

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*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

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, “Prelim. Resp.”).

To institute *inter partes* review, we must determine that the information presented in the Petition shows “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2018). For the reasons discussed below, after considering the parties’ submissions and the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one claim of the ’120 patent, and we institute *inter partes* review on all challenges raised in the Petition. 37 C.F.R. § 42.108 (2022).

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 Party-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.

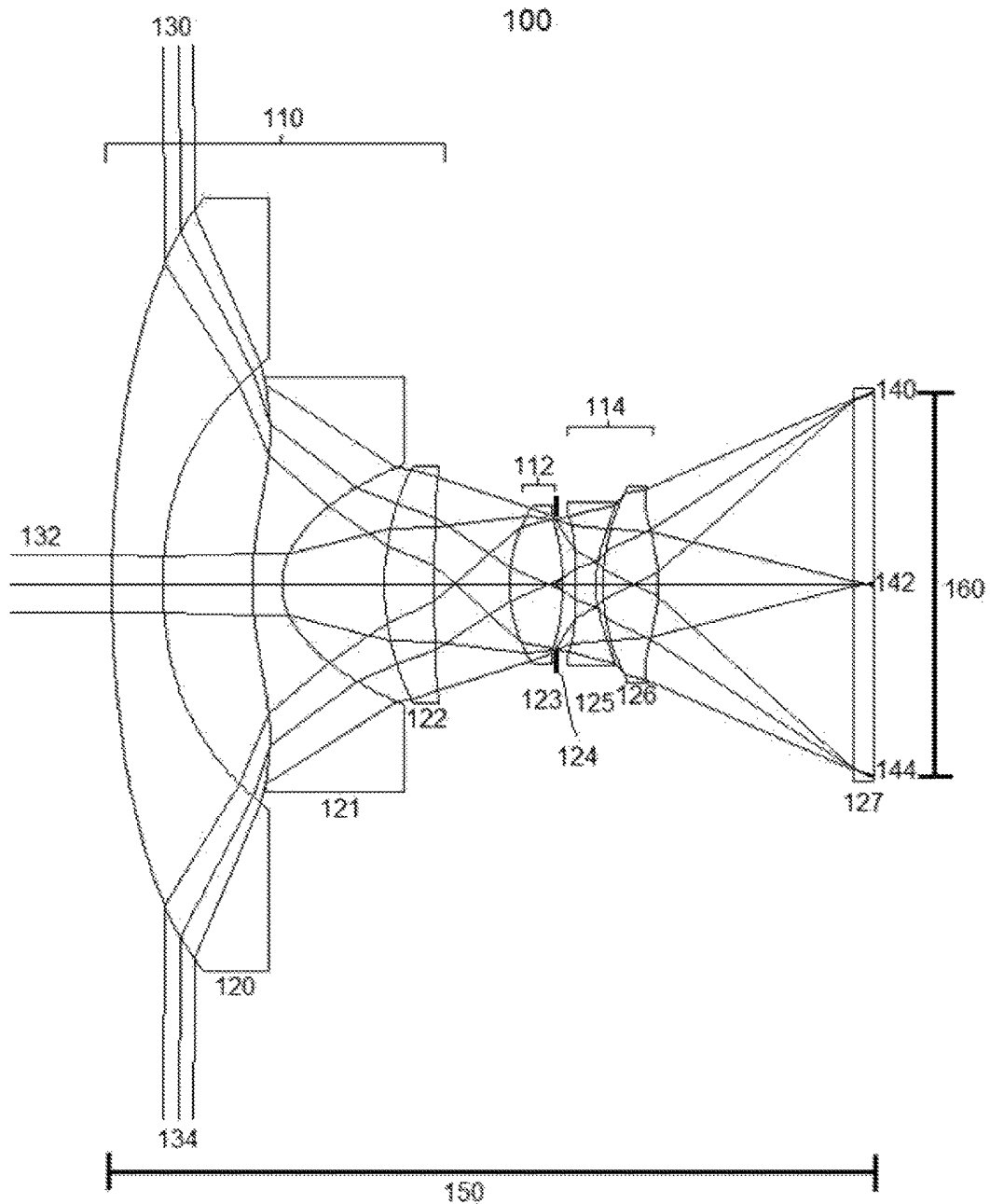


Figure 1 shows “an optical layout for a design having six optical elements in an asymmetric configuration around the stop, having four optical elements before the stop and two optical elements after the

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 1:53–59. 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 “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 2:53–55). 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.

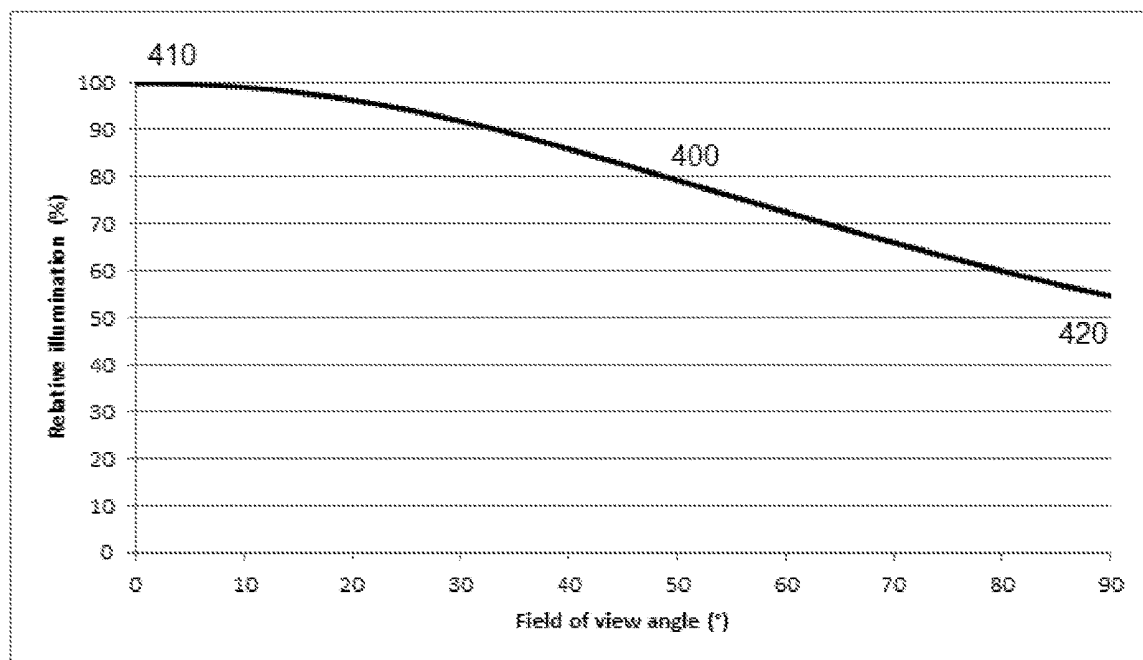


Figure 4 shows “a typical relative illumination curve 400.” *Id.* at 5:57. “The exact values of the relative illumination with respect to the field of view vary between each embodiment of the present invention,” but “the overall shape having a value around 100% at 0° shown at center 410 and under 80% 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.

