

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4
5 MOBILEYE GLOBAL, INC.,

6 Petitioner,

7 v.

8 FACET TECHNOLOGY CORP.,

9 Patent Owner.

10
11 Inter Partes Review No. IPR2024-01110

12 U.S. Patent No. 9,335,255

13
14 ORAL DEPOSITION of CHARLES E. THORPE, PH.D.

15 (VIA ZOOM VIDEOCONFERENCE)

16 Tuesday, October 14, 2025

17 9:31 a.m. CST

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19
20
21
22 Job No.: 603331

23 Pages: 1 - 49

24 Reported By: Linda Russell

1 Remote Oral Deposition of CHARLES E.
2 THORPE, PH.D. produced as a witness at the
3 instance of the Patent Owner, and duly sworn, was
4 taken in the above-styled and numbered cause on
5 October 14, 2025, from 9:31 a.m. to 11:11 a.m.,
6 before Linda Russell, CSR in and for the State of
7 Texas, recorded by machine shorthand, via Zoom
8 Videoconference pursuant to 37 C.F.R. 42.53 and
9 any provisions stated on the record or attached
10 hereto.

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A P P E A R A N C E S

ON BEHALF OF PETITIONER MOBILEYE GLOBAL, INC.:

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ALSO PRESENT:

Frantz Clervil, Zoom Technician

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I N D E X

Page

CHARLES E. THORPE, PH.D.

BY MR. SAUNDERS

5

EXHIBITS MARKED

No.

Description

Page

(None marked)

1 P-R-O-C-E-E-D-I-N-G-S

2 THE COURT REPORTER: I am Linda Russell,
3 Court Reporter representing Planet Depos. We are
4 going on the record at 9:31 a.m.

5 CHARLES E. THORPE, PH.D.,
6 having been first duly sworn, testified as
7 follows:

8 EXAMINATION

9 BY MR. SAUNDERS:

10 Q Good morning, Dr. Thorpe. Can you state
11 your full name for the record.

12 A Charles E. Thorpe.

13 Q And you're appearing today for this
14 deposition via Zoom; is that correct?

15 A That is correct.

16 Q And do you understand that the -- we're
17 going to do two depositions today, but the first
18 one right now is IPR2024-01110 relating to
19 U.S. Patent No. 9,335,255?

20 A That is correct.

21 Q And you've been deposed before in this
22 IPR, correct?

23 A By you.

24 Q And you remember I went over some ground
25 rules last time with you?

1 A Yes.

2 Q So I'll just abbreviate that a little bit,
3 but...

4 If you don't understand any of my
5 questions today, will you agree to ask for
6 clarification?

7 A I will.

8 Q And is there any reason why you cannot
9 provide truthful and complete testimony today?

10 A There is no reason I cannot provide
11 truthful and complete testimony.

12 Q Is there -- where are you physically
13 located right now?

14 A I'm physically located in my home office
15 in Potsdam, New York.

16 Q Is there anyone at home with you right
17 now?

18 A My wife is home. I have closed the door
19 to the office.

20 Q Since I'm not in the room there with you,
21 will you agree that you won't communicate with
22 anyone secretly while you're on the record?

23 A I will not communicate with anyone
24 secretly while I'm on the record.

25 Q And did you mention you have physical

1 papers with you today?

2 A I do. Counsel has provided me with a
3 physical binder that includes -- let me list
4 them -- my Supplemental Declaration, the
5 '255 Patent, the Gallagher Patent, the Lumia
6 Patent, my Original Declaration, Professor
7 Papanikolopoulos's Declaration, and the Patent
8 Owner Response.

9 Q And are all those clean copies with no
10 markups?

11 A These are all clean copies. Anything that
12 had markup is gone from this office.

13 Q And are you able to access the
14 exhibit share link on your computer?

15 A Yes.

16 Q And do you see in the exhibit share
17 Exhibits 1001, 1005, 1014, 1030, and 2023?

18 A The titles are truncated, but I believe
19 those are the correct ones.

20 Q If you're having trouble seeing the
21 titles, I think there's a little icon with three
22 horizontal bars you can click on that might show
23 you the full names, or most of the names.

