

A. Chang

53. Chang is ~~aan 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, ¶53.~~.) Chang’s hub addresses the express goal of “easily establishing a connection between a computer and another computer.” (EX1014, [0003]; ~~EX2019, ¶53.~~.) 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, ¶53.~~.) FIG. 3 illustrates: (EX1014, FIG. ~~3~~; ~~EX2019, ¶53.~~.)

54. 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, ¶54.~~.) 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, ¶54.~~.)

B. Chang II

55. Chang II is ~~aan 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, ¶55.~~) 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, ¶55.~~) FIG. 1 illustrates: (EX1015, FIG. 1).

56. 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, ¶56.~~) Chang II's control chip implements this feature via a process shown in FIG. 6: (EX1015, [0023], [0042], FIG. ~~6; EX2019, ¶56.~~)

57. As shown in the figure, upon connection of an external device to the second connection interface (S601, S613, S625), a detection unit 134 of the control chip 13 switches to a virtual slave state (S603) and/or a virtual host state (S615), and detects a signal from the external device (S605, S617) on the second connection interface to determine whether the external device is a host device

(S607) or a slave device (S619). (EX1015, [0042]-[0046], FIG. 6;~~EX2019, ¶57.~~) If the external device is a host device, a CPU 135 of the control chip switches the device to the first connection interface via a bridge transmission path, which includes a first USB controller 131, a buffer unit 136, and a second USB controller 132. (EX1015, [0023]; ~~EX2019, ¶57.)~~ FIG. 5 illustrates: (EX1015, FIG. ~~5; EX2019, ¶55.~~)

58. Conversely, if the external device is a host device, CPU 135 switches the device to the first connection interface via a bypass path, which includes the first USB controller 131 and a bypass circuit unit 133, bypassing the buffer unit 136 and the second USB controller 132. (EX1015, [0023]; ~~EX2019, ¶58.)~~)

59. Upon connecting either the bridge transmission path or the bypass path, the control chip waits for the user to insert a different external device (S613, S625) before performing any additional detection or switching. (EX1015, FIG. ~~6; EX2019, ¶59.~~)

~~VII~~. GROUND I: CLAIMS 13-14 AND 18-20 ARE NOT RENDERED OBVIOUS BY CHANG IN VIEW OF CHANG II AND POSITA KNOWLEDGE

60. The Petition proposes in Ground I that claims 13-14 and 18-20 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 ~~allegedly~~which

Petitioner claims were within the knowledge of the POSITA. (*See, e.g.*,
Petition, 36-48; ~~EX2019, ¶60.~~)

~~As explained below~~61. 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, ¶61.)~~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, ¶61.)~~ 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, ¶61.)~~

A. The Petition's Proposed Combination

62. The Petition proposes three separate implementations of combining Chang, Chang II, and the POSITA's knowledge. (Petition, 36-49; ~~EX2019, ¶62.~~) Each proposed implementation offers a modification of Chang by Chang II, plus a switching element—either a multiplexer (mux) or a crossbar—inserted downstream of the purported bridge. (Petition, 36-49; ~~EX2019, ¶62.~~)

63. 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, ¶63.~~) 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.~~(EX2019, ¶63.)~~ as described herein.

1. The Mux Implementation

64. The Petition discloses a proposed implementation (the “mux implementation”), that inserts a multiplexer within Chang’s USB hub 40. (Petition, 42-43.) Notably, the Petition does not identify the mux implementation as a basis for challenging any claim. (*See* Petition, 36-87; EX2021, 216:5-217:24 (Petitioner’s expert explaining that he chose not to rely on the mux implementation for his claim analysis of a related patent).) The mux implementation is thus outside the scope of Ground I. (*See* 35 U.S.C. § 312(a)(3).)

65. In the Petition’s mux 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, 37-45;~~EX2019, ¶65.~~) 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, 42; ~~EX2019, ¶65.~~)

66. The Petition then modifies the combination further to incorporate Chang II's bridge device 1; the Petition supposes that Chang II's detection unit/bridge would generate signals that control the multiplexer's switching, surmising that doing so "would have been routine and obvious." (Petition, 41-42 n. ~~11; EX2019, ¶66.~~) ~~However, the implementation does not utilize Chang II's switching, relying instead on the mux for switching paths as described above.11.)~~

2. The Internal Crossbar Implementation

67. In two other proposed implementations (the "crossbar implementations"), Chang and Chang II are modified by inserting a crossbar switch. (Petition, 45-49; ~~EX2019, ¶67.~~) In the "internal crossbar implementation," or "Hub 46 implementation," the crossbar is inserted within Chang's USB hub 40. (Petition, 45-46; ~~EX2019, ¶67.~~) Various additional modifications are made to the combination of Chang and Chang II. Chang's host port 50 and downlink ports 44 are transformed into dual-role USB ports and connected to inputs of the crossbar; Chang's bridge 52 is decoupled from USB port 50 and instead connected to a first output of the crossbar; and Chang's transmission paths 48 are decoupled from their respective downlink

ports 44 and instead connected to additional outputs of the crossbar: (Petition, 45-48, 57-58; ~~EX2019, ¶67.~~)

~~This implementation does not utilize Chang II's internal switching between the bridge path and the bypass path. (EX2019, ¶70.) Instead, 68.~~

According to the Petition, the crossbar 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, ¶68.~~)

69. Alternatively, the crossbar can switch the downstream USB port to the hub control unit 46 through bridge 52 (if the connected device is in host mode): (Petition, 62; ~~EX2019, ¶69.~~)