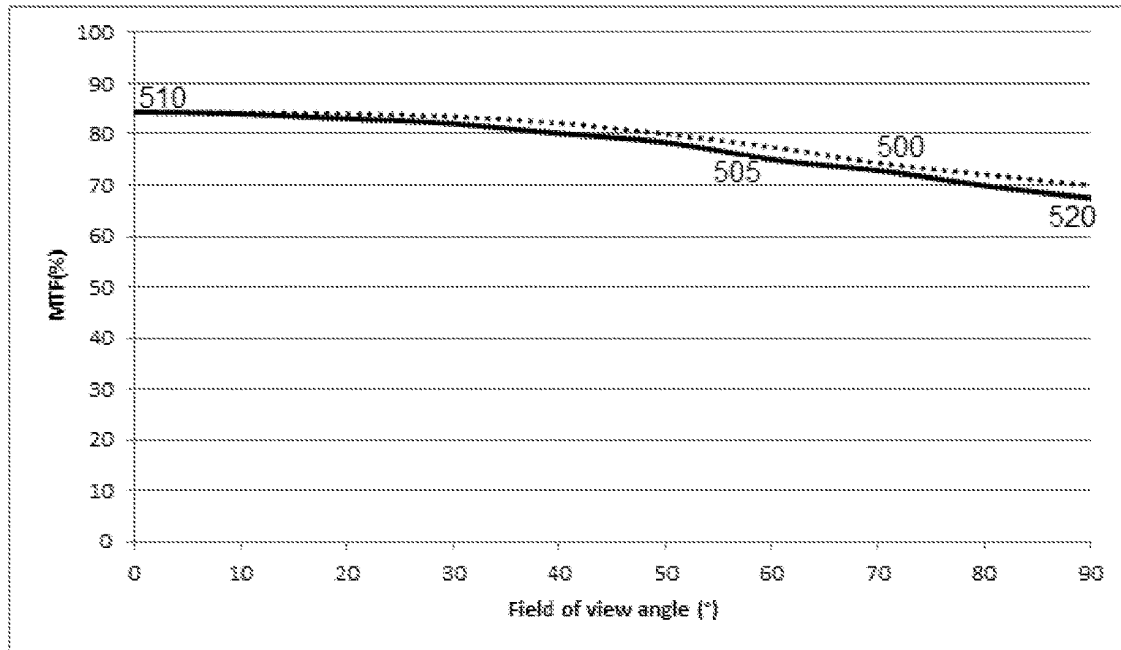


Figure 5 shows “a typical sagittal MTF curve 500 and tangential MTF curve 505 for a miniature wide-angle lens according to embodiments of the present invention.” *Id.* at 5:66–6:1. “The exact values of the MTF with respect to the field of view vary between each embodiment of the present invention and 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 other embodiments of the miniature wide-angle lens, 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.

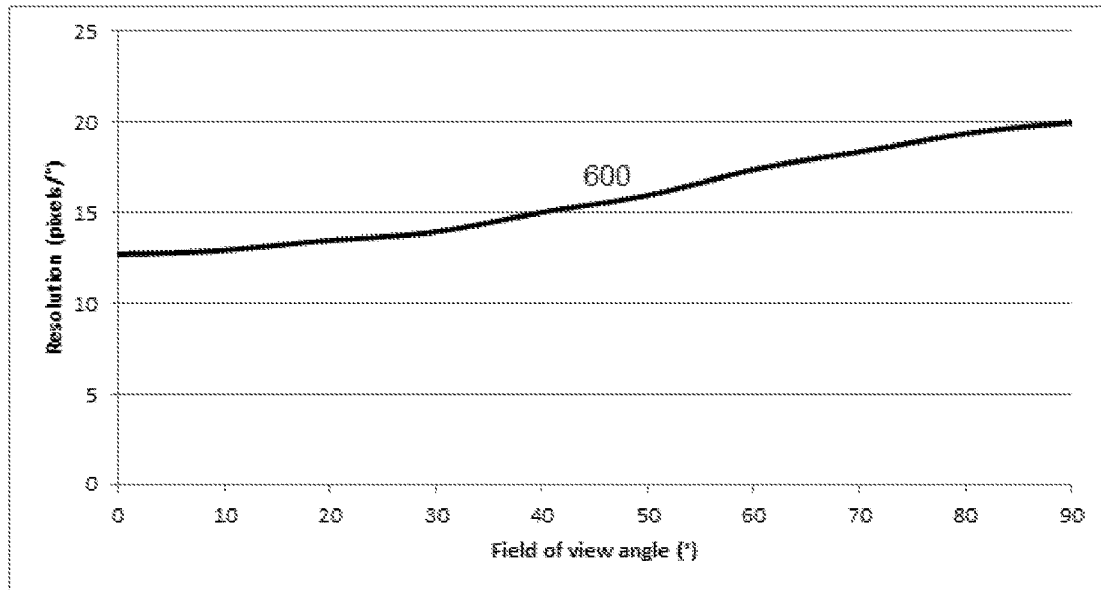


Figure 6 “shows an example targeted resolution curve 600” whereby “the targeted resolution is non-linear and a higher number of pixels per degree is intentionally present in a part of the image.” *Id.* at 6:9–13. “In the zone where the resolution is higher, there are more pixels of the sensors used to 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.

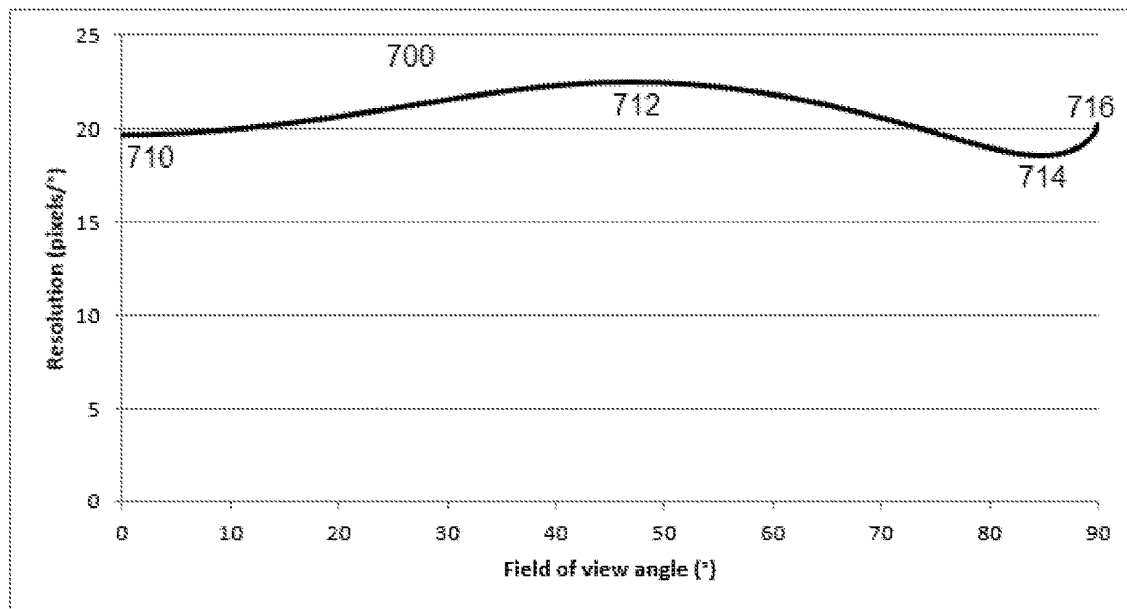


Figure 7 shows nonlinear targeted resolution curve 700 having “an upward curve between the center resolution value 710 and a maximum 712 (number of pixels/degree), followed by a downward curve between the maximum 712 and a region near the edge of the field of view around position 714.” *Id.* at 6:28–35.

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, 7:10–8:4 (bracketed annotations added by Petitioner).

E. Asserted Grounds of Unpatentability

Petitioner asserts that claims would have been unpatentable on the following grounds:

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

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 unpatentability arguments, Petitioner relies on the Declaration of Dr. David Kessler, Ph.D. Ex. 1003.

II. ANALYSIS

A. Claim Construction

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). 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 then only to the extent necessary to resolve the controversy. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms ... that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

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. 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.* at 11 (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.*

Patent Owner responds that Petitioner’s request for removing the disputed phrase because it is allegedly an “intended use limitation” “ignores the surrounding claim language and the supporting specification.” Prelim. Resp. 10. Patent Owner argues that the “being used to compensate” language “explains, *inter alia*, **where** the created zone is in the apparatus – *i.e.*, in a location within the field of view in regards to the relative illumination or MTF drop.” *Id.* at 11. Patent Owner points to the resolution plot of Figure 6 that “shows a resolution plot where a zone of higher magnification is provided in a location corresponding to drops in relative illumination and MTF exhibited in Figs. 4 and 5, respectively” as well as other portions of the specification that tie the “being used to compensate” language to zone location. *Id.* at 11–12 (quoting Ex. 1001, 6:9–27, 2:45–

55). Patent Owner summarizes that the “being used to compensate” language at issue “results in a structural difference – it at least explains where the targeted zone is located in the apparatus” and “it must therefore be assigned patentable weight.” *Id.* at 12 (citing *K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363–1364 (Fed. Cir. 1999) (reading functional language as separate, structural limitation)).

We are persuaded, on this record, that we should not read any terms out of claim 1. 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 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 quality drops due to a drop either of relative illumination or of MTF, and where the 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. lower relative illumination or lower MTF) that lead to the intentional creation of the “zone” where the image magnification is required. As Patent Owner notes, the “being used to compensate” language explains “how the created zone is arranged within the field of view of the optical apparatus.” Prelim. Resp. 11. This “tells us something about the structural requirements” of the zone intentionally created within the apparatus. *K-2 Corp.*, 191 F.3d at 1364.

