carrier frequency of the up-link messages. (*Id.* at 2:14-15). The communication apparatus then prepares the up-link messages to be transmitted according to the information. (*Id.* at 2:15-17). The communication apparatus generates a control signal to the power amplifier according to the information. (*Id.* at 2:17-19). The communication apparatus switches on the power amplifier

during a first time interval of a data frame and switches off the power amplifier during a second time interval of the data frame according to the control signal, wherein during the second time interval of the data frame, there is no up-link message to be transmitted. (*Id.* at 2:19-24). Thus, instead of switching on the power amplifier all the time during the up-link period of a data frame, the on and off time of the power amplifier may be flexibly controlled. (*Id.* at 4:43-46, 54-58). By switching off the power amplifier when there is no up-link message to be transmitted, power consumption is reduced. (*Id.* at 4:61-66).

Asserted Claim

12. Claim 11 of the ‘575 Patent claims:

A method for handling a transmitting process of a communication apparatus in a communication system, wherein the communication apparatus comprises a power amplifier amplifying a plurality of up-link messages before the up-link messages are transmitted by an antenna, comprising:

receiving a bit stream comprising information indicating corresponding transmitting time and sub-carrier frequencies of the up-link messages;

preparing the up-link messages to be transmitted according to the information;

generating a control signal to the power amplifier according to the information; and,

wherein the control signal indicates switching on the power amplifier during a first time interval of a data frame and switching off the power amplifier during a second time interval of the data frame, wherein during the second time interval of the data frame, there is no up-link message to be transmitted.

IV. COUNT I **(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 8,265,575)**

13. Upon information and belief, Defendant directly infringes claim 11 of the ‘575 Patent in Texas, in this District, and elsewhere in the United States, by using and performing the claimed method by using the Microsoft Surface Pro 11 (“Accused Instrumentality”).

14. **Direct Infringement.** As explained below, the Accused Instrumentality practices a method for handling a transmitting process of a communication apparatus (*e.g.*, Microsoft Surface Pro 11 tablet/laptop) in a communication system (*e.g.*, a Wi-Fi network system), wherein the communication apparatus (*e.g.*, Microsoft Surface Pro 11 tablet/laptop) comprises a power amplifier (*e.g.*, a power amplifier or PA of the Front End Module) amplifying a plurality of up-link messages (*e.g.*, Data field in the PPDU) before the up-link messages (*e.g.*, Data field in the PPDU) are transmitted by an antenna (*e.g.*, antenna of the Front End Module), receiving a bit stream comprising information (*e.g.*, Trigger frame) indicating corresponding transmitting time (*e.g.*, transmitting opportunity duration) and sub-carrier frequencies (*e.g.*, subcarrier and resource allocation) of the up-link messages (*e.g.*, Data field in the PPDU). As shown below, the accused product supports Wi-Fi 7 connectivity by utilizing a Front-End Module. This Qualcomm Front End module comprises integrated power amplifiers with multiple operation modes. Wi-Fi 7 is backward compatible, thereby supporting earlier standard such as Wi-Fi 6. As shown below, an exemplary 5G FEM comprises antenna modules which connect power amplifiers for uplink transmission. The power amplifiers can be enabled with a control signal PAEN, *e.g.*, PA Enable. The Accused Instrumentality follows Wi-Fi 6 or IEEE 802.11ax standard. The standard discloses that a non-AP HE STA (*e.g.*, the Accused Instrumentality) receives a trigger frame (*e.g.*, bit stream) from an access point. The non-AP HE STA gets transmission opportunity on receiving the trigger frame. The trigger frame comprises details of transmitting duration and resource unit information (*e.g.*, sub-carrier frequencies).

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Processor

[What does a processor do?](#)

▼ About Surface Pro, Copilot+ PC, 13-inch

Surface Pro, 11th Edition. Exceptional performance, all-day battery life,¹ and new, unique AI experiences help make your device smarter, faster, and more creative—all in a flexible design combining the portability of a tablet and the power of a laptop. Windows 11 Copilot+ PCs are designed for advanced AI experiences to make every day more efficient and productive.²

▼ What's in the box?

- **Surface Pro (11th Edition)**
- Quick Start Guide
- Safety and warranty documents

(E.g., https://www.microsoft.com/en-us/store/configure/surface-pro-13-inch/8n9t09p96cmj?icid=deals-page_R1_CP1_SurfacePro11-13inch).



Surface Pro, Copilot+ PC, 13-inch

Connectivity

Wi-Fi 7³

Processor

Snapdragon[®] X Plus (10 Core),
with LCD display

Snapdragon[®] X Elite (12 Core),
with OLED display

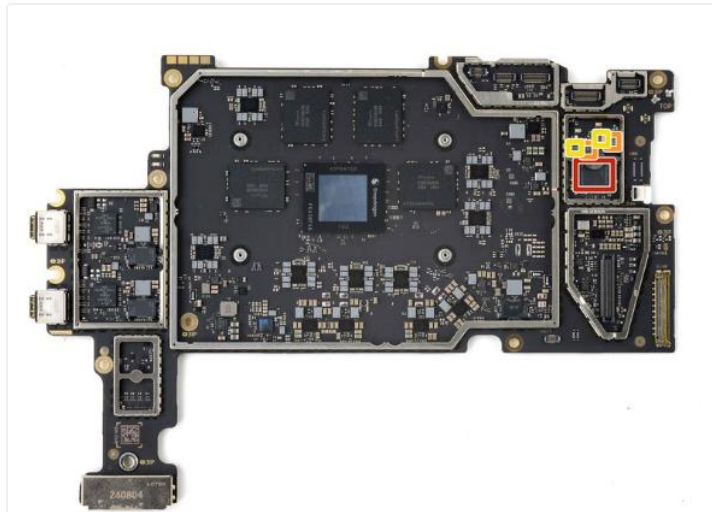
(E.g., https://www.microsoft.com/en-us/store/configure/surface-pro-13-inch/8n9t09p96cmj?icid=deals-page_R1_CP1_SurfacePro11-13inch).

Which Surface devices support Wi-Fi 7?

[Surface Laptop 7th Edition](#) and [Surface Pro 11th Edition](#) both support Wi-Fi 7.¹ This allows you to surf the web—among other things—even faster on these AI-powered devices. If you're looking for a stylish laptop with a smart CPU (central processing unit) and exceptionally powerful NPU (neural processing unit), Surface Laptop 7th Edition is right for you. But if you're looking for an AI-powered 2-in-1 device that you can turn into a tablet or laptop, you'll love the unrivaled flexibility of the ultra-light, ultra-thin Surface Pro 11th Edition. Also, these

(E.g., <https://www.microsoft.com/en-us/surface/do-more-with-surface/what-is-wi-fi-7>).

Step 5 Main Board Side 1 - Connectivity



- Qualcomm WCN7851-501 FastConnect 7800 Wi-Fi 7 & Bluetooth 5.4 controller
- Qualcomm 2.4 GHz front-end module
- Qualcomm 5 GHz front-end module

(E.g., <https://www.ifixit.com/Guide/Microsoft+Surface+Pro+11+Chip+ID/174016>).

 Products ▾ Applications ▾ Developer ▾ Support ▾ Company ▾

Wi-Fi / Products / FastConnect / FastConnect 7800



FastConnect 7800

[Overview](#) [Documentation](#) [Software](#) [Hardware](#)

Leading Wi-Fi 7, premium Wi-Fi 6/6E, and advanced Bluetooth audio come together in this powerful and versatile connectivity system to unlock extreme performance for mobile, compute, and XR experiences.

(E.g., <https://www.qualcomm.com/wi-fi/products/fastconnect/fastconnect-7800>).

The Qualcomm® FastConnect™ 7800 Mobile Connectivity System is an advanced 14nm Wi-Fi and Bluetooth® Connectivity system delivering ultra-high speeds (up to 5.8 Gbps*), sustained low latency (2 ms), and premium Bluetooth audio.

While maintaining compliance with the latest Wi-Fi 6/6E and Wi-Fi 7 standards, FastConnect 7800 is packed with sophisticated innovation that goes beyond standard benchmarks. High Band Simultaneous Multi-Link Wi-Fi technology uniquely harnesses the potential of 5 and 6GHz bands for multiple links of high band performance for throughput hungry and latency sensitive applications,

Specifications

Wi-Fi	
Generation	<u>Wi-Fi 7, Wi-Fi 6E, Wi-Fi 6, Wi-Fi 5, Wi-Fi 4</u>
Standards	<u>802.11be, 802.11ax, 802.11ac, 802.11n, 802.11g, 802.11b, 802.11a</u>
Spectral Bands	<u>6 GHz, 5 GHz, 2.4 GHz</u>
Channels	320 MHz, 240 MHz, 160 MHz, 80 MHz, 40 MHz, 20 MHz
Part	
Part Number(s)	<u>WCN785x-1</u> , WCN785x-5

(E.g., <https://www.qualcomm.com/wi-fi/products/fastconnect/fastconnect-7800>).

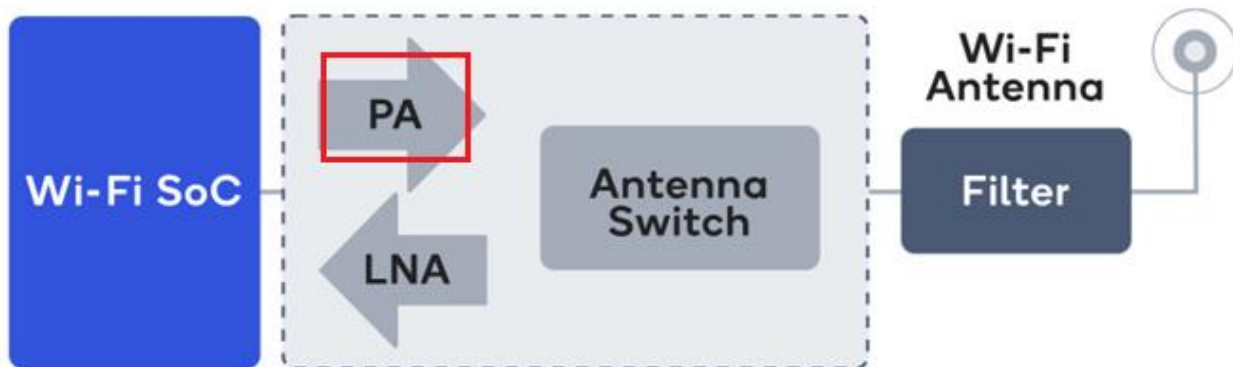
Fully Integrated front end module designed for Wi-Fi

Our Qualcomm® QXM108x Wi-Fi Front End Modules (FEMs) are comprised of small size RFFEs with integrated active and passive components used to cover the wide breadth of IEEE802.11b/g/ac/ax/be applications. Our latest offering includes integrated power amplifiers, low noise amplifiers, switches, and directional couplers. The latest Wi-Fi air interface standards are supported, including Wi-Fi 6, Wi-Fi 6E and Wi-Fi 7.

(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).

Paired with the latest Qualcomm® FastConnect 6900 and Qualcomm® FastConnect 7800 Wi-Fi solutions, our Qualcomm® QXM108x Wi-Fi Front End Modules deliver a comprehensive modem-to-antenna system for flexible, cost-effective, high-performance Wi-Fi connected experiences.

(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x#overview>).



(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).

- Small-size PA/LNA RFFEs for IEEE802.11 a/n/ac/ax/be applications
- Covers 2.4GHz, 5GHz and 6GHz frequency ranges
- Supports Wi-Fi 7
- Integrated power amplifier (PA) supporting several high linearity and high-efficiency modes
- Integrated low noise amplifier supporting high gain, high efficiency, and bypass modes
- Integrated switches for single antenna Wi-Fi Rx and Wi-Fi Tx operation
- Integrated directional coupler for precise transmit power control
- Optimized for use with Qualcomm® WCN685x and Qualcomm® WCN785x

(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).

Wi-Fi Front End Modules

Our Wi-Fi front end modules (QXM modules) combine power amplifiers (PAs), low noise amplifiers (LNAs) and switches into packages that offer high performance, highly integrated solutions that enable our modem-to-antenna Wi-Fi solutions for advanced Wi-Fi 6, Wi-Fi 6E, Wi-Fi 7 and Bluetooth 5.x applications.

(E.g., <https://www.qualcomm.com/modems/rf-front-end-wifi-solutions>).

Our end-to-end design: The advantage for OEMs

Wi-Fi Front End Modules are integrated RF components that help amplify and route signals between the Wi-Fi SoC and the antenna. This typically consists of power amplifiers (PA), low noise amplifiers (LNA), filters, and switches packaged inside a module. An end device typically includes a FEM for 2.4 GHz Wi-Fi and Bluetooth frequencies, and a FEM for 5-7 GHz Wi-Fi.

(E.g., <https://www.qualcomm.com/news/onq/2022/06/new-rf-front-end-connectivity-solution-to-boost-wi-fi-and-blueto>).

Let's take a look at how FEMs work.

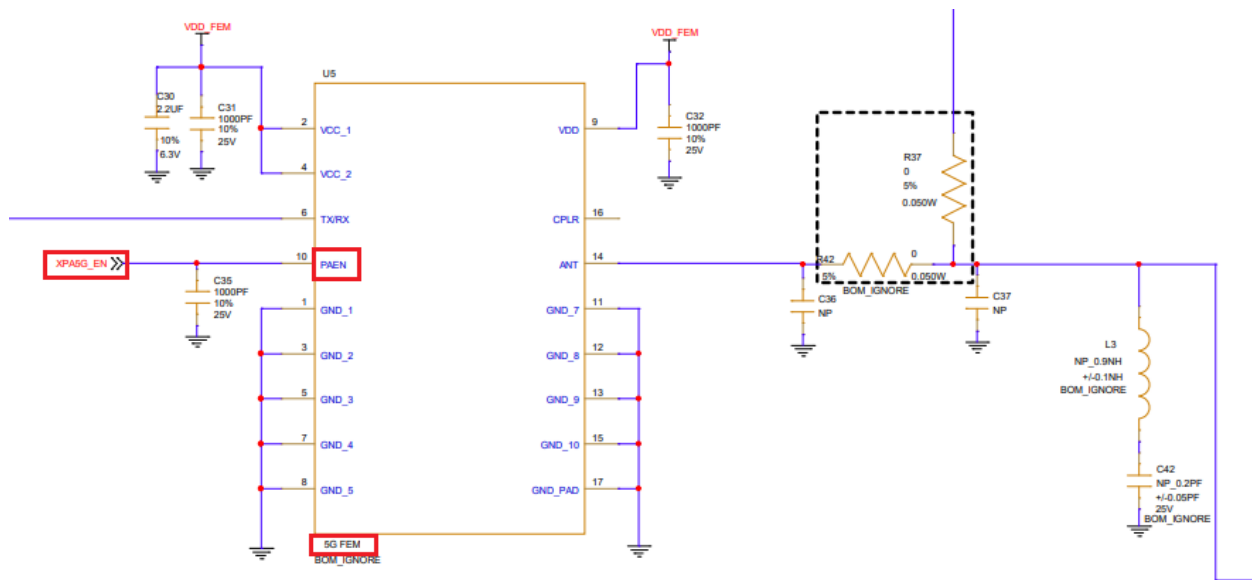
On the receive (Rx) side, an integrated LNA boosts weak incoming RF signals. The main objective is to boost the signal-to-noise ratio (SNR), which makes the listening device more sensitive to the signal.

On the transmit (Tx) side, an integrated PA boosts the outgoing RF signals that are delivered from the Wi-Fi SoC. This is done in a highly efficient and linear manner, such that transmission range is extended while power is efficiently used.

(E.g., <https://www.qualcomm.com/news/onq/2022/06/new-rf-front-end-connectivity-solution-to-boost-wi-fi-and-blueto>).

To achieve the best module level performance, at Qualcomm Technologies we co-design the PA and LNA together in-house so that they work together as efficiently as possible. To achieve the best possible system-level performance, the Wi-Fi FEMs are designed in close collaboration with the Wi-Fi SoC and complementary discrete filter solutions. In addition to Wi-Fi and Bluetooth operating harmoniously together, there must be seamless concurrency with 5G cellular signals as well. Qualcomm Technologies is uniquely positioned as the only technology provider providing a comprehensive, baseband-to-antenna wireless solution.

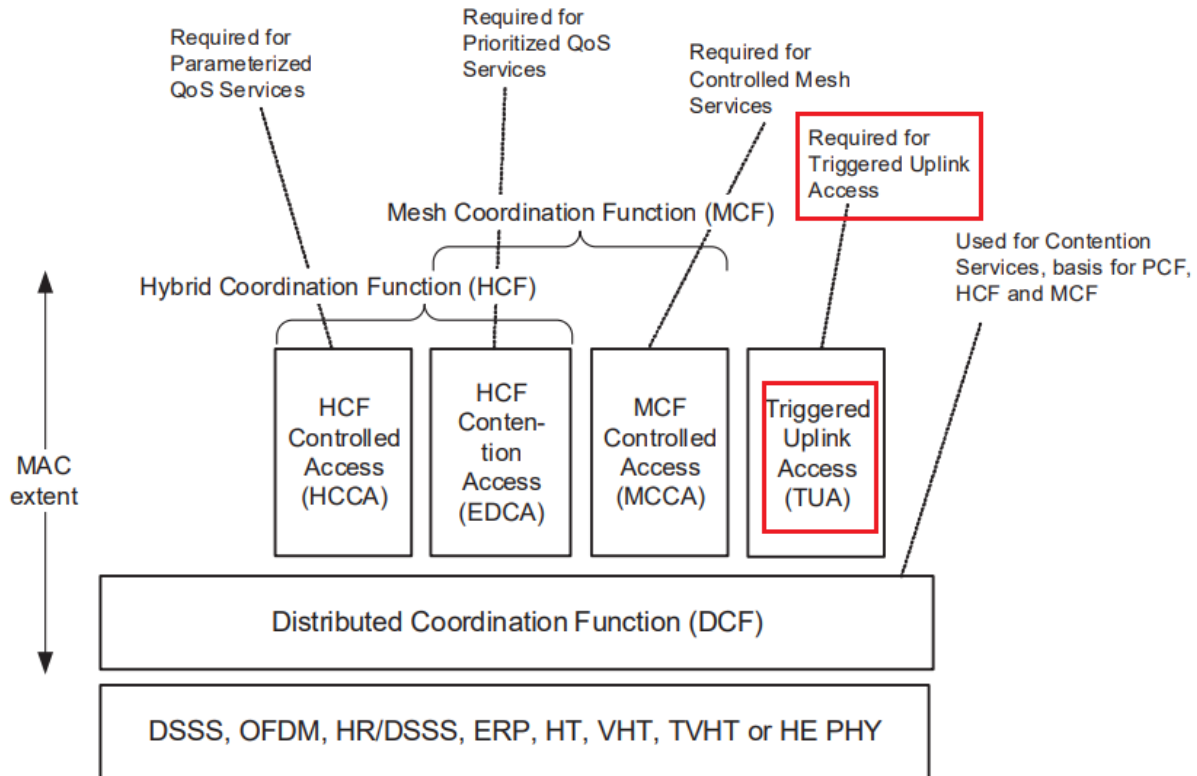
(E.g., <https://www.qualcomm.com/news/onq/2022/06/new-rf-front-end-connectivity-solution-to-boost-wi-fi-and-blueto>).



(E.g., https://docs.qualcomm.com/doc/80-WL730-43/80-WL730-43_REV_AE_QCC730_iPA_Hostless_Design_Sample_Reference_Schematic.pdf).

The MAC functional description is presented in this clause. The architecture of the MAC sublayer, including the distributed coordination function (DCF), the hybrid coordination function (HCF), the mesh coordination function (MCF), the triggered UL access (TUA), and their coexistence in an IEEE 802.11 LAN are introduced in 10.2. These functions are expanded on in 10.3, 10.23, and 10.24, and 26.2. Fragmentation and defragmentation are defined in 10.4 and 10.5. Multirate support is addressed in 10.6. A number of additional restrictions to limit the cases in which MSDUs are reordered or discarded are described in 10.7. Operation across regulatory domains is defined in 10.22. The block ack mechanism is described in 10.25. The No Ack mechanism is described in 10.26. The protection mechanism is described in 10.27. Rules for processing MAC frames are described in 10.28.

(E.g., IEEE 802.11ax standard).



(E.g., IEEE 802.11ax standard).

triggered uplink access (TUA): A mechanism by which one or more non-access-point (non-AP) stations (STAs) simultaneously participate in an uplink (UL) transmission to an access point (AP) using resource units (RUs) allocated in the preceding Trigger frame.

triggering frame: A Trigger frame or a frame carrying a TRS Control subfield.

(E.g., IEEE 802.11ax standard).

The main PHY features in an HE STA that are not present in VHT STA or HT STA are the following:

- Mandatory support for DL and UL OFDMA
- Mandatory support for DL MU-MIMO by an HE AP that supports 4 or more spatial streams when MU-MIMO is done on the entire PPDU bandwidth
- Mandatory support for DL MU-MIMO reception for a non-AP HE STA
- Mandatory support for the HE sounding protocol to support beamforming for a non-AP STA beamformee and optional otherwise
- Optional support for HE-MCSs 10 and 11
- Optional support for UL MU-MIMO
- Optional support for preamble puncturing

(E.g., IEEE 802.11ax standard).

An HE AP sends a Trigger frame to initiate UL MU operation using UL OFDMA or UL MU-MIMO transmissions or a frame containing a TRS Control subfield to initiate UL OFDMA transmissions. The frame initiating these transmissions in the uplink direction is a triggering frame. The triggering frame identifies non-AP STAs participating in UL MU operation and assigns RUs and/or spatial streams to these STAs. Multi-STA BlockAck frames can be used by the AP to acknowledge the frames transmitted by multiple non-AP STAs. The scheduling of these Trigger frames can be set up between a non-AP STA and the AP using TWT operation to save power and reduce collisions.

9.3.1.22 Trigger frame format

9.3.1.22.1 General

A Trigger frame allocates resources for and solicits one or more HE TB PPDU transmissions. The Trigger frame also carries other information required by the responding STA to send an HE TB PPDU.

