

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC,
Petitioner,

v.

DIGIMEDIA TECH, LLC,
Patent Owner.

IPR2022-01182
Patent 6,473,532 B1

Before GEORGIANNA W. BRADEN, JOHN A. HUDALLA, and
MICHAEL T. CYGAN, *Administrative Patent Judges*.

HUDALLA, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining One Challenged Claim Unpatentable
35 U.S.C. § 318(a)

Unified Patents, LLC (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 6 and 16 (“the challenged claims”) of U.S. Patent No. 6,473,532 B1 (Ex. 1001, “the ’532 patent”).

DigiMedia Tech, LLC (“Patent Owner”) did not file a preliminary response. We determined that the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail with respect to its unpatentability challenges. Pursuant to 35 U.S.C. § 314, we instituted this proceeding on January 19, 2023, as to both challenged claims and the patentability challenge presented in the Petition. Paper 7 (“Dec. on Inst.”).

During the course of trial, Patent Owner filed a Patent Owner Response (Paper 10, “PO Resp.”), and Petitioner filed a Reply to the Patent Owner Response (Paper 12, “Pet. Reply”). Patent Owner did not file a sur-reply. An oral hearing was held on October 19, 2023, and a transcript of the hearing is included in the record. Paper 25 (“Tr.”).

Petitioner filed a declaration of Lina J. Karam, Ph.D. (Ex. 1002) with its Petition. We authorized Dr. Karam to file a brief supplemental declaration (Ex. 1020) to address an error in one paragraph of her initial declaration that became apparent at the oral hearing. Patent Owner neither put forth its own testimony nor took cross-examination testimony from Dr. Karam.

Petitioner filed a motion to exclude each of Patent Owner’s exhibits. Paper 19 (“Exclude Mot.”). Patent Owner filed an opposition (Paper 20, “Exclude Opp.”), and Petitioner filed a reply (Paper 21, “Exclude Reply”).

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 6 and 16 of the ’532 patent. For the reasons discussed below, Petitioner has demonstrated by a preponderance of the evidence that claim 6 of the ’532 patent is unpatentable. Moreover, for the reasons discussed below,

this Decision does not include a determination of patentability as to claim 16 of the '532 patent.

I. BACKGROUND

A. *Real Parties-in-Interest*

Petitioner identifies Unified Patents, LLC, as the real party-in-interest. Pet. 72. Patent Owner identifies DigiMedia Tech, LLC, and Brainbox Innovations, LLC, as real parties-in-interest. Paper 3, 1.

B. *Related Proceedings*

The parties identify the following proceedings related to the '532 patent (Pet. 73; Paper 3, 1):

DigiMedia Tech, LLC v. ViacomCBS, Inc., No. 1:21-cv-01831 (S.D.N.Y. filed Mar. 2, 2021);

DigiMedia Tech, LLC v. Lenovo US Inc., No. 1:21-cv-00227 (D. Del. filed Feb. 18, 2021); and

DigiMedia Tech, LLC v. Panasonic Corp., No. 1:20-cv-04995 (N.D. Ga. filed Dec. 9, 2020).

C. *The '532 patent*

The '532 patent is directed to “syntactic encoding of images for later compression by standard compression techniques.” Ex. 1001, 1:6–9. The invention of the '532 patent

separates the details of a frame into two different types, those that can only be detected (for which only one bit will suffice to describe each of their pixels) and those which can be distinguished (for which at least three bits are needed to describe the intensity of each of their pixels).

Id. at 5:28–33.

Figure 3 of the '532 patent is reproduced below.

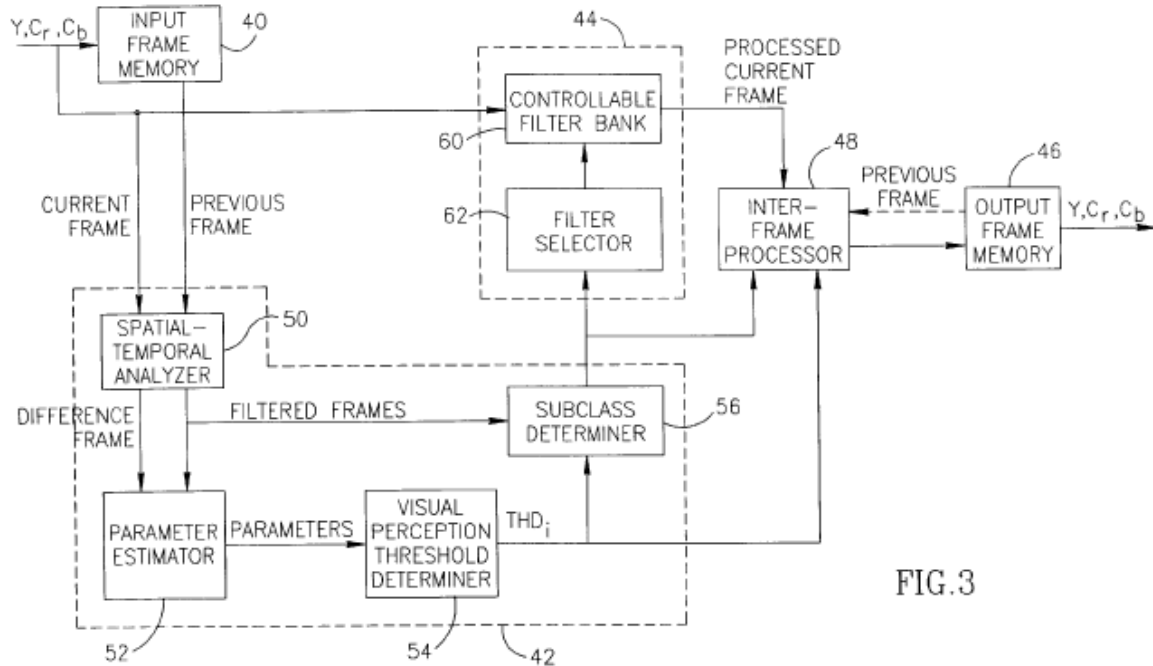


FIG. 3

Figure 3 is a block diagram illustration of a visual lossless syntactic encoder. Ex. 1001, 4:36–37. The encoder comprises input frame memory 40, frame analyzer 42, intra-frame processor 44, output frame memory 46, and inter-frame processor 48. *Id.* at 5:67–6:3. Frame analyzer 42 comprises spatial-temporal analyzer 50, parameter estimator 52, visual perception threshold determiner 54, and subclass determiner 56. *Id.* at 6:22–24.

Frame analyzer 42 analyzes each frame to separate it into subclasses, which define areas where pixels cannot be distinguished from one another. *Id.* at 6:3–5. Spatial-temporal analyzer 50 generates a plurality of filtered frames from the current frame, each filtered through a different high pass filter (HPF), where each high pass filter retains a different range of frequencies. Ex. 1001, 6:30–34. Parameter estimator 52 takes the current frame and the filtered and difference frames and generates a set of parameters that describe the information content of the current frame. *Id.*

at 7:10–13. Visual perception threshold determiner 54 determines the visual perception threshold THD_i per pixel. *Id.* at 8:27–32. Subclass determiner 56 “compares each pixel i of each high pass filtered frame HPF- X to its associated threshold THD_i to determine whether or not that pixel is significantly present in each filtered frame.”¹ *Id.* at 8:34–41. Subclass determiner 56 then defines the subclass to which the pixel belongs. *Id.* at 8:41–42.

Intra-frame processor 44 spatially filters each pixel of the frame according to its subclass. Ex. 1001, 6:5–8. Inter-frame processor 48 provides temporal filtering (i.e., inter-frame filtering) and updates output frame memory 46 with the elements of the current frame that are different than those of the previous frame. *Id.* at 6:8–12.

The application that led to the ’532 patent was filed on March 14, 2000, and claims priority to an Israeli patent application that was filed on January 23, 2000 (i.e., the earliest possible effective filing date). Ex. 1001, codes (22), (30). We apply the January 23, 2000, date for qualifying the asserted references as prior art.

D. Illustrative Claim

Of the challenged claims, claim 6 is independent. Claims 16 depends from claim 6. Claim 6 is illustrative of the challenged claims and recites:

6. A method of visual lossless encoding of frames of a video signal, the method comprising steps of:

¹ The ’532 patent states that “‘significantly present’ is defined by the threshold level and by the ‘detail dimension’ (i.e. the size of the object or detail in the image of which the pixel forms a part).” Ex. 1001, 8:34–41.

spatially and temporally separating and analyzing details of said frames;

estimating parameters of said details;

defining a visual perception threshold for each of said details in accordance with said estimated detail parameters;

classifying said frame picture details into subclasses in accordance with said visual perception thresholds and said detail parameters; and

transforming each said frame detail in accordance with its associate subclass.

Ex. 1001, 12:50–63.

E. Prior Art of Record

Petitioner relies on the following prior art:

U.S. Patent No. 6,366,705 B1, filed Jan. 28, 1999, issued Apr. 2, 2002 (Ex. 1005, “Chiu”); and

U.S. Patent No. 7,006,568 B1, PCT filed May 26, 2000, issued Feb. 28, 2006 (Ex. 1006, “Gu”).

