UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of

CERTAIN LIGHT-EMITTING DIODE PRODUCTS, FIXTURES, AND COMPONENTS THEREOF

INV. NO. 337-TA-1213

INITIAL DETERMINATION ON VIOLATION OF SECTION 337 AND RECOMMENDED DETERMINATION ON REMEDY AND BOND

Administrative Law Judge Clark S. Cheney

(August 17, 2021)

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5. [Claim 10] A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, the lens comprising: an outer surface; a refracting inner surface configured for refracting light from the emitter, the refracting inner surface comprising: a front sector centered on the preferential side; and a back sector centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector; and a reflecting primary back surface positioned to receive light from at least a portion of the refracting-inner-surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface.

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INITIAL DETERMINATION ON VIOLATION OF SECTION 337 AND RECOMMENDED DETERMINATION ON REMEDY AND BOND

Administrative Law Judge Clark S. Cheney

(August 17, 2021)


For the reasons stated herein, I have determined that a violation of section 337 of the Tariff Act of 1930, as amended, has occurred in the importation into the United States and the sale within the United States after importation of certain light-emitting diode products, fixtures, and components thereof based on infringement of U.S. Patent No. 9,261,270 and U.S. Patent No. 9,476,570.
I.  INTRODUCTION

A.  Procedural History

On July 15, 2020, complainant Ideal Industries Lighting LLC d/b/a Cree Lighting (“Cree”) filed a complaint alleging violations of section 337 based on the importation into the United States, the sale for importation, and the sale within the United States after importation of certain light-emitting diode products, fixtures, and components thereof. 85 Fed. Reg. 44106 (Jul. 20, 2020); see EDIS Doc. ID 714726.

On August 17, 2020, the Commission instituted Investigation No. 337-TA-1213 to determine:

[W]hether there is a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain products identified in paragraph (2) by reason of infringement of one or more of claim 1, 10, 12, 17, 21, and 24-26 of the ’531 patent [U.S. Patent No. 8,403,531]; claims 1, 24-27, 29, 48-50, 52, 57-60, and 65-67 of the ’819 patent [U.S. Patent No. 8,596,819]; claims 1-14 of the ’449 patent; claims 1-12 of the ’270 patent [U.S. Patent No. 9,261,270]; and claims 1-24 of the ’570 patent [U.S. Patent No. 9,476,570]; and whether an industry in the United States exists as required by subsection (a)(2) of section 337.


The plain language description of the accused products is “LED fixtures for indoor or outdoor applications, and components of such products.” Notice of Investigation; see also 19 C.F.R. § 210.10(b)(1).

The Commission also ordered that:

[T]he presiding administrative law judge shall take evidence or other information and hear arguments from the parties or other interested persons with respect to the public interest in this investigation, as appropriate, and provide the Commission with findings of fact and a recommended determination on this issue, which shall be limited to the statutory public interest factors set forth in 19 U.S.C. 1337(d)(1), (f)(1), (g)(1).

Notice of Investigation.

The Notice of Investigation named RAB Lighting Inc. (“RAB”) as the sole respondent. Id.
On August 25, 2020, I set the target date for this investigation at sixteen months, which makes this final initial determination due no later than August 17, 2021. Order No. 4 (August 25, 2020).


In accordance with the procedural schedule issued as Order No. 6 (Sept. 2, 2020), the parties submitted a joint chart of proposed claim constructions on November 9, 2020. Under the modified schedule in Order No. 9 (Nov. 13, 2020), the parties submitted opening claim construction briefs on November 25, 2020, and responsive claim construction briefs on December 18, 2020. On January 13, 2021, I convened a claim construction hearing. I subsequently issued Order No. 19 (“CC Order”) on March 31, 2021, construing certain disputed claim terms. I subsequently construed certain other disputed terms on April 20, 2021, in Order No. 22.


On May 5, 2021, I granted an unopposed motion filed by Cree seeking to terminate this investigation in part based on withdrawal of the complaint with respect to asserted claims 1-9 and 11-14 of the ’449 patent, claims 3-12 of the ’270 patent, and claims 2, 6-9, and 11-24 of the ’570 patent. Order No. 25 (May 5, 2021), unreviewed, Comm’n Notice (May 21, 2021). The remaining patents and claims at issue are claims 1, 10, 11, 12, 25, and 26 of the ’531 patent; claims 1, 24-27,
29, 48-50, 52, 57-59, 60, and 65-67 of the ’819 patent; claim 10 of the ’449 patent; claims 1 and 2 of the ’270 patent; and claims 1, 3, 5, and 10 of the ’570 patent.


I held a prehearing conference on April 30, 2021, and convened the evidentiary hearing May 3, 2021. The evidentiary hearing ended on May 7, 2021. See Tr. at 1–1166.

B. The Private Parties

1. Complainants

Cree is a North Carolina corporation organized and existing pursuant to the laws of the state of Delaware, with its principal place of business located at 4401 Silicon Drive, Durham, North Carolina, 27703. Am. Compl. ¶ 7. Cree is the assignee and sole owner of the patents asserted in this investigation. See JX-0001 (the ’531 patent), JX-0002 (the ’819 patent), JX-0003 (the ’449 patent), JX-0004 (the ’270 patent), JX-0005 (the ’570 patent).

2. Respondents

Respondent RAB Lighting Inc. is a privately held company incorporated in the State of New York, with its principal place of business at 170 Ludlow Ave, Northvale, New Jersey, 07647. Am. Compl. ¶ 12.
C.  The Asserted Patents

Cree asserts five patents in this investigation: the ’531 patent, the ’819 patent, the ’449 patent, and the ’270 patent, and the ’570 patent (collectively, the “Asserted Patents”).

1.  U.S. Patent No. 8,403,531

The ’531 patent, titled “Lighting Device and Method of Lighting” issued on March 26, 2013, and names Gerald H. Negley, Antony Paul Van de Ven, Thomas G. Coleman, and Mark D. Edmond as inventors. ’531 patent at cover page. The ’531 patent issued from application no. 12/277,745, filed on November 25, 2008, and is a continuation-in-part of an application that led to U.S. Patent No. 8,596,819. Id. The ’531 patent expires on January 28, 2030. Id.

Cree asserts claims 1, 10-12, 25, and 26 of the ’531 patent against RAB. See Notice of Investigation. Cree and RAB have stipulated that certain of Cree’s domestic industry products practice claims 1, 10-12, 25, and 26 of the ’819 patent. See Infringement Stip. at 4-5. The claims at issue in this investigation read as follows:

1. A lighting device comprising at least one solid state light emitter, said lighting device, when supplied with electricity of a first wattage, emitting output light having a wall plug efficiency of at least 85 lumens per watt of said electricity.

10. A lighting device as recited in claim 1, wherein said lighting device, when supplied with electricity of a first wattage, emits output light having a wall plug efficiency in the range of from 85 to about 113.5 lumens per watt of said electricity.

11. A lighting device as recited in claim 1, wherein said lighting device, when supplied with electricity of a first wattage, emits output light having a wall plug efficiency of at least 110 lumens per watt of said electricity.

12. A lighting device as recited in claim 1, wherein said lighting device, when supplied with electricity of a first wattage, emits output light having a wall plug efficiency in the range of from about 100 to about 113.5 lumens per watt of said electricity.

25. A lighting device as recited in claim 1, wherein said lighting device, when supplied with electricity of a first wattage, emits output light having a wall plug efficiency in the range of from about 85 to about 100 lumens per watt of said electricity.
26. A lighting device as recited in claim 1, wherein said lighting device, when supplied with electricity of a first wattage, emits output light having a wall plug efficiency in the range of from about 85 to about 110 lumens per watt of said electricity.

531 patent at claims 1, 10-12, 25, 26.

2. U.S. Patent No. 8,596,819

The ’819 patent, titled “Lighting Device and Method of Lighting,” issued on December 3, 2013, and names Gerald Negley, Antony Paul Van De Ven, and Thomas Coleman as inventors.


Cree and RAB have stipulated that certain of Cree’s domestic industry products practice claims 1, 24-27, 29, 48-50, 52, 57-59, 60, and 65-67 of the ’819 patent. See Infringement Stip. at 4-5. The independent claims of the ’819 patent at issue in this investigation read as follows:

1. A lighting device comprising at least one light emitting diode, said lighting device, when supplied with electricity of a first wattage, emitting output light with a wall plug efficiency of at least 60 lumens per watt of said electricity.

29. A method of lighting, comprising supplying a lighting device with electricity of a first wattage, said lighting device comprising at least one light emitting diode, said lighting device emitting output light with a wall plug efficiency of at least 60 lumens per watt of said electricity.

52. A lighting device comprising at least a first light emitting diode, said lighting device, when supplied with AC electricity of a first wattage, emitting output light having a wall plug efficiency of at least 60 lumens per watt of said electricity, said output light being a quantity of light exiting from the lighting device, said output light being perceived as white light.

60. A method of lighting, comprising supplying a lighting device with AC electricity of a first wattage, said lighting device comprising at least a first light emitting diode, said lighting device emitting output light having a wall plug efficiency of at least 60 lumens per watt of said electricity, said output light
being a quantity of light exiting from the lighting device, said output light being perceived as white light.

’819 patent at claims 1, 29, 52, 60.

3. **U.S. Patent No. 8,777,449**

The ’449 patent, titled “Lighting Devices Comprising Solid State Light Emitters,” issued on July 15, 2014, and names Antony Paul Van De Ven, Wai Kwan Chan, and Ho Chin Wah as inventors. ’449 patent at cover page. The ’449 patent issued from application 12/566,861, filed on September 25, 2009. *Id.* Cree asserts claim 10 of the ’449 patent against RAB. See Notice of Investigation; Order No. 25. To prove satisfaction of the technical prong of the domestic industry requirement, Cree relies on claim 10 of the ’449 patent. See Compl. Ex. 33.

The claim at issue in this investigation read as follows:

10. A lighting device, comprising:

   a trim element;

   an electrical connector;

   at least a first driver component; and

   at least one solid state light emitter,

   the lighting device weighing less than 750 grams,

   at least one of the at least one solid state light emitter mounted on the trim element,

   the trim element defining a trim element space,

   the first driver component in the trim element space,

   wherein if not more than about 15 watts is supplied to the electrical connector, the at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens.

’449 patent at claim 10.
4. U.S. Patent No. 9,261,270

The ’270 patent, titled “LED Lighting Fixture,” issued on February 16, 2016, and names Alan Ruud, Kurt Wilcox, Steven Walczak, and Wayne Guillien as inventors. ’270 patent at cover page. The ’270 patent issued from application 14/708,558, filed on May 11, 2015. Id. Cree asserts claims 1 and 2 of the ’270 patent against RAB. See Notice of Investigation. To prove satisfaction of the technical prong of the domestic industry requirement, Cree relies on claim 1 of the ’270 patent. See Compl. Ex. 35.

Cree and RAB have stipulated that certain of Cree’s domestic industry products practice claims 1 and 2 of the ’270 patent. See Infringement Stip. at 4-5. The claims at issue in this investigation read as follows:

1. A light fixture comprising a chamber, at least one power-circuitry driver within the chamber, at least one LED module outside the chamber, and at least one air gap between the chamber and the at least one LED module, the air gap permitting air/water-flow therethrough.

2. The light fixture of claim 1 wherein the chamber is defined by a housing.

’270 patent at claims 1 and 2.

5. U.S. Patent No. 9,476,570

The ’570 patent, titled “Lens with Controlled Backlight Management,” issued on October 25, 2016, and names Kurt Wilcox and Christopher Strom as inventors. ’570 patent at cover page. The ’570 patent issued from application 13/735,701, filed on January 7, 2013. Id. Cree asserts claims 1, 3-5, and 10 of the ’570 patent against RAB. See Notice of Investigation. To prove satisfaction of the technical prong of the domestic industry requirement, Cree relies on claims 1, 3-5, and 10 of the ’570 patent. See Compl. Ex. 35.
Cree and RAB have stipulated that certain of Cree’s domestic industry products practice claims 1, 3-5, and 10 of the ’270 patent. See Infringement Stip. at 4-5. The claims at issue in this investigation read as follows:

1. A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, comprising:

   an outer Surface configured for refracting emitter light predominantly toward the preferential side; and

   a refracting inner Surface configured for refracting light from the emitter, the refracting inner Surface comprising:

   a front sector centered on the preferential side; and

   a back sector centered on the non-preferential side radially opposite the preferential side and having a Surface configuration differing from a surface configuration of the front sector.

3. The lens of claim 1 wherein the inner refracting surface defines an emitter-surrounding cavity with an emitter-receiving opening in an emitter-adjacent base end of the lens.

4. The lens of claim 3 further comprising a reflecting primary back surface positioned to receive light from at least a portion of the refracting-inner-surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface.

5. The lens of claim 4 wherein the emitter-adjacent base end forms a back opening to a back cavity substantially centered on the non-preferential side and partially bounded by the primary back surface.

10. A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, the lens comprising:

    an outer surface;

    a refracting inner Surface configured for refracting light from the emitter, the refracting inner Surface comprising:

    a front sector centered on the preferential side; and
a back sector centered on the non-preferential side radially opposite the preferential side and having a Surface configuration differing from a surface configuration of the front sector, and

a reflecting primary back Surface positioned to receive light from at least a portion of the refracting-inner Surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface.

‘570 patent at claims 1, 3-5, and 10.

D. The Technologies at Issue

The five patents are related to four different technologies, as summarized below.

1. Wall Plug Efficiency (‘531 and ‘819 Patents)

The ‘531 and ‘819 patents describe solid-state light emitters, including those capable of producing more appealing color rendering as perceived by the human eye. To better understand the inventions described in the ‘531 and ‘819 patents, the history of their development is useful. I find that history to be as follows.

In September 2005, the named inventors of the ‘819 patent founded LED Lighting Fixtures, Inc. (“LLF”) with the goal of developing an LED lighting device that emits warm white light at a wall plug efficiency of 100 lumens per watt or higher. See Tr. at 327:7-10, 331:15-20 (Negley). One of the first projects at LLF was billboard illumination. Id. 327:17-328:4.

Gerald H. Negley, the first inventor listed on the ‘531 and ‘819 patents, was the only inventor to testify at the evidentiary hearing. As Mr. Negley explained, the “a-ha” moment for the ‘819 patent inventors occurred during the billboard project. Tr. at 393:6-19 (Negley). Specifically, the inventors were experimenting with billboard illumination in a field on the property of Thomas Coleman, another of the inventors listed on the ‘819 patent. Id. at 393:12-19. The inventors experimented with the red, green, blue, and white LEDs in a billboard prototype, tuning them independently and changing their ratios. Id. at 328:5-329:3. When they added a little bit of red to
what they called an “ugly BSY [blue-shifted yellow],” Mr. Negley recalls that “pow, it just popped!” *Id.* at 394:5-17.

Thus, in November 2005, the named inventors created a “greenish yellow or yellowish green” color called blue-shifted yellow, or BSY, and thought to combine it with red to create “a very efficacious and high-color rendering light source.” *Id.* at 329:4-330:5. The inventors named this color scheme BSY+R and implemented it using an LED component that provides the BSY color and another component that adds red. *See, e.g.*, RX-745.7 (“Using BSY lamps of various colors and ‘pulling’ to the Black body locus with RED gives superior efficacy and color”); RX-0765 (U.S. Patent No. 7,213,940) (claiming BSY+R LED lighting devices). The inventors also sought to maximize efficiency while managing other technical challenges posed by LED lighting, like heat. *See* Tr. at 331:22-332:16 (Negley).

After the billboard project, the inventors worked on applying the BSY+R technique to interior LED lighting devices, in particular a six-inch ceiling downlight. *Id.* at 330:14-24; 331:22-332:16 (Negley). By February 2006, the inventors constructed a prototype device based on the BSY+R color scheme that emitted warm white light at 53.5 lumens per watt, setting an efficiency record. Tr. at 361:23-363:5 (Negley); RX-738.4 (February 16, 2006 CSA test report); RX-50.2 (February 16, 2006 Cree press release). By April 2006, the inventors succeeded in developing a prototype downlight that produced warm white light with over 70 lumens per watt in wall plug efficiency. Tr. at 337:9-19 (Negley). An independent agency tested the prototype and reported the following results in April 2006:
JX-14 at 3401; see also id. at 3394 (Negley declaration describing the results of the April 2006 CSA testing); JX-66C (April 21, 2006 Negley email stating “At 110 V . . . we were just shy of 80 lpw . . . at 79.79 LPW”); JX-17 (April 24, 2006 Cree press release describing that LLF’s lighting device achieved “an efficacy of 73 lumens per watt, a staggering gain in efficacy . . .”); CPX-144. The April 2006 prototype output light at color temperatures of 3124K and 3189K, thus “perceived as warm white.” JX-14 at 3401.

2. **Recessed Light Fixtures (’449 Patent)**

The ’449 patent describes LED light fixtures with improved weight and energy efficiency properties for use as recessed ceiling lights (i.e., “can lights”). Figure 9 from the patent is illustrative of one embodiment of the disclosed invention:

The ’270 patent describes an LED lighting fixture with an air gap that permits air/water-flow. Figure 1 of that patent illustrates one embodiment of the disclosed invention:
4. **LED Lenses (’570 Patent)**

The ’570 patent describes lenses for use in directional lamps with LED emitters. Figure 12 of the patent illustrates a light ray trace diagram of one embodiment of the invention, showing how the lens directs light in a preferred direction:

![Light Ray Trace Diagram](image-url)

**FIG. 12**

E. **The Accused Products**

RAB has stipulated that the accused products identified in CPX-0699C infringe one or more asserted claims of the ’531 patent. JX-0169C.0003; *see also* CPX-0699C (native spreadsheet listing Accused ’531 Products). Because the asserted ’531 patent claims are directed to certain lighting efficiencies, the stipulation encompasses hundreds of models in multiple product families.
RAB has stipulated that the accused products identified in CPX-0697C and CPX-0698C infringe one or more asserted claims of the '819 patent. JX-0169C.0002; see also CPX-0697C; CPX-0698C (native spreadsheet listing Accused '819 Products attached to JX-0169C). As with the asserted '531 patent claims, the asserted '819 patent claims are directed to certain lighting efficiencies, and the stipulation concerning infringement of those claims encompasses hundreds of models in multiple product families.

