UNITED STATES
INTERNATIONAL TRADE COMMISSION

In the Matter of:	)	Investigation No.
CERTAIN LIGHT-EMITTING DIODE	)	337-TA-1213
PRODUCTS, FIXTURES, AND	)	
COMPONENTS THEREOF	)	

OPEN SESSIONS

Pages: 285 through 522 (with excerpts)

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UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

BEFORE THE HONORABLE CLARK S. CHENEY

Administrative Law Judge

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United States

International Trade Commission

500 E Street, Southwest

Washington, D.C.

Tuesday, May 4, 2021

EVIDENTIARY HEARING, VOLUME II - REMOTE PROCEEDINGS

The hearing commenced remotely, pursuant to the notice of the Judge, at 9:02 a.m. EDT

Reported By: Marjorie Peters, RMR, CRR, FAPR

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** Index appears at end of transcript **

P R O C E E D I N G S

(9:02 a.m.)

JUDGE CHENEY: Let's go on the record now.

We're on the record now in Investigation Number 337-TA-1213.

This is Certain Light-Emitting Diode Products, Fixtures, and Components Thereof. This is the second day of the evidentiary hearing.

Before we continue with the direct examination of Dr. Lebby, who is Cree's technical exert -- let me back up.

Yesterday we finished the direct examination of Dr. Lebby, Cree's technical exert on the '570 Patent, but before we continue with cross-examination of Dr. Lebby, let's see if there are any housekeeping matters from the parties.

Mr. Moskin, is there something you wanted to say about the order of presentation for fact witnesses that might appear in both a direct or rebuttal case?

MR. MOSKIN: Yes, Your Honor. Thank you.

I would simply note on the record that the parties have stipulated as to fact witnesses, we needn't separately call the other side's witnesses as part of our respective cases-in-chief.

So we will do the full examination and

cross-examination of the fact witnesses, including scheduled today, Mr. Negley and Mr. Edmond, without later calling them again.

JUDGE CHENEY: That sounds good.

Are there other housekeeping matters that the parties which to raise before we resume testimony today?

MR. ERWINE: Yes, Your Honor.

First, the parties have an agreed list of exhibits for Mr. Wilcox and Mr. Bakewell, and I would ask to move to admit those exhibits, and we can provide the list to the court reporter.

JUDGE CHENEY: And there is no objection; is that right?

Hearing no objection, the list of exhibits will be admitted.

MR. MOSKIN: No.

JUDGE CHENEY: Do coordinate with the court reporter to make sure it's entered in the record.

(Exhibits, as submitted by counsel and reflected in the attached index, were received into evidence.)

JUDGE CHENEY: Anything else, Mr. Erwine?

MR. ERWINE: Thank you.

Yes, Your Honor. One last thing. Counsel for LEDiL is on the line, and is here to address your questions concerning the CBI of the slides at issue.

JUDGE CHENEY: Okay. Let's go on the LEDiL confidential record.

(Whereupon, the trial proceeded in confidential session.)

O P E N S E S S I O N

JUDGE CHENEY: We're back on the public record now after having a discussion with counsel for LEDiL about the nature of some confidential business information that was presented during the direct examination of Cree's technical expert on the '570 Patent, Dr. Lebby.

Mr. Jedlinski persuasively argued that the images in slide 20 of Dr. Lebby's demonstrative exhibit, which were derived from CX-0646C, CX-0647C and CX-0648C, are confidential business information, and they will be protect as such.

Yesterday, I asked the parties to prepare a public version of CDX-0002C; and when the parties prepare that public version, they should redact the images that we have just discussed.

Does anyone have any questions on what we should do with exhibits from the direct examination of Dr. Lebby?

MR. HAMSTRA: Nothing from Cree Lighting, Your Honor.

MR. ROUSH: Nothing from RAB, Your Honor.

JUDGE CHENEY: Thank you all.

Are there any other housekeeping matters we should discuss before resume the cross-examination of Dr. Lebby?

MR. ERWINE: Nothing else from us, Your Honor.

Thank you.

JUDGE CHENEY: And from RAB?

MR. ROUSH: Nothing from RAB, Your Honor.

JUDGE CHENEY: Okay. Let's have Dr. Lebby return to the stand.

Good morning, Dr. Lebby. Thanks for being with us again today. I'll remind you that you remain under oath during your cross-examination.

Is there cross-examination for Dr. Lebby?

MR. ROUSH: Yes, Your Honor.

JUDGE CHENEY: Please proceed when you are ready, Mr. Roush.

CROSS-EXAMINATION

BY MR. ROUSH:

Q. Good morning, Dr. Lebby, good to see you again. I just have a few follow-up questions.

Can you turn to CDX-002, page 15.

Now, the LED in the accused RAB products is not part of the LEDiL lens; correct?

A. That's my understand, that's correct.

Q. The lens and the LED are separate components; is that right?

A. Yes. If you look at this image, the LED is affixed to the base plate, and it looks like the lens panel is a separate unit.

Q. Please turn to CDX-002, page 24.

In each of the T2, T3 and T4 lenses from here, the emitter axis is shown in a blue dashed line; correct?

A. That's correct.

Q. The preferential side is shown on the right side of the emitter axis; correct?

A. Yes, as indicated by the green contour line, that's correct.

Q. The non-preferential side is shown on the left side of the emitter axis; correct?

A. That is correct.

Q. In your opinion, the boundary between the preferential side and the non-preferential side is defined by the emitter axis; correct?

A. Well, that's one of the criteria that defines the front sector to the back sector as taught by the '570 Patent.

Q. Is there any other criteria shown in these images on CDX-002.0024?

A. The only criteria that's shown is the emitter axis, which is the vertical blue dotted line. The other criteria is not on this annotated figure.

Q. Okay. The refracting inner surface is shown in the magenta and green lines; is that correct?

A. Yes, it is. You can see the contour profile.

Q. And the back sector of the refracting inner surface begins at the corner in the middle of the lenses for each of the T2, T3, T4; is that correct?

A. Well, as we have indicated through the criteria, the back sector begins from the non-preferential side of the emitter axis, but remember, we also have to think about the other parts of the criteria in the '570 Patent, which is the "centered-on" phrase, which is the bilateral symmetry, and it also has to be radially opposite the front sector. So those other criteria have to come into play, too.

Q. Well, as shown in the slide here, though, the only criteria for the beginning of the inner refracting surface is the corner that's in the middle of the -- middle of the lens; correct?

A. What I have shown annotated on this slide is one of the parts of the criteria.

You are, indeed, correct. It's to the left on the non-preferential side of the emitter axis.

Q. As shown in the slide here, the front sector of the refracting inner surface begins at the right corner of the lens; correct?

A. So as we've annotated on this slide, this is also one of the criterias as caught by the '570 Patent, but you are, indeed, correct. The front sector on this slide

begins on the preferential side, on the right-hand side of the emitter axis, but there are other criteria, too.

Q. As shown in the figures on slide 24, in your opinion, the boundary condition between the front sector and the back sector is defined by the emitter axis; correct?

A. Well, that is one of the criterias as indicated and taught by the '570 Patent, but as I've already indicated earlier, there's two other major criteria that needs to be achieved, and that's the bilateral symmetry for the centered-on as well as the radially opposite criteria.

Q. But the only criteria shown in these figures here is the emitter axis; correct?

A. Yes, I would agree with you. On this particular slide, only one part of the criteria is shown, and that's the emitter axis.

Q. In your opinion, as shown in the figures on slide 24, the only boundary condition between the front sector and the back sector is not defined by a discontinuity in the inner -- in the refracting inner surface of the lens; is that correct?

A. I'm not sure I understand your question, but the back sector is on the left-hand side, the non-preferential side of the emitter axis. It does have a discontinuity, which is the -- sort of the backwards 7 magenta contour

shape. That's just one of the three major criterias that I have indicated that has been taught in the '570 Patent.

Q. But there's not a discontinuity where the front sector and back sectors meet at the emitter axis, is there?

A. Well, it depends how you define discontinuity. I mean, certainly, as I look through the different lens designs in T2, T3 and T4, the position of the emitter axis on T4 looks like it could be aligned to a discontinuity between the front sector and the back sector as one of the criterias, but we also have to take into account the position of the emitter chip, the LED chip which defines where the emitter axis is on T4, and the fact that it's -- is it centered-on, does it have bilateral symmetry, and is the back sector, you know, radially opposite the front sector as indicated by the claims, especially Claim 1.

Q. But in the way you've defined it here, the emitter axis is defined by the LED; correct?

A. So the '570 Patent teaches that the position of the emitter axis, I think, as indicated in Figure 4, line 2, is a vertical dotted line is perpendicular to the emitter plane is actually at the center of the LED chip.

Q. Yeah. Yes.

Where that emitter axis, as shown in the figures on slide 24, crosses the refracting inner surface, that, in your opinion, is going to be the boundary between the front

sector and the back sector; correct?

A. Well, that's certainly one of the criteria of, you know, the front sector and the back sector, as I have already indicated. The emitter axis is one of the boundary conditions. The other one is the bilateral symmetry, and the third one is the has to be radially opposite as indicated through Claim 1.

Q. A discontinuity in the inner refracting surface is not one of the boundary conditions, in your opinion; is that correct?

A. The discontinuity that is shown in the back sector is not one of the criterias. It's just a surface configuration that is different than the front sector, as you can see in this Claim Element 1E.

So the discontinuity is quite different in shape, the magenta contour compared to the green contour.

Q. Now, if the emitter axis were moved along the same plane as shown on slide 24, what you're calling the front and back sectors would also change; correct?

A. I think, yes, you asked me that question in deposition, you'd have to move the LED because the emitter axis is actually defined by the center of the LED chip.

So if you actually move the LED chip, then the emitter axis would actually, indeed, move, as I indicated in my depo.

Q. Well, you said the emitter axis would move; however, not all LED packages have the same emitter axis; correct?

A. Well, it just depends on each LED package. I mean, what I'm looking at here is what's been taught by the '570 Patent, and the '570 Patent defines the emitter axis to be the center of the LED chip.

So in this particular case, this is where the emitter axis is. I mean, I can't really speak for other LED packages because I haven't really looked at them.

Q. So you don't have an opinion as to whether, for other LED packages, if there would be a different emitter axis; is that correct?

A. Depends on how other LED chips and packages are defined. What we're looking at here is the '570 is very clear about how it defines where the emitter axis is. The emitter axis is in the center of the LED chip.

So that teaching I've applied to understand as part of the criteria where the front and back sector is, where the front -- sorry, the preferential versus the non-preferential side is, and how to develop the criteria to really understand what the '570 is teaching.

Q. Now, assuming -- like, if the LED package could be moved along the same plane as shown here in slide 24, the emitter axis would also move; is that correct?

A. Yes, I think I have already indicated that. I mean, it's a similar answer as I gave in my depo.

If you move the LED chip -- because the '570 Patent defines the center of the LED chip to be where the emitter axis is, and so if you moved, hypothetical, the chip to the left or the chip to the right, yes, then that would change the boundary condition for the preferential and the non-preferential side because that's how the '570 Patent teaches.

Q. Can you pull up RDX-0012-002?

So in this case, in this annotated version of CDX-002 slide 24, what we were just looking at, if the emitter axis were moved to the left, the -- what is called the front sector and back sectors would correspondingly move to the left; is that correct?

A. Hypothetically, yes. I mean, if you have the room to move the LED chip. I mean, when I look at those cross-sections, there's not a lot of flexibility to move the chip one way or the other.

But hypothetically, if you did move the LED chip, then you would look at where the center of the LED chip would be, then you would know where the emitter axis would be. And if you moved it to the left, then, yes, the preferential side would be a little more than it was, and the non-preferential side would be a little less than it

was.

So I would agree with you.

Q. So can you turn to the next page, slide RDX-0012-003.

As another example, if the emitter axis were shifted to the right, the preferential side and non-preferential -- the front sectors and back sectors would correspondingly move to the right; correct?

A. So you have to look at the criteria for the front and back sectors, as I've indicated. It's not just the criteria of the under condition of the emitter axis.

So the front and back sectors would still need to be centered on. So that means as per, I think, Figure 4, the horizontal bilateral symmetry line, which is labeled number 4, I believe, as well as the front and back sectors, must be radially opposite each other.

So as long as you've got those criterias lined up and achieved, then you can start talking about the position of the front and back sectors.

But as you can see from this figure, you've moved the LED chip, presumably, to the right, because the emitter axis has been moved to the right, and that's defined as the center of the chip.

So yeah, as long as the chip has been moved, then that emitter axis can move, too.

Q. For example, if you turn to slide RDX-0012-004, if the emitter axis were moved even -- or were moved way further to left on the same plane and to, I believe what you are referring to as the back cavity, there would no longer be a front sector and back sector of the refracting inner surface; is that correct?

A. Well, you've got more complex things going on here. I mean, I don't know if you have moved the LED chip to this back cavity, whether you would have a preferential direction of light or not.

That's certainly changing the whole concept of the original design when the LED was in the -- if you like, the right cavity.

So optically, that would be very different. But as I've already indicated, if you moved the LED chip to the back cavity, then the '570 patent defines at least the emitter axis is in the center of the LED chip.

But this is a hypothetical, and I'm not even sure that the lens would operate in the way you wanted it to operate, if you did this.

Q. So hypothetically, if the LED chip were moved on the same plane as shown in slide 24 of your presentation, the -- such that the LED chip is in the back cavity -- strike that.

Hypothetically, if the LED chip were moved along

the same plane of -- as shown in slide 24 of your presentation, farther to the left, such that the LED chip is in the back cavity, in the -- there would no longer be a front sector of the inner refracting surface; is that correct?

A. We have to look at the criteria again. The criteria is, is the emitter axis still centered on? Does it still have bilateral symmetry? Is the front sector versus the back sector radially opposite as indicated by the claims?

So you look at all of these criteria, in addition to the boundary condition of where the emitter axis is to make that determination.

I certainly haven't thought about, you know, placing the LED chip in the back cavity, but certainly, as I look at the claim limitations, I have to look at the criteria that's taught in the '570 Patent.

Q. So as shown in this annotated version on RDX-0012-004, you're not able to identify what would be the front sector of the inner refracting surface; is that correct?

A. Well, the inner refracting surface as defined by the '570 Patent is in the right-hand cavity, and so the front sector of the inner refracting surface doesn't apply when you put the LED chip in the back cavity.

So that would mean that the criteria would not be met.

Q. Similarly, you would not be able to identify a back sector for the inner refracting surface shown here?

A. So I'd have to think about this a little long. Because if the LED chip was in the back cavity, then the inner refracting surface could well be the refractive surface that dissects the vertical blue dotted line, and so -- because light would go from the LED chip into that acrylic material, which is an optical refraction -- optical refracting material, so I'd have to really think about the position of that chip and the operation of the lens as taught by the '570 Patent. But I certainly haven't thought about that coming into this cross-examination today.

But as I've already indicated, you're going to have to look at the different types of criterias as taught by the '570 Patent to make a proper determination, and look at the claim elements in Claim 1, and you'd need to do those.

Q. Can you turn to JX-005. That's the '570 Patent.

In column 6, lines 8 to 9 identifies the front sector as 20, correct, and the back sector as 30; is that correct?

A. I believe that's correct.

Q. Could you turn to RDX-0012-005. This is an

annotated version of Figure 6 of the '570 Patent.

Shown in green is the front sector 20, and the back -- and the back sector 30 is shown in pink.

The front and back sectors meet; correct?

A. Yeah, as indicated by the boundary condition. The boundary condition is the emitter axis, and that is where the front and back sectors meet.

Q. But here, I mean, the emitter axis is not shown as being the boundary condition in Figure 6; correct?

A. Well, the emitter axis is defined as one of the criteria or the relative positions of the front and back sector as we've already indicated.

Certainly, on this perspective, top-down view, you know, the pink is not right at where the green is at the 2, but we have to think about the criteria.

The criteria for 2, which is coming out of the page and into the page, the emitter axis is perpendicular to the emitter plane.

We have to think about the bilateral symmetry line number 4 as well as whether the back sector is radially opposite the front sector.

Q. In Figure 6 of the '570 Patent, there is discontinuity between the front sector and the back sector; correct?

A. It certainly looks like there's a discontinuity,

but when you try and figure out which is front and which is back, you just apply the three major conditions of the criteria of which the boundary of the emitter axis is one of them.

Q. Can you turn to RDX-0012.006.

The figure on the left is from your demonstratives, and the figure on the right is from your expert report; correct?

A. That is correct.

Q. Is it still your opinion that the front sector shown in green on the right is accurately shown?

A. So the way the criteria works on the image on the right side is that the front sector is on the preferential side. The boundary condition is the emitter axis.

It has to be on the bilateral symmetry line, which is the red horizontal dotted line, and it has to be radially opposite the back sector.

So from that criteria, what we see on the right is actually correct, but it could be more than that, too.

Q. So it's still your opinion that the annotations in the version of Figure 5 on the right hand of the slide is correct?

A. The annotations are not wrong. I think the image on the left-hand side is more accurate.

Q. I want to switch to your secondary considerations analysis.

I believe that you briefly identified three license agreements as being relevant to your secondary considerations analysis; is that correct?

A. I believe that's correct.

Q. Did you determine how many patents were subject to each agreement?

A. I believe you asked me each of those license agreements in my deposition. The number of patents, I don't recall the number, but each license agreement had a different number of patents.

Q. Did you attempt to analyze the significance of the '570 Patent to any of these license agreements?

A. So only other than looking at the license agreements themselves, on the faceplate standpoint, I didn't delve into any of the business opportunities or businesses achieved through the license agreements. So no, I did not do that.

Q. The documents that you rely on for long-felt need, these are Cree, Inc.'s own press release; is that correct?

A. To the best of my knowledge, I believe that's correct.

Q. And Cree, Inc. was the former owner of the '570

Patent; is that correct?

A. I'll take your word for that. I don't know the details there.

Q. Cree Lighting is not the only company to sell roadway lighting products; correct?

A. So as a general question, roadway lighting products is a commercial business that not only Cree participates in, but other companies, too.

Q. Did you do any analysis as to the optical components used by other roadway lighting products?

A. No, I did not.

Q. Did you analyze Cree Lighting's market share for roadway lighting products?

A. No, I did not.

MR. ROUSH: No further questions.

JUDGE CHENEY: Okay. Dr. Lebby, I have a couple of questions for you.

Let's start -- if we could, before we put the slide up, Counsel, I'd like to discuss slides 12 and 13 from Dr. Lebby's demonstrative presentation.

I think slide 12 can be on the public record; is that right?

MR. HAMSTRA: Your Honor, this is David Hamstra.

Yes, that's right.

JUDGE CHENEY: Okay. Let's put that up, please.

Dr. Lebby, do you remember your testimony that is summarized in this demonstrative slide?

THE WITNESS: Yes, I do.

JUDGE CHENEY: I believe that you testified in connection with this slide that these light distribution diagrams show a preferential side to the lighting device.

Did I understand your testimony correctly?

THE WITNESS: Yes, I believe you did.

JUDGE CHENEY: Can you walk through for me how these diagrams show a preferential side?

THE WITNESS: So a preferential side is when the light is directed to one side. What we're seeing here if you look at the top left-hand yellow contour map, and the contours represent the intensity of light, so the darker yellow with the inner contours is the highest intensity of light, and that drops off the further out you go.

If you just assume for a minute that the emitter is where the black dot is, one way of looking at -- thinking about that is it's where the streetlight would be, you can see the light is all going basically across the road, but not behind the road. And you can see that annotation in the image below in T2, where the road is sort of schematically drawn in gray underneath.

So as you look at these distributions of T2, T3 and T4, you can see it's not a normal omnidirectional

distribution of light. The light is actually sent in one direction.

JUDGE CHENEY: So these diagrams here on slide 12 of CDX-0002C are from a bird's-eye view looking down at the ground; is that right?

THE WITNESS: Yes, that's one way to view these, is if you look at the bird's-eye view down, you can see the distribution of light coming out of the streetlight, which is in a majority direction; it's not omnidirectional.

JUDGE CHENEY: Okay. So if we were to look at the T2 example, I think that you've testified that the preferential side shown in this diagram is the side of the light toward the street; am I understanding that right?

THE WITNESS: That is correct.

JUDGE CHENEY: So in that sense, we're looking at the preference in a plane horizontal to the ground; is that right?

THE WITNESS: Certainly, it can be viewed from that perspective, yes.

JUDGE CHENEY: I mean, this diagram doesn't show us more than that because it's a two-dimensional plane from a bird's-eye view; is that right?

THE WITNESS: Yeah, and also, I mean, the light is not -- because the streetlight is -- you know, is 6 meters up, I mean, the light is coming down, too. So it's

got to be directed to a preferential side.

But the distribution of light is specific. I mean, it's along the roadway, but not behind the roadway. So you have to think about it in a three-dimensional perspective.

JUDGE CHENEY: There may be three-dimensional effects, but these diagrams don't show that; right?

THE WITNESS: That's correct. They only show contour maps of intensity.

JUDGE CHENEY: Okay. In the bottom row of the figures, I see not just a single black dot, I see a black dot and a black ellipse, maybe, connected by a line.

What is that?

THE WITNESS: A black ellipse.

So I believe that is the highest intensity contour. I think is it's labeled number 2.

JUDGE CHENEY: Actually, let me, we're not looking at the same thing. So instead of the black dot in T2, there is something different in the row below.

Do you see how there's this other black thing that's connected --

THE WITNESS: Yes. I actually don't know the answer to the question, but if I was going to guess, I believe the lower dot is where the emitter is positioned, because that's where the highest intensity contour of light

is.

JUDGE CHENEY: Okay. Thank you.

I think we now need to go on the LEDiL confidential record.

(Whereupon, the trial proceeded in confidential session.)

O P E N S E S S I O N

JUDGE CHENEY: We're back on the public record after I finished asking Dr. Lebby some questions about ray traces in the accused products or in digital models of the accused products.

Is there any redirect for Dr. Lebby?

MR. HAMSTRA: No, Your Honor.

JUDGE CHENEY: Okay.

Dr. Lebby, thank you for joining us in the hearing. Your testimony helped me understand the case. You are excused.

THE WITNESS: Thank you.

JUDGE CHENEY: Will Cree call its next witness.

MR. ERWINE: Yes, Your Honor.

Cree calls Mr. Gerald Negley. Your Honor, I believe we are just waiting for Mr. Negley to log on. He's at a conference room, so he should be on any second.

JUDGE CHENEY: While we're waiting for Mr. Negley, can you sketch for me who he is and what we will be hearing.

MR. ERWINE: Yes.

Mr. Negley is one of the named inventors on the '819 and '531 Patents.

I believe Mr. Negley has joined us.

THE WITNESS: Hello.

JUDGE CHENEY: Hello, Mr. Negley, thank you for joining us. I'm going to ask you to raise your right hand, and I will place you under oath.

GERALD NEGLEY,

a witness, having been first duly sworn, was examined and testified as follows:

THE WITNESS: Yes, I do.

JUDGE CHENEY: Thank you.

Please proceed with your examination, counsel.

MR. ERWINE: Thank you, Your Honor.

DIRECT EXAMINATION

BY MR. ERWINE:

Q. Good morning, Mr. Negley. Could you please, again, state your full name for the record?

A. Gerald Harris Negley.

Q. Mr. Negley, are you named as an inventor on any patents?

A. Yes. Last time I checked, I am inventor or co-inventor on 254 issued US patents.

Q. Generally, in what field of technology do your patents relate to?

A. For the most part, they relate to LED technology. It could be from chip design, packaging aspects or lighting devices.

Q. To the extent you know, are you a named inventor on any of the patents asserted in this investigation?

A. Yes, I believe I'm a named inventor on of the two patents.

Q. Thanks, Mr. Negley.

Before we get to those patents, let me first ask you about your background.

Could you please summarize for the Court your educational background?

A. Yes.

I received a bachelor's of science degree in physics from Widener University, 1981. And then I went to graduate school, University of Delaware, and got a master's degree in physics, solid-state physics, with an emphasis in luminescence in 1984.