F. The Instituted Challenge to Patentability

We instituted *inter partes* review of claims 6 and 16 of the ’532 patent on the following challenge (Dec. on Inst. 22), which was the only challenge presented in the Petition (Pet. 1):

Claims Challenged	35 U.S.C. §	References
6, 16	103(a) ²	Chiu, Gu

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103. Because the application leading to ’532 patent was filed before March 16, 2013 (the effective date of the relevant amendments), the pre-AIA versions of §§ 102 and 103 apply.

II. ANALYSIS

A. *Legal Standards*

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007).

The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations.³ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We also recognize that prior art references must be “considered together with the knowledge of one of ordinary skill in the pertinent art.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (citing *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); *see also* 37 C.F.R. § 42.104(b) (specific requirements for a patentability challenge). Except in limited circumstances not present here, this burden of persuasion does not shift to the patent owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

³ The trial record does not include any evidence of objective indicia of nonobviousness.

B. Level of Ordinary Skill in the Art

Citing testimony from Dr. Karam, Petitioner contends a person of ordinary skill in the art “would have had a Bachelor’s Degree in Computer Science, Computer Engineering, or Electrical Engineering, and two or more years of experience working with image processing or visual perception based video coding.” Pet. 10 (citing Ex. 1002 ¶¶ 36–37). Patent Owner does not address the level of ordinary skill in the art. We adopt Petitioner’s definition of the level of ordinary skill in the art without the qualifier “or more,” which introduces ambiguity. We are satisfied that this definition comports with the level of skill necessary to understand and implement the teachings of the ’532 patent and the asserted prior art.

C. Claim Interpretation

In an *inter partes* review, we construe each claim using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

37 C.F.R. § 42.100(b) (2023). Accordingly, our claim construction standard is the same as that of a district court. *See id.* Under the standard applied by district courts, claim terms are generally given their plain and ordinary meaning, as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). “There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when

the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

1. “detail”

Claim 6 recites “detail” or “details” in each of its limitations. Petitioner contends that a “detail” should be interpreted as encompassing at least “a pixel or a group of pixels that is detectable or distinguishable by the human visual system.” Pet. 7–8 (citing, *inter alia*, Ex. 1001, 5:28–33; Ex. 1002 ¶¶ 25–35, 73), 29; Pet. Reply 2 (similar argument). Petitioner notes that Dr. Karam’s supporting testimony for this interpretation is un rebutted. Pet. Reply 2 (citing Ex. 1002 ¶¶ 30–32).

Patent Owner contends that “details” are “elements of an image composed of pixels that have high frequency content.” PO Resp. 6 (citing Ex. 1001, 6:27–30). Patent Owner contrasts “details” with the background of an image, which has no details, i.e., high frequency content. *Id.* (citing Ex. 1001, 5:18–20, 5:24–25). Patent Owner also notes that the ’532 patent discloses a high pass filter that is used to identify details. *Id.* (citing Ex. 1001, 6:31–34). Patent Owner states that “if there is no high frequency content present (i.e., pixel is not in any of the high pass filtered frames) then the pixel is only detected but not distinguished—because there are no ‘details’ present.” *Id.* at 6–7. Regarding the composition of “details,” Patent Owner argues that “‘details’ are composed of multiple pixels,” but “‘details’ cannot simply mean pixels.” *Id.* at 7 (citing Ex. 1001, 2:39–41, 8:40–41). Patent Owner also cites a 2023 internet dictionary definition that “defines

‘detail’ as ‘photography: the small elements of an image corresponding to those of the subject.’”⁴ *Id.* at 11 (citing Ex. 2001, 1).

Petitioner disputes Patent Owner’s construction because the term “element” in “elements of an image” is not described in the ’532 patent specification. Pet. Reply 3. In contrast, Petitioner contends “the claims and specification do expressly describe ‘*details*’ as ‘pixels or groups of pixels.’” *Id.* (citing Ex. 1001, 5:28–32). Petitioner also notes that details are described in the specification as potentially being “1–4 pixels in size” or “up to 11 pixels.” *Id.* at 4 (citing Ex. 1001, 6:66–7:2). Petitioner also asks us to discount Patent Owner’s cited dictionary definition as being “after the ’532 patent’s claimed priority date” and “unsupported by any expert testimony.” *Id.* at 4–5 (citing PO Resp. 11).

We agree with Petitioner that the composition of “details” is better described as “pixels or groups of pixels” rather than “elements of an image.” This is supported by the ’532 patent specification’s discussion of “very small details in a frame” being “1–4 pixels” and “much larger details” being “up to 11 pixels.” Ex. 1001, 6:66–7:2. Indeed, Patent Owner’s counsel conceded at the oral hearing that details can be groups of pixels or even a

⁴ As discussed below (*see infra* § II.E.3), Patent Owner introduces an earlier internet dictionary printout and a dictionary volume excerpt for “detail” at Exhibits 2005 and 2007, respectively, with its opposition to Petitioner’s motion to exclude. *See* Exclude Opp. 5–6 (citing Exs. 2005, 2007). We find Patent Owner’s introduction of Exhibits 2005 and 2007 to be improper and untimely, so we disregard Exhibits 2005 and 2007. *See infra* § II.E.3. Patent Owner also cites certain college course notes in Exhibit 2003 to support its construction of “details” (*see* PO Resp. 11), but we accord no weight to Exhibit 2003 in light of Patent Owner’s statement that this exhibit is illustrative only and not substantive extrinsic evidence of the meaning of any claim term. *See* PO Resp. 13 n.2; Exclude Opp. 7; *see infra* § II.E.2.

single pixel. Tr. 20:23–22:2. Furthermore, the specification sheds no light on what might constitute an “element of an image,” which makes Patent Owner’s proposal imprecise. Instead, Patent Owner’s proposal regarding “elements of an image” appears to be based entirely on a particular 2023 internet dictionary definition (*see* Ex. 2001, 1 (definition 2d)), which is extrinsic evidence that does not overcome the description in the specification. *See McRO, Inc. v. Bandai Namco Games Am. Inc.*, 959 F.3d 1091, 1099 (Fed. Cir. 2020) (“[T]he existence of one broader meaning in the field is not controlling. What matters is the meaning most appropriate in the context of the particular patent.”). Patent Owner’s dictionary evidence also merits little to no weight given the lack of evidence or testimony linking this particular definition to the understanding of an ordinarily skilled artisan as of the earliest possible effective filing date. *See Fenner Invs., Ltd. v. Cellco P’ship*, 778 F.3d 1320, 1322–23 (Fed. Cir. 2015) (“The terms used in patent claims are not construed in the abstract, but in the context in which the term was presented and used by the patentee, as it would have been understood by a person of ordinary skill in the field of the invention on reading the patent documents”); *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004) (“A [tribunal] construing a patent claim seeks to accord a claim the meaning it would have to a person of ordinary skill in the art at the time of the invention”). For these reasons, we determine that “details” relate to pixels or groups of pixels.

Next, we consider Patent Owner’s proposal that “details” relate to “high frequency content.” PO Resp. 6. We agree with Petitioner (Pet. Reply 6–7) that Patent Owner’s proposed interpretation necessarily excludes detectable pixels. *See* PO Resp. 6–7 (stating that a pixel that is only detected

but not distinguished is not a “detail”). This conflicts with the disclosure of the ’532 patent that “[t]he present invention separates the details of a frame into two different types, those that can only be detected (for which only one bit will suffice to describe each of their pixels) and those which can be distinguished (for which at least three bits are needed to describe the intensity of each of their pixels).” Ex. 1001, 5:28–33. Contrariwise, this passage from the ’532 patent supports Petitioner’s interpretation that “details” are “detectable or distinguishable by the human visual system.” Pet. 8; Ex. 1002 ¶¶ 30–32 (Dr. Karam’s un rebutted testimony). We also agree with Petitioner (Pet. Reply 7–8) that the ’532 patent discloses the use of low pass filters for detecting certain details (*see* Ex. 1001, 9:61–65, Table 3), which undermines Patent Owner’s interpretation that details must only relate to high frequency content. Thus, we decline to restrict “details” to only high frequency content.

Given the alignment between Petitioner’s proposed construction and the specification of the ’532 patent, we adopt Petitioner’s construction and interpret “details” as at least encompassing a pixel or a group of pixels that is detectable or distinguishable by the human visual system.

