

PUBLIC VERSION

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CIRRUS LOGIC, INC.;
OMNIVISION TECHNOLOGIES, INC.; and
TEXAS INSTRUMENTS INCORPORATED,
Petitioner,

v.

GREENTHREAD, LLC,
Patent Owner.

IPR2024-00017¹
Patent 8,421,195 B2

Before KRISTEN L. DROESCH, GRACE KARAFFA OBERMANN,
and MONICA S. ULLAGADDI, *Administrative Patent Judges*.

OBERMANN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)
Denying Petitioner's Motion to Exclude
37 C.F.R. § 42.64(c)

¹ Texas Instruments Inc., which filed a petition in IPR2024-00771, has been joined as a party to this proceeding.

I. INTRODUCTION

A. *Background and Summary*

Cirrus Logic, Inc., OmniVision Technologies, Inc. and Texas Instruments Inc. (collectively, “Petitioner”)² challenge claims 1–6 of U.S. Patent No. 8,421,195 B2 (Ex. 1001 (“the ’195 patent”)) in this *inter partes* review proceeding. Paper 1 (“Pet.”). Greenthread, LLC (“Patent Owner”) opposes the challenges. We refer in this Final Written Decision to the Board’s Institution Decision (Paper 30, “Inst. Dec.”).³

The Board heard arguments on January 31, 2025. Paper 75 (“Tr.”). As explained in more detail below, after hearing arguments, the time for filing this Final Written Decision was extended for good cause by six months, allowing the Board to order discovery and briefing, and conduct a hearing, on a privity issue. Papers 77, 79. For reasons set forth below, we determine that Petitioner is not in privity with a time-barred entity.

Taking account of the information set forth in the Petition, Patent Owner’s Response to the Petition (Paper 45, “PO Resp.”), Petitioner’s Reply (Paper 54, “Pet. Reply”), and Patent Owner’s Sur-reply (Paper 59, “Sur-reply”), we determine that claims 1–6 of the ’195 patent are unpatentable.

² On October 18, 2023, Cirrus Logic, Inc., OmniVision Technologies, Inc., and ams Sensors USA, Inc. filed a Petition for *inter partes* review (Paper 1 (“Pet.”)). Thereafter, ams Sensors USA, Inc. merged into ams-OSRAM USA Inc. Paper 24 (Petitioner’s Updated Mandatory Notices). On April 18, 2024, the Board issued an Order (Paper 28) granting the parties’ Joint Motion to Terminate the Proceedings as to ams-OSRAM USA Inc. (Paper 26). On October 11, 2024, the Board joined Texas Instruments Inc. as a Petitioner. Paper 52.

³ We cite to the sealed versions of confidential papers and exhibits.

B. Real Parties-in-Interest

Petitioner identifies itself (the two parties identified in the caption) and OSRAM GmbH, Heptagon Holding CA Inc., ams-OSRAM USA Inc., ams-OSRAM AG, and GlobalFoundries, U.S., Inc., as the real parties-in-interest. Pet. 1; Paper 24, 1 (Updated Mandatory Notices); *supra* n.2 (discussing order terminating ams-OSRAM USA Inc). Texas Instruments Inc. was joined as a Petitioner in this proceeding and is also a real party-in-interest. *See supra* n.1.

In a transcript of a telephonic hearing concerning privity, the parties confirmed that the undisputed real parties in interest are Cirrus Logic, OmniVision, Texas Instruments, and GlobalFoundries for Petitioner. Ex. 1076, 10:9–11:8. Petitioner’s counsel further confirmed that ams-OSRAM USA Inc., Heptagon Holding CA Inc., ams Sensors USA, Inc. had all been terminated. *Id.* at 10:20–11:3.

Patent Owner identifies itself as the real party-in-interest. Paper 5, 1.

C. Related Matters

The parties identify several proceedings involving the ’195 patent as related matters, including *Greenthread, LLC v. Cirrus Logic, Inc.*, 1:23-cv-00369 (W.D. Tex.); *Greenthread, LLC v. OmniVision Technologies, Inc.*, No. 2:23-cv-00212 (E.D. Tex.); *Greenthread, LLC v. OSRAM GmbH*, No. 2:23-cv-00179 (E.D. Tex.); *Greenthread, LLC v. Texas Instruments Inc.*, No. 2:23-cv-00157 (E.D. Tex.); *Greenthread, LLC v. Monolithic Power Systems, Inc.*, No. 1:23-cv-00579 (D. Del.). Pet. 1–2; Paper 5, 1–2.

In addition, two related co-pending *inter partes* reviews, namely, IPR2024-00018 and IPR2024-00021 were heard together with this proceeding in a consolidated hearing (Tr. 1 (heading)). Additional related

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co-pending *inter partes* reviews; namely, IPR2024-00001, IPR2024-00016, IPR2024-00019, and IPR2024-00020, were heard together in a consolidated hearing held on January 28, 2025. *See* IPR2024-00001, Paper 76 (consolidated hearing transcript).

D. The '195 Patent

The '195 patent, titled “Semiconductor Devices with Graded Dopant Regions,” issued on April 16, 2013. Ex. 1001, codes (45), (54). The '195 patent “relates to all semiconductor devices and systems.” *Id.* at 1:13–14. The challenged claims are directed to a complementary metal-oxide-semiconductor (“CMOS”) device, a type of metal-oxide-semiconductor field-effect transistor (“MOSFET”) that uses complementary and symmetrical pairs of p-type and n-type MOSFETs. Pet. 1; Ex. 1003 ¶ 38.

Bipolar junction transistors employ minority carriers as the principle conduction mechanism. *Id.* at 1:23–24. According to the '195 patent, in bipolar junction transistors, “[e]fforts have been made in graded base transistors to create an ‘aiding drift field’, to enhance the diffusing minority carrier’s speed from emitter to collector” versus the standard “uniformly doped base.” *Id.* at 1:32–51. This improvement has not been implemented in “most semiconductor devices, including various power MOSFETs [and] IGBT’s” (that is, insulated gate bipolar transistors), which “still use a uniformly doped drift epitaxial region in the base.” *Id.* at 1:36–40.

The invention of the '195 patent implements graded dopant concentration in these devices, which causes “[t]wo important performance enhancements.” *Id.* at 2:49–3:9. These include sweeping electrons “from source to drain rapidly” and simultaneously causing holes to “be recombined

closer to the n⁺ buffer layer,” which “can improve t(on) and t(off) in the same device.” *Id.* at 3:10–13.

E. Illustrative Claim

Of the challenged claims, claim 1 is independent and is reproduced below.

1. [pre] A CMOS Semiconductor device comprising:

[1.1] a surface layer;

[1.2] a substrate;

[1.3] an active region including a source and a drain, disposed on one surface of said surface layer;

[1.4] a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate,

[1.5] said drift layer further having a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate; and

[1.6] at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

Ex. 1001, 4:13–29 (bracketed designations added by Petitioner).

F. Asserted Unpatentability Challenges

Petitioner asserts the following grounds of unpatentability.

Claims Challenged	35 U.S.C. § ⁴	Reference(s)/Basis
1, 2, 4–6	103	Payne ⁵
1–6	102	Onoda ⁶
1–6	103	Onoda, Wolf ⁷
2, 3	103	Payne, Wolf
3	103	Payne, Parrillo ⁸

Pet. 6. Petitioner relies on two declarations from Sanjay Banerjee, Ph.D. Ex. 1003 (original declaration); Ex. 1060 (supplemental declaration). Patent Owner relies on a declaration from Alexander D. Glew, Ph.D. Ex. 2057.

II. ANALYSIS

A. Legal Standards

Petitioner bears “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). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

To establish anticipation under 35 U.S.C. § 102, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d

⁴ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. § 102 and § 103, effective March 16, 2013. Because applications from which the ’195 patent claims priority were filed before this date, we apply the pre-AIA version of § 102 and § 103.

Neither party indicates the result would change applying the AIA versions.

⁵ US 4,684,971, issued Aug. 4, 1987 (Ex. 1005).

⁶ Japanese Unexamined Patent Application Publication No. H8-279598, published Oct. 22, 1996 (Ex. 1043). A certified translation, to which we cite, is provided. Ex. 1042.

⁷ STANLEY WOLF & RICHARD N. TAUBER, SILICON PROCESSING FOR THE VLSI ERA, Vols. 1–4 (Lattice Press 2000) (Ex. 1008).

⁸ US 4,435,896, issued Mar. 13, 1984 (Ex. 1025).

1359, 1369 (Fed. Cir. 2008). 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). The dispositive question is whether one skilled in the art would have reasonably understood or inferred from a prior art reference that every claim element is disclosed in that reference. *Eli Lilly & Co. v. L.A. Biomedical Research Inst.*, 849 F.3d 1073, 1074–1075 (Fed. Cir. 2017).

A claim is unpatentable under 35 U.S.C. § 103, by contrast, if “the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” 35 U.S.C. § 103. The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when present, objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

To demonstrate obviousness, it is not enough to merely show that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). “Rather, obviousness requires the additional showing that a person of ordinary skill at the time of the invention would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.* (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007)).

“This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.” *KSR*, 550 U.S. at 418–19. On the other hand, an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *Id.* at 418; accord *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1259 (Fed. Cir. 2007). Nevertheless, “[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, 550 U.S. at 421.

B. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 1324 (Fed. Cir. 1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)). In assessing the level of ordinary skill in the art, we may consider various factors, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995).

Petitioner argues that a person of ordinary skill in the art “would have had a Bachelor’s degree in electrical engineering, material science, applied physics, or a related field, and four years of experience in semiconductor design and manufacturing or equivalent work experience.” Pet. 6–7 (citing

Ex. 1003 ¶¶ 55–58). According to Petitioner, “[a]dditional education might compensate for a deficiency in experience, and vice-versa.” *Id.* at 7.

Patent Owner counterargues that a person of ordinary skill in the art would have had “at least a Bachelor’s of Science degree in electrical or computer engineering, materials science, chemical engineering, applied physics, or a related field, with emphasis on semiconductor manufacturing, or an equivalent degree, and at least four years of experience in semiconductor design and manufacturing.” PO Resp. 5–6 (citing Ex. 2057 ¶¶ 17–18). According to Patent Owner, “[a]dditional education in a relevant field or industry experience may compensate for a deficit in one of the other aspects of the requirements stated above.” *Id.* at 6.

Upon review of the parties’ arguments and the prior art of record, we adopt Petitioner’s definition of the person of ordinary skill in the art as it is consistent with the disclosures of the ’195 patent and the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (holding that the prior art itself can reflect the appropriate level of ordinary skill in the art). Neither party asserts, however, that the outcome of this proceeding would differ based on the minor differences between the two parties’ definitions of an ordinarily skilled artisan. Nor does either party question whether the opposing party’s declarant is a person of ordinary skill in the art under either proposed definition.

C. Claim Construction

In an *inter partes* review proceeding, a patent claim is construed “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under that standard, the words of a claim are generally given

their “ordinary and customary meaning,” which is the meaning the term would have had to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). Under this standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

The parties are in agreement that express claim construction is not necessary in order to resolve the issues presented in the Petition. Pet. 8; PO Resp. 6. We concur with the parties that no claim terms require express construction for purposes of this Decision. *See 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)).

Nevertheless, Patent Owner asks that we “clarify” that “the plain and ordinary meaning of ‘aid the movement of minority carriers’ requires that a carrier move in the specified direction.” PO Resp. 6–7. Patent Owner asserts that this claim phrase cannot be met “in situations where there is no carrier movement—an absurd result.” *Id.* at 6. We address these issues, as well as a new issue raised by Patent Owner during the final hearing involving the meaning of the phrase “minority carriers,” in our analysis of the merits of the grounds.

D. Timeliness of the Petition Under 35 U.S.C. § 315(b)

Pursuant to 35 U.S.C. § 315(b), “[a]n inter partes review may not be instituted if the petition requesting the proceeding is filed more than 1 year after the date on which the petitioner, real party in interest, or privy of the petitioner is served with a complaint alleging infringement of the patent.”

During the pre-institution phase of this proceeding, Patent Owner argued that the Petition should be dismissed because it is untimely. Paper 16 (“Prelim. Resp.”) 2. In particular, Patent Owner argued that Petitioner is in privity with [REDACTED]⁹, Intel Corp. (“Intel”), and [REDACTED] (collectively “Licensees”), who Patent Owner asserts are time-barred under Section 315(b) and licensed under the ’502 patent. Prelim. Resp. 2–3.

⁹ During the pre-institution phase of this proceeding, Patent Owner asserted a privity relationship between Petitioner and [REDACTED] but identified no evidence sufficient to support a finding that Petitioner provided a product that was accused of infringement in the [REDACTED] litigation. *See* Paper 16 at 2–3 (Preliminary Response, identifying the [REDACTED] litigation), 5–8, 10, 16–18, 27 & n.7, 33 (declining to identify any product provided by Petitioner that was accused in the [REDACTED] litigation). During the trial phase of this proceeding, by contrast, Patent Owner expressly limited its privity assertions to Petitioner’s alleged relationships with Intel and “both [REDACTED] and [REDACTED] two other time-barred parties,” effectively waiving any argument that Petitioner is time barred based on a privity relationship with [REDACTED] Paper 94 at 2 n.3. In view of that waiver, we do not address any alleged privity relationship with [REDACTED] Alternatively, because Patent Owner produced no evidence at any time during this proceeding sufficient to establish that Petitioner had an opportunity to control the [REDACTED] litigation or is acting as a proxy for [REDACTED] in this proceeding, we find that Petitioner was not in privity with [REDACTED] during the [REDACTED] litigation and no time bar arises on that basis under Section 315(b). *See ibid.*

Patent Owner advanced several theories supporting its privity arguments, including that Petitioner serves as an “agent” of Licensees by exercising their “have made” rights under the license, that Petitioner and Licensees “become ‘preceding and succeeding owners of’ licensed (or infringing) products,” and “Petitioners apparently indemnify the time-barred parties” for custom-made products. *Id.* at 3. Based on these theories, Patent Owner argued that “Petitioners have a ‘pre-existing substantive legal relationship’ with Licensees giving rise to privity.” *Id.* (citing *Applications in Internet Time, LLC v. RPX Corp.*, 897 F.3d 1336, 1360 (Fed. Cir. 2018)).

In our Institution Decision, we determined that Patent Owner had not provided a sufficient factual basis upon which to question Petitioner’s representation that it is not time-barred, or that Petitioner and [REDACTED] Intel, or [REDACTED] were, in fact, privies, based on any of its theories regarding privity. Inst. Dec. 10–23. We incorporate that analysis here, and reconsider Patent Owner’s contentions to the extent warranted by subsequent, post-hearing argument and evidence. *See Achates Reference Publ’g. Inc. v. Apple Inc.*, 803 F.3d 652, 658 (Fed. Cir. 2015) (“The Board’s reconsideration of the time-bar [in the final determination] is ‘still fair[ly] characterize[ed] as part of the decision to institute.’”) (citations omitted).

Subsequent to the Institution Decision, Patent Owner asserts that (1) control of prior litigation is not required to establish privity (PO Resp. 39–43); (2) even though Petitioner bears the burden to show that the Petition was timely—namely, that Petitioner is not in privity with [REDACTED] Intel, or [REDACTED]—Petitioner has not attempted to carry its burden (*id.* at 43–48); (3) evidence of record shows that the petition is time-barred (*id.* at 48–58); and (4) a finding in Petitioner’s favor would violate Patent Owner’s

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constitutional right to due process (*id.* at 58–61). We address these arguments below.

Patent Owner’s argument (4) regarding violation of its constitutional right to due process is based on denial of its opportunity to show that Petitioner’s assertions as to its relationships with Licensees is inapposite. PO Resp. 60–61 (citing *Goldberg v. Kelly*, 397 U.S. 254, 269 (1970); *Greene v. McElroy*, 360 U.S. 474, 496 (1959); Paper 18, 11). Since Patent Owner’s Response, we have allowed and ordered additional discovery concerning privity for the reason discussed below.

On April 22, 2025, the Board entered Final Written Decisions in related proceedings. IPR2024-00001, Paper 78; IPR2024-00016, Paper 74. On July 23, 2025, Patent Owner’s Request for Director Review in those proceedings was granted, and the Final Written Decisions were vacated and remanded to the Board for further proceedings. IPR2024-00016, Paper 85; IPR2024-00001, Paper 89 (Director Review Order or Dir. Rev. Order).

The Director Review Order remands “to the Board with instructions to allow discovery, narrowly tailored to [a] privity issue” relating to an alleged relationship between Petitioner and a non-party, Intel, “as the Board already has authorized in” a number of related cases. Dir. Rev. Order 3. In particular, the Director Review Order states that

[t]he Board should then determine on the full record whether Petitioner has met its burden of demonstrating it is not time-barred under § 315(b); that is, whether Patent Owner has produced some evidence to support its argument that Intel should be named as a privy so as to have put the issue into dispute.

Id. (citing *Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237, 1242–44 (Fed. Cir. 2018)). As the same privity issue arises in the present proceeding, we follow the guidance of the Director Review Order here as well.

When we asked Patent Owner what discovery it sought to substantiate its privity theory, Patent Owner stated that “no additional discovery is needed.” Ex. 3011, 1. Accordingly, in this proceeding (as well as in IPR2024-00018, IPR2024-00019, IPR2024-00020, and IPR2024-00021), we *sua sponte* issued a Corrected Discovery Order (Paper 87, Disc. Order), “narrowly tailored,” consistent with the Director Review Order, ordering Petitioner to provide the following discovery to Patent Owner:

- (a) . . . documents [including]:
 - i. [s]ales agreements between Petitioner and Intel for the Intel Accused Products;¹⁰ and
 - ii. [i]ndemnification agreements between Petitioner and Intel for the Intel Accused Products. *See* IPR2023-01242, Paper 94, 3.
- (b) Documents sufficient to show the asserted privity relationship between Petitioner and Intel, including any new declaration(s) that establish that no documents responsive to Subsection (a) above exist, as well as any documents and new declaration(s) that establish (1) the time by which Petitioner became aware of the Intel litigation referenced in the [Director Review Order]; (2) whether Petitioner was the supplier of any product, or component of a product, accused of infringement in the Intel litigation; and (3) whether Petitioner was in a position to control, or actually controlled, Intel’s defense of that litigation.

Disc. Order 2–3.

