

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LENOVO (UNITED STATES) INC., DELL TECHNOLOGIES INC.,
DELL INC., and HP INC.,
Petitioners,

v.

UNIVERSAL CONNECTIVITY TECHNOLOGIES, INC.,
Patent Owner.

IPR2024-01482
U.S. Patent No. 7,856,520

**PETITION FOR INTER PARTES REVIEW
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.10**

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EXHIBIT LIST

Exhibit	Description
1001	U.S. Patent No. 7,856,520 (“’520 patent”)
1002	File History of the ’520 patent
1003	Declaration of Brian A. Berg (“Berg”)
1004	<i>Curriculum Vitae</i> of Brian A. Berg
1005	US Patent Application No. 2006/0095596 A1 to Lin Che Yung, <i>et al.</i> (“Yung”)
1006	HDMI Specification Version 1.3 and a CEC 1.3 Supplement (“HDMI 1.3”)
1007	<i>Design of a Multicode Bi-phase Encoder for Data Transmission</i> , Raida Al-Alawi et al., Journal of Circuits Systems and Computers, February 2006 (“Al-Alawi”)
1008	Declaration of Steve Venuti
1009	Declaration of June Ann Munford
1010	<i>Universal Connectivity Techs. Inc. v. Lenovo Grp. Ltd.</i> , No. 2:23-cv-00449-JRG, Dkt. 1-15
1011	Universal Serial Bus Specification, Revision 2.0, April 27, 2000 (“USB 2.0”)
1012	HDMI Specification Version 1.0 (“HDMI 1.0”)
1013	HDMI Specification Version 1.1 (“HDMI 1.1”)

I. INTRODUCTION

Lenovo (United States) Inc. (“Lenovo US”), Dell Inc., Dell Technologies Inc., and HP Inc. (“Petitioners”) respectfully request the Board institute *inter partes* review of and cancel claims 1, 2, 4, 8-10, 12-13, 15, 18-20, and 25 (“Challenged Claims”) of U.S. Patent No. 7,856,520 (“’520 patent”).

II. STANDING, MANDATORY NOTICES, AND FEE AUTHORIZATION

Grounds for Standing: Pursuant to 37 C.F.R. § 42.104(a), Petitioners certify that the ’520 patent is available for IPR and that Petitioners are not barred or estopped from requesting an IPR challenging the ’520 patent on the grounds identified in this petition.

Real Parties-in-Interest: Petitioners hereby name Lenovo (United States) Inc., Dell Inc., Dell Technologies Inc., and HP Inc. as real parties-in-interest and, solely because it is named as a defendant in a co-pending district court case listed below, further identify Lenovo Group Limited (“LGL”) as a real party-in-interest.

Related Matters Under 37 C.F.R. § 42.8(b)(2):

Universal Connectivity Technologies Inc. asserted eight patents, including the ’520 patent, against Lenovo Group Limited in *Universal Connectivity Technologies Inc. v. Lenovo Group Limited*, 1:23-cv-00449-JRG (E.D. Tex.), in a complaint filed on September 28, 2023. On March 20, 2024, the Court granted the parties’ joint

motion to waive formal service and set the deadline for Lenovo Group Limited's response to the complaint to May 17, 2024.

Universal Connectivity Technologies Inc. asserted eight patents, including the '520 patent, against Dell Inc. and Dell Technologies Inc. in *Universal Connectivity Technologies Inc. v. Dell Technologies Inc. et al.*, 1:23-cv-01506-RP (W.D. Tex.), in a complaint filed on December 12, 2023, and served on December 18, 2023.

Universal Connectivity Technologies Inc. asserted eight patents, including the '520 patent, against HP Inc. in *Universal Connectivity Technologies Inc. v. HP Inc.*, 1:23-cv-01177-RP (W.D. Tex.), in a complaint filed on September 28, 2023, and served on October 2, 2023.

Lenovo (United States) Inc., Dell Inc., Dell Technologies Inc., and HP Inc. are concurrently filing this Petition and IPR petitions for seven other asserted patents: IPR2024-01428, IPR2024-01429, IPR2024-01478, IPR2024-01479, IPR2024-01480, IPR2024-01481, and IPR2024-01484

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Pursuant to 37 C.F.R. § 42.10(b), Petitioners have filed powers of attorney with the above designation of counsel.

37 C.F.R. §42.8(b)(4) Service Information: Service information is provided in the designation of counsel above. Petitioners consent to service of all documents via electronic mail at the email addresses above and at Lenovo-UCT-IPR@cov.com, HP-UCT-IPR@shb.com, and DL-DELL-UCT-MWE@mwe.com.

Payment of Fees Under 37 C.F.R. §42.103: The Office is authorized to charge the fee set forth in 37 C.F.R. §42.15(a)(1) for this Petition to Deposit Account No. 60-3160. The undersigned further authorizes payment for any additional fees that may be due in connection with this Petition.

III. NOTE

Petitioners cite to exhibits' original page numbers. **Emphasis** in quoted material has been added. Claim terms are presented in *italics*.

IV. SUMMARY OF THE '520 PATENT

The '520 patent relates to “a method and apparatus for a control bus for connection of electronic devices.” Ex.1001, Abstract. In the '520 patent, a transmitting device converts control signals to data packets and transmits them to a receiving device through a bi-directional, single-line control bus. *Id.*, Abstract, 1:57-67. Furthermore, the bi-directional bus can use “bi-phase mark encoding”—in

which “each bit of data is presented by two logical states”—to transmit data bits. *Id.*, 3:23-26. The ’520 patent also discloses a modified protocol that “allows dual-mode operation in which a device may be connected to a personal computer or to another portable device.” *Id.*, 2:65-67.

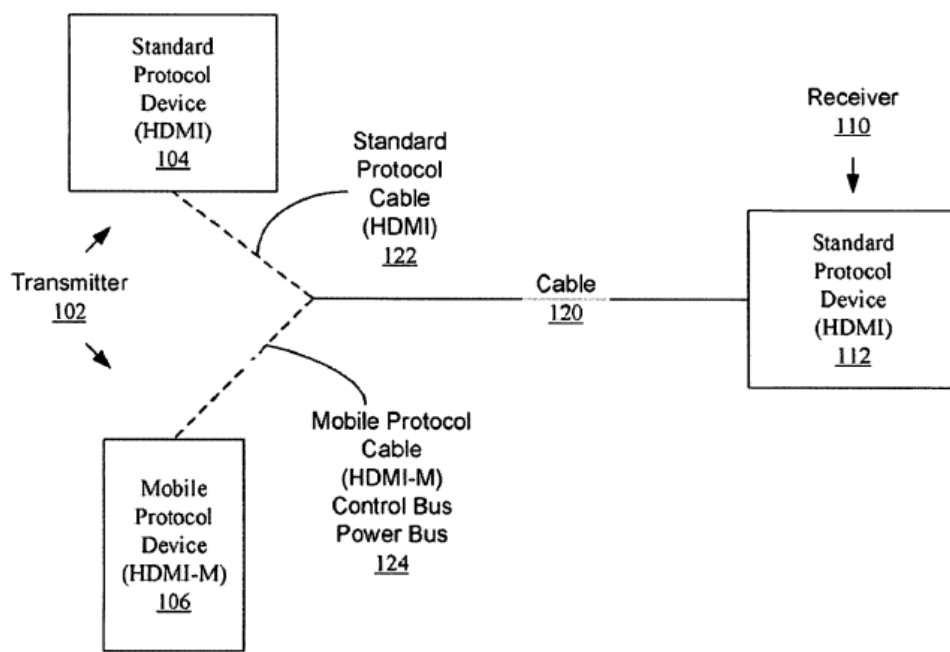


Fig. 1

Id., Fig. 1.

The ’520 patent also describes an arbitration process in which either the transmitter or the receiver is given control over the control bus as “an initiator,” while the other becomes “a follower,” to enable collision-free transmission over the

control bus. *Id.*, Abstract. In this process, “there is [a] determination of the status of the control bus 304. If it is determined that the CBUS is idle (having been unused for a certain number of cycles) or has been unused by the other device for a certain number of cycles (indicating that it is the device’s turn to utilize the control bus) 306, then the use of the bus may be arbitrated 310. Otherwise, the device may determine that the control bus is in use by the other device 308.” *Id.*, 7:48-67. The ’520 patent also explains that “because the duty cycle on a control bus (which may be engaged in bi-phase mark encoding) may tend to be skewed away from 50%, the follower may maintain separate calibrations for the high time and low time of the sync pulse.” *Id.*, 6:16-20.

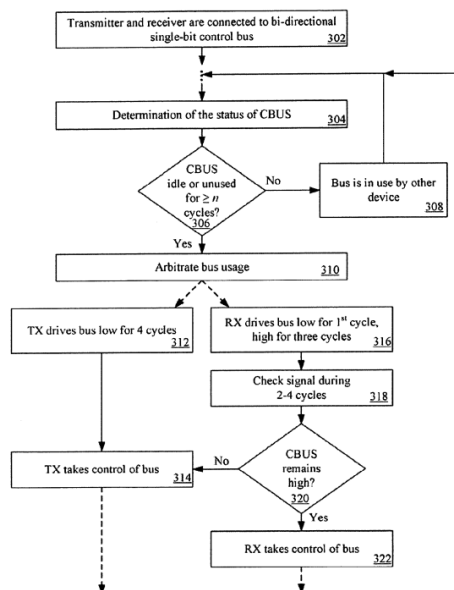


Fig. 3

Id., Fig. 3.

V. PROSECUTION HISTORY

The application leading to the '520 patent was filed on January 4, 2008. Ex.1002, 1. The initial claims of U.S. Application No. 11/969,852 were rejected on September 25, 2009 under 35 U.S.C. 102(b) as anticipated by the prior art of Maxim Application Note 244 “Advanced 1-Wire Network Driver.” *Id.*, 132. To overcome the rejection, the applicant narrowed the independent claims on December 29, 2009 by incorporating a standard protocol and a detailed arbitration process. *Id.*, 164-170. The Examiner allowed these amended claims on April 8, 2010. *Id.*, 311. The '520 patent issued on December 21, 2010. Ex.1001, cover.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSITA”) as of the time of the alleged invention of the '520 patent would have had a bachelor’s degree in electrical engineering, computer engineering, computer science, or equivalent training, and three years of experience with data communications systems or interfaces, including at least some experience with serial or display data communications systems or interfaces. Additional education can substitute for less work experience, and vice versa. Berg, ¶¶100-102.

VII. CLAIM CONSTRUCTION

Petitioners submit that for the purposes of this proceeding, the terms of the challenged claims should be given their plain and ordinary meaning, and no terms require specific construction.

VIII. RELIEF REQUESTED AND THE REASONS FOR THE REQUESTED RELIEF

Petitioners ask that the Board institute an *inter partes* review and cancel the Challenged Claims in view of the analysis below.

IX. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

A. Challenged Claims

Petitioners challenge claims 1, 2, 4, 8-10, 12-13, 15, 18-20, and 25.

B. Grounds for Challenges

Ground	Claim(s)	Basis
1	1, 4, 8-10, 12, 15, 18-19, 25	Obvious under 35 U.S.C. § 103 over Yung in view of HDMI 1.3
2	2, 13, 20	Obvious under 35 U.S.C. § 103 over Yung in view of HDMI 1.3 in further view of Al-Alawi

The '520 patent was filed on January 4, 2008, which is the patent's earliest priority date.

Yung was filed on November 3, 2004 and published on May 4, 2006 and is thus prior art under 35 U.S.C. § 102(b). Ex.1005.

HDMI Specification Version 1.3 (“HDMI 1.3”) was released on June 22, 2006 and is thus prior art under 35 U.S.C. § 102(b). Ex.1006. As explained in the declaration of Steve Venuti, Ex.1008, HDMI 1.3 was widely available to interested members of the public by way of the website at <http://hdmi.org>, when publicly released on June 22, 2006, and included a CEC 1.3 supplement at the end as part of the same document containing the HDMI 1.3 specification. Ex.1008, ¶19.

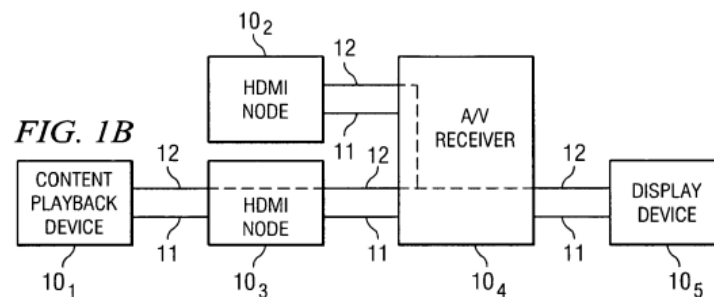
Al-Alawi was published in February 2006 and is thus prior art under 35 U.S.C. § 102(b). Ex.1007; Ex. 1009.

