A. Chang

52. Chang is an abandoned U.S. patent application that discloses a USB hub for implementing host-to-host USB transmission through a dedicated host port connected to a bridge. (EX1014, Abstract, [0020~~]; EX2019, ¶52~~] .) Chang's hub addresses the express goal of "easily establishing a connection between a computer and another computer." (EX1014, [0003~~]; EX2019, ¶52~~] .) In Chang's hub, a USB host device (such as a computer) can connect to a dedicated host port (50), and communicate via a bridge (52) and hub control unit (46) to another USB host device—such as a second computer—connected to an uplink port (42). (EX1014, [0020~~]; EX2019, ¶52.)~~].) FIG. 3 illustrates: (EX1014, FIG. ~~3; EX2019, ¶52~~3.)

53. The Chang hub also comprises a number of downlink ports (44) for linking devices connected to the downlink ports to the uplink port. (EX1014, [0019~~]; EX2019, ¶53.)~~].) The downlink ports allow for host-to-device transmission between USB devices (in a device mode) connected to the downlink ports and a host device connected to the uplink port. (EX1014, [0019~~]; EX2019, ¶53.)~~].)

B. Chang II

54. Chang II is an abandoned U.S. patent application that discloses a data transmission bridge device. (EX1015, Abstract.) The Chang II bridge device (1) has a first connection interface (11) and a second connection interface (12)

connected by a control chip (13) in communication with a memory unit (14). (EX1015, [0023~~]; EX2019, ¶54.)~~].) The bridge device permits data transmission between a first USB host device (2) connected to the first connection interface, and a second USB device connected to the second connection interface; the second USB device may be a device in a host mode (3) or a slave mode (4) (elsewhere referred to as a device mode). (EX1015, [0021]-[0022~~]; EX2019, ¶54.)~~].) FIG. 1 illustrates: (EX1015, FIG. 1.

55. Chang II's "main feature" is providing two different transmission paths, automatically detecting whether a host or "slave" USB device is connected to the second connection interface, and selecting one of two different transmission paths between the first and second connection interfaces accordingly. (EX1015, [0021~~]; EX2019, ¶55.)~~].) Chang II's control chip implements this feature via a process shown in FIG. 6: (EX1015, [0023], [0042], FIG. ~~6; EX2019, ¶55~~6.)

C. Chutorash

56. Chutorash is directed to a system for connecting a vehicle control system to a device, such as a mobile phone, via USB. ~~(EX2019, ¶56.)~~ Chutorash identifies two problems with vehicle user interface systems. First, it notes that the human-machine interfaces of vehicles and portable devices are "typically separate, look very different, and are difficult to use together." (~~EX1029~~EX-1029,1:31-1:32~~;~~

~~EX2019, ¶56~~.) Because "[a]pplications provided on portable devices are typically not configured to interact with a vehicle," Chutorash explains that there is a need for "improved user interface features and/or connectivity features." (~~EX1029~~EX-1029, 1:32-1:33, 1:34-35~~; EX2019, ¶56~~.) Second, Chutorash states that "[t]here is a need for effective display reproduction and/or user interface reproduction from a remote source to an in-vehicle display or other in-vehicle interface." (~~EX1029~~EX-1029, 1:36-1:39~~; EX2019, ¶56~~.) The portions of Chutorash quoted in Petitioner's summary stand for the unremarkable proposition that USB was a known method for connecting a mobile phone to a vehicle's infotainment system. (Petition, 39-41~~; EX2019, ¶56~~.)

~~VII.~~ D. AN96527

57. AN96527 is an application note by Cypress Semiconductor titled "Designing USB Type-C Products Using Cypress's CCG1 Controllers." (EX1064, 1.) As the title indicates, the note describes using Cypress's CCG1 product to implement USB Type-C systems. (EX1064, 1-2.) Neither Chang nor Chang II are related to USB Type-C or to the CCG1 product; as the note indicates, USB Type-C was not introduced until August 2014, years after Chang and Chang II. (EX1064, 1.) Moreover, unlike Chang, Chang II, and the '643 patent, the AN96527 document is

unrelated to multi-host USB systems; instead, it discusses "USB link pairs" formed when "a USB Host and USB device are interconnected." (EX1064, 3.)

IX. GROUND I: CLAIMS 1-15 ARE NOT RENDERED OBVIOUS BY CHANG IN VIEW OF CHANG II AND POSITA KNOWLEDGE

58. The Petition proposes in Ground I that claims 1-15 are met by combining the electronic circuit of Chang with the electronic circuit of Chang II; and by further modifying that combination by inserting circuit elements not found in or suggested by either reference, but which Petitioner claims were within the knowledge of the POSITA. (See, e.g., Petition, 42-69~~; EX2019, ¶58~~.)

