



Handheld Mode

Pick it up and play with the Joy-Con™ controllers attached to enjoy the 6.2" LCD touch screen.

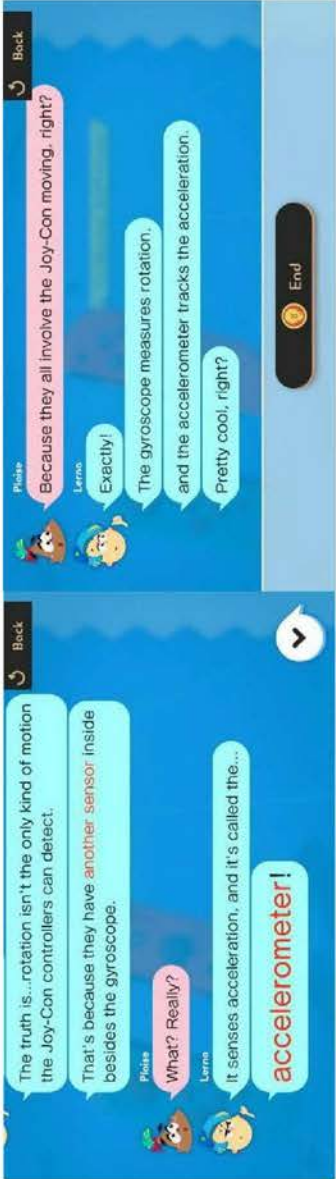
<https://www.nintendo.com/us/store/products/nintendo-switch-neon-blue-neon-red-joy-con-117972/>

CPU/GPU	NVIDIA Custom Tegra processor
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<https://www.nintendo.com/us/switch/tech-specs/#switch-section>

Sensor	Joy-Con [L] Accelerometer Gyroscope Joy-Con [R] Accelerometer Gyroscope IR Motion Camera
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<https://www.nintendo.com/us/switch/tech-specs/#joycon-section>

	The processor of the Nintendo Switch with Joy-Con Controller is operable to receive and process the directional input signal in conjunction with the second directional input signal. 				
	Nintendo Labo, Discover Topics.				
1[e] a memory subsystem, the memory storing an operating system executed by the processor to display on the display a graphical user interface for controlling the operation of the handheld computing device, wherein the graphical user interface provides a graphical element;	The Nintendo-branded devices include a memory subsystem, the memory storing an operating system executed by the processor to display on the display a graphical user interface for controlling the operation of the handheld computing device, wherein the graphical user interface provides a graphical element. The Nintendo-branded devices include a memory subsystem, the memory storing an operating system executed by the processor to display on the display a graphical user interface for controlling the operation of the handheld computing device. <table><tr><td>CPU/GPU</td><td>NVIDIA Custom Tegra processor</td></tr><tr><td>Storage</td><td>32 GB of internal storage, a portion of which is reserved for use by the system. Users can easily expand storage space using microSDHC or microSDXC cards up to 2TB (sold separately).</td></tr></table> https://www.nintendo.com/us/switch/tech-specs/#switch-section	CPU/GPU	NVIDIA Custom Tegra processor	Storage	32 GB of internal storage, a portion of which is reserved for use by the system. Users can easily expand storage space using microSDHC or microSDXC cards up to 2TB (sold separately).
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	  Handheld Mode Pick it up and play with the Joy-Con™ controllers attached to enjoy the 6.2" LCD touch screen. https://www.nintendo.com/us/store/products/nintendo-switch-neon-blue-neon-red-joy-con-117972/ Play anytime, anywhere Get the gaming system that lets you play the games you want, wherever you are, however you like. Bring the full home gaming system experience with you to the park, on an airplane, in a car, or to a friend's apartment.  https://www.nintendo.com/us/store/products/nintendo-switch-neon-blue-neon-red-joy-con-117972/ The graphical user interface provides a graphical element.
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Malikie Innovations Ltd. vs. Nintendo Co. Ltd. et al.
Exhibit H – U.S. Patent No. 8,115,731

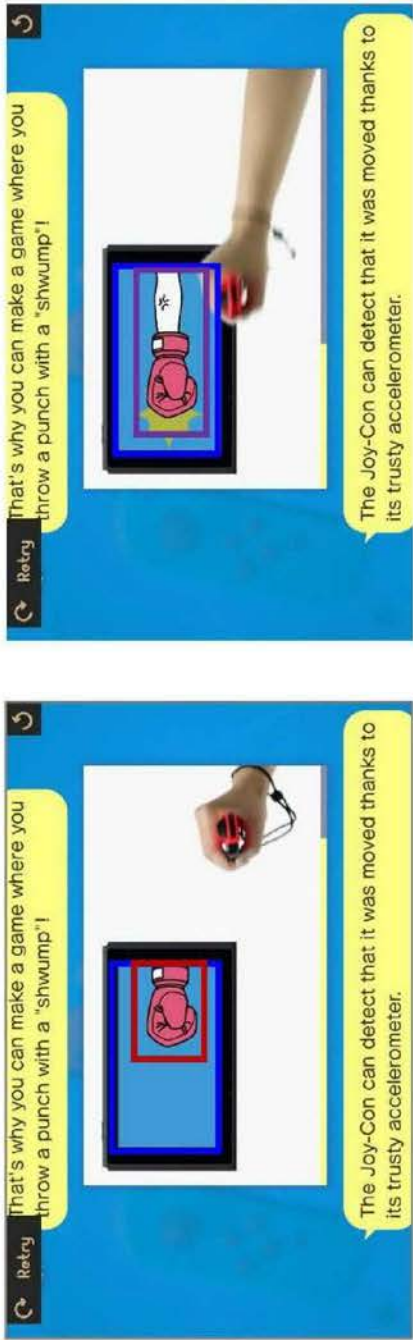
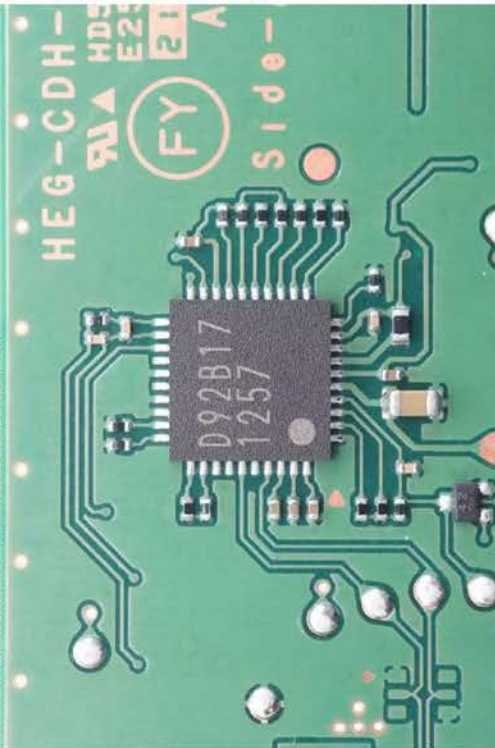
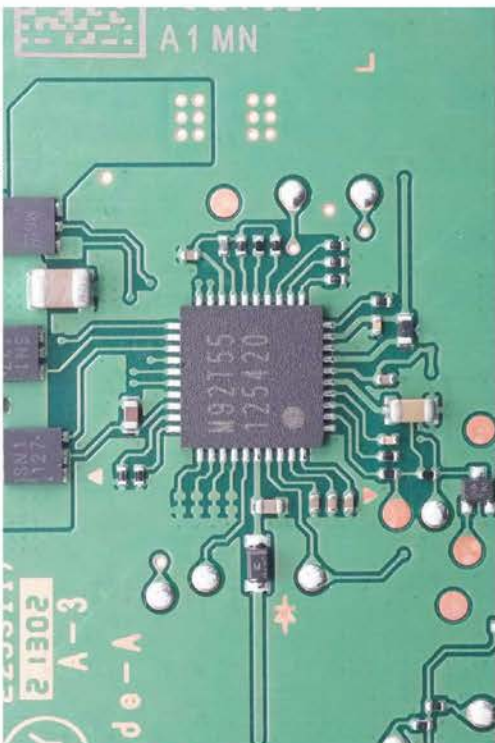
	 Nintendo Labo, Discover Topics.
1(f) wherein the operating system comprises processor-executable instructions that cause the graphical element to move by the amount of displacement in a direction substantially parallel or substantially perpendicular to the orientation.	The operating system of the Nintendo-branded devices comprises processor-executable instructions that cause the graphical element to move by the amount of displacement in a direction substantially parallel or substantially perpendicular to the orientation.  Nintendo Labo, Discover Topics.

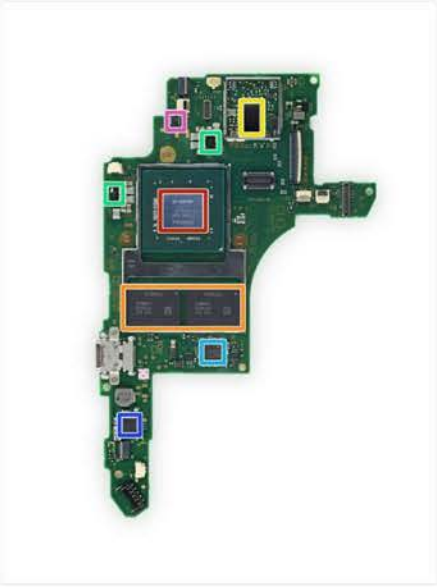
EXHIBIT I

Exhibit 1 – U.S. Patent No. 8,610,397

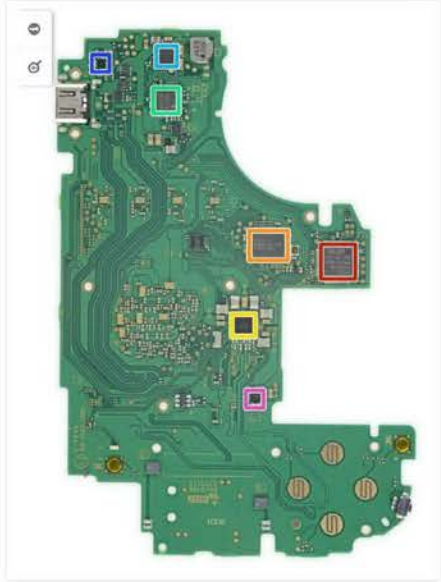
Claim	Identification						
1[pre] A battery charger for a portable wireless communications device, the portable wireless communications device including a rechargeable battery and a wireless communications transceiver coupled thereto, the portable wireless communications device and rechargeable battery each respectively having a portable device type and a rechargeable battery type associated therewith from among a plurality of different portable device types and different rechargeable battery types having respective charging rates.	Nintendo Switch™ - OLED Model [...] <table><tr><td>USB connector</td><td>USB Type-C Used for charging or for connecting to the Nintendo Switch dock.</td></tr></table> Nintendo Switch™ console (HAC-001(-01)) [...] <table><tr><td>USB connector</td><td>USB Type-C Used for charging or for connecting to the Nintendo Switch dock.</td></tr></table> Nintendo Switch Lite (HDH-001) [...] <table><tr><td>USB connector</td><td>USB Type-C Used for charging only.</td></tr></table> See, e.g., <i>Nintendo Switch Technical Specs</i>, Nintendo, https://www.nintendo.com/us/switch/tech-specs/.	USB connector	USB Type-C Used for charging or for connecting to the Nintendo Switch dock.	USB connector	USB Type-C Used for charging or for connecting to the Nintendo Switch dock.	USB connector	USB Type-C Used for charging only.
USB connector	USB Type-C Used for charging or for connecting to the Nintendo Switch dock.						
USB connector	USB Type-C Used for charging or for connecting to the Nintendo Switch dock.						
USB connector	USB Type-C Used for charging only.						

Malikie Innovations Ltd. et al. v. Nintendo Co. Ltd. et al.
Exhibit I – U.S. Patent No. 8,610,397

Claim	Identification
	 The Nintendo Switch OLED charging dock uses a black plastic shell, in addition to the slot in the middle of the dock, there are logo, non-slip pads, etc.  There is a USB-C port in the center of the slot, and the Switch can be charged by placing it in it.  The USB-C controller is from ROHM, marked with D92B17.  Another USB-C controller is marked with M92T55. See, e.g., Joey, <i>Teardown of Original Nintendo Switch OLED Charging Dock</i>, ChargerLab (Nov. 9, 2022), https://www.chargerlab.com/teardown-of-original-nintendo-switch-oled-charging-dock/; Sam Goldheart, <i>Nintendo Switch OLED Teardown: More Than Screen Deep</i>, IFIXIT (Oct. 13, 2021), https://www.ifixit.com/News/53272/nintendo-switch-oled-teardown-more-than-screen-deep.

Claim	Identification
	Step 11  - A small gathering of ~~Mini~~ ICs populates the front side of the motherboard: - NVIDIA ODNX02-A2 (presumably the Tegra X1-based SoC) - Samsung K4FEE304HB-MGCH 2 GB LPDDR4 DRAM (x2 for a total of 4 GB) - Broadcom/Cypress BCM4356 802.11ac 2x2 + Bluetooth 4.1 SoC - Maxim Integrated MAX77621AEW1+T three phase buck regulator (x2) Rohm BM92T36 USB-C controller - Texas Instruments BQ24193 single cell battery charger (possibly) - Texas Instruments TMP451 remote/local temperature sensor Step 23  Step 23  - Dockside fish-and chips: - Macronix International MX25L512E 512 Kb CMOS flash - Macronix International MX25V2006E 2 Mb CMOS flash - Megachips STDP2550 Mobility DisplayPort (MyDP) to HDMI Converter Rohm BM92T17 USB-C power delivery controller - STMicroelectronics STM32P048 32-bit microcontroller - VIA Labs VL210 USB 3.0 Hub Controller Rohm BM92T55 USB-C power delivery controller 

See, e.g., Evan Noronha et al., *Nintendo Switch Teardown, IFIXIT* (Mar. 3, 2017), <https://www.ifixit.com/Teardown/Nintendo+Switch+Teardown/78263>.

Claim	Identification
	Step 9   • Let's turn that copybara around for some more chips: • ST Microelectronics STM32F038C6 32-bit microcontroller w/ 32 KB flash • B1913 GCBRG HAC STD T1056719A1 secure MCU (likely) • Maxim Integrated MAX77620:HEWJ power management IC • Rohm BM92T10MWV-Z USB-C power delivery controller • Texas Instruments BQ24193 battery charge management • Maxim Integrated MAX17050 battery fuel gauge • Ricoh RP602Z330C 1.5 A buck-boost regulator See, e.g., Jeff Suovanen et al., <i>Nintendo Switch Lite Teardown</i>, IFIXIT (Sept. 24, 2019), https://www.ifixit.com/Teardown/Nintendo+Switch+Lite+Teardown/126223. This AC Adapter is the same as the one included with every Nintendo Switch The screen includes capacitive multi-touch capabilities for compatible games. Battery life can last for more than six hours, but will vary depending on the software and usage conditions. For example, The Legend of Zelda: Breath of the Wild can be played for roughly three hours on a single charge. While away from home, Nintendo Switch can be charged by plugging the AC adapter into the console's USB Type-C connector.  See, e.g., Nintendo Switch AC Adapter, <i>Amazon.com</i>, https://www.amazon.com/Nintendo-Switch-AC-Adapter/dp/B01N7RUZ49/.

Claim	Identification
	While attached to the Joy-Con charging grip. 1. Attach the Joy-Con to the Joy-Con charging grip. 2. Connect the Joy-Con charging grip to the Nintendo Switch dock using the USB cable that was included in the box, or connect it directly to the Nintendo Switch AC adapter (HAC-002).  See, e.g., <i>How to Charge the Joy-Con Controllers</i>, Nintendo, https://www.nintendo.com/au/support/articles/how-to-charge-the-joy-con-controllers/; <i>Spawn Wave, Taking Apart The Nintendo Switch Charge Grip! Is It Worth The Price?</i>, YouTube (Mar. 4, 2017), https://www.youtube.com/watch?v=qE9Ef19RXo (noting that the device comes with a USB-C cable).

Claim	Identification						
	Using a Nintendo Switch Pro Controller In addition to the Joy-Con controllers, you can also play Nintendo Switch with the Pro Controller (sold separately). This controller allows you to play comfortably for longer periods of time when the console is in TV mode or tabletop mode. When you are using the console in TV mode, you can attach the Pro Controller to the dock with the USB charging cable (HAC-010) to pair or charge it. When the Pro Controller is done charging, you can disconnect it from the USB charging cable and use it wirelessly. USB Type-C™ and USB-C™ are trademarks of the USB Implementers Forum. Specifications: <table><tr><th>Compatibility:</th><th>Power:</th><th>Connectivity:</th></tr><tr><td> • Nintendo Switch (USB-C and Bluetooth) • PC (USB-C) </td><td> • Lithium-ion battery (CTR-003) battery capacity 1300 mAh • USB-C connector (recharge) • Estimated 40-hour battery life </td><td> • Bluetooth • USB-C </td></tr></table> See, e.g., <i>Using a Nintendo Switch Pro Controller</i>, Nintendo, https://www.nintendo.com/au/support/articles/nintendo-switch-pro-controller/; Nintendo Switch Pro Controller Repair, IFIXIT, https://www.ifixit.com/Device/Switch_Pro_Controller. 1.1 Overview This specification defines how USB Devices can negotiate for more current and/or higher or lower voltages over the USB cable (using the USB Type-C CC wire as the communications channel) than are defined in the [USB 2.0], [USB 3.2], [USB Type-C 1.3] or [USBBC 1.2] specifications. It allows Devices with greater power requirements than can be met with today's specification to get the power they require to operate from V_{BUS} and negotiate with external power sources (e.g. Wall Warts). In addition, it allows a Source and Sink to swap power roles such that a Device could supply power to the Host. For example, a display could supply power to a notebook to charge its battery.	Compatibility:	Power:	Connectivity:	• Nintendo Switch (USB-C and Bluetooth) • PC (USB-C)	• Lithium-ion battery (CTR-003) battery capacity 1300 mAh • USB-C connector (recharge) • Estimated 40-hour battery life	• Bluetooth • USB-C
Compatibility:	Power:	Connectivity:					
• Nintendo Switch (USB-C and Bluetooth) • PC (USB-C)	• Lithium-ion battery (CTR-003) battery capacity 1300 mAh • USB-C connector (recharge) • Estimated 40-hour battery life	• Bluetooth • USB-C					