C. Ground 1: Claims 1, 4, 8-10, 12, 15, 18-19, and 25 Are Obvious Under 35 U.S.C. § 103 over Yung in View of HDMI 1.3

1. Summary of Yung

Similar to the ’520 patent, Yung relates to a “solution for consumer electronics control.” Yung, Abstract; Berg, ¶¶105-108. Yung discloses a system including multiple devices, such as a content playback device, an Audio/Video Receiver, HDMI nodes, and a display device, which are interconnected using HDMI cables that have a consumer electronic control (“CEC”) bus. Yung, ¶¶4,26-28. Each device includes a command control unit that switches between an initiator mode and follower mode to avoid collisions during transmission. *Id.*, ¶¶9,29. Specifically, to avoid collisions during transmission, the command control unit waits a signal free time prior to transmission of signals onto the command bus to confirm whether the

command bus is active or inactive. *Id.*, ¶¶36-38. If no interrupt is detected during the signal free time, the command control unit switches to an “initiator” mode. *Id.* Yung also teaches an arbitration process that determines which device takes control of the bus if more than one device tries to take control of the bus at the same time. *Id.* Furthermore, Yung discloses that commands are transmitted as frames that include header blocks and data blocks for identifying source, destination, and content. *Id.*, ¶¶34, 38. Ultimately, Yung’s system uses the command control units to efficiently convert high-level commands to low-level signals and transmit them over HDMI and CEC lines without collisions. *Id.*, ¶¶8-10.



Id., Fig. 1B.

2. Summary of HDMI 1.3

HDMI 1.3 covers transmission of audiovisual signals from a variety of devices, such as set-top boxes and DVD players, to displays. HDMI 1.3, 1; Berg, ¶¶109-111. HDMI 1.3 explains that HDMI can carry “high quality multi-channel audio data and can carry all standard and high definition consumer electronics video formats.” *Id.*

Furthermore, HDMI 1.3 “completely describes the interface such that one could implement a complete transmission and interconnect solution or any portion of the interface. The underlying Transition Minimized Differential Signaling (TMDS)-based protocol and associated electrical signaling is described in detail.” *Id.* HDMI 1.3 further describes the CEC protocol, which “provides high-level control functions between all of the various audiovisual products in a user’s environment.” *Id.*, CEC-1.

3. Reasons to Combine Yung and HDMI 1.3

For the reasons set forth below, a POSITA would have been motivated to combine the teachings of HDMI 1.3 with those of Yung. Berg, ¶¶120-124. Yung discloses that “[u]nder the HDMI standard, there is an optional protocol, the consumer electronic control (CEC) protocol,” and that the “CEC protocol is described in the supplement 1 attached to the HDMI standard.” Yung, ¶¶4,5. Yung teaches that its “invention is embodied in an HDMI compliant network of audio/visual devices in which the network is also compliant with and employs the CEC protocol of the HDMI standard.” *Id.*, ¶26. While HDMI 1.3 was released after Yung’s filing date, Yung provides an express motivation to a POSITA to combine Yung’s teachings with such future versions of this protocol, including specifically its CEC protocol. *Id.* (“One of ordinary skill in the art will recognize that the

teachings of the preferred embodiments can be applied in a variety of different contexts, including future versions of the CEC protocol as well as other protocols currently existing or that may be developed in the future.”). Berg, ¶122.

Thus, a POSITA starting with Yung’s HDMI-based audiovisual system would have looked to HDMI 1.3 because Yung directly uses the HDMI standard and its CEC supplement and expressly teaches that future versions can be used, to enable transmission of audiovisual signals between interconnected devices. Yung, ¶¶4,5,26; Berg, ¶123. Accordingly, the combination of Yung and HDMI 1.3 would require applying only known techniques (as described in the HDMI 1.3 standard) to a known system ready for improvement (Yung’s HDMI-based audiovisual systems) to yield predictable results (enabling digital communications between interconnected audiovisual devices). Berg, ¶124.

4. Claim 1

[1(pre)] A method comprising:

To the extent the preamble is limiting, Yung discloses and/or renders obvious this element. Berg, ¶132.

Yung discloses “a method and a device for a host control unit [of a device] to communicate over a protocol compliant bus via the introduction of an auxiliary control unit that handles communications to and from the protocol compliant bus.”

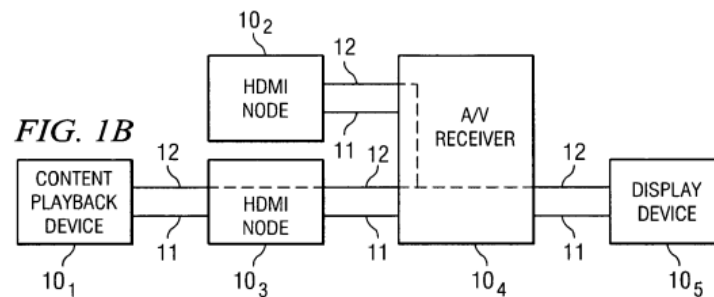
Yung, ¶7. Thus, Yung discloses a method by which interconnected devices transmit and receive audiovisual signals over a command bus. Berg, ¶133.

[1(a)] coupling a first device to a second device, the first device being one of a transmitting device or a receiving device and the second device being the other of a transmitting device or a receiving device, coupling of the first and second devices including connecting a first control bus between the first device and the second device, the first control bus being a bi-directional, single-line bus;

Yung discloses and/or renders obvious this element. Berg, ¶134.

Yung discloses “*a first device*” in the form of a “content playback device 10₁” and “*a second device*” in the form of a “display device 10₅” in Fig. 1B. Yung, ¶27; Berg, ¶135. As shown in Fig. 1B, these two devices are coupled via lines 11 and 12 (“*coupling a first device to a second device*”).¹ Yung, ¶28; Berg, ¶135.

¹ The ’520 patent uses the term “couple” to encompass elements that are either “directly coupled” or “indirectly coupled” through other elements. Ex.1001, 10:40-42 (“If it is said that an element “A” is coupled to or with element “B,” element A may be directly coupled to element B or be indirectly coupled through, for example, element C.”).



Yung, Fig. 1B.

Yung explains that “with reference to FIG. 1B, pressing a ‘play’ button of a DVD player **10₁** **generates a high-level command**. It is preferred that the high-level command be **transmitted to a display device, in this case a TV 10₅** connected to the DVD player.” Yung, ¶28. A POSITA would have thus understood that the transmitting content playback device 10₁ transmits signals (“*the first device being one of a transmitting device*”) to the receiving display device 10₅ (“*the second device being the other of a transmitting device or a receiving device.*”) in Fig. 1B. Berg, ¶136.

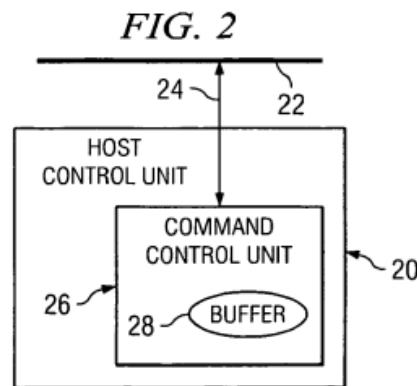
Yung further discloses an “HDMI cable that includes an additional **CEC bus** [that] **interconnects the display device, the content play back device** and other CEC compliant devices.” Yung, ¶11. Referring to Fig. 1B, Yung explains that “the devices 10 are compliant with both the HDMI standard and the CEC protocol, such as the system illustrated in FIG. 1B.” *Id.*, ¶27. Yung adds that “the optional CEC protocol provides high-level control functions between all of the CEC compliant

nodes in the CEC network.... **The CEC bus preferably consists of a single, bi-directional line.** *Id.* In other words, the “content playback device 10₁” is “*coupl[ed]*” to the “display device 10₅” through a “**CEC bus** that preferably consists of a single, bi-directional line” (*coupling of the first and second devices including connecting a first control bus between the first device and the second device, the first control bus being a bi-directional, single-line bus*). Yung, ¶¶11,27; Berg, ¶137. Furthermore, Yung clarifies that the CEC bus is a control bus because it teaches that “the **consumer electronic control (CEC) protocol ... provides high-level control functions** between audio visual appliances interconnected in the HDMI environment.” Yung, ¶4; *see also id.*, ¶¶7,8,10,11; Berg, ¶138. Therefore, Yung discloses a content playback device 10₁ in Fig. 1B that is connected to a display device 10₅ (“*coupling a first device to a second device, coupling of the first and second devices*”) through a CEC bus that consists of a single bi-directional line (“*coupling of the first and second devices including connecting a first control bus between the first device and the second device, the first control bus being a bi-directional, single-line bus*”). *Id.*

[1(b)] determining whether the first control bus is in use by the second device;

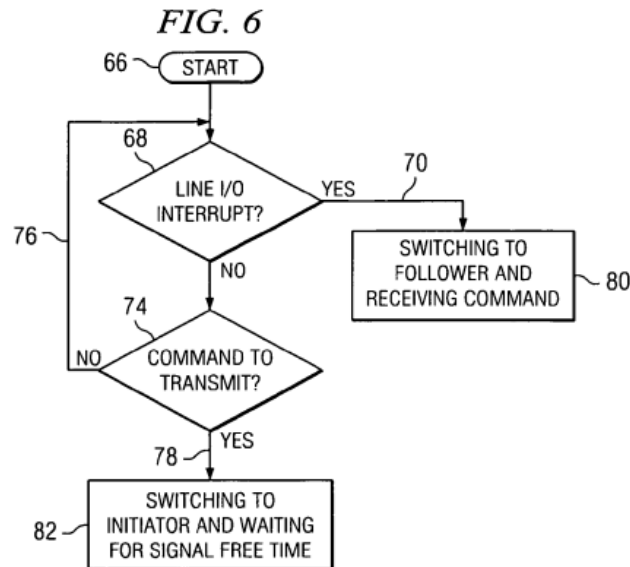
Yung discloses and/or renders obvious this element. Berg, ¶139.

Yung discloses that “[a] host control unit [such as host control unit 20] is contained in each device 10 (HDMI node) [that] execut[es] high-level commands” (Yung, ¶28), and that “a command control unit 26 is embedded in [each] host control unit 20 of [each] HDMI node, as illustrated in FIG. 2” (*id.*, ¶29). Berg, ¶140.



Yung, Fig. 2.

Yung further discloses that “commands sent by one command control unit are received by all other command control units incorporated into the respective devices 10 of the network,” and “when one command control unit starts to transmit a command frame, it ... caus[es] a command line interrupt.” *Id.*, ¶35. Referring to Fig. 6, Yung explains that “[w]hen a command control unit is not transmitting, it **checks interrupts on the command bus.**” *Id.*, ¶36, Fig. 6 (block 68); Berg, ¶141.



Id., Fig. 6. Therefore, Yung discloses that the content playback device 10₁ in Fig. 1B checks the CEC bus for interrupts to determine if the CEC bus is in use, such as by being in use by the display device 10₅ (“*determining whether the first control bus is in use by the second device*”), and switches its operating mode accordingly. Berg, ¶142.

[1(c)] if the first control bus is not in use by the second device, conducting arbitration for control of the first control bus; and

Yung discloses and/or renders obvious this element. Berg, ¶143.