~~According to the Petition~~70. As with the mux implementation, the Petition does not rely on Chang II's internal switching between the bridge path or the bypass path; instead, “asserting the appropriate crossbar control signals connects the consumer product to the bridge (for host-to-host path 54) or directly to the hub (for host-device path 48).” (Petition, 41-42 n. 11, 58-65; EX1013, ¶189; ~~EX2019, ¶70.~~) the Petition apparently relies on signals generated by Chang II's “bridge and/or detection unit” to meet these crossbar control signals, speculating that this proposed modification “would have been routine and obvious.” (Petition, 41-42 n. 11; ~~EX2019, ¶70.~~)

3. The External Crossbar Implementation

71. In the “external crossbar implementation,” or “Hub 40 implementation,” the crossbar is inserted external to Chang’s USB hub 40. (Petition, 42-43 ~~EX2019, ¶71.~~) 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 a crossbar between the dual-role USB ports and the bridge 52; and connecting the outputs of the crossbar to the hub control unit 46: (Petition, 45-49, 58; ~~EX2019, ¶71.~~)

~~This implementation again does not utilize Chang II’s internal switching. (EX2019, ¶74.)~~ Instead, 72. According to the Petition, as above, the crossbar 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, ¶72.~~)

73. And as above, the crossbar can switch the downstream USB port to the hub control unit 46 through bridge 52 (if the connected device is in host mode): (Petition, 62; ~~EX2019, ¶73.~~)

~~In the proposed combination~~ 74. As above, the Petition does not rely on Chang II’s internal switching between the bridge path or the bypass path; instead, the crossbar apparently performs the switching based on the signals generated by Chang II’s bridge/detection unit. (Petition, 41-42 n. 11, 58-61, 64-65; EX1013,

¶189;~~EX2019, ¶74.~~) The Petition speculates that this proposed modification “would have been routine and obvious.” (Petition, 41-42 n. 11;~~EX2019, ¶74.~~)

B. The Proposed Combination Is Incomplete and Technically Unsound

75. Petitioner’s proposed combination—including all three 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, ¶75.~~) The proposed combination further is unsupported by the references, and relies solely on expert testimony that is contradictory and unreliable. (~~EX2019, ¶75.~~)

1. The Petition Fails to Show the Switching Limitations With Particularity For Any Challenged Claim

76. All challenged claims recite switching limitations (*e.g.*, a USB routing switch) having a particular configuration. As described above, the proposed combination relies on “off-the-shelf” switching elements—multiplexers or crossbar switches—to implement the claimed USB routing switch. (*See* Petition, 49-50;~~EX2019, ¶76.~~) These switching elements are absent from Chang and Chang II, and are instead supplied from the POSITA’s alleged knowledge. (*See* Petition, 36-48, 41-42 n. 11, 58-61, 64-65;~~EX2019, ¶76.~~)

77. The claimed ~~switching elements~~ USB routing switch cannot be met by off-the-shelf switching components alone. (~~EX2019, ¶77.~~) The claims instead have particular requirements for the USB routing switch. *First*, as recited in independent claim 18 and its dependents, the claimed USB routing switch provides a first communication path between the second USB port and the USB host-to-host bridge, and a second communication path between the second USB port and the first USB port that bypasses the USB host-to-host bridge. (EX1003, claim 18.) *Second*, the USB routing switch connects the first communication path when the first consumer device is connected to the second USB port and is operating in a USB host mode, thereby providing bidirectional initiation of communication between the USB host and the consumer device. (EX1003, claim 18.) *Third*, the USB routing switch connects the second communication path, thereby only responding to communication initiated by the USB host when the first consumer device is connected to the second USB port and is operating in a USB device mode. (EX1003, claim 18.) Independent claim 13 and its dependent claim 14 recite analogous ~~switching~~ limitations. (EX1003, claim 13; ~~EX2019, ¶77.~~)

78. The Petition fails to show how generic switching elements—muxes or crossbars—would be combined with Chang and Chang II to meet these

specialized requirements. As the Petition recognizes, switching components such as multiplexers and crossbars rely on “control signals” or “select lines” to configure which input(s) are routed to which output(s) within the switching element. (Petition, 77, 79-80; ~~EX2019, ¶78~~; EX1013, ¶¶89, 91, 253 (citing EX1055, 284-288, EX1015, [0038])).) For example, as Mr. Welch provides, the switching paths of a crossbar are controlled by its control signals, as defined by a truth table: (EX1013, ¶¶252 (citing EX1063, 8), 228; ~~EX2019, ¶78~~.)

79. 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 or crossbar would implement the claimed switching configurations, the Petition relegates the required control signals to a footnote, speculating that “It would have been routine and obvious for the detection unit and/or bridge [of Chang II] to control the switching functionality.” (Petition, 41-42 n. 11; ~~EX2019, ¶79~~.)