The format for the Trigger frame is defined in Figure 9-64a.

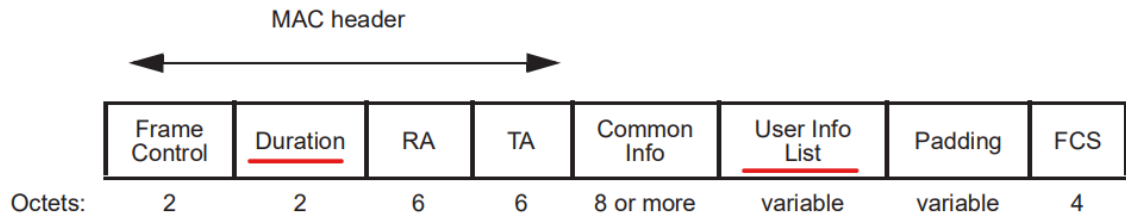


Figure 9-64a—Trigger frame format

The Duration field is set as defined in 9.2.5.

(E.g., IEEE 802.11ax standard).

- 7) In a Basic Trigger frame, the Duration/ID field is set to the estimated time required to transmit the solicited HE TB PPDU, plus the estimated time required to transmit the acknowledgment for the solicited HE TB PPDU if required, plus applicable SIFSs.

Multiple protection settings. The Duration/ID field is set to a value D as follows:

...

- 4) Else $T_{END-NAV} - T_{PPDU} \leq D \leq T_{TXOP-REMAINING} - T_{PPDU}$

where

$T_{SINGLE-MSDU}$	is the estimated time required for the transmission of the allowed frame exchange sequence defined in 10.23.2.9 (for a TXOP limit of 0), including applicable IFS durations
$T_{PENDING}$	is the estimated time required for the transmission of — Pending MPDUs of the same AC — Any associated immediate response frames — Any HT NDP, VHT NDP, <u>HE sounding NDP</u>, or Beamforming Report Poll frame transmissions and explicit feedback response frames — Applicable IFSs — Any RDG — Any BDT — Any pending QoS Null frame exchanges by paged STAs — Any pending PS-Poll or NDP PS-Poll frame exchanges by paged STAs
T_{TXOP}	is the duration given by dot11EDCATableTXOPLimit (dot11QAPEDCATableTXOPLimit for the AP) for that AC
$T_{TXOP-REMAINING}$	is T_{TXOP} less the time already used time within the TXOP
$T_{END-NAV}$	is the remaining duration of any NAV set by the TXOP holder, or 0 if no NAV has been established
T_{PPDU}	is the time required for transmission of the current PPDU

(E.g., IEEE 802.11ax standard).

The Common Info field is defined in Figure 9-64b.

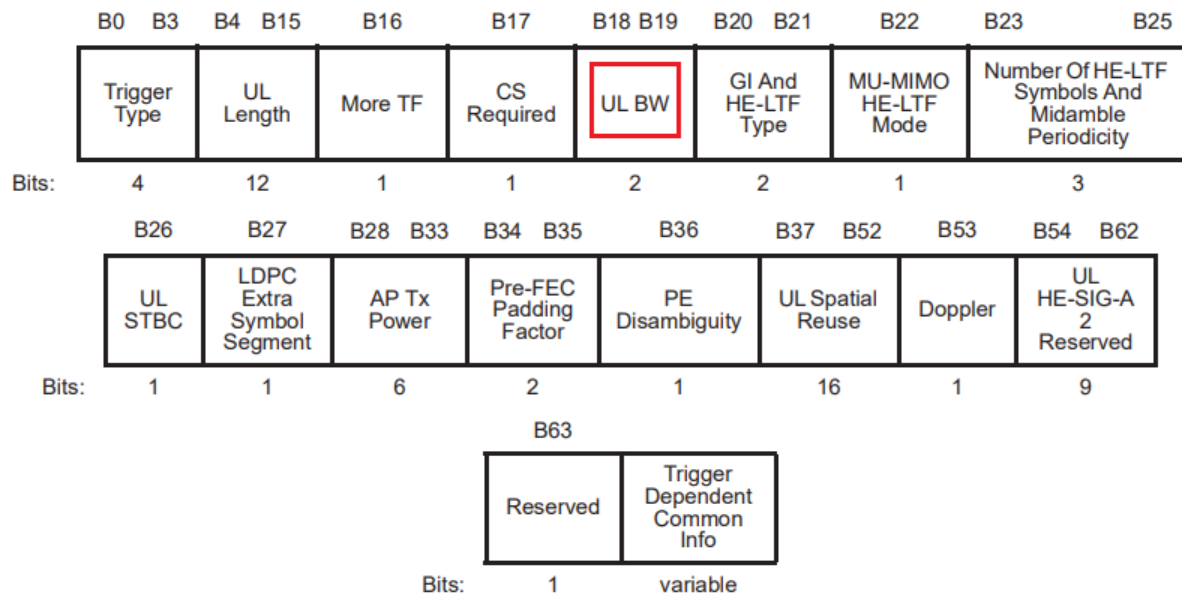


Figure 9-64b—Common Info field format

(E.g., IEEE 802.11ax standard).

The UL BW subfield of the Common Info field indicates the bandwidth in the HE-SIG-A field of the HE TB PPDU and is defined in Table 9-29d.

Table 9-29d—UL BW subfield encoding

UL BW subfield value	Description
0	20 MHz
1	40 MHz
2	80 MHz
3	80+80 MHz or 160 MHz

(E.g., IEEE 802.11ax standard).

The User Info field is defined in Figure 9-64d for all Trigger frame variants, except the NFRP Trigger frame, which is defined in 9.3.1.22.9.

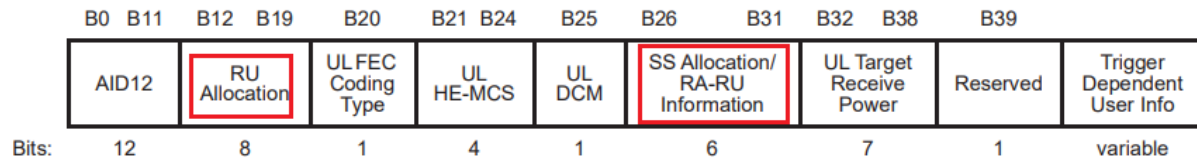


Figure 9-64d—User Info field format

The AID12 subfield in the User Info field is encoded as defined in Table 9-29h:

Table 9-29h—AID12 subfield encoding

AID12 subfield	Description
0	User Info field allocates one or more contiguous RA-RUs for associated STAs
1–2007	User Info field is addressed to an associated STA whose AID is equal to the value in the AID12 subfield
2008–2044	Reserved
2045	User Info field allocates one or more contiguous RA-RUs for unassociated STAs
2046	Unallocated RU
2047–4094	Reserved
4095	Start of Padding field

If the AID12 subfield is 2046, then the remaining subfields in the User Info field are reserved, except for the RU Allocation subfield, which indicates the RU location of the unallocated RU.

(E.g., IEEE 802.11ax standard).

27.3.2 Subcarrier and resource allocation

27.3.2.1 General

An OFDM symbol is constructed of subcarriers, the number of which is a function of the PPDU bandwidth. There are several subcarrier types:

- a) Data subcarriers, which are used for data transmission (see 27.3.2.2).
- b) Pilot subcarriers, which are used for phase information and parameter tracking (see 27.3.2.4).
- c) Unused subcarriers, which are not used for either data or pilot transmission. The unused subcarriers are the DC subcarriers (see 27.3.2.2), the Guard band subcarriers at the band edges (see 27.3.2.2), and the Null subcarriers (see 27.3.2.3).

The following notations are used to describe the indices for a set of subcarriers:

- $[x1:y1]$ represents the set of subcarriers with index k that satisfies $x1 \leq k \leq y1$.
- $[x1:y1, x2:y2]$ represents the set of subcarriers with index k that satisfies either $x1 \leq k \leq y1$ or $x2 \leq k \leq y2$.

(E.g., IEEE 802.11ax standard).

27.3.2.2 Resource unit, guard, and DC subcarriers

The RUs defined for DL and UL transmission are as follows: 26-tone RU, 52-tone RU, 106-tone RU, 242-tone RU, 484-tone RU, 996-tone RU, and 2×996-tone RU.

The 26-tone RU, 52-tone RU, 106-tone RU, and 242-tone RU are used in the 20 MHz, 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz HE MU PPDU format. The 52-tone RU, 106-tone RU and 242-tone RU are used in the 20 MHz, 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz HE TB PPDU format. The 26-tone RU is used in the 20 MHz, 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz HE TB PPDU format unless a STA is operating in an operating class for which the behavior limits set listed in Annex E includes the DFS 50 100 Behavior (see 26.5.2.2.1 and 26.5.2.3). The 106-tone RU is used in the HE ER SU PPDU format.

The 484-tone RU is used in the 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz HE MU PPDU and HE TB PPDU formats. The 996-tone RU is used in the 80 MHz, 160 MHz, and 80+80 MHz HE MU PPDU and HE TB PPDU formats. The 2×996-tone RU is used in the 160 MHz and 80+80 MHz HE MU PPDU format and 160 MHz and 80+80 MHz HE TB PPDU format.

The 242-tone and larger RUs are used in the HE SU PPDU format. The 242-tone RU is used in the 20 MHz HE SU PPDU and HE ER SU PPDU formats. The 484-tone RU is used in the 40 MHz HE SU PPDU format. The 996-tone RU is used in the 80 MHz HE SU PPDU format. The 2×996-tone RU is used in the 160 MHz and 80+80 MHz HE SU PPDU formats.

The maximum number of RUs in the 20 MHz, 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz HE PPDU formats is defined in Table 27-6.

(E.g., IEEE 802.11ax standard).

15. The Accused Instrumentality practices preparing the up-link messages (*e.g.*, Data field in the PPDU) to be transmitted according to the information (*e.g.*, transmitting opportunity duration and resource unit allocation).

27.3.4 HE PPDU formats

Four HE PPDU formats are defined: HE SU PPDU, HE MU PPDU, HE ER SU PPDU, and HE TB PPDU. The HE sounding NDP is a variant of the HE SU PPDU and defined in 27.3.17. The HE TB feedback NDP is a variant of the HE TB PPDU and defined in 27.3.18.

NOTE—The HE ER SU PPDU is not a variant of the HE SU PPDU. Requirements related to HE SU PPDU and HE ER SU PPDU are specified separately.

The format of the HE SU PPDU is defined as in Figure 27-8. This PPDU format is used for SU transmission, and in this format, the HE-SIG-A field is not repeated.

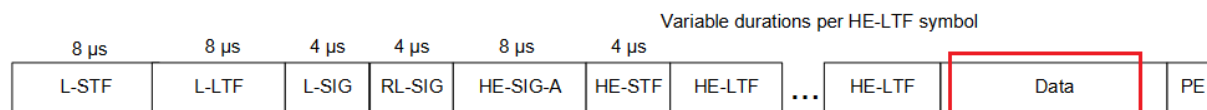


Figure 27-8—HE SU PPDU format

(*E.g.*, IEEE 802.11ax standard).

27.3.6.10 Construction of the Data field in an HE SU PPDU, HE ER SU PPDU, and HE TB PPDU

27.3.6.10.1 Using BCC

The construction of the Data field in an HE SU PPDU, HE ER SU PPDU, and HE TB PPDU with BCC encoding proceeds as follows:

- a) Construct the SERVICE field as described in 27.3.12.3, and append the PSDU to the SERVICE field.
- b) Pre-FEC padding: Append the pre-FEC pad bits and tail bits as described in 27.3.12.
- c) Scrambler: Scramble the pre-FEC padded data.
- d) BCC encoder: BCC encode as described in 27.3.12.5.1.
- e) Post-FEC padding: Append the post-FEC pad bits and PE field as described in 27.3.12.
- f) Stream parser: Rearrange the output of BCC encoder into blocks as described in 27.3.12.6.
- g) BCC interleaver: Interleave as described in 27.3.12.8.
- h) Constellation mapper: Map to BPSK, BPSK DCM, QPSK, QPSK DCM, 16-QAM, 16-QAM DCM, 64-QAM, or 256-QAM constellation points as described in 27.3.12.9.
- i) STBC: Apply STBC as described in 27.3.12.12.
- j) Pilot insertion: Insert pilots following the steps described in 27.3.12.13.
- k) CSD: Apply CSD for each space-time stream and frequency segment as described in 27.3.11.2.2.
- l) Spatial mapping: Apply the Q matrix as described in 27.3.12.14.
- m) IDFT: In an 80+80 MHz transmission, map each frequency subblock to a separate IDFT. Compute the inverse discrete Fourier transform.
- n) GI and windowing: Prepend a GI determined by the TXVECTOR parameter GI_TYPE, and apply windowing as described in 27.3.10.
- o) Analog and RF: Upconvert the resulting complex baseband waveform with each transmit chain to an RF signal according to the center frequency of the desired channel and transmit. Refer to 27.3.10 and 27.3.11 for details.

(E.g., IEEE 802.11ax standard).

fragmentation: The process of partitioning a medium access control (MAC) service data unit (MSDU), aggregate MAC service data unit (A-MSDU) or MAC management protocol data unit (MMPDU) into a sequence of smaller MAC protocol data units (MPDUs) prior to transmission. The process of recombining a set of fragment MPDUs into an MSDU, A-MSDU, or MMPDU is known as defragmentation. These processes are described in 5.8.1.9 of ISO/IEC 7498-1:1994.

(E.g., IEEE 802.11ax standard).

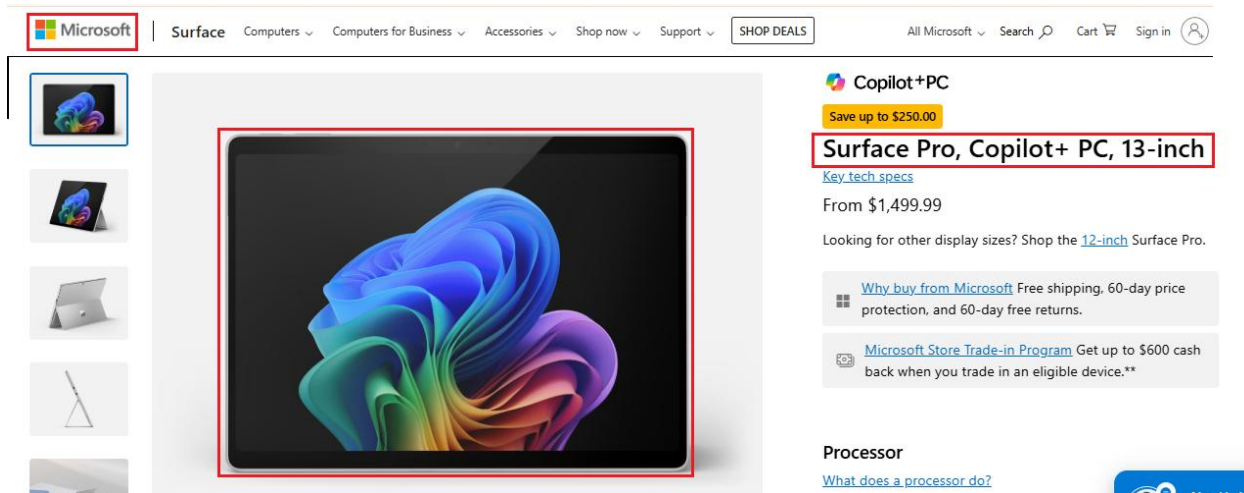
An AP that transmits a PPDU may solicit an HE TB PPDU from one or more non-AP STAs through one of the following mechanisms:

- Including in the PPDU one or more Trigger frames that include one or more User Info fields with one of the following AID12 subfield settings:
 - The AID12 subfield is set to the 12 LSBs of the AID of the non-AP STA if the User Info field is addressed to a STA that is associated with the AP.
 - The AID12 subfield is set to the 12 LSBs of the AID of the non-AP STA if the User Info field is addressed to a STA that is associated with an AP corresponding to a nontransmitted BSSID in a multiple BSSID set to which the AP belongs, the TA field of the Trigger frame is set to the transmitted BSSID, and the non-AP STA has set the Rx Control Frame To MultiBSS subfield in the HE Capabilities element it transmits to 1.
 - The AID12 subfield indicates that one or more contiguous RA-RUs are allocated (see 26.5.4).
- Including in the PPDU one or more individually addressed frames that include a TRS Control subfield and that are carried in one of the following:
 - An S-MPDU that solicits an immediate Ack frame (see 10.12.8).
 - An A-MPDU that solicits an immediate BlockAck frame (see 10.25.6.7).
 - A multi-TID A-MPDU that solicits an immediate Multi-STA BlockAck frame (see 26.6.3).

The AP shall follow the rules in 26.3.2 if any MPDUs are fragments.

(E.g., IEEE 802.11ax standard).

16. The Accused Instrumentality practices generating a control signal to the power amplifier (e.g., control signal PAEN, *i.e.*, PA Enable, to switch on the power amplifier/PA via SPDT as illustrated by the diagrams for QXM108x) according to the information. As shown below, the Accused Instrumentality supports Wi-Fi 6 connectivity by utilizing a Front-End Module from Qualcomm QXM108X. This Wi-Fi 6 Front End module comprises antenna modules which connect power amplifiers for uplink transmission. The power amplifiers can be enabled with a control signal PAEN, *e.g.*, PA Enable. When the Accused Instrumentality transmits data, power amplifier is enabled for transmitting uplink data. As shown below, an exemplary 5G FEM comprises antenna modules which connect power amplifiers for uplink transmission. The power amplifiers can be enabled with a control signal PAEN, *e.g.*, PA Enable.



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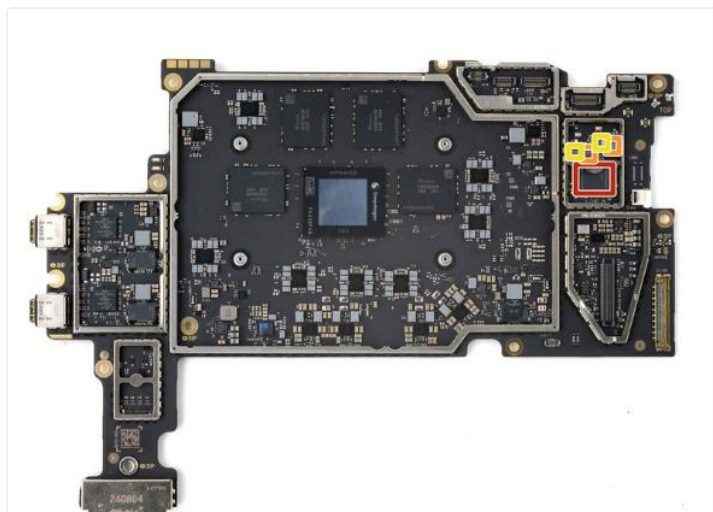
Surface Pro, 11th Edition. Exceptional performance, all-day battery life,¹ and new, unique AI experiences help make your device smarter, faster, and more creative—all in a flexible design combining the portability of a tablet and the power of a laptop. Windows 11 Copilot+ PCs are designed for advanced AI experiences to make every day more efficient and productive.²

(E.g., https://www.microsoft.com/en-us/store/configure/surface-pro-13-inch/8n9t09p96cmj?icid=deals-page_R1_CP1_SurfacePro11-13inch).

Which Surface devices support Wi-Fi 7?

Surface Laptop 7th Edition and Surface Pro 11th Edition both support Wi-Fi 7.¹ This allows you to surf the web—among other things—even faster on these AI-powered devices. If you're looking for a stylish laptop with a smart CPU (central processing unit) and exceptionally powerful NPU (neural processing unit), Surface Laptop 7th Edition is right for you. But if you're looking for an AI-powered 2-in-1 device that you can turn into a tablet or laptop, you'll love the unrivaled flexibility of the ultra-light, ultra-thin Surface Pro 11th Edition. Also, these

(E.g., <https://www.microsoft.com/en-us/surface/do-more-with-surface/what-is-wi-fi-7>).

Step 5 Main Board Side 1 - Connectivity

- Qualcomm WCN7851-501 FastConnect 7800 Wi-Fi 7 & Bluetooth 5.4 controller
- Qualcomm 2.4 GHz front-end module
- Qualcomm 5 GHz front-end module

(E.g., <https://www.ifixit.com/Guide/Microsoft+Surface+Pro+11+Chip+ID/174016>).


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FastConnect 7800

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Leading Wi-Fi 7, premium Wi-Fi 6/6E, and advanced Bluetooth audio come together in this powerful and versatile connectivity system to unlock extreme performance for mobile, compute, and XR experiences.

The Qualcomm® FastConnect™ 7800 Mobile Connectivity System is an advanced 14nm Wi-Fi and Bluetooth® Connectivity system delivering ultra-high speeds (up to 5.8 Gbps*), sustained low latency (2 ms), and premium Bluetooth audio.

While maintaining compliance with the latest Wi-Fi 6/6E and Wi-Fi 7 standards, FastConnect 7800 is packed with sophisticated innovation that goes beyond standard benchmarks. High Band Simultaneous Multi-Link Wi-Fi technology uniquely harnesses the potential of 5 and 6GHz bands for multiple links of high band performance for throughput hungry and latency sensitive applications,

(E.g., <https://www.qualcomm.com/wi-fi/products/fastconnect/fastconnect-7800>).

Specifications

Wi-Fi	
Generation	<u>Wi-Fi 7, Wi-Fi 6E, Wi-Fi 6, Wi-Fi 5, Wi-Fi 4</u>
Standards	<u>802.11be, 802.11ax, 802.11ac, 802.11n, 802.11g, 802.11b, 802.11a</u>
Spectral Bands	<u>6 GHz, 5 GHz, 2.4 GHz</u>
Channels	320 MHz, 240 MHz, 160 MHz, 80 MHz, 40 MHz, 20 MHz
Part	
Part Number(s)	<u>WCN785x-1</u> , WCN785x-5

(E.g., <https://www.qualcomm.com/wi-fi/products/fastconnect/fastconnect-7800>).