Cree accuses two RAB product families of infringing the '449 patent: the Recessed Retrofit Downlight Products and the Performance Downlight Products. RAB has stipulated that, for purposes of infringement of the '449 patent, the RAB R4R89FA120WB is representative of the Recessed Retrofit Products. See Representative Products Stip., Exhibit A at 3; CX-0016C. RAB has also stipulated that RAB C6R7/10/189FAUNVW is representative of the Performance Downlight Products. Representative Products Stip., Exhibit A at 1; CX-0016C.

Cree accuses the FALCOR, CANVS/EZLED, FFLED, PIP and PIPXL products of infringing the '270 patent. CPB at 390-397. RAB has also stipulated that its PIP/PIP XL products infringe asserted claims 1-4, 7, and 9-11 of the '270 patent. JX-0169C.0003.

Cree accuses the RAB LOTBLASTER and TRIBORO product families of infringing the '570 patent. CPB at 539-543. RAB has stipulated that RAB LOT4T65/D10 is representative of the LOTBLASTER product family, and that RAB TBLED2T48NRG/D10/7PR is representative of the TRIBORO product family. Representative Products Stip.

F. The Domestic Industry Products

Cree points to its CR4T LED Downlight (CX-0843), CR6T LED Downlight (CX-0837); CR6T-G LED Gimbal Downlight (CX-0838), CR4 LED Downlight (CX-0835), CR6 LED Downlight (CX- 0836), DS4 LED Surface Mount Disk Light (CX-0844), and DS6 LED Surface
Mount Disk Light (CX-1899) (“Domestic Industry Products”) as products satisfying the domestic industry requirement. The parties have stipulated that Cree’s Domestic Industry Products practice at least one claim of each of the ’531, ’819, ’270, and ’570 patents. Infringement Stip. at ¶¶ 11-13.

II. JURISDICTION & IMPORTATION

A. Subject Matter Jurisdiction

Section 337 of the Tariff Act prohibits the importation, the sale for importation, or the sale after importation of articles that infringe a valid and enforceable patent if an industry exists in the United States relating to articles protected by the patent. 19 U.S.C. §§ 1337(a)(1)–(2). Cree’s Amended Complaint states a cause of action under section 337 by alleging that RAB imports and sells after importation certain LED lighting products and components thereof that infringe the Asserted Patents. See Compl. at ¶¶ 33-75. RAB does not contest that the Commission has subject matter jurisdiction over this Investigation. RPreHB at 26.

The Commission, therefore, has subject matter jurisdiction over this investigation.

B. Personal Jurisdiction

By filing a complaint and amended complaint and participating in the investigation, Cree has consented to personal jurisdiction at the Commission. See Certain Toner Cartridges, Components Thereof, and Systems Containing the Same, 337-TA-1174, Initial Determination at 35, not reviewed, Comm’n Determination Not to Review an Initial Determination Granting Complainants' Motion for Summary Determination of a Violation of Section 337, EDIS Doc. ID 728235 (Dec. 17, 2020). By appearing and participating in this investigation and not contesting the Commission’s jurisdiction over it, RAB has consented to personal jurisdiction at the Commission. See RPreHB at 26 (“RAB submitted to the personal jurisdiction of the Commission”). I therefore find that the Commission has personal jurisdiction over all parties. See,
C. Importation

A violation of section 337 based on patent infringement requires “[t]he importation into the United States, the sale for importation, or the sale within the United States after importation by the owner, importer, or consignee” of infringing products. 19 U.S.C. §§ 1337(a)(1)(A)–(B). RAB has stipulated that it has imported the accused products into the United States. Import Stip. ¶¶ 5-9. I therefore find that the importation requirement of section 337 has been satisfied. See Radioisotope Infusion Systems, Inv. No. 337-TA-1110, Initial Determination at 9-10 (Aug. 1, 2019), not reviewed in pertinent part, EDIS Doc. ID 689653.

D. In Rem Jurisdiction

RAB has stipulated that the Commission has in rem jurisdiction over the accused products. RPB at 26; see also Importation Stip. I therefore find the Commission has in rem jurisdiction over the Accused Products in this investigation. See Sealed Air Corp. v. Int’l Trade Comm’n, 645 F.2d 976, 985–86 (C.C.P.A. 1981) (noting the Commission has jurisdiction over imported goods).

E. Standing

RAB does not dispute Cree’s ownership of the Asserted Patents. The record demonstrates that Cree has standing in this investigation due to its ownership by assignment of the Asserted Patents. See Am. Compl. Exs. 1-10.

III. LEVEL OF ORDINARY SKILL IN THE ART

Cree proposed a level of ordinary skill in the art for each of the five asserted patents in its opening claim construction brief. Complainant’s Opening Claim Construction Brief (EDIS Doc.
ID 726474) at 5. RAB never disputed Cree’s proposals in its briefing, and neither party has argued that the level of skill is material to any disputed issue. The only discussion about the skill of an ordinary artisan in either party’s post-hearing briefing appears in connection with non-enablement defenses raised by RAB against infringement of the ’531 and ’819 patents. See RIB at 48; CRB at 46-47. Even with respect to that issue, however, neither party proposes a level of ordinary skill. Id.

To the extent a finding on the ordinary level of skill in the art is necessary, I adopt Cree’s description of the ordinary artisan in this field. See Complainant’s Opening Claim Construction Brief (EDIS Doc. ID 726474) at 5; cf. Genzyme Therapeutic Prod. Ltd. P’ship v. Biomarin Pharm. Inc., 825 F.3d 1360, 1372 (Fed. Cir. 2016) (failure to make a specific finding about the required level of skill in the art is not reversible error where the record did not show any meaningful differences in proposed definitions or that the outcome of the case would have been different based on which definition was selected).

IV. THE ’531 PATENT

A. Infringement

RAB has stipulated to infringement of the ’531 patent by all of its products so accused. See Infringement Stipulation CPX-0699C. Upon review of the infringement contentions provided by Cree, see Am. Compl. Ex. 15, and the parties’ joint stipulation of infringement, I find that Cree has shown that each RAB product listed in CX-699C practices each of the claims of the ’531 patent indicated in that stipulation.

B. Technical Prong of the Domestic Industry Requirement

RAB has stipulated that the products listed in Exhibit B of the Infringement Stipulation practice the ’531 patent. See Infringement Stipulation at ¶ 12 and Exhibit B. Upon review of the
claim charts provided by Cree, see Am. Compl. Ex. 31, and the related stipulation concerning Cree’s Domestic Industry Products, I find that Cree has shown that the Cree products listed in Infringement Stipulation Exhibit B practice the relevant claims of the ’531 patent.

C. Defenses to Infringement

RAB raises several defenses to the allegations that it infringes the ’531 patent. RAB at 19-79; 94-107. I will address each in turn.

1. Patent Ineligible Subject Matter (§ 101)

RAB contends that all of the asserted claims of the ’531 patent are directed to ineligible subject matter under § 101 of the Patent Act. 35 U.S.C. § 101; RAB at 63-76. In particular, RAB argues that the asserted claims of the ’531 patent are directed to the abstract idea of efficiency of solid-state lighting devices. RAB at 63.

35 U.S.C. § 101 permits patenting of “any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof.” 35 U.S.C. § 101. Prohibited, however, are patents claiming “[l]aws of nature, natural phenomena, and abstract ideas” because they “are basic tools of scientific and technological work.” Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 70 (2012). While these narrow exceptions to the broad scope of patentability are necessary to serve the patent clause’s stated function of “promot[ing] the progress of science and useful arts,” Art. I., Sec. 8, Cl. 8, “too broad an interpretation of this exclusionary principle could eviscerate patent law. For all inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas.” Mayo, 566 U.S. at 70.

To determine whether a patent’s claims fall within one of the narrow exemptions to patentability, courts must engage in a two-step inquiry. First, the court must “determine whether
the claims at issue are directed to one of those patent-ineligible concepts.” *Alice Corp. Pty. v. CLS Bank Int'l*, 573 U.S. 208, 216 (2014). If not, the inquiry ends, and the claims are not directed to ineligible subject-matter under section 101. *Id.* This inquiry “focus[es] on the language of the Asserted Claims themselves…. considered in light of the specification.” *See TecSec, Inc. v. Adobe Inc.*, 978 F.3d 1278, 1292 (Fed. Cir. 2020) (cleaned up). “A relevant inquiry at *Alice* Step 1 is ‘whether the claims in the[] patent[] focus on a specific means or method that improves the relevant technology or are instead directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery.’” *Free Stream Media Corp. v. Alphonso Inc.*, 996 F.3d 1355, 1363 (Fed. Cir. 2021) (quoting *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1314 (Fed. Cir. 2016)).

Only if one or more claims are found to be directed to a patent-ineligible concept does the inquiry then turn to the second step: examination of the elements of each claim “both individually and ‘as an ordered combination’ to determine whether the additional elements ‘transform the nature of the claim’ into a patent-eligible application.” *Alice*, 573 U.S. at 217 (quoting *Mayo*, 566 U.S. at 79). A patent is directed to ineligible subject-matter only if it fails both steps. *See id.*

I previously rejected similar arguments about patentable subject matter in connection with RAB’s motion for summary determination. Order No. 22 at 9-12. I found “there is no merit to RAB’s contention that the invention in the asserted claims is abstract” because the patent discloses particular physical structures that “inform[] the ordinary artisan that the device as a whole must have the claimed characteristics.” *Id.* at 12. I also found that RAB had failed to identify “what has been inappropriately preempted” by the challenged claims and rejected the argument on that ground as well. *Id.*
RAB now renews its arguments concerning § 101. RIB at 63-76; Order No. 22. RAB relies on two primary grounds: (1) two recent Federal Circuit decisions, *Free Stream* and *Yu v. Apple Inc.*, 1 F.4th 1040 (Fed. Cir. 2021),¹ which RAB contends further clarify jurisprudence concerning patent eligible subject matter, and (2) expert testimony from the trial stating that the patents are not directed to LED-based lighting devices with specific, non-abstract characteristics.

Upon further consideration, and after the benefit of hearing the trial evidence and reviewing the arguments presented in the post-hearing briefing, I vacate any findings or reasoning in Order No. 22 inconsistent with my findings and conclusions below.²

In *Free Stream*, the Federal Circuit emphasized that *Alice* Step 1 requires examination of “whether the claims in the patent focus on a specific means or method that improves the relevant technology or are instead directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery.” *Free Stream Media Corp. v. Alphonso Inc.*, 996 F.3d 1355, 1363 (Fed. Cir. 2021) (quoting *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1314 (Fed. Cir. 2016)). Thus, *Alice* Step 1 requires me to focus on the words of “the claims” to determine if they are “directed to a result or effect.”

Claim 1 of the ’531 patent states:

1. A lighting device comprising at least one solid state light emitter, said lighting device, when supplied with electricity of a first wattage, emitting output light having a wall plug efficiency of at least 85 lumens per watt of said electricity.

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¹ RAB raised *Yu* in a “Notice of Supplemental Authority” filed after briefing concluded. *See* EDIS Doc. ID 744743. Cree likewise filed a response. EDIS Doc. ID. 745293.

² Because Order No. 22 denied summary determination, it was not subject to Commission review.
'531 patent, claim 1. Other claims in the ’531 patent recite different numerical efficiencies but are otherwise the same for all purposes material to this analysis.

On their face, the claims of the ’531 patent are “directed to a result or effect that itself is the abstract idea” of wall plug efficiency of LED lighting devices, however achieved. See Free Stream, 996 F.3d at 1363 (“a claim is ineligible if it ‘fail[s] to recite a practical way of applying an underlying idea … and instead is drafted in such a result-oriented way that it amounts to encompassing ‘the principle in the abstract’ no matter how implemented” (emphasis added)). Indeed, as Cree has articulated throughout its briefing, the claims are not limited to any particular structure, but instead read on any and all means of achieving the claimed efficiencies in a lighting device that uses a solid-state emitter. See, e.g., CRB at 55 (“the claims cover more than that specific [BSY+R] mode. . . .[The] ’531 patent[ ]never suggest[s] . . . that those other approaches could not or should not be used to practice the inventions.”). The asserted claim language recites only one structure, and only in the most generic terms: “at least one solid state light emitter.” ’531 patent, claims 1, 10-12, 25-26. Any lighting device with a solid state emitter will satisfy the asserted claims if it produces at least 85 lumens per watt of electricity supplied. Thus, the claims are directed to an abstract goal, namely, the energy efficiency of LED lighting devices at or above 85 LPW, however achieved.

The Federal Circuit has admonished that a “claim must ‘have the specificity required to transform [it] from one claiming only a result to one claiming a way of achieving it’ to avoid ineligibility.” SAP Am., Inc. v. InvestPic, LLC, 898 F.3d 1161, 1167–68 (Fed. Cir. 2018) (cleaned up) (collecting cases). A claim is ineligible if it “fail[s] to recite a practical way of applying an

3 See infra IV.C.1.a). All the other claims recite a specific upper bound of efficiency except claim 11, which covers efficiencies of 110 lumens per watt and upward.
underlying idea . . . and instead [is] drafted in such a result-oriented way that [it] amount[s] to encompassing ‘the principle in the abstract’ no matter how implemented.” Interval Licensing LLC v. AOL, Inc., 896 F.3d 1335, 1343 (Fed. Cir. 2018) (emphasis added). To survive Alice Step 1, the claim itself “must identify ‘how’ that functional result is achieved by limiting the claim scope to structures specified at some level of concreteness, in the case of a product claim.” Am. Axle & Mfg., Inc. v. Neapco Holdings LLC, 967 F.3d 1285, 1302 (Fed. Cir. 2020). But as addressed above and admitted by Cree, the claims here read on improved efficiency of LED lighting devices no matter how achieved, and no matter the color of light emitted. While I previously held that the written description portion of the patent specification clarified to a person of skill in the art how to achieve the claimed result, satisfying Step 1, see Order No. 22 at 10-11, that holding was in error, as the claims themselves, even when properly construed in light of the specification, do not delineate how the claimed result is achieved. The asserted ’531 patent claims are directed to an abstract idea, and the inquiry thus moves on to Step 2 of Alice.

The asserted claims of the ’531 patent recite no limitations that would “‘transform the nature of the claim[s]’ into a patent-eligible application” under Step 2. Alice, 573 U.S. at 217 (quoting Mayo, 566 U.S. at 79). As Free Stream clarified, the eligibility inquiry must remain squarely on the claims themselves. Free Stream, 996 F.3d at 1366 (“nothing inventive disclosed in the claims that permits communications that were previously not possible. Indeed, the claims simply recite the use of generic features, as well as routine functions, to implement the underlying idea.” (emphasis added)) (citing Affinity Labs of Tex., LLC v. DIRECTV, LLC, 838 F.3d 1253, 1262 (Fed. Cir. 2016)). As in Free Stream, the claims here “simply recite that the abstract idea will be implemented using conventional components and functions generic to the technology.” See id.; see also Intellectual Ventures I LLC v. Capital One Fin. Corp., 850 F.3d 1332, 1342 (Fed.
Cir. 2017) (rejecting argument that “the claims set forth a unique solution to a problem” because the claims [did] “not recite particular features to yield these advantages”).

The Federal Circuit’s recent decision in *Yu* is likewise instructive. The claim at issue in *Yu* is reproduced below:

1. An improved digital camera comprising:

   a first and a second image sensor closely positioned with respect to a common plane, said second image sensor sensitive to a full region of visible color spectrum;

   two lenses, each being mounted in front of one of said two image sensors;

   said first image sensor producing a first image and said second image sensor producing a second image;

   an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image;

   an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image;

   and a digital image processor, coupled to said image memory and receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image.

U.S. Patent No. 6,611,289 (“the ’289 patent”).

The Federal Circuit held in *Yu* that claim 1 of the ’289 patent was “directed to the abstract idea of taking two pictures . . . and using one picture to enhance the other in some way.” *Yu*, 1 F.4th at 1043. Despite the extensive physical structure recited in claim 1 of the ’289 patent, the Federal Circuit held that it was “directed to a result or effect that itself is the abstract idea and merely invoke[s] generic processes and machinery” rather than “a specific means or method that improves the relevant technology.” *Id.* (citing *Smart Sys. Innovations, LLC v. Chi. Transit Authority*, 873 F.3d 1364, 1371 (Fed. Cir. 2017); see *id.* at 1044 n. 2 (“whether a device is ‘a
tangible system (in § 101 terms, a ‘machine’) is not dispositive”) (quoting Alice, 573 U.S. at 224). The court reasoned that, despite the extensive structure recited, all of it was “well known and conventional” and “as claimed, these conventional components perform only their basic functions.” Id.

In contrast, none of the claims of the ’531 patent include any physical structure beyond a generic “solid state light emitter,” which performs the conventional function of producing light when supplied with electricity. “What is claimed is simply a generic environment in which to carry out the abstract idea.” Yu, 1 F.4th at 1043(citing In re TLI Commc’ns LLC Pat. Litig., 823 F.3d 607, 611 (Fed. Cir. 2016)). Like the ’289 patent in Yu, the asserted ’531 patent claims describe no more than an abstract idea; they do not delineate a particular structure for achieving that result. See Yu, 1 F.4th at 1044.