Accordingly, we decline to view the “being used to compensate” language of claim 1 as an “intended use.” Any claim construction at this stage in the proceeding is preliminary, and our final determinations as to claim construction will be made on the full record, as developed during trial.

B. Level of Ordinary Skill in the Art

Petitioner asserts 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 that solely for purposes of the Preliminary Response, it “does not object to Petitioner’s definition of a POSA [person of ordinary skill in the art].” Prelim. Resp. 10.

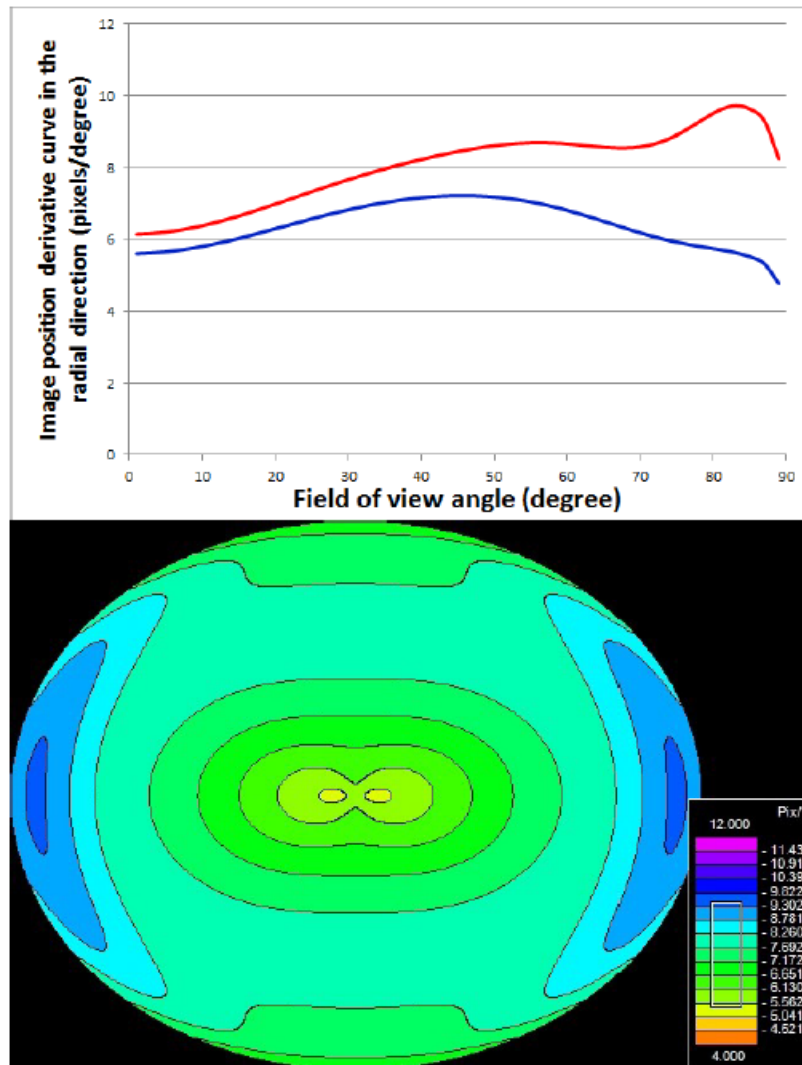
Accordingly, for the purposes of this Decision, we adopt Petitioner's proposal regarding the level of ordinary skill in the art with the exception of the open-ended phrase "at least," which expands the range of experience indefinitely without an upper bound. The level of ordinary skill in the art is also reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

C. Asserted Prior Art

1. Thibault (Ex. 1004)

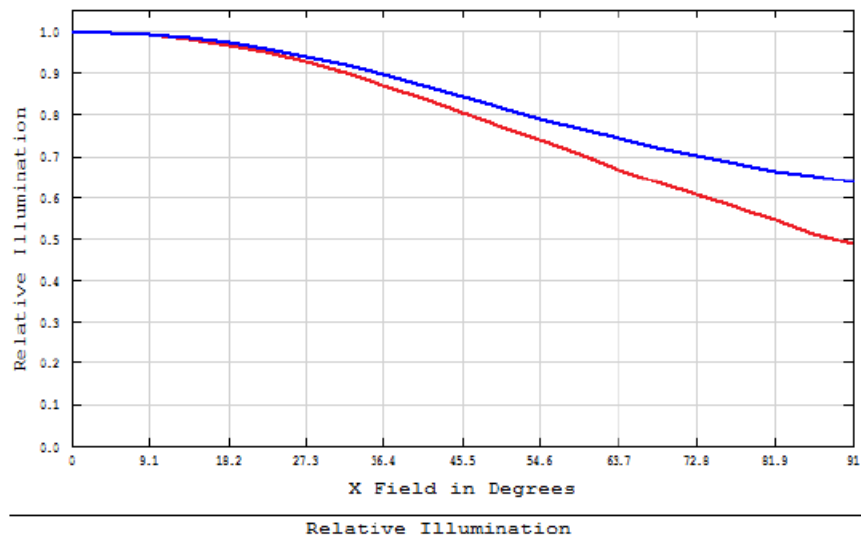
Thibault is titled "Design, fabrication and test of miniature plastic panomorph lenses with 180° field of view." Ex. 1004, 1. Thibault "addresses the challenges of designing and manufacturing miniature panomorph lenses suitable for state of the art megapixels sensor" and presents "two miniature all plastic 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.



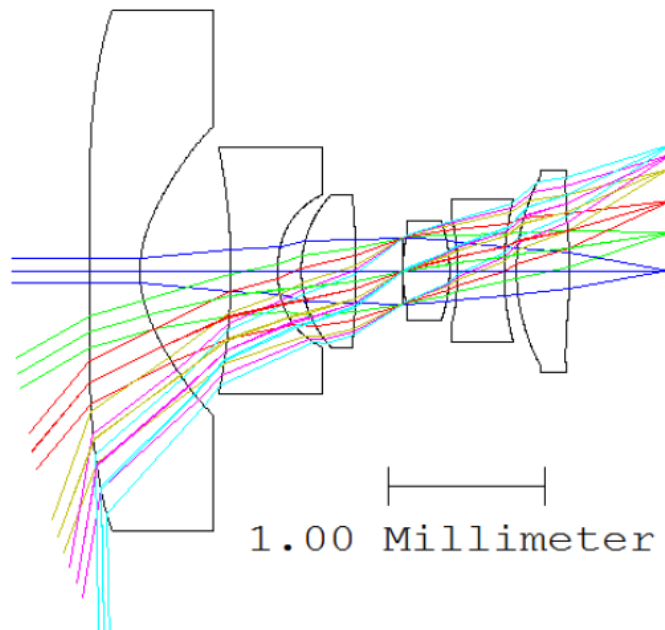
Thibault describes Figure 3 as follows: “The number of pixels of $1.75\text{ }\mu\text{m}$ is increased toward the edge. Top) Image position derivative curve in the radial direction (pixels/degree) in both the long (red) and short (blue) axis. Bottom) Surfacic resolution over the full elliptical panomorph 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.



