IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

SEOUL SEMICONDUCTOR CO., LTD.; and SEOUL VIOSYS CO., LTD.,	)	1:25-cv-444
Plaintiffs,	)	
v.	)	
HAWTHORNE GARDENING COMPANY,	)	
Defendant.	)	

MEMORANDUM ORDER

This patent-infringement case concerns patents involving LED technology. The parties have briefed six disputes regarding claim construction; and the Court held a *Markman* Hearing on June 4, 2026, to hear argument on the five most central of these terms.[1]

After careful consideration of the parties' briefs, the patents, the intrinsic evidence, and any specific extrinsic evidence that is noted in this order, the Court resolves all six disputes, as follows:

[1] There are technically seven disputed terms. But because two of the disputed terms turn on the same word—"intensity"—the Court groups them together as one dispute.

Dispute No. 1

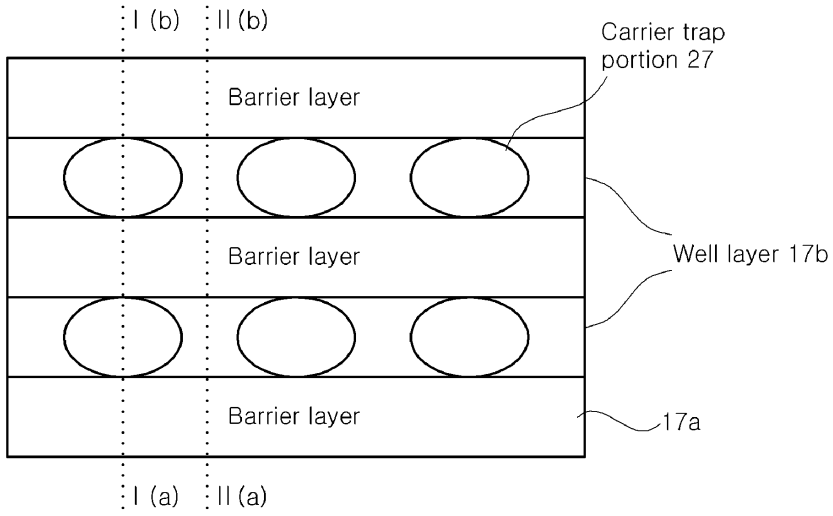
Disputed term	Seoul's Proposal	Hawthorne's Proposal	The Court's Construction
"carrier trap portion(s)" '225 Patent: claims 1, 4–7, 10, 11, 17–19	"A physical shape or a quantum mechanical energy state that can confine injected electrons and holes"	Indefinite[2]	A physical shape or a quantum mechanical energy state that can confine injected electrons and holes

The '225 Patent focuses on increasing the efficiency of light production. More specifically, the concerned invention of a "carrier trap portion" seeks to better improve the rate at which carriers (holes and electrons) recombine to produce light. Ex. B at 5:34-37. Within semiconductor layers, crystal defects may dislocate the traveling carriers, which causes them to recombine and emit heat instead of light. Ex. T at 11. The carrier trap portion is designed to improve the "internal quantum efficiency" by capturing those carriers and reducing dislocation. Ex. B at 6:14-15.

A carrier trap portion is "a structure capable of using carriers which can be trapped and lost by the dislocations. Such a structure is not limited to a physical shape . . . [it] may be a physical shape or a quantum-mechanical energy state." *Id.* at 4:40-45. The structure works by having a "band-gap energy that gradually decreases from a periphery of the carrier trap portion [27] to the center thereof, as shown in [Figure 3]." *Id.* at 4:16-19. Figure 3 is below:

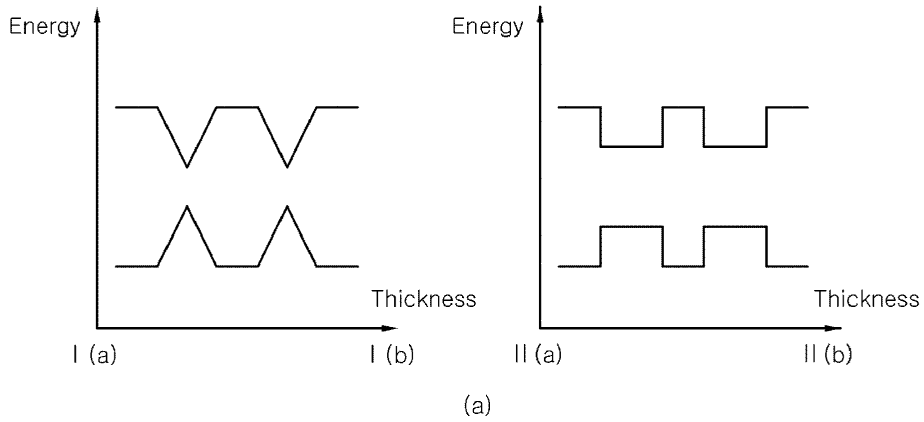
[2] This is not intended to be a finding on the question of indefiniteness as to these '225 Patent terms. Rather, Hawthorne's indefinite arguments are more suited for resolution on a developed record at summary judgment or trial. *See Sensormatic Elecs., LLC v. Genetec (USA) Inc.*, No. CV 20-760 (MN), 2021 WL 4453594, at *4 (D. Del. Sept. 29, 2021) (declining to rule on the indefinite issue and allowing defendant to re-raise the issue at summary judgment).

