NOTE: This disposition is nonprecedential.

United States Court of Appeals for the Federal Circuit

UNIVERSAL ELECTRONICS, INC.,
Appellant

v.

ROKU, INC.,
Appellee

2021-1992, 2021-1993, 2021-1994

Appeals from the United States Patent and Trademark Office, Patent Trial and Appeal Board in Nos. IPR2019-01612, IPR2019-01613, IPR2019-01614.

Decided: August 18, 2023

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Before NEWMAN, REYNA, and STOLL, *Circuit Judges*.

NEWMAN, *Circuit Judge*.

This is a consolidated appeal of three *Inter Partes* Review ("IPR") petitions filed by Roku, Inc., for three patents derived from the same parent application and owned by Universal Electronics, Inc. ("UEI"). The Patent Trial and Appeal Board ("Board") held that claims 1–4, 6, 8, 9, and 22–25 of U.S. Patent No. 7,589,642 ("the '642 patent"); claims 2–5, 7–13, and 15 of U.S. Patent No. 8,004,389 ("the '389 patent"); and claims 1–5 of U.S. Patent No. 9,911,325 ("the '325 patent") are unpatentable on the ground of obviousness.[1] The Board upheld challenged claim 14 of the '389 and claim 7 of the '325 patent; Roku does not cross-appeal those rulings.

For the reasons we discuss, we affirm the Board's decisions in all three IPRs.

BACKGROUND

The Patented Inventions

The three UEI patents are entitled "Relaying Key Code Signals Through a Remote Control Device," and state that they relate "generally to remote control devices and, more specifically, to relaying key code signals through a remote control device to operate an electronic consumer device . . .

[1] *Roku, Inc. v. Universal Elecs., Inc.,* No. IPR2019-01612, 2021 WL 1192127 (P.T.A.B. Mar. 29, 2021); No. IPR2019-01613, 2021 WL 1192128 (P.T.A.B. Mar. 29, 2021); No. IPR2019-01614, 2021 WL 1395255 (P.T.A.B. Apr. 13, 2021). The Board issued analogous opinions for all three reviews. Citations to "Board Op." are to IPR2019-01612 unless otherwise noted.

such as televisions, stereo radios, digital video disk players, video cassette recorders, set-top cable television boxes and set-top satellite boxes." '642 patent, col. 1, ll. 6–16.[2]

The patents discuss problems accompanying the provision and use of electronic remote control technology:

> A remote control device typically controls a selected electronic consumer device by transmitting infrared key code signals to the selected electronic consumer device. The infrared signals contain key codes of a codeset associated with the selected electronic consumer device. Each key code corresponds to a function of the selected electronic device, such as power on, power off, volume up, volume down, play, stop, select, channel up, channel down, etc. In order to avoid the situation where a remote control device unintentionally operates an electronic consumer device that is associated with a different remote control device, manufacturers sometimes use distinct codesets for the communication between various electronic consumer devices and their associated remote control devices.

Id., col. 1, ll. 21–34. The patents' written descriptions elaborate on these problems and describe a method to relay a key code through a "remote control device to control a selected one of multiple different electronic consumer devices without requiring the codeset associated with the selected electronic consumer device to be stored on the remote control device." *Id.*, col. 1, ll. 51–55.

The representative claim for each patent is as follows:

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[2] The '325 patent is a continuation of the '389 patent, which is a continuation of the '642 patent. The specifications are the same. Unless otherwise noted the citations are to the '642 patent.

['642 patent] Claim 1. A method comprising:

(a) receiving a keystroke indicator signal from a remote control device, wherein the keystroke indicator signal indicates a key on said remote control device that a user has selected;

(b) generating a key code within a key code generator device using the keystroke indictor signal;

(c) modulating said key code onto a carrier signal, thereby generating a key code signal; and

(d) transmitting said key code signal from said key code generator device to said remote control device.

['389 patent] Claim 2. A method comprising:

(a) receiving a keystroke indicator signal from a remote control device, wherein the keystroke indicator signal indicates a key on said remote control device that a user has selected;

(b) generating a key code within a key code generator device using the keystroke indicator signal, wherein said key code is part of a codeset that controls an electronic consumer device;

(c) modulating said key code onto a carrier signal, thereby generating a key code signal;

(d) transmitting said key code signal from said key code generator device; and

(e) identifying said codeset using input from a user of said remote control device, wherein said codeset is identified when said user

stops pressing a key on said remote control device.