In response to our Discovery Order, Petitioner produced and Patent Owner filed the Declarations of Terence Ng (Ex. 2080), Elizabeth Leach (Ex. 2081), and Robert Cleary, Jr. (Ex. 2082). Patent Owner cross-examined these witnesses and filed deposition transcripts for each respective declarant

¹⁰ The “products accused” consist of “the ‘Intel Accused Products’” identified on pages 4–8 Exhibit 2021, namely, the Intel “products accused of practicing the challenged claims” in Patent Owner’s prior litigation.

(Exs. 2083, 2084, 2085).¹¹ Patent Owner subsequently filed a Patent Owner's Post-Hearing Brief Concerning Board-Ordered Discovery (PO Privity Resp., Paper 94), Petitioner filed Petitioner's Response to Post-Hearing Brief (Pet. Privity Reply, Paper 98), and Patent Owner filed Patent Owner's Reply Post-Hearing Brief Concerning Board-Ordered Discovery (PO Privity Sur-Reply, Paper 100).

We conducted a telephonic hearing on September 19, 2025 (Privity Tr., Ex. 1076). Having considered the evidence of record, we determine that Petitioner is not in privity with Intel, and the Petition is not time-barred under Section 315(b).

The briefs comingle analyses of the issues of real party in interest (RPI) and privity, and often use the terms interchangeably. *See, e.g.*, PO Privity Resp. 2; PO Privity Sur-Reply 2. The two terms, however, describe distinct concepts with differing effects under the statute. *See, e.g.*, 35 U.S.C. § 312(a)(2) (petition must identify all RPIs, but not privies). Prior to analyzing the parties' arguments, we summarize the concept of privity below.

1. Statutory Bar as Nonparty Preclusion

The one-year statutory bar of Section 315(b) "helps to ensure that *inter partes* review provides a quick and cost effective alternative to litigation, and is not used as a tool for harassment or litigation gamesmanship." *Johnson Health Tech. Co. v. Icon Health & Fitness, Inc.*, Case IPR2014-01242, Paper 16 at 3 (PTAB Feb. 11, 2015) (citing H.R.

¹¹ The record includes two of each of Exhibits 2083, 2084, and 2085, a public version and a sealed version. We cite to the *sealed* version of each of these exhibits. *See supra* n.3.

REP. NO. 112-98 at 48, *as reprinted in* 2011 U.S.C.C.A.N. at 78). In this sense, Section 315(b) is analogous to the common-law doctrines of claim preclusion and issue preclusion, which “preclude parties from contesting matters that they have had a full and fair opportunity to litigate,” thereby “protect[ing] their adversaries from the expense and vexation attending multiple lawsuits, conserv[ing] judicial resources, and foster[ing] reliance on judicial action by minimizing the possibility of inconsistent decisions.” *Montana v. United States*, 440 U.S. 147, 153–54 (1979). Our Practice Guide, therefore, looks to these doctrines of preclusion in interpreting the language of Section 315(b). *See* CTPG 12–17.

Like the common-law preclusion doctrines, the preclusive effect of Section 315(b) also extends beyond those who were parties to the prior lawsuit. Because nonparty preclusion risks binding those who have not had a full and fair opportunity to litigate, the Supreme Court has cautioned that there is a general rule against nonparty preclusion, subject only to limited exceptions. *See Taylor v. Sturgell*, 553 U.S. 880, 892–93 (2008). In *Taylor*, while noting that it was not a “definitive taxonomy” (*id.* at 893 n.6), the Court set forth a list of six “categories” under which nonparty preclusion may apply.¹²

(1) “[A] person who *agrees to be bound* by the determination of issues in an action between others is bound in accordance with the terms of his agreement.” *Id.* at 893.

(2) “[N]onparty preclusion may be justified based on a variety of *pre-existing substantive legal relationships* between the person to be bound and a party to the judgment,” such as “preceding and succeeding owners of property, bailee and bailor, and

¹² For clarity, we omit internal quotation marks and citations throughout the list of categories enumerated in *Taylor*, add emphasis on certain key phrases, and generally cleaned up the quotations.

assignee and assignor.” *Id.* at 894.

(3) “[I]n certain limited circumstances,” such as class actions, “a nonparty may be bound by a judgment because she was *adequately represented* by someone with the same interests who was a party to the suit.” *Id.* The Court later elaborated that this exception applies only if there are “special procedures to protect the nonparties’ interests, or an understanding by the concerned parties that the first suit was brought in a representative capacity.” *Id.* at 900.

(4) “[A] nonparty is bound by a judgment if she *assumed control* over the litigation,” because that person “has had the opportunity to present proofs and argument . . . even though he was not a formal party to the litigation.” *Id.* at 895.

(5) “[A] party bound by a judgment may not avoid its preclusive force by *relitigating through a proxy*,” such as “when a nonparty later brings suit as an agent for a party who is bound by a judgment.” *Id.*

(6) “[A] *special statutory scheme*,” such as bankruptcy or probate, “may expressly foreclose successive litigation by nonlitigants . . . if the scheme is otherwise consistent with due process.” *Id.*

Having listed these categories, the Court then held that a broader doctrine of nonparty preclusion, termed “virtual representation,” was inconsistent with Federal common law, and risked violating due process. *Id.* at 898–900.

Therefore, nonparty preclusion cannot be based on mere “identity of interests and some kind of relationship between parties and nonparties.” *Id.* at 901.

2. *Caselaw on Privity*

“[T]he mere existence of some relationship between a petitioner and another entity is not sufficient” to place that petitioner in privity with that entity. *Google LLC v. DDC Technology, LLC*, IPR2023-00707, Paper 27 at 37 (PTAB Oct. 25, 2023). Instead, “that relationship must be related to [an

earlier] lawsuit and be sufficiently close that it can be fairly said *the petitioner had a full and fair opportunity to litigate the validity of the patent in that lawsuit.*” *Id.* (emphasis added). In other words, privity concerns “whether the petitioner and the prior litigant’s relationship—as it relates to the [earlier] lawsuit—is sufficiently close that it can be fairly said that the petitioner had a full and fair opportunity to litigate the validity of the patent in that lawsuit,” or “whether the petitioner is simply serving as a proxy to allow another party to litigate the patent validity question that the other party raised in an earlier filed litigation.” *WesternGeco LLC v. ION Geophysical Corp.*, 889 F.3d 1308, 1319 (Fed. Cir. 2018).

Though expansive, the concept of privity has boundaries set by due process. As the Court held in *Taylor*, extending the preclusive concept of privity to those in “virtual representation,” through identity of interest and a determination that the relationship of the parties is “‘close enough’ to bring the second litigant within the judgment,” is impermissible. *See Taylor*, 553 U.S. at 898. Only if the nonparty can be said to have had a “full and fair opportunity to litigate” can that nonparty be precluded as a privy. *Id.* at 892–93; *see Aspex Eyewear, Inc. v. Zenzi Optical, Inc.*, 713 F.3d 1377, 1382 (Fed. Cir. 2013) (“A full and fair opportunity to litigate is the touchstone of any preclusion analysis.”).

Courts examine different aspects of the parties’ relationship, depending on the issue for which privity is being asserted. *See Int’l Nutrition Co. v. Horphag Research, Ltd.*, 220 F.3d 1325, 1329 (Fed. Cir. 2000) (“A variety of relationships between two parties can give rise to the conclusion that a nonparty to an action is ‘in privity’ with a party to the action”). For example, the parties’ contractual relationship (privity of contract) regarding a product is relevant when determining whether an injunction against the

sale of that product applies. *See In re Cyclobenzaprine Hydrochlorine Extended-Release Capsule Patent Litigation*, 504 F. App'x 900, 906 (Fed. Cir. 2013) (unpublished). In other situations—for example, in the case of a judgment with respect to a particular property interest—the relationship between the parties with respect to the transfer of the property may be the focus. *See Int'l Nutrition*, 220 F.3d at 1329. Therefore, the same two parties may be in privity for certain purposes, but not for others. *Id.*

In the context of Section 315(b), the goal of the preclusion is to prevent successive challenges to a patent by those who previously have had the opportunity to make such challenges in prior litigation. As such, the focus of our privity inquiry is on the relationship between the parties *during the prior lawsuit*. In other words, we ask whether the instant petitioner and the prior litigant's relationship—as it relates to the lawsuit—is sufficiently close that it can be fairly said that the petitioner has had a full and fair opportunity to litigate the validity of the patent in the lawsuit.

In this sense, our privity inquiry will typically fall into *Taylor*'s fourth category of nonparty preclusion, which applies to situations in which the petitioner “has had the opportunity to present proofs and argument” such that it can be said to have “assumed control” over the action. *Taylor*, 553 U.S. at 895. Our Practice Guide reflects this, noting that control is a “common consideration” in the privity inquiry. CTPG 16.

Furthermore, we note that *actual* assumption of control of the lawsuit is not necessary for a finding of privity; the opportunity, or legal right, to assume control is sufficient. “Substantial control . . . connotes the availability of a significant degree of effective control in the prosecution or defense of the case—what one might term, in the vernacular, the power—whether exercised or not—to call the shots.” *Gonzalez v. Banco Central*

Corp., 27 F.3d 751, 758 (1st Cir. 1994); *see Arris Group, Inc. v. C-Cation Techs., LLC*, Case IPR2014-00746, slip op. at 10 (PTAB Nov. 24, 2014) (Paper 22) (inquiring into whether party exercised, or could have exercised, control over District Court action); *see also* Practice Guide, 77 Fed. Reg. at 48,759 (quoting 18A Charles Alan Wright, Arthur R. Miller & Edward H. Cooper, Federal Practice & Procedure § 4451 (2d ed. 2011)) (“[C]ontrol generally means that ‘it should be enough that the nonparty has the actual measure of control or *opportunity to control* that might reasonably be expected between two formal coparties.’”) (emphasis added).

Finally, privity is based on “flexible and equitable considerations,” and, therefore, neither the Practice Guide nor our decisions set any bright-line test for when privity exists. CTPG 14. Nor should the preceding discussion be understood to mandate that all Section 315(b) privity relationships must fall within the fourth “assumed control” category set forth in *Taylor*. Common to our cases, however, is a focus on the relationship between the parties in the context of the prior lawsuit, and an inquiry as to whether the petitioner’s relationship with the prior litigant was sufficiently close that it can be said that the petitioner had, or will have, a full and fair opportunity to litigate the validity of the patent in that prior action.

If we are satisfied that petitioner has “enjoyed its day in court” through its relationship with the litigant, it is fair to consider the parties to be privies. In *Taylor*, the Court held that

a party bound by a judgment may not avoid its preclusive force by relitigating through a proxy. Preclusion is thus in order when a person who did not participate in a litigation later brings suit as the designated representative of a person who was a party to the prior adjudication . . . [I]t also seems clear that preclusion is appropriate when a nonparty later brings suit as an agent for a party who is bound by a judgment.

3. *Petitioner's Arguments*

Petitioner contends that it “is not in privity with Intel, and the IPR petition is not time-barred.” Pet. Privity Reply 1. According to Petitioner, it “does not have any sales or indemnification agreements with Intel or indemnity obligations to Intel for the IAPs.” *Id.* Petitioner further contends that, “Intel neither sought indemnity from Petitioner nor contacted any Petitioner regarding *Greenthread, LLC v. Intel Corp.*, 6:22-cv-105 (W.D. Tex.) (‘Intel Litigation’).” *Id.* Petitioner also contends that “[n]o Petitioner either controlled or was in a position to control Intel’s defense” at least because “Petitioner was not even aware of the Intel Litigation until PO filed complaints against CL and OV.”¹³ *Id.* With respect to each of GlobalFoundries, Cirrus Logic, and OmniVision, Petitioner presents specific reasons why these companies could not have produced the IAPs or components thereof, which we address in detail in Section II.D.5 *infra*.

4. *Patent Owner's Arguments*

Patent Owner argues that it “has presented far more than ‘some evidence’ that time-barred parties, including Intel, should have been named as RPIs.” PO Privity Resp. 2. Patent Owner also argues that it “maintains that Petitioners are in privity with both [REDACTED], two other time-barred parties,” and “that discovery should have been granted as to these parties for at least the reasons presented in the Joint Paper Concerning Additional Discovery in the Wave 1 (*onsemi*) IPRs.” *Id.* at 2–3 n.3 (citing IPR2023-01242, Paper 108 at 2–5).

¹³ The parties use the following abbreviations: CL for Cirrus Logic, OV for OmniVision, and GF for Global Foundries.

With respect to *Cirrus Logic*, Patent Owner argues that it “is a fabless semiconductor company that sells component parts to Intel through distributors” and that its “declarant [Elizabeth Leach] confirmed that its Standard T&Cs, which indemnify its customers for infringement claims (EX2026), apply to *all* customers, including Intel.” *Id.* at 1–2 (citing Ex. 2084, 17:14–20, 26:12–13, 55:10–16, 63:6–15).

With respect to *OmniVision*, Patent Owner argues that it “has historically supplied ‘a variety of [OV] products, primarily image sensors,’ to Intel” and that its “[REDACTED],” and that he has historically ‘fielded [] indemnity requests’ on behalf of OV.” *Id.* at 3 (alterations in original) (citing Ex. 2085, 25:2–9, 27:19–21, 39:12–17, 47:7–16; Ex. 2015 (Intel data sheet listing OV image sensors)).

With respect to *Global Foundries*, Patent Owner similarly argues “GF is a ‘custom manufacturer’ touting Intel as one of its customers” and that “[REDACTED]” *Id.* (citing Ex. 2014, 19; Ex. 2083, 19:6–8, 18:10–12, 37:5–11, 37:22–38:3 (Intel purchase orders), 38:8–22 (Intel manufacturing agreements); Ex. 2033).

Based on those allegations, Patent Owner takes issue with Petitioner’s declarations as “merely repeat[ing] its previously-offered attorney argument without providing any additional detail, documentation, or substantiation.” PO Privity Resp. 4–5; *see id.* at 5–6. Patent Owner contends that “[t]hese declarants did not contact anybody within their companies (save for one *uncorroborated* assertion from Cleary) or, more importantly, at Intel to

discuss whether any Intel parts (accused or otherwise) include any of Petitioners' components." *Id.* at 7; *see id.* at 7–10.

Patent Owner contends, *instead*, that “[a]ll these declarants ‘confirmed’ was that Petitioners do not sell the Intel Accused Products (IAPs) to Intel, something that PO has never alleged.” *Id.* at 7. Patent Owner takes the position that “[n]one of the Petitioners have established whether or not they were the ‘supplier of any . . . **component** of a product[] accused in the Intel litigation,’ as required by the Board.” *Id.* at 8 (citing Disc. Order 6). Patent Owner further contends that Petitioner’s Declarants did not consult with the parties or people who would possess relevant information and that Petitioner failed to present any documentary evidence supporting their Declarants’ statements. PO Privity Resp. 10–15.

5. *Analysis of the Parties’ Arguments*

Our analysis below concerns whether Petitioner is in privity with Intel. *See* Dir. Rev. Order 3; Privity Tr. 13:4–14:17 (Petitioner’s counsel asserting that privity, not RPI, is in dispute in the present proceeding). *Worlds* is a seminal case that addresses burdens on the parties when Section 315 is at issue. In *Worlds*, the Court held that “an IPR petitioner’s initial identification of the real parties in interest should be accepted unless and until disputed by a patent owner.” *Worlds*, 903 F.3d at 1242. The Court also “agree[d] that a patent owner must produce *some evidence* to support its argument that a particular third party should be named a real party in interest.” *Id.* “There can be no doubt that the IPR petitioner bears the ultimate burden of persuasion to show that its petitions are not time-barred under Section 315(b) based on a complaint served on an alleged real party in interest more than a year earlier.” *Id.* Although *Worlds* addressed RPI, it

more broadly discussed Section 315 in general, which covers both RPI and privity.

In the present proceeding, Patent Owner did not produce “some evidence” tending to show that Petitioner is in privity with Intel, and the burden never shifted to Petitioner. Even if Patent Owner did produce sufficient evidence to put the relationship between Petitioner and Intel into dispute, the evidence adduced during trial sufficiently supports Petitioner’s position and, in particular, satisfies Petitioner’s burden to show it is not time-barred under Section 315(b).

The evidence adduced during trial does not support a finding that the relationship between Petitioner and Intel is sufficiently close that both should be bound by the trial outcome and related estoppels, nor does it suggest, without more, that the parties were litigating either the district court action or the IPRs as proxies for one another. In a nutshell, the record is devoid of evidence tending to show that Petitioner controlled, or had an opportunity to control, the litigation. To the contrary, as explained below, the only record evidence on point supports Petitioner’s position that it did not control, or have any opportunity to control, the litigation.

Petitioner contends that “[n]o Petitioner either controlled or was in a position to control Intel’s defense,” at least because “each Petitioner was not even aware of the Intel Litigation until PO filed complaints against CL and OV.” Pet. Privity Reply 1. According to Petitioner’s Declarant Terrence Ng, GlobalFoundries “became aware of the Greenthread Intel Litigation only around June 2023” and “was not aware of the Greenthread Intel Litigation before that.” Ex. 2080 ¶ 11. Declarant Elizabeth Leach testifies that “Cirrus Logic did not become aware of any litigation involving Greenthread . . . and Intel until after Cirrus Logic itself was sued by Greenthread on March 31,

2023.” Ex. 2081 ¶ 8. Likewise, Declarant Robert Cleary, Jr. testifies that, with the filing of Greenthread’s infringement complaint in the Eastern District of Texas, “OmniVision first became aware of the complaint on the next day, May 11, 2023” and “first became aware of the Greenthread Intel Litigation and the Intel IPR proceedings on May 15, 2023.” Ex. 2082 ¶ 10.

In light of the assertions of lack of *actual* participation in and control of, or opportunity to control, the Intel litigation by Petitioner, and the lack of evidence as to whether Intel controlled or had an opportunity to control Petitioner’s decisions in the Petitioner-initiated IPRs¹⁴, we next consider Petitioner’s and Intel’s relationship, as it relates to the Intel litigation. We consider whether that relationship is sufficiently close such that the Intel litigation would have given Petitioner a full and fair opportunity to litigate the validity of the challenged claims of the ’195 patent or whether Petitioner is “simply serving as a proxy to allow” Intel “to litigate the patent validity question that” Intel “raised in an earlier filed litigation.” *See WesternGeco*, 889 F.3d at 1319, 1320 (“[T]he privity analysis is broader than simply inquiring whether PGS controlled or had an opportunity to control ION’s decisions in the ION patent infringement litigation, or whether ION controlled or had an opportunity to control PGS’s decisions in the PGS-initiated IPRs.”).