2. *“spatially and temporally separating . . . details of said frames”*

Patent Owner contends “spatially and temporally separating . . . details of said frames” should be construed to mean “set apart, isolate, or divide into parts the spatial details from the frame and to set apart, isolate, or divide into parts the temporal details from the frame relative to an earlier frame.” PO Resp. 11. Patent Owner argues that “[t]he specification . . . discloses the extraction of two different types of content from the frames:

1) high frequency filtered frames (spatially separated and analyzed details of frames); and 2) difference frames (temporally separated and analyzed details of frames).” *Id.* at 12 (citing Ex. 1001, 6:30–34, 7:5–6, 11:53–56). Patent Owner also cites a 2023 internet dictionary definition that “defines ‘separate’ as ‘1a: to set . . . apart . . . 5a: to isolate from a mixture . . . b: to divide into constituent parts.’”⁵ *Id.* at 15 (citing Ex. 2002, 1). In light of this, Patent Owner contends that “‘separating’ within the context of claim 6 means to set apart, isolate, or divide into parts the spatial details from the frame (e.g., generate one or more high frequency filtered frames) and to set apart, isolate, or divide into parts the temporal details from the frame relative to an earlier frame (e.g., generate a difference frame).” *Id.*

Patent Owner additionally contends that “it is clear from the plain language of claim 6 that ‘spatially and temporally separating . . . details’ is performed on a frame basis based on the recitation ‘of said frames.’” *Id.* at 15–16. Although Patent Owner acknowledges that certain operations in the ’532 patent are performed on a per-pixel basis, Patent Owner highlights that other operations are performed on a frame basis. *Id.* at 16–17. Patent

⁵ As discussed below (*see infra* § II.E.3), Patent Owner introduces an earlier internet dictionary printout and a dictionary volume excerpt for “separate” at Exhibits 2006 and 2007, respectively, with its opposition to Petitioner’s motion to exclude. *See* Exclude Opp. 5–6 (citing Exs. 2006, 2007). We find Patent Owner’s introduction of Exhibits 2006 and 2007 to be improper and untimely, so we disregard Exhibits 2006 and 2007. *See infra* § II.E.3. Patent Owner also cites college course notes in Exhibit 2003 and a technical paper at Exhibit 2004 to support its construction of the “spatially and temporally separating” limitation (*see* PO Resp. 12–15), but we accord no weight to these exhibits in light of Patent Owner’s statement that they are illustrative only and not substantive extrinsic evidence of the meaning of any claim term. *See* PO Resp. 13 n.2; Exclude Opp. 7; *see infra* § II.E.2.

Owner contends that “analysis to describe spatial and temporal characteristics of pixels on a per pixel basis is inconsistent with the ordinary meanings of the words and inconsistent with their usage in the ‘532 patent.” *Id.* at 18 (internal quotation omitted).

Petitioner did not put forth a construction for the “spatially and temporally separating” limitation (Pet. Reply 11), a fact acknowledged by Patent Owner (PO Resp. 17). Notwithstanding, Patent Owner characterizes Petitioner’s implied construction as “analysis to describe spatial and temporal characteristics of pixels on a per pixel basis.” PO Resp. 11. Petitioner argues against a per-frame restriction in the interpretation of this limitation because even “Patent Owner’s citations allegedly showing separating on a per-frame basis . . . are consistent with the notion of per-pixel separating because any per-frame separating must be done by processing individual pixels.” Pet. Reply 12 (citing PO Resp. 17). In support of this argument, Petitioner cites Dr. Karam’s testimony that, “[a]s described in the ’532 patent, image filtering, whether it is applied to an entire frame or a local area of the frame, must be performed by applying the filters to individual pixel values.” *Id.* (citing Ex. 1002 ¶¶ 81, 85).

We agree with Petitioner (*see* Pet. Reply 12–14) that “spatially and temporally separating . . . details of said frames” is not limited to full-frame analysis and includes per-pixel analysis as part of analyzing a frame. Indeed, Patent Owner acknowledges that the ’532 patent describes per-pixel operations. PO Resp. 16–17 (citing, *inter alia*, Ex. 1001, 9:13–15, 11:2–4) (describing both intra-frame and inter-frame processing related to pixels). Even if this were not the case, we are persuaded by Petitioner’s argument that image filtering, even when applied to an entire frame, is performed by

applying filters to individual pixel values. Pet. Reply 12 (citing Ex. 1002 ¶¶ 81, 85). This is supported by Dr. Karam’s un rebutted testimony, which itself is supported by other contemporaneous references in the record that she cites. Ex. 1002 ¶¶ 29, 81, 85; *see also* Ex. 1018 (“Jayant”), 1395 (discussing “block-by-block” motion compensation in successive frames); Ex. 1019 (“Wu”), 802 (“One approach to selective high-pass filtering . . . is to calculate the output of the filter whenever the high-pass operator covers pixels from at least two different regions, where there is a possibility that it is in the vicinity of an edge.”). Thus, we decline to limit “spatially and temporally separating” to full-frame analysis. And, as discussed in further detail below, Petitioner’s cited prior art discloses both per-pixel and per-frame filtering (*see infra* § II.D.3.b), thus making this aspect of Patent Owner’s construction unnecessary to resolve the instant controversy. *See, e.g., Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

Regarding the “separating” aspect, Patent Owner’s proposal to “set apart, isolate, and divide” appears to be based on a website printout of a dictionary definition. PO Resp. 15 (citing Ex. 2002, 1). Even if we were to credit this extrinsic evidence, we find that the dictionary definition is consistent with filtering image content into the spatial domain and temporal domain separately. *See* Pet. Reply 15. The definition is likewise consistent with Patent Owner’s conception of “spatially and temporally separating” as “the extraction of two different types of content from the frames: 1) high

frequency^[6] filtered frames (spatially separated and analyzed details of frames); and 2) difference frames (temporally separated and analyzed details of frames).” PO Resp. 12 (citing Ex. 1001, 6:30–34, 7:5–6, 11:53–56). And, similar to above, Petitioner’s cited prior art teaches the recited “separating” even under Patent Owner’s proposed construction, i.e., “set[ting] apart, isolat[ing], and divid[ing]” spatial and temporal information from a frame. *See infra* § II.D.3.b. Accordingly, we need not put forth an express construction of “separating” to resolve the instant controversy. *See Realtime Data*, 912 F.3d at 1375.

For these reasons, we decline to adopt Patent Owner’s proposed construction “spatially and temporally separating . . . details of said frames” and instead apply its plain and ordinary meaning.

3. “subclass”

Claim 6 recites “classifying said frame picture details into subclasses in accordance with said visual perception thresholds and said detail parameters.” Ex. 1001, 12:59–61. Patent Owner contends that “subclass” in this limitation (and a later limitation) should be construed to mean “an area with pixels related to the same detail and which cannot be distinguished from each other.” PO Resp. 18–19 (citing Ex. 1001, code (57), 2:36–41, 6:3–5, 8:35–42, 8:55–9:12). Patent Owner additionally notes that Table 2 of the ’532 patent lists various exemplary subclasses. *Id.* at 19.

Petitioner again did not put forth a construction for “subclass” (Pet. Reply 15), as acknowledged by Patent Owner (PO Resp. 19).

⁶ As discussed in the previous section, we do not agree with Patent Owner that “details” are limited to high frequency content. *See supra* § II.C.1.

Notwithstanding, Patent Owner characterizes Petitioner’s implied construction as a “characteristic of a macroblock as containing small, random details or large, connected details.” PO Resp. 18. Petitioner argues that this characterization is incorrect, because “Petitioner does not propose that the thing to be classified is a macroblock.” Pet. Reply 16. Petitioner explains that its unpatentability contentions rely on prior art teachings where “*the surviving pixels* in a macroblock are classified into different subclasses—large, connected details and small, random details.” *Id.* (emphasis added) (citing Pet. 58). We agree. As such, Patent Owner’s misapprehension of Petitioner’s unpatentability contentions undermines the distinction Patent Owner seeks to make by its proposed construction of “subclass.” And, as explained below (*see infra* § II.D.3.e), Petitioner establishes that its cited prior art teaches the recited “subclass” even under Patent Owner’s proposed construction. Accordingly, we need not put forth an express construction of “subclass” to resolve the instant controversy. *See Realtime Data*, 912 F.3d at 1375.

4. *Other Terms*

We determine that no other aspects of the challenged claims require explicit construction. *See Realtime Data*, 912 F.3d at 1375.

D. *Alleged Obviousness in View of Chiu and Gu*

Petitioner contends the subject matter of claims 6 and 16 would have been obvious over the combination of Chiu and Gu. Pet. 11–68. Patent Owner disputes Petitioner’s contentions. PO Resp. 20–29.

1. *Chiu (Ex. 1005)*

Chiu is a U.S. patent directed to “perceptual-based video signal coding techniques resulting in reduced complexity of video coders implementing same.” Ex. 1005, 1:15–18. Figure 2 of Chiu is reproduced below.

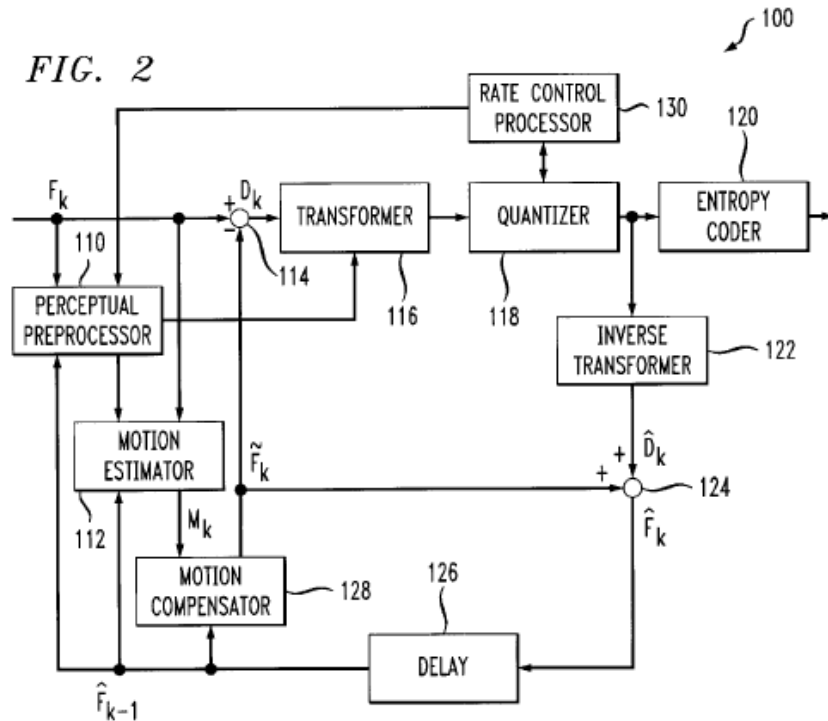


Figure 2 is a block diagram of video encoder 100. *Id.* at 5:32–33, 7:53–55. Video encoder 100 includes perceptual preprocessor 110, motion estimator 112, and signal subtractor 114 coupled to the input of encoder 100. *Id.* at 7:63–67. Motion estimator 112 also is coupled to perceptual preprocessor 110. *Id.* at 7:67–8:1. Encoder 100 also includes transformer 116 (e.g., a discrete cosine transform (DCT) generator) coupled to perceptual preprocessor 110 and signal subtractor 114, quantizer 118 coupled to transformer 116, and entropy encoder 120 coupled to quantizer 118 and the output of encoder 100. *Id.* at 8:1–6. Inverse transformer 122 (e.g., an inverse DCT generator) is coupled between

