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Paper 22
Entered: July 29, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

IMMERVISION, INC.,
Patent Owner.

IPR2023-00472
Patent 10,795,120 B2

Before KRISTINA M. KALAN, JOHN D. HAMANN, and STEPHEN E. BELISLE, *Administrative Patent Judges.*

KALAN, *Administrative Patent Judge*.

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

I. INTRODUCTION

Apple Inc. ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting *inter partes* review of claims 1–7 of U.S. Patent No. 10,795,120 B2 (Ex. 1001, "the '120 patent"). ImmerVision, Inc. ("Patent Owner") filed a Preliminary Response (Paper 5).

We instituted *inter partes* review of claims 1–7 of the '120 patent on the grounds of unpatentability alleged in the Petition. Paper 6 ("Dec."). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 10 ("PO Resp."). Petitioner filed a Reply. Paper 13 ("Reply"). Patent Owner filed a Sur-Reply. Paper 14 ("Sur-Reply"). With Board authorization, Petitioner filed a Rebuttal to the Sur-Reply. Paper 15 ("Rebuttal").

We held an oral hearing on May 3, 2024, and a transcript of the hearing is included in the record. Paper 21 ("Tr.").

We have jurisdiction over this *inter partes* review under 35 U.S.C. § 6 (2018). This Final Written Decision is issued pursuant to 35 U.S.C. § 318. We find that Petitioner has shown, by a preponderance of the evidence, that claims 1–7 of the '120 patent are unpatentable.

A. Related Proceedings

The parties identify the following district court litigation as a related matter: *ImmerVision, Inc. v. Apple Inc.*, 1:21-cv-01570 (D. Del). Pet. 88; Paper 3, 2 (Patent Owner's Mandatory Notices).

B. Real Parties-in-Interest

Petitioner states: "Apple Inc. is the real party-in-interest." Pet. 88. Patent Owner states: "ImmerVision, Inc. is the real party-in-interest." Paper 3, 2.

C. The '120 Patent

The '120 patent is titled "Miniature Wide-Angle Imaging Lens." Ex. 1001, code (54). The '120 patent "relates to optical lenses and more particularly to miniature lenses having a wide-angle field of view." *Id.* at 1:20–22. Figure 1 of the '120 patent is reproduced below.

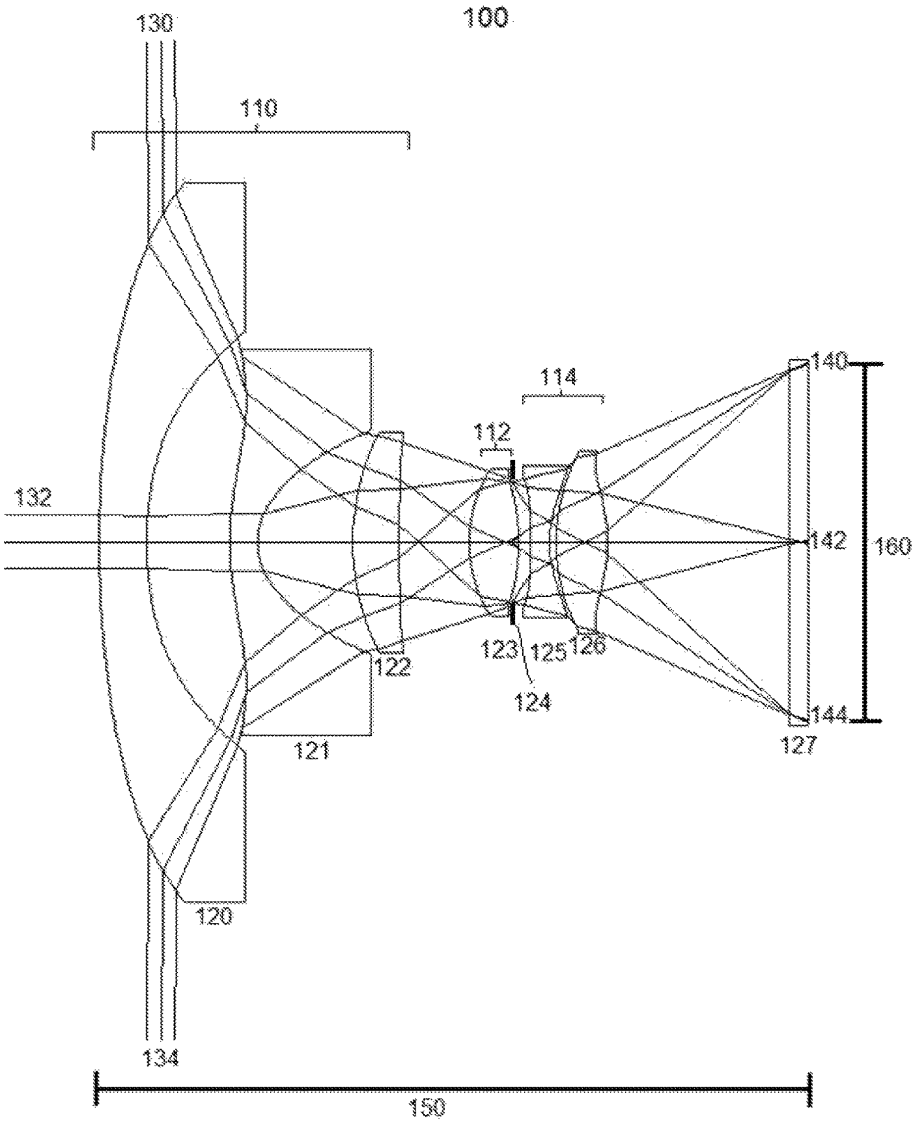


Figure 1 shows "an optical layout for a design having six optical elements in an asymmetric configuration around the stop, having four optical elements before the stop and two optical elements after the stop." *Id.* at 3:42–45.

"The lens 100 is comprised of the three groups 110, 112 and 114." *Id.* at 3:45–46. First group 110 is made of lenses 120, 121, and 122; second group 112 includes aperture stop 124 and lens 123; and third group 114 has optical elements 125 and 126. *Id.* at 3:47–54. A "total field of view around the central field 132 of the lens 100 is 180°, but any total field of view over 100° can be considered as a wide-angle lens." *Id.* at 3:58–60. Light passes through all the elements to reach IR filter and image sensor 127. *Id.* at 3:62–66. "The lens 100 has a total track length 150, which is a measure from the first surface on the object side of lens 120 to the image sensor 127." *Id*. at 4:15–17. "The miniaturization ratio is calculated by dividing the total track length 150 over the footprint diameter 160 and is less than 3.0 for any miniature lens according to the present invention and could even be less than 2.0 for an extreme miniature lens." *Id*. at 4:21–25.

One challenge is that, in "wide-angle lenses, the relative illumination is usually maximum in the center and drops continuously toward the edge of the field of view." *Id.* at 1:53–58. Another challenge "is a drop of the modulation transfer function (MTF) from the center to the edge of the field of view." *Id*. at 1:63–66. Both cause "lower image quality at the edge." *Id*. at 1:61, 2:2–3. As a mechanism to overcome the above issues, "the targeted resolution curve of the miniature wide-angle lens is configured to offset, at least in part, the drop of relative illumination from the miniature wide-angle lens by increasing the number of pixels imaged in the zone where the relative illumination is lower" (*id*. at 2:45–50), and "to offset, at least in part, the drop of MTF from the miniature wide-angle lens by increasing the number of pixels imaged in the zone where the MTF is lower" (*id*. at 2:51–55). The "targeted resolution curve of the miniature wide-angle lens is

configured as the optimal curve to produce the highest relative illumination and MTF values combination and hence produce the optimal image quality." *Id*. at 2:56–60.

Figure 4 of the '120 patent is reproduced below.

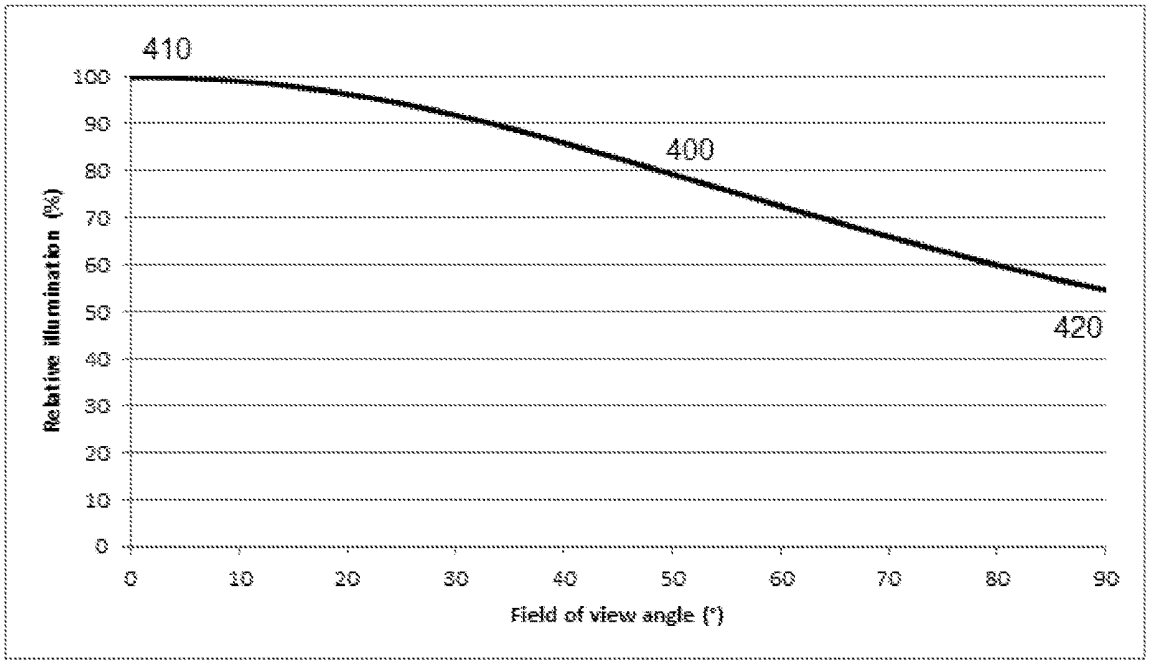


Figure 4 shows "a typical relative illumination curve 400." *Id*. at 5:57. "The exact values of the relative illumination with respect to the field of view vary between each embodiment of the present invention," but "the overall shape having a value around 100% at 0° shown at center 410 and under 80% at the maximum field angle shown at position 420 is present in all families of miniature wide-angle lenses according to the present invention." *Id.* at 5:59–65. In some embodiments, "the shape of the targeted resolution curve is intentionally designed to compensate for the drop of relative illumination seen in FIG. 4." *Id.* at 6:13–16.

Figure 5 of the ’120 patent is reproduced below.

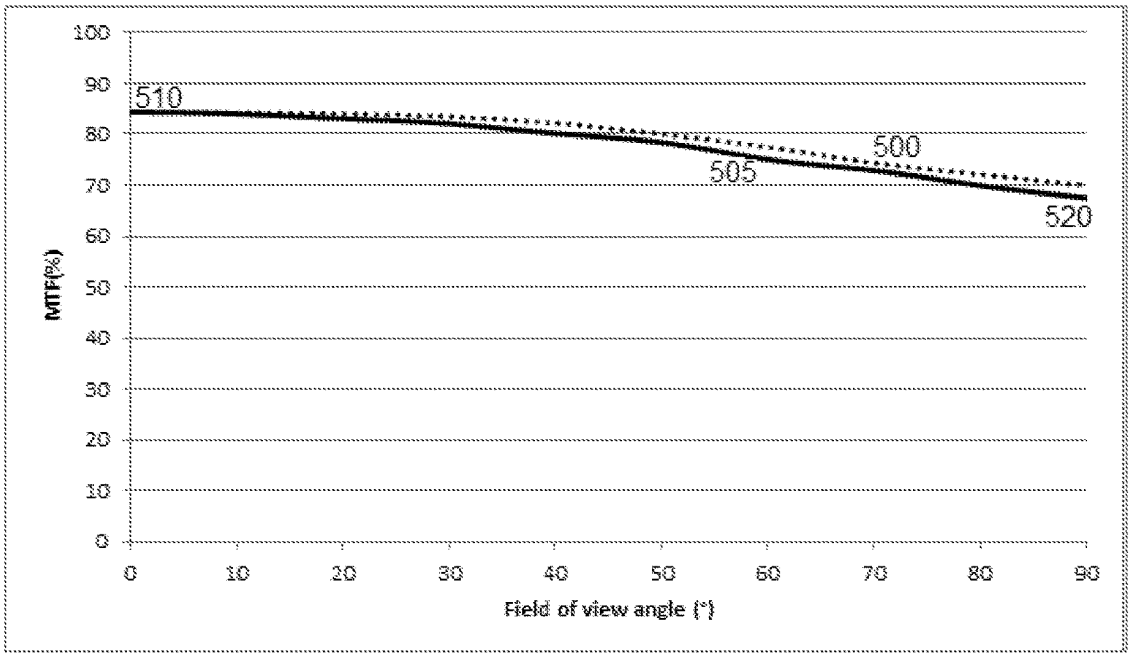


Figure 5 shows “a typical sagittal MTF curve 500 and tangential MTF curve 505 for a miniature wide-angle lens according to embodiments of the present invention.” *Id*. at 5:66–6:1. “The exact values of the MTF with respect to the field of view vary between each embodiment of the present invention and also vary according to the spatial frequency at which the MTF is calculated,” but “the overall shape having a higher value at 0° shown at center 510 than at the edge shown at position 520 is present in all families of miniature wide-angle lenses according to the present invention.” *Id.* at 6:1–8. In some embodiments, “the shape of the targeted resolution is intentionally designed to compensate for the drop of MTF seen in FIG. 5.” *Id.* at 6:16–19.

Figure 6 of the ’120 patent is reproduced below.

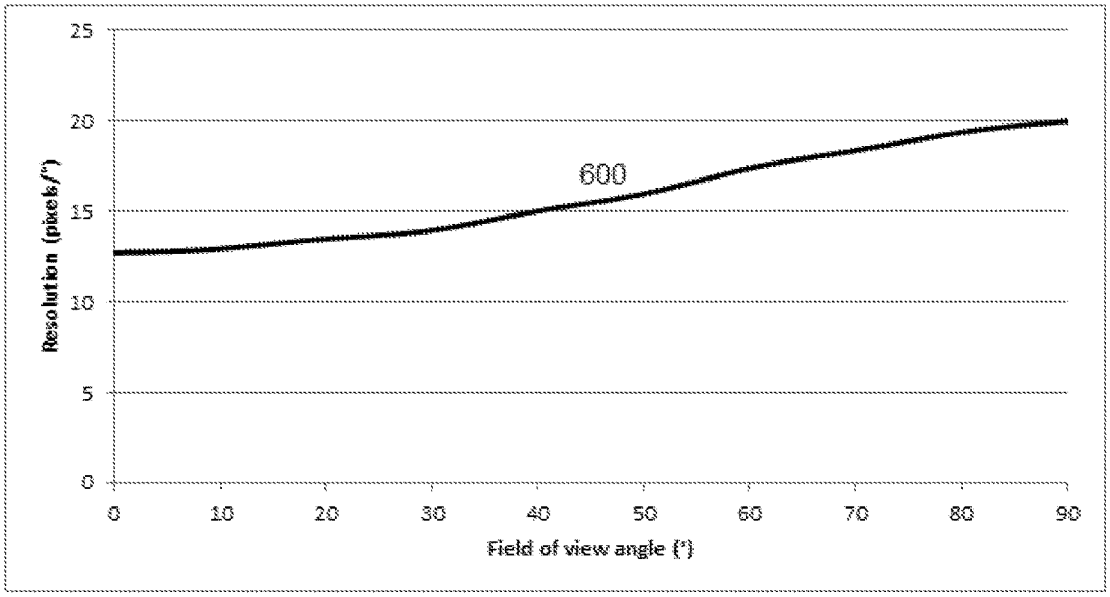


Figure 6 “shows an example targeted resolution curve 600” where “the targeted resolution is non-linear and a higher number of pixels per degree is intentionally present in a part of the image.” *Id.* at 6:9–13. “In the zone where the resolution is higher, there are more pixels of the sensors used to image a given angle of the object space” and “this compensates for the lower image quality caused in this zone either due to the lower relative illumination or the lower MTF.” *Id.* at 6:19–24. “The final resulting image can then be processed to create a resulting image with constant image quality across the whole field of view.” *Id.* at 6:24–27.