In response to the Board’s Discovery Order, Petitioner produced evidence, none of which supports Patent Owner’s argument that Intel should be named as a privy. *See Dir. Rev. Order 3*. It is worth emphasizing here that, contrary to Patent Owner’s position (*see, e.g., PO Privity Resp. 2*), the

¹⁴ Patent Owner does not argue that Intel is an RPI to the present proceeding and there is no evidence in the record for this.

Director did not indicate that Patent Owner had met its burden of production under the *Worlds* decision. To the contrary, the Director ordered the Board to allow discovery to determine, on the full record, “whether Patent Owner has produced some evidence to support its argument that Intel should be named as a party *so as to have put the issue into dispute*.” Dir. Rev. Order 3 (emphasis added) (citing *Worlds*, 903 F.3d at 1242–44).

We are not persuaded that Petitioner is in privity with Intel because the evidence of record supports the following findings: (1) “[n]o Petitioner has supplied any IAPs” (Pet. Privity Reply 3); (2) each of Petitioner’s Declarants “has stated under penalty of perjury and under oath that it has not supplied any components of the IAPs;” (*id.* at 6) (3) “[s]ince Petitioner has not supplied any IAPs or components thereof to Intel, there are no agreements pertaining to the IAPs, as confirmed by Petitioner’s investigations” (*id.* at 10); and (4) Petitioner did not have control over the Intel litigation it was “not even aware of the Intel Litigation until PO filed complaints against CL and OV” (*id.* at 1; *see id.* at 10–11).

Notwithstanding Patent Owner’s arguments, addressed below, we find persuasive Petitioner’s Declarants’ testimony. Specifically, with respect to *GlobalFoundries*, Declarant Ng has been in sales at GlobalFoundries U.S. Inc. since 2019, and “was promoted to Sales Director in 2022” which required him to “provid[e] customers commercial support and work[] with customers to bring future business to GF.” Ex. 2080 ¶ 4. In 2023, Declarant Ng’s “responsibilities included managing GF’s sales relationship with Intel.” *Id.* ¶ 5. We are persuaded Declarant Ng’s experience supports that he had sufficient knowledge to attest to his testimony that Global Foundries “has never manufactured or sold any Intel Accused Products to Intel, and . . . is

unaware of having supplied any components of the Intel Accused Products.”
Id. ¶ 8.

According to Petitioner, Declarant Ng “explained that GF lacks the process technology to manufacture Intel processors and flash memories enumerated in PO’s infringement contentions.” Pet. Privy Reply 4 (citing Ex. 2083, 15:12–15, 48:11–17). Petitioner contends that GlobalFoundries



Id. (citing Ex. 2083, 18:13–19:5, 24:8–14). Petitioner persuasively contends that “none of these products can be incorporated into an IAP because they are not designed to be components of a microprocessor or flash memory.” *Id.* at 8 (citing Ex. 2083, 16:1–3, 48:5–17). Petitioner also persuasively contends that Declarant Ng’s “testimony confirms that GF does not and cannot provide any components that are included in the IAPs” because “[t]he IAP processors are manufactured as one piece of silicon (e.g., a 300 mm wafer) which does not have any components from third parties.” *Id.* at 8. In support, Declarant Ng “testified that [the] ‘[p]rocessor is one piece. So, either you make it or you don’t, so there are no different parts of it.’” *Id.* (second alteration in original) (citing Ex. 2083, 16:1–3).

In view of the foregoing, it follows that GlobalFoundries “never entered into any sales agreements with Intel (or any other party) regarding the Intel Accused Products or entered into any indemnifications agreements with Intel (or with any other party) regarding the Intel Accused Products.”

Ex. 2080 ¶ 8. In support, Declarant Ng testified during deposition as follows:

Q. And the latter part of that sentence states: And GF is unaware of having supplied any components of Intel accused products. Do you see that?

A. Yes.

Q. What do you mean by “unaware”?

A. GF doesn't make or sell any of these components.

Q. And what do you mean when you're saying “any of these components”?

A. These processors or the NAND flash of accused product, I guess, yeah, uh-huh.

Ex. 2083, 13:8–19.

With respect to *Cirrus Logic*, Declarant Leach has “been employed by Cirrus Logic in various positions for more than 14 years,” has “held various sales roles during that period,” and is now “the Manager [of] Sales Administration for Cirrus Logic, Inc.” Ex. 2081 ¶ 2. We determine, on that basis, that she is qualified to know “Cirrus Logic’s product sales and customers, including whether any Cirrus Logic products have been sold to Intel Corporation.” *Id.* ¶ 3. We are persuaded her experience supports that she had sufficient knowledge to attest that “Cirrus Logic does not currently and has never sold any of the Intel Accused Products” and “has never sold any component of the Intel Accused Products to Intel.” *Id.* ¶ 6.

Declarant Leach persuasively testifies that Cirrus Logic has not provided to Intel

Pet.

Privity Reply 9 (citing IPR2024-00001, Paper 83, 3). To be clear, Patent Owner acknowledges this point in its Request for Director review of the

Board's Final Written Decision in IPR2024-00001, by arguing that Cirrus Logic "collaborates with Intel to manufacture audio chips that are *compatible with Intel's processors for use in laptops.*" IPR2024-00001, Paper 83, 3 (emphasis added). As such, it follows that Cirrus Logic "never signed, created, or received any sales agreements or indemnification agreements relating to the Intel Accused Products," that "Intel has never submitted to [Declarant Leach]" or "[her] team, an indemnification request regarding the Intel Accused Products," nor has ever "tendered any patent infringement indemnification request to Cirrus Logic regarding the Intel Accused Products," as confirmed by Cirrus Logic's legal team. Ex. 2081 ¶¶ 6, 7.

With respect to *OmniVision*, Declarant Cleary is "OmniVision's General Counsel" and has been since August of 2019. Ex. 2082 ¶ 4. He "worked in the legal department of OmniVision since January 2018." *Id.* We are persuaded his experience supports that he had sufficient knowledge to attest to his testimony. Declarant Cleary persuasively testifies that he "confirmed that OV does not design and is not involved in the design of processors or flash memory products, and has never sold any IAPs to Intel," "has only supplied image sensors to Intel" and "[REDACTED]" Pet. Privy Reply. 4–5 (citing Ex. 2082 ¶¶ 7, 8; Ex. 2085, 10:22–11:1, 25:6–11, 27:19–28:8). According to Petitioner, Declarant Cleary

also repeatedly explained that PO's components argument is misguided because OV supplied image sensors, which cannot function within a processor or flash memory device. An image sensor must receive light, and as such, would not be a component of a processor or flash memory. As PO appears to admit, image sensors are separate components and not integrated into processors or flash memory.

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Id. at 9 (citing Ex. 2085, 25:6–11, 27:10–13, 36:2–3, 45:22–46:4, 50:14–52:1; IPR2024-00001, Paper 83, 10). Patent Owner apparently acknowledges that “image sensors are separate components and not integrated into processors or flash memory” because in its Request for Director Review of the Final Written Decision in IPR2024-00001, Patent Owner states that it “produced evidence that tends to show that OV sold image sensor chips (directly or indirectly) to Intel for use in Intel’s camera systems.” IPR2024-00001, Paper 83, 10.

Petitioner also states that Patent Owner’s “own infringement contentions from the Intel Litigation confirm that IAPs do not have any components that are supplied by the Petitioner.” Pet. Privy Reply. 6. In particular, Petitioner notes that “[e]xhibits to those contentions demonstrate that, as part of the Intel Litigation, PO procured a wide variety of Intel processors and flash memories and conducted detailed teardown analyses of those products, i.e., PO disassembled those products and analyzed the internal structure of the IAPs.” *Id.* (citing Ex. 2021, 48–112). Petitioner contends that, accordingly, Patent Owner’s

own infringement contentions from the Intel Litigation confirm that PO was aware that the accused Intel processors are a single chip and do not contain any components that are supplied by any third parties, much less Petitioner. Otherwise, PO would have eagerly identified such components and suppliers of such components in its infringement contention.

Mirroring the Intel processors, PO stated in its infringement contentions that *Intel* designs and fabricates the accused flash memory products. Specifically, PO alleged that “flash memory products [are] designed or manufactured (in whole or in part) by Intel” and excerpted [] [an] image [] stating

that [the] “exemplary product was manufactured by Intel and bears Intel die marks.”

Id. at 7 (citing Ex. 2021, 8).

In view of the foregoing, it follows that “OmniVision has never entered into any sales agreements with Intel (or with any other party) regarding the Intel Accused Products or entered into any indemnification agreements with Intel (or with any other party) regarding the Intel Accused Products.” Ex. 2082 ¶ 8.

We see no issue as to Petitioner’s inability to provide purchase orders or other documents that would prove a negative—that Petitioner did not sell the IAPs or components thereof to Intel. Patent Owner alleges that Petitioner’s Declarants “cabined their ‘investigations’ to just reviewing the list of IAPs.” PO Privity Resp. 7. According to Patent Owner, for example, Declarant “Leach admitted that she *did not investigate* whether any amplifiers of DACs manufactured by CL fabs or foundries are included in Intel products.” *Id.* at 9 (citing Ex. 2084, 29:22–30:21). This is beyond the scope of the Discovery Order, which required, sales and indemnifications agreements “*between* Petitioner and *Intel* for the Intel Accused Products,” “as well as any documents and new declaration(s) that establish . . . whether Petitioner was the supplier of *any product, or component of product, accused of infringement in the Intel litigation.*” Disc. Order 2–3 (emphasis added). The Discovery Order did not specifically require Petitioner to adduce evidence concerning whether Petitioner supplied products or components to Intel for use in or with other Intel products not accused in the Intel Litigation.

6. *Indirect Sales and Third-Party Resellers*

Patent Owner takes the position that Petitioner's Declarants' investigations included insufficient efforts to learn whether any of its parts or products are or were, in any way, incorporated into Intel processors in post-transfer, downstream transactions because "none of Petitioner[s] [D]eclarants contacted their company's distributors, resellers, affiliates, or the fabs and foundries that manufacture Petitioner[s] parts." PO Privity Resp. 11–12. The Discovery Order did not specifically require Petitioner to produce evidence beyond agreements between Petitioner and Intel concerning products accused of practicing the challenged claims. Disc. Order 2–3. Stated differently, the Discovery Order did not require Petitioner to produce evidence of any *indirect* sales of its components or products to Intel that occurred after Petitioner surrendered control of the items. Disc. Order 2–3; *cf.* PO Privity Resp. 2–3 ("CL is a fabless semiconductor company that sells component parts to Intel through distributors"). Such evidence, in any case, would be insufficient to establish privity between Petitioner and Intel based on control of, or an opportunity to control, the relevant litigation.

According to Patent Owner, Cirrus Logic's Declarant "confirmed that its Standard T&Cs, which indemnify its customers for infringement claims apply to *all* customers, including Intel." PO Privity Resp. 3 (citing Ex. 2026; Ex. 2084, 55:10–16, 63:6–15). Similarly, Patent Owner contends that OmniVision's Declarant confirmed that its "T&Cs 'include indemnification for patent infringement,' and that he has historically 'fielded [] indemnity requests' on behalf of OV." *Id.* (alteration in original) (citing Ex. 2085, 39:12–17, 47:7–16). Patent Owner also contends that GlobalFoundries' Declarant confirmed that its [REDACTED]

[REDACTED] *Id.* (citing Ex. 2083, 37:5–11, 37:22–38:3, 38:8–22; Ex. 2033). Petitioner’s Declarants’ testimony “confirm[] that Intel did not make any indemnity demands to any Petitioner.” Pet. Privity Reply 10 (citing Ex. 2080 ¶¶ 11, 12; Ex. 2083, 49:6–21; Ex. 2081 ¶¶ 7, 9; Ex. 2084, 62:8–21; Ex. 2082 ¶¶ 9, 11, 12); *see, e.g., id.* at 1–2. We agree with Petitioner that

[l]ack of demand from Intel simply underscores the fact that Petitioner has not supplied the IAPs (or any components thereof). If Intel believed that Petitioner supplied any of the accused technology, Intel would have been highly motivated to ask Petitioner to indemnify Intel for those claims.

Pet. Privity Reply 10–11.

*7. Incorporation of Petitioner’s Products
Into Non-Accused Intel Products*

To the extent Patent Owner is arguing that Petitioner’s investigation is lacking for failure to determine any potential use of Cirrus Logic, OmniVision, or GlobalFoundries products in *non-accused* Intel products (*see, e.g.,* PO Privity Resp. 2–3), this argument is unavailing. A “manufacturer-customer relationship alone does not establish privity” at least because any such relationship does not concern supplying *IAPs or components thereof*. *See WesternGeco*, 889 F.3d at 1321 (“Regarding the pre-suit business alliance, the Board found that ION and PGS had a contractual and fairly standard customer-manufacturer relationship regarding the accused product. This finding does not necessarily suggest that the relationship is sufficiently close.”). The Discovery Order did not specifically require evidence of sales of components to Intel for integration in non-accused Intel products because, even if such evidence existed, it would be

insufficient to establish privity between Petitioner and Intel based on control of, or an opportunity to control, the relevant litigation.

8. *Providing Custom Products to Customers*

To the extent that Patent Owner suggests that, because “CL ‘engineers work closely’ with customers to make custom products” or “GF is a ‘custom manufacturer’ touting Intel as one of its customers,” such collaboration implies privity, presumably with Intel, we disagree. PO Privity Resp. 3 (citations omitted). Generally collaborating and making custom products is not dispositive and, instead, what matters for privity is that Petitioner did not make the Intel Accused Products or components thereof such that Petitioner was in a position to control or had opportunity to control the relevant litigation and should not be provided a second bite at the same apple. *See, e.g., WesternGeco*, 889 F.3d at 1319–22 (the parties “had a contractual and fairly standard customer-manufacturer relationship regarding the accused product,” which “does not necessarily suggest that the relationship is sufficiently close that both” parties should be considered to be in privity); *Wi-Fi One, LLC v. Broadcom Corp.*, 887 F.3d 1329, 1340–41 (Fed. Cir. 2018)(same); *Samsung Electronics Co. Ltd. v. Netlist Inc.*, IPR2022-00615, Paper 64 at 22–26 (PTAB June 30, 2023)(same).

We did not order a particular style or depth of investigation (*see* Disc. Order 2–3), nor do we discern that Petitioner’s investigations were in any way insufficient. In particular, we disagree with Patent Owner’s position that compliance with the Discovery Order required any of Petitioner’s Declarants to undertake discovery from Intel to determine whether any IAPs that were accused of infringement in the related litigation included components sold or manufactured by Petitioner, much less contact distributors, manufacturing fabrication plants, or corporate affiliates as part of their investigation to

discover whether any of Petitioner's products ultimately were included in such IAPs. *See, e.g.*, PO Privity Resp. 10–12. The respective Declarations produced by Petitioner are sufficient to comply with the Discovery Order.

When Patent Owner was asked to describe the discovery it sought to substantiate its privity theory, Patent Owner stated that “no additional discovery is needed.” Ex. 3011, 1. Thus, it is not clear to us what Petitioner could have produced that would satisfy Patent Owner's demands for an adequate investigation. Moreover, we are not apprised of, and can discern no evidence of inaccuracies, inconsistencies, or any other impropriety, particularly as Petitioner's Declarants testified under penalty of perjury.

We further agree with Petitioner's contention that Patent Owner's teardown analyses of the IAPs do not tend to show that the IAPs “contain any components that are supplied by any third parties, much less Petitioner,” “[o]therwise, PO would have eagerly identified such components and suppliers of such components in its infringement contentions.” Pet. Privity Reply 7. Thus, the teardown analyses support Petitioner's view that the accused products in the Intel litigation are limited to the enumerated Intel products listed on pages 4–8 of Exhibit 2021. *Id.* at 7–8; *see* Ex. 2021, Appendix A-1 through A-6 (Intel Accused Products analysis). Our analysis, in that regard, satisfies the Director's mandate in IPR2023–01242 (which applies with equal force here) that we resolve, on the full record, whether “Petitioner was a supplier of” products that were “accused of practicing the challenged claims” in the Intel litigation. IPR2023-01242, Paper 94 at 3. The resounding answer is no.

In view of the above, the evidence adduced during trial does not support Patent Owner's argument that Intel should be named as a privy so as to put the issue into dispute. *See* Dir. Rev. Order 3 (making plain that the

question on remand is whether Patent Owner has met that burden of production). Moreover, even if Patent Owner had met their burden of production, the totality of evidence adduced during trial does not support a finding that the relationship between Petitioner and Intel is sufficiently close that both should be bound by the trial outcome and related estoppels, nor does it suggest, without more, that the parties were litigating either the district court action or the IPRs as proxies for one another. Further, the record is devoid of evidence that Petitioner had any opportunity to control the Intel litigation.

As for Patent Owner's argument that it "maintains that Petitioners are in privity with both [REDACTED], two other time-barred parties," and "that discovery should have been granted as to these parties for at least the reasons presented in the Joint Paper Concerning Additional Discovery in the Wave 1 (*onsemi*) IPRs," we decline to address this argument. PO Privity Resp. 2–3 n.3 (citing IPR2023-01242, Paper 108 at 2–5). The Director Review Order made clear that the Final Written Decisions in IPR2024-00001 and IPR2024-00016 were remanded to consider issues of privity with respect to only Intel and we decline to enlarge the scope of the "narrowly tailored" discovery set forth in the Director Review Order. IPR2024-00001, Paper 89 at 3; IPR2024-00016, Paper 85 at 3.

Furthermore, [REDACTED] was served with an infringement complaint on January 23, 2023 (*see* Ex. 2009), and the Petition in the present proceeding was filed in October of 2023—[REDACTED] could not reasonably be, based on the evidence before us, considered a party giving rise to a time bar under Section 315(b). [REDACTED] is not alleged to be an RPI or privy of Petitioner. *See* PO Resp. 31 (identifying Licensees as [REDACTED] Intel, and [REDACTED]). Rather, [REDACTED] is alleged to be an RPI of an alleged RPI; namely, [REDACTED] (*see* PO

Resp. 30–31) — a degree of separation that is not contemplated by the clear language of the statute.

E. Objective Indicia of Non-Obviousness

Objective indicia of non-obviousness, or secondary considerations of non-obviousness, serve “an important role as a guard against the statutorily proscribed hindsight reasoning in the obviousness analysis,” and must be considered in every case in which they are presented. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1328 (Fed. Cir. 2016). Objective indicia of non-obviousness may include evidence of a long-felt need in the art, praise within the industry, skepticism in the industry about whether or how a problem could be solved, copying, and commercial success. *Id.* at 1132–37.