The ’520 patent discloses at least two scenarios for this element relating to conducting arbitration for control of the first control bus, depending on whether just the first device is attempting to take control if the bus is not in use, or whether the first device and a second device are both attempting to take control. Berg, ¶144,

In a first scenario, the '520 patent describes that “[i]f the bus is inactive, either side needs to arbitrate to gain control of it” (Ex.1001, 5:61-63) and a first device (called “a potential initiator”) “must first check if the line is busy” and if it has been idle “for a certain time period” then the device “may start arbitration” and become an “initiator” after “arbitration is won” and “start sending packets of data” over the bus. Ex.1001, 5:1-9. In other words, “[i]f it is determined that the CBUS [control bus] is idle ... or has been unused by the other device for a certain number of cycles ... then the use of the bus may be arbitrated” and the device may take control—“[o]therwise, the device may determine that the control bus is in use by the other device.” Ex.1001, 7:51-60; Berg, ¶145. This first scenario is claimed in, for example, claim 4, which recites that the “arbitrating for control of the first control bus” of claim 1 includes “determining the first control bus is idle or unused for a first time period,” “sending a low signal for a first number of cycles,” and then “taking control of the first control bus.” Ex.1001, 11:51-62 (claim 4); Berg, ¶146. This first scenario is illustrated by the highlighted path on the left side of Figure 3 below (304>306>310>312>314):

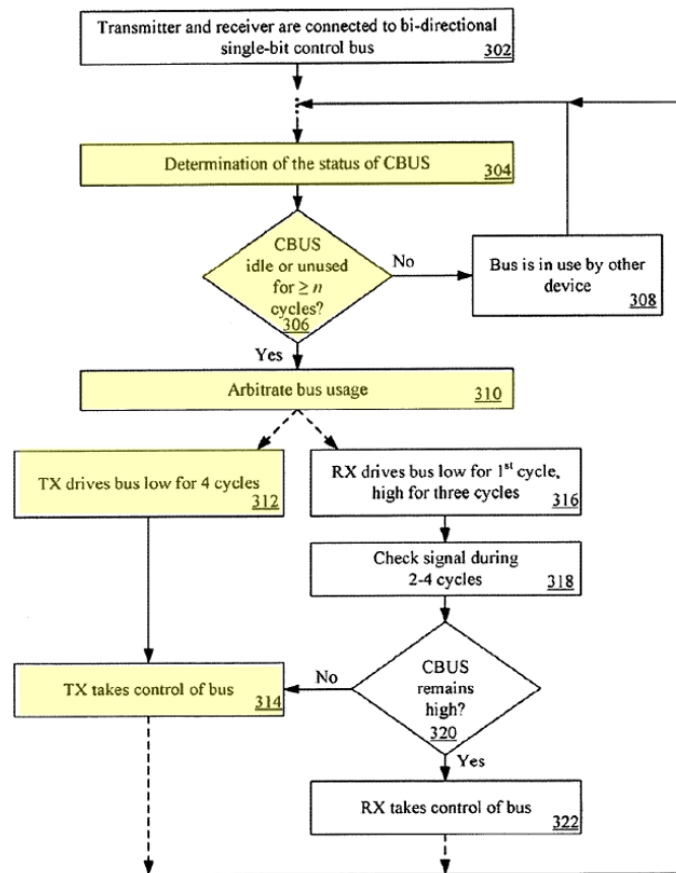


Fig. 3

Ex.1001, Fig. 3 (annotated); Berg, ¶147.

In a second scenario, both the transmitter (*first device*) and receiver (*second device*) attempt to take control of the control bus, such that “the transmitter and receiver arbitrate at about the same time, [and] the transmitter always wins the arbitration.” Ex.1001, 5:40-42, 7:60-67. Specifically, when “the transmitter seeks to control the bus,” the transmitter transmits a low signal for a time period of a certain number of cycles to “provide notice to the receiver that the transmitter is seeking control of the bus” and then “take[s] control of the bus.” Ex.1001, 7:60-67; Berg,

¶148. This second scenario is claimed in, for example, claims 18 and 25, which recite “the logic to arbitrate use of the first control bus [claimed in claims 12 and 19] is further operable to allow the transmitting device to take control of the first control bus if the transmitting device and the receiving device arbitrate use of the first control bus at the same time.” Ex.1001, 13:1-5 (claim 18), 14:21-25 (claim 25); Berg, ¶149. This second scenario is depicted by the highlighted path in Figure 3 below (304>306>310>316>318>320>314 and 304>306>310>312>314):

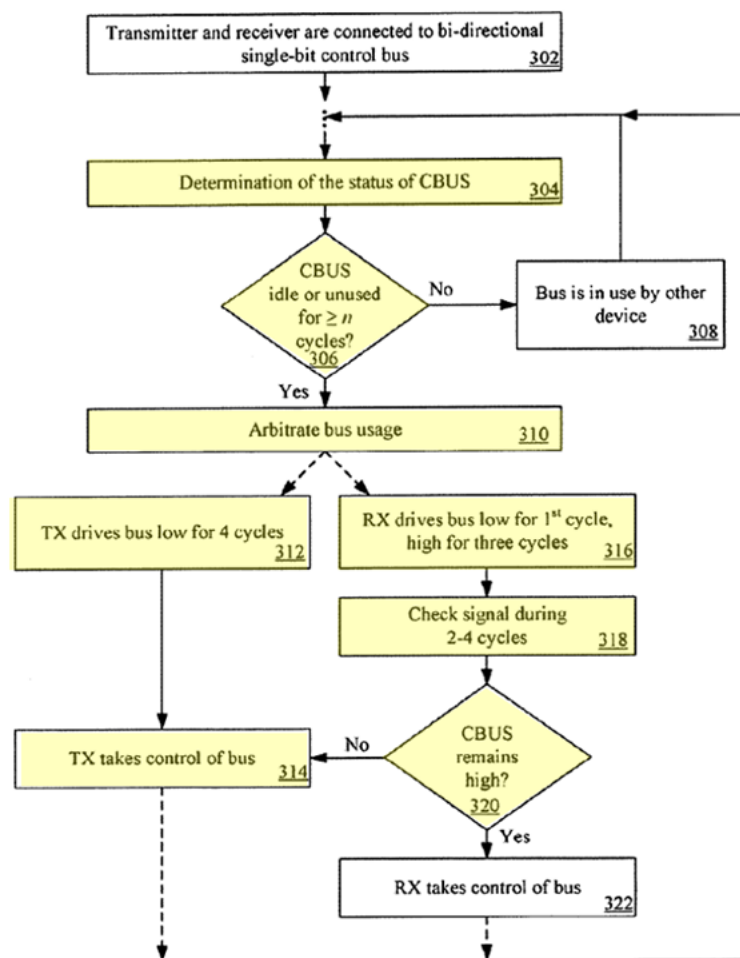


Fig. 3

Ex.1001, Fig. 3 (annotated); Berg, ¶150.

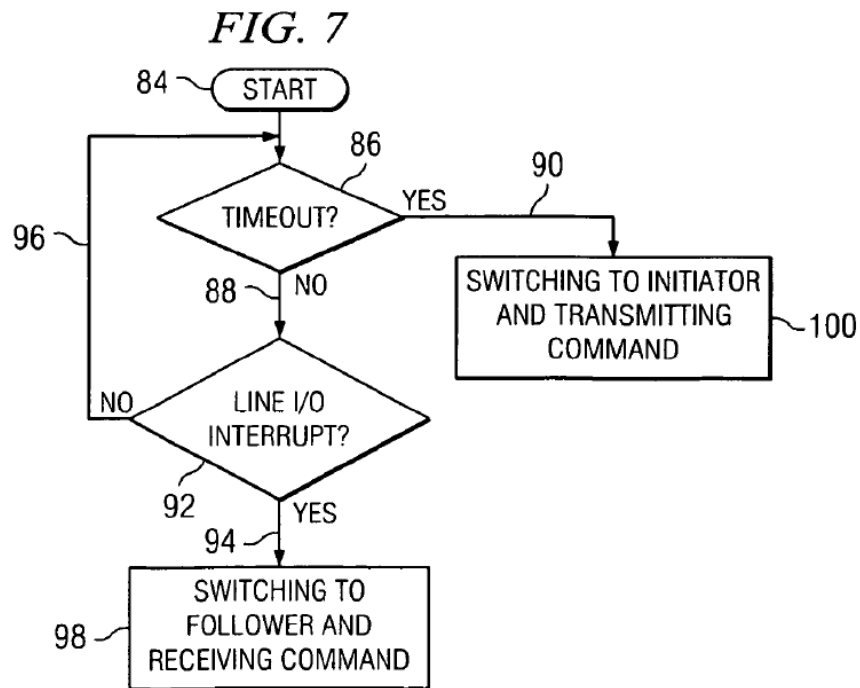
Thus, both scenarios described by the '520 patent fall within the scope of “*arbitration for control of the first control bus.*” Berg, ¶151.

Yung teaches both scenarios of “*arbitration for control of the first control bus.*” Yung, ¶¶35-38, Fig. 5-8; Berg, ¶152. As discussed in more detail below, Yung teaches performing an “*arbitration for control of the first control bus*” in at least two ways, both of which are consistent with the above-described scenarios of the '520 patent: first, Yung teaches that the first device checks to see if the bus is in use, waits a defined “signal free” time period to see if the bus is in use, and then takes control if it is not in use (or cedes control to the second device if it is using the bus); and second, Yung teaches that when the first device, after detecting the bus is not in use and waiting a defined “signal free” period, attempts to start transmitting on the bus, but if the second device is attempting to transmit simultaneously, an arbitration process is conducted to determine which device has higher priority. Yung, ¶¶35-38, Fig. 5-8; Berg, ¶153.

First, as described for [1(b)] above, Yung teaches that the command control unit of a first device first checks the bus to determine whether it is in use by the second device. Yung, ¶¶35-36, Fig. 6. If the bus is not in use by the second device, the “command control unit [of a device 10 in Fig. 1B] **does not transmit a message**

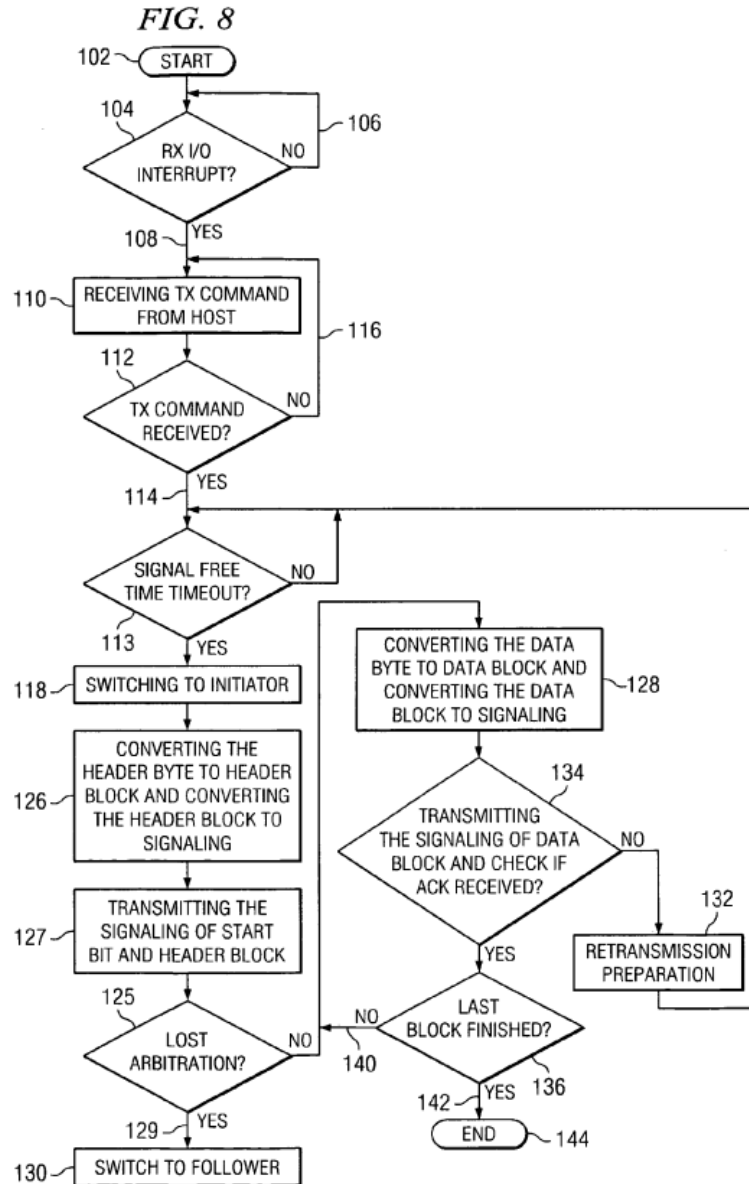
immediately even if it detects that the command bus is not used. It goes through a **‘wait for signal free time’** process...ensuring that no collision occurs.” *Id.*, ¶37. This “‘wait for free time’ process” is illustrated in Figure 7 and Yung describes that the “command control unit must wait before it switches to initiator mode.” *Id.*, ¶37, Fig. 7; Berg, ¶154.

Waiting for the signal free time to timeout is depicted in block 86 of Figure 7 below. *Id.*, ¶37, Fig. 7; Berg, ¶155. If an interrupt is detected on the bus (indicating it is in use), the command control unit of the first device becomes a follower. Yung, ¶¶37,9. But, if “the signal free time has elapsed without a higher priority interrupt being generated on the bus,” then the command control unit of the first device “takes control of the command bus and starts transmitting a message” as block 100, which Figure 7 describes as “switching to initiator and transmitting command.” *Id.*, ¶37, Fig. 7.



Yung, Fig. 7.

A similar “[w]aiting for free time’ process” in which the “command control unit [] wait[s] and see[s] if the command bus is active or inactive prior to transmission of signals onto the command bus” is also described with reference to Figure 8. Yung, ¶38, Fig. 8; Berg, ¶156. As shown below, “the command control unit waits a time period, namely the signal free time (block 113)” and “[o]nce the command bus is inactive for a pre-determined bit period since this process starts, it shall be time for the command control unit to use the command bus.” Yung, ¶38, Fig. 8. “The command control unit then switches to initiator mode (block 118).” Yung, ¶38, Fig. 8.