The Yu court also observed that “the mismatch between the specification” and “the breadth of claim 1” underscores the abstract nature of the claims. Yu, 1 F.4th at 1044-1045. The same “mismatch” exists in the ’531 patent. Despite the broad sweep of the claims, the ’531 patent’s sole embodiment utilizes the BSY+R approach to achieving perceived white light and denigrates other technologies conventional at the time. The patent describes a previously known approach that blends light from red, green, and blue (RGB) LEDs to produce white light but criticizes that solution as having poor color rendering and limited efficiency. ’531 patent at 6:40-51; Tr., 468:17-469:2 (Wetzel), 682:2-10 (Jiao); see also ’819 patent at 6:29-40. As Dr. Jiao testified at trial, green

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4 While Cree also argues that “the inventors applied a ‘set of design rules,’” CIB at 4, they do not specify what these design rules are, where they are found in the ’531 patent, or how they relate to the claimed LPW ranges. Cf. Ariad Pharms., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1345 (Fed. Cir. 2010) (“[i]t is part of the quid pro quo of a patent; one describes an invention, and, if the law’s other requirements are met, one obtains a patent”). Cree also did not argue that any “design rules” limited the scope of the claims at the claim construction stage of the investigation.
LEDs used in the RGB scheme have limited efficiencies due to the semiconductor materials required to make those components. Tr. at 682:11-16. The patent further describes another conventional technology, phosphor-converted LEDs, as having better color rendering but goes on to criticize that solution because the efficacy is “significantly less” than even the RGB LED approach. ’531 patent at 6:52-58; Tr. at 469:3-6 (Wetzel), 682:17-683:10 (Jiao); see also ’819 patent at 6:41-47. The ’531 patent thereby discourages experimentation with the RGB LED and phosphor-converted LED approaches to achieve the desired wall plug efficiency. See CRB at 55 (Cree admitting that “the exemplary lighting devices in the … ’531 patent[, ] only employed the BSY+R approach” and that “the specifications identify the areas of improvement for other white light approaches”); Tr. at 681:6-682:1 (Jiao) (“the patent describe[s] conventional approach to produce white light”); 682:2-684:7 (the ’531 disparages other methods than BSY+R); 728:7-10 (patent discouraged use of RGB LED and phosphor-converted LED approaches); 783:19-25 (“the asserted claims are only enabled for the BSY+R color scheme? Yes”).

Thus, while the ’531 patent specification focuses exclusively on the BSY+R approach, the claims of the ’531 patent read on any structure that achieves the claimed efficiencies. This “mismatch between the specification” and “the breadth of claim 1 underscores that the focus of the claimed advance is the abstract idea and not the particular configuration discussed in the specification that allegedly departs from the prior art.” See Yu, 1 F.4th at 1045 (emphasis added).

Finally, with respect to at least claims 1 and 11, the threat of undue preemption confirms that the claims encompass an abstract idea. Claims 1 and 11 read on all lighting devices with solid state emitters, however achieved, with wall plug efficiency over 85 and 110 LPW, respectively. ’531 patent, claims 1 and 11. Cree’s expert admitted as much. See Tr. at 1105:9-1106:13 (Wetzel) (“you’re not aware of any conventional LED lighting technology that could be employed to avoid
the asserted claims of the '819 and the '531 patents other than just having a lower efficiency, is that correct? A: At the heat of the moment, no.”). Claims 1 and 11 read on a majority of LED lighting devices marketed today and will read on all more efficient LED technology developed in the future, threatening to unduly throttle innovation in an important industry. Tr. at 587:2-9 (Barna) (RAB’s commercially significant products have wall plug efficiency greater than 60 LPW), 587:10-588:8 (LED industry as a whole in similar efficiency range to RAB), 710:3-11 (Jiao) (residential and commercial LED lighting devices of 110 to 130 LPW or higher regularly available, citing RX-0752); CX-474C. Claims of such breadth “create a greater risk of preemption, thus implicating the primary concern driving § 101 jurisprudence.” *McRO, Inc.*, 837 F.3d 1299, 1314 (Fed. Cir. 2016).

The Federal Circuit gave a prescient analogy in *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336 (Fed. Cir. 2005). Writing for the court, Judge Bryson hypothesized an inventor who created a particular fuel-efficient automobile engine and described the engine in such detail in the specification that a person of ordinary skill in the art would be able to build the engine. *Id.* at 1346. Judge Bryson observed that the specification “would not necessarily support a broad claim to every possible type of fuel-efficient engine, no matter how different in structure or operation from the inventor’s engine.” *Id.* The ’531 patent specification at issue here, like the hypothetical specification describing a fuel-efficient car in *LizardTech*, explains to one of skill in the art how to make and use a particular LED lighting device using the BSY+R technique to achieve a certain efficiency. But the asserted ’531 patent *claims* read on any advancement in

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5 As explained in part IV.C.3.a) *infra* and elsewhere herein, the only way later products were able to achieve efficiencies in the upper end of the claimed ranges was through the development of more efficient LED components unknown to the inventors.
energy efficiency in the field. The fact that the claims would cover unknown, future technologies is a strong indication that the claims are directed not to a particular improvement in the field but to the abstract idea of efficiency itself.

Under the precedents examined above, the asserted claims of the ’531 patent are directed to ineligible subject matter, and therefore there can be no liability under section 337 for importing or selling articles upon which those claims read.

2. Enablement

RAB contends that claims 1 and 11 of the ’531 patent are invalid because they cover devices with efficiencies above 113.5 lumens per watt but the specification “does not enable any wall plug efficiency range above 113.5 LPW.” RIB at 26. RAB further argues that the asserted claims of the ’531 patent are invalid because they read on modalities of producing light other than those expressly enabled by the specification. RIB at 32. Finally, RAB contends that the ’531 patent claims are invalid because the claims cover an invention with only one LED but the specification fails to enable any modality with fewer than two LEDs. RIB at 40.

Section 112 of the Patent Act requires that a patent specification “enable any person skilled in the art to which it pertains . . . to make and use” the claimed invention. 35 U.S.C. § 112, ¶ 1 (pre-AIA). “Claims are not enabled when, at the effective filing date of the patent, one of ordinary skill in the art could not practice their full scope without undue experimentation.” Wyeth & Cordis Corp. v. Abbott Lab’ys, 720 F.3d 1380, 1384 (Fed. Cir. 2013). The enablement requirement “prevents . . . overbroad claiming that might otherwise attempt to cover more than was actually invented.” MagSil Corp. v. Hitachi Glob. Storage Techs., Inc., 687 F.3d 1377, 1381 (Fed. Cir. 2012). “The scope of the claims must be less than or equal to the scope of the enablement to ensure
that the public knowledge is enriched by the patent specification to a degree at least commensurate with the scope of the claims.” Sitrick v. Dreamworks, LLC, 516 F.3d 993, 999 (Fed. Cir. 2008).

Enablement is a question of law based on underlying facts. Wyeth & Cordis Corp., 720 F.3d at 1384. In analyzing whether the full scope of a claim is enabled, the Federal Circuit has considered the following factors: “(1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.” In re Wands, 858 F.2d 731, 737 (Fed. Cir. 1988). However, the Wands factors “are illustrative, not mandatory.” Amgen, Inc. v. Chugai Pharm. Co., Ltd., 927 F.2d 1200, 1213 (Fed. Cir. 1991).

a) Unbounded Ranges (Claims 1, 11)

Claims 1 and 11 of the ’531 patent both recite a lighting device that, “when supplied with electricity of a first wattage, emits output light having a wall plug efficiency of at least” a given lumens per watt of electricity, with no stated upper bound. ’531 patent at claim 1 (“at least 85 lumens per watt”), claim 11 (“at least 113.5 lumens per watt”). As explained below, these claims are invalid for lack of enablement.

Claims 1 and 11, on their face, recite no upper bound to the claimed range of efficiencies. ’531 patent at claims 1, 11. Though such an unbounded range is “not inherently improper,” see Andersen Corp. v. Fiber Composites, LLC, 474 F.3d 1361, 1376 (Fed. Cir. 2007), the enabling disclosure must be commensurate with the scope of the claims. Unbounded ranges “may be supported if there is an inherent, albeit not precisely known, upper limit and the specification enables one of skill in the art to approach that limit.” Id. at 1376-77 (quoting Scripps Clinic & Research Found. v. Genetech, Inc., 927 F.2d 1565, 1572 (Fed. Cir. 1991)) (emphasis added).
It is undisputed that the record intrinsic to the ’531 patent contains no disclosure of an upper limit for wall plug efficiency. RAB argues that a person of ordinary skill in the art at the time of the filing of the patents would recognize that there is an inherent upper limit to the possible efficiency of an LED. RIB at 26. RAB contends that, in the absence of such disclosure, “any inherent upper wall plug efficiency limit must be the ‘theoretical maximum’ for LED efficacy.” RIB at 27.

Cree, for its part, takes inconsistent positions about the scope of the claims in its infringement and enablement arguments. In its infringement arguments, Cree maintains that there is no upper limit to the efficiencies covered by the claims. See Tr. at 45:3-5. But in its enablement arguments, Cree postulates there is an implied “reasonable upper limit” to claims 1 and 11 that an ordinary artisan would understand based on the disclosure and the state of the art at the time of filing. CRB at 10-11.


The record contains evidence that a person of ordinary skill in the art at the time of the filing of the patents would understand that the theoretical maximum efficiency for a green LED (specifically, a laser of 555 nanometer wavelength) is 683 LPW, and the theoretical maximum efficiency for an LED device producing perceived white light is around 300 LPW. See Tr. at 835:2-837:13 (Jiao); 1131:16-1133:8 (Wetzel). The claims of the ’531 patent do not expressly limit themselves to devices producing perceived-white light, but neither would a person of ordinary skill understand the claimed “lighting device” to encompass a single wavelength laser.
See Tr. at 1131:14-1132:19. Thus, the inherent upper limit to the ranges in claims 1 and 11 would have been understood by a person of skill in the art to be somewhere less than 300 LPW. Because the exact upper boundary of the range need not be identified to resolve the enablement question, as will become clear below, I go no further on that point. See AK Steel Corp. v. Sollac & Ugine, 344 F.3d 1234, 1242 (Fed. Cir. 2003) (“We need not determine the upper limit, if any, of silicon that the claim language permits, but the claims must cover up to at least 10% silicon, as the parties do not dispute that a mixture of about 10% silicon and approximately 90% aluminum is an “aluminum alloy” and “an aluminum ... metal.”); Andersen Corp., 474 F.3d at 1376 (inherent limit need not be precisely determined for enablement analysis).

I next examine whether RAB has met its burden of showing, by clear and convincing evidence, that the disclosure of the ’531 patent fails to reasonably enable a person of ordinary skill to practice the full scope of the claim, including by approaching the inherent upper limit of the claim’s scope, without undue experimentation. See MagSil Corp., 687 F.3d at 1384 (citing Application of Fisher, 427 F.2d 833, 839 (C.C.P.A. 1970)). It has been nearly 13 years since the filing of the application that led to the ’531 patent, and it is undisputed that no lighting device available today comes anywhere close to a 300 LPW efficiency, to say nothing of what was achievable at the time the application was filed. Cree’s own expert Dr. Wetzel admitted that it “would have been too much to expect” devices with 200 LPW efficiencies based on the teachings of the ’531 patent without undue experimentation. Tr. at 1094:21-1095:24. He further admitted “we’re obviously far away from” devices capable of 300 LPW, and he was “surprised” to see commercial products with efficiencies even as high as 173 LPW today. Tr. at 1133:3-8; see also Tr. at 475:23-476:3 (Q: “Is an LED light fixture with 300 lumens per watt of wall plug efficiency producing warm white light currently possible today?” A: “Not per my understanding.”). Thus,
the full scope of claims 1 and 11 has not been enabled. See *MagSil Corp. v. Hitachi Glob. Storage Techs., Inc.*, 687 F.3d 1377, 1384 (Fed. Cir. 2012) (finding claims not enabled where 12 years of experimentation was required to reach claimed values).

Cree attempts to save claims 1 and 11 by disclaiming any coverage beyond an unidentified “reasonable upper limit.” CRB at 10-11. But “[a] patentee chooses broad claim language at the peril of losing any claim that cannot be enabled across its full scope of coverage.” *MagSil Corp.* 687 F.3d at 1381. When a problem with a claimed range is discovered, a patentee “can’t simply disavow the invalid portion and keep the valid portion of the claim.” *Alcon Res. v. Apotex Inc.*, 687 F.3d 1362, 1367-68 (Fed. Cir. 2012). If part of a claimed range is not enabled, “then the entire claim is invalid.” *Id.* So here. Because RAB has shown by clear and convincing evidence that the patent’s teachings failed to enable a person of ordinary skill at the time of filing to practice the full scope of the claimed invention, claims 1 and 11 of the ’531 patent are invalid for lack of enablement.

b) Alternative Modalities (All claims)

The broad language in the ’531 patent claims does not limit the claimed invention to LED lighting devices that use the BSY+R technique disclosed in the specification; rather, the claims cover devices that use alternatives like RGB LED combinations and the phosphor-converted LED approach. I find that the ’531 patent specification fails to enable a person of skill in the art to achieve the claimed efficiencies with modalities other than BSY+R, and therefore fails to enable a person of skill to practice the full scope of the claims.

“Claims must be enabled to correspond to their scope.” *Auto. Techs. Int'l, Inc. v. BMW of N. Am., Inc.*, 501 F.3d 1274, 1285 (Fed. Cir. 2007). While the enablement requirement can sometimes be satisfied with enabling disclosure of a single mode to practice an invention, where
a claim indisputably reads on multiple distinct modes, enabling disclosure of a single mode may be insufficient. See Auto. Techs., 501 F.3d at 1285; see also LizardTech, 424 F.3d at 1346 (“[T]he description of one method for creating [the claimed invention] does not entitle the inventor of the . . . patent to claim any and all means for achieving that objective.” (emphasis added)). Indeed, despite the broad sweep of the claims, the ’531 patent only enables the BSY+R approach and teaches away from other approaches that fall within the scope of the claims. “Where the specification teaches against a purported aspect of an invention, such a teaching ‘is itself evidence that at least a significant amount of experimentation would have been necessary to practice the claimed invention.’” See Liebel-Flarsheim Co. v. Medrad, Inc., 481 F.3d 1371, 1379 (Fed. Cir. 2007) (quoting AK Steel, 344 F.3d at 1244); see Idenix, 941 F.3d at 1161 (“[w]here, as here, working examples are present but are very narrow, despite the wide breadth of the claims at issue, this factor weighs against enablement”).

The sole embodiment of the ’531 patent utilizes the BSY+R approach to achieving perceived white light. See CRB at 55 (Cree admitting that “the exemplary lighting devices in the . . . ’531 patent[ ] only employed the BSY+R approach” and that “the specifications identify the areas of improvement for other white light approaches”); see Tr. at 783:19-25 (Jiao) (“the asserted claims are only enabled for the BSY+R color scheme? Yes”). Although the patent describes a previously known approach that blends light from red, green, and blue (RGB) LEDs to produce white light, it criticizes that solution as having poor color rendering and limited efficiency. ’531

6 While Cree also argues that “the inventors applied a ‘set of design rules,’” CIB at 4, they do not specify what these design rules are, where they are found in the ’531 patent, or how they relate to the claimed LPW ranges. Cf. Ariad Pharms., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1345 (Fed. Cir. 2010) (“[i]t is part of the quid pro quo of a patent; one describes an invention, and, if the law’s other requirements are met, one obtains a patent”). Cree also did not argue that any “design rules” limited the scope of the claims at the claim construction stage of the investigation.
patent at 6:40-51; Tr., 468:17-469:2 (Wetzel), 682:2-10 (Jiao); see also ’819 patent at 6:29-40. As Dr. Jiao testified at trial, green LEDs used in the RGB scheme have limited efficiencies due to the semiconductor materials required to make those components. Tr. at 682:11-16. The patent further describes another conventional technology, phosphor-converted LEDs, as having better color rendering but goes on to criticize that solution because the efficacy is “significantly less” than even the RGB LED approach. ’531 patent at 6:52-58; Tr. at 469:3-6 (Wetzel), 682:17-683:10 (Jiao); see also ’819 patent at 6:41-47. The ’531 patent thereby discourages experimentation with the RGB LED and phosphor-converted LED approaches to achieve the desired wall plug efficiency.

Tr. at 681:6-682:1 (Jiao) (“the patent describe[s] conventional approach to produce white light”); 682:2-684:7 (the ’531 disparages other methods than BSY+R); 727:20-728:10 (’819 and ’531 patents teach no new method of producing white light other than BSY+R and discouraged use of RGB LED and phosphor-converted LED approaches).

Even if not taught away from, the limited disclosures of other modalities are also inadequate. The ’531 patent states that persons of skill in the art “are aware of, and have ready access to, a wide variety” of solid-state light emitters that “can be employed in accordance with the present inventive subject matter.” ’531 patent at 10:59-62. But nothing in the patent teaches a person of ordinary skill how to use those other approaches, or how efficiencies higher than 113.5 LPW could be achieved with other “known” or readily available components. Record testimony indicates just the opposite: components known in the art at the time of the application could not achieve efficiencies higher than the inventors disclosed using the BSY+R technique, let alone any of the other techniques disparaged by the inventors. Tr. at 453:14:24 (Wetzel) (higher efficiencies could be achieved “only over time” when better components would become available), 456:13-17, 453:25-454:9.
As the Federal Circuit held in *Automotive Technologies International v. BMW of North America*, “it is the specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement.” *See Auto. Techs. Int'l*, 501 F.3d at 1283 (Fed. Cir. 2007) (quoting *Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997)) (emphasis added). The *Automative Technologies* court explained that “although the knowledge of one skilled in the art” may fill in gaps, “the novel aspect of an invention must be enabled in the patent.” *Id.* If the novel aspect of the invention is wall plug efficiency through any mechanism, “it [was] insufficient to merely state that known technologies can be used to create” the claimed efficiencies. *Id.* (affirming summary judgment of invalidity for lack of enablement because specification failed to enable claimed electronic means in anything but generic terms). The record in fact shows that higher efficiencies could be achieved with non-BSY+R methods “only over time when better components would become available.” Tr. at 453:14:24 (Wetzel) (emphasis added), see also id. at 456:13-17, 453:25-454:9, 459:20-25. If more efficient components than those in the specification were known to “the educated public” in the relevant field at the time, Dr. Wetzel did not know what they were, whether from the disclosures in the patent or any other source he considered. Tr. at 455:9-12, 459:11-24.