Q. Mr. Negley, are you currently employed?

A. No, I am not; I'm retired.

Q. Mr. Negley, are you familiar with a company by the name of LED Lighting Fixtures or LLF?

A. Yes. We -- I cofounded LED Lighting Fixtures, Inc., which was quickly shortened by the industry to LLF, Inc. We cofounded that company in September of 2005.

Q. Thank you, Mr. Negley.

Before we get to your work at LLF, can you explain to the Court what you did employment-wise prior to

LLF?

A. Prior to LLF, I worked for a company called Cree. I joined Cree in February of 1993. I originally managed their clean room, their wafer fabrication process.

At that time, Cree only made LED -- blue LED light-emitting chips. They didn't package them. They just made the chips. So I ran the clean room for them.

I quickly assumed responsibility for the test and package area. We tested all of the LEDs prior to shipping to the customer, and we would package a few to verify their performance.

I inherited that part of the business because they wanted to see what I was making in the FAB.

From that point, I gained more responsibility, and Cree was growing quickly. By the end of the 1990s, I was responsible for manufacturing and engineering for the optoelectronic division, which was what generated most of their revenue.

After that, I started up a packaging business for Cree. It's something they said they would never do, but we came out with a power chip, and none of our customers could package it, so we decided to get into the packaging business.

After that, I started up a back-lighting business for Apple -- I mean, for Cree. We -- we started

down the path of back-lighting TV screens with LEDs. Shortly -- that would have taken us up to about 2005, and I left Cree in August of 2005.

Q. Mr. Negley, why did you leave Cree in August of 2005?

A. I -- myself and a fellow named Tony Van de Ven, who also cofounded LLF, we thought that the technology was ready for using LEDs in general illumination. Most people didn't think so, and we actually had that discussion in the summer of 2004. It took a year to work up the courage of quitting a very good job, and risking it all.

But we started LLF in 2005.

Q. You mentioned you cofounded it with Mr. Van de Ven and others.

Can you describe who else you cofounded LLF with?

A. Yeah. Tony and I were really technology guys, and -- I mean, he has run his own business before, but we're really technology guys.

At the same time, in the summer of 2005, Neal Hunter, who was a cofounder of Cree, and president and chairman, he was leaving Cree to work full time on real estate development that he was putting together, and when he heard what we were doing, he offered his assistance.

Neal, although he is a mechanical engineer by

education, he is a fantastic businessman. Neal came on board with a fellow named Tommy Coleman. Tom was also a cofounder of Cree.

They came onboard as -- you know, the four of us started the company.

Q. Thank you very much, Mr. Negley.

Can you remind the Court again when LLF was founded?

A. Yeah. We were founded in September of 2005. I believe we were incorporated September 15th of 2005.

Q. What was the original goal or mission of LLF?

A. Our plan was to -- you know, accelerate the adoption of solid-state lighting. Most of the world didn't believe it was ready yet. We did.

So, you know, our goal was to go after the business.

Q. After you and others founded LLF in September of 2005, what was the first project that you worked on?

A. The very first project we worked on was actually -- was LED lighting for billboard illumination. Customers -- we had a particular customer who came to mind, but he has a lot of billboards up and down I-95.

They pay a lot of money for the billboards. They look great during the daylight. They look not so great at night. Typically, illuminated with metal halide

lights, which has very low color rendering.

So what pops during the day doesn't pop at night, and we thought we would solve that problem with LEDs.

Q. Can you tell us a little bit more about the billboard project, Mr. Negley?

A. Yeah. We put together a prototype, and it was -- it was RGBW. It was red, green, blue and white LEDs combined. The white LEDs would have been cool white LEDs.

Each color was independently controlled with a potentiometer so we could do adjustments.

We tuned in the light source to provide very high-color rendering, and good light quality. We had a billboard set up in the middle of a farm field, Pittsboro, North Carolina, Tommy's house.

And we compared that light source to a metal halide, and which we had our customer watching. He was thrilled. He thought it looked fantastic.

So Tony Van de Ven, Tommy Coleman and myself were there, and we -- Tony is sort of a -- he's a color scientist by -- that's what he has learned. So he did what comes naturally to him, which is starting to adjust the colors.

You know, he would take the red up and down, see what the light source looked like. Took the green up and

down. Talking brighter and dimmer. And did the same with the blue. Change the ratio of white to blue, white to red. Almost anything you can imagine.

At some point, he tuned in this color. We argued whether it was greenish yellow or yellowish green, and he asked if I could make a component that had that color.

I asked him a few questions. There's what's called the CIE diagram. It's a color chart. I asked him where it was on the chart. I said, yeah, I think we can. What he saw and what I saw was if we had that -- could make that particular color from one component, we could add red light from another component, and we believed we would get a very efficacious and high-color rendering light source.

So the -- these yellowish green or greenish yellow, which we eventually called BSY, which stood for blue-shifted yellow. It's a blue LED. It's a yellow phosphor. So it's easier to say BSY.

So we made those components in what we called the Hillsboro Technology Center. That was the other side of my duplex where I set up a lab to start the company.

And I spent two days making components that were not commercially available. We put together -- cobbled together a very crude prototype just to sort of show our proof of concept, and lo and behold, we could make a light

source that was warm white, which that would be the color of an incandescent bulb, the technology we're trying to replace, at least in terms of color, and it also had a very high-color rendering, which was not typical of LEDs at the time.

Q. Thanks, Mr. Negley.

What was the time frame, again, for when you came up with this prototype?

A. It's been a while. It's 2005. It's probably October or November. It was in the fall. I just remember we were -- billboard -- you look at that at night. We were out. It's chilly. So it was the fall of 2005.

Q. Thanks, Mr. Negley.

Once you came up with that, what did you and your team work on next?

A. Well, we knew we had something in terms of how good light quality and good efficacy -- or better efficacy than anything out there.

We decided to go after a 6-inch downlight, and people said why. It was pretty simple. There were a billion holes in the ceiling already in the United States. We figured if we could get a few percent of that business, that we -- we would have a viable business to run with. So that was the first product we went off.

Q. Thank you, Mr. Negley.

Are you familiar with the term "wall plug efficiency"?

A. Yes. Wall plug efficiency is something that, in a sense, we pushed from the very beginning, and it is -- it is measuring the device -- the lighting device with how much power is coming out of the wall.

So it incorporates every loss that is imaginable, power supply, thermal loss, because LEDs get dimmer.

So every time we would report a number, we would look at how much power was consumed coming out of the wall versus how many lumens were generated, and that's how we -- that's what we call a wall plug efficiency. And it's measured in lumens per watt.

Q. Is there any specific wall plug efficiency that LLF sought to attain?

A. Yeah. Our goal was 100 lumens per watt. It just seemed like a good number. Yeah.

So that's where we set our target, and I would say -- you know, and we ran for it.

Q. Thank you, Mr. Negley.

Can you describe for the Court the approach you and your team took to design this lighting device to achieve the wall plug efficiency that you mentioned?

A. Well, we ultimately came up with our -- a set of

design rules, and there's mechanical aspects of the lighting device. There's the electrical aspects, right. You got to convert 120 or whatever is coming out of that wall plug to AC. You have to convert that to DC.

There's optical considerations to consider, and there's thermal considerations to consider.

Those four items are intertangled, and we likened it to the Whac-A-Mole problem, that boardwalk game where a mole pops up, and you smack it in the head, and another one pops up.

You know, you can go forth and, you know, minimize losses of one of these design rules, optical or whatever, and minimize losses and maximize performance, but that may have impact on other parameters.

So they're intertangled, and you need to basically solve them as a group.

Q. Thanks.

Let's take those one by one. Can you first tell us about the optical considerations that you considered for a lighting device?

A. Yes. Okay. I grew up making LED chips. I considered myself a photon generator, and I hated throwing them away.

So the optical losses were very important to us. We also -- we also knew that we had to do some mixing,

right. We got two different colors that were -- we need to blend together so it looks like a uniform light source in application.

So from the optical standpoint, not only did we produce a very optically efficient lens for the system, we also -- where the LEDs were inside, we lined that with a material from the backlighting industry called MCPET, M-C-P-E-T, and we just called it MCPET. It's easier.

It's very interesting material. It's, I believe, about 96 percent reflective across the entire visible spectrum. Most materials, when they reflect -- they reflect blue poorly. This material does not.

It is also a diffuse reflector. So not only does it reflect -- it's not a mirror, but it's a very diffuse reflector, so it actually helps blend and mix the light together.

That gave us very a high optical output for the lighting device.

Q. Thanks, Mr. Negley.

Can you also remind the Court again of the specific color scheme you used for this particular development?

A. Yeah. We -- again, we were using what we calmed BSY. That is our custom component, blue-shifted yellow. I mean, the standard cool white LEDs in the industry used the

same LED, same chip and the same phosphor, but we used much more phosphor because we didn't want to make a white color just with that one component. By making it more yellowish, it was near peak eye response.

So we got more lumens per blue photons going in, we got more lumens coming out by making it yellowish in color. And then by adding red light to it with a red LED, that BSY color, the color point that we made the components at, plus red would give us a very high-quality warm white color. When I say warm white, that's typically between 2700 kelvin and 3,000 kelvin, the same color as an incandescent light bulb.

Q. Thank you, Mr. Negley.

Can you also tell us a little more about the electrical aspect of the design rules?

A. Yeah. The power supply, I mean, there's off-the-shelf conversion things that you can buy, but you realize that whatever is not converted efficiently from AC to DC generates more heat, and that means something else you have to, you know, worry about dissipating.

So we paid particular attention to the power supply, realized that also we had two different colors. So we had some independent control between the BSY string or strings of LEDs versus the red string of LED so that we could do a detailed balance and tune into the color point

of the lighting device.

Q. Finally, could you touch on the thermal and mechanical aspects of design rules?

A. Yeah. They're very much coupled together. LEDs, as they get warmer, they get dimmer. So you don't want to let them get too hot, they're just going to dim down on you, and it may also affect the lifetime of the LED itself.

So mechanical aspects, you know, whatever the fixture you're going to make, in this case, we were going after a downlight, so it's got to be able to hold the LEDs in place on the printed circuit board inside mechanically, some housing aspects to it.

But you also need a heat sink, and if you think about it, when you put a downlight up into the ceiling, nowadays, they're typically insulated cans that you are putting them into. So there's not a lot of airflow up there. You know, it's loss of energy for the building.

So we had to take into account, how do we get heat to the room somehow, and that's a combination of a heat sink, and then some exposure to the room, which is, you know, designed into the mechanical aspects of the fixture.

Q. Thank you, Mr. Negley.

I'd like to turn to -- a little bit further in

the time period, the April 2006 time period, and ask if you could take a look at JX-14.

Mr. Jay, if you could call that up.

Mr. Negley, do you recognize this document?

A. Yes, I do. It's a test report from a company called CSA International, which CSA stood for Canadian Standards Association. They're sort of like the UL of Canada.

They were a company that had set up an office in Alpharetta, Georgia, and for a fee, they would measure your lighting device for you, and tell you what the performance was.

Q. All right. Did you and LLF ask CSA to perform a particular test for you in April of 2006?

A. Yes, they -- yes, we did.

We had a prototype of a downlight, and we wanted to verify the performance. In this case, I believe we did two different tests at different input voltages, and then it gave us what the results were.

Q. Before we get to the test results, was there a reason that you went to CSA versus another lab?

A. There weren't a lot of labs offering test time at this point. CSA, UL, but UL basically didn't answer the phone for us.

I had actually -- I had met the president of CSA

at a lighting conference before this, and they provided -- you know, they do lifetime testing for people's products, and they also provide individual -- photometric testing on individual units. So we chose CSA.

Q. Thank you, Mr. Negley.

If we could go to JX-14.9, which is page 4 of the report. I'd like to get to the test results you mentioned.

Can you tell us what's shown here?

A. Yes. There's two different test results. One test was performed at 110 volts, and the other test was performed at 115 volts. This particular power supply that we put together was non-regulated, so as you change the input voltage, the power consumption or, really, the amount of current that the LEDs would consume would change.

So the one test at 110 volts, we achieved an efficacy of 79.79 lumens per watt, according to the document. And at 115 volts, we achieved an efficacy of 72.7 lumens per watt.

The current voltage characteristics of an LED is a diode, so it's not like Ohm's law V equals IR. It's not a straight line. So it's a non-linear performance when you change the current, which we did by changing the input voltage.

Q. Can you explain to the Court total lamp

operation time for the two tests?

A. Yes. They -- CSA had -- they have a protocol. I'd have to look to see what the details of it are, but what they measure is that thermal equilibrium, and they determine thermal equilibrium by successive measurements. And when the light output is stable, they have a rule -- I can't remember if it's a half percent or -- they have some rule that it can't be more than a certain percentage difference from the previous reading, when you get to that point, they consider you to be at thermal equilibrium.

In this case, we did the first test at 115 volts, and it took 112 minutes, according to this, for the device to reach thermal equilibrium. You can see it was consumed nearly 10 watts of power, 9.737.

So we did the first test at 115 volts, and then we did the second test at 110 volts. And at 110 volts, it's consuming less power than the previous test, right, it was consuming 7.446 watts.

So essentially, the fixture is cooling down at this point. It's not warming up. Because it's -- you know, it has to dissipate less power. So it took 35 minutes for the second test to reach thermal equilibrium.

Q. I think you mentioned -- or you touched on this already, but can you tell us again what type of power supply was used by the prototype tested by CSA?

A. Yeah. It was a non-regulated power supply. Something we put together to -- for this prototype.

Q. What was your and your team's takeaway after seeing the results from the CSA test?

A. We were quite excited, without a doubt. Really excited. And we figured at that point, we had all of the pieces of the puzzle to go -- you know, step away from a prototype, and starting to design and construct a commercial unit that would be viable to sell as a product.

Q. You mentioned test protocols. Did you provide any of the test protocols that you wanted CSA to use?

A. No. The only thing we were allowed to tell them -- we were allowed to dictate the input voltage. You know, so we did the 110 and the 115.

If you look at -- if you ask people what wall plug is coming out of the wall, you know, some people will tell you it's 110, some people say it's 117, some people say it's 120. But -- so we wanted to be in that range, but that was the only parameter we were able to tell them.

Q. Mr. Negley, were you present at the CSA testing?

A. Yes, I was. I was there with another LLF employee, and honestly, I don't recall who that was. It either would have been Tommy Coleman or Tony Van de Ven. I just don't recall who was there.

I do recall that a fellow named Paul Pickard

came to witness the test. He wasn't able to hold the prototype. He wasn't allowed to look inside the prototype. We wouldn't even let him see this -- what's called the spectral power distribution of the prototype; it's the power versus wavelength.

He was able to see basically what the test data collected was.

Q. Okay. Mr. Negley, if you can see on my screen, I'd like to show what's been marked as CPX-144, as a physical exhibit, and ask if you recognize this physical exhibit?

A. Yes, I believe that's the prototype that was tested that day.

Q. Mr. Negley, did you end up putting together a commercial product based on the prototype that was tested by CSA in April of 2006?

A. We used -- we put together a product that was called the LR6. It very much resembled the prototype. There were clearly design considerations that we had to take into account for the commercial unit. So that prototype helped us create the LR6 commercial product.

Q. Thanks, Mr. Negley.

I'd ask if you could take a look at another document. This is JX-17. And we'll have Mr. Jay pull this up a little bit.

Do you recognize this document?

A. Yes. This was a press release that we did in April of 2006. And it was really the 115-volt test results from CSA where we achieved 73 lumens per watt. And, you know, it's -- I think nobody else had done that at that point. So we wanted to tell the world about it.

Q. Thanks very much, Mr. Negley.

I'd ask if you could now turn to JX-2, and we'll have Mr. Jay pull that up.

And I'd ask if you recognize this document?

A. Yes. That's an issued patent where myself, Tony Van de Ven and Tony Coleman are co-inventors. That was the patent that we had filed at -- you know, after this CSA measurement to, you know, document the prototype we had put together.

Q. Do you remember approximately when you filed the application for this patent?

A. Our standard methodology was to file a provisional. So I see there's a date there for provisional filing of May 31, 2006.

Q. So that would have been a few months after the April 2006 CSA test?

A. Yes, that's correct.

Q. Thanks, Mr. Negley.

I'd ask next if you could take a look at Figures

8 and 9 of the '819 Patent. Those are on pages JX-2.12 and 2.13.

Can you tell us what's depicted here?

A. Yes. Those are renderings of our commercial product. They -- it shows an aluminum cast housing in Figure 8, and then a little cut-away view of sort of the inside conical area where the -- I'll call it the light chamber, and that was a casting as opposed to a machine housing like we had in our prototype.

Figure 9 shows a cut-away view showing 5-millimeter LEDs in this case inside the optical chamber. And it's just sort of a cross-sectional view of the LEDs, the printed circuit board, and then there's an area in the back for the power supply.

Q. Thanks, Mr. Negley.

Could you also take a look at Figures 4 and 5 of the '819 Patent. Those are an JX-2.10, and tell us what's depicted here.

A. Yeah, Figure 4 is sort of out of scale a little bit, but it shows a 5-millimeter LEDs through a hole on the printed circuit board. And we paid particular attention to try to keep those things heat-sunk as possible. And it shows sort of what the chamber would look like, the optical chamber.

Then 18 is the output lens. We ultimately had a

lens specifically designed for us. In the prototype, we had cut off the face of a PAR 38 bulb -- a frosted PAR 38 bulb used in the prototype, but clearly, that wasn't going to be the solution for a commercial product.

Figure 5, in this case, we're still using the little 5-millimeter LEDs for our radial lamps -- radial LEDs.

As I said, we had two different colors, BSY, and we had the red, and we had particular layouts that we liked to do to further promote color mixing, and make sure that the light output looked uniform in color.

Q. Mr. Negley, did these figures relate to the prototype that was tested at CSA in April of 2006?

A. Yes. The prototype had similar configurations, and the difference was machined housing versus the cast housing, and stuff like that.

Q. All right. Now, after you achieved the test results at CSA in April of 2006, can you tell us the next steps you and your team took towards achieving the goal of 100 lumens per watt?

A. Yes. You know, we were a small group of guys at the time. We couldn't do everything we wanted. I had to look to see -- try to see if we can get to 90 lumens per watt, and we weren't there. It's just not there.

We decided to take our efforts at that time of

maybe pausing this whole efficacy thing. Some of my friends were getting a little tired of, you know, okay, Gerry, how -- what can you really do.

So we focused on making a commercial product. Getting -- how do you get castings made. A lot of work to do. And we only had so many hats. For the most part, when we realized we weren't going to get to 90 easily, we decided to buckle down and see if we could make a product and sell it.

Q. Do you recall an individual by the name of Mark Edmond?

A. Yes. Mark Edmond, I knew him from Cree. He was an engineer there. He became unemployed during the summer of 2000, and -- 2006, and we hired him. He's a ceramic engineer by education. That's okay.

We hired him. And what did he do? Whatever we told him to. I think the first project I set him off on when he came in was how to design and do layouts of printed circuit boards. Why? Didn't have expertise in-house. He had never done it before. Didn't stop him. He was an engineer.

At the same time, other than a project like that, he also had to learn and understand what we did, and how we did it, and why we did it. That's BSY plus red. You know, all of the different aspects and interactions.

So we threw Mark into the fire, and he responded quite well.

Q. Did Mark assist with your goal of achieving 100 lumens per watt and higher?

A. Yes. We -- I actually tasked him with that. He -- that was one of the tasks that he was given was, as you learn everything we do, and of course, we always want to learn how to do it better, Mark had that task.

He helped put together a prototype that we later had measured, and we surpassed the 100 lumens per watt goal.

Q. Which prototype was that?

A. We ended up calling it the LRP38. It was a concept for a PAR 38 LED-equivalent lamp, and we -- we had him put that together, and we got some test time, and we had it tested. People -- people were --

Q. Thanks.

A. People were surprised.

Q. Sorry to interrupt. Thanks, Mr. Negley.

Before we turn to that test, let's take a quick look at a document, JPX-70.

Let us know if you recognize this document.

A. Yes. This is a spreadsheet put together by Tony Van de Ven. He loves to model stuff. And basically you can see up column A, rows 3, 4 -- 4, 5, and 6, it says,

BSG1, BSG2 red. We had always used two strings of BSG, or that's what we ended up calling BSY. You know, green, yellow and red.

So we were able to put in individual parameters for the lamps. We were able to put in color point that we're looking for, power supply efficiencies, optical efficiencies. And so that's what was modeled here.

The model predicted with all of those parameters, if we could hit them, we would have a wall plug efficiency -- that's column J, line 36 -- of 114 lumens per watt. That's what our model predicted.

Q. Was there a prototype that was developed based on this model?

A. Yes. That would have been the LRP38.

Q. Thanks, Mr. Negley.

If we could turn next to -- I think the test results that you were referring to, and this would be JX-45.

Can you let us know if you recognize this document?

A. Yes, I do.

That is a test report put together for the LRP38 that was tested at NIST. That's National Institute of Standards and Technology. It is our government lab. They set test methodologies and specifications. It used to be

called the National Bureau of Standards.

But we got some test time at NIST, and we wanted it there. It was a very important measurement for us, and I think for the LED community.

They asked us two questions. One was what was the input voltage, and how much did it weight. They just wanted to make sure they could handle both. The weight had to come down to -- they wanted to make sure they could adequately fixture it so it would not fall and damage their test equipment, which is called an integrating sphere.

Q. Were you present at the NIST test, Mr. Negley?

A. No, I was not. I sent Mark up to do that, Mark Edmond. Might as well let him finish what he started.

Q. Did you or anyone at LLF provide any testing protocols to NIST?

A. Again, the only thing that we were able to -- the only things we were able to dictate was what was the input voltage. That's 120 volts AC.

Q. Before we get to the results, can you tell us why you wand to have NIST perform this testing?

A. We believed it was going to be such a great result that there would still be doubters out there if we had it tested any other place.

So why don't you -- you know, we went to the people who made the test rules and did the design rules for

the testing, and had probably the -- and still have the best equipment in the world. So we went to NIST.

Q. Thanks, Mr. Negley.

If you could ask you to turn to table 1, which is on page 2 of JX-45.

Can you tell us what's shown there?

A. Yes. Those were the test results for the LRP38. Input voltage, 120 volts. We specified that. LED lamp current at 120 volts.

This lamp consumed 0.1158 amps of current, which equates to 5.802 watts. That's just volts times current.

So that's how much power was consumed from the wall plug. Luminous output, 658.7 lumens. Divide the lumens by the power from the wall, 113.5 lumens per watt. We were thrilled.

Q. I think you mentioned that Mr. Edmond was present.

Do you know what you learned from him about NIST's reaction to the test results?

A. Yes. Mark was allowed to -- he was allowed to go in and witness the setup in their test equipment, the integrating sphere. But he was not allowed to be in the lab when the measurements were done.

They didn't want any undue influence, you know, from -- I'll call it from the crowd. So their policy is

nobody's in the lab other than the NIST employees.

I was on the cell phone with Mark at the time. He was out in the lobby. He was sort of laughing because every few minutes another NIST employee would go into the lab, and his comment was, wow, it's getting pretty crowded in there.

They -- I think they wanted more than a few sets of eyes on it. But they were quite impressed.

Q. Thanks, Mr. Negley.

If I could ask you to turn next to JX-1, and Mr. Jay can pull that up.

Do you recognize this document?

A. Yes. This was -- it was a patent that we had filed, and it was issued. This was a patent that represented in a sense that LRP38 prototype, and that's why Mark's there. We had the original three inventors from the previous patent, and then we added Mark's contribution, which was his work to get us over 100 lumens per watt.

Q. Do you recall the time period when you filed the application that led to this patent?

A. Okay. I see line 60. It says, provisional application filed November 27, 2007.

Q. All right. That was a few weeks after the NIST test?

A. Yes.

Q. Thanks, Mr. Negley.

If you could turn to Figure 1 of the '531 Patent. That's on JX-1.4, and could you tell us what's depicted there?