Claim	Identification														
	To facilitate optimum charging, the specification defines two mechanisms a USB Charger can advertise for the Device to use: 1. A list of fixed voltages each with a maximum current. The Device selects a voltage and current from the list. This is the traditional model used by Devices that use internal electronics to manage the charging of their battery including modifying the voltage and current actually supplied to the battery. The side-effect of this model is that the charging circuitry generates heat that may be problematic for small form factor devices. 2. A list of programmable voltage ranges each with a maximum current (PPS). The Device requests a voltage (in 20 mV increments) that is within the advertised range and a maximum current. The USB Charger delivers the requested voltage until the maximum current is reached at which time the USB charger reduces its output voltage so as not to supply more than the requested maximum current. During the high current portion of the charge cycle, the USB Charger can be directly connected (through an appropriate safety device) to the battery. This model is used by Devices that want to minimize the thermal impact of their internal charging circuitry.														
	1.2 Purpose The USB Power Delivery specification defines a power delivery system covering all elements of a USB system including: Hosts, Devices, Hubs, Chargers and cable assemblies. This specification describes the architecture, protocols, power supply behavior, connectors and cabling necessary for managing power delivery over USB at up to 100W. This specification is intended to be fully compatible and extend the existing USB infrastructure. It is intended that this specification will allow system OEMs, power supply and peripheral developers adequate flexibility for product versatility and market differentiation without losing backwards compatibility. USB Power Delivery is designed to operate independently of the existing USB bus defined mechanisms used to negotiate power which are: • <i>[USB 2.0], [USB 3.2]</i> in band requests for high power interfaces. • <i>[USBBC 1.2]</i> mechanisms for supplying higher power (not mandated by this specification). • <i>[USB Type-C 1.3]</i> mechanisms for supplying higher power														
	1.6 Terms and Abbreviations This section defines terms used throughout this document. For additional terms that pertain to the Universal Serial Bus, see Chapter 2, "Terms and Abbreviations," in <i>[USB 2.0], [USB 3.2], [USB Type-C 1.3]</i> and <i>[USBBC 1.2]</i>.														
	<table> <tr> <td>PD</td><td>USB Power Delivery</td></tr> <tr> <td>PD Capable</td><td>A Port that supports USB Power Delivery.</td></tr> <tr> <td>PD Connection</td><td>See Connected.</td></tr> <tr> <td>PD Power (PDP)</td><td>The output power of a Source, as specified by the manufacturer and expressed in Fixed Supply PDOs as defined in Section 10.</td></tr> <tr> <td>PDP Rating</td><td>Manufacturer declared PDP for a Source.</td></tr> <tr> <td>PDUSB</td><td>USB Device Port or USB Host Port that is both PD capable and capable of USB Communication. See also PDUSB Host, PDUSB Device and PDUSB Hub.</td></tr> <tr> <td>PDUSB Device</td><td>A USB Device with a PD Capable UFP. A PDUSB Device is only addressed by SOP Packets.</td></tr> </table>	PD	USB Power Delivery	PD Capable	A Port that supports USB Power Delivery.	PD Connection	See Connected.	PD Power (PDP)	The output power of a Source, as specified by the manufacturer and expressed in Fixed Supply PDOs as defined in Section 10.	PDP Rating	Manufacturer declared PDP for a Source.	PDUSB	USB Device Port or USB Host Port that is both PD capable and capable of USB Communication. See also PDUSB Host, PDUSB Device and PDUSB Hub.	PDUSB Device	A USB Device with a PD Capable UFP. A PDUSB Device is only addressed by SOP Packets.
PD	USB Power Delivery														
PD Capable	A Port that supports USB Power Delivery.														
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PDUSB Device	A USB Device with a PD Capable UFP. A PDUSB Device is only addressed by SOP Packets.														

Claim	Identification														
	<table><tr><td>PDUSB Host</td><td>A USB Host which is PD Capable on at least one of its DFPs. A PDUSB Host is only addressed by SOP Packets.</td></tr><tr><td>PDUSB Hub</td><td>A port expander USB Device with a UFP and one or more DFPs which is PD Capable on at least one of its Ports. A PDUSB Hub is only addressed by SOP Packets.</td></tr><tr><td>PDUSB Peripheral</td><td>A USB Device with a PD Capable UFP which is not a PDUSB Hub. A PDUSB Peripheral is only addressed by SOP Packets.</td></tr><tr><td>Sink</td><td>The Port consuming power from V_{BUS}; most commonly a Device.</td></tr><tr><td>Source</td><td>A role a Port is currently taking to supply power over V_{BUS}; most commonly a Host or Hub downstream port.</td></tr><tr><td>USB Device</td><td>Either a hub or a peripheral device as defined in [USB 2.0] and [USB 3.2].</td></tr><tr><td>USB Host</td><td>The host computer system where the USB host controller is installed as defined in [USB 2.0] and [USB 3.2].</td></tr></table> 2.4 USB Power Delivery Capable Devices Some examples of USB Power Delivery capable devices can be seen in Figure 2-1 (a Host, a Device, a Hub, and a Charger). These are given for reference only and do not limit the possible configurations of products that can be built using this specification. Figure 2-1 Logical Structure of USB Power Delivery Capable Devices	PDUSB Host	A USB Host which is PD Capable on at least one of its DFPs. A PDUSB Host is only addressed by SOP Packets.	PDUSB Hub	A port expander USB Device with a UFP and one or more DFPs which is PD Capable on at least one of its Ports. A PDUSB Hub is only addressed by SOP Packets.	PDUSB Peripheral	A USB Device with a PD Capable UFP which is not a PDUSB Hub. A PDUSB Peripheral is only addressed by SOP Packets.	Sink	The Port consuming power from V_{BUS} ; most commonly a Device.	Source	A role a Port is currently taking to supply power over V_{BUS} ; most commonly a Host or Hub downstream port.	USB Device	Either a hub or a peripheral device as defined in [USB 2.0] and [USB 3.2].	USB Host	The host computer system where the USB host controller is installed as defined in [USB 2.0] and [USB 3.2].
PDUSB Host	A USB Host which is PD Capable on at least one of its DFPs. A PDUSB Host is only addressed by SOP Packets.														
PDUSB Hub	A port expander USB Device with a UFP and one or more DFPs which is PD Capable on at least one of its Ports. A PDUSB Hub is only addressed by SOP Packets.														
PDUSB Peripheral	A USB Device with a PD Capable UFP which is not a PDUSB Hub. A PDUSB Peripheral is only addressed by SOP Packets.														
Sink	The Port consuming power from V_{BUS} ; most commonly a Device.														
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USB Device	Either a hub or a peripheral device as defined in [USB 2.0] and [USB 3.2].														
USB Host	The host computer system where the USB host controller is installed as defined in [USB 2.0] and [USB 3.2].														

Claim	Identification
	2.7 Architectural Overview Figure 2-5 shows the logical blocks between two Attached PD ports. In addition to the communication stack described above there are also: • For a Provider or Dual-Role Power Device: one or more Sources providing power to one or more ports. • For a Consumer or Dual-Role Power Device: A Sink consuming power. • A USB-C Port Control module (see Section 4.4) that detects cable Attach/Detach as defined in [USB Type-C 1.3]. • USB Power Delivery uses standard cabling as defined in [USB Type-C 1.3]. The Device Policy Manager talks to the communication stack, Source/Sink and the USB-C Port Control block in order to manage the resources in the Provider or Consumer. Figure 2-5 High Level Architecture View The diagram illustrates the high-level architecture of a USB-C system with two Attached PD ports: a Provider and a Consumer. Provider Side: A Device Policy Manager is connected to a Source Port, a Policy Engine, a Protocol block, a Physical Layer, a USB-C Port Control block, and Power Source(s). The Policy Engine, Protocol, and Physical Layer are interconnected. The Physical Layer is connected to the USB-C Port Control and the BMC (Bus Master Controller) block. The Power Source(s) is connected to the VBUS block. The VBUS and CC (Configuration Channel) blocks are connected to the external VBUS and CC lines. Consumer Side: A Device Policy Manager is connected to a Sink Port, a Policy Engine, a Protocol block, a Physical Layer, a USB-C Port Control block, and a Power Sink. The Policy Engine, Protocol, and Physical Layer are interconnected. The Physical Layer is connected to the USB-C Port Control and the BMC block. The Power Sink is connected to the VBUS block. The VBUS and CC blocks are connected to the external VBUS and CC lines. Interconnection: The BMC blocks of the Provider and Consumer are connected. The VBUS and CC blocks of both are connected to the common external VBUS and CC lines.

Claim	Identification
	6.4.1.3 Sink Capabilities Message A Sink Port shall report power levels it is able to operate at in a series of 32-bit Power Data Objects (see Table 6-7). These are returned as part of a Sink Capabilities Message in response to a Get_Sink_Cap Message (see Figure 6-12). This is similar to that used for Source Port capabilities with equivalent Power Data Objects for Fixed, Variable and Battery Supplies as defined in this section. Power Data Objects are used to convey the Sink Port's operational power requirements including Dual-Role Power Ports presently operating as a Source. Each Power Data Object shall describe a specific Sink operational power level, such as a Battery (e.g. 2.8-4.1V) or a fixed power supply (e.g. 12V). The Number of Data Objects field in the Message Header shall define the number of Power Data Objects that follow the Message Header in a Data Message. All Sinks shall minimally offer one Power Data Object with a power level at which the Sink can operate. A Sink shall not offer multiple Power Data Objects of the same type (fixed, variable, Battery) and the same voltage but shall instead offer one Power Data Object with the highest available current for that Sink capability and voltage. All Sinks shall include one Power Data Object that reports vSafe5V even if they require additional power to operate fully. In the case where additional power is required for full operation the Higher Capability bit shall be set. 6.4.1.3.1 Sink Fixed Supply Power Data Object Table 6-14 describes the Sink Fixed Supply (00b) PDO. See Section 7.1.3 for the electrical requirements of the power supply. The Sink shall set Voltage to its required voltage and Operational Current to its required operating current. Required operating current is defined as the amount of current a given device needs to be functional. This value could be the maximum current the Sink will ever require or could be sufficient to operate the Sink in one of its modes of operation. Since all USB Consumers support vSafe5V, the required vSafe5V Fixed Supply Power Data Object is also used to convey additional information that is returned in bits 29 through 20. All other Fixed Supply Power Data Objects shall set bits 29...20 to zero. For a Sink requiring no power from the Source, the Voltage (B19...10) shall be set to 5V and the Operational Current shall be set to 0mA.

Claim	Identification						
	6.4.4.3.1Discover Identity The Discover Identity Command is provided to enable an Initiator to identify its Port Partner and for an Initiator (VCONN Source) to identify the Responder (Cable Plug). The Discover Identity Command is also used to determine whether a Cable Plug is PD-Capable by looking for a GoodCRC Message Response. The Discover Identity Command shall be used to determine whether a given Cable Plug is PD Capable (see Section 8.3.3.18.1 and Section 8.3.3.22.3). In this case a Discover Identity Command request sent to SOP' shall Not cause a Soft Reset if a GoodCRC Message response is not returned since this can indicate a non-PD Capable cable. Note that a Cable Plug will not be ready for PD Communication until tVCONNStable after VCONN has been applied (see [USB Type-C 1.3]). During Cable Plug discovery, when there is an Explicit Contract, Discover Identity Commands are sent at a rate defined by the DiscoverIdentityTimer (see Section 6.6.14) up to a maximum of nDiscoverIdentityCount times (see Section 6.7.5). The Discover Identity Command ACK sent back by the Responder shall contain an ID Header VDO, a Cert Stat VDO, a Product VDO and the Product Type VDOs defined by the Product Type as shown in Figure 6-15. This specification defines the following Product Type VDOs: • Passive Cable VDO (see Section 6.4.4.3.1.4) • Active Cable VDOs (see Section 6.4.4.3.1.5) • Alternate Mode Adapter VDO (see Section 6.4.4.3.1.6) • VCONN Powered USB Device VDO (see Section 6.4.4.3.1.7) No VDOs other than those defined in this specification shall be sent as part of the Discover Identity Command response. Where there is no Product Type VDO defined for a specific Product Type, no VDOs shall be sent as part of the Discover Identity Command response. Any additional VDOs received by the initiator shall be Ignored. Figure 6-15 Discover Identity Command response <table><tr><th>Header No. of Data Objects = 4-7¹</th><th>VDM Header</th><th>ID Header VDO</th><th>Cert Stat VDO</th><th>Product VDO</th><th>0..3² Product Type VDO(s)</th></tr></table> ¹ Only Data objects defined in this specification can be sent as part of the Discover Identity Command. ² The following sections define the number and content of the VDOs for each Product Type. 6.4.4.3.1.1.3Product Type (UFP) The Product Type (UFP) field indicates the type of Product when in UFP Data Role, whether a VDO will be returned and if so the type of VDO to be returned. The Product Type indicated in the Product Type (UFP) field shall be the closest categorization of the main functionality of the Product in UFP Data Role or “Undefined” when there is no suitable category for the product. For DRD Products this field shall always indicate the Product Type when in UFP role regardless of the present Data Role. Table 6-30 defines the Product Type VDOs which shall be returned.	Header No. of Data Objects = 4-7 ¹	VDM Header	ID Header VDO	Cert Stat VDO	Product VDO	0..3 ² Product Type VDO(s)
Header No. of Data Objects = 4-7 ¹	VDM Header	ID Header VDO	Cert Stat VDO	Product VDO	0..3 ² Product Type VDO(s)		

Claim**Identification**

Table 6-30 Product Types (UFP)			
Product Type	Description	Product Type VDO	Reference
Undefined	<i>Shall</i> be used where no other Product Type value is appropriate.	None	
PDUSB Hub	<i>Shall</i> be used when the Product is a PDUSB Hub.	None	
PDUSB Peripheral	<i>Shall</i> be used when the Product is a PDUSB Device other than a PDUSB Hub.	None	
PSD	<i>Shall</i> be used when the Product is a PSD, e.g. power bank.	None	
Alternate Mode Adapter	<i>Shall</i> be used when the Product is a PDUSB Device that supports one or more Alternate Modes.	AMA VDO	Section 6.4.4.3.1.6
VCONN Powered USB Device	<i>Shall</i> be used when the Product is a PDUSB VCONN Powered USB Device.	VPD VDO	Section 6.4.4.3.1.7

6.4.4.3.1.1.4 Product Type (Cable Plug)

The Product Type (Cable Plug) field indicates the type of Product when the Product is a Cable Plug, whether a VDO will be returned and if so the type of VDO to be returned. Table 6-31 defines the Product Type VDOs which *Shall* be returned.

Table 6-31 Product Types (Cable Plug)

Product Type	Description	Product Type VDO	Reference
Undefined	<i>Shall</i> be used where no other Product Type value is appropriate.	None	
Active Cable	<i>Shall</i> be used when the Product is a cable that incorporates signal conditioning circuits.	Active Cable VDO	Section 6.4.4.3.1.5
Passive Cable	<i>Shall</i> be used when the Product is a cable that does not incorporate signal conditioning circuits.	Passive Cable VDO	Section 6.4.4.3.1.4

6.4.4.3.1.3 Product VDO

The Product VDO contains identity information relating to the product. The fields in the Product VDO *Shall* be as defined in Table 6-34.

Table 6-34 Product VDO

Bit(s)	Description	Reference
B31...16	16-bit unsigned integer. USB Product ID	[USB 2.0]/[USB 3.2]
B15...0	16-bit unsigned integer. bcdDevice	[USB 2.0]/[USB 3.2]

Claim

Identification

6.5.5 Battery_Capabilities Message

The **Battery_Capabilities** Message is sent in response to a **Get_Battery_Cap** Message. The **Battery_Capabilities** Message contains one Battery Capability Data Block (BCDB) for one of the Batteries its supports as reported by Battery field in the **Source_Capabilities_Extended** Message. The returned BCDB **shall** correspond to the Battery requested in the **Battery_Cap_Ref** field contained in the **Get_Battery_Cap** Message.

The **Battery_Capabilities** Message returns a 9-byte BCDB whose format **shall** be as shown in Figure 6-35 and Table 6-46.

Figure 6-35 Battery_Capabilities Message

Extended Header

Data Size = 9

BCDB

Table 6-50 Battery Capability Data Block (BCDB)

Offset (Byte)	Field	Description						
0	VID	Vendor ID (assigned by the USB-IF)						
2	PID	Product ID (assigned by the manufacturer)						
4	Battery Design Capacity	Battery's design capacity in 0.1 WH Note: 0x0000 = Battery not present 0xFFFF = design capacity unknown						
6	Battery Last Full Charge Capacity	Battery's last full charge capacity in 0.1 WH Note: 0x0000 = Battery not present 0xFFFF = last full charge capacity unknown						
8	Battery Type	<table> <tr> <th>Bit</th> <th>Description</th> </tr> <tr> <td>0</td> <td>Invalid Battery reference</td> </tr> <tr> <td>1-7</td> <td>Reserved</td> </tr> </table>	Bit	Description	0	Invalid Battery reference	1-7	Reserved
Bit	Description							
0	Invalid Battery reference							
1-7	Reserved							

6.5.5.1 Battery Design Capacity Field

The Battery Design Capacity field **shall** return the Battery's design capacity in tenths of WH. If the Battery is Hot Swappable and is not present, the Battery Design Capacity field **shall** be set to 0. If the Battery is unable to report its Design Capacity, it **shall** return 0xFFFF.