['325 patent] Claim 1. A first device for transmitting a command to control a functional operation of a second device, the first device comprising:

a receiver;

a transmitter;

a processing device coupled to the receiver and the transmitter; and

a memory storing instructions executable by the processing device, the instructions causing the processing device to:

generate a key code using a keystroke indicator received from a third device in communication with first device via use of the receiver, the keystroke indicator having data that indicates an input element of the third device that has been activated;

format the key code for transmission to the second device; and

transmit the formatted key code to the second device in a key code signal via use of the transmitter;

wherein the generated key code comprises a one of a plurality of key code data stored in a codeset, wherein the one of the plurality of key code data is selected from the codeset as a function of the keystroke indicator received from the third device, wherein each of the plurality of key code data stored in the codeset comprises a series of digital ones and/or digital zeros, and wherein the codeset further comprises time information

> that describes how a digital one and/or a digital zero within the selected one of the plurality of key code data is to be represented in the key code signal to be transmitted to the second device.

UEI appeals as to all the invalidated claims, arguing that the Board erred in holding that a skilled artisan would have been motivated to combine known wireless transmission technology with known modulation techniques.

The Cited References

Roku filed separate petitions for IPR of the three patents, citing Mishra, Rye, and Caris as primary references for relevant wireless transmission technology, combined with Dubil and Skerlos as references regarding relevant modulation techniques. UEI argues that the Board misunderstood and misconstrued the references, that the Board erred in finding a motivation to combine the references, and that the combination of references does not teach the inventions claimed in the UEI patents.

A

Wireless transmission of key codes

The Mishra, Rye, and Caris references relate to the wireless transmission of key codes:

Mishra, U.S. Patent Pub. No. 2001/0005197

The Mishra reference is titled, "Remotely Controlling Electronic Devices," and describes "a way to program a remote control unit to handle a variety of electronic devices in a fashion which is easy and quick for the user." *Id.* at ¶ 5. The Mishra Abstract summarizes:

> A control system enables telephone calls to be answered remotely using a remote control unit also adapted to remotely control an electronic device such as VCR. A processor based station may

> communicate with a remote control unit using both infrared and radio frequency protocols to enable remote telephone communications and remote control of electronic devices.

Rye, U.S. Patent Pub. No. US2004/0080428

The Rye reference is titled, "RF Audiovisual Component Remote Control System," and states that the object is "to provide a remote control system for use in controlling the operation of a multi-brand audiovisual component system that is cost effective and reliable." *Id.* at ¶ 12. Its Abstract summarizes:

> A handheld remote control unit transmits binary coded rf address and control signals to an addressable transceiver where those signals are detected, decoded and processed to derive binary coded control signals that are coded in accordance with the brands or manufacturers of the audiovisual components that are to be controlled along with the function that is to be thus controlled for the addressed components.

Caris, U.S. Patent No. 7,562,128 B1

The Caris reference is titled, "STB Connects Remote to Web Site for Customized Code Downloads," and "addresses perceived disadvantages in conventional programming of a remote control to be used with consumer electronics equipment." Board Op. at *13. Caris discusses the need for simplifying the process of configuring a remote for use with different pieces of equipment. '128 patent, col. 3, ll. 37–42. The Abstract summarizes:

> A set top box (STB) is marketed together with a programmable remote. The remote has a dedicated button to connect the STB to a specific server on the Internet. The consumer can notify the server of his/her other CE equipment, which he/she desires to be controllable through the same remote as

> the one that came with the STB. The server downloads to the STB data representative of the relevant control codes. The STB is provided with means to program the remote with these codes. In return the server has obtained detailed and accurate information about this consumer's equipment. A reliable customer base can thus be built for streamlining Help Desk operations.

B

Modulation techniques

Dubil and Skerlos describe the transmission of control codes using known modulation techniques.

Dubil, U.S. Patent No. 8,132,105 B1

The Dubil reference is titled, "Control Codes for Programmable Remote Supplied in XML Format" and "relates to remote control devices and to a service for enabling the programming of remote controls to be used with consumer electronics ("CE") equipment." *Id.*, col. 1, ll. 6–8. The Abstract describes the subject matter:

> An Internet service makes available control codes for use on a programmable universal remote. The remote controls CE equipment through IR or RF commands. A server supplies the control codes as XML data that gets processed at the receiver's set top box or PC, or the remote itself, for being properly installed on the remote.