A. Yeah, this is sort of a cross-sectional view, again, of the LRP38 in this case. Couple of notable differences. I mean, we still have the MCPET layer in there. We still have 22 output lens. But instead of having those 5-millimeter LEDs, you can see -- I think it's pointing to 30 -- 30, 32. Those are what we call power LEDs typically designed for one-watt input. That's the design point of them.

Those are the same power LEDs that I did the product line for Cree back in 2003.

But they were power LEDs custom made to our color point, the BSY color, but that's just a cross-sectional view. Then you can see the housing in the back also has a power supply -- power supply. That's 16.

Q. Thanks, Mr. Negley.

Now, if I could ask you to turn to a later part of the '531 Patent, in particular what's shown on JX-1.20, and I'd ask you to focus on column 21, line 64, to column 22, line 7.

Can you tell us what's shown here from the '531 Patent?

A. Yes. That specifically calls out the test results by NIST, and then lists the individual parameters, input voltage, lamp current, power consumed in the lamp, and the wall plug efficiency, and the color rendering and --

Q. Okay. Thank you. Sorry.

A. And I was going to say and the color temperature.

So this is the equivalent color of an incandescent light bulb.

Q. Thanks, Mr. Negley.

Turning -- switching gears for just a moment, is LLF an existing business?

A. No, it's not. LLF was acquired by former employee -- employer, Cree, February 29, 2008.

Q. For how much was LLF acquired?

A. Purchase price, I believe, was about $77 million. And then on top of that, there was a three-year earnout of I think about $26 million, total yield is, I think, a little bit north of 103 altogether.

That three-year earnout was our incentive not to bail. We -- if we wanted our extra money, we had to be employed there.

Q. As a result of the acquisition, did Cree, Incorporated, get access to the work LLF did to develop the

lighting devices you mentioned?

A. Cree got everything lock, stock and barrel. All of our IP, every -- you know, everything we generated, any hardware, everything. They bought us.

Q. I think you mentioned that you stayed at Cree. How long were you at Cree after the acquisition?

A. I left Cree in 2014, so I stayed quite a while.

Q. Do you have any affiliation with the Complainant, Cree Lighting, in this investigation today?

A. No, I do not.

Q. Can you tell the Court why you're here to testify today about these patents?

A. I'm very proud of the patents that I helped generate, and I'd like to defend them. I just feel it's the right thing to do.

MR. ERWINE: Thank you very much, Mr. Negley.

No further questions.

JUDGE CHENEY: Okay. This is probably a natural time for us to take our 15-minute morning break. So I will see you all at, say, 10:57.

During the break, Mr. Negley, please don't discuss your testimony with anyone.

THE WITNESS: Okay.

JUDGE CHENEY: When we return from the break, there will be some questions for you from RAB Lighting, and

I might have a few questions for you also.

With that, we are off the record for 15 minutes.

(Whereupon, the morning recess was taken, 10:43 a.m. - 10:57 a.m.)

JUDGE CHENEY: We're back on the record now after taking our morning recess.

Before the recess, we heard the completion of the direct examination of Mr. Negley, one of the named inventors on the '819 and '531 Patents.

Is there any cross-examination for Mr. Negley?

MR. ROUSH: Yes, Your Honor.

JUDGE CHENEY: Please proceed when you are ready, counsel.

CROSS-EXAMINATION

BY MR. ROUSH:

Q. Brad Roush on behalf of RAB Lighting. Good to see you again, Mr. Negley.

A. Hello.

Q. Earlier, you testified about the BSY approach, and I wanted to ask you some follow-up questions. The '531 Patent references non-white non-saturated phosphor-converted light-emitting diodes, these are the BSY emitters or the BSY+R approach; correct?

A. Yes.

Q. The '531 Patent also references saturated LEDs,

and these would be the red LEDs of the BSY approach; correct?

A. Yes.

Q. LLF did not manufacture its own blue LED dies; correct?

A. That is correct.

Q. LLF did not manufacture its own red LED dies; is that correct?

A. That is correct.

Q. LLF did not manufacture its own phosphors; correct?

A. That is correct.

Q. These components were purchased from third parties; correct?

A. The red LEDs were purchased from third parties. The BSY color was a custom-made component for us, and we had that made by Cree, who was our vendor.

Q. But the blue LED dies used in the BSY component would have been manufactured by Cree, Inc.?

A. Maybe. In many of -- in the early prototypes, we used Nichia chips, and we used Cree chips. It depended.

Q. So LLF would take a blue LED chip manufactured by a third party and modify it to make the BSY emitter; is that right?

A. When we were making 5-millimeter LED prototypes,

we would get the chips from a vendor, and I would make those lamps in my lab.

Q. So now up until LLF was acquired by Cree, Inc. in 2008, did all of LLF's lighting devices use the BSY approach?

A. Let me -- the -- there was one prototype that did not. It was the very first prototype. It was a cool white lamp that we announced. After that, BSY plus red was the approach that we took to make warm white, high color-rendering, light sources.

Q. So to practice the BSY approach, you need at least two LEDs; correct?

A. To practice the BSY plus red approach, you need at least two LEDs.

Q. That's a blue LED and a red LED; correct?

A. No. That is a blue-shifted yellow LED plus a red LED.

Q. Okay. So you --

A. I'm talking components, sir. I'm not talking the chips inside.

Q. So on the chip level, you would need a blue LED die and a red LED die; is that correct?

A. That is correct.

Q. Prior to your BSY+R approach, it was known that white light could be produced using LEDs; correct?

A. Yes.

Q. One of those approaches was using red, green and blue LEDs clustered together; correct?

A. Red, green and blue LEDs, RGB, is one approach to make white light.

Q. Another approach was using a blue LED with a luminescent material such as a phosphor; correct?

A. Other approach would be what I would call phosphor -- complete phosphor converted. So that would be a blue chip plus whatever phosphor combination you put together trying to -- depending on what color temperature lamp you are trying to make.

Q. Would that be a phosphor-converted LED approach?

A. Yes.

Q. Prior to the BSY approach, it was known that you could make warm white using a phosphor-converted LED approach; correct?

A. That is correct.

Q. In the BSY approach, you're using a red LED instead of a red phosphor; correct?

A. That is correct.

Q. The red LEDs are more efficient than a phosphor-converted red; is that correct?

A. Yes, that is correct. If you use a phosphor to create a red light, you're using what -- the blue light is

approximately 3 electron volts. The red light is approximately 2 electron volts.

So you're throwing away one-third of energy to make a phosphor-converted red, that's why we didn't go that way.

Q. What you just described there, is that called a Stokes shift loss?

A. Yes, that's a Stokes shift loss.

Q. I want to pull up -- actually, LLF was founded in September 2005 by Mr. Hunter, Mr. Coleman and Mr. Van de Ven and yourself; correct?

A. That is correct.

Q. And LLF always had a Hong Kong office; is that correct?

A. Yes. Tony Van de Ven lived in Hong Kong at the time.

Q. I next want to discuss with you the timeline associated with the development of LLF's prototypes.

I believe you testified that you came up with the BSY approach in -- is it October or November 2005, around that time period?

A. Yeah. It was in the fall. I just remember it was chilly outside. Billboards set up, and we were playing around with our RGBW light source.

Q. At that time, you didn't know how to -- how to

build a 60 lumen per watt lighting device; correct?

A. Until we had our a-ha moment that night in the field and figured out BSY plus red, we did not achieve -- we were not at 60 lumens per watt before that time.

Q. So immediately after your a-ha moment, you knew you were at 60 lumens per watt; is that correct?

A. I think it's better to say after our a-ha moment, we made some prototype devices BSY, and we learned about BSY plus red. And once we learned enough, then we put together a prototype.

Q. When you say you put together a prototype, what prototype are you referring to?

A. We had a couple of different press releases and it's a little foggy right now.

So I -- I don't recall. I do recall very well the moment when we went over 70 lumens per watt, which was at that test at CSA.

Q. You built several prototypes; correct?

A. Yes.

Q. These would be tested at CSA; is that correct?

A. If we did a press release, then it was tested by a third party. If we didn't do a press release, then we trusted our in-house measurements, which were nearly identical to the test equipment at CSA.

Q. So was the first of those prototypes tested at

CSA in January of 2006?

A. Could be, I don't recall.

Q. Can you turn to RX-0737?

Do you recognize this document?

A. I'm looking at it right now.

Yes, it looks like a test report from CSA, and it looks like it's dated January 25, 2006.

Q. Can you turn to page 16 of the report?

A. Yep, I see it.

Q. This prototype had a wall plug efficiency of 47.36 lumens per watt; is that correct?

A. That's what the document says, yes.

Q. Can you turn to page 22 of the report?

Is this a second LLF prototype? If you turn to page 2 of the --

A. Yeah, yeah. Okay. I'm looking at it. I don't recall the details of this.

Q. But shortly after the January 2006 CSA test, if you pull up JX-0016, LLF issued a press release. In this press release, LLF is announcing a wall plug efficiency of 47 lumens per watt; is that correct?

A. That's what I read, yes.

Q. Was that a record for LLF at the time?

A. I believe it was. And I believe it was also a record for warm white LED lighting device, period.

Q. Could you turn back to RX-737, page 16? Can you look at the correlated color temperature there?

A. Yes, I see that. It's 6,000 kelvin.

Q. That would not be a warm white lighting device; is that correct?

A. I'd have to see -- I'd have to look at details of this report.

At one point, we -- the very first press release we ever did was a cool white product, okay, then we also had that compared to a CFL lamp that we had tested at CSA.

I'd have to look at the details of this report. Jumping around is very confusing for me.

Q. Can we turn back to the press release, JX-0016.

This is announcing the record of 47 lumens per watt. So at the time LLF had not figured out how to build a lighting device with a wall plug efficiency higher than 47 lumens per watt; correct?

A. Yes. Can I see more of this document, please?

Okay. So this document, although it -- I don't see where -- this press release, I don't see where it calls out the color temperature. I do remember this now where it says, "We are targeting the release of a result from our warm white fixture within 60 days." Okay.

This was a cool white prototype that we put together with the best cool white LED components that we

could. Okay. This is a cool white result. This is not a warm white result. This is not BSY plus red. This is a completely phosphor-converted LED prototype that we put together.

That's why the color temperature, as you pointed out before, was nearly 6,000 kelvin, which is the color of a cool white lamp.

Q. But at the time, as of January 2006, this was LLF's best wall plug efficiency result to date; is that correct?

A. Yes.

Q. So can you turn to -- if you pull up RX-0738. This is another CSA test report, and this one, I believe, is dated February 16, 2006, if you turn to page 2.

Do you recognize this document?

A. It looks like a test report for LLF prepared by CSA.

Q. This would be -- these tests -- these tests that you conducted, would they be considered technology demonstrations?

A. This is a prototype. This would be a technology demonstration, yes.

Q. Can you turn to page 4 of the report. This report shows a wall plug efficiency of 53.5 lumens per watt; correct?

A. Yes, it does. It also shows a correlated color temperature of 29,000 -- I mean, yeah, 2,904 kelvin, which is the color of a warm white LED -- a warm white light fixture, very similar to that of an incandescent bulb.

Q. So did this prototype use the BSY+R approach?

A. Yes, it did.

Q. Can you turn to RX-50.

This is another LLF press release dated February 16, 2006.

Do you recognize this document?

A. Yes, I do. It's a press release that LLF released on the previous test results that you just displayed.

Q. In this press release, LLF is announcing a new record for wall plug efficiency; is that correct?

A. I -- I believe nobody had achieved a warm white LED, high-color rendering lighting device that had an efficacy this high.

So this is a record.

Q. At the time LLF had not figured out how to build a lighting device with a higher wall plug efficiency; correct?

A. We were still learning all of the details to maximize the performance.

Q. So at the time, 54 lumens per watt for wall plug

efficiency was the best that LLF knew how to do?

A. 54 lumens per watt on this date was the best that we had done, and it was the best that anybody in the world had done for warm white, high-efficacy, high-CRI light source.

Q. I want to turn back briefly to the January 2006 test. You mentioned that was a cool white prototype.

Was the wall plug efficiency of 47 lumens per watt a record for a cool white lighting device?

A. I had never seen another product in the cool white regime that had an efficacy that high.

Q. So, Mr. Negley, can you pull up JX-0014. This is a copy of the declaration that you testified earlier on. It was submitted in the prosecution of the '819 Patent.

Can you turn to page Cree_Lighting-RAB 3398. This is the CSA report for April 20, 2006 that you were testifying earlier about; is that correct?

A. It appears to, correct.

Q. This is another technology demonstration?

A. Anything with a prototype we termed a technology demonstration.

Q. Can you turn to page 9 of the report. Actually, that page right there, yes.

JUDGE CHENEY: Sorry. For the record, Counsel, what page are we looking at?

MR. ROUSH: Cree_Lighting-RAB 0003401.

JUDGE CHENEY: Which is page 14 of -- I'm sorry, is that page 9 of the report?

MR. ROUSH: It's actually page 4 of the report, Cree_Lighting-RAB 003401.

JUDGE CHENEY: Thank you.

Q. Earlier you were testifying about these test results. You also mentioned that an unregulated power supply was used; is that correct?

A. That's correct.

Q. You mentioned that wall plug voltage can vary; is that correct?

A. What do you mean, "wall plug voltage can vary"?

Q. I think you said people have different ideas of wall plug voltage.

A. Well, if you ask -- I think even if you ask an engineer, you know, what is the wall plug or if you look at an appliance document, sometimes they call it 110. Sometimes they call it 115. Sometimes they call it 117. Sometimes they call it 120 volts.

I mean, I -- I can tell you my wall voltage at the Hillsboro Technology Center was 124 volts. That's what came to the house.

Q. Here the -- there are two tests; one was conducted at 110 volts, and one was conducted at 115 volts;

correct?

A. That is correct.

Q. The 110-volt test had a 79.79 lumens per watt; is that correct?

A. That's what the report says, yes.

Q. Then the 115-volt test had 72.7 lumens per watt?

A. Yes.

Q. And if the input voltage were further increased, would you expect the wall plug voltage to also decrease -- strike that. I misspoke.

If the input voltage to the power supply were further increased, for example, to 120 volts, would you expect the wall plug efficiency of the prototype to decrease?

A. For this prototype, it would because it's a non-regulated supply.

Let me just tell you something about LEDs. If you have -- say, you have a power LED that's made to operate at 350 milliamps of drive current.

Okay. If you double that drive current to 700, you only get 60 percent more light out. So the LEDs become less efficient.

If you have the same LED at 350 milliamps and turn it down by half, okay, so 175 milliamp drive current, then your efficacy will go up a little bit because it's

more efficient.

I mean, again, this is a prototype, you know, and we had a non-regulated supply. Our final commercial product had a regulated supply. So input line voltage variations would not change output -- the amount of light output.

Q. So next -- so you issued as part of this a press release, right, in April of 2006; is that correct?

A. That is correct.

Q. That's JX-0017. In this press release, I believe you said that your LLF had set a wall plug efficiency record of 73 lumens per watt; is that correct?

A. That is correct. That's what we announced that day.

Q. So was that, in fact, a record for LLF at the time?

A. It was -- okay. On the day that we did that test, we did two different tests at the same -- at different input voltages. Okay.

This was the efficacy that we wished to release at that day, and it was a world record. You know, an unprecedented gain in light output.

Over 70 lumens per watt was a very significant number.

The Department of Energy had a 2010 goal or

2011, one of the two, and their goal for warm white LED in that -- in 2010, 2011, whatever year that their goal was to be made, or they thought it could be achieved, was 70 lumens per watt for a warm white LED component. Okay.

That means no lens loss. No optical loss. No power conversion loss. It was a DC measurement. That was what the Department of Energy thought would be capable in 2011.

We did this as a system, with -- as a wall plug efficiency, with all of those losses, in 2006.

This was a significant result.

Q. So -- but in this press release, you chose to release the lower of the two test results from the April 20, 2006, CSA test; is that correct?

A. That is correct.

Q. Can you pull up RX-0051.

This is another LLF press release dated May 30, 2006. Do you recognize this document?

A. Yes, I do.

Q. This press release announced a world record at 80 lumens per watt; correct?

A. That is correct.

Q. And this press release is also referring to the April 20, 2006, CSA test?

A. Yes, it is.

Q. So the April 24, 2006, and May 30, 2006, press releases are referring to the same test; correct?

A. Same -- same test date, right. It is the same -- the same prototype unit, but yes, both tests were performed on -- in April.

Q. Okay. So for this press release, LLF had not built a prototype with a better wall plug efficiency than what was tested at CSA in April of 2006; correct?

A. That is correct.

Q. So when -- on May 31, 2006, when the provisional application for the '819 Patent was filed, LLF's wall plug efficiency record was 79.79 lumens per watt; is that correct?

A. That was -- yes, that is correct.

Q. In fact, in May 2006, LLF tried to build a better prototype but fell short; correct?

A. I believe -- it's not that we fully constructed a prototype. I looked at the base components. I looked at everything we had.

We had -- Tony Van de Ven had put together an Excel model. We called it "Predictor." For what we had at that time, we were not going to be able to do what we -- what somebody had asked me to do, which was try to demonstrate 90 lumens per watt.

It just wasn't possible. We couldn't do it at

that time.

Q. So can you turn to RX-743? This is an e-mail between yourself, Cynthia Merrell, Mike Rogers and Mr. Hunter and Mr. Van de Ven dated May 22, 2006.

Do you recognize this document?

A. Yes, I do. It's an e-mail correspondence where I basically said we weren't going to be able to do 90 lumens per watt at this time.

Q. In fact, you said you fell short, way short; is that correct?

A. I believe that's -- I read the same as you, yes.

Q. I believe you were only able to get to 77 lumens per watt; is that correct?

A. I don't know. I don't know where you see that. I --

Q. It's in the third paragraph down below or in the -- "our best measured number to date is 79.79 lumens per watt," and it goes on to say, "this attempt is at 640 lumens, 77LPW."

A. Okay. I see that now.

Yeah, that's what it says.

Q. Then later on in the e-mail chain, you state that, "With each successive gain we release, it's getting dramatically tougher."

Do you see that?

A. Oh, yeah. Yeah. Yes.

Q. So at the time, it was getting dramatically tougher for LLF to improve on the wall plug efficiency for its prototypes; is that correct?

A. I'm sorry. Can you repeat that?

Q. Sure.

So at the time, May 2006, it was getting dramatically tougher for LLF to improve on the wall plug efficiency for its prototypes; is that correct?

A. We were nibbling away at gains. We took out all the big stuff, and it gets incrementally more difficult to move higher.

Q. As a result of not being able to improve upon the April 20, 2006, prototype that was tested at CSA, for your May 31, 2006, press release, you elected to go with the 110-volt value of 79.7 lumens per watt at press release; is that correct?

A. The 80 lumen per watt press release, slightly rounded up from the 79.79, is a release of the April test results, yes.

Q. In achieving the April 20, 2006 CSA test results, you were using a lower current density; correct?

A. Yes. That's -- well, by the non-regulated -- non-regulated power supply, you source the voltage, and then see how much current it will consume.

So, yes, the 110-volt test was at a lower current density, that is correct.

Q. And lowering the current density will increase the wall plug efficiency when an unregulated power supply is used; is that correct?

A. It may. If you turn it down too low, then it may not.

But typically, if you are near the operating point and you take down the current a little bit, you -- or current density a little bit, yes, your efficacy will go up.

Q. Can you go to the bottom of this e-mail? It's -- were you using, at the time, XT33 and XT31 chips; is that correct?

A. That's what the e-mail says. Those were Cree XT33 versus XT31s.

Q. Would those be Cree blue LED dies?

A. Those were Cree blue LED dies of some configuration.

Q. Now, Mr. Negley, it was not until the NIST test in November 2007 that LLF was able to build a lighting device with a wall plug efficiency greater than 79.79 lumens per watt; correct?

A. That is correct. The truth is we stopped working on efficacy improvements, and we went to

commercializing a product. We only had so many people in the company. We could only do so much.

Q. Can you pull up RX-658?

Is this the press release for the November 2007 NIST test?

A. Yes, I believe it is.

Q. For this test, you are announcing that LLF had shattered a world record; is that correct?

A. I believe that's what the -- that's what the headline says.

Q. Is this the same test that's referenced in the '531 Patent?

A. '531, is that the -- that's the patent that includes Mark Edmond as an inventor; is that correct?

Q. Sure. Let me pull up JX-001.

Can you turn to column 21?

A. Yes. That's the same data that's in this patent.

Q. And --

A. Yes. Bottom of column 21 to the top of column 22.

Q. Okay. So these are all referring to the same NIST test that was conducted in November of 2007?

A. Yeah. I think it actually says that, right. The devices in Figure 1 and 2 was tested by NIST and

resulted in the following performance. Those were the NIST numbers. Yes.

Q. So you just mentioned that you turned your attention to a commercial product. Is that LLF LR6 product?

A. Yes. We went from the prototype development, and then we went to commercialize the LR6 product, which was our first product, our 6-inch downlight.

Q. And can you turn back to JX-0014 and can you turn to page number Cree_Lighting-RAB_00003395?

Your declaration attaches two reports from CALiPER; correct?

A. That's what it says, yes.

Q. CALiPER was a program started by the Department of Energy to verify the performance of solid-state lighting devices; is that correct?

A. Yes. CALiPER is an acronym. I don't remember what it stands for now.

But the Department of Energy, there's part of what I would call their truth in lighting advocacy where they would buy products not -- they weren't supplied by the manufacturer. They would buy them outright in a store, and they would test the performance to see how honest or dishonest the manufacturers were with the numbers that they reported.

Q. Can you turn to page Cree_Lighting-0003413?

The CALiPER testing took place in September 2007; correct?

A. That is -- I see on this report, it calls out two dates, September 7th and September 10th.

Q. Can you turn to Cree_Lighting-RAB_003414, the following page?

The LR6 tested by CALiPER was purchased in August 2007; is that correct?

A. That's -- that's what it says.

Q. According to the product literature, it was dated -- the product was dated July 2007; is that correct?

A. That is correct.

Q. I want to turn back to the April 20, 2006, CSA test.

A. Okay.

Q. Can you pull up JX-66?

At this time, you were in this e-mail. As you testified, you were explaining that Mr. Pickard was also at the April 20, 2006, test; correct?

A. Yes, he was.

Q. Mr. Pickard is an employee of Acuity; is that correct?

A. He was an employee of Acuity. I believe Paul, on that day, was there representing himself.

Q. Acuity is another light fixture manufacturer; correct?

A. That is correct. Acuity Brands Lighting.

Q. Do you recall whether Mr. Pickard was under a confidentiality agreement with LLF at the time?

A. I believe before this test was done -- during my deposition, I -- I wasn't sure.

I talked to Paul after my deposition, and he was under an NDA for that test.

Q. Since -- did you review the -- a copy of the NDA?

A. I have not.

Q. Do you have one in your records?

A. I -- if -- all records of LLF should be records of Cree.

Q. Can you pull up RX-07 -- 0077?

This is an e-mail between Mr. Van de Ven and Mr. Hunter and yourself, correct, dated April 12, 2006?

A. I see that.

Q. Do you recognize this document?

A. I don't recall it. I can read it, and I'm sure it may spark some memories, you know. It was a little while ago.

Q. So this is about a little over a week before the April 20, 2006, CSA test. If you turn to the following

page, page 2 of RX-077, Acuity or ABL had questions about LLF technologies.

Do you recall seeing this document?

A. It looks familiar. I can't say -- if you hadn't shown it to me, I probably wouldn't have remembered it, but it looks familiar.

Q. Did LLF provide a prototype -- or strike that.

Was LLF in negotiations with Acuity at the time?

A. We were looking for strategic investment partners.

Q. Was Acuity one of those potential strategic investment partners?

A. I would -- I would say any company that we talked to, we were always looking for money. So our interest in -- you know, at Acuity would be, you know, we're not going to give away what we make. We had no products at this point. But we did have technology that we were developing.

So we were always looking for investment partners.

Q. So this would be a commercial interest; is that correct?

A. What do you mean commercial interest?

Q. You were interested in establishing a relationship with Acuity that would benefit you

financially?

A. In a small startup that, you know, when -- you don't raise money when you need it. You raise money before you need it and when you can.