Fig. 3



The specification clarifies that the carrier trap portions aren't limited to a physical shape, the design has the band-gap energy decrease toward the center, and the ultimate purpose is to increase efficiency. So it's important to compare how the bandgap energy changes through a structure with MQWs but no carrier trap portions (II(a)-(II(b)), and a structure that includes both MQWs and carrier trap portions (I(a)-I(b)). *See* Ex. B at 4:19-26. Figure 4(a) depicts those energy changes:

Fig. 4



The Court agrees with Seoul's construction. As demonstrated, and described in the specification, the energy changes become much more gradual where a carrier trap is present (left side) as opposed to where a carrier trap is not present (right side). *Id.* The gradual bandgap energy changes improve the capture of carriers that otherwise would have been lost to dislocations in the MQWs. *Id.* at 4:11-19; Ex. T at 12. Crediting Seoul's expert Dr. Doolittle, a POSITA would understand that the carrier trap portion "channel[s] the electrons and the holes into the same location inside the quantum well." Ex. T at 15.

Dispute No. 2

Disputed term	Seoul's Proposal	Hawthorne's Proposal	The Court's Construction
"superlattice layer" '210 Patent: claims 1 & 22; '514 Patent: claim 1[3]	Plain and ordinary meaning; "a semiconductor layer comprising a periodic structure of alternating layers of different compositions"	"semiconductor layer including a plurality of thin lower band-gap layers alternating with a plurality of thin higher band-gap layers"	semiconductor layer including a plurality of thin lower band-gap layers alternating with a plurality of thin higher band-gap layers

The '210 Patent, a continuation of two previous patents, is focused on "improv[ing] electrostatic discharge characteristics and/or luminous efficiency and a method of fabricating the same." Ex. E at 1:24-28. To this end, the '210 Patent is designed to reduce current leakage, improve current spreading performance, and reduce efficiency droop. *Id.* at 3:16-30.

One of the semiconductor layers in line with these goals is a "superlattice layer." It "may be formed by alternately stacking the GaN layer and the InGaN layer

[3] Both the figures and specification in the '210 Patent and the '514 Patent mirror each other with respect to the current dispute. The Court cites the '210 Patent for reference, but, to be clear, the Court is considering both patents in its analysis.

at a thickness of, for example, 20 Å." *Id.* at 6:33-35. A POSITA would consider 20 Å (angstroms) to be thin. Ex. S at 18. And the alternating layers (described in the specification above as GaN and InGaN layers) would have to have different band-gap energies, alternating low to high, to definitionally be a superlattice layer. *Id.* at 19.