The Board found that Dubil teaches "different modulation schemes that may be used in transmitting control codes having different bit patterns, including frequency-shift keying ("FSK"), binary phase-shift keying ("BPSK"), and pulse-width modulation ("PWM")." Board Op. at *13. Dubil states that "[t]he invention covers both the usage of XML for IR or RF codes and for the GUI. The codes can be described using a number of parameters defined by XML

tags. Examples have been mentioned above: carrier frequency, duty cycle, protocol type (FSK, biphase, PWM, etc.), repetition time, on/off[.]" Dubil, col. 4, ll. 33–37.

Skerlos, U.S. Patent No. 4,426,662

The Skerlos reference is titled, "IR Remote Control Detector/Decoder," and "relates to remote control receivers and more specifically is directed to an infrared (IR) remote control detector/decoder providing improved noise immunity particularly adapted for use with a television receiver." *Id.*, col. 1, ll. 5–9. The Abstract describes the subject matter:

> A pulse code modulated (PCM) infrared (IR) remote control detector/decoder with improved noise immunity particularly adapted for use with a television receiver is disclosed. The IR pulses are modulated by means of a high frequency dock signal in translating the transmitted signal to a higher frequency, more noise immune portion of the IR spectrum. After receipt of the transmitted signal by a signal detector, the high frequency modulation is removed from the pulses which are then decoded. Under the control of a microcomputer, the decoder looks for the start data bit and, if received, the subsequent control instructions. When the data transmission has been decoded, the microcomputer activates the appropriate control outputs to the television receiver's tuner system to achieve the desired control function.

Skerlos explains that "[t]he present invention is utilized with a remote control system in which pulse code modulated (PCM) output signals are generated in response to user operated controls." *Id.*, col. 2, l. 67–col. 3, l. 2**.**

DISCUSSION

Obviousness is a question of law, based on underlying factual findings. *In re NTP, Inc.*, 654 F.3d 1279, 1297 (Fed.

Cir. 2011). On appeal from the Board, we review factual findings for support by substantial evidence and review legal conclusions *de novo*. *Gen. Elec. Co. v. Raytheon Techs. Corp.*, 983 F.3d 1334, 1345 (Fed. Cir. 2020). Substantial evidence is "such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 229 (1938).

Patent claim construction is a question of law that the court reviews *de novo*. *Trs. Of Columbia Univ. v. Symantec Corp.*, 811 F.3d 1359, 1362 (Fed. Cir. 2016) (citing *Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318 (2015)) ("The construction of claim terms based on the claim language, the specification, and the prosecution history are legal determinations."). When claim construction involves underlying factual findings, these findings are reviewed for support by substantial evidence. *Knowles Elecs. LLC v. Cirrus Logic, Inc.*, 883 F.3d 1358, 1361–62, 1364 (Fed. Cir. 2018).

Claim Construction

The Board invalidated various claims based on its construction of certain claim terms. UEI argues that the Board erred in construing and applying four terms: (A) the "generating" term relating to the key code of the '642 patent and the '389 patent ("generating a key code within a key code generator device using the keystroke indicator signal"); (B) the "means" term in the '389 patent ("means for receiving a key code from said RF receiver and for sending said key code to said IR transmitter such that said key code is modulated onto an IR carrier signal"); (C) the "processing device" term in the '325 patent ("causing the processing device to: generate a key code . . . format the key code . . . and transmit the formatted key code"); and (D) the "timing information" term in the '642 and '325 patents ("codeset further comprises time information").

A

The term *"generating a key code"*

The Board held claims 1–4, 6, 8, 9, and 22–25 of the '642 patent and claims 2–3 of the '389 patent obvious over Mishra or Rye in combination with Dubil. UEI states that the Board erroneously construed "generating a key code within a key code generator device using the keystroke indicator signal" and that the Board's construction is inconsistent with the plain language of the claims and with the undisputed construction of the "key code generator device." UEI Br. 2–3.

UEI argues that the specifications and prosecution histories of the '642 and '389 patents state the correct construction and that "[t]he Board's finding that Mishra and Rye disclose 'generating a key code within a key code generator device using the keystroke indicator signal' is based on a construction of that limitation that includes 'receiving an appliance control code and merely translating or converting the code into another format, such as an infrared signal.'" *Id.* at 44.