Figure 7 of the '120 patent is reproduced below.

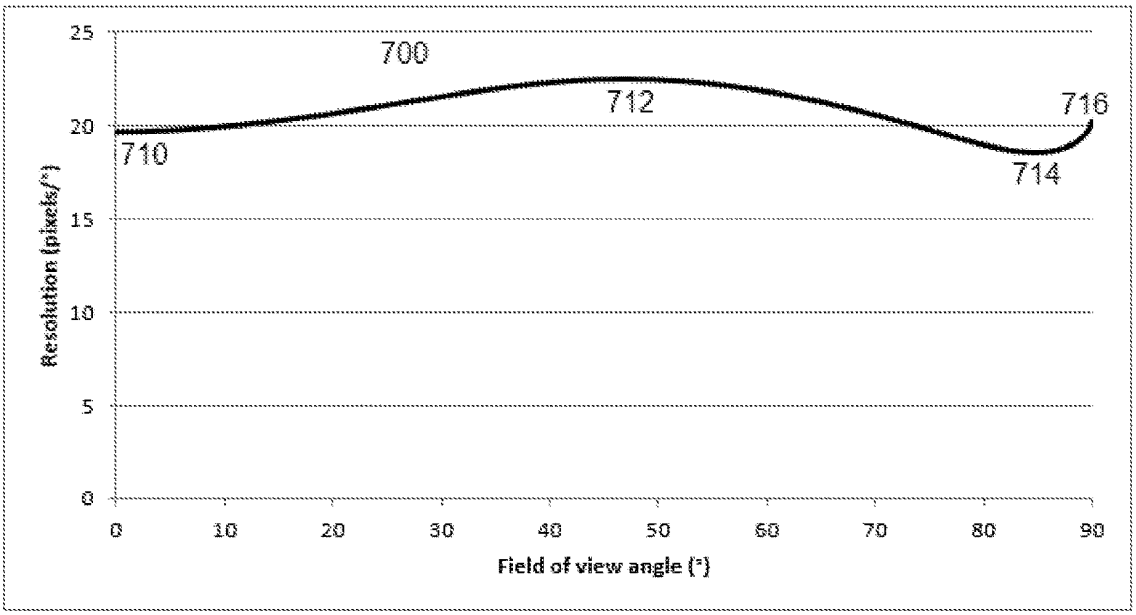


Figure 7 shows nonlinear targeted resolution curve 700 having "an upward curve between the center resolution value 710 and a maximum 712 (number of pixels/degree), followed by a downward curve between the maximum 712 and a region near the edge of the field of view around position 714." *Id.* at 6:28–35.

> This downward curve between maximum value 712 and position 714 allows the lens system to have a higher relative illumination value toward the edge of the field of view by having a lower object to image magnification ratio in that region and hence redirecting the same quantity of light from an object to a smaller region in the image with more illumination.

Id. at 6:35–41.

D. Illustrative Claim

Claim 1, reproduced below, is the sole independent claim.

1. [1pre] A miniature wide-angle optical apparatus comprising:

[1a] a light-receiving first surface;

[1b] a focal plane;

[1c] a total track length measured from a center of the first surface to the focal plane;

[1d] a miniaturization ratio with a value less than 3.0, the miniaturization ratio being a ratio of the total track length divided by an image circle diameter; and

[1e] a non-linear targeted resolution to intentionally create a zone in an image captured by the miniature wide-angle optical apparatus with a lower or higher object to image magnification compared to linear targeted resolution, the lower or higher object to image magnification being used to compensate, at least in part, for a lower image quality due to at least one of a drop of relative illumination or a drop of MTF in a zone of the image,

[1f] an opening angle of light entering the optical apparatus being over 100°.

Ex. 1001, 7:11–8:4 (bracketed annotations added by Petitioner).

E. Instituted Grounds of Unpatentability

We instituted review of claims 1–7 on the following grounds:

Claims Challenged	35 U.S.C. §[1]	Reference/Basis
1–7	102	Thibault[2]
1–7	103	Thibault
1, 3–6	102	Matsusaka[3]
1, 3–6	103	Matsusaka
1, 4, 5, 7	102	Kim[4]
1, 4, 5, 7	103	Kim

[1] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. § 102 and § 103. Because the '120 patent has an effective filing date after the effective date of the applicable AIA amendments, we refer to the AIA versions of § 102 and § 103.

[2] S. Thibault, J. Parent, H. Zhang, and P. Roulet, *Design, fabrication and test of miniature plastic panomorph lenses with 180° field of view*, Proceedings of SPIE, 2014 ("Thibault") (Ex. 1004).

[3] U.S. Patent Pub. No. 2010/0194853 A1 ("Matsusaka") (Ex. 1005).

[4] Korean Patent No. 10-0677055 ("Kim") (Ex. 1006; Ex. 1007 (certified translation)).

In support of its arguments, Petitioner relies on the Declarations of Dr. David Kessler, Ph.D. Ex. 1003; Ex. 1023. Patent Owner relies on the Declaration of Dr. Michael Lebby, Ph.D. Ex. 2001.

II. ANALYSIS

A. Legal Standards

"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) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")); *see also* 37 C.F.R. § 42.104(b) (requiring a petition for *inter partes* review to identify how each challenged claim is to be construed and where each element of the claim is found in the prior art patents or printed publications relied upon).

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). A "prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements 'arranged as in the claim.'" *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)). Although the elements must be arranged or combined in the same way as in the claim, "the reference need not satisfy an *ipsissimis verbis* test," i.e., identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009).

A patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the invention, as a whole, would have been obvious to a person having ordinary skill in the art to which said invention pertains. 35 U.S.C. § 103; *see KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved based on 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 ordinary skill in the art; and (4) when presented, objective evidence of nonobviousness, i.e., secondary considerations.[5] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Subsumed within the *Graham* factors are the requirements that all claim limitations be found in the prior art references and that the skilled artisan would have had a reasonable expectation of success in combining the prior art references to achieve the claimed invention. *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007). Additionally, the obviousness inquiry typically requires an analysis of "whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring "articulated reasoning with some rational underpinning to support the legal conclusion of obviousness")).

[5] Neither Patent Owner nor Petitioner presents any evidence directed to objective indicia of nonobviousness, i.e., secondary considerations, as to any of the challenged claims. *See* Pet.; PO Resp.; Reply; Sur-Reply; Rebuttal.

B. Level of Ordinary Skill in the Art

In our Institution Decision, we adopted Petitioner's undisputed contention that a POSITA (person of ordinary skill in the art) "would have had at least a Bachelor's degree in an academic area emphasizing physics, optical engineering, electrical engineering and/or a similar discipline, and at least five years of experience in developing and designing optical imaging systems and have familiarity with image processing algorithms and optical design software" and that "[s]uperior education could compensate for a deficiency in work experience, and *vice-versa*." Pet. 8 (citing Ex. 1003 ¶ 15).

Patent Owner states: "***Solely*** for purposes of this Response, Patent Owner does not object to Petitioner's definition of a POSA [person of ordinary skill in the art]." PO Resp. 14 (citing Ex. 2001 ¶ 45).

Accordingly, we adopt Petitioner's proposal regarding the level of ordinary skill in the art with the exception of the open-ended phrase "at least," which expands the range of experience indefinitely without an upper bound. The level of ordinary skill in the art is also reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that "specific findings on the level of skill in the art . . . [are not required] 'where the prior art itself reflects an appropriate level and a need for testimony is not shown'" (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))).

C. Claim Construction

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). Under *Phillips*, claim terms are afforded "their ordinary and

customary meaning." *Phillips*, 415 F.3d at 1312. The "ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention." *Id.* at 1313. Only terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

1. Petition

Petitioner "submits that no formal claim constructions are necessary," but asserts "claim 1 includes an 'intended use' limitation" that "assigns intention to the claim's optical apparatus . . . or speaks to the intention of the designer/producer of the optical apparatus." Pet. 8–9. Petitioner identifies the alleged "intended use" limitation as follows: "the lower or higher object to image magnification ***being used to*** compensate, at least in part, for a lower image quality due to at least one of a drop of relative illumination or a drop of MTF in a zone of the image." *Id.* at 9 (emphasis added by Petitioner). Petitioner contends that the claimed "compensation" is a "necessary byproduct of the optical apparatus including the claimed 'zone . . . with a lower or higher object to image magnification compared to linear targeted resolution'" limitation immediately preceding the "being used to compensate" language. *Id.* at 11. More particularly, Petitioner contends that the '120 patent describes that either increasing or decreasing the image magnification (i.e., pixels per degree) in regions of the image away from the center compensates for the "natural drops in relative illumination and/or MTF" from the center to the edge of the field of view for a wide-angle lens. *Id.* (citing Ex. 1001, 1:56–58, 1:63–2:3, 5:57–6:50, Figs. 4–7; Ex. 1003 ¶ 80). Petitioner further contends that, by implementing the "zone"

limitation, the '120 patent "teaches that the optical apparatus compensates, at least in part, for a lower image quality due to at least one of a drop of relative illumination or a drop of MTF in a zone of the image." *Id.* at 12. Thus, Petitioner argues, "the claims should be construed to be met if the prior art anticipates or renders obvious the claimed 'zone.'" *Id.*

2. Response

Patent Owner responds that the "being used to compensate" language "explains, *inter alia*, ***where*** the created zones are placed in the apparatus – *i.e.*, in locations within the FOV [field of view] corresponding to the relative illumination or MTF drop." PO Resp. 15. Relying on passages from the Specification, Patent Owner argues that the "language at issue results in a structural difference – it at least indicates where the targeted zone is located in the apparatus" and, therefore, must be assigned patentable weight. *Id.* at 16 (citing Ex. 1001, 2:45–55, 6:9–27, Figs. 4–6; Ex. 2001 ¶¶ 52, 66–67). According to Patent Owner, the "being used to compensate" language is "not reciting a new use for an old product, does not relate to a process of making the optical apparatus, nor does it provide a step for operation. Rather, it at least explains to the POSA how the created zone is arranged within the FOV of the optical apparatus." *Id.* at 17 (citing Ex. 2001 ¶ 66). Patent Owner's declarant presents an interpretation of limitation 1[e] relying on Figures 4, 5, and 6 alone. Ex. 2001 ¶¶ 58 (annotated Figure 6), 64–67. Patent Owner relies on this testimony, which discusses Figures 4, 5, and 6, but which does not discuss Figure 7, in putting forth its claim construction arguments. PO Resp. 14–17 (citing Ex. 2001 ¶¶ 52, 60, 62, 65–67).

3. Reply

Petitioner replies that Patent Owner "presents a new construction of limitation 1[e]" that is "inconsistent with the intrinsic record and makes little technical sense." Reply 1. According to Petitioner, all of Patent Owner's "identification and briefing of this construction occurred months ***after*** the Petition was filed." *Id*. at 3. Petitioner further replies that Patent Owner's proposed construction, in essence, "seeks to exclude the '120 Patent's teachings with respect to FIG. 7 as a 'separate and different approach' than the approach allegedly claimed" and that Patent Owner's proposed construction "should be rejected because it is inconsistent with the intrinsic record by unjustifiably reading embodiments out of the claim that the claim language and its own prosecution arguments clearly sought to include." *Id.* at 5. Petitioner argues that "the limitation should at least encompass the teachings of both FIG. 6 and FIG. 7 of the '120 Patent." *Id.*

First, Petitioner argues that Patent Owner's "current construction is inconsistent with the intrinsic record" and that Patent Owner "argues for the first time that, under this construction, FIG. 7 of the '120 Patent is 'a separate and different approach' than the approach allegedly claimed, and therefore should be excluded from the scope of the claim language." *Id.* at 6–7. Petitioner refers to Patent Owner's briefing in the district court proceeding, in which Patent Owner stated that the wording of limitation 1[e] "may not be the perfect word choice" and "may not be the most articulate way to phrase the claim." *Id.* at 6 (citing Ex. 1024, 65, 78). Petitioner argues that, during prosecution, Patent Owner stated that "claim 1 is supported by <u>both</u> FIGS. 6 and 7, as well as the supporting description for those figures in the specification." *Id.* at 7 (citing Ex. 1002, 27; Ex. 1023

¶ 19). Petitioner also argues that "the '120 Patent makes clear that the 'overall shape' of the relative illumination curve of FIG. 4 and the MTF curve of FIG. 5 are intended to apply [to] all embodiments—including FIG. 7." *Id.* at 8 (citing Ex. 1001, 5:57–65, 6:1–8; Ex. 1023 ¶ 20). Petitioner argues that Figure 6 covers the case of "a zone where the resolution is ***higher***," but "does not describe or otherwise support a case where a lower object to image magnification would provide this compensation," while Figure 7 has "***a lower object to image magnification ratio in that region.***" *Id.* at 8–9 (citing Ex. 1001, 6:19–27, 6:35–41; Ex. 1023 ¶¶ 13, 15–17).

Second, Petitioner argues that Patent Owner's construction "makes little technical sense, whereas the Petition's approach is consistent with the '120 patent's purported benefits." *Id.* at 10. Petitioner argues that in Figure 6, "it is not the lens that compensates for the lower image quality . . . it is the processing of the image data after it is captured by the sensor that compensates for the lower image quality." *Id.* at 10–11 (citing Ex. 1023 ¶ 14). According to Petitioner, Figure 7, on the other hand, "purports to show a method by which the lens system itself 'compensates' for the drop in relative illumination or MTF experienced in these usual wide-angle lenses based on the shape and position of the targeted resolution curve." *Id.* at 11 (citing Ex. 1023 ¶ 15 (citing Ex. 1001, 1:53–2:3) ("In wide-angle lenses, the relative illumination is usually maximum in the center and drops continuously toward the edge of the field of view," and "the image MTF is usually maximum in the center and drops continuously toward the edge of the field of view."). This "is consistent" with Patent Owner's "opening position" on the construction of this disputed term, where Patent Owner

"attempted to explain that physical characteristics of the 'claimed lens' itself 'applies [a] type of correction' to account for the 'undesirable amounts of relative illumination and/or MTF.'" *Id.* at 11–12 (citing Ex. 1024, 69–70).

4. Sur-Reply

Patent Owner responds that Petitioner was aware of the evidence required to show alleged unpatentability, and criticizes Petitioner's "framing the issue as a new claim construction dispute and professing to have been caught entirely unaware." Sur-Reply 2. Patent Owner argues that the dispute is not over claim construction, but evidence sufficiency. *Id.* at 3. "Far from being an unanticipated claim construction position, Patent Owner's arguments related to evidentiary gaps in the Petition, which Petitioner should not be permitted to fill at the reply stage." *Id.* at 4. Patent Owner also argues (1) "Petitioner's knowledge is demonstrated by its own provision of the correct evidence in certain instances" (*id.* at 5); (2) Petitioner served Patent Owner with invalidity contentions more than a month before commencing this IPR (*id.* at 6); and (3) Patent Owner served Petitioner with initial infringement contentions over two months before the Petition's filing date (*id.*).

Patent Owner argues that "Petitioner exaggerates Fig. 7's importance through selective misquotations." *Id.* at 8–12. Patent Owner maintains: "That one aspect of Fig. 7 (the downward curve segment used to actively raise illumination) differs from the 'compensate' concept in claim 1 does not mean other aspects of Fig. 7 lack any relevance." *Id.* at 9–10. Relying on the Specification, Patent Owner argues that, when "considered in full context, the '120 Patent does not support Petitioner's contention that Fig. 4 or 5 may be used to accurately assess correspondence with the resolution

curve in Fig. 7." *Id.* at 10. A "downward curve does not necessarily implicate a zone of lower object to image magnification," and "Fig. 6 shows an example where a zone having lower object to image magnification compensates for a drop of relative illumination or MTF in a zone of the image." *Id.* at 11 (citing Ex. 2001 ¶¶ 83–87, 59–62).