quantizer 118 and entropy encoder 120. *Id.* at 8:6–9. Encoder 100 also includes signal combiner 124 coupled to inverse transformer 122, delay 126 coupled to signal combiner 124 and perceptual preprocessor 110, and motion compensator 128 coupled to delay 126, signal subtractor 114, signal combiner 124, and motion estimator 112. *Id.* at 8:9–14. Encoder 100 additionally includes rate control processor 130 coupled to quantizer 118. *Id.* at 8:14–16.

Perceptual preprocessor 110 accounts for the insensitivity of the human visual system (HVS) to mild changes in pixel intensity by segmenting video into regions according to perceptibility of picture changes. Ex. 1005, 4:25–29, 8:27–31. Based on the segmentation, encoder 100 can determine which macroblocks require motion estimation. *Id.* at 8:32–33. The procedure for removing perceptual redundancy in the pixel domain is known as “bush-hogging.” *Id.* at 7:24–26.

The encoding method disclosed in Chiu compares elements of a portion of a first video image (e.g., pixels of a macroblock of a current frame) with elements of a portion of a second video image (e.g., corresponding pixels of a macroblock of a previous frame) to generate respective intensity difference values. Ex. 1005, 4:40–45. The intensity difference values are compared to a visually perceptible threshold value, which may be a function of a “just-noticeable-distortion (JND)” value and a quantization parameter associated with the bit rate of the encoding process. *Id.* at 4:50–54, 10:30–36. This is accomplished using a δ -function test performed on every pixel, which results in a “1” when the intensity difference value is above the threshold value and a “0” otherwise. *Id.* at 4:46–50, 9:6–10, 10:23–36. The method then performs further processing

on sub-blocks within a macroblock to determine whether surviving pixels (those pixels having a δ -function test result of “1”) are connected or isolated. *Id.* at 11:1–6. This is accomplished by summing the surviving pixels in the sub-block and comparing the sum to a decision value. *Id.* at 4:54–58, 11:10–25. The macroblock may or may not be motion compensated based on the comparison results for the constituent sub-blocks. *Id.* at 4:58–65, 11:15–30.

Petitioner contends that Chiu qualifies as prior art under 35 U.S.C. § 102(e) based on its filing date. Pet. 11. Patent Owner does not contest the prior art status of Chiu.

The trial record includes no evidence of an invention date other than the earliest possible effective filing date of the challenged claims. Thus, we determine that Chiu qualifies as prior art under 35 U.S.C. § 102(e) because Chiu’s filing date of January 28, 1999, is before the earliest possible effective filing date of the challenged claims, which is January 23, 2000. Ex. 1001, code (30); Ex. 1005, code (22).

2. *Gu (Ex. 1006)*

Gu is a U.S. patent directed to “compressing data with a human perceptual model.” Ex. 1006, 1:22–24. Gu notes the competing needs in the art to compress video signals and “to maintain the subjective visual quality of an image, arguably, the ultimate objective of video transmission systems.” *Id.* at 1:35–39. In light of these needs, Gu states that “performance metrics that take the psycho visual properties of the human visual system (HVS) into account are needed.” *Id.* at 1:39–42.

Gu states that “[d]istortion sensitivity profiles of human perception are driven as functions of frequency, brightness, texture, and temporal parameters.” *Id.* at 5:40–42. Gu further states that the concept of just-noticeable-distortion (JND) has been successfully applied to perceptual coding of video signals in order to remove redundancy due to spatial and temporal correlation and the irrelevancy of perceptually insignificant components from video signals. *Id.* at 7:1–6.

Gu discloses a method of generating a JND model. *Id.* at 9:65–66, Fig. 7. The model includes, *inter alia*, parameters f_1 representing the error visibility threshold due to texture masking, f_2 representing the visibility threshold due to average background luminance, and f_3 representing the error visibility threshold due to motion. *Id.* at 10:10–12, 11:44.

Petitioner contends that Gu qualifies as prior art under 35 U.S.C. § 102(e) based on its priority claim to an earlier provisional application filed on May 27, 1999. Pet. 12–13. Petitioner contends that the “[p]rovisional application provides written description and enablement support for at least claim 1 of *Gu*.” *Id.* at 12. In support of this contention, Petitioner provides a mapping of Gu’s claim 1 to the provisional application. *Id.* at 12–25 (citing, *inter alia*, Ex. 1002 ¶¶ 41–57). Patent Owner does not contest the prior art status of Gu.

We credit Petitioner’s uncontested evidence that the earlier provisional application related to Gu provides written description and enablement support for at least one claim of Gu. *See* Pet. 12–25; Ex. 1002 ¶¶ 41–57. We further note that the trial record includes no evidence of an invention date other than the earliest possible effective filing date of the challenged claims. Thus, we determine that Gu qualifies as prior art under

35 U.S.C. § 102(e) because the May 27, 1999, filing date of the provisional application to which Gu claims priority is before the earliest possible effective filing date of the challenged claims, which is January 23, 2000. Ex. 1001, code (30); Ex. 1006, code (60).

3. *Claim 6*

a. *Preamble*

The preamble of claim 6 recites “[a] method of visual lossless encoding of frames of a video signal.” Ex. 1001, 12:50–51. Petitioner cites Chiu’s perceptual preprocessor in a video encoder that can improve the computational complexity and compression ratio without loss of perceived picture quality. Pet. 27–28 (citing Ex. 1005, 4:22–37, 6:64–66, 8:17–22, 13:9–12). Petitioner also cites evidence that Chiu’s encoding system encodes frames of video. *Id.* at 28 (citing Ex. 1005, 10:19–21). Neither party addresses whether the preamble is limiting. Patent Owner does not dispute Petitioner’s analysis of the preamble. Because we find that Chiu teaches the preamble (*see, e.g.*, Ex. 1005, 4:22–37, 6:64–66, 8:17–22, 10:19–21, 13:9–12), we need not determine whether the preamble is limiting. *See Realtime Data*, 912 F.3d at 1375.

b. “spatially and temporally separating and analyzing details of said frames” and Rationale for the Combination

Claim 6 further recites “spatially and temporally separating and analyzing details of said frames.” Ex. 1001, 12:53–54. Petitioner contends Chiu’s perceptual preprocessing method “uses a visually perceptible threshold value to analyze the degree of visual perception of the details, where the threshold is modeled based on a just-noticeable-distortion (JND)

value.” Pet. 28–29 (citing Ex. 1002 ¶¶ 73–75; Ex. 1005, 12:25–38). In particular, Petitioner cites Chiu’s teaching of a δ -function test performed on every pixel based on a visually perceptible threshold value $T = T_o + C * QP$, where T_o is the JND, QP is the quantization parameter, and C is a constant.⁷ *Id.* at 29–31 & n.4 (citing Ex. 1005, 6:64–66, 7:19–22, 10:17–11:50, Fig. 4). Citing testimony from Dr. Karam, Petitioner contends that an ordinarily skilled artisan would have understood that the JND value T_o is used to measure whether a pixel is perceived by a human eye, and that perceivable pixels correspond to the recited “details.” *Id.* at 31–32 (citing Ex. 1002 ¶¶ 73–75).

For “spatially and temporally separating and analyzing details,” Petitioner cites Gu’s teaching of “generating a spatial-temporal JND profile for a set of two frames consisting of a current frame and a previous frame.” Pet. 32 (internal quotation and alteration omitted) (citing Ex. 1006, 9:54–59). According to Petitioner, Gu’s system “divides and describes pixels based on the local characteristics of the neighborhood associated with each pixel using spatial texture characteristics due to local luminance changes, spatial average background luminance, and temporal characteristics due to intensity changes between frames.” *Id.* (citing Ex. 1002 ¶¶ 41–64, 76–93; Ex. 1006, 9:50–11:55); *see also id.* at 32–40 (Petitioner’s in-depth analysis of Gu’s system for this limitation, including generation of a JND model).