UEI argues that under the correct construction "[n]either Mishra nor Rye discloses 'generating a key code within a key code generator device using the keystroke indicator signal.'" *Id.* at 50. UEI states that the Board found that "Mishra and Rye disclose merely 'translating' or 'converting' a received key code into another format." *Id.* UEI emphasizes that "the correct construction of the limitation 'generating a key code within a key code generator device using the keystroke indicator signal' excludes 'translating' or 'converting' a received key code into another format." *Id.*

Roku responds that the "generating" limitation as construed by the Board does not exclude translating or converting a key code into another format, and that "[t]he Board properly construed this limitation consistent with its plain and ordinary meaning to encompass scenarios where

the set-top box (1) translates a keystroke indicator signal received from a remote control into a format appropriate for controlling a consumer device, as disclosed in Mishra; and (2) uses the received keystroke indicator signal to obtain the corresponding key code from a look-up table and converts the signal to the appropriate code, as disclosed in Rye and Caris." Roku Br. 38–39. We discern no error in the Board's statement:

> We are not persuaded that there is sufficient basis for construing the "generating" limitation so broadly as to capture the *identification* of a key code from a codeset while simultaneously excluding *translation* of a received code. By forgoing a straightforward recitation of "identifying" in the claims in favor of a broader recitation of "generating," the patentee clearly meant for the term not to be limited to mere identification of a key code but also to include other forms of generation of the key code.

Board Op. at *11.

Substantial evidence supports the Board's finding that each of Mishra, Rye, and Caris discloses the "generating" limitation under the Board's construction. Mishra generates a key code signal by translating a command signal received from the remote control into a format suitable for controlling a device. The Board explained for claim 1 of the '642 patent:

> Independent claim 1 recites "generating a key code within a key code generator device using the keystroke indicator signal." Petitioner contends that this limitation is disclosed by Mishra's determination of a corresponding control code through translation of the command signal received from the RCU into a format appropriate for controlling an appliance . . . . In accordance with our adopted construction of the limitation, we agree that such

> translation qualifies as "generating a key code," and that Mishra therefore meets the limitation.

Board Op. at *15 (internal citations omitted).

Rye describes converting an input control signal to be compatible with the operating binary code for the selected audiovisual component. The Board applied Rye to claim 2 of the '642 patent:

> Like independent claim l, independent claim 2 recites "generating a key code within a key code generator device using the keystroke indicator signal." Petitioner contends that this limitation is disclosed by Rye's procedure of "convert[ing] the input control signal so that it is compatible with the operating binary code for the selected audiovisual component whose IR remote control code is obtained from the look-up table 46."

Board Op. at *21 (internal citations omitted).

UEI argued to the Board that "Rye's converting of a received control code was expressly disclaimed from 'generating a key code' during prosecution." *Id.* (quoting UEI Board Br. 40) The Board stated that "we disagree that there was an effective prosecution history disclaimer that limits the scope of the 'generating' limitation as Patent Owner proposes." *Id.* Roku states that "UEI makes a similar argument on appeal. While UEI tries to disguise its true argument by not using the word 'disclaimer' in its brief, its invitation for the Court to depart from the ordinary meaning of 'generating' is obviously premised on a disclaimer theory." Roku Br. 43. However, we are not directed to a disclaimer, and none is cited. A disclaimer of a legal right should be clear and explicit. *See Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1063–64 (Fed. Cir. 2016) ("The party seeking to invoke prosecution history disclaimer bears the burden of proving the existence of a 'clear

and unmistakable' disclaimer that would have been evident to one skilled in the art.").

The Board found that both Mishra and Rye disclose the "generating" limitation, Board Op. at *15, *21, and that Caris generates a key code signal by identifying the corresponding code from a look-up table, *id.* at *27. Substantial evidence supports the Board's findings that Mishra, Rye, and Caris disclose generating a key code by converting or translating a received signal, as the term is used in claims 1–4, 6, 8, 9, and 22–25 of the '642 patent and claims 2 and 3 of the '389 patent. We conclude that the Board correctly applied these references to the claim term "generating a key code."

B

The term "*means for receiving a key code*"

The "means" limitation, "means for receiving a key code from said RF receiver and for sending said key code to said IR transmitter such that said key code is modulated onto an IR carrier signal," appears in claims 12–15 of the '389 patent. UEI argues that the Board erred in holding these claims obvious based on Mishra in combination with Dubil, and also based on Caris in combination with Skerlos and Yazolino (U.S. Patent No. 5,329,370). UEI Br. 3–4.