Patent Owner also argues that "Petitioner's explanation for disregarding Fig. 6 is not supported by the '120 Patent's Specification." *Id.* at 12–14. Patent Owner emphasizes that "the 'targeted resolution curve is used to at least partially compensate' the relative illumination or MTF, and the resolution curve is a characteristic of the lens." *Id.* at 13 (citing Ex. 1001, 3:18–21, 2:6–19). Patent Owner maintains that the Specification "demonstrates that the image processing subsequently ***obtains a better result due to the compensation provided by the lens***, not that the processing provides the benefit of the invention, (a known solution that increased unwanted noise)." *Id.* at 14.

5. Rebuttal

Petitioner argues that none of Patent Owner's prior briefing or contentions—including Patent Owner's "preliminary infringement contentions in the parallel district court case (Ex. 2012)—argued that the downward slope in the '120 Patent's Fig. 7 had no significance to claim 1, or explained why," and, thus, Petitioner's first opportunity to respond was in the Reply. Rebuttal 1. Petitioner maintains that it properly replied to the arguments after being faced for the first time in the Preliminary Response and Response with Patent Owner's contention "that the downward slope in the '120 Patent's Fig. 7 had no significance to claim 1." *Id.* at 1–2.

6. Oral Hearing

At oral hearing, Petitioner summarized its "Petitioner Construction" of limitation 1[e] as follows: "If given patentable weight, satisfied **if either** of the relevant feature of FIG. 6 ('zone . . . with a higher object to image magnification' aligned with a drop in relative illumination or MTF) or FIG. 7 ('a downward curve between the maximum 712 and a region near the edge of the field of view around position 714') is present in resolution curve." Ex. 1025, 6 (citing Reply 6–10); Tr. 7:6–8. Petitioner stated that the "relevant feature" for Figure 6 is "that a zone with a higher object to image magnification is aligned with a drop in relative illumination, or MTF," and that the "relevant feature" for Figure 7 is "a 'downward curve between the maximum 712 and a region near the edge of the field of view around position 714.'" Tr. 7:8–12. Petitioner also opined the Board judges did not "actually need to come [up] with a traditional, exactly worded claim construction to ultimately resolve the dispute," but "simply have to understand what the parties are arguing about with respect to that scope and then make a determination with respect to that dispute." *Id.* at 10:4–7.

Petitioner characterized the "Patent Owner Construction" as follows: "Satisfied **only if** the relevant feature of FIG. 6 ('zone . . . with a higher object to image magnification' aligned with a drop in relative illumination or MTF) is present in resolution curve." Tr. 7:13–15; Ex. 1025, 6 (citing PO Resp. 19–23). Patent Owner stated at oral hearing that if "you look at the first half of [Petitioner's] construction before the or, it says pretty much the same thing [as] the Patent Owner's alleged construction in the right hand column." Tr. 31:22–25. Patent Owner also stated that Petitioner's

"construction, they say on the right hand side, slide six, I think is missing some aspects to it." *Id.* at 34:7–8.

7. Analysis

a. Patentable Weight

As discussed in the Institution Decision, we are persuaded that we should not read any terms out of claim 1, and that the disputed term should be given patentable weight. Dec. 10–13. Claim interpretations "that render some portion of the claim language superfluous are disfavored." *Power Mosfet Techs., L.L.C. v. Siemens AG*, 378 F.3d 1396, 1410 (Fed. Cir. 2004); *see also Merck & Co. v. Teva Pharm. USA, Inc.*, 395 F.3d 1364, 1372 (Fed. Cir. 2005) ("A claim construction that gives meaning to all the terms of the claim is preferred over one that does not do so." (citations omitted)); *In re Wilson*, 424 F.2d 1382, 1385 (CCPA 1970) ("All words in a claim must be considered in judging the patentability of that claim against the prior art."). The preference for giving meaning to all terms, however, is not an inflexible rule that supersedes all other principles of claim construction, and so we consider Petitioner's allegations that the "being used to compensate" language is merely intended use. *See Power Mosfet*, 378 F.3d at 1410.

In this instance, notwithstanding Petitioner's argument in the Petition that the "being used to compensate" language is an "intended use," we agree with Patent Owner that the language including and following the "being used to compensate" language of claim 1 results in a structural limitation. Per the language of claim 1, the location of the "zone" is keyed to an area of the image where the image quality drops due to a drop either of relative illumination or of MTF, and where the lower or higher object to image magnification takes effect. The language of claim 1 requires that the zone

be "intentionally" created. Within this "zone," lower or higher object to image magnification (compared to linear targeted resolution) is required depending on the conditions. The "being used to compensate" language describes the conditions (i.e. a drop of relative illumination or a drop of MTF) that lead to the intentional creation of the "zone" where the lower or higher object to image magnification is required. As Patent Owner notes, the "being used to compensate" language explains "how the created zone is arranged within the FOV of the optical apparatus." PO Resp. 17. This "tells us something about the structural requirements" of the zone intentionally created within the apparatus. *K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1364 (Fed. Cir. 1999). Accordingly, we decline to view the "being used to compensate" language of claim 1 as an "intended use."

b. Allegedly Belated Argument and Evidence

Regarding Patent Owner's argument that Petitioner should have presented a more comprehensive claim construction position in its Petition, we are not persuaded that Petitioner's "claim construction" positions in this proceeding are improperly responsive or belated. Claim construction can be an evolving issue. We have reviewed Petitioner's presentation of its arguments at the outset, in the Petition, and we have addressed the Petition's arguments regarding whether limitation 1[e] is an intended use, above. Regarding the remaining arguments, we note that our rules provide that a "reply may only respond to arguments raised in the corresponding . . . patent owner response." 37 C.F.R. § 42.23(b). The Board "will permit the petitioner, in its reply brief, to address issues discussed in the institution decision," but a petitioner "may not submit new evidence or argument in reply that it could have presented earlier, e.g. to make out a prima facie case

of unpatentability. A party also may submit rebuttal evidence in support of its reply." Patent Trial and Appeal Board Consolidated Trial Practice Guide 73 (Nov. 2019), *available at* https://www.uspto.gov/TrialPracticeGuideConsolidated (citing *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1077–78 (Fed. Cir. 2015)).

We have reviewed the parties' post-institution arguments regarding limitation 1[e], and we are not persuaded that the subsequent development of both parties' positions on the interpretation of this term throughout the course of this proceeding is contrary to our rules. "There is no rule, for example, requiring a petition to describe all possible or reasonable claim constructions and to present invalidity theories under those constructions." *Axonics, Inc. v. Medtronic, Inc.*, 75 F.4th 1374, 1380–81 (Fed. Cir. 2023). The *Axonics* court further opined that "we have continued to recognize that a petitioner is entitled under the APA to respond to new claim construction arguments made by a patent owner." *Id.* at 1382. A recent Federal Circuit case addressing *Axonics* and a petitioner's opportunity to respond to a patent owner's newly presented claim construction argument, which was decided after oral hearing in this case, supports the *Axonics* approach. *Apple v. Omni MedSci*, No. 2023-1034, slip op. at 11–12 (Fed. Cir. June 21, 2024). This case summarizes some relevant pre-existing case law in reaching its conclusion that under "both *Axonics* and earlier precedents, the Board abused its discretion here in refusing to consider [petitioner] Apple's reply argument." *Id.* (citing *SAS Inst., Inc. v. ComplementSoft, LLC*, 825 F.3d 1341, 1351 (Fed. Cir. 2016), *rev'd on other grounds sub nom. SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348 (2018); *Hamilton Beach Brands, Inc. v. f'real Foods LLC*, 908 F.3d 1328, 1338–39 (Fed. Cir. 2018)).

There is a dispute about whether the exercise the parties are conducting with respect to limitation 1[e] is claim construction *per se*. Reply 9 (Petitioner arguing that Patent Owner and its declarant "attempt to construe the claims in a way that focuses exclusively on higher object to image magnification and all but reads lower object to image magnification out of the claims"), 12 (Petitioner characterizing Patent Owner's treatment of limitation 1[e] as claim construction); Sur-Reply 3 ("Petitioner mischaracterizes the Patent Owner Response as advancing a 'new claim construction.'"); Tr. 33:7–8 (Patent Owner's counsel opining: "I would also argue that this is not a claim construction issue at all.").

The fact remains that limitation 1[e] is in dispute as to its scope and application. Petitioner noted in the Rebuttal that it believes it is "reasonably permitted here to respond to [Patent Owner's] arguments about the scope of the claims." Rebuttal 2 (citing *Axonics*, 75 F.4th at 1380–82); *see also* Tr. 53:5–7 (Patent Owner stating: "What Axonics says is there's no rule that a petition must describe all possible or reasonable claim constructions and to present invalidity theories under those constructions, keyword being all."). In our view, the best manner to handle the dispute about the scope of this limitation is to consider the evidence before us and address the proper scope of limitation 1[e] before applying an understanding of limitation 1[e] to an analysis of the grounds, below. Notwithstanding the lack of a "conventional" claim construction proposal from either party, we review the parties' contentions, which we view as properly and timely submitted, as follows. *See generally Axonics*, 75 F.4th at 1380–82.

c. Figure 6, Figure 7

Regarding whether we should consider only Figure 6, but not Figure 7, in applying the "construction" of the disputed limitation 1[e], we decline to limit the scope of limitation 1[e] to Figure 6 only.

i. Claim Language – Limitation 1[e]

The language of limitation 1[e] itself provides for "a zone" with "a lower or higher object to image magnification compared to linear targeted resolution." The object to image magnification can be lower, or higher, but is not limited to one or the other. The language of limitation 1[e] continues: "the lower or higher object to image magnification being used to compensate . . . for a lower image quality." Again, limitation 1[e] encompasses lower or higher object to image magnification.

As explained by Petitioner and its declarant, Figure 6 "describes itself as covering a case of 'a zone where the resolution is ***higher***," which means there are "'more pixels of the sensors used to image a given angle of the object space'" to purportedly compensate "'for the lower image quality in this zone either due to the lower relative illumination or the lower MTF.'" Reply 8–9 (citing Ex. 1001, 6:19–27). Figure 6, according to Petitioner, does not "describe or otherwise support a case where a lower object to image magnification would provide this compensation." *Id.* at 9 (citing Ex. 1023 ¶ 16). Petitioner argues, however, that Figure 7 provides for the situation where there is a lower object to image magnification: "FIG. 7 is an embodiment in which the lens system itself is alleged to compensate for a lower relative illumination that would normally exist in a 'usual' wide angle lens system" and "FIG. 7 is one example where a lower object to image magnification is used to compensate, at least in part, for a lower image

quality due to a drop of relative illumination." *Id.* (citing Ex. 1023 ¶¶ 13, 15–16). Petitioner argues that Patent Owner and its declarant "attempt to construe the claims in a way that focuses exclusively on higher object to image magnification" as in Figure 6, and that "all but reads lower object to image magnification out of the claims." *Id.*

Patent Owner argues that it "never wholesale disavowed Fig. 7's relevance – the dispute is over ***one particular aspect*** of the curve in Fig. 7." Sur-Reply 9 (quoting PO Resp. 10 ("Fig. 7 ***partially*** embodies a different, complementary concept to the compensation scheme described above")). Patent Owner represents that it "argued that the downward slope in the '120 Patent's Fig. 7 had no significance to claim 1, not that Fig. 7 was wholly inapplicable." *Id.* at 1.

The parties do not disagree that limitation 1[e] encompasses the relevant feature of Figure 6. Regarding the relevant feature of Figure 7, namely, the "downward curve between the maximum 712 and a region near the edge of the field of view around position 714," we agree with Petitioner's reasoning that the "lower object to image magnification ratio in that region" falls within the scope of limitation 1[e]. Reply 8–9; Ex. 1023 ¶¶ 13, 15–17. Based on the explanations provided by Petitioner with respect to the language of limitation 1[e], we agree that the "lower or higher" language of limitation 1[e] may be read to encompass both the Figure 6 and the Figure 7 embodiments, including the respective "relevant features" of each of those Figures.

ii. Specification

The specification is "the single best guide to the meaning of [the] disputed term." *Phillips*, 415 F.3d at 1315 (quoting *Vitronics Corp. v.*

Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996)). The Specification provides that the relative illumination curve of Figure 4 and the MTF curve of Figure 5 apply equally to Figure 6 and Figure 7. In Figure 4, the "exact values of the relative illumination [RI] with respect to the field of view vary between each embodiment of the present invention, but the overall shape . . . *is present in all families of miniature wide-angle lenses according to the present invention*." Ex. 1001, 5:57–65 (emphasis added). In Figure 5, the "exact values of the MTF with respect to the field of view vary between each embodiment of the present invention and also vary according to the spatial frequency at which the MTF is calculated," but "the overall shape . . . *is present in all families of miniature wide-angle lenses according to the present invention*." *Id.* at 6:1–8 (emphasis added). Therefore, the Specification supports that the shape of Figure 4's RI curve and the shape of Figure 5's MTF curve apply to all embodiments, i.e., the embodiments of both Figure 6 and Figure 7. The Specification does not support Patent Owner's assertion that "the '120 Patent does not align FIG. 7 with any illustrated relative illumination or MTF plot." PO Resp. 21; Reply 8.

iii. Prosecution History

The prosecution history supports the interpretation that limitation 1[e] encompasses both Figure 6 and Figure 7. In the prosecution history, Patent Owner's amendment to claim 1, and in particular, to limitation 1[e], added the language "or higher" to expand the phrase to read "a lower <u>or higher</u> object to image magnification." Ex. 1002, 25. Patent Owner stated that support for the amendment to claim 1 was in both Figure 6 and Figure 7. *Id.* at 27 ("Support for the further amendments to claim 1 can be found, for example, at least in original Figs. 6 and 7, and in the original specification at

paragraphs [0040]-[0041].”). Paragraph [0040] of the original specification describes Figure 6, and paragraph [0041] of the original specification describes Figure 7. Ex. 1002, 120. Although Patent Owner now opines that limitation 1[e] does not apply to all of Figure 7 (Sur-Reply 9), there was no such qualification in the prosecution history. To the contrary, the prosecution history indicates that Patent Owner intended for claim 1 to derive support from both Figure 6 and Figure 7, from the features described therein, and from the Specification language describing Figure 6 and Figure 7. As Petitioner argued, this “demonstrates a clear understanding and intention for the language of independent claim 1 to at least encompass the embodiments disclosed in each of FIGS. 6 and 7.” Reply 7.

8. Summary

We decline to view the “being used to compensate” language of claim 1 as an “intended use.” We decline to read this language out of the claim.

We disagree that Petitioner is unable to submit additional argument and evidence to respond to Patent Owner’s arguments regarding the applicability of portions of Figure 7, or lack thereof, to limitation 1[e], for the reasons given above.