80. The Petition’s evidentiary support is limited and nonspecific. (~~EX2019, ¶80~~.) The Petition identifies that “Chang II’s bridge controls routing”; observes generically that the Chang II bridge includes a control chip and detection unit, and that Chang II discloses an “inquire signal” internal to the

control chip; and cites to Mr. Welch’s description of garden-variety multiplexers and crossbars. (Petition, 41-42 n. 11, 59, 64-65; ~~EX2019, ¶80.~~) From this, the Petition surmises that “any known host/device detection technique could be (and would have been) used in the Crossbar Implementations” to determine when the consumer device is in a USB host mode and in a USB device mode. (Petition, 58-59; ~~EX2019, ¶80.~~) The Petition further concludes, without explanation, that “Upon detection, asserting the appropriate crossbar control signals connects the consumer product to the bridge (for host-to-host path 54) or directly to the hub (for host-device path 48).” (Petition, 61; ~~EX2019, ¶80.~~)

81. The Petition fails to set forth how the inquire signal of Chang II (or any other signal) would be utilized by the crossbar in the Crossbar Implementations to perform the claimed determining or connecting the USB ports in the specific configurations recited by the claims; or how any such modification to Chang and Chang II would be within the scope of the POSITA’s general knowledge. (~~EX2019, ¶81.~~) To the contrary, ~~as Dr. Houh explains,~~ while the POSITA’s knowledge may include multiplexer and crossbar 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 switching requirements of the claims. (~~EX2019, ¶81.~~) Moreover, And while Mr. Welch’s declaration explains that at paragraph 159 provides

description of Chang II’s detection unit, which “produces either a ‘bridging detection signal’ (after detecting a host) or ‘slave detection signal’ (after detecting a device),” Mr. Welch fails to explain ~~(and the Petition does not allege)~~ how these signals could satisfy the claim limitations: and in any event, the Petition does not rely on this portion of Mr. Welch’s declaration to meet any limitation of any challenged claim. (EX1013, ¶159; ~~EX2019, ¶81.~~)

82. 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, ¶82.))~~.) The Petition is deficient with respect to all challenged claims for at least this reason.

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

83. 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, ¶83.)~~

84. 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

USB routing switch. (See EX2021, 147:10-24, 148:11-25; ~~EX2019, ¶84.~~)

Instead, the Petition relies on a *crossbar* as the USB routing switch. (Petition, 56-58; EX1013, ¶¶185, 189-190; ~~EX2019, ¶84.~~) As described above in Section ~~VHIX~~.A, the crossbar (whether in the internal or external 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 (2) connecting the USB port to the hub control module 46 via the bridge, if the device on the downstream port is in host mode. ~~(EX2019, ¶84.)~~

85. Notwithstanding the Petition’s deficient description of the crossbar control signals, discussed above, the proposed combination relies on Chang II’s control chip 13 and detection unit 134 in the bridge to provide the control signals that cause the crossbar to route the downstream ports through the appropriate transmission path. For example, the Petition indicates that “*Chang II’s bridge* controls routing, viz., ‘Bridge Device 1’ in Fig. 1 includes ‘control chip 13’ (shown in Fig. 5) with ‘detection unit’ (134) and CPU (135)’; and further that “it would have been obvious for *Chang’s bridge and/or detection unit* to control, e.g., the switch’s select lines.” (Petition, 41-42 n. 11, 50; EX1013, ¶¶192-193, 227-228; ~~EX2019, ¶85.)~~.) Similarly, Mr. Welch clarifies that “Chang II’s bridge includes [the] ‘*detection unit*’ (in the control chip) that detects the mode of the downstream product for selection of the appropriate transmission path.”

(EX1013, ¶193 (citing EX1015, [0022]-[0023], [0034]); ~~EX2019, ¶85~~; *see also* EX1015, [0016], [0022]-[0028], Fig. 2 (circuit diagram of bridge device and control chip).)

86. The Petition relies on the detection unit's control signals to connect the appropriate transmission path: "Upon detection, *asserting the appropriate crossbar control signals* connects the consumer product to the bridge (for host-to-host path 54) or directly to the hub (for host-device path 48)." (Petition, 61; EX1013, ¶254; ~~EX2019, ¶86.~~) For instance, the Petition describes that "Chang II's control chip selects the bridge path upon detecting a downstream host and a bridge connection is made to 'complete the bridging.'" (Petition, 64-65 (citing EX1015, [0026], [0021], [0038]; ~~EX2019, ¶86.~~)). The Petition further relies on Mr. Welch's declaration, which explains the mechanism by which the detection unit of the bridge provides the control signals: "the detection unit detects the connection of a host or device by ~~(1)~~ sending an 'inquire signal' and receiving a response (when a host connects) or ~~(2)~~ receiving an 'inquire signal' (when a device connects). The detection unit then produces either a 'bridging detection signal' (after detecting a host) or 'slave detection signal' (after detecting a device). These signals cause the switching to the appropriate transmission 'path' (to use the bridge or bypass the bridge)." (EX1013, ¶¶159 (internal citations omitted), 80, 189-190, 259; ~~EX2019, ¶86.~~) For instance,

these detection signals “would be used to control the crossbar control signals and establish the appropriate routing connections” (*i.e.*, for a downstream port to use the bridge or to bypass the bridge). (EX1013, ¶¶252, 159, 190, 193, 265; ~~EX2019, ¶86.~~)

87. In order to send or receive the inquire signal, and thus produce the bridging/slave detection signals, the detection unit 134 executes the process shown in FIG. 6 of Chang II, described above. (Petition, 32, 59; EX1015, FIG. 6, [0024]; ~~EX2019, ¶87;~~ EX1013, ¶¶159, 189 (citing EX1015).)