Yung, Fig. 8.

Yung's process of the first device determining "*the first control bus is not in use by the second device*" and then taking control of the bus after waiting for a

“signal free” time period aligns with *the first scenario* of the ‘520 patent described above for “conducting arbitration for control of the first control bus.” Berg, ¶157.

Second, Yung teaches that after the first device waits for “the signal free time” and “[o]nce the command bus is inactive for a pre-determined bit period” after this “[w]aiting for free time’ process” starts, the first device starts “to use the command bus” and starts transmitting. Yung, ¶38, Fig. 8. If the second device starts “sending [] simultaneously,” then an “arbitration process is conducted” so as to “determine[] which device has higher priority to have control of the command bus.” Yung, ¶38. “The arbitration process may be conducted according to pre-set rules,” such as “[f]or example, the device having logical address 0001 (with three leading zeros) has higher priority than another device having logical address 0010 (with only two leading zeros).” Yung, ¶38. This arbitration process determines which device is the winner, and the loser “switches back to follower mode” while the winner is confirmed in initiator mode and “starts transmitting.” Yung, ¶38; *see also id.*, ¶¶9, 35-37; Berg, ¶158.

Yung’s process of the first device determining “*the first control bus is not in use by the second device*” and then conducting an arbitration process to determine which device has priority in the event both devices attempt to start transmitting on

the bus aligns with *the second scenario* of the '520 patent described above for “conducting arbitration for control of the first control bus.” Berg, ¶159.

Yung, therefore, discloses and/or renders obvious this limitation [1(c)] in two ways by teaching two ways for performing this limitation that align with two scenarios disclosed in the '520 patent for this limitation. Berg, ¶160.

[1(d)] if the first device obtains control of the first control bus through the arbitration for control of the first control bus, the first device becoming an initiator and the second device becoming a follower,

Yung discloses and/or renders obvious this element. Berg, ¶161.

As explained in [1(c)] above, after waiting a signal free time, Yung's devices engage in arbitration to obtain control of the command bus through two ways that align with two scenarios disclosed in the '520 patent. Yung, ¶38; Berg, ¶162. In both instances, Yung discloses that *if the first device obtains control of the first control bus through the arbitration for control of the first control bus, then the first device becom[es] an initiator and the second device becom[es] a follower*. The '520 patent describes that an “initiator” is “the device gaining control of the bus,” while a “follower” is described as “the other device in the transaction,” i.e., the loser, which does not gain control. Ex.1001, 3:55-58.

In the first instance of arbitration in Yung, where a device takes control after a “signal free period” and begins transmitting, Yung teaches, with reference to

Figures 7 and 8, that after the device waits, it “switches to initiator mode.” Yung, ¶9 (“When the command control unit has a command to send, it waits a signal free time to avoid conflicts and then switches to **initiator mode**.”); ¶37 (“In preferred embodiments, each device on the network is associated with a predefined signal free time. A command control unit must wait before it switches to **initiator mode**.”), ¶38 (“Once the command bus is inactive for a pre-determined bit period since this process starts, it shall be time for the command control unit to use the command bus. The command control unit then switches to **initiator mode** (block 118).”). After switching to initiator mode, the device “takes control of the bus and starts transmitting.” Yung, ¶37. Thus, when the first device takes control of the bus after the waiting period, the first device would become an “*initiator*,” as claimed, both because Yung teaches that it switches to “initiator mode” and because the first device, at that point, aligns with the ’520 patent’s description of an “initiator” as being “the device gaining control of the bus.” Ex.1001, 3:55-58; Berg, ¶163.

Similarly, Yung teaches that the second device *becom[es] a follower* in this first instance of arbitration. “If a command control unit [of a device] detects that a command is to be sent by another command control unit in the network, it switches to a **follower mode**.” Yung, ¶9. Thus, where the first device switches to initiator mode and starts transmitting, the second device then switches to follower mode. *Id.*;

Berg, ¶164. The second device switching to follower mode would be “*becoming a follower*,” as claimed, because the ’520 patent describes a “follower” as being “the other device in the transaction,” which does not gain control. Ex.1001, 3:55-58; Berg, ¶164. Thus, in this first instance of *arbitration* in Yung, which is consistent with the first scenario described above in the ’520 patent, the first device, which takes control, *becom[es] an initiator*, and the second device, which does not take control, *becom[es] a follower*. Berg, ¶164.

In the second instance of arbitration in Yung, where a first device, after waiting, takes control after an arbitration is conducted to determine which of two simultaneously transmitting devices has priority, the first device, which is determined to have higher priority, is deemed the winner, while the second device is deemed the loser and “switches back to **follower mode**.” Yung, ¶38; Berg, ¶165. When the first device wins, it takes control of the bus and “starts transmitting.” Yung, ¶38; Berg, ¶165. This first device, which wins and takes control, would become an “*initiator*,” as claimed, because the ’520 patent describes an “initiator” as “the device gaining control of the bus.”² Ex.1001, 3:55-58; Berg, ¶165. The

² Although Yung’s second instance of *arbitration* uses a slightly different nomenclature in certain embodiments to refer to a device switching to an “initiator

second device, which loses, switches back to “follower mode,” and does not take control, would become a “*follower*,” as claimed, because the ’520 patent describes a “follower” as being “the other device in the transaction,” which does not gain control. Ex.1001, 3:55-58; Berg, ¶165.

Therefore, Yung discloses and/or renders obvious this limitation [1(d)] independently through each of the two instances of *arbitration* disclosed in Yung, which align with the two scenarios disclosed in the ’520 patent discussed above. Berg, ¶166.

mode” (e.g., at block 118 in Figure 8) before arbitration is completed with a simultaneously transmitting second device, Petitioners do not rely on this “initiator mode” for satisfying the requirement of *becoming an initiator* in this claim limitation. Petitioners instead rely only on the first device *becoming an initiator* by winning this arbitration against the second device and gaining control of the bus as a result, which is consistent with the ’520 patent’s description of an “initiator” being “the device gaining control of the bus.” Ex.1001, 3:55-58; Berg, ¶165, n.17.

[1(e)] then further comprising: converting one or more control signals for a standard protocol to one or more data packets, each of the one or more control signals representing one of a plurality of different types of control signals, each data packet including a plurality of bits to be transmitted; and

Yung discloses and/or renders obvious this element. Berg, ¶167.

First, Yung discloses “*converting one or more control signals for a standard protocol to one or more data packets.*” Berg, ¶168. The ’520 patent describes that “standard control commands and data are converted into data packets for transmission on the single bit control bus, with the data packets identifying the types of commands and data being transmitted” (Ex.1001, 3:34-37), and the receiver receives “one or more data packets containing command data” on the bus “and will handle each command as required **under the standard protocol 224, such as, for example, HDMI.**” *Id.*, 7:42-47. Thus, the ’520 patent describes HDMI as being a “standard protocol.” *Id.*, 7:44-47; *see also id.*, 6:33-37 (“a standard protocol device 104, such as a HDMI transmitting device”), claim 6 (“wherein the standard protocol is HDMI”); Berg, ¶168. Because the CEC protocol is part of the HDMI protocol (as discussed above with reference to paragraphs 4-5 of Yung), CEC controls signals are HDMI control signals (*id.*, 6:53-57, 7:31-34) and, thus, CEC is a “standard protocol” under the ’520 patent. *Id.*, 3:3-11, 3:34-42.

Further, the ’520 patent describes that the control commands can be comprised of “bytes” that are converted to data packets for transmission over the

bus. Ex.1001, 7:28-31 (“In some embodiments, **the control signals are converted from bytes of data to data packets** that identify the type of data within each packet.”), 9:19-20 (“In an embodiment, **control data bytes are formed into data packets** for transfer on the control bus.”); Berg, ¶169.

Yung’s teachings align with these disclosures of the ’520 patent and, therefore, disclose *converting one or more control signals for a standard protocol to one or more data packets*, because Yung teaches, after arbitration is complete such that one device has become an initiator and the other device has become a follower, “high-level” HDMI commands in the form of “CEC commands” comprised of “bytes” (*control signals for a standard protocol*) are converted to “frames,” such as “CEC frames” (*to one or more data packets*) for transmission over the bus. Yung, ¶¶4-5,28-29,31-34,42, claims 1, 2, & 7; Berg, ¶170. Specifically, Yung teaches that “CEC allows users to control all HDMI devices with a single remote and enables high-level functions such as ‘one-touch play’” and distributes commands it calls “CEC commands” between A/V components using a common communication protocol. Yung, ¶4. These “high-level commands” can be generated, for example, by a user “pressing a ‘play’ button of a DVD player 10₁” and transmitted to a receiving device, such as a TV 10₅. Yung, ¶28.

To do so, the host control unit 20 of the transmitter “constructs a command” that can be comprised of fields comprised of “bytes,” just like the control signals described in the ’520 patent, and that are recognizable by the command control unit 26 of the transmitter. Yung, ¶¶31-32; Berg, ¶171. “Once the recognizable command is determined to be valid, the fields of header and data bytes [of the command] are converted into command blocks for transmission.” Yung, ¶33. Specifically, the **“commands are transmitted as frames”** that are comprised of “a start bit and a header block” and “may further comprise one or more data blocks” where the header blocks and data blocks may be “command block[s]” that can be in “the command block format [] provided in the CEC protocol of the HDMI standard.” Yung, ¶34.

Yung teaches that these command frames can be “CEC frames defined by the CEC protocol.” Yung, ¶42, claim 1, claim 7. A POSITA would have understood CEC frames would have constituted “*data packets*,” because such frames are comprised of a start bit and a header block and can also be comprised of one or more additional data blocks. Berg, ¶172 (citing Yung, ¶34 and HDMI 1.0, CEC-9 & CEC-10 (describing CEC frame format)). Further, the ’520 patent expressly teaches that an example of a “data packet” transmitted over its bus can be a “CEC packet,” which a POSITA would have understood to refer to a CEC frame. Ex.1001, 9:48-59; Berg, ¶172 (citing Yung, ¶34; HDMI 1.0, CEC-9 & CEC-10 (describing CEC frame

format); HDMI 1.1, CEC-9 & CEC-10). Thus, the '520 patent includes a CEC frame as an example of a “data packet.” Berg, ¶172.

Finally, when Yung refers to “the command block format [] provided in the CEC protocol of the HDMI standard,” (Yung, ¶34), Yung, which was filed on November 3, 2004, would have been referring to the CEC frame format of either HDMI 1.0 (released December 9, 2002) or HDMI 1.1 (released May 20, 2004). *See* HDMI 1.0; HDMI 1.1; Berg, ¶173. Thus, the *one or more control signals for a standard protocol* that are *convert[ed]... to one or more data packets* in Yung are the CEC commands that are converted to CEC frames as defined by either HDMI 1.0 or HDMI 1.1 (i.e., the *standard protocol*). HDMI 1.0, CEC-9 to CEC-10; HDMI 1.1, CEC-9 to CEC-10; Berg, ¶173.

Second, Yung discloses “*each data packet including a plurality of bits to be transmitted*” because Yung teaches that the transmitted CEC frames’ command blocks are “**10-bit** command block[s]” in which “bits 1 through 8 are information bits” (Yung, ¶34) and in which the other two bits are an “‘end of message’ (EOM) bit, and an acknowledgement (ACK) bit.” Yung, ¶38; *see also id.*, claim 2 (“wherein the CEC frames contain bits”); Berg, ¶174.

Third, Yung discloses “*each of the one or more control signals representing one of a plurality of different types of control signals.*” Berg, ¶175. With regard to

“different types of control signals,” the ’520 patent explains that “[t]he receiver will read **the header** of each received data packet and determine **the control type** 222.” Ex.1001, 7:44-45. Each data packet includes “a 2-bit header 804 to indicate the **type** of data packet.” *Id.*, 9:23-27; Figs. 8-9. The two header bits “indicate whether the data packet includes **a DDC packet** (header field ‘00’), **a CEC packet** (header field ‘01’), **or private channel data** for the control bus (header field ‘10’).” *Id.*, Fig. 9, 9:31-32, 9:48-54. Thus, the ’520 patent treats CEC and DDC commands as “different types” of control signals. Berg, ¶175.

Similarly, Yung discloses that, in addition to transmitting CEC commands over CEC bus 12, it also uses HDMI cable 11 and “HDMI carries a display data channel (DDC),” which is used for transmitting control signals “for configuration and status exchange between HDMI nodes.” Yung, ¶27. Thus, Yung teaches “a plurality of different types of control signals” because it discloses both DDC and CEC controls signals, which the ’520 patent describes as express examples of “different types” of control signals. Berg, ¶176.