Claim	Identification												
	6.5.5.3 Battery Type Field The Battery Type Field is used to report additional information about the Battery’s capabilities. 6.5.7 Manufacturer_Info Message The <i>Manufacturer_Info</i> Message Shall be sent in response to a <i>Get_Manufacturer_Info</i> Message. The <i>Manufacturer_Info</i> Message contains the USB VID and the Vendor’s PID to identify the device or Battery and the device or Battery’s manufacturer byte array in a variable length Data Block of up to <i>MaxExtendedMsgLegacyLen</i>. The <i>Manufacturer_Info</i> Message returns a Manufacturer Info Data Block (MIDB) whose format Shall be as shown in Figure 6-35 and Table 6-46. Extended Header Data Size = 4..26 MIDB Table 6-52 Manufacturer Info Data Block (MIDB) <table><tr><th>Offset</th><th>Field</th><th>Description</th></tr><tr><td>0</td><td>VID</td><td>Vendor ID (assigned by the USB-IF)</td></tr><tr><td>2</td><td>PID</td><td>Product ID (assigned by the manufacturer)</td></tr><tr><td>4</td><td>Manufacturer String</td><td>Vendor defined null terminated string of 0...21 characters If the Manufacturer Info Target field or Manufacturer Info Ref field in the <i>Get_Manufacturer_Info</i> Message is unrecognized return zero bytes.</td></tr></table>	Offset	Field	Description	0	VID	Vendor ID (assigned by the USB-IF)	2	PID	Product ID (assigned by the manufacturer)	4	Manufacturer String	Vendor defined null terminated string of 0...21 characters If the Manufacturer Info Target field or Manufacturer Info Ref field in the <i>Get_Manufacturer_Info</i> Message is unrecognized return zero bytes.
Offset	Field	Description											
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Claim	Identification																														
	6.5.7.1Vendor ID (VID) This field shall contain the device's or Battery's 16-bit vendor ID assigned by the USB. 6.5.7.2Product ID (PID) This field shall contain the device's or Battery's 16-bit product identifier designated by the vendor. 6.5.7.3Manufacturer String This field shall contain the device's or Battery's manufacturer string as defined by the vendor. If the Manufacturer Info Target field or Manufacturer Info Ref field in the Get_Manufacturer_Info Message is unrecognized the field shall return a null terminated ascii text string "Not Supported". See, e.g., USB 3.0 Promoter Group, <i>USB Power Delivery Specification</i> (Rev. 3.0, Ver. 1.2, June 21, 2018) available at https://web.archive.org/web/20190212011507/https://www.usb.org/document-library/usb-power-delivery; see also, e.g., <i>USB Power Delivery – Base Specification</i>, USB-IF (Oct. 31, 2023), https://www.usb.org/document-library/usb-power-delivery; usb.org, <i>USB Power Delivery Specification 1.0 – USB.org</i>, Yumpu (Nov. 24, 2012), https://www.yumpu.com/en/document/view/4321520/usb-power-delivery-specification-10-usborg. USB Power Delivery 1.0, 2.0, 3.0 and 3.1 Standards - Confused yet? There is no need to be. There are four iterations of the USB PD standard. USB PD 1.0 is a rather basic version providing fixed power profiles, whereas the newer PD 2.0, 3.0 and 3.1 revisions are more dynamic and provide greater flexibility. USB Power Delivery 1.0 <table><thead><tr><th>Profile</th><th>Voltage</th><th>Current</th><th>Power</th><th>Supported devices</th></tr></thead><tbody><tr><td>1</td><td>5 V</td><td>2 A</td><td>10 W</td><td>smartphones, hard drives, small accessories</td></tr><tr><td>2</td><td>12 V</td><td>1.5 A</td><td>18 W</td><td>smartphones, tablets, Ultrabooks™, larger accessories</td></tr><tr><td>3</td><td>12 V</td><td>3 A</td><td>36 W</td><td>future smartphones, notebooks, displays, hubs</td></tr><tr><td>4</td><td>20 V</td><td>3 A</td><td>60 W</td><td>larger notebooks, hubs, docking stations</td></tr><tr><td>5</td><td>20 V</td><td>5 A</td><td>100 W</td><td>workstations, hubs, external graphic cards</td></tr></tbody></table>	Profile	Voltage	Current	Power	Supported devices	1	5 V	2 A	10 W	smartphones, hard drives, small accessories	2	12 V	1.5 A	18 W	smartphones, tablets, Ultrabooks™, larger accessories	3	12 V	3 A	36 W	future smartphones, notebooks, displays, hubs	4	20 V	3 A	60 W	larger notebooks, hubs, docking stations	5	20 V	5 A	100 W	workstations, hubs, external graphic cards
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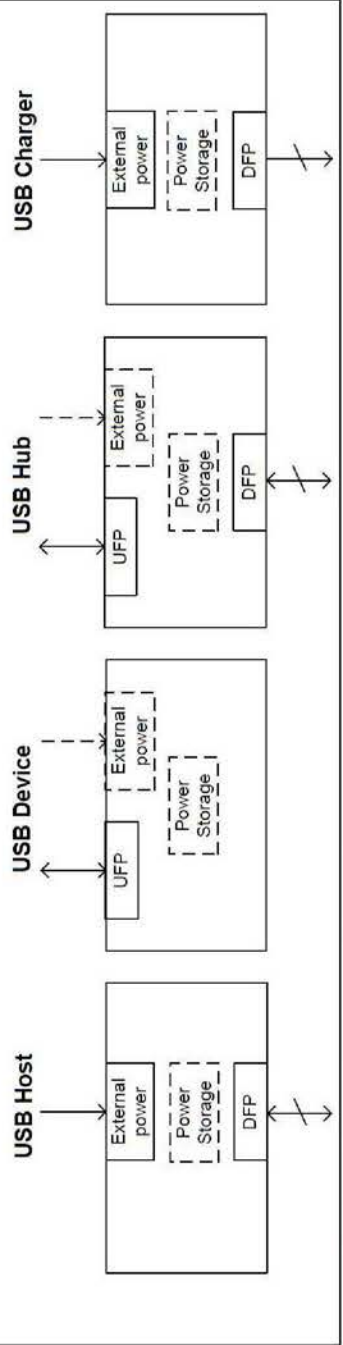
Claim

Identification

USB Power Delivery 2.0/3.0				
Profile	Voltage	Current	Power	Supported devices
1	5 V	0.1 - 3.0 [A]	10 W	headphones, small accessories
2	9 V	1.67 - 3.0 [A]	15 - 27 W	smartphones, cameras and drones
3	15 V	1.8 - 3.0 [A]	27 - 45 W	tablets, and small laptops
4	20 V	2.25 - 3.0 [A] 3.0 - 5.0 [A]	45 - 100 W	large laptops and displays
* Requires specially rated 100 W USB-C charging cable				
USB Power Delivery 3.1				
The USB PD 3.1 specification divides power into two ranges: Standard Power (SPR), which is the current USB PD3.0 standard with a maximum charging power of 100 W and Extended Power (EPR) with three newly added voltages of 28 V, 36 V, and 48 V. The maximum output current to the three voltages is still 5 A, while the maximum output power can reach 240 W.				
Profile	Voltage	Current	Power	Supported devices
5	28 V	3.57 - 5.0 [A]	140 W	displays, gaming laptops
6	36 V	3.89 - 5.0 [A]	180 W	displays, gaming laptops
7	48 V	3.75 - 5.0 [A]	240 W	displays, gaming laptops, desktop PCs
* Requires specially rated 240 W USB-C charging cable				

See, e.g., USB-C Power Delivery, Manhattan Products, <https://manhattanproducts.eu/pages/usb-c-pd-charging-everything-you-need-to-know>.

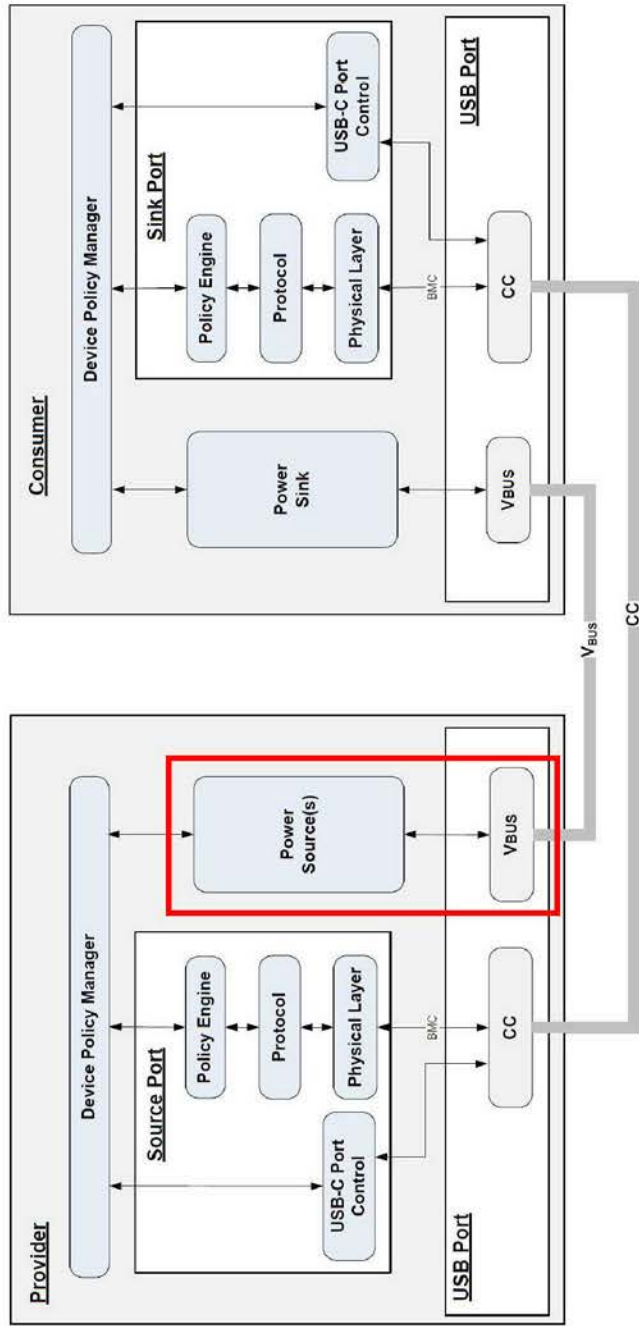
Claim	Identification
1[a] a charging circuit, and	Nintendo-branded devices include or are accompanied by a charger including a charging circuit. 1.1 Overview This specification defines how USB Devices can negotiate for more current and/or higher or lower voltages over the USB cable (using the USB Type-C CC wire as the communications channel) than are defined in the [USB 2.0], [USB 3.2], [USB Type-C 1.3] or [USBBC 1.2] specifications. It allows Devices with greater power requirements than can be met with today's specification to get the power they require to operate from V_{BUS} and negotiate with external power sources (e.g. Wall Warts). In addition, it allows a Source and Sink to swap power roles such that a Device could supply power to the Host. For example, a display could supply power to a notebook to charge its battery. To facilitate optimum charging, the specification defines two mechanisms a USB Charger can advertise for the Device to use: 1. A list of fixed voltages each with a maximum current. The Device selects a voltage and current from the list. This is the traditional model used by Devices that use internal electronics to manage the charging of their battery including modifying the voltage and current actually supplied to the battery. The side-effect of this model is that the charging circuitry generates heat that may be problematic for small form factor devices. 2. A list of programmable voltage ranges each with a maximum current (PPS). The Device requests a voltage (in 20 mV increments) that is within the advertised range and a maximum current. The USB Charger delivers the requested voltage until the maximum current is reached at which time the USB charger reduces its output voltage so as not to supply more than the requested maximum current. During the high current portion of the charge cycle, the USB Charger can be directly connected (through an appropriate safety device) to the battery. This model is used by Devices that want to minimize the thermal impact of their internal charging circuitry. 1.2 Purpose The USB Power Delivery specification defines a power delivery system covering all elements of a USB system including Hosts, Devices, Hubs, Chargers and cable assemblies. This specification describes the architecture, protocols, power supply behavior, connectors and cabling necessary for managing power delivery over USB at up to 100W. This specification is intended to be fully compatible and extend the existing USB infrastructure. It is intended that this specification will allow system OEMs, power supply and peripheral developers adequate flexibility for product versatility and market differentiation without losing backwards compatibility. USB Power Delivery is designed to operate independently of the existing USB bus defined mechanisms used to negotiate power which are: • [USB 2.0], [USB 3.2] in band requests for high power interfaces. • [USBBC 1.2] mechanisms for supplying higher power (not mandated by this specification). • [USB Type-C 1.3] mechanisms for supplying higher power

Claim	Identification
	2.4 USB Power Delivery Capable Devices Some examples of USB Power Delivery capable devices can be seen in Figure 2-1 (a Host, a Device, a Hub, and a Charger). These are given for reference only and do not limit the possible configurations of products that can be built using this specification. Figure 2-1 Logical Structure of USB Power Delivery Capable Devices  2.7 Architectural Overview Figure 2-5 shows the logical blocks between two Attached PD ports. In addition to the communication stack described above there are also: • For a Provider or Dual-Role Power Device: one or more Sources providing power to one or more ports. • For a Consumer or Dual-Role Power Device: A Sink consuming power. • A USB-C Port Control module (see Section 4.4) that detects cable Attach/Detach as defined in [USB Type-C 1.3]. • USB Power Delivery uses standard cabling as defined in [USB Type-C 1.3]. The Device Policy Manager talks to the communication stack, Source/Sink and the USB-C Port Control block in order to manage the resources in the Provider or Consumer.

Claim

Identification

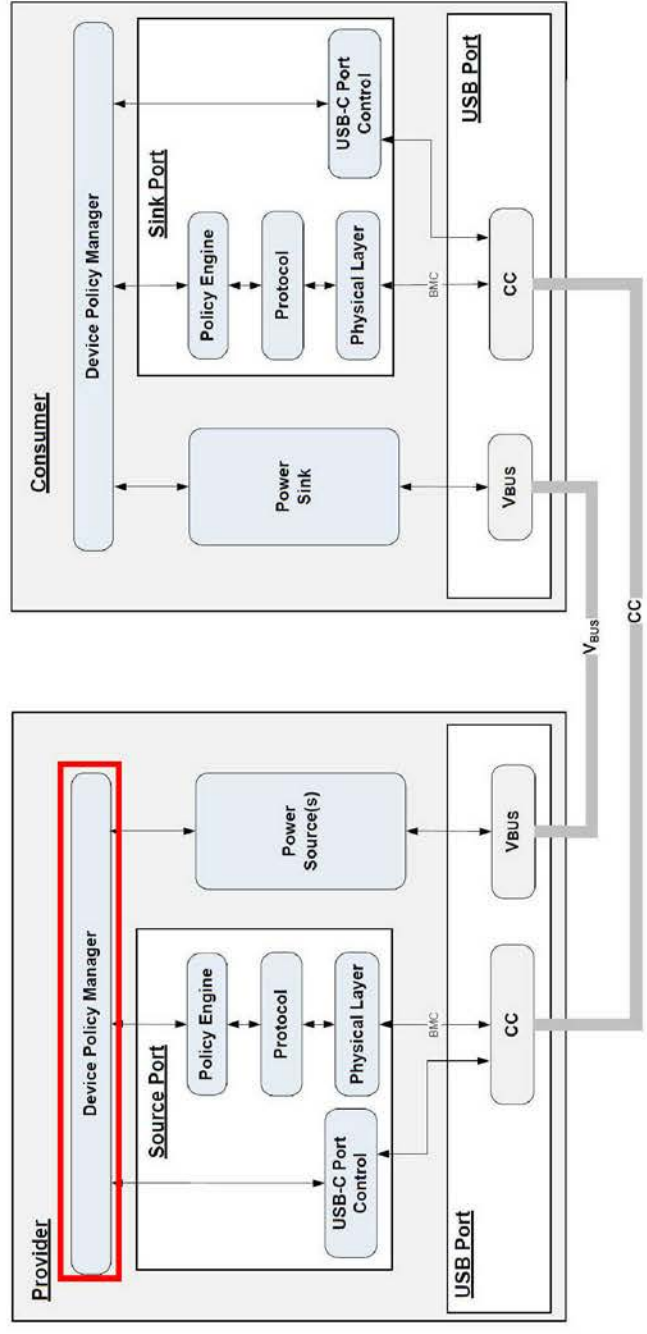
Figure 2-5 High Level Architecture View



See, e.g., USB 3.0 Promoter Group, USB Power Delivery Specification (Rev. 3.0, Ver. 1.2, June 21, 2018) available at <https://web.archive.org/web/20190212011507/https://www.usb.org/document-library/usb-power-delivery>; see also, e.g., USB Power Delivery – Base Specification, USB-IF (Oct. 31, 2023), <https://www.usb.org/document-library/usb-power-delivery>; usb.org, *USB Power Delivery Specification 1.0 – USB.org*, Yumpu (Nov. 24, 2012), <https://www.yumpu.com/en/document/view/4321520/usb-power-delivery-specification-10-usborg>.

Claim	Identification
1[b] a controller coupled to said charging circuit and configured to cause said portable wireless communications device to identify its corresponding rechargeable battery type, and	Identification Nintendo-branded devices include or are accompanied by a charger including a controller coupled to said charging circuit and configured to cause said portable wireless communications device to identify its corresponding portable device type and its corresponding rechargeable battery type. 2.7 Architectural Overview Figure 2-5 shows the logical blocks between two Attached PD ports. In addition to the communication stack described above there are also: • For a Provider or Dual-Role Power Device: one or more Sources providing power to one or more ports. • For a Consumer or Dual-Role Power Device: A Sink consuming power. • A USB-C Port Control module (see Section 4.4) that detects cable Attach/Detach as defined in [USB Type-C 1.3]. • USB Power Delivery uses standard cabling as defined in [USB Type-C 1.3]. The Device Policy Manager talks to the communication stack, Source/Sink and the USB-C Port Control block in order to manage the resources in the Provider or Consumer.

Figure 2-5 High Level Architecture View



Claim	Identification
8.2 Device Policy Manager The Device Policy Manager is responsible for managing the power used by one or more USB Power Delivery ports. In order to have sufficient knowledge to complete this task it needs relevant information about the device it resides in. Firstly, it has a priori knowledge of the device including the capabilities of the power supply and the receptacles on each Port since these will for example have specific current ratings. It also has to know information from the USB-C Port Control module regarding cable insertion, type and rating of cable etc. It also has to have information from the power supply about changes in its capabilities as well as being able to request power supply changes. With all of this information the Device Policy Manager is able to provide up to date information regarding the capabilities available to a specific Port and to manage the power resources within the device. When working out the capabilities for a given Source Port the Device Policy Manager will take into account firstly the current rating of the Port's receptacle and whether the inserted cable is PD or non-PD rated and if so what is the capability of the plug. This will set an upper bound for the capabilities which might be offered. After this the Device Policy Manager will consider the available power supply resources since this will bound which voltages and currents might be offered. Finally, the Device Policy Manager will consider what power is currently allocated to other ports, which power is in the Power Reserve and any other amendments to Policy from the System Policy Manager. The Device Policy Manager will offer a set of capabilities within the bounds detailed above. When selecting a capability for a given Sink Port the Device Policy Manager will look at the capabilities offered by the Source. This will set an upper bound for the capabilities which might be requested. The Device Policy Manager will also consider which capabilities are required by the Sink in order to operate. If an appropriate match for Voltage and Current can be found within the limits of the receptacle and cable then this will be requested from the Source. If an appropriate match cannot be found then a request for an offered voltage and current will be made, along with an indication of a capability mismatch. 8.2.1 Capabilities The Device Policy Manager in a Provider Shall know the power supplies available in the device and their capabilities. In addition, it Shall be aware of any other PD Sources of power such as batteries and AC inputs. The available power sources and existing demands on the device Shall be taken into account when presenting capabilities to a Sink. The Device Policy Manager in a Consumer Shall know the requirements of the Sink and use this to evaluate the capabilities offered by a Source. It Shall be aware of its own power sources e.g. Batteries or AC supplies where these have a bearing on its operation as a Sink. The Device Policy Manager in a Dual-Role Power Device Shall combine the above capabilities and Shall also be able to present the dual-role nature of the device to an Attached PD Capable device.	

Claim	Identification
	8.2.3 Control of Source/Sink The Device Policy Manager for a Provider shall manage the power supply for each PD Source Port and shall know at any given time what the negotiated power is. It shall request transitions of the supply and inform the Policy Engine whenever a transition completes. The Device Policy Manager for a Consumer shall manage the Sink for each PD Sink Port and shall know at any given time what the negotiated power is. The Device Policy Manager for a Dual-Role Power Device shall manage the transition between Source/Sink roles for each PD Dual-Role Power Port and shall know at any given time what operational role the Port is in. 8.3.2.2 Power Negotiation 8.3.2.2.1 Explicit Contract Negotiation Figure 8-5 illustrates an example of a successful Message flow while negotiating an Explicit Contract. The negotiation goes through 5 distinct phases: • The Source sends out its power capabilities in a Source_Capabilities Message. • The Sink evaluates these capabilities and in the request phase selects one power level by sending a Request Message. • The Source evaluates the request and accepts the request with an Accept Message. • The Source transitions to the new power level and then informs the Sink by sending a PS_RDY Message. • The Sink starts using the new power level. • For PPS operation: ◦ the Source starts its keep alive timer ◦ the Sink starts its request timer to send periodic Request Messages 6.4.2 Request Message A Request Message shall be sent by a Sink to request power, typically during the request phase of a power negotiation. The Request Data Object shall be returned by the Sink making a request for power. It shall be sent in response to the most recent Source_Capabilities Message (see Section 8.3.2.2). A Request Message shall return one and only one Sink Request Data Object that shall identify the Power Data Object being requested. The Request Message includes the requested power level. For example, if the Source_Capabilities Message includes a Fixed Supply PDO that offers 12V @ 1.5A and if the Sink only wants 12V @ 0.5A, it will set the Operating Current field to 50 (i.e. $10\text{mA} * 50 = 0.5\text{A}$). The Request Message requests the highest current the Sink will ever require in the Maximum Operating Current Field (in this example it would be 100 ($100 * 10\text{mA} = 1.0\text{A}$)).