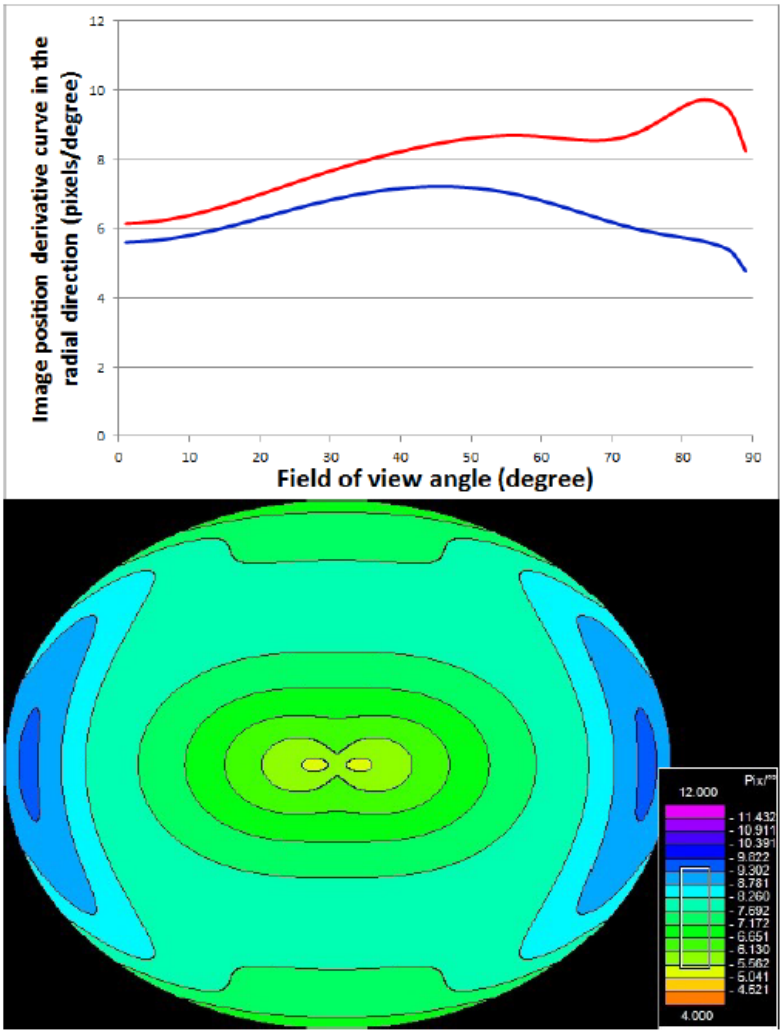
To the extent necessary to determine whether the disputed language of limitation 1[e] encompasses both Figure 6 and Figure 7, we agree with Petitioner that the language of limitation 1[e] encompasses both Figure 6 and Figure 7.

We determine we need not expressly construe any other claim terms. *See Vivid Techs.*, 200 F.3d at 803.

D. Summary of Select Asserted Art

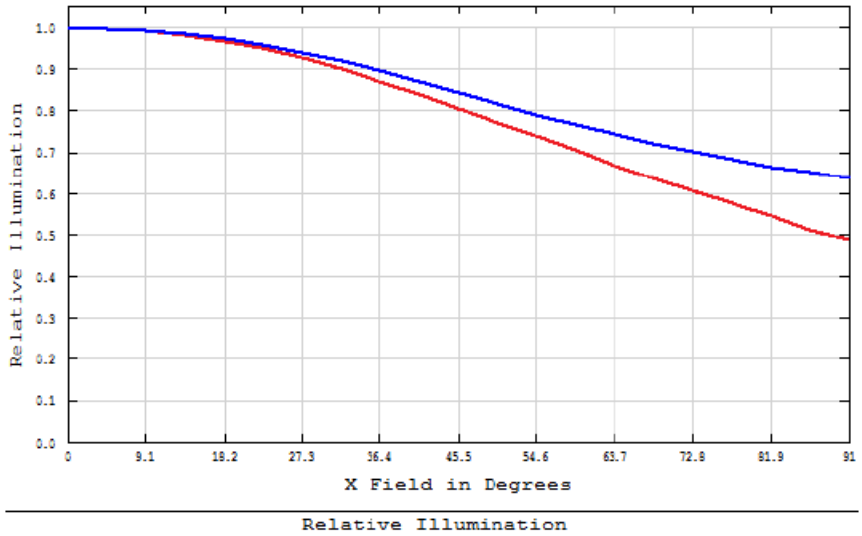
1. Thibault (Ex. 1004)

Thibault is titled "Design, fabrication and test of miniature plastic panomorph lenses with 180° field of view." Ex. 1004, 1. Thibault "addresses the challenges of designing and manufacturing miniature panomorph lenses suitable for state of the art megapixels sensor[s]" and presents "two miniature all plastic megapixel panomorph lenses for consumer electronics (total track length (TTL) of 6.56 mm) and mobile devices (TTL of 3.80 mm)." *Id.* at 2. Figure 3 of Thibault is reproduced below.



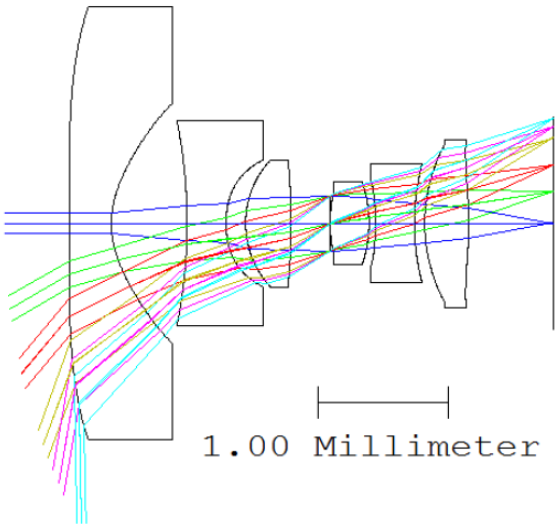
Thibault describes Figure 3 as follows: "The number of pixels of 1.75 µm is increased toward the edge. Top) Image position derivative curve in the radial direction (pixels/degree) in both the long (red) and short (blue) axis. Bottom) Surfacic resolution over the full elliptical panomorph image." *Id.* at 5. Figure 3 shows this increase via the graph charting "pixels/degree" (y-axis) versus "Field of view angle (degree)" (x-axis) and an included topological-type diagram of changes in "resolution over the full elliptical panomorph image." *Id.*

Figure 4 of Thibault is reproduced below.



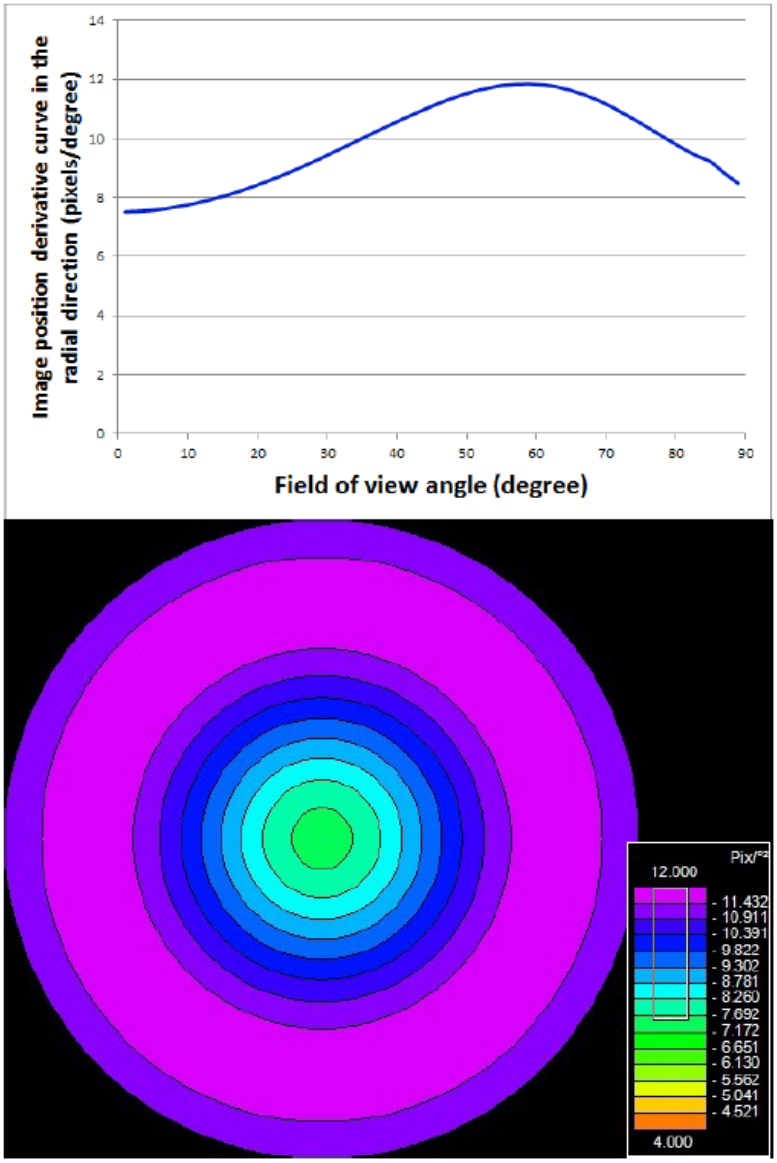
Thibault describes Figure 4 as follows: "Relative illumination along both the long (red) and the short (blue) axis of the panomorph lenses with a TTL of 6.56 mm." *Id.*

Under the heading "DESIGN OF 3.80 MM MOBILE DEVICE PANOMORPH LENS," Thibault describes a "second miniature panomorph lens" having a "smaller TTL and diameter." *Id.* at 6. Figure 5 of Thibault is reproduced below.



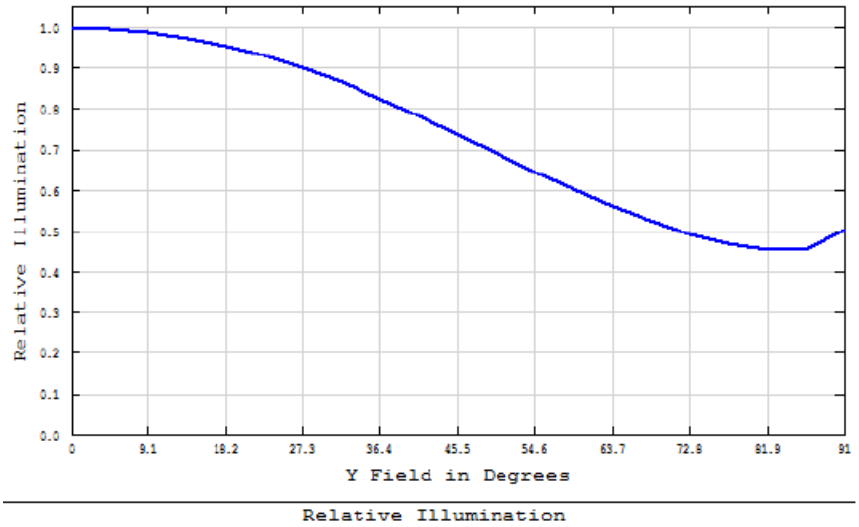
Thibault describes Figure 5 as follows: "Layout of a panomorph lenses with a TTL of 3.80 mm using the same scale as figure 2. Not shown on the image is the 0.20 mm cover glass of the sensor which is included in the TTL measurement of 3.80 mm." *Id.* This "design achieved a TTL of 3.80 mm including a 0.2 mm cover glass (3.72 mm in air)." *Id.* The lens uses "targeted distortion to increase the number of pixels in the zone of interest for mobile video chat applications." *Id.*

Figure 6 of Thibault is reproduced below.



Thibault describes Figure 6 as follows: "The number of pixels of 1.12 µm is increased in the zone for mobile video chat applications. Top) Image position derivative curve in the radial direction (pixels/degree). Bottom) Surfacic resolution over the full circular panomorph image." *Id.* at 7. Figure 6 shows this increase via an included graph charting "pixels/degree" (y-axis) versus "Field of view angle (degree)" (x-axis) and an included topological-type diagram of changes in "resolution over the full circular panomorph image." *Id.*

Figure 7 of Thibault is reproduced below.



Thibault describes Figure 7 as follows: "Relative illumination of the panomorph lenses with a TTL of 3.80 mm." *Id.*

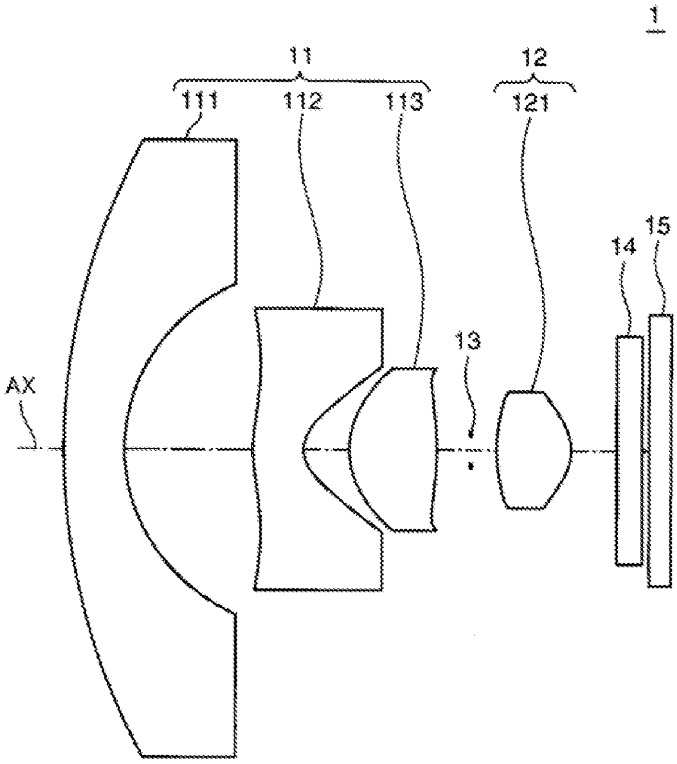
2. Matsusaka (Ex. 1005)

Matsusaka is titled "Wide-Angle Optical System, Image Pickup Lens Device, Monitor Camera, and Digital Apparatus." Ex. 1005, code (54). Matsusaka "relates to a wide-angle optical system that is compact" and "suitable to a super wide-angle optical system that copes with a super wide angle and has a total angle of view of 90° or more." *Id.* ¶ 2. Matsusaka describes wide-angle optical systems being used, e.g., "for the purpose of a surveillance system and onboard system" and for "an onboard camera for monitoring rear view of a vehicle." *Id.* ¶¶ 3–4.

Matsusaka addresses prior, particular solutions to "shading that is a problem caused when the optical system has a super wide angle and is formed of a small number of lenses such as about four or five lenses" and "fluctuations of an image forming position under various temperature environments." *Id.* ¶ 5. Matsusaka particularly addresses, in these prior

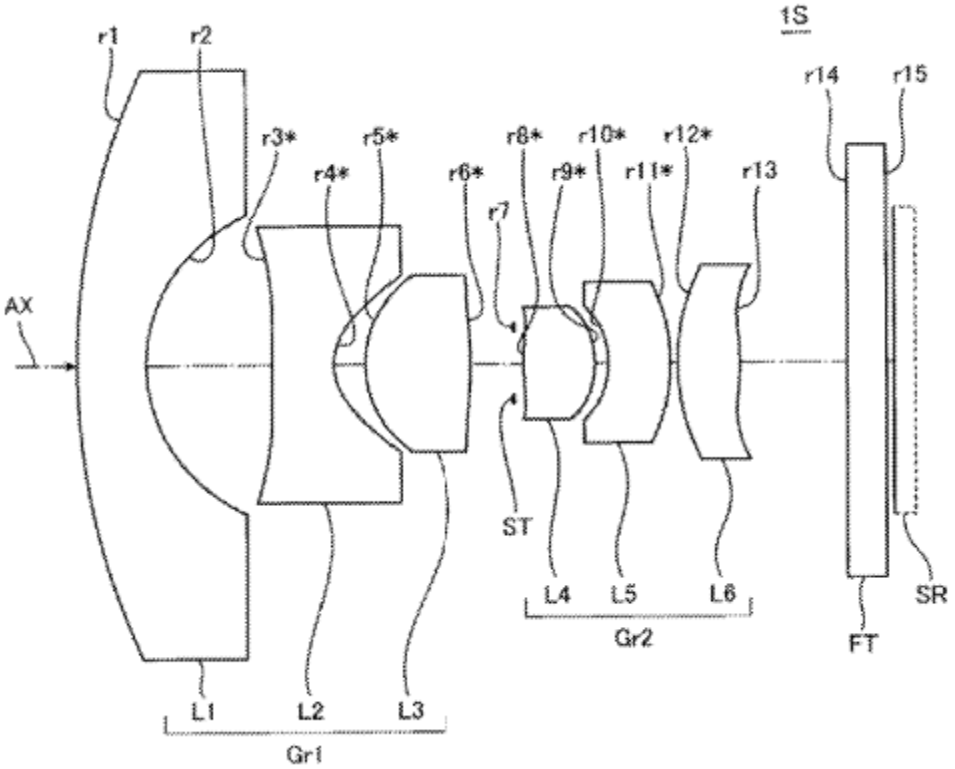
solutions, that chromatic aberrations are caused because "downsizing of the optical system is not sufficiently corrected" and that "contrast over the entire image area is lowered." *Id.* ¶ 8.