24 A There you go. 1110 -- oh. Exhibit 1001,
25 1005, 1014, 1030, 2023.

1 Q And today you understand if I'm referring
2 to an exhibit I've uploaded, you can look at the
3 uploaded version or you can look at the paper
4 version, however you prefer, in answering my
5 question; do you understand?

6 A Thank you.

7 Q Okay. And do you understand today that
8 we're going to ask some questions about
9 Exhibit 1030, which is your Supplemental
10 Declaration you submitted in this IPR?

11 A Yes.

12 Q Okay. Why don't we start with -- why
13 don't we start with paragraph 28 of your -- of
14 your Supplemental Declaration.

15 ZOOM TECHNICIAN: Stand by, Counsel, and I
16 will also put that on the screen for you.

17 A Paragraph 28, "The construction proposed
18 by Patent Owner and Dr. Papanikolopoulos"?

19 BY MR. SAUNDERS:

20 Q Yeah.

21 And do you see in paragraph 28 you say,
22 let's see, I believe the first sentence there, "a
23 person of ordinary skill in the art would
24 understand the term" -- sorry, let me withdraw.
25 Let me see where I am.

1 A By the way, do give my greetings to
2 Dr. Papanikolopoulos. I knew him when he was a
3 graduate student.

4 Q Thank you.

5 All right. Sorry there. Do you see the
6 first sentence of paragraph 28 says, "The
7 construction proposed by Patent Owner and
8 Dr. Papanikolopoulos lacks context for relating
9 the characterization profile to determining a
10 luminance value"? Do you see that?

11 A I see that.

12 Q Okay. So is it your opinion that a
13 characterization profile includes any way of
14 converting light intensity values to luminance
15 values?

16 MR. HIGH: Objection. Form.

17 A In my paragraph 26, I say, "The
18 construction for characterization profile that
19 Patent Owner and Dr. Papanikolopoulos put forward
20 is not consistent with how a person of ordinary
21 skill in the art would have read that term."

22 "Concept of 'sensor characterization' is
23 very broad and does not require all of the
24 elements in the construction proposed by Patent
25 Owner and Dr. Papanikolopoulos."

1 BY MR. SAUNDERS:

2 Q Okay. So I'm trying to understand. You
3 believe that Patent Owner and
4 Dr. Papanikolopoulos' construction is too narrow;
5 is that right?

6 A I don't believe I opine on too narrow or
7 too broad, simply that the term "characterization
8 profile" is a vague term that admits a variety of
9 different interpretations.

10 Q Well, you say, "The concept of 'sensor
11 characterization' is very broad and does not
12 require all of the elements in the construction
13 proposed by Patent Owner and
14 Dr. Papanikolopoulos." You say that in
15 paragraph 26, right?

16 A Yes.

17 Q Okay. So what are the elements that
18 you're referring to in that sentence?

19 A In the general case or in the context of
20 this particular application?

21 Q Well, in the -- yeah, in the context of
22 this -- the meaning of this particular term in
23 this '255 Patent.

24 A In my paragraph 27, I say, "A person of
25 ordinary skill in the art would not understand a

1 'characterization profile' to require 'a
2 compilation, presented in a usable format, of the
3 description of the properties and performance
4 characteristics of a sensor across various
5 conditions.' This vague definition does not
6 consider the context in which the term
7 'characterization profile' is used in the
8 '255 Patent."

9 Q Okay. So that's one aspect that you
10 disagree with the construction. Anything else?

11 A "A 'characterization profile' also does
12 not require a description of the sensor
13 characteristics across various conditions.
14 Nothing in the language of claim 15 or the
15 specification of the '255 Patent supports limiting
16 claim 15 to require a luminance value across
17 various conditions."