88. But the proposed combination includes a structural flaw. ~~(EX2019, ¶88.)~~ As Mr. Welch cautions: “the detection unit *must connect* to the downstream port to detect the mode, as shown in Chang II.” (EX1013, ¶193 (emphasis added).) But in the proposed combination, the control chip and detection unit (in the bridge) are *separated* from the downstream ports (*i.e.*, 44, 50) by the routing switch—*i.e.*, a crossbar². ~~(EX2019, ¶88.)~~ The Petition illustrates this separation, in both the Hub 46 and Hub 40 implementations: (Petition, 45-49; ~~EX2019, ¶88.~~)

89. The behavior of the routing switch demonstrates the need for Mr. Welch’s admonition. When the crossbar connects the downstream port 50 to the hub via the bridge 52, the bridge 52 is connected to the downstream port 50 through the switching element: (Petition, 80, 58; ~~EX2019, ¶89.~~)

90. But when the crossbar 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, 81, 63-64; ~~EX2019, ¶90~~; *see* EX1013, ¶¶159 (“These signals cause the switching to the appropriate transmission ‘*path*’ (to use the bridge or bypass the bridge)”)), 179, 190, 247.)

~~As Dr. Houh explains, 91.~~ Consistent with Mr. Welch’s description of crossbars and supporting evidence, the crossbar selecting the direct-to-hub path electrically disconnects the bridge device from all downstream USB ports.

~~(EX2019, ¶91;~~ *(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, ¶91.)~~ Similarly, a reference cited by Mr. Welch explains that transmission gates, such as those that connect a crossbar’s inputs to its outputs, comprise transistors that switch between a closed circuit and an open circuit of “essentially infinite resistance.” (EX1069, 23; ~~EX2019, ¶91.~~) And the MAX4989 switch, on which Mr. Welch relies to illustrate a crossbar, indicates that the control logic operates to electrically connect and disconnect (via open circuits) its inputs and outputs: (EX1063, 8 (annotated); ~~EX2019, ¶91;~~ *see also* EX1013, ¶58.)

92. When the bridge device is bypassed by the crossbar, it is thus electrically disconnected from the downstream USB ports coupled to the

crossbar. ~~(EX2019, ¶92.)~~ Because the bridge device and its control chip and detection unit 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. ~~(EX2019, ¶92.)~~ This, accordingly, prevents the bridge device and the control chip and the detection unit from generating the bridging detection signal, or otherwise providing control signals to the crossbar.

~~(EX2019, ¶92.)~~ Consequently, once the USB hub module in the proposed combination switches to the device mode, it is *incapable* of directing the crossbar 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, 33-36; EX1013, ¶¶80, 159, 251; ~~EX2019, ¶92.~~)

93. FIG. 6 of Chang II further demonstrates the flaw in the proposed combination. As described above, FIG. 6 illustrates the process performed by Chang II’s bridge device (*i.e.*, control chip 13 and detection unit 134 of the bridge device) to detect whether a connected external device is in host mode or device (“slave”) mode. ~~(EX2019, ¶93.)~~ (EX1015, FIG. 6; ~~EX2019, ¶93.~~)

94. In the illustrated process, the control chip exchanges inquire signals with the external device at least at stages S603, S605, and S617; and

checks for a newly inserted external device at stages S601, S613, and S625.

(EX1015, FIG. 6; EX2019, ¶94.)^{6.} In the proposed combination, once a connected device is detected to be in device mode, the crossbar switches to a direct-to-hub path that bypasses the bridge device and disconnects it from downstream ports, as described above. (EX2019, ¶94.) 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 crossbar 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, ¶94.) This prevents the proposed combination from performing "hot-swapping" of devices. (EX2019, ¶136.)

C. The Proposed Combination Does Not Meet the Claim Limitations

i. Claim 13

95. The Petition's proposed combination fails to meet the limitations of claim 13 and its dependent claim 14. (EX2019, ¶95.)

- a. a. — The Proposed Combination Does Not Meet the Claimed *Determining When the Consumer Device Is Operating In A USB Host Mode And In A USB Device Mode***

96. Claim 13 ~~recites, and its dependent claim 14, recite~~ *determining when the consumer device is operating in a USB host mode and in a USB device mode.* (EX1003, claims 13, 14.) To meet this claim limitation, the Petition relies on its proposed Crossbar Implementations, in which Chang II’s bridge and detection unit “automatically operate[s] ... to determine the type of device connected with the second connection interface, and a detection signal is produced accordingly.” (Petition, 58-59 (citing EX1015, [0013], [0027], [0046]); ~~EX1013, ¶¶189, 193; EX2019, ¶96.~~) (Petition, 58-59 (citing EX1015, Fig. 5).)

97. The Petition further relies on Chang II’s description of “operational details of detection unit 134,” such as by providing an inquire signal, with Fig. 6 of Chang II providing the host/device detection algorithm. (Petition, 58-59 (citing EX1015, [0038]-[0040], [0042]-[0045], Fig. ~~6; EX2019, ¶97.~~6).)

98. But as explained above in Section ~~VHIX~~.B, the Petition’s characterization of the proposed combination is inaccurate, and the Petition thus relies on faulty premises to meet these limitations. ~~(EX2019, ¶98.)~~ For example, the proposed combination is incapable of providing the claimed determining when the consumer device is operating in a USB host mode and in a USB device mode. ~~(EX2019, ¶98.)~~ Instead, it reaches a state in which the

crossbar routes the downstream consumer device directly to the USB hub, bypassing and disconnecting the bridge, control chip, and detection unit on which the Petition relies; and rendering it unable to detect the consumer device's operating mode. ~~(EX2019, ¶98.)~~ For example, once the consumer device has been routed directly to the USB hub, bypassing the bridge, the consumer device may operate in a USB host mode or in a USB device mode, but the detection unit will be unable to determine any such operation mode as described above in Section ~~VHIX.B.~~ ~~(EX2019, ¶98.)~~ Thus, the proposed combination cannot determine *when* the consumer device is operating in a USB host mode and in a USB device mode and thus cannot meet the claim limitation. ~~(EX2019, ¶98.)~~