Malikie Innovations Ltd. et al. v. Nintendo Co. Ltd. et al.
Exhibit I – U.S. Patent No. 8,610,397

Claim	Identification
	6.4.2.3 Capability Mismatch A Capability Mismatch occurs when the Sink cannot satisfy its power requirements from the capabilities offered by the Source. In this case the Sink shall make a Valid request from the offered capabilities and shall set the Capability Mismatch bit (see Section 8.2.5.2). When a Sink returns a Request Data Object in response to advertised capabilities with this bit set, it indicates that the Sink wants power that the Source cannot provide. This can be due to either a voltage that is not available or the amount of available current. At this point the Source can use the information in the Request Message combined with the contents of the Sink_Capabilities Message to ascertain the Voltage and Current required by the Sink for full operation. In this context a Valid Request Message means the following: • The Object position field shall contain a reference to an object in the last received Source_Capabilities Message. • The Operating Current/Power field shall contain a value which is less than or equal to the maximum current/power offered in the Source_Capabilities Message. • If the GiveBack flag is set to zero i.e. there is a Maximum Operating Current/Power field: ○ If the Capability Mismatch bit is set to one: ▪ The Maximum Operating Current/Power field may contain a value larger than the maximum current/power offered in the Source_Capabilities Message's PDO as referenced by the Object position field. This enables the Sink to indicate that it requires more current/power than is being offered. If the Sink requires a different voltage this will be indicated by its Sink_Capabilities Message. ○ Else if the Capability Mismatch bit is set to zero: ▪ The Maximum Operating Current/Power field shall contain a value less than or equal to the maximum current/power offered in the Source_Capabilities Message's PDO as referenced by the Object position field. • Else if the GiveBack flag is set to one i.e. there is a Minimum Operating Current/Power field: ○ The Minimum Operating Current/Power field shall contain a value less than the Operating Current/Power field.

Claim	Identification
	6.4.1.3 Sink Capabilities Message A Sink Port Shall report power levels it is able to operate at in a series of 32-bit Power Data Objects (see Table 6-7). These are returned as part of a Sink_Capabilities Message in response to a Get_Sink_Cap Message (see Figure 6-12). This is similar to that used for Source Port capabilities with equivalent Power Data Objects for Fixed, Variable and Battery Supplies as defined in this section. Power Data Objects are used to convey the Sink Port's operational power requirements including Dual-Role Power Ports presently operating as a Source. Each Power Data Object Shall describe a specific Sink operational power level, such as a Battery (e.g. 2.8-4.1V) or a fixed power supply (e.g. 12V). The Number of Data Objects field in the Message Header Shall define the number of Power Data Objects that follow the Message Header in a Data Message. All Sinks Shall minimally offer one Power Data Object with a power level at which the Sink can operate. A Sink Shall Not offer multiple Power Data Objects of the same type (fixed, variable, Battery) and the same voltage but Shall instead offer one Power Data Object with the highest available current for that Sink capability and voltage. All Sinks Shall include one Power Data Object that reports vSafe5V even if they require additional power to operate fully. In the case where additional power is required for full operation the Higher Capability bit Shall be set. 6.4.1.3.1 Sink Fixed Supply Power Data Object Table 6-14 describes the Sink Fixed Supply (00b) PDO. See Section 7.1.3 for the electrical requirements of the power supply. The Sink Shall set Voltage to its required voltage and Operational Current to its required operating current. Required operating current is defined as the amount of current a given device needs to be functional. This value could be the maximum current the Sink will ever require or could be sufficient to operate the Sink in one of its modes of operation. Since all USB Consumers support vSafe5V, the required vSafe5V Fixed Supply Power Data Object is also used to convey additional information that is returned in bits 29 through 20. All other Fixed Supply Power Data Objects Shall set bits 29...20 to zero. For a Sink requiring no power from the Source, the Voltage (B19...10) Shall be set to 5V and the Operational Current Shall be set to 0mA.

Claim	Identification																																		
	Table 6-14 Fixed Supply PDO - Sink <table border="1"> <thead> <tr> <th>Bit(s)</th><th>Description</th></tr> </thead> <tbody> <tr> <td>B31...30</td><td>Fixed supply</td></tr> <tr> <td>B29</td><td>Dual-Role Power</td></tr> <tr> <td>B28</td><td>Higher Capability</td></tr> <tr> <td>B27</td><td>Unconstrained Power</td></tr> <tr> <td>B26</td><td>USB Communications Capable</td></tr> <tr> <td>B25</td><td>Dual-Role Data</td></tr> <tr> <td>B24...23</td><td>Fast Role Swap required USB Type-C Current (see also [USB Type-C 1.3]):</td></tr> <tr> <td></td><td> <table border="1"> <thead> <tr> <th>Value</th><th>Description</th></tr> </thead> <tbody> <tr> <td>00b</td><td>Fast Swap not supported (default)</td></tr> <tr> <td>01b</td><td>Default USB Power</td></tr> <tr> <td>10b</td><td>1.5A @ 5V</td></tr> <tr> <td>11b</td><td>3.0A @ 5V</td></tr> </tbody> </table> </td></tr> <tr> <td>B22...20</td><td>Reserved – Shall be set to zero.</td></tr> <tr> <td>B19...10</td><td>Voltage in 50mV units</td></tr> <tr> <td>B9...0</td><td>Operational Current in 10mA units</td></tr> </tbody> </table> 8.2.4 Cable Detection 8.2.4.1 Device Policy Manager in a Provider The Device Policy Manager in the Provider Shall control the USB-C Port Control module and Shall be able to use the USB-C Port Control module to determine the Attachment status. Note: that it might be necessary for the Device Policy Manager to also initiate additional discovery using the Discover Identity Command in order to determine the full capabilities of the cabling (see Section 6.4.4.2).	Bit(s)	Description	B31...30	Fixed supply	B29	Dual-Role Power	B28	Higher Capability	B27	Unconstrained Power	B26	USB Communications Capable	B25	Dual-Role Data	B24...23	Fast Role Swap required USB Type-C Current (see also [USB Type-C 1.3]):		<table border="1"> <thead> <tr> <th>Value</th><th>Description</th></tr> </thead> <tbody> <tr> <td>00b</td><td>Fast Swap not supported (default)</td></tr> <tr> <td>01b</td><td>Default USB Power</td></tr> <tr> <td>10b</td><td>1.5A @ 5V</td></tr> <tr> <td>11b</td><td>3.0A @ 5V</td></tr> </tbody> </table>	Value	Description	00b	Fast Swap not supported (default)	01b	Default USB Power	10b	1.5A @ 5V	11b	3.0A @ 5V	B22...20	Reserved – Shall be set to zero.	B19...10	Voltage in 50mV units	B9...0	Operational Current in 10mA units
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B9...0	Operational Current in 10mA units																																		

Claim	Identification						
	6.4.4.3.1 Discover Identity The <i>Discover Identity</i> Command is provided to enable an Initiator to identify its Port Partner and for an Initiator (VCONN Source) to identify the Responder (Cable Plug). The <i>Discover Identity</i> Command is also used to determine whether a Cable Plug is PD-Capable by looking for a <i>GoodCRC</i> Message Response. The <i>Discover Identity</i> Command <i>shall</i> be used to determine whether a given Cable Plug is PD Capable (see Section 8.3.3.18.1 and Section 8.3.3.22.3). In this case a <i>Discover Identity</i> Command request sent to SOP' <i>shall Not</i> cause a Soft Reset if a <i>GoodCRC</i> Message response is not returned since this can indicate a non-PD Capable cable. Note that a Cable Plug will not be ready for PD Communication until tVCONNStable after VCONN has been applied (see <i>USB Type-C 1.3</i>). During Cable Plug discovery, when there is an Explicit Contract, <i>Discover Identity</i> Commands are sent at a rate defined by the <i>DiscoverIdentityTimer</i> (see Section 6.6.14) up to a maximum of <i>nDiscoverIdentityCount</i> times (see Section 6.7.5). The <i>Discover Identity</i> Command ACK sent back by the Responder <i>shall</i> contain an ID Header VDO, a Cert Stat VDO, a Product VDO and the <i>Product Type VDOs</i> defined by the <i>Product Type</i> as shown in Figure 6-15. This specification defines the following <i>Product Type VDOs</i>: • Passive Cable VDO (see Section 6.4.4.3.1.4) • Active Cable VDOs (see Section 6.4.4.3.1.5) • Alternate Mode Adapter VDO (see Section 6.4.4.3.1.6) • VCONN Powered USB Device VDO (see Section 6.4.4.3.1.7) No VDOs other than those defined in this specification <i>shall</i> be sent as part of the <i>Discover Identity</i> Command response. Where there is no <i>Product Type VDO</i> defined for a specific <i>Product Type</i>, no VDOs <i>shall</i> be sent as part of the <i>Discover Identity</i> Command response. Any additional VDOs received by the initiator <i>shall</i> be <i>Ignored</i>. Figure 6-15 Discover Identity Command response <table><tr><th>Header No. of Data Objects = 4-7¹</th><th>VDM Header</th><th>ID Header VDO</th><th>Cert Stat VDO</th><th>Product VDO</th><th>0...3² Product Type VDO(s)</th></tr></table> ¹ Only Data objects defined in this specification can be sent as part of the <i>Discover Identity</i> Command. ² The following sections define the number and content of the VDOs for each <i>Product Type</i>.	Header No. of Data Objects = 4-7 ¹	VDM Header	ID Header VDO	Cert Stat VDO	Product VDO	0...3 ² Product Type VDO(s)
Header No. of Data Objects = 4-7 ¹	VDM Header	ID Header VDO	Cert Stat VDO	Product VDO	0...3 ² Product Type VDO(s)		

Claim	Identification																																												
	6.4.4.3.1.1.3Product Type (UFP) The Product Type (UFP) field indicates the type of Product when in UFP Data Role, whether a VDO will be returned and if so the type of VDO to be returned. The Product Type indicated in the Product Type (UFP) field shall be the closest categorization of the main functionality of the Product in UFP Data Role or “Undefined” when there is no suitable category for the product. For DRD Products this field shall always indicate the Product Type when in UFP role regardless of the present Data Role. Table 6-30 defines the Product Type VDOs which shall be returned. Table 6-30 Product Types (UFP) <table><tr><th>Product Type</th><th>Description</th><th>Product Type VDO</th><th>Reference</th></tr><tr><td>Undefined</td><td>shall be used where no other Product Type value is appropriate.</td><td>None</td><td></td></tr><tr><td>PDUSB Hub</td><td>shall be used when the Product is a PDUSB Hub.</td><td>None</td><td></td></tr><tr><td>PDUSB Peripheral</td><td>shall be used when the Product is a PDUSB Device other than a PDUSB Hub.</td><td>None</td><td></td></tr><tr><td>PSD</td><td>shall be used when the Product is a PSD, e.g. power bank.</td><td>None</td><td></td></tr><tr><td>Alternate Mode Adapter</td><td>shall be used when the Product is a PDUSB Device that supports one or more Alternate Modes.</td><td>AMA VDO</td><td>Section 6.4.4.3.1.6</td></tr><tr><td>VCONN Powered USB Device</td><td>shall be used when the Product is a PDUSB VCONN Powered USB Device.</td><td>VPD VDO</td><td>Section 6.4.4.3.1.7</td></tr></table> 6.4.4.3.1.1.4Product Type (Cable Plug) The Product Type (Cable Plug) field indicates the type of Product when the Product is a Cable Plug, whether a VDO will be returned and if so the type of VDO to be returned. Table 6-31 defines the Product Type VDOs which shall be returned. Table 6-31 Product Types (Cable Plug) <table><tr><th>Product Type</th><th>Description</th><th>Product Type VDO</th><th>Reference</th></tr><tr><td>Undefined</td><td>shall be used where no other Product Type value is appropriate.</td><td>None</td><td></td></tr><tr><td>Active Cable</td><td>shall be used when the Product is a cable that incorporates signal conditioning circuits.</td><td>Active Cable VDO</td><td>Section 6.4.4.3.1.5</td></tr><tr><td>Passive Cable</td><td>shall be used when the Product is a cable that does not incorporate signal conditioning circuits.</td><td>Passive Cable VDO</td><td>Section 6.4.4.3.1.4</td></tr></table>	Product Type	Description	Product Type VDO	Reference	Undefined	shall be used where no other Product Type value is appropriate.	None		PDUSB Hub	shall be used when the Product is a PDUSB Hub.	None		PDUSB Peripheral	shall be used when the Product is a PDUSB Device other than a PDUSB Hub.	None		PSD	shall be used when the Product is a PSD, e.g. power bank.	None		Alternate Mode Adapter	shall be used when the Product is a PDUSB Device that supports one or more Alternate Modes.	AMA VDO	Section 6.4.4.3.1.6	VCONN Powered USB Device	shall be used when the Product is a PDUSB VCONN Powered USB Device.	VPD VDO	Section 6.4.4.3.1.7	Product Type	Description	Product Type VDO	Reference	Undefined	shall be used where no other Product Type value is appropriate.	None		Active Cable	shall be used when the Product is a cable that incorporates signal conditioning circuits.	Active Cable VDO	Section 6.4.4.3.1.5	Passive Cable	shall be used when the Product is a cable that does not incorporate signal conditioning circuits.	Passive Cable VDO	Section 6.4.4.3.1.4
Product Type	Description	Product Type VDO	Reference																																										
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Claim

Identification

6.4.4.3.1.3

Product VDO

The Product VDO contains identity information relating to the product. The fields in the Product VDO *shall* be as defined in Table 6-34.

Table 6-34 Product VDO

Bit(s)	Description	Reference
B31...16	16-bit unsigned integer. USB Product ID	[USB 2.0]/[USB 3.2]
B15...0	16-bit unsigned integer. bcdDevice	[USB 2.0]/[USB 3.2]

6.5.5 Battery_Capabilities Message

The *Battery_Capabilities* Message is sent in response to a *Get_Battery_Cap* Message. The *Battery_Capabilities* Message contains one Battery Capability Data Block (BCDB) for one of the Batteries its supports as reported by Battery field in the *Source_Capabilities_Extended* Message. The returned BCDB *shall* correspond to the Battery requested in the *Battery_Cap_Ref* field contained in the *Get_Battery_Cap* Message.

The *Battery_Capabilities* Message returns a 9-byte BCDB whose format *shall* be as shown in Figure 6-35 and Table 6-46.

Figure 6-35 Battery_Capabilities Message

Extended Header

Data Size = 9

BCDB

Table 6-50 Battery Capability Data Block (BCDB)

Offset (Byte)	Field	Description
0	VID	Vendor ID (assigned by the USB-IF)
2	PID	Product ID (assigned by the manufacturer)
4	Battery Design Capacity	Battery's design capacity in 0.1 WH Note: 0x0000 = Battery not present 0xFFFF = design capacity unknown
6	Battery Last Full Charge Capacity	Battery's last full charge capacity in 0.1 WH Note: 0x0000 = Battery not present 0xFFFF = last full charge capacity unknown

Claim	Identification																		
	8 Battery Type <table><thead><tr><th>Bit</th><th>Description</th></tr></thead><tbody><tr><td>0</td><td>Invalid Battery reference</td></tr><tr><td>1-7</td><td><i>Reserved</i></td></tr></tbody></table> 6.5.5.1 Battery Design Capacity Field The Battery Design Capacity field <i>shall</i> return the Battery's design capacity in tenths of WH. If the Battery is Hot Swappable and is not present, the Battery Design Capacity field <i>shall</i> be set to 0. If the Battery is unable to report its Design Capacity, it <i>shall</i> return 0xFFFF. 6.5.5.3 Battery Type Field The Battery Type Field is used to report additional information about the Battery's capabilities. 6.5.7 Manufacturer_Info Message The <i>Manufacturer_Info</i> Message <i>shall</i> be sent in response to a <i>Get_Manufacturer_Info</i> Message. The <i>Manufacturer_Info</i> Message contains the USB VID and the Vendor's PID to identify the device or Battery and the device or Battery's manufacturer byte array in a variable length Data Block of up to <i>MaxExtendedMsgLegacyLen</i>. The <i>Manufacturer_Info</i> Message returns a Manufacturer Info Data Block (MIDB) whose format <i>shall</i> be as shown in Figure 6-35 and Table 6-46. Extended Header Data Size = 4..26 MIDB Figure 6-37 Manufacturer_Info Message Table 6-52 Manufacturer Info Data Block (MIDB) <table><thead><tr><th>Offset</th><th>Field</th><th>Description</th></tr></thead><tbody><tr><td>0</td><td>VID</td><td>Vendor ID (assigned by the USB-IF)</td></tr><tr><td>2</td><td>PID</td><td>Product ID (assigned by the manufacturer)</td></tr><tr><td>4</td><td>Manufacturer String</td><td>Vendor defined null terminated string of 0...21 characters If the Manufacturer Info Target field or Manufacturer Info Ref field in the <i>Get_Manufacturer_Info</i> Message is unrecognized return zero bytes.</td></tr></tbody></table>	Bit	Description	0	Invalid Battery reference	1-7	<i>Reserved</i>	Offset	Field	Description	0	VID	Vendor ID (assigned by the USB-IF)	2	PID	Product ID (assigned by the manufacturer)	4	Manufacturer String	Vendor defined null terminated string of 0...21 characters If the Manufacturer Info Target field or Manufacturer Info Ref field in the <i>Get_Manufacturer_Info</i> Message is unrecognized return zero bytes.
Bit	Description																		
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Claim	Identification
	6.5.7.1 Vendor ID (VID) This field shall contain the device's or Battery's 16-bit vendor ID assigned by the USB. 6.5.7.2 Product ID (PID) This field shall contain the device's or Battery's 16-bit product identifier designated by the vendor. 6.5.7.3 Manufacturer String This field shall contain the device's or Battery's manufacturer string as defined by the vendor. If the Manufacturer Info Target field or Manufacturer Info Ref field in the Get_Manufacturer_Info Message is unrecognized the field shall return a null terminated ascii text string "Not Supported". See, e.g., USB 3.0 Promoter Group, <i>USB Power Delivery Specification</i> (Rev. 3.0, Ver. 1.2, June 21, 2018) available at https://web.archive.org/web/20190212011507/https://www.usb.org/document-library/usb-power-delivery; see also, e.g., <i>USB Power Delivery – Base Specification</i>, USB-IF (Oct. 31, 2023), https://www.usb.org/document-library/usb-power-delivery; usb.org, <i>USB Power Delivery Specification 1.0 – USB.org</i>, Yumpu (Nov. 24, 2012), https://www.yumpu.com/en/document/view/4321520/usb-power-delivery-specification-10-usborg.
1[c] to cause said charging circuit to charge the rechargeable battery based on the respective charging rate thereof.	Nintendo-branded devices include or are accompanied by a charger including a controller coupled to said charging circuit and configured to cause said charging circuit to charge the rechargeable battery based on the respective charging rate thereof. 8.3.2.2 Power Negotiation 8.3.2.2.1 Explicit Contract Negotiation Figure 8-5 illustrates an example of a successful Message flow while negotiating an Explicit Contract. The negotiation goes through 5 distinct phases: • The Source sends out its power capabilities in a Source_Capabilities Message. • The Sink evaluates these capabilities and in the request phase selects one power level by sending a Request Message. • The Source evaluates the request and accepts the request with an Accept Message. • The Source transitions to the new power level and then informs the Sink by sending a PS_RDY Message. • The Sink starts using the new power level. • For PPS operation: ○ the Source starts its keep alive timer ○ the Sink starts its request timer to send periodic Request Messages