Figure 1 of Matsusaka is reproduced below.



"FIG. 1 is a sectional view of lenses for the explanation of a wide-angle optical system in an embodiment, showing the schematic structure." *Id.* ¶ 83. As shown, the "wide-angle optical system comprises a front lens group (11), and a rear lens group (12), with an aperture stop (13) interposed between." *Id.*, code (57). "The front lens group (11) includes at least two negative lenses (111, 112) and at least one positive lens (113)." *Id.* "At least one of the positive lenses included in the front lens group (11) has at least one aspherical surface." *Id.*

Figure 23 of Matsusaka is reproduced below.



"FIG. 23 is a sectional view showing an arrangement of lens groups in a wide-angle optical system of Example 19." *Id.* ¶ 404. "The first lens group (Gr1) is composed of a negative meniscus lens (first lens L1) whose convex surface faces the object side, a negative meniscus lens (second lens L2) whose convex surface faces the object side, and of a biconvex positive lens (third lens L3)." *Id.* ¶ 407. "The second lens group (Gr2) is composed of a biconvex positive lens (fourth lens L4), a negative meniscus lens (fifth lens L5) whose convex surface faces the image side and of a biconvex positive lens (sixth lens L6)." *Id.* ¶ 408. "[O]n the image side of the lens group (Gr2) as the rear lens group, there is arranged a light-receiving surface of image pickup element SR through parallel flat plate FT serving as a filter." *Id.* ¶ 409.

E. Asserted Anticipation and Obviousness over Thibault (Petitioner's Ground 1)

1. Petition

Petitioner asserts that claims 1–7 are anticipated by and/or would have been obvious over Thibault. Pet. 13–43. Petitioner argues that every element of claim 1 is found in Thibault, as follows.

1. [1pre] A miniature wide-angle optical apparatus comprising: (Pet. 18–19 (citing Ex. 1004, 2, 6, 10, Fig. 5; Ex. 1003 ¶ 108));

[1a] a light-receiving first surface; (Pet. 19–21 (citing Ex. 1004, 3, 6, Fig. 5; Ex. 1003 ¶¶ 109–112));

[1b] a focal plane; (Pet. 22 (citing Ex. 1004, Fig. 5; Ex. 1003 ¶ 113));

[1c] a total track length measured from a center of the first surface to the focal plane; (Pet. 23–24 (citing Ex. 1004, 1, 6, Fig. 5; Ex. 1003 ¶ 114));

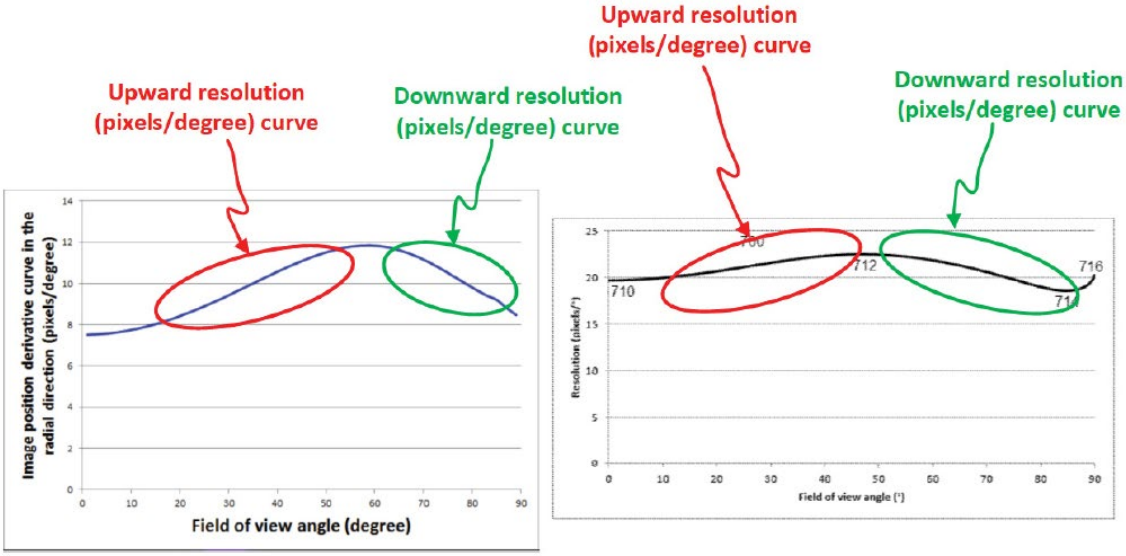
[1d] a miniaturization ratio with a value less than 3.0, the miniaturization ratio being a ratio of the total track length divided by an image circle diameter; and (Pet. 24–25 (citing Ex. 1004, 6; Ex. 1003 ¶¶ 115–116));

[1e] a non-linear targeted resolution to intentionally create a zone in an image captured by the miniature wide-angle optical apparatus with a lower or higher object to image magnification compared to linear targeted resolution, the lower or higher object to image magnification being used to compensate, at least in part, for a lower image quality due to at least one of a drop of relative illumination or a drop of MTF in a zone of the image, (Pet. 25–32 (arguing that Thibault "discloses or at least renders obvious this element") (citing Ex. 1004, 6–10, Figs. 5–7, 11, Ex. 1003 ¶¶ 117–124));

[1f] an opening angle of light entering the optical apparatus being over 100° (Pet. 33–34 (citing Ex. 1004, 6, 10, Fig. 5; Ex. 1003 ¶ 125)).

Petitioner points to Thibault's lens assembly of Figure 5, which is a "f/2.8 lens [that] has a 1:1 anamorphic ratio and use[s] ***targeted distortion to increase the number of pixels in the zone of interest*** for mobile video chat applications as shown in figure 6," in which "the lens design has non-linear targeted resolution such that some zones have higher resolution (e.g., purple and magenta zones) and other zones have a lower resolution (e.g. green and cyan zones)." Pet. 26–27 (emphasis by Petitioner) (citing Ex. 1004, 6, 7, Fig. 6; Ex. 1003 ¶ 118).

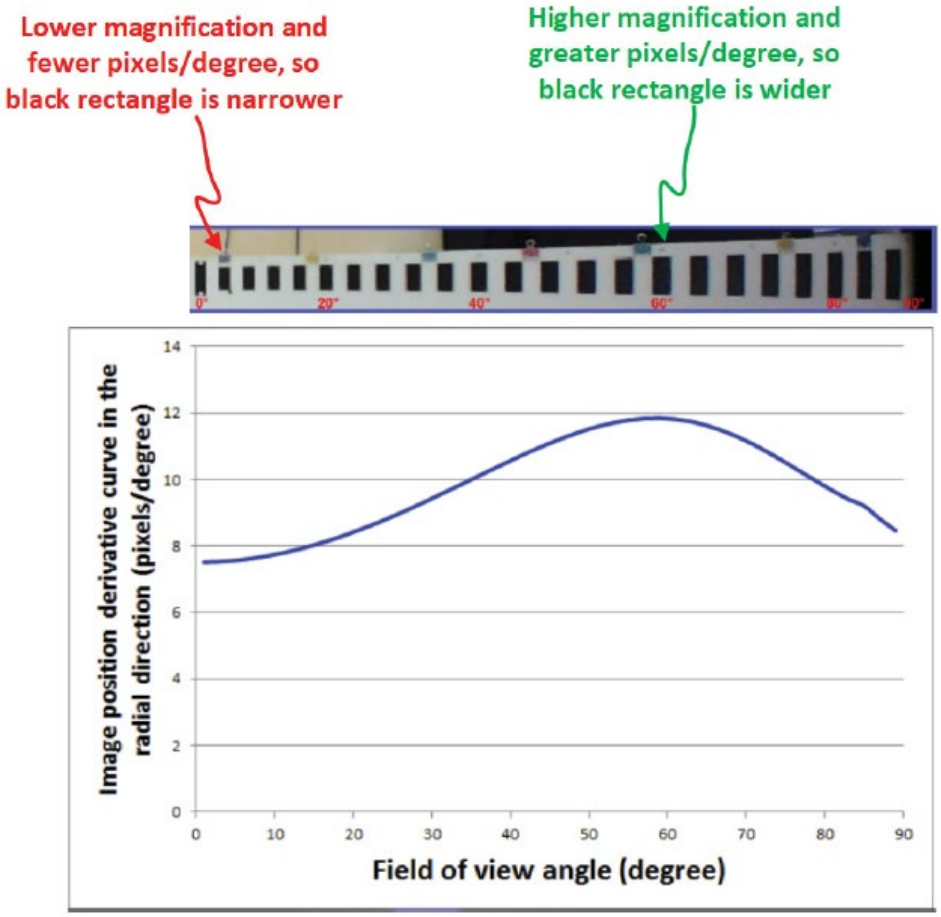
Comparing the '120 patent to Thibault, Petitioner presents the following annotated diagrams, reproduced below.



EX1004, Annotated Figure 6 **EX1001, Annotated FIG. 7**

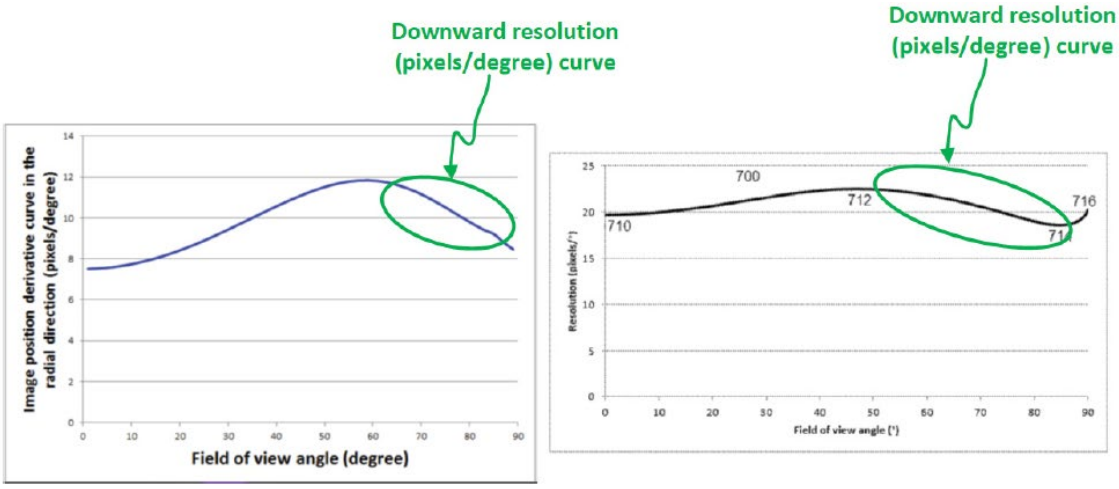
Pet. 28. Petitioner's annotated version comparing Thibault's Figure 6 (left) and the '120 patent's Figure 7 (right) shows an "upward resolution curve" circled in red and a "downward resolution curve" circled in green. *Id.*

Petitioner also illustrates its argument that Thibault discloses the claimed "zone . . . with a lower or higher object to image magnification" in its annotated Figures 11 and 6 of Thibault, reproduced below.

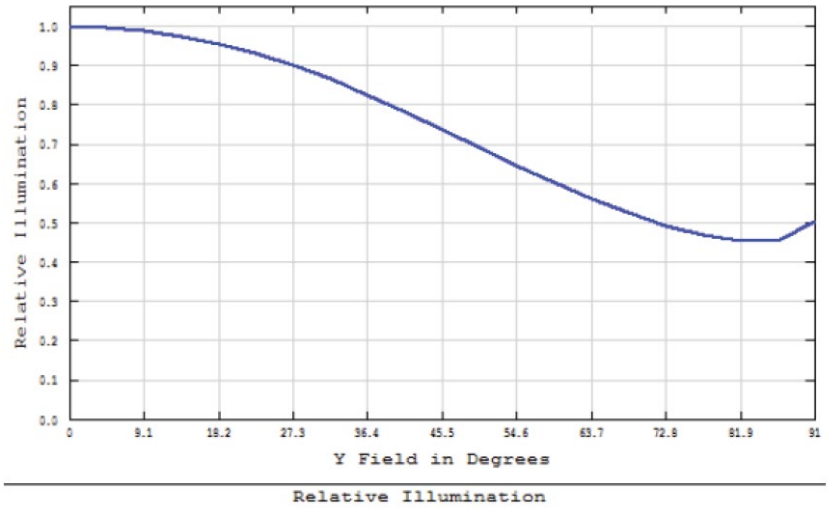


Pet. 29. According to Petitioner, "the lens of Figure 5 causes the black rectangles at approximately 60º to be magnified (i.e. wider horizontally) and therefore have a greater resolution (i.e. pixels/degree)" than those "nearer the center or edges of the image, where the magnification drops (i.e. the images are thinner horizontally) and therefore the resolution (i.e. pixels/degree) decreases." *Id.* at 28–29 (citing Ex. 1003 ¶ 120). Petitioner argues that the "distortion described above is introduced 'intentionally,'" because Thibault teaches that its Figure 5 lens uses "***targeted*** distortion to increase the number of pixels in the zone of interest." *Id.* at 29 (citing Ex. 1004, 6; Ex. 1003 ¶ 122). Additionally, Petitioner links the "zone" with the "drop of relative illumination," arguing that with respect to the disputed

"being used to compensate" language of limitation 1[e], the "resolution curve in Thibault's Figure 6 has a similar downward slope to Figure 7 of the '120 Patent as annotated below, and would therefore have the same impact on relative illumination as described in the '120 Patent." *Id.* at 31–32 (citing Ex. 1003 ¶ 123).



The comparison of Thibault's annotated Figure 6 and the '120 patent's annotated Figure 7 above demonstrates, according to Petitioner, the same downward resolution (pixels/degree) curve described in green. *Id.* at 32. Thibault's Figure 7 is reproduced below.



Id. Petitioner argues that Thibault's Figure 7 "illustrates an increase in relative illumination toward the edge of the field of view." *Id.* (citing Ex. 1003 ¶ 124).

Petitioner presents additional arguments for dependent claims 2–7. Pet. 34–43.

2. Response

Patent Owner argues generally that "Petitioner's 'downward slope' analysis is irrelevant to the claim language." PO Resp. 19–23. Patent Owner alleges that Petitioner's "error" is based on "the mistaken notion that the '120 Patent 'conflated a negative or downward sloped resolution curve as having lower object to image magnification ratio,'" and "'a positive or upward sloped resolution curve as having a higher object to image magnification ratio.'" *Id.* at 19 (quoting Pet. 26). First, Patent Owner argues that this is incorrect because Petitioner's Matsusaka plot (Pet. 58) is inconsistent with this position regarding downward slope. *Id.* at 20–21. Second, Patent Owner argues that Figure 6 of the '120 patent does not support Petitioner's position, and Figure 7's downward curve is not aligned "with any illustrated relative illumination or MTF plot." *Id.* at 21. Rather, Patent Owner argues, Figure 7 illustrates a different principle that "a decrease in resolution can be utilized to ***actually raise relative illumination***" such that "***instead of compensating*** for poor image quality from low relative illumination by magnifying that area to capture more detail, as is done in Fig. 6, the illumination itself can be increased by dropping resolution." *Id.* at 22 (citing Ex. 2001 ¶¶ 89–90; Ex. 2004 ¶¶ 1, 37, 42, 44, 76–77, Figs. 1, 10, 11).

Patent Owner also argues that "Petitioner has not identified any magnification zones in Thibault's resolution curve," and thus "one cannot determine whether those zones are properly located to compensate for the drop in relative illumination experienced by Thibault's lens." PO Resp. 24.