UEI states that the Board's construction of the "means" limitation is legally erroneous, and that Roku's combinations of references does not disclose this limitation under the proper construction. *Id.*

The means-plus-function provision of Title 35 (previously § 112(6)) states:

> **§ 112(f) Element in Claim for a Combination.—**
>
> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure,

> material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

This provision "allows a patentee to recite a function to be performed as a claim limitation rather than reciting structure or materials for performing that function." *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1321 (Fed. Cir. 2003). Analysis of a means-plus-function limitation follows an established protocol:

> The construction of a means-plus-function limitation follows a two-step approach. First, we must identify the claimed function, staying true to the claim language and the limitations expressly recited by the claims. Once the functions performed by the claimed means are identified, we must then ascertain the corresponding structures in the written description that perform those functions. A disclosed structure is corresponding "only if the specification or the prosecution history clearly links or associates that structure to the function recited in the claim." In other words, the structure must be necessary to perform the claimed function.

Id. (internal citations omitted).

The parties agree that the claimed function is "receiving a key code from said RF receiver and for sending said key code to said IR transmitter such that said key code is modulated onto an IR carrier signal." Board Op. ('389 patent) at *12. Construing the recited means, the Board adopted Roku's proposed construction: "a microcontroller that performs the algorithm of receiving a key code from an RF receiver that has received a first key code signal and translating the key code so that the key code is modulated onto an infrared carrier signal resulting in a second key code signal." *Id.* at *14. This construction is consistent with the specification's description of the remote control

that performs the receiving and sending functions. As § 112(f) provides, the claim scope is limited to the structure in the specification and its equivalents. *See Aristocrat Techs. Austl. Pty v. Int'l Game Tech.*, 521 F.3d 1328, 1333 (Fed. Cir. 2008).

The Board determined that the '389 patent describes the algorithm for the claimed sending and receiving functions, stating that "Petitioner's proposed structure goes beyond a mere restatement of the function by including specific reference to key code signals and translation of the key code. Petitioner supports its proposal by citing to column 5, lines 45–59, of the '389 patent, which makes specific reference to the first and second key code signals, as well as to 'translating the communicated key code.'" Board Op. ('389 patent) at *13. The specification of the '389 patent illustrates:

> Next (step 104), an RF transmitter 20 of key code generator device 12 transmits first key code signal 19 in the form of an RF transmission to an RF receiver 21 on remote control device 11.
>
> Next (step 105), remote control device 11 receives first key code signal 19 and relays the key code communicated by first key code signal 19 to VCR 13 in the form of a second key code signal 22. Remote control device 11 is a slave to key code generator device 12. Remote control device 11 relays the key code by receiving first key code signal 19 in RF form and translating the communicated key code so that the key code is modulated onto a second carrier signal resulting in second key code signal 22. In this example, the second carrier signal is an infrared signal with a frequency in the range between three hundred gigahertz and three hundred terahertz.

'389 patent, col. 5, ll. 45–59. The Board correctly concluded that the algorithm for performing the claimed "receiving"

and "sending" functions is disclosed, for this passage describes the claimed means by which the remote control microcontroller carries out the function of receiving a key code from the RF receiver and sending the code to the IR transmitter.

Roku correctly states that "the Board's articulation of the claimed structure, which includes only the particular algorithm required to perform the claimed function, is faithful to the specification's own description and consistent with the extrinsic evidence of record." Roku Br. 55. *See Univ. of Pitt. of Commonwealth Sys. Of Higher Educ. v. Varian Med. Sys., Inc.*, 561 F. App'x 934, 941 (Fed. Cir. 2014) ("The district court properly located the disclosure of an algorithm that covered what was necessary to perform the claimed function . . . and nothing more . . . . The algorithm need only include what is necessary to perform the claimed function.").

UEI argues that "[t]he Board's finding that Mishra in combination with Dubil and Caris in combination with Skerlos and Yazolino disclose the Means Limitation should also be reversed because it is based on a legally erroneous construction of the structure of the Means Limitation as 'a microcontroller that performs the algorithm of receiving a key code from an RF receiver that has received a first key code signal and translating the key code so that the key code is modulated onto an infrared carrier signal resulting in a second key code signal.'" UEI Br. 58.