18 Q Okay. Anything else that you disagree
19 with their construction on?

20 A Keep going down through paragraph 28.

21 Q Does 28 discuss another aspect of the
22 construction you disagree with?

23 A "A person of ordinary skill in the art
24 would understand the term 'characterization
25 profile' is used in the context of converting from

1 light intensity values to luminance values. In my
2 opinion, the Board's preliminary construction is
3 consistent with the opinion in my initial
4 declaration that Lumia teaches determining a
5 luminance value utilizing a characterization
6 profile of the light intensity sensor."

7 If we turn and look at the Lumia patent --
8 sorry, the Lumia exhibit, it is not a patent.

9 The first main point is that Lumia's
10 Equation 2 clearly shows the relationship between
11 retroreflectance and luminance. And that is a
12 simple matter of algebra, given the value of the
13 normal illumination, which Lumia shows carefully
14 how to calculate.

15 The second place I would draw your
16 attention to is on page 15 talking about one
17 example of the calibration that Lumia performs.
18 This one example happens to be for white, although
19 Lumia clearly discloses different colors such as
20 his stop sign that has both red and white. His
21 method for calibrating the system is comparing
22 what his video camera sees with the ground truth
23 from the handheld retroreflectometer.

24 He then points to Figure 11(a) showing the
25 very good linear correlation between the values as

1 sensed by his calibrated sensor and the values
2 sensed by the handheld reflectometer.

3 So Lumia for the purposes of his task
4 clearly has calibrated his sensor so he can
5 measure both retroreflectance and can then easily
6 calculate luminance.

7 MR. SAUNDERS: I'll object as
8 nonresponsive.

9 BY MR. SAUNDERS:

10 Q Dr. Thorpe, I don't believe my question
11 was asking about Lumia. So let me ask this
12 question. You reference in paragraph 28 the
13 Board's preliminary construction. Are you opining
14 that that is the correct construction of
15 "characterization profile"?

16 A I am agreeing with the Board's preliminary
17 construction.

18 Q And other than converting a luminance
19 value to a light intensity value, do you
20 understand the Board's constructions requiring
21 anything else of something to be a
22 characterization profile in the context of the
23 '255 Patent?

24 MR. HIGH: Objection. Form.

25 A I do not have the exact wording of the

1 Board's decision in front of me.

2 MR. SAUNDERS: I could upload that, if you
3 give me a second.

4 ZOOM TECHNICIAN: So you want to introduce
5 a new exhibit; is that correct?

6 MR. SAUNDERS: It's a previously marked
7 paper in this case. I will not -- I don't think
8 we need to treat it as an exhibit.

9 One second.

10 All right.

11 A I found the phrase quoted in my
12 paragraph 25. "A conversion factor to convert
13 measured light intensity into luminance." And I
14 agree with the Board's preliminary construction.
15 And my answer that you thought was nonresponsive
16 referring to Lumia was illustrating that this is
17 how Lumia does it.

18 BY MR. SAUNDERS:

19 Q So what is your understanding of the
20 phrase "a conversion factor," then?

21 A I don't think I have opined on what the
22 Board means by that.

23 Q Do you opine that Lumia satisfies the
24 Board's construction?

25 A I do.

1 Q Okay. Then when you were performing that
2 analysis, what did you understand "conversion
3 factor" to mean?

4 MR. HIGH: Objection. Form. Scope.

5 A Lumia calculates -- demonstrates a method
6 to convert the gray levels from his image to
7 retroreflectance and thence, if desired, to
8 luminance. Lumia's method turns out to be a
9 linear scale factor calibrated for one particular
10 color. Of course for different colors you would
11 need a different scale factor.

12 BY MR. SAUNDERS:

13 Q So you're not opining that
14 characterization profile -- sorry. Withdraw it.

15 You're not opining that conversion factor
16 requires a linear conversion factor; is that
17 right?

18 A "Conversion factor" seems to be plain in
19 its meaning without me interpreting it.

20 Q So is it -- let me ask the question this
21 way. If -- why don't you go to claim 15 of the
22 '255 Patent. Let me know when you're there.