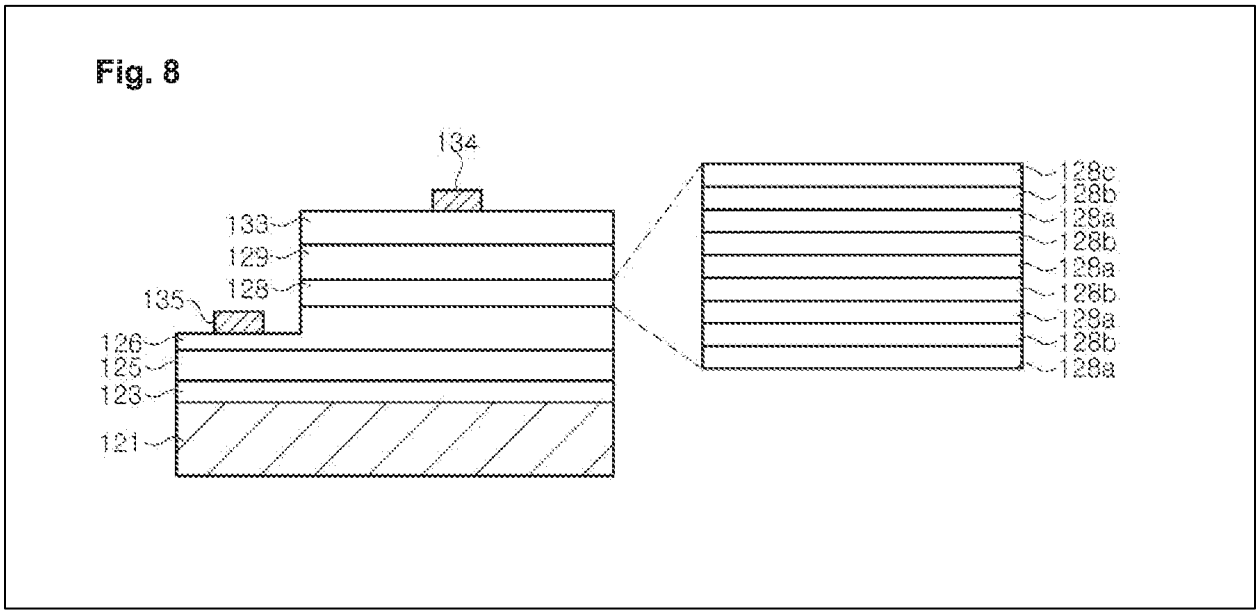
The Court agrees with Hawthorne's construction. The differences between the parties' positions are narrow. The two disputes are whether the alternating layers must be thin and whether the layers must switch between lower band-gap layers and higher band-gap layers. ECF 78 at 13–14. Though Seoul argues that the specification doesn't require Hawthorne's definition, Seoul never argues that Hawthorne's definition is factually inaccurate. *See id.* at 15. That is, Seoul never argues that a superlattice layer doesn't have to be thin or that it doesn't have to alternate lower and higher band-gap layers. *See id.* (stating that "[e]ven if alternating lower and higher band-gap layers were necessary . . ." the Court doesn't have to "take[] into account every scientific or technical property of [the] term"). The Court finds that Hawthorne's proposal would help a jury and accurately defines a superlattice layer in the '210 Patent. The Court thus adopts Hawthorne's proposed construction for "superlattice layer."

Dispute No. 3

Disputed term	Seoul's Proposal	Hawthorne's Proposal	The Court's Construction
"adjacent" '210 Patent: claim 4; '514 Patent: claim 4	Plain and ordinary meaning; "near"	"directly next to"	near

The term "adjacent" appears in claim 4 as follows: "The light emitting diode of claim 1, wherein the at least one layer of the plurality of layers in the spacer layer

positioned adjacent to the active region is doped with n-type impurities." Ex. E at 14:62-65. Figure 8 depicts the location of the spacer layer relative to the active region:



The spacer layer is depicted at 128, and the active region is depicted at 129. Ex. E at 9:44-47. So, in this sense, the term "adjacent" would mean "directly next to," as Hawthorne proposes. But as the specification later makes clear through context, "adjacent" really means "near."

The specification refers to "at least one" of the spacer layers 128a or 128b as being "adjacent to the active region 129." *Id.* at 10:52-64. As shown in Figure 8, neither 128a nor 128b is directly next to 129, rather 128c is. So when read in context, "adjacent" makes more sense when read as the word "near" than "directly next to." The Court adopts Seoul's proposed construction for "adjacent."

Dispute No. 4

Disputed term	Seoul's Proposal	Hawthorne's Proposal	The Court's Construction
"an intensity" '509 Patent: claims 1 & 10	Plain and ordinary meaning; "a spectral intensity"	"a relative or actual intensity"	a relative intensity
"the intensity of light emitted from the lighting device at 700 nm is configured to be less than about 10% of the maximum intensity of light emitted from the lighting device" '290 Patent: claims 1, 8, 14	Plain and ordinary meaning; "the intensity of light emitted from the lighting device at 700 nm is configured to be less than about 10% of the maximum spectral intensity of light emitted from the lighting device"	"the relative or actual intensity emitted from the lighting device at 700 nm is configured to be less than about 10% of the maximum relative or actual intensity of light emitted from the lighting device"	Plain and ordinary meaning[4]

The '509 Patent is a continuation patent aimed at light sources for plant cultivation. More specifically, the patent aims at inventing a light source to better optimize plant photosynthesis. Ex. G at 1:16-20.