“The irony of this situation is that [Cree] successfully pressed to have its claims include” non-BSY+R systems, “but, having won that battle, it then had to show that such a claim was fully enabled, a challenge it could not meet.” *See Auto. Techs.*, 501 F.3d at 1285 (quoting *Liebel*, 481 F.3d at 1379). Because a person of ordinary skill at the time of the invention would not know from the specification how to practice the full scope of the claimed invention, *i.e.*, all solid-state lighting devices with efficiencies above 85 LPW including RGB and phosphor-converted lighting devices,
I find that claims 1, 10-12, 25, and 26 of the ’531 patent are invalid for lack of enablement under 35 U.S.C. § 112, ¶ 1.

c) “At least one LED” (All claims)

RAB’s final enablement argument with respect to the ’531 patent is built upon the fact that each asserted claim recites “at least one LED,” which, in RAB’s view, means each claim covers an embodiment that uses only one LED to achieve the claimed efficiencies. According to RAB, the specification teaches only embodiments with two or more LEDs using the BSY+R approach, and therefore the full scope of the claims is not enabled. RIB at 40.

To prevail on this argument, it was RAB’s burden to show by clear and convincing evidence that a person of skill in the art at the relevant time could not achieve the claimed efficiencies in a device having only a single LED. Unlike the unbounded range argument, the evidence on this point does not squarely line up in RAB’s favor. RAB’s own expert Dr. Jiao opined that the ’531 patent specification teaches how to achieve the claimed invention using the BSY+R technique. Tr. at 783:18-25 (Jiao). Cree’s expert Dr. Wetzel gave testimony that could support a conclusion that the BSY+R technique does not necessarily require two LEDs. Tr. at 1099:2-1100:5 (Wetzel) (the claims cover embodiments that use one LED and the BSY+R approach is “not only” a two LED technique). Dr. Wetzel’s testimony is supported by the ’531 patent, which teaches that “one or more of the light emitting diodes can be included in a package together with one or more of the lumiphors” to achieve the invention. ’531 patent at 13:58-60. Additionally, the ’531 patent discloses, and RAB admits, that other techniques were known at the time of the invention, such as the Phosphor-Converted LED approach. RIB at 32.

In contrast to the evidence recounted above, no one at the hearing testified that the claimed efficiencies could not be achieved in a device that had only a single solid-state emitter. Viewing
the record as a whole, I find RAB has not shown clear and convincing evidence that the asserted ’531 patent claims are not enabled based on its single LED argument. See Alcon Rsch. Ltd. v. Barr Lab’ys, Inc., 745 F.3d 1180, 1189 (Fed. Cir. 2014) (reversing finding of non-enablement “because [Defendant] did not show that any claimed embodiments would be inoperable and that a person of ordinary skill in the art would have been unable to practice the asserted claims without resorting to any experimentation, let alone undue experimentation, … by clear and convincing evidence.”).

3. **Written Description**

Section 112 of the Patent Act requires that a patent specification “shall contain a written description of the invention . . . in . . . full, clear, concise, and exact terms.” 35 U.S.C. § 112, ¶ 1 (pre-AIA). This requirement is separate and distinct from the enablement requirement. Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1340 (Fed. Cir. 2010) (en banc). The written description requirement has several policy objectives. One purpose is to convey to the public what the applicant claims as the invention. See Regents of the Univ. of Cal. v. Eli Lilly, 119 F.3d 1559, 1566 (Fed. Cir. 1997), cert. denied, 523 U.S. 1089 (1998). Another objective is to “ensure that the inventor had possession, as of the filing date of the application relied on, of the specific subject matter later claimed.” Application of Wertheim, 541 F.2d 257, 262 (C.C.P.A. 1976); Billups-Rothenberg, Inc. v. Associated Reg’l & Univ. Pathologists, Inc., 642 F.3d 1031, 1036 (Fed. Cir. 2011) (“[t]he written description requirement exists to ensure that inventors do not attempt to preempt the future before it has arrived”).

When evaluating a written description defense, the Commission conducts “an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art” to determine whether “the inventor actually invented the invention claimed.” Rivera v. Int’l Trade Comm’n, 857 F.3d 1315, 1319 (Fed. Cir. 2017) (quoting Ariad, 598 F.3d at 1351).
satisfy the statute, an applicant need not describe “every conceivable and possible future embodiment” of the invention. *Cords Corp. v. Medtronic AVE, Inc.*, 339 F.3d 1352, 1365 (Fed. Cir. 2003). Disclosure of a single species of the claimed invention may be sufficient for a claim reading on an entire genus, “[b]ut the specification must demonstrate that the applicant has made a generic invention.” *See Ariad*, 598 F.3d at 1349. Whether a specification complies with the written description requirement of § 112, ¶ 1 is a question of fact. *Rivera*, 857 F.3d at 1319. When raising a written description defense, the accused party “must show a lack of written description by clear and convincing evidence.” *Id.*

There is no dispute the application that led to the ’531 patent disclosed one embodiment of the invention with a wall plug efficiency of 113.5 LPW. '531 patent at 21:64-22:7 (“The device of FIGS. 1 and 2 was tested by NIST and resulted in the [f]ollowing performance: . . . Wall plug efficiency: 113.5 lm/w”). Nevertheless, RAB contends the ’531 patent fails the written description requirement for two main reasons. RIB at 52. First, RAB argues the specification demonstrates possession of a lighting device capable of efficiencies only up to 113.5 LPW and therefore fails to demonstrate the inventors possessed the invention of claims 1 and 11, which recite no upper bound of efficiency. RIB at 52. Second, RAB contends the BSY+R embodiment disclosed in the specification fails to demonstrate the inventors knew how to achieve the claimed efficiencies with other LED modalities, such as those accused in this investigation, and therefore all of the asserted claims of the ’531 patent are invalid. RIB at 58-61. I address both arguments below.

a) **Unbounded Ranges (Claims 1, 11)**

First, I find that a person of ordinary skill would not know from the relevant application that the applicants possessed the inventions in claims 1 and 11, which recite no upper efficiency bound. The record contains clear and convincing evidence supporting this conclusion. Cree tacitly
concedes that “the exemplary lighting devices in the ’819 and ’531 patents only employed the BSY+R approach.” CRB at 55. The inventors described and illustrated the BSY+R device in Figures 1 and 2 of the ’531 patent. The device utilized two kinds off-the-shelf LED dies: “Cree X Lamps,” which were phosphor converted blue LEDs that produced blue-shifted yellow (BSY) light, and “OSRAM Golden Dragon” LEDs, which were saturated LEDs that produced red (R) light. ’531 patent at 21:21-45; Tr. at 689:20-690:10 (Jiao), 696:8-18 (Jiao), 1065:16-24 (Wetzel). The patent identified a range of color coordinates for each type of LED die. Id. It is undisputed that the inventors did not invent these off-the-shelf LED parts. The device disclosed in Figures 1 and 2 of the ’531 patent also used an off-the-shelf LED driver. ’531 patent at 21:52-63; Tr. at 692:19-693:10 (Jiao), 1066:1-13 (Wetzel). The specification states the device the inventors assembled from these parts “was tested by NIST and resulted in the following performance: . . . Wall plug efficiency: 113.5 lm/w.” ’531 patent at 21:64-22:7.

The record contains evidence of what a person of skill in the art reading the application would understand from this disclosure. Both Cree’s expert Dr. Wetzel and RAB’s expert Dr. Jiao agreed that the component having the greatest effect on the wall plug efficiency of a lighting device is the LED light source; the device as a whole can never be more efficient than that critical component. Tr. at 457:14-458:22 (Wetzel); 717:18-718:5 (Jiao); see also id. at 693:22-694:4 (Jiao). Significantly, Cree’s expert Dr. Wetzel stated at his deposition that efficiencies higher than those disclosed by the inventors could be achieved “only over time when better components would become available.” Tr. at 453:14:24 (emphasis added). Dr. Wetzel endorsed that testimony under cross-examination at trial. Id. at 456:13-17; see also id. 453:25-454:9 (“over time as components would improve” efficiencies could improve); 459:20-25. Dr. Wetzel admitted that he did not know whether more efficient LED components than those in the specification were known to “the
educated public” in the relevant field at the time. Tr. at 455:9-12, 459:11-24. He said he could testify “about the devices as apparently obtained by the inventors,” id. at 456:9-10, but he never identified an LED component known to the inventors or anyone else that could be used to achieve wall plug efficiencies higher than 113.5 LPW at the time of the inventors’ application. Dr. Wetzel also admitted he had not seen any results indicating the inventors could do better than 113.5 LPW. Tr. at 1098:22-1099:1. He testified that the mechanism possessed by the inventors to achieve their higher efficiency was the BSY+R approach:

Q. Okay. Now, you'd agree that LLF relied on the BSY+R approach in order to achieve improved efficacy and color characteristics as compared to approaches that were conventional at the time?

A. It seems that those were the approaches by which they achieved those improvements. Tr. at 1101:13-18 (Wetzel). Dr. Jiao agreed. See Tr. at 728:13-20 (“Q. Is there anything in the ’819 or ’531 [p]atents indicating the inventors thought their invention involved using any approach [to] producing white light other than BSY+R? A. No . . .”).

RAB’s expert Dr. Jiao explained why higher efficiency LED components were unknown to persons of ordinary skill in the art at the time of application leading to the ’531 patent. It was a material science problem fundamental to the LED dies themselves: even in 2008, after the inventors’ provisional application was filed, it was still “very challenging to emit the green light in the semiconductor devices.” Tr. at 718:6-18 (Jiao). This limited the efficiency of the components known to the inventors. See id. Cree does not contend that the off-the-shelf parts identified in the specification could be configured in some way to achieve efficiencies over 113.5 LPW at the time of the application, and indeed the record evidence shows that they could not be. See Tr. at 691:4-7 (Jiao) (patent does not identify how to achieve any particular efficiency using the identified LED parts or other LED parts), id. at 453:14-24 (Wetzel) (higher efficiencies could
The disclosure of a device with a wall plug efficiency of 113.5 LPW in the ’531 patent specification does not demonstrate to a person of ordinary skill that the inventors possessed the invention capable of substantially exceeding that efficiency, as covered by claims 1 and 11. See supra part IV.C.1.a). RAB has presented clear and convincing evidence that the inventors did not have possession of an invention with an efficiency much beyond 113.5 LPW. Claims 1 and 11 are invalid for at least that reason.

b) Alternative Modalities (All Claims)

Turning to RAB’s second argument, the ’531 patent specification also fails to demonstrate that the inventors possessed an invention as generic as the claims. Cree claims that the ’531 patent specification teaches that “any combinations of LEDs and lumiphors and not just the BSY+R approach” could be used to achieve the claimed efficiencies. CRB at 55. The passages that Cree relies upon for that argument are from the ’819 patent, but similar passages may be found in the ’531 patent, and they do not prove Cree’s assertion. First, the ’531 patent states that persons of skill in the art “are aware of, and have ready access to, a wide variety” of solid-state light emitters that “can be employed in accordance with the present inventive subject matter.” ’531 patent at 10:59-62. But that passage does not say “the inventive subject matter” is more than the BSY+R approach, or that efficiencies higher than 113.5 LPW could be achieved with other “known” or readily available components. Record testimony indicates just the opposite. Persons of skill in the art would understand “the inventive subject matter” was the BSY+R approach. Tr. at 696:4-15 (Jiao) (inventors proposed the BSY+R approach), 728:13-20 (Jiao) (nothing in the ’531 patent indicates the inventors thought their invention involved any approach other than BSY+R),
1101:13-18 (Wetzel) (BSY+R was the approach “by which they achieved those improvements”). And components known in the art at the time of the application could not achieve efficiencies higher than the inventors disclosed even using something different than the BSY+R technique. Tr. at 453:14:24 (Wetzel) (higher efficiencies could be achieved “only over time when better components would become available), 456:13-17 (Wetzel), 453:25-454:9 (Wetzel).

Cree also points to the inventors’ allusion to lumiphors. CRB at 55. The ’531 patent states that “one or more lumiphors can be provided in the package and spaced from the one or more light emitting diode in the package to achieve improved light extraction efficiency.” ’531 patent at 13:61-64. But again, this passage does not suggest that lumiphors be used outside the BSY+R approach. Even if there were some record evidence that persons of skill would understand the reference to lumiphors to indicate something other than the BSY+R technique (and there is none), there is no evidence in the record that the inventors understood—or anyone of skill in the art could have achieved—efficiencies in the claimed ranges using lumiphors at the time of the application. The evidence is the opposite: higher efficiencies could be achieved “only over time when better components would become available.” Tr. at 453:14:24 (Wetzel) (emphasis added), see also id. at 456:13-17, 453:25-454:9, 459:20-25. If more efficient components than those in the specification were known to “the educated public” in the relevant field at the time, Dr. Wetzel did not know what they were, whether from the disclosures in the patent or any other source he considered. Tr. at 455:9-12, 459:11-24.

Additionally, the ’531 patent specification denigrates other approaches that were conventional at the time of the application. For example, the inventors characterized the known RGB LED approach as having poor color rendering and limited efficiency. ’531 patent at 6:40-51. The inventors also criticized the known phosphor-converted LED approach because its
efficacy was “significantly less” than even the RGB LED approach. ’531 patent at 6:52-58; Tr. at 469:3-6 (Wetzel), 682:17-683:10 (Jiao). Dr. Jiao testified that a person of skill reading this disclosure would understand that the applicants did not regard their invention to include approaches other than BSY+R. See Tr. at 728:13-20 (“Q. Is there anything in the ’819 or ’531 [p]atents indicating the inventors thought their invention involved using any approach producing white light other than BSY+R? A. No . . . Actually, they discouraged the conventional approach.”); see also Tr. at 681:6-682:1 (Jiao) (“the patent describe[s] conventional approach to produce white light . . . the background also described [RGB and phosphor converted approached] are not good enough in terms of efficacy”); 682:2-684:1 (the ’531 disparages all other disclosed methods than BSY+R); 684:2-5 (“does the ’819 [p]atent encourage use of . . . the RGB or phosphor-conversion approached to achieve higher efficiencies? A. No. The ’819 [p]atent discourages these two conventional approaches due to the description of these two approaches were less efficient at the time.”); 727:20-728:10 (’819 and ’531 patents teach no new method of producing white light other than BSY+R and discouraged use of RGB LED and phosphor-converted LED approaches); 783:19-25 (the asserted claims are only enabled for the BSY+R color scheme). And Dr. Wetzel, Cree’s own expert, agreed that the inventors found the then-conventional approaches and components to be inferior to their preferred BSY+R approach. Tr. at 468:17-469:16 (Wetzel). Disparaging approaches other than those taken by the inventors is another indication to a person of ordinary skill in the art that the inventors did not possess the invention encompassing those approaches. See Tronzo, 156 F.3d at 1158 (holding patent for artificial joint invalid for lack of written description where claims read on every species of joint shape but specification distinguished those other than the preferred embodiment as “inferior”).
“[T]he description of one method for creating [the claimed invention] does not entitle the inventor of the . . . patent to claim any and all means for achieving that objective.” See LizardTech, 424 F.3d at 1346 (emphasis added). Because a person of ordinary skill at the time of the invention would not know from the embodiment disclosed in the application that the inventors possessed the entire genus of all solid-state lighting devices with efficiencies above 85 LPW as encompassed by the claims, I find that all of the asserted claims of the ’531 patent are invalid for lack of written description under 35 U.S.C. § 112, ¶ 1.

4.   Definiteness

RAB argues that Mr. Negley’s testimony at the hearing “confirms that same device could fall both within and outside the bounds of the claim based on unclaimed operating conditions thus rendering the term ‘wall plug efficiency’ indefinite” because wall plug efficiency depends on the input voltage supplied to the device. But as I ruled previously, a patent need not “disclose details as to every possible variable that may affect the calculation of a measured value or range of values recited in a patent claim.” Order No. 22 at 8 (citing Pac. Coast Bldg. Prod., Inc. v. CertainTeed Gypsum, Inc., 816 F. App’x 454, 459 (Fed. Cir. 2020) (citing Koninklijke Philips N.V. v. Zoll Med. Corp., 656 F. App’x 504 (Fed. Cir. 2016))). And as RAB’s own briefing acknowledges, the relationship between efficacy of an LED and the supplied drive current was well known in the art at the time of the invention. See RIB at 62 n. 12.

RAB has not shown by clear and convincing evidence that the asserted claims of the ’531 patent are indefinite.

5.   Anticipation

A prior art reference anticipates when it discloses or contains all the claimed limitations “arranged or combined in the same way as in the claim.” Wm. Wrigley Jr. Co. v. Cadbury Adams
USA LLC, 683 F.3d 1356, 1361 (Fed. Cir. 2012). RAB contends claims 1, 10, 12, and 25 of the ’531 patent are rendered invalid by the intervening ’819 patent. I detail and analyze this argument below. I then analyze other prior art references asserted by RAB.

a) The Priority Date of Claims 1 and 25

The application that led to the ’531 patent asserts that it is a continuation-in-part of U.S. Application No. 11/755,153 (“the ’153 application”), which matured into the ’819 patent. The ’153 application was filed on May 30, 2007.