~~Further, the Petition relies for this element on the testimony of Mr. Welch, which is inaccurate and unreliable for the reasons described herein and should be afforded no weight. (EX2019, ¶99.)~~ Further, the Petition relies for this element on the testimony of Mr. Welch, which is inaccurate and unreliable for the reasons described herein and should be afforded no weight. .) The Petition thus fails to show this claim element is met. ~~(EX2019, ¶99.)~~

**b. The Proposed Combination Does Not Meet
The Claimed *Connecting The Consumer
Device* Steps**

100. The crossbar implementations similarly cannot meet the required steps of connecting the consumer device via the second USB port to the USB host via the first USB port through the USB routing switch and the USB bridge, thereby providing bidirectional initiation of communication between the USB host and the consumer device when the consumer device is determined to be in the USB host mode; and connecting the consumer device via the second USB port to the USB host via the first USB port through the USB routing switch and the USB hub thereby bypassing the USB bridge to only respond to communication initiated by the USB host when the consumer device is determined to be in the USB device mode. (EX1003, claim 13; ~~EX2019, ¶100.~~)

101. To meet these claimed steps, the Petition relies on its proposed Crossbar Implementations being able to “connect the appropriate transmission path upon detecting the downstream consumer product’s operating mode (i.e., device/host).” (Petition, 60-63; ~~EX2019, ¶101.~~) The Petition explains the limitations are met because “Upon detection, asserting the appropriate crossbar control signals connects the consumer product to the bridge (for host-to-host path 54) or directly to the hub (for host-device path 48).” (*Id.*) Further, the Petition apparently relies on the detection unit 134 of Chang II’s bridge to meet

these crossbar control signals. (Petition, 41-42 n. 11, 50; EX1013, ¶193; EX1015, [0022]-[0023], [0034]; ~~EX2019, ¶101.)~~.)

102. But as with the “determining” step described above, the Petition’s characterization of the proposed combination is inaccurate, and the Petition thus relies on faulty premises to meet these limitations. ~~(EX2019, ¶102.)~~ For example, the proposed combination does not “connect[] said first communication path when the first consumer device is connected to said second USB port and is operating in a USB host mode”; or “connect[] said second communication path ... when the first consumer device is connected to said second USB port and is operating in a USB device mode.” ~~(EX2019, ¶102.)~~

103. Instead, as described above in Section ~~VHIX~~.B, the proposed combination reaches a state in which the crossbar routes the downstream consumer device directly to the USB hub, disconnecting the bridge and detection unit that generates the crossbar control signals; and rendering it unable to detect the consumer device’s operating mode, let alone “connect the appropriate transmission path” or assert “the appropriate crossbar control signals,” as described above. ~~(EX2019,~~

~~¶103.)~~ The proposed combination is thus unable to connect the first/second communication path when the consumer device is determined to be in the USB host/device mode, as required by claim 13. ~~(EX2019, ¶103.)~~ ~~Further, the Petition relies for this element on the testimony of Mr. Welch, which is inaccurate and unreliable for the reasons described herein and should be afforded no weight.~~ Further, the Petition relies for this element on the testimony of Mr. Welch, which is inaccurate and unreliable for the reasons described herein and should be afforded no weight. ~~(EX2019, ¶103.)~~ The Petition thus fails to show this claim element is met. ~~(EX2019, ¶103.)~~

~~2.~~ ii. Claim 14

104. Claim 14 depends from claim 13. In addition to the reasons described above for claim 13, claim 14 is not rendered obvious because the Petition's proposed combination cannot meet claim 14's limitation that *the step of determining if when the consumer device is operating in the USB host mode or in the USB device mode is performed by the USB routing switch.* (EX1003, claim 14.) This limitation is not taught by any reference, and further cannot be met while also satisfying the parent claim's requirement of *bypassing the USB bridge.* ~~(EX2019, ¶104.)~~

105. To show that the "determining" limitation is performed by the USB routing switch, Petitioner speculates that it would have been obvious for the

proposed combination to feature a single integrated circuit (IC) including both the alleged USB routing switch (*i.e.*, the crossbar) and the detection unit 134 of Chang II, which is alleged to meet the “determining” limitation. (Petition, 69-71, 58-59; ~~EX2019, ¶105.~~)

106. This fails to show that claim 14 is met. ~~(EX2019, ¶106.)~~ First, the Petition points to no evidence of a single IC that includes both detection unit 134 and the crossbar relied upon by the Petition. ~~(EX2019, ¶106.)~~ Instead, the Petition apparently contends the POSITA would have known to design a custom IC, speculating that the POSITA “would have known how to easily do so,” and that it would have been “common sense.” (Petition, 69-71; ~~EX2019, ¶106.~~)

107. But IC design is a complex field posing non-trivial technical challenges, and requiring specific electronic design expertise. ~~(EX2019, ¶107.)~~ These complexities are overlooked by the Petition, which fails to explain in any detail how the POSITA would have been able to combine the crossbar and Detection Unit 134 into a single IC, and to incorporate that IC into the proposed combination, with any reasonable expectation of success. This is particularly so given the level of skill in the art, which under either party’s formulation does not include any IC design experience. (*See supra* Section ~~III~~V.D; Petition, 22-

23;~~EX2019, ¶107.~~) Moreover, as the Federal Circuit has explained, the Petition’s appeal to “common sense” to supply missing claim limitations is proper only if supported by evidence and a reasoned explanation—both absent here. *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016).