The Board found that the microcontroller of Mishra controls reception of a key code from an RF transceiver and transmits the key code with an IR transmitter. And, in light of Dubil's modulating key code techniques, the Board concluded that Misha thus teaches the "means for receiving a key code." *See* Board Op. ('389 patent) at *27 ("For the 'means for receiving a key code,' Petitioner identifies the microcontroller, discussed above in connection with dependent claim 10, which controls reception of a key code

from an RF transceiver, and transmits the key code with an IR transmitter. Because this identification is sufficient under our adopted construction of the 'means for receiving a key code,' and because Petitioner makes explicit reference to its analysis of modulating key codes in light of Dubil, we conclude that Petitioner makes a sufficient showing." (internal citations omitted)).

The Board made a similar finding regarding the microcontroller of the means limitations for Caris in combination with Skerlos and Yazolino, stating:

> In addition to Caris and Skerlos, Petitioner relies on Yazolino in addressing limitations of claims that recite a "microcontroller" in some form . . . . [Roku's expert] testifies that, in Petitioner's proposed combination of Caris and Skerlos, the modulation described in Skerlos "would be performed by a microcontroller in the remote control," but that "Caris does not explicitly describe these operational details." Petitioner accordingly reasons that a person of ordinary skill in the art "would have known to look to references, such as Yazolino, which explicitly describes the circuitry of a remote control such as the one disclosed by Caris." In light of Petitioner's evidence, we find this reasoning, which is supported by rational underpinning, sufficient to effect the combination of those teachings with those of Caris and Skerlos.

Board Op. ('389 patent) at *31 (internal citations omitted).

These findings are supported by substantial evidence, particularly the disclosures in the cited references as discussed above. These findings support the Board's construction. On this construction, UEI does not dispute that Mishra in combination with Dubil, and Caris in combination with Skerlos and Yazolino, disclose the "means" limitation. We affirm the Board's determinations regarding this term.

C

The term "*processing device*"

The Board found that it would have been obvious to a skilled artisan that Caris' set top box (STB) would include a processing device as recited in the processing device limitation in claims 1–5 of the '325 patent. Board Op. ('325 patent) at *20. UEI states that the Board erred. UEI argues that "Claim 1 of the '325 patent recites a 'processing device' that performs the steps or functions of 'generat[ing] a key code,' 'format[ting] the key code,' and 'transmit[ting] the formatted key code.'" UEI Br. 62. UEI states that "Roku conceded that Caris does not disclose that its set-top box ("STB") has a 'processing device.'" *Id.*

UEI states that the Board offered no reasoning to support its conclusion that it would have been obvious to modify Caris to include a processing device that performs the functions of generating, formatting, and transmitting. *Id.* at 62–63. Roku responds with the testimony of its expert, Dr. Russ, that "set-top boxes containing such devices for processing received commands and transmitting key codes were well-known in the art." Roku Br. 65. Dr. Russ stated:

> Caris describes the functionality of an STB as well as a receiver and a transmitter but does not explicitly illustrate the processing device of the STB that is used for generating a key code and transmitting the key code as will be further described below. However, in view of the STB functionality described in Caris, a POSA would have found it obvious that this functionality would have been performed using a processing device coupled to the receiver and the transmitter. STBs typically included processing devices such as processors or microcontrollers that controlled the functionality of the STBs.

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> A POSA would have understood that STBs would receive a command from a remote control and use a processing device to interpret the command and identify a corresponding key code. The STBs would also identify potential parameters, such as modulation and timing parameters, used to transmit the key code to another device. A processing device would be used to access memory and retrieve the corresponding key code as well as perform the modulation of the key code for transmission. Thus, a POSA would have understood that Caris' STB would include a processing device in order to perform the functions described in Caris.

Russ Decl. ¶¶ 173, 176 (Appx2334, 2336) (internal citations omitted). Dr. Russ provided U.S. Patent No. 6,909,471 (Bayley), as a reference, and stated: "As illustrated in Bayley, processing devices in STBs were well-known prior to the '325 patent and executed instructions in memory to receive commands and transmit corresponding control codes." *Id.* at ¶¶ 174–75 (Appx2334–36). The Board stated:

> We credit Dr. Russ' testimony and are persuaded by Petitioner's argument and the cited evidence that, in view of what was well-known to ordinarily skilled artisans, it would have been obvious to a person of ordinary skill in the art that Caris's STB would include a processing device that performs the claimed functions, including the functions to "generate a key code," "format the key code," and "transmit the formatted key code" and that for Caris to perform the claimed functions, the STB would include memory storing instructions executed by the processing device.