59. In my view, the challenged claims are not rendered obvious by the Petition's proposed combination at least because, as explained below, the proposed combination fails to meet all limitations of the challenged claims. ~~(EX2019, ¶59.)~~I understand the proposed combination is additionally improper for relying on conclusory statements and unspecific expert testimony to supply missing claim elements, defying Federal Circuit precedent. ~~(EX2019, ¶59.)~~ Furthermore, as explained below, the hindsight-driven combination is technically unsound and would render the references more costly and inoperable for their intended purposes, thus failing to motivate the POSITA to make the proposed combination with any reasonable expectation of success. ~~(EX2019, ¶59.)~~

A. The Petition's Proposed Combination

60. The Petition proposes two separate implementations of combining Chang, Chang II, and the POSITA's knowledge. (Petition, 49-51~~; EX2019, ¶60~~.) Each proposed implementation offers a modification of Chang by Chang II, plus a switching element—i.e., a multiplexer (mux)—inserted downstream of the purported bridge. (Petition, 42-52~~; EX2019, ¶60~~.)

61. Asked to explain why multiple implementations are proposed, Mr. Welch testified: "It was about if a specific claim had language which could be interpreted in order to have one of these rather than the other." (EX2021, 220:11~~-~~–221:11~~; EX2019, ¶61.)~~.) I understand this admitted claims-first approach to combining the prior art is precisely the type of hindsight reconstruction that is prohibited. Even so, the proposed combination is fundamentally defective and fails to meet the claim limitations as described herein. ~~(EX2019, ¶61.)~~

1. The Hub 46 Mux Implementation

62. The Petition discloses a proposed implementation (the "Hub 46 mux implementation"), that inserts a multiplexer within Chang's USB hub 40.

(Petition, 47-52.) In this implementation, Chang is modified by replacing its ports with dual-role ports; and inserting a 2:1 multiplexer between Chang's port 50 and

bridge 52. (Petition, 42-52~~; EX2019, ¶62~~.) Chang's transmission paths 48 are rewired such that host port 50 is connected to the input of the multiplexer; and the multiplexer can connect host port 50 to either Chang's bridge 52 (Chang II's bridge device 1) or Chang's hub control unit 48, depending on its select lines: (Petition, 47-52~~; EX2019, ¶62~~.)

63. The Petition then modifies the combination further to incorporate Chang II's detection unit 134, which belongs to control chip 13 of Chang II's bridge device 1. (Petition, 48~~; EX2019, ¶63~~.) The Petition supposes that Chang II's detection unit and/or bridge would generate signals that control the multiplexer's switching, surmising that doing so "would have been routine and obvious." (Petition, 48~~; EX2019, ¶63~~.)

64. According to the Petition, the mux can switch a downstream USB port (44, 50) to the hub control unit 46 directly, bypassing bridge 52 (if a connected device is in device mode): (Petition, 67-68~~; EX2019, ¶64~~.)

65. Alternatively, the mux can switch the downstream USB port to the hub control unit 46 through bridge 52 (if the connected device is in host mode): (Petition, 61-62~~; EX2019, ¶65~~.)

66. The Petition does not rely on Chang II's internal switching between the bridge path or the bypass path; instead, the multiplexer apparently performs the

switching based on signals generated by Chang II's detection unit 134 of control chip 13. (Petition, 48-49~~; EX2019, ¶66~~.) The Petition speculates that this proposed modification "would have been routine and obvious." (Petition, 48-49.)

2. The Hub 40 Mux Implementation

67. In the "Hub 40 mux implementation," the multiplexer is inserted external to Chang's USB hub 40. (Petition, 47~~; EX2019, ¶67~~.) Chang and Chang II are further modified by relocating Chang's bridge 52 outside the USB hub 40; adding new dual-role USB ports (44, 50) outside the USB hub 40; inserting the multiplexer between the dual-role USB ports and the bridge 52; and connecting the outputs of the multiplexer to the hub control unit 46: (Petition, 48-50, 52~~; EX2019, ¶67~~.)

68. As above, the Petition modifies the combination further to incorporate Chang II's detection unit 134, which belongs to control chip 13 of Chang II's bridge device 1. (Petition, 48~~; EX2019, ¶68~~.) The Petition supposes that Chang II's detection unit and/or bridge would generate signals that control the multiplexer's switching, surmising that doing so "would have been routine and obvious." (Petition, 48~~; EX2019, ¶68~~.)

69. According to the Petition, as above, the multiplexer can switch a downstream USB port (44, 50) to the hub control unit 46 directly, bypassing bridge 52 (if a connected device is in device mode): (Petition, 68~~; EX2019, ¶69~~.)

70. And as above, the mux can switch the downstream USB port to the hub control unit 46 through bridge 52 (if the connected device is in host mode): (Petition, 63~~; EX2019, ¶70~~.)

71. As above, the Petition does not rely on Chang II's internal switching between the bridge path or the bypass path; instead, the multiplexer apparently performs the switching based on the same bridging detection signal generated by Chang II's control chip 13. (Petition, 48~~; EX2019, ¶71.)~~) The Petition speculates that this proposed modification "would have been routine and obvious." (Petition, 48~~; EX2019, ¶71~~.)