So if somebody's knocking on our door, we're going to be knocking on theirs for something else. Something in return. Absolutely.

Q. Can you take a look at -- on that same page, page 2 of the document, at the -- I think it's the first paragraph below the bullet points?

It says -- apparently, Acuity had a question for you. They asked, "Is the power quality such as inrush current, harmonics and power factor equal to or better than standard instant electronic fluorescent ballast and suitable for installation in commercial buildings?"

Do you see that?

A. Yes, I see that.

Q. In LLF's response, it says, it's -- currently you have a very basic power supply design; is that correct?

A. That is what is written, yes.

Q. So at the time, LLF power supply design was very basic; is that correct?

A. I would say that we -- we would make the most efficient, but very, you know, simplified design for our prototypes. Okay.

During this time as we stopped going after efficacy records, we knew there were things we had to do. Power factor correction, that's PFC. Very important, okay, if you wanted to get into commercial applications.

Q. So at the time, though, your power supply was simple; is that correct?

A. At the time, our power supply was sufficient for us to develop prototypes and characterize the technology that we were creating.

Q. Can you pull up one more document associated with this, RX-0180.

In this you're talking about a recent Acuity contract, and in it -- do you recall whether or not a contract between LLF and Acuity was exchanged?

A. There was -- I believe there was a document put forth by Acuity. They wanted us to design and construct some products for them.

And we turned down the deal. It just didn't make sense.

Q. Did Acuity make a financial offer?

A. No. I can't remember how the deal was structured. It wasn't like they were going to buy a piece of LLF or an investment. They -- there was -- you know, you make this widget for us, and this is how much we'll pay you, and this -- design and make the widget.

All I remember is that they were quite upset when -- when we basically would not sign the agreement that they wanted us to sign.

Q. Did LLF ever make an offer to Acuity?

A. I don't know. I tried to stay more on the technology side, and let Neal Hunter, Mike Rogers, and Cindy Merrell, our CEO, president, and CFO do first pass on business deals.

So I -- I don't recall. Just -- I really don't recall.

Q. Can you pull up JX-002 again. This is the '819 Patent. Earlier we were talking about the BSY+R approach.

The BSY+R approach requires a BSY emitter, and a red LED; correct?

A. That is -- yes, that's correct.

Q. And the BSY emitter uses a blue LED die; correct?

A. The blue LED die is in -- in all phosphor-converted LEDs, there's a blue LED chip in there, yes.

Q. Can you turn to Claim 1 of the '819 Patent. Claim 1 recites a lighting device comprising at least one light-emitting diode.

So you could not perform the BSY+R approach with just one LED; correct?

A. I think it comes down to what are you calling one light-emitting diode? Okay. It's a package. In that package there could be a BSY -- a blue chip and a red chip. Okay. There could be. So it has at least one light-emitting diode.

Q. Okay. But you would -- but in your design, the -- there would be a BSY emitter package, and a red LED package; correct?

A. In our design, we had -- we had a separate BSY package and a separate red LED package.

Q. So that would be at least two LED packages; correct?

A. That answer to your question is -- sounds like it's yes. Okay. If you are trying to get me to interpret this claim, okay -- this is a legal document. Okay. I'm not a lawyer. Okay. You're looking at a specific legal document.

I'm not a lawyer, so I can't comment on this claim per se. But the way we constructed, got to BSY plus red was one BSY package plus one red package.

Q. Can you turn to in the '819 Patent, the column 16. This is beginning at line 39. This reference is a Cree XT LED, a C460XT290.

Do you see that?

A. I see where it says that, yes.

Q. It also mentions that the optical power would be greater than 24 milliwatts.

Do you see that?

A. Yes, I see that.

Q. Do you know whether the -- whether or not the April 20, 2006, CSA prototype used this LED die or not?

A. I -- I don't recall the specific LED dies that were called out in there.

So I don't recall that detail.

Q. Can you pull up RX-0750.

Do you recognize this document?

Actually, can you pull up another document. Can you pull up JX-0159?

Do you recognize this document, JX-0159?

A. It looks like -- I mean, I don't recognize it specifically, but it looks like it is a product sheet from Cree about their XThin LEDs, XT290.

Q. So is this the data sheet for C -- the C460XT290 referenced in the '819 Patent?

A. I don't know.

Q. Can you take a look at about mid-way down, it says XT24 24-milliwatt minimum.

Do you see that?

A. Yes, I see that.

Q. Would this be referring to, as the patent calls

it, an optical power greater than 24 milliwatts?

A. It very well may be referring to that.

Q. So could the reference in the '819 Patent to a -- the C460XT290 be referring to the XT24 shown here?

A. It could be. I'd have to do my homework on it, because I really don't recall the details.

Q. You recall testifying earlier today that you're named as an inventor on several -- I believe you said LED chip-level patents; is that correct?

A. Yes.

Q. So you're not able today to identify whether or not that is the data sheet for the only blue LED die identified in your '819 Patent; is that correct?

A. I mean, it -- the names and numbers seem to go together. I just -- I'd have to go back, and just sort of piece it all together. You know, you're talking 16 years ago or so.

Q. Can you pull up RX-750 again?

Do you recognize this document?

A. It looks familiar.

Q. So this is an LLF document?

A. That's -- that's -- I see it says company confidential, copyright 2006, LED Lighting Fixtures, Inc. There's a date 5/5/2006. So it must be an LLF document.

Q. Do you see the prototype -- the project name

D3-1?

A. Yes.

Q. If you see, it goes along columns, and the -- one of the columns is L/W 73, and another one it's like CSA, yes. And it also mentions the purpose, press release.

Is this D3-1 project the prototype that was tested on April 20, 2006?

A. It could be.

Q. In it mentions description 3 strings, 117X, XT31. Do you see that?

A. Yes, I see that.

Q. Is the XT31 referring to a blue LED die?

A. I believe it is.

Q. Is that blue LED die -- that's not the same blue LED die referenced in the '819 Patent, is it?

A. I don't know. I don't -- I don't recall the detail. I don't know.

Q. So you can't tell me whether or not the XT31 is the same as the C460XT290; is that correct?

A. I -- yes, I don't know.

Q. Now, I believe Mr. Erwine showed you a physical exhibit during your direct examination --

A. Yes.

Q. -- the CPX0114.

Do you know what chips were used in that

prototype?

A. I don't recall.

Q. So you don't know what blue LED dies were used in that prototype?

A. I don't recall.

Q. Could you determine what blue LED dies were in that prototype?

A. I would think that you could de-encapsulate one of the components, and look at it with a microscope or some other technique to figure out, does it look the same, what size is it, et cetera, et cetera.

Q. Can you pull up RX-740. This is an e-mail dated March 29, 2006, from you to Mr. Hunter, and Mr. Van de Ven; correct?

A. That's -- I see the date of March 29th, and it is from me, and it's to Tony and Neal, yes.

Q. This is about three weeks before the April 20, 2006, CSA test; correct?

A. Yeah, that's correct.

Q. This is discussing the Cree XT24; correct?

A. I see Cree XT24, yes.

Q. So do you know whether or not this Cree XT24 is the same as the C460XT290 referenced in the '819 Patent?

A. I don't know if it is the same or not.

Q. So this appears to be discussing lumen per watt

values; correct?

A. Yes. So they look to be cool white lumen per watt values. I say cool white because I see 5,176 kelvin, and I see 5,528 kelvin. Those are cool white color, not a warm white color.

Q. So would these be efficacy numbers for the LED packages?

A. I would presume so.

Q. If you also see, there's 3.15 next to VF. Would that 3.15 forward voltage?

A. Yes, that would be 3.15, I believe it says, VF, yes.

Q. And the wall plug efficiency or efficacy of the LED -- an LED lighting fixture will be less than the efficacy of its LED packages; correct?

A. Yes.

Q. Can you pull up -- also -- actually, one more question.

At the end of this e-mail, it references -- it says, "I think we can get close to the 100 lumens per watt component number with the forward voltage of 2.9 for 2800 kelvin if Cree delivers what they call the 31 milliwatt chips.

Do you see that?

A. Yes, I see that.

Q. Is that referring to the XT31s?

A. I don't know it that's referring to the XT31s or -- I mean, if I remember the spec sheet that you showed me, it said that Cree XT24 is a 24-milliwatt min.

So I don't know this -- the high end of the XT24 bin or whether this is a different bin. I don't know.

Q. Can you turn -- can you turn back to JX-070. Can you turn -- you mentioned bins.

Turning back to the Cree data sheet. This is JX-0159, I believe. There's no bin for XT31; correct?

A. Yeah. That's really what I was just referring to. When you showed me the spec sheet -- you know, you asked me if it was an XT31. I don't know if Cree had an XT31, but I do see an XT24. It says 24-milliwatt min.

Because 31 is higher than 24, I don't know if it's just the top end of that bin or not.

I'm not -- I don't know. But it very well could be an XT24 because it's a 24-milliwatt min, and 31 is higher than 24, so that could fit into that bin.

I don't know. You're actually having me speculate at this point, and that's not good. That's not good.

Q. You mentioned bins, and the bins mentioned here are XT12, XT16, XT18, XT21, and XT24; correct?

A. I see that, yes.

Q. So XT31 would be on the extremely high side of those bins; correct?

A. If it belongs in one of these bins, it would be on the high side of XT24, without a doubt.

Q. So these bins, they're essentially a normal distribution of LED parts and their manufacturing process, and they're binned out, and sort of the higher you up go, the fewer number there will be in a particular bin; is that correct?

A. Well, you said -- when you said "normal distribution," are you talking a Gaussian distribution?

Q. Yes.

A. Yeah, I -- look, I am not a statistical expert, but I really believe this data with more follow-up plus some distribution, and not a Gaussian or a normal distribution.

Gaussians distributions are used in accounting statistics where you get close -- you sort of get close to this limit, and it comes up really big peak, and then it tails off.

Q. Yes. It gets asymptotic towards the end of the range; correct?

A. Yeah, the heavy side towards the lower bins and, you know, less on the higher side.

Q. So the XT31 would be way out in the tail of that

distribution; correct?

A. I -- it all depends what the distribution looks like, but it's clearly not at the peak of the distribution, okay.

Q. Okay. Could you turn to -- I believe one other document that you turned to in your direct testimony, JX-070. I believe it's the JPX version, the Excel spreadsheet in Dr. Negley's direct examination -- or Mr. Negley's direct examination.

A. Mr. Negley, thank you.

Q. Do you recall -- you testified about this document today. Can you go to the first tab, actually?

Do you know when this document was created?

A. No, I really don't. I mean, there's a nomenclature following that says BSG specials 07/11 -- is that what it says? My eyes are pretty bad. 01. But I don't -- I don't know when this document was created. I don't know.

Q. Was this created by Mr. Van de Ven?

A. Mr. Van de Ven made the model. Whether he put the data into this particular model or not, I -- I don't know.

Q. Mr. Van de Ven is based in Hong Kong; correct?

A. Mr. Van de Ven ran our Hong Kong office.

Q. So in, like, a typical often international

dating system, wouldn't be surprised that 07/11/01 would refer to November 1, 2007; is that correct?

A. You just told me something I -- I don't recall what those numbers were, and maybe that's what it stood for. So I -- you know, you put words in my mouth. I can -- I don't know.

Q. I wanted to show you just one more document. If you turn to RPX-001. This is a spreadsheet dated February 16, 2006.

Do you recognize this document?

A. I mean, I see the tab, it says, "Final CSA results," but I don't recall this document.

Q. Do you recall --

A. I may have seen it before, but I don't recall it.

Q. Do you recall earlier testifying that the first LLF prototype to use the BSY+R approach was the prototype tested in February 2006?

A. Okay.

Q. I believe you announced the record at 54 lumens per watt --

A. Because -- that was probably a generous round-up from 53.5.

Q. So would the efficacy number be referring to the 53.5 number?

A. I believe it very well could be, yes.
Q. So if you turn to Tab 2, T3 test results, do you see the chips identified there as 2XT24-465; do you see that?
A. Yes.
Q. Do you know whether or not these were the same chips that were -- as the C460XT290s referenced in the '819 Patent?
A. I don't know if these were the same specific chips or not. I don't know.
Q. Do you recall saying that the BSY -- the first BSY prototype was the February 6th -- or strike that.
Do you recall testifying that the first LLF prototype to use the BSY approach was the February 2006 prototype?
A. Yes, I believe I said that, yes.
Q. And after February 2006, did all of LLF's lighting devices and prototypes use the BSY+R approach?
A. Yes.
MR. ROUSH: No further questions.
JUDGE CHENEY: Okay.
Mr. Negley, I just have a couple of questions for you.
THE WITNESS: Okay.
JUDGE CHENEY: Can you explain to me the

difference between color temperature and color rendering?

THE WITNESS: Yes. Color temperature is -- you've probably seen -- let's see. Color temperature. Okay. So the color temperature sort of -- it comes off the scale. If you heat up a piece of -- NIST would heat up a piece of platinum, okay, and as you heat that up, it goes from a reddish glow to -- you know, to a bluish -- actually it gets blue hot. Okay.

So the red hot is around 2700 kelvin. That's the color of an incandescent bulb. You've probably seen fluorescent lamps that are more bluish in color. That's about 4,000 kelvin. That's referring to the black-body temperature of the unit.

If that makes sense at all.

The color rendering index is actually a number of swatches, in their unsaturated colors, which means it's not -- you know, it's not a saturated red, blue or green. It's where all of the colors are mixed together in the color chart.

The color rendering, I believe it was originally 15 swatches, but they use R1 through R9, typically, to come up with a color rendering index, and it is how well the light source renders unsaturated colors.

This became very important because I remember in graduate school, my advisor was a phosphor expert. One of

the first fluorescent lamps ever created by Phillips Corporation was used in a very high-end clothing store, and the problem was what the clothes looked like in the store is not what -- the same colors as they looked like under sunlight.

So the color rendering is supposed to help that light source match what the color is supposed to look like. This is, you know, people -- you know, people tried to use RGB, red-green-blue LEDs, to make white light in general illumination.

And the problem there is, you know, you can imagine it, there's three peaks, right, and there's dead space, I'll call it dead space, but there's no wavelength in there. So if an RGB light source, although it can appear -- you can trick the system into having it calculate a very high color rendering, it can't render colors that aren't there.

So color rendering became very important because you want to be able to -- you know, what it looks like inside, you want to make it look like what is outside, and truly be able to reproduce the colors.

So color temperature is warm or cool. Color rendering can range.

A metal halide lamp. Maybe you have been in a parking lot at night. You go into a parking lot with metal

halide lamps or sodium lamps. Sodium lamp has a color rendering of like 40. I mean, all the cars almost look the same color.

So anyway, I hope that helps.

JUDGE CHENEY: It does. Thank you.

You mentioned that you had an a-ha moment in the field.

THE WITNESS: Yes.

JUDGE CHENEY: Can you tell me about what you meant by "in the field" and what you remember of that moment?

THE WITNESS: Yeah. I mean, literally, we were in a field. We had our billboard set up, and Tommy Coleman has ten acres, and we had a billboard set up in a field. We start working when it gets dark, because it's a billboard. It has to be illuminated. It was that night where we had our first -- you know, our first approach at making a high efficacy and good color rendering or high color rendering.

See, LEDs only -- a typical LED has a color rendering of about 80, and some of us don't think that is adequate enough because we're always comparing it to an incandescent. Incandescent has a color rendering of 100.

But we're out in this field, and we made this RGBW, so it's red, green, blue and white, cool white LEDs.

And we are tuning the colors around and all this stuff. And that's where Tony just focuses in on this -- it wasn't a pleasant looking color; it was either yellowish green or greenish yellow.

And he -- I was like, wow, that's terrible. And he goes, can you make that? I said, yeah, I think we can. He goes, well, watch this. And he tweaks in just a little bit of red, okay, and that ugly BSY -- I mean, that ugly yellowish green or greenish yellow color, tweaked in a little bit of red, and boom, we bring it down onto what's called the black-body curve. You know, beautiful coloring rendering.

I mean, this billboard that we had up had, I think, a Ferrari, a scene with a palm tree in it. But all around the perimeter, we had these different color swatches, from the same color swatches used for CRI. When we did that, pow, it just popped!

And we looked at each other and he was like, are you sure you can make that component? And literally stayed up two days to see if we could do what we wanted to do.

And we did it. I mean, it was fun. It was just a lot of fun.

JUDGE CHENEY: Thank you for sharing that.

That's all the questions I have for you.

Is there any redirect for this witness?

MR. ERWINE: Minimally, Your Honor. I just had a few questions.

REDIRECT EXAMINATION

BY MR. ERWINE:

Q. Mr. Negley, you were asked, I believe, in your cross-examination about some of the CSA testing, and I think you said you termed those a technology demonstration; is that right?

A. Yeah, everything that we made with a prototype we would typically call a technology demonstration, because, I mean, that's what it was. We wanted people to understand what could be done with solid-state lighting.

Q. Were those tests that were performed at CSA, were they open to the public?

A. No.

MR. ERWINE: Okay. No further questions, Your Honor.

JUDGE CHENEY: Okay.

Well, thank you so much for coming in, Mr. Negley. Your testimony helped me understand this case better.

You may step down.

THE WITNESS: Okay. Thank you very much. Bye.

JUDGE CHENEY: Will Cree call its next witness?

MR. ERWINE: Yes, Your Honor. Cree will be

calling Mr. Mark Edmond, who is one of the named inventors on the '570 Patent. My colleague, Mr. Kevin Jang, will be constructing the direct examination.

MR. JANG: Good morning, Your Honor.

JUDGE CHENEY: Welcome to the podium, Mr. Jang.

MR. JANG: Thank you.

JUDGE CHENEY: When we see Mr. Edmond.

MR. JANG: Yeah. He will be on momentarily. He just confirmed that he will be logging on.

JUDGE CHENEY: While Mr. Edmond is making the correction, I'll just let you all know that we'll get this direct examination going to make the most of the time we have before lunch, but we will still take our lunch break right around 12:30.

Good afternoon, Mr. Edmond. Can you see and hear me?

THE WITNESS: Yes, I can.

JUDGE CHENEY: Great.

I'm going to ask you to take the oath, if you would please raise your right hand.

MARK EDMOND,

a witness, having been first duly sworn, was examined and testified as follows:

THE WITNESS: I do.

JUDGE CHENEY: Thank you.

You may proceed, Mr. Jang.

MR. JANG: Thank you, Your Honor.

DIRECT EXAMINATION

BY MR. JANG:

Q. Good morning, Mr. Edmond. Would you please state your full name for the record.

A. Mark Daniel Edmond.

Q. Are you named as an inventor on any patents?

A. Yes, 37 of them.

Q. Is there a general field that your patents relate to in terms of technology?

A. Yes, LED lighting.

Q. Are you a named inventor on any asserted patents in this investigation?

A. Yes, the '570 Patent.

Q. Okay. We'll get to the '570 Patent later. But let me first ask you about your background.

Would you please give us your educational background, please.

A. Yes. I have a bachelor of science in ceramic engineering from Alfred University; graduated in 1998.

Q. What was your first employment after college?

A. I was with Cree Incorporated.

Q. What was your title when you joined Cree Incorporated?

A. I was a process engineer.

Q. Would you tell us about your responsibilities as a product engineer at Cree.

A. I'm sorry. Process engineer, not product.

Q. I'm sorry. Process engineer?

A. Yes.

I maintained processes involved with silicon carbide substrates that would be used to grow layers -- crystal layers on it for -- to be diced up into LED chips.

I would determine whether or not these wafers would pass on to the next processes based on the color of the light and brightness on these wafers.

Q. How long were you at Cree Incorporated?

A. Six-and-a-half years.

Q. When did you leave Cree?

A. In the summer of 2006.

Q. What did you do after leaving Cree?

A. I started working with LED Lighting Fixtures, Incorporated, LLF.

Q. Why did you join LLF?

A. I knew Neal Hunter and Gerry Negley, who were the CEO and CTO of the company. I liked the idea of what they were trying to build and what they were working on.

So I was able to set up an interview with them, and got hired for the job.

Q. When did you join LLF?
A. It was in August of 2006.
Q. Would you tell us about your responsibilities at LLF.
A. Yeah. I was a product engineer there. You know, being a startup, you had to wear a lot of hats, but mainly, I spent a lot of time helping to develop the -- the LR6 product. That was the first product that we had sold to market. But also on some other projects, including one where we were trying to achieve a very high wall plug efficiency lamp.
Q. Are you familiar with the term "wall plug efficiency"?
A. Yes, I am.
Q. What's your understanding of that term?
A. The wall plug efficiency is the light output compared to the -- of a lighting device compared to the total power used by the unit as it is plugged into a standard wall plug socket.
Q. Did you measure wall plug efficiency in the course of your work at LLF?
A. Yes, I did.
Q. Why did you use the wall plug efficiency as a measure?
A. It was really -- it was really industry standard

of a lighting device, and it tells you the true -- you know, the true power output that you would get when converting the AC electricity into the -- AC voltage into the useable power for a lighting device.

Q. You said you joined LLF in August of 2006.

Do you recall where LLF was in terms of wall plug efficiency when you joined?

A. I don't specifically recall, but I know it was starting to approach 100 lumens per watt.

Q. Were there any specific goals or milestones that you were trying to achieve at LLF?

A. Yes. When I started working on the -- with them, we wanted to achieve 100 lumens per watt at a minimum. You know, any -- of course, the target. You know, anything over that is -- would just be even better.

Q. What's the significance of 100 lumens per watt?

A. At that point in time, 100 lumens per watt had never been achieved or demonstrated at the -- for a wall plug efficiency of these -- of the -- of a color point that was on the black-body curve, and doing so would provide a -- a lot of credibility to the company as we were trying to break into the market.

Q. Did you achieve that goal at LLF?

A. Yes, we did.

Q. Okay. Let's talk more about your work at LLF.

At a high level, could you describe the kind of approach that you took to develop a lighting device?

A. Yeah, we would look at the -- at an entire system. So the system would involve the optics, the mechanical structure, electrical -- you know, electrical components and thermal management for heat generated by the device.

So all of those, you know, in conjunction with the LEDs had to be considered.

Q. Did your work involve collecting and looking at data?

A. Yes, it did.

Q. Could you give an example of how you did so?

A. Yeah. There was a tool we used called an integrating sphere. That would measure light output, the brightness of the light, the color of the light, quality of the light.

And so you take a measurement on that, and then measure the power of the lamp based on a power meter, and wall plug efficiency could be calculated with that.

Q. Thank you.

Now, you mentioned various efficiencies of components associated with the lighting device. I'd like to ask you about those.

Is there any specific technique that you use to

address the efficiency of optical components?

A. Yeah. The -- we used an LED array called the -- called BSY plus red. There were two different color LEDs, a red LED component, and then a -- the BSY, which was a blue-shifted yellow.

So it was a blue LED with a YAG phosphor to make a yellowish blue light, and those two colors in combination created a white light that would mimic an incandescent lamp.

Q. Why did you use the BSY+R approach?

A. The BSY plus red allowed for a higher lumens per watt than other methods at the time.

Q. You also mentioned electrical efficiency.

Would you tell us more about that?

A. Yes. So the -- that was an important component in getting a high wall plug efficiency. There were a -- there's a -- an architecture for the power supply that, when run at a certain -- runs at a peak efficiency at a certain voltage, DC voltage output of that architecture.

So it was really important to have an LED array that provided that voltage to maximize the efficiency of the power supply.

Q. You also mentioned thermal performance.

Could you tell us about what you did to address the thermal performance?

A. Yeah. There were a couple of things. You know, we looked at a lot of -- and evaluated a lot of different materials, and heat -- the mechanical heat sink shape to be able to efficiently move excess heat out of system.

Along with that, the LEDs were also spread out in a manner that would not create a high spot due to wasted -- or, you know, heat generated by the LEDs themselves, and that helped keep the system very thermally efficient.

Q. Thank you.

I'd like to show you a document, JPX-70, and if you go to the second tab, which is named "Predictor."

Do you recognize the document shown as JPX-70?