[1(f)] transmitting the generated data packets from the first device to the second device via the first control bus, and

Yung discloses and/or renders obvious this element. Berg, ¶177.

As explained in [1(a)] and [1(e)] above, Yung discloses a “content playback device 10₁” in Fig. 1B or other transmitting device that transmits commands in the

form of CEC frames over the CEC control bus to a receiving device, such as “display device 10₅” (“*transmitting the generated data packets from the first device to the second device via the first control bus*”). Yung, ¶¶7,38, Fig. 8 (block 134); Berg, ¶178.

[1(g)] wherein the receiving device is a device utilizing the standard protocol and the transmitting device is a mobile device utilizing a modified protocol, the modified protocol being a modification of the standard protocol that is not included in the standard protocol.

Yung in view of HDMI 1.3’s HDMI-C protocol renders obvious this element. Berg, ¶179.

Yung discloses that a transmitting device, such as content playback device 10₁, which can be “a DVD player, a CD player, or other devices,” transmits commands and data to receiving devices, such as display device 10₅, e.g., “a TV, a speaker, etc.,” using HDMI’s CEC protocol. Yung, ¶¶3-5,26-27; Berg, ¶180. Yung was filed on November 3, 2004. Yung, code (22). Thus, the version of HDMI that Yung would have been expressly implementing in its disclosure would have been a version that predated November 3, 2004.³ See HDMI 1.0; HDMI 1.1. Versions 1.0 or 1.1, as implemented by Yung, would have been understood by a POSITA to encompass a “standard protocol” because those versions only included connectors

³ HDMI 1.3 was not released until June 22, 2006. HDMI 1.3, 1.

that supported standard devices, such as DVD players and TVs, and not mobile devices. Berg, ¶181; HDMI 1.0; HDMI 1.1. The ‘520 patent describes a “standard protocol” as one designed for use with a “standard device” that uses a “standard cable.” Ex.1001, 1:43-44 (describing problem of an interface for a “standard device” being difficult to use for “smaller devices”), 2:17-18, 2:42-25, 4:26-29, 8:14-15; *see also id.* 2:56-59 (describing “a standard HDMI device (such as, for example, a television monitor).”).

Because Yung discloses a receiving device 10₅, such as a TV, that can receive HDMI signals (i.e., CEC frames), which the ’520 patent deems a “standard HDMI device,” and because the available versions of HDMI prior to Yung’s filing included only HDMI 1.0 and 1.1, which only supported standard devices, not mobile devices, Yung discloses using a “standard HDMI” protocol and, therefore, discloses “*wherein the receiving device is a device utilizing the standard protocol.*” Berg, ¶182.

Next, Yung in view of HDMI 1.3’s HDMI-C protocol renders obvious “*the transmitting device is a mobile device utilizing a modified protocol, the modified protocol being a modification of the standard protocol that is not included in the standard protocol.*” As discussed above in Section IX.C.3, Yung expressly teaches that its disclosure may be applied to future versions of CEC and other future protocols, and thus expressly teaches using its disclosure with future versions of

HDMI (Yung, ¶26); this would have motivated a POSITA to combine Yung with HDMI 1.3's HDMI-C protocol, which was a future HDMI protocol adopted in HDMI 1.3 about 18 months after the filing of Yung. Berg, ¶183. HDMI-C was added in HDMI 1.3 to support mobile devices through addition of the HDMI Type C connector. HDMI 1.3, iii (noting addition of Type C connector), 10 ("The Type C connector carries the same signals as the Type A but is **more compact and intended for mobile applications.**"); Berg, ¶184. While the HDMI-C connector uses the same 19 pin types as HDMI-A, the HDMI-C connector uses a different pin layout and a smaller form factor designed for mobile devices, as shown below. HDMI 1.3, 11 (Type A pin assignment), 13 (Type C pin assignment), 21-31 (Type A and Type C dimensions). Berg, ¶184.

4.1.4 Connector Pin Assignments

Table 4-1 Type A Connector Pin Assignment

PIN	Signal Assignment	PIN	Signal Assignment
1	TMDS Data2+	2	TMDS Data2 Shield
3	TMDS Data2–	4	TMDS Data1+
5	TMDS Data1 Shield	6	TMDS Data1–
7	TMDS Data0+	8	TMDS Data0 Shield
9	TMDS Data0–	10	TMDS Clock+
11	TMDS Clock Shield	12	TMDS Clock–
13	CEC	14	Reserved (N.C. on device)
15	SCL	16	SDA
17	DDC/CEC Ground	18	+5V Power
19	Hot Plug Detect		

HDMI 1.3, 11 (Type A pin assignment).

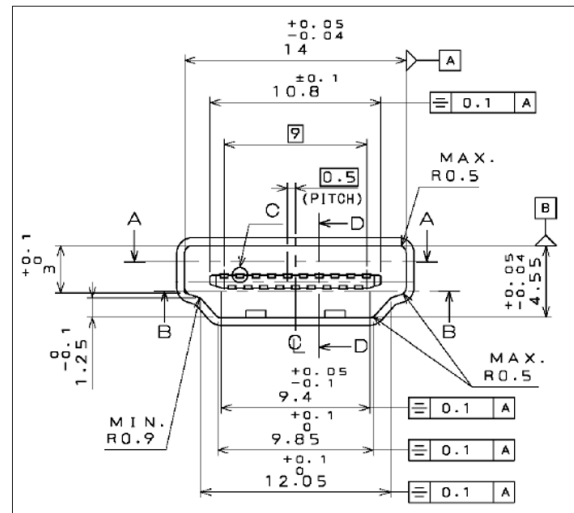
Table 4-3 Type C Connector Pin Assignment

PIN	Signal Assignment
1	TMDS Data2 Shield
2	TMDS Data2+
3	TMDS Data2-
4	TMDS Data1 Shield
5	TMDS Data1+
6	TMDS Data1-
7	TMDS Data0 Shield
8	TMDS Data0+
9	TMDS Data0-
10	TMDS Clock Shield
11	TMDS Clock+
12	TMDS Clock-
13	DDC/CEC Ground
14	CEC
15	SCL
16	SDA
17	Reserved
18	+5V Power
19	Hot Plug Detect

HDMI 1.3, 13 (Type C pin assignment). As shown above, in HDMI –C switched pins 1 and 2, pins 4 and 5, pins 7 and 8, and pins 10 and 11, among others.

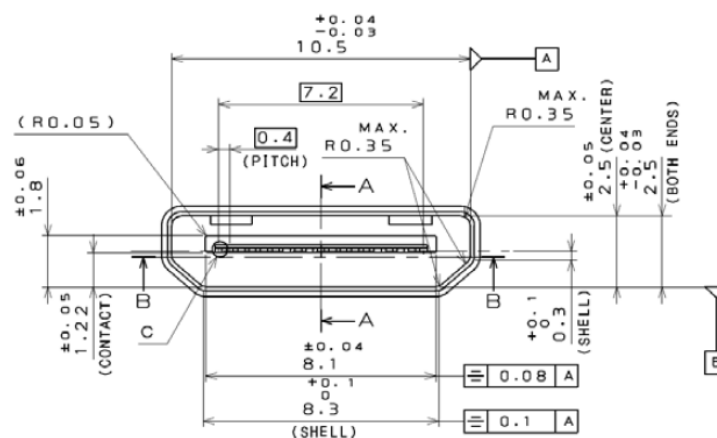
HDMI 1.3, 11, 13; Berg, ¶184. Further, as shown below, HDMI-C uses a smaller form factor than HDMI-A to support mobile devices. Berg, ¶184.

4.1.9.1 Type A Receptacle



HDMI 1.3, 21 (14mm x 4.55mm).

4.1.9.5 Type C Receptacle



HDMI 1.3, 29 (10.5mm x 2.5mm). HDMI 1.3 teaches that either a transmitter or receiver can use a HDMI-C connector, which is for mobile devices, and an HDMI-

A-to-HDMI-C adaptor can be used to interface between the two. HDMI 1.3, 10, 29-31, 37; Berg, ¶185. Thus, HDMI 1.3’s HDMI-C protocol discloses that the transmitting device can be a *mobile device*. Berg, ¶185.

Yung in view of HDMI 1.3’s HDMI-C protocol also discloses that the transmitting device is a mobile device *utilizing a modified protocol*. Berg, ¶186. The ’520 patent describes a “modified protocol” as a relative term in comparison to a “standard protocol” —a “modified protocol” being “a modification of the standard protocol that is not included in the standard protocol” that is “utiliz[ed]” by a “mobile device,” and that uses “a different cable,” such as a “mobile protocol cable,” which may be the ’520 patent’s coined “HDMI-M compatible cable,” as distinguished from “a standard protocol cable.” Ex.1001, claim 1, 4:24-31, 6:39-43, 7:4-8. The ’520 patent describes that this need for a modified/mobile protocol arises from the difficulty of using an interface designed for a standard device with smaller devices, such as mobile devices. *Id.*, 1:40-43. The ’520 patent describes that its so-called “HDMI-M” cable may “in some embodiments” utilize “fewer lines because of smaller device size,” which indicates that not all embodiments of its HDMI-M cable require fewer lines and can instead encompass the same number of lines. *Id.*, 8:61-64. HDMI 1.3’s HDMI-C protocol discloses a *mobile device utilizing a modified protocol* in a manner consistent with the ’520 patent because, as discussed above,

HDMI-C uses a different connector having a different pin arrangement and smaller form factor designed for connection to mobile devices. HDMI 1.3, 10, 11, 13, 21, 29-31; Berg, ¶187. Also like the '520 patent, HDMI 1.3 discloses an HDMI Type C-to-Type A adapter for connecting a mobile device to a standard device. HDMI 1.3, 37. Berg, ¶188.

Further, Yung in view of HDMI 1.3's HDMI-C protocol renders obvious *the modified protocol being a modification of the standard protocol that is not included in the standard protocol*. Berg, ¶189. As discussed above, Yung's implementation of either HDMI 1.0 or 1.1 constitutes "*the standard protocol*" that does not support mobile devices while HDMI 1.3's HDMI-C protocol constitutes "*the modified protocol*," because HDMI-C constitutes *a modification of the standard protocol* (HDMI 1.0 or 1.1) *that is not included in the standard protocol* given that neither HDMI 1.0 nor 1.1 used by Yung include the HDMI-C protocol for mobile devices. HDMI 1.0; HDMI 1.1; HDMI 1.3, iii (noting the addition of Type C as a "[s]ignificant new feature"); Berg, ¶189.

Finally, Petitioners note that the Examiner rejected claims 6-8, among others, as unpatentable over Kobayashi in view of knowledge commonly known in the art, as evidenced by a Lindy article. Ex.1002, 141 (9-25-2009 Office Action, 11). Specifically, while the examiner noted Kobayashi was "silent as to the protocol

used,” he took official notice based on Lindy “that connecting a device having a standard protocol (HDMI) to a modified protocol (mini-HDMI) [was] well known in the art” and that “devices capable of communicating with both . . . [were] well known in the art.” *Id.* In response, the Applicant argued that Lindy was directed to HDMI 1.3 and that the HDMI 1.3 Type C connector used “the same 19-pin connection” as HDMI 1.3’s “standard HDMI.” *Id.*, 186 (12-29-2009 Response, 27); Berg, ¶190. The Applicant further argued that “[t]hus, the Mini-HDMI connector shown in *Lindy* does not illustrate a modified protocol” and “illustrates an adaptor (sic) for a smaller scale connector that is provided in the HDMI [1.3] specification.” *Id.*

These arguments do not affect Petitioner’s mapping above for several reasons. Berg, ¶191. First, unlike the combination of Yung and HDMI 1.3, the combination of Kobayashi and Lindy did not include two different protocols. The only protocol at issue in Kobayashi and Lindy is HDMI 1.3, which the Examiner mapped to both the “standard protocol” and the “modified protocol” (e.g., the HDMI Type C connector). Thus, Applicant was merely distinguishing the Examiner’s mapping of Lindy’s use of HDMI 1.3’s HDMI-C connector from HDMI 1.3’s “standard HDMI” connector contained in the same HDMI 1.3 specification as “not illustrat[ing] a modified protocol,” because HDMI-C is “provided in the HDMI [1.3] specification.”

Thus, Applicant was merely arguing that HDMI-C is not a modification of HDMI 1.3 and thereby not a “modified protocol” because HDMI-C is contained in HDMI 1.3. Petitioners, on the other hand, have mapped Yung’s disclosed HDMI protocol, which uses HDMI 1.0 or 1.1, as the “standard protocol” that does *not* include the “modified protocol” of HDMI Type C, which was first contained in HDMI 1.3. Thus, unlike the mapping addressed by the Examiner, Petitioners’ mapping identifies a modified protocol that is *a modification of the standard protocol that is not included in the standard protocol*. Berg, ¶192.