In particular, Petitioner notes various expressions used to calculate Gu’s JND profile, including $mg(x, y)$, which “denotes the maximal weighted

⁷ Because there is an apparent typo in the formula for T from equation (9) of Chiu, we use the formula for T from Figure 4 of Chiu. *See* Pet. 31 n.4 (citing Ex. 1002 ¶ 74).

average of luminance gradients around the pixel at (x, y) ”; $bg(x, y)$, which “is the average background luminance”; and $ild(x, y, n)$, which “denotes the average interframe luminance difference between the n th and $(n-1)$ th frame.” Pet. 33–35 (quoting Ex. 1006, 10:3–16, 11:29–36). As such, Petitioner contends that Gu’s steps for generating the JND model teach the recited “spatially and temporally *separating* . . . details of said frames”

by disclosing transforming the pixel information in each video frame n into:

- $mg(x, y)$: spatial texture characteristics due to local luminance changes;
- $bg(x, y)$: spatial average background luminance;
- $ild(x, y, n)$: temporal characteristics due to motion or due to temporal intensity changes.

Pet. 35–36 (citing Ex. 1002 ¶¶ 79–82; Ex. 1006, 9:30–11:55); *see also id.* at 38 (citing Ex. 1003 ¶¶ 76–84) (similar argument). According to Petitioner, “*Gu* teaches that $mg(x, y)$ and $bg(x, y)$ filter the pixel information in each video frame with respect to its visual characteristics ‘in the spatial domain,’ while $ild(x, y, n)$ filters the pixel information in each video frame with respect to its visual characteristics ‘due to motion,’ i.e., changes between frames or temporal change.” *Id.* at 38 (citing Ex. 1002 ¶¶ 81–84; Ex. 1006, 10:13–15, 10:34–11:28, 11:34–43). Petitioner additionally cites Dr. Karam’s testimony that an ordinarily skilled artisan “would have understood these functions to be forms of separating details because they relate neighboring pixels to one another, both within the frame to which they belong and between frames.” Pet. Reply 19 (quoting Ex. 1002 ¶ 84).

For “spatially and temporally . . . *analyzing* details of said frames,” Petitioner again cites Gu’s teaching of “mathematical operations for calculating the spatial (i.e., $mg(x, y)$ and $bg(x, y)$) and temporal (i.e.,

ild(x,y,n)) components.” Pet. 38 (citing Ex. 1002 ¶¶ 80–86); *see also id.* at 32–38 (citing, *inter alia*, Ex. 1006, 9:50–11:55) (providing further details on these functions). Petitioner additionally cites certain component operators used to calculate $mg(x,y)$ and $bg(x,y)$, such as “highpass operators $G_k(I, j)$ and weighted lowpass operator $B(I, j)$.” *Id.* at 38–39 (citing Ex. 1002 ¶¶ 81–86); *see also id.* at 33–34, 36–37 (citing, *inter alia*, Ex. 1006, 10:37–41, 10:56–11:10, 11:15–28) (further details on these operators). Petitioner also contends that “in generating the temporal component, *Gu* performs motion analysis by calculating “the average interframe luminance difference between the n th and $(n-1)$ th frame.” *Id.* at 39 (citing Ex. 1002 ¶¶ 81–86; Ex. 1006, 11:34–43). According to Petitioner, an ordinarily skilled artisan “would . . . have understood that the generation of the temporal component (i.e., $ild(x,y,n)$), as taught by *Gu*, is performed by using highpass difference operations.” *Id.* (citing Ex. 1002 ¶¶ 76–79, 81–86).

Petitioner notes that Chiu describes the JND value T_o , but does not expressly provide details about how to calculate the JND value. Pet. 40. Thus, Petitioner contends an ordinarily skilled artisan “would have found it obvious to improve *Chiu* with *Gu*’s JND generation method to calculate the JND used in *Chiu*’s threshold value to improve the performance of *Chiu*’s video encoding method.” *Id.* (citing Ex. 1002 ¶¶ 58–64,⁸ 71–93). Petitioner notes the two references’ common teachings on video encoding that takes human visual perception into account. *Id.* at 40–42 (citing, *inter alia*,

⁸ In two instances on page 40 of the Petition, Petitioner mistakenly cites this range of paragraphs in Dr. Karam’s declaration as “58-54,” but the context makes clear that Petitioner intended to cite to paragraphs 58–64.

Ex. 1002 ¶¶ 58–64, 87–93). Petitioner further notes that both references use the JND model to study the visual perceptibility and visual redundancy of details in a video. *Id.* at 42–43 (citing, *inter alia*, Ex. 1002 ¶¶ 90–91).

Petitioner also contends that combining Chiu and Gu would have yielded a predictable result because both references disclose similar JNDs. *Id.* at 43–45 (citing, *inter alia*, Ex. 1002 ¶¶ 92–93).

Patent Owner cites its proposed construction of this limitation (*see supra* § II.C.2) and argues that “[w]hile *Gu* provides disclosure of calculating intermediate values that are used in the generation of the JND threshold, nothing is being *separated out* from the frame in either *Chiu* or *Gu*, as required by the claim.” PO Resp. 21. Patent Owner also criticizes Dr. Karam’s supporting testimony insofar as she allegedly “shifts between characterizing the JND calculations as a description of ‘pixels based on the local characteristics of the neighborhood associated with each pixel’ . . . to a characterization that ‘these functions [are] forms of separating details because they relate neighboring pixels to one another.’” *Id.* at 23 (quoting Ex. 1002 ¶¶ 76, 84). Patent Owner argues that “calculating characteristics of pixels based on neighboring pixels is not a disclosure of separating pixels from a frame—as claim 6 requires.” *Id.* Patent Owner additionally argues that Petitioner shows only that “the thing from which the ‘details’ . . . are ‘separated’ are *pixels* as opposed to *frames*.” *Id.* at 24.

We find that perceivable pixels, which are determined using Chiu’s δ -function test based on a visually perceptible threshold value T , teach the recited “details.” *See, e.g.*, Ex. 1002 ¶¶ 73–75; Ex. 1005, 10:17–11:50, Fig. 4. This teaching is consistent with our construction of “details” above

because perceptible pixels are detectable or distinguishable by the human eye. *See supra* § II.C.1.; Pet. 31–32; Ex. 1002 ¶¶ 30, 75.

Petitioner also shows that Gu teaches the recited “separating” even under Patent Owner’s proposed construction, i.e., Gu’s calculation of the functions $mg(x, y)$, $bg(x, y)$, and $ild(x, y, n)$ “set[s] apart, isolate[s], and divide[s]” spatial and temporal information from a frame. *See, e.g.*, Ex. 1006, 10:13–15, 10:34–11:28, 11:34–43. This is backed by Dr. Karam’s unrebutted testimony, which we credit, that an ordinarily skilled artisan “would have understood these functions to be forms of separating details because they relate neighboring pixels to one another, both within the frame to which they belong and between frames.” Ex. 1002 ¶ 84. Although Patent Owner argues that calculating Gu’s functions does not amount to “a disclosure of separating pixels from a frame” (PO Resp. 23), Patent Owner’s argument does not square with its own conception of the similar “separating” operations disclosed in the ’532 patent (i.e., spatial-temporal analyzer 50 generating “filtered frames” and “difference frames”). *Id.* at 12 (citing Ex. 1001, 6:30–34, 7:5–6, 11:53–56).

Furthermore, we find that Gu’s calculation of the functions $mg(x, y)$, $bg(x, y)$, and $ild(x, y, n)$ teaches the recited “analyzing.” *See, e.g.*, Ex. 1006, 9:50–11:55. Petitioner also shows how Gu’s calculation of operators $G_k(I, j)$ and $B(I, j)$ and the average interframe luminance difference teach the recited “analyzing.” *See, e.g., id.* at 10:37–41, 10:56–11:10, 11:15–28, 11:34–43.

We have considered Patent Owner’s argument that the Chiu–Gu system does not teach the recited “separating” because it operates on a per-pixel rather than a per-frame basis. *See* PO Resp. 24. We find that Gu teaches both: spatial filters $mg(x, y)$ and $bg(x, y)$ are applied to pixels in

frame, and temporal filter $ild(x, y, n)$ compares differences between two frames. *See, e.g.*, Ex. 1006, 9:54–59, 10:13–15, 10:34–11:44. Thus, Patent Owner’s argument is unavailing.

Patent Owner does not dispute Petitioner’s rationale for combining the teachings of Chiu and Gu. Considering that Chiu discloses the use of a JND profile but does not state expressly how to generate it, we find that an ordinarily skilled artisan would have implemented Gu’s JND generation method as part of Chiu’s threshold value calculation to improve the performance of Chiu’s video encoding method. *See, e.g.*, Ex. 1002 ¶¶ 58–64, 71–93. Indeed, as noted by Dr. Karam (*id.* ¶ 64), Chiu expressly states that “given the teachings of [Chiu’s] invention, one of skill in the art will contemplate other methods of modeling the threshold function.” Ex. 1005, 9:16–18. Petitioner also establishes that an ordinarily skilled artisan would have expected success in making the combination. *See, e.g.*, Ex. 1002 ¶¶ 92–93. We agree with Dr. Karam that “the JNDs described in *Chiu* and *Gu* are the same values (i.e., a threshold level below which reconstruction error is imperceptible by human eye) used for quantifying the same physical phenomena (i.e., visual masking)” (*id.* ¶ 92), which supports Petitioner’s contentions about expected success in making the combination.