B. The Proposed Combination Is Incomplete and Technically Unsound

72. Petitioner's proposed combination—including both implementations—is incompletely described in the Petition; and is technically unsound and would not be operable in the manner set forth in the Petition. ~~(EX2019, ¶72.)~~ The proposed combination further is unsupported by the references, and relies solely on expert testimony that is contradictory and unreliable. ~~(EX2019, ¶72.)~~

1. The Petition Fails to Show the Claimed Method or Routing Logic Circuit With Particularity For Any Challenged Claim

73. All challenged claims recite a method with particular steps of routing USB signals, requiring a specific routing logic circuit. As described above, the proposed combination relies on outside switching elements—multiplexers—to implement the claimed method steps and meet the claimed routing logic circuit. (See Petition, 58~~; EX2019, ¶73~~.) These switching elements are absent from Chang and Chang II, and are instead supplied from the POSITA's alleged knowledge. (See Petition, 42~~-~~52~~; EX2019, ¶73~~.)

74. The claimed method cannot be met by off-the-shelf switching components alone. ~~(EX2019, ¶74.)~~ The method instead requires the USB signals to be routed in a particular manner. First, the USB signals emanating from the consumer USB device must be routed to the first USB port via a routing logic circuit connected directly to a USB bridge and a USB hub connected to the USB bridge, in accordance with a determination by the signal detection circuit that the consumer device is operating in a USB host mode. (EX1011, claim 1.) Second, the USB signals must be routed to the first USB port via the routing logic connected directly to the USB hub and thereby bypassing the USB bridge, in accordance with a

determination by the signal detection circuit that the consumer device is operating in a USB device mode. (EX1011, claim 1.)

75. The Petition fails to show how generic switching elements— multiplexers— would be combined with Chang and Chang II to meet these specialized configuration requirements. ~~(EX2019, ¶75.)~~ As the Petition recognizes, multiplexers rely on control signals ("select lines") to configure which input(s) are routed to which output(s) within the switching element: (Petition, 12~~; EX2019, ¶75~~.)

76. A datasheet relied on by Petitioner's expert further illustrates the required select lines (i.e., SEL[0], SEL[1]): (EX1060 (annotated); EX1013, ¶93 (citing EX1060~~); EX2019, ¶76).~~)).

77. But the Petition is incomplete, inconsistent, and erroneous about how those control signals would be supplied or implemented in the proposed combination. Instead of explaining with particularity how the control signals of the multiplexer would implement the claimed switching configurations, the Petition merely speculates that "It would have been routine and obvious for the detection unit and/or bridge [of Chang II] to control the switching functionality." (Petition, 48~~; EX2019, ¶77~~.)

78. The Petition's evidentiary support is limited and nonspecific. ~~(EX2019, ¶78.)~~ The Petition identifies that "Chang II's bridge controls routing"; and observes generically that the Chang II bridge includes a control chip and detection unit. (Petition, 48~~; EX2019, ¶78~~.) From this, the Petition concludes that "it would have been obvious for Chang's bridge and/or detection unit to control, e.g., the switch's select lines." (Petition, 48~~; EX2019, ¶78~~.) But the Petition fails to set forth how the detection unit of Chang II would be utilized by the multiplexer in the proposed combination to route the USB ports in the specific manner recited by claim 1; or how any such modification to Chang and Chang II would be within the scope of the POSITA's general knowledge. ~~(EX2019, ¶78.)~~ To the contrary~~, as Dr. Houh explains~~, while the POSITA's knowledge may include multiplexer components, it does not include the specific knowledge of how to use such generic switching components to modify Chang and Chang II to meet the specific routing requirements of the claims. ~~(EX2019, ¶78.)~~

79. The Petition's generic and evidence-starved description of switching cannot meet the Petitioner's duty to identify, "in writing and with particularity ~~…~~... the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge". (35 U.S.C. § 312(a)(3~~); EX2019, ¶79.)~~).) The Petition is deficient with respect to all challenged claims for at least this reason. ~~(EX2019, ¶79.)~~

2. The Proposed Combination Is Technically Unsound Because the Routing Logic Circuit Would Disconnect Its Control Signals

80. The Petition's proposed combination simply would not operate as described, and the Petition is further deficient with respect to all challenged claims for at least this additional reason. ~~(EX2019, ¶80.)~~

81. In the proposed combination, as described above in Section ~~VII~~IX.A, a multiplexer (whether in the Hub 46 or Hub 40 implementation) is used to switch between (1) connecting a downstream USB port directly to the hub control module 46, if a device on the downstream port is in device mode; and connecting the USB port to the hub control module 46 via Chang's bridge 52, if the device on the downstream port is in host mode. ~~(EX2019, ¶81.)~~ The Petition proposes modifying Chang with Chang II's bridge device 1, which includes a control chip 13 for detecting (via detection unit 134) the mode of a connected downstream device, and switching between two transmission paths accordingly. (See Petition, 34-35 (citing EX1015, [0024], [0046~~]); EX2019, ¶81.)~~]).)

82. Even though Chang II provides its own mechanism for switching transmission paths based on the mode of a connected device, the proposed combination does not rely on Chang II's switching elements to meet the claimed routing logic circuit. (See EX2021, 147:10-24, 148:11-25~~; EX2019, ¶82~~.) Instead,

the Petition relies on the multiplexer as the routing logic circuit, with Chang II's bridge and/or detection unit to control the select lines. (Petition, 48; EX1013, ¶¶185, 190~~; EX2019, ¶82~~.) This switching process is described in Section ~~VII~~IX.A.