First, Patent Owner argues that Petitioner cannot rely on the "being used to compensate" language being read out of claim 1, because this language provides structural limitations to the optical apparatus. *Id.*

Second, Patent Owner argues that Petitioner fails to identify any magnification zone in Thibault. *Id.* at 25. According to Patent Owner, "Dr. Kessler would have only needed to place the [red] line at the appropriate height on Thibault's Fig. 6 to identify the low and high resolution zones." *Id.* at 26 (citing Ex. 2001 ¶ 82). Instead, Dr. Kessler, according to Patent Owner, "provides ***no*** evidence regarding a location of any particular magnification zone in Thibault with respect to Thibault's relative illumination curve" but, rather, "relies on Fig. 6 in Thibault exhibiting a 'similar downward slope to Figure 7 of the '120 patent.'" *Id.* Patent Owner argues that "the existence of a downward slope" is "insufficient to demonstrate the location of a magnification zone or its relationship to the lens' relative illumination or MTF." *Id.* Patent Owner argues that even "if the brief, minor upturn in relative illumination in Thibault's Fig. 7 is somehow attributable to the decline in resolution shown over a span of 30° in the article's Fig. 6," this "does ***not*** demonstrate using magnification zones to compensate for low relative illumination or MTF." *Id.* (citing Ex. 2001 ¶¶ 89–91; Ex. 1001, 6:35–41; Ex. 2004 ¶¶ 76–77). "Since Petitioner does not even bother to identify the magnification zones, it

has not demonstrated how such zones correlate to any portion of the relative illumination curve illustrated in Thibault's Fig. 7." *Id.* at 26–27.

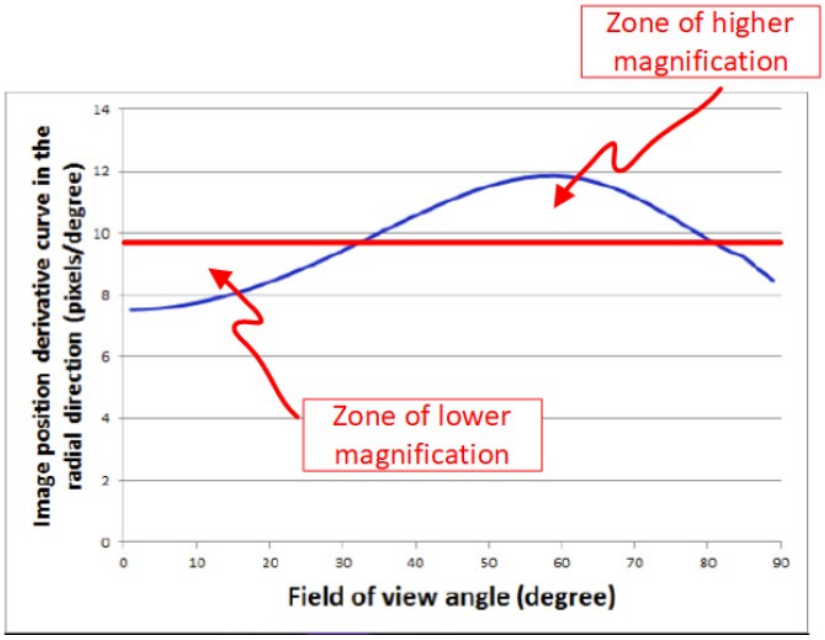
3. Reply

Regarding Patent Owner's argument that the "downward slope" analysis is irrelevant, Petitioner replies that its declarant "utilized the explicit teachings of the '120 Patent to identify the characteristics of the targeted resolution curve presented in FIG. 7 that allegedly 'more balanced relative illumination' and 'more balanced MTF,' which included the shape of the targeted resolution curve after its absolute maximum within the field of view." Reply 11–12 (citing Ex. 1023 ¶¶ 15, 17–18; Ex. 1001, 6:28–61, 1:53–2:3). Petitioner's declarant further opined that "an area around the absolute maximum resolution in a non-linear targeted resolution curve will always be a zone of increased magnification" in order to provide the necessary balance of area above and below the linear targeted resolution curve described by Patent Owner's declarant. Ex. 1023 ¶ 18 (citing Ex. 2001 ¶ 57). Accordingly, the focus "on the downward slope that succeeded the absolute maximum resolution" was done because "this downward slope after an absolute maximum corresponds to the benefits the '120 Patent purports to claim." *Id.* (citing Ex. 1001, 6:28–41; Ex. 1002 ¶ 27).

Petitioner replies that it previously argued that "Thibault's zone of increased magnification is located within the field of view at a position where the relative illumination is lower." Reply 13 (citing Ex. 1003 ¶ 87; Pet. 17). According to Petitioner, Dr. Kessler's original declaration explained that in Thibault's "Figure 6, the zone shown in magenta has the highest number of pixels per degree associated with it," and "Figure 6 shows

an increase in the number of pixels in various zones of the resulting image." *Id.* (citing Ex. 1003 ¶ 87). "Thus, contrary to [Patent Owner's] assertion, the Petition and Dr. Kessler explicitly identified a zone of increased magnification (*i.e.*, the zone shown in magenta in the top portion of FIG. 6)." *Id.* (citing Pet. 16–17, 25–32; Ex. 1003 ¶¶ 87, 117–124).

According to Petitioner, applying the "simple horizontal line method to the image position derivative curve," shown by the red line in Dr. Kessler's annotated Figure 6, reproduced below (Ex. 1004, Fig. 6 (annotated)), "confirms that the magenta zone identified in Dr. Kessler's original declaration corresponds to a zone of higher magnification." Reply 15–16 (citing Ex. 1023 ¶ 24).



Petitioner's annotated Figure 6 of Thibault places a horizontal red line at slightly under 10 pixels/degree, and identifies a "Zone of lower magnification" under the line and a "Zone of higher magnification" above the line. Petitioner argues that all of the evidence necessary to place this red line "was submitted with the Petition, and both the Petition and Dr. Kessler

identified the relevant zone of higher magnification through an alternative method." *Id.* at 16–17. Petitioner also presents an annotated comparison of this annotated Figure 6 with previously presented Figure 7 of Thibault to show that "the zone of higher magnification in Thibault's lens is positioned where the relative illumination curve is lower, just as Dr. Lebby argues it is for the '120 Patent." *Id.* at 16 (citing Ex. 1023 ¶ 25 (citing Ex. 2001 ¶¶ 57–60)).

4. Sur-Reply

Patent Owner argues that the Reply shows three "newly identified" magnification zones in Thibault's resolution curve (0 to 33–34°, 33–34° to 80°, 80° to edge) and this "comparison with the relative illumination curve shows a misalignment." Sur-Reply 15 (referring to Reply 16). According to Patent Owner, the "***worst relative illumination area***" occurs between about 80–85° which correlates with a "***low magnification zone***" in Petitioner's plot. *Id.* According to Patent Owner, this "behavior indicates the magnification zones in Thibault are ***not*** being used to compensate for a drop in relative illumination." *Id.* at 16. Patent Owner also argues that Dr. Kessler erred by not realizing that "surfacic resolution" in Thibault's "bottom image is ***not equivalent*** to the image position derivative curve at the top." *Id.* More particularly, Patent Owner argues that the units in the bottom image are in pixels per degree squared, whereas the upper plot's units are in pixels per degree. *Id.* at 17.

5. Analysis

With respect to Patent Owner's first argument about claim construction and intended use, we agree with Patent Owner's position, discussed above, that every element of claim 1 should be given patentable

weight. Accordingly, we consider every limitation of claim 1 when evaluating Petitioner's Thibault-based arguments.

With respect to Patent Owner's second argument about Petitioner's failure to identify a magnification zone in Thibault, we disagree. We first address Petitioner's arguments, presented in the Petition, that the '120 patent's Figure 7 illustrates limitation 1[e], and Thibault's disclosure meets limitation 1[e]. According to Petitioner, the "petition specifically noted that if the claim limitation, the compensate limitation, was to be given patentable weight, it then applied the teachings of figure seven against that limitation." Tr. 8:8–10. Regarding the significance of the downward slope, Petitioner relied on the language describing Figure 7 in the '120 patent, which provides: "This downward curve between maximum value 712 and position 714 allows the lens system to have a higher relative illumination value toward the edge of the field of view by having a lower object to image magnification ratio in that region." Pet. 26 (citing Ex. 1001, 6:28–41). We agree with Petitioner's reliance on the language describing the downward curve and the "focus on the downward slope that succeeded the absolute maximum resolution," because the downward slope "corresponds to the benefits the '120 Patent purports to claim," and particularly the benefits that the '120 patent describes in relation to Figure 7. Ex. 1023 ¶ 18 (citing Ex. 1001, 6:28–41; Ex. 1002, 27); Tr. 23:6–23 (the downward slope "will directly improve relative illumination over what it otherwise would be" and "will lead to the lens 'redirecting the same quantity of light from an object to a smaller region with more illumination'" (quoting Ex. 1001, 6:28–41)). We agree with Petitioner's comparison of this curve with Thibault's Figure 6, which illustrates the "distortion profile ratio from minimum to maximum

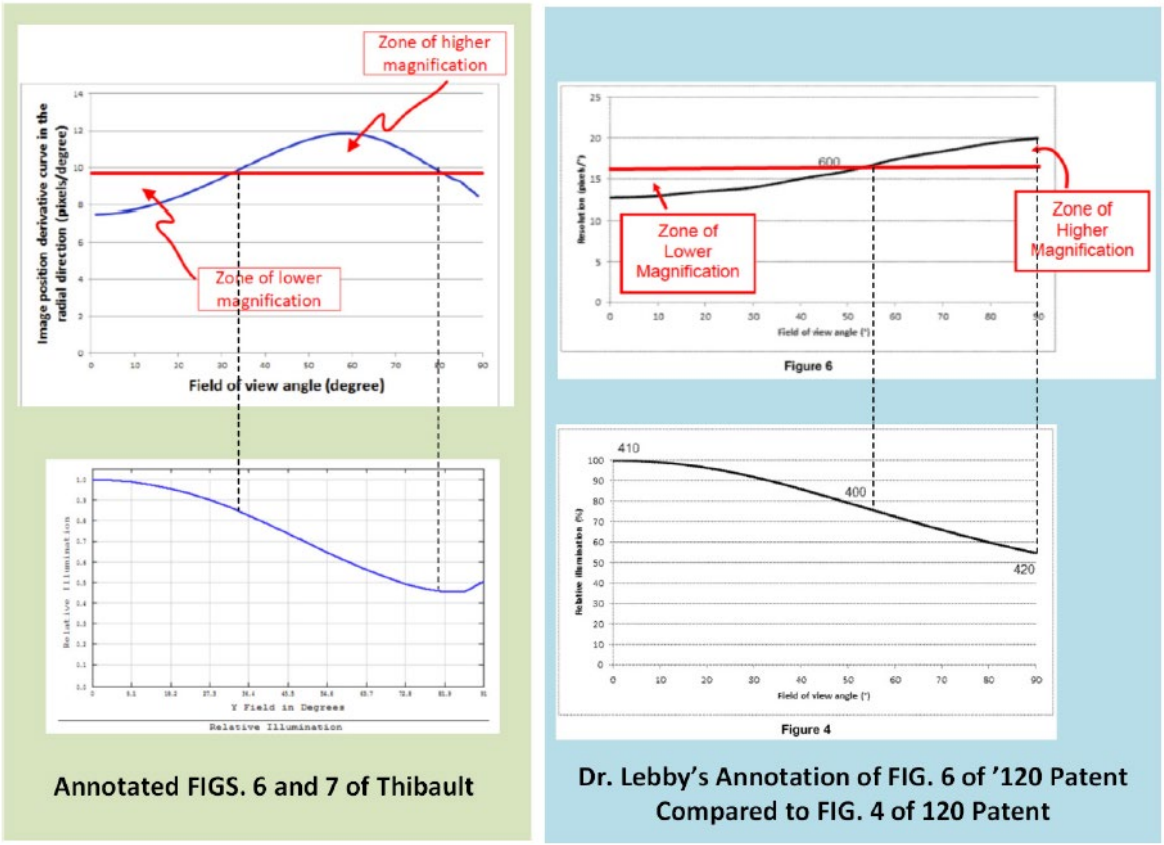
number of degrees," i.e., the resolution of the image in pixels/degree (Ex. 1003 ¶ 120) in which the "image of the object is being distorted such that portions of the object are magnified and therefore imaged at a higher resolution than other portions." Pet. 27–29 (also discussing Petitioner's comparison of Thibault's Figure 11 rectangles with Figure 6); Tr. 23:18–20 ("There's no argument or evidence on this record that Thibault's figure six would not benefit from the downward curve in the way described with respect to figure seven of the 120 patent."). Regarding the "intentionally" language, we agree with Petitioner that Thibault's teaching that its lens uses "***targeted*** distortion to increase the number of pixels in the zone of interest" supports Petitioner's argument that Thibault "intentionally create[d] a zone" as in limitation [1e]. *Id.* at 30 (citing Ex. 1003 ¶ 122).

We also agree with Petitioner that regarding the "being used to compensate" language of limitation 1[e], "the curvature of the resolution curve in Thibault's Figure 6 will 'compensate, at least in part, for a lower image quality due to at least one of a drop of relative illumination or a drop of MTF in a zone of the image' for the same reasons as described in the '120 Patent." Pet. 31 (citing Ex. 1003 ¶ 123; Ex. 1001, 6:28–41 (those reasons being, *inter alia*, "redirecting the same quantity of light from an object to a smaller region in the image with more illumination")); *see also* Tr. 23:7–10 (arguing that "in his original analysis, Dr. Kessler identified a downward slope in Thibault's figure six that is consistent with the description of a feature in figure seven that the 120 patent explains will directly improve the relative illumination over what it otherwise would be").

Addressing Patent Owner's argument that Petitioner fails to identify any magnification zone in Thibault (PO Resp. 25), we note again that

Thibault's description of its Figure 5 lens assembly states that Thibault uses "targeted distortion to increase the number of pixels in the ***zone of interest*** for mobile video chat applications as shown at figure 6." Ex. 1004, 6 (emphasis added); Pet. 26–27; Ex. 1003 ¶ 118. We agree that a "POSITA would have understood from Thibault that this 'distortion profile ratio' [in Thibault's Figure 6] is the resolution of the image projected onto the focal plane in pixels/degree" in which "the image of the object is being distorted such that portions of the object are magnified and therefore imaged at a higher resolution than other portions," and, thus, Thibault's "non-linear targeted resolution creates a zone" as in limitation [1e]. Pet. 28–30 (citing Ex. 1003 ¶¶ 120–121). We find persuasive Petitioner's reliance on Thibault's Figure 6 resolution graph and diagram, showing that that "some zones have higher resolution" and "other zones have lower resolution" (*id.* at 27 (citing Ex. 1003 ¶ 118)), and Petitioner's annotated comparison of Thibault's Figures 11 and 6 (*id.* at 29), which visually illustrates the zones in another manner. *See also* Ex. 1003 ¶ 121.

Petitioner's Reply presents comparisons of Thibault's annotated Figures and Dr. Lebby's annotated Figures of the '120 Patent, reproduced below.



Petitioner's comparison above shows annotated Figure 6 (top left) and Figure 7 (bottom left) of Thibault, side by side with Dr. Lebby's annotation of Figure 6 of the '120 patent (top right) compared to Figure 5 of the '120 patent (bottom right); the visual correlation of Thibault's zones to Petitioner's previously relied-upon Figure 7 of Thibault (Pet. 32) aligns the zone of higher magnification with a drop in relative illumination, in a similar manner introduced by Dr. Lebby's testimony comparing Figures 4 and 6 of the '120 patent. Reply 16 (citing Ex. 1023 ¶ 25; Ex. 2001 ¶¶ 57–60).