Like with natural sunlight, plants can also photosynthesize with certain artificial lighting sources. *Id.* at 1:24-31. But a current issue that the '509 Patent seeks to remedy is that most conventional lightings designed for plant cultivation "do

[4] Because the intensity referenced in the '290 Patent already incorporates the relative nature of the term—by comparing the emitted intensity to the maximum intensity—the Court does not add onto the term "relative," because it would be redundant.

not adequately provide plants with light having a wavelength band necessary for plant photosynthesis." *Id.*

To build a better mousetrap, the patent "provide[s] a plant cultivation light source including at least two light sources" which emit different lights, and those lights which peak at different wavelengths. *Id.* at 1:40-53. With this patented device, the result should be a small, but "remarkably" efficient, light apparatus, reduced energy costs, and a better method for plant photosynthesis. *Id.* at 2:19-29. The disputes at issue with the '509 Patent terms surround the wavelengths of the lights being emitted and how the different lights interact.

The term "intensity" refers to the quantity of light emitted at various wavelength peaks from the different lights and different light sources. *See id.* at 12:41-54. "Intensity" captures "how much" light is emitted. Figure 3A shows the relationship between the intensity of light and wavelengths of the different light sources (L1 & L2):

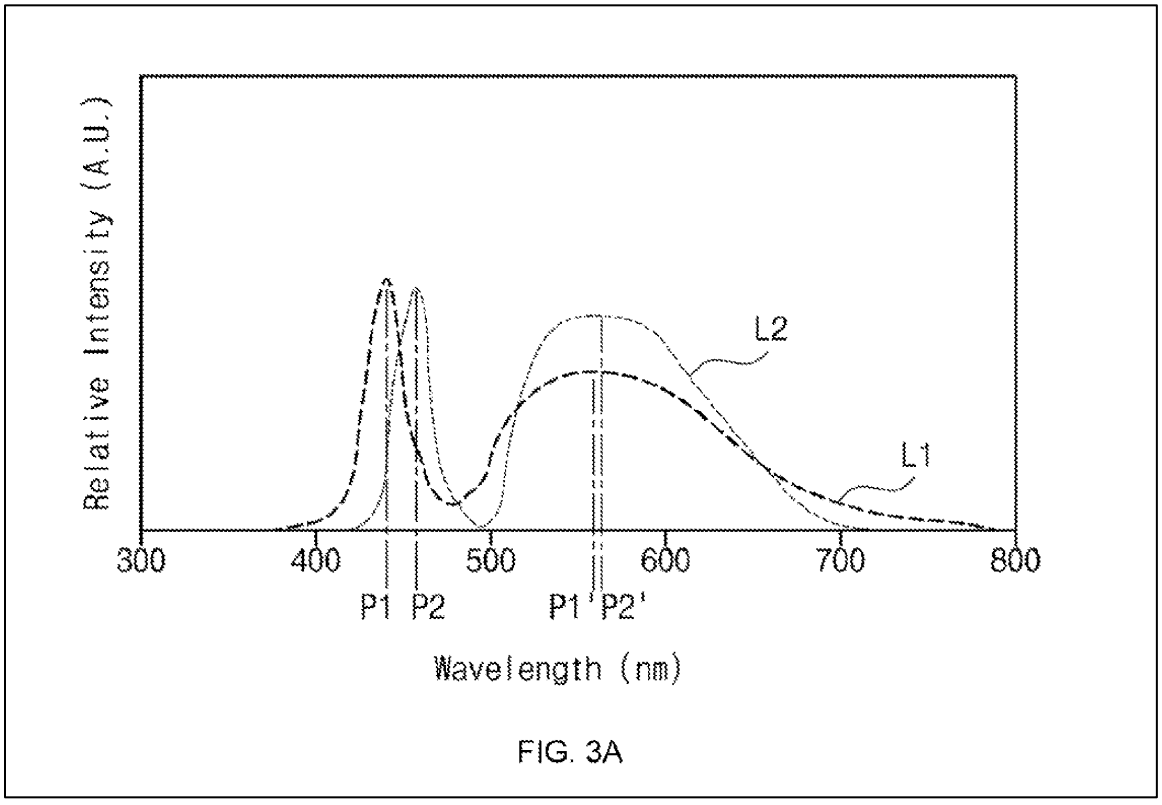


FIG. 3A

The quantity of light emitted from one source compared to the other isn't measured in precise units; it's relative. That's why Figure 3A measures the intensity of light with arbitrary units (A.U.) and labels the axis as "relative intensity." According to the specification, "when using artificial lighting such as LEDs, there is a need to provide a light having a uniform intensity distribution in the wavelength band from about 400 nanometers to about 700 nanometers." *Id.* at 6:31-37. With multiple light sources and an objective for a uniform intensity distribution, what matters in the design is how much light is emitted at each peak relative to other light sources. In line with the specification and the purpose of the '509 Patent, the Court construes the term "an intensity" to mean, "a relative intensity."[5]