Claim	Identification
	6.4.1.3 Sink Capabilities Message A Sink Port shall report power levels it is able to operate at in a series of 32-bit Power Data Objects (see Table 6-7). These are returned as part of a Sink_Capabilities Message in response to a Get_Sink_Cap Message (see Figure 6-12). This is similar to that used for Source Port capabilities with equivalent Power Data Objects for Fixed, Variable and Battery Supplies as defined in this section. Power Data Objects are used to convey the Sink Port's operational power requirements including Dual-Role Power Ports presently operating as a Source. Each Power Data Object shall describe a specific Sink operational power level, such as a Battery (e.g. 2.8-4.1V) or a fixed power supply (e.g. 12V). The Number of Data Objects field in the Message Header shall define the number of Power Data Objects that follow the Message Header in a Data Message. All Sinks shall minimally offer one Power Data Object with a power level at which the Sink can operate. A Sink shall not offer multiple Power Data Objects of the same type (fixed, variable, Battery) and the same voltage but shall instead offer one Power Data Object with the highest available current for that Sink capability and voltage. All Sinks shall include one Power Data Object that reports vSafe5V even if they require additional power to operate fully. In the case where additional power is required for full operation the Higher Capability bit shall be set. 6.4.1.3.1 Sink Fixed Supply Power Data Object Table 6-14 describes the Sink Fixed Supply (00b) PDO. See Section 7.1.3 for the electrical requirements of the power supply. The Sink shall set Voltage to its required voltage and Operational Current to its required operating current. Required operating current is defined as the amount of current a given device needs to be functional. This value could be the maximum current the Sink will ever require or could be sufficient to operate the Sink in one of its modes of operation. Since all USB Consumers support vSafe5V, the required vSafe5V Fixed Supply Power Data Object is also used to convey additional information that is returned in bits 29 through 20. All other Fixed Supply Power Data Objects shall set bits 29...20 to zero. For a Sink requiring no power from the Source, the Voltage (B19...10) shall be set to 5V and the Operational Current shall be set to 0mA.

Claim	Identification																																		
	Table 6-14 Fixed Supply PDO - Sink <table border="1"> <thead> <tr> <th>Bit(s)</th><th>Description</th></tr> </thead> <tbody> <tr> <td>B31...30</td><td>Fixed supply</td></tr> <tr> <td>B29</td><td>Dual-Role Power</td></tr> <tr> <td>B28</td><td>Higher Capability</td></tr> <tr> <td>B27</td><td>Unconstrained Power</td></tr> <tr> <td>B26</td><td>USB Communications Capable</td></tr> <tr> <td>B25</td><td>Dual-Role Data</td></tr> <tr> <td>B24...23</td><td>Fast Role Swap required USB Type-C Current (see also [USB Type-C 1.3]):</td></tr> <tr> <td></td><td> <table border="1"> <thead> <tr> <th>Value</th><th>Description</th></tr> </thead> <tbody> <tr> <td>00b</td><td>Fast Swap not supported (default)</td></tr> <tr> <td>01b</td><td>Default USB Power</td></tr> <tr> <td>10b</td><td>1.5A @ 5V</td></tr> <tr> <td>11b</td><td>3.0A @ 5V</td></tr> </tbody> </table> </td></tr> <tr> <td>B22...20</td><td>Reserved – <i>Shall</i> be set to zero.</td></tr> <tr> <td>B19...10</td><td>Voltage in 50mV units</td></tr> <tr> <td>B9...0</td><td>Operational Current in 10mA units</td></tr> </tbody> </table> 6.4.2 Request Message A Request Message Shall be sent by a Sink to request power, typically during the request phase of a power negotiation. The Request Data Object Shall be returned by the Sink making a request for power. It Shall be sent in response to the most recent Source_Capabilities Message (see Section 8.3.2.2). A Request Message Shall return one and only one Sink Request Data Object that Shall identify the Power Data Object being requested. The Request Message includes the requested power level. For example, if the Source_Capabilities Message includes a Fixed Supply PDO that offers 12V @ 1.5A and if the Sink only wants 12V @ 0.5A, it will set the Operating Current field to 50 (i.e. 10mA * 50 = 0.5A). The Request Message requests the highest current the Sink will ever require in the Maximum Operating Current Field (in this example it would be 100 (100 * 10mA = 1.0A)).	Bit(s)	Description	B31...30	Fixed supply	B29	Dual-Role Power	B28	Higher Capability	B27	Unconstrained Power	B26	USB Communications Capable	B25	Dual-Role Data	B24...23	Fast Role Swap required USB Type-C Current (see also [USB Type-C 1.3]):		<table border="1"> <thead> <tr> <th>Value</th><th>Description</th></tr> </thead> <tbody> <tr> <td>00b</td><td>Fast Swap not supported (default)</td></tr> <tr> <td>01b</td><td>Default USB Power</td></tr> <tr> <td>10b</td><td>1.5A @ 5V</td></tr> <tr> <td>11b</td><td>3.0A @ 5V</td></tr> </tbody> </table>	Value	Description	00b	Fast Swap not supported (default)	01b	Default USB Power	10b	1.5A @ 5V	11b	3.0A @ 5V	B22...20	Reserved – <i>Shall</i> be set to zero.	B19...10	Voltage in 50mV units	B9...0	Operational Current in 10mA units
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Claim	Identification
	6.4.2.3 Capability Mismatch A Capability Mismatch occurs when the Sink cannot satisfy its power requirements from the capabilities offered by the Source. In this case the Sink shall make a Valid request from the offered capabilities and shall set the Capability Mismatch bit (see Section 8.2.5.2). When a Sink returns a Request Data Object in response to advertised capabilities with this bit set, it indicates that the Sink wants power that the Source cannot provide. This can be due to either a voltage that is not available or the amount of available current. At this point the Source can use the information in the Request Message combined with the contents of the Sink_Capabilities Message to ascertain the Voltage and Current required by the Sink for full operation. In this context a Valid Request Message means the following: • The Object position field shall contain a reference to an object in the last received Source_Capabilities Message. • The Operating Current/Power field shall contain a value which is less than or equal to the maximum current/power offered in the Source_Capabilities Message. • If the GiveBack flag is set to zero i.e. there is a Maximum Operating Current/Power field: ○ If the Capability Mismatch bit is set to one: ▪ The Maximum Operating Current/Power field may contain a value larger than the maximum current/power offered in the Source_Capabilities Message's PDO as referenced by the Object position field. This enables the Sink to indicate that it requires more current/power than is being offered. If the Sink requires a different voltage this will be indicated by its Sink_Capabilities Message. ○ Else if the Capability Mismatch bit is set to zero: ▪ The Maximum Operating Current/Power field shall contain a value less than or equal to the maximum current/power offered in the Source_Capabilities Message's PDO as referenced by the Object position field. • Else if the GiveBack flag is set to one i.e. there is a Minimum Operating Current/Power field: ○ The Minimum Operating Current/Power field shall contain a value less than the Operating Current/Power field.

Claim	Identification																														
	10.2.2 Normative Voltages and Currents The voltages and currents a Source with a PDP Rating of x Watts <i>Shall</i> support are as defined in Table 10-2. Table 10-2 Normative Voltages and Minimum Currents <table><tr><th>PDP Rating (W)</th><th>Current at 5V (A)</th><th>Current at 9V (A)</th><th>Current at 15V (A)</th><th>Current at 20V (A)</th></tr><tr><td>$0.5 \leq x \leq 15$</td><td>$x \div 5$</td><td></td><td></td><td></td></tr><tr><td>$15 < x \leq 27$</td><td>3</td><td>$x \div 9$</td><td></td><td></td></tr><tr><td>$27 < x \leq 45$</td><td>3</td><td>3</td><td>$x \div 15$</td><td></td></tr><tr><td>$45 < x \leq 60$</td><td>3</td><td>3</td><td>3</td><td>$x \div 20$</td></tr><tr><td>$60 < x \leq 100$</td><td>3</td><td>3</td><td>3</td><td>$x \div 20^1$</td></tr></table> ¹ Requires a 5A cable. Figure 10-1 illustrates the minimum current that a Source <i>Shall</i> support at each voltage for a given PDP Rating. Note: Not illustrated are that currents higher than 3A are allowed to be offered up to a limit of 5A given that a 5A cable is detected by the Source and the voltage times current remains within the Source PDP Rating. Figure 10-1 Source Power Rule Illustration	PDP Rating (W)	Current at 5V (A)	Current at 9V (A)	Current at 15V (A)	Current at 20V (A)	$0.5 \leq x \leq 15$	$x \div 5$				$15 < x \leq 27$	3	$x \div 9$			$27 < x \leq 45$	3	3	$x \div 15$		$45 < x \leq 60$	3	3	3	$x \div 20$	$60 < x \leq 100$	3	3	3	$x \div 20^1$
PDP Rating (W)	Current at 5V (A)	Current at 9V (A)	Current at 15V (A)	Current at 20V (A)																											
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$45 < x \leq 60$	3	3	3	$x \div 20$																											
$60 < x \leq 100$	3	3	3	$x \div 20^1$																											

Claim	Identification																																																																																																			
	10.2.3.2 Optional Normative Programmable Power Supply The voltages and currents a Programmable Power Supply with a PDP Rating of x Watts shall support are as defined Table 10-7. When Optional Programmable Power Supply APDOs are offered, the following requirements shall apply: • A Source that advertises Optional Programmable Power Supply APDOs shall advertise the PDOs and APDOs shown in Table 10-7. • A Source shall advertise Optional Programmable Power Supply APDOs with Maximum Voltage and Minimum Voltages for nominal voltage as defined in Table 10-8. • A Source that advertises Programmable Power Supply APDOs other than the ones listed in Table 10-8 shall advertise additional APDO's with a maximum current of RoundDown (x/Max Voltage) to the nearest 50mA. • In no case shall a Source advertise a current that exceeds the attached cable's current rating. Table 10-7 Programmable Power Supply PDOs and APDOs based on the PDP <table><tr><th>PDP Rating (W)</th><th>5V fixed</th><th>9V fixed</th><th>15V fixed</th><th>20V fixed</th><th>5V Prog</th><th>9V Prog</th><th>15V Prog</th><th>20V Prog</th></tr><tr><td>x < 15W</td><td>PDP/5⁴</td><td>-</td><td>-</td><td>-</td><td>PDP/5¹</td><td>-</td><td>-</td><td>-</td></tr><tr><td>15W</td><td>3A</td><td>-</td><td>-</td><td>-</td><td>3A</td><td>-</td><td>-</td><td>-</td></tr><tr><td>15 < x < 27W</td><td>3A³</td><td>PDP/9⁴</td><td>-</td><td>-</td><td>3A²</td><td>PDP/9¹</td><td>-</td><td>-</td></tr><tr><td>27W</td><td>3A³</td><td>3A</td><td>-</td><td>-</td><td>-</td><td>3A</td><td>-</td><td>-</td></tr><tr><td>27 < x < 45W</td><td>3A³</td><td>3A³</td><td>PDP/15⁴</td><td>-</td><td>-</td><td>3A²</td><td>PDP/15¹</td><td>-</td></tr><tr><td>45W</td><td>3A³</td><td>3A³</td><td>3A</td><td>-</td><td>-</td><td>-</td><td>3A</td><td>-</td></tr><tr><td>45 < x < 60W</td><td>3A³</td><td>3A³</td><td>3A³</td><td>PDP/20⁴</td><td>-</td><td>-</td><td>3A²</td><td>PDP/20¹</td></tr><tr><td>60W</td><td>3A³</td><td>3A³</td><td>3A³</td><td>3A³</td><td>-</td><td>-</td><td>-</td><td>3A</td></tr><tr><td>60 < x < 100W</td><td>3A³</td><td>3A³</td><td>3A³</td><td>PDP/20⁴</td><td>-</td><td>-</td><td>-</td><td>PDP/20²</td></tr><tr><td>100W</td><td>3A³</td><td>3A³</td><td>3A³</td><td>5A</td><td>-</td><td>-</td><td>-</td><td>5A</td></tr></table> Notes: 1. The PPS APDOs Maximum Current field shall advertise RoundDown (PDP/Prog Voltage) to the nearest 50mA. 2. The PPS APDOs Maximum Current field shall advertise at least 3A, but may advertise up to RoundDown(PDP/Prog voltage) to the nearest 50mA. 3. The Fixed PDOs Maximum Current field shall advertise at least 3A, but may advertise up to RoundUp (PDP/voltage.) to the nearest 10mA. 4. The Fixed PDOs Maximum Current field shall advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA. See, e.g., USB 3.0 Promoter Group, USB Power Delivery Specification (Rev. 3.0, Ver. 1.2, June 21, 2018) available at https://web.archive.org/web/20190212011507/https://www.usb.org/document-library/usb-power-delivery; see also e.g.,	PDP Rating (W)	5V fixed	9V fixed	15V fixed	20V fixed	5V Prog	9V Prog	15V Prog	20V Prog	x < 15W	PDP/5 ⁴	-	-	-	PDP/5 ¹	-	-	-	15W	3A	-	-	-	3A	-	-	-	15 < x < 27W	3A ³	PDP/9 ⁴	-	-	3A ²	PDP/9 ¹	-	-	27W	3A ³	3A	-	-	-	3A	-	-	27 < x < 45W	3A ³	3A ³	PDP/15 ⁴	-	-	3A ²	PDP/15 ¹	-	45W	3A ³	3A ³	3A	-	-	-	3A	-	45 < x < 60W	3A ³	3A ³	3A ³	PDP/20 ⁴	-	-	3A ²	PDP/20 ¹	60W	3A ³	3A ³	3A ³	3A ³	-	-	-	3A	60 < x < 100W	3A ³	3A ³	3A ³	PDP/20 ⁴	-	-	-	PDP/20 ²	100W	3A ³	3A ³	3A ³	5A	-	-	-	5A
PDP Rating (W)	5V fixed	9V fixed	15V fixed	20V fixed	5V Prog	9V Prog	15V Prog	20V Prog																																																																																												
x < 15W	PDP/5 ⁴	-	-	-	PDP/5 ¹	-	-	-																																																																																												
15W	3A	-	-	-	3A	-	-	-																																																																																												
15 < x < 27W	3A ³	PDP/9 ⁴	-	-	3A ²	PDP/9 ¹	-	-																																																																																												
27W	3A ³	3A	-	-	-	3A	-	-																																																																																												
27 < x < 45W	3A ³	3A ³	PDP/15 ⁴	-	-	3A ²	PDP/15 ¹	-																																																																																												
45W	3A ³	3A ³	3A	-	-	-	3A	-																																																																																												
45 < x < 60W	3A ³	3A ³	3A ³	PDP/20 ⁴	-	-	3A ²	PDP/20 ¹																																																																																												
60W	3A ³	3A ³	3A ³	3A ³	-	-	-	3A																																																																																												
60 < x < 100W	3A ³	3A ³	3A ³	PDP/20 ⁴	-	-	-	PDP/20 ²																																																																																												
100W	3A ³	3A ³	3A ³	5A	-	-	-	5A																																																																																												

See, e.g., USB 3.0 Promoter Group, USB Power Delivery Specification (Rev. 3.0, Ver. 1.2, June 21, 2018) available at <https://web.archive.org/web/20190212011507/https://www.usb.org/document-library/usb-power-delivery>; see also, e.g.,

Claim	Identification																														
	<i>USB Power Delivery – Base Specification, USB-IF (Oct. 31, 2023), https://www.usb.org/document-library/usb-power-delivery; usb.org, <i>USB Power Delivery Specification 1.0 – USB.org</i>, Yumpu (Nov. 24, 2012), https://www.yumpu.com/en/document/view/ 4321520/usb-power-delivery-specification-10-usborg.</i> USB Power Delivery 1.0, 2.0, 3.0 and 3.1 Standards - Confused yet? There is no need to be. There are four iterations of the USB PD standard. USB PD 1.0 is a rather basic version providing fixed power profiles, whereas the newer PD 2.0, 3.0 and 3.1 revisions are more dynamic and provide greater flexibility. USB Power Delivery 1.0 <table><tr><th>Profile</th><th>Voltage</th><th>Current</th><th>Power</th><th>Supported devices</th></tr><tr><td>1</td><td>5 V</td><td>2 A</td><td>10 W</td><td>smartphones, hard drives, small accessories</td></tr><tr><td>2</td><td>12 V</td><td>1.5 A</td><td>18 W</td><td>smartphones, tablets, Ultrabooks™, larger accessories</td></tr><tr><td>3</td><td>12 V</td><td>3 A</td><td>36 W</td><td>future smartphones, notebooks, displays, hubs</td></tr><tr><td>4</td><td>20 V</td><td>3 A</td><td>60 W</td><td>larger notebooks, hubs, docking stations</td></tr><tr><td>5</td><td>20 V</td><td>5 A</td><td> 100 W </td><td>workstations, hubs, external graphic cards</td></tr></table>	Profile	Voltage	Current	Power	Supported devices	1	5 V	2 A	10 W	smartphones, hard drives, small accessories	2	12 V	1.5 A	18 W	smartphones, tablets, Ultrabooks™, larger accessories	3	12 V	3 A	36 W	future smartphones, notebooks, displays, hubs	4	20 V	3 A	60 W	larger notebooks, hubs, docking stations	5	20 V	5 A	100 W	workstations, hubs, external graphic cards
Profile	Voltage	Current	Power	Supported devices																											
1	5 V	2 A	10 W	smartphones, hard drives, small accessories																											
2	12 V	1.5 A	18 W	smartphones, tablets, Ultrabooks™, larger accessories																											
3	12 V	3 A	36 W	future smartphones, notebooks, displays, hubs																											
4	20 V	3 A	60 W	larger notebooks, hubs, docking stations																											
5	20 V	5 A	100 W	workstations, hubs, external graphic cards																											

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Exhibit I – U.S. Patent No. 8,610,397