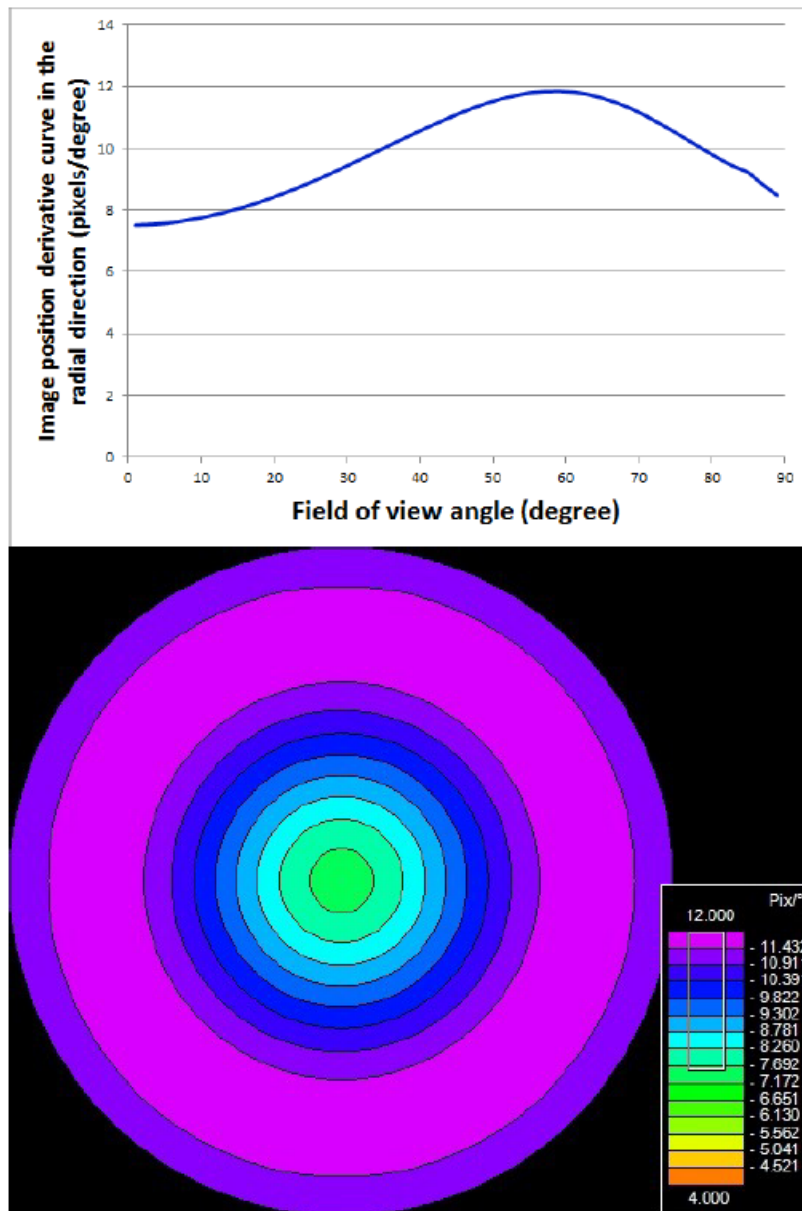
Thibault describes Figure 4 as follows: “Relative illumination along both the long (red) and the short (blue) axis of the panomorph lenses with a TTL of 6.56 mm.” *Id.*

Under the heading of “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.” 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.*

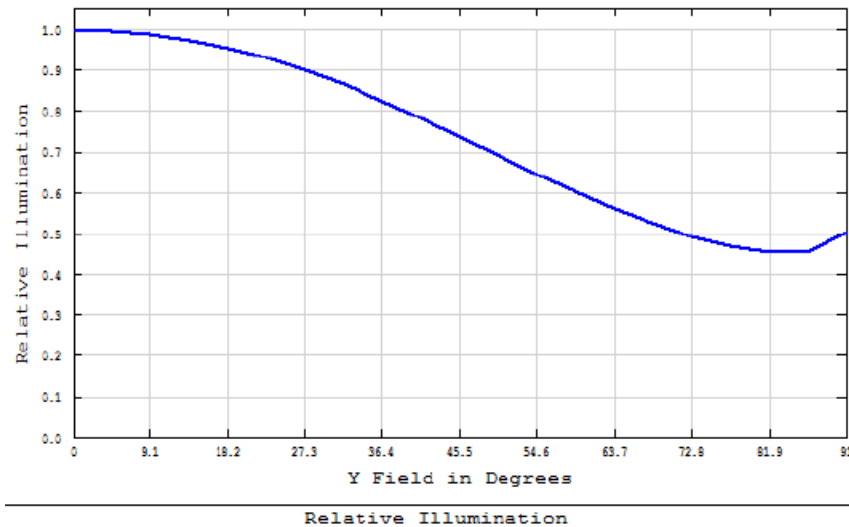
Figure 6 of Thibault is reproduced below.



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.* at 7.

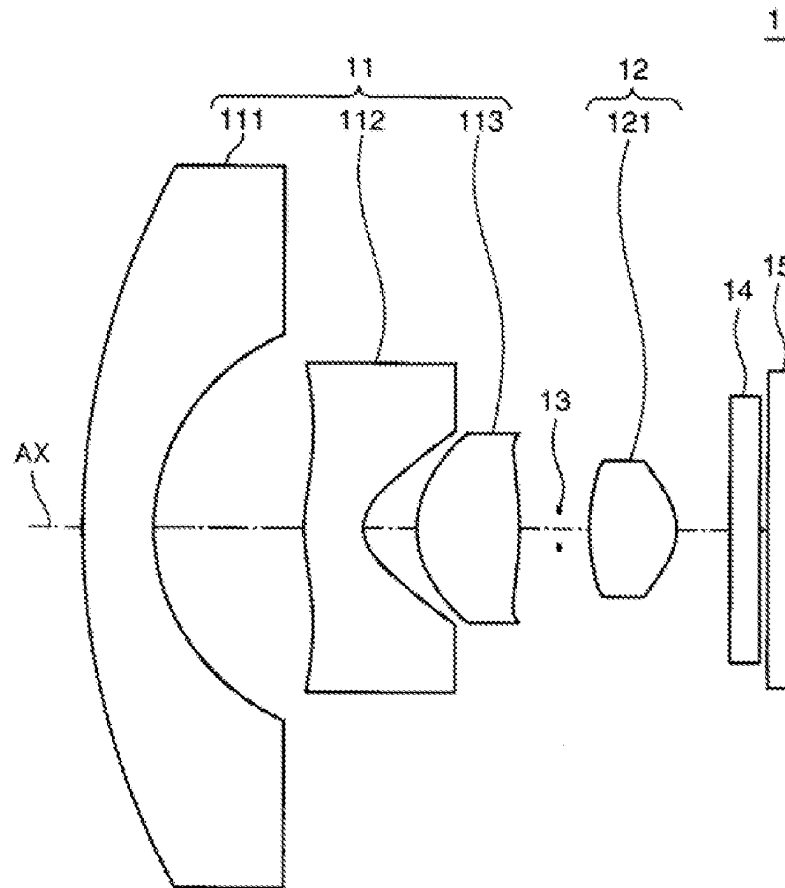
2. Matsusaka (Ex. 1005)

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 background art as being used, e.g., “for the purpose of a surveillance system and onboard system . . . [and] 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.

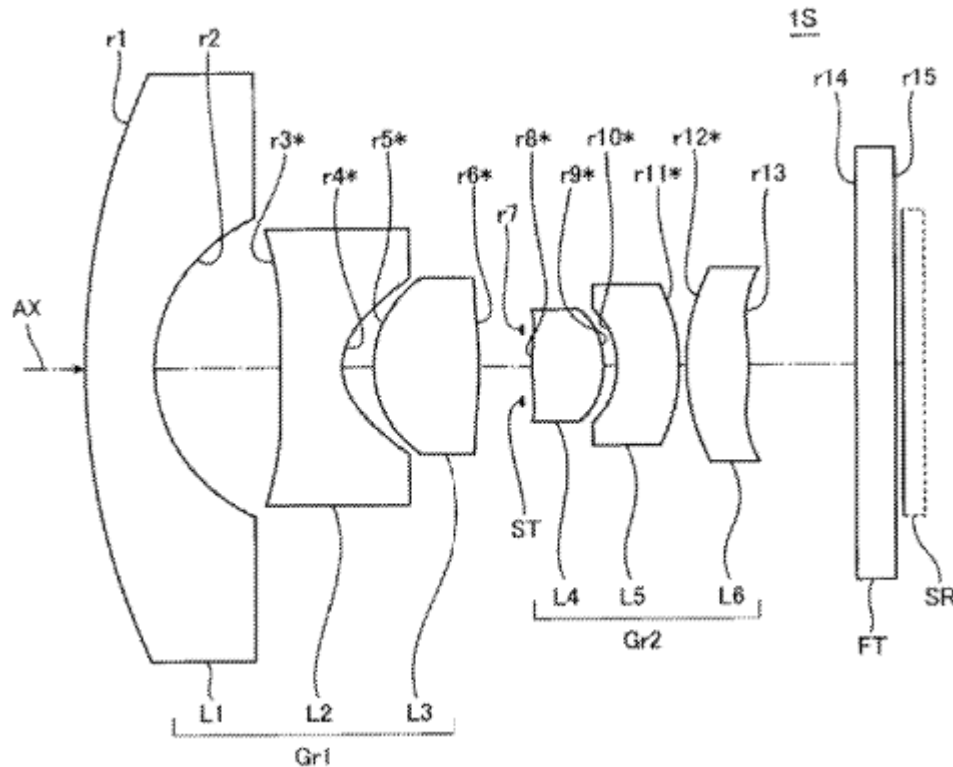


“FIG. 1 is a sectional view of lenses for the explanation of a wide-angle optical system in an embodiment, showing the schematic structure.”