108. Second, the Petition’s proposed IC would defeat another limitation of claim 14: that connecting the consumer device to the USB host through the USB routing switch when the device is in USB device mode must *bypass* the USB bridge. (EX1003, claim 13;~~EX2019, ¶108.~~) As proposed by Petitioner, claim 14 is met by a single IC component that includes both the USB routing switch and Chang II’s detection unit 134. (Petition, 69-70;~~EX2019, ¶108.~~) But as Petitioner and its expert recognize, the detection unit 134 is a component of the USB bridge. (~~EX2019, ¶108.~~) For example, the Petition observes that Chang II’s “‘Bridge Device 1’ in Fig. 1 includes ‘control chip 13’ [...] with ‘detection unit’ (134) and CPU (135).” (Petition, 41-42 n. 11;~~EX2019, ¶108.~~) And Mr. Welch explains that “Chang II’s bridge includes [the] ‘*detection unit*’ (in the control chip) that detects the mode of the downstream product for selection of the appropriate transmission path.” (EX1013, ¶193 (citing EX1015, [0022]-[0023], [0034]); ~~EX2019, ¶108;~~ *see also* EX1015, [0016], [0022]-[0028], Fig. 2 (circuit diagram of bridge device and control chip).)

109. The Petition relies on this detection unit, and thus the bridge, to perform the determining step. (Petition, 58-59;~~EX2019, ¶109.~~) Thus, in the proposed combination, the same electronic component (the IC) comprises both the bridge and the USB routing switch. ~~(EX2019, ¶109.)~~ This IC makes it impossible for the proposed combination to connect the consumer device through the USB routing switch, and also to bypass the USB bridge, as required by claim 14. ~~(EX2019, ¶109.)~~ The proposed combination fails to satisfy claim 14 for at least this additional reason.~~(EX2019, ¶109.)~~

iii. Claims 18-20

**a. The proposed combination does not meet the claimed
*USB routing switch***

110. Claim 18~~requires, and its dependent claims 19 and 20, require~~ a USB routing switch configured according to specific requirements. For example, the claimed USB routing switch provides a first communication path between the second USB port and the USB host-to-host bridge, and a second communication path between the second USB port and the first USB port that bypasses the USB host-to-host bridge. Further, the claimed USB routing switch connects the first communication path when the first consumer device is connected to the second USB port and is operating in a USB host mode, thereby providing bidirectional initiation of communication between the USB host and the consumer device. The USB routing switch also connects the second

communication path, thereby only responding to communication initiated by the USB host, when the first consumer device is connected to the second USB port and is operating in a USB device mode. (EX1003, claims 18-20;~~EX2019, ¶110.~~)

111. To meet this claim limitation, the Petition relies on its proposed Crossbar Implementations “automatically detecting the type of device connected (host or slave),” and thus “switch[ing] to the proper transmission path.” (Petition, 77-82; *see* EX1013, ¶¶189, 193;~~EX2019, ¶111.~~) The Petition explains the limitation is met by “asserting appropriate crossbar control signals based on the downstream product’s host/device mode.” (Petition, 77; *see* EX1013, ¶¶189, 193;~~EX2019, ¶111.~~) Further, the Petition apparently relies on Chang II’s bridge, including the control chip 13 and detection unit 134, to meet these crossbar control signals. (Petition, 41-42 n. 11; *see* EX1013, ¶¶189, 193;~~EX2019, ¶111.~~) But as the Petition illustrates, when the host-device path is selected, the bridge is bypassed entirely: (Petition, 77-78;~~EX2019, ¶111.~~)

112. But as explained above in Section ~~VHIX~~.B, and further with respect to claim 13, the Petition’s characterization of the proposed combination is inaccurate, and the Petition thus relies on faulty premises to meet these limitations. (~~EX2019, ¶112.~~) For example, the proposed combination does not “automatically detect[] the type of device connected (host or slave),” and thus “switch to the proper transmission path.” (Petition, 77;~~EX2019, ¶112.~~)

113. Instead, as described above, the proposed combination reaches a state in which the crossbar routes the downstream consumer device directly to the USB hub, disconnecting the bridge, control chip, and detection unit that generate the crossbar control signals; and rendering it unable to detect the consumer device's operating mode. ~~(EX2019, ¶113.)~~ The USB routing switch of the proposed combination is thus unable to connect the first/second communication path when the consumer device is operating in a USB host/device mode, as required by claim 18. ~~(EX2019, ¶113.)~~ Further, the Petition relies for this element on the testimony of Mr. Welch, which is inaccurate and unreliable for the reasons described herein and should be afforded no weight. ~~(EX2019, ¶113.)~~ The Petition thus fails to show this claim element is met. ~~(EX2019, ¶113.)~~

b. The proposed combination does not meet the claimed USB hub including a first USB port and a second USB port

114. As described above in Section IVV.A, the Board declined to adopt the proposed construction of claim 18 as *a USB hub interconnected to a first USB port and a second USB port*. (DI, 15.) Similarly, the Board declined to adopt the proposed construction of claim 19 as *wherein the USB hub is interconnected to a third USB port*. (DI, 15.) Accordingly, for the purposes of this proceeding, claim 18 and its dependent claims 19 and 20 require a USB hub

including a first USB port and a second USB port. Similarly, ~~dependent~~ claim 19 (and its dependent claim 20) further require that the USB hub includes a third USB port.