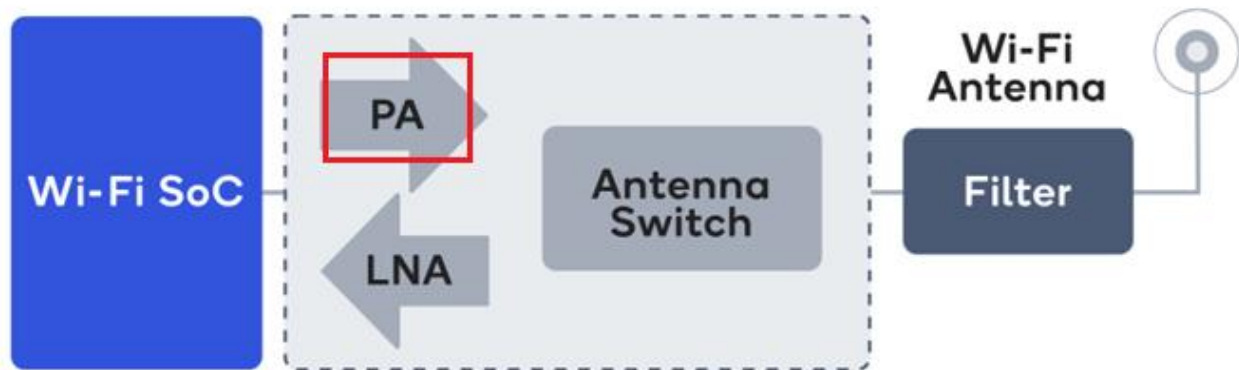
Fully Integrated front end module designed for Wi-Fi

Our Qualcomm® QXM108x Wi-Fi Front End Modules (FEMs) are comprised of small size RFFEs with integrated active and passive components used to cover the wide breadth of IEEE802.11b/g/ac/ax/be applications. Our latest offering includes integrated power amplifiers, low noise amplifiers, switches, and directional couplers. The latest Wi-Fi air interface standards are supported, including Wi-Fi 6, Wi-Fi 6E and Wi-Fi 7.

(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).

Paired with the latest Qualcomm® FastConnect 6900 and Qualcomm® FastConnect 7800 Wi-Fi solutions, our Qualcomm® QXM108x Wi-Fi Front End Modules deliver a comprehensive modem-to-antenna system for flexible, cost-effective, high-performance Wi-Fi connected experiences.

(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).



(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).

- Small-size PA/LNA RFFE for IEEE802.11a/n/ac/ax/be applications
- Covers 2.4GHz, 5GHz and 6GHz frequency ranges
- Supports Wi-Fi 7
- Integrated power amplifier (PA) supporting several high linearity and high-efficiency modes
- Integrated low noise amplifier supporting high gain, high efficiency, and bypass modes
- Integrated switches for single antenna Wi-Fi Rx and Wi-Fi Tx operation
- Integrated directional coupler for precise transmit power control
- Optimized for use with Qualcomm® WCN685x and Qualcomm® WCN785x

(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).

Wi-Fi Front End Modules

Our Wi-Fi front end modules (QXM modules) combine power amplifiers (PAs), low noise amplifiers (LNAs) and switches into packages that offer high performance, highly integrated solutions that enable our modem-to-antenna Wi-Fi solutions for advanced Wi-Fi 6, Wi-Fi 6E, Wi-Fi 7 and Bluetooth 5.x applications.

(E.g., <https://www.qualcomm.com/modems/rf-front-end-wifi-solutions>).

Our end-to-end design: The advantage for OEMs

Wi-Fi Front End Modules are integrated RF components that help amplify and route signals between the Wi-Fi SoC and the antenna. This typically consists of power amplifiers (PA), low noise amplifiers (LNA), filters, and switches packaged inside a module. An end device typically includes a FEM for 2.4 GHz Wi-Fi and Bluetooth frequencies, and a FEM for 5-7 GHz Wi-Fi.

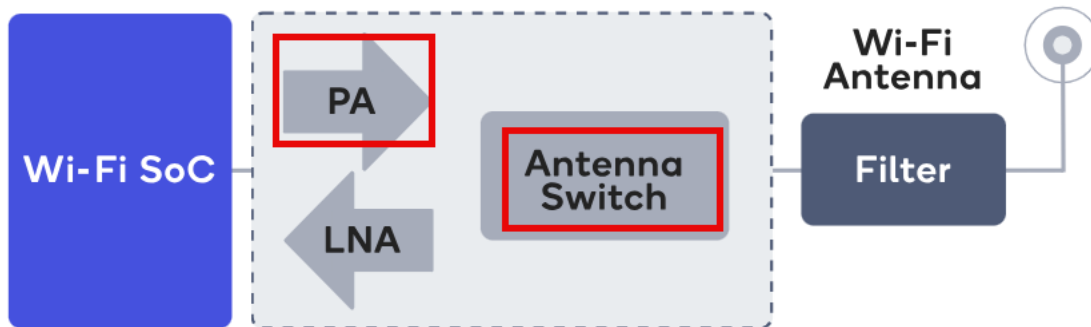
Let's take a look at how FEMs work.

On the receive (Rx) side, an integrated LNA boosts weak incoming RF signals. The main objective is to boost the signal-to-noise ratio (SNR), which makes the listening device more sensitive to the signal.

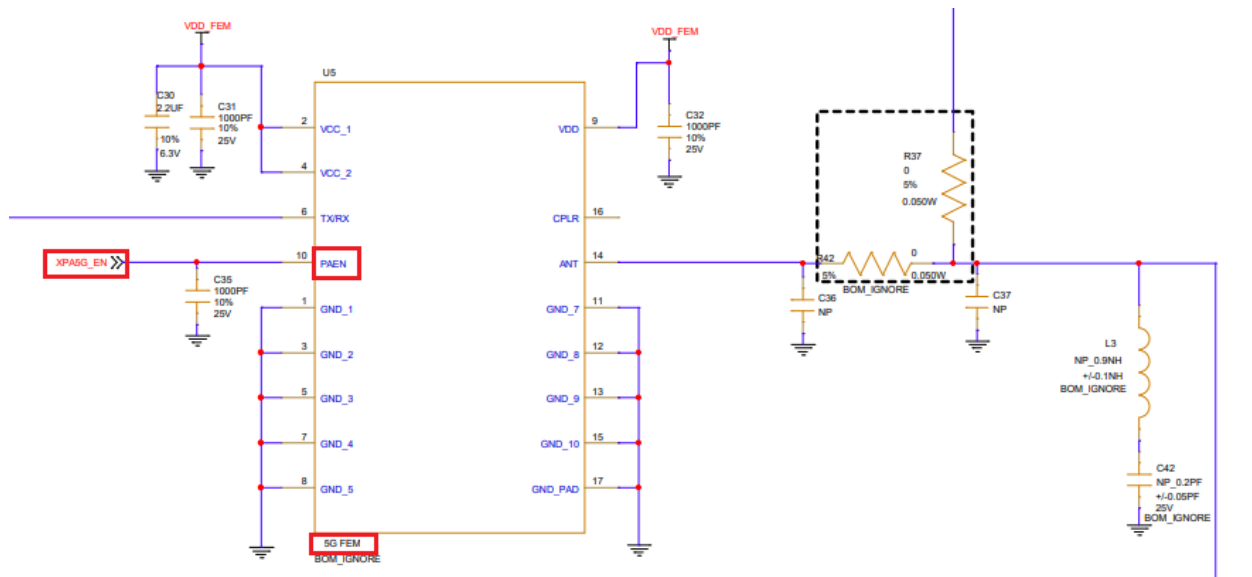
On the transmit (Tx) side, an integrated PA boosts the outgoing RF signals that are delivered from the Wi-Fi SoC. This is done in a highly efficient and linear manner, such that transmission range is extended while power is efficiently used.

To achieve the best module level performance, at Qualcomm Technologies we co-design the PA and LNA together in-house so that they work together as efficiently as possible. To achieve the best possible system-level performance, the Wi-Fi FEMs are designed in close collaboration with the Wi-Fi SoC and complementary discrete filter solutions. In addition to Wi-Fi and Bluetooth operating harmoniously together, there must be seamless concurrency with 5G cellular signals as well. Qualcomm Technologies is uniquely positioned as the only technology provider providing a comprehensive, baseband-to-antenna wireless solution.

(E.g., <https://www.qualcomm.com/news/onq/2022/06/new-rf-front-end-connectivity-solution-to-boost-wi-fi-and-blueto>).



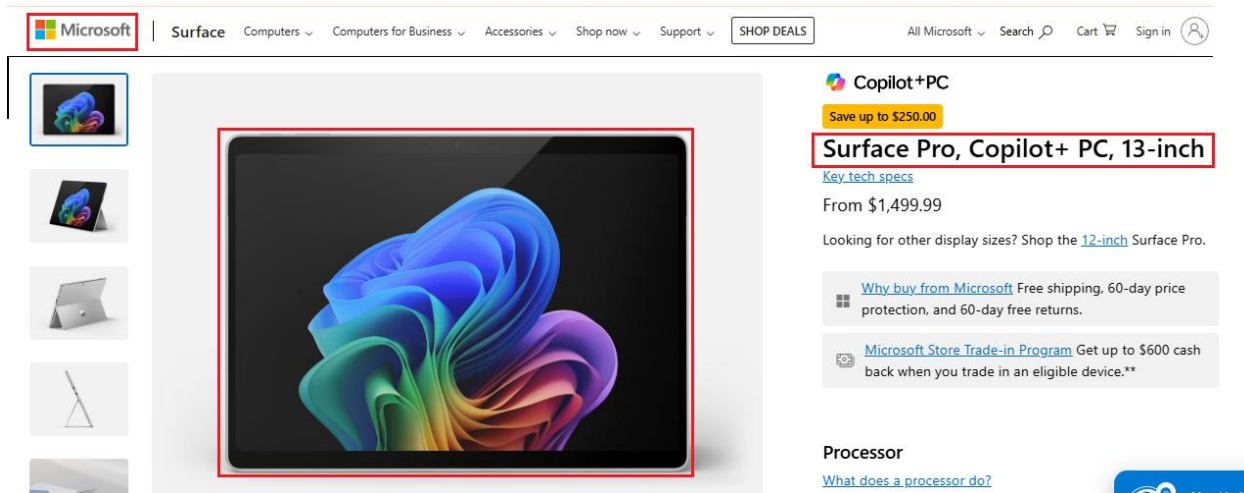
(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).



(E.g., https://docs.qualcomm.com/doc/80-WL730-43/80-WL730-43_REV_AE_QCC730_iPA_Hostless_Design_Sample_Reference_Schematic.pdf).

17. The Accused Instrumentality practices the step such that the control signal (e.g., control signal for enabling power amplifier) indicates switching on the power amplifier (e.g., power amplifier) during a first time interval (e.g., fragment MPDU transmitting interval) of a data frame (e.g., Aggregate MPDUs, A-MPDU, MSDU, or MMPDU) and switching off the power

amplifier (*e.g.*, power amplifier) during a second time interval (*e.g.*, immediate response or Ack period after each fragment is transmitted) of the data frame (*e.g.*, Aggregate MPDUs, A-MPDU, MSDU, or MMPDU), wherein during the second time interval (*e.g.*, immediate response or Ack period after each fragment is transmitted) of the data frame (*e.g.*, Aggregate MPDUs, A-MPDU, MSDU, or MMPDU), there is no up-link message to be transmitted (*e.g.*, the Accused Instrumentality receives Ack message from access point in downlink transmission). As shown below, the Accused Instrumentality supports Wi-Fi 6 connectivity by utilizing a Front-End Module. This Wi-Fi 6 Front End module comprises an antenna module which connects with a power amplifier. The power amplifier can be enabled with a control signal. When the Accused Instrumentality transmits data then power amplifier is enabled for transmitting uplink data. As shown below, an exemplary 5G FEM comprises antenna modules which connect power amplifiers for uplink transmission. The power amplifiers can be enabled with a control signal PAEN, *e.g.*, PA Enable. The Accused Instrumentality follows Wi-Fi 6 or IEEE 802.11ax standard. The standard discloses that a non-AP HE STA (*e.g.*, the Accused Instrumentality) receives a trigger frame (*e.g.*, bit stream) from an access point. The non-AP HE STA gets transmission opportunity on receiving the trigger frame. The standard also discloses that the non-AP HE STA can transmit fragmented MPDUs which would be part of an aggregated MPDU, A-MPDU, MSDU or MMPDU. It turns on power amplifier (*e.g.*, TX PA) during transmission of fragmented MPDUs (*e.g.*, first interval of data frame) and switches off TX PA during the immediate response or Ack period after each fragment is transmitted (*e.g.*, second interval of data frame), in order to allow the RX amplifier (*e.g.*, LNA) to be turned on to receive the immediate response or Ack.



▼ About Surface Pro, Copilot+ PC, 13-inch

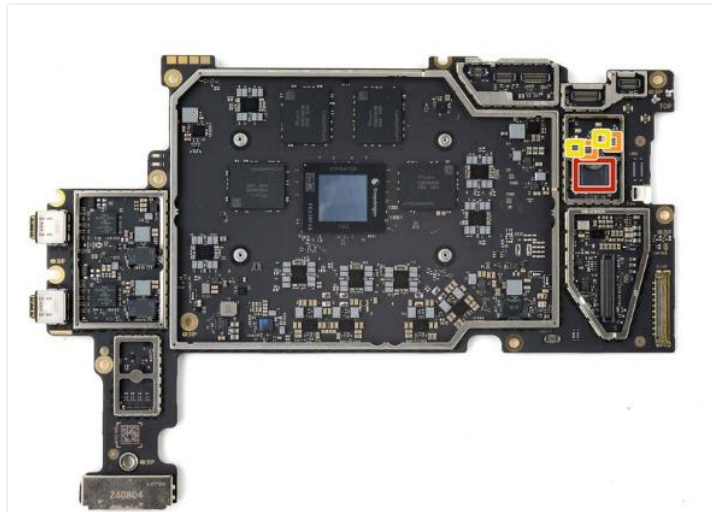
Surface Pro, 11th Edition. Exceptional performance, all-day battery life,¹ and new, unique AI experiences help make your device smarter, faster, and more creative—all in a flexible design combining the portability of a tablet and the power of a laptop. Windows 11 Copilot+ PCs are designed for advanced AI experiences to make every day more efficient and productive.²

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FastConnect 7800

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Leading Wi-Fi 7, premium Wi-Fi 6/6E, and advanced Bluetooth audio come together in this powerful and versatile connectivity system to unlock extreme performance for mobile, compute, and XR experiences.

(E.g., <https://www.qualcomm.com/wi-fi/products/fastconnect/fastconnect-7800>).

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Specifications

Wi-Fi	
Generation	<u>Wi-Fi 7, Wi-Fi 6E, Wi-Fi 6, Wi-Fi 5, Wi-Fi 4</u>
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Spectral Bands	<u>6 GHz, 5 GHz, 2.4 GHz</u>
Channels	320 MHz, 240 MHz, 160 MHz, 80 MHz, 40 MHz, 20 MHz
Part	
Part Number(s)	<u>WCN785x-1</u> , WCN785x-5

(E.g., <https://www.qualcomm.com/wi-fi/products/fastconnect/fastconnect-7800>).

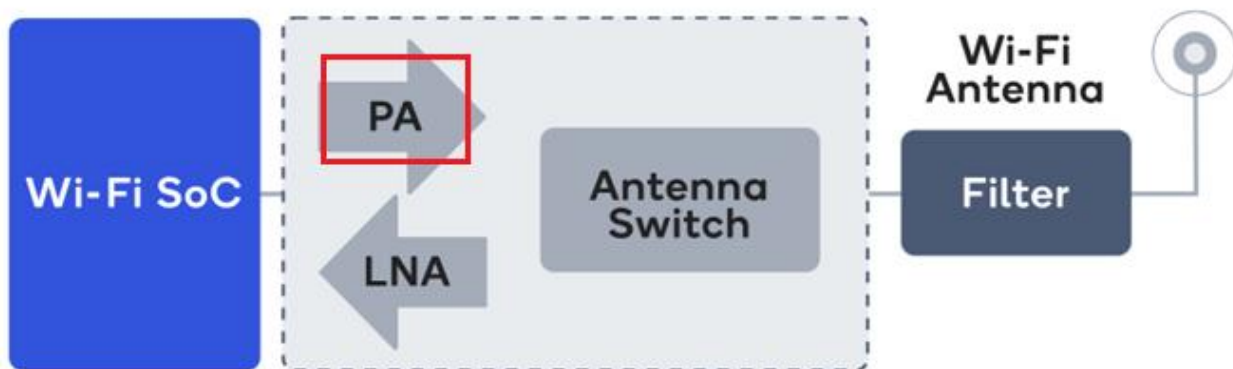
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(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).

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(E.g., <https://www.qualcomm.com/modems/rf-front-end-wifi-solutions>).

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Let's take a look at how FEMs work.

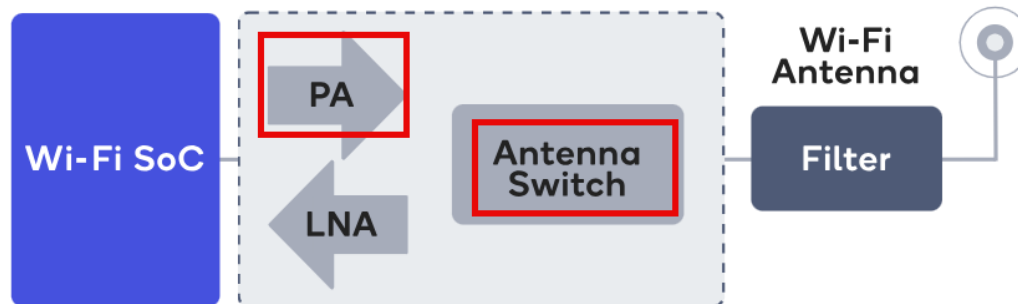
On the receive (Rx) side, an integrated LNA boosts weak incoming RF signals. The main objective is to boost the signal-to-noise ratio (SNR), which makes the listening device more sensitive to the signal.

On the transmit (Tx) side, an integrated PA boosts the outgoing RF signals that are delivered from the Wi-Fi SoC. This is done in a highly efficient and linear manner, such that transmission range is extended while power is efficiently used.

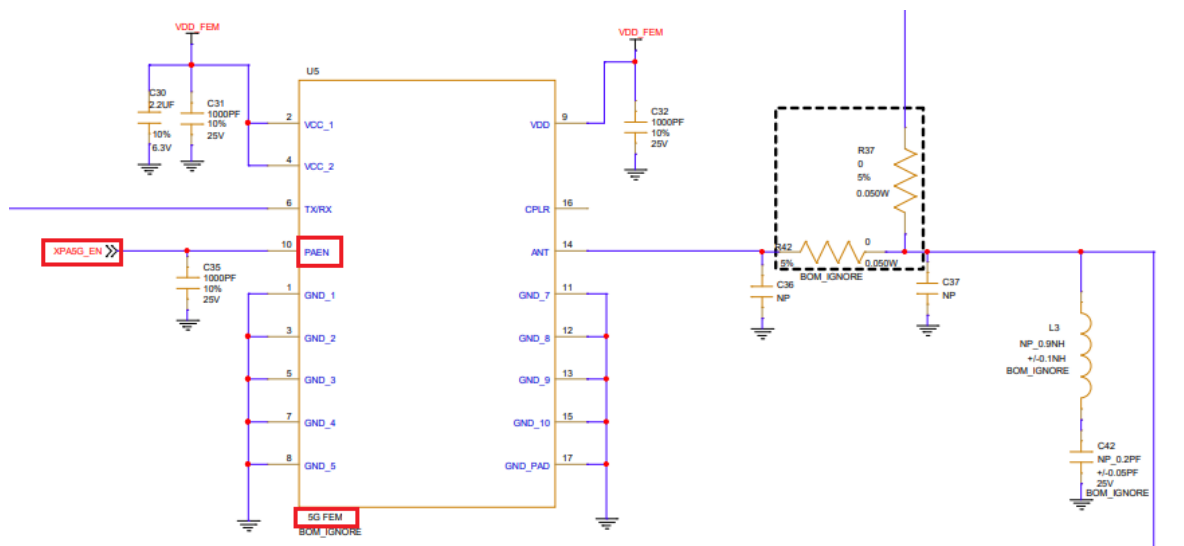
(E.g., <https://www.qualcomm.com/news/onq/2022/06/new-rf-front-end-connectivity-solution-to-boost-wi-fi-and-blueto>).

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(E.g., <https://www.qualcomm.com/news/onq/2022/06/new-rf-front-end-connectivity-solution-to-boost-wi-fi-and-blueto>).