A. Yes, I do.

Q. Would you tell us what it is?

A. It is a -- it is a Predictor that would take different inputs of an -- of a lighting device. This one is looking at LEDs, and would predict the light output color, lumen output, wall plug efficiency.

Q. What kinds of input could you provide to this spreadsheet to predict the performance of a lighting device?

A. You could look at different LEDs with the color of the LEDs, the lumen output of LEDs at current levels. You could also look at number of LEDs that you would have

in this system.

And additionally, you would also look at what the -- what the -- thermal efficiencies, power supply efficiencies, and the physical optics itself. Any losses involved with those could be inputted into the -- into there to give you a fairly accurate prediction.

Q. Earlier you mentioned that you took the approach of looking at the system as a whole.

Does the Predictor relate in any way to the approach that you explained earlier?

A. Yes. It was a really good tool for being able to see where the biggest room for improvement could be achieved in a system. So really, it helped us concentrate efforts onto, you know, certain aspects of the system that -- to help provide the biggest bang for the buck.

Q. Is there a particular wall plug efficiency that was predicted by this model?

A. This one is 114 lumens per watt.

Q. That's at column J, line 26?

A. Yes. Correct.

Q. Now, the name of the first tab of this document says "BSG Specials 071101."

Do you recall what that indicates?

A. Well, BSGs were a synonym for BSY that we used back then, and the 071101 would be looking at the year

2007, November 1st, for the 1101.

Q. Was there a prototype that was developed in accordance with this model?

A. Yes, there was. We called it the LRP38.

Q. Were you able to verify the performance of LRP38?

A. Yes, I was.

Q. Let's look at another document, JX-45.

Mr. Erwine, do you recognize what JX-45 is?

A. Yes, it is a report from NIST that was -- that had measured the LRP38 for us as a third party.

Q. You mentioned NIST. What is NIST?

A. NIST is the National Institute of Standards and Technology. They're a government agency that would measure lighting devices.

Q. Why did you have NIST perform the testing?

A. They really are like the gold standard for third-party verification, you know, in the industry. So it just made sense to use them.

Q. When did NIST perform this testing, if you recall?

A. It was in early November 2007.

Q. Now, were you present at the NIST test?

A. I was -- I delivered the lamp there. I was present at the facility while it was tested, but I was not

allowed in the room while the test was conducted.

Q. Did you or anyone at LLF provide any testing protocols to NIST?

A. No. The only thing I had given them was the input AC voltage needed to run the LRP38.

Q. Do you know if NIST has its own testing protocols?

A. Yes, they do.

Q. Let's take a look at the report.

In Section 2 shown on the screen, in the paragraph starting with, "The LED lamp was calibrated," do you see a reference to an integrating sphere?

A. Yes.

Q. Do you know what that is?

A. Yeah. Similar to the tool that we had at our facility, it was -- it's just a tool used to measure the light output of a -- of a lighting fixture.

Q. Please turn to page 2 of the report. In the first full paragraph, direct your attention the second sentence. It says, "Readings were taken after the LED lamp had stabilize."

Do you see that?

A. Correct. Yes, I see it.

Q. Did LLF provide any input as to how to stabilize the device?

A. None whatsoever.

Q. Based on what's stated in the report, is it your understanding that NIST stabilized the device before taking the measurements?

A. Yes, they did.

Q. Please turn to the last page of the document, which is JX-45.5.

Do you recognize the device shown there?

A. Yeah. That's the LRP38 lamp that was tested at NIST.

Q. Now, please turn to Table 1 on page 2 of the report, it's JX-45.2.

What is shown here?

A. That is the results of the testing that NIST performed on the LRP38, and it's showing 113.5 lumens per watt.

Q. What was your reaction to the NIST test result?

A. I was not surprised. It was what I expected. We had had similar readings in our own integrating sphere, so it was nice to see that it validated the work we were doing.

Q. Do you recall how the folks at NIST reacted to the test results?

A. Yeah. They were -- they were definitely pretty surprised and very impressed. You know, in fact, when I

had first got there, and they had asked me what I expected the results to be, they sort of laughed at me. And they were like, nobody has -- nobody can do that.

When they saw it, it was -- I don't know, they were definitely impressed by it.

Q. Thank you.

JUDGE CHENEY: Is this a good place for to us stop for lunch, Mr. Jang?

MR. JANG: It is, Your Honor.

JUDGE CHENEY: Okay.

We'll take one hour. I'll see you at 1:30. We're off the record.

MR. JANG: Thank you.

(Whereupon, the lunch recess was taken, 12:33 p.m. - 1:30 p.m.)

A F T E R N O O N S E S S I O N

(1:30 p.m.)

JUDGE CHENEY: We're back on the record now in the 1213 Investigation.

Before our lunch break, we were hearing the direct examination of Mr. Edmond. Mr. Edmond is an inventor listed on the asserted '531 Patent.

Please continue your examination, Mr. Jang.

MR. JANG: Thank you, Your Honor.

BY MR. JANG:

Q. Welcome back, Mr. Edmond.

Let me show you another document. It's JX-1.

Do you recognize JX-1, Mr. Edmond?

A. Yes, it is the '531 Patent.

Q. Do you remember when you filed the application for the '531 Patent?

A. It was in late November of 2007. That was a provisional application.

Q. Before the lunch break, we were talking about the NIST test. When is the filing of this patent relative to the date of the NIST testing?

JUDGE CHENEY: Before you answer that, sir, I just want to say, I may have misspoken about Mr. Jang -- or, Mr. Jang, I may have misspoken in my introduction that Mr. Edmond is an inventor on the '531 Patent.

MR. JANG: That's right, Your Honor.

JUDGE CHENEY: Okay. I just wanted to make sure the record is clear on that.

Sorry to interrupt. Please go ahead.

THE WITNESS: Okay. What was the question again? I'm sorry.

BY MR. JANG:

Q. When was the filing of this '531 Patent relative to the date of testing at NIST?

A. Yeah. That was shortly after -- roughly a couple of weeks afterwards.

Q. Please turn to Figure 1 of the '531 Patent, which is on JX-1.4.

Would you please tell us what is depicted here?

A. Yeah. That's a cross-section of the LRP38 lamp.

Q. Would you tell us about some of components that you see on this figure?

A. Sure.

So some of the main things to note are numbers 30 and 32 are representing LEDs that would -- different LEDs within the system.

Number 34 would be the power supply that would convert the AC voltage to DC voltage.

And, you know, really the rest of it is, you know, pretty much a bunch of the mechanical makeup of

the -- of the lamps.

Q. Let's now turn to column 21, line 64, through column 22, line 7, of the '531 Patent.

Would you please describe what's shown here?

A. Yes. Those are the results from the NIST test on the LRP38.

Q. What's the wall plug efficiency that's shown there?

A. 113.5 lumens per watt.

Q. Let's now turn to the paragraph that follows, in column 22, lines 8 through 14.

Would you please take a look at paragraph and tell us what is described there?

A. That is describing the efficiency of the optical chamber and the power supply.

Q. Now, shifting gears, is LLF an ongoing business?

A. No, it is not.

Q. What happened to LLF?

A. LLF was purchased by Cree in early 2008.

Q. Do you know for how much LLF was purchased?

A. Yeah. It was $77 million up front at the beginning, and then another 26.4 over the next three years, $26.4 million.

Q. Do you know what Cree received as part of that acquisition?

A. Yeah. Cree received all of assets of LLF, and all of the intellectual property of LLF.

Q. What happened to LLF in terms of its organization within Cree after the acquisition?

A. LLF became the -- a lighting division within Cree. They did not have -- Cree did not have a lighting division at that time, so most people's -- if not all, people's role at LLF remained the same as a part of Cree.

Q. Did you remain at Cree as part of that acquisition?

A. Yes, I did.

Q. Are you still with Cree?

A. No. I left in March of 2016.

Q. Why did you leave Cree?

A. I started a new -- started a new business, materials development business, with a couple other people.

Q. Do you have an affiliation with Cree Lighting, the Complainant in this investigation?

A. No, I do not.

Q. What led you to testify here today?

A. Really, just it's -- I was proud of the work that we did on this patent, and wanted to defend it.

MR. JANG: Thank you, Mr. Edmond.

No further questions.

JUDGE CHENEY: Is there cross-examination for

this witness?

MR. ROUSH: Yes, Your Honor.

JUDGE CHENEY: Please proceed when you are ready, Mr. Roush.

CROSS-EXAMINATION

BY MR. ROUSH:

Q. Good afternoon, Mr. Edmond. My name is Brad Roush. It's good to see you again.

A. Yep. Good to see you again, Brad. I recognize you.

Q. Can you turn back to JX-001?

A. Yes. Sure.

Q. If you turn to Claim 1, Claim 1 recites at least one solid-state light emitter; correct?

A. Correct.

Q. An LED is one type of solid-state light emitter; correct?

A. Yes.

Q. There are other types of solid-state light emitters; is that also correct?

A. That is correct.

Q. For example, a laser diode is another type of solid-state light emitter; correct?

A. Yes, correct.

Q. While at LLF, do you recall ever working with

laser diodes?

A. I did not work with laser diodes.

Q. Are there other types of LED -- strike that.

LEDs can be inorganic or organic; correct?

A. Correct.

Q. For example, the NIST prototype we have been discussing here, that used inorganic LEDs; correct?

A. Correct.

Q. While at LLF, did you ever build a prototype that used an organic LED?

A. I tested some organic LEDs to look at their performance. I don't recall -- don't believe that I had built any prototypes with them.

Q. Do you recall ever building a prototype with a solid-state light emitter other than an inorganic LED while at LLF?

A. No.

Q. You don't recall ever having built a product that used anything other than an inorganic LED while at LLF; correct?

A. Correct.

Q. Now, can you turn to in the patent, I believe it's the bottom of column 21.

Earlier you were testifying about the electrical efficiency of the NIST prototype; is that right?

A. Yes.
Q. You mentioned using a particular driver; correct?
A. Correct.
Q. Was that -- if you turn to column 21, is that starting at line 53 going to Paragraph -- line -- or going to line 63.
LLF did not build this driver; correct?
A. Yeah. I don't recall.
Q. If you see a line -- beginning at line 60, it says, "The HV9910B is a universal high-brightness LED driver from Supertex, Inc., from Sunnyvale, California."
Do you see that?
A. Yes, I do.
Q. So that would have been an LED driver that LLF purchased; correct?
A. Yeah, that would be correct.
Q. You believe in your previous -- or in your testimony here today, you mentioned working on a project where the goal was building a 100 lumen per watt prototype; is that correct?
A. Correct.
Q. The first LLF lighting device that had a wall plug efficiency of at least 100 lumens per watt was the NIST prototype; is that correct?

A. That is correct.
Q. As of early 2007, did you not know whether or not you could build a 100 lumen per watt lighting device; correct?
A. I would -- we hadn't been able to up and to that point, but we were moving in that direction, and it was -- it was the goal to hit that number or exceed it.
Q. It was a goal, but you didn't know how to get there yet; correct?
A. Well, we knew as far as the system what -- what parts of the system that we needed to work on to improve to -- to be able to get there.
Q. It wasn't until November of 2007, LLF measured a lighting device with a wall plug efficiency higher than 100 lumens per watt; correct?
A. Correct.
Q. Can you pull up RX-0658.
This is the press release for the November 2007 NIST prototype; is that correct?
A. Yes. That's correct.
Q. So LLF described this as shattering the world record for efficiency; is that correct?
A. That's what I read up there, yes.
Q. So as of November 28, 2007, the NIST prototype was the highest wall plug efficiency that LLF was able to

achieve; is that correct?

A. That is correct.

Q. Do you recall whether you tested the prototype tested at NIST in November of 2007 internally prior to bringing it to NIST?

A. Yes. It would have been tested internally.

Q. Were those internal measurements higher or lower than what NIST tested?

A. It was -- we had measured a little bit lower than the NIST number.

Q. Do you recall by how much?

A. It was -- it was about -- around 2 percent lower.

MR. ROUSH: No further questions.

JUDGE CHENEY: Okay. I don't think I have any questions for you either, Mr. Edmond.

Is there any redirect for this witness?

MR. JANG: No, Your Honor.

JUDGE CHENEY: Okay. Thank you for coming in, Mr. Edmond. Your testimony was very helpful to me in understanding the case.

You are excused.

THE WITNESS: All right. Thank you.

JUDGE CHENEY: Will Cree call its next witness.

MR. ERWINE: Yes, Your Honor. Cree will be

calling Dr. Christian Wetzel to testify, and, Your Honor, my colleague, Mr. Matthew Robson will conduct the examination.

JUDGE CHENEY: Okay. Welcome to the podium, Mr. Robson.

Can you see and hear me?

MR. ROBSON: Good afternoon, Your Honor. I can. Can you hear me well?

JUDGE CHENEY: I can.

MR. ROBSON: Great.

JUDGE CHENEY: Dr. Wetzel, can you see and hear me?

THE WITNESS: Yes. Good afternoon.

JUDGE CHENEY: I will administer the oath, if you would please raise your right hand.

CHRISTIAN M. WETZEL,

a witness, having been first duly sworn, was examined and testified as follows:

JUDGE CHENEY: Thank you.

Please proceed, Counsel.

DIRECT EXAMINATION

BY MR. ROBSON:

Q. Good afternoon, Dr. Wetzel. Could you please start by stating your name for the record.

A. Dr. Christian Wetzel.

Q. Are you employed, Dr. Wetzel?

A. Yes, I'm a professor at Rensselaer Polytechnic Institute in Troy, New York, in the department of physics, applied physics and astronomy.

Q. What is your educational background, Dr. Wetzel?

A. I have an equivalent of a bachelor of science in technical physics from the Technical University of Munich from 1984. I have the equivalent of a master's degree from the same place in 1988, and a PhD in physics also from the Technical University of Munich in Germany from 1993.

Q. Can you please tell us what your responsibilities are as a professor at RPI?

A. Yeah. I primarily teach physics to engineering and science students. I also educate graduate students from material science, electrical engineering, and physics, and I do research, and I publish about that.

Q. You mentioned your research.

Could you briefly describe what your research is directed to?

A. My topic is primarily about the opportunities of white --

(Clarification requested by the Court Reporter.)

JUDGE CHENEY: Let's go off the record and see if we can fix this for just a moment.

(Off the record.)

JUDGE CHENEY: Let's go back on the record. I will read back the last question that was posed to Dr. Wetzel, and if you will answer it again, please, sir.

You mentioned your research. Could you briefly describe what your research is directed to?

A. Yes. I am mostly interested in opportunities of wide-band-gap semiconductors, in particular group 3 nitrides and their opportunity to emit light for LEDs, laser diodes, and similar applications.

I'm also engaged in the lighting-enabled applications and systems and applications research center at RPI that is concerned about how to put them to the benefit of future lighting technologies.

Q. Dr. Wetzel, do you have any experience designing and developing LED-based lighting device?

A. Yes. My research concerns for once, the characterization of the materials, but also the materials' deposition and epitaxial processes, but also the fabrication to LED devices and lamps. And I've also been involved in the Department of Energy's solid-state lighting program where all aspects are discussed about how to put them into luminaires.

Q. Dr. Wetzel, are you being compensated for your work on this investigation?

A. Yes, at my customary hourly rate.

Q. Is your compensation tied at all to the outcome of this investigation?

A. No.

Q. Okay. Now, Dr. Wetzel, did you prepare some slides to assist with your testimony today?

A. Yes, in coordination with counsel, I had some slides prepared.

Q. Dr. Wetzel, do you see on the screen CDX-1C, and I wanted to ask you if you recognize these as the slides that you prepared?

A. Yes, they are.

Q. Okay. Could we -- excuse me. I'm going to turn to the next slide. On this slide, we have excerpted the cover page of JX-18.

Is this your CV, Dr. Wetzel?

A. Yes, it is.

Q. Does your CV accurately reflect your educational background and work experience, to the best of your knowledge?

A. Yes, it does.

Q. Okay.

MR. ROBSON: Your Honor, pursuant to the parties' April 21, 2021 stipulation, I proffer Dr. Christian Wetzel as a technical expert with respect to LEDs and lighting devices in this investigation.

JUDGE CHENEY: As there is a stipulation and no objection, Dr. Wetzel will be accepted as an expert in the fields tendered.

MR. ROBSON: Thank you.

BY MR. ROBSON:

Q. Dr. Wetzel, do you have an understanding of the topics that you are here to testify about today?

A. Yes. It's about the priority dates of the '819 and the '531 Patents, but also secondary factors of non-obviousness.

Later, I will be talking about -- coming back and talk about the validity of those patents.

Q. Dr. Wetzel, have you previously offered opinions in this investigation concerning infringement and technical domestic industry?

A. Yes.

Q. Do you understand that the parties have reached a stipulation concerning infringement and technical domestic industry?

A. Yes.

Q. Now, have you testified in an ITC investigation before?

A. Yes, and in one of them, I was a technical expert for Cree Incorporated. This was the '947 Investigation in which also one of those patents, the '819

Patent was at issue.

There I shared my opinions on terms of validity and infringement.

Q. All right. I'm going to turn to the next slide of your presentation, slide 3.

Dr. Wetzel, here on slide 3, you have an excerpt of JX-2.

What is JX-2?

A. That is the '819 Patent, and it was filed May 30, 2007.

Q. Can you provide an overview of what the subject matter of the '819 Patent is generally?

A. Yes. The inventors of the '819 Patent came to look at creating LED-based lighting fixtures, or luminaires, using LED components.

In particular, they were achieving those with unprecedented wall plug efficiency.

Q. Okay. You mentioned LED-based lighting devices. What other kinds of lighting devices were known at the time of the invention of the '819 Patent?

A. Typical luminaires would include either incandescent light bulbs or fluorescent bulbs.

Q. What problems, if any, were there with the prior art incandescent and fluorescent bulbs that you mentioned?

A. The incandescent bulbs were very low in their

wall plug efficiency, and had a rather short lifetime of operation.

The fluorescent bulbs had somewhat higher efficiency, but still suffered from very poor color rendering.

Q. Okay. If we could turn to the next slide, slide 4.

Now, Dr. Wetzel, you mentioned the term "wall plug efficiency." Do you understand that the Court has construed the term "wall plug efficiency"?

A. Yes. The Court has construed the term "wall plug efficiency" in this -- for these purposes to mean "brightness of light emitted by a lighting device, as measured relative to outlet energy, the power input to the lighting device in lumens per watt."

Q. Okay. For purposes of your opinions in this investigation, did you apply the Court's construction of the term "wall plug efficiency"?

A. Yes, I did.

Q. Okay. Let's turn to the next slide, which is slide 5.

Could you please tell us what you have listed here on slide 5?

A. Here is a list of further agreed terms as constructed.

Q. Did you use these constructions for each of the terms listed for purposes of your opinions in this investigation?

A. Yes, I did.

Q. Turn to the next slide, slide 6.

Do you recognize what is shown here on slide 6 as JX-1?

A. Yes. This is the '531 Patent, and it was filed November 25, 2008.

Q. Can you provide a general overview of the '531 Patent subject matter?

A. Yes. Similar to '819 Patent, it addressed LED-based lighting devices, and luminaires. And particularly here, the inventors achieved even higher wall plug efficiencies.

Q. Okay. Turn to the next slide, slide 7.

Dr. Wetzel, do you have an understanding of what the asserted claims of the '819 and '531 Patents are in this investigation?

A. Yes.

Q. Okay -- sorry, go ahead, Dr. Wetzel.

A. The claims asserted for the '819 Patent are as follows: Claims 1, 24 through 27, 29, 48 through 50, 52, 57 through 59, 60, and 65 through 67.

Q. And the '531 claims?

A. The '531 asserted claims are Claims 1, 10, 11, 12, 25 and 26.

Q. Okay. Let's turn to the next slide, slide 8.

Dr. Wetzel, what do you have depicted here on slide 8?

A. This is a graphical representation of the RAB accused product in -- on an axis that lists the reported wall plug efficiency.

So obviously, the products range from about 60 lumens per watt all the way up to 173.7 lumens per watt.

Q. Okay. Let's turn to the next slide.

Here on slide 9, do you see, Dr. Wetzel, under "Related US Application Data" for the '819 Patent excerpted here, it refers to a provisional application?

A. Yes. Here, it indicates that the '819 Patent refers back to the provisional filing, the '618 filing, which was filed on May 31, 2006.

Q. Okay. Turning to the next slide, slide 10.

What is shown here, Dr. Wetzel, as JX-80?

A. Yes. That's the very -- original filing, the '618 filing I just mentioned.

Q. Okay. Let's take a look at the disclosures in the '618 provisional.

Turning to the next slide, slide 11, can you please explain what's shown here in this excerpt from

JX-80, pages 7 and 8?

A. Yes. On the left-hand side, you have the -- what is known as the CIE chromaticity diagram. On the right, it provides the background of how to use and its meaning. In particular, how visual -- human vision perceives color, and how it relates to properties such as correlated color temperature.

Q. Okay. In the 2006 time frame, would persons of ordinary skill in the art have known what a desired color temperature range is for a given lighting application?

A. Yes. The color temperatures are identified as part of that diagram, and POSITA would have been knowledgeable on how to use it.

Q. Okay. You mentioned a PHOSITA, is that short for a person having ordinary skill in the art?

A. Yes.

Q. Okay. I'll use that term as well, and can we have an understanding that I am referring to person of ordinary skill in the art?

A. Yes.

Q. Okay. Now, in 2006, would a PHOSITA have been able to choose an appropriate LED based on the disclosures of the '618 provisional to obtain a desired color temperature?

A. Yes. By that time, definitely, a POSITA would

have known what kind of LEDs to choose to achieve any desired color within the gamut of that diagram.

Q. Turning to your next slide, Dr. Wetzel, slide 12.

What is shown here in this excerpt from JX-80, pages 17 to 18?

A. Here, the '618 provisional speaks about LEDs and the power supply as part of the lighting device. In particular, it speaks about how the dies, the LEDs are connected to the power lines, depending on the number and the voltage of the AC line. It speaks about what type of LEDs to be used, and suitable numbers, including electrical properties of those.

Q. Dr. Wetzel, in 2006, in light of the disclosures that we've gone over, would a PHOSITA have been knowledgeable about the different types of LEDs that could be used in connection with this invention?

A. Yes, clearly, a POSITA, at that time, would have been knowledgeable about which LEDs to use for such an application.

Q. If we could turn to the next slide, slide 13.

Dr. Wetzel, can you please explain what you've excerpted here from JX-80, pages 18 through 19, about mixing LEDs with phosphors?

A. Here is further details provided about how the

LEDs interact with a selection of phosphors, how they're arranged physically and the different types of phosphors that could be envisioned.

Q. Okay. Moving to the next slide, slide 14.

What do you have excerpted here, Dr. Wetzel, from the '618 provisional?

A. Here, additional information is provided about the choice of a power supply to operate the LEDs. The POSITA knows that they are driven -- need to be provided with direct current at a low voltage, and the power supply would have to fulfill the requirements to interface to the low pitch provided through a wall outlet.

Q. Dr. Wetzel, in light of the disclosures of the provisional application and the background of a PHOSITA, would they have been, excuse me, knowledgeable about the different types of power supplies that could be used in connection with the invention that is described here?

A. Yes. Given all the technical requirements of the LEDs and the interface to the wall plug, a PHOSITA would have definitely been able to select and decide upon a power supply.

Q. Can you turn to the next slide, slide 15?

You have excerpted a portion of the provisional, JX-80, pages 21 through 22. What is described in this portion of the provisional, Dr. Wetzel?

A. Here, in specific, the provisional goes into details about managing the thermal requirements of the lighting device. It speaks about cooling devices. It considers fans of different types and cooling mechanisms.

Q. Okay. Let me go on to your next slide, slide 16.

What is shown here on slide 16 with respect to the '618 provisional disclosures?

A. Here is provided a schematic outline in Figure 4, plus it's textual description as a first embodiment as employed for a lighting device.

It speaks about the individual elements in there, such as heat spreading element, 11; insulating regions, 12; highly reflective surface, 13; conductive traces, 14; lead frames, 15; reflective cone, 17; diffusing element, 18.

It also speaks about the materials and how they are going to be formed.