Claim	Identification																																													
	USB Power Delivery 2.0/3.0 <table><tr><th>Profile</th><th>Voltage</th><th>Current</th><th>Power</th><th>Supported devices</th></tr><tr><td>1</td><td>5 V</td><td>0.1 - 3.0 [A]</td><td>10 W</td><td>headphones, small accessories</td></tr><tr><td>2</td><td>9 V</td><td>1.67 - 3.0 [A]</td><td>15 - 27 W</td><td>smartphones, cameras and drones</td></tr><tr><td>3</td><td>15 V</td><td>1.8 - 3.0 [A]</td><td>27 - 45 W</td><td>tablets, and small laptops</td></tr><tr><td>4</td><td>20 V</td><td>2.25 - 3.0 [A] 3.0 - 5.0 [A]</td><td>45 - 100 W</td><td>large laptops and displays</td></tr></table> * Requires specially rated 100 W USB-C charging cable USB Power Delivery 3.1 The USB PD 3.1 specification divides power into two ranges: Standard Power (SPR), which is the current USB PD3.0 standard with a maximum charging power of 100 W and Extended Power (EPR) with three newly added voltages of 28 V, 36 V, and 48 V. The maximum output current to the three voltages is still 5 A, while the maximum output power can reach 240 W. <table><tr><th>Profile</th><th>Voltage</th><th>Current</th><th>Power</th><th>Supported devices</th></tr><tr><td>5</td><td>28 V</td><td>3.57 - 5.0 [A]</td><td>140 W</td><td>displays, gaming laptops</td></tr><tr><td>6</td><td>36 V</td><td>3.89 - 5.0 [A]</td><td>180 W</td><td>displays, gaming laptops</td></tr><tr><td>7</td><td>48 V</td><td>3.75 - 5.0 [A]</td><td>240 W</td><td>displays, gaming laptops, desktop PCs</td></tr></table> * Requires specially rated 240 W USB-C charging cable	Profile	Voltage	Current	Power	Supported devices	1	5 V	0.1 - 3.0 [A]	10 W	headphones, small accessories	2	9 V	1.67 - 3.0 [A]	15 - 27 W	smartphones, cameras and drones	3	15 V	1.8 - 3.0 [A]	27 - 45 W	tablets, and small laptops	4	20 V	2.25 - 3.0 [A] 3.0 - 5.0 [A]	45 - 100 W	large laptops and displays	Profile	Voltage	Current	Power	Supported devices	5	28 V	3.57 - 5.0 [A]	140 W	displays, gaming laptops	6	36 V	3.89 - 5.0 [A]	180 W	displays, gaming laptops	7	48 V	3.75 - 5.0 [A]	240 W	displays, gaming laptops, desktop PCs
Profile	Voltage	Current	Power	Supported devices																																										
1	5 V	0.1 - 3.0 [A]	10 W	headphones, small accessories																																										
2	9 V	1.67 - 3.0 [A]	15 - 27 W	smartphones, cameras and drones																																										
3	15 V	1.8 - 3.0 [A]	27 - 45 W	tablets, and small laptops																																										
4	20 V	2.25 - 3.0 [A] 3.0 - 5.0 [A]	45 - 100 W	large laptops and displays																																										
Profile	Voltage	Current	Power	Supported devices																																										
5	28 V	3.57 - 5.0 [A]	140 W	displays, gaming laptops																																										
6	36 V	3.89 - 5.0 [A]	180 W	displays, gaming laptops																																										
7	48 V	3.75 - 5.0 [A]	240 W	displays, gaming laptops, desktop PCs																																										
	See, e.g., USB-C Power Delivery, Manhattan Products, https://manhattanproducts.eu/pages/usb-c-pd-charging-everything-you-need-to-know.																																													

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EXHIBIT J

Exhibit J - U.S. Patent No. 8,545,247

Claims	Identification
1[pre] A dock for receiving a portable electronic device, comprising:	To the extent the preamble is limiting, the Nintendo-branded devices include a dock for receiving a portable electronic device. The Nintendo-branded devices area dock:  See?e.g., https://www.nintendo.com/us/store/products/nintendo-switch-dock-105663/

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	The the Nintendo-branded devices receive a portable electronic device:  https://www.ifixit.com/Guide/Nintendo+Switch+Dock+Circuit+Board+Replacement/146408
1[a] a housing comprising an aperture;	The Nintendo-branded devices include a housing comprising an aperture. The Nintendo-branded devices include a housing:



<https://gtrusted.com/nintendo-switch-dock>

The housing comprises an aperture.

	  https://gameusagi.com/2017/02/more-on-the-inside-of-the-nintendo-switch-dock/ (left); Photo taken of Nintendo Switch Dock (right) (Model HAC-002(-01)).
1[b] a support coupled to an inner wall of the housing, a portion of the support being elastically deformable;	The Nintendo-branded devices include a support coupled to an inner wall of the housing, a portion of the support being elastically deformable. The Nintendo-branded devices include a support coupled to an inner wall of the housing.

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<https://gameusagi.com/2017/02/more-on-the-inside-of-the-nintendo-switch-dock/> (left); Photo taken of Nintendo Switch Dock (right) (Model HAC-002(-01)).



Photo taken of Nintendo Switch Dock (Model HAC-002(-01)).

The Nintendo-branded devices include a portion of the support being elastically deformable.



Photo taken of Nintendo Switch Dock (Model HAC-002(-01)).

	 <i>Photo taken of Nintendo Switch Dock (Model HAC-002(-01)).</i>
1[c] a connector received in the support and extending through the aperture for electrically communicating with the portable electronic device, wiring of the connector for	The Nintendo-branded devices include a connector received in the support and extending through the aperture for electrically communicating with the portable electronic device, wiring of the connector for transferring data from the portable electronic device.

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transferring data
from the portable
electronic device;
and

The Nintendo-branded devices include a connector received in the support and extending through the aperture for electrically communicating with the portable electronic device.



<https://gameusagi.com/2017/02/more-on-the-inside-of-the-nintendo-switch-dock/> (left); Photo taken of Nintendo Switch Dock (right) (Model HAC-002(-01)).

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	The Nintendo-branded devices include wiring of the connector for transferring data from the portable electronic device.  <i>Photo taken of Nintendo Switch Dock (Model HAC-002(-01)).</i>
1[d] a collar abutting the connector within the housing to limit translation of the connector, the connector being pivotable relative to the collar;	The Nintendo-branded devices include a collar abutting the connector within the housing to limit translation of the connector, the connector being pivotable relative to the collar. The Nintendo-branded devices include a collar abutting the connector within the housing to limit translation of the connector.



Photo taken of Nintendo Switch Dock (Model HAC-002(-01)).

The Nintendo-branded devices include the connector being pivotable relative to the collar.

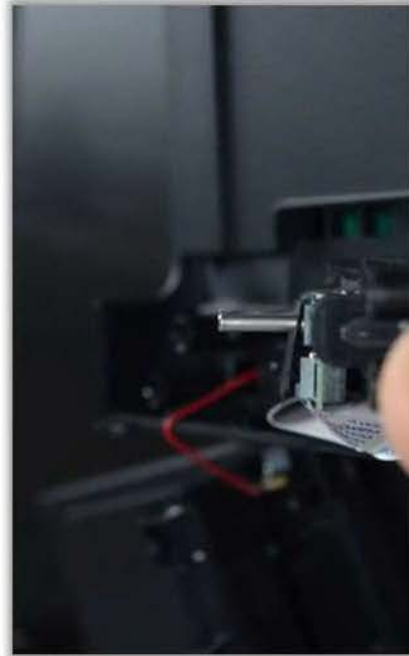
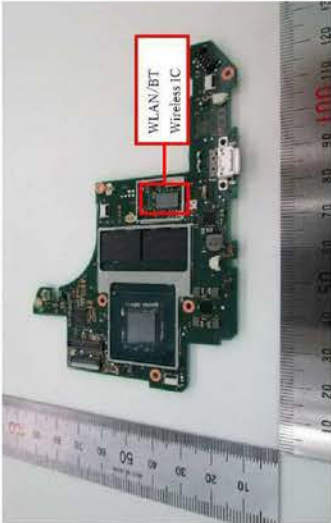


Photo taken of Nintendo Switch Dock (Model HAC-002(-01)).

1[e] wherein the portion of the support elastically deforms in response to non-axial movement of at least a portion of the connector.	In the Nintendo-branded devices, the portion of the support elastically deforms in response to non-axial movement of at least a portion of the connector. <i>Photo taken of Nintendo Switch Dock (Model HAC-002(-01)).</i>
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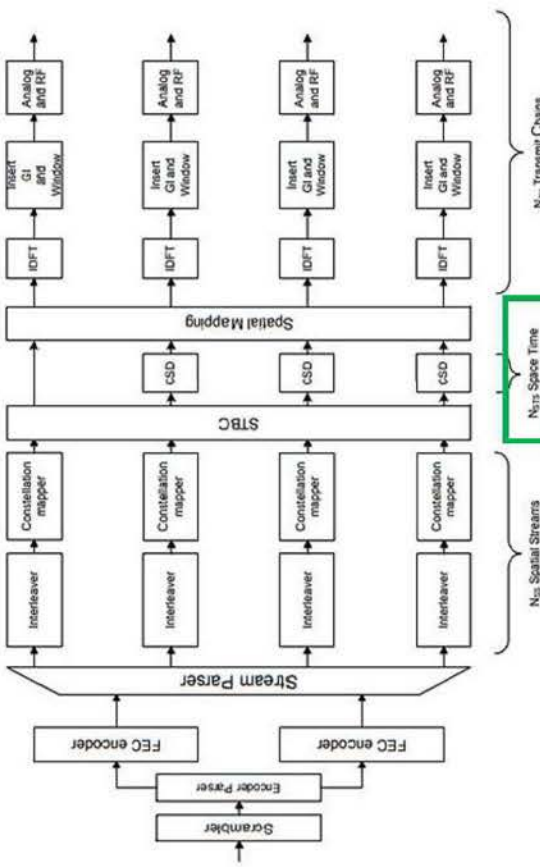
EXHIBIT K

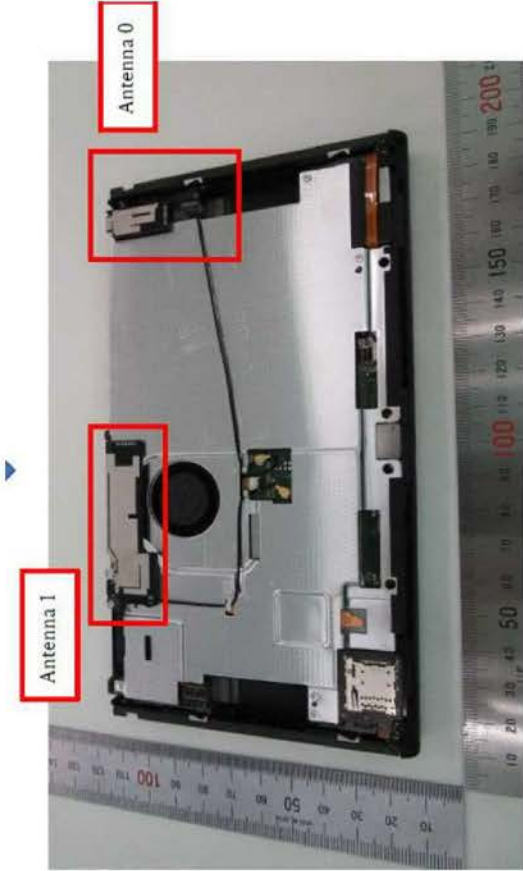
Exhibit K Nintendo – U.S. Patent No. 7,529,305

Claim	Identification
1 [pre] A transmitter adapted to process a plurality M of symbol substreams, the transmitter comprising: the transmitter comprising:	To the extent the preamble is limiting the Nintendo-branded devices include a transmitter adapted to process a plurality M of symbol substreams. The Nintendo Switch Lite/Switch OLED comprises a transmitter implemented by an Infineon/Cypress/Broadcom 4356 wireless IC. 20. High Throughput (HT) PHY specification 20.1.1 Introduction to the HT PHY In addition to the requirements found in Clause 20, an HT STA shall be capable of transmitting and receiving frames that are compliant with the mandatory PHY specifications defined as follows: — In Clause 18 when the HT STA is operating in a 20 MHz channel width in the 5 GHz band — In Clause 17 and Clause 19 when the HT STA is operating in a 20 MHz channel width in the 2.4 GHz band Wireless module PCB (Front, Shield removed): 

<https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=5337261>

Claim	Identification
	<u>How to Connect to a Wireless Network</u> Support Nintendo Switch Description: Information on connecting a Nintendo Switch console to a wireless home network Additional Information: Before continuing, it is recommended that you verify the following information for the wireless network: • The SSID (network's name) • The wireless password, if a password is required Complete These Steps: 1. Place the Nintendo Switch console within 3 metres (10 feet) of the wireless router to ensure a strong wireless signal. 2. On the Nintendo Switch console, select "System Settings" from the HOME Menu 3. Select "Internet", and then "Internet Settings". 4. The Nintendo Switch console will automatically search for nearby Wi-Fi signals. 5. Select the appropriate network name (SSID) from the list. 6. If you are unable to find your network's name, stand closer to the wireless router and press the Y Button to search again. 7. If the network name is greyed out, this indicates the wireless security type being used is not supported by the Nintendo Switch console. 8. If you are still unable to find your network, this may indicate an issue with the wireless network environment. 9. If prompted, use the on-screen keyboard to enter the network's wireless password. https://www.nintendo.com/en-gb/Support/Nintendo-Switch/FAQ/How-to-Connect-to-a-Wireless-Network-1228927.html

Claim	Identification
	IEEE 802.11-2020 19.3.3 Transmitter block diagram HT-mixed format and HT-greenfield format transmissions can be generated using a transmitter consisting of the following blocks: g) STBC encoder spreads constellation points from <i>NSS</i> spatial streams into <i>NSTS</i> space-time streams using a space-time block code. STBC is used only when ; see 19.3.11.9.2. h) Spatial mapper maps space-time streams to transmit chains. 19.3.4 Overview of the PPDU encoding process The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure:  Figure 19-3—Transmitter block diagram 2

Claim	Identification
a space-time coding block adapted to produce M space time coded symbols per input set of M symbols, each input set of M symbols comprising one symbol per symbol substream, each of the M space-time coded symbols being included in a respective one of M space-time coded streams,	The Nintendo-branded devices include a space-time coding block adapted to produce M space time coded symbols per input set of M symbols, each input set of M symbols comprising one symbol per symbol substream, each of the M space-time coded symbols being included in a respective one of M space-time coded streams. The Nintendo Switch Lite/Switch OLED transmits M space-time coded streams using two antennas 

<https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=5337261>

Claim	Identification
	The Nintendo Switch/Switch Lite/Switch OLED transmits M space-time coded streams using two antennas Figure 1. Functional Block Diagram The diagram illustrates the functional blocks of the Nintendo Switch/Switch Lite/Switch OLED. At the center is the CYW4356 chip. It is connected to various external interfaces: WLAN Host I/F (WLAN_REG_ON, PCIE, SDIO), External Coexistence I/F (COEX), and Bluetooth Host I/F (CLK_REQ, BT_REG_ON, UART, USB 2.0, I²S, PCM, BT_DEV_WAKE, BT_HOST_WAKE). The chip also has VIO and VBAT power inputs. On the right side, the chip connects to four T/R Switches and one 3PST Switch. The first three T/R Switches are connected to 5G WLAN and 2G WLAN lines, which then connect to two Diplexers (Ant1 and Ant0) and finally to two antennas. The fourth T/R Switch is connected to 2G WLAN Tx and 2G WL/BT Rx lines. The 3PST Switch is connected to the BT Tx line. https://www.infineon.com/dgdl/Infineon-CYW4356_CG8674_Single-Chip_5G_WiFi_IEEE_802.11ac_2x2_MAC_Baseband_Radio_with_Integrated_Bluetooth_5.0-DataSheet-v03_00-EN.pdf?fileId=8ac78c8c7d0d8da4017d0ee4c6ad6bfa

Malikie Innovations Ltd. vs. Nintendo Co. Ltd. et al.
Exhibit K – U.S. Patent No. 7,529,305

Claim	Identification
	1.3 Standards Compliance The CYW4356/CG8674 supports the following standards: ■ Bluetooth 5.0 with Basic Rate (BR), Enhanced Data Rate (EDR) and Bluetooth Low Energy (BLE) ■ IEEE802.11ac mandatory and optional requirements for 20 MHz, 40 MHz, and 80 MHz channels ■ IEEE 802.11n—Handheld Device Class (Section 11) ■ IEEE 802.11a ■ IEEE 802.11b ■ IEEE 802.11g The Nintendo Switch/Switch Lite/Switch OLED uses the 4356 chip compliant with the 802.11 standards

Claim	Identification
	IEEE 802.11-2020 19.3.4 Overview of the PPDU encoding process The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure: p) Map each of the complex numbers in each of the N_{ST} subcarriers in each of the OFDM symbols in each of the N_{STS} space-time streams to the N_{TX} transmit chain inputs. For direct-mapped operation, $N_{TX} = N_{STS}$, and there is a one-to-one correspondence between space-time streams and transmit chains. In this case, the OFDM symbols associated with each space-time stream are also associated with the corresponding transmit chain. Otherwise, a spatial mapping matrix associated with each OFDM subcarrier, as indicated by the EXPANSION_MAT parameter of the TXVECTOR, is used to perform a linear transformation on the vector of N_{STS} complex numbers associated with each subcarrier in each OFDM symbol. This spatial mapping matrix maps the vector of N_{STS} complex numbers in each subcarrier into a vector of N_{TX} complex numbers in each subcarrier. The sequence of N_{ST} complex numbers associated with each transmit chain (where each of the N_{ST} complex numbers is taken from the same position in the N_{TX} vector of complex numbers across the N_{ST} subcarriers associated with an OFDM symbol) constitutes an OFDM symbol associated with the corresponding transmit chain. For details, see 19.3.11.11. Spatial mapping matrices may include cyclic shifts, as described in 19.3.11.11.2. The Nintendo-branded devices include each symbol of the M symbol substreams is represented in all M space-time coded streams.
wherein each symbol of the M symbol substreams is	

Claim	Identification
represented in all M space-time coded streams,	IEEE 802.11-2020 19.3.11.11.2 Spatial mapping If the data to be transmitted on subcarrier k on space-time stream i_{STS} are $X_k^{(i_{STS})}$, the transmitted data on the transmit chain i_{TX} shall be as shown in Equation 19-57 $r_{Field}^{(i_{TX})} = \frac{1}{\sqrt{N_{STS} \cdot N_{Field}}} w_{Tone}^{i_{Tone}}(t) \sum_{k=-N_{SG}}^{N_{SG}} [Q_k]_{i_{TX}, i_{STS}} X_k^{(i_{STS})} \exp(j2\pi k \Delta_f (t - t_{CS}^{i_{STS}})) \quad (20-57)$ where $[Q_k]_{i_{TX}, i_{STS}}$ is the element in row i_{TX} and column i_{STS} in a matrix Q_k with N_{TX} rows and N_{STS} columns; Q_k may be frequency dependent $Field$ is any field, as defined in 20.3.7, excluding L-STF, L-LTF, L-SIG, and HT-SIG in HT_MF format PPDU Below are examples of spatial mapping matrices that might be used. There exist many other alternatives; implementation is not restricted to the spatial mapping matrices shown. The examples are: <i>Direct mapping:</i> Q_k is a diagonal matrix of unit magnitude complex values that takes one of two forms: $Q_k = \mathbf{I}$, the identity matrix - A CSD matrix in which the diagonal elements represent cyclic shifts in the time domain: $[Q_k]_{i,i} = \exp(-j2\pi k \Delta_f t_{CS}^{i_{STS}})$, where $t_{CS}^{i_{STS}}, i = 1, \dots, N_{TX}$ represents the CSD applied. <i>Indirect mapping:</i> Q_k may be the product of a CSD matrix and a unitary matrix such as the Hadamard matrix or the Fourier matrix. <i>Spatial expansion:</i> Q_k is the product of a CSD matrix and a square matrix formed of orthogonal columns. As an illustration:
wherein the transmitter comprises a delay arrangement, arranged such that for each symbol of the M symbol M streams a time of	The Nintendo-branded devices include the transmitter comprising a delay arrangement, arranged such that for each symbol of the M symbol substreams a time of representation of the symbol in the M space-time coded streams is different for each of the M space-time coded streams.