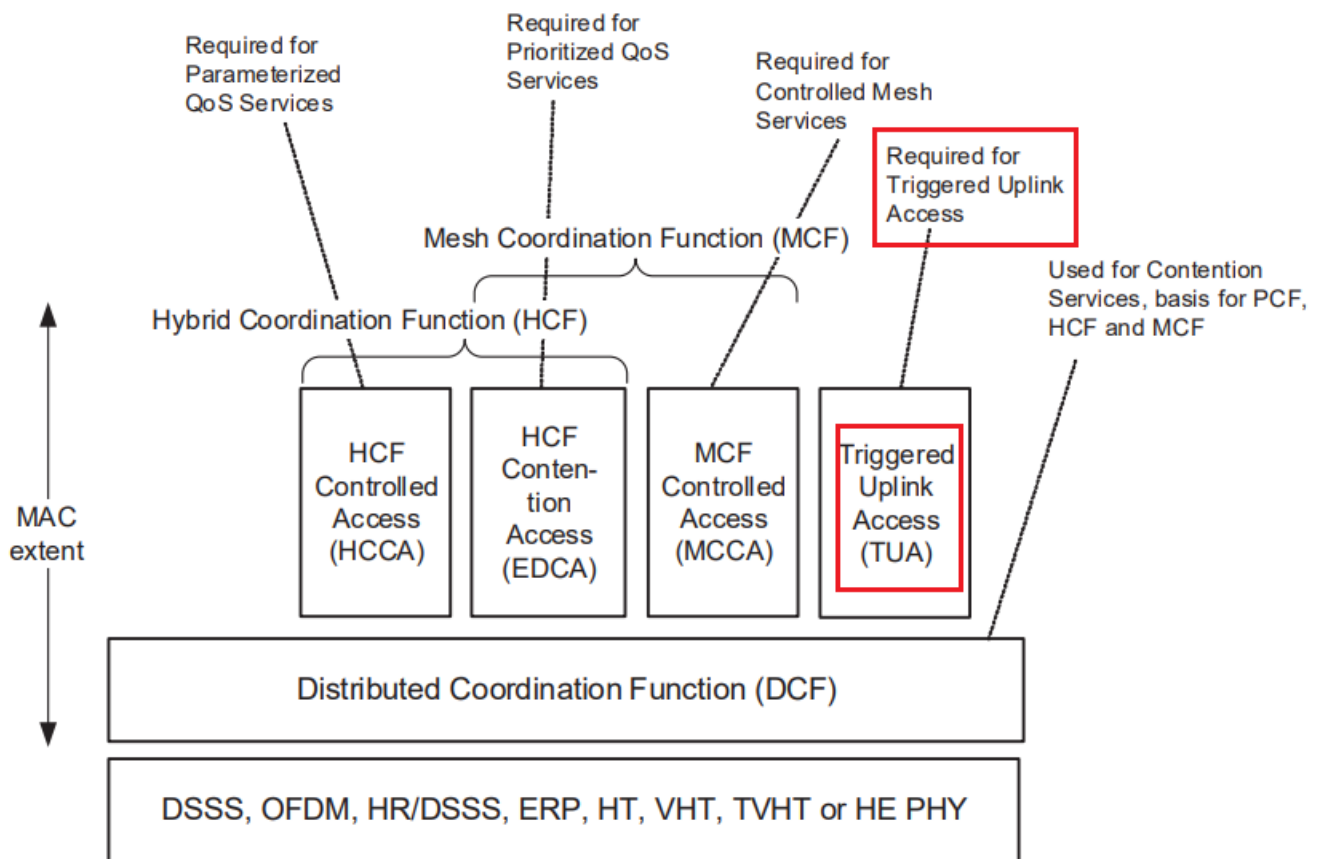
(E.g., <https://www.qualcomm.com/modems/rf/products/qxm108x>).



(E.g., https://docs.qualcomm.com/doc/80-WL730-43/80-WL730-43_REV_AE_QCC730_iPA_Hostless_Design_Sample_Reference_Schematic.pdf).

The MAC functional description is presented in this clause. The architecture of the MAC sublayer, including the distributed coordination function (DCF), the hybrid coordination function (HCF), the mesh coordination function (MCF), the triggered UL access (TUA), and their coexistence in an IEEE 802.11 LAN are introduced in 10.2. These functions are expanded on in 10.3, 10.23, ~~and 10.24~~, and 26.2. Fragmentation and defragmentation are defined in 10.4 and 10.5. Multirate support is addressed in 10.6. A number of additional restrictions to limit the cases in which MSDUs are reordered or discarded are described in 10.7. Operation across regulatory domains is defined in 10.22. The block ack mechanism is described in 10.25. The No Ack mechanism is described in 10.26. The protection mechanism is described in 10.27. Rules for processing MAC frames are described in 10.28.

(E.g., IEEE 802.11ax standard).



(E.g., IEEE 802.11ax standard).

triggered uplink access (TUA): A mechanism by which one or more non-access-point (non-AP) stations (STAs) simultaneously participate in an uplink (UL) transmission to an access point (AP) using resource units (RUs) allocated in the preceding Trigger frame.

triggering frame: A Trigger frame or a frame carrying a TRS Control subfield.

(E.g., IEEE 802.11ax standard).

The main PHY features in an HE STA that are not present in VHT STA or HT STA are the following:

- Mandatory support for DL and UL OFDMA
- Mandatory support for DL MU-MIMO by an HE AP that supports 4 or more spatial streams when MU-MIMO is done on the entire PPDU bandwidth
- Mandatory support for DL MU-MIMO reception for a non-AP HE STA
- Mandatory support for the HE sounding protocol to support beamforming for a non-AP STA beamformee and optional otherwise
- Optional support for HE-MCSs 10 and 11
- Optional support for UL MU-MIMO
- Optional support for preamble puncturing

(E.g., IEEE 802.11ax standard).

An HE AP sends a Trigger frame to initiate UL MU operation using UL OFDMA or UL MU-MIMO transmissions or a frame containing a TRS Control subfield to initiate UL OFDMA transmissions. The frame initiating these transmissions in the uplink direction is a triggering frame. The triggering frame identifies non-AP STAs participating in UL MU operation and assigns RUs and/or spatial streams to these STAs. Multi-STA BlockAck frames can be used by the AP to acknowledge the frames transmitted by multiple non-AP STAs. The scheduling of these Trigger frames can be set up between a non-AP STA and the AP using TWT operation to save power and reduce collisions.

(E.g., IEEE 802.11ax standard).

9.3.1.22 Trigger frame format

9.3.1.22.1 General

A Trigger frame allocates resources for and solicits one or more HE TB PPDU transmissions. The Trigger frame also carries other information required by the responding STA to send an HE TB PPDU.

(E.g., IEEE 802.11ax standard).

The format for the Trigger frame is defined in Figure 9-64a.

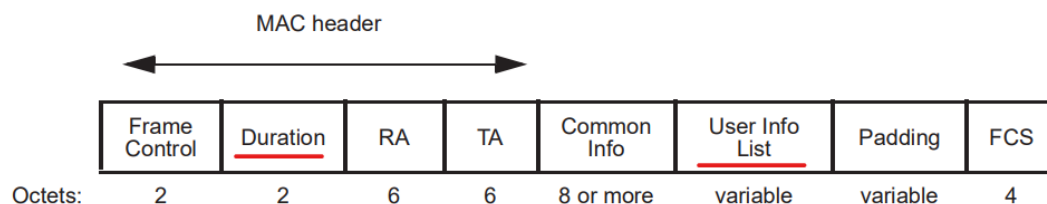


Figure 9-64a—Trigger frame format

The Duration field is set as defined in 9.2.5.

(E.g., IEEE 802.11ax standard).

- 7) In a Basic Trigger frame, the Duration/ID field is set to the estimated time required to transmit the solicited HE TB PPDU, plus the estimated time required to transmit the acknowledgment for the solicited HE TB PPDU if required, plus applicable SIFSs.

Multiple protection settings. The Duration/ID field is set to a value D as follows:

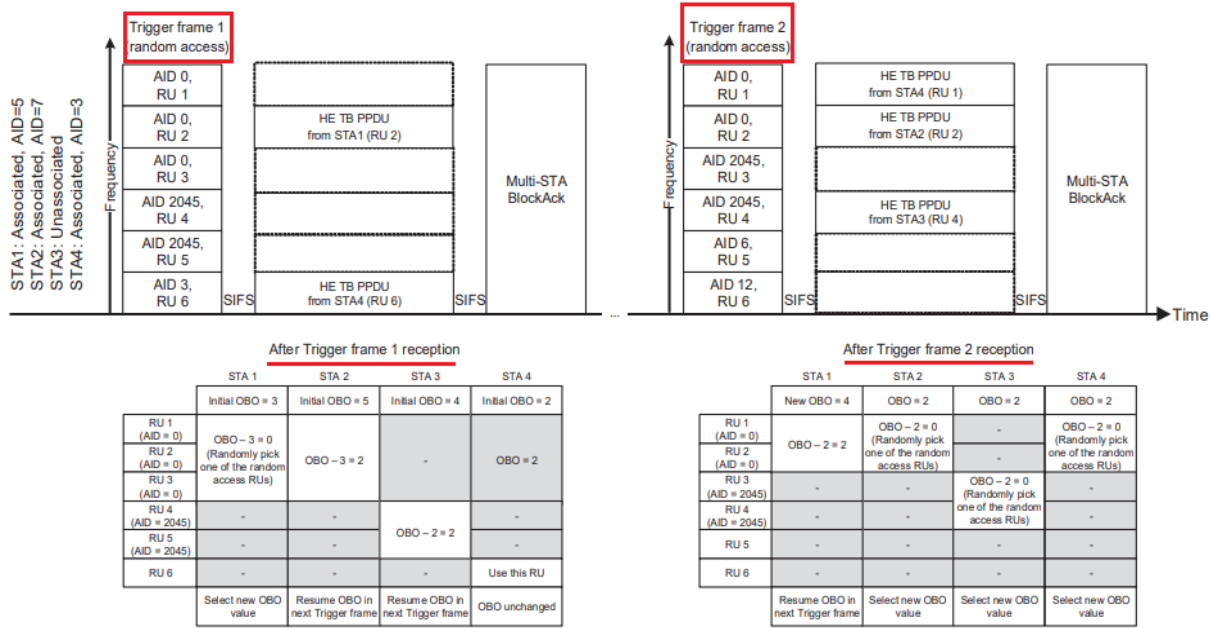
...

- 4) Else $T_{END-NAV} - T_{PPDU} \leq D \leq T_{TXOP-REMAINING} - T_{PPDU}$

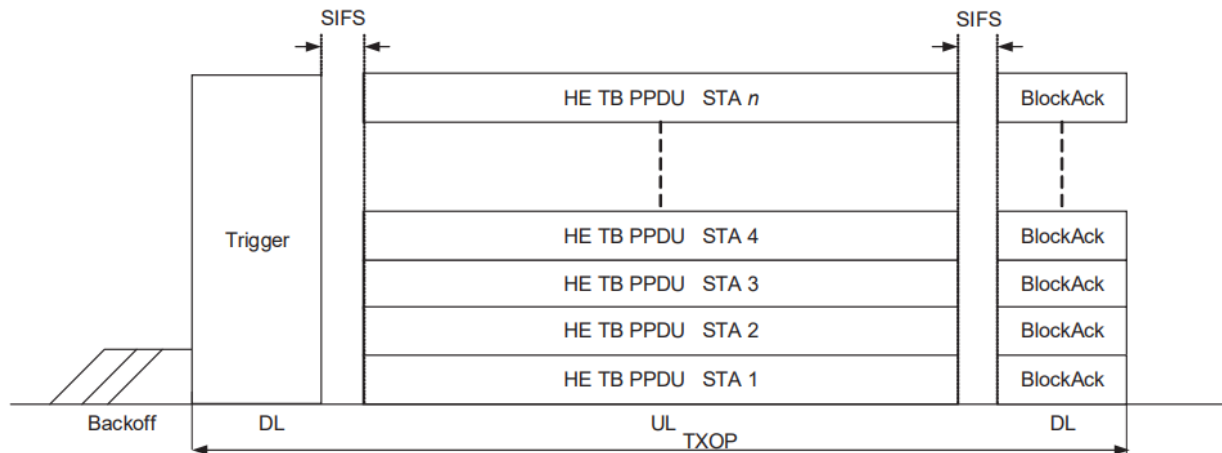
where

$T_{SINGLE-MSDU}$	is the estimated time required for the transmission of the allowed frame exchange sequence defined in 10.23.2.9 (for a TXOP limit of 0), including applicable IFS durations
$T_{PENDING}$	is the estimated time required for the transmission of — Pending MPDUs of the same AC — Any associated immediate response frames — Any HT NDP, VHT NDP, <u>HE sounding NDP</u>, or Beamforming Report Poll frame transmissions and explicit feedback response frames — Applicable IFSs — Any RDG — Any BDT — Any pending QoS Null frame exchanges by paged STAs — Any pending PS-Poll or NDP PS-Poll frame exchanges by paged STAs
T_{TXOP}	is the duration given by dot11EDCATableTXOPLimit (dot11QAPEDCATableTXOPLimit for the AP) for that AC
$T_{TXOP-REMAINING}$	is T_{TXOP} less the time already used time within the TXOP
$T_{END-NAV}$	is the remaining duration of any NAV set by the TXOP holder, or 0 if no NAV has been established
T_{PPDU}	is the time required for transmission of the current PPDU

(E.g., IEEE 802.11ax standard).



(E.g., IEEE 802.11ax standard).



(E.g., IEEE 802.11ax standard).

27.3.4 HE PPDU formats

Four HE PPDU formats are defined: HE SU PPDU, HE MU PPDU, HE ER SU PPDU, and HE TB PPDU. The HE sounding NDP is a variant of the HE SU PPDU and defined in 27.3.17. The HE TB feedback NDP is a variant of the HE TB PPDU and defined in 27.3.18.

NOTE—The HE ER SU PPDU is not a variant of the HE SU PPDU. Requirements related to HE SU PPDUs and HE ER SU PPDUs are specified separately.

The format of the HE SU PPDU is defined as in Figure 27-8. This PPDU format is used for SU transmission, and in this format, the HE-SIG-A field is not repeated.

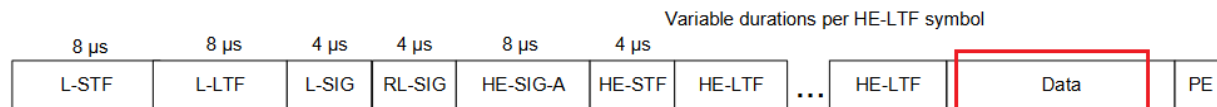


Figure 27-8—HE SU PPDU format

(E.g., IEEE 802.11ax standard).

fragmentation: The process of partitioning a medium access control (MAC) service data unit (MSDU), aggregate MAC service data unit (A-MSDU) or MAC management protocol data unit (MMPDU) into a sequence of smaller MAC protocol data units (MPDUs) prior to transmission. The process of recombining a set of fragment MPDUs into an MSDU, A-MSDU, or MMPDU is known as defragmentation. These processes are described in 5.8.1.9 of ISO/IEC 7498-1:1994.

(E.g., IEEE 802.11ax standard).

An AP that transmits a PPDU may solicit an HE TB PPDU from one or more non-AP STAs through one of the following mechanisms:

- Including in the PPDU one or more Trigger frames that include one or more User Info fields with one of the following AID12 subfield settings:
 - The AID12 subfield is set to the 12 LSBs of the AID of the non-AP STA if the User Info field is addressed to a STA that is associated with the AP.
 - The AID12 subfield is set to the 12 LSBs of the AID of the non-AP STA if the User Info field is addressed to a STA that is associated with an AP corresponding to a nontransmitted BSSID in a multiple BSSID set to which the AP belongs, the TA field of the Trigger frame is set to the transmitted BSSID, and the non-AP STA has set the Rx Control Frame To MultiBSS subfield in the HE Capabilities element it transmits to 1.
 - The AID12 subfield indicates that one or more contiguous RA-RUs are allocated (see 26.5.4).
- Including in the PPDU one or more individually addressed frames that include a TRS Control subfield and that are carried in one of the following:
 - An S-MPDU that solicits an immediate Ack frame (see 10.12.8).
 - An A-MPDU that solicits an immediate BlockAck frame (see 10.25.6.7).
 - A multi-TID A-MPDU that solicits an immediate Multi-STA BlockAck frame (see 26.6.3).

The AP shall follow the rules in 26.3.2 if any MPDUs are fragments.

(E.g., IEEE 802.11ax standard).

26.3.2 Dynamic fragmentation

26.3.2.1 General

With level 1 and level 2 dynamic fragmentation, the following apply:

- An originator STA transmitting one or more dynamic fragments shall solicit an immediate response from the recipient STA for each of the fragments.
- The originator STA shall transmit the fragments in order as defined in 10.4.

(E.g., IEEE 802.11ax standard).

9.7 Aggregate MPDU (A-MPDU)

9.7.1 A-MPDU format

An A-MPDU consists of a sequence of one or more A-MPDU subframes and a variable amount of EOF padding as shown in Figure 9-971.

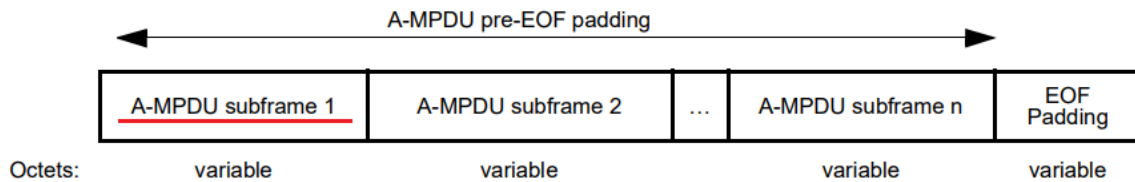


Figure 9-971—A-MPDU format

(E.g., IEEE 802.11ax standard).

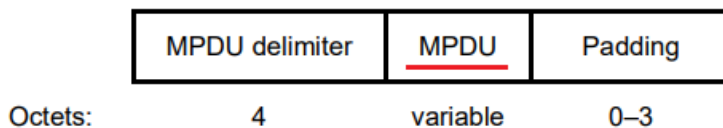


Figure 9-973—A-MPDU subframe format

(E.g., IEEE 802.11ax standard).

10.3.4.5 Control of the channel

The SIFS is used to provide an efficient MSDU delivery mechanism. Once the STA has contended for the channel, that STA shall continue to send fragments until either all fragments of a single MSDU or MMPDU have been sent or an acknowledgment is not received. Should the sending of the fragments be interrupted due to one of these reasons, when the next opportunity for transmission occurs the STA shall resume transmission. The algorithm by which the STA decides which of the outstanding MSDUs shall next be attempted after an unsuccessful transmission (as defined in 10.3.4.3) attempt is beyond the scope of this standard, but any such algorithm shall comply with the restrictions listed in 10.7.

Figure 10-20 illustrates the transmission of a fragmented MSDU using the SIFS.

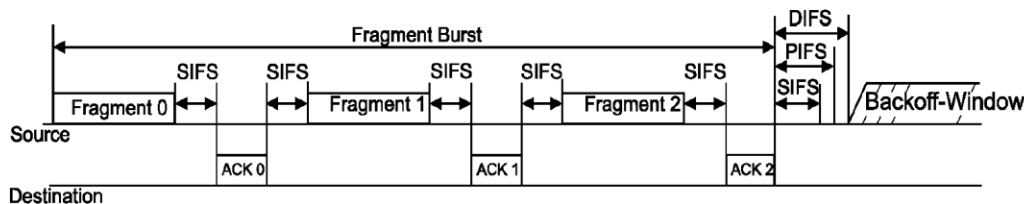


Figure 10-20—Transmission of a fragmented MSDU using SIFS

(E.g., IEEE 802.11-2020 standard).

18. **Indirect Infringement.** Upon information and belief, Defendant has been and now is indirectly infringing by way of inducing infringement and contributing to the infringement of claim 11 of the ‘575 Patent in the State of Texas, in this District, and elsewhere in the United States, by providing the Accused Instrumentality for use as described above by Defendant’s customers. Defendant advertised, offered for sale, and/or sold the Accused Instrumentality to its customers for use in a manner that Defendant knew infringed claim 11 of the ‘575 Patent. For example, Defendant provided marketing material that the Accused Instrumentality performs the claimed method for handling a transmitting process of a communication apparatus in a communication system as claimed in claim 11 of the ‘575 Patent. (*Supra* ¶¶14-17 (identifying marketing materials)).

19. On information and belief, since Defendant became aware of the ‘575 Patent and the infringement at least as of the date of the service of the Original Complaint, Defendant is and has been committing the act of inducing infringement by specifically intending to induce infringement by providing the Accused Instrumentality to its customers and by aiding and abetting its use as demonstrated by the marketing materials in a manner known to infringe by Defendant. Since becoming aware of the infringing use of the Accused Instrumentality, Defendant knew that the use of the Accused Instrumentality by its customers as instructed constituted direct patent infringement. Despite this knowledge, Defendant continued to encourage and induce its customers to use the Accused Instrumentality to infringe as described above and provided instructions for using the Accused Instrumentality to infringe, including through instructional materials, support, and user’s guides. Exemplary materials are cited above. (*Supra* ¶¶14-17 (identifying marketing materials)). Defendant therefore knowingly induced infringement and specifically intended to encourage and induce the infringement of the ‘575 Patent by its customers.

20. On information and belief, since Defendant became aware of the infringement at least as of the date of the service of the Original Complaint, Defendant is and has been committing the act of contributory infringement by intending to provide the identified Accused Instrumentality to its customers knowing that it is a material part of the invention, knowing that its use was made and adapted for infringement of the '575 Patent, and further knowing that the accused use of the Accused Instrumentality is not a staple article or commodity of commerce suitable for substantially non-infringing use. As described above, Defendant was aware that all material claim limitations are satisfied by the use and implementation of the Accused Instrumentality by Defendant's customers in the manner described above yet continued to provide the Accused Instrumentality to its customers knowing that it is a material part of the invention. (*Supra* ¶¶14-17 (identifying marketing materials)). As described above, since learning of the infringement, Defendant knew that the use and implementation of the Accused Instrumentality by its customers was made and adapted for infringement of the '575 Patent. (*Id.*). A new act of direct infringement occurred each time a customer implemented and/or used the Accused Instrumentality in the manner described above. After Defendant became aware that the use of the Accused Instrumentality infringes claim 11 of the '575 Patent, Defendant knew that each such new use was made and adapted for infringement of claim 11 of the '575 Patent and Defendant continued to advertise and provide the Accused Instrumentality for such infringing activities. (*Supra* ¶¶14-17 (identifying marketing materials)). Furthermore, as described more fully above, the Accused Instrumentality has functionality designed to perform the steps in the manner described above and is therefore not a staple article or commodity of commerce suitable for substantially non-infringing use. (*Id.*).

21. Plaintiff has been damaged as a result of Defendant's infringing conduct. Defendant is thus liable to Plaintiff for damages in an amount that adequately compensates

Plaintiff for such Defendant's infringement of the '575 Patent, *i.e.*, in an amount that by law cannot be less than would constitute a reasonable royalty for the use of the patented technology, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

22. Unless a preliminary and permanent injunction are issued enjoining Defendant and all others acting in active concert therewith from infringing the '575 Patent, Plaintiff will be greatly and irreparably harmed.