In one aspect, it also speaks about the MCPET that highly reflective diffuse light scattering surface that forms the optical chamber.

Q. Turning to the next slide, Dr. Wetzel, slide 17, can you please explain what additional disclosure about what you've called the first embodiment is shown here in this excerpt from JX-80 at page 23?

A. Yes. Here, provided is additionally how the individual LEDs are distributed over various strings of LEDs, and it is giving their type, their color, their number, how many of those.

But also it's specific about what voltage drop to expect across each of those LEDs, and at what current they are to be operated.

So it also -- this disclosure, therefore, provides, for example, the power requirements of the electronic components.

Q. Okay. Now, Dr. Wetzel, in your opinion, in light of the disclosures we just went over, would a PHOSITA in 2006 have been able to create the first embodiment described here with a wall plug efficiency of at least 60 lumens per watt in your opinion?

A. Yes. Given the detailed and ample description of all the components and their interplay, a PHOSITA, at the time of the filing, definitely would have been able to practice the invention and obtain the results without any undue experimentation.

Q. Dr. Wetzel, what is your opinion as to whether the asserted claims of the '819 Patent are entitled to the filing date of the '618 provisional?

A. Yes. All of the asserted claims are entitled to at least the filing date of the provisional.

Q. More specifically, do you have an opinion as to whether the '618 provisional would have demonstrated to a PHOSITA that the inventors possessed the inventions claimed in the asserted claims of the '819 Patent?

A. Yes. Based on the very detailed information included in this provisional application, it was -- is very obvious that, indeed, the inventors also possessed the device that performed at that level.

Q. Turning to enablement, do you have an opinion as to whether the '618 Patent would have enabled a PHOSITA to make and use the inventions claimed in the '819 claims without undue experimentation?

A. Yes, again, based on the detail and level of the description provided in this provisional, the '819 Patent would have enabled a PHOSITA to practice the inventions without any undue experimentation.

Q. Okay. Let's turn now to the '531 Patent.

Dr. Wetzel, can you explain what's depicted here in the related US application data of the '531 Patent?

A. Yes. This is evidence that the '531 Patent refers to provisional applications '439 and '435, both filed November 27, 2007.

It also indicates that it is a continuation, in part, of an application '153 that was filed on May 30, 2007.

Q. Okay. The '153 application you just mentioned, do you understand that that issued as the '819 Patent?

A. Yes.

Q. Okay. Let's turn to slide 19.

Dr. Wetzel, what is shown here as JX-81 on slide 19?

A. Yes. This is one of the provisional applications I had just mentioned, the '435, and it was filed November 27, 2007.

Q. Let's turn to the next slide, slide 20.

What is shown here, Dr. Wetzel, on slide 20, JX -- which is an excerpt of JX-81, page 1 -- or 10, excuse me?

A. Yes. This is the first page of a slide deck that was included in the '435 provisional. It is a slide deck presentation given by LLF, and it names the authors Antony Van de Ven and Gerry Negley.

It is dated November 28, 2007. I'm not so sure about that. I think it's 2007, yes.

Q. All right. Well, we can -- let's turn to the next slide. Maybe we can confirm the date there.

Dr. Wetzel, what's shown here on JX-72 on slide 21?

A. Yes. This is a more legible version of the same slide deck of the -- that was included in the '435

provisional. Here the date is legible to be November 28, 2007.

Q. Thank you.

Let's turn in this presentation to the next slide. Here on slide 22 of your presentation, you have an excerpt from JX-72, at page 4.

What is being shown on this portion of the LLF presentation?

A. Yeah. Here the authors present their latest result, a lighting device prototype lamp that was measured by an independent testing lab, NIST, and it quotes the performance at a value of 113.5 lumens per watt for the wall plug efficiency.

Q. Okay. You mentioned NIST. What is NIST?

A. NIST is the National Institute of Standards and Technology. It's a US Federal Government agency that provides and maintains standards, and also provides measurements for industry in all of their calibration needs.

Q. Okay. I'd like to turn to the next slide, slide 23.

What is shown here, Dr. Wetzel, as JX-82?

A. This is the other provisional, the '439 provisional, filed on the same day, November 27, 2007.

Q. Can you explain generally what the subject

matter disclosed in the '439 provisional is?

A. This provisional describes the prototype as it was tested by NIST, and it also includes the test results. There is imagery and descriptions of the physical appearance of that device.

Q. Okay. Turn to your next slide, slide 24. You have an excerpt from JX-82 at page 12.

What is shown in this portion of the '439 provisional?

A. In this portion, the provisional quotes the NIST test results, and specifically it identifies the luminous efficacy, the wall plug efficiency, as a value of 113.5 lumens per watt.

Q. Okay. Turning to your next slide here. Dr. Wetzel, what is your opinion as to whether the asserted claims of the '531 Patent are entitled to the filing dates of the '435 and '439 provisional applications?

A. Based on the detailed description, including test results from third-party measurement labs, it is evident that, indeed, all asserted claims of the '531 Patent at least can claim their priority to the provisional applications '439 and '435 of November 27, 2007.

They are entitled to them, at least.

Q. Okay.

Specifically, Dr. Wetzel, do you have an opinion

as to whether the '435 and '439 provisionals that would demonstrate to a POSITA that the inventors possessed the inventions claimed in the asserted claims of the '531 Patent?

A. Again, from the detailed description of the physical aspects, the teachings provided, and the measurement results, it would have been obvious that a POSITA would have been able to accomplish similar results.

Q. Okay. And what -- and changing to enablement. What is your opinion as to whether the '435 and '439 provisionals would enable a POSITA to make and use the inventions claimed in the '531 Patent asserted claims?

A. Again, based on the detailed description and the evidence of physical examples and measurement results, it is pretty evident that a POSITA would have been able to practice the invention, and achieve similarly the claimed results without any undue experimentation.

Q. Okay. Turning to the next slide, Dr. Wetzel, 26.

Earlier today, Dr. Wetzel, you testified that the '531 Patent identifies the '153 application under its related US application data. Do you remember that?

A. Yes.

Q. Okay. Do you have an opinion as to whether any of the asserted claims of the '531 Patent are entitled to

the priority date of the '153 application?

A. Yes. Those are claims 1 and 25 of the '531 Patent are entitled to that priority date of the '153 Patent, which is May 30, 2007 -- '153 application.

Q. Thank you.

Let's turn to the claims you just mentioned. Here on slide 27, you have claims 1 and 25 from the '531 Patent.

Dr. Wetzel, what are the recited wall plug efficiencies of claims 1 and 25?

A. Those are at least 85 lumens per watt.

Q. What about Claim 25?

A. It's from about 85 to about 100 lumens per watt.

Q. Okay. Dr. Wetzel, do you have an opinion as to whether the '153 application would enable the POSITA to practice claims 1 and 25?

A. Yes. Again, based on the detailed description of the invention and all of the technical background provided in the description of the '153 filing, the POSITA would have been able to practice the invention at that performance level without undue experimentation.

Q. Dr. Wetzel, we're going to change topics a bit here to secondary considerations.

Dr. Wetzel, did you form an opinion as to whether secondary considerations of non-obviousness support

validity of the asserted claims of the '531 and '819 Patents?

A. Yes.

Q. Just generally, what is your opinion?

A. Yes, they do support the validity of the '819 and the '531 Patents.

Q. Let's balk through your opinion on secondary considerations.

Dr. Wetzel, were you at the hearing when Mr. Negley and Mr. Edmond testified that Cree acquired LLF in 2008 for -- I think all-in the number was around $103 million?

A. Yes.

Q. Okay. In light of that testimony, what is your opinion as to whether the inventions of the '819 and '531 Patents resulted in commercial success?

A. It is pretty evident that the inventions as reflected in those two patents contributed to the commercial success and its associated high sales value.

MR. ROBSON: Before we go to the next slide, Your Honor, I'd like to switch to the confidential record as we're going to see Cree Lighting, RAB, and third-party CBI.

Generally, what I'm going to present is spreadsheets of sales information as well as license

agreements.

JUDGE CHENEY: Okay. We're going onto the confidential record.

It sounds like if you are not signed onto the protective order, you need to go to the breakout room.

(Whereupon, the trial proceeded in confidential session.)

O P E N S E S S I O N

JUDGE CHENEY: Okay. We're now back on the public record.

BY MR. ROBSON:

Q. Dr. Wetzel, did you see any evidence of skepticism, unexpected results or industry recognition with respect to the inventions of the '819 and '531 Patents?

A. Yes.

Q. Okay. We have here, we're now on slide 32, and you've excerpted here from CX-712, at page 2, what is shown in this Exhibit, Dr. Wetzel?

A. Yes. This is a report by the Department of Energy on product testing as published in December 2006.

Q. What was the purpose of this report?

A. The purpose was to establish and get information on what luminaire performance, what lighting device performance was out there in the market. They assembled testing products by walking into stores and purchasing those from different vendors, different designs, and also meant for different applications.

Q. Okay. Turning to the next slide, slide 32. I want to direct your attention to Table 1 of the DOE 2006 report.

What's shown in this table?

A. This table is contained in the previously

mentioned report. Among other data, it shows the efficacy of those luminaires, the wall plug efficiency in terms of lumens per watt.

Q. What are the luminaire efficacies that are reported in Table 1?

A. They either range from about 11.6 up to 19.3 lumens per watt.

Q. How do the efficacies found by the DOE in its December 2006 report compare to the efficacies that the inventors of the '819 and '531 Patents achieved?

A. It is pretty evident that those number are merely a fraction of those luminaire efficacies achieved by the inventors around the same time.

Q. Let's turn to your next slide, slide 34.

Dr. Wetzel, excerpted here, we have CX-56 at pages 6 through 7. Can you please explain, Dr. Wetzel, what CX-56 is?

A. This is a Department of Energy roadmap as published November 2002.

Q. Okay. I'd like to direct your attention to the passage and table that you've excerpted here from pages 6 through 7.

What does this table show?

A. Yes. This data lists technology targets for LEDs at the component level over the time as of 2002.

Q. Okay. The targets here, are they directed to just LED components, or efficacies of lighting devices as a whole?

A. No, no. They're just LEDs at the component. There's no mentioning with about luminaires or devices as such.

Q. Okay. What, if anything, do these technology targets that you've explained suggest to you about whether the inventions of the '819 and '531 Patents achieved unexpected results?

A. As of 2002, the technology target was estimated to be at the level of 75 lumens per watt at the component level for the year 2007. That's around the value that, in that year, LLF and the inventors, indeed, obtained on fixture level, on a luminaire level.

So this is a very surprising result that only a few years before what was -- what was hoped for in a technology target on the component level, LLF would already achieve at the device level.

Q. Thank you, Dr. Wetzel. We can take down these slides now.

Dr. Wetzel, as part of your opinion on secondary considerations, did you form any opinion as to whether the inventions of the '819 and '531 Patents satisfied any long-felt but unmet need?

A. Yes, they do.

Q. How so, Dr. Wetzel?

A. Well, the incumbent technology was based on incandescent bulbs and fluorescent bulbs. The incandescent bulbs suffered from very low wall plug efficiency and low short operational lifetime. The incandescent bulbs had somewhat higher efficiency, but overall had a very poor color rendering.

And the invention here really addressed all those concerns with a new product that, as a whole, not as a component level, would address the lighting needs for the consumer, with significantly improved performance as, for example, expressed in the terms of wall plug efficiency.

MR. ROBSON: Thank you very much, Dr. Wetzel. I have no further questions for you at this time.

JUDGE CHENEY: Is there cross-examination for Dr. Wetzel?

Mr. Beck, are you the cross-examining attorney.

MR. BECK: Yes. Sorry, Your Honor.

JUDGE CHENEY: Welcome to the podium. Please proceed when you are ready.

CROSS-EXAMINATION

BY MR. BECK:

Q. Dr. Wetzel, as you recall, I'm one of the attorneys from RAB Lighting. Good to see you again.

A. Good to see you.

Q. I would first like to ask you some questions about your testimony regarding the priority claim to the '618 provisional with respect to the '819 Patent.

I believe you testified that, in your view, all the asserted claims of the '819 Patent are entitled to the May 31, 2006, filing date of the '618 provisional; is that correct?

A. Yes.

Q. Do you recall that all the asserted claims of the '819 Patent recite ranges of wall plug efficiencies?

A. I believe so, yes.

Q. For example, Claim 1 recites a range of at least 60 lumens per watt; do you recall that?

A. Yes.

Q. Other claims recite ranges between 70; is that correct?

A. Yes.

Q. Some recite 70 to 80; is that correct?

A. Yes.

Q. And some recite 80 to 85; correct?

A. Yes.

Q. Now, I think in your summary of the '618 provisional, you refer to a first embodiment; is that correct?

A. Correct.
Q. In fact, the first embodiment is the only embodiment that's provided in the '618 provisional; correct?
A. It is one of the embodiments that is claimed as an -- is -- that uses the word "embodiment."
Q. Right. That describes an example in reference to Figures 4 to 7, I believe, is that --
A. Yes.
Q. Do you recall that?
A. Yes.
Q. You would agree that the '618 provisional, in its description of the first embodiment, does not identify any particular wall plug efficiency number?
A. It lists so, and I'm repeating myself, so already in the abstract.
Q. I'm sorry. I didn't understand what you meant by "it lists so."
A. It is my recollection that a lumens per watt efficiency number is stated in the abstract of the patent.
Q. Yeah. I'm not asking you about the abstract. I'm asking you about the description of the first embodiment that you referred to earlier in your earlier testimony today.
Does that description identify any wall plug

efficiency associated with the device described in the drawings of the '618 provisional?

A. Under that headline, not.

Q. Okay. I think in connection with the -- let me withdraw that.

I think -- you mentioned you were present for the testimony of one of the inventors, Mr. Negley?

A. Yes.

Q. Do you recall that Mr. Negley submitted certain test results as part of his declaration to the Patent Office during the prosecution of the '819 Patent?

A. Yes.

Q. Those test results included tests performed by CSA International in April of 2006?

A. That's my current understanding, Yes.

Q. Okay. So those tests were performed more than a month before the filing date of the '618 provisional; correct?

A. It was not the same month. It was -- there was a month in between, yes.

Q. Okay. Those test results from CSA, they don't appear anywhere in the '618 provisional; correct?

A. That is correct.

Q. I think the other test results were from the CALiPER tests; do you recall that?

A. There are test results from the CALiPER tests. The question is where.

Q. Well, what I'm -- let me clarify.

I'm referring to the test results Mr. Negley identified to the Patent Office during prosecution.

A. Yes.

Q. Right. Those tests were run at a later time so they wouldn't have been included in the '618 provisional; correct?

A. They could have been done at a later time. I only have the date of the report of those.

Q. Right. Do you recall that those tests were conducted in the second half of 2007?

A. I remember only the -- the only report was dated in that time frame.

Q. Okay. Going back to the CSA test, do you recall that the highest efficacy number reported in the -- by CSA was 79.79 lumens per watt?

A. Yes.

Q. Now, let's -- let me ask you some questions about the priority claim of the asserted claims of the '531 Patent.

I believe you testified earlier today that Cree's -- I'm sorry, that claims 1 and 25 of the '531 Patent are entitled to claim priority to the filing date of

the application that led to the '819 Patent.

Do you recall that?

A. Yes.

Q. And I think you may refer to that as the '153 application; right?

A. Yes.

Q. The '153 application was filed May 30th, 2007.

Do you recall that?

A. Yes.

Q. Okay. Do you recall that Claim 1 of the '531 patent refers to a lighting device that emits output light having a wall plug efficiency of at least 85 lumens per watt?

A. Yes.

Q. Claim 25 of the '531 Patent recites a lighting device that emits output light having a wall plug efficiency in a range of -- from about 85 to about 100 lumens per watt; correct?

A. Yes.

Q. I believe you testified that the '153 application provides both enabling support and written description for those two claims; correct?

A. Yes.

Q. Now, in your opinion, as of the filing date of the '819 Patent, you'd agree that there's an inherent

limit, in your view, as to the wall plug efficiency of 100 lumens per watt based on the state of the art and the teachings of the '153 application?

A. What do you mean by "inherent limit"?

Q. Well, in your opinion, is there an inherent limit of up to 99 lumens per watt as to the scope and teachings of the '153 application?

A. Well, those claims are open-ended, and the teachings are necessary and useful for any performance above 60 lumens per watt.

Q. So sitting here today, do you recall testifying or expressing an opinion that there's an inherent upper limit in the wall plug efficiencies obtainable based on the state of the art and the teachings of the '819 Patent of 99 lumens per watt?

A. The claim language does not identify an inherent limit per your definition.

Q. Now, do you recall being deposed in this matter on April 12, 2021?

A. Yes.

Q. I think I asked you some questions about this topic. Do you recall that?

A. Yes.

Q. Let's look at page 102, starting at line 3 of the transcript from the deposition conducted April 12,

2021.

Can you bring that up?

At your deposition, I asked you the following question. I said, "Sure. Based on your testimony this morning, it's my understanding that it's your opinion that the inherent upper limit in the wall plug efficiencies obtainable based on the state of the art and the teachings of the '819 Patent is 99 lumens per watt; is that correct?"

And you initially said that was not correct. And then I asked, "How so?"

And your answer was, "The 99 was the edge of infringement claim. It was -- it was not -- on the other hand, it was stated by the -- okay. Hold on."

I think at that point, you said, "Okay. The enablement at the time of the patent was, indeed, limited to below 100 lumens per watt. It is only over time when better components would become available that this number would lie higher."

Did I read that correctly?

A. Okay. That discussion was part of a lengthy exchange --

Q. My first question, Dr. Wetzel, is did I read that accurately for the record?

A. You read that accurately.

Q. Okay. So you had testified that it was your

view that the '819 Patent specification was only enabling as to LED lighting devices having a wall plug efficiency of up to 99 lumens per watt; correct?

That was your testimony?

A. The evidence of the performance at the time was that lighting devices up to about that number seemed possibly achievable, and over time as components would improve, the teachings of the patent would, indeed, enable a POSITA to reach even higher performance values.

Q. All right. So you testified, but without those improvements in components that would happen later, that there was an inherent limit of up to 99 lumens per watt; is that correct?

A. I don't think that this word "inherent" is the proper use of the term. There is a physics limit, of course, that is a maximum that just from thermodynamic laws cannot be surpassed.

Q. Just using an -- I'm just using inherent based on your prior testimony. I think you used that term in your expert report as well; isn't that correct?

A. The discussion there was very mix of infringement and enablement analysis, which me not being a lawyer kind of got commingled.

Q. I think you also acknowledged that the components that needed to become available after the filing

date of the '819 Patent specification, in order to enable a wall plug efficiency over 99 lumens per watt had to -- had to be later developed after the actual filing date of the '819 Patent; is that correct?

A. I don't think I limited it to such a date. We would have to -- have to obtain them. As I earlier stated on the issue, these may have already been in existence. Maybe they were not built into any lighting devices yet.

The technology for that may have well been at hand, undisclosed to the public, of course, or maybe, but it is no need that they would have to necessarily be developed after.

It is only at the time that such information becomes available widely.

Q. So you don't recall testifying that there was a limit of below 100 lumens per watt as to scope of enablement of the '819 Patent based on the availability of better components.

Do you recall that?

A. If they had not been able, then it probably would have been limited to such numbers, yes.

Q. And you were saying that there were not better components available as of May 30, 2007, the filing date of the '819 Patent such that a person of ordinary skill in the art would practice the -- or I'm sorry, could implement an

LED lighting device with a wall plug efficiency greater than 100 -- or I'm sorry, 100 or greater?

A. I cannot confirm the absence, the non-existence of such devices; therefore, I am having difficulties to verify such plausibility of such statement.

Q. You don't --

A. I can --

Q. Sorry. Go ahead.

A. I can only state about -- speak about the devices as apparently obtained by the inventors. I cannot speak about those that were not obvious to be obtained -- or excuse me, obtained above.

Q. See, I don't -- in your deposition testimony, I think you said that the limit of below 100 was based on the need to reach components that became higher in time as to the efficacy of the components; do you recall that?

A. That statement is correct, yes.

Q. Right.

And the -- so in your view, there were not LED components available as of the time of the '819 Patent filed May 30, 2007, that would allow someone of ordinary skill -- a person of ordinary skill to make and use a lighting device having a wall plug efficiency of 100 lumens per watt.

Is that --

A. I cannot subscribe to that statement.
Q. Okay. Let's look at your deposition testimony at page 103, starting at line 2.
Do you have that in front of you?
I had asked you, "For '819, you discern a limit of below 100 based on the availability of better components; correct? That's what you just testified to."
Your answer was, "Unless better components are available, I am stating there, yes. So it's -- it moves -- at the time of disclosure of the patent, they were limited to that range and would reach higher only with time."
Do you recall that testimony?
A. Yes. I stand at that statement.
Q. Okay. In that statement, the components that you were referring to included LED components; correct?
A. Correct.
Q. I think you acknowledged that the overall efficacy -- the wall plug efficiency of a LED lighting device can't be more efficient than the limitations imposed by the efficiency of the LED components themselves.
Do you recall that?
A. Yes.
Q. For example, if an LED lighting device has an efficacy of 100 lumens per watt -- and I'm talking about the lamp.

So the component of the lighting device -- the overall lighting fixture containing that would only have a lower efficacy; correct?

A. In usual expectations, yes, unless of course, the --

(Clarification requested by the Court Reporter.)

A. Unless you manipulate the device into very different operating regimes.

Q. Well, an LED lamp, as a component emits light; correct?

A. Correct.

Q. And that imposes the maximum in terms of wall plug efficiency.

The numerator for lumens per watt is lumens; correct?

A. Correct.

Q. So if the lamp has 100 -- if the efficacy -- just taking into account the LED components -- is 100 lumens per watt, you can only have a lower amount when those components are placed inside a lighting fixture; correct?

A. Correct.

Q. You agree that such losses that you might get when you put into a lighting fixture would include conversion of, for example, an AC power supply to DC

electricity; correct?

A. Yes.

Q. It might also include losses in the transmission of light associated with secondary optics; correct?

A. Correct.

Q. Okay. Now, is it your opinion that in order to make and use a lighting device having a wall plug efficiency greater than 100 lumens per watt, as of the filing date of the '819 Patent, that there needed to be improvement of other components such as improvements in the performance of the phosphor, thermal management components, optical components, and electrical components?

A. They would benefit the invention, of course. It is known that such components, typically, over development, in time get better. That's usually the direction.

So over time, all of those would be known to gain in their respective components aspects. However, the proper balancing would still be needed as taught in the patents.

Q. Right. So there would need -- your testimony is that you would need improvements after May 30, 2007, in all the components of an LED lighting fixture in order to exceed 99 lumens per watt.

That was your opinion; correct?

A. They would help achieve that.

As I stated earlier, I cannot exclude the possibility that the respective components already were in the drawers of the inventors, and they just simply still had to put them together or any aspect of that.

I can only state -- I cannot say what they did not have. I can only state if those components, indeed, improve even forward, it would have very been expected that the performance overall would go even higher, and yes, break that barrier, that magical numbers, that in itself has no particular relevance.

Q. I don't think your prior testimony mentioned, you know, the possibility of components in the drawers of the inventors. I think you were talking about components that were -- would have been recognized as being available reading the '819 Patent.

You'd agree with that; right?

A. Correct. You know, I can only speak to product that is out in the open. I don't know what is in company's drawers, or what they are developing. "Drawer" being metaphorical.

Q. Right.

A. You know, being what is in their research labs. Typically, there is a time lag about once the public, even the educated public, knows about their existence.

Q. All right. Now, you provided infringement

opinions in connection with this matter; correct?

A. Yes.

Q. In connection with the infringement analysis you conducted, you opine that Claim 1 of the '531 Patent is infringed by all accused LED lighting fixtures sold by RAB that have a wall plug efficiency of greater than 85 lumens per watt; is that correct?

A. Yes.

Q. And it's your opinion that Claim 25 of the '531 Patent is infringed by LED lighting fixtures sold by RAB that have a wall plug efficiency between 85 and 100 lumens per watt; correct?