RAB disputes that claims 1 and 25 of the ’531 patent are supported by the disclosure of the ’153 application. Claim 1 recites wall plug efficiencies of 85 LPW and above, and claim 25 recites wall plug efficiencies from about 85 to about 100 LPW. RAB contends that when the ’153 application was filed, the inventors could not build a lighting device with a wall plug efficiency greater than 79.79 LPW. RRB at 9; RIB at 12-13.

Cree asserts that claims 1 and 25 of the ’531 patent are entitled to an effective filing date of May 30, 2007, the filing date of the ’153 application. CIB at 13. Cree contends that the ’153 application enables and provides a written description of devices with wall plug efficiency ranges of at least 85 LPW, which is within the ranges required by claims 1 and 25. Cree argues that a person of ordinary skill therefore would understand the inventors to possess the invention in claims 1 and 25, relying on testimony of its expert, Dr. Wetzel. CIB at 14 (citing Tr. at 437:14-21 (Wetzel)).

For claim 1 to be entitled to claim priority to the ’153 application, the ’153 application must show the inventors possessed and enabled an LED lighting device as advanced as the invention in claim 1. Wertheim, 541 F.2d at 262; Wyeth, 720 F.3d at 1384. Above I found that even the disclosure of a device that achieves an efficiency of 113.5 LPW in the later ’531 patent
lacks a written description and an enabling disclosure as broad as claim 1. See supra parts IV.C.2 and 3. The less advanced disclosures of the ’153 application do not cure that deficiency; the ’153 application at best discloses a device with an efficiency of 80 LPW. I therefore find that the ’153 application also lacks a written description and an enabling disclosure broad enough to support claim 1.

As for claim 25, which covers efficiencies from about 85 to about 100 LPW, Cree’s own expert Dr. Wetzel admitted, “a [person of ordinary skill] could not build a device that would achieve 100 lumens per watt” based on the teachings of the ’819 patent, which issued from the ’153 application. Tr. at 1091:22-1092:3, 1092:18-1093:4. Cree does not dispute that conclusion. See CRB at 76 (admitting the ’819 is not enabling at or beyond 100 LPW). I therefore find that the ’153 application also lacks a written description and an enabling disclosure broad enough to support claim 25. Wertheim, 541 F.2d at 262; Wyeth, 720 F.3d at 1384.

RAB does not dispute that the asserted claims of the ’531 patent are entitled at least to an effective filing date of November 27, 2007, the filing date of provisional application Nos. 60/990/439 (JX-82) and 60/990,435 (JX-81), to which the ’531 patent also claims priority. RIB at 80-81.

b) The Prior Art

i. The ’819 Patent

RAB contends that the ’819 patent, if enabled, constitutes invalidating prior art to the ’531 patent claims under 35 U.S.C. § 102(e) due to the purportedly different inventive entities of the two patents and the overlapping efficiency ranges of the claims. RIB at 93-96.

I find that the ’819 patent constitutes prior art to the ’531 patent for all asserted claims but claim 25. “Because co-inventors need not contribute to the subject matter of every claim of the
patent, inventorship is determined on a claim-by-claim basis.” Gemstar-TV Guide Int’l, Inc. v. Int’l Trade Comm’n, 383 F.3d 1352, 1381 (Fed. Cir. 2004). The ’531 patent includes an additional inventor, Mr. Edmond, who, according to co-inventor Mr. Negley’s unrebuted testimony, helped build the 113.5 LPW prototype tested at NIST in November 2007. Tr. at 349:16-18; see also Tr. at 1091:22-1092:3 (Wetzel) (’819 patent not enabling at or beyond 100 LPW); CRB at 76 (admitting the ’819 is not enabling beyond 100 LPW). According to Mr. Negley, it was Mr. Edmond’s work that got the inventors over the threshold of 100 lumens per watt. Tr. at 349:16-18.

Thus, at least for claims 1, 10-12, and 26, which recite efficiency ranges at or in excess of 100 LPW, the claimed invention is that of “another” under § 102(e). Cree’s bare assertion that claim 1 has “the same inventive entity” as the ’819 patent is unsupported by the record and contradicted by Mr. Negley’s clear and convincing testimony concerning the contributions of Mr. Edmond. Accordingly, the ’819 patent is prior art to claims 1, 10-12, and 26 of the ’531 patent.

Claim 25 recites efficiencies between 85 and 100 LPW. RAB has not provided clear and convincing evidence that Mr. Edmund contributed to development of efficiencies in those ranges, so I do not find RAB has met its burden of showing a different inventive entity for claim 25. RAB has therefore not shown that the ’819 patent is prior art to claim 25.

Although the ’819 patent is prior art to claims 1, 10, 12, and 26, it “must also enable one of skill in the art to make and use the claimed invention” in order to anticipate the ’531 patent claims. See Bristol–Myers Squibb Co. v. Ben Venue Labs., Inc., 246 F.3d 1368, 1374 (Fed. Cir. 2001). As discussed in more detail elsewhere, the ’819 patent does not enable a person of ordinary skill to make and use a device with the high efficiencies claimed in the ’531 patent. See infra part V.C.2. Accordingly, I do not find it to be clear and convincing evidence of anticipation. RAB has not shown that the ’819 patent anticipates claims 1, 10, 12, and 26 of the ’531 patent.
ii. Medendorp

U.S. Patent No. 8,125,137 (RX-0493) ("Medendorp") was filed on May 2, 2007, with named inventors Nicholas W. Medendorp, Mark McClear, Bernd P. Keller, George R. Brandes, and Ronan P. LeToquin. Medendorp predates the November 27, 2007, effective filing date of the ’531 patent and names different inventors. RX-0493 at Cover. Thus, Medendorp is prior art under 35 U.S.C. §102(e).

Medendorp discloses “[a] multi-chip light emitting device (LED) lamp for providing white light.” RX-0493 at Abstract. Medendorp also discloses:

LED light fixtures according to some embodiments of the present invention, such as the LED light fixtures 100a and/or 10b, may provide a number of features and/or benefits.

For example, LED light fixtures including multiple multi-chip lamps according to some embodiments of the present invention may provide a relatively high luminous efficacy (as expressed in lumens per watt) for a given CRI.

More particularly, conventional light fixtures may offer 10-20 lumens per watt for a CRI of 90, while LED light fixtures according to some embodiments of the present invention may offer 60-85 lumens per watt for the same CRI. *Id.* at 9:35-62 (emphasis added). Medendorp also discloses a control circuit 150a configured “apply[] drive currents to the individual LED chips.” Medendorp goes on to claim a light fixture with a wall plug efficiency of at least about 85 LPW. *Id.* at claim 22.

At the hearing, RAB’s expert Dr. Jiao testified that Medendorp discloses efficiencies no higher than 85 LPW. Tr. at 816:7-10 (Jiao). He subsequently admitted that Medendorp did not anticipate claims 11 and 12 of the ’531 patent, which each require at least 110 and 100 LPW, respectively. Tr. at 816:20-818:2.

In response, Cree focuses not on the efficiency disclosed by Medendorp but whether Medendorp’s efficiency of 85 LPW accounts for necessary losses from AC to DC conversion.
CRB at 77-79. Cree relies on the testimony of its expert, Dr. Wetzel, that Medendorp does not specify whether the sole disclosed source of power, the control circuit, is converting DC to DC or AC to DC. Tr. at 1083:8-1084:17.

Wall plug efficiency, as disclosed and claimed in the ’531 patent, must account for losses for any power conversion or power driving circuitry in the fixture. Order No. 22 at 7; see Tr. at 445:7-15 (Wetzel) (explaining that the inventors’ LPW results were “obtained on the fixture level”). Here, I do not find clear and convincing evidence that Medendorp discloses a wall plug efficiency that accounts for power conversion or power driving loses. Medendorp does not expressly state that losses from its disclosed control circuit are included in its efficiency rating, or which losses from other components have or have not been included. Indeed, Medendorp does not explain the methodology it used to arrive at its disclosed efficiencies, so it is difficult, if not impossible, to know if the disclosed efficiencies are comparable to the claimed “wall plug efficiency” in the ’531 patent claims.

Anticipation requires clear and convincing disclosure every element of the claimed invention “arranged or combined in the same way as in the claim.” Wm. Wrigley Jr. Co., 683 F.3d at 1361. That standard has not been met here. RAB has failed to show that Medendorp anticipates any asserted ’531 patent claim under 35 U.S.C. § 102(b).

iii. Ibbetson Report

RAB relies on the invention disclosed in the Ibbetson Report, a prototype LED lamp, as purportedly anticipatory prior art under 35 U.S.C. § 102(g). The Ibbetson Report was submitted to the Department of Energy on April 18, 2007 and describes work done between October 1, 2003 and December 31, 2006. JX-0151.0001. The Ibbetson Report “contains a summary of technical achievements during a three-year project to demonstrate high efficiency, solid-state lamps based
on gallium nitride/silicon carbide light emitting diodes.” JX-0151.0002. The Ibbetson Report also explains that “[t]he ultimate goal of the program is to deliver to the Department of Energy solid-state lamp prototypes that produce 1000 lumens of white flux at an efficacy of 100 lumens per watt, with the potential of 150 lumens per watt beyond the time frame of the project.” Id., 0004. As part of this project, a prototype lamp was built as shown in Figure 15 of the Ibbetson Report.

![Figure 15: Experimental high flux lamp module consisting of an array of individual emitters on a metal core circuit board.](image)

Id., 0017.

The Ibbetson Report includes the following test results for this lighting device:
As shown in the above table, Ibbetson reported that at 50 A/cm\(^2\) the lighting device was able to achieve an efficacy of 87 lumens per watt. Figure 16 of the Ibbetson Report shows that at lower current densities, Ibbetson reported even higher efficacy results exceeding 110 LPW.

“A person shall be entitled to a patent unless … before such person’s invention thereof, the invention was made in this country by another inventor who had not abandoned, suppressed, or
concealed it.” 35 U.S.C. § 102(g). “[P]riority of invention goes to the first party to reduce an invention to practice,” which in turn requires the inventor to prove that “(1) he constructed an embodiment or performed a process that met all the limitations ... and (2) he determined that the invention would work for its intended purpose.” Barry v. Medtronic, Inc., 914 F.3d 1310, 1332 (Fed. Cir. 2019). “In order to establish an actual reduction to practice, an inventor’s testimony must be corroborated by independent evidence.” Cooper v. Goldfarb, 154 F.3d 1321, 1330 (Fed. Cir. 1998). “Sufficient circumstantial evidence of an independent nature can satisfy the corroboration requirement.” Id.

RAB relies solely on the Ibbetson Report document itself to demonstrate prior inventorship under § 102(g), without any corroborating evidence. Cf. Cooper, 154 F.3d at 1330 (“In order to establish an actual reduction to practice, an inventor’s testimony must be corroborated by independent evidence.”). Although “sufficient circumstantial evidence of an independent nature can satisfy the corroboration requirement,” id., RAB does not point to any circumstantial or corroborating evidence to demonstrate that Ibbetson invented the purportedly disclosed device on a date prior to the date of the report. Without any corroborating evidence, the Ibbetson Report itself is no better than bare inventor testimony of prior inventorship. Indeed, the Ibbetson Report is arguably worse than inventor testimony because at least inventor testimony would be under the penalty of perjury.

Furthermore, RAB has failed to show that the Ibbetson Report’s lighting device was not abandoned. Although submission of the report to the DOE shows the purported invention was neither suppressed nor concealed, see RIB at 89-90, there is no indication whatsoever that Ibbetson continued work on the device after the stated ended date of the work, December 31, 2006, so as to prevent abandonment. This further undercuts a conclusion that RAB has met its burden.
Most importantly, however, the report does not show every element of the asserted ’531 patent claims. The report does not show, clearly and convincingly, that the stated efficacy of 87 LPW constitutes “wall plug efficiency” as claimed in the ’531 patent. A person of skill in the art would understand the claimed “wall plug efficiency” must account for any losses to convert the power supplied at the wall to the current driving an LED inside lighting device. See Order No. 22 at 7-8. The Ibbetson Report shows an “experimental” device connected with alligator clips to an external power supply, which power supply is connected to a wall plug. Tr. at 1079:17-1080:19 (Wetzel). There is no evidence that the Ibbetson Report accounted for any efficiency losses from the power supply when it calculated the efficiency of the disclosed device. Id. at 1080:20-24 (Wetzel).

Additionally, because the Ibbetson Report is silent on how the efficacy testing it discloses was conducted, the Ibbetson Report’s test results are “inconsistent, unreliable and non-reproducible.” Tr. at 808:6-809:8 (Jiao).

Viewing the evidence relating to the Ibbetson Report as a whole, RAB has failed to establish by clear and convincing evidence that there was prior invention by another under pre-AIA section 102(g).

6. Obviousness


Under 35 U.S.C. § 103, a patent may be found invalid as obvious if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary
skill in the art to which said subject matter pertains.” 35 U.S.C. § 103(a). Because obviousness is determined at the time of invention, rather than the date of litigation, “[t]he great challenge of the obviousness judgment is proceeding without any hint of hindsight.” Star Scientific, Inc. v. R.J. Reynolds Tobacco Co., 655 F.3d 1364, 1375 (Fed. Cir. 2011).

The critical inquiry in determining the differences between the claimed invention and the prior art is whether there is an apparent reason to combine the known elements in the fashion claimed by the patent at issue, and a reasonable expectation of success in doing so. See KSR Int’l Co. v. Teleflex, Inc., 550 U.S. 398, 417-418 (2007). Though rare, “in appropriate circumstances, a patent can be obvious in light of a single prior art reference if it would have been obvious to modify that reference to arrive at the patented invention.” Arendi S.A.R.L. v. Apple Inc., 832 F.3d 1355, 1361 (Fed. Cir. 2016). Obviousness is a determination of law based on underlying determinations of fact. Star Scientific, 655 F.3d at 1374.

a) Narukawa Is Prior Art to the Asserted Claims of the ’531 Patent

Narukawa was published online by The Japan Society of Applied Physics on October 13, 2006. RX-0038. Therefore, Narukawa is prior art under 35 U.S.C. §102(b) to the ’531 patent. Cree does not contest that Narukawa is prior art to the asserted claims of the ’531 patent.

b) Narukawa Does Not Render the Asserted Claims of the ’531 Patent Obvious

RAB relies on Narukawa’s Fig. 2, which plots the luminous efficiency of an LED versus the operating current and discloses that Narukawa’s experimental LEDs achieved 174 LPW at close to zero current. RIB at 104.
See RX-38 at Fig. 2 (and accompanying text).

Narukawa admittedly fails to disclose a “wall plug efficiency” within the range of any asserted claim of the ’531 patent, as Narukawa is directed to the performance of an LED, not a lighting device. RIB at 103-104 (Narukawa’s “white LED packages would need to be incorporated into a light fixture to meet the limitations of the ’531 Asserted Claims”). Although Narukawa squarely presents a motivation to modify its high-efficiency LEDs into a lighting device, see RX-38.0002 (“[t]he ultimate goal is to replace every light you will see in and outside of homes and offices with solid-state lighting”), RAB has failed to present clear and convincing evidence that a person of ordinary skill at the time of the invention would have a reasonable expectation of success in arriving at the wall plug efficiencies covered by the ’531 patent claims after reviewing Narukawa.

Narukawa is a research paper disclosing the experimental design of a white LEDs at the cutting edge of the art and is silent on the losses from other components that would occur if the experimental design were incorporated into a lighting device having a wall plug efficiency. Indeed, rather than measuring efficacy under normal operating conditions, Narukawa is explicit...
that the LED characteristics it discloses were “measured under pulsed operation \((f = 200\, \text{Hz} \text{ and } \text{Duty} = 1\%)\),” meaning that each individual current pulse has only a duration of about 50 microseconds. RX-38.1, Fig. 2; Tr. at 1085:19-1086:18 (Wetzel). As Dr. Wetzel explained, such a “non-standard pulse mode” was likely “designed to avoid all of the thermal issues that are known to affect LED components” and is not to be “used in any reasonable lighting device.” Id. Although Dr. Jiao testified the pulse method is a “standard method” that is “very commonly used” to measure LED performance, Tr. at 820:12-821:1 (Jiao), RAB points to nothing in the record to indicate that, even if commonly used, pulsed operation efficacies are comparable to wall plug efficiency measurements as claimed in the patents. See Tr. at 1085:19-1086:18 (Wetzel) (pulsed mode cannot be “used in any reasonable lighting device.”).

RAB argues that “174 LPW is so far above the ranges of the ’531 Asserted Claims that a POSITA could easily build a basic light fixture that meets wall plug efficiency of the ’531 Asserted Claims after accounting for industry recognized and expected losses,” citing the testimony of Dr. Jiao that a person of skill would be able to account for expected losses from additional elements. RIB at 103 (citing Tr. at 776:6-777:11 (Jiao)). But RAB points to nothing in the record that would indicate a person of skill in the art, armed with no other references, would have a reasonable likelihood of success in creating a lighting device with the claimed wall-plug efficiencies. As RAB’s own expert Dr. Jiao testified, “in order to integrate the light source into a lighting device, namely, a lamp or a luminaire, . . . other devices must be used such as a driver, optics, sometimes, and other mechanical devices.” Tr. at 771:17-772:4 (Jiao). Narukawa provides no guidance or suggestion about those other components.