23. Plaintiff is only asserting a method claim in the '575 Patent and as such the marking requirements of 35 U.S.C. 287(a) do not apply. *Crown Packaging Technology, Inc. v. Rexam, Beverage Can Co.*, 559 F.3d 1308, 1316-1317 (Fed. Cir. 2009) ("Because Rexam asserted only the method claims of the '839 patent, the marking requirement of 35 U.S.C. 287(a) does not apply."); *Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1083 (Fed.Cir. 1983) ("It is 'settled in the case law that the notice requirement of this statute does not apply where the patent is directed to a process or method." (*Quoting Bandag, Inc. v. Gerrard Tire Co.*, 704 F.2d 1578, 1581 (Fed. Cir. 1983)). Plaintiff has therefore complied with the marking requirements 35 U.S.C. 287(a).

V. UNITED STATES PATENT NO. 9,538,177

24. Plaintiff incorporates the above paragraphs herein by reference.

25. On January 3, 2017, United States Patent No. 9,538,177 ("the '177 Patent") was duly and legally issued by the United States Patent and Trademark Office. The '177 Patent is titled "Apparatus and Method for Buffering Context Arrays Referenced for Performing Entropy Decoding Upon Multi-Tile Encoded Picture and Related Entropy Decoder." A true and correct copy of the '177 Patent is attached hereto as Exhibit 2 and incorporated herein by reference.

26. Kreatosphere LLC is the assignee of all right, title, and interest in the '177 Patent, including all rights to enforce and bring actions for infringement and to collect damages for all

relevant times against infringers of the ‘177 Patent. Accordingly, Kreatosphere LLC possesses the exclusive right and standing to bring the present action for infringement of the ‘177 Patent by Defendant.

27. The invention in the ‘177 Patent relates to decoding a multi-tile video/image bitstream which transmits a plurality of multi-tile encoded pictures/compressed frames each having a plurality of tiles, and more particularly, to an apparatus and a method for buffering context arrays referenced for performing entropy decoding upon a multi-tile encoded picture and a related entropy decoder. (Ex. 2 at 1:19-25). The goal of the ‘177 Patent is to improve performance and lower cost production for the High-Efficiency Video Coding (“HEVC”). (*Id.* at 2:52-56).

28. The HEVC specification has pictures broken into smaller tiles that are then bound vertically and horizontally. (*Id.* at 1:29-37). These tiles are then scanned and indexed and decoded sequentially. (*Id.* at 1:38-41). This works well for some imagines, but the encoding/decoding of tiles based on a dependent tile (*e.g.*, motion vector prediction, intra prediction, or entropy coding among others) must consider data provided by other tiles. Vertical and horizontal buffers are therefore required to successfully decode a multi-tile encoded picture/compressed frame having dependent tiles. (*Id.* at 2:7-9). The vertical buffer is used for buffering decoded information of largest coding units (LCUs)/treeblocks (TBs) of an adjacent tile beside a vertical boundary (*e.g.*, a left vertical boundary) of a currently decoded tile, and the horizontal buffer is used for buffering decoded information of LCUs/TBs of another adjacent tile beside a horizontal boundary (*e.g.*, a top horizontal boundary) of the currently decoded tile. (*Id.* at 2:10-17).

29. This form of encoding and decoding requires a large buffer size for decoding the multi-tile encoding picture/compressed frame, which leads to high production costs, and general inefficiencies, and thus a need for an innovative entropy decoder design with lower production

costs and higher performance, which the inventors recognized. (*Id.* at 2:17-19, 38-48; 5:18-19; 7:51-57; 8:1-2; 10:22-29).

Asserted Claim

30. Claim 10 of the ‘177 Patent claims:

A buffering method for buffering context arrays of a multi-tile encoded picture having a plurality of tiles, the buffering method comprising:

buffering a first context array referenced for performing entropy decoding upon a first tile of the multi-tile encoded picture;

buffering a second context array referenced for performing entropy decoding upon a second tile of the multi-tile encoded picture when the first tile is currently decoded according to the buffered first context array; and

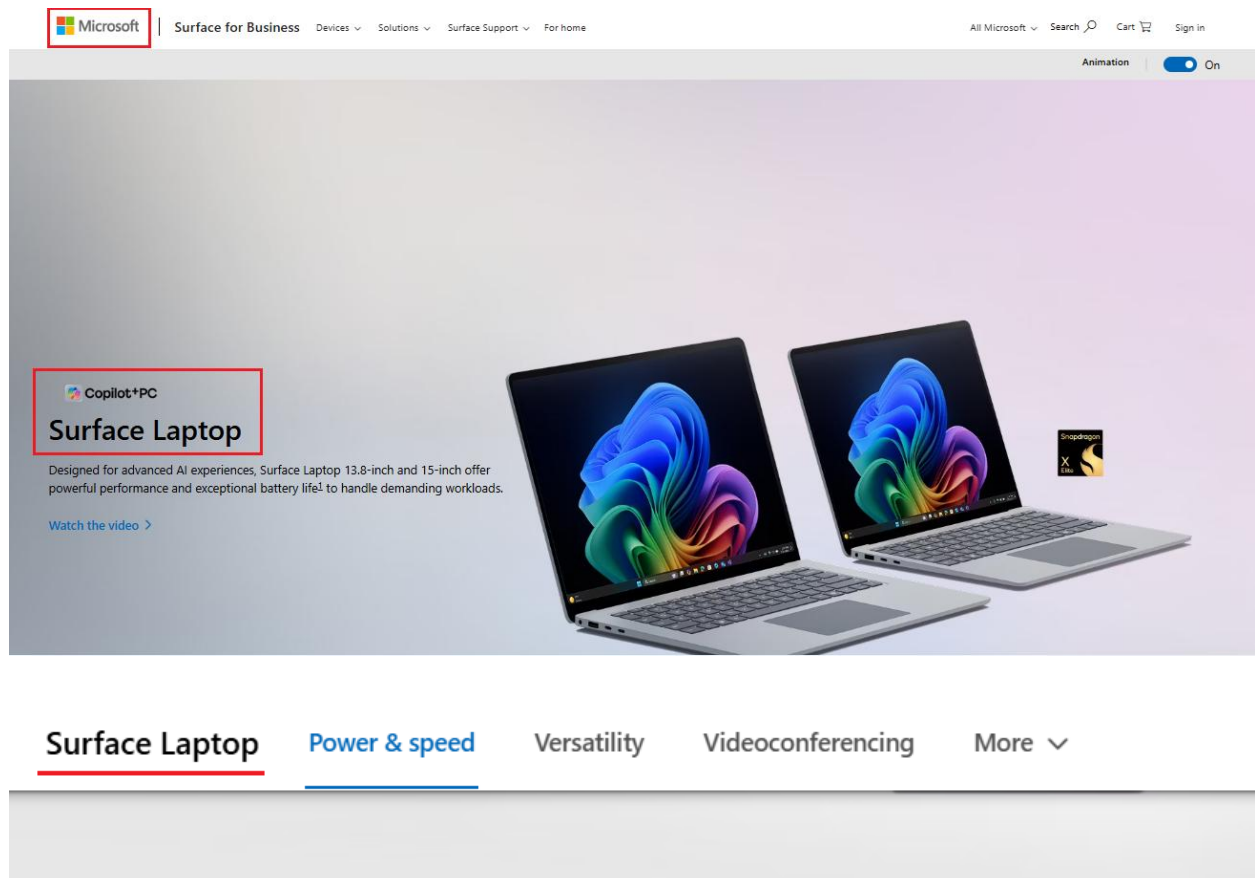
when entropy decoding of the first tile encounters a tile boundary, performing a multiplexing operation to switch between the buffered first context array and the buffered second context array;

wherein entropy decoding of the second tile is started before the first tile is fully entropy decoded.

VI. COUNT II
(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 9,538,177)

31. Upon information and belief, Defendant has directly infringed claim 10 of the ‘177 Patent in Texas, in this District, and elsewhere in the United States, by using and performing the claimed method by using the Microsoft Surface Laptop (“Accused Instrumentality”).

32. **Direct Infringement.** As explained below, the Accused Instrumentality practices a buffering method for buffering context arrays of a multi-tile encoded picture having a plurality of tiles. As shown below, the Accused Instrumentality supports HEVC standard for video encoding/decoding. HEVC standard provides a buffering method for buffering context arrays (*e.g.*, CABAC context variables) of a multi-tile encoded picture having a plurality of tiles (*e.g.*, multiple CTU rows).



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(E.g., <https://www.microsoft.com/en-us/surface/business/surface-laptop-7th-edition>).

VPU

Video Processing Unit (VPU) Name:
Adreno VPU

Encode: 4K60 10-bit encode – H.264,
HEVC (H.265), AV1

Decode: 4K120 10-bit decode – H.264,
HEVC (H.265), VP9, AV1

Concurrency: 4K60 decode – H.264,
HEVC (H.265), VP9, AV1 / 2x 4K30 encode –
H.264, HEVC (H.265), AV1

(E.g., <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/Product-Brief-Snapdragon-X-Elite.pdf>).

VPU

Video Processing Unit (VPU) Name:
Qualcomm Adreno VPU

Encode:

- 4K UHD 30 fps 8-bit recording – H.264, HEVC (H.265), AV1
-

Decode:

- 4K 30 fps 10-bit playback – HEVC (H.265), VP9, AV1
 - 4K 60 fps 8-bit playback – H.264, HEVC (H.265)
-

Concurrency:

- 4K 30 fps 8-bit decode + 1080p 30 fps encode
- 1080p 60 fps 10-bit decode + 1080p 30 fps encode

(E.g., <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/Snapdragon-X-Plus-8-Core-Product-Brief.pdf>).

The Qualcomm Snapdragon X Plus features Qualcomm® Adreno™ Video Processing Unit (VPU), which offers advanced video encoding and decoding capabilities. The encoder supports 4K at 60 Hz, 10-bit depth, and codecs such as H.264 (AVC), AV1, and H.265 (HEVC). Meanwhile, the decoder can handle 4K at 120 Hz, 10-bit depth, and codecs like H.264 (AVC), VP9, AV1, and H.265 (HEVC). The processor includes a dual Qualcomm® Spectra™ Image Signal Processor (ISP) with 18-bit depth, enabling advanced camera capabilities.

(E.g., <https://www.gadgetbytenepal.com/snapdragon-x-plus/>).

In order to overcome the limitations of the parallelization strategies employed in H.264 | MPEG-4 AVC, HEVC provides VCL-based coding tools that are specifically designed to enable processing on high-level parallel architectures. Two new tools aiming at facilitating high-level parallel processing have been included in the HEVC standard [9, 10, 18]:

- **Wavefront Parallel Processing (WPP):** A parallel processing approach along the wavefront scheduling principle, which is based on a partitioning of the picture into CTU rows such that the dependencies between CTUs of different partitions, both in terms of predictive coding and entropy coding, are preserved to a large extent.

(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

Both of these tools allow subdivision of each picture into multiple partitions that can be processed in parallel. Each partition contains an integer number of CTUs that may or may not have dependencies on CTUs of other partitions. When WPP or tiles are enabled, typically for each partition a separate slice segment subset is used such that the corresponding entry point offsets (in the slice segment header) indicate the start positions of all picture partition substreams (except for the first substream) in the slice segment. This is necessary for each core to immediately access the partition it has been assigned to decode. More details about parallel partition access are given in Sect. 3.3.2.3 below.

(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

3.3.2.2 Wavefront Parallel Processing (WPP)

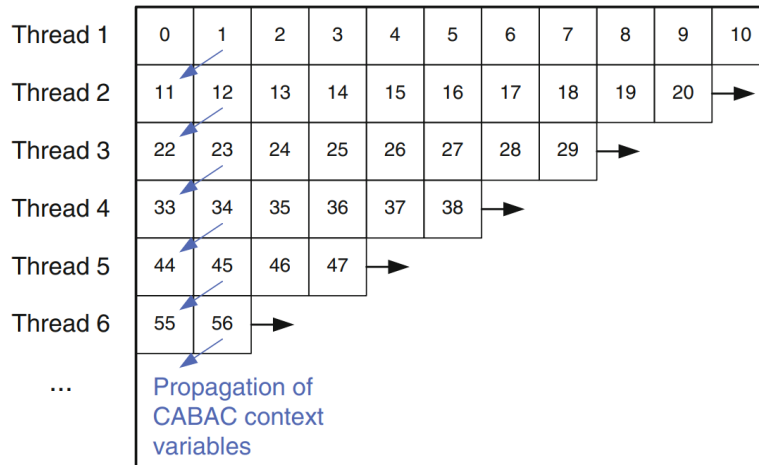
When wavefront parallel processing (WPP) is enabled in HEVC, each CTU row of a picture constitutes a separate partition [10, 18]. WPP is enabled/disabled by the PPS syntax element `entropy_coding_sync_enabled_flag`. As shown in Fig. 3.12, in WPP mode each CTU row is processed relative to its preceding CTU row by using a delay of two consecutive CTUs. In this way, no dependencies between consecutive CTU rows are broken at the partition boundaries except for the CABAC context variables at the end of each CTU row. To mitigate the potential loss in coding efficiency that would result from the conventional CABAC initialization at the starting point of each CTU row, the content of the (partially) adapted CABAC context variables are propagated from the encoded/decoded second CTU of the preceding CTU row to the first CTU of the current CTU row, as shown in Fig. 3.12. As a result, the coding efficiency losses introduced by WPP are relatively small compared to the case of a picture encoding using no WPP but with otherwise identical settings [6, 10]. Also, WPP does not change the regular raster scan order of CTUs. Furthermore, by using a relatively simple CABAC transcoding technique, a WPP bitstream can be transcoded to or from a non-WPP bitstream without any change to the picture reconstruction process [7].

When WPP is enabled, a number of threads up to the number of CTU rows in a picture can work in parallel to process the individual CTU rows, where the number of CTU rows depends on the ratio of the picture height in luma samples and the luma CTB size in either width or height.

By using wavefront parallel processing in a decoder, each decoding thread processes a single CTU row of the picture. Since the CTU dependencies need to be maintained between the decoding threads, the scheduling of the thread processing must be organized in such a way that for each CTU the decoding of its top right

(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

Fig. 3.12 Wavefront parallel processing along CTU rows and propagation of CABAC context variables from CTU1 to CTU11, from CTU12 to CTU22, ..., from CTU45 to CTU55, and so on



(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

CABAC Context-based Adaptive Binary Arithmetic Coding

(E.g., <https://www.itu.int/rec/T-REC-H.265>).

Thus, CABAC in its improved form, both with respect to throughput speed and compression efficiency, became the single entropy coding method of the HEVC standard.

The basic design of CABAC involves the key elements of binarization, context modeling, and binary arithmetic coding. These elements are illustrated as the main algorithmic building blocks of the CABAC encoding block diagram in Fig. 8.1. Binarization maps the syntax elements to binary symbols (bins). Context modeling estimates the probability of each non-bypassed (i.e., regular coded) bin based on some specific context. Finally, binary arithmetic coding compresses the bins to bits according to the estimated probability.

(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

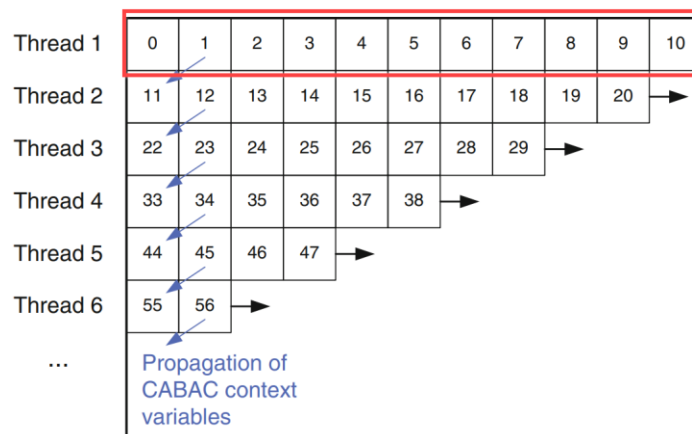
The storage process for context variables is applied as follows:

- When ending the parsing of the CTU syntax in clause 7.3.8.2, `entropy_coding_sync_enabled_flag` is equal to 1 and either `CtbAddrInRs % PicWidthInCtbsY` is equal to 1 or both `CtbAddrInRs` is greater than 1 and `TileId[ CtbAddrInTs ]` is not equal to `TileId[ CtbAddrRsToTs[ CtbAddrInRs - 2 ] ]`, the storage process for context variables, Rice parameter initialization states, and palette predictor variables as specified in clause 9.3.2.4 is invoked with `TableStateIdxWpp`, `TableMpsValWpp`, `TableStatCoeffWpp` when `persistent_rice_adaptation_enabled_flag` is equal to 1, and `PredictorPaletteSizeWpp` and `PredictorPaletteEntriesWpp` when `palette_mode_enabled_flag` is equal to 1 as outputs.

(E.g., <https://www.itu.int/rec/T-REC-H.265>).

33. The Accused Instrumentality performs the step of buffering a first context array referenced for performing entropy decoding upon a first tile of the multi-tile encoded picture. Upon information and belief, the Accused Instrumentality complies with the HEVC standard. As shown below, the HEVC standard provides WPP method which comprises buffering a first context array (e.g., storing CABAC context variables for a first CTU row/Thread 1) referenced for performing entropy decoding upon a first tile (e.g., a first CTU row/Thread 1) of the multi-tile encoded picture.

Fig. 3.12 Wavefront parallel processing along CTU rows and propagation of CABAC context variables from CTU1 to CTU11, from CTU12 to CTU22, ..., from CTU45 to CTU55, and so on



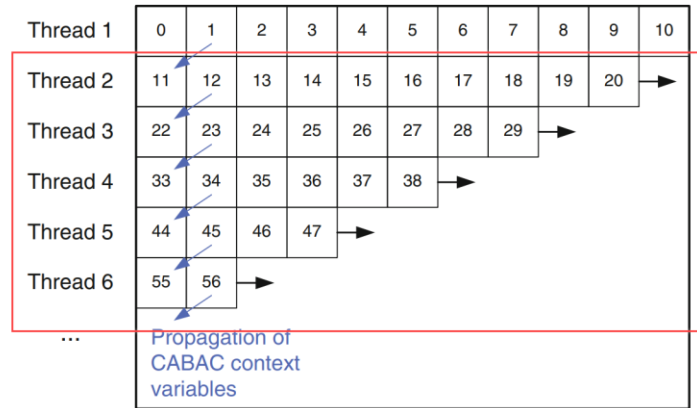
(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

As an additional small overhead in processing, WPP requires to store the content of all CABAC context variables after having finished encoding/decoding of the second CTU in each CTU row. Beyond that, however, WPP does not require any extra handling of partition borders to preserve the dependencies utilized by entropy encoding/decoding, in-picture prediction or in-loop filtering. An example WPP scheme for executing all HEVC decoder operations within the hybrid video coding loop can be found in [6].

(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

34. The Accused Instrumentality performs the step of buffering a second context array referenced for performing entropy decoding upon a second tile of the multi-tile encoded picture when the first tile is currently decoded according to the buffered first context array. Upon information and belief, the Accused Instrumentality complies with the HEVC standard. As shown below the HEVC standard performs the WPP method which comprises buffering a second context array (e.g., storing CABAC context variables for a second CTU row/Thread 2 or any other CTU rows from Thread 3 to Thread 6) referenced for performing entropy decoding upon a second tile (e.g., a second CTU row/Thread 2 or any other CTU rows from Thread 3 to Thread 6) of the multi-tile encoded picture when the first tile is currently decoded according to the buffered first context array (e.g., CTU rows/Thread 2 – Thread 6 are all decoded in parallel with the first CTU row/Thread 1).

Fig. 3.12 Wavefront parallel processing along CTU rows and propagation of CABAC context variables from CTU1 to CTU11, from CTU12 to CTU22, ..., from CTU45 to CTU55, and so on



(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

As an additional small overhead in processing, WPP requires to store the content of all CABAC context variables after having finished encoding/decoding of the second CTU in each CTU row. Beyond that, however, WPP does not require any extra handling of partition borders to preserve the dependencies utilized by entropy encoding/decoding, in-picture prediction or in-loop filtering. An example WPP scheme for executing all HEVC decoder operations within the hybrid video coding loop can be found in [6].

(E.g., *id.*).

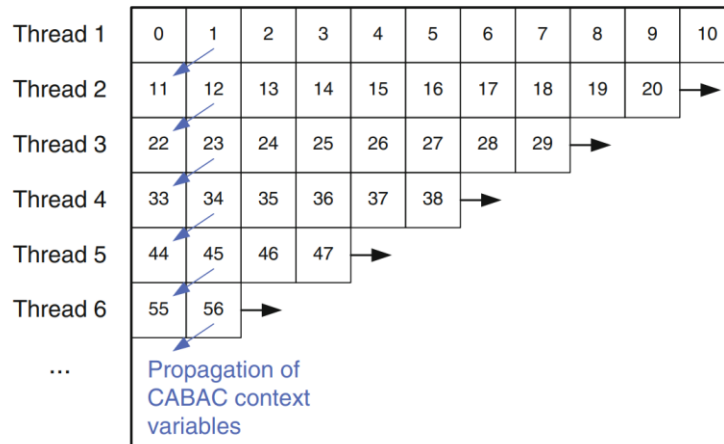
By using wavefront parallel processing in a decoder, each decoding thread processes a single CTU row of the picture. Since the CTU dependencies need to be maintained between the decoding threads, the scheduling of the thread processing must be organized in such a way that for each CTU the decoding of its top right neighboring CTU in the preceding CTU row must have been finished. In other words, at any time the thread processing of the preceding CTU row must have processed two consecutive CTUs more than the thread processing of the current CTU row, which results in a “wavefront” of CTUs rolling from the top left to the bottom right corner of the picture, as illustrated in Fig. 3.12. This is why the wavefront dependencies do not allow all threads of processing CTU rows to start decoding simultaneously. Consequently, the row-wise CTU processing threads cannot finish decoding at the same time at the end of each row. This

(E.g., *id.*).