115. In addition to the reasons discussed above, claims 18-20 are additionally not rendered obvious because the Petition's proposed combination cannot meet these claim limitations. ~~(EX2019, ¶115.)~~ That is, neither of the two crossbar implementations relied on by the Petition—the internal (Hub 46) and external (Hub 40) implementations—can meet the claimed USB hub that includes the claimed USB ports. ~~(EX2019, ¶115.)~~

116. First, with respect to the internal crossbar implementation, the Petition relies on the USB hub control unit 46 of Chang as the alleged USB hub, as illustrated below: (Petition, 71-73 (citing EX1014, Fig. 3 (modified and annotated by Petitioner)), 51-53; ~~EX2019, ¶116.~~)

117. The internal crossbar implementation of the proposed combination cannot meet the claimed USB hub at least because the alleged USB hub does not include the first USB port and the second USB port. ~~(EX2019, ¶117.)~~ Instead, the first USB port (identified as uplink port 42) and second USB port (downlink ports 44 and host port 50) are located entirely outside of the alleged USB hub 46, and are further separated from the alleged USB hub by the crossbar switch, as evident from the above figure and the Petitioner's annotations. ~~(EX2019,~~

~~¶117.)~~ Similarly, Chang discloses that the hub control unit 46 (the alleged USB hub) is separated from the host port 50 (the alleged second USB port) by bridge 52; this configuration is inconsistent with the hub control unit 46 including the host port 50. (EX1014, [0020]; Petition, 29; ~~EX2019, ¶117.)~~

118. The Petition does not dispute that the USB hub does not include the first and second USB ports; to the contrary, the Petition contends only that the USB hub is *interconnected to* the first and second USB ports, without addressing whether the USB hub includes those ports. (Petition, 71-73, 51-53; ~~EX2019, ¶118.)~~

119. Second, with respect to the external crossbar implementation, the Petition relies on the USB hub 40 of Chang as the alleged USB hub, as illustrated below: (Petition, 71-73 (citing EX1014, Fig. 3 (modified and annotated by Petitioner)), 53-54; ~~EX2019, ¶119.)~~

120. The external crossbar implementation of the proposed combination cannot meet the claimed USB hub at least because the alleged USB hub does not include the claimed second USB port. ~~(EX2019, ¶120.)~~ Instead, the second USB port (identified as downlink ports 44 and host port 50) are located entirely outside of the alleged USB hub 40, and are further separated from the alleged USB hub by the crossbar switch, as evident from the above figure and the Petitioner's annotations. ~~(EX2019, ¶120.)~~

121. The Petition does not dispute that the USB hub does not include the second USB port; to the contrary, the Petition contends only that USB hub is *interconnected to the second USB port*, without addressing whether the USB hub includes that port. (Petition, 71-73, 53-54; ~~EX2019, ¶121.~~)

122. Likewise, with respect to claims 19 and 20, the proposed combination cannot meet the claimed USB hub that *includes* a third USB port. ~~(EX2019, ¶122.)~~ As the Petition explained, “In the Crossbar implementations, the ‘third USB port’ is any of ports 44 or 50 not mapped as the ‘second USB port.’” (Petition, 82; ~~EX2019, ¶122.~~) Thus, in either the internal or external crossbar implementations, the alleged USB hub (*i.e.*, hub control unit 46 or USB hub 40, respectively) does not include the third USB port for at least the reasons described above with respect to the second USB port (downlink ports 44 and host port 50). ~~(EX2019, ¶122.)~~ The proposed combination cannot meet claims 19 and 20 ~~are not met~~ for this additional reason. ~~(EX2019, ¶122.)~~

4.—iv. Claims 19, 20

~~Further,~~123. Claim 19 depends from claim 18, and claim 20 depends from claim 19. In addition to the reasons described above for parent claim 18, claims 19 and 20 are not rendered obvious because the Petition’s proposed USB routing switch cannot meet *connecting a third communication path between said third USB port and said first USB port when a second consumer device is*

connected to said third USB port and is operating in the USB device mode, as recited in claim 19. ~~(EX2019, ¶123.)~~

124. As described above, the Petition relies on Chang II's control chip 13 and detection unit 134 of the bridge device to generate control signals that direct the crossbar to select a transmission path for a downstream USB port. (Petition, 82-85; ~~EX2019, ¶124.~~) However, as the Petition acknowledges, Chang II's bridge device includes only a "single port" that accepts either a host device or a slave device: (Petition, 30-31; EX1015, [0030], [0012]; ~~EX2019, ¶124.)].~~)

125. The proposed combination thus lacks the requisite control logic for configuring the crossbar to connect multiple devices (*i.e.*, the claimed first and second consumer devices on the second and third USB ports) to the first USB port in the manner required by claim 19. ~~(EX2019, ¶125.)~~ And the Petition does not offer any modification that would permit Chang II's bridge to accept multiple devices. ~~(EX2019, ¶125.)~~ The proposed combination ~~thus~~ cannot meet claims 19 and 20. ~~(EX2019, ¶125.)~~ for at least this reason.