Claim	Identification
representation of the symbol in the M space-time coded streams is different for each of the M space-time coded streams,	IEEE 802.11-2020 19.3.3 Transmitter block diagram HT-mixed format and HT-greenfield format transmissions can be generated using a transmitter consisting of the following blocks: j) Cyclic shift (CSD) insertion is where the insertion of the cyclic shifts prevents unintentional beamforming. CSD insertion may occur before or after the IDFT. There are three cyclic shift types as follows: 1) A cyclic shift specified per transmitter chain with the values defined in Table 19-9 (a possible implementation is shown in Figure 19-2). 2) A cyclic shift specified per space-time stream with the values defined in Table 19-10 (a possible implementation is shown in Figure 19-3). 3) A cyclic shift that may be applied as a part of the spatial mapper; see 19.3.11.11.2.

Claim	Identification
	IEEE 802.11-2020 19.3.11.11.2 Spatial Mapping If the data to be transmitted on subcarrier k on space-time stream i_{STS} are $X_k^{(i_{STS})}$, the transmitted data on the transmit chain i_{TX} shall be as shown in Equation 19-57 $r_{Field}^{(i_{TX})} = \frac{1}{\sqrt{N_{STS} \cdot N_{Field}}} w_{Tone}^{Tone}(t) \sum_{k=-N_{SR}}^{N_{SR}} [Q_k]_{i_{TX}, i_{STS}} X_k^{(i_{STS})} \exp(j2\pi k \Delta_F(t - T_{CS}^{i_{STS}})) \quad 19-57$ Below are examples of spatial mapping matrices that might be used. There exist many other alternatives; implementation is not restricted to the spatial mapping matrices shown. The examples are: a) <i>Direct mapping</i>: Q_k is a diagonal matrix of unit magnitude complex values that takes one of two forms: 1) $Q_k = I$, the identity matrix 2) A CSD matrix in which the diagonal elements represent cyclic shifts in the time domain: $[Q_k]_{i,i} = \exp(-j2\pi k \Delta_F \tau_{CS}^i), \text{ where } \tau_{CS}^i, i = 1, \dots, N_{TX} \text{ represents the CSD applied.}$ b) <i>Indirect mapping</i>: Q_k may be the product of a CSD matrix and a unitary matrix such as the Hadamard matrix or the Fourier matrix. c) <i>Spatial expansion</i>: Q_k is the product of a CSD matrix and a square matrix formed of orthogonal columns. As an illustration:

Claim	Identification
each space time coded symbol comprising a representation of a symbol of each of the M symbol substreams; Below are examples of spatial mapping matrices that might be used. There exist many other alternatives; implementation is not restricted to the spatial mapping matrices shown. The examples are: a) <i>Direct mapping</i>: Q_k is a diagonal matrix of unit magnitude complex values that takes one of two forms: 1) $Q_k = \mathbf{I}$, the identity matrix 2) A CSD matrix in which the diagonal elements represent cyclic shifts in the time domain: $[Q_k]_{i,i} = \exp(-j2\pi k \Delta_F \tau_{CS}^i)$, where $\tau_{CS}^i, i = 1, \dots, N_{TX}$ represents the CSD applied. b) <i>Indirect mapping</i>: Q_k may be the product of a CSD matrix and a unitary matrix such as the Hadamard matrix or the Fourier matrix. c) <i>Spatial expansion</i>: Q_k is the product of a CSD matrix and a square matrix formed of orthogonal columns.	The Nintendo-branded devices include each space time coded symbol comprising a representation of a symbol of each of the M symbol substreams. a) <i>Direct mapping</i>: Q_k is a diagonal matrix of unit magnitude complex values that takes one of two forms: 1) $Q_k = \mathbf{I}$, the identity matrix 2) A CSD matrix in which the diagonal elements represent cyclic shifts in the time domain: $[Q_k]_{i,i} = \exp(-j2\pi k \Delta_F \tau_{CS}^i)$, where $\tau_{CS}^i, i = 1, \dots, N_{TX}$ represents the CSD applied. b) <i>Indirect mapping</i>: Q_k may be the product of a CSD matrix and a unitary matrix such as the Hadamard matrix or the Fourier matrix. c) <i>Spatial expansion</i>: Q_k is the product of a CSD matrix and a square matrix formed of orthogonal columns.
a plurality M of transmit antennas each adapted to transmit a respective one of the M space-time coded streams,	The Nintendo-branded devices include a plurality M of transmit antennas each adapted to transmit a respective one of the M space-time coded streams.

Claim	Identification
	IEEE 802.11-2020 19.3.4 Overview of the PPDU encoding process The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure: NOTES — There might be 1 or 2 FEC encoders when BCC encoding is used. — The stream parser might have 1, 2, 3 or 4 outputs. — When LDPC encoding is used, the interleavers are not used. — When STBC is used, the STBC block has more outputs than inputs. — When spatial mapping is used, there might be more transmit chains than sd. — The number of inputs to the spatial mapper might be 1, 2, 3, or 4.
such that for each symbol of each input set of M symbols, the M space-time coded symbols that	Figure 20-3—Transmitter block diagram 2 In the Nintendo-branded devices, for each symbol of each input set of M symbols, the M space-time coded symbols that contain a representation of the symbol are transmitted at different times.

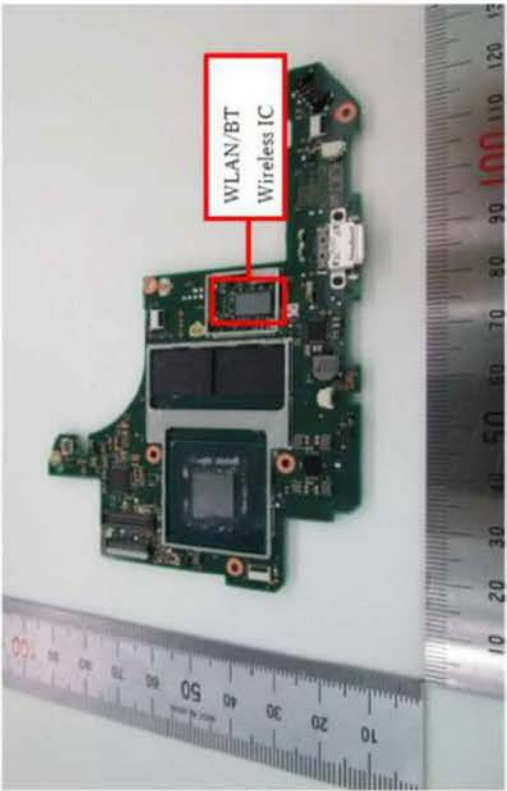
Claim	Identification
contain a representation of the symbol are transmitted at different times.	IEEE 802.11-2020 19.3.11.11.2 Spatial mapping If the data to be transmitted on subcarrier k on space-time stream i_{STS} are $X_k^{(i_{STS})}$, the transmitted data on the transmit chain i_{TX} shall be as shown in Equation 19-57 $r_{Field}^{(i_{TX})} = \frac{1}{\sqrt{N_{STS} \cdot N_{Field}^{Tone}}} w_{T_{Field}}(t) \sum_{k=-N_{SR}}^{N_{SR}} [Q_k]_{i_{TX}, i_{STS}} X_k^{(i_{STS})} \exp(j2\pi k \Delta_F (t - T_{CS}^{i_{STS}})) \quad 19-57$ Below are examples of spatial mapping matrices that might be used. There exist many other alternatives; implementation is not restricted to the spatial mapping matrices shown. The examples are: <i>Direct mapping:</i> Q_k is a diagonal matrix of unit magnitude complex values that takes one of two forms: 1) $Q_k = \mathbf{I}$, the identity matrix 2) A CSD matrix in which the diagonal elements represent cyclic shifts in the time domain: $[Q_k]_{i,i} = \exp(-j2\pi k \Delta_F \tau_{CS}^i)$, where $\tau_{CS}^i, i = 1, \dots, N_{TX}$ represents the CSD applied. <i>Indirect mapping:</i> Q_k may be the product of a CSD matrix and a unitary matrix such as the Hadamard matrix or the Fourier matrix. <i>Spatial expansion:</i> Q_k is the product of a CSD matrix and a square matrix formed of orthogonal columns. As an illustration:

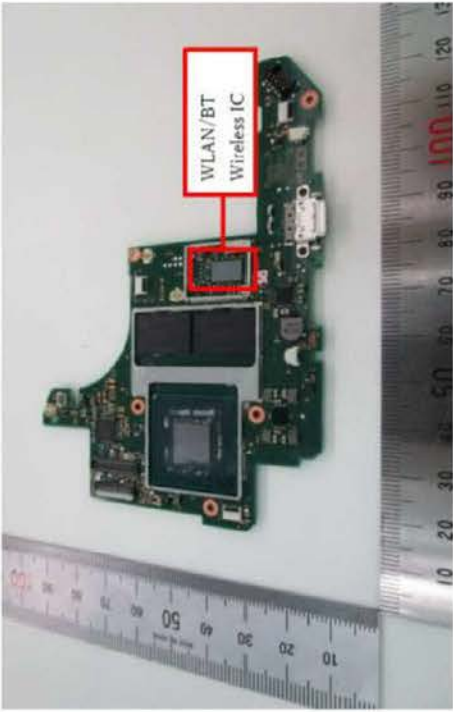
EXHIBIT L

Exhibit L Nintendo – U.S. Patent No. 9,313,065

Claim	Identification
1. A method of transmitting symbols using Orthogonal Frequency Division Multiplexing, OFDM, frames at an OFDM transmitter having at least two transmitting antennas, the OFDM frames having a time domain and a frequency domain, each OFDM frame comprising a plurality of OFDM symbols in the time domain and a plurality of sub-carriers in the frequency domain.	To the extent the preamble is limiting, the Nintendo-branded devices include a method of transmitting symbols using Orthogonal Frequency Division Multiplexing, OFDM, frames at an OFDM transmitter having at least two transmitting antennas, the OFDM frames having a time domain and a frequency domain, each OFDM frame comprising a plurality of OFDM symbols in the time domain and a plurality of sub-carriers in the frequency domain. For example, the Nintendo Switch/Switch Lite/Switch OLED transmits symbols using OFDM frames implemented by an Infineon/Cypress/Broadcom 4356 wireless IC. IEEE 802.11-2020 19 High Throughput (HT) PHY specification 19.1.1 Introduction to the HT PHY In addition to the requirements found in Clause 19 an HT STA shall be capable of transmitting and receiving frames that are compliant with the mandatory PHY specifications defined as follows: — In Clause 17 when the HT STA is operating in a 20 MHz channel width in the 5 GHz band — In Clause 16 and Clause 18 when the HT STA is operating in a 20 MHz channel width in the 2.4 GHz band 19.3.3 Transmitter block diagram HT-mixed format and HT-greenfield format transmissions can be generated using a transmitter consisting of the following blocks: 19.3.4 Overview of the PPDU encoding process The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure: a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and p) Map each of the complex numbers in each of the N_{ST} subcarriers in each of the OFDM symbols in each of the N_{STS} space-time streams to the N_{TX} transmit chain inputs. For direct-mapped operation,
of transmitting symbols using Orthogonal Frequency Division Multiplexing, OFDM, frames at an OFDM transmitter having at least two transmitting antennas, the OFDM frames having a time domain and a frequency domain, each OFDM frame comprising a plurality of OFDM symbols in the time domain and a plurality of sub-carriers	

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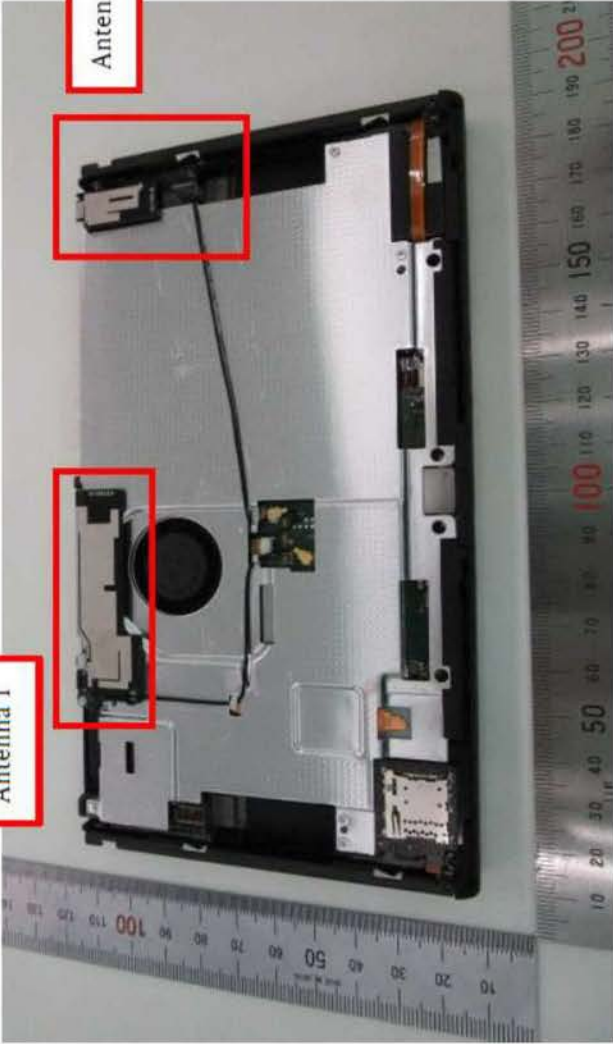
Claim	Identification
in the frequency domain, the method comprising the steps of:	The Nintendo Switch/Switch Lite/Switch OLED comprises an HT STA implemented by an Infineon/Cypress/Broadcom 4356 wireless IC 19 High Throughput (HT) PHY specification 19.1.1 Introduction to the HT PHY In addition to the requirements found in Clause 19 an HT STA shall be capable of transmitting and receiving frames that are compliant with the mandatory PHY specifications defined as follows: — In Clause 17 when the HT STA is operating in a 20 MHz channel width in the 5 GHz band — In Clause 16 and Clause 18 when the HT STA is operating in a 20 MHz channel width in the 2.4 GHz band
	Wireless module PCB (Front, Shield removed):  https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=5337261

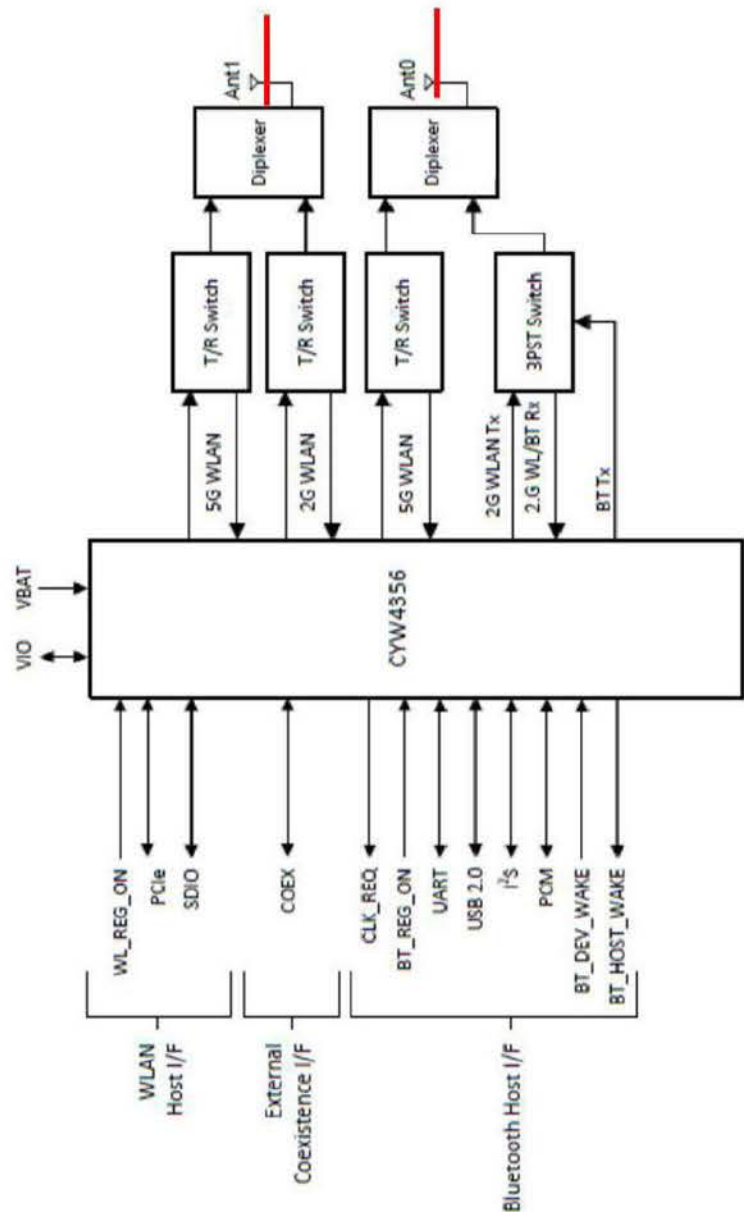
Claim	Identification
	The Nintendo Switch Lite/Switch OLED comprises an HT STA implemented by an Infineon/Cypress/Broadcom 4356 wireless IC 19 High Throughput (HT) PHY specification 19.1.1 Introduction to the HT PHY In addition to the requirements found in Clause 19 an HT STA shall be capable of transmitting and receiving frames that are compliant with the mandatory PHY specifications defined as follows: — In Clause 17 when the HT STA is operating in a 20 MHz channel width in the 5 GHz band — In Clause 16 and Clause 18 when the HT STA is operating in a 20 MHz channel width in the 2.4 GHz band Wireless module PCB (Front, Shield removed):  https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=5337261