23 A I'm there.

24 Q And do you see it says, "determining a
25 luminance value utilizing the plurality of light

1 intensity values and a characterization profile of
2 the at least one light intensity sensor"?

3 A Yes.

4 Q Well, what is -- let me start this way.
5 If the claim already recites "determining a
6 luminance value utilizing the plurality of light
7 intensity values," what is being further
8 restricted by the remainder of the language in
9 claim 15 as you interpret it?

10 MR. HIGH: Objection. Form.

11 A Where in the patent is characterization
12 profile described?

13 BY MR. SAUNDERS:

14 Q I think you talk about that in your
15 declaration.

16 A I do.

17 So, again, in my paragraph 25,
18 Dr. Papanikolopoulos has a particular definition
19 of "characterization profile," and I am agreeing
20 with the Board's construction that it is a
21 conversion factor. And I'm illustrating, in the
22 case of Lumia, that it's a fairly simple -- it can
23 be a fairly simple conversion factor.

24 Q Maybe let me frame the question this way,
25 then. Looking at claim 15 that already recites

1 "determining a luminance value utilizing the
2 plurality of light intensity values," how is the
3 language "a conversion factor" making that any
4 narrower? Is there some scenario that that is now
5 excluding that would not be excluded by just the
6 language "determining a luminance value utilizing
7 the plurality of light intensity values"?

8 MR. HIGH: Objection. Form.

9 A The question is what is your construction
10 for what the characterization profile must be, and
11 in my document paragraphs 25, 26, 27, 28, 29, 30,
12 and 31 are all disputing Professor
13 Papanikolopoulos' complex definition of
14 "characterization profile" and agreeing with the
15 Board's preliminary construction.

16 BY MR. SAUNDERS:

17 Q Let me ask the question this way. Can you
18 image anything that would be determining a
19 luminance value utilizing the plurality of light
20 intensity values that does not satisfy the Board's
21 construction of a conversion factor to convert
22 measured light intensity into luminance?

23 MR. HIGH: Objection. Form.

24 A That's a big hypothetical question, can I
25 image any way where this would not work using the

1 Board's construction.

2 BY MR. SAUNDERS:

3 Q No, it's -- let me clarify. You know,
4 there's multiple language in this claim 15,
5 correct? Do you understand that?

6 A Well, "determining a luminance value,"
7 that is plain. "Utilizing the plurality of light
8 intensity values," that is plain. "At least one
9 light intensity sensor," that is plain. I believe
10 what we're discussing is what is the
11 characterization profile.

12 Q Yeah, so if the claim already recites
13 "determining a luminance value utilizing the
14 plurality of light intensity values," is that
15 being in any way restricted? Is there some
16 scenario that you can imagine being encompassed by
17 that language that would then not be encompassed
18 by the phrase "a conversion factor to convert
19 measured light intensity into luminance"?

20 MR. HIGH: Objection. Form.

21 A The Board has agreed that the
22 characterization profile can be -- is -- means a
23 conversion factor. I am agreeing with the Board.

24 BY MR. SAUNDERS:

25 Q I understand that. And now to clarify,

1 that's the Board's -- you understand that's the
2 Board's preliminary construction, which the Board
3 can change, correct?

4 A I understand. I'm agreeing with the
5 Board's preliminary construction and I'm offering
6 Lumia's method as evidence that the Board got it
7 right.

8 Q And when you were reaching your conclusion
9 as to the appropriate construction of
10 "characterization profile," did you look at the
11 remainder of the language in claim 15?

12 A Remainder of the language meaning?

13 Q All of the words in claim 15 other than
14 "characterization profile."

15 A "Determining a luminance value utilizing
16 the plurality of light intensity values of at
17 least one light intensity sensor." In my opinion,
18 Lumia demonstrates that method with the simpler
19 version of the "characterization profile" as
20 agreed to by the Board.