Narukawa’s disclosed efficiencies do not account for losses from power conversion or optical inefficiencies that commonly arise from components included in lighting devices. As I
noted in my claim construction, the ‘531 patent is express that “the term ‘wall plug efficiency’ refers to the ratio of lumens delivered by the lamp to the watts of input power from a power source to which the lamp is connected and includes losses for any power supply and optical losses of the lamp. Thus, lumens reflected in wall plug efficiencies described herein are ‘delivered lumens’ and power is total input power.” ’531 patent at 9:56-62 (emphasis added).

Moreover, RAB has not demonstrated that if an artisan did integrate Narukawa’s experimental pulse LEDs into a lighting device, the claimed wall plug efficiencies would result. RAB propounds a hypothetical formula for calculating the wall plug efficiency of a full lighting device given a particular LED’s energy efficiency: multiplying the LED’s efficiency by 0.7. RIB at 106; Tr. at 776:21-777:2 (Jiao). If applied to the experimental LED’s disclosed in Narukawa, this formula yields a wall plug efficiency of 120 LPW (i.e., 174 LPW x 70%). RIB at 106. But the record evidence on which RAB relies for this conclusion undercuts it. RAB cites to a presentation by Mr. Negley from 2008 as supporting their “conservative estimate” of 70%, but that document reports the “system efficacy” of one of Mr. Negley’s devices to be approximately 60% of “LED component efficacy.” RX-745.11. In addition, the 60% figure reflects Mr. Negley’s understanding of his own work, including his work that led to the inventions of the ’819 and ’531 patents, and thus cannot constitute evidence of obviousness of his own invention. See Otsuka Pharm. Co. v. Sandoz, Inc., 678 F.3d 1280, 1296 (Fed. Cir. 2012) (“The inventor's own path itself never leads to a conclusion of obviousness; that is hindsight.”).

And though Dr. Jiao supplied estimates of efficiency losses for LED drivers and optical components, see Tr. at 772:5-773:18 and RX-0054, he did not explain how these numbers would come together in a unified device using the experimental pulsed operation of Narukawa. See JX-157 (estimating efficiency of roughly 54 to 69 percent of the efficacy of the LED package);
RX-0745 (2008 letter estimating the wall plug efficiency of an LED lighting device would be about 60 percent of the LED package).

Viewing the evidence as a whole, I find that RAB has not shown clear and convincing evidence that the asserted claims of the ’531 patent are invalid as obvious in light of Narukawa.

V. THE ’819 PATENT

A. Infringement

RAB has stipulated to infringement of the ’819 patent by all of its products so accused. See Infringement Stipulation; CPX-0697C, CPX-0698C. Upon review of the infringement contentions provided by Cree, see Am. Compl. Ex. 16, and the parties’ joint stipulation of infringement, I find that Cree has shown that the RAB products listed in CX-0697C and CX-0698C practice the claims of the ’819 patent.

B. Technical Prong of the Domestic Industry Requirement

RAB has stipulated that the products listed in Exhibit B of the Infringement Stipulation practice the ’819 patent. See Infringement Stipulation at ¶ 12 and Exhibit B. Upon review of the claim charts provided by Cree, see Am. Compl. Ex. 32, and the related stipulation concerning practice of the patents by the domestic industry products, I find that Cree has shown that the Cree products listed in Infringement Stipulation Exhibit B practice the ’819 patent.

C. Defenses to Infringement

RAB raises several defenses to the allegations that it infringes the ’819 patent. RIB at 19-26, 27-58, 59-94. I will address each in turn.

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7 I have considered Cree’s secondary indicia of non-obviousness, CIB at 9-12, in my analysis, but I need not discuss it as I find obviousness has not been proved for the reasons stated here.
1. **Patent Ineligible Subject Matter (§101)**

My analysis of the ’819 patent under §101 is the same as for the ’531 patent, and the parties have briefed the issues together. *See supra part IV.C.1.* As with the ’531 patent, I find the asserted claims of the ’819 patent are directed to the abstract idea of efficient LED lighting. *See id.* The asserted claims of the ’819 patent are directed to ineligible subject matter, and therefore there can be no liability under section 337 for importing or selling articles upon which those claims read.

2. **Enablement**

RAB raises the same arguments with respect to the ’819 patent as it does with ’531 patent. *See RIB at 24-51.*

   a) **Unbounded Ranges (Claims 1, 24, 29, 52, and 60)**

Claims 1, 24, 29, 52, and 60 of the ’819 patent each recite an LED lighting device having a wall plug efficiency within a range having “at least” a particular threshold but no upper bound. ’819 patent, claims 1, 24, 29, 52, and 60. For substantially the same reasons set forth above concerning claims 1 and 11 of the ’531 patent, I find that those claims are invalid for lack of enablement. *See supra part IV.C.2.a.***

As discussed in my enablement analysis of the ’531 patent, *see supra IV.C.2.a.*** a person of ordinary skill in the art at the time of the filing of the ’819 patent would understand that the ranges in claims 1, 24, 29, 52, and 60 of the ’819 patent have an inherent upper limit somewhere less than 300 LPW. *See Tr. at 835:2-837:13 (Jiao); 1131:16-1133:8 (Wetzel).*

Cree’s own expert admitted that “a [person of ordinary skill] could not build a device that would achieve 100 lumens per watt” based on the teachings of the ’819 patent. *Tr. at 1091:22-1092:3 (Wetzel).* Indeed, Cree admits that the ’819 patent was enabling at the time of its filing up to at most 100 LPW. *See CRB at 76 (‘the open-ended claims of the ’819 patent that recite a WPE*
of ‘at least 60’ LPW (i.e., claims 1, 24, 29, 52, and 60) were only enabled at the time of the invention in such a way that they would not overlap with claims 11 and 12 of the ’531 patent, which recite ‘at least 110’ and ‘from about 100 to about 113.5’ LPW, respectively,” citing Tr. at 455:15-21, 457:5-13.) Even current technology is far short of any inherent limit in the claims. Tr. at 475:23-476:3 (Q: “Is an LED light fixture with 300 lumens per watt of wall plug efficiency producing warm white light currently possible today?” A: “Not per my understanding.”), 1094:21-1095:24 (Wetzel) (“200 [LPW] would be too much to expect to achieve [based on the teachings of the more advanced ’531 patent] without undue experimentation”), 1133:3-8 (“we’re obviously far away from” values of 300 LPW, and he was “surprised” to see commercial products with efficiencies as high as 173 LPW). The earlier filing date of the ’819 patent compared to the ’531 patent only exacerbates the lack of enablement. See MPEP 2164.05(a) (“The state of the art for a given technology is not static in time. It is entirely possible that a disclosure which would not have been enabled if filed on January 2, 1990, might be enabled if the same disclosure had been filed on January 2, 1996. Therefore, the state of the prior art must be evaluated for each application based on its filing date.”).

If part of a claimed range is not enabled, “then the entire claim is invalid.” Alcon Res. v. Apotex Inc., 687 F.3d 1362, 1367-68 (Fed. Cir. 2012). So here. Because RAB has shown by clear and convincing evidence that the patent’s teachings failed to enable a person of ordinary skill at the time of filing to practice the full scope of the claimed invention, claims 1, 24, 29, 52, and 60 of the ’819 patent are invalid for lack of enablement.
b) Remaining Enablement Arguments (All Claims)

RAB’s remaining arguments concerning enablement of the ’819 patent are substantially the same as those raised concerning the ’531 patent, and succeed for substantially the same reasons. See supra IV.C.2.b), IV.C.2.c).

This reasoning is reinforced by the eight-factor analysis laid out in In re Wands, 858 F.2d 731, 737 (Fed. Cir. 1988). The claims would require substantial, undue experimentation to enable approaches other than BSY+R, see Tr. at 470:6-10 (Wetzel), 717:4-8 (Jiao), and the patents specifically discourage pursuing those other modalities. Id. at 684:2-7, 728:7-10; see also Liebel-Flarsheim, 481 F.3d at 1379 (“where the specification teaches against a purported aspect of an invention, such a teaching ‘is itself evidence that at least a significant amount of experimentation would have been necessary to practice the claimed invention’” (quoting AK Steel, 344 F.3d at 1244)). This experimentation would be unguided by the patent, which does not teach an approach other than BSY+R to arrive at the claimed efficiencies. See Tr. at 728:13-16 (Jiao).

Accordingly, I find that claims 1, 24–27, 29, 48–50, 52, 57–60, and 65–67 of the ’819 patent are invalid for lack of enablement.

3. Written Description

For substantially the same reasons discussed above concerning the ’531 patent, I find that RAB has shown clear and convincing evidence that the inventors did not have possession of the inventions recited in the asserted ’819 patent claims. Those claims are therefore invalid for lack of written description under 35 U.S.C. § 112. See supra part IV.C.3.

4. Definiteness

For substantially the same reasons discussed above concerning the ’531 patent, I find that RAB has not shown by clear and convincing evidence that the use of the term “wall plug
efficiency” in the asserted claims of the ’819 patent renders them indefinite. See supra part IV.C.4; Order No. 22.

5. Anticipation
   a) The Prior Art
      i. April 20, 2006 CSA Test

RAB contends that, if the ’819 patent has an effective filing date of May 30, 2007, then the April 20, 2006 CSA Test disclosed in the ’819 patent constitutes invalidating public use under 35 U.S.C. § 102(b). RIB at 82-86.

No matter the effective filing date of the claims, RAB has not shown by clear and convincing evidence the April 20, 2006, CSA test constituted a public use under 35 U.S.C. § 102(b). “[T]he test for the public use prong includes the consideration of evidence relevant to experimentation, as well as, inter alia, the nature of the activity that occurred in public; public access to the use; confidentiality obligations imposed on members of the public who observed the use; and commercial exploitation.” Invitrogen Corp. v. Biocrest Mfg., L.P., 424 F.3d 1374, 1380 (Fed. Cir. 2005) (emphasis added). “Given the nature of the inquiry, our case law understandably focuses on the limitations, restrictions, or secrecy obligations associated with a purported public use.” Pronova Biopharma Norge AS v. Teva Pharms. USA, Inc., 549 F. App’x 934, 940 (Fed. Cir. 2013). “More dispositively, although sometimes … even a limited disclosure can make an invention accessible to the public …, an accessibility determination may be rejected where the evidence establishes a sufficient obligation of confidentiality.” Barry v. Medtronic, Inc., 914 F.3d 1310, 1327 (Fed. Cir. 2019).

Mr. Pickard, the purported member of the public at the test, testified that he was under a confidentiality agreement. JX-152C (Pickard Dep.) at 23:15-18 (“I entered into a confidentiality
agreement before I even had my first meeting …”); Tr. at 375:8-9 (Negley) (“[Mr. Pickard] was under an NDA for that test.”); see also JX-152C (Pickard Dep.) at 37:3-8, 53:16-19; Tr. at 340:1-7. RAB argues that a subsequent press release reporting the results of the test purportedly extinguished any confidentiality obligations for Mr. Pickard and evidenced that the April 2006 CSA test was performed for “commercial purpose, i.e., to gain recognition in the lighting industry and/or to support additional funding and investment.” RIB at 83-84. But RAB points to no evidence that the press lease extinguished Mr. Pickard’s confidentiality obligations, and the press release did not disclose any details that would put the public in possession of the invention. At bottom, the public did not use the invention; it was merely tested in a confidential setting. See Invitrogen, 424 F.3d at 1380; see also Tone Bros. v. Sysco Corp., 28 F.3d 1192, 1199 (Fed. Cir. 1994) (finding that there is no “exploitative purpose” where the product at issue was shown to students for testing purposes). RAB has not shown clear and convincing evidence of prior public use that would render the ’819 patent claims invalid under 35 U.S.C. § 102(b).

ii. The Fini/Nakamura Report


8 RAB does not contend that the Fini/Nakamura Report discloses claim 24’s requirement that the “output light is perceived as warm white.” RIB at 86.
The Fini/Nakamura Report describes the concept of scattered photon extraction (“SPE”) that Dr. Nadarajah Narendran and his team developed at Rensselaer Polytechnic Institute (“RPI”). JX-0150.0001. The SPE concept demonstrates that by “put[ting] the phosphor away from the die,” the backscattered photons can be extracted and the overall light output and luminous efficacy can be significantly increased in a white LED package. Tr. at 731:4-15, 737:15-738:6 (Jiao).

The Fini/Nakamura Report also describes tests of an LED light fixture using SPE packages. Tr. at 731:17-732:12 (Jiao). According to the Fini/Nakamura Report, “[m]ultiple SPE LEDs were packaged into a fixture and its performance was measured.” JX-0150.0064. More specifically, “six 3 W blue LEDs were fitted with YAG:Ce-coated secondary optics and mounted inside a fixture housing with an aluminum heat sink and electronic driver (Fig. 64)” Id.
Id., 65. The Fini/Nakamura report disclosed the following results:

- Efficacy: 36 lm/W (at 700 mA) to 78 lm/W (at 50 mA)
- Luminous flux: 66 lm (at 50 mA) to 541 lm (at 700 mA)
- CCT: ~6500 K
- CRI: > 70
- CIE x,y: x: 0.3084, y: 0.3414 without diffuser and x: 0.3139, y: 0.3513 with diffuser (at 700 mA in both cases)
Id. The Fini/Nakamura Report includes results of testing the efficacy of the experimental fixture at different current levels.

Figure 65 of the Fini/Nakamura Report, reproduced above, visualizes the results the authors purported to achieve and indicates the SPE light fixture had measured efficacy ranging from 36 LPW (at 700 mA shown on the right side) to 78 LPW (at 50 mA shown on the left side).

Id.; see also id. at 65.

Figure 65 of the Fini/Nakamura Report, reproduced above, visualizes the results the authors purported to achieve and indicates the SPE light fixture had measured efficacy ranging from 36 LPW (at 700 mA shown on the right side) to 78 LPW (at 50 mA shown on the left side).

Id.; see also id. at 65.

No matter the effective filing date of the ’819 claims, or the conception date of the invention in those claims, RAB has not shown the Fini/Nakamura Report discloses every element of the claimed invention “arranged or combined in the same way as in the claim.” Wm. Wrigley Jr. Co., 683 F.3d at 1361. An analysis of claim 52 of the ’819 patent, which contains all of the limitations of the other asserted independent claims, illustrates this point.
“A lighting device comprising at least a first light emitting diode,”

The light fixture disclosed in the Fini/Nakamura Report used SPE LED packages and, thus, meets this limitation. Tr. at 734:7-9 (Jiao); see, e.g., JX-0150.0010, .0064.

“said lighting device, when supplied with AC electricity of a first wattage.”

The Fini/Nakamura report is silent on whether its light fixture is being supplied with AC electricity. Although Dr. Jiao testified a person of ordinary skill would understand the disclosed driver of figure 64 to be an AC to DC converting driver, Tr. at 734:10-15 and JX-0150.0065, the record shows that DC to DC drivers are also known in the art. Tr. at 648:21-649:4 (Shackle) (“The normal definition [of a driver] also include[s] taking in DC power at the input; still a driver . . . [T]he ones that take in DC power also exist, and are a standard item of commerce.”), 650:19-22 (“drivers can have DC input.”).
Fig. 64. Fixture incorporating six SPE LED packages. The micro-lens diffuser is not shown in the picture for clarity.

JX-0150.0065.
Indeed, figure 47 of the Fini/Nakamura Report shows a DC power supply was used to power the LEDs when tested individually.

![Experimental setup](image)

**Fig. 47.** Experimental setup used for measuring the transmitted and reflected light off the phosphor (Left: schematic of the experimental setup; Right: experimental setup).

JX-0150.0054.

Thus, the Fini/Nakamura Report does not clearly and convincingly disclose the AC limitation.

- “emitting output light having a wall plug efficiency of at least 60 lumens per watt of said electricity”

All asserted claims of the '819 patent require a wall plug efficiency of at least 60 LPW. RAB argues that, on its face, the Fini/Nakamura Report discloses a light fixture with a reported efficacy of 78 LPW measured at the fixture level (at 50 mA), which is in excess of the required 60 LPW minimum wall plug efficiencies found in the claims. RIB at 90 (citing Tr. at 732:14-23 (Jiao) and JX-0150.0065 at 92-94).
I find the Fini/Nakamura Report does not sufficiently disclose a device within the claimed ranges of wall plug efficiencies to support a finding of anticipation.

To begin, Fini/Nakamura is silent on how its efficiency testing was conducted. Tr. at 794:4-15 ("The test method was not described.") (Jiao). A variety of testing protocols were used in the industry at the time that would not comport with the inventors’ use of the term wall plug.
efficiency. Tr. at 794:13-796:6. The lack of a disclosed test methodology thus cuts against a finding of clear and convincing evidence.

Even assuming that Fini/Nakamura’s test results were produced by a reliable and discernible methodology, the Fini/Nakamura Report’s reported efficacy values do not clearly constitute the claimed “wall plug efficiency” values for other reasons. The evidence indicates that the report authors did not properly account for the losses associated with the fixture (e.g., driver loss, optical losses, etc.) and thus their numbers do not constitute the claimed “wall plug efficiency.” Tr. at 1073:9-13 (Wetzel). This discrepancy would have been apparent to a person of ordinary skill reading the Fini/Nakamura Report. The individual LEDs tested were reported to have an efficacy of approximately 80 LPW at the lowest current, yet the purported efficacy measurement of a fixture using those same LEDs was reported to be 78 LPW, reflecting only 2 LPW losses for all of the fixture components. See JX-0150, Fig. 63. Dr. Wetzel testified that a person of skill in the art would know that only a 2 LPW loss for device components “would not be possible” if the authors were evaluating wall plug efficiency in the same manner claimed by the inventors. Tr. at 1074:7-22. Had the Fini/Nakamura Report accounted for the relevant fixture-level losses, the overall fixture efficacy—the true “wall plug efficiency”—necessarily must have been significantly lower. Id. Indeed, as shown in Figure 64, the Fini/Nakamura Report inherently identifies the losses associated with different components of its fixture by reciting efficiencies for those components, namely 94% efficiency for a reflector, 93% for a diffuser, and >97% for high reflectance paint:
JX-0150.0065. As a person of ordinary skill would have understood, based on the component efficiency disclosures in the Fini/Nakamura report, that an 80 LPW efficient LED could not be incorporated into a fixture that incurs these component losses and still achieve a wall plug efficiency of 78 LPW. For example, the diffuser efficiency (93%) alone would have resulted in the wall plug efficiency to drop below 78 LPW. Tr. at 1075:15-19.