Board Op. at *20.

We conclude that substantial evidence, including expert testimony and the cited references, supports the Board's findings, and that the Board correctly construed the processing device limitation.

D

The term "*timing information*"

The parties also debate the "timing information" limitation wherein key code/codeset comprises timing/time information. This term is present in claims 4, 9, 23, and 25 of the '642 patent and claims 1–5 of the '325 patent.

UEI states that substantial evidence does not support the Board's findings that: "(i) Mishra or Rye in combination with Dubil and Caris in combination with Skerlos disclose the limitation 'wherein said key code . . . comprises timing information' in challenged claims 4 and 23 of the 642 patent; (ii) that Mishra or Rye in combination with Dubil discloses the limitation 'wherein said codeset comprises timing information' in challenged claims 9 and 25 of the 642 patent; and (iii) Caris in combination with Dubil discloses the limitation 'wherein the codeset further comprises time information' in challenged claim 1 of the [']325 patent." UEI Br. 51.

Claim 4 of the '642 patent is representative:

> 4. The method of claim 1, wherein said key code comprises a binary number and timing information, and wherein said timing information defines how said binary number is modulated in (c) onto said carrier signal.

'642 patent, col. 10, ll. 36–39.

UEI argues that the Board simply "adopted Roku's position that Dubil and Skerlos disclose 'wherein said key code comprises . . . timing information' because the alleged timing information in Dubil and Skerlos would purportedly

be 'used to modulate a binary number onto a carrier frequency.'" UEI Br. 51. UEI states that:

> Even if it is true that the timing information in Dubil and Skerlos is ***used*** to modulate a key code or binary number onto a carrier frequency, this has no bearing on whether the key code or codeset ***comprises*** timing information, as claimed. Indeed, the claims of the Challenged Patents expressly distinguish between a key code or codeset that "comprises timing information," and using timing information to modulate a key code or binary number onto a carrier frequency.

UEI Br. 52–53 (emphases original).

The Board found that Dubil discloses timing parameters such as "duty cycle," "repetition time," and "on/off times of the signal." Board Op. at *25. Roku's expert explained that Dubil's "on/off times" define timing for the binary numbers of the key codes, wherein "the amount of 'on/off' time used for each digital one or digital zero would describe timing information . . . to define how the binary key code would be modulated onto a carrier signal." Russ Decl. ¶ 137 (Appx1091).

The Board found that a skilled artisan would have considered Dubil's and Skerlos' teaching of timing information "as part of considering the teachings for wireless transmission of key codes." Board Op. at *19, *29. This conclusion was supported by the expert testimony that "[i]f a POSA did not already understand the formatting of a key code, a POSA would look to references" such as Dubil and Skerlos, which "describ[e] the format as well as how to transmit the key codes using a carrier signal." Russ Decl. ¶ 139 (Appx1092). Dr. Russ declared:

> A POSA would understand that the Skerlos teaches a key code comprising the timing information because Skerlos uses this the timing

> information described in Skerlos to modulate the "bits of coded information" onto a carrier signal. As previously explained . . ., this type of modulation was well-known and the inclusion of timing information in a key code to modulate the key code onto a carrier signal was well-known.

Id. at ¶230 (Appx1150).

We conclude that the Board correctly construed the "timing information" limitation to conform with existing knowledge such as is shown in the Dubil and Skerlos references, which describe the format and transmission of key codes using a carrier signal.

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The combination of references

The Board found that Mishra, Rye, and Caris describe wirelessly transmitting a key code signal from a set-top box to a remote control. The Board found that a person of ordinary skill in this field would have been motivated to combine known modulation techniques with known wireless transmission, for the references are in closely related fields of endeavor, and the Board's conclusion was supported by expert testimony and citations to relevant references.

The parties repeat the debate on this appeal. We conclude that substantial evidence supports the Board's findings concerning the combination of references, in turn supporting the Board's conclusion that it would have been obvious to a skilled artisan to combine Dubil's and Skerlos' modulation and timing information with the wireless key code transmission of Mishra, Rye, and Caris. This conclusion is founded on the content of the references and the expert testimony, and is in accordance with law. We affirm the Board's holding that it would have been obvious to modulate the Mishra/Rye/Caris codes as in Dubil and Skerlos.

CONCLUSION

We have considered all the arguments concerning these three patents and affirm the Board's decisions of invalidity of the claims at issue.

AFFIRMED