Patent Owner bears the burden of establishing that a nexus exists between the objective evidence and the claimed invention. *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019). Nexus is a legally and factually sufficient connection between the objective evidence and the claimed invention, such that the objective evidence should be considered in determining non-obviousness. *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988).

“A nexus may not exist where, for example, the merits of the claimed invention were ‘readily available in the prior art.’” *ClassCo, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016) (quoting *Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983)). “Unlike products, which may incorporate numerous features beyond those claimed or described in a patent and therefore may require careful parsing to establish a nexus, actual licenses to the subject patent do not demand the same, as they are, by their nature, directly tied to the patented technology.” *Ancora Techs.*

Inc. v. Roku Inc., 140 F.4th 1351, 1362 (Fed. Cir. 2025) (citing *Institut Pasteur & Universite Pierre Et Marie Curie v. Focarino*, 783 F.3d 1337, 1347 (Fed. Cir. 2013)).

|1. *The Parties' Arguments*

Patent Owner contends that during its prior litigation with [REDACTED] RPX Corp. ("RPX") approached Patent Owner about negotiating a license for [REDACTED] PO Resp. 23 (citing Ex. 2072 (Rao Declaration)). Patent Owner contends it never threatened [REDACTED] [REDACTED] with litigation in any way prior to the license negotiations. *Id.* Patent Owner further contends that, as part of litigation settlements, at least five large, sophisticated parties have taken licenses, with eight major semiconductor companies now having paid more than \$50 million for licenses to just one patent family. *Id.* at 26.

Patent Owner does not specifically address the nexus requirement, but asserts that licenses taken without threat of litigation are especially probative of non-obviousness, and contends even litigation-inspired licenses have some probative value. PO Resp. 23–24, 26 (citing *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012); *Fox Factory Inc. v. SRAM LLC*, IPR2017-00472, Paper 64 at 44). Patent Owner contends [REDACTED] are sophisticated companies who frequently file IPR petitions, yet both paid for licenses covering just the single patent family at issue here. *Id.* at 23–24.

Petitioner disagrees, arguing that licenses that result from settlement require affirmative evidence of nexus because it is often cheaper to take a license than to defend infringement suits, and [REDACTED] licenses were made through RPX, which structures its arrangements to avoid

litigation costs. Pet. Reply 30. Petitioner further argues that a recent license for the relevant patent family was made for a greatly reduced amount. *Id.* at 30–31.

In its Sur-reply, Patent Owner counters that “[p]aying money for a patent license, when no litigation is threatened only makes sense if the licensee thinks the patent is valid and valuable.” Sur-reply 22. Patent Owner further argues that the sales volume for the recent licensee was lower than Patent Owner’s other licensees, which “confirms the value” of Patent Owner’s patents. *Id.*

2. Analysis of the Parties’ Arguments

We find that there is a nexus between the objective indicia and the challenged claim based on the RPX license that includes the ’195 patent in the listing of the patent family covered by the license. *See* Ex. 2072, 45 (Appendix B, Exhibit B); *Ancora*, 140 F.4th at 1362. Patent Owner relies on the RPX license to [REDACTED] and asserts that its technique of “creating ‘a drift field to sweep these unwanted minority carriers from the active circuitry at the surface into the substrate’” is “part and parcel” with the RPX license. PO Resp. 24–25 (quoting Ex. 1001, 3:30–33). We have considered the RPX license to [REDACTED] [REDACTED] and Patent Owner’s argument.

Even though Patent Owner has established a nexus between its licensing revenue and the challenged claims, such evidence does not outweigh the strong evidence of obviousness presented by Petitioner. As set forth above, Patent Owner asserts that the innovative and “novel technique” of the patent family is creating “a drift field to sweep these unwanted minority carriers from the active circuitry at the surface into the substrate.”

PO Resp. 24 (citing Ex. 1001, 3:30–33). For the reasons discussed below, Petitioner persuasively demonstrates that Payne discloses such a drift field. Thus, the allegedly novel advancement of the '195 patent is found in the prior art. *See Yita LLC v. MacNeil IP LLC*, 69 F.4th 1356, 1364 (Fed. Cir. 2023) (“But our case law makes clear that objective evidence of non-obviousness lacks a nexus if it exclusively relates to a feature that was known in the prior art—not necessarily well-known.” (internal quotations and citations omitted)).

Even though the RPX license conveys a right to the challenged claims sufficient to support a nexus, we decline to give significant weight to the RPX license. We do not agree with Patent Owner that the RPX license is especially probative because [REDACTED] were under no apparent threat of litigation. *See* PO Resp. 23–26. Although Patent Owner argues that the RPX license was not motivated by a threat of litigation, and that the expense for [REDACTED] to litigate the challenged patents “would have been trivial” (*id.* at 24), the weight of evidence does not support those arguments. RPX markets itself as a cost-saving service that spreads litigation cost across a large network of companies and “remove[s] patents from circulation before they become costly issues.” Ex. 1067, 1. RPX further markets itself as working on behalf of its clients to prevent potential litigation and associated legal defense costs and settlements. *Id.* at 3.

In view of this evidence, Patent Owner’s argument that [REDACTED] entered a license under no apparent threat of litigation is not persuasive because RPX is a risk mitigation service and, therefore, on this record, the license may reflect the value of avoiding the risk of litigation rather than the value of the challenged patent specifically. *Cf. Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d

1340, 1353 (Fed. Cir. 2012) (License found to be due to the merits of the claimed invention to support non-obviousness where royalties exceeding the cost of litigation reflected the value of the licensed technology); *Samsung Elec. Co. Ltd. v. Neonode Smartphone LLC*, IPR2021-00144, Paper 59 at 51 (PTAB Dec. 15, 2022) (License found to be due to an interest in “[the patent owner’s] technology exclusively” and not some “other economic reason that might discount . . . interest in exclusively licensing the technology.”).

Unlike in the *Samsung Electric* case, the record here does not provide sufficient evidence that the amount paid for the RPX license is due exclusively to the licensed technology rather than some other economic reason. In addition, unlike in the *Transocean* case, the record here includes no evidence of the contribution that [REDACTED] made towards the lumpsum licensing fee, relative to the contribution of [REDACTED] and/or any other RPX member. The record is not sufficiently developed to determine whether the contribution amounts of [REDACTED] are significant compared to the potential cost of litigation. Ex. 2072 ¶ 6.

As to Patent Owner’s argument that the license evidences non-obviousness because “moving carriers ‘from the active circuitry at the surface’ is missing from the prior art” (PO Resp. 25), we disagree for the reasons discussed below. *See Tokai Corp. v. Easton Enters., Inc.*, 632 F.3d 1358, 1369 (Fed. Cir. 2011) (“If commercial success is due to an element in the prior art, no nexus exists.”); *Ormco Corp. v. Align Technology, Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006) (“[I]f the feature that creates the commercial success was known in the prior art, the success is not pertinent.”). Accordingly, we find the RPX licenses are not entitled to significant weight.

Having determined the weight to be given to Patent Owner’s licenses, we turn to the evidence and argument regarding the remaining *Graham* factors in evaluating Petitioner’s obviousness contentions as to the challenged claims. Even if we were to give the RPX license significant weight, we determine that Petitioner’s showings of *prima facie* obviousness, particularly in view of the strength of the grounds based on Payne (a single reference obviousness ground) discussed below outweigh Patent Owner’s objective evidence of non-obviousness. *See Tokai Corp. v. Easton Enters., Inc.*, 632 F.3d at 1371 (“A strong case of *prima facie* obviousness . . . cannot be overcome by a far weaker showing of objective indicia of nonobviousness.”).

F. Challenges Based on Payne

Petitioner contends claims 1, 2, and 4–6 would have been obvious in view of Payne, that claims 2 and 3 would have been obvious in view of the combination of Payne and Wolf, and that claim 3 would have been obvious in view of the combination of Payne and Parrillo. Pet. 8–44, 89–97. As explained in more detail below, Petitioner directs us to evidence showing where each feature of the challenged claims is disclosed in the prior art and why an ordinarily skilled artisan would have been led to arrange those features in the manner claimed. *Id.*

Patent Owner contests three issues pertaining to Petitioner’s evidence regarding independent claim 1: Patent Owner contends that the challenges based on Payne fail because (1) a graded dopant concentration does not inherently aid minority carrier movement; (2) the Petition fails to otherwise demonstrate that Payne discloses the “aid the movement of minority

carriers” limitation; and (3) the Petition fails to present a proper obviousness analysis. PO Resp. 7–22. We focus our analysis on those areas of dispute.

During the final hearing, Patent Owner newly-raised a fourth issue, arguing for the first time that Petitioner erroneously identifies majority carriers as minority carriers when applying the prior art to the claims. *See generally* Tr.¹⁵ In our analysis below, we explain why that argument is untimely and, alternatively, unpersuasive on this record.

We organize this section into six main subparts, providing first an overview of the asserted prior art references (subpart 1), then addressing Petitioner’s evidence as to claim 1 (subpart 2), Petitioner’s evidence as to the remaining claims (subpart 3), the three contested issues raised in the briefs (subpart 4), the additional contested issue raised for the first time during the final hearing (subpart 5), and, finally, our conclusions on the grounds based on Payne (subpart 6).

1. Overview of the Asserted Prior Art References

a. Payne

Payne “relates to complementary field effect transistors formed by ion implantation, and in particular to a structure and method of fabrication which permit high packing density.” Ex. 1005, 1:5–8. According to Payne, CMOS devices “comprise n-channel and p-channel devices formed in the

¹⁵ *See* Tr. 41:19–44:14, 64:4–68:4, 71:9–72:2, (Patent Owner’s counsel, arguing that Petitioner misidentifies majority carriers in the challenges and promising, but failing, to cite a brief that raises that argument); *see also id.* at 72:15–77:5 (Petitioner’s counsel, persuasively arguing that Patent Owner did not provide adequate notice of this argument in its briefs), 85:16–91:18 (Patent Owner’s counsel, reading much of its sur-reply into the record, but failing to identify any brief in which Patent Owner argues that Petitioner misidentifies the minority carriers in its challenges).

same substrate,” and they were traditionally “formed by diffusion or implantation of a p-type ‘tub’ in an n-type silicon substrate so that the n-channel device is fabricated in the tub and the p-channel device is fabricated in the adjacent portion of the substrate.” *Id.* at 1:9–18.

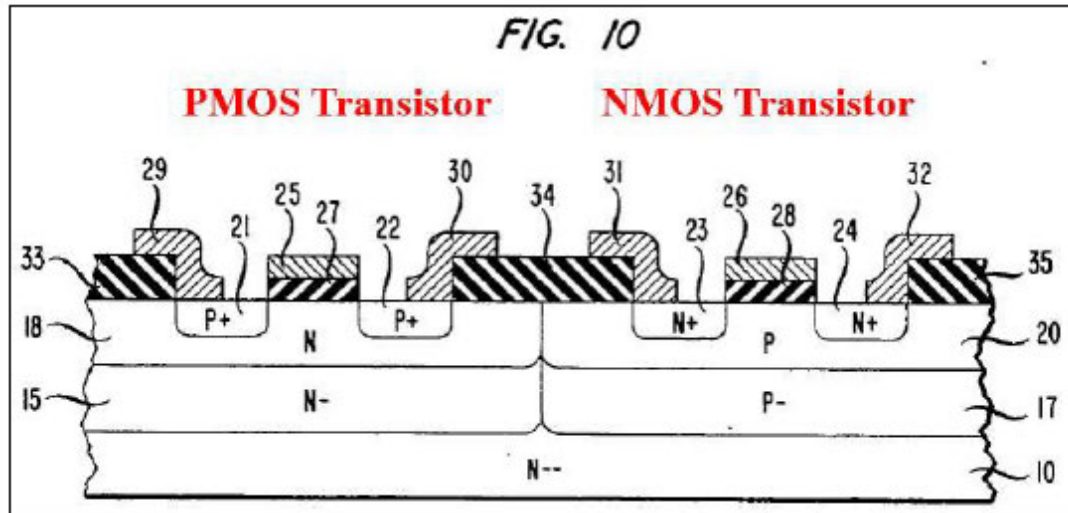
This method “led to the constraint that the concentration at the surface in the tub was much greater than the surface concentration of the substrate.” *Id.* at 1:18–22. To avoid this constraint, Payne states that one method was “to form the p-channel device in a second tub of n-conductivity type and higher impurity concentration than a more lightly doped substrate.” *Id.* at 1:24–27. “Using either the single tub or twin tub approach, a considerable amount of semi-conductor area is needed due to the fact that the tub impurities will diffuse laterally as well as vertically during the drive-in to establish the desired tub depth.” *Id.* at 1:34–38.

Payne states that this “is particularly troublesome in the twin-tub process since any significant overlap of the two tubs results in decreased doping concentration of each tub at the boundaries which can cause punch through or field inversion channeling during device operation.” *Id.* at 1:39–43. This problem required large spacing of the source and drain regions of the transistors, and Payne seeks to avoid this need by providing “a CMOS structure and method of manufacture which requires little semiconductor space.” *Id.* at 1:53–54.

Payne’s “device is fabricated in a silicon semiconductor substrate, 10, of ‘N--’ conductivity type which . . . is typically approximately 20 mils thick.” Ex. 1005, 2:56–60. On this substrate, tub regions 15 and 17 are formed, one “having the same conductivity type as the substrate but higher impurity concentration” and the other having the opposite conductivity type. *Id.* at 3:35–39, 4:12–14, Figs. 2–5. Surface regions 18 and 20 are formed

“covering essentially the same area as” tubs 15 and 17, with each region having the same conductivity type as the tub over which it lies but with higher impurity concentration. *Id.* at 4:31–5:17, Figs. 7–9, 11.

These features are illustrated in Petitioner’s annotated version of Payne’s Figure 10, which we reproduce below.



Pet. 9; Ex. 1005, Fig. 10. Figure 10 is a cross-sectional view of a portion of Payne’s integrated circuit, showing various stages of fabrication. Ex. 1005, 2:34–36. Petitioner annotates Figure 10 to indicate a PMOS Transistor portion (on the left) and an NMOS Transistor portion (on the right).

Payne’s CMOS device includes a “p-channel device [that] includes source and drain regions, 21 and 22, respectively, of P+ conductivity type formed with[in] the N surface region, 18” and an “n-channel device [that] includes source and drain regions, 23 and 24, of N+ conductivity type formed within the P surface region 20.” *Id.* at 5:21–27, Fig. 10. Payne states that this approach can reduce the spacing between “source and drain regions of adjacent devices” from 12 microns to 5 microns. *Id.* at 5:56–6:19, Figs. 12, 13.

b. Wolf

Wolf is a four-volume textbook titled “Silicon Processing for the VLSI Era.” Ex. 1008. Chapter 16 focuses on CMOS technology. Ex. 1008, xxiv–xxv, 807–40.

c. Parrillo

Parrillo is a U.S. Patent titled “Method for Fabricating Complementary Field Effect Transistor Devices.” Ex. 1025, code (54). Parrillo is directed to “an eight-mask twin-tub CMOS process which forms contiguous p- and n-tubs in a relatively lightly doped bulk region in a self-aligned manner using a single masking step.” *Id.* at code (57).

2. *Petitioner’s Evidence Regarding Claim 1*

The preamble of claim 1 recites: “A CMOS Semiconductor device comprising:” Ex. 1001, 4:13. Petitioner argues that Payne teaches the preamble. Pet. 8–9. Specifically, Payne discloses that “a primary object of [its] invention [is] to provide a CMOS structure and method of manufacture which requires little semiconductor space.” Ex. 1005, 1:51–54.¹⁶

Claim 1.1 recites “a surface layer.” Ex. 1001, 4:14. Petitioner argues that Payne teaches or suggests this limitation. Pet. 9–11. Petitioner directs us to evidence that tends to show that Payne discloses a surface layer similar to that in the ’195 patent. Ex. 1001, Fig. 5(b); Ex. 1003 ¶¶ 74–76; Ex. 1005, 2:50–60, 5:21–27, 6:57–59, Fig. 10; Ex. 1030, 6, 7, 9, 12, 13; Ex. 1033. In particular, Figure 5(b) of the ’195 patent and Payne’s Figure 10 show quite similar structures, and Patent Owner’s district court claim construction brief

¹⁶ We need not resolve whether the preamble is limiting because Petitioner demonstrates that the prior art satisfies the recitation in the preamble.

identified the relevant structure in Figure 5(b) of the '195 patent as a surface layer. Ex. 1030, 7, 12.

Claim 1.2 recites “a substrate.” Ex. 1001, 4:15. Petitioner argues that Payne teaches this limitation. Pet. 11–13. Payne discloses fabricating its CMOS device “in a silicon semiconductor substrate.” Ex. 1005, 1:60–65, 2:50–60, Fig. 10.

Claim 1.3 recites “an active region including a source and a drain, disposed on one surface of said surface layer.” Ex. 1001, 4:16–17. Petitioner argues that Payne teaches this limitation. Pet. 13–16. Payne discloses forming p-channel and n-channel transistors, each with source and drain regions. Ex. 1005, 1:5–19, 5:18–29, 6:57–59. Petitioner directs us to additional evidence that a person of ordinary skill in the art would have considered the transistors to be active regions. Ex. 1001, Fig. 5(b); Ex. 1030, 6–7, 11; Ex. 1003 ¶¶ 79–83; Ex. 1008B, 299–300.

Claim 1.4 recites “a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate.” Ex. 1001, 4:18–21. Petitioner directs us to evidence that Payne teaches this limitation. Pet. 16–21. Specifically, Payne discloses a first tub region with a surface region in it that, on the present record, appears quite similar to the single drift layer and well region of the '195 patent. *Compare* Ex. 1003 ¶ 87; Ex. 1005, 3:28–42, 4:19–39, 5:7–17, 5:44–50, *with* Ex. 1001, Fig. 5(b); Ex. 1030, 7, 11. Additionally, Payne’s Figure 11 shows a dopant concentration in tubs 15, 17 that decreases with increasing depth. Ex. 1005, 2:38–41, 5:14–17, 5:56–57, Figs. 10, 11.

Claim 1.5 recites “said drift layer further having a first static unidirectional electric drift field to aid the movement of minority carriers

from said surface layer to said substrate.” Ex. 1001, 4:21–24. Petitioner directs us to evidence that Payne teaches this limitation. Pet. 22–30. In that regard, Petitioner relies on the parent file history and cited references to argue that the presence of a graded dopant concentration similar to that in Payne “creates a ‘built-in’ electrical field that forces the movement of carriers into a particular direction” and that the direction in which carriers are forced with the concentration profile disclosed in Payne is downward, toward the substrate and away from the surface. Pet. 22–25 (emphasis omitted) (citing Ex. 1002,¹⁷ 289–290, 237–238, 253–254). In addition, Payne discloses that its active regions are located on the surface, rather than in the substrate. Ex. 1005, 5:7–17, 5:44–55, Figs. 10–11; Ex. 1003 ¶¶ 101–107.