RAB argues that the diffuser is only an optional component of the light fixture, and that the tests in the Fini/Nakamura Report were conducted with and without a diffuser. RIB at 93. But
RAB points to nothing in the Fini/Nakamura Report that discloses a diffuser-less test. *But see JX-150 at 64 (“[t]he fixture array consisted of … a micro-lens diffuser with 93% efficiency” . . . “[t]he reflector and micro-lens diffuser combined increase mix uniformity and direct light output in the desired direction.”).* The Fini/Nakamura Report’s fixture at the top of Fig. 64 is likewise depicted as including the micro-lens diffuser. Although RAB points to the photograph of the fixture in Fig. 64 as a diffuser-less embodiment, the Fini/Nakamura Report explains that the diffuser “is not shown … for clarity,” not because it is optional. JX-150 at 65; Tr. at 1075:20-1076:12 (Wetzel). In any event, even if the diffuser were optional, RAB points to no disclosure that avoids diffuser losses but accounts for other losses necessary to calculate wall plug efficiency in accordance with the claims.

With respect to the reflector, RAB argues that its efficiency (*i.e.*, 94%) would be relevant only to the portion of the light actually contacting or being reflected off of the reflector and that, because the majority of the light would not contact the reflector, the reflector array would account for only a minimal loss. RIB at 93. It is true that the experts in this investigation agree that not all light emitted is reflected off the reflector array. Tr. at 1123:19-24 (Wetzel); 734:23-735:20 (Jiao). But if the disclosed 94%-efficiency figure does not already incorporate that fact into account, then the Fini/Nakamura Report is left with no disclosure that would allow a person of ordinary skill to determine what the reflector’s impact on the wall plug efficiency is, further ambiguating the reference. Tr. at 1122:11-19 (Wetzel).

Finally, the Fini/Nakamura Report’s 78 LPW figure is not clearly a claimed “wall plug efficiency” because it is unclear whether it incorporates the losses associated with the disclosed driver. As Dr. Jiao admitted, the Fini/Nakamura Report does not provide any details concerning its driver. Tr. at 799:12. Although the Fini/Nakamura report’s measurements were purportedly
taken at the fixture level, implying it includes the driver’s losses, Tr. at 736:18-737:2 (Jiao), the actual numbers cast that inference into doubt. Specifically, the Fini/Nakamura Report’s disclosed fixture-level efficacy was 97.5% of the LED efficacy. Tr. at 1074:14-22 (Wetzel). But RAB’s own expert, Dr. Jiao, testified that “the typical efficacy for LED drivers” is “in the range of 90 percent electrical efficacy.” Tr. at 772:5-12 (Jiao).

Thus, although a close question, RAB has not shown by clear and convincing evidence that the Fini/Nakamura report discloses any claimed wall plug efficiencies. This finding alone defeats RAB’s entire argument based on the Fini/Nakamura reference.

- “said output light being a quantity of light exiting from the lighting device,”

The SPE LED packages emit a measurable amount of light, e.g., at 50 mA, and the light fixture of the Fini/Nakamura Report is reported to have a luminous flux of 66 lumens. JX-0150.0065; see Tr. at 830:9-21 (Jiao). Thus, the Fini/Nakamura Report meets this limitation.

- “said output light being perceived as white light.”

The chromaticity coordinates and correlated color temperature numbers disclosed in the Fini/Nakamura Report indicate that the output light is white light. JX-0150.0065; Tr. at 802:6-25 (Jiao). Thus, the Fini/Nakamura Report meets this limitation.

- **Dependent Range Claims**

  If the Fini/Nakamura Report discloses wall-plug efficiencies within the meaning of the claims at all, it explicitly meets the limitations of the dependent claims reciting wall plug efficiency ranges below 80 LPW. Claims 25, 48, 57, and 65 each recite a wall plug efficiency range from about 60 to about 70 LPW. Claims 26, 49, 58, and 66 each recite a wall plug efficiency range from about 70 to about 80 LPW. As shown in Figure 65 of the Fini/Nakamura Report, at about
100 mA, the efficacy of the fixture is about 65 LPW and, at 50 mA, the efficacy of the fixture is 78 LPW. Tr.at 732:14-20 (Jiao).

![Graph: SPE Fixture Performance](image)

**Fig. 65.** Measured efficacy and flux for the SPE fixture.

JX-0150.0066. Thus, the Fini/Nakamura Report would meet the limitations of claims 1, 24-26, 29, 48-49, 52, 57-58, 60, and 65-66 if its efficiency disclosures were consistent with the claim term wall plug efficiency. *See* Tr. at 732:25-733:8 (Jiao). But, as noted above, the values in the report would not be understood by a person of ordinary skill to be the claimed wall plug efficiencies, and so RAB’s arguments as to the dependent claims fail.

Claims 27, 50, 59, and 67 each recite a range from about 80 to about 85 LPW. RAB admits that the Fini/Nakamura report does not disclose efficacy between 80 and 85 LPW, RIB at 92, which necessarily negates a finding of anticipation for those claims. RAB instead contends in passing “it would be … obvious to modify the light fixture to reach such an efficacy because the Figure 65
shows a trend where lowering the current to slightly, increases wall plug efficiency.” RIB at 92 (citing Tr. at 733:9-17). RAB thus contends “having the fixture reach an efficacy of 80 LPW would merely require reducing the current below 50 mA.” Id. (citing Tr. at 733:18-734:6 (Negley)). But RAB points to nothing to indicate the LEDs used would still be able to produce light at such a low operating current, nor does it point to any motivation to make such a modification. See Tr. at 1078:14-1079:11 (Wetzel). This passing obviousness argument has no merit.

For the foregoing reasons, I find that RAB has not shown by clear and convincing evidence that the Fini/Nakamura Report anticipates any claims of the ’819 patent.

VI. THE ’449 PATENT

A. Claim Construction

I construed the disputed terms “trim element,” “trim element space,” and “at least a first driver component” as part of the claim construction order issued as Order No. 19. See CC Order at 17–20. I hereby incorporate the discussion of those terms on pages 17-20 of Order No. 19 as part of this initial determination

B. Infringement

Cree asserts claim 10 of the ’449 patent against RAB’s “Recessed Retrofit” family of products9 and RAB’s “Performance Downlight” family of products (collectively, “449 Accused Products”). See CIB at 18; CX-0017C.0005, .0007; Tr. at 503:2-505:4 (Katona). RAB has stipulated that, within each of the two accused product families, each product has the same

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9 The Recessed Retrofit family of products includes both Recessed Retrofit products and “Field Adjustable Recessed Retrofit” products. The only difference between the two subfamilies is a switch that allows a user to select the desired color temperature of white light. Tr. at 504:12-19. That difference is immaterial for the present analysis.
structural configuration, and each 3D model and sample identified for a particular product family is representative of the relevant structural features for every product in that product family. CX-0017C.0002.

RAB Recessed Retrofit

RAB Performance Downlight

CPX-002.0001; CPX-0029.0001.

Claim 10 of the ‘449 patent is as follows, with annotations in square brackets:

[10.0] A lighting device, comprising:

[10.1] a trim element;

[10.2] an electrical connector;

[10.3] at least a first driver component; and

[10.4] at least one solid state light emitter,

[10.5] the lighting device weighing less than 750 grams,
[10.6] at least one of the at least one solid state light emitter mounted on the trim element,

[10.7] the trim element defining a trim element space,

[10.8] the first driver component in the trim element space,

[10.9] wherein if not more than about 15 watts is supplied to the electrical connector, the at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens

As discussed below, the record evidence demonstrates that the ’449 Accused Products do not satisfy all claim limitations and thus do not infringe claim 10.

1.  [Claim 10.0] “a lighting device”

No party contends that the preamble of the ’449 patent is limiting. To the extent that it is, RAB does not dispute that the ’449 Accused Products are lighting devices, in accordance with the preamble. As shown below, the ’449 Accused Products contain LEDs used to illuminate an area when provided with power. Tr. at 505:7-18 (Katona). The LEDs can be seen in the images of the Accused Product samples.

Accordingly, I find that the ’449 Accused Products are “lighting devices” within the meaning of the preamble of claim 10.

CPX-0029.0003; CPX-0002.0002.

Accordingly, I find that the ’449 Accused Products are “lighting devices” within the meaning of the preamble of claim 10.
2. **[Claim 10.1] “a trim element”**

I previously construed the term “trim element” according to the parties’ agreed construction: “a structure that forms a flange wherein the flange is configured to abut against a mounting surface and defines an outward-facing surface of the lighting device and is configured to be inserted into an opening in the mounting surface.” CC Order at 19.

I find that the ’449 Accused products contain a trim element as identified in blue in the images below.

![Image of trim elements](image)

RRB at 19; RDX-0004.0043; CX-0485C (annotated); CX-0487C (annotated).

Cree argues that the driver housing, shown in red above, see RDX-0004.0043, is part of the trim element. CIB at 21. According to Cree, the trim element includes both the flange structure and the connected driver housing because the driver housing is “not designed or intended to be separated during installation or use.” CIB at 21. But Cree’s proposed reasoning is not dispositive. Other elements, such as the electrical connector, are not designed to be separated from the trim structure during installation or use. Yet these elements are not identified as part of the trim element. See CIB at 21. So too for the driver electronics, LED module, and mixing chamber. Id.
Cree also contends that the presence of other claims in the 819 patent—such as one describing a chamber in the trim element (claim 8) and one describing a trim element that is a unitary structure (claim 12)—indicate that the trim element of claim 10 is broad enough to encompass the red portions indicated in the figure above. CPB at 293. RAB does not disagree. RRB 18-19. But even though claim 10 could encompass trim element structures with multiple parts and compartments, the whole structure must still be a trim element to satisfy the claims. For the reasons discussed below, I find, as a matter of fact, that the driver housing indicated in red in the figures above is not part of the trim element.

The driver housing of the 449 Accused Products is analogous to that described in Patent No. 7,614,768 (Sell), a prior art patent that the inventors distinguished during the prosecution of the 449 patent. During prosecution of the 449 patent, the limitation “the first driver component in the trim element space” was added in response to a rejection stating that claim 10 was obvious in light of Sell. JX-0008.0689; JX-0008.0673. The applicant argued, “there is no disclosure or suggestion in Sell 769 of an LED conversion system in which a driver component is in a trim element space defined by a trim element.” JX-0008.0693. As a result, claim 10 was allowed. JX.0008.0724-.0725.
The location of the driver housing and components in the '449 Accused Products is analogous to the driver housing depicted in Sell:

*Compare* RDX-0004.043; RX-0721.0004 (annotated) *with* CX-0485C (annotated); CX-0487C (annotated). Both Dr. Katona and Dr. Shackle agree. Tr. at 564:2-4 (Katona) (“the location of what you’re calling the driver housing is analogous to the red shaded area of Sell.”); Tr. at 632: 1-3 (Shackle) (“The RAB accused products on the right and Sell on the left are, in my opinion, topologically identical.”). The similarity between the driver housing of Sell and the driver
housing of the RAB products supports a conclusion that the RAB driver housing are not part of the trim element.

Additionally, trim is called trim because it is what is seen when a product is installed. The driver housing identified by Cree as part of the trim element would never been seen after installation. In contrast, the structure indicated in blue above would be seen after installation. The flange and the interior of the structure would be visible and aesthetically pleasing; it is trim. See CPX-487C; CPX-0029..0002, 0003, .0005; CPX-0002.0002, .0003, .0005.

For the forgoing reasons, I find that ’449 Accused Products have a trim element, but the driver housing of those products is separate from and outside of the trim element.

3. **[Claim 10.2] “an electrical connector”**

RAB does not dispute that the ’449 Accused Products contain an electrical connector. I find that the ’449 Accused Products contain an electrical connector. The electrical connectors can be seen in blue below.

CX-0485C (annotated); CX-0487C (annotated); Tr. (Katona) 508:19-5:09:1; CDX-0003C.0047.

4. **[Claim 10.3] “at least a first driver component”**

RAB does not dispute that the ’449 Accused Products contain at least a first driver component. I previously construed the term “at least a first driver component” according to the parties’ agreed construction: “any component that is part of the driver and is involved in
performing the functions of the driver.” CC Order at 22. I find that the ’449 Accused Products contain at least a first driver component. The first driver component can be seen in the product sample images below.

![Recessed Retrofit](image1.png) ![Performance Downlight](image2.png)

CPX-0029.0004-.0005; CPX-0002.0003; Tr. (Katona) 509:1-510:7; CDX-0003C.0048.

5. **[Claim 10.4] “at least one solid state light emitter”**

RAB does not dispute that the ’449 Accused Products contain at least one solid state light emitter. As shown below, the ’449 Accused Products contain LEDs, which are a type of solid state light emitter. Tr. at 505:7-18 (Katona). The LEDs can be seen in the images below. I find that the ’449 Accused Products contain at least one solid state light emitter. See CPX-0002.0002; CPX-0029.0003

![RECESSED RETROFIT](image3.png) ![PERFORMANCE DOWNLIGHT](image4.png)
6. **[Claim 10.5] “weighing less than 750 grams”**

RAB does not dispute that the ’449 Accused Products are devices weighing less than 750 grams. I find that the ’449 Accused Products weigh less than 750 grams. JPX-0143C.

7. **[Claim 10.6] “at least one of the at least one solid state light emitter mounted on the trim element”**

RAB does not dispute that the ’449 Accused Products contain at least one solid state light emitter mounted on the trim element. I find that the ’449 Accused Products contain at least one solid state light emitter mounted on the trim element. See CPX-0002; CPX-0029.

8. **[Claim 10.7] “the trim element defining a trim element space”**

I previously construed the term “trim element space” according to the agreement of the parties as “a volume of space defined by the interior of the trim element and planes orthogonal to the device axis at the upper-most and lower-most points of the trim element.” CC Order at 22; See CC Tr. at 148:1-24.

In accordance with the previously described trim element, see VI.B.2, I find that the trim element space of the accused products is as shown in red in the image below.

RRB at 13; RDX-0004.0040 (citing CX-0487C) (yellow highlighting added).
9. [Claim 10.8] “the first driver component in the trim element space”

The driver components in the ’449 Accused Products are contained within a gray enclosure above the trim element, as shown below.

RECESSED RETROFIT

As can be seen above, the driver components are above, and outside of, the trim element space. See VI.B.2 and VI.B.8. The location of the driver components in the ’449 Accused Products is analogous to that taught in Sell, which Cree admits is “not within the volume of space defined by the trim element.” CPB at 352; see Tr. at 563:24-564:25 (Katona); Tr. at 631:12-632:8 (Shackle); JX-0008.0693 (prosecution history of the ’449 patent).

For these reasons, I find that the ’449 Accused Products do not meet this limitation.
10. [Claim 10.9] “wherein if not more than about 15 watts is supplied to the electrical connector, the at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens”

RAB does not dispute that in the ’449 Accused Products at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens if not more than about 15 watts is supplied to the electrical connector. I find that the ’449 Accused Products satisfy this limitation.

The record shows that for each of the ’449 Accused Products, if not more than about 15 watts is supplied to the electrical connector, the at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens. JPX-0048C; see Tr. at 531:14-21 (Katona); 532:3-16; 532:21-533:5; 533:11-534:6; 534:14-21; CDX-0003C.0056-58. The record also shows that the color temperatures for all the ’449 Accused Products is perceived as white. JPX-0048C; Tr. at 532:6-16 (Katona); 534:14-21; CDX-0003C.0056-58. Accordingly, I find that the ’449 Accused Products meet this limitation.

11. Conclusion

Because I find that the Recessed Retrofit and Performance Downlight accused products do not have a “first driver component in the trim element space,” see VI.B.9, I find that those accused products do not infringe claim 10 of the ’449 patent.

C. Technical Prong of the Domestic Industry Requirement

Cree relies on the following products to satisfy the domestic industry requirement of section 337: CR4T LED Downlight (CX-0843), CR6T LED Downlight (CX-0837), CR6T-G LED Gimbal Downlight (CX-0838), CR4 LED Downlight (CX-0835), CR6 LED Downlight (CX-0836), DS4 LED Surface Mount Disk Light (CX-0844), and DS6 LED Surface Mount Disk Light
(CX-1899) (collectively “the ’449 Domestic Industry Products”). CIB at 37. I find that Cree’s CR6T Downlight is representative of all of Cree’s’449 Domestic Industry Products. See CDX-0003C.0060; Tr. at 535:10-536:10. RAB does not dispute that the CR6T Downlight is representative of the other ’449 Domestic Industry Products.

I further find that Cree’s CR6T Downlight does not practice claim 10 of the ’449 patent. My explanation follows.

1.  [Claim 10.0] “a lighting device”

   No party contends that the preamble of the ’449 patent is limiting. To the extent that it is, RAB does not dispute that the ’449 Domestic Industry Products are lighting devices, in accordance with the preamble. I find that the ’449 Domestic Industry Products are lighting devices, in accordance with the preamble. As shown below, the CR6T Downlights contain LEDs used to illuminate an area when provided with power.

   CX-0837; CX-0834C.

2.  [Claim 10.1] “a trim element”

   I find that the ’CR6T Downlight contains a trim element as identified in blue in the image below.
CX-0834C.0005 (annotated).