83. Notwithstanding the Petition's deficient description of the multiplexer control signals, discussed above, the proposed combination relies on Chang II's bridge device 1 and detection unit 134 to provide the control signals that cause the multiplexer to route the downstream ports through the appropriate transmission path. (Petition, 48-49~~; EX2019, ¶83~~.) As Chang II indicates, and as the Petition acknowledges, the detection unit is part of the control chip 13 of bridge device 1. (Petition, 47; EX1015, FIGs. 1, 5, [0034], [0037]-[0038], [0040~~]; EX2019, ¶83.)~~

].) For example, the Petition indicates that Chang II's "bridging detection signal," which is provided by detection unit 134, is applied to the multiplexer to direct it to connect the downstream port to the bridge upon detecting a downstream host. (Petition, 56-57~~; EX2019, ¶83~~; see also EX1060, 1; EX1055, 284-288.)

84. In order to generate the detection signal, the detection unit 134 executes the process shown in FIG. 6 of Chang II, described above. (Petition, 35, 45, 59; EX1015, FIG. 6, [0024]; ~~EX2019, ¶84;~~ EX1013, ¶¶159, 271 (citing EX1015).) Generating the detection signal requires that the detection unit 134 (and thus the bridge) communicate with the downstream port. ~~(EX2019, ¶84.)~~ For example, as

described by Mr. Welch, the detection unit determines the connection of either a host or device on the port by "sending an 'inquire signal' and receiving a response" when a host connects (as shown in S603 and S605 of FIG. 6), or "receiving an 'inquire signal'" when a device connects (S617); and producing a detection signal (e.g., a bridging detection signal or slave detection signal) accordingly. (EX1013, ¶¶80, 159, 249, 261~~; EX2019, ¶84~~.)

85. But the proposed combination includes a structural flaw. As Mr. Welch cautions: "the detection unit must connect to the downstream port to detect the mode, as shown in Chang II." (EX1013, ¶193.) And as discussed above, the detection unit is a component of the bridge. ~~(EX2019, ¶85.)~~ But the claims require routing the USB signals from the consumer USB device to the first USB port via the routing logic connected directly to the USB hub, and thereby bypassing the USB bridge, in accordance with a determination that the consumer device is in a USB device mode. (EX1011, claims 1, 10.) Thus, in order to satisfy the "bypassing the USB bridge" limitation of the claims, the detection circuit in the proposed combination must be bypassed when the USB signals are routed to the USB hub, when the consumer device is in the USB device mode. ~~(EX2019, ¶85.)~~

86. The behavior of the multiplexer thus demonstrates the need for Mr. Welch's admonition. In either the Hub 46 or Hub 40 implementations, when the multiplexer

connects the downstream port 50 to the hub via the bridge 52, the bridge 52 is connected to the downstream port 50 through the multiplexer: (Petition, 61-62~~; EX2019, ¶86~~.) (Petition, 63~~; EX2019, ¶86~~.)

87. But when the multiplexer connects the downstream port 50 via the direct-to-hub path—i.e., when the device on the port is in device mode—it bypasses the bridge entirely: (Petition, 67-69~~; EX2019, ¶87~~.)

~~As Dr. Houh explains,~~ 88. Consistent with Mr. Welch's description of switching elements and supporting evidence, the multiplexer selecting the direct-to-hub path electrically disconnects the bridge device from all downstream USB ports. (~~EX2019, ¶88;~~ see, e.g., EX1013, ¶93.) For example, Mr. Welch explains that in a switch, a disconnected path "will be left floating (e.g., tri-stated)." (EX1013, ¶188~~; EX2019, ¶88~~.) Similarly, a reference cited by Mr. Welch explains that transmission gates, such as those that connect a multiplexer's inputs to its outputs, comprise transistors that switch between a closed circuit and an open circuit of "essentially infinite resistance." (EX1069, 23~~; EX2019, ¶93~~.) And the FSUSB63 component, on which Mr. Welch relies to illustrate a multiplexer, indicates that the control logic operates to electrically connect and disconnect (via open circuits) its inputs and outputs: (EX1060, 1; ~~EX2019, ¶88;~~ see also EX1013, ¶93.)

89. When the bridge device is bypassed by the multiplexer, it is thus electrically disconnected from the downstream USB ports coupled to the multiplexer. ~~(EX2019, ¶89.)~~ Because the bridge device cannot send or receive signals (e.g., "inquire signals") from a downstream USB port in this state, the bridge device is rendered incapable of detecting whether a device is in host or device mode, such as described above for FIG. 6 of Chang II; and, accordingly, prevents the bridge device from generating or providing control signals to the multiplexer. (See Petition, 29-30; EX1013, ¶¶80, 159, 254~~; EX2019, ¶89~~.) Consequently, once the proposed combination switches to the device mode, the bridge (and thus the detection unit) is incapable of directing the multiplexer to perform any further switching operations—including connecting or reconnecting any downstream ports to the bridge 52 or to the hub control unit 46 (e.g., in response to a connected device switching to a host or device mode). (See Petition, 29-30; EX1013, ¶¶80, 159, 254~~; EX2019, ¶89.)~~ .)