Second, notwithstanding that claims 16 and 25 recite “wherein the standard protocol is HDMI” and the ‘520 patent states that its receiver can use “standard protocol 224, such as, for example, HDMI” (Ex.1001, 7:46-47), the ’520 patent does not consider all HDMI protocols to be “standard protocols,” because its preferred embodiment of a “modified protocol” is coined “HDMI-M,” which is an HDMI protocol for connecting to mobile devices. Ex.1001, 2:61-62 (“As used herein, HDMI-M is utilized here to indicate a mobile device utilizing a modified protocol.”), 6:37-41, 7:6-8, 8:13-17, 8:61-64; Berg, ¶193. Thus, Applicant could not have been arguing that all HDMI protocols are considered “standard protocols” by the ’520 patent.

Third, Applicant was incorrect to assert that HDMI Type C uses “the same 19-pin connection as standard HDMI [i.e., HDMI Type A],” because, as discussed above, Type C uses a different configuration of pins than Type A and a smaller form factor. Berg, ¶194. Moreover, the ’520 patent itself makes clear that only “in some embodiments” does its modified protocol for mobile devices (HDMI-M) use “fewer lines,” indicating that some embodiments of a “modified protocol” can use the same number of lines/pins. Ex.1001, 8:61-64; Berg, ¶194.

Fourth, as discussed above, the ’520 patent merely describes a “modified protocol” in the context of a different, mobile interface that can be designed for smaller mobile devices, as compared to a “standard protocol” that uses a standard interface for standard-size devices. Ex.1001, 1:41-45, 2:56-59, 4:24-31, 6:39-43, 7:4-8. HDMI 1.3’s addition of HDMI-C thus aligns precisely with these teachings of the ’520 patent because it uses a different cable having a smaller form factor connector that is arranged differently and designed for mobile devices. Berg, ¶195.

Finally, Applicant’s statements are inapposite here because Applicant ignored the ’520 patent’s statement that only “some embodiments” use fewer lines/pins, and Applicant’s argument regarding “a smaller scale connector” than a cable having a smaller scale connector designed for mobile devices would not be a modified protocol overlooked that the ’520 patent’s only distinction between a standard

protocol and a modified protocol is the use of a modified/different cable designed for smaller, mobile devices that is not the same as that used for standard-size devices.

Berg, ¶196.

5. Claim 4

[4(pre)] The method of claim 1, wherein, if the first device is a transmitting device for transmission of data to the second device, then arbitrating for control of the first control bus includes:

To the extent this preamble is limiting, Yung discloses and/or renders obvious this element for the same reasons set forth above for elements [1(a)] and [1(c)].

Berg, ¶197.

[4(a)] determining the first control bus is idle or unused for a first time period;

Yung discloses and/or renders obvious this element for the same reasons set forth above for element [1(b)]. Berg, ¶198.

[4(b)] if the first control bus is idle or unused for the first time period, then sending a low signal for a first number of cycles; and

Yung discloses and/or renders obvious this limitation, and, in addition, Yung in view of HDMI 1.3 renders obvious this element. Berg, ¶199.

Yung discloses that its transmitting device, such as the content playback device 105 in Fig. 1B, waits for a time period, such as a “signal free time period” to determine whether the CEC command bus is inactive and, if so, then begins transmitting a signal on the bus (“*if the first control bus is idle or unused for the first*

time period”). See [1(b)]; Berg, ¶200. Yung further discloses that this initial signal transmission may “pull[] the high voltage on the command bus . . . to a low voltage, causing a command line interrupt” (*then sending a low signal*). Yung, ¶35; *see also id.*, ¶¶36-38. Yung teaches that this low voltage may be transmitted for a “low voltage . . . period[]” having “a time duration” that is measured by the command control units of other devices in the network. Yung, ¶35. A POSITA would have understood that this “low voltage period” that has “a time duration” constitutes a *first number of cycles* because it is a defined time period having a duration, which would be consistent with at least one cycle defined by a “period” where the voltage is “low.” Berg, ¶201.

To the extent it is argued that Yung does not disclose *sending a low signal for a first number of cycles*, then this would have been obvious over Yung in view of HDMI 1.3. HDMI 1.3 discloses that after “[a]n initiator...tests[s] that the control signal line is free for use,” it then “generates a high to low transition on the CEC line, followed by a series of pulses comprising data bits whose starting point is defined by a high to low transition.” HDMI 1.3, CEC-7; Berg, ¶202. HDMI 1.3 teaches that “CEC line arbitration commences with the leading edge of the start bit and continues until the end of the initiator address bits within the header block.”

HDMI 1.3, CEC-14. The initiator address bits are contained in bits one to four of the header block, as shown below. HDMI 1.3, CEC-11.

Header Block									
3	2	1	0	3	2	1	0	-	-
Initiator				Destination				EOM	ACK

CEC Figure 7 Header Block

HDMI 1.3, CEC-11 (CEC Figure 7) (annotated). And these data bits, after the start bit, “have consistent timing,” which can be a “nominal data bit period” of “2.4ms.” HDMI 1.3, CEC-7 to CEC-8. Thus, HDMI 1.3 discloses an initiator transmitting a series of four data bits where each bit’s starting point is defined by a high to low transition (*sending a low signal*) that occurs during a consistent, defined bit period for each of the four bits (*for a first number of cycles*). Berg, ¶203. This teaching is consistent with the ’520 patent’s description that “[i]n one implementation, to arbitrate, a transmitting device drives the bus low for 4 bit times” and “the receiver drives high for a short time at the start of each bit time and then releases the bus” such that “the bus becomes low” during each bit time “if the transmitter drives the bus low to obtain the bus.” Ex.1001, 5:10-11, 5:22-24; Berg, ¶204.

[4(c)] after the conclusion of the first number of cycles, then taking control of the first control bus.

Yung in view of HDMI 1.3 renders obvious this element. Berg, ¶205. HDMI 1.3 discloses that “[o]nly one initiator is allowed at any one time” and “[a] control signal line arbitration mechanism avoids conflict when more than one initiator begins transmitting at the same time.” HDMI 1.3, CEC-7. Specifically, “CEC line arbitration “continues until the end of the initiator address bits within the header block” (i.e., *after the four-bit periods constituting conclusion of the first number of cycles*), and after arbitration is completed, it is determined whether the initiator loses to a second initiator, or whether the initiator wins, *taking control of the first control bus*. HDMI 1.3, CEC-14; Berg, ¶206. Further, Yung, which uses CEC, discloses that the device that wins arbitration “takes control of the command bus.” Yung, ¶37.

6. Claim 8

[8] The method of claim 1, wherein standard protocol requires that the plurality of different types of control signals be transmitted over a plurality of different control buses.

Yung discloses and/or renders obvious this limitation. Berg, ¶207.

First, Yung discloses this limitation. As discussed above for [1(e)], Yung discloses using a “*standard protocol*” in the form of the HDMI protocol as it existed at the time of Yung (i.e., HDMI 1.0 or 1.1) and its included CEC protocol. Yung further discloses that the HDMI protocol (i.e., HDMI 1.0 or 1.1) also includes a display data channel (“DDC”) that is used for configuration and status exchange

between HDMI nodes. Yung, ¶27; Berg, ¶208. A POSITA would have understood that in Yung’s HDMI protocol (i.e., HDMI 1.0 or 1.1), “[t]he DDC is used by the Source to read the Sink’s Enhanced Extended Display Identification Data (E-EDID) in order to discover the Sink’s configuration and/or capabilities.” Berg, ¶209; HDMI 1.0, 9; HDMI 1.1, 9. Further, the DDC would have been understood to be a “separate communication channel” from CEC. Berg, ¶210; HDMI 1.0, 77; HDMI 1.1, 83. As such, a POSITA would have understood DDC to be a second control bus in addition to the CEC control bus (*plurality of different control buses*). Berg, ¶210. Further, DDC connections send control signals to perform the function of enabling physical address discovery for CEC devices, which “cannot alone ascertain the physical connectivity of the network,” and, thus, the DDC signals sent over a separate DDC bus are *required* to allow CEC to ascertain physical connectivity of the network. Berg, ¶211; HDMI 1.0, CEC-14; HDMI 1.1, CEC-14. This is **a first way** that the HDMI protocol *requires the plurality of different types of control signals be transmitted over a plurality of different control buses*. Berg, ¶211.

As discussed above for element [1(e)], Yung discloses *a plurality of different types of control signals* through its disclosure of transmitting DDC signals and CEC signals. Berg, ¶212. Further, Yung’s HDMI standard (i.e., HDMI 1.0 or 1.1) requires these DDC signals and CEC signals be transmitted over “separate

communication channels,” i.e., the DDC bus and CEC bus, respectively. Berg, ¶212; HDMI 1.0, 77; HDMI 1.1, 83. This is *a second way* that the HDMI protocol *requires the plurality of different types of control signals be transmitted over a plurality of different control buses*. Berg, ¶212. A POSITA, therefore, would have understood that Yung discloses and/or renders obvious that *the standard protocol* (i.e., HDMI 1.0 or 1.1) *requires the plurality of different types of control signals be transmitted over a plurality of different control buses*. Berg, ¶213.

7. Claim 9

[9] The method of claim 1, wherein the transmission of a data packet by the initiating device⁴ is followed by an acknowledge (ACK) message from the following device to the initiating device on the first control line.

Yung discloses and/or renders obvious this claim. Berg, ¶214.

Yung discloses that “[o]n the follower side, a receiving function is performed, which is illustrated by an exemplary flowchart in FIG. 9.” Yung, ¶39. Yung further explains that after the “follower receives each bit” of the transmitted frames, the follower “combines bits into bytes and sends an **acknowledgement** for each byte.”

⁴ Claim 1, on which claim 9 depends, does not recite an “initiating device,” a “following device,” or a “first control line.” Petitioners reserve the right to argue that claim 9 and its dependents are indefinite due to the lack of antecedent basis for those limitations.

Id., ¶39; *see also id.*, ¶¶33-34,42. Specifically, “[a]fter eight bits are received, the eight bits are combined to form a byte (block 164), and an **acknowledgement** is sent to the initiator (block 170).” *Id.*, ¶39; *see also id.*, ¶38 (“**Acknowledgement** is expected from the receiver; otherwise re-transmission occurs.”), claim 21 (“checking acknowledgement from the remote command unit”). Berg, ¶215.

Further, for facilitating this “acknowledgment” sent by the follower device back to the initiator device, Yung teaches that the initiator device adds an “ACK” bit or “acknowledgment (ACK) bit” to the end of command blocks that are transmitted via frames over the command bus to the follower device. Yung, ¶38; Berg, ¶216. Specifically, the ACK bit can be the “tenth bit ‘acknowledgment’ indicating the received status of a command block” that “contains 10 bits.” *Id.*, ¶34. A POSITA would have understood that such ACK bits in Yung, which uses CEC, are used by follower devices to acknowledge receipt by the follower changing an ACK bit set to “1” by the initiator to a “0” and transmitting the ACK bit back over the CEC bus to the initiator, which reads a “1” as indicating a successful transmission of the block. Berg, ¶216 (citing HDMI 1.0, CEC-9 to CEC-10). A POSITA, therefore, would have understood that the acknowledgment is transmitted over the same CEC bus over which the initiator transmits to the follower. Berg, ¶217. Therefore, Yung discloses and/or renders obvious this limitation.

8. Claim 10

[10] The method of claim 9, wherein the initiating device transmits a second data packet after receipt of the ACK message from the following device.

Yung disclosed and/or renders obvious this limitation, and, in addition, Yung in view of HDMI 1.3 also renders obvious this claim. Berg, ¶218.