The configuration of the trim element and driver housing in the CR6T Downlight is analogous to that of the ’449 Accused Products.

\[
\begin{array}{|c|c|c|}
\hline
\text{CR6T Downlight (CX-0834C.0005) (annotated)} & \text{RAB Recessed Retrofit CX-0485C (annotated)} & \text{RAB Performance Downlight CX-0487C (annotated)} \\
\hline
\end{array}
\]

For the same reasons discussed with respect to the ’449 Accused Products, see supra part VI.B.2, I find, as a matter of fact, that the driver housing of the ’449 Domestic Industry Products is not part of the trim element.
3. **[Claim 10.2] “an electrical connector”**

RAB does not dispute that the '449 Domestic Industry Products contain an electrical connector. I find that the '449 Domestic Industry Products contain an electrical connector. The electrical connector can be seen in blue below.

![Image of electrical connector]({CX-0834C.0004})

4. **[Claim 10.3] “at least a first driver component”**

RAB does not dispute that the '449 Domestic Industry Products contain at least a first driver component. I find that the '449 Domestic Industry Products contain at least a first driver component. The first driver component can be seen in the CR6T Downlight below.

![Image of driver component]({CX-0834C.0005})
5. **[Claim 10.4]** “at least one solid state light emitter”

RAB does not dispute that the ’449 Domestic Industry Products contain at least one solid state light emitter. I find that the ’449 Domestic Industry Products contain at least one solid state light emitter. *See* CX-0834C-.0001; CX-0837.0001.

6. **[Claim 10.5]** “the lighting device weighing less than 750 grams”

RAB does not dispute that the ’449 Domestic Industry Products are devices weighing less than 750 grams. I find that the ’449 Domestic Industry Products weigh less than 750 grams. CPX-0137; CPX-0138; CPX-0139.

7. **[Claim 10.6]** “at least one of the at least one solid state light emitter mounted on the trim element”

RAB does not dispute that the ’449 Domestic Industry Products comprise at least one solid state light emitter mounted on the trim element. I find that the ’449 Domestic Industry Products contain at least one solid state light emitter mounted on the trim element. CX-0834C-.0001; CX-0837.0001.

8. **[Claim 10.7]** “the trim element defining a trim element space”

In accordance with the previously describe trim element, *see supra* part VI.C.2, and because the configuration of the trim element in the ’449 Domestic Industry Products is analogous to the configuration in the ’449 Accused Products, I find that the trim element space is as indicated in red in the image below.

![Diagram](RDX-0004.0040 (citing CX-0487C) (yellow highlighting added); Tr. at 632:14-633:4 (Shackle).)
9. [Claim 10.8] “the first driver component in the trim element space”

The driver components in the ’449 Domestic Industry Products are contained within an enclosure above the trim element.

CX-0834C.0005 (annotated).

As can be seen above, the driver components are above, and outside of, the trim element space. See supra parts VLC.2 and VLC.8. As in the ’449 Accused Products, the location of the driver components in the ’449 Domestic Industry Products is analogous to that taught in Sell, which Cree admitted was “not within the volume of space defined by the trim element.” CPB at 352. See CX-0834C; JX-0008.0693 (prosecution history of ’449 patent).

For these reasons, I find that the ’449 Domestic Industry Products do not meet this limitation.

10. [Claim 10.9] “wherein if not more than about 15 watts is supplied to the electrical connector, the at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens”

RAB does not dispute that in the ’449 Domestic Industry Products at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens if not more than about 15 watts is supplied to the electrical connector. I find that the ’449 Domestic Industry Products satisfy this limitation. As shown in Cree’s product specifications, the ’449 Domestic Industry Products will emit white light of at least 500 lumens if not more than about 15
watts is supplied to the electrical connector. CX-0837.0001; CX-0843.0001; CX-0838.0001; CX-0835.0001; CX-0836.001; CX-0844.0001.

11. Conclusion

Because I find that Cree’s ’449 Domestic Industry Products do not have “a first driver component inside the trim element space,” I find that the technical prong of the domestic industry requirement is not satisfied with respect to the ’449 patent.

D. Validity (Enablement)

RAB argues claim 10 of the ’449 patent is invalid for lack of enablement because it contains two unbounded limitations: “the lighting device weighing less than 750 grams” (limitation [10.5] above) and “wherein if not more than about 15 watts is supplied to the electrical connector, the at least one solid state light emitter will illuminate so that the lighting device will emit white light of at least 500 lumens” (limitation [10.9] above). RAB contends that, “[s]imilar to the unbounded LPW Asserted Claims, [claim 10] recites unbounded ranges, the Weight and Lumen Output Limitations, that were impossible when the ’449 patent was filed (and are still impossible today). Nor could a POSITA identify any inherent limits for these limitations.” RIB at 107-108.

I will address each of the disputed claim limitations in turn.

1. Weight Limitation [10.5]

The weight limitation [10.5], on its face, has no lower limit for the weight of the claimed lighting device. ’449 patent, claim 10. Though such an unbounded range is “not inherently improper,” see Andersen Corp., 474 F.3d at 1376, the enabling disclosure must be commensurate with the scope of the claims. Unbounded ranges “may be supported if there is an inherent, albeit not precisely known, [lower] limit and the specification enables one of skill in the art to approach that limit.” Id. at 1376-77.
RAB contends the weight limitation is not enabled because the ’449 patent indisputably does not teach a person of ordinary skill “how to build a lighting device with weights approaching zero.” RIB at 107. A person of skill in the art would certainly understand that a lighting device with the other claimed features of claim 10 could not be weightless and would thus understand there to be an inherent lower limit to the claimed range of weights near, but above, zero. See Andersen Corp., at 1376; accord Gen. Elec. Co. v. SonoSite, Inc., 641 F. Supp. 2d 793, 817 (W.D. Wis. 2009) (“The question is not whether claim 11 enables a weightless ultrasound system but, as the Federal Circuit suggests in AK Steel Corp., 344 F.3d at 1244, whether the hypothetical person of ordinary skill in the art would be able to make an ultrasound system weighing between ten pounds and” an inherent lower limit). Nothing in the record, however, indicates that a person of ordinary skill would have been able to understand what that inherent lower limit is. See Tr. at 1047:2-10 (Katona) (expert testimony that theoretical minimum weight would be “much greater” than zero, but unable to identify what the theoretical lower limit is).

Even if the claim had an ascertainable inherent lower limit other than zero, the ’449 patent’s disclosure of various methods for producing a lighting device with the claimed features falls far short of what is necessary to approach an extremely low weight. Dr. Shackle testified credibly that “making an extremely light downlight is a challenging task [that] would involve very careful choice of materials, and you would have to tell people exactly what material to use, and what thickness of materials to use, and so on.” Tr. at 633:12-18 (Shackle). Though the ’449 patent has various high-level disclosures on saving weight (e.g. using the trim element as a heat sink and mixing chamber, ’449 patent at 29:45-57), and a long list of various conventional materials that are “suitable,” such high-level details would be insufficient to teach a person of skill to make an extremely light lighting device with the other claimed features. Tr. at 633:12-18. Indeed, Cree’s
own expert Dr. Katona could not himself identify what the inherent lower limit of the weight limitation was, see Tr. at 1047:2-6, and testified that it is “highly unlikely” that the ’449 patent enables a downlight of five grams or less. Id. at 1047:7-10.

I find that the weight limitation [10.5] has an unbounded range that lacks a discernible inherent lower limit, and thus is invalid as indefinite under 35 U.S.C. § 112. Alternatively, I find that if the weight limitation [10.5] would be understood by a person of skill in the art to have a bounded range, that range would be between at least 5 and 750 grams. In such a scenario, the disclosure of the ’449 patent does not enable the full scope of the claimed range and the asserted claims are therefore invalid under 35 U.S.C. § 112 for lack of enablement. Tr. at 1047:7-10.

2. Lumen Output Limitation [10.9]

Similar to the unbounded range claims of the ’531 and ’819 patents, see supra part IV.C.2.a) (’531 claims 1 and 11) and V.C.2.a) (’819 claims 1, 24, 29, 52, and 60), RAB contends that the lumen output imitation [10.9] is an unbounded range that lacks enablement. See RIB at 108. For similar reasons to those already outlined in this determination, I find that the lumen output limitation of claim 10 lacks enablement.

As with the unbounded efficiency ranges of the ’531 patent and ’819 patent, a person of ordinary skill would understand that the efficiency of the device described in claim 10 of the ’449 patent would have an inherent upper limit of efficiency around 300 LPW. See supra part IV.C.2.a); Tr. at 634:7-20 (Shackle) (claim 10’s upper efficiency boundary is the “theoretical limits to how many lumens per watt can be produced by any LED”). Yet the ’449 patent provides little if any guidance to an ordinary artisan “on how to get to these very high levels of light output.” Tr. at 634:7-20 (Shackle). Cree’s expert Dr. Katona did not disagree, admitting that “one would not be
able to reach the theoretical limits of the lumens per watt” limitation based on the teachings of the ‘449 patent. *Id.* at 1048:12-1049:9.

3. Conclusion

For the reasons stated above, I find that claim 10 of the ‘449 patent is invalid for lack of enablement.

VII. THE ’270 PATENT

A. Claim Construction

I construed the disputed terms “A light fixture” and “air/water-flow” as part of the claim construction order issued as Order No. 19. *See* CC Order at 11–15. I hereby incorporate the discussion of those terms on pages 11-15 of Order No. 19 as part of this initial determination.

B. Technical Prong of the Domestic Industry Requirement

RAB has stipulated that the following Cree products practice the ’270 patent: XSP SERIES (not including XSPSM, XSPR, and XSPW product SKUs); THE EDGE HIGH OUTPUT (ARE-EHO and HBY-EHO product SKUs); THE EDGE SERIES (Square) and THE EDGE FLOOD (ARE-EDG, FLD-EDG, CAN-EDG, PKG-EDG product SKUs); THE EDGE SERIES (Round) (not including ARE-EDR product SKUs); and THE EDGE TRANSPORT MOUNT (TSP-EDG product SKUs). *See* Infringement Stipulation at ¶¶ 11, 13. Upon review of the claim charts provided by Cree, *see* Am. Compl. Ex. 34, and the related stipulation concerning practice of the patents by the domestic industry products, I find that those products practice the ’270 patent.

C. Infringement

Cree asserts claims 1 and 2 of the ’270 patent against certain of RAB’s products. As discussed further below, the record evidence demonstrates that those products infringe these claims.
1. **Accused Products**

RAB stipulated that its products accused of infringing the ’270 patent could be divided into product families having the same structural configuration. CX-0017C.0002. RAB further stipulated that certain identified 3D models and product samples for each product family are representative of the relevant structural features for every product in that product family. CX-0017C.0002. The stipulation is summarized in the following chart:

<table>
<thead>
<tr>
<th>Product Family</th>
<th>SKU Numbers (Products Beginning With)</th>
<th>Sample SKU Number</th>
<th>Sample Production Number</th>
<th>3-D Model Production Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFLED</td>
<td>FFLED120, FFLED230</td>
<td>FFLED23095/D10</td>
<td>CPX-0009</td>
<td>RAB0136249, CPX-0484C</td>
</tr>
<tr>
<td>FFLED</td>
<td>FFLED18, FFLED26, FFLED39, FFLED52, FFLED80</td>
<td>FFLED52G26D14:G28</td>
<td>CPX-0010</td>
<td>RAB0136281</td>
</tr>
<tr>
<td>FALCOR</td>
<td>FALCOR80W</td>
<td>CPX-0008</td>
<td></td>
<td>CPX-0478C, CPX-0479C, CPX-0480C</td>
</tr>
<tr>
<td>Canvas/EZLED</td>
<td>CANVAS, EZLED</td>
<td>CANVAS78T</td>
<td>CPX-0003</td>
<td>CPX-0477C</td>
</tr>
<tr>
<td>Canvas/EZLED</td>
<td>CANVAS, EZLED</td>
<td>EZLED78T</td>
<td>CPX-0007</td>
<td>CPX-0477C</td>
</tr>
</tbody>
</table>

RAB does not dispute that the CAD file bearing production number RAB0136253 (CX-0484C) is structurally representative of all products in the FFLED product family, including products with SKUs beginning with FFLED120, FFLED230, FFLED18, FFLED39, FFLED52, and FFLED80 (collectively referred to as “FFLED Products”). *See* Tr. at 484:14-19 (Katona); *see* RRB at 20-23.

RAB has stipulated that the CAD file bearing production number RAB0136173 (CX-0478C) and sample bearing production number RAB_SAMPLE0000011 (CPX-0008) is representative of all products in the FALCOR family. *Id.* This includes products with SKUs beginning with FALCOR (collectively referred to as “FALCOR Products”). Tr. at 484:14-19 (Katona).
RAB has also stipulated that the CAD file bearing production number RAB0136161 (CX-0477C) is representative of all products in the Canvas/EZLED product family. *Id.* This includes products with SKUs beginning with CANVAS or EZLED (collectively referred to as “CANVAS/EZLED Products”). Tr. (Katona) 484:14-19.

The FFLED Products, FALCOR Products, and CANVAS/EZLED Products are together referred to as “the ’270 Accused Products.”

RAB has stipulated that the PIP and PIPXL Products infringe claims 1 and 2 of the ’270 Patent. JX-0169C.

2. **The ’270 Accused Products Infringe at Claims 1 and 2**

For at least the reasons set forth below, the FFLED Products, FALCOR Products, and CANVAS/EZLED Products infringe claims 1 and 2 of the ’270 patent. RAB only disputes claim elements 1(c) and 1(d) in the accused products, as follows.

<table>
<thead>
<tr>
<th>Claim</th>
<th>Claim Language</th>
<th>FFLED</th>
<th>FALCOR</th>
<th>Canvas/EZLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(pre)</td>
<td>A light fixture comprising</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>1(a)</td>
<td>a chamber,</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>1(b)</td>
<td>at least one power-circuitry driver within the chamber,</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>1(c)</td>
<td>at least one LED module outside the chamber, and</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>1(d)</td>
<td>at least one air gap between the chamber and the at least one LED module, the air gap permitting air/water-flow therethrough.</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

CDX-0003C.0027; RDX-0004.008; Tr. at 608:2-5 (Shackle).
a) [Claim 1.0] A light fixture comprising:

In Order No. 19, I found that the preamble phrase “[a] light fixture” was limiting. CC Order at 17.

Each FFLED, FALCOR, and CANVAS/EZLED Product is a light fixture. For example, as illustrated below, each accused product contains LEDs to illuminate an area when provided with power, and includes a mounting bracket for use in affixing the device in installation.

![Images of FFLED, FALCOR, and CANVAS/EZLED products showing LED arrays and mounting brackets.]

CPX-0484C (annotated), CPX-0478C (annotated), CPX-0477C (annotated); Tr. at 485:25-486:23 (Katona); CDX-0003C.0013.

b) [Claim 1.1] a chamber

Each FFLED, FALCOR, and CANVAS/EZLED Product includes a chamber that encloses an LED driver. This chamber is indicated by the purple arrow in the images below, which are taken from CAD files when the outer cover of the housing is either made transparent (FFLED) or removed (FALCOR and CANVAS/EZLED):
c) [Claim 1.2] at least one power-circuitry driver within the chamber

The chamber in the ’270 Accused Products has at least one power-circuitry driver within it. For example, a driver can be seen in the chambers of the FFLED, FALCOR, and CANVAS/EZLED Products in the images below, and data sheets describe that driver:

CX-0484C (annotated); CX-0489.0004 (annotated); Tr. (Katona) 488:3-8; CDX-0003C.0017.
As further illustrated by the datasheets above, each component identified above is a driver at least because it accepts line level A/C voltage (e.g., at 120v), and outputs a DC voltage suitable for driving the LEDs. Tr. at 488:12-490:9 (Katona); CX-0489.0004 (annotated); CX-0488.0004 (annotated); CX-0596.0001(annotated).
d) **[Claim 1.3] at least one LED module outside the chamber**

In each FFLED, FALCOR, and CANVAS/EZLED there is “at least one LED module outside the chamber.” RAB does not dispute that its FALCOR Products each contain two printed wiring boards with several surface mounted LEDs, thereby satisfying the claim limitation. This is illustrated in the image from the CAD file below, where at least one LED module (orange arrow) is outside the chamber (purple arrow).

CPX-0478C (annotated); CPX-0008 (annotated); Tr. (Katona) 490:17-491:2; CDX-0003C.0021.

I further find that RAB’s FFLED and CANVAS/EZLED products meet limitation 1.3.

As illustrated by the images of the CAD file below, the FFLED Products uses chip-on-Board (“COB”) LED assemblies (four orange arrows in the configuration below) that are outside the chamber (purple arrow).
As illustrated by the images of the CAD file and product sample below, the CANVAS/EZLED Products uses three COB LED assemblies (orange arrows) that are outside the chamber (purple shaded area).

RAB disputes that the COB LED assemblies used in its FFLED and CANVAS/EZLED products are LED modules. RRB at 20. I find, however, that the COB LEDs are LED modules as recited in claims 1 and 2 because each COB is an array of LEDs mounted onto a substrate that is wired to the light fixture. Tr. at 493:14-22 (Katona). The ’270 specification states that LEDs and LED arrays are often referred to as LED modules. Tr. at 493:25-494:5 (Katona); see ’270 patent at 1:29-30 (“advances have been made in LEDs and in LED arrays, often referred to as ‘LED modules.’”).

Definitions of “LED module” relied upon by RAB’s expert further confirm that COBs are LED modules. For example, the Tenth Edition of the Illuminating Engineering Society (“IES”) Lighting Handbook (2011), on which RAB relies, see RRB at 21, states that an LED module is a