Claim 1.6 recites

at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

Ex. 1001, 4:25–29.

Petitioner directs us to evidence that Payne teaches this limitation. Pet. 30–36. Specifically, Petitioner argues, Payne’s tub region 15 satisfies this claim limitation to the same extent as the well region that Patent Owner identifies in Figure 5(b) of the ’195 patent, and this layer has a graded dopant concentration. Pet. 31–34 (citing Ex. 1001, Fig. 5(b); Ex. 1030, 7; Ex. 1005, 1:65–68, 4:31–39, 4:63–5:14, 5:44–55, Figs. 10–11). Relying on Patent Owner’s arguments during prosecution and on a district court claim

¹⁷ Our citations are to the pagination added by Petitioner to the exhibit.

construction, Petitioner contends that the presence of this layer creates a second “static unidirectional electric drift field that aids the movement of minority carriers from the surface layer to the substrate.” *Id.* at 34–36; Ex. 1003 ¶¶ 115–118.

3. *Petitioner’s Evidence Regarding the Remaining Claims*

Petitioner presents evidence tending to establish the obviousness of claims 2 and 4–6 based on Payne alone. Pet. 36–44. Petitioner also presents evidence tending to establish the obviousness of claims 2 and 3 based on Payne and Wolf, and for obviousness of claim 3 based on Payne and Parrillo. *Id.* at 89–97.

Regarding a reason to combine Payne with Wolf, Petitioner argues that an ordinarily skilled artisan would have “understood and expected that the teachings of Wolf would apply to Payne, and would have looked to Wolf for advances in CMOS technology and additional process details to the extent not covered in Payne.” *Id.* at 89 (citing Ex. 1003 ¶ 209).

Regarding a reason to combine Payne with Parrillo, Petitioner argues that an ordinarily skilled artisan “would have been motivated to fabricate Payne’s ‘twin-tub’ device using Parrillo’s epitaxial substrate to protect Payne’s high-density CMOS device, which” an ordinarily skilled artisan would have understood to be “susceptible to latchup failures due to the close proximity of their transistors.” *Id.* at 96 (citing Ex. 1008B, 381, 414; Ex. 1025, 3:38–41; Ex. 1003 ¶¶ 227–229).

4. *Resolution of the Three Contested Issues Raised in the Briefs*

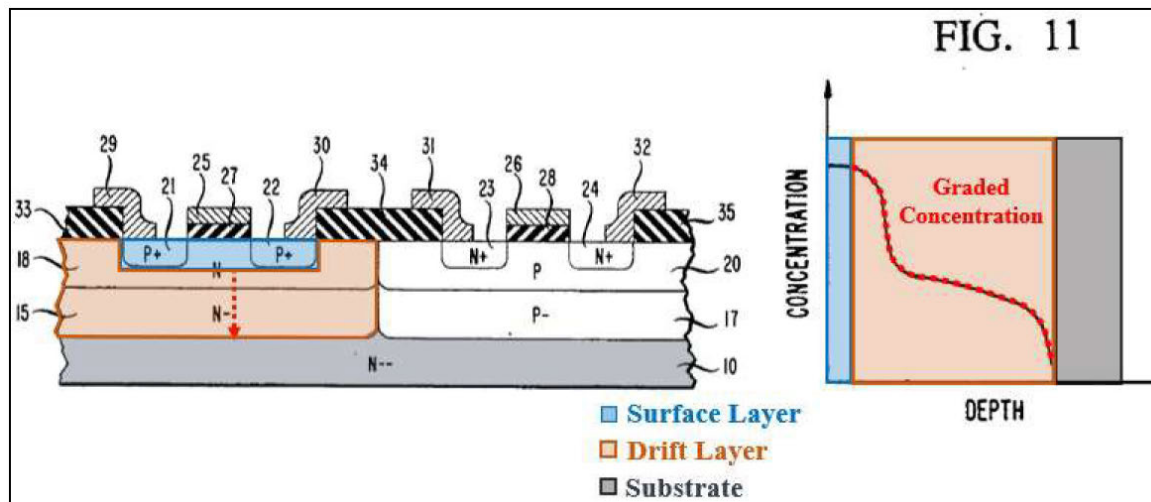
Patent Owner, in the briefs, does not challenge Petitioner’s evidence as to any ground based on Payne, except to contest three issues pertaining to independent claim 1: Patent Owner contends that the challenges based on

Payne fail because (a) a graded dopant concentration does not inherently aid minority carrier movement; (b) the Petition fails to address other forces in Payne that allegedly are relevant to the “aid the movement of minority carriers” limitation; and (c) the Petition fails to present a proper obviousness analysis. PO Resp. 7–22. We resolve each of those three contested issues in turn below.

a. Graded Dopant Concentration and Aiding Carrier Movement

1) The Parties’ Arguments

Petitioner contends that Payne includes a graded dopant concentration that extends from the principal surface to the substrate, as shown in an annotated side-by-side comparison of Figures 10 and 11, which we reproduce below.



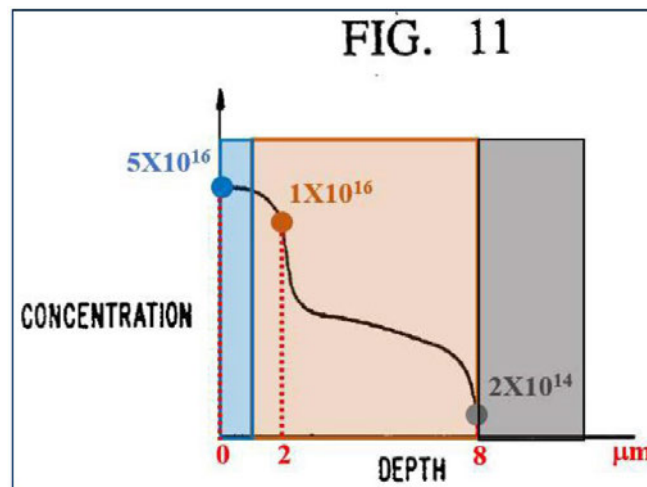
Pet. 20, 22. The above figure is Petitioner’s side-by-side comparison of Payne’s Figure 10 (on the left) and Payne’s Figure 11 (on the right). Figure 10 is a cross-sectional view of a portion of an integrated circuit, whereas Figure 11 is an illustration of the approximate concentration of implanted impurities as a function of depth in the semiconductor. Ex. 1005, 2:34–40. Petitioner annotates and color-codes these figures to highlight in blue the

surface layer, in orange the drift layer, and in gray the substrate. Pet. 20; Ex. 1003 ¶¶ 90–91.

Petitioner directs us to evidence that this configuration in Payne results in, or at minimum renders obvious, “a downward-sloping graded-dopant concentration” that “aids the movement of minority carries” in the semiconductor. Pet. 16–22 (and citations therein to evidence).

In particular, Payne describes a “surface impurity concentration of the surface regions” that “is typically $0.5\text{--}5 \times 10^{16}$ ions/cm³” where the concentration of tub regions “is typically $10^{15}\text{--}10^{16}$ ions/cm³,” such that the former concentration is “at least twice as much as the latter.” *Id.* at 21 (emphasis omitted) (quoting Ex. 1005, 5:51–55). “The concentration is lowest at the substrate, where it is ‘ $1\text{--}2 \times 10^{14}$ ions/cm³.’” *Id.* (quoting Ex. 1005, 2:56–59). Petitioner further points us to disclosures in Payne, and explanatory declaration testimony of Petitioner’s witness, Dr. Banerjee, describing the relative depths of these dopant concentrations in Payne’s semiconductor. *Id.* at 19–21 (citing Ex. 1003 ¶¶ 89–93; Ex. 1005, 5:48–50).

We reproduce below Petitioner’s further annotated version of Figure 11, which illustrates these features in Payne’s semiconductor.



Pet. 21. The above figure is Petitioner’s further annotated version of Payne’s Figure 11, labeled to identify the downward-sloping graded-dopant concentration as described in the reference.

Referring to the right side of Figure 10 in the side-by-side comparison of Figure 10 and Figure 11, reproduced *supra* 50, Petitioner argues, and Dr. Banerjee testifies, that Payne discloses an N-channel metal-oxide (“NMOS”) transistor having “a downward-sloping graded-dopant concentration.” *Id.* at 21 (citing Ex. 1003 ¶¶ 91–93; Ex. 1005, 5:14–17). Petitioner further argues that this “downward-sloping graded-dopant concentration aids the movement of minority carriers from the surface layer to the substrate to the same extent to which [the] Applicant relied on the prior art and admitted to the Patent Office that such carrier movement would occur under the same scenario.” *Id.* at 22 (citing Ex. 1003 ¶¶ 95–99).

On that point, Petitioner argues, the Applicant “represented to the Patent Office that a downward-sloping graded-dopant concentration was known in the prior art to create an ‘inherent “built-in” unidirectional electric field’ that moves carriers deep into the substrate.” *Id.* at 22–23. Specifically, as Petitioner points out, the Applicant represented to the Patent Office:

[T]he graded dopant concentration itself creates a ‘built-in’ electrical field that forces the movement of carriers into a particular direction, whereby the ‘direction’ of the electrical field and the resulting direction of the carrier movement depends solely on the slope of the graded concentration of dopant.
Id. at 23 (underlining in original, emphasis omitted) (quoting Ex. 1002, 289–290; citing Ex. 1003 ¶¶ 95–96).

In Petitioner’s view, the Applicant also represented to the Patent Office “that ‘a unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way’” and “[d]epending on the

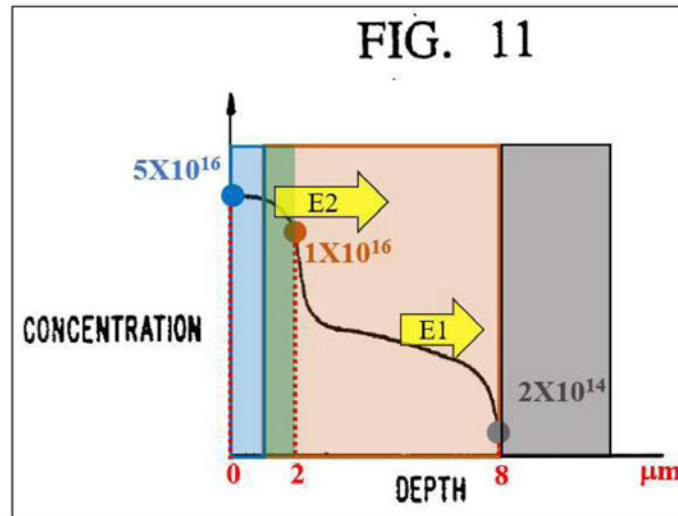
particular slope of the graded concentration of dopant, all minority carriers are either swept ‘down’... or ‘up.’” *Id.* (emphasis omitted) (quoting Ex. 1002, 289).

According to Petitioner, the Applicant cited two prior art references in support of these assertions to the Patent Office. *Id.* at 23–28 (citing Exhibit 1009 (Kamins)¹⁸ and Exhibit 1010 (Jastrzebski)¹⁹). Petitioner directs us to disclosures in Kamins and Jastrzebski that, in Petitioner’s view, describe, in terms indistinguishable from Payne, a downward-sloping graded-dopant concentration. *Id.* Petitioner also directs us to evidence that the Applicant represented to the Patent Office that such a concentration necessarily sweeps and accelerates minority carriers into the substrate. *Id.*

In other words, just like the graded dopant regions described in Kamins, Jastrzebski, and the ’195 patent specification, Petitioner argues, Payne also describes a graded-dopant concentration that creates a static unidirectional electric drift field that aids the movement of minority carriers from the surface layer to the substrate. *Id.* at 29 (citing Ex. 1003 ¶¶ 101–107; Ex. 1005, Fig. 11). Based on a similar rationale, Petitioner submits that Payne meets the additional limitation of claim 1 requiring a “second” such field. *Id.* at 30–36. Petitioner illustrates those first and second fields in the following further annotated version of Payne’s Figure 11.

¹⁸ U.S. Patent No. 4,160,985.

¹⁹ U.S. Patent No. 4,481,522.



Pet. 35. The above figure is Petitioner’s further annotated version of Payne’s Figure 11, labeled to identify first (E1) and second (E2) downward-sloping graded-dopant concentrations, which, in Petitioner’s view, necessarily sweep and accelerate minority carriers into the substrate.

In this proceeding, Patent Owner reverses course and contends that a “graded concentration of dopants does not inherently aid carrier movement.” PO Resp. 7. Patent Owner reasons that the claims require movement of carriers and there may be other forces in play within a transistor, or the semiconductor from which the transistor is made, that affect such movement. *Id.* at 8–13. Consistent with the testimony of its witness, Dr. Glew, Patent Owner contends that Dr. Banerjee testified on cross-examination that carrier motion is determined by the sum of the forces acting on the carrier, or the net force. *Id.* at 8–9; Sur-reply 4.

According to Patent Owner, Dr. Banerjee conceded that there are many different potential forces at play in a semiconductor device, such as “periodic crystalline potential,” “externally applied forces or a built-in electric field,” temperature, magnetic fields, the Hall effect, and forces due to the gate and gate oxide. Sur-Reply 4–5 (citing Ex. 2078, 82:9–12, 83:19–

84:1, 84:16–21, 113:18–114:13, 138:11–20, 140:11–21, 183:11–20, 219:16–220:20, 222:19–22). Patent Owner contends Dr. Banerjee’s and Dr. Glew’s testimony is consistent with both the Examiner’s arguments during prosecution and with Petitioner 30(b)(6) witness, Mr. Scott Warrick, who agreed that “there’s a long list of . . . physical attributes which affect the movement of carriers” and one could not tell based solely on the presence of a graded dopant concentration that the gradient would “aid carrier movement.” PO Resp. 7–8 (emphasis omitted) (citing Ex. 2056, 72:6–8, 95:2–5, 96:1–13).

Somewhat relatedly, Patent Owner argues, Petitioner cannot interpret the claims one way when comparing them to an accused product and another way when comparing them to the prior art. *Id.* at 8 (citing *Amazon.com, Inc. v. Barnesandnoble.com, Inc.*, 239 F.3d 1343, 1351 (Fed. Cir. 2001)).

Petitioner counterargues that, during prosecution of the ’195 patent, other evidence of the Applicant’s representations to the Office “that a graded dopant concentration sloped in a particular direction necessarily aids the movement of minority carriers, regardless of other alleged factors.” Pet. Reply 9. Specifically, when the Examiner observed, with respect to pending claims “identical in relevant respect” to the claims challenged here, “that ‘any magnitude of the drift electric field, however small, reads on the claim,” the Applicant “did not dispute this representation.” *Id.* (emphasis omitted) (quoting Ex. 1002, 139–140).

The issued claims were rejected under 35 U.S.C. § 112, first paragraph, with the Examiner “theorizing that ‘movement of minority carriers is affected by multiple forces and fields” and, further, that “it does not appear that simply the presence of ‘a unidirectional drift field’ itself can achieve ‘drawing all minority carriers from said surface to said substrate”

absent knowledge about “other parameters of the device.” Pet. Reply 9 (quoting Ex. 1002, 269–270, 289).

The Applicant respectfully disagreed with the Examiner’s assertions, stating:

[A] unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way - moving all minority carriers in the same direction because of the unidirectional drift due to the existence of the electric field. *See* “Physics and Technology of Semiconductor Devices,” A.S. Grove, pp. 224–225, John Wiley and Sons, Inc., New York, 1st Edition 1967 (“This same electric field will then be of such direction as to aid the motion of injected holes. Thus, the injected minority carriers will now move not only by diffusion but also by drift due to the existence of this electric field.”). Depending on the particular slope of the graded concentration of dopant, all minority carriers are either swept “down” (from the surface layer to the substrate) or “up” (from the substrate to the surface layer). *See* Applicant’s Figs. 5(b) and 5(c).

Ex. 1002, 289–290; Pet. Reply 9–10.

In response to the Examiner’s assertion that the simple presence of a “graded dopant concentration” “does not appear to ensure (without knowing [the] other parameters of the device) that it will draw ‘all’ minority carriers” from the surface layer to the substrate, the Applicant further asserted:

[This] argument appears to not consider that the graded dopant concentration itself creates a “built-in” electrical field that forces the movement of carriers into a particular direction, whereby the “direction” of the electrical field and the resulting direction of the carrier movement depends solely on the slope of the graded concentration of dopant. With regard to the existence of a “built-in” electric field created by a graded dopant density, . . . this *inherent “built-in” unidirectional electric field is the additional parameter for ensuring that all minority carriers are being moved in one direction* and which

parameter the Office Action deemed to be missing from the disclosure.

Ex. 1002, 289–290 (emphasis added).

Observing that “nothing in the specification suggests measuring and comparing various forces, let alone in connection with ‘to aid carrier movement,’” Petitioner argues, Patent Owner “overcame the written description rejection by advancing the same inherency argument it now rejects.” Pet. Reply 11 (emphasis omitted) (citing Ex. 1002, 289).

Petitioner observes that Patent Owner “now cites the specification’s discussion of relative slope” (PO Resp. 9) “but that merely refers to slope direction (increasing or decreasing), not magnitude.” Pet. Reply 11 (emphasis omitted). In Petitioner’s view, Patent Owner admits “‘relative slope’ means ‘nothing more than the fact that one-side is relatively lower than the other side.’” *Id.* at 12 (emphasis omitted) (quoting Ex. 1064, 5; Ex. 1070, 9).

Petitioner also points out that the written description of the ’195 patent “provides exemplary gradient slopes” but “does not suggest that carrier movement hinges on the magnitude of those slopes.” *Id.* (emphasis omitted) (citing Ex. 1001, 2:35–40). Thus, in Petitioner’s view, the intrinsic record (including, importantly, the very disclosure of Patent Owner’s own patent specification) “completely undermines” Patent Owner’s “present argument that the slope magnitude must be ‘measure[d]’ and ‘compare[d]’ with alleged other forces.” *Id.*; *see id.* at 8–9 (quoting PO Resp. 8).