For these reasons, Petitioner establishes that the combination of Chiu and Gu teaches “spatially and temporally separating and analyzing details of said frames.” Petitioner also shows that a person of ordinary skill in the art would have had reasons to combine the teachings of Chiu and Gu with a reasonable expectation of success.

c. “estimating parameters of said details”

Claim 6 further recites “estimating parameters of said details.”

Ex. 1001, 12:55. Petitioner contends “*Gu*’s JND generation includes the estimation of parameters.” Pet. 45 (citing Ex. 1002 ¶¶ 94–99). Specifically, Petitioner contends that “[t]he calculations involved in *Gu*’s JND generation demonstrate spatial and temporal separation and analysis, [and] the resulting values teach the estimation of parameters.” *Id.* at 46 (citing Ex. 1006, 10:3–16, 11:29–36). Petitioner cites *Gu*’s teachings about parameters f_1 , f_2 , and f_3 , which Petitioner describes as follows:

- f_1 : error visibility threshold due to texture masking;
- f_2 : error visibility threshold due to average background luminance;
- f_3 : error visibility threshold due to motion or temporal masking.

Id. at 46–48 (citing, *inter alia*, Ex. 1002 ¶¶ 94–99, 116–117; Ex. 1006, 5:45–46, 5:61–63, 6:8–12, 10:3–11:55).

Patent Owner does not dispute Petitioner’s analysis of this limitation. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. Based on the complete trial record, we find that *Gu* teaches estimating parameters f_1 , f_2 , and f_3 to describe the content of a frame. *See, e.g.*, Ex. 1002 ¶¶ 94–99, 116–117; Ex. 1006, 5:45–46, 5:61–63, 6:8–12, 10:3–11:55.

d. “defining a visual perception threshold for each of said details in accordance with said estimated detail parameters”

Claim 6 further recites “defining a visual perception threshold for each of said details in accordance with said estimated detail parameters.”

Ex. 1001, 12:56–58. Petitioner cites Chiu’s teachings of “a visual perception threshold for each of said details in accordance with a JND value.” Pet. 48–49 (citing Ex. 1005, 7:38–52, 10:17–38). Petitioner also cites Gu’s teaching of generating a JND value using the parameters f_1 , f_2 , and f_3 . *Id.* at 49 (citing Ex. 1006, 10:3–11:55). Petitioner contends an ordinarily skilled artisan “would have been motivated to combine the teachings of *Chiu* and *Gu*, to use f_1 , f_2 , and f_3 to generate the JND as taught in *Gu*” and “would have found obvious, in accordance with the proposed combination, to further use in *Chiu*’s method to generate *Chiu*’s visual perception threshold.” *Id.* (citing Ex. 1002 ¶¶ 58–64, 71–93, 100–104). As such, Petitioner contends that an ordinarily skilled artisan would have understood the resulting visual perception threshold T to be defined by Gu’s estimated detail parameters f_1 , f_2 , and f_3 . *Id.* at 49–50 (citing Ex. 1002 ¶¶ 100–104; Ex. 1005, 10:30–36). Petitioner additionally contends that “both *Gu*’s JND and *Chiu*’s threshold are computed on a per pixel basis, [so] they are both consistently calculated for each detail.” *Id.* at 51 (citing Ex. 1002 ¶ 104; Ex. 1005, 7:14–52; Ex. 1006, 10:3–11:55).

Patent Owner does not dispute Petitioner’s analysis of this limitation. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. Based on the complete trial record, we are persuaded that the combined Chiu–Gu system uses parameters f_1 , f_2 , and f_3 to generate the JND value T_o , which in turn is used to calculate a visually perceptible threshold value T for each detail. *See, e.g.*, Ex. 1002 ¶¶ 100–104; Ex. 1005, 7:38–52, 10:17–38; Ex. 1006, 10:3–11:55.

- e. “classifying said frame picture details into subclasses in accordance with said visual perception thresholds and said detail parameters”

Claim 6 further recites “classifying said frame picture details into subclasses in accordance with said visual perception thresholds and said detail parameters.” Ex. 1001, 12:59–61. Petitioner cites Chiu’s teaching of performing a δ -function test for each pixel of a difference frame (which is calculated using the pixel values of the current frame and the previously reconstructed picture) and comparing the result to the visually perceptible threshold value T . Pet. 54–55 (citing, *inter alia*, Ex. 1005, 9:19–21, Fig. 4). Petitioner also cites its proposed modification of Chiu to implement Gu’s JND and estimated detail parameters f_1 , f_2 , and f_3 in the δ -function test. *Id.* at 51, 54–55 (citing, *inter alia*, Ex. 1006, 9:50–11:55).

Petitioner notes Chiu’s Figure 4 process of determining whether to encode particular macroblocks based on the results of the δ -function test for pixels within the macroblock. Pet. 55 (citing Ex. 1005, 11:1–4). Petitioner additionally notes how Chiu’s Figure 4 process accounts for surviving pixels—those pixels that are above the δ -function test’s visually perceptible threshold—by determining whether such pixels are connected or isolated. *Id.* (citing Ex. 1005, 11:4–6). This is accomplished by considering the δ -function test results for sub-blocks of a macroblock. *Id.* at 55–58 (citing, *inter alia*, Ex. 1005, 11:9–38, Fig. 4). In particular, Dr. Karam explains step 408 of Chiu’s Figure 4 process as follows:

When the number of noticeable pixels in the subblock exceeds n_s , they collectively occupy a majority area of the subblock and thus are more likely to be connected; conversely, when the number of noticeable pixels in the subblock does not exceed n_s , they are scarce and are more likely to be scattered randomly in the subblock.

Ex. 1002 ¶ 113 (as corrected by Ex. 1020 ¶¶ 2–3); *see also* Pet. 58 (citing Ex. 1002 ¶¶ 112–114). Petitioner further contends that step 410 of Chiu’s Figure 4 process “determines whether all the sub-blocks in a particular macroblock likely have connected surviving pixels (i.e., details).” Pet. 58 (citing Ex. 1002 ¶¶ 112–114). According to Petitioner, an ordinarily skilled artisan would have understood that, “if all the sub-blocks in a particular macroblock likely have connected surviving pixels (i.e., details), the surviving pixels (i.e., details) in the macroblock likely form large, connected details . . . ; otherwise, the surviving pixels (i.e., details) in the macroblock are small, random details.” *Id.* at 58 (citing Ex. 1002 ¶¶ 105–114; Ex. 1005, 11:15–25, 12:7–11). As such, Petitioner contends the combined Chiu–Gu system classifies details into two subclasses: small, random details and large, connected details. *Id.* at 58–59 (citing Ex. 1002 ¶¶ 105–114).

Petitioner establishes that applying Chiu’s δ -function test based on a visually perceptible threshold value T —as modified by Gu’s JND and detail parameters—to a difference frame results in surviving pixels (i.e., “details”); thereafter, the number of surviving pixels in each sub-block is compared to a decision value n_s to effect the recited “classifying” of details into subclasses (i.e., large, connected details and small, random details). *See, e.g.*, Ex. 1002 ¶¶ 105–114; Ex. 1005, 9:19–21, 11:1–6, 11:9–38, 12:7–11; Ex. 1006, 9:50–11:55. We now consider Patent Owner’s arguments against Petitioner’s showing.

Patent Owner argues that Petitioner reinterprets “details” for purposes of this limitation:

Whereas Petitioner previously interpreted “details” as the thing that was analyzed in order to *generate* the visual perception threshold (e.g., calculating $mg(x,y)$, $bg(x,y)$, and $ild(x,y,n)$ in

order to generate the just-noticeable-distortion (JND) value), now the Petitioner and Dr. Karam are interpreting “details” as the thing that is the result of a comparison *using* the visual perception threshold (e.g., surviving pixels).

PO Resp. 26–27. In its Reply, Petitioner argues that “there is no such inconsistency” because “any processing of the details, whether it being ‘*separating*,’ ‘*analyzing*,’ or ‘*classifying*,’ can be performed on the pixels.”

Pet. Reply 23. We agree with Petitioner because Petitioner’s analysis ultimately relies on analyzing pixels associated with “details” to perform the recited “classifying” just as the ’532 patent does. *Compare* Pet. Reply 24 (citing Pet. 58) (“*Chiu* discloses that the surviving pixels in a macroblock are classified into small, random details or large, connected details”), *with* Ex. 1001, 2:36–38 (“The association unit utilizes the threshold levels and the detail dimensions to associate the pixels of the video frame into subclasses.”). In light of this and our construction of “details” above as at least encompassing *a pixel or a group of pixels* that is detectable or distinguishable by the human visual system (*see supra* § II.C.1), it is not surprising that Petitioner cites different sorts of pixel analysis from Chiu and Gu for teaching various limitations in claim 6.

Patent Owner also reprises its claim construction position for “subclass” in which it argues that Petitioner establishes the classification of macroblocks, not details. PO Resp. 27–28; *see supra* § II.C.3. We disagree with this argument because, as discussed above, Petitioner actually contends that “*the surviving pixels* in a macroblock are classified into different subclasses—large, connected details and small, random details.” Pet. Reply 16 (emphasis added) (citing Pet. 58).