35. The Accused Instrumentality performs the step of when entropy decoding of the first tile encounters a tile boundary, performing a multiplexing operation to switch between the buffered first context array and the buffered second context array. Upon information and belief, the Accused Instrumentality complies with the HEVC standard. As shown below, the HEVC standard provides the WPP method when entropy decoding of the first tile (e.g., decoding of the first CTU row/Thread 1) encounters a tile boundary (e.g., decoding of first CTU row reaches the end of that row, *i.e.*, vertical boundary), performing a multiplexing operation to switch between the buffered first context array and the buffered second context array (e.g., resources are allocated to another CTU row or any of the Thread 2-Thread 6 when the first CTU row is finished decoding). As shown below, when decoding of the first CTU row reaches its end (e.g., CTU 10), CTU rows 2-6 are still in process of decoding because each CTU row can only start decoding after two CTUs are decoded in the preceding row. On information and belief, when the first row finishes decoding, the processor core can continue to decode any of the rows below the first row that was assigned to it and that has not finished. This requires a switch to the corresponding buffered context array which is used for decoding of that CTU row. Additionally, on information and belief, a processor core interweavingly decodes two adjacent CTU rows as long as the top CTU row of the two adjacent CTU rows precedes the bottom CTU row by two CTUs. In this scenario, the processor core can first decode the top row and pause at a CTU as long as decoding passes the first two CTUs, then the processor core switches to the bottom row for decoding several CTUs, and switches back to the top row where it is left off. Hence the single processor core can interleave decoding of two CTU rows by time-slicing when dependencies allow, and the horizontal boundary between them is crossed each time the processor core switches to the other CTU row and each cross requires a switch to the corresponding buffered context array which is used for decoding of that CTU row.

Interleaving decoding could happen because a row may temporarily stall because it is waiting for the row above to decode more CTUs and instead of idling, the core can decode CTUs from another row whose dependencies are satisfied.

Fig. 3.12 Wavefront parallel processing along CTU rows and propagation of CABAC context variables from CTU1 to CTU11, from CTU12 to CTU22, ..., from CTU45 to CTU55, and so on



(E.g., https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

Both of these tools allow subdivision of each picture into multiple partitions that can be processed in parallel. Each partition contains an integer number of CTUs that may or may not have dependencies on CTUs of other partitions. When WPP or tiles are enabled, typically for each partition a separate slice segment subset is used such that the corresponding entry point offsets (in the slice segment header) indicate the start positions of all picture partition substreams (except for the first substream) in the slice segment. This is necessary for each core to immediately access the partition it has been assigned to decode. More details about parallel partition access are given in Sect. 3.3.2.3 below.

(E.g., *id.*).

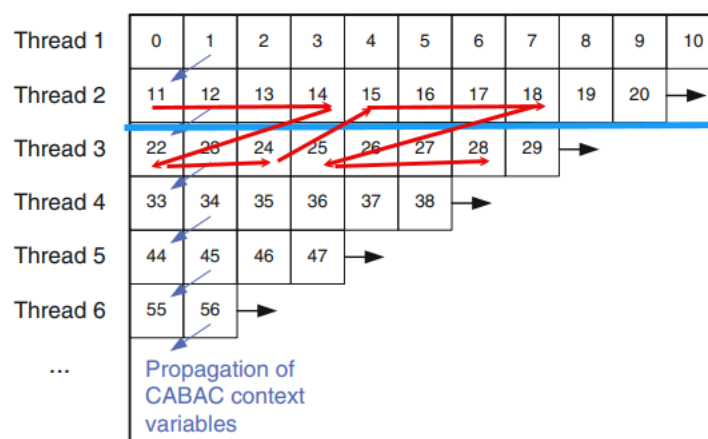
Multi-threading in the software context refers to a programming model in which the computation is specified in multiple independent units called threads that share some resources, specifically memory. These threads can run in a time division or in a parallel manner depending on the implementation and underlying hardware. Threads usually communicate via shared memory, and have to use synchronization operations to ensure a proper use of shared resources and to satisfy ordering constraints in the program. Commonly synchronization statements such as locks, semaphores, barriers, and condition variables are used to control the progress among the threads.

(E.g., *id.*).

By using wavefront parallel processing in a decoder, each decoding thread processes a single CTU row of the picture. Since the CTU dependencies need to be maintained between the decoding threads, the scheduling of the thread processing must be organized in such a way that for each CTU the decoding of its top right neighboring CTU in the preceding CTU row must have been finished. In other words, at any time the thread processing of the preceding CTU row must have processed two consecutive CTUs more than the thread processing of the current CTU row, which results in a “wavefront” of CTUs rolling from the top left to the bottom right corner of the picture, as illustrated in Fig. 3.12. This is why the wavefront dependencies do not allow all threads of processing CTU rows to start decoding simultaneously. Consequently, the row-wise CTU processing threads cannot finish decoding at the same time at the end of each row. This

(E.g., *id.*).

Fig. 3.12 Wavefront parallel processing along CTU rows and propagation of CABAC context variables from CTU1 to CTU11, from CTU12 to CTU22, ..., from CTU45 to CTU55, and so on



(E.g., *id.*).

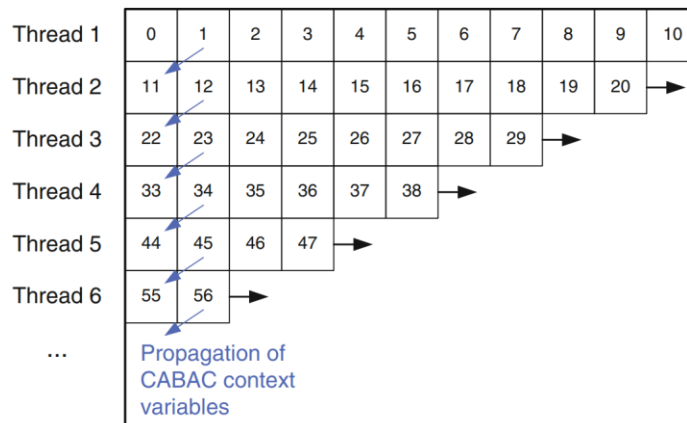
36. The Accused Instrumentality performs the step of wherein entropy decoding of the second tile is started before the first tile is fully entropy decoded. Upon information and belief, the

Accused Instrumentality complies with the HEVC standard. As shown below, the HEVC standards provides WPP method wherein entropy decoding of the second tile (*e.g.*, any CTU row of CTU rows 2-6) is started before the first tile (*e.g.*, first CTU) is fully entropy decoded (*e.g.*, entropy decoding of the second tile can start as soon as it's preceding row finishes decoding the first two CTUs).

By using wavefront parallel processing in a decoder, each decoding thread processes a single CTU row of the picture. Since the CTU dependencies need to be maintained between the decoding threads, the scheduling of the thread processing must be organized in such a way that for each CTU the decoding of its top right neighboring CTU in the preceding CTU row must have been finished. In other words, at any time the thread processing of the preceding CTU row must have processed two consecutive CTUs more than the thread processing of the current CTU row, which results in a “wavefront” of CTUs rolling from the top left to the bottom right corner of the picture, as illustrated in Fig. 3.12. This is why the wavefront dependencies do not allow all threads of processing CTU rows to start decoding simultaneously. Consequently, the row-wise CTU processing threads cannot finish decoding at the same time at the end of each row. This

(*E.g.*, https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/High%20Efficiency%20Video%20Coding%20%28HEVC%29_%20Algorithms%20and%20Architectures%20%5BSize%2C%20Budagavi%20%26%20Sullivan%202014-08-24%5D.pdf).

Fig. 3.12 Wavefront parallel processing along CTU rows and propagation of CABAC context variables from CTU1 to CTU11, from CTU12 to CTU22, . . . , from CTU45 to CTU55, and so on



(*E.g.*, *id.*).

37. **Indirect Infringement.** Upon information and belief, Defendant has been and now is indirectly infringing by way of inducing infringement and contributing to the infringement of claim 10 of the '177 Patent in the State of Texas, in this District, and elsewhere in the United States, by providing the Accused Instrumentality for use as described above by Defendant's customers. Defendant advertised, offered for sale, and/or sold the Accused Instrumentality to its customers for use in a manner that Defendant knew infringed claim 10 of the '177 Patent. For example, Defendant provided marketing material that the Accused Instrumentality performs the claimed buffering method for buffering context arrays of a multi-tile encoded picture having a plurality of tiles as claimed in claim 10 of the '177 Patent. (*Supra* ¶¶32-36 (identifying marketing materials)).

38. On information and belief, since Defendant became aware of the '177 Patent and the infringement at least as of the date of the service of the Original Complaint, Defendant is and has been committing the act of inducing infringement by specifically intending to induce infringement by providing the Accused Instrumentality to its customers and by aiding and abetting its use as demonstrated by the marketing materials in a manner known to infringe by Defendant. Since becoming aware of the infringing use of the Accused Instrumentality, Defendant knew that the use of the Accused Instrumentality by its customers as instructed constituted direct patent infringement. Despite this knowledge, Defendant continued to encourage and induce its customers to use the Accused Instrumentality to infringe as described above and provided instructions for using the Accused Instrumentality to infringe, including through instructional materials, support, and user's guides. Exemplary materials are cited above. (*Supra* ¶¶32-36 (identifying marketing materials)). Defendant therefore knowingly induced infringement and specifically intended to encourage and induce the infringement of the '177 Patent by its customers.

39. On information and belief, since Defendant became aware of the infringement at least as of the date of the service of the Original Complaint, Defendant is and has been committing the act of contributory infringement by intending to provide the identified Accused Instrumentality to its customers knowing that it is a material part of the invention, knowing that its use was made and adapted for infringement of the '177 Patent, and further knowing that the accused use of the Accused Instrumentality is not a staple article or commodity of commerce suitable for substantially non-infringing use. As described above, Defendant was aware that all material claim limitations are satisfied by the use and implementation of the Accused Instrumentality by Defendant's customers in the manner described above yet continued to provide the Accused Instrumentality to its customers knowing that it is a material part of the invention. (*Supra* ¶¶32-36 (identifying marketing materials)). As described above, since learning of the infringement, Defendant knew that the use and implementation of the Accused Instrumentality by its customers was made and adapted for infringement of the '177 Patent. (*Id.*). A new act of direct infringement occurred each time a customer implemented and/or used the Accused Instrumentality in the manner described above. After Defendant became aware that the use of the Accused Instrumentality infringes claim 10 of the '177 Patent, Defendant knew that each such new use was made and adapted for infringement of claim 10 of the '177 Patent and Defendant continued to advertise and provide the Accused Instrumentality for such infringing activities. (*Supra* ¶¶32-36 (identifying marketing materials)). Furthermore, as described more fully above, the Accused Instrumentality has functionality designed to perform the steps in the manner described above and is therefore not a staple article or commodity of commerce suitable for substantially non-infringing use. (*Id.*).

40. Plaintiff has been damaged as a result of Defendant's infringing conduct. Defendant is thus liable to Plaintiff for damages in an amount that adequately compensates

Plaintiff for such Defendant's infringement of the '177 Patent, *i.e.*, in an amount that by law cannot be less than would constitute a reasonable royalty for the use of the patented technology, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

41. Unless a preliminary and permanent injunction are issued enjoining Defendant and all others acting in active concert therewith from infringing the '177 Patent, Plaintiff will be greatly and irreparably harmed.

42. Plaintiff is only asserting a method claim in the '177 Patent and as such the marking requirements of 35 U.S.C. 287(a) do not apply. *Crown Packaging Technology, Inc. v. Rexam, Beverage Can Co.*, 559 F.3d 1308, 1316-1317 (Fed. Cir. 2009) ("Because Rexam asserted only the method claims of the '839 patent, the marking requirement of 35 U.S.C. 287(a) does not apply."); *Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1083 (Fed.Cir. 1983) ("It is 'settled in the case law that the notice requirement of this statute does not apply where the patent is directed to a process or method." (*Quoting Bandag, Inc. v. Gerrard Tire Co.*, 704 F.2d 1578, 1581 (Fed. Cir. 1983)). Plaintiff has therefore complied with the marking requirements 35 U.S.C. 287(a).

VII. UNITED STATES PATENT NO. 7,327,404

43. Plaintiff incorporates the above paragraphs herein by reference.

44. On February 5, 2008, United States Patent No. 7,327,404 ("the '404 Patent") was duly and legally issued by the United States Patent and Trademark Office. The '404 Patent is titled "Methods And Systems for Color Image Processing." A true and correct copy of the '404 Patent is attached hereto as Exhibit 3 and incorporated herein by reference.

45. Kreatosphere LLC is the assignee of all right, title, and interest in the '404 Patent, including all rights to enforce and bring actions for infringement and to collect damages for all relevant times against infringers of the '404 Patent. Accordingly, Kreatosphere LLC possesses the

exclusive right and standing to bring the present action for infringement of the '404 Patent by Defendant.

46. The invention in the '404 Patent relates to color image processing specifically a method for color adjustment in color image processing. (Ex. 3 at 1:6-8). The goal of the '404 Patent is to improve performance of the transmission of chrominance and luminance signals by reducing the error rate of the signals. (*Id.* at 1:51-62).

47. In typical systems, a chrominance signal is represented by two color signals, I and Q or U and V, where the I and Q are Cartesian coordinates of the chrominance signal and are linear transformations of the U and V color Signals. (*Id.* at 1:9-13). The I and Q signals are color signals transmitted simultaneously as quadrature-modulated waves using a single chrominance subcarrier whose phase and amplitude are modulated. (*Id.* at 1:18-21). The I and Q color signals are separated from the chrominance signal by demodulating with the chrominance subcarrier, and subsequent color image processing is performed on the two-color signals. I and Q color signals precisely specify the location of the respective picture element in the color plane. (*Id.* at 1:21-26). A luminance signal is fed to a separate processing stage and subsequently combined with the two-color signals in a color matrix to generate the value for the red (R), green (G), and blue (B) signals. (*Id.* at 1:26-30). Prior art methods would use magnitude and angle vectors to demodulate the signal, but this would still lead to significant errors. (*Id.* at 1:36-55). The inventors recognized the utility of a new and improved system for color image processing.

Asserted Claim

48. Claim 10 of the '404 Patent claims:

A color image processing method for color adjustment, comprising:

generating phase information for determining a phase of a received chrominance signal;

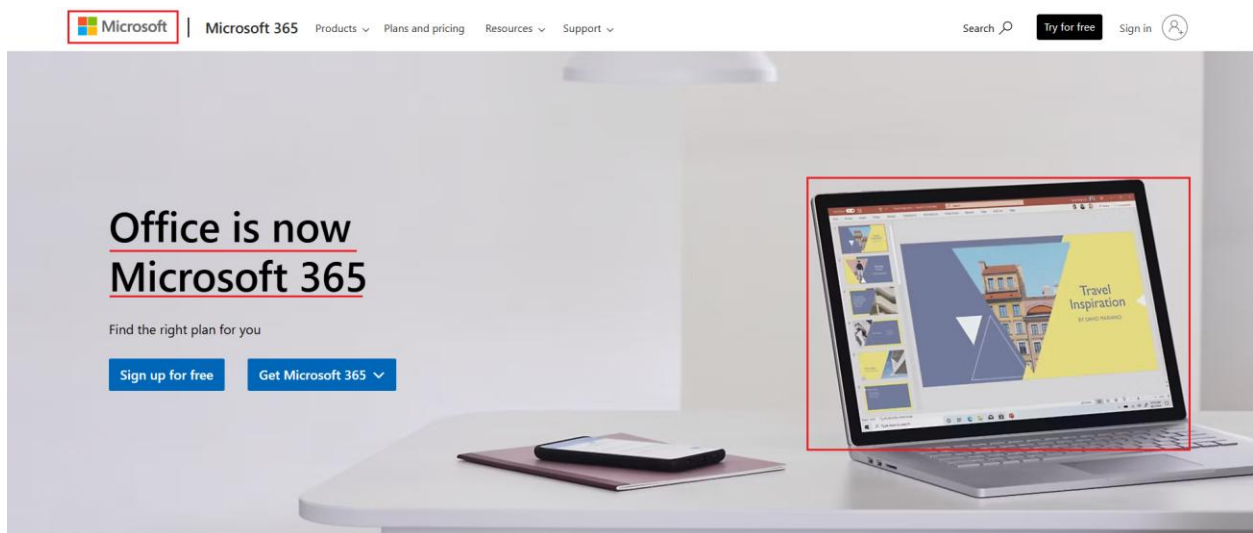
searching a plurality of angles of rotation corresponding to various phase information for a specific angle of rotation according to the generated phase information; and

rotating the received chrominance signal by the specific angle of rotation using a matrix algorithm, such that hue of the chrominance signal is adjusted.

VIII. COUNT III **(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 7,327,404)**

49. Upon information and belief, Defendant directly infringed claim 10 of the ‘404 Patent in Texas, in this District, and elsewhere in the United States, by using and performing the claimed method by using the Microsoft 365 (“Accused Instrumentality”).

50. **Direct Infringement.** As explained below, the Accused Instrumentality practiced a color image processing method (*e.g.*, color image processing using color matrix) for color adjustment. As shown, the Accused Instrumentality utilizes a processor and GPU for color image processing using Direct2D. When a user inserts and edits pictures in applications such as PowerPoint, Docs, etc., the image is rendered through Direct2D. It applies color adjustment effects such as color matrix transformations, saturation changes, and hue rotation.



(*E.g.*, <https://www.microsoft.com/en-us/microsoft-365/microsoft-office>).

Microsoft 365 and Office Resources

Microsoft 365 system requirements

For individuals and families

For enterprise, business, education, and government

System requirements for Microsoft 365 for home use

Microsoft 365 suites for individuals and families are subscription plans that include premium versions of productivity apps across all your devices, monthly feature updates, and 1 TB of cloud storage per user.

The system requirements below apply to [Microsoft 365 Family](#) and [Microsoft 365 Personal](#).

(E.g., <https://support.microsoft.com/en-us/office/system-requirements/system-requirements-for-microsoft-365-for-home-use>).

System requirements

Component	Windows	Mac	Android	iOS
Computer and processor	1.6 GHz or faster, 2-core	Intel processor	ARM-based or Intel x86 processor	Not applicable
Operating system	Windows 11	One of the three most recent versions of macOS. When a new major version of macOS is released, the macOS and the previous two versions.	The last 4 major versions of Android	The 2 most recent versions of iOS
Memory	4 GB RAM; 2 GB RAM (32-bit)	4 GB RAM	1 GB	Not applicable.
Hard disk	4 GB of available disk space	10 GB of available disk space; HFS+ hard disk format (also known as Mac OS Extended) or APFS. Updates may require additional storage over time.	Not applicable.	Not applicable.
Display	1280 x 768 screen resolution (32-bit requires hardware acceleration for 4K and higher)	1280 x 800 screen resolution. Web apps require the same minimum resolution as the OS they are running on. Apps running inside of Microsoft Teams adhere to the Teams minimum resolution. Minimum resolution assumes zoom, DPI settings, and text scaling are set at 100%. If not set to 100%, minimum resolution should be scaled accordingly.	Not applicable.	Not applicable.
Graphics	Graphics hardware acceleration <u>requires</u> DirectX 9 or later.	No graphics requirements.	Not applicable.	Not applicable.

(E.g., <https://support.microsoft.com/en-us/office/system-requirements/system-requirements-for-microsoft-365-for-home-use>).

Microsoft 365 and Office Resources

Microsoft 365 system requirements

For individuals and families

For enterprise, business, education, and government

Office suites system requirements

System requirements for Microsoft 365 for business, education and government use

Microsoft 365 and Office 365 suites for enterprise, business, education, and government are subscription plans that include premium versions of productivity apps across all your devices, monthly feature updates, and 1-5TB of cloud storage per user.

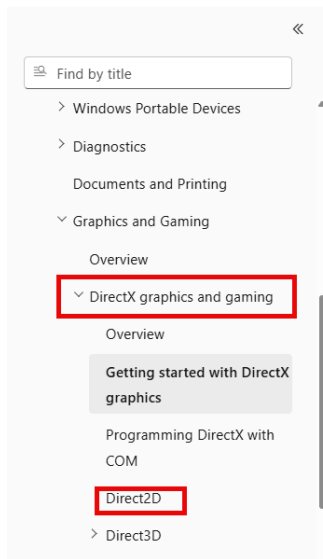
The system requirements below apply to [Microsoft 365 Apps for enterprise](#) and [Microsoft 365 Apps for business](#), as well as all [enterprise](#), [business](#), [education](#), [government](#), and [nonprofit](#) plans that include Microsoft 365 client apps. They also apply to standalone plans for individual services, such as email-only or online-meetings-only plans. Apps such as Exchange Online, SharePoint Online, Skype for Business, Viva Engage, Project, Visio, and Power BI are also covered by the table below.

(E.g., <https://support.microsoft.com/en-us/office/system-requirements/system-requirements-for-microsoft-365-for-business-education-and-government-use>).

System requirements

Component	Windows	Mac	Android	iOS
Computer and processor	1.6 GHz or faster, 2-core. 2 GHz or greater recommended for Skype for Business	Intel processor	ARM-based or Intel x86 processor	Not applicable
Operating system	Windows 11, Windows Server 2025, or Windows Server 2022. See Windows Server end of support and Microsoft 365 Apps for the Windows Server support dates.	One of the three most recent versions of macOS. When a new version of macOS is released, the macOS requirement becomes one of the then-current three most recent versions: the new version of macOS and the previous two versions	The last 4 major versions of Android	The 2 most recent versions of iOS
Memory	4 GB RAM; 2 GB RAM (32-bit)	4 GB RAM	1 GB	Not applicable
Hard disk	4 GB of available disk space	10 GB of available disk space; HFS+ hard disk format (also known as macOS Extended) or APFS. Updates may require additional storage over time		
Display	1280 x 768 screen resolution (32-bit requires hardware acceleration for 4K and higher)	1280 x 800 screen resolution. Web apps require the same minimum resolution as the OS they are running on. Apps running inside of Microsoft Teams adhere to the Teams minimum resolution. Minimum resolution assumes zoom, DPI settings, and text scaling are set at 100%. If not set to 100%, minimum resolution should be scaled accordingly	Not applicable	Not applicable
Graphics	Graphics hardware acceleration requires DirectX 9 or later. Skype for Business requires DirectX 9 or later, 128 MB graphics memory, and 32-bits-per-pixel-capable format	No graphics requirements	Not applicable	Not applicable

(E.g., <https://support.microsoft.com/en-us/office/system-requirements/system-requirements-for-microsoft-365-for-business-education-and-government-use>).