In addition, Petitioner argues, Patent Owner’s representations before a district court are consistent with the Applicant’s assertions during prosecution. Pet. Reply 12–13 (citing Ex. 1030, 2, 25, 28; Ex. 2057 ¶ 33); Pet. 33. Specifically, in that proceeding, Patent Owner’s counsel stated:

Electric fields are a well-known phenomenon that cause carriers to move, and a [person of ordinary skill in the art] would have readily recognized that when a ‘static unidirectional electric drift field’ is present that it aids the movement of the minority carriers.’ If it isn’t present, then it doesn’t. The claim turns on the presence of the ‘unidirectional electric drift field,’ and the phrase ‘to aid the movement of minority carriers’ merely states what the ‘unidirectional electric drift field’ does.

Ex. 1030, 26–27; *see id.* at 28 (“The intrinsic record consistently confirms that electric fields aid the movement of the carriers.”).

2) Analysis

Although there may be myriad forces acting upon carriers in a transistor, the Applicant made clear during prosecution that the “aid the movement of minority carriers” limitation does not require an analysis of these parameters, nor does the disclosure of the ’195 patent mention such forces or the need to account for them. Ex. 1002, 289–290. Rather, “a unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way - moving all minority carriers in the same direction” and “this inherent ‘built-in’ unidirectional electric field . . . ensur[es] that all minority carriers are being moved in one direction.” *Id.*

The public is entitled to rely upon these clear and unambiguous assertions regarding the effect of a unidirectional drift field when considering the scope of the challenged claims. *See Hockerson-Halberstadt v. Avia Group Int’l*, 222 F.3d 951, 957 (Fed. Cir. 2000) (“The prosecution history constitutes a public record of the patentee’s representations concerning the scope and meaning of the claims, and competitors are entitled to rely on those representation when ascertaining the degree of lawful conduct, such as designing around the claim invention.”).

Thus, we determine that evidence of a sloping gradient that creates a unidirectional drift field in the appropriate location, and pointing in the appropriate direction, is sufficient to demonstrate the “aid the movement of minority carriers” limitation of the claims. Ex. 1030, 26 (Patent Owner’s counsel representing before the district court that “a POSITA would have readily recognized that when a ‘static unidirectional electric drift field’ is present that it aids the movement of the minority carriers.”).

That determination is consistent with the disclosure of the ’195 patent—which nowhere mentions any need to account for the other forces or parameters that Patent Owner now asserts are critical to the assessment—and we decline to hold the applied prior art to a higher standard of disclosure than the disclosure of the challenged patent. *See In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994) (“[T]he Board’s observation that appellant did not provide the type of detail in his specification that he now argues is necessary in prior art references supports the Board’s finding that one skilled in the art would have known how to implement the features of the references.”).

Patent Owner contends that the Applicant never said that all graded dopant concentrations aid carrier movement. PO Resp. 10. According to Patent Owner, if any “graded dopant concentration” would “aid the movement of minority carriers,” then there would have been no reason to include the second claim phrase, which strongly implies that a “graded dopant concentration” does not inherently aid the carrier movement. *Id.*

We disagree. The term “to aid the movement of minority carriers from” a surface to a substrate is not superfluous as it indicates both the direction and the area in which the graded dopant concentration must aid carrier movement (from the surface to the substrate). The inclusion of this

phrase, therefore, is consistent with a “graded dopant concentration” that inherently aids carrier movement.

Patent Owner also contends that Petitioner misconstrues the Applicant’s statements. PO Resp. 11–13. Patent Owner asserts that, when the Applicant stated to the Patent Office “that the ‘graded dopant concentration itself creates a ‘built-in’ electrical field that forces the movement of carriers into a particular direction,’” what the Applicant really meant was that this was a requirement of the claim, not an inherent or necessary result. *Id.* at 11 (quoting Pet. 23).

According to Patent Owner, its argument during prosecution was that movement of carriers “[d]epend[s] on the particular slope of the graded concentration of dopant[s],” and it was responding to an Office Action regarding a claim that required a “single static unidirectional electric drift field to aid the movement of carriers,” which was an “additional parameter” that ensured “that all minority carriers are moved in one direction.” *Id.* (emphasis omitted) (citing Ex. 1002, 286, 289–90).

Patent Owner’s arguments are not persuasive, at least because they are at odds with the prosecution history. During prosecution, the Applicant unequivocally stated that “the graded dopant concentration itself creates a ‘built-in’ electric field that forces the movement of carrier into a particular direction,” and that this direction “depends solely on the slope of the graded concentration of dopant.” Ex. 1002, 289–290. Thus, the graded dopant concentration creates the “additional parameter” that ensures that “all minority carriers are being moved in one direction.” *Id.*

We find no merit, moreover, in Patent Owner’s additional view that Petitioner’s “position that *any* gradient aids carrier movement, leads to absurd results that are plainly inconsistent with the claim language.” PO

Resp. 9. According to Patent Owner, Petitioner’s “‘graded’ entails ‘aided’ assumption (or claim construction) implies that a gradient can ‘aid’ the movement of carriers that do not move at all.” *Id.* An assumption that a graded dopant concentration will necessarily aid carrier movement, Patent Owner argues, is inconsistent with the Examiner’s assertions during prosecution, Petitioner’s 30(b)(6)²⁰ witness’ testimony, and at least two district courts’ conclusions. *Id.* at 7–10.

The Examiner’s assertions and Patent Owner’s responses (as the Applicant of the ’195 patent) are addressed above. Patent Owner’s arguments with respect to Petitioner’s 30(b)(6) witness and the two district courts’ findings are addressed below.

3) Testimony of Petitioner’s 30(b)(6) Witness

Patent Owner contends that during the deposition of Petitioner’s (Cirrus Logic’s) 30(b)(6) witness, Mr. Warrick, he agreed that “there’s a long list of . . . physical attributes which affect the movement of carriers” and he could not say if the downward sloping gradient of a particular accused product met the “aid carrier movement” limitation “because there’s other things that might affect carrier movement besides the gradient.” PO Resp. 7–8 (emphasis omitted) (citing Ex. 2056, 72:6–8, 95:2–5, 96:1–13).

Petitioner responds that Patent Owner “blatantly mischaracterizes the deposition of” Mr. Warrick, as the question Mr. Warrick was actually asked was whether “there’s anything that affects the *ease of* carrier movement.”

²⁰ Pursuant to 30(b)(6) of the Federal Rules of Civil Procedure (“FRCP”), “a party may name as the deponent a public or private corporation, a partnership, an association, a governmental agency, or other entity” and the “named organization must designate one or more officers, directors, or managing agents,” to testify on its behalf. FRCP, 30(b)(6).

Pet. Reply 19–20 (quoting Ex. 2056, 71:22–72:8). According to Petitioner, because other factors may affect the speed or acceleration of carrier movement, Mr. Warrick’s statements did not suggest that these forces could overwhelm the drift field and preclude it from aiding carrier movement. *Id.* at 20. Petitioner further argues that Patent Owner never established the “there” it was referring to, or whether the direction of the gradient was suited to aid movement “downward,” let alone that Mr. Warrick understood such to be the case. *Id.*

Mr. Warrick testified as a corporate representative of Cirrus Logic in the district court proceeding. Patent Owner does not contend that Mr. Warrick is qualified to testify about the understanding of the hypothetical person of ordinary skill in the art, much less that he considered the Applicant’s assertions during prosecution regarding the meaning and scope of the “aid carrier movement” limitation. Ex. 1002, 289–290. Nor does Patent Owner contend that Mr. Warrick considered Patent Owner’s unequivocal representation to the district court that “when a ‘static unidirectional electric field’ is present” such a field “aid[s] the movement of minority carriers.” Ex. 1030, 26; Pet. 36.

Although Mr. Warrick provided a statement that is generally consistent with Patent Owner’s reasoning in this proceeding, as well as the Examiner’s initial reasoning during prosecution, that statement does not outweigh the Applicant’s express assertions during prosecution that this reasoning is incorrect in view of the scope of the claims. Ex. 1002, 289–290. As such, we find that Mr. Warrick’s testimony does not support, on this record, that a sloping dopant concentration gradient in the appropriate direction and location will not necessarily aid the movement of carriers.

4) The District Courts' Findings

Patent Owner contends that “two District Courts have previously agreed with [Patent Owner] that not *all* doping gradients *must* aid carrier movement.” PO Resp. 10. In particular, Patent Owner contends the Western District of Texas “unequivocally stated, ‘a graded concentration . . . that is [not ‘sufficiently graded’] will not aid in the movement of minority carriers,’” and the Eastern District of Texas understood that direction alone does not determine whether a gradient aids carrier movement, as the magnitude of the gradient must also be considered. *Id.* (citing Ex. 2074, 39–40; Ex. 2075, 15).

Before the Western District of Texas, Petitioner (Cirrus Logic) asserted that the term “graded dopant concentration” was indefinite, as it was unclear where the boundary between “graded” and “uniform” doping concentrations would be. Ex. 2074, 32. Patent Owner argued in response that the patent provides sufficient guidance as to the meaning of the claim term, with “graded” meaning varying or not “uniform.” *Id.* at 37–38 (“Greenthread contends that Figure 1 in the ’195 Patent depicts the difference between uniform and graded concentration, namely, that the concentration in the former is the same across a region while in the latter, the concentration has a slope.”). The District Court determined that the term was not indefinite for multiple reasons and that “graded” “describes a sloped doping concentration.” *Id.* at 39–41. According to the court, a graded dopant concentration must be sufficiently graded to result in a “static unidirectional electric drift field to aid the movement of minority carriers,” as recited in claim 1 of U.S. Patent No. 8,421,195. *Id.* at 39–40.

We discern no finding in that court’s order that one must quantify the magnitude of the field in order to know if the electric field will “aid the

movement of minority carriers.” First, the court was not addressing the same argument raised by Patent Owner in this proceeding. Rather, it was addressing whether the term “graded dopant concentration” is indefinite. Second, the court’s order reasonably can be interpreted to require only that the graded dopant concentration be sufficiently graded to create a “static unidirectional electric drift field,” as recited in the claims, which, as the Applicant argued during prosecution and in its claim construction brief before that court, would “aid in the movement of minority carriers.” Ex. 2074, 39–40; Ex. 1030, 26 (“[A] [person of ordinary skill in the art] would have readily recognized that when a ‘static unidirectional electric drift field’ is present that it aids the movement of the minority carriers. If it isn’t present, then it doesn’t.”), 28 (“The intrinsic record consistently confirms that the electric fields aid the movement of the carriers.”).

Before the Eastern District of Texas, the parties disputed the proper construction of the term “single drift layer . . . having a graded concentration of dopants generating a first static unidirectional electric drift field.” Ex. 2075, 10. The plaintiff asserted that no construction was necessary, whereas the defendant argued that the term should be construed as a “single layer whose concentration of dopants either increases across the layer or decreases across the layer.” *Id.* The court explained that the dispute distilled into two issues: (1) whether the graded concentration of dopants could only increase or decrease; and (2) whether the “single drift layer” is necessarily a single layer. *Id.* at 13–14.

In addressing the question of whether the graded concentration of dopants could both increase and decrease in the drift layer, the court rejected the defendant’s suggestion that the prosecution statement—that the direction of the electrical field and the carrier movement “depends solely on the slope

of the graded concentration of dopant”—demonstrates that “the slope must be only increasing or only decreasing to maintain a unidirectional drift field.” *Id.* at 15. In rejecting that argument, the court found that the Applicant affirmatively argued during prosecution “that a graded dopant concentration will provide a unidirectional electric drift field to move the minority carriers in a single direction and *Grove*,” relied upon by the Applicant during prosecution, “discloses a dopant concentration that both increases and decreases in the drift layer.” *Id.* at 15–16. Contrary to Patent Owner’s arguments, the court’s conclusion regarding the scope of the claims is consistent with both the Applicant’s assertion during prosecution and Petitioner’s arguments in this proceeding, i.e., that “a graded dopant concentration will provide a unidirectional electric drift field to move the minority carriers in a single direction.” *Id.* at 16.

5) Conclusions on the First Contested Issue

In view of the foregoing, we determine that Petitioner and the public at-large were entitled to rely upon the Applicant’s statements during prosecution that a graded dopant concentration will create a unidirectional electric drift field in a particular direction and this field will “aid carrier movement.” Ex. 1002, 289–290.

b. Other Forces Assertedly Relevant in Payne

1) The Parties’ Arguments

Petitioner argues that Payne discloses a single drift layer generating first and second static unidirectional electric drift fields that “aid the movement of minority carriers” as required by claim elements [1.5] and [1.6]. Pet. 22–36 (and evidence cited therein). That proposition is supported by the Applicant’s representations to the Office during prosecution, wherein

the Applicant acknowledged that a downward-sloping graded-dopant concentration would have been understood “to create an ‘inherent ‘built-in’ unidirectional electric field’ that moves carriers deep into the substrate” and that the “direction of the carrier movement depends solely on the slope of the graded concentration dopant.” *Id.* at 22–23 (emphasis omitted) (quoting Ex. 1002, 289–290); *see id.* at 24–25 (citing Ex. 1009, Fig. 2, Fig. 3, 2:67–314, 3:6–13; Ex. 1002, 237–238, 253–254) (additional, similar representations made by the Applicant). That proposition further is supported by Dr. Banerjee’s testimony. Ex. 1003 ¶¶ 94–107 (for claim element [1.5], 108–118 (for claim element [1.6])); *see* Pet. 26–30 ((persuasively explaining Dr. Banerjee’s testimony).

Patent Owner contends that Petitioner’s proposition fails because “it restricts its analysis to the direction of the gradient—and nothing else.” PO Resp. 13 (heading). In Patent Owner’s view, Petitioner’s proposition is deficient because (1) “a mere downward sloping gradient does *not* inherently “aid the movement of minority carriers” and (2) Petitioner fails to consider “other things” that Mr. Warrick testified “might affect carrier movement besides the gradient.” *Id.* at 13–14 (citing back to the arguments that we dispose of above and quoting Ex. 2056, 96:10–13) (Mr. Warrick’s deposition transcript).

2) *Analysis*

We agree with Petitioner’s view, supported by Dr. Banerjee’s persuasive testimony, that Payne’s graded concentration of dopants creates a static, or built-in, unidirectional electric field that will apply a force on minority carriers “thereby causing those carriers to *move* in a particular direction (depending on charge type), based on a phenomenon called ‘carrier drift’” by which “carriers do not need to overcome any opposing forces

before they move” in that direction. Pet. Reply 14–15; Ex. 1060 ¶¶ 10–32; Ex. 1003 ¶¶ 88, 94–96.

The Applicant was clear during prosecution that such a static, unidirectional electric field will “necessarily” aid carrier movement, and that other potential forces present in the transistor need not be considered. Ex. 1002, 289–290 (emphasis omitted). Patent Owner unpersuasively “resorts to dismissing the importance of” that history as lacking “the clarity of the specification,” but, as Petitioner points out, “there is nothing ambiguous about” the Applicant’s representations to the Office. Pet. Reply 10–11 (quoting PO Resp. 11).

Tellingly, on that point, Patent Owner’s own witness, Dr. Glew, confirms that it is “just basic physics” that an electric field will aid movement in the direction of the force. Ex. 1069, 108:15–23 (testifying that “a field will provide a force in a direction aiding – direction – aiding movement in the direction of the force. That’s just basic physics.”).

Patent Owner unequivocally confirmed that fact during district court proceedings. Ex. 1030, 26 (“Electric drift fields are a well-known phenomenon that cause carriers to move, and a [person of ordinary skill in the art] would have readily recognized that when a ‘static unidirectional electric drift field’ is present that it aids the movement of minority carriers.’ If it isn’t present, then it doesn’t.”); *see* Pet. Reply 12–13 (providing additional examples of Patent Owner’s “change-of-course from the litigation to” the *inter partes* review, representing “a classic ‘effort[] to twist claims, like a nose of wax, in one way to avoid invalidity and another to find infringement’” (quoting *Data Engine Techs. LLC v Google LLC*, 10 F.4th 1375, 1381 (Fed. Cir. 2021))).

To the extent that other factors within the transistor are relevant to the inquiry, Patent Owner identifies none in Payne, much less provides evidence that any such unidentified force could overwhelm or negate the electric field created by the downward sloping gradient, except to provide general information about “the inherent resistance of silicon.” PO Resp. 8; *but see id.* at 13–15 (failing to address that alleged force when discussing Payne).

Patent Owner contends that “Petitioners’ assumption that the gradients in their prior art references would aid carrier movement fails, because they assume that any gradient would suffice to overcome the other forces that are present, such as the inherent resistance of silicon.” *Id.* at 8. Patent Owner argues that “if the forces acting on a carrier—i.e. the force exerted by a gradient and *any other forces*—cancel each other out, the carriers do not move at all.” *Id.* at 9 (emphasis added). Patent Owner also argues that,

during prosecution, the examiner said that in “a complex electronic device, movement of minority carriers is affected by multiple forces and fields” and that a “drift field may attempt to apply a force on all minority carriers in a specific direction” but that “without knowing other parameters of the device” one cannot say whether the field would aid carrier movement. This is exactly what Cirrus Logic’s 30(b)(6) [expert] and Greenthread’s expert testified.

Id. at 9–10 (internal citation omitted) (citing Ex. 1002, 270; Ex. 2057 ¶ 50) (alteration added); *see id.* at 13–14 (citing Ex. 2056, 95:2–96:13; Ex. 2057 ¶¶ 50–51) (“Since the Petition fails to analyze the magnitude of the dopant gradient or the magnitude of other forces, it cannot show that the prior art dopant gradients aided carrier movement.”).

Patent Owner further contends that it

showed Cirrus’s corporate representative a doping profile from one of the Cirrus accused products and asked him if the downward sloping gradient met the “aid carrier movement”

claim limitation. He said “I cannot tell you that.” Greenthread then asked “is that because there’s other things that might affect carrier movement besides the gradient?” to which Mr. Warrick replied “Yes.”

PO Resp. 8 (emphasis omitted) (citing Ex. 2056, 95:2–5; 96:1–13); *see id.* at 2–3 (citing Ex. 2056, 72:6–8, 95:2–5, 96:1–13).

In addition, Patent Owner argues that

Petitioners now argue that *Greenthread* has “mischaracterized” the claim and that “aiding the movement of minority carriers ” does not refer to the flow of carriers in a semiconductor device, but rather the constant, random, thermal—a.k.a. “Brownian”—vibration of individual electrons. . . . The specification and claim language speak of moving electrons “from” one location “to” another to influence the operation of the device, not individual electrons vibrating. Furthermore, Dr. Banerjee said that the net effect of “Brownian” motion is precisely *zero*, because “statistically you have as many electrons moving to the right as to the left.”