Id. ¶ 83. As shown, “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

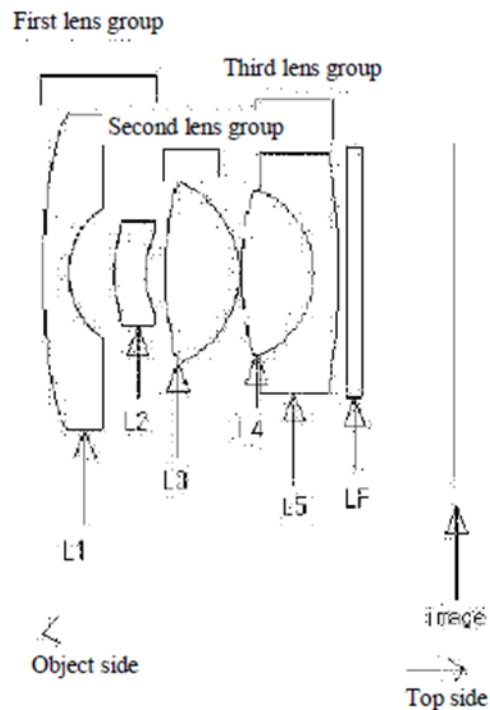
image pickup element SR through parallel flat plate FT serving as a filter.”

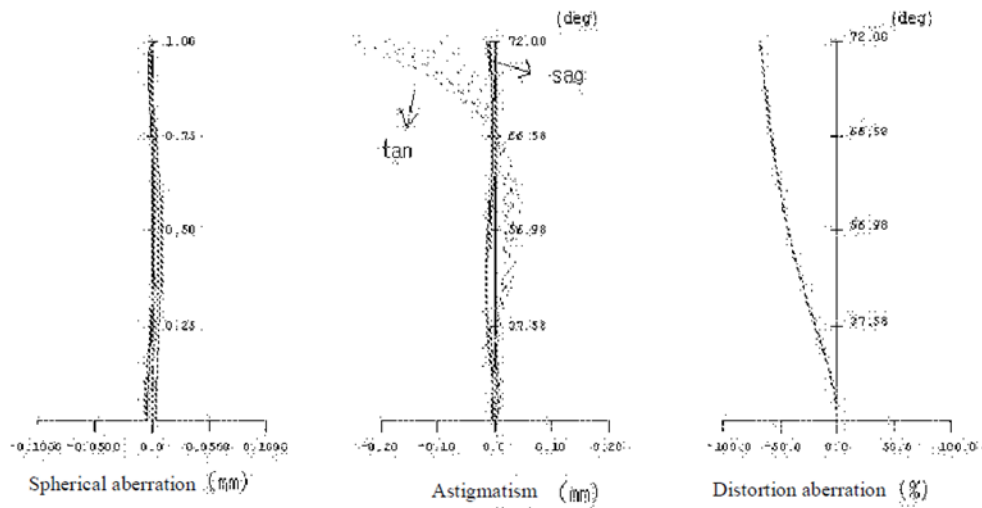
Id. ¶ 409.

3. *Kim (Ex. 1007)*

Kim is titled “Compact superwide angle optical system” and discloses a “superwide angle lens having a higher resolution performance while having a brighter F-number.” Ex. 1007, codes (54), (57). The invention “is relevant to a surveillance camera capable of monitoring a wide area, particularly to a compact superwide angle optical system mounted on a vehicle,” which “must be a bright lens” to “photograph an object even in a low light amount,” and “must have high resolution performance.” *Id.* at 3.

Kim’s Diagrams 1a and 1b are reproduced below.





“Diagram 1a and Diagram 1b are diagrams showing a configuration diagram and an aberration diagram of an optical system according to the first embodiment of the present invention, respectively.” *Id.* at 8. “The first lens group, the second lens group, and the third lens group are distributed to have negative, positive, and positive refractive power, respectively,” and “in order to have a superwide angle, it has a structure in which the strong positive refractive power of the second lens group is complemented by the arrangement of the first lens group and the third lens group.” *Id.* at 4. “In particular, a meniscus-shaped lens having a convex object side is used as the first lens (L1) so as to be suitable for incident light in the superwide angle areas.” *Id.* “In addition, in order to increase lens brightness and resolution, all four lens surfaces of the first and second lenses are made of aspherical surfaces.” *Id.*

D. Analysis

“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 the 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). Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements,” but “must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

“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 subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *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”)).

1. *Ground 1*

a. *Petitioner’s Arguments*

Petitioner asserts that claims 1–7 are anticipated and/or 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));

⁵ At this stage, Patent Owner does not present any objective evidence of secondary considerations as to any of the challenged claims.

[1a] a light-receiving first surface; (Pet. 19–21 (citing Ex. 1004, 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, 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 (citing Ex. 1004, 6, 7, 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 presents additional arguments for dependent claims 2–7. Pet. 34–43.

b. Patent Owner's Arguments

Patent Owner argues that Petitioner did not properly show Thibault includes a magnification zone arranged as in claim 1. Prelim. Resp. 13. 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

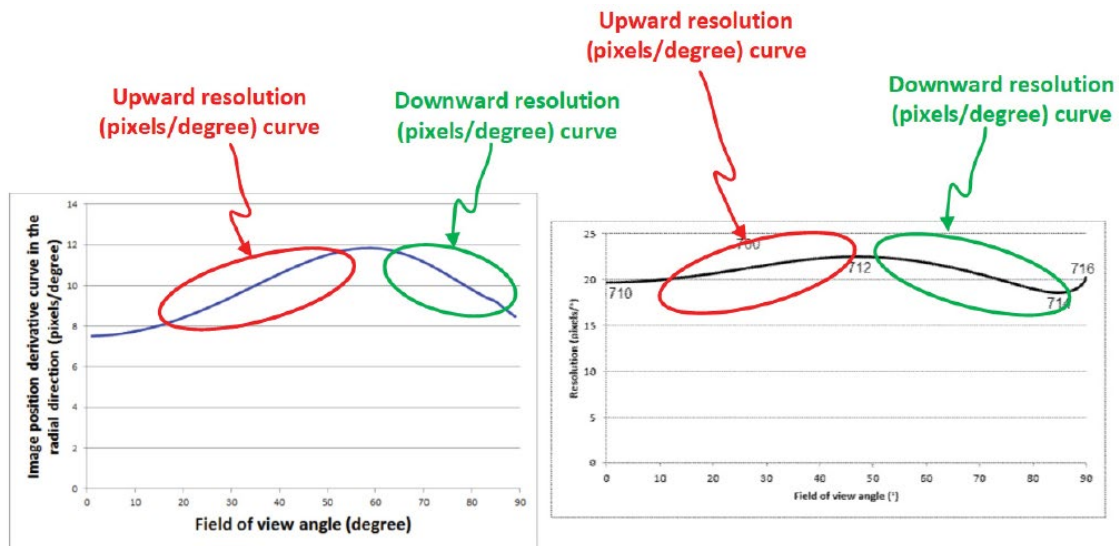
Owner argues that Petitioner fails to identify any magnification zone in Thibault and instead relies on an unsupported theory. *Id.* at 14. Patent Owner argues that “Petitioner provides *no* evidence regarding a location of any particular magnification zone in Thibault with respect to Thibault’s relative illumination curve” but, rather, “relies on the mere presence of a ‘downward slope’ in Thibault’s resolution plot.” *Id.* at 14–15. Patent Owner argues that nothing in the relied-upon portions of the ’120 patent “remotely suggests that a downward slope itself provides a lower magnification (or the corollary that an upward slope automatically means a higher magnification)” and “slope alone cannot equate to the claimed magnification zones.” *Id.* at 16.

c. Analysis

With respect to Patent Owner’s first argument about claim construction and intended use, we preliminarily 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 Thibault-based arguments.