90. FIG. 6 of Chang II further demonstrates the flaw in the proposed combination. As described above, FIG. 6 illustrates a process performed by Chang II's bridge device (i.e., control chip 13 of the bridge device) to detect whether a connected external device is in host mode or device ("slave") mode ~~(EX2019, ¶90.)~~: (EX1015, FIG. 6~~; EX2019, ¶90~~.)

91. In the illustrated process, the control chip exchanges signals with the external device at least at stages S603, S605, S617; and checks for a newly inserted external device at stages S601, S613, and S625. (EX1015, FIG. 6~~; EX2019, ¶91~~.) In the proposed combination, once a connected device is detected to be in device mode, the multiplexer switches to a direct-to-hub path that bypasses the bridge device and disconnects it from downstream ports, as described above. ~~(EX2019, ¶91.)~~ In this disconnected state, the bridge device is unable to exchange signals with an external device; thus, the bridge device will never reach stages S607 or S619 in the FIG. 6 process and cannot direct the multiplexer to switch paths accordingly. Moreover, because the bridge device is unable to detect a newly inserted external device; the Petition's USB hub module will remain in the device mode even if a new device is connected. ~~(EX2019, ¶91.)~~ This dead-end state— which the Petition wholly fails to address— renders the proposed combination incapable of meeting the claimed dynamic switching as described above. ~~(EX2019, ¶91.)~~

C. The Proposed Combination Does Not Meet the Claim Limitations

1. Claims 1, 5, and 10

92. The Petition's proposed combination fails to meet the limitations of claim 1 or analogous claims 5 and 10. ~~(EX2019, ¶92.)~~ Because all challenged claims depend from claims 1, 5, or 10, this defect is fatal to the Petition.

93. Claim 1 requires routing USB signals according to specific requirements. For example, the USB signals emanating from the consumer USB device must be routed to the first USB port via a routing logic circuit connected directly to a USB bridge and a USB hub connected to the USB bridge, in accordance with a determination by the signal detection circuit that the consumer device is operating in a USB host mode. Further, the USB signals must be routed to the first USB port via the routing logic connected directly to the USB hub and thereby bypassing the USB bridge, in accordance with a determination by the signal detection circuit that the consumer device is operating in a USB device mode. (EX1011, claim 1.)

94. To meet this claim limitation, the Petition relies on its proposed Mux Implementations "includ[ing] a switching structure, such as a mux, to select the appropriate transmission path." (Petition, 59.) The Petition explains the limitation is met based on the Hub 46 or Hub 40 mux implementations, which allegedly perform the claimed routing based on control signals (e.g., a bridging detection signal) provided by Chang II's detection unit 134 to the multiplexer of the proposed combination. (Petition, 62-64~~; EX2019, ¶94~~.)

95. But as explained above in Section ~~VII~~IX.B, the Petition's characterization is inaccurate. ~~(EX2019, ¶95.)~~ The proposed combination does not provide, or act in accordance with, the claimed "determination by the signal detection circuit that the consumer device is operating in a USB host mode." ~~(EX2019, ¶95.)~~ Instead, as described above, it reaches a state in which the multiplexer routes the downstream consumer device directly to the USB hub, disconnecting the detection unit that generates the control signals; and rendering it unable to make or respond to such determination as required by the claims. ~~(EX2019, ¶95.)~~

96. Further, to the extent the Petition proposes that Chang II's detection unit 134 could be relocated to access the downstream USB ports—e.g., proximate to or integrated with the multiplexer, see Petition at 49 n.14—this would fail to meet claim 1 because it would fail to meet the claim requirement of "bypassing the USB bridge." (EX1011, claim 1~~; EX2019, ¶96~~.) As the Petition acknowledges, Chang II's detection unit is part of the bridge (e.g., via control chip 13), such that providing USB signals to the detection unit would not "bypass[]" the bridge. (Petition, 48~~; EX2019, ¶96~~.) There is no way for the proposed combination to satisfy the "bypassing" limitation while allowing the detection unit access to the downstream USB ports. ~~(EX2019, ¶96.)~~

97. The Petition thus fails to show that claim 1, or analogous claims 5 and 10 (and their respective dependent claims) are met. ~~(EX2019, ¶97.)~~

2. Claims 2, 7, 13

98. Claims 2, 7, and 13 depend from claims 1, 5, and 10, respectively. In addition to the reasons described above for the parent claims 1, 5, and 10, claims 2, 7, and 13 are not rendered obvious because the Petition's proposed combination fails to meet that the USB host is embedded in an infotainment system. ~~(EX2019, ¶98.)~~

99. Neither Chang I nor Chang II disclose or relate to infotainment systems, or to vehicles; the Petition's citations to generic descriptions of infotainment systems for vehicles thus fail to support that a POSITA would have modified the Petition's proposed combinations to incorporate such systems in a manner that meets the claim limitations. (Petition, 69-71~~; EX2019, ¶99~~.) Moreover, even if the proposed combinations could be modified to include an infotainment system, the Petition makes no attempt to show that the modification would meet the particular data connection requirements of such systems. (Petition, 69-71~~; EX2019, ¶99~~.)