A. Yes.

Q. So if I can, I'll ask you a hypothetical.

Sitting here today, in your view, if a lighting device with at least one LED has a wall plug efficiency of 100 lumens per watt, it would not infringe Claim 1 of the '819 Patent, but if the lighting device with at least one LED had a wall plug efficiency of 99 lumens per watt, it would infringe Claim 1 of the '819 Patent, in your opinion?

A. That's not correct.

Q. Okay. Again, I think I asked you that question at your deposition.

Do you recall that?

A. I recall getting confused as a non-lawyer about

enablement and infringement analysis. It was not correct statement that I did.

Q. Right. So you initially testified to that effect, and then you changed your opinion; is that right?

A. I recalled the separation between those two analyses, and before we even finished the thought, caught myself on it and corrected it.

Q. Well, I think you did articulate that, and then you indicated that such a device with a 100 lumens per watt, it would infringe Claim 1 of the '819 Patent, but Claim 1 of the '819 Patent would not be enabled up to that level of 100 lumens per watt; isn't that correct?

A. The enablement analysis is done as of the date of the priority. The infringement is not tied to that date.

The infringement can include after-arising technology that would still fall under the infringement of the claim as written.

Q. I think, in your view, do you recall -- strike that.

Do you recall testifying, acknowledging that it would be far-fetched to say that a device with a wall plug efficiency of 100 lumens per watt would infringe Claim 1 of the '819 Patent?

A. It would be inappropriate statement, and I

should correct that.

Q. But you recall testifying to that effect?

A. It is possible. I don't know off the top of my head.

Q. Well, maybe I can refresh your recollection. Let's look at your deposition testimony at page 56, lines 3 to 16.

I asked you, "So if there's a lighting device with at least one LED that, when supplied with electricity in the first wattage, emits output light with a wall plug efficiency of 100 lumens per watt, would that product infringe Claim 1, in your opinion?"

Your response was, "You see, the specification provides a lot of technology, and explains how it relates and enables the invention. Yet, and it certainly covers the possibility for -- for various efficiencies, as would be quoted in the claims, but -- but driving it to a number as high as you just offered to me, like 100 lumens per watt, is probably a little bit far-fetched."

Do you recall that testimony now?

A. I do recall it. This was prior to my correction that I co-mixed infringement and validity, enablement analysis.

Q. Right. We did explore that issue a little bit more. I think I asked you why you thought -- at that point

in time, at least, you thought it was far-fetched.

And I believe you identified that there would be particular challenges that -- and so there would be a need for a little bit more than what's in the '819 Patent specification to enable a device to have a wall plug efficiency greater than 99 lumens per watt.

Do you recall that?

A. Yes.

Q. I think you also said that would need a little bit extra; correct?

A. Correct.

Q. I think you had indicated that that extra would be improvements in the LED components, for example; correct?

A. For example, among other issues.

Q. All right. Improvements in phosphor technology; correct?

A. And a proper designing of power supplies, addressing thermal issues and the components' arrangement, and the like.

Q. Now, do you recall that some of the claims of the '531 Patent recite a wall plug efficiency with a range with an upper boundary of 113.5 lumens per watt?

A. Yes.

Q. All right. And that 113.5 lumens per watt value

appears to be based on the test results from NIST that are reported in the '439 provisional to which the '531 Patent claims priority; correct?

A. I have no firsthand knowledge of that, but the number looks identical.

Q. Right. I think you had indicated that the '439 provisional reports the 113.5 lumens per watt value.

Do you recall that?

A. Yes, that's correct.

Q. All right. Now, do you recall Mr. Negley's testimony earlier today about LLF issuing press releases after they conducted a test of their prototype devices?

A. Yes.

Q. And LLF -- do you recall that LLF issued a press release shortly after the NIST test was conducted?

A. Sometime after, yes.

Q. Do you recall what was reported in that press release?

A. Vaguely, yes.

Q. Maybe, can we bring up RX-658, please? Next page.

So the headline of this press release was "New Lamp From LED Lighting Fixtures Shatters World Record for Energy Efficiency."

Do you see what I'm referring to?

A. Yes.
Q. That was issued November 28, 2007; correct?
A. Correct.
Q. That referred to a wall plug efficiency of -- I think it says 113.6 lumens per watt; right?
A. Yes.
Q. All right. So you'd agree, at the time of that press release, according to LLF, that was a world record, they couldn't do any better than what they were reporting; otherwise, it wouldn't be a world record; correct?
A. I don't know who coins those terms. Usually, it's the press release department. I don't know that there's an official tally that keeps track of records. Usually, it's a Google search. I cannot attest to that specifically.
Q. Sorry. Just give me one second, Dr. Wetzel.
Do you recall the testimony by Mr. Negley and others earlier in the hearing about LLF's use of what they called the BSY+R approach?
A. Yes.
Q. And I think you'd agree that all of the embodiments, the specific embodiments disclosed in the '819 Patent and the provisionals to which the '531 Patent claim priority, describe that BSY+R approach that LLF developed; correct?

A. Besides other approaches, they spend a lot of time on those portions, yes.

Q. Well, you --

JUDGE CHENEY: Mr. Beck, is this --

MR. BECK: Yes, Your Honor.

JUDGE CHENEY: -- a good place to take our afternoon break, or are you almost done?

MR. BECK: I'm hesitating, Your Honor. It depends on the answers. This probably is a good time to take a break.

JUDGE CHENEY: Okay. Let's take 15 minutes. I will see you all back here at 3:19. We're off the record.

(Whereupon, the afternoon recess was taken, 3:05 p.m. - 3:19 p.m.)

JUDGE CHENEY: Let's go back on the record now.

We're back on the record in the 1213 Investigation. Before our afternoon break, we were hearing the cross-examination of Cree's technical expert on the '819 and '531 Patents, Dr. Wetzel.

Please continue the cross-examination, Mr. Beck.

MR. BECK: Thank you, Your Honor.

BY MR. BECK:

Q. Dr. Wetzel, I think before the break, I had asked you about the priority applications in the '819 Patent and the '531, and had asked in particular about

their focus on the BSY+R technique.

Do you recall that?

A. Yes.

Q. I think you had said that they primarily focus on that, but that's -- I understood you were suggesting that they focus on other techniques as well; is that --

A. Sure.

Q. -- is that what you meant to suggest?

A. They contemplate those, yes.

Q. Now, one -- you'd agree that one known prior art technique, conventional prior art technique for producing white light using LEDs was the RGB technique; correct?

A. Correct.

Q. That's a mixture of red, green and blue LEDs?

A. In one form. It could also be done by phosphors.

Q. Well, in the context of the patent, it talks about RGB LED light fixtures, for example, in the background section of the '819 Patent.

Do you recall that?

A. Yes.

Q. I think it indicates that such RGB light fixtures had limitations, and it attributes that to the fact that currently available green LEDs are relatively inefficient, and thus, limit the efficacy.

Do you recall that?

A. Yes.

Q. All right. It also talks about warm light LEDs for indoor use, but says that their efficacy is generally significantly less than that of standard cool white LEDs?

A. Yes.

Q. Okay. I think you had referred to the -- you had referred to the provisional applications for the '819 -- I'm sorry, for the '531 Patent, including a PowerPoint presentation by LLF.

Do you recall that?

A. Yes.

Q. Do you recall that those -- that PowerPoint presentation refers to BSY+R being a different approach? Do you recall that?

A. Yes.

Q. Now, when you provided opinions regarding secondary considerations earlier today, I think you pointed to some of RAB's own products.

Do you recall that?

A. Correct.

Q. When you considered your opinions regarding secondary considerations and infringement as to the RAB products, did you ever consider whether they utilized the BSY+R approach or not?

A. That was not necessary to be done.
Q. Why in your --
A. I did not.
Q. Why in your view was that not necessary?
A. It's not -- it's not a claim term.
Q. In other words, in your view, there's nothing in the asserted claims of the '819 or the '531 Patent that would exclude approaches other than BSY+R. Is that a fair statement?
A. Yes.
MR. BECK: I have no further questions at this time, Your Honor.
JUDGE CHENEY: Okay. Dr. Wetzel, I have just a couple of questions.
Based on your expertise in physics that was mentioned at the beginning of your testimony, I think you said that there is a physics limit to wall plug efficiency of an LED lighting device.
Did I recall that correctly?
THE WITNESS: Yes, I referred to that term, yes.
JUDGE CHENEY: What is that physics limit?
THE WITNESS: Thank you for asking.
It's very interesting. The physics of human light perception, it is obviously not very easy to assess, but over the years, people have succeeded in standardizing

it.

It turns out that a number -- how much lumens a human eye can perceive, and how little optic -- sorry, radiation power would be needed to achieve that light, how little could that be.

So that obviously is a different definition of wall plug efficiency. If I were to assume that all of the electrical input power were converted into optical power -- into radiation power, sorry, and then this were -- or a lot of those described and concerned losses were eliminated, then it was at one time thought that maybe 200 or 300 lumens could be the maximum achieved per watt of white light. So lumens of white light per watt.

If, however, I were to reduce the spectrum to be a laser-sharp spectrum that, you know, is a single color only, and if it were in the range of about 555 nanometers only, so not a wide spectrum, then the physics limits were upwards of 600 to 700 lumens per watt of radiation power.

So this is not possible to surpass.

So, of course, then one starts to reduce that number by throwing in expectations that it would be a white light. That it would be -- have to be driven with LEDs, which are by all means not perfect, and all of the other considerations that inventors take care of.

JUDGE CHENEY: Could I have our trial presenters

put up in some form Claim 1 of the '819 Patent?

So, Dr. Wetzel, I want to make sure that I understand what you have just told me and apply it to what a person of ordinary skill in the art at the time of the '819 invention would understand these words in Claim 1 to mean.

Would such a person understand that there is a theoretical limit to the efficiency covered by this claim?

THE WITNESS: Yes.

JUDGE CHENEY: What would such a person understand that limit to be?

THE WITNESS: Somewhere if the range between 200, 300, and 700 lumens per watt.

JUDGE CHENEY: Why do you distinguish between 200, 300, and 700 lumens per watt?

In other words -- let me try to connect some dots from what you've told me before to what you're saying now.

I think you were explaining to me before that if we were to limit ourselves to a specific visible wavelength of light, there could be a higher efficiency. Is that right?

THE WITNESS: Correct. If -- since there are no other qualifiers beyond light, and if I would allow myself to narrow it down to a laser-sharp beam, then I would use

this 700, 650, 700 lumens per watt number.

JUDGE CHENEY: The reason that you're applying that number here to Claim 1 is because Claim 1 has no restriction as to, say, color temperature; is that right?

So it could cover this laser beam you're talking about?

THE WITNESS: Correct.

JUDGE CHENEY: Okay.

Would your answer be the same for Claim 1 of the '531 Patent?

We can put that up, if you need to see it. Would that assist you?

THE WITNESS: Yes. Let's -- let me --

JUDGE CHENEY: Here is Claim 1 of the '531 Patent.

Take a moment to read it, and let me know when you're ready for the question.

THE WITNESS: I'm ready.

JUDGE CHENEY: Would a person of skill in the art at the time of the invention that is disclosed here in the '531 Patent understand that the words of this claim describe an invention that has a theoretical efficiency limit?

THE WITNESS: Yes.

JUDGE CHENEY: What would such a person

understand that limit to be?

THE WITNESS: The same number I mentioned before. It was somewhere between 600 and 700 lumens per watt.

JUDGE CHENEY: Okay. If you will bear with me for just a minute, I want to ask you similar questions about some different claims.

Can we have claim 24 of the '819 Patent put up?

Dr. Wetzel, take a look at the words of this claim. Let me know when you're ready for the question.

THE WITNESS: Yes.

JUDGE CHENEY: Would a person of skill in the art at the time of the invention that is disclosed in the '819 Patent understand that the words of this claim describe an invention that has a theoretical efficiency limit?

THE WITNESS: Yes.

JUDGE CHENEY: What would they understand the limit to be for this claim?

THE WITNESS: There has been some work over the years. I have to try to be close to the year of priority here.

The number was somewhere in the range of -- between 200 and 300 lumens per watt.

JUDGE CHENEY: Can you help me understand why

there is a range based on the work being done at the time?

Was it not clearly understood at the time?

THE WITNESS: The physics of it was probably clear and understood. The question is would a POSITA have been faced with that number at the time or not, or would he have to read it up?

That it would be reasonable and feasible was -- you know, to nail it down further between the ranges of numbers that I gave you is not a very easy job.

But around that number would certainly be -- have the clear understanding.

JUDGE CHENEY: Okay. Just to make sure that the record is clear about what is different about this claim 24 that led you to change your answer from the 6 to 700 lumens per watt to 2 to 300 lumens per watt; what is different about this claim?

THE WITNESS: It is particularly the terms "warm white."

JUDGE CHENEY: Okay. So that limitation is to be understood with your earlier explanation about how humans perceive white light?

THE WITNESS: Correct.

JUDGE CHENEY: It is a device that -- let me start that question again.

Is an LED light fixture with 300 lumens per watt

of wall plug efficiency producing warm white light currently possible today?

THE WITNESS: Not per my understanding.

JUDGE CHENEY: Why is it not possible today?

THE WITNESS: There are many steps involved between the wall plug and the lumen measurement at the output. The electrical power would have to be converted into -- from an AC 110 volts to something in the range of 2 to 5 volts that a typical LED component can take in DC.

So there are losses with that.

The next level losses is not all of the electrons that flow through the device convert their energy in 100 percent to photons of the same energy.

So there can be a loss in number of photons, but also in terms of energy that they lose when going through there.

At that stage, we have to just generate the photons in the device. And I need to be careful, the LED component.

They have to come out from this semiconductor material. Along that way, they can get lost by reabsorption. Then they can come out of that LED component and scatter and might not reach to the outside where they could get measured, could get absorbed somewhere else in the fixture, in the device, at a component, at every level.

And the conversion of those photons from blue to, for example, yellow, of different wavelength would incur, again, a predictable or expected loss in the number of photons that get converted, but also in a reduction of their energy while they undergo this conversion.

After they are converted, they still face the challenges of getting absorbed or scattered in the wrong direction before they leave the device and can be counted towards the intended goal.

JUDGE CHENEY: Thank you.

We can put away the patent claim that's being displayed right now.

That's all of the questions that I have for this witness.

Is there any redirect for this witness?

MR. ROBSON: No, Your Honor.

JUDGE CHENEY: Okay. Well, I want to thank you, Dr. Wetzel, for making yourself available today.

Your testimony helped me understand the case better.

You are excused.

Will Cree call its next witness.

MR. ERWINE: Yes, Your Honor. Cree next calls Dr. Thomas Katona.

My colleague, Mr. Hamstra will proceed with the

direct examination of Dr. Katona.

JUDGE CHENEY: Let's go off the record for just a moment while everybody gets settled.

(Off the record.)

JUDGE CHENEY: We're back on the record. Everyone is in position now. I will administer the oath to Dr. Katona.

THOMAS KATONA, PhD,

a witness, having been first duly sworn, was examined and testified as follows:

THE WITNESS: I do.

JUDGE CHENEY: Thank you.

Please proceed with your examination, Mr. Hamstra.

DIRECT EXAMINATION

BY MR. HAMSTRA:

Q. Good afternoon, Dr. Katona. Can you state your full name for the record?

A. Dr. Thomas Matthew Katona.

Q. Dr. Katona, I understand that you have some demonstratives prepared for today.

Mr. Jay, can you put those up?

So, Dr. Katona, what is your current occupation?

A. I am an associate professor at California Polytechnic State University in San Luis Obispo in the

college of engineering.

Q. Can you summarize your educational background?

A. Yes.

I have a bachelor's in engineering physics from Westmont College. A master's and PhD degree in electrical and computer engineering, from University of California at Santa Barbara. And an MBA from the University of South Carolina.

Q. At a high level, what is going to be the subject matter, technically, of your testimony today?

A. At a high level, discussing the design of LED-based lighting products, and their thermal design, primarily.

Q. Dr. Katona, could you just highlight a few aspects of your work experience that are most pertinent to the technical subject matter you just identified?

A. Yes. I started working with LED-related products in -- around 2000 in grad school. I have been working with development of LED and LED lighting products since that time, both at the LED chip or die level, at the packaged LED level, and also designed and integrated and shipped full LED-based lighting products.

MR. HAMSTRA: Your Honor, pursuant to the parties' stipulation, I proffer Dr. Katona as a technical expert in the field of LED lighting technology in this

investigation.

JUDGE CHENEY: Based on the stipulation and the lack of objection, Dr. Katona will be accepted as an expert in the tendered fields.

BY MR. HAMSTRA:

Q. Dr. Katona, are you being compensated for your testimony today?

A. I am. I'm being compensated at a rate of $450 per hour.

Q. Is your compensation at all dependent on the outcome of this investigation?

A. It is not.

Q. Dr. Katona, what will be the first patent upon which you're testifying today?

A. The first patent is listed here as the '270 Patent.

Q. Turning to CDX-003C.0004, could you at a high level summarize the subject matter of the '270 Patent?

A. The '270 Patent is about an LED-based lighting fixture and the design of such a fixture to separate the chamber of the driver electronics from that of the LED modules.

Q. What benefit, if any, is there to separating the driver from the emitter in that way?

A. In light fixtures, the LED electronics or driver

is -- in the LED modules themselves are the two primary sources of heat, and by separating those, they don't influence one another. That effects is sometimes called thermal crosstalk, where one thermal load influences the other. And as we have heard in previous testimony, heat -- LEDs don't really like heat. They tend to get less efficient, and dim and lose total output of light.

Q. What, if any, negative effect is experienced by drivers due to heat?

A. Similar to LEDs, it's not uncommon that the efficiency goes down with heat. And also, as I did not mention, the lifetime of both LEDs and driver electronics tends to be reduced as -- if they run at a higher temperature.

Q. Dr. Katona, turning to slide 5 of your deck, can you briefly describe the solution of the '270 Patent to this problem?

A. Sure.

The -- this image here referred to as CX-0447, sorry, shows a cross-section of one such embodiment, and the triangular shaped area on the right side of that image is the chamber that's defined for the driver electronics. And the left side is depicted, you can see from the bottom, with what looks like an array of circles which is where the LED modules are at, and there's a physical gap shown to

allow airflow through between the two.

Q. What benefit does that airflow allow for?

A. A couple of different benefits.

So there's a few different numerical designations on this picture.

So the numerical designations 1 show how air can flow up through the device fixture itself in between the chamber and the LED modules, and then the air flows over laterally across the fins of the LED heat sink that the LED modules are mounted to. That helps draw heat off the fixture itself.

And then number 2 designates where water or precipitation of some sort would be able to actually come down and drain through the fixture, also providing a cooling effect.

And then the openness of the fixture is -- just allows for better conductive thermal radiation.

Q. So turning to slide 6 --

MR. HAMSTRA: Your Honor, after our conversation yesterday, I just want to note one thing. Throughout this presentation today, there will be a number of citations to native files; typically, native CAD files. The parties -- both of Cree Lighting and RAB, the parties are each maintaining confidentiality over their -- the underlying native CAD files, but I understand are permitting the

excerpts within this slide deck to be on the public record.

JUDGE CHENEY: Great. Thank you for letting me know about that. Thank you for working out that understanding.

BY MR. HAMSTRA:

Q. All right, Dr. Katona, what products of RAB are going to be opining on today with respect to the '270 Patent?

A. The FALCOR Series of products, which is shown in the photograph CPX-0008.

The CANVAS/EZLED family of products with the photograph here, CPX-0003.

And the FFLED products with the -- this is from the CAD file, with designation CPX-0484C.

Q. What is your conclusion about infringement of Claims 1 and 2 of the '270 Patent and the FALCOR, CANVAS/EZLED and FFLED products?

A. My conclusion is that all three of these product families do infringe Claims 1 and 2 of the '270 Patent.

Q. Mr. Jay, could you jump forward to CDX-0003C.009?

Dr. Katona, were you also prepared to offer opinions on the PIP and PIPXL products today?

A. I was.

Q. But what is your understanding of the parties'

agreement with respect to the PIP and PIPXL products?

A. It's my understanding that the parties do agree that these products infringe the claims of the '270 Patent.

Q. Okay. I won't ask you any more questions about that one, then.

Mr. Jay, can you go back to CDX-0003C.0007?

Dr. Katona, the parties have reached a stipulation regarding representative products in this matter. Could you just share your understanding of that stipulation?

A. My understanding is that they've grouped the products into product families by -- at least for the purposes of structural analysis for each of the products.

Q. Turning to your slide 8, how did you further group the products in your analysis?

A. To three groupings of the products which are separated here with the red lines.

The FFLED products were grouped together, and for structural analysis, I used the CAD file CPX-0484C.

The FALCOR family of products were grouped together, and for that, the CAD file that was used as representative was CPX-0478C.

And the CANVAS/EZLED product families were grouped together also, and they're representative CAD file is highlighted here, CPX-0477C.

Q. Thank you, Dr. Katona.

Mr. Jay, could you turn to slide 11?

Dr. Katona, what claims of the '270 Patent are you offering opinions on today?

A. Claims 1 and 2 of the '270 Patent.

Q. What tests did you apply to determine whether the RAB products infringed these claims of the '270 Patent?

A. I looked at each element of each of claims, and applied them against the accused products.

Q. What interpretations did you apply in your analysis of these claims?

A. In the case where there was a construction by the Court, I applied the Court's construction. And in the case where there was no construction, I applied just the plain and ordinary meaning of the words as they were written.

Q. For what terms did the Court provide a construction?

A. Specifically for the terms "a light fixture," in which the Court found that the preamble was, indeed, limiting.

And then air/water-flow, with the Court's construction shown here, as permitting airflow, permitting water-flow, or permitting the flow of both air and water.

Q. So, Dr. Katona, let's start with the preamble of

Claim 1, a light fixture comprising; what did you conclude regarding the FFLED, FALCOR and CANVAS/EZLED products?

A. I found that all three were, indeed, light fixtures. They all have mounting brackets which are highlighted for each of the three product families here with the green blocks, and they have lighting devices that are meant to provide light to an area.

Q. What evidence did you rely on to come to that conclusion?

A. So specifically on the left, the FFLED product, again, from the CAD file CPX-0484C, there's the mounting, the place where it's supposed to be mounted on the bottom. And in blue, are the LED modules that would create the illumination.

The FALCOR is shown in the center from the CAD file CPX-0478C. Again, the green block is showing where the mounting bracket or hinge is, and the blue is the location of LED modules that provide the light.

And similarly, on the right for the CANVAS/EZLED products, from the CAD file CPX-0477C, again, the green block is showing where the mounting -- the mounting fixture is, and the navy blue are highlighting where the LED modules are located.

Q. Do you understand RAB to dispute whether these products are, in fact, light fixtures?

A. It's my understanding they do not dispute that.
Q. What is the next element of Claim 1?
A. A chamber. I believe they all contain chambers.
Q. So, Dr. Katona, turning to CDX-3C.15, can you identify where you located a chamber in the accused products?
A. Yes.
So, again, on the left, the FFLED products, the CAD file, this -- in this case, the back of the fixture is made transparent so that we have -- we can see into it, and exposes the chamber area of the fixture.
The FALCOR product in the center has a navy blue arrow pointing to the chamber, and in this case, the panel is removed from the image so that we can see the insides of it.
And the CANVAS EZLED on the right has the navy area kind of highlighted. In this case, again, the panel is removed so we can see the inside of what is the chamber of the fixture.
Q. Do you understand whether RAB disputes whether these products do, in fact, include a chamber?
A. It's my understanding that there is no dispute on this.
Q. Dr. Katona, what is the next element of the '270 Patent?

A. At least one power circuitry driver within the chamber.

Q. Turning to slide 17 of your presentation, what conclusion did you come to regarding whether the accused products include such a driver?

A. The FFLED product family first is shown here from the CAD file CPX-0484C, and, again, that back panel is transparent, so we can see inside.

But inside that chamber, the green -- at least one power circuitry driver is highlighted, and it shows its physical location in the chamber.

Q. Dr. Katona, stepping back a moment, what is your understanding of the plain and ordinary meaning of what a power circuitry driver is to one skilled in the art?