With respect to Patent Owner’s second argument about Petitioner’s failure to identify a magnification zone in Thibault, we preliminarily disagree. Petitioner relies on the language of the ’120 patent describing its Figure 7, 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). Thus, Petitioner’s reading of the ’120 patent is that a negative or downward sloped resolution curve has a lower object to image magnification

ratio, and a positive or upward sloped resolution curve has a higher object to image magnification ratio. *Id.* (citing Ex. 1003 ¶ 117). 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 of Thibault’s Figure 6, on the left, and the '120 patent’s Figure 7, on the right, shows an “upward resolution curve” circled in red and a “downward resolution curve” circled in green. *Id.* We agree, on this record, that a “POSITA would have understood from Thibault that this ‘distortion profile ratio’ is the resolution of the image projected onto the focal plane in pixels/degree” and, thus, Thibault’s “non-linear targeted resolution creates a zone” as in limitation [1e]. *Id.* at 28–30 (citing Ex. 1003 ¶ 121). We also agree 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). With respect to the “being used to compensate” language, we are persuaded on this record

that Petitioner's comparison of Thibault's Figure 6 and the '120 patent's Figure 7 (above), particularly with respect to the downward resolution curve circled in green, supports Petitioner's assertion that Thibault's apparatus meets the "being used to compensate" language. *Id.* at 30–31. We are also persuaded that Petitioner's comparison of Thibault's Figure 6 and the '120 patent's Figure 7, in view of the language of the '120 patent (the "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," Ex. 1001, 6:36–41), supports Petitioner's assertion that Thibault's apparatus "would therefore have the same impact on relative illumination as described in the '120 Patent." *Id.* at 31 (citing Ex. 1003 ¶ 123). Although Patent Owner argues that "slope alone cannot equate to the claimed magnification zones" (Prelim. Resp. 16), at this stage in the proceeding we have un rebutted testimony from Petitioner's declarant, providing reasoning supporting Petitioner's arguments about Thibault's disclosures and limitation [1e]. Pet. 25–32 (citing Ex. 1003 ¶¶ 117–124). On this record, we are persuaded that Petitioner establishes a reasonable likelihood of prevailing on its arguments that Thibault discloses and/or renders obvious the limitations of claim 1.

On the present record, Patent Owner does not substantively dispute Petitioner's arguments as to dependent claims 2–7. Prelim. Resp. 13–18. We have reviewed Petitioner's arguments and the cited evidence, and, on the present record, Petitioner shows sufficiently that Thibault discloses the limitations of claims 2–7. Accordingly, Petitioner shows a reasonable likelihood of prevailing on its argument that claims 1–7 would have been anticipated by or obvious in view of Thibault.

2. *Ground 2*

a. Petitioner's Arguments

Petitioner asserts that claims 1 and 3–6 are anticipated and/or 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, Abstract, ¶¶ 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, ¶¶ 404–411, 246; 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 (citing Ex. 1005, Figs. 23, 43A, 43B, ¶¶ 404–412, 4, 229–233; 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 presents additional arguments for dependent claims 3–6. Pet. 60–65.

b. Patent Owner's Arguments

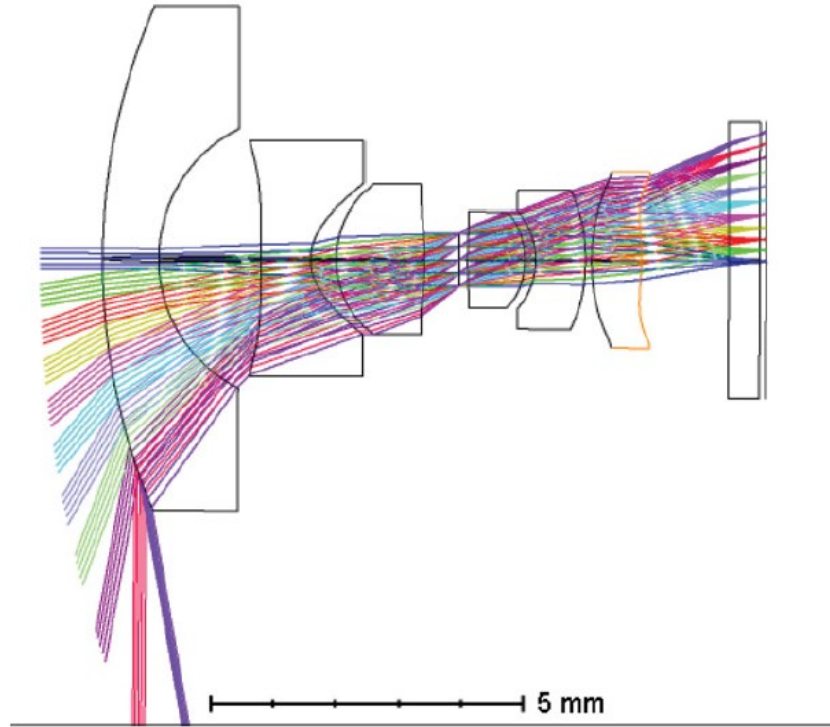
Patent Owner argues, first, that to the extent “Petitioner is relying on a claim feature not having patentable weight to prove invalidity, Ground 2 is deficient.” Prelim. Resp. 18. Second, Patent Owner argues that Petitioner’s backup position that the claim element is met “based on the fact that Matsusaka’s lens includes the claimed ‘zones’” is not enough, because “claim 1 also calls for the zone’s location to correlate with a drop in relative illumination or MTF.” *Id.* Patent Owner criticizes Petitioner’s reliance on “its calculated resolution plot for Matsusaka and the ‘120 Patent’s Fig. 7 both exhibiting ‘a similar downward slope’” even though “the slope of the resolution curve alone is insufficient to demonstrate the location of a magnification zone or its relationship to the lens’ relative illumination or MTF.” *Id.* at 19. According to Patent Owner, the ‘120 patent “makes clear that any magnification zones present in the Fig. 7 resolution curve are carefully located according to at least one of the relative illumination or the MTF of the subject lens” but Petitioner offers “no similar evidence from Matsusaka to correlate any portion of their calculated resolution plot to the lens’ undisclosed relative illumination or MTF.” *Id.*

c. Analysis

With respect to Patent Owner’s argument about claim construction and “intended use,” we preliminarily 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.

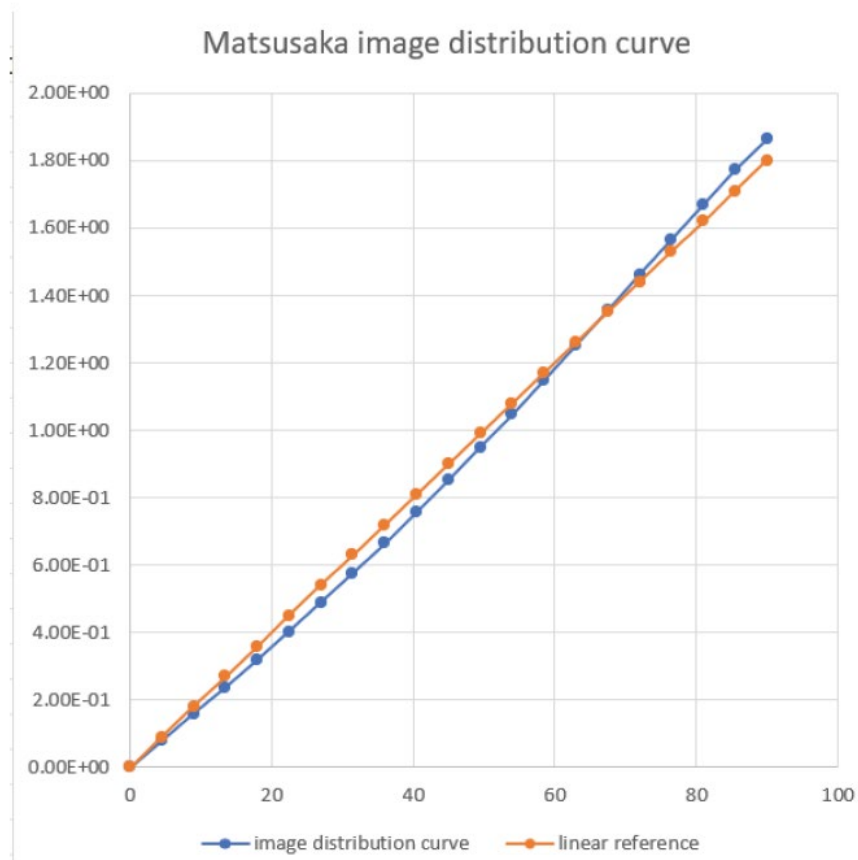
With respect to Patent Owner’s argument about whether Matsusaka discloses the “zones,” we look to Petitioner’s evidence and argument for limitation [1e]. Petitioner’s declarant modeled the optical system 1S of Matsusaka’s Example 19 in Zemax,⁶ creating the following model:

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). Petitioner’s declarant describes 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 or zones of limitation [1e]. *Id.* at 58 (citing Ex. 1003 ¶ 163). Petitioner’s declarant further derives the derivative of the image height and converts it to resolution in terms of pixels/degree, reproduced below.