We next address Petitioner's arguments that the insertion of the red line is proper. Reply 14–17. Petitioner provides these arguments as a response to Patent Owner's "new construction" (*id.* at 14), which we have determined is proper. To address Patent Owner's argument that "Dr. Kessler

would have only needed to place the line at the appropriate height on Thibault's Fig. 6 to identify the low and high resolution zones" (PO Resp. 26 (citing Ex. 2001 ¶ 82)), we agree that the subsequent submission of Petitioner's plot doing just that identifies the low and high resolution zones and is not improper. *Apple Inc. v. Andrea Elecs. Corp.*, 949 F.3d 697, 706–707 (Fed. Cir. 2020) (addressing the situation where reply arguments do not change the theory of unpatentability: "Apple's reply relies on the same algorithm from the same prior art reference to support the same legal argument")). Petitioner relates this plot to its previously submitted evidence: "[A]pplying Dr. Lebby's horizontal line method to the image position derivative curve shown at the top of FIG. 6 confirms that the magenta zone that I identified in my earlier declaration corresponds to a zone of higher magnification." Ex. 1023 ¶ 24 (citing Ex. 1003 ¶ 87); *see also* Tr. 22:6–11 (Petitioner stating that "you actually don't need this line" to "be able to identify the zones of higher object to image magnification"), 49:26–50:2 (Patent Owner stating: "It's clear that a person of ordinary skill in the art doesn't need those red lines to understand the invention.").

Regarding Patent Owner's argument that the claimed "zone" must be the "worst relative illumination area" (Sur-Reply 15), we agree with Petitioner that the language of claim 1 only requires that the zone correspond to a "drop of relative illumination" (or a drop of MTF), to which Thibault's identified zone corresponds, as shown in Petitioner's annotated Figures 6 and 7 of Thibault (Reply 16–17). We are not directed to any language in the claims or Specification requiring exact alignment of the zone with a drop of RI or MTF, or requiring a particular level of RI to correspond with the zone.

Regarding Patent Owner's argument that the units in Thibault's Figure 6 bottom image are in pixels per degree squared, whereas the upper plot's units are in pixels per degree (Sur-Reply 17), we agree with Petitioner's explanation that "it's degrees, not degrees squared," for the reasons given by Petitioner during oral hearing, the earliest time at which Petitioner was able to respond to Patent Owner's Sur-Reply argument. Tr. 19:12–20:6, 47:1–48:6. Petitioner argues that ultimately the surfacic resolution plot "is for a cone and it's for an area of degrees," and is consistent with the linear resolution plot. *Id.*; *see also id.* at 20:7–24 (making the same point with respect to the graphs and plots associated with Thibault's first lens with a TTL of 6.56 mm). Although we acknowledge Patent Owner's alleged inconsistency in units (degrees vs. degrees squared) between the two images, the explanation provided by Petitioner sufficiently aligns the "zone" demonstrated by the identified color bands in Thibault's Figure 6 surfacic resolution plot with the "zone" demonstrated by the co-presented graph. Pet. 16–17; Tr. 19:12–20:6; Ex. 1003 ¶ 87 ("Collectively, Figure 6 shows an increase in the number of pixels in various zones of the resulting image.").

6. Remaining Claims

Petitioner contends that the additional limitations of claims 2–7 are taught or suggested by Thibault. Pet. 12, 34–43. Patent Owner does not present separate arguments for the patentability of claims 2–7 apart from its arguments for the patentability of independent claim 1. *See* PO Resp.

Regarding claim 2 (further requiring "wherein the optical apparatus is configured to create a resulting image with a constant image quality across a whole field of view"), the Petition does not appear to argue anticipation by

Thibault but, rather, only that "Thibault renders obvious claim 2." Pet. 34 (citing Ex. 1003 ¶¶ 127–128). Petitioner argues that Thibault teaches "special optimization" of MTF to "control the image quality in production so that it remains in the specification." *Id.* (citing Ex. 1004, 3). Petitioner further argues that "a POSITA would have understood that Thibault's lens designs were intended to achieve 'constant image quality across a whole field of view,'" or "that it would have been obvious to achieve such an outcome using known 'guidelines' within the industry." *Id.* at 35 (citing Ex. 1003 ¶ 128). Petitioner provided no development of an anticipation position with respect to claim 2. Accordingly, although Petitioner's uncontested position on claim 2 supports a finding of obviousness based on Thibault, because it is reasonable, not persuasively controverted, and supported by testimony, it does not support a finding of anticipation.

We have reviewed the undisputed argument and evidence presented by Petitioner, and we find that Thibault teaches or suggests the additional limitations of claims 3–7, and we find that a person of ordinary skill in the art would have understood the reference to teach the limitations of claims 3–7 in the manner asserted by Petitioner. Pet. 35–43; Ex. 1003 ¶¶ 127–145. For the same reasons as set forth above for independent claim 1, we determine that Petitioner has met its burden of proof for the disputed limitations of claims 3–7, whether expressly recited in the independent claims or incorporated by reference in the dependent claims. *See* 35 U.S.C. § 112(d) ("A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers.").

7. Conclusion as to Petitioner's Ground 1

Accordingly, based on the totality of Petitioner's arguments, evidence, and testimony, we are persuaded that Petitioner has met its burden to demonstrate that claims 1 and 3–7 are anticipated by Thibault, and that claims 1–7 would have been obvious in view of Thibault. *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (it is well settled that "a disclosure that anticipates under § 102 also renders the claim invalid under § 103, for 'anticipation is the epitome of obviousness'") (citing *In re Fracalossi*, 681 F.2d 792, (CCPA 1982)).

F. Asserted Anticipation and Obviousness over Matsusaka (Petitioner's Ground 2)

1. Petition

Petitioner asserts that claims 1 and 3–6 are anticipated by and/or would have been obvious over Matsusaka. Pet. 43–65. Petitioner argues that every element of claim 1 is found in Matsusaka, as follows.

1. [1pre] A miniature wide-angle optical apparatus comprising: (Pet. 46–47 (citing Ex. 1005, code (57), ¶¶ 2, 9, 82, 149, 188, 224, 233, 450; Ex. 1003 ¶¶ 148–149));

[1a] a light-receiving first surface; (Pet. 47–49 (citing Ex. 1005, Fig. 23, ¶¶ 404–410; Ex. 1003 ¶¶ 150–151));

[1b] a focal plane; (Pet. 49–51 (citing Ex. 1005, Fig. 23, ¶¶ 404–410; Ex. 1003 ¶¶ 152–153));

[1c] a total track length measured from a center of the first surface to the focal plane; (Pet. 51–54 (citing Ex. 1005, Fig. 23, ¶¶ 246, 404–411; Ex. 1003 ¶¶ 154–157));

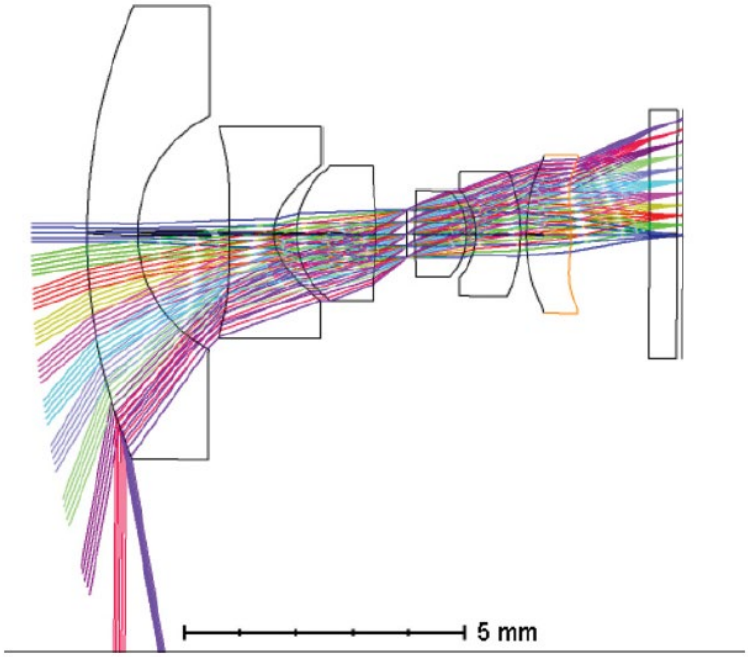
[1d] a miniaturization ratio with a value less than 3.0, the miniaturization ratio being a ratio of the total track length divided by an image circle diameter; and (Pet. 54–56 (citing Ex. 1005 ¶¶ 161, 246, 411; Ex. 1003 ¶¶ 158–160));

[1e] a non-linear targeted resolution to intentionally create a zone in an image captured by the miniature wide-angle optical apparatus with a lower or higher object to image magnification compared to linear targeted resolution, the lower or higher object to image magnification being used to compensate, at least in part, for a lower image quality due to at least one of a drop of relative illumination or a drop of MTF in a zone of the image, (Pet. 56–60 (arguing that Matsusaka "discloses this element or at least renders it obvious") (citing Ex. 1005, Figs. 23, 43A, 43B, ¶¶ 4, 229–233, 404–412; Ex. 1003 ¶¶ 95–99, 161–167));

[1f] an opening angle of light entering the optical apparatus being over 100° (Pet. 60 (citing Ex. 1005 ¶ 450; Ex. 1003 ¶ 168)).

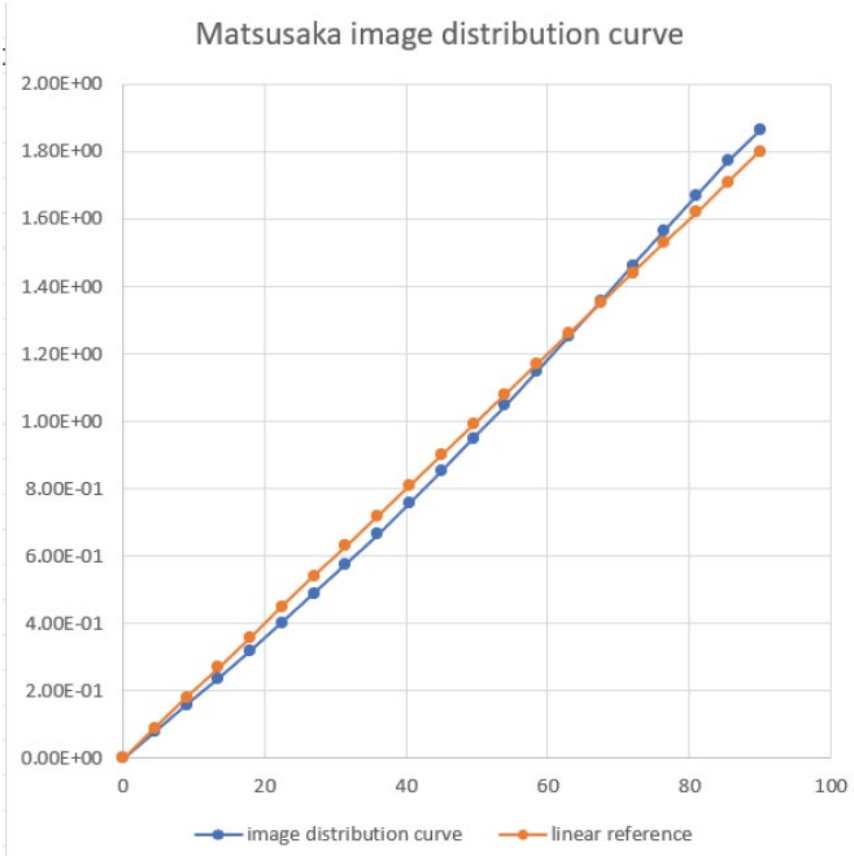
Petitioner's declarant modeled the optical system 1S of Matsusaka's Example 19 in Zemax,[6] creating the following model:

[6] "Zemax is an optical design software program, and has been commercially available since at least 1990." Pet. 46 (citing Ex. 1003 ¶¶ 94–99). "Those of ordinary and above-ordinary skill in the art of optical system design are usually familiar with Zemax or equivalent optical design software." *Id.*

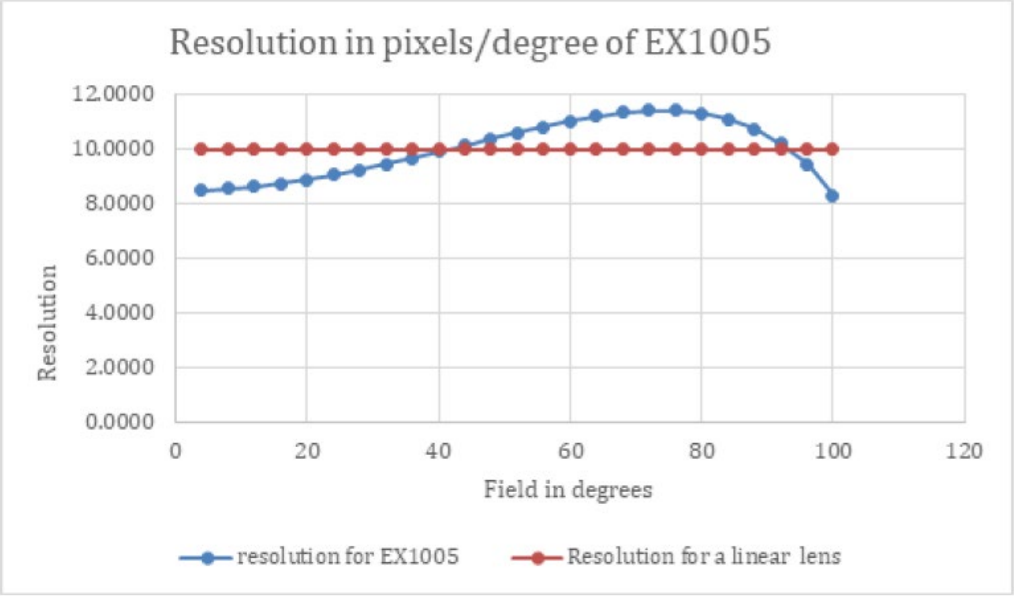


Zemax Model of Matsusaka's Optical System 1S of Example 19

Pet. 56–57 (citing Ex. 1003 ¶¶ 95, 161). Petitioner's declarant also used Zemax to provide the image height at the sensor as a function of the field angle, reproduced below.



Pet. 57 (citing Ex. 1003 ¶ 162). This "image distribution curve" shows an orange linear reference line and a blue image distribution curve. Petitioner's declarant explains that where "the slope of the blue image distribution curve differs from the slope of the orange linear reference line, there is a change of magnification such that these areas of deviation" are the zone(s) of limitation [1e]. *Id.* at 58 (citing Ex. 1003 ¶ 163). Petitioner's declarant provides the derivative of the image height and converts it to resolution in terms of pixels/degree, reproduced below.



Id. (citing Ex. 1003 ¶ 164). This "Resolution in pixels/degree of EX1005" shows "Resolution for a linear lens" as a straight red line and "resolution for EX1005" as a blue curve. Petitioner's declarant explains that areas "where the blue curve are above the red curve are areas of increased magnification with respect to the linear targeted resolution," and "areas where the blue curve are below the red curve are areas of decreased magnification with respect to the linear targeted resolution." *Id.* at 58–59 (citing Ex. 1003 ¶ 165). Although "Matsusaka does not explicitly describe that these areas or zones of increased and decreased magnification with respect to the linear targeted resolution are 'intentional,'" Petitioner argues that "it would have been obvious to a POSITA to intentionally utilize the areas or zones of increased and decreased magnification, depending on the relevant use case," such as Matsusaka's "onboard camera for monitoring rear view of a vehicle." *Id.* at 59 (citing Ex. 1003 ¶ 166; Ex. 1005 ¶¶ 4, 229–233). Regarding the "being used to compensate" language, Petitioner argues that Matsusaka "teaches or at least renders obvious that claim language based on

the fact that Matsusaka's lens includes the claimed 'zones,'" and that the "resolution curve of Matsusaka's wide-angle optical system 1S of Example 19 has a similar downward slope to Figure 7 of the '120 Patent, and would therefore have the same impact on relative illumination as described in the '120 Patent." *Id.* at 59–60 (citing Ex. 1003 ¶ 167).

Petitioner presents additional arguments for dependent claims 3–6. Pet. 60–65.

2. Response

Patent Owner argues generally that "Petitioner has not identified any information about the MTF or relative illumination characteristics of Matsusaka's Example 19 lens," and thus "one cannot determine whether the magnification zones identified by Petitioner are located to compensate for any drop in relative illumination or MTF." PO Resp. 27.