Dispute No. 5

Disputed term	Seoul's Proposal	Hawthorne's Proposal	The Court's Construction
"a spectrum of a combined light obtained by mixing the first light and the second light only" '509 Patent: claims 1 & 10	Plain and ordinary meaning; "a spectrum of a combined light obtained by mixing the first light from the first light source and the second light from the second light source only"	"a spectrum of a combined light obtained by adding the intensities of the first light and the second light"	a spectrum of a combined light obtained by mixing the first light from the first light source and the second light from the second light source only

The dispute here really comes down to the term "mixing." ECF 78 at 30. Hawthorne argues that the only way to give effect to "a spectrum of a combined light" is to add the intensities from the different lights. Not so. The "mixing" is how the spectrum of a combined light is created, which is the most natural reading of the

[5] This mostly mirrors Hawthorne's construction, as Hawthorne proposed "a relative or actual intensity." The Court doesn't add the "actual" descriptor because it's confusing and wouldn't help a jury. After all, as Hawthorne points out, "[t]he key is preserving comparative magnitude when the claim requires comparing intensities." ECF 78 at 29. The term "a relative intensity" does just that.

term. Seoul's construction tracks claim 1 well, where each light source has its own wavelength with different peaks, but then so too does the spectrum caused by mixing the light from light source one, and the light from light source two. The Court adopts Seoul's construction of the term.

Dispute No. 6

Disputed term	Seoul's Proposal	Hawthorne's Proposal	The Court's Construction
"an intensity of light emitted from the lighting device is configured to increase from 500 nm to 600 nm" '290 Patent: claims 1, 8, 14	Plain and ordinary meaning; "an intensity of light emitted from the lighting device is configured to increase as the wavelength increases from 500 nm to 600 nm"	"a relative or actual intensity of light is emitted from the lighting device is configured to increase consistently from 500 nm to 600 nm"	Plain and ordinary meaning

The '290 Patent is a continuation patent of Seoul's '682 Patent. *See* ECF 78 at 40–41. Hawthorne argues that the "increase" in the '290 Patent must be limited to a gradual increase because "the applicants clearly and unmistakably disavowed claim scope relating to this term." *Id.* at 40. The Court disagrees.

A disavowal of claim scope is when the scope of a claim is seemingly broad, but the patentee during prosecution disavowed this broad meaning and essentially narrowed the claim scope. *Omega Eng'g, Inc v. Raytek Corp.*, 334 F.3d 1314, 1323–25 (Fed. Cir. 2003). So where "increase" would ordinarily allow for gradual, step-by-step growth, exponential growth, volatile growth, etc., the disclaimer would limit the word to a certain type of increase—here, as Hawthorne alleges, "consistent[]." There's a "heavy presumption that claim terms carry their full ordinary and customary meaning," so an alleged disavowal cannot be ambiguous. *See id.* (cleaned up). In