Pet. 58 (citing Ex. 1003 ¶ 164). 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). Petitioner concedes that “Matsusaka does not explicitly describe that these areas or zones of increased and decreased magnification with respect to the linear targeted resolution are ‘intentional’” but 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 discloses “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 60 (citing Ex. 1003 ¶ 167).

Although Patent Owner argues that Petitioner’s declarant’s testimony does not offer “evidence from Matsusaka to correlate any portion of their calculated resolution plot to the lens’ undisclosed relative illumination or MTF” (Prelim. Resp. 19), we have unrebutted testimony on this record that one of ordinary skill in the art would have found it obvious to “intentionally utilize the areas or zones of increased and decreased magnification, depending on the relevant use case,” and that comparing Matsusaka’s resolution curve with Figure 7 of the '120 patent shows they would “have the same impact on relative illumination.” Ex. 1003 ¶¶ 166–167. Petitioner demonstrates sufficiently on this record, through its Zemax and other modeling, the existence of “zones” in the Matsusaka apparatus. Pet. 56–60. Although support for the argument that these zones are “intentional” or related to a drop in relative illumination or MTF is not as well-developed, and concerns a portion of the claim that Petitioner contends is “intended use,” it is before us without counterpoint at this stage in the proceeding. The parties are urged to further develop these arguments at trial, in accordance with our Rules.

Patent Owner does not substantively dispute Petitioner’s arguments as to dependent claims 3–6. Prelim. Resp. 18–20. We have reviewed Petitioner’s arguments and the cited evidence, and, on the present record, Petitioner shows sufficiently that Matsusaka discloses the limitations of claims 3–6. Accordingly, Petitioner shows a reasonable likelihood of prevailing on its argument that claims 1 and 3–6 would have been anticipated by or obvious in view of Matsusaka.

3. *Ground 3*

a. Petitioner's Arguments

Petitioner asserts that claims 1, 4, 5, and 7 are anticipated and/or obvious over Kim. Pet. 65–85. Petitioner argues that every element of claim 1 is found in Kim, as follows.

1. [1pre] A miniature wide-angle optical apparatus comprising:
(Pet. 68–70 (citing Ex. 1007, 4–6, Summary, Diagram 1a; Ex. 1003 ¶¶ 182–184));

[1a] a light-receiving first surface; (Pet. 70–72 (citing Ex. 1007, 4–5, Diagram 1a; Ex. 1003 ¶¶ 185–186));

[1b] a focal plane; (Pet. 72–73 (citing Ex. 1007, 6, 8, Diagram 1a; Ex. 1003 ¶ 187));

[1c] a total track length measured from a center of the first surface to the focal plane; (Pet. 74–75 (citing Ex. 1007, 6, Diagram 1a; Ex. 1003 ¶¶ 188–189));

[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. 75–76 (citing Ex. 1007, 6, Table 1; Ex. 1003 ¶ 190–191));

[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. 76–80 (citing Ex. 1007, Diagrams 1a–1b; Ex. 1003 ¶¶ 192–198));

[1f] an opening angle of light entering the optical apparatus being over 100°. Pet. 81 (citing Ex. 1007, 6, Table 1; Ex. 1003 ¶ 199).

Petitioner presents additional arguments for dependent claims 4, 5, and 7. Pet. 81–85.

b. Patent Owner's Arguments

Patent Owner argues, first, that to the extent “Petitioner is relying on a claim feature not having patentable weight to prove invalidity, Ground 3 is deficient.” Prelim. Resp. 20. Second, Patent Owner argues that Petitioner’s backup position that the claim element is met “based on the fact that Kim’s lens includes the claimed ‘zones’” is not enough, because “claim 1 also calls for the zone’s location to correlate with a drop in relative illumination or MTF.” *Id.* Patent Owner criticizes Petitioner’s reliance on “its calculated resolution plot for Kim and the ‘120 Patent’s Fig. 7 both exhibiting ‘a similar downward slope’” even though “the slope of the resolution curve alone is insufficient to demonstrate the location of a magnification zone or its relationship to the lens’ relative illumination or MTF.” *Id.* at 21.

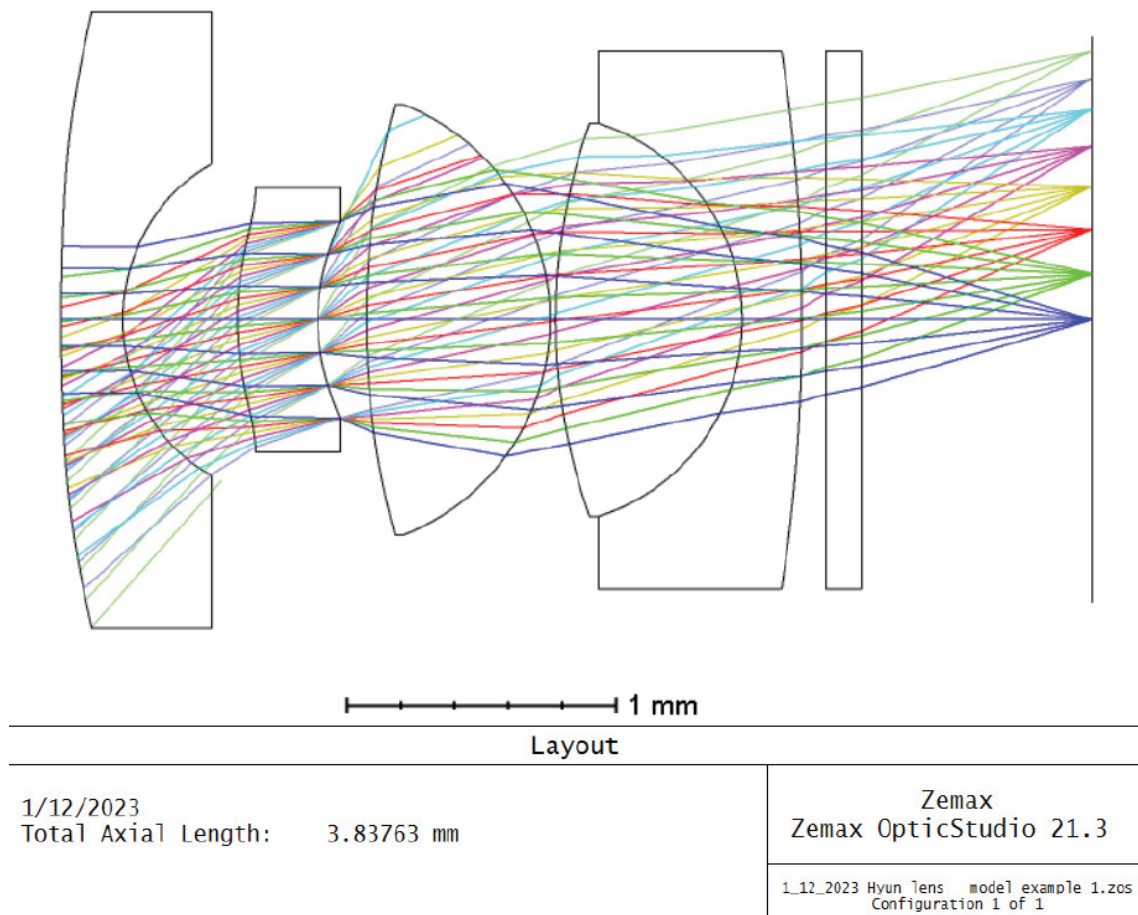
According to Patent Owner, the ‘120 patent “makes clear that any magnification zones present in the Fig. 7 resolution curve are carefully located according to at least one of the relative illumination or the MTF of the subject lens” but Petitioner offers “no similar evidence from Kim to correlate any portion of their calculated resolution plot to the lens’ relative illumination or MTF.” *Id.*