First, Yung discloses and/or renders obvious this limitation. Referring to step 134 of Fig. 8, Yung discloses that following transmission, a transmitter’s “command control unit then checks whether the transmitted byte has been acknowledged or not” by the receiving device, and if transmission was successful, at step 136, additional “bytes are transmitted one by one until all the bytes have been transmitted.” Yung, ¶38, ¶39 (“The follower continues receiving until it determines that the last command block is received (block 174) [as] indicated by an EOM bit in the command block.”); Berg, ¶219. As discussed for [1(e)] above, Yung’s frames (*data packets*) are comprised of “command blocks” comprised of “bytes,” such as “header and data bytes,” and may be in the format of CEC frames. Yung, ¶33 (“Once the recognizable command is determined to be valid, the fields of header and data bytes are converted into command blocks for transmission.”), ¶34 (stating that “commands are transmitted in frames” and the command block format may be that provided in the CEC protocol); Berg, ¶220. As discussed for claim 9 above, “the transmitted byte [that is] acknowledged or not” in Yung would be understood to be the ACK bit

at the end of a command block of a frame (a first data packet). Berg, ¶221. A POSITA, therefore, would have understood that the bytes transmitted by the transmitter after receipt of an acknowledgement “until all bytes have been transmitted” and “until the last command block is received” would have constituted transmitting an additional CEC frame, which would be a *second data packet* transmitted after acknowledgment of the ACK bit in the first data packet (i.e., *the initiating device transmits a second data packet after receipt of the ACK message from the following device*). *Id.*

To the extent it is argued that Yung does not disclose or render obvious this limitation, Yung in view of HDMI 1.3 renders obvious this limitation. Berg, ¶222. HDMI 1.3 teaches that, for certain messages, an ACK bit can be “negatively acknowledged” by the follower device adjusting a “1” ACK bit to a “0” ACK bit (an *ACK message*), indicating to the initiator that the message/frame has been “rejected” by the follower. HDMI 1.3, CEC-11 to CEC-12. In such a case, a frame can be re-transmitted, which a POSITA would have understood to constitute the transmitting of a new frame (*second packet*) given that the first frame was rejected and is, therefore, lost. *Id.*, CEC-12; Berg, ¶223. A POSITA, therefore, would have understood this to constitute *wherein the initiating device transmits a second data packet after receipt of the ACK message from the following device*. *Id.*

9. Claim 12

[12(pre)] A transmitting device comprising:

See claim element [1(pre)] in Sec. IX.C.4. Additionally, Yung discloses a “*transmitting device*” as a “content playback device 10₁” in Fig. 1B. Yung, ¶27. Berg, ¶224.

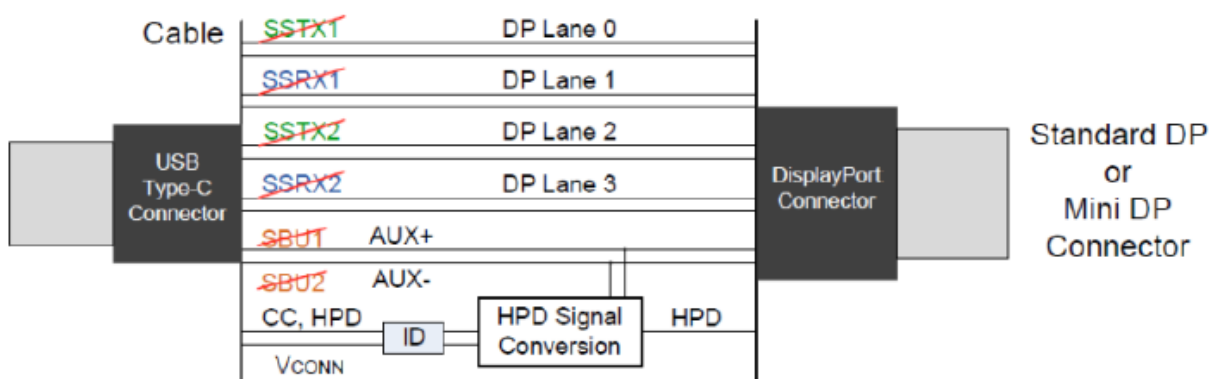
[12(a)] a connection to a single first control bus, the first control bus being a bi-directional, single-line bus, wherein the transmitting device is operable for coupling with a receiving device via the first control bus;

Yung discloses and/or renders obvious this element for the same reasons set forth above for [1(a)]. Berg, ¶225. Further, Yung discloses that its CEC bus, such as CEC bus 12, can be “referred to as a command line, or command bus” (*control bus*) and that “[t]he CEC bus preferably consists of a **single**, bi-directional line.” Yung, ¶12.

To the extent *the transmitting device comprising a connection to a single first control bus* is not limited to a connection to one and only one control bus and is instead broad enough to encompass a transmitting device being connected to more than one control bus, as Patent Owner contends in parallel litigation, then Yung discloses this limitation. Berg, ¶226. Specifically, under this interpretation of Patent Owner, Yung’s CEC bus is a “**single first control bus**” notwithstanding that Yung’s

transmitting device (e.g., device 10₁) is also connected to Yung’s receiving device (e.g., device 10₅) by HDMI cable 11, in addition to CEC bus 12.

Specifically, in its district court preliminary infringement contentions attached to the complaint, Patent Owner accuses, *inter alia*, products employing DisplayPort Alt Mode on USB-C. Ex.1010, 1-3. Patent Owner maps the “single first control bus” to the “CC bus” of USB4. *Id.*, 5-8. However, as is clear from Patent Owner’s contentions, the CC bus is not the only control bus to which the transmitter is connected. Berg, ¶227. As shown in the following figure from a DisplayPort Alt Mode overview (quoted in the preliminary infringement contentions), the USB-C side includes multiple control buses, including AUX, HPD, and VCONN in addition to the CC bus, and the DisplayPort side includes multiple control buses, including AUX and HPD.:



Id., 12; Berg, ¶227.

Thus, Patent Owner interprets “single first control bus” as not requiring a connection to one and only one control bus, but as encompassing a connection to multiple control buses. Under this interpretation, Yung’s CEC bus 12 is a “single first control bus.” Berg, ¶228.

[12(b)] logic to convert each of one or more control signals into a data packet, each of the one or more control signals being one of a plurality of different types of control signals for a standard protocol, each data packet including a plurality of bits to be transmitted;

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).⁵ Under Patent Owner’s position that this limitation is not a means-plus-function limitation and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation and, in addition, Yung in view of HDMI 1.3 also renders obvious this limitation for the reasons set forth above for [1(e)]. Berg, ¶229.

⁵ Petitioners reserve the right to argue in the co-pending litigations that this limitation is a means-plus-function limitation that lacks disclosed corresponding structure and is, therefore, indefinite. However, this Petition applies Patent Owner’s proposed construction.

For example, Yung explains that its flowcharts and description (including Figures 8-9, for example) “conceptually illustrate **the logic**; [though] the particular computer language used to implement **the logic** may vary, depending on the programmer’s preference.” Yung, ¶33. Yung further discloses that the features of the invention can be implemented in “a general purpose or special purpose processor[, which] could be realized using an ASIC, a logic array, or other special purpose circuitry. Alternatively, the functions could be accomplished using hard-wired **logic circuits**, custom circuits, and the like.” Yung, ¶43. Berg, ¶230.

[12(c)] a transmitter, the transmitter to transmit the data packets to the receiving device on the first control bus; and

Yung discloses and/or renders obvious this element for the reasons set forth above for [1(f)]. Additionally, a POSITA would have understood that Yung’s “content playback device 10₁” in Fig. 1B includes a transmitter because of its transmitting function. Berg, ¶231.

[12(d)] logic to arbitrate use of the first control bus, the logic to arbitrate use being operable to: determine whether the control bus is in use by the receiving device, and

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).⁶ Under

⁶ *Supra* n.5.

Patent Owner’s position that this limitation is not a means-plus-function limitation and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation for the reasons set forth above for [1(b)], [1(c)], and [1(d)]. Berg, ¶232.

For example, Yung explains that its flowcharts (including Figures 5-8, which illustrate the arbitration process) “conceptually illustrate the logic; the particular computer language used to implement the logic may vary, depending on the programmer’s preference.” Yung, ¶33. As explained above for [12(b)], Yung discloses that the features of the invention, such as the disclosed arbitration, can be implemented in “a general purpose or special purpose processor[, which] could be realized using an ASIC, a logic array, or other special purpose circuitry. Alternatively, the functions could be accomplished using hard-wired logic circuits, custom circuits, and the like.” Yung, ¶43; Berg, ¶233.

[12(e)] if the first control bus is not in use by the receiving device, conduct arbitration for control of the first control bus, and

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).⁷ Under Patent Owner’s position that this limitation is not a means-plus-function limitation

⁷ *Supra* n.5.

and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation for the reasons set forth above for [1(c)]. Berg, ¶234.

[12(f)] wherein the receiving device is a device utilizing the standard protocol and the transmitting device is a mobile device utilizing a modified protocol, the modified protocol being a modification of the standard protocol that is not included in the standard protocol.

Yung in view of HDMI 1.3's HDMI-C protocol renders obvious this element for the reasons set forth above for [1(g)]. Berg, ¶235.

10. Claim 15

[15] The transmitting device of claim 12, further comprising a switchable pull-up circuit coupled with the first control bus.

Yung in view of HDMI 1.3 renders obvious this element. Berg, ¶236.

HDMI 1.3 discloses that a “pull-up circuit” can be “disconnected from the CEC line when the device is off.” HDMI 1.3, CEC-6; *see also* HDMI 1.3, 52. Accordingly, a POSITA would have understood that the pull-up circuit connected with the CEC line (“*pull-up circuit coupled with the first control bus*”) is switchable between being a pull-up circuit and a pull-down circuit, as disclosed in the '520 Patent. *See* Ex.1001, 4:4-9. Berg, ¶237.

11. Claim 18

[18] The transmitting device of claim 12, wherein the logic to arbitrate use of the first control bus is further operable to take control of the first control bus if the transmitting device and the receiving device arbitrate use of the first control bus at the same time.

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).⁸ Under Patent Owner’s position that this limitation is not a means-plus-function limitation and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation for the reasons set forth above for [1(c)] with regard to the second arbitration scenario taught by Yung in which the transmitting device and receiving device arbitrate use of the first control bus at the same time. Berg, ¶238.

Further, Yung discloses that the transmitting device can win the arbitration and take control of the first bus in this second scenario, as explained above for [1(c)]. Berg, ¶239. Yung further discloses that the features of the invention can be implemented in “a general purpose or special purpose processor[, which] could be realized using an ASIC, a logic array, or other special purpose circuitry.

⁸ *Supra* n.5.

Alternatively, the functions could be accomplished using hard-wired logic circuits, custom circuits, and the like.” Yung, ¶43.

12. Claim 19

[19(pre)] A receiving device comprising:

Yung discloses and/or renders obvious this element for the reasons set forth above for 1[a]. Additionally, Yung discloses a “receiving device” as a “display device 105” in Fig. 1B. Yung, ¶27. Berg, ¶240.

[19(a)] a connection to a single first control bus, the first control bus being a bi-directional, single-line bus wherein the receiving device is operable for coupling with a transmitting device via the first control bus;

At least under UCT’s interpretation of this limitation for purposes of infringement, Yung discloses and/or renders obvious this element for the same reasons set forth above for [12(a)] and [1(a)]. Berg, ¶241. Like [12(a)], UCT maps “single first control bus” of [19(a)] to the USB CC bus in either HDMI Alt Mode or DisplayPort Alt Mode over USB-C. Thus, for purposes of infringement, UCT proposes that “single first control bus” does not require a connection to one and only one control bus. At least as interpreted by UCT for purposes of infringement, the CEC bus of Yung and/or HDMI 1.3 is a “single first control bus.” *Id.*

[19(b)] a receiver to receive one or more data packets on the first control bus, each of the one or more data packets representing one of a plurality of different types of control signals;

Yung discloses and/or renders obvious this element, and, in addition, Yung in view of HDMI 1.3 also renders obvious this element for the reasons set forth above for [1(e)] and [1(f)]. Berg, ¶242.

[19(c)] logic to convert each of the one or more data packets into a control signal; and

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).⁹ Under Patent Owner’s position that this limitation is not a means-plus-function limitation and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation for the reasons set forth above for [1(e)]. Berg, ¶243.

Further, Yung teaches that the command blocks of the CEC frames (*data packets*) are received by the receiver/follower, which “strips off the acknowledge bit and end of message bit” of the blocks and then “combines and converts them into a command after all blocks are received, and sends it to the host control unit” (*the receiver . . . convert[ing] each of the one or more data packets into a control signal*).

⁹ *Supra* n.5.

Yung, ¶39, Fig. 9. Yung explains that its flowcharts and description (including Figures 8-9, for example) “conceptually illustrate the logic; the particular computer language used to implement the logic may vary, depending on the programmer’s preference.” Yung, ¶33. Yung further discloses that the features of the invention can be implemented in “a general purpose or special purpose processor[, which] could be realized using an ASIC, a logic array, or other special purpose circuitry. Alternatively, the functions could be accomplished using hard-wired logic circuits, custom circuits, and the like.” Yung, ¶43; Berg, ¶244.

[19(d)] logic to arbitrate use of the first control bus, the logic to arbitrate use being operable to: determine whether the control bus is in use by the transmitting device, and

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).¹⁰ Under Patent Owner’s position that this limitation is not a means-plus-function limitation and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation for the reasons set forth above for claim elements [1(b)], [1(c)], and [1(d)]. Berg, ¶245.

¹⁰ *Supra* n.5.