100. The POSITA would have recognized that infotainment systems present unique difficulties for hubs with host-to-host functionality. ~~(EX2019, ¶100.)~~ At the time the '643 patent was filed in 2013, the POSITA would understand automotive

infotainment systems with USB support to require more functionality than a radio, CD or cassette player; they were also expected to support mapping, video, and screen mirroring functionality. (See~~,~~ e.g., EX1011, 1:57-62 (describing vehicle infotainment systems as accessing "streaming music, video and other services" provided by consumer devices, such as smartphones~~); EX2019, ¶100.)~~).) If the data for these functions is being provided by a USB device—as described in the specification—it must be transferred in real-time, i.e. streamed, to the head unit for display.~~ (EX2019, ¶100.)~~

101. As the POSITA would recognize, a USB data connection pipe between such infotainment systems and consumer devices would have specific and heightened requirements for latency and bandwidth; however, the Petition makes no attempt to establish that such requirements are met by the proposed combination. ~~(EX2019, ¶101.)~~ The USB specification itself recognizes the unique challenges presented by streaming data and has defined a specific type of data transfer pipe— isochronous or "ISO"—which is capable of transferring constant-rate, time-critical data that, unlike the other types of USB data transfers, is not retried if there is an error. (EX1018, 4.7.4~~; EX2019, ¶ 101~~.) But none of the prior art USB bridges identified by Petitioner support such isochronous data transfer pipes. (EX1035, 1 ("Supports USB Full/High Speed Control/Interrupt/Bulk Endpoints Transfer"); EX1036, 14 (listing only control, bulk, and interrupt endpoints); EX1037, 1 (same~~); EX2019,~~

¶101.)).) Instead, because those bridges were not designed to handle the time-sensitive transfers required in the streaming context, those bridges include only control, interrupt, and bulk data transfers. (Id.)

102. The Petition offers no attempt to explain how the proposed combination could be modified to support the isochronous transfers required by infotainment systems, or how a POSITA would have been motivated to make such a modification with any reasonable expectation of success. (EX2019, ¶102.) The proposed combination accordingly fails to meet claim 2, or analogous claims 7 and 13. (EX2019, ¶102.)

3. Claims 3, 4, 8, 9, 14, 15

103. Claim 3 depends from claim 1 and recites that bypassing the USB bridge is performed by a USB routing switch. Claims 8 and 14 depend from claims 5 and 10, respectively, and recite analogous limitations. Claims 4, 9, and 15 depend from claims 3, 9, and 14, respectively, and recite that the USB routing switch includes the signal detection circuit.

104. As discussed above for claim 1, the Petition does not meet these claims at least because it relies on proposed combination's multiplexer—directed by control signals provided by Chang II's detection unit—to meet the claimed routing logic circuit or the claimed USB routing switch. (Petition, 71-72; EX2019, ¶104.) As

discussed above, by bypassing the USB bridge as recited in the claim, the multiplexer disconnects the detection unit (part of the bridge), preventing it from providing the control signals that would perform the routing recited in claim 1. ~~(EX2019, ¶104.)~~ Similarly, because the Petition maps the claimed signal detection circuit to detection unit 134, the multiplexer cannot include the signal detection circuit because it would fail to meet the limitation of the parent claims that routing the USB signals bypasses the bridge (which includes detection unit 134). (Petition, 72-75~~; EX2019, ¶104~~.) Accordingly, the Petition fails to meet any of claims 3, 4, 8, 9, 14, and 15. ~~(EX2019, ¶104.)~~

~~E.~~ D. The POSITA Would Not Have Been Motivated to Modify Chang in View of Chang II and the POSITA's Knowledge To Meet The Claim Limitations

105. The Petition's proposed combination additionally fails to render the challenged claims obvious because it relies on hindsight reconstruction—a process employed by Petitioner's expert, see EX2021 at 64:24-65:17, EX2021 at 9:15-10:10, but that I understand has long been rejected as impermissible. Graham v. John Deere Co., 383 U.S. 1, 36 (1966); In re Kotzab, 217 F.3d 1365, 1369 (Fed. Cir. 2000). The Petition proposes a multiple-stage reconstruction: first modifying a prior art USB hub (Chang) with a control circuit from an unrelated reference

(Chang II); and then modifying the combination again—transforming components and rewiring internal connections in the process—to insert new electronic switching components (multiplexers) cherry-picked from the "POSITA's knowledge." ~~(EX2019, ¶105.)~~ At best, the Petition's results-driven proposal describes how the POSITA might have combined the prior art, disregarding how the POSITA as of the priority date would have been motivated to combine the prior art with a reasonable expectation of success. ~~(EX2019, ¶105.)~~