Sur-reply 1–2 (citing Ex. 2078, 104:11–14); *see id.* at 5–6 (citing Pet. Reply 8, 12 n.8; Ex. 1060 ¶¶ 19, 95) (“According to Petitioners, ‘carriers do not need to overcome any opposing forces before they move’ because carriers ‘are *constantly moving* (i.e., in “Brownian” motion) due to thermal effects.’”).

Petitioner persuasively counterargues, however, that a “static field superimposes a force onto minority carriers, thereby causing those carriers to *move* in a particular direction (depending on charge type), based on a phenomenon called ‘carrier drift’—that is, to *aid carrier movement* in that direction.” Pet. Reply 14 (citing Ex. 1060 ¶¶ 21–27). Petitioner contends, and we agree, that “carriers do not need to overcome any opposing forces before they move,” because “in a doped semiconductor region, at room temperatures, carriers in the conduction band of a silicon atom are not

bound, but are *free to move*,” and “are *constantly moving* (i.e., in ‘Brownian’ motion) due to thermal effects.” *Id.* at 14–15 (citing Ex. 1060 ¶¶ 12–20); *see* Ex. 1003 ¶ 95 (quoting Ex. 1002, 289–290 (prosecution history consistent with Petitioner’s counterview)).

Patent Owner’s position that a threshold voltage is required “to liberate an extra electron from a crystal structure” is unpersuasive because, on this record, the evidence demonstrates that “the extra electrons in a doped semiconductor are not bonded to silicon atoms, but are free to move, and already in Brownian motion.” Pet. Reply 16 (emphasis omitted) (citing Ex. 1063, 105:6–9, 107:8–10). “‘Intrinsic resistance’ (or *resistivity*) is an inherent property of a material and its effect on carriers is analogous to a dampening force that may affect the *degree* of carrier mobility (i.e., the *speed* of carrier movement), but does not prevent carrier movement altogether.” Pet. Reply 17 (citing Ex. 1060 ¶¶ 36–41, 58–59).

Petitioner’s 30(b)(6) witness “[Mr.] Warrick[,] never suggested they could overwhelm the drift field and preclude it from *aiding carrier movement* altogether. Warrick’s statements are thus entirely consistent with Dr. Banerjee’s analysis.” *Id.* at 20 (citing Ex. 1060 ¶¶ 58–59). We find “[t]he devices in their ON state (*i.e.*, when an external voltage is applied) presents an entirely *different* scenario that was not raised by Greenthread when describing its invention during prosecution (*i.e.*, that the ‘built in’ electric field alone move carriers via drift).” Pet. Reply 18–19 (citing Ex. 1060 ¶¶ 49–51, 91–95). Further, “Dr. Glew’s failure to analyze *OFF*-state carrier movement, even when given the opportunity during deposition, warrants disregarding his analysis on this term altogether.” *Id.* at 13 (internal citation omitted) (citing Ex. 1063, 50:10–62:22).

Petitioner is not relying on “the constant, random, thermal—a.k.a. ‘Brownian’—vibration of individual electrons” to teach or suggest the carrier movement recited in the claims. Sur-Reply 1–2, 5–6. Petitioner only discusses Brownian motion to support its position that no additional threshold voltage is required “*to liberate an extra electron from a crystal structure*” because “the extra electrons in a doped semiconductor are not bonded to silicon atoms, but are free to move, and already in Brownian motion.” Pet. Reply 14–16 (citing Ex. 1063, 105:6–9, 107:8–10).²¹

To be clear, we determine, “carriers do not need to overcome any opposing forces before they move,” because “in a doped semiconductor region, at room temperatures, carriers in the conduction band of a silicon atom are not bound, but are *free to move*,” and “are *constantly moving* (i.e., in ‘Brownian’ motion) due to thermal effects.” *Id.* at 14–15 (citing Ex. 1060 ¶¶ 12–20); *see* Ex. 1003 ¶ 95. Further supporting that determination, Patent Owner itself relies on the testimony of Petitioner’s witness, Dr. Banerjee, to show that the net effect of “Brownian” motion is precisely zero, because “statistically you have as many electrons moving to the right as to the left.” Sur-reply 1–2 (citing Ex. 2078, 104:11–14); *see id.* at 5–6 (citing Pet. Reply 14, 18, n.8; Ex. 1060 ¶¶ 19, 95).

In a nutshell, we find persuasive Dr. Banerjee’s explanation as to why Brownian motion is not the relevant mechanism attributable to carrier

²¹ We need not address this argument because Patent Owner nowhere asserts in its briefing that the electrons in a semiconductor are not free to move without an externally applied voltage. Nor does Petitioner rely on Brownian motion to make out a limitation of any challenged claim. For completeness, we address this argument only because it consumes a fair amount of the post-Response briefing. *See* Pet. Reply 14–16; Sur-reply 1–2, 5–8, 10.

movement addressed by the '195 patent and its claims—an explanation supported by the objective, intrinsic evidence of the challenged patent and its prosecution history. *See* Ex. 1001, 2:42–45 (“The relative slope of the donor concentration throughout the base, creates a suitable aiding drift electric field, to help the holes (p-n-p transistor) transverse from emitter to collector.”); Ex. 1002, 289–90, 128 (prosecution history, notifying the public that “the claimed invention relates to . . . devices which include graded dopant concentrations in regions capable of providing a localized drift electric field without the application of an external potential”).

Accordingly, we find that “[i]ntrinsic resistance’ (or *resistivity*) is an inherent property of a material and its effect on carriers is analogous to a dampening force that may affect the *degree* of carrier mobility (i.e., the *speed* of carrier movement), but does not prevent carrier movement altogether.” Pet. Reply 17 (citing Ex. 1060 ¶¶ 36–41, 58–59). Dr. Banerjee cogently explains that “neither resistivity nor resistance serves as a barrier that a carrier must overcome in order to drift under the influence of a static electric field.” Ex. 1060 ¶ 59 (citing Ex. 1060 § IV.C.1–2).

As Dr. Banerjee further explains, “[t]he resistance of the silicon would affect the *speed* of carrier movement, or the ease of carrier movement in response to an electric field.” *Id.* “It would not impose a barrier to the drift of minority carriers caused by the graded dopant concentration.” *Id.* To the extent Dr. Glew provides conflicting testimony on these points, Patent Owner does not adequately explain or clarify that testimony in its briefing. *See, e.g.*, Ex. 2057 ¶ 50 (discussing “opposing forces” and the “intrinsic resistance of silicon”). Dr. Banerjee’s testimony is persuasive on this point.

In its Sur-reply, Patent Owner identifies a series of additional, potential forces that Dr. Banerjee testified could influence carrier movement,

including three broad categories of forces: (1) “periodic crystalline potential;” (2) “externally applied forces or a built-in electric field;” and (3) “random forces, . . . such as lattice vibrations or static random forces due to structural defects in the crystal.” Sur-reply 3–4 (citing Ex. 2078, 80:18–81:5, 82:9–12, 83:19–84:1, 84:16–21). But as Dr. Banerjee explained on re-direct, those forces are either not mentioned in the ’195 patent²² or would not be sufficient to overcome or negate the downward-facing electric field in the prior art. Ex. 2078, 319:10–22, 320:1–14.²³

Patent Owner and its own witness, Dr. Glew, by contrast, direct us to no persuasive evidence to support that these forces are present in Payne,

²² Dr. Banerjee, on this point, was testifying in connection with a related patent (which is the subject of IPR2024-00001); however, Patent Owner makes plain that this testimony is relevant to the ’195 patent and the prior art references asserted in the instant case. Ex. 2078, 1 (case heading); *see, e.g.*, Sur-reply 2, 4, 7–15 (Patent Owner’s extensive citations to Exhibit 2078 as evidence relevant to the instant case).

²³ Patent Owner avers that, prior to re-direct examination, Dr. Banerjee met with counsel for approximately 40 minutes. Sur-reply 13 (citing Ex. 2078, 339:1–20). When asked if he discussed his testimony with counsel during this time, counsel instructed the witness not to answer. Ex. 2078, 339:21–340:4. Patent Owner argues that this gives the appearance of improper witness coaching. *See* Sur-reply 13–14. Such behavior may lead to the Board giving redirect testimony little to no weight. In this case, however, Patent Owner does not move to strike or exclude Dr. Banerjee’s re-direct testimony. Furthermore, we find particularly significant that Dr. Banerjee was able to clearly articulate, under oath, why the categories of forces mentioned during cross-examination would either not affect whether the prior art electric field would “aid carrier movement” or are not mentioned or contemplated in the ’195 patent. The re-direct testimony is consistent with the witness’ direct testimony and, importantly, the intrinsic record; thus, notwithstanding Patent Owner’s assertions of improper coaching, we find this sworn re-direct testimony reliable under the particular facts at hand.

much less evidence sufficient to support that such forces are so large as to negate the field disclosed in Payne and relied upon by Dr. Banerjee. Instead, Patent Owner merely speculates that such forces might overwhelm the electric field and asserts that Dr. Banerjee did not quantify them.

PO Resp. 13–15; Sur-reply 3–5.

3) Conclusions on the Second Contested Issue

For the reasons set forth above, Petitioner persuasively demonstrates that Payne teaches or suggests the “aid the movement of minority carriers” limitations of claim [1.5] and [1.6].

c. Sufficiency of Petitioner’s Obviousness Analysis

Patent Owner argues that Petitioner’s obviousness analysis (1) is “sustained by mere conclusory statements,” (2) fails to address “what is missing from Payne such that an obviousness modification would be hypothetically made,” and (3) does not assess whether an ordinarily skilled artisan “would have had a reasonable expectation of success regarding any hypothetical obviousness implementation. PO Resp. 16–18. Somewhat relatedly, Patent Owner contends that the Board, as a result of those asserted insufficiencies in Petitioner’s analysis, would violate the notice requirements of the Administrative Procedures Act (“APA”) by finding claim 1 unpatentable over Payne. *Id.* at 19–22 (relying on *M&K Holdings, Inc. v. Samsung Electronics Co.*, 985 F.3d 1376 (Fed. Cir. 2021)).

We disagree. As Petitioner aptly points out, under binding Federal Circuit precedent, the fact that “all claim elements are present in Payne” (a fact Petitioner demonstrates adequately on this record) “is sufficient to find the challenged claims obvious in view of Payne.” Pet. Reply 28 (citing

Realtime Data, LLC v. Iancu, 912 F.3d 1368, 1372; *Unification Tech. LLC v. Micron Tech. Inc.*, 2024 WL 3738401, at *6 (Fed. Cir. Aug. 9, 2024)).

We further agree with Petitioner that such a finding would not violate the notice requirements of the APA, and the Federal Circuit’s decision in *M&K Holdings* is distinguishable. *Id.* at 29. In *M&K Holdings*, a petition “expressly stated” that the asserted prior art reference “did *not* disclose” one of the claim limitations, therefore, the patent owner there “was *not* put on notice that the Board might find” the reference anticipatory. *Id.* (quoting 985 F.3d at 1385). Here, by contrast, Petitioner consistently avers “that Payne discloses or suggests every element of the challenged claims” and Patent Owner “had no basis to argue unfair surprise or improper notice.” *Id.* (comparing Pet. 8–44, with PO Resp. 16–22).

5. Resolution of Contested Issue Newly Raised at Final Hearing

During the final hearing, Patent Owner raised a new, fourth argument in opposition to the challenges raised in the Petition.²⁴ Specifically, Patent Owner presented a new argument that the Petitioner erroneously identifies Payne’s majority carriers as minority carriers when applying that reference to the challenged claims. We resolve that dispute below.

In its Response and Sur-reply, Patent Owner argues that Petitioner fails to show that the “aid the movement of minority carriers” limitation is disclosed in the prior art. *See, e.g.*, PO Resp. 1, Sur-reply 3. Patent Owner provides several reasons in its papers, each of which we have addressed above. During the final hearing, Patent Owner raised a new reason not stated in its papers; namely, that Petitioner incorrectly identifies the minority carriers in the prior art. Tr. 42:2–4 (Patent Owner’s counsel: “Where we’ve

²⁴ *See supra* n.15 (identification of relevant parts of the hearing transcript).

said the majority carrier is the electron, they've said it's the hole. Where we said the minority carriers are holes, they said it's the electrons. And we'll show why that's incorrect.").

During the hearing, the panel questioned whether this constituted a new argument. *See, e.g.*, Tr. 42:23–43:4, 44:11–14. Patent Owner contends that it did not present a new argument during the final hearing because it argued generally in its papers that Petitioner fails to show the art discloses the “aid the movement of minority carriers” limitation, and because Dr. Glew offers testimony suggesting that what Petitioner had identified as the minority carrier is wrong. Tr. 43:5–9. In particular, Patent Owner directed us to paragraph 36 of Dr. Glew's Declaration and Ex. 1030 in support of its argument that Petitioner had notice of Patent Owner's position that Petitioner incorrectly identified minority carriers. *See, e.g.*, Tr. 40:16–41:10, 43:5–9; 44:15–21.

Patent Owner, however, directs us to no express statement in the Patent Owner Response or Sur-reply that clearly articulates Patent Owner's position, namely, that Petitioner fails to show the art discloses “aiding the movement of minority carriers” *because* Petitioner's identification of what constitutes a “minority” carrier is wrong.²⁵ Nor do we discern any such

²⁵ Both parties agree that this claim term requires no express construction, and the term should be given its plain and ordinary meaning. Pet. 10; PO Resp. 5–6; Tr. 42:11–12 (counsel for Patent Owner stating that “I want to be clear that we are not here to, you know, argue about claim construction.”). To the extent Patent Owner's new argument is based on its view that the plain and ordinary meaning of the phrase “aiding the movement of minority carriers” precludes a finding of obviousness because Petitioner's identification of what constitutes a minority carrier is wrong, that argument should have been, but was not, presented in Patent Owner's Response to the

express statement or articulation by Patent Owner in our own review of Patent Owner's filings. On this record, we determine that Patent Owner raised this argument for the first time during the final hearing.

Patent Owner did include paragraph 36 of Dr. Glew's Declaration in a range of paragraphs cited on page 4 of the Patent Owner Response when discussing the '195 patent. PO Resp. 4. There, Patent Owner stated: "The claimed invention is clearly disclosed in, e.g., Figs. 5B-5C of the Challenged Patent, and the corresponding parts of the specification." *Id.* (citing Ex. 2057 ¶¶ 34–37 (Dr. Glew's overview of the relevant technology)).

That sentence falls short of placing Petitioner on notice that Patent Owner relies on the footnote in paragraph 36 of Dr. Glew's Declaration to demonstrate that Petitioner fails to show that the prior art discloses "aiding the movement of minority carriers" *because* Petitioner's identification of what constitutes a minority carrier is wrong. Although paragraph 36 of Dr. Glew's Declaration includes a footnote regarding what Dr. Glew considers to be minority carriers, by reference to his annotated version of Figure 5B of the '195 patent, neither Patent Owner nor Dr. Glew articulate the argument (first presented at the final hearing) that Petitioner misidentifies the minority carriers when assessing the prior art. Ex. 2057 ¶ 36 n.3.

Indeed, after providing an overview of the '195 patent, Dr. Glew sets forth to identify alleged deficiencies in the grounds based on Payne and Onoda as asserted in the Petition. Ex. 2057 ¶¶ 48–54. In his analysis, Dr. Glew opines that the Petition contains insufficient analysis to demonstrate

Petition. Patent Owner's exercise of reading significant portions of its Sur-reply into the record during the final hearing does not cure that defect, or demonstrate that Petitioner was fairly put on notice of this new argument in any trial brief. Tr. 85:16–89:15, 90:7–91:15.

that Payne or Onoda disclose the “aid the movement of minority carriers” limitation because Petitioner fails to consider the magnitude of the force acting on the carriers in these references or whether other external, opposing forces exist that might negate the force created by Payne’s and Onoda’s downward sloping gradient. *Id.* ¶¶ 50, 52.

If Dr. Glew believed that holes or electrons were *not* minority carriers in the N-well or P-well of Payne or Onoda, and Patent Owner intended to defend against the challenge on that basis, such an argument should have been presented in a clear, straightforward manner in the declaration and briefing. It was not, and Patent Owner’s statement of this argument at the final hearing comes too late. Dr. Glew, in his declaration, proposed only that the magnitude of the force may not be sufficient to “aid the movement of minority carriers.” That argument makes little sense if, as Petitioner argued at the final hearing, the identity of the minority and majority carriers in Payne and Onoda are switched. *See* Ex. 1060 ¶¶ 23–24, 34–35.

In view of the foregoing, we do not consider the citation to paragraph 36 of Dr. Glew’s Declaration (PO Resp. 4) a sufficient basis for a finding that Patent Owner raised, prior to the final hearing, the argument that Petitioner fails to show that the prior art discloses “aiding the movement of minority carriers” *because* Petitioner wrongly identifies in its briefs what constitutes a minority carrier. On this record, Petitioner was not fairly put on notice of that argument in the briefs.²⁶ Accordingly, we decline to consider

²⁶ For example, Patent Owner’s citation to paragraph 36 of Dr. Glew’s Declaration is insufficient to place Petitioner on notice, where our rules expressly prohibit incorporation by reference of arguments from a declaration into a brief. 37 C.F.R. § 42.6(a)(3)(“It is improper to incorporate by references arguments from one document into another document.”).

Patent Owner’s new argument as untimely and forfeited. *Dell Inc. v. Acceleron, LLC*, 884 F.3d 1364, 1369 (Fed. Cir. 2018) (noting that the “Board was obligated to dismiss [a party’s] untimely argument . . . raised for the first time during oral argument”).

Assuming, *arguendo*, Patent Owner’s argument was timely, we provide below an analysis of Patent Owner’s argument to demonstrate that the outcome would not change even if that argument is deemed timely. The assessment supplies an independent basis that fully supports our ultimate conclusion that Petitioner demonstrates by a preponderance of the evidence that the “aiding the movement of minority carriers” limitation is met by the prior art.

Petitioner asserts that the region and the dopant type in the region dictates what constitutes the majority and minority carriers in a transistor. Ex. 1060 ¶ 83; Ex. 2078, 301:1–12. Relying on persuasive objective evidence, Petitioner and Dr. Banerjee identify minority carriers as holes in N-wells and electrons in P-wells. Pet. 27 n.6; Ex. 1003 ¶ 106; Ex. 1060 ¶ 12 (citing Ex. 1061, 27, 38; Ex. 1062, 62 (Fig. 3–1) (objective evidence)).