c. Analysis

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

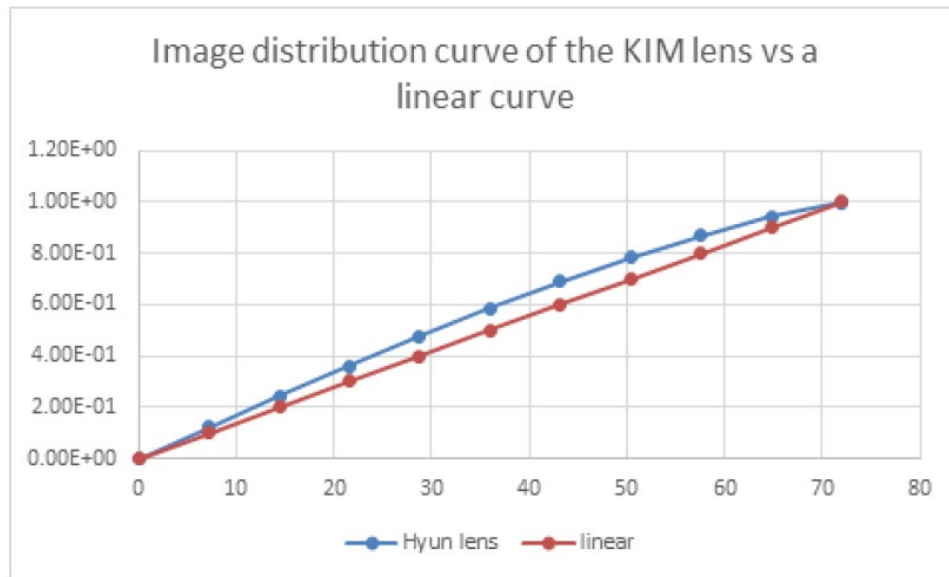
Accordingly, we consider every limitation of claim 1 when evaluating Petitioner's Kim-based arguments.

With respect to Patent Owner's argument about whether Kim discloses the "zones," we look to Petitioner's evidence and argument for limitation [1e]. Petitioner's declarant modeled Kim's Diagram 1a in Zemax, creating the following model:

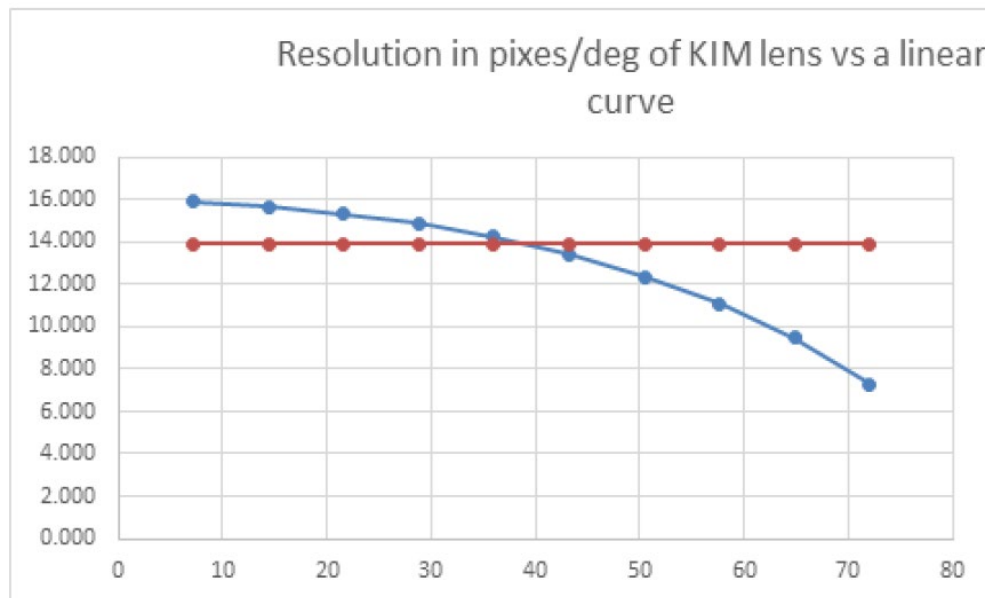


Zemax Model of Kim's First Embodiment

Pet. 76–77 (citing Ex. 1003 ¶ 192). Petitioner's declarant also used Zemax to provide the image height at the sensor as a function of the field angle, reproduced below.



Pet. 77–78 (citing Ex. 1003 ¶ 194). Petitioner’s declarant describes 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 or zones of limitation [1e]. *Id.* at 78 (citing Ex. 1003 ¶ 194). Petitioner’s declarant further derives the derivative of the image height and converts it to resolution in terms of pixels/degree, reproduced below.



Pet. 79. 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/zones where the blue curve are below the red curve are areas of decreased magnification with respect to the linear targeted resolution.” *Id.* at 78–79 (citing Ex. 1003 ¶ 196). Petitioner concedes that “Kim does not explicitly describe that these areas or zones of increased and decreased magnification with respect to the linear targeted resolution are ‘intentional’” but 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 Kim’s “superwide angle optical system” that “is used in surveillance cameras **for vehicles.**” *Id.* at 79 (citing Ex. 1003 ¶ 197; Ex. 1007, 3). Regarding the “being used to compensate” language, Petitioner argues that Kim discloses “zones,” and that the “resolution curve of Kim’s first embodiment has a downward slope and would therefore have the same impact on relative

illumination as described in the '120 Patent.” *Id.* at 80 (citing Ex. 1003 ¶ 198).

Although Patent Owner argues that Petitioner’s declarant’s testimony does not offer “evidence from Kim to correlate any portion of their calculated resolution plot to the lens’ relative illumination or MTF” (Prelim. Resp. 21), we have un rebutted testimony on this record that one of ordinary skill in the art would have found it obvious to “intentionally utilize the areas or zones of increased and decreased magnification, depending on the relevant use case” and that comparing Kim’s resolution curve with Figure 7 of the '120 patent shows they would “have the same impact on relative illumination.” Ex. 1003 ¶¶ 197–198. Petitioner demonstrates sufficiently on this record, through its Zemax and other modeling, the existence of “zones” in the Kim apparatus. Pet. 76–80. Although support for the argument that these zones are “intentional” or related to a drop in relative illumination or MTF is not as well-developed, and concerns a portion of the claim that Petitioner contends is “intended use,” it is before us without counterpoint at this stage in the proceeding. The parties are urged to further develop these arguments at trial, in accordance with our Rules.

Patent Owner does not substantively dispute Petitioner’s arguments as to dependent claims 4, 5, and 7. Prelim. Resp. 20–21. We have reviewed Petitioner’s arguments and the cited evidence, and, on the present record, Petitioner shows sufficiently that Kim discloses the limitations of claims 4, 5, and 7. Accordingly, Petitioner shows a reasonable likelihood of prevailing on its argument that claims 1, 4, 5, and 7 would have been anticipated by or obvious in view of Kim.

E. Word Count

Patent Owner argues that Petitioner violated the word count limit under 37 C.F.R. § 42.24(a)(1) because Petitioner used improper formatting to obtain its certified word count. Prelim. Resp. 22–23. Patent Owner estimates that “the Petition’s word count is nearly 550 words over the limit, at least.” *Id.* at 22.

Our Rules require “normal spacing” be used in documents created for a proceeding. *See* 37 C.F.R. § 42.6(a)(2)(ii). Our Consolidated Trial Practice Guide (November 2019)⁷ (“CTPG”), provides that if “a party feels that it would suffer undue prejudice from an opposing party’s alleged word count limit violation or abuse, that party should raise the issue with the Board promptly after discovering the issue.” CTPG 40. If Patent Owner had done so, and if we agreed with Patent Owner, we could have fashioned an appropriate remedy, such as allowing 550 additional words for Patent Owner’s Preliminary Response or not considering a portion of the Petition. Thus, at this point, we find that this issue need not be further addressed.

III. CONCLUSION

For the reasons set forth above, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one challenged claim of the ’120 patent, and we institute *inter partes* review on all challenges raised in the Petition.

At this preliminary stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or any factual or legal issue underlying the patentability inquiry. Any final determination

⁷ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

will be based on the record developed during trial. We place Patent Owner on express notice that any argument not asserted in a timely-filed Response to the Petition, or in another manner permitted during trial, shall be deemed waived, even if that argument was presented in the Preliminary Response.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that *inter partes* review is instituted on each of the grounds asserted in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which shall commence on the entry date of this decision.

IPR2023-00472
Patent 10,795,120 B2

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