106. As Petitioner's expert admitted, the proposed combination is a product of a claims-first analysis, in which Mr. Welch was provided with various patent claims, and with the Chang and Chang II references; and tasked with determining whether they taught the claims. (EX2021, 64:24-65:17.) Asked to explain why multiple implementations were proposed but not relied on for claims, Mr. Welch testified: "It was about if a specific claim had language which could be interpreted in order to have one of these rather than the other." (EX2021, 220:11-221:11.) This hindsight analysis improperly fails to consider evidence of how the POSITA would not have been motivated to make the proposed combination; the Petition fails to make a prima facie case of obviousness for at least these reasons. ~~(EX2019, ¶106.)~~

1. The Proposed Combination Would Change the Principles Under Which The Prior Art Was Designed to Operate And Would Render The Prior Art Inoperable For Its Intended Purposes

107. I understand that if a proposed prior art combination would "change the 'basic principles under which the [prior art] was designed to operate,'" or would "render the prior art 'inoperable for its intended purpose,'" then the proposed combination is insufficient to render the claims prima facie obvious. Plas-Pak Indus., Inc. v. Sulzer Mixpac AG, 600 F. App'x 755, 758 (Fed. Cir. 2015) (internal citations omitted); see also McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1354 (Fed. Cir. 2001) (inoperative combinations of references "teach away from the combination and thus cannot serve as predicates for a prima facie case of obviousness").

108. The proposed combination improperly transforms the references, removing key functionality, and cannot support a prima facie case. As the Petition repeatedly emphasizes, Chang II repeats two "fundamental concepts": "(1) host/device detection and (2) selecting between two different transmission paths." (Petition, 34-35 (citing EX1015, [0024], [0046]). These concepts enable Chang II's express "main feature": a control chip that can automatically detect the type of device connected and internally switch to the

appropriate transmission path (i.e., the bridge transmission path or the bypass path). (Petition, 34-38, 46; EX1015, [0021~~]; EX2019, ¶108.)~~].) But as described above, the Petition's proposed combination would be unable to "automatically detect" the type of device once the hub module has been placed into device mode, and to switch to the appropriate transmission path accordingly (e.g., from a device mode back to a host mode). ~~(EX2019, ¶108.)~~

109. Thus, the proposed combination would render Chang II inoperable for its admitted main feature and intended purpose. ~~(EX2019, ¶109.)~~ And with respect to Chang, limiting the user's ability to connect a consumer device to a USB hub would defeat Chang's intended purpose of providing "a device capable of easily establishing a connection between a computer and another computer." (See EX1014, [0002]; EX1013, ¶178~~; EX2019, ¶109~~.) Moreover, by replacing the existing internal switching functionality of Chang II with an external switching element (a multiplexer), the proposed combination physically bypasses Chang II's bridge circuit, thus changing Chang II's principle of operation: utilizing its switching circuitry to switch to the appropriate transmission path. (Petition, 35-38; EX1013, ¶¶160-165~~; EX2019, ¶109~~.)

2. The Proposed Combination Would Impair Usability And Functionality And Undermine USB Goals

110. The proposed combination suffers from additional defects that no POSITA would be motivated to incur. ~~(EX2019, ¶110.)~~ As described above, the proposed combination enters a state from which it cannot return: Chang II's control chip 13 is physically disconnected from the downstream USB ports (and any devices connected to those ports), and can no longer perform the process of Chang II's FIG. 6 to determine whether the connected device is in a host mode. ~~(EX2019, ¶110.)~~ Further, Chang II's control chip 13 cannot re-execute this process unless and until the control chip is somehow reconnected to the downstream USB port—an operation wholly unaddressed by the Petition. ~~(EX2019, ¶110.)~~ Additionally, as described above, the proposed combination would be unable to properly detect new external devices connected to the bridge device. ~~(EX2019, ¶110.)~~ This would impair usability and result in confusion, because the proposed combination would respond to user input in a manner inconsistent according to users' expectations—such as by retaining an out-of-date, and perhaps inapplicable, USB mode when a new device is connected (e.g., a direct-to-hub connection for a newly inserted device in host mode). ~~(EX2019, ¶110.)~~ Moreover, the proposed combination would remove existing USB hub functionality, including the ability to connect and reconnect USB devices in host mode or device mode, present in Chang and Chang II. ~~(EX2019, ¶110.)~~ No POSITA would thus be motivated to modify Chang and Chang II in the manner proposed. ~~(EX2019, ¶110.)~~

111. Furthermore, as described above, the proposed combination limits or disables "hot-swapping" functionality, by removing Chang II's ability to detect newly inserted downstream devices. ~~(EX2019, ¶111.)~~ But as the USB 2.0 specification demonstrates, support for "dynamically attachable and reconfigurable peripherals" was a key design feature of USB. (EX1018, 41~~; EX2019, ¶111.)~~

.) Similarly, Mr. Welch identified "Support [for] hot plug and unplug" as motivation for the development of USB. (EX1013, ¶51.) The proposed combination's loss of functionality would thus undermine the goals of USB generally, and would defeat the '643 patent's ability to maintain USB compatibility. (EX1011, 4:7-15~~; EX2019, ¶111~~.) No POSITA would be motivated to implement this combination. ~~(EX2019, ¶111.)~~