... > Graphics and Gaming > DirectX graphics and gaming >

Ask Learn

Getting started with DirectX Graphics

Summarize this article for me

Microsoft DirectX graphics provides a set of APIs that you can use to create games and other high-performance multimedia applications. DirectX graphics includes support for high-performance 2-D and 3-D graphics.

For 3-D graphics, use the Microsoft Direct3D 11 API. Even if you have Microsoft Direct3D 9-level or Microsoft Direct3D 10-level hardware, you can use the Direct3D 11 API and target a feature level 9_x or feature level 10_x device. For info about how to develop 3-D graphics with DirectX, see [Create 3D graphics with DirectX](#).

For 2-D graphics and text, use [Direct2D](#) and [DirectWrite](#) rather than Windows Graphics Device Interface (GDI).

To compose bitmaps that Direct3D 11 or Direct2D populated, use [DirectComposition](#).

(E.g., <https://learn.microsoft.com/en-us/windows/win32/getting-started-with-directx-graphics>).

Learn > Microsoft 365 >

Ask Learn

Release notes for Semi-Annual Enterprise Channel

Summarize this article for me

These release notes provide information about new features and nonsecurity updates that are included in Semi-Annual Enterprise Channel updates for Microsoft 365 Apps for enterprise, Microsoft 365 Apps for business, and the subscription versions of the desktop apps for Project and Visio.

New, or updated, features are released in Semi-Annual Enterprise Channel twice a year, on the second Tuesday in January and July.

(E.g., <https://learn.microsoft.com/en-us/officeupdates/semi-annual-enterprise-channel#version-2208-january-10>).

Office Suite

- We fixed an issue that addressed a number of cases where opening Word, Excel or PowerPoint documents from OneDrive or SharePoint would yield a close unexpectedly.
- We fixed an issue that caused contact cards to not show properly.
- We fixed an issue when opening up the font drop-down in Excel; the highlighted font wasn't the one currently selected in the document.
- We fixed an issue where the font drop-down wouldn't accurately reflect what font was selected in a shape.
- We fixed an issue where font download requests for endpoints that don't support font service were being issued. These requests are known to stop working for those endpoints so we shouldn't even try to issue them for unsupported endpoints.
- We fixed an issue where we attempt font downloads in cases they're known and expected to stop working during downloading, which results in unnecessary resources being used.
- We fixed an issue where the video to introduce the new visuals wasn't displaying.
- We fixed an issue in Color Picker text selection scenarios with Shapes and SmartArt.
- We fixed an issue where operations would reinstall Office.
- We fixed an issue when users were unable to install M365 apps when PowerShell was disabled.
- We fixed an issue that was causing a "Publish Package Failed" error during an update, which would cause a file-type association to be lost.
- We fixed an issue to default blocking macros from the Internet from executing.
- We fixed an instability issue related to animations for the user interface.
- We fixed an issue to allow a gradient stop to be added when clicking along the slider.
- We fixed an issue related to multi-threading for Direct2D and Direct3D interoperability.
- We fixed an issue related to text layout within SVG graphics.
- We fixed an issue with SVG objects to handle text-anchor, end attributes and correctly

(E.g., <https://learn.microsoft.com/en-us/officeupdates/semi-annual-enterprise-channel#version-2208-january-10>).

What's the difference between Office 2013 and Microsoft 365?

Office 2013 include applications such as Word, Excel, PowerPoint, and Outlook. They're available as a one-time purchase for use on a single PC. Microsoft 365 plans include premium versions of these applications plus other services that are enabled over the internet, including online storage with OneDrive for home use. With Microsoft 365 you get the full, installed Office experience on PCs, Macs, tablets (including iPad® and Android™ tablet) and phones. Microsoft 365 plans are available as a monthly or annual subscription. [learn more](#)

(E.g., <https://www.microsoft.com/en-us/microsoft-365/previous-versions/microsoft-office-2013>).

End of support for Office 2013

► Applies To

Support for Office 2013 ended on April 11, 2023 and there will be no extension and no extended security updates. All of your Office 2013 apps will continue to function. However, you could expose yourself to serious and potentially harmful security risks.

(E.g., <https://support.microsoft.com/en-us/office/end-of-support-for-office-2013-90e4b0d1-098f-4656-b6e7-8b13b67ed62f>).

But Office 2013 uses Direct2D, DXGI, and DirectWrite. On Windows 7, if I draw something on the screen - it gets erased the next time the cursor blink. On Windows 8 - I don't even have access to the screen.

(E.g., <https://stackoverflow.com/questions/18170817/modifying-the-screen-of-existing-direct2d-application>).

Office Adopts New Windows Display Technology



Summarize this article for me

Office 2013 has undergone a substantial shift to a relatively new display facility, Direct2D, and a new text facility, DirectWrite. These are the display facilities that are used on Windows Phone 8, the new Windows RT slates, and optionally on Windows 7 & 8. Up through Office 2010, the Windows Graphics Device Interface (GDI) and complex script support by Uniscribe were used. RichEdit 8.0 interfaces to both kinds of display

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/direct2d-overview>).

About Direct2D



Summarize this article for me

This topic introduces Direct2D, an API that provides Win32 developers with the ability to perform 2-D graphics rendering tasks with superior performance and visual quality.

What is Direct2D?

Direct2D is a hardware-accelerated, immediate-mode 2-D graphics API that provides high performance and high-quality rendering for 2-D geometry, bitmaps, and text. The Direct2D API is designed to interoperate with existing code that uses GDI, GDI+, or Direct3D.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/direct2d-overview>).

Requirements

Requirement	Value
Minimum supported client	<u>Windows 8 and Platform Update for Windows 7 [desktop apps]</u> Windows Store apps]

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

Effects

What are Direct2D effects?

You can use Direct2D to apply one or more high quality effects to an image or a set of images. The effects APIs are built on [Direct3D 11](#) and take advantage of GPU features for image processing. You can chain effects in an effect graph and compose or blend the output of effects.

A Direct2D effect performs an imaging task, like changing brightness, de-saturating an image, or creating a drop shadow. Effects can accept zero or more input images, expose multiple properties that control their operation, and generate a single output image.

Each effect creates an internal transform graph made up of individual transforms. Each transform represents a single image operation. The main purpose of a transform is to house the shaders that are executed for each output pixel. These shaders can include pixel shaders, vertex shaders, the blend stage of a GPU, and compute shaders.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/effects-overview>).

There are a range of [built-in effects](#) from categories like the ones here. See the [Built-in Effects](#) section for a full list.

- Filtering
- Composition and Blending
- Transparency
- **Color**
- Lighting and Stylizing
- Transforming and Scaling
- Sources

You can apply effects to any bitmap, including: images loaded by the [Windows Imaging Component \(WIC\)](#), primitives drawn by [Direct2D](#), text from [DirectWrite](#), or scenes rendered by [Direct3D](#).

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/effects-overview>).

Built-in Effects



Summarize this article for me

Direct2D effects provides this set of built-in effects. The effects come in several categories and are listed below along with the CLSID of the effect.

Color

- 3D lookup table effect - CLSID_D2D1LookupTable3D
- Color management effect - CLSID_D2D1ColorManagement
- Color matrix effect - CLSID_D2D1ColorMatrix
- HDR tone map effect - CLSID_D2D1HdrToneMap
- Hue to RGB effect - CLSID_D2D1HueToRgb
- Hue rotation effect - CLSID_D2D1HueRotation

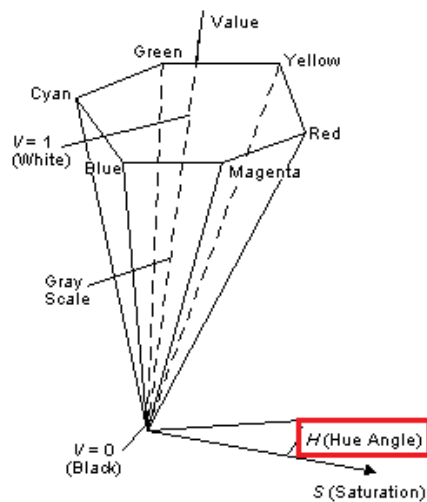
(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/built-in-effects>).

HSV Color Spaces



Summarize this article for me

Hue, saturation, and value (HSV) color spaces are often used by artists. "Hue" is what we normally think of as color. It is the attribute of a color by which we give it a name such as "red" or "blue". "Value" is another word for "lightness," the attribute of a color that makes it seem equivalent to some shade of gray between black and white. Saturation is a measure of how different a color appears from a gray of the same lightness. Zero saturation indicates no hue, just gray scale. The HSV color space is normalized.



The preceding figure shows a line drawing of HSV space in the form of a hexcone. Each of its cross sections is a hexagon. At the vertices of each cross section are the colors red, yellow, green, cyan, blue, and magenta. A color in HSV space is specified by stating a hue angle, the chroma level, and the lightness level. A hue angle of zero is red. The hue angle increases in a counterclockwise direction. Complementary colors are 180 apart.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/wcs/hsv-color-spaces>).

HueRotationEffect Class

Alters the color of an image by rotating its hue values.

▲ Inheritance Hierarchy

System.Object

Microsoft.Graphics.Canvas.Effects.HueRotationEffect

Namespace: Microsoft.Graphics.Canvas.Effects

Assembly: Microsoft.Graphics.Canvas (in Microsoft.Graphics.Canvas.dll) Version: 0.0.0.0

▲ Syntax

C#

```
public sealed class HueRotationEffect : ICanvasEffect,
    IGraphicsEffect, IGraphicsEffectSource, ICanvasImage, IDisposable
```

▲ Properties

	Name	Description
	<u>Angle</u>	<u>Angle to rotate the hue, in radians. Default value 0, range 0 to 2*pi.</u>
	BufferPrecision	Specifies what precision to use for intermediate buffers when drawing this effect.
	CacheOutput	Enables caching the output from drawing this effect.
	Name	Attaches a user-defined name string to the effect.
	<u>Source</u>	<u>Gets or sets the input source for HueRotation effect.</u>

(E.g., https://microsoft.github.io/Win2D/WinUI2/html/T_Microsoft_Graphics_Canvas_Effects_HueRotationEffect.htm).

Hue rotation effect

Use the hue rotate effect to alter the hue of an image by applying a color matrix based on the rotation angle.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

Color matrix effect

Use the color matrix effect to alter the RGBA values of a bitmap.

You can use this effect to:

- Remove a color channel from an image.
- Reduce the color in an image.
- Swap color channels.
- Combine color channels.

Many built-in effects are specializations of color matrix that are optimized for the intended use of the effects. Examples include [saturation](#), [hue rotate](#), [sepia](#), and [temperature and tint](#).

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/color-matrix>).

Constants

 Expand table

D2D1_HUEROTATION_PROP_ANGLE

Value: 0

The angle to rotate the hue, in degrees.

The type is FLOAT.

The default is 0.0f.

D2D1_HUEROTATION_PROP_FORCE_DWORD

Value: 0xffffffff

(E.g., https://learn.microsoft.com/en-us/windows/win32/api/d2d1effects/ne-d2d1effects-d2d1_huerotation_prop).

Example image

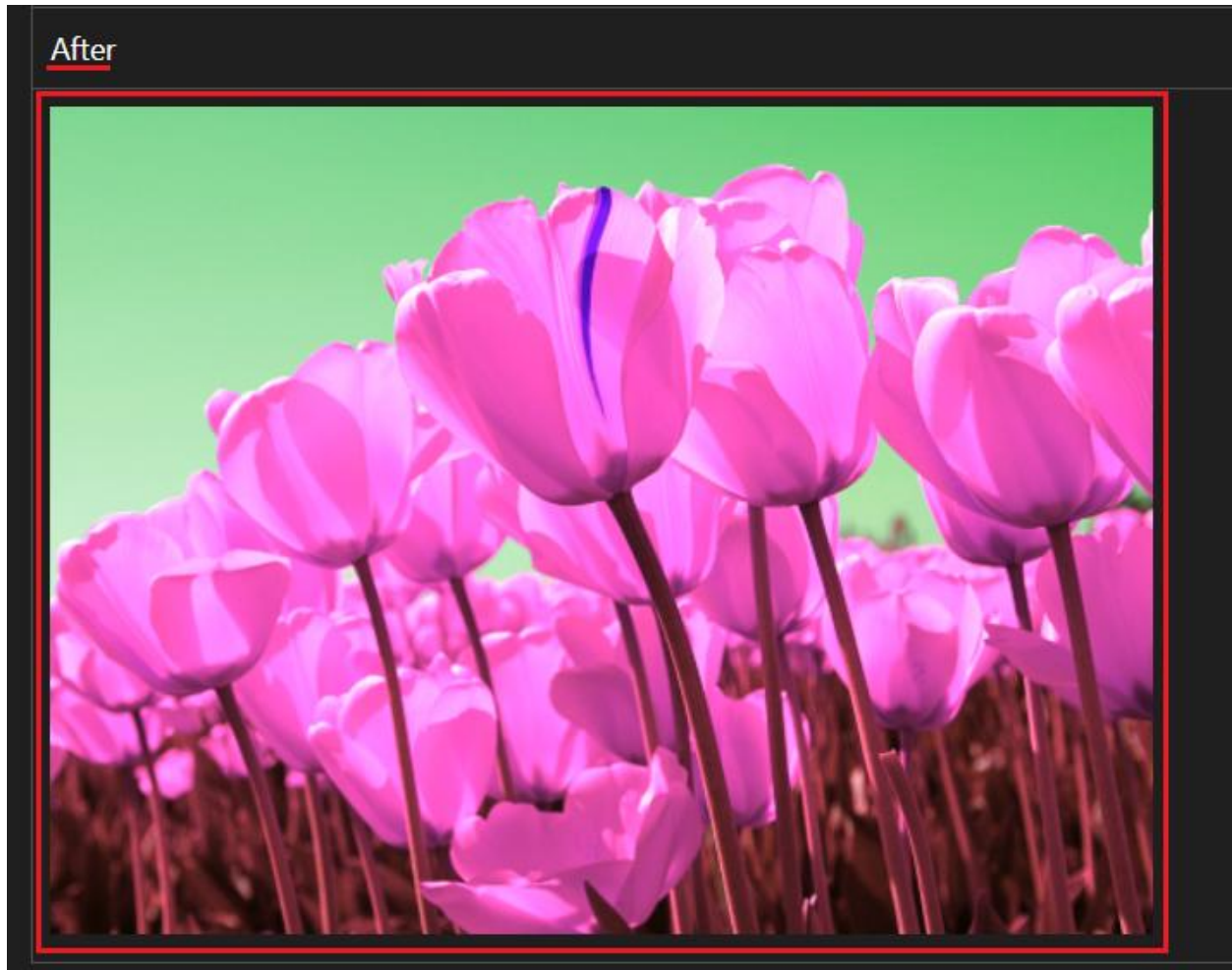
The example here shows the input and output images of the hue rotate effect with a rotation angle of 270 degrees.

 Expand table

Before



(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).



(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

```

ComPtr<ID2D1Effect> hueRotationEffect;
m_d2dContext->CreateEffect(CLSID_D2D1HueRotation, &hueRotationEffect);

hueRotationEffect->SetInput(0, bitmap);
hueRotationEffect->SetValue(D2D1_HUEROTATION_PROP_ANGLE, 270.0f);

m_d2dContext->BeginDraw();
m_d2dContext->DrawImage(hueRotationEffect.Get());
m_d2dContext->EndDraw();

```

The effect calculates a color matrix based on the rotation angle (?) you specify with the D2D1_HUEROTATION_PROP_ANGLE property. Here are the matrix equations.

$$\begin{bmatrix} R' & G' & B' & A' \end{bmatrix} = \begin{bmatrix} R & G & B & A \end{bmatrix} \begin{bmatrix} A_{00} & A_{01} & A_{02} & 0 \\ A_{10} & A_{11} & A_{12} & 0 \\ A_{20} & A_{21} & A_{22} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} A_{00} & A_{01} & A_{02} \\ A_{10} & A_{11} & A_{12} \\ A_{20} & A_{21} & A_{22} \end{bmatrix} = \begin{bmatrix} 0.213 & 0.213 & 0.213 \\ 0.715 & 0.715 & 0.715 \\ 0.072 & 0.072 & 0.072 \end{bmatrix} + \cos(\theta) * \begin{bmatrix} 0.787 & -0.213 & -0.213 \\ -0.715 & 0.285 & -0.715 \\ -0.072 & -0.072 & +0.928 \end{bmatrix} + \sin(\theta) * \begin{bmatrix} -0.213 & 0.143 & -0.787 \\ -0.715 & 0.140 & 0.715 \\ 0.928 & -0.283 & 0.072 \end{bmatrix}$$

The matrix created depends only on the rotation angle. You can use the color matrix effect if you need a specific matrix.

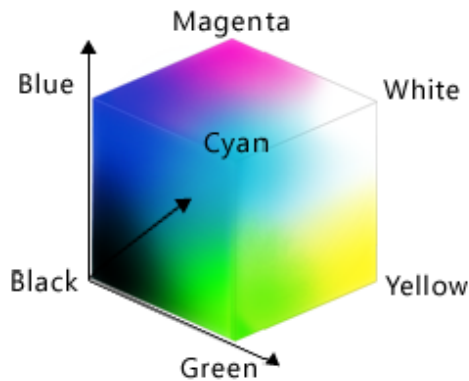
Effect properties

Expand table

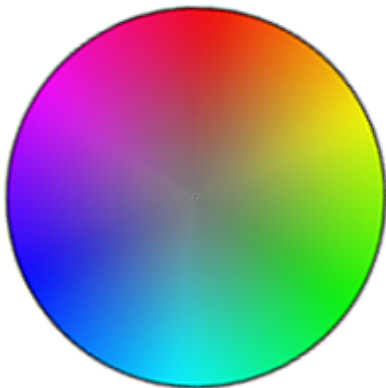
Display name and index enumeration	Type and default value	Description
Angle	FLOAT	The angle to rotate the hue, in degrees.
D2D1_HUEROTATION_PROP_ANGLE	0.0f	

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

Color is often thought of in terms of a color space, where RGB (red, green, blue), HSL (hue, saturation, luminosity), and HSV (hue, saturation, value) are the most commonly used color spaces.



- **Hue:** The basic color in the color wheel, ranging from 0 to 360 degrees where both 0 and 360 degrees are red.



The color wheel, where red is 0 degrees, yellow is 60 degrees, green is 120 degrees, cyan is 180 degrees, blue is 240 degrees, and magenta is 300 degrees.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/uxguide/vis-color>).

Choosing colors in the Colors dialog box

▼ Applies To

Excel for Microsoft 365, Word for Microsoft 365, Outlook for Microsoft 365, PowerPoint for Microsoft 365, Access for Microsoft 365, OneNote for Microsoft 365, Project Online Desktop Client, Visio Plan 2, Excel 2024, Outlook 2024, PowerPoint 2024, Access 2024, OneNote 2024, Project Professional 2024, Project Standard 2024, Excel 2021,

The **Colors** dialog box lets you fine-tune your choice of colors. If you don't like any of the choices on the **Standard** tab, switch to the **Custom** tab and refine your choice. When you make a new selection, you can see how it looks compared to the selection you started with in the box that displays the **New** and **Current** colors.

On the **Custom** tab, try dragging your selection around the **Colors** rectangle and notice how the selected color changes. Colors along the top of the rectangle are fully saturated (no gray), and colors along the bottom of the rectangle are completely gray, not saturated at all.

(E.g., <https://support.microsoft.com/en-us/office/choosing-colors-in-the-colors-dialog-box-c3d59ddf-65a7-4e62-aad7-f7b8d7684a2d>).

51. The Accused Instrumentality practiced generating phase information (e.g., chrominance phase information of an image) for determining a phase (e.g., phase of a chroma) of a received chrominance signal (e.g., a received chrominance image signal). As shown, the Accused Instrumentality allows users to edit inserted pictures in the documents. It utilizes Windows operating system. It shows a preview image to a user using its operating system. It generates a preview image by determining phase information (e.g., phase information) from the received image.

About Direct2D



Summarize this article for me

This topic introduces Direct2D, an API that provides Win32 developers with the ability to perform 2-D graphics rendering tasks with superior performance and visual quality.

What is Direct2D?

Direct2D is a hardware-accelerated, immediate-mode 2-D graphics API that provides high performance and high-quality rendering for 2-D geometry, bitmaps, and text. The Direct2D API is designed to interoperate with existing code that uses GDI, GDI+, or Direct3D.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/direct2d-overview>).

Requirements

Requirement	Value
Minimum supported client	<u>Windows 8 and Platform Update for Windows 7 [desktop apps]</u> Windows Store apps]

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

Phase relationship of the chrominance components. Hue is specified in degrees, and the valid range is from -180 through 180, with a default of 0. *Deprecated.*

Definition

 Expand table

Visual Basic	Public Property Hue As Integer
C#	public int Hue { get; set; }
C++	public: property int Hue { int get(); void set(int value); }
JScript	public function get Hue() : int public function set Hue(int);

(E.g., [https://learn.microsoft.com/en-us/previous-versions/windows/desktop/bb321750\(v=vs.85\)](https://learn.microsoft.com/en-us/previous-versions/windows/desktop/bb321750(v=vs.85))).

Constants

 Expand table

D2D1_HUEROTATION_PROP_ANGLE

Value: 0

The angle to rotate the hue, in degrees.

The type is FLOAT.

The default is 0.0f.

D2D1_HUEROTATION_PROP_FORCE_DWORD

Value: 0xffffffff

(E.g., https://learn.microsoft.com/en-us/windows/win32/api/d2d1effects/ne-d2d1effects-d2d1_huerotation_prop).

The hue is determined by the phase shift of the chrominance signal, but to determine the phase there must be a reference signal. This reference is provided in the form of a "color burst", which is a fixed-phase chrominance signal of at least 8 cycles performed during each horizontal blank period. The difference between the high points of the chrominance signal in relation to those of the color burst determines the hue that will be shown. This explains why you get two different colors depending on whether your display line has points drawn on even pixels or on odd pixels. It also shows that drawing the line just a fraction of a pixel off can dramatically change the hue. Compare the output of the original CTIA chips with the newer GTIA chips.

(E.g., https://user.xmission.com/~trevin/atari/video_notes.html).