Furthermore, we agree with Petitioner (Pet. Reply 16 (citing Pet. 58)) that the Chiu–Gu combination teaches “subclasses” even under Patent Owner’s proposed construction. We note that Patent Owner cites the subclass examples in Table 2 of the ’532 patent and endorses Dr. Karam’s testimony regarding Table 2 that “if a pixel is not significantly present in the filtered frames, it belongs to a large detail or one that is ‘only detected but not distinguished.’ Or if the pixel is present in all of the filtered frames, then it belongs to a very small single detail.” PO Resp. 19 (quoting Ex. 1002 ¶ 34 with citations omitted). This echoes Petitioner’s unpatentability contentions including subclasses of “large, connected details and small, random details.” Pet. 58. We further note that a “Large detail or detected detail only” is an example of a subclass in Table 2 of the ’532 patent. Ex. 1001, 8:60. Petitioner additionally explains that, based on teachings from Chiu cited in the Petition, “pixels relating to the small, random details are not distinguishable from each other” (Pet. Reply 17 (citing Pet. 58; Ex. 1002 ¶¶ 105–114; Ex. 1005, 12:7–11)), which corresponds to Patent Owner’s proposed construction of “subclass,” i.e., “an area with pixels related to the same detail and which cannot be distinguished from each other.” Thus, Petitioner’s obviousness contentions for this limitation are persuasive even under Patent Owner’s proposed construction.

For these reasons, Petitioner establishes that the combination of Chiu and Gu teaches “classifying said frame picture details into subclasses in accordance with said visual perception thresholds and said detail parameters.”

- f. “transforming each said frame detail in accordance with its associate subclass”

Claim 6 further recites “transforming each said frame detail in accordance with its associate subclass.” Ex. 1001, 12:62–63. Petitioner cites Chiu’s teaching that macroblocks with large, connected details are motion compensated, whereas macroblocks with small, random details are skipped for motion compensation. Pet. 64 (citing Ex. 1005, 11:33–36). Petitioner also cites Chiu’s teachings of implementing motion compensation by transforming a macroblock. *Id.* at 65 (citing Ex. 1005, 1:53–57, 3:7–19). Petitioner additionally cites Chiu’s Figure 2 and contends that “motion compensated macroblocks are sent to the transformer 116 for transformation, while the skipped macroblocks are made equal to the corresponding macroblocks on the previously reconstructed picture \hat{F}_{k-1} , which are inverse transformed by inverse transformer 122.” *Id.* at 65–66 (citing Ex. 1002 ¶¶ 121–124; Ex. 1005, Fig. 2). Thus, Petitioner contends that Chiu teaches transforming subclasses of details as follows:

- Small, random details: skipped, use previously reconstructed picture \hat{F}_{k-1} obtained by inverse transform;
- Large, connected details: motion compensated, transform current macroblock.

Id. at 66 (citing Ex. 1002 ¶ 124; Ex. 1005, 1:53–57, 3:7–19, 11:15–12:6, Fig. 2).

Patent Owner does not dispute Petitioner’s analysis for this limitation. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. Based on the complete trial record, we find that Chiu teaches that macroblocks with large, connected details (i.e., one subclass) are motion compensated using a

transform, whereas macroblocks with small, random details (i.e., another subclass) are not motion compensated such that a previously reconstructed picture is obtained by inverse transform and used. *See, e.g.*, Ex. 1002 ¶¶ 121–124; Ex. 1005, 3:7–8, 11:15–12:6.

g. Conclusion Regarding Claim 6

Petitioner has shown persuasively that the combination of Chiu and Gu teaches all limitations of claim 6. Petitioner also has put forth persuasive reasons for combining these references with a reasonable expectation of success. Accordingly, we determine Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 6 would have been obvious over the combination of Chiu and Gu.

4. Claim 16

Claim 16 depends from claim 6 and recites “[t]he method according to claim 6, and wherein said intensity is a luminance value.” Ex. 1001, 16:31–32. Petitioner states that “said intensity” in claim 16 lacks antecedent basis in claim 6. Pet. 66–67. Notwithstanding, Petitioner asks us to consider the patentability of claim 16 in accordance with the holding in *Fitbit, Inc. v. Valencell, Inc.*, 964 F.3d 1112, 1119–20 (Fed. Cir. 2020) (holding that the Board should resolve the merits of patentability despite a lack of antecedent basis when the intended meaning of a claim is not subject to a reasonable debate). As such, Petitioner puts forth obviousness contentions “to the extent ‘intensity’ refers to the intensity of ‘details’ recited in claim 6.” *Id.* at 67 (citing Ex. 1001, 5:28–33, 13:1–31); *see also id.* at 67–68 (Petitioner’s further obviousness contentions for claim 16 based on Chiu and Gu and

testimony from Dr. Karam). Patent Owner “does not oppose Petitioner’s request to consider whether claim 16 is obvious over the cited references under the holding of *Fitbit*.” PO Resp. 28–29. Notwithstanding, Patent Owner relies on the same arguments it makes with respect to claim 6. *Id.*

In our Decision on Institution, we encouraged the parties to further address the construction of “said intensity” during the course of trial, with a particular focus on how any such construction is supported in the specification and claims of the ’532 patent. Dec. on Inst. 21. Neither party further addressed the construction of “said intensity.”

We agree with Petitioner that “said intensity” in claim 16 lacks antecedent basis in claim 6. “The lack of antecedent basis signals a potential indefiniteness problem but does not end the inquiry.” *Bushnell Hawthorne, LLC v. Cisco Sys., Inc.*, 813 F. App’x 522, 526 (Fed. Cir. 2020).

Accordingly, we must consider “[w]hether [the] claim, despite lack of explicit antecedent basis . . . nonetheless has a reasonably ascertainable meaning,” an issue that “must be decided in context.” *Energizer Holdings, Inc. v. Int’l Trade Comm’n*, 435 F.3d 1366, 1370 (Fed. Cir. 2006). We note that antecedent basis can be present via inherent characteristics of a related claim limitation or by implication. *See Bose Corp. v. JBL, Inc.*, 274 F.3d 1354, 1359 (Fed. Cir. 2001); *Slimfold Mfg. Co. v. Kinkead Indus., Inc.*, 810 F.2d 1113, 1116 (Fed. Cir. 1987).

In the specification of the ’532 patent, “intensity” is described as a characteristic of pixels. *See, e.g.*, Ex. 1001, 2:40–42 (“the intensity of each pixel of the video frame”), 3:21–22 (“a per-pixel signal intensity change”), 3:41–42 (“the intensities of the pixels in the filtered frame”), 5:32–33 (“at least three bits are needed to describe the intensity of each of [the] pixels”),

7:24–25 (“the maximum intensity [sic] I_{MAX} possible for the pixel”), 9:27–30 (“intra-frame processor 44 changes the intensity of the pixel by an amount less than the visual distinguishing threshold for that pixel”), code (57) (“the intensity of each pixel of the video frame”). According to the specification, “the intensity can be a luminance value or a chrominance value.” *Id.* at 4:23–24. The specification states that “luminance” is also a characteristic of pixels. *See, e.g., id.* at 6:13–14 (“[i]t is noted that frames are composed of pixels, each having luminance Y ”), 7:56–57 (“ Y_i is the luminance level of a pixel in the current frame”).

Given that Petitioner purports to link “said intensity” in claim 16 to the intensity of “details” in claim 6 (*see* Pet. 67), we must decide whether “intensity” is an inherent characteristic of the recited “details,” or else whether “intensity” finds antecedent basis from “details” by implication. *See Bose*, 274 F.3d at 1359; *Slimfold*, 810 F.2d at 1116. Yet the evidence of record links intensity to pixels, not details. Dr. Karam testifies that “*pixels, which make up details*, were said to have a given intensity based on their brightness or color.” Ex. 1002 ¶ 126 (emphasis added) (citing Ex. 1008, 3, 5–10). Further, the specification of the ’532 patent supports that *pixels* within a detail have an intensity: “The present invention separates the details of a frame into two different types, those that can only be detected (for which only one bit will suffice to describe *each of their pixels*) and those which can be distinguished (for which at least three bits are needed to

describe the intensity of *each of their pixels*).”⁹ Ex. 1001, 5:28–33 (emphasis added).

Although Petitioner may be correct that an intensity is an inherent property of a pixel, Petitioner has not established that each detail inherently has an intensity. For example, in the case of a single multi-pixel detail (i.e., a “group of pixels”), each pixel within that detail might have a different intensity. *See* Ex. 1001, 5:28–33 (discussing the number of bits needed to describe the intensity of *each* of the pixels in a detail). In this scenario, a “detail” would have multiple different intensities, which renders “said intensity” in claim 16 ambiguous to the extent it refers to a detail in claim 6. We further note that claim 8,¹⁰ a separate claim depending from claim 6 that Petitioner cites in support of its position (Pet. 67), ostensibly distinguishes between details and pixels in the context of intensity. Claim 8 recites further limitations on the step of “estimating parameters of said details” in claim 6. Ex. 1001, 12:55, 13:1–2. Even though claim 8 relates to estimating parameters of a detail, it nonetheless recites per-pixel steps pertaining to intensity: “determining $N\Delta_i$, a per-pixel signal intensity change between a current frame and a previous frame, normalized by a maximum intensity” and “generating NY_i , a normalized intensity value per-pixel.” *Id.* at 13:3–5, 13:29. The related discussion in the specification also supports per-pixel treatment for intensity. *See id.* at 3:21–24, 3:46, 7:31–34, 7:56–58. As such, the ’532 patent’s per-pixel intensity operations undercut the notion that an

⁹ As discussed above, this passage from the specification supports our construction of “details” as encompassing a pixel or a group of pixels. *See supra* § II.C.1.