3. The proposed combination would introduce unnecessary complexity, redundancy, and additional costs

112. The proposed combination is wasteful and inefficient. As described above, the Petition takes existing USB solutions in Chang and Chang II; adds duplicative switching components and new electronic hardware; and disregards existing components, for no reason other than to conjure a hindsight version for the challenged claims. ~~(EX2019, ¶112.)~~ For example, as described above, the Petition proposes modifying Chang's USB hub by replacing its ports with new dual-role

ports, and applying the bridge device of Chang II to the existing bridge device of Chang. ~~(EX2019, ¶112.)~~

113. Even though Chang II already includes, as its "main feature," circuitry for switching between two transmission paths, EX1015 at [0021], the Petition proposes further modifying the Chang/Chang II combination to insert additional switching hardware, inside and outside of Chang's hub, e.g.: (Petition, 49~~; EX2019, ¶113~~.)

114. As described above, the proposed combination uses the new switching hardware as a replacement for Chang II's existing switching circuitry. ~~(EX2019, ¶114.)~~ For example, the Petition explains that when the multiplexer switches a USB port to a direct-to-hub path, it bypasses the bridge of Chang 2 (Petition, 67-68~~; EX2019, ¶114~~.) In this combination, the Chang II control chip circuit is left intact, but neither the bypass circuit unit 133, nor the existing switching circuitry connecting to the bypass circuit unit, are utilized: (EX1015, FIG. 5 (annotated~~); EX2019, ¶114.)~~).)

115. Similarly, the proposed combination, at least in some implementations, introduces additional ports (44, 50) to Chang's USB hub, which already includes ports; and extends the circuitry outside Chang's existing hub enclosure 40: (Petition, 49~~; EX2019, ¶115~~.)

116. In at least these instances, the proposed combination introduces redundant components with no clear benefit; adds unnecessary complexity; and wastefully leaves existing components unused or underutilized. ~~(EX2019, ¶116.)~~ This inefficiency brings with it real costs, as Petitioner's expert does not dispute (and did not consider in his analysis)—potentially including, for example, expenses associated with manufacturing, purchasing, integrating, and maintaining components; additional bulk and power consumption; unnecessary heat dissipation; and overall complexity. (See EX2021, 235:19-24, 236:5-22, 237:7-16, 240:24-241:18~~; EX2019, ¶116~~.) No POSITA would be motivated to combine the prior art in a manner that introduces such costs and complexity unnecessarily. ~~(EX2019, ¶116.)~~ Moreover, the proposed combination would undercut key goals of Chang and Chang II: simplicity, efficiency, and convenience. (EX1014, [0002], [0003], [0024]; EX1015, [0010], [0021~~]; EX2019, ¶116.)~~].) Chang II thus discourages the Petition's proposed combination. ~~(EX2019, ¶116.)~~

4. The POSITA Would Not Have Any Reasonable Expectation Of Success In Combining The References

117. The Petition additionally fails to establish a prima facie case of obviousness because the POSITA would have no reasonable expectation of success in combining the references as proposed by the Petition to achieve the claimed

invention. In re Merck & Co., Inc., 800 F.2d 1091, (Fed. Cir. 1986~~); EX2019, ¶).~~ ~~117.~~ For the reasons described above, the proposed combination would be incapable of meeting the claim limitations, and would suffer from critical defects in usability, including as the loss of detection functionality once a device mode has been entered. ~~(EX2019, ¶117.)~~ The Petition fails to acknowledge these defects, let alone to offer any evidence of how a POSITA would be able to combine the prior art with any reasonable expectation of success. ~~(EX2019, ¶117.)~~

X. GROUND II: CLAIMS 2, 7, AND 13 ARE NOT RENDERED OBVIOUS BY CHANG IN VIEW OF CHANG II, CHUTORASH, AND POSITA KNOWLEDGE

118. Ground II challenges dependent 2, 7, and 13, which depend from claims 1, 5, and 10, respectively. Ground II fails to render obvious any of these claims for at least the reasons discussed in Section ~~VII~~IX with respect to Ground I and parent claims 1, 5, and 10. ~~(EX2019, ¶118.)~~ The addition of the Chutorash reference, which relates generally to providing USB support in an automotive head unit, cannot correct the deficiencies of the Chang and Chang II references, in view of the POSITA's knowledge. (See EX1064~~; EX2019, ¶118~~.) This is at least because the Chutorash reference is silent regarding USB routing or routing circuitry, let

alone the particular routing logic or method steps recited in claim 1 and not taught by the remaining references, as described above. ~~(EX2019, ¶118.)~~

119. Further, The POSITA would not have been motivated to modify Chang in view of Chang II, Chutorash, and the POSITA's knowledge to meet the claim limitations for at least the same reasons discussed above for Ground 1. ~~(EX2019, ¶119.)~~ That is, the proposed combination of Ground II suffers from the same defects discussed for Ground 1—e.g., improper hindsight bias, rendering the prior art inoperable for its intended use, and introduction of complexity, redundancy, and additional costs—and the introduction of yet another reference, Chutorash, is irrelevant to and does nothing to mitigate those defects. ~~(EX2019, ¶119.)~~ Ground II fails for at least these reasons. ~~(EX2019, ¶119.)~~