Example image

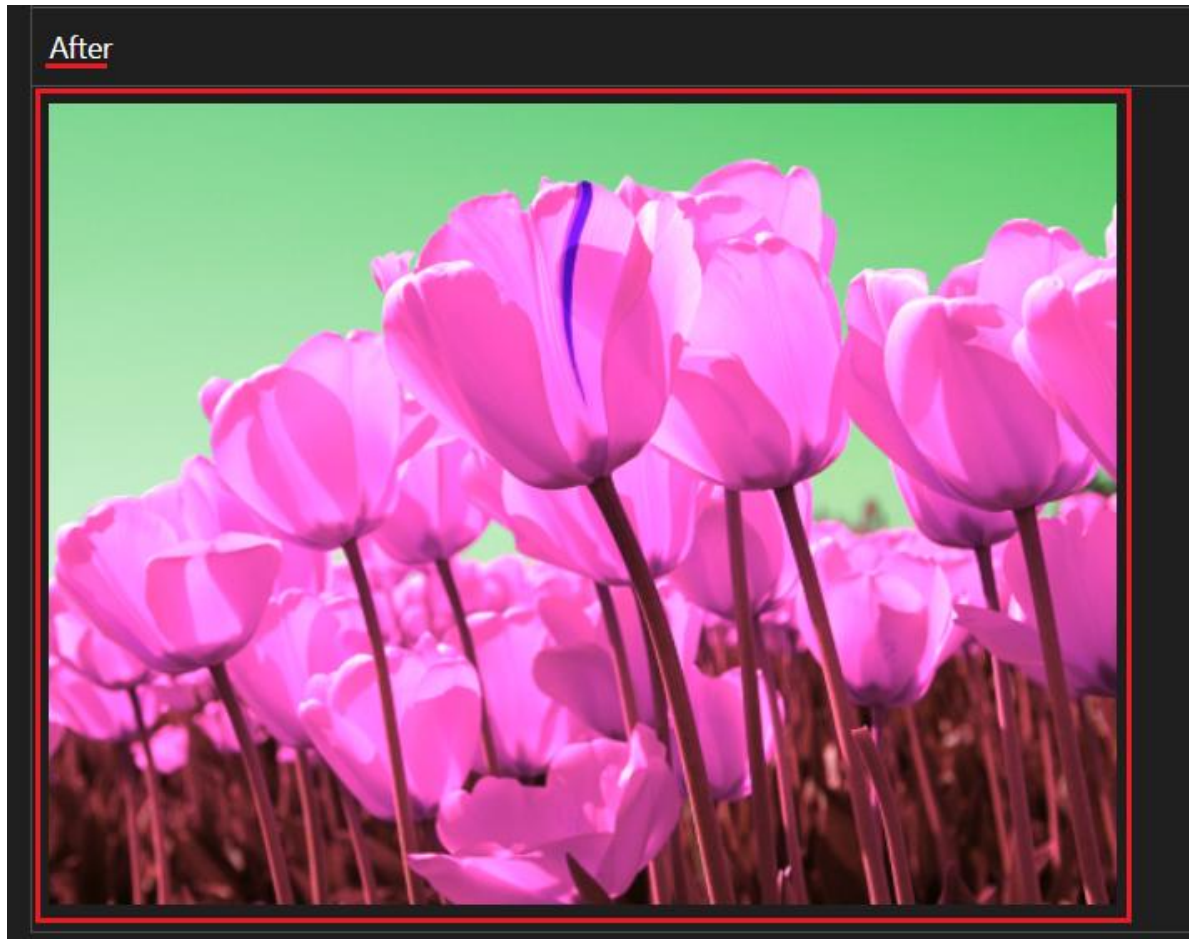
The example here shows the input and output images of the hue rotate effect with a rotation angle of 270 degrees.

 Expand table

Before



(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).



(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

52. The Accused Instrumentality practiced searching a plurality of angles of rotation (e.g., different angles of rotation) corresponding to various phase information (e.g., phase information) for a specific angle of rotation (e.g., a desired angle of rotation) according to the generated phase information (e.g., chrominance phase value of an image) and rotating the received chrominance signal (e.g., chrominance phase value of an image) by the specific angle of rotation (e.g., a desired angle of rotation) using a matrix algorithm (e.g., color matrix), such that hue of the chrominance signal is adjusted (e.g., hue adjustment of the chrominance signal). As shown below, the Accused Instrumentality utilizes a processor and GPU for color image processing using Direct2D. When a user inserts and edits pictures in applications such as PowerPoint, Docs, etc.,

the image is rendered through Direct2D. It applies color adjustment effects such as color matrix transformations, saturation changes, and hue rotation. A user can set a particular angle of rotation for an axis using the color matrix which results in hue adjustment of the chrominance signal.

Effects

What are Direct2D effects?

You can use Direct2D to apply one or more high quality effects to an image or a set of images. The effects APIs are built on [Direct3D 11](#) and take advantage of GPU features for image processing. You can chain effects in an effect graph and compose or blend the output of effects.

A Direct2D effect performs an imaging task, like changing brightness, de-saturating an image, or creating a drop shadow. Effects can accept zero or more input images, expose multiple properties that control their operation, and generate a single output image.

Each effect creates an internal transform graph made up of individual transforms. Each transform represents a single image operation. The main purpose of a transform is to house the shaders that are executed for each output pixel. These shaders can include pixel shaders, vertex shaders, the blend stage of a GPU, and compute shaders.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/effects-overview>).

Requirements

Requirement	Value
Minimum supported client	<u>Windows 8 and Platform Update for Windows 7 [desktop apps Windows Store apps]</u>

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

There are a range of built-in effects from categories like the ones here. See the Built-in Effects section for a full list.

- Filtering
- Composition and Blending
- Transparency
- **Color**
- Lighting and Stylizing
- Transforming and Scaling
- Sources

You can apply effects to any bitmap, including: images loaded by the Windows Imaging Component (WIC), primitives drawn by Direct2D, text from DirectWrite, or scenes rendered by Direct3D.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/effects-overview>).

Built-in Effects



Summarize this article for me

Direct2D effects provides this set of built-in effects. The effects come in several categories and are listed below along with the CLSID of the effect.

Color

- 3D lookup table effect - CLSID_D2D1LookupTable3D
- Color management effect - CLSID_D2D1ColorManagement
- Color matrix effect - CLSID_D2D1ColorMatrix
- HDR tone map effect - CLSID_D2D1HdrToneMap
- Hue to RGB effect - CLSID_D2D1HueToRgb
- **Hue rotation effect - CLSID_D2D1HueRotation**

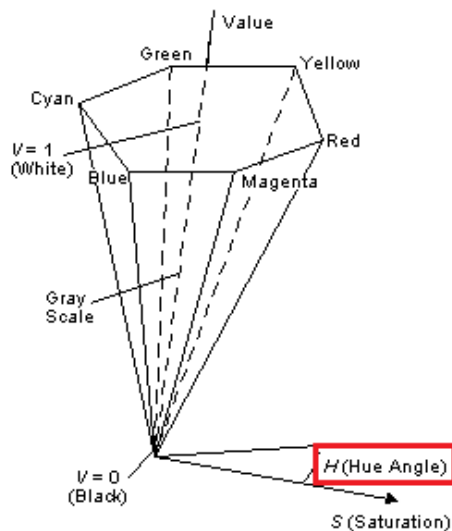
(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/built-in-effects>).

HSV Color Spaces



Summarize this article for me

Hue, saturation, and value (HSV) color spaces are often used by artists. "Hue" is what we normally think of as color. It is the attribute of a color by which we give it a name such as "red" or "blue". "Value" is another word for "lightness," the attribute of a color that makes it seem equivalent to some shade of gray between black and white. Saturation is a measure of how different a color appears from a gray of the same lightness. Zero saturation indicates no hue, just gray scale. The HSV color space is normalized.



As an additional small overhead in processing, WPP requires to store the content of all CABAC context variables after having finished encoding/decoding of the second CTU in each CTU row. Beyond that, however, WPP does not require any extra handling of partition borders to preserve the dependencies utilized by entropy encoding/decoding, in-picture prediction or in-loop filtering. An example WPP scheme for executing all HEVC decoder operations within the hybrid video coding loop can be found in [6].

(E.g., <https://learn.microsoft.com/en-us/windows/win32/wcs/hsv-color-spaces>).

Hue rotation effect

Use the hue rotate effect to alter the hue of an image by applying a color matrix based on the rotation angle.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

Color matrix effect

Use the color matrix effect to alter the RGBA values of a bitmap.

You can use this effect to:

- Remove a color channel from an image.
- Reduce the color in an image.
- Swap color channels.
- Combine color channels.

Many built-in effects are specializations of color matrix that are optimized for the intended use of the effects. Examples include [saturation](#), [hue rotate](#), [sepia](#), and [temperature and tint](#).

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/color-matrix>).

ColorMatrix Class

Definition

Namespace: [System.Drawing.Imaging](#)

Assembly: [System.Drawing.Common.dll](#)

Source: [ColorMatrix.cs](#)

Defines a 5 x 5 matrix that contains the coordinates for the RGBAW space. Several methods of the ImageAttributes class adjust image colors by using a color matrix. This class cannot be inherited.

C#

Copy

```
public sealed class ColorMatrix
```

Inheritance [Object](#) → [ColorMatrix](#)

(E.g., <https://learn.microsoft.com/en-us/dotnet/api/system.drawing.imaging.colormatrix?view=windowsdesktop-10.0>).

Phase relationship of the chrominance components. Hue is specified in degrees, and the valid range is from -180 through 180, with a default of 0. *Deprecated.*

Definition

 Expand table

Visual Basic	Public Property Hue As Integer
C#	public int Hue { get; set; }
C++	public: property int Hue { int get(); void set(int value); }
JScript	public function get Hue() : int public function set Hue(int);

(E.g., [https://learn.microsoft.com/en-us/previous-versions/windows/desktop/bb321750\(v=vs.85\)](https://learn.microsoft.com/en-us/previous-versions/windows/desktop/bb321750(v=vs.85))).

The hue is determined by the phase shift of the chrominance signal, but to determine the phase there must be a reference signal. This reference is provided in the form of a "color burst", which is a fixed-phase chrominance signal of at least 8 cycles performed during each horizontal blank period. The difference between the high points of the chrominance signal in relation to those of the color burst determines the hue that will be shown. This explains why you get two different colors depending on whether your display line has points drawn on even pixels or on odd pixels. It also shows that drawing the line just a fraction of a pixel off can dramatically change the hue. Compare the output of the original CTIA chips with the newer GTIA chips.

(E.g., https://user.xmission.com/~trevin/atari/video_notes.html).

Constants

 Expand table

D2D1_HUEROTATION_PROP_ANGLE

Value: 0

The angle to rotate the hue, in degrees.

The type is FLOAT.

The default is 0.0f.

D2D1_HUEROTATION_PROP_FORCE_DWORD

Value: 0xffffffff

(E.g., https://learn.microsoft.com/en-us/windows/win32/api/d2d1effects/ne-d2d1effects-d2d1_huerotation_prop).

Example image

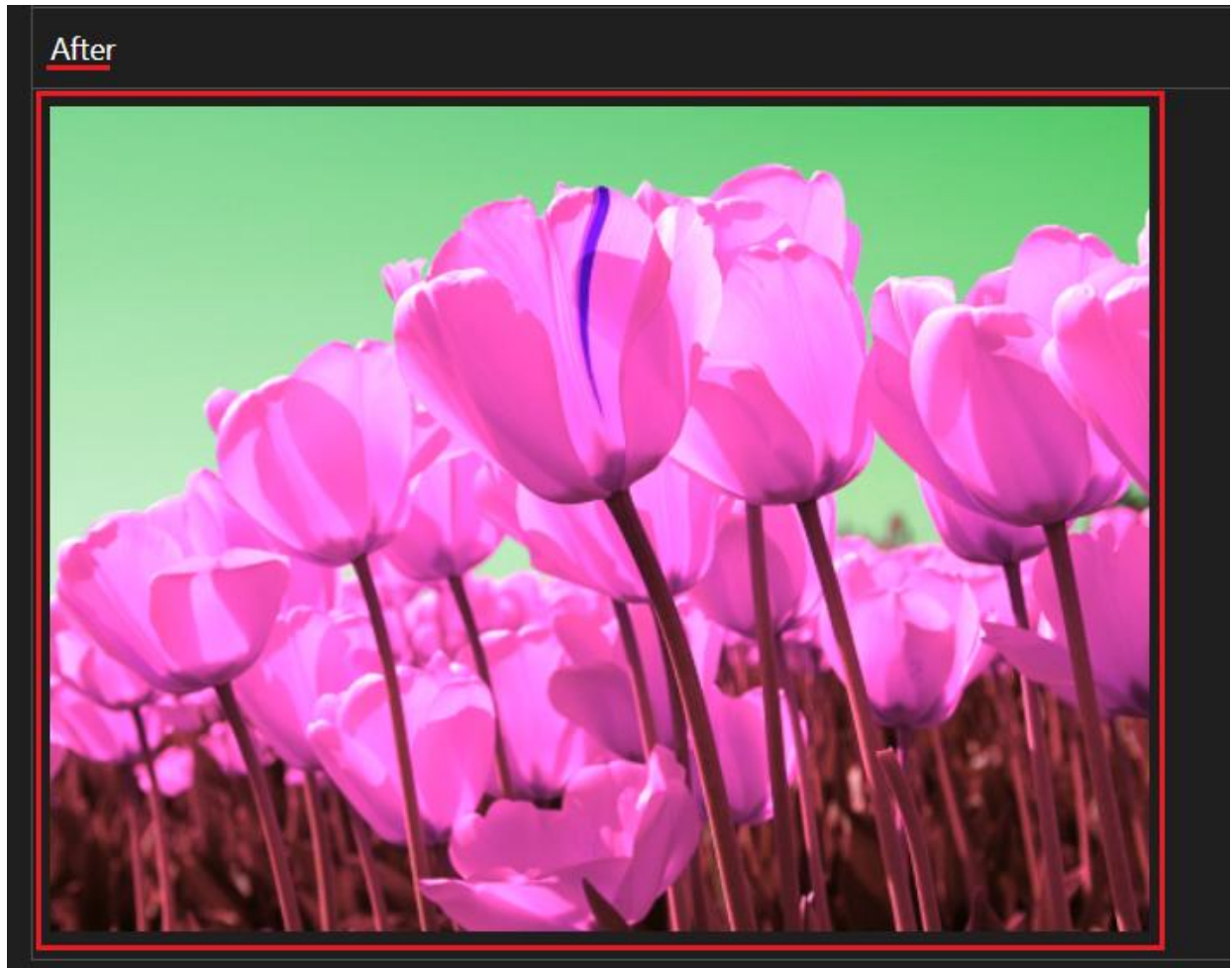
The example here shows the input and output images of the hue rotate effect with a rotation angle of 270 degrees.

 Expand table

Before



(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).



(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

```

ComPtr<ID2D1Effect> hueRotationEffect;
m_d2dContext->CreateEffect(CLSID_D2D1HueRotation, &hueRotationEffect);

hueRotationEffect->SetInput(0, bitmap);
hueRotationEffect->SetValue(D2D1_HUEROTATION_PROP_ANGLE, 270.0f);

m_d2dContext->BeginDraw();
m_d2dContext->DrawImage(hueRotationEffect.Get());
m_d2dContext->EndDraw();

```

The effect calculates a color matrix based on the rotation angle (?) you specify with the D2D1_HUEROTATION_PROP_ANGLE property. Here are the matrix equations.

$$\begin{bmatrix} R' & G' & B' & A' \end{bmatrix} = \begin{bmatrix} R & G & B & A & 1 \end{bmatrix} \begin{bmatrix} A_{00} & A_{01} & A_{02} & 0 \\ A_{10} & A_{11} & A_{12} & 0 \\ A_{20} & A_{21} & A_{22} & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} A_{00} & A_{01} & A_{02} \\ A_{10} & A_{11} & A_{12} \\ A_{20} & A_{21} & A_{22} \end{bmatrix} = \begin{bmatrix} 0.213 & 0.213 & 0.213 \\ 0.715 & 0.715 & 0.715 \\ 0.072 & 0.072 & 0.072 \end{bmatrix} + \cos(\theta) * \begin{bmatrix} 0.787 & -0.213 & -0.213 \\ -0.715 & 0.285 & -0.715 \\ -0.072 & -0.072 & +0.928 \end{bmatrix} + \sin(\theta) * \begin{bmatrix} -0.213 & 0.143 & -0.787 \\ -0.715 & 0.140 & 0.715 \\ 0.928 & -0.283 & 0.072 \end{bmatrix}$$

The matrix created depends only on the rotation angle. You can use the color matrix effect if you need a specific matrix.

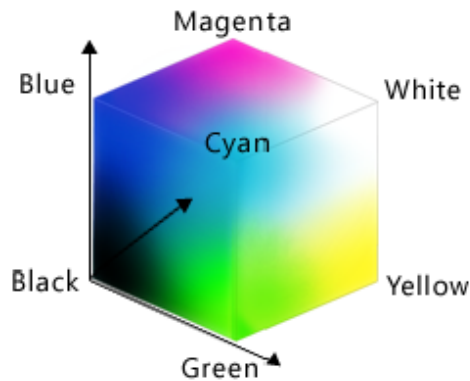
Effect properties

 Expand table

Display name and index enumeration	Type and default value	Description
Angle	FLOAT	The angle to rotate the hue, in degrees.
D2D1_HUEROTATION_PROP_ANGLE	0.0f	

(E.g., <https://learn.microsoft.com/en-us/windows/win32/direct2d/hue-rotate>).

Color is often thought of in terms of a color space, where RGB (red, green, blue), HSL (hue, saturation, luminosity), and HSV (hue, saturation, value) are the most commonly used color spaces.



- **Hue:** The basic color in the color wheel, ranging from 0 to 360 degrees where both 0 and 360 degrees are red.



The color wheel, where red is 0 degrees, yellow is 60 degrees, green is 120 degrees, cyan is 180 degrees, blue is 240 degrees, and magenta is 300 degrees.

(E.g., <https://learn.microsoft.com/en-us/windows/win32/uxguide/vis-color>).

Choosing colors in the Colors dialog box

▼ Applies To

Excel for Microsoft 365, Word for Microsoft 365, Outlook for Microsoft 365, PowerPoint for Microsoft 365, Access for Microsoft 365, OneNote for Microsoft 365, Project Online Desktop Client, Visio Plan 2, Excel 2024, Outlook 2024, PowerPoint 2024, Access 2024, OneNote 2024, Project Professional 2024, Project Standard 2024, Excel 2021,

The **Colors** dialog box lets you fine-tune your choice of colors. If you don't like any of the choices on the **Standard** tab, switch to the **Custom** tab and refine your choice. When you make a new selection, you can see how it looks compared to the selection you started with in the box that displays the **New** and **Current** colors.

On the **Custom** tab, try dragging your selection around the **Colors** rectangle and notice how the selected color changes. Colors along the top of the rectangle are fully saturated (no gray), and colors along the bottom of the rectangle are completely gray, not saturated at all.

(E.g., <https://support.microsoft.com/en-us/office/choosing-colors-in-the-colors-dialog-box-c3d59ddf-65a7-4e62-aad7-f7b8d7684a2d>).

53. Plaintiff has been damaged as a result of Defendant's infringing conduct. Defendant is thus liable to Plaintiff for damages in an amount that adequately compensates Plaintiff for such Defendant's infringement of the '404 Patent, *i.e.*, in an amount that by law cannot be less than would constitute a reasonable royalty for the use of the patented technology, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

54. Plaintiff is only asserting a method claim in the '404 Patent and as such the marking requirements of 35 U.S.C. 287(a) do not apply. *Crown Packaging Technology, Inc. v. Rexam, Beverage Can Co.*, 559 F.3d 1308, 1316-1317 (Fed. Cir. 2009) ("Because Rexam asserted only the method claims of the '839 patent, the marking requirement of 35 U.S.C. 287(a) does not apply."); *Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1083 (Fed.Cir. 1983) ("It is 'settled in the case law that the notice requirement of this statute does not apply where the patent is directed to a process or method." (Quoting *Bandag, Inc. v. Gerrard Tire Co.*, 704 F.2d 1578,

1581 (Fed. Cir. 1983)). Plaintiff has therefore complied with the marking requirements 35 U.S.C. 287(a).

IX. JURY DEMAND

Plaintiff, under Rule 38 of the Federal Rules of Civil Procedure, requests a trial by jury of any issues so triable by right.

X. PRAYER FOR RELIEF

WHEREFORE, Plaintiff respectfully requests that the Court find in its favor and against Defendant, and that the Court grant Plaintiff the following relief:

- a. Judgment that claim 11 of United States Patent No. 8,265,575 has been infringed and is being infringed, either literally and/or under the doctrine of equivalents, directly and/or indirectly, by Defendant;
- b. Judgment that claim 10 of United States Patent No. 9,538,177 has been infringed and is being infringed, either literally and/or under the doctrine of equivalents, directly and/or indirectly, by Defendant;
- c. Judgment that claim 10 of United States Patent No. 7,327,404 has been infringed and is being infringed, either literally and/or under the doctrine of equivalents, directly and/or indirectly, by Defendant;
- d. Judgment that Defendant account for and pay to Plaintiff all damages to and costs incurred by Plaintiff because of Defendant's infringing activities and other conduct complained of herein, and an accounting of all infringements and damages not presented at trial;
- e. That Defendants be preliminarily and permanently enjoined from any further activity or conduct that infringes claim 11 of United States Patent No. 8,265,575 and/or claim 10 of United States Patent No. 9,538,177;
- f. That Plaintiff be granted pre-judgment and post-judgment interest on the damages caused by Defendant's infringing activities and other conduct complained of herein; and
- g. That Plaintiff be granted such other and further relief as the Court may deem just and proper under the circumstances.

July 30, 2026

DIRECTION IP LAW

/s/David R. Bennett

David R. Bennett (IL Bar No.: 6244214)

Steven G. Kalberg (IL Bar No.: 6336131)

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Chicago, Illinois 60614-0184

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Counsel for Plaintiff

Kreatosphere LLC