A. It would be a electronics driver that accepts an AC line voltage in, converts it to a constant current output to power the LEDs.

Q. What kind of constant current output?

A. Let's see.

So in this case, you can see the -- this is an image on the right from a data sheet on the FFLED products. It's CX-0489.

You can see that it's highlighted. The power circuitry driver is designed to accept anywhere from 100 to 277 volts, which are standard line voltages in the US, at

50 to 60 hertz, which is where our power grid kind of runs on, and converts it to a constant current such that the LEDs would run and not flicker or something. That would be not desirable to the customer.

Q. What sort of voltage output does the driver shown here output?

A. In this case, it's a class 2 voltage.

Q. Is that a DC voltage?

A. Yes, that's a DC voltage.

Q. So, Dr. Katona, turning to the FALCOR, what evidence did you see regarding whether the FALCOR products include a -- at least one power circuitry driver within the chamber?

A. So similarly, this is the same image that we used from a slightly different angle to show where the chamber is. The green arrow here is highlighting where the -- at least one power circuitry driver is located inside that chamber, and the data sheet for that product family, CX-0488, again, highlights -- they advertise a driver.

It, again, has the input acceptance of what would be standard AC line voltages and an output of a constant current to the LEDs.

Q. Turning to slide 19.

What evidence do you see regarding this element

and the CANVAS/EZLED products?

A. The CANVAS EZLED is once again shown with the back panel removed on the left of this exhibit to expose the chamber, and the green arrow is pointing to the location within the chamber of the -- at least one power circuitry driver.

Once again, highlighted in yellow from the data sheet CX-0596, there's an AC sort of line voltage input and a constant current output.

Q. Dr. Katona, do you understand RAB to dispute whether the accused products include at least one power circuitry driver within the chamber?

A. It's my understanding they do not dispute this.

Q. Dr. Katona, what is the next element, what you've labeled 1C of Claim 1 of the '270 Patent?

A. At least one LED module outside the chamber.

Q. What conclusion did you reach regarding that element and the FALCOR products?

A. So the FALCOR products -- this is one side of the product that's shown here. So to orient yourself, the blue arrow is still there pointing to the chamber, and in this case, we see the side where the LED -- at least one LED module is located with the yellow arrow pointing to its location, clearly outside of the chamber.

On the right is a photograph of at least one LED

module, CPX-0008, showing the array of LEDs on a circuit board, and a close-up photograph of one of the LEDs itself.

Q. Do you understand RAB to dispute whether the FALCOR products include at least one LED module outside the chamber?

A. It's my understanding they do not dispute that.

Q. So let's turn to the FFLED products in this element.

So what did you conclude regarding whether the FFLED products include such an LED module?

A. It's my conclusion that the FFLED products do include at least one LED module outside the chamber.

Q. What kind of LED module is included in the FFLED products?

A. These are called chip-on-board, or some people will call it COB type LED modules.

Q. Where do those appear in this annotated version of CPX-484C on slide 21?

A. They show up -- there are two locations on this slide. The front view is on the left where it would be the illumination side of the light fixture. You can see their location.

Then for purposes to demonstrate that they are, indeed, outside of the chamber, the middle image has them sort of in the view from the top of where that would

physically be located.

The chamber is obviously the back side of that fixture, which is -- the LED modules are not contained within.

Q. Can you explain in a little bit more detail, what a chip-on-board or a COB is?

A. Sure. A chip-on-board or COB is a circuit board that you mount LED die directly to. Sometimes they're either a metal core circuit board or a ceramic substrate.

They have traces or circuitry that connect arrays of LEDs on the board themselves, and the boards are designed such that they can be integrated directly into a fixture just like a normal circuit board would be so that they don't need a secondary reflow step.

Q. I'm sorry, Dr. Katona. I didn't catch the last piece of your answer there.

A secondary what?

A. A reflow. So in the FALCOR products, those packages are melted -- melted onto a substrate or circuit board. In the case of a COB, the LED arrays are directly attached.

The package is a circuit board itself. So it's equivalent to what's on the previous slide, just in a singular form.

Q. Thank you, Dr. Katona.

So turning to slide .22, what conclusions did you reach regarding whether the CANVAS/EZLED products and the -- this element?

A. Similar for the FFLED, with the CANVAS and EZLEDs.

So the photograph in the center here, CPX-0003, shows the -- a photographic image from the front side of the fixture where the chip-on-board LED modules are exposed, and you can see the direct connection to those circuit boards.

From the top, the images are transposed into the light fixture showing that they're physically outside of the chamber from the CAD file CPX-0477C.

Q. What do you understand to be RAB's argument with respect to these COBs on the FFLED and CANVAS/EZLED products?

A. It's my understanding that they contend that they're not an LED module.

Q. What is your response?

A. I disagree with that. They are arrays of LEDs mounted onto a circuit board, and in such a fashion that they can be directly connected from the light fixture.

Q. So turning to slide .24, you've excerpted a portion of the '270 Patent, JX-0004.

How did this portion of the specification impact

your determination regarding this element?

A. Yeah. So the specification here has highlighted a phrase right up front that says, "Advances have been made in LEDs, and in LEDs arrays" -- I'm sorry, "and in LED arrays, often referred to as LED modules."

Which highlights that those working this field use those terms interchangeably.

Q. So, Dr. Katona, what did you conclude regarding whether the FFLED and CANVAS/EZLED products satisfy this element of the claims?

A. It's my conclusion that both do satisfy the element of the claims.

Q. Dr. Katona, what is the last element of Claim 1 on which you're going to be opining on today?

A. The last element is that there is at least one air gap between the chamber and the at least one LED module, the air gap permitting air/water-flow therethrough.

Q. Turning to slide .26, what did you conclude regarding this element and the accused RAB products?

A. Again, let's see.

We'll start with the FFLED products on the left. So this is a view from the top of the fixture, and, again, the yellow shows the location of the at least one LED module relative to the chamber, which is highlighted with the darker blue, and in this case, you can see the air gap

right through the middle of it between the two, which is -- there's a turquoise arrow, which kind of points us to that.

Then for the CANVAS/EZLED products in the center of this exhibit, similarly, the yellow shows the location of the at least one LED module kind of superimposed.

We're looking, again, from the top of the fixture. You can see the location of the chamber highlighted with the navy blue, and, again, we're sort of seeing the gap right through between those two, highlighted with the turquoise arrow.

And last, the FALCOR products are shown on the right of this image, and, again, the location of the at least one LED module are shown with the yellow arrows.

We looked at those early on. And then the chamber location with the dark blue, and the turquoise -- in this case, it's a dashed arrow -- goes right up through the air gap between the two.

Q. With respect to the FFLED and CANVAS/EZLED products, do you understand RAB to dispute the presence of this element?

A. It's my understanding they do not.

Q. What do you understand RAB's argument to be with respect to the FALCOR?

A. It's my understanding that they contend that there's not an air gap there, that it's two separate

structures.

Q. What is your response to that argument of RAB?

A. I disagree with it. They're not two separate structures. The physical connection, kind of there's a hinged bracket that you can see between the two that does physically connect them. It's one light fixture, so that's kind of how you buy it.

There is a gap there, and even in the way that this is designed, the fins on the back side of the -- at least one LED module are geometrically oriented to enhance airflow that would come through that gap over that heat sink. So that -- yeah.

Q. Thank you, Dr. Katona.

So what conclusion did you ultimately reach regarding infringement of Claim 1 of the '270 Patent by the FFLED, FALCOR and CANVAS/EZLED products?

A. My opinion is that the FFLED, FALCOR and CANVAS/EZLED all infringe the elements of Claim 1 of the '270 Patent.

Q. So, Dr. Katona, what is the other claim on which you are opining today of the '270 Patent?

A. Claim 2.

Q. And what does Claim 2 read?

A. Claim 2 reads, "The light fixture of Claim 1 wherein the chamber is defined by a housing."

Q. Let's turn to your slide 20.29.

Could you outline where you found such a chamber defined by the housing in the accused products?

A. Sure.

So the FFLED products, again, we're looking at the CAD files CPX-0484C, is shown on the left, and the chamber once again is exposed. The housing that defines the chamber is the turquoise shell to it. So it's shown here.

The FALCOR, similarly, has the housing shown as a turquoise shell around the chamber, which we previously identified in the Claim 1 discussion.

And on the CANVAS/EZLED product on the right, this time with the back panel which was previously removed, also shown with the turquoise highlight shows the housing that defines that chamber.

Q. Dr. Katona, do you understand RAB to dispute presence of this limitation in the accused '270 products?

A. It's my understanding they do not dispute them.

Q. So, Dr. Katona, what is your ultimate conclusion regarding infringement of Claims 1 and 2 of the '270 Patent and the accused '270 products?

A. My opinion is that the -- or conclusion is that the -- all three product families, the FFLED, FALCOR and CANVAS/EZLED, do, in fact, infringe Claims 1 and 2 of the

'270 Patent.

Q. Dr. Katona, were you preparing to opine on technical domestic industry with respect to the '270 Patent today?

A. I was.

Q. What is your understanding of the parties' agreement with respect to '270 Patent technical domestic industry?

A. My understanding is the parties have agreed that the technical domestic industry does, indeed, practice the claims of the '270 Patent.

Q. Okay. So I won't ask you any further questions about that.

Mr. Jay, could you jump to slide .34.

So, Dr. Katona, what is the next patent on which you are opining today?

A. The next patent is the '449 Patent.

Q. What's the general subject matter of the '449 Patent?

A. The '449 Patent was directed at a design, a thermally advantageous design, as well as certain performance metrics for an LED-based downlight or can light.

Q. What particular challenges face downlight systems?

A. Downlights -- this was alluded to in earlier testimony.

Downlights are stuck into a ceiling, which is not a fantastic thermal environment for them to exist in, and they're also geometrically constrained, so you don't get to arbitrarily pick the size of the hole. The holes sort of exist.

So you have a lighting device where, you know, users in a room are used to getting a certain amount of light out, but you're constrained in how you can handle the thermal load of any heat generated in that light fixture. And as we discussed previously, the primary sources of heat are from the LEDs themselves, and the driver electronics.

So you have to figure out how to manage that thermal load, and get it out of the fixture while still keeping your LEDs and components running at an efficiency in total output power that you would desire for the application.

Q. So traditionally, what approaches were taken in downlights to control that thermal load?

A. The most conventional approach was to stick a big heat sink on the back side of it, and try to provide as low a thermal resistance from the LEDs to the outside can as possible, with a big bulky heat sink.

Others used methods like active cooling, and

specifically, an example of that would be putting a fan on the back side of the fixture.

Q. What's the downside of the heat sink approach you mentioned there?

A. The main downside -- well, there are a couple. The main downsides of the big heat sink are it tends to add cost in just materials, and it also adds cost in the shipping of the product. And also the -- I guess one other effect, if you've ever put one of these in, if they're heavy, they tend to slide out of the existing can, so that's a potential other downside.

Q. What's a downside with the active cooling or fan example you mentioned?

A. They're known to not be very reliable in this type of application. Ceilings are not that clean, and so, you know, sticking something like a computer fan up in your ceiling not only adds weight and cost, which we talked about other components in your bill and materials, but has a potential for just being the lifetime choke point of your lighting fixture.

Q. So, Dr. Katona, you mentioned some requirements imposed by the claims of the '449 Patent, such as relating to light output, power input and weight.

How do those considerations compete with one another?

A. Well, listening to the testimony this morning, I think Mr. Negley, he very clearly elicited it. His description of the Whac-A-Mole problem is, you know, quite relevant.

You've got -- when you're trying to get a certain amount of light out of this can, you start pumping more power into it to get that light output up, but the more you do that, the more thermal load you're generating in the fixture that you have to remove.

If you don't efficiently remove it, the LEDs themselves have a characteristic called thermal droop, where their total light output and efficiency starts dropping.

So you -- the only way to compensate for that is either to have more heat sink or thermal handling, or put more power into the device, which sort of has a bad feedback loop for you.

So, yeah, it is a classic Whac-A-Mole problem, and, you know, you kind of wish that you were someone with five or six arms when you are playing that game. So that's how it feels designing these things.

Q. Dr. Katona, turning to your slide .35, what is one particular aspect of the design of the '449 Patent that attempted to address some of these concerns?

A. One of the design elements that they used was to

try to use the trim element itself as at least a portion of the heat sink. So you're utilizing an existing element to try to draw heat out of the fixture as opposed to just using it as an independent device.

That has two benefits. One, it has the benefit of reducing the weight, and we have seen that's an important part of this patent, which we're going to discuss. But in addition, it has a secondary benefit in that it pulls some of the heat into the room side of the fixture. And as I mentioned, the ceiling side is not a great place to be trying to get rid of heat, where the room side is actually quite a large thermal reservoir.

So utilizing that trim element has that secondary advantage.

Q. Dr. Katona, turning to your slide .36, what claim of the '449 Patent are you opining on today?

A. I'll be speaking specifically on Claim 10 of the '449.

Q. What interpretation of Claim 10 and its terms did you apply in your analysis?

A. Again, I looked at each element of the claim and tried to apply the wording of each element against the -- my analysis of the products.

And as before, if terms were construed by the court, I used that construction. And if not, I used the

plain and ordinary meaning.

Q. So, Dr. Katona, your slide 38 addresses the representative product stipulation.

So how did you group the products for your analysis today?

A. So similar to the other ones, my understanding is that the parties agreed on sort of structural groupings, and into two families, and we'll discuss them or I've grouped them here as recessed retrofit products and performance downlight products.

Q. For the recessed retrofit products, based on your analysis of the evidence, what 3D CAD model and sample did you select as representative of those two families in the stipulation?

A. Yeah. So the recessed retrofit products encompass what's shown here as both recessed retrofit and field-adjustable recessed retrofit. And the representative CAD file that was used for those, again, for structural purposes was CPX-0485C.

Q. Which production number did you identify as representative of those two different product families in the stipulation?

A. The production number was CPX-0029.

Q. Which -- well, I'll just ask: Are you offering opinions on all of the SKUs in the recessed retrofit

families?

A. No. For the recessed retrofit, it's the ones that begin with SKU number R4 and R6, and do not have the letters FA in the SKU.

And for the field-adjustable recessed retrofits, it's the ones with, similarly, SKU numbers that begin with R4 and R6, with the letters FA in the SKU.

Q. Okay. And then combining those two together, are you offering opinions on all the R4 and R6 products today?

A. Yes.

Q. What do you understand the difference between the field-adjustable and non-field-adjustable recessed retrofit products?

A. The field-adjustable recessed retrofit products have a switch on them that allows the user, presumably at the time of installation, to select the color temperature of white light that they would like for the product to emit.

Q. Dr. Katona, turning to the second category there, performance downlight products, what performance downlight products are you going to be opining on today and into tomorrow?

A. The field-adjustable performance downlight and performance downlight product families.

I'm specifically going to be speaking about the ones with SKU numbers that begin with C6R, and the representative CAD file that I used in the structural analysis of these is highlighted here as CPX-0487C.

MR. HAMSTRA: Mr. -- Jay, can you go forward to .41.

Q. So, Dr. Katona, let's start with the first element of Claim 10, a lighting device.

What opinion did you reach about the recessed retrofit in performance downlight products?

A. Yeah, I think they're both lighting devices. The photographs of the products are shown here. The CPX-0029 for the recessed retrofit, and from the front side, you can see the LEDs that are meant to light the room.

And the performance downlights on the right, the photograph, CPX-0002, again, you can clearly see the LEDs that are on front side to provide light.

Q. Turning to slide .42, element 10A recites a trim element.

First of all, Dr. Katona, what construction of trim element do you apply in your analysis?

A. I'm using the Court's construction of a structure that forms a flange wherein the flange is configured to abut against a mounting surface, and defines

the outward facing surface of the lighting device and is configured to be inserted into an opening of the mounting surface.

Q. Did you identify something in the recessed retrofit products that satisfied that construction?

A. Yes. So the kind of side view of the CAD file, CPX-0485C is shown here. It's very clear to see a structure that forms a flange. The flange being at the bottom.

That flange is configured to abut against a mounting surface. It defines the outward-facing surface of the lighting device, and the structure is figured to be inserted into an opening in the mounting surface.

So I think it does meet the construction of a trim element.

Q. Turning to slide .43, what conclusion did you draw about that element in the performance downlight products?

A. Similarly, that they look very similar. The CAD file here is CPX-0487C, and, again, there's a structure. It forms the flange. It's configured to be abutted against the mounting surface.

It defines that outward-facing surface of the lighting device, and as we can see, it is configured to be inserted into an opening in the mounting surface.

Q. Dr. Katona, turning to slide .44, in what condition is the trim element you identified when it is sold to customers?

A. It's ready to be inserted into the mounting surface.

Q. And the white and gray pieces shown in CPX-0029 and CPX-002, these photos here, under what circumstances would those be taken apart in normal operation?

A. I can't think of a reason in normal operation those would be taken apart.

Q. Dr. Katona, what do you understand RAB's dispute to be with your identification of a multi-piece trim element?

A. My understanding is RAB's contention is that trim element need to be a unitary -- needs to be a unitary structure.

Q. What is your response to that, Dr. Katona?

A. I don't agree with that. I don't read anything in the Court's construction, first, that would call -- that it needs to be a unitary structure, and the patent itself -- so there's a image from the patent, JX-0003, shown here, with two different claims in which the inventors differentiated Claim 10, which we're speaking about today, from claim 12, which specifically calls out a unitary structured trim element.

Q. So, Dr. Katona, turning to slide .46, what do you understand RAB's dispute to be with your identification of a trim element that includes a housing for the driver?

A. My understanding is they dispute that the trim element includes any of the driver.

Q. What is your response, Dr. Katona?

A. Well, my response is that the specification itself in the patent -- the '449 Patent specifically says that in some embodiments, the trim element can comprise at least one chamber, which means that it can comprise more than one chamber, and specifically calls out that it can accommodate a variety of driver modules or power supply modules, so it's addressed in the specification itself.

Q. My apologies.

Dr. Katona, turning to slide .47, what's the next element of Claim 10, the '449 Patent?

A. The next element is that there's an electrical connector.

Q. Could you identify such an electrical connector in the accused products?

A. Yes, both in the recessed retrofit products on the left, the blue arrow showing to a place where the orange connectors exists providing electrical connection, and in the performance downlight products on the right, you can see the conduit that runs into the downlight providing

the electrical connection.

Q. Dr. Katona, turning to your slide .48, what's the next element of Claim 10?

A. The next element is at least a first driver component.

Q. Were you able to -- well, first of all, what construction or interpretation of that term did you apply in your analysis?

A. Yes. I used the Court's construction for this, which is any component that is a part -- so that is part of the driver, and is involved in performing the functions of the driver.

Q. What did you conclude about whether the accused products do, in fact, include at least the first driver component?

A. They most certainly do.

We've got photographs of the recessed retrofit family of products on the left, CPX-0029, and you can see the circuit board with a variety of components that are part -- at least part of the driver.

And the performance downlight product is on the right, the photograph CPX-0002. In this case, the trim element is cracked open so you can see the -- at least the first driver component inside there with the circuit board and the components.

Q. How did you determine that these circuit boards and their components are involved in performing the functions of a driver?

A. In both cases, there's -- the input to these devices is an AC signal. So all of the -- really, all the driver is happening inside here, not just a single component even.

Q. Dr. Katona, turning to your slide .49, what's the next element, 10D, of Claim 10?

A. At least one solid-state light emitter.

Q. What conclusion did you draw about the accused products and this element?

A. Yeah, this one is quite easy. The photographs here, both on the left, CPX-0029 of the front side of the lighting device show the LED or at least one solid-state emitter, and similarly on the right, the performance downlight, CPX-0002, the LEDs or at least one solid-state light emitter are clearly visible.

Q. So, Dr. Katona, turning to your slide .50, what is the next element of Claim 10 of the '449 Patent?

A. The next element is the lighting device weighing less than 750 grams.

Q. How did you connect -- conduct your analysis of this element with respect to the accused products?

A. So this was done analyzing a spreadsheet

supplied by RAB. It's listed as JPX-0143C, and then in this case, what's being shown here is, first, a sort was performed on the products that have -- that start with R4, and R6 SKUs, and then they're listed -- the weight of each of the fixtures is listed on the right column from lowest to highest, and you can see that for all of these SKUs, they do, indeed, weigh far less than 750 grams.

Q. And what conclusion did you draw about this element weighing less than 750 grams in the performance downlight products?

A. For the performance downlight products, similarly, looking at the spreadsheets supplied by RAB, JPX-0143C, these were -- all of the 6-inch downlight products were sorted by the SKUs that start with C6R, and then, again, from lowest to highest weight. And all of the C6R SKUs weigh less than 750 grams.

Q. So, Dr. Katona, what did you conclude about whether the -- all of the recessed retrofit products and the 6-inch performance downlight products satisfy the element of the lighting device weighing less than 750 grams?

A. That they, in fact, do.

MR. HAMSTRA: Your Honor, yes.

JUDGE CHENEY: We have reached the end of the hearing day.

So, Dr. Katona, I'll remind you that you shouldn't discuss your testimony with anyone until you return to the stand tomorrow morning.

THE WITNESS: Okay. Understood.

JUDGE CHENEY: You can step down while I discuss things with the attorneys.

THE WITNESS: Thank you, Your Honor.

JUDGE CHENEY: Thank you, Dr. Katona.

Are there any housekeeping matters that we should talk about before we end the hearing day?

First, from the Complainant, Cree.

MR. ERWINE: Nothing from Cree Lighting, Your Honor.

JUDGE CHENEY: Okay. And from the Respondent, RAB?

MR. ROUSH: Nothing from RAB Lighting, Your Honor.

JUDGE CHENEY: Let's talk a little bit about the time estimates and how we're doing on our schedule. I received an updated schedule.

I appreciate that. It looks like we're still running behind. Are we going to make it up? How are we going to deal with this?

Let me hear from Cree.

How much time is left with Dr. Katona?

MR. ERWINE: I was going to ask my colleague, Mr. Hamstra, but I think it's about 20 minutes on direct examination, Your Honor.

JUDGE CHENEY: Okay. I see that we have 20 minutes for RAB on cross, and then we were supposed to start Mr. Barna.

So we're almost an hour behind schedule. That's what I'm hearing. So how are we going to make it up?

MR. ERWINE: So, Your Honor, I think, first of all, in terms of our timing, even with the current estimates, we would still be finishing early in the afternoon on Friday. So I think there's some wiggle room there.

JUDGE CHENEY: Okay.

RAB, anything to add to that?

MR. ROUSH: I agree with Mr. Erwine, Your Honor.

JUDGE CHENEY: Okay. Do be mindful because we're closing the record on this one on Friday. We're not going to go into the next week.

I'll keep reminding you as we go along.

Let me just say that everyone's doing a really excellent job. I'm learning a lot. I'm looking forward to hearing the defense case starting tomorrow.

I hope you all are able to get some rest, continue to take care of your health, especially in this

time of pandemic. I don't want anyone getting sick because their immune system is worn out.

So do take care, and we're off the record for the evening.

(Whereupon, the proceedings were adjourned at 4:34 p.m.)

I N D E X

E X H I B I T S

EXHIBIT NO:	RECEIVED
*Lists Provided by Counsel to be received in Evidence	
CDX-0004C	
CDX-0008	
CPX-1030C	
CX-0208C	
CX-0209C	
CX-0210C	
CX-0211C	
CX-0212C	

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JPX-0101C
JPX-0109C
JPX-0110C
JPX-0113C
JPX-0115C
JPX-0117C
JPX-0118C
JPX-0119C
JPX-0120C
JPX-0121C
JX-0001
JX-0002
JX-0003
JX-0004

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JX-0062C
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CERTIFICATE OF REPORTER

TITLE: Certain Light-Emitting Diode Products, Fixtures, and Components Thereof

INVESTIGATION NO: 337-TA-1213

HEARING DATE: May 4, 2021

LOCATION: Washington, D.C. - Remote

NATURE OF HEARING: Evidentiary Hearing

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Date: May 4, 2021

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