Further, Yung discloses and/or renders obvious that the second device or receiver may determine whether the control bus is in use by the transmitting device, such as by the receiver receiving “an interrupt” indicating the bus is in use by the transmitter and switching to a follower mode. Yung, ¶¶36-37. Further, Yung discloses that the command control units 26 of its HDMI nodes 10 can operate as both transmitters and receivers (or initiators and followers). Yung, ¶¶26,28,35. As such, Yung’s disclosures with regard to the arbitration performed by its command control units and the determining of whether the CEC bus is in use, including that for element [1(c)] above, applies to both receivers and transmitters operating as initiators and followers, respectively, and vice versa. Yung, ¶¶36-38; Berg, ¶246. Yung explains that its flowcharts (including Figures 5-8, which illustrate the arbitration process) “conceptually illustrate the logic; the particular computer language used to implement the logic may vary, depending on the programmer’s preference.” Yung, ¶33. Yung further discloses that the features of the invention can be implemented in “a general purpose or special purpose processor[, which] could be realized using an ASIC, a logic array, or other special purpose circuitry. Alternatively, the functions could be accomplished using hard-wired logic circuits, custom circuits, and the like.” Yung, ¶43; Berg, ¶247.

[19(e)] if the first control bus is not in use by the transmitting device, conduct arbitration for control of the first control bus, and

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).¹¹ Under Patent Owner’s position that this limitation is not a means-plus-function limitation and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation for the reasons set forth above for [1(c)]. Berg, ¶248.

Further, a POSITA would have understood that either or both of the receiving and transmitting devices can conduct arbitration for the control of the command bus if the bus is not in use by the other, as discussed above for [19(d)]. Berg, ¶249. Yung explains that its flowcharts (including Figures 5-8, which illustrate the arbitration process) “conceptually illustrate the logic; the particular computer language used to implement the logic may vary, depending on the programmer’s preference.” Yung, ¶33. Yung further discloses that the features of the invention can be implemented in “a general purpose or special purpose processor[, which] could be realized using an ASIC, a logic array, or other special purpose circuitry.

¹¹ *Supra* n.5.

Alternatively, the functions could be accomplished using hard-wired logic circuits, custom circuits, and the like.” Yung, ¶43.

[19(f)] wherein the receiving device is a device utilizing the standard protocol and the transmitting device is a mobile device utilizing a modified protocol, the modified protocol being a modification of the standard protocol that is not included in the standard protocol.

Yung in view of HDMI 1.3’s HDMI-C protocol renders obvious this element for the reasons set forth above for [1(g)]; Berg, ¶250.

13. Claim 25

[25] The receiving device of claim 19, wherein the logic to arbitrate use of the first control bus is further operable to allow the transmitting device to take control of the first control bus if the transmitting device and the receiving device arbitrate use of the first control bus at the same time.

Patent Owner has proposed in the co-pending litigation against Dell that this limitation requires no construction and is not governed by 35 U.S.C. 112(6).¹² Under Patent Owner’s position that this limitation is not a means-plus-function limitation and instead encompasses any form of logic, which Petitioners adopt for purposes of this proceeding only, Yung discloses and/or renders obvious this limitation for the reasons set forth above for [1(c)] and [18] with regard to the second arbitration scenario taught by Yung in which the transmitting device and receiving device arbitrate use of the first control bus at the same time. Berg, ¶251.

¹² *Supra* n.5.

Further, Yung discloses that the transmitting device can win the arbitration and take control of the first bus in this second scenario, as explained above for [1(c)]. Berg, ¶252. Yung explains that its flowcharts (including Figures 5-8, which illustrate the arbitration process) “conceptually illustrate the **logic**; the particular computer language used to implement the **logic** may vary, depending on the programmer’s preference.” Yung, ¶33. Yung further discloses that the features of the invention can be implemented in “a general purpose or special purpose processor[, which] could be realized using an ASIC, a **logic** array, or other special purpose circuitry. Alternatively, the functions could be accomplished using hard-wired **logic** circuits, custom circuits, and the like.” Yung, ¶43.

D. Ground 2: Claims 2, 13, and 20 Are Obvious Under 35 U.S.C. § 103 over Yung in View of HDMI 1.3 in further view of Al-Alawi

1. Summary of Al-Alawi

Al-Alawi discloses a communication system that includes a Bi-Phase encoder for data transmission. Al-Alawi, Sec. 1; Berg, ¶¶112-114. Al-Alawi’s objective is to “develop a controller in the physical layer that can cope with multiple protocols.” *Id.*, Sec. 1. Furthermore, Al-Alawi recognizes that “[s]ource encoding reduces the average number of data bits for a given message to the minimum possible value while channel coding is used for error control,” and uses a “Bi-Phase Mark” method in its encoder to support the intensive demands of using multiple protocols. *Id.*

Ultimately, Al-Alawi facilitates the process of altering the data transmission protocol without changing encoder hardware by using multiple lines that are capable of processing different protocols. *Id.*, Abstract.

2. Reasons to Combine Yung, HDMI 1.3, and Al-Alawi

For the reasons set forth below, a POSITA would have been motivated to combine the teachings of Al-Alawi with those of Yung and HDMI 1.3. Berg, ¶125. Al-Alawi is directed to multiple protocols employing line codes for digital communications network architectures for multimedia applications where data, voice, images, and video signals are to be transmitted. Al-Alawi, Sec. 1. As such, Al-Alawi is in the same field of endeavor as and reasonably pertinent to the problems addressed by the '520 patent as well as Yung and HDMI 1.3, which are similarly directed to multi-protocol digital communications for audio-video applications between interconnected devices. Yung, ¶¶4,11,26-28; HDMI 1.3, 1; Ex.1001, 1:7-39, 2:54-3:2; Al-Alawi, Sec. 1; Berg, ¶126. Al-Alawi, therefore, is analogous art. Berg, ¶127.

Further, Al-Alawi discloses an encoder circuit that uses Bi-Phase Mark modulation for signal transmission. Al-Alawi, Sec. 1; Berg, ¶127. For example, Al-Alawi discloses that its transmission system includes a “Bi-Phase encoder circuit that can handle the change in the baseband encoding scheme,” where the encoder

circuit can use a “Bi-Phase Mark” encoding standard. Al-Alawi, Sec. 1, 2. A POSITA starting with Yung and HDMI 1.3’s multi-protocol systems for digital communications would have looked to and would have been motivated to combine Al-Alawi’s Bi-Phase Mark encoding because Al-Alawi discloses a specific encoding method in the form of Bi-Phase Mark encoding that can efficiently “cope with [the demands of] multiple protocols.” *Id.*; Berg, ¶128.

Further, Yung’s teaching that “[t]he implementation of logical 0s and logical 1s can be defined by the designers, providing the implementation is recognizable by both initiators and followers” (Yung, ¶38) would have motivated a POSITA to look to known methods of defining logical 0s and 1s, such as the Bi-Phase Mark encoding taught by Al-Alawi. Berg, ¶129. Further, a POSITA would have appreciated that Bi-Phase Mark encoding would have provided the benefits of robust clock recovery from a guaranteed transition occurring at least once every bit and less errors being likely in noisy environments due to transition detection being less error-prone than comparing signal levels against a threshold. Berg, ¶130; ¶130, n.15.

Accordingly, the combination of Yung and HDMI 1.3 with Al-Alawi would have required applying only known techniques (Bi-phase Mark encoding) to a known system ready for improvement (Yung’s and HDMI 1.3’s encoder circuits in multi-protocol systems) to yield predictable results (coping with the intensive

demands of multi-protocol systems, enhanced clock recovery, and fewer errors).

Berg, ¶131.

3. Claim 2

[2] The method of claim 1, wherein the signaling for transmitting the one or more generated data packets on the first control bus utilizes bi-phase mark encoding.

Yung discloses and/or renders obvious this element, and, in addition, Yung in view of Al-Alawi renders obvious this element. Berg, ¶253.

Yung discloses and/or renders obvious *transmitting the one or more generated data packets on the first control bus* for the same reasons as set forth above for [1(f)], because Yung teaches transmitting CEC frames over the CEC bus from a transmitter, such as playback device 10₁ in Fig. 1B, to a receiver, such as display device 10₅. Yung, ¶¶4, 11, 34, 27, 38; Berg, ¶254. Further, when transmitting CEC frames comprised of command blocks, Yung teaches converting command blocks of CEC frames to “*signaling*” and transmitting that signaling onto the command bus (*signaling for transmitting the one or more generated data packets on the first control bus*). Yung, ¶38, Fig. 8 (blocks 126 and 128, which “convert[] the header block [or] data block to signaling” and blocks 127 and 134, which “transmit[] the signaling” onto the CEC bus).

In addition, Yung discloses that its “10-bit command block[s]” are “converted to command signaling by converting 0s into logical 0s, and 1s into logical 1s (block

128).” Yung, ¶38, Fig.8. Yung teaches that logical 0s can be distinguished from logical 1s using the CEC protocol’s approach of using “durations of high and low voltages” (also known as “bit timing”) or they can be distinguished by using different voltage levels to represent logical 0s and logical 1s. Yung, ¶¶38-39. However, Yung teaches that this is flexible as “[t]he implementation of logical 0s and logical 1s can be defined by the designers, providing the implementation is recognizable by both initiators and followers.” Yung, ¶38; Berg, ¶255. A POSITA would have understood from the CEC protocol as it existed prior to Yung’s filing that the CEC approach of using “bit timing” as taught by Yung would have involved defining the starting point of data bits “by a high to low transition” such that “[t]he high to low transition at the end of a data bit is the start of the next data bit.” Berg, ¶256 (citing HDMI 1.0, CEC-6). This approach is similar to and consistent with the ’520 patent’s description of “bi-phase mark encoding,” in which “each bit of data is represented by two logical states, such as a “logical ‘0’” and a “logical ‘1,’” and in which “the first state of a symbol is always different from the last state of a previous symbol.” Ex.1001, 3:23-31; Berg, ¶256. Therefore, Yung discloses or at least

renders obvious *utiliz[ing] bi-phase mark encoding* for the signaling for transmitting Yung's CEC frames (*packets*) comprised of bits. Berg, ¶257.

In the event it is argued that Yung does not disclose *utiliz[ing] bi-phase mark encoding*, this would have been obvious over Yung in view of Al-Alawi. Berg, ¶258. Al-Alawi discloses a data transmission system, which includes a "Bi-Phase encoder circuit that can handle the change in the baseband encoding scheme." Al-Alawi, Sec. 1. Al-Alawi's Bi-Phase encoder circuit can use "Bi- Φ -M," which it describes as "Bi-Phase Mark" encoding, which "belong[s] to the Bi-Phase code family which is characterized by having at least one transition per bit time." *Id.*, Sec. 1. Al-Alawi describes this "Bi- Φ -M" (Bi-Phase Mark) code as a code in which "a transition is present at the start of every transmitted bit, with '1' represented by an additional transition at the middle of the bit period." *Id.*, Sec. 2. Al-Alawi, therefore, discloses *utiliz[ing] bi-phase mark encoding*. Berg, ¶259. For at least the reasons explained above at Sec. IX.D.2, a POSITA would have been motivated to implement Al-Alawi's Bi-Phase Mark encoding into Yung as a means of implementing Yung's

logical 1's and 0's, which Yung teaches can be implemented by designers. Yung, ¶4, 38; Al-Alawi, Sec. 1; Berg, ¶260.

4. Claim 13

[13] The transmitting device of claim 12, wherein the transmitter is to drive the first control bus in a bi-phase mark signaling manner.

Yung discloses and/or renders obvious this element, and, in addition, Yung in view of Al-Alawi renders obvious this element for the same reasons as set forth in Section IX.D.3. Berg, ¶261.

5. Claim 20

[20] The receiving device of claim 19, wherein the receiver is operable to decode the one or more received data packets according to bi-phase mark encoding.

See claim [2] in Sec. IX.D.3. Berg, ¶262. A POSITA would have understood that upon receipt of Bi-Phase Mark encoded data, the receiving device must decode the data as received in data packets using the Bi-Phase Mark decoding technique so that a playback device such as a TV can display video data and reproduce audio data. *Id.*

X. CONCLUSION

Petitioners respectfully request that the Challenged Claims be cancelled for the aforementioned reasons.

Date: October 1, 2024

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

I certify that the foregoing complies with the type-volume limitation of 37 C.F.R. § 42.24 and contains 13,945 words based on the word count indicated by the word-processing system used to prepare the paper, and excluding those portions exempted by § 42.24(a).

Date: October 1, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6 and 42.105, I hereby certify that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 7,856,520 under U.S.C. §§ 311–319 and 37 C.F.R. § 42.100 *et seq.*, together with its supporting exhibits, and Power of Attorney was served by Federal Express, a means at least as fast and reliable as Priority Mail Express®, on the following correspondence address of record for patent owner:

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