Claim	Identification
	The Nintendo Switch Lite/Switch OLED transmits symbols using OFDM frames <u>Radio Specification</u> Wireless LAN, Bluetooth (BR / EDR / Low Energy function) part: Equipment Type : Transceiver Frequency of Operation : Wireless LAN part: (2.4 GHz): 2412 MHz – 2472 MHz, (U-NII-1): 5180 MHz – 5240 MHz, (U-NII-2A): 5260 MHz – 5320 MHz, (U-NII-2C): 5500 MHz – 5700 MHz, (U-NII-3): 5745 MHz- 5825 MHz, Bluetooth (BR / EDR / Low Energy) part: 2402 MHz - 2480 MHz 37.4 MHz Radio part clock frequency : Wireless LAN part: (2.4 GHz): 5 MHz, (5 GHz): 20 MHz, Channel spacing : Bluetooth part: (BR / EDR): 1 MHz, (Low Energy): 2 MHz Type of modulation : Wireless LAN part: 2.4 GHz band: DBPSK, DQPSK, CCK, <u>OFDM</u> 5 GHz band: <u>OFDM</u> https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=5337247

Claim	Identification
	The Nintendo Switch/Switch Lite/Switch OLED transmits symbols using OFDM frames when the wireless internet connection is set up using the instructions indicated below: Activating and Deactivating Wireless Internet Connection To activate wireless internet connection, go to INTERNET in (System Settings) on the HOME Menu and proceed to set up a connection. To deactivate wireless internet connection in handheld mode, hold down the HOME Button to enter Quick Settings, then set Flight Mode to On. Alternatively, in handheld mode, start (System Settings) from the HOME Menu, then set Flight Mode to On. https://www.nintendo.com/eu/media/downloads/support_1/nintendoswitch/NSwitch_ImportantInformation_UKV_01.pdf

Malikie Innovations Ltd. vs. Nintendo Co. Ltd. et al.
Exhibit L – U.S. Patent No. 9,313,065

Claim	Identification
	The Nintendo Switch Lite/Switch OLED transmits using two antennas  Antenna 1 Antenna 0 https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=5337261

Claim	Identification
	The Nintendo Switch/Switch Lite/Switch OLED transmits using two antennas Figure 1. Functional Block Diagram  The diagram illustrates the functional block architecture of the Nintendo Switch/Switch Lite/Switch OLED. At the center is the CYW4356 chip, which interfaces with various external components and internal modules. Power is supplied to the chip via VIO and VBAT pins. The chip's interfaces include: WLAN Host I/F: Connected to WL_REG_ON, PCIe, and SDIO pins. External Coexistence I/F: Connected to COEX and CLK_REQ pins. Bluetooth Host I/F: Connected to BT_REG_ON, UART, USB 2.0, I²S, PCM, BT_DEV_WAKE, and BT_HOST_WAKE pins. The internal components and their connections are as follows: Antenna 1 (Ant1) Path: The CYW4356 connects to a 5G WLAN module, which then connects to a T/R Switch. This switch is connected to a Diplexer, which finally connects to Ant1. Antenna 2 (Ant0) Path: The CYW4356 connects to a 2G WLAN module, which then connects to a T/R Switch. This switch is connected to a Diplexer, which finally connects to Ant0. BT Path: The CYW4356 connects to a 2G WLAN Tx module, which then connects to a 3PST Switch. This switch is connected to a BT Tx module. https://www.infineon.com/dgdl/Infineon-CYW4356_CG8674_Single-Chip_5G_WiFi_IEEE_802.11ac_2x2_MAC_Baseband_Radio_with_Integrated_Bluetooth_5.0-DataSheet-v03_00-EN.pdf?fileId=8ac78c87d0d8da4017d0ee4c6ad6bfa

Claim	Identification
	IEEE 802.11-2020 19 High Throughput (HT) PHY specification 19.1.1 Introduction to the HT PHY In addition to the requirements found in Clause 19, an HT STA shall be capable of transmitting and receiving frames that are compliant with the mandatory PHY specifications defined as follows: — In Clause 17, when the HT STA is operating in a 20 MHz channel width in the 5 GHz band — In Clause 16 and Clause 19, when the HT STA is operating in a 20 MHz channel width in the 2.4 GHz band The HT PHY data subcarriers are modulated using binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), 16-quadrature amplitude modulation (16-QAM), or 64-QAM. Forward error correction (FEC) coding (convolutional coding) is used with a coding rate of 1/2, 2/3, 3/4, or 5/6. LDPC codes are added as an optional feature. 19.3.3 Transmitter block diagram p) Map each of the complex numbers in each of the N_{ST} subcarriers in each of the OFDM symbols in each of the N_{STS} space-time streams to the N_{TX} transmit chain inputs. For direct-mapped operation, $N_{TX} = N_{STS}$, and there is a one-to-one correspondence between space-time streams and transmit chains. In this case, the OFDM symbols associated with each space-time stream are also associated

Claim	Identification
	The Nintendo Switch Lite/Switch OLED uses the 4356 chip compliant with the following 802.11 standards 1.3 Standards Compliance The CYW4356/CG8674 supports the following standards: ■ Bluetooth 5.0 with Basic Rate (BR), Enhanced Data Rate (EDR) and Bluetooth Low Energy (BLE) ■ IEEE802.11ac mandatory and optional requirements for 20 MHz, 40 MHz, and 80 MHz channels ■ IEEE 802.11n—Handheld Device Class (Section 11) ■ IEEE 802.11a ■ IEEE 802.11b ■ IEEE 802.11g ■ IEEE 802.11d ■ IEEE 802.11h ■ IEEE 802.11i ■ Security: □ WEP □ WPA Personal □ WPA2 Personal □ WMM □ WMM-PS (U-APSD) □ WMM-SA □ AES (Hardware Accelerator) □ TKIP (HW Accelerator) □ CKIP (SW Support) ■ Proprietary Protocols: □ CCXv2 □ CCXv3 □ CCXv4 □ CCXv5 ■ IEEE 802.15.2 Coexistence Compliance—on silicon solution compliant with IEEE 3 wire requirements The CYW4356/CG8674 will support the following future drafts/standards: ■ IEEE 802.11w—Secure Management Frames ■ A4WP Wireless Power Transfer System Baseline System Specification V1.0 ■ IEEE 802.11 Extensions: □ IEEE 802.11e QoS Enhancements (In accordance with the WMM specification, QoS is already supported.) □ IEEE 802.11h 5 GHz Extensions □ IEEE 802.11i MAC Enhancements □ IEEE 802.11k Radio Resource Measurement https://www.infineon.com/dgdl/Infineon-CYW4356_CG8674_Single_Chip_5G_WiFi_802.11ac_2x2_MAC_Baseband_Radio_with_Integrated_Bluetooth_5.0-DataSheet-v03_00-EN.pdf?fileId=8ac78c8c7d0d8da4017d0ee4c6ad6bfa

Claim	Identification
transmitting, on an OFDM symbol, pilot symbols corresponding to the first antenna using a scattered pattern; and transmitting, on the OFDM symbol, pilot symbols corresponding to the second antenna using a scattered pattern;	The Nintendo-branded devices transmit, on an OFDM symbol, pilot symbols corresponding to the first antenna using a scattered pattern; and transmit, on the OFDM symbol, pilot symbols corresponding to the second antenna using the scattered pattern The Nintendo Switch/Switch Lite/Switch OLED transmits pilot symbols on first and second antennas using a scattered pattern in accordance with 802.11 when the Switch is connected to an 802.11 access point based on the instructions indicated below: How to Connect to a Wireless Network Support Nintendo Switch Description: Information on connecting a Nintendo Switch console to a wireless home network Additional Information: Before continuing, it is recommended that you verify the following information for the wireless network: • The SSID (network's name) • The wireless password, if a password is required Complete These Steps: 1. Place the Nintendo Switch console within 3 metres (10 feet) of the wireless router to ensure a strong wireless signal. 2. On the Nintendo Switch console, select "System Settings" from the HOME Menu 3. Select "Internet", and then "Internet Settings". 4. The Nintendo Switch console will automatically search for nearby Wi-Fi signals. 5. Select the appropriate network name (SSID) from the list. 6. If you are unable to find your network's name, stand closer to the wireless router and press the Y Button to search again. 7. If the network name is greyed out, this indicates the wireless security type being used is not supported by the Nintendo Switch console. 8. If you are still unable to find your network, this may indicate an issue with the wireless network environment. 9. If prompted, use the on-screen keyboard to enter the network's wireless password. https://www.nintendo.com/en-gb/Support/Nintendo-Switch/FAQ/How-to-Connect-to-a-Wireless-Network-1228927.html

Claim	Identification
	IEEE 802.11-2020 <u>19.3.11.10 Pilot subcarriers</u> In a 20 MHz transmission four pilot tones shall be inserted in the same subcarriers used in Clause 17, i.e., in subcarriers -21, -7, 7, and 21. The pilot sequence for the n^{th} symbols and i_{STS}^{th} space-time stream shall be as shown in Equation (19-54). $P_{(i_{STS}, n)}^{28,28} = \left\{ \begin{array}{l} 0, 0, 0, 0, 0, 0, \Psi_{i_{STS}, n \bmod 4}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \Psi_{i_{STS}, (n+1) \bmod 4}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \\ 0, 0, 0, 0, 0, 0, \Psi_{i_{STS}, (n+2) \bmod 4}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \Psi_{i_{STS}, (n+3) \bmod 4}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 \end{array} \right\} \quad (19-54)$ where $n \oplus a$ indicates symbol number modulo integer a and the patterns $\Psi_{i_{STS}, n}^{(N_{STS})}$ are defined in Table 20-19 and Table 20-20. NOTE—For each space-time stream, there is a different pilot pattern, and the pilot patterns are cyclically rotated over symbols.

Claim	Identification
	IEEE 802.11-2020 19.3.11.10 Pilot subcarriers In a 40 MHz transmission (excluding MCS 32; see 19.3.11.11.5), pilot signals shall be inserted in subcarriers $-53, -25, -11, 11, 25$, and 53. The pilot sequence for symbol n and space-time stream i <i>ISTS</i> shall be as shown in Equation (19-55). $P_{(iSTS, n)}^{58, 58} = \left\{ \begin{array}{l} 0, 0, 0, 0, 0, \Psi_{iSTS, n \bmod 6}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \\ 0, 0, \Psi_{iSTS, (n+1) \bmod 6}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \Psi_{iSTS, (n+2) \bmod 6}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, \\ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \Psi_{iSTS, (n+3) \bmod 6}^{(N_{STS})}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \Psi_{iSTS, (n+4) \bmod 6}^{(N_{STS})}, \\ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \Psi_{iSTS, (n+5) \bmod 6}^{(N_{STS})}, 0, 0, 0, 0, 0, 0 \end{array} \right\} \quad (19-55)$ where the patterns are defined in Table 19-19 and Table 19-20. NOTE—For each space-time stream, there is a different pilot pattern, and the pilot patterns are cyclically rotated over symbols.

Claim Identification**The Switch passed testing by the FCC for transmission on two antennas****4.1 Operating Mode(s)**

*1) Test operating mode was determined as follows according to "Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals -" of TCB Council Workshop October 2009 and also was judged the necessity of 802.11ac mode by the pre-test.

Test item	Mode	Tested frequency	Worst data rate *2)	Antenna *2)
Conducted emission, Radiated emission (below 1 GHz), Out of band emissions (Conducted) *1)	Transmitting (Tx), IEEE 802.11ac VHT20 (11ac-20), SISO	5260 MHz	MCS 3, PN9	0
26 dB Emission Bandwidth, 20 dB Bandwidth, Occupied Bandwidth (99%), Maximum Conducted Output Power, Maximum Power Spectral Density	Transmitting (Tx), IEEE 802.11a (11a)	(Low bands): 5180 MHz, 5220 MHz, 5240 MHz, (Middle bands): 5260 MHz, 5300 MHz, 5320 MHz (Additional bands): 5500 MHz, 5580 MHz, 5700 MHz, (Upper bands): 5745 MHz, 5785 MHz, 5825 MHz	48 Mbps, PN9	0
	Transmitting (Tx), IEEE 802.11n HT20 (11n-20), SISO	(Low bands): 5180 MHz, 5220 MHz, 5240 MHz, (Middle bands): 5260 MHz, 5300 MHz, 5320 MHz (Additional bands): 5500 MHz, 5580 MHz, 5700 MHz, (Upper bands): 5745 MHz, 5785 MHz, 5825 MHz	MCS 3, PN9	0
	Transmitting (Tx), IEEE 802.11n HT20 (11n-20), MIMO	(Low bands): 5180 MHz, 5220 MHz, 5240 MHz, (Middle bands): 5260 MHz, 5300 MHz, 5320 MHz (Additional bands): 5500 MHz, 5580 MHz, 5700 MHz, (Upper bands): 5745 MHz, 5785 MHz, 5825 MHz	MCS11, PN9	0 & 1
	Transmitting (Tx), IEEE 802.11ac VHT20 (11ac-20), SISO	(Low bands): 5180 MHz, 5220 MHz, 5240 MHz, (Middle bands): 5260 MHz, 5300 MHz, 5320 MHz (Additional bands): 5500 MHz, 5580 MHz, 5700 MHz, (Upper bands): 5745 MHz, 5785 MHz, 5825 MHz	MCS 3, PN9	0
	Transmitting (Tx), IEEE 802.11ac VHT20 (11ac-20), MIMO	(Low bands): 5180 MHz, 5220 MHz, 5240 MHz, (Middle bands): 5260 MHz, 5300 MHz, 5320 MHz (Additional bands): 5500 MHz, 5580 MHz, 5700 MHz, (Upper bands): 5745 MHz, 5785 MHz, 5825 MHz	MCS 3, PN9	0 & 1

<https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=5337247>

Claim	Identification																																																																		
wherein the pilot symbols for the first antenna correspond to a first code and the pilot symbols for the second antenna correspond to a second code.	In the Nintendo-branded devices, wherein the pilot symbols for the first antenna correspond to a first code and the pilot symbols for the second antenna correspond to a second code. IEEE 802.11-2020 <u>19.3.11.10 Pilot Subcarriers</u> Table 19-19 Pilot values for 20 MHz transmission <table><tr><th>N_{STS}</th><th>i_{STS}</th><th>$\Psi^{(N_{STS})}_{i_{STS}, 0}$</th><th>$\Psi^{(N_{STS})}_{i_{STS}, 1}$</th><th>$\Psi^{(N_{STS})}_{i_{STS}, 2}$</th><th>$\Psi^{(N_{STS})}_{i_{STS}, 3}$</th></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>-1</td></tr><tr><td>2</td><td>1</td><td>1</td><td>1</td><td>-1</td><td>-1</td></tr><tr><td>2</td><td>2</td><td>1</td><td>-1</td><td>-1</td><td>1</td></tr><tr><td>3</td><td>1</td><td>1</td><td>1</td><td>-1</td><td>-1</td></tr><tr><td>3</td><td>2</td><td>1</td><td>-1</td><td>1</td><td>-1</td></tr><tr><td>3</td><td>3</td><td>-1</td><td>1</td><td>1</td><td>-1</td></tr><tr><td>4</td><td>1</td><td>1</td><td>1</td><td>1</td><td>-1</td></tr><tr><td>4</td><td>2</td><td>1</td><td>1</td><td>-1</td><td>1</td></tr><tr><td>4</td><td>3</td><td>1</td><td>-1</td><td>1</td><td>1</td></tr><tr><td>4</td><td>4</td><td>-1</td><td>1</td><td>1</td><td>1</td></tr></table> First antenna, first code: $i_{STS}=1$ (red) Second antenna, second code: $i_{STS}=2$ (green) A code is comprised of a sequence of phase shifts in each row. Each row is referred to as a code.	N_{STS}	i_{STS}	$\Psi^{(N_{STS})}_{i_{STS}, 0}$	$\Psi^{(N_{STS})}_{i_{STS}, 1}$	$\Psi^{(N_{STS})}_{i_{STS}, 2}$	$\Psi^{(N_{STS})}_{i_{STS}, 3}$	1	1	1	1	1	-1	2	1	1	1	-1	-1	2	2	1	-1	-1	1	3	1	1	1	-1	-1	3	2	1	-1	1	-1	3	3	-1	1	1	-1	4	1	1	1	1	-1	4	2	1	1	-1	1	4	3	1	-1	1	1	4	4	-1	1	1	1
N_{STS}	i_{STS}	$\Psi^{(N_{STS})}_{i_{STS}, 0}$	$\Psi^{(N_{STS})}_{i_{STS}, 1}$	$\Psi^{(N_{STS})}_{i_{STS}, 2}$	$\Psi^{(N_{STS})}_{i_{STS}, 3}$																																																														
1	1	1	1	1	-1																																																														
2	1	1	1	-1	-1																																																														
2	2	1	-1	-1	1																																																														
3	1	1	1	-1	-1																																																														
3	2	1	-1	1	-1																																																														
3	3	-1	1	1	-1																																																														
4	1	1	1	1	-1																																																														
4	2	1	1	-1	1																																																														
4	3	1	-1	1	1																																																														
4	4	-1	1	1	1																																																														

Claim **Identification**

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19.3.11.10 Pilot Subcarriers

Table 19-20—Pilots values for 40 MHz transmission (excluding MCS 32)

N_{STS}	i_{STS}	$\Psi_{i_{STS}, 0}^{(N_{STS})}$	$\Psi_{i_{STS}, 1}^{(N_{STS})}$	$\Psi_{i_{STS}, 2}^{(N_{STS})}$	$\Psi_{i_{STS}, 3}^{(N_{STS})}$	$\Psi_{i_{STS}, 4}^{(N_{STS})}$	$\Psi_{i_{STS}, 5}^{(N_{STS})}$
1	1	1	1	1	-1	-1	1
2	1	1	1	-1	-1	-1	-1
2	2	1	1	1	-1	1	1
3	1	1	1	-1	-1	-1	-1
3	2	1	1	1	-1	1	1
3	3	1	-1	1	-1	-1	1

Claim	Identification
	IEEE 802.11-2020 20.3.4 Overview of the PPDU encoding process The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure: o) Determine whether 20 MHz or 40 MHz operation is to be used from the CH_BANDWIDTH parameter of the TXVECTOR. Specifically, when CH_BANDWIDTH is HT_CBW20 or NON_HT_CBW20, 20 MHz operation is to be used. When CH_BANDWIDTH is HT_CBW40 or NON_HT_CBW40, 40 MHz operation is to be used. For 20 MHz operation (with the exception of non-HT formats), insert four subcarriers as pilots into positions -21, -7, 7, and 21. The total number of the subcarriers, N_{ST}, is 56. For 40 MHz operation (with the exception of MCS 32 and non-HT duplicate format), insert six subcarriers as pilots into positions -53, -25, -11, 11, 25, and 53, resulting in a total of $N_{ST} = 114$ subcarriers. See 19.3.11.11.5 for pilot locations when using MCS 32 and 19.3.11.12 for pilot locations when using non-HT duplicate format. The pilots are modulated using a pseudorandom cover sequence. Refer to 19.3.11.10 for details. For 40 MHz operation, apply a $+90^\circ$ phase shift to the complex value in each OFDM subcarrier with an index greater than 0, as described in 19.3.11.11.4, 19.3.11.11.5, and 19.3.11.12. p) Map each of the complex numbers in each of the N_{ST} subcarriers in each of the OFDM symbols in each of the N_{STS} space-time streams to the N_{TX} transmit chain inputs. For direct-mapped operation,