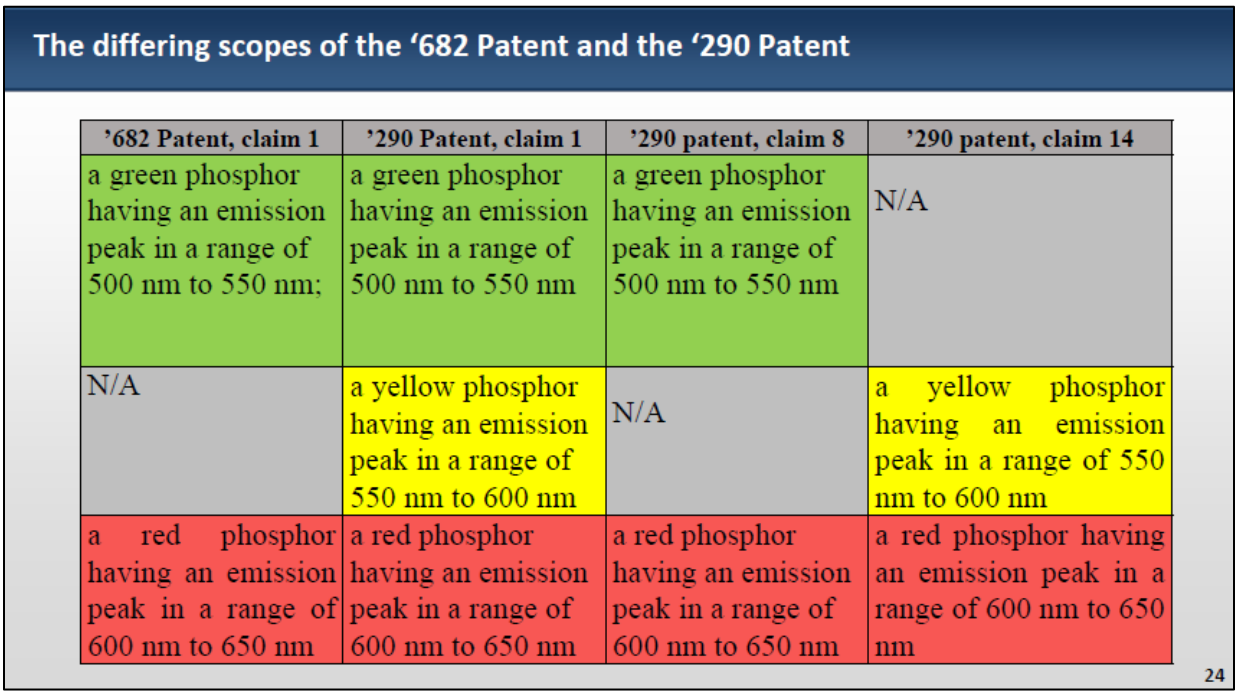
other words, the patentee must have "unequivocally disavowed a certain meaning to obtain his patent" for the doctrine of prosecution disclaimer to attach and limit the term's meaning. *Id.*

Disavowals made during an earlier patent application can apply to a related or continuation patent. *See id.* at 1333. "As long as the same claim limitation is at issue, prosecution disclaimer made on the same limitation in an ancestor application will attach." *Id.*

Here, Hawthorne's disavowal theory is based on the disavowals made during prosecution of the '682 Patent. *See* ECF 78 at 40–41. The '682 Patent originally used the similar "increase" language, the patent was rejected for being too similar to Radkov's patent, and the '682 Patent distinguished itself in an amended claim by writing the term as "gradually increase." *Id.* at 41. The examiner accepted this distinction because, as the applicant argued, Radkov's use of "increase" included depressions along certain wavelength ranges. *Id.* at 41–42.

Seoul agrees that the '682 Patent was amended, but disagrees that the prior amendment restricts the word "increase" here. *Id.* at 45. Seoul highlights the

differences in the '682 Patent claim compared to here, as shown in this comparison that Seoul presented during the Markman hearing:



The Court agrees with Seoul that the term's plain and ordinary meaning should apply here. Hawthorne hasn't shown the exacting standard of an unequivocal disavowal of the broad term "increase" to only mean "consistently increase." The different contexts and claimed designs from the two patents sufficiently counter Hawthorne's argument that the two claims across the two patents share the same meaning of "increase." Because Hawthorne hasn't met its exacting burden, the Court gives the term its plain and ordinary meaning.

Agreed-upon Terms

The parties also agreed upon construction of a number of claim terms, and the Court will adopt those constructions. ECF 78 at 4. The terms and constructions are as follows.

Patent	Term	Construction
'225 Patent: claim 1; '210 Patent: claims 1 & 9; '514 Patent: claims 1 & 14	"multi-quantum well structure"	a structure comprised of alternating quantum well layers and barrier layers
'210 Patent: claims 3 & 18; '514 Patent: claims 3 & 23	"different InGaN layers"	layers having different compositions of InGaN
'514 Patent: claims 1 & 14	"the barrier layer"	a barrier layer in the multi-quantum well structure

’514 Patent: claims 1 & 14	“the quantum well layer”	a quantum well layer in the multi-quantum well structure
’302 Patent: claim 1	“second light source that emits second light having a wavelength for cryptochrome”	second light source that emits second light having a wavelength that can be absorbed by a cryptochrome
’302 Patent: claim 1	“third light source that emits third light having a wavelength for phytochrome”	third light source that emits third light having a wavelength that can be absorbed by a phytochrome

SO ORDERED.

DATED this 16th day of June, 2026.

BY THE COURT:

/s/ *J. Nicholas Ranjan*
United States District Judge