¹⁰ Petitioner does not challenge claim 8 in the Petition.

intensity is inherently or impliedly linked directly to a detail. We further find Petitioner's proposed linkage between "said intensity" in claim 16 and "details" in claim 6 via various disclosures about pixels to be too attenuated to resolve the ambiguity in claim 16.

For these reasons, we find that the scope of claim 16 is subject to reasonable debate, so we disagree that *Fitbit* applies. *See Fitbit*, 964 F.3d at 1119–20. In *Fitbit*, the parties proposed to correct a claim dependency that had been misnumbered during prosecution. *Id.* at 1119. There was no reasonable debate as to the intended claim dependency and whether the antecedent basis problem would be resolved by the correction of the claim dependency. *Id.* Here, however, Petitioner's position that "said intensity" might refer to the intensity of the "details" recited in claim 6 goes beyond correcting an apparent antecedent basis error in claim 16.

Although 35 U.S.C. § 318 obligates us to issue a final written decision with respect to the patentability of every challenged claim, this "does not mean that the Board must reach a determination of the patentability of a claim on the presented prior-art grounds if such a determination is rendered impossible because of the indefiniteness of an essential claim limitation." *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 813 (Fed. Cir. 2021). We also have considered the guidance of the *Intel* court about the possibility of rejecting a prior art challenge on another basis despite the indefiniteness of a limitation (*see id.*); unfortunately, that is not possible here because we do not perceive other faults in Petitioner's analysis under its hypothesis that "intensity" might ultimately refer to the intensity of "details" recited in claim 6. *See* Pet. 67.

Accordingly, we determine that it is impossible to conduct the necessary factual inquiry for determining obviousness with respect to claim 16, such as ascertaining differences between the claimed subject matter and the prior art. *See Graham*, 383 U.S. at 17–18; *In re Steele*, 305 F.2d 859, 862–63 (CCPA 1962). Accordingly, this Decision does not include a determination of patentability as to claim 16. *See Intel*, 21 F.4th at 813.

E. Petitioner’s Motion to Exclude

1. Exhibits 2001 and 2002

Exhibits 2001 and 2002 are website printouts of dictionary definitions for “detail” and “separate.” Patent Owner cites these definitions in conjunction with certain claim construction arguments. PO Resp. 11, 15. Petitioner moves to exclude Exhibits 2001 and 2002 under Federal Rules of Evidence 401, 402, and 403 as irrelevant, prejudicial, and confusing. Exclude Mot. 1–4. Petitioner’s primary argument is based on the fact that these dictionary website printouts bear a copyright date of 2023, which is 23 years after the earliest effective filing date for the challenged claims. *Id.* at 2–4. Petitioner argues that Patent Owner has not established the relevance of these recent dictionary definitions to the understanding of an ordinarily skilled artisan 23 years earlier. *Id.*

In response, Patent Owner states that “Petitioner does *not* argue—or cite any evidence to suggest—that the meanings of these common words have changed since the date of invention.”¹¹ Exclude Opp. 5.

We note that the Board acts as both the gatekeeper and the weigher of evidence. Similar to a district court in a bench trial, the Board, sitting as a non-jury tribunal with administrative expertise, is well positioned to determine and assign appropriate weight to evidence presented, including giving it no weight. *See, e.g., Donnelly Garment Co. v. NLRB*, 123 F.2d 215, 224 (8th Cir. 1941) (“One who is capable of ruling accurately upon the admissibility of evidence is equally capable of sifting it accurately after it has been received . . .”). For these reasons, we *deny* Petitioner’s motion to exclude Exhibits 2001 and 2002. Rather than excluding evidence that is allegedly confusing, misleading, unsupported, and/or irrelevant, we either have determined that it does not meaningfully affect our analysis or else have given it little or no probative weight, as appropriate.

2. *Exhibits 2003 and 2004*

Exhibit 2003 appears to be undated course notes from an engineering course at Rutgers University. Exhibit 2004 is a technical article dated 2017. Petitioner moves to exclude these exhibits under Federal Rules of Evidence 401, 402, and 403 as irrelevant, prejudicial, and confusing. Exclude Mot. 4–6. Although Patent Owner cites Exhibits 2003 and 2004 in conjunction with certain claim construction arguments (*see* PO Resp. 11–14), Patent Owner

¹¹ In support of its argument, Patent Owner introduces Exhibits 2005–2008. Exclude Opp. 5–6. Nevertheless, as discussed below, we disregard this evidence as being improper and untimely. *See infra* § II.E.3.

states in its opposition to the motion to exclude that it “uses these exhibits not as substantive extrinsic evidence of any claim term’s meaning, but merely examples to help visualize the use of the techniques taught and claimed by the patent.” Exclude Opp. 7; *see also* PO Resp. 13 n.2 (“Patent Owner cites [Exhibit 2003] as an example of the technique for illustrative purposes only, not as evidence of the skill in the art at the time of the invention.”). In light of this statement, we accord no weight to Exhibits 2003 and 2004 in rendering this Decision, and we *dismiss as moot* Petitioner’s motion to exclude Exhibits 2003 and 2004.

3. *Exhibits 2005–2008*

Exhibits 2005 and 2006 are Wayback Machine printouts of dictionary definitions from the years 2005 and 2006. Exhibit 2007 includes excerpts of a dictionary volume from the year 1989. Exhibit 2008 is a paralegal’s declaration in which she describes the provenance of Exhibits 2005–2007. Patent Owner apparently introduced Exhibits 2005–2008 for the first time with its opposition to the motion to exclude that was filed on October 6, 2023. *See* Exclude Opp. 2.

Petitioner argues that Exhibits 2005–2008 amount to untimely and improper supplemental evidence that attempt to cure objections to, *inter alia*, Exhibits 2001 and 2002. Exclude Reply 1–2. Petitioner notes that it objected to Exhibits 2001 and 2002 on May 5, 2023, which “set a 10 day window for Patent Owner to respond with supplemental evidence.” *Id.* (citing 37 C.F.R. § 42.64(b)(2)).¹² As such, Petitioner contends that Patent

¹² Petitioner mistakenly cited to “37 C.F.R. § 42.62(b)(2),” but the context makes clear Petitioner’s intended citation.

Owner introduced Exhibits 2005–2008 “more than 5 months after the objections were raised” and without “offer[ing] any explanation or justification as to why these untimely exhibits should now be considered.” *Id.* (emphasis omitted). Thus, Petitioner argues that Exhibits 2005–2008 should be excluded. *Id.*

We agree with Petitioner that Patent Owner offers no rationale as to why we should entertain Exhibits 2005–2008. In particular, Patent Owner does not offer any evidence that it served Exhibits 2005–2008 on Petitioner within the 10-day window after Petitioner’s objections in accordance with 37 C.F.R. § 42.64(b)(2). As such, Patent Owner’s attempt to introduce Exhibits 2005–2008 as supplemental evidence during the motion to exclude briefing comes five months too late. Thus, we consider Patent Owner’s introduction of Exhibits 2005–2008 to be improper and untimely.

Although Petitioner asks us to exclude Exhibits 2005–2008 (*see* Exclude Reply 1–2), we do not find that remedy—which pertains to evidentiary objections—appropriate in this instance. For this reason, we *deny* Petitioner’s motion to exclude Exhibits 2005–2008. Nevertheless, we find the issue of whether Exhibits 2005–2008 have been belatedly presented to be beyond dispute, so we disregard Exhibits 2005–2008 in rendering this decision. *See* Patent Trial and Appeal Board Consolidated Trial Practice Guide at 80 (Nov. 2019), *available at* <https://www.uspto.gov/TrialPracticeGuideConsolidated> (“[T]he Board is capable of identifying . . . belatedly presented evidence when weighing the evidence at the close of trial, and disregarding any . . . belatedly presented evidence that exceeds the proper scope of reply or sur-reply.”).

III. CONCLUSION

Petitioner has shown, by a preponderance of the evidence, that claim 6 would have been obvious over the combined teachings of Chiu and Gu. This Decision does not include a determination of patentability as to claim 16.

IV. ORDER

Accordingly, it is

ORDERED that claim 6 of the '532 patent is unpatentable;

FURTHER ORDERED that this Decision does not include a determination of patentability as to claim 16;

FURTHER ORDERED that Petitioner's Motion to Exclude is *denied* as to Exhibits 2001, 2002, and 2005–2008 and *dismissed as moot* with respect to Exhibits 2003 and 2004; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
6, 16 ¹³	103(a)	Chiu, Gu	6	
Overall Outcome			6	

¹³ As noted above, this Decision does not include a determination of patentability as to claim 16. *See Intel*, 21 F.4th at 813.

IPR2022-01182
Patent 6,473,532 B1

PETITIONER:

Trenton Ward
GREENBERG TRAURIG, LLP
trenton.ward@gtlaw.com

Roshan Mansinghani
David Seastrunk
UNIFIED PATENTS, LLC
roshan@unifiedpatents.com
david@unifiedpatents.com

William Neer
FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, LLP
william.neer@finnegan.com

PATENT OWNER:

Warren J. Thomas
Lawrence A. Aaronson
MEUNIER CARLIN & CURFMAN LLC
wthomas@mcciplaw.com
laaronson@mcciplaw.com