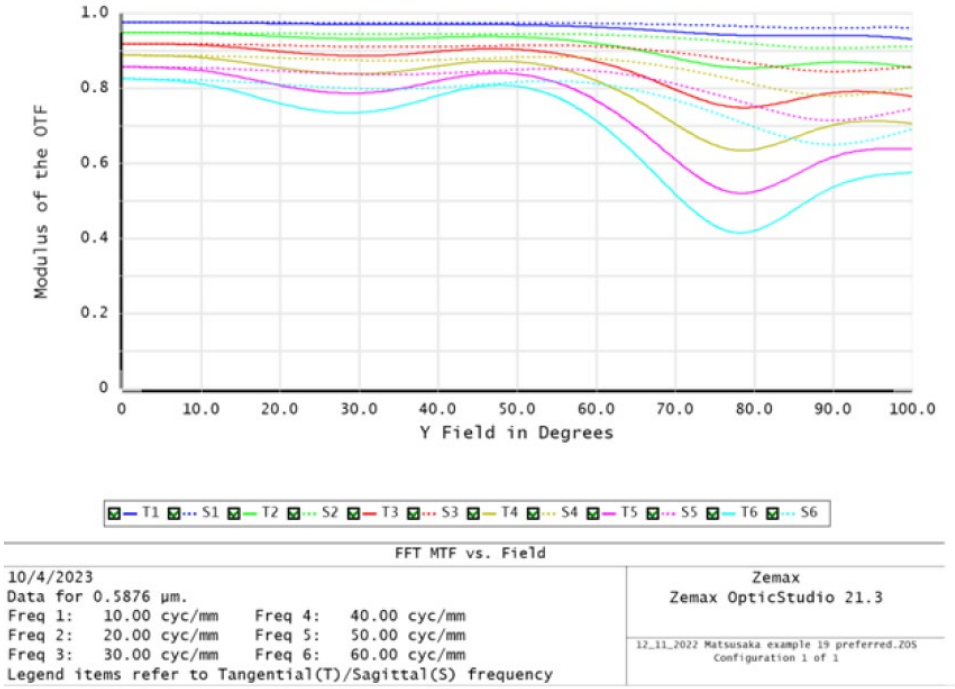
First, Patent Owner argues that Petitioner cannot rely on the "being used to compensate" language being read out of claim 1, because this language provides structural limitations to the claim. *Id.* at 28.

Second, Patent Owner argues that Petitioner fails to identify any MTF or relative illumination curve for correlating the magnification zone positions. *Id.* Patent Owner argues that despite "quantifying the zones in Matsusaka's Example 19 lens, Petitioner did not include in its Petition (nor did Dr. Kessler include in his declaration) any data relating to the MTF or relative illumination characteristics" and, thus, "Petitioner cannot show whether any particular zone identified in Matsusaka's purported resolution curve is located as required by claim 1." *Id.* at 30 (citing Ex. 2001 ¶ 96). Referring to Petitioner's arguments based on Figure 7 of the '120 patent, Patent Owner argues that "not only is the existence of a downward slope

insufficient to demonstrate the location of a magnification zone or its relationship to the lens' relative illumination or MTF," but also increasing "relative illumination through a downward slope is different from using magnification zones to compensate for low relative illumination or MTF." *Id.* (citing Ex. 2001 ¶¶ 83–91, 97).

3. Reply

Petitioner maintains that "Matsusaka's zone of increased magnification is located within the field of view at a position where the MTF is lower." Reply 17. Petitioner replies that its declarant originally used "the construction data provided by Matsusaka for Example 19 to model the lens in a program called Zemax and to evaluate various of its properties." *Id.* (citing Ex. 1003 ¶¶ 94–99; Ex. 1023 ¶ 27). In its declarant's supplemental declaration, Petitioner posits that the "sequential Zemax model of Matsusaka's Example 19 lens" results in the following plot of MTF, reproduced below.



Id. at 18 (citing Ex. 1023 ¶¶ 29–31). Comparing this to the original declaration, Petitioner argues that "it is clear that the zone of higher magnification aligns with a zone of lower MTF" and a comparison of the Zemax plots shows that "there is a marked drop in MTF in the region corresponding to the zone of increased magnification, just as Dr. Lebby argues it is for the '120 Patent." *Id.* at 18–19 (citing Ex. 1023 ¶¶ 32–33; Ex. 2001 ¶¶ 57–59, 61–62). Petitioner argues that, thus, even under Patent Owner's "new construction," in response to which this evidence was submitted, "Matsusaka's Example 19 lens anticipates or at least renders obvious the claim language." *Id.* at 19.

4. Sur-Reply

Patent Owner argues that the MTF data for Matsusaka is unreliable for at least two reasons. Sur-Reply 18. First, "Dr. Kessler has conspicuously changed parameters between his resolution plot and his MTF plot," namely, from a weighted average of three common visible wavelengths (blue, yellow, and red) to monochromatic wave definition. *Id.* at 18–19. According to Patent Owner, this "change is unusual because not only is MTF plotting possible using weighted wavelengths," but "MTF can differ significantly depending on the wavelength(s) used for measurement." *Id.* at 19 (citing Ex. 2008, 17; Ex. 2004, Figs. 4–6, ¶ 69). "To do a proper analysis, Dr. Kessler should have at least consistently used the same wavelength information across both sets of data." *Id.* at 20.

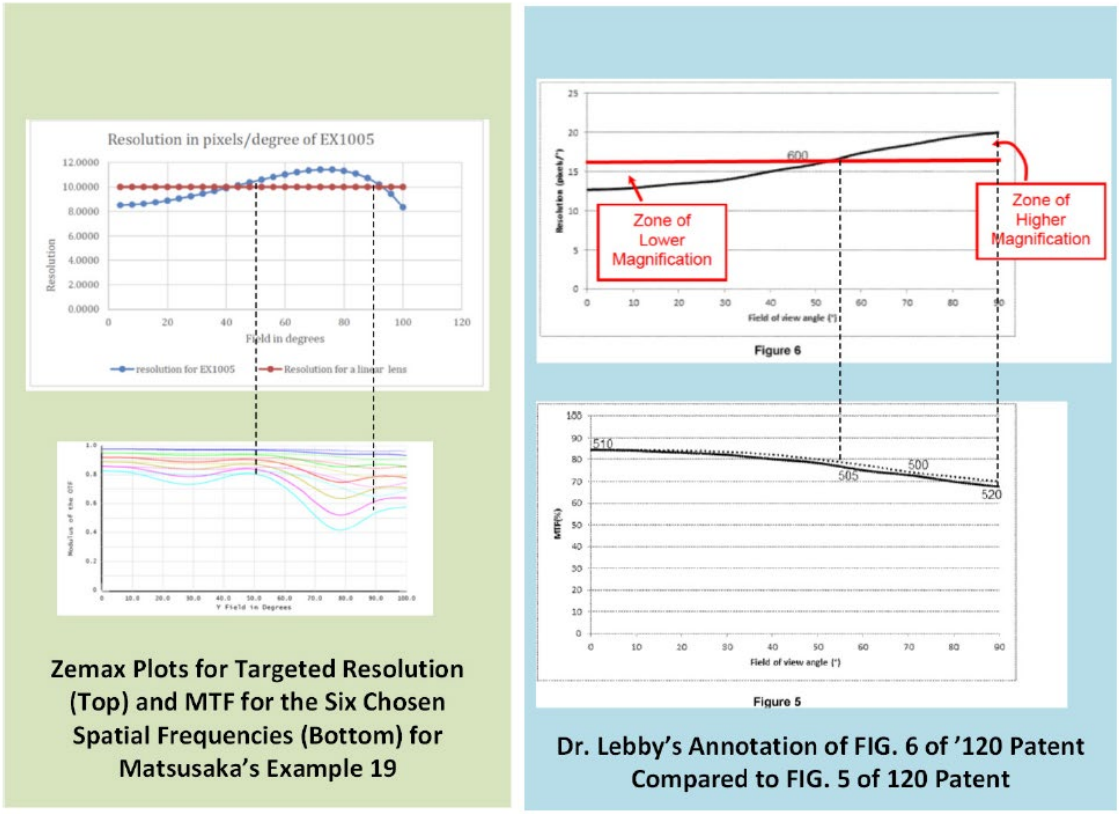
Second, Patent Owner argues that "Dr. Kessler still has not corrected his data to account for Matsusaka's proper field of view," i.e., data relying "on a 100° half field of view instead of Matsusaka's given value of 104.183°." *Id.* Patent Owner criticizes Dr. Kessler's assertion that he went

back into his models and corrected this issue, because Dr. Kessler "does not provide the allegedly corrected data to prove his understanding." *Id.*

5. Analysis

With respect to Patent Owner's first argument about claim construction and intended use, we agree with Patent Owner's position, above, that every element of claim 1 should be given patentable weight. Accordingly, we consider every limitation of claim 1 when evaluating Petitioner's Matsusaka-based arguments.

With respect to Patent Owner's second argument about whether Matsusaka discloses the "zones," we address Petitioner's arguments that respond to Patent Owner's position that Petitioner failed to identify any MTF or RI curve for correlating the magnification zone in Matsusaka. PO Resp. 28. Petitioner provided an annotated graph showing Matsusaka's area of increased resolution (above the red reference line) based on Petitioner's declarant's Zemax extrapolations. Pet. 59–60; Ex. 1003 ¶ 165. In response to Patent Owner's allegations that Petitioner had not identified any corresponding "zone" in Matsusaka, as required by Patent Owner's claim construction (Ex. 2001 ¶¶ 58, 64–67), Petitioner's declarant provided graphs using the same previously generated Zemax data demonstrating the existence of a "zone" of drop in MTF in Matsusaka that lined up with the "zone" of increased magnification. Ex. 1023 ¶ 33; Reply 19. Petitioner compares this "zone" correlation in Matsusaka with Dr. Lebby's "zone" correlation between Figures 5 (illustrating drop in MTF) and 6 (illustrating zone of higher magnification) in the '120 patent, reproduced below.



Reply 19. Petitioner's comparison above shows Zemax plots for targeted resolution (top left) and MTF (bottom left) for Matsusaka's Example 19, side by side with Dr. Lebby's annotation of Figure 6 of the '120 patent (top right) compared to Figure 5 of the '120 patent (bottom right), to illustrate that Matsusaka's "zone of higher magnification aligns with a zone of lower MTF, just as Dr. Lebby argues it is for the '120 Patent." *Id.* at 18–19.

Regarding Patent Owner's argument that Petitioner's argument is new and unreliable (Sur-Reply 18), we are not persuaded that Dr. Kessler's graphs are "new" *per se*. They appear to constitute a use of data from the original Zemax models, to respond to Patent Owner's argument that Matsusaka does not disclose the claimed "zone" correlating to a drop in RI or MTF in the manner proposed by Dr. Lebby. *See* Tr. 25:1–2, 42:4–9 ("Dr. Kessler utilized the same model he created in the first instance with

respect to the petition," "took the model that existed when he prepared his original declaration, and he created those plots after seeing the Patent Owner's arguments," so "that data existed within the model."). Even if we were to consider the arguments "new," our reviewing court has stated that "the petitioner in an inter partes review proceeding may introduce new evidence after the petition stage if the evidence is a legitimate reply to evidence introduced by the patent owner." *Apple*, 949 F.3d at 706–707; *see also Axonics*, 75 F.4th at 1380–82.

Regarding Patent Owner's argument that Dr. Kessler changed parameters between his resolution plot and his MTF plot (Sur-Reply 19), and "should have at least consistently used the same wavelength information across both sets of data," we disagree that there is any resulting error in the MTF plot. We credit Petitioner's observation that "the MTF data changes potentially based on the light wavelength that you choose to put through the model and analyze with those MTF graphs," but "there is no argument that the resolution curve changes," and "there is no allegation or evidence on this record that you would see a different location of the zones if you ran different light through the model." Tr. 44:11–16. Regarding Patent Owner's argument that Dr. Kessler did not use the proper field of view, i.e., he used 100° instead of Matsusaka's given value of 104.183° (Sur-Reply 20), we are not directed to any countervailing evidence that the 4.183° difference in field of view materially impacts Dr. Kessler's conclusions. We acknowledge Dr. Kessler's assertion that he went back into his models and corrected "these minor issues," finding "that the outcome did not substantively change, and my original analysis and conclusions remain the same." Ex. 1023 ¶ 27 n.3; Reply 17.

Thus, we are persuaded that Petitioner demonstrates sufficiently, through its Zemax modeling, the existence of "zones" in the Matsusaka apparatus, and the alignment of the "zone" with a drop in MTF. Pet. 56–60; Reply 17–19.

The Petition, however, argued that "Matsusaka does not explicitly describe that these areas or zones with respect to linear target resolution are 'intentional'" but that "it would have been obvious to a POSITA to intentionally utilize the areas or zones of increased and decreased magnification, depending on the relevant use case." Pet. 59 (citing Ex. 1003 ¶ 166 (discussing hypothetical zones that a POSITA would have recognized "are more important for a user of such a vehicle-mounted camera" that "may benefit from increased magnification" or "other areas or zones that are not as important and may have decreased magnification"); Ex. 1005 ¶¶ 4, 229–233). Petitioner provided no persuasive development of an anticipation position with respect to this "intentional" element of limitation 1[e] but, rather, framed its arguments for this element in terms of obviousness. Accordingly, although Petitioner's uncontested position on this element supports a finding of obviousness based on Matsusaka, because it is reasonable, not persuasively controverted, and supported by testimony, it does not support a finding of anticipation.

6. Remaining Claims

Petitioner contends that the additional limitations of dependent claims 3–6 are taught or suggested by Matsusaka. Pet. 60–65. Patent Owner does not present separate arguments for the patentability of claims 3–6 apart from its arguments for the patentability of independent claim 1. *See* PO Resp. We have reviewed the undisputed argument and evidence

presented by Petitioner, and we find that Matsusaka would have rendered obvious the additional limitations of claims 3–6, and we find that a person of ordinary skill in the art would have understood the reference to teach the limitations of claims 3–6 in the manner asserted by Petitioner. Pet. 60–65; Ex. 1003 ¶¶ 169–179. For the same reasons as set forth above for independent claim 1, we determine that Petitioner has met its burden of proof for the disputed limitations of the challenged dependent claims. *See* 35 U.S.C. § 112(d).

7. Conclusion as to Petitioner's Ground 2

Accordingly, based on the totality of Petitioner's arguments, evidence, and testimony, we are persuaded that Petitioner has met its burden to demonstrate that claims 1 and 3–6 would have been obvious in view of Matsusaka.

G. Alleged Anticipation and Obviousness Based on Kim (Petitioner's Ground 3)

Petitioner asserts that claims 1, 4, 5, and 7 are anticipated by and/or would have been obvious over Kim. Pet. 65–85. For the purposes of this decision, we do not determine the merits of Petitioner's Ground 3 because, as explained above, every challenged claim 1–7 in this proceeding is anticipated by or would have been obvious over the Thibault-based challenges in Ground 1, and claims 1 and 3–6 would have been obvious over the Matsusaka-based challenges in Ground 2. *See SAS*, 138 S. Ct. at 1359 (holding a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"); *Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) (nonprecedential) ("We agree that the Board need not address [alternative grounds] that are not necessary to the resolution of the proceeding.").

III. CONCLUSION

For the reasons discussed above, we determine Petitioner meets its burden of establishing, by a preponderance of the evidence, that the challenged claims are unpatentable,[7] as summarized in the following table:

Claims	35 U.S.C. §	Reference/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–7	102	Thibault	1, 3–7	2
1–7	103	Thibault	1–7	
1, 3–6	102	Matsusaka		1, 3–6
1, 3–6	103	Matsusaka	1, 3–6	
1, 4, 5, 7	102	Kim[8]		
1, 4, 5, 7	103	Kim		
Overall Outcome			1–7	

[7] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. §§ 42.8(a)(3), (b)(2).

[8] We do not reach the grounds based on Kim as to claims 1, 4, 5, and 7 because we determined those claims would have been unpatentable as anticipated by or obvious over Thibault, or obvious over Matsusaka.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner establishes, by a preponderance of the evidence, that claims 1–7 of U.S. Patent No. 10,795,120 B2 are unpatentable; and

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

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