126. Moreover, even if Chang II were modified to detect multiple downstream device connections, the bridge device is disconnected from downstream USB ports once the crossbar selects the direct-to-hub path,

bypassing the bridge, as described in Section ~~VHIX~~.B and shown in the Petition:
(Petition, 83-85; ~~EX2019, ¶126.~~)

~~This cannot satisfy~~ 127. Even this hypothetical modification still could
not meet claims 19 or 20, ~~which:~~ the claims require that the routing switch be
configured to “connect[] a third communication path ... when the second
consumer device is connected to said third USB port and is operating in the USB
device mode.” (EX1003, claim 19; ~~EX2019, ¶127.~~) As recited in the claim,
this connection “bypasses” the bridge and thus prevents the bridge’s detection
unit from determining “when the second consumer device ... is operating in the
USB device mode” and providing the crossbar with the control signals that
would be needed to connect the second consumer device as recited by the claims.
(~~EX2019, ¶127.~~)

~~With respect to claim 20,~~ 128. Claim 20 is not rendered obvious for the
additional reason that the proposed combination cannot meet “*simultaneously*
provid[ing] the [third] communication path³ ... without interrupting the first
communication path between said first USB port and said second USB port.”
(EX1003, claim 20; ~~EX2019, ¶128.~~) The Petition relies on “asserting the
appropriate crossbar lines” to make this connection via the crossbar. (Petition,
86-87; ~~EX2019, ¶128.~~) However, in addition to the ~~deficiencies of defects~~

described in Section IX.B regarding asserting the crossbar lines, the proposed combination ~~described above, it~~ cannot provide the third communication ~~path~~ without interrupting the first communication path.

129. As described above in Sections VII.B and ~~VHIX~~.B, Chang II's detection unit provides control signals in response to determining whether a downstream device is in a host mode or a device mode, in a process described by Fig. 6 of Chang II. ~~(EX2019, ¶129.)~~ But as explained in Chang II, and further by Mr. Welch, that process involves entering a "virtual slave state" and a "virtual host state" to determine the mode of the downstream device—interrupting any existing communication path ~~by changing the operation mode while USB communications are ongoing.~~ (EX1015, [0026]-[0027], [0038]-[0045]; EX1013, ¶¶159, 259; ~~EX2019, ¶129.~~) Claim 20 is thus not met for this additional reason. ~~(EX2019, ¶129.)~~

ED. 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

130. 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 and crossbars) cherry-picked from the “POSITA’s knowledge.” ~~(EX2019, ¶130.)~~ 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, ¶130.)~~

131. 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, at 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, ¶131.)~~

1. ~~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

132. 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”).

133. The proposed combination improperly transforms the references, removing key functionality, and cannot support a *prima facie* case. ~~(EX2019, ¶133.)~~—As the Petition repeatedly emphasizes, Chang II repeats two “fundamental concepts”: “(1) host/device detection and (2) selecting between two different transmission paths.” (Petition, 32 (citing EX1015, [0024], [0046]); ~~EX2019, ¶133.)~~)). 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, 32-36, 41; EX1015, [0021]; ~~EX2019, ¶133.)~~ 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, ¶133.)~~

134. Thus, the proposed combination would render Chang II inoperable for its admitted main feature and intended purpose. ~~(EX2019, ¶134.)~~ 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, ¶134.~~) Moreover, by replacing the existing internal switching functionality of Chang II with an external switching element (a crossbar), 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, 32-36, 41-42, 45-49; EX1013, ¶¶160-165; ~~EX2019, ¶134.)~~ ~~In addition~~

~~to being non-functional, as described herein, this replacement circuitry disposes of one of Chang II's "fundamental concepts.".)~~

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

135. The proposed combination suffers from additional defects that no POSITA would be motivated to incur. ~~(EX2019, ¶135.)~~ As described above, the proposed combination enters a state from which it cannot return: Chang II's control chip 13 and detection unit 134 are 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, ¶135.)~~ 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, ¶135.)~~ Additionally, as described above, the proposed combination would be unable to properly detect new external devices connected to the bridge device. ~~(EX2019, ¶135.)~~ 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, ¶135.)~~ This concern may be especially critical in the context of vehicle systems, *see, e.g.*, claim 18, in which safety and regulatory matters may be implicated by the failure or unexpected behavior of vehicle control and communication systems. ~~(EX2019, ¶135.)~~ 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, ¶135.)~~ No POSITA would thus be motivated to modify Chang and Chang II in the manner proposed. ~~(EX2019, ¶135.)~~

136. 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, ¶136.)~~ 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, ¶136.~~) 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 could defeat the ’420 patent’s ability to maintain compatibility with the USB standard and other USB devices. (EX1003, 4:3-11;

~~EX2019, ¶136.)~~ No POSITA would be motivated to implement this combination. ~~(EX2019, ¶136.)~~

3. The Proposed Combination Would Introduce Unnecessary Complexity, Redundancy, and Additional Costs

137. 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, ¶137.)~~ 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, ¶137.)~~

138. 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, 46; ~~EX2019, ¶138.)~~

139. As described above, the proposed combination uses the new switching hardware as a replacement for Chang II’s existing switching circuitry. ~~(EX2019, ¶139.)~~ For example, the Petition explains that when the crossbar switches a USB port to a direct-to-hub path, the switch “bypasses the bridge.”

(Petition, 77-78;~~EX2019, ¶139.~~) 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, ¶139.~~)).

140. 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, 46; EX2019, ¶140.~~)

141. 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, ¶141.~~)—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, ¶141.~~) No POSITA would be motivated to combine the prior art in a manner that introduces such costs and complexity unnecessarily. (~~EX2019, ¶141.~~)—Moreover, the proposed combination would undercut key goals of Chang II: simplicity, efficiency, and convenience.

(EX1015, [0010], [0021]; ~~EX2019, ¶141.~~) Chang II thus discourages the Petition's proposed combination. ~~(EX2019, ¶141.)~~

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

142. 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, ¶142.~~ 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, ¶142.)~~ 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, ¶142.)~~