Petitioner applies that understanding of majority and minority carriers in its unpatentability challenges. For example, in its challenges based on Payne, Petitioner contends that Payne’s figures depict the electric field generated in Payne’s nested N-wells 15/18. Pet. 22; Ex. 1005, Figs. 10–11. Petitioner contends the electric field aids the movement of minority carriers, which Petitioner identifies as holes in N-wells, downward toward the substrate. Pet. 27 n.6; Ex. 1003 ¶¶ 105–106. Petitioner also contends that the electric field would be pointing in the opposite direction in Payne’s P-wells, but would still aid the movement of minority carriers, identified as electrons in P-wells, downward to the substrate. Pet. 27 n.6; Ex. 1003 ¶¶ 105–106.

Patent Owner counterargues that, in the context of the '195 patent, dopant type in a particular region is not the basis for characterizing majority and minority carriers. According to Patent Owner “[t]he patent was written from the perspective of what’s going to flow between the source and the drain, not what’s in the well between them.” Tr. 62:9–10. Therefore, “what would conduct the charge between the source and the drain is the carrier of interest.” *Id.* at 61:15–16.

Consistent with this, Patent Owner asserts that in an n-p-n transistor; that is, a transistor with n-type source and drain formed in a p-type layer, the only carrier that can conduct a charge is an electron – so electrons are the majority carrier, and holes are the minority carriers. Tr. 62:6–8; 63:13–14 (identifying the majority carrier as the carrier that can conduct the charge); *see* Ex. 2057 ¶ 36 n.3 (Dr. Glew, explaining that when a positive voltage is applied to the gate shown in Figure 5B of the patent and enough electrons have accumulated in the surface layer, they form a conductive channel of electrons between the source and drain, and “[b]ecause the channel is formed by electrons with a **n**egative charge, the MOSFET is referred to as an **n**-channel MOSFET, and the ‘minority carriers’ are holes.”). Patent Owner further argues that the opposite would be true for a p-n-p transistor (as depicted in Payne), meaning holes are the majority carriers and electrons are the minority carriers. Tr. 62:15–16.

Contrary to the position taken at the final hearing, however, Patent Owner’s prior statements to the Office (made as the Applicant during prosecution) indicate dopant type is the basis for determining what constitutes majority and minority carriers in transistors. For example, during prosecution of the '195 patent, Patent Owner stated that

The specification further states that ‘the relative slope of the donor concentration throughout the base creates a suitable aiding drift electric field, to help the holes (p-n-p transistor) transverse from emitter to collector.’ In other words, the drift field for the *holes (minority carriers)* is unidirectional, i.e., from the emitter (surface layer) to the collector (substrate) because of the particular slope of the donor concentration.

Ex. 1002, 254 (emphasis added).

Additionally, in its Sur-reply, Patent Owner itself directs us to, and relies upon, the following statement it made in an Office Action response during prosecution of its own patent application²⁷: “*a suitable aiding drift electric field*, to help the holes (minority carriers in a p-n-p transistor) traverse from emitter to collector.” Sur-reply 18 (quoting Ex. 1070, 11).

In the same Office Action response, moreover, Patent Owner stated that “in an n-p-n transistor, p-type minority carriers are transitioning across a p-type base and the minority carrie[r]s for the p-type material are electrons.” Ex. 1070, 10. Each of these statements by Patent Owner, made in reference to the discussion of a bipolar junction transistor (“BJT”) in the specification, align with Petitioner’s position that electrons are the minority carriers in a p-type well of transistor, and holes are the minority carriers in an n-type well of a transistor. Pet. 27 n.6; Ex. 1003 ¶ 106.

Furthermore, in a paragraph discussing the embodiment shown in Figures 5A, 5B, and 5C, which Patent Owner contends is an NMOS transistor (Tr. 59:12), Patent Owner stated:

²⁷ The statement appears in the file history for Application No. 17,728,588 (“the ’588 application”), which claims priority back to the ’195 patent through U.S. Patent Application No. 10/934,915. Ex. 1001, code (62).

The embodiment initially refers to a subterranean n[-]layer as having a graded donor concentration (an n-type material) to sweep the minority carriers (holes) “deep into the substrate.” Since this is an n-type material, it is a “donor” type material and would have a slope resulting in a drift field that would aid in moving minority carriers (holes in an n-type material) in a direction away from the active circuitry and “into the substrate.” In a p-type material, the minority carriers would be electrons.

Ex. 1070, 10.

These unequivocal statements made during prosecution not only contradict Patent Owner’s newly-raised position about the meaning of the claim phrase “minority carriers,” but also fully comport with Petitioner’s position. Notably, during prosecution, Patent Owner consistently identified “minority carriers” based on dopant type in its discussion of portions of the specification directed to both BJT and NMOS transistors. Patent Owner does not attempt to reconcile its new and contrary arguments, raised for the first time during the final hearing, with these prosecution statements, which apprise the public of the correct meaning of the phrase “minority carriers.”²⁸

Additional evidence of record supports Petitioner’s view that majority and minority carriers are identified based on dopant type. For example, Jastrzebski, a reference Patent Owner relied on during prosecution of the ’195 patent (as noted by Petitioner in the Petition), refers to holes as minority carriers in n-type semiconductive material. Ex. 1010, 1:57–62; Pet. 23, 34–35; Ex. 1002, 290.

Patent Owner’s arguments, regarding the identity of minority carriers in NMOS transistors, and which are based on the assertion that “[t]he patent was written from the perspective of what’s going to flow between the source

²⁸ See *supra* n.15 (citations to relevant portions of the hearing transcript).

and the drain, not what’s in the well between them,” is unavailing. Tr. 62:9–10; *see id.* at 60:5–8 (counsel for Patent Owner arguing that “what the patent is talking about here is getting rid of these unwanted minority carriers that are interfering with the active circuitry of the surface and the formation of the channel”). By way of support, Patent Owner refers to the language in column 1 of the ’195 patent regarding MOS devices being “majority carrier devices for conduction.” *Id.* at 59:10–19; Ex. 1001, 1:23–47.

According to Patent Owner, this language refers to the channel between the source and drain, and the fact that electrons would move from the source to the drain through the channel between them. Tr. 59:10–19. Patent Owner also refers to the language in column 3 of the ’195 patent discussing Figures 5(a), 5(b), and 5(c), referring to sweeping “unwanted minority carriers” into the substrate and away from the active circuitry at the surface. Tr. 59:23–25; Ex. 1001, 3:14–40.

In Patent Owner’s further view, this discussion depicts the inventor’s preferred embodiment. Tr. 60:16–23. The language Patent Owner focuses on, however, was part of the specification of the descendent ’588 application when Patent Owner made statements to the Office suggesting that dopant type determines what are minority and majority carriers.²⁹

Patent Owner does not reconcile the discrepancies among its varying statements, considering they are all made with reference to the same specification. Nor does Patent Owner sufficiently explain how Petitioner’s position is incorrect because it excludes the inventor’s allegedly preferred

²⁹ U.S. Patent Application No. 17/728/588 (“the ’588 application”) includes the same specification as the ’195 patent.

embodiment,³⁰ particularly under the circumstance here, where Petitioner’s position aligns with abundant statements made during prosecution.

Patent Owner’s attempt to support its position by reference to paragraph 36 of Dr. Glew’s Declaration and, in particular, footnote 3 of that paragraph, also is unavailing. Footnote 3 explains that, “[b]ecause the channel is formed by electrons with a **n**egative charge, the MOSFET is referred to as an **n**-channel MOSFET, and the ‘minority carriers’ are holes.” Ex. 2057, ¶ 36 n.3. Dr. Glew, however, does not direct us to any textbook, technical disclosure, or other objective evidence to support this statement. *See, e.g., Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9, at 15–17 (PTAB Aug. 24, 2022) (precedential) (holding an expert’s declaration testimony is entitled to little weight when it “is conclusory and unsupported, [and] adds little to the conclusory assertion for which it is offered to support”).

Our Trial Practice Guide cautions against crediting unsupported testimony:

The Board has broad discretion to assign weight to be accorded expert testimony. *Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010). However, the testimony must be based on sufficient facts and data. Fed. R. Evid. 702(b). “Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.” 37 C.F.R. § 42.65(a).

CTPG 35 . Because Dr. Glew’s statement in footnote 3 is conclusory, we assign it little or no weight. *See Xerox Corp.*, Paper 9 at 15 (“Dr. Jones does

³⁰ The ’195 patent states that, “[a]lthough the invention has been described with reference to specific embodiments, these descriptions are not meant to be construed in a limiting sense.” Ex. 1001, 3:62–64.

not cite to any additional supporting evidence or provide any technical reasoning to support his statement.”).

Furthermore, by asserting that the identification of majority and minority carriers is not based on dopant type, but rather on the charge carrier, Patent Owner overlooks the fact that the dopant type of the source and drain will determine what the charge carrier will be in the channel between them. Tr. 76:1–11. Patent Owner offers no adequate explanation for the fact that the charge carriers for a p-n-p transistor are different from the charge carriers for an n-p-n transistor. Tr. 61:65–62:22. Additionally, Patent Owner’s identification of what the charge carriers are, for each type of transistor, is consistent with Petitioner’s assertion that the dopant type of the source and drain determines what the majority carriers will be – electrons in an N-type source, holes in a p-type source. Tr. 61:65–62:22, 76:1–11. This further supports Petitioner’s position that dopant type generally controls the identification of majority and minority carriers.

For these reasons, the preponderance of evidence supports Petitioner’s identification of minority carriers. We disagree with Patent Owner that Petitioner incorrectly identifies minority carriers in the prior art.

6. Conclusions on the Grounds Based on Payne

For the reasons set forth above, Petitioner demonstrates by a preponderance of the evidence that claims 1, 2, and 4–6 would have been obvious in view of Payne, that claims 2 and 3 would have been obvious in

view of Payne and Wolf, and claim 3 would have been obvious in view of Payne and Parrillo.³¹ Pet. 8–44, 89–97.

G. Challenges Based on Onoda

Petitioner contends claims 1–6 are anticipated by Onoda and, in the alternative, that the subject matter of those claims would have been obvious in view of Onoda and Wolf. Pet. 6 (grounds chart). In support of the ground based on anticipation by Onoda, Petitioner directs us to evidence showing where each feature of the challenged claims is disclosed in the prior art. Pet. 44–88. Where any doubt remains as to whether Onoda discloses any particular feature of the claimed invention, Petitioner directs us to evidence that Wolf teaches the missing feature and, further, explains why an ordinarily skilled artisan would have been led to arrange those features in the manner claimed. *Id.*

In the Response, Patent Owner does not challenge Petitioner’s evidence, except to contest the same issues raised in connection with the grounds based on Payne. PO Resp. 7–22. Patent Owner argues these references together, declining to assert any separate arguments as to the merits of the grounds based on Onoda. *Id.* Accordingly, our analysis above, presented in the context of the grounds based on Payne, applies with equal force to the grounds based on Onoda.

On this record, Petitioner demonstrates by a preponderance of the evidence that claims 1–6 are anticipated by Onoda and, in the alternative,

³¹ Patent Owner raises no arguments against the grounds that include Wolf and Parrillo, except to contend that those references do not cure the alleged deficiencies that we discuss and dispose of above. PO Resp. 15.

that the subject matter of those claims would have been obvious in view of Onoda and Wolf.

H. Reliance on Dr. Banerjee's Testimony

Patent Owner contends that Dr. Banerjee's testimony is "unreliable and should be disregarded for numerous reasons." PO Resp. 26. In particular, Patent Owner contends that Dr. Banerjee's declaration is unreliable because (1) he did not write or validate each statement or assertion made in his declaration; and (2) Dr. Banerjee has a monetary conflict of interest due to his pre-existing relationship with Texas Instruments, a joined Petitioner in this proceeding. PO Resp. 26–29; Sur-reply 12–14.

1. Manner of Drafting the Declaration

Patent Owner contends Dr. Banerjee admitted that he did not write his entire declaration and included material that was provided to him by Petitioner's attorneys, which he did not necessarily verify. PO Resp. 26–29. Patent Owner further asserts that Dr. Banerjee's declaration relies on the same grounds as those presented by Dr. Travis Blalock in another proceeding related to the '195 patent and that his analysis "matches Dr. Blalock's declaration nearly verbatim." *Id.* at 27 (citing Ex. 1003; Ex. 2076). According to Patent Owner, "it is apparent that Petitioners just asked Dr. Banerjee to sign on to Dr. Blalock's existing analysis, and Dr. Banerjee complied." *Id.* Patent Owner also contends that Dr. Banerjee included a paragraph in his declaration stating that "[a]n internet search for [the Wolf textbook title] limited to the '.edu' domain yields over 800 results," but admitted during cross-examination that he did not do that search himself or take action to confirm that this statement is accurate. *Id.* at 28.

Declarants have broad latitude in how they research, structure, and draft their declarations. They may rely upon information that they personally identified or information provided by the parties' attorneys. They may also adopt nearly verbatim a previous declarant's testimony. Indeed, this procedure is often employed when a previous declarant is no longer able to testify in a proceeding. *See Jeisys Medical Inc v. Serendia, LLC*, IPR2024-00384, Paper 8 (PTAB March 1, 2024). This does not make the declaration inherently unreliable or necessarily entitled to less weight.

Through effective cross-examination, counsel may identify portions of a declaration that the declarant cannot explain or justify. In that case, the declarant's testimony on those matters may be entitled to less or even no weight, and if it happens repeatedly may lead to a conclusion that the entire declaration should be given little to no weight. Patent Owner identifies no testimony related to the key, disputed issues in this case, however, that Dr. Banerjee could not explain or provide the basis for his testimony. As such, we find that the manner in which Dr. Banerjee's declaration was drafted does not require that we disregard or give less weight to his testimony, which is provided under oath and appears reliable on this record.

2. Conflict of Interest

Patent Owner contends that Dr. Banerjee depends on research funding from private industry for his career advancement and has only two active private grants, one of which is from Texas Instruments and provides \$90,000 for his lab. Sur-reply 12 (citing Ex. 2078, 29:4–7, 29:14–30:4, 46:22–47:7). Dr. Banerjee also indicates that he plans to pursue additional funding from Texas Instruments in the future. *Id.* at 13 (citing Ex. 2078, 49:15–50:1).

Declarants are often well paid for their efforts. *See* Ex. 1003 ¶ 2 (Dr. Banerjee explaining that he is being compensated \$675 per hour in this proceeding). That does not make their testimony inherently unreliable. *See Trend Micro Inc. v Cupp Computing AS*, IPR2019-00561, Paper 28 at 6–7 (PTAB July 6, 2020).

Similarly, although Dr. Banerjee’s financial interest with Texas Instruments has a potential to bias his testimony, it does not make his testimony inherently unreliable or inadmissible. We assess Dr. Banerjee’s testimony “on its merits” and “substantive persuasiveness,” assigning “it proper weight” in view of the objective evidence cited to support the testimony, not “the circumstances of the expert’s retention.” *Id.* at 7 (citation omitted).

III. MOTION TO EXCLUDE

Petitioner moves to exclude the Declaration of Dr. Rao (Ex. 2072). Paper 64 (“Mot.”). Dr. Rao’s Declaration contains six paragraphs, which are provided to support Patent Owner’s arguments with respect to objective indicia of non-obviousness. Ex. 2072. In his Declaration, Dr. Rao identifies specific licenses and how much licensing revenue Patent Owner has received from each party. Ex. 2072 ¶ 2. Dr. Rao also testifies that Patent Owner never threatened litigation against [REDACTED], or any of their affiliates, and received \$30,000,000 from RPX for the license to [REDACTED]. *Id.* ¶¶ 4, 6.

Petitioner contends Dr. Rao did not personally negotiate the licenses and learned of the facts from others and “was unaware of the amount each licensee contributed to the total payment under the first RPX license.” Mot. 3. As Dr. Rao lacked personal knowledge of the facts alleged in the

Declaration, Petitioner contends the Declaration should be excluded under Federal Rules of Evidence 402, 403, and 602.

We are not persuaded by this argument. Dr. Rao provides the identified licenses in the Appendix to his Declaration and appears to have personal knowledge of much of his declaration testimony. For example, although he did not personally negotiate the licenses, he appears to have personal knowledge that they were entered into and how much licensing revenue was received. It is also sufficient for Dr. Rao to note that he is not aware of Greenthread ever threatening [REDACTED] with litigation, without having to rely upon potential hearsay testimony. As such, we decline to exclude his Declaration.

Dr. Rao, however, testifies that the RPX license provided rights to future patents Patent Owner may acquire, and he asserts that this “is a standard term in RPX licenses and many other licenses to ensure permanent peace between the parties.” Ex. 2072 ¶ 3. As Dr. Rao does not adequately explain his basis for the testimony regarding the standard terms of RPX’s licenses, we give this testimony little weight. Mot. 5.

In view of the foregoing, Petitioner’s Motion to Exclude Exhibit 2072 is *denied*.

IV. CONCLUSION³²

For the foregoing reasons, we determine that Petitioner demonstrates by a preponderance of the evidence that claims 1–6 are unpatentable. Our conclusions are summarized in the following table.

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1, 2, 4–6	103	Payne	1, 2, 4–6	
1–6	102	Onoda	1–6	
1–6	103	Onoda, Wolf	1–6	
2, 3	103	Payne, Wolf	2, 3	
3	103	Payne, Parrillo	3	
Overall Outcome			1–6	

V. ORDER

For the foregoing reasons, it is:

ORDERED that Petitioner demonstrates by a preponderance of the evidence that claims 1–6 of the '195 patent are unpatentable;

ORDERED that Petitioner's Motion to Exclude Exhibit 2072 is *denied*;

³² 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).

FURTHER ORDERED that, because this is a Final Written Decision, 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; and

FURTHER ORDERED that, within ten (10) business days from the date of entry of this Decision, Patent Owner and Petitioner shall jointly file a proposed redacted version of this Decision for public entry into the record.

IPR2024-00017
Patent 8,421,195 B2

PETITIONER:

Scott Weidenfeller
Anupam Sharma
COVINGTON & BURLING LLP
sweidenfeller@cov.com
asharma@cov.com

Bert Greene
Andrew Liddell
DUANE MORRIS LLP
bgreene@duanemorris.com
waliddell@duanemorris.com

David Bluestone
BENESCH FRIEDLANDER COPLAN & ARONOFF LLP
dbluestone@beneschlaw.com

PATENT OWNER:

Alan Whitehurst
Arvind Jairam
Scot Hejny
Archis Ozarkar
MCKOOL SMITH, P.C.
awhitehurst@mckoolsmith.com
ajairam@mckoolsmith.com
shejny@mckoolsmith.com
nozarkar@mckoolsmith.com