21 Q So sitting here today you can't think of a
22 scenario that would involve determining a
23 luminance value utilizing the plurality of light
24 intensity values that would not require a
25 conversion factor to convert measured light

1 intensity into luminance; is that correct?

2 MR. HIGH: Objection. Form.

3 A Can you give me an example?

4 BY MR. SAUNDERS:

5 Q Well, that's why I'm trying to ask you.

6 To me, it seems like this construction is
7 synonymous with the other language in the claim of
8 "determining a luminance value utilizing the
9 plurality of light intensity values," and I'm
10 trying to understand if you agree or disagree with
11 that.

12 MR. HIGH: Objection. Form.

13 A I don't think we're disagreeing about
14 "determining a luminance value based on the
15 plurality of light intensity values." I think our
16 disagreement is only over the definition of
17 "characterization profile."

18 BY MR. SAUNDERS:

19 Q And what I'm trying to figure out is, is
20 as you've interpreted a characterization profile,
21 is that actually restricting the claim in a way
22 that there are methods of determining a luminance
23 value utilizing the plurality of light intensity
24 values that is not covered by your interpretation
25 of "characterization profile"?

1 MR. HIGH: Objection. Form.

2 A If you look at Lumia, page 7. Let me know
3 when you're there.

4 BY MR. SAUNDERS:

5 Q Yeah, do you mean the page 7 as the
6 original pagination or the page 7 that was added
7 by counsel?

8 A The added by counsel. I believe that's
9 what we agreed to last time.

10 Q All right. I am there.

11 A Equation Number 2, retroreflectance is
12 luminance divided by normal illumination.

13 THE WITNESS: Thank you.

14 ZOOM TECHNICIAN: You're welcome.

15 BY MR. SAUNDERS:

16 Q Is your answer complete?

17 A Luminance is proportional to the
18 brightness sensed, given a couple of caveats that
19 I will get to. So the luminance is related by a
20 conversion factor from light intensity to
21 luminance.

22 One of those caveats that I said I would
23 get to, if you'd turn to page 9 of Lumia, the top
24 paragraph.

25 ZOOM TECHNICIAN: Stand by.

1 MR. SAUNDERS: Okay.

2 THE WITNESS: Thank you.

3 A Notice he's very careful in his
4 description of the particular sensor he's using.
5 Notice he's done things like turn off the
6 automatic gain control so that his camera has a
7 fixed response to a given brightness. And notice
8 that last sentence, "A color conversion filter to
9 correct the spectral distribution of the flash,
10 and a filter to correct the camera response to a
11 photopic behavior."

12 Luminance is really described not in terms
13 of raw sensed brightness but it's described in
14 terms of the human visual system, and that's what
15 this filter for photopic behavior is about.

16 THE WITNESS: While we're in Lumia, can
17 you back up one page?

18 ZOOM TECHNICIAN: Stand by.

19 A Notice there Lumia is taking an image of a
20 stop sign. The stop sign clearly has two
21 different colors, a sign background, which would
22 be red, and a sign legend, which would be white.
23 Since those are two different colors and since
24 this is a black-and-white camera, there have to be
25 two different conversion factors for the two

1 different colors. That is not hard to implement.
2 Lumia demonstrates calculating that conversion
3 factor for one color, but that is simply an
4 experimental result. The teaching is clear that
5 you can do this for multiple colors for -- for
6 pieces like this.

7 Furthermore, your expert witness -- in my
8 paragraph 31 -- argues that it would be
9 impractical to create a separate conversion factor
10 for all different colors of the spectrum. That is
11 a red herring. Nobody here is talking about
12 sensing all different colors of the spectrum,
13 we're talking about sensing a handful of colors
14 that are commonly found on retroreflective signs
15 and retroreflective pavement markers. So having a
16 handful of what the Board describes as conversion
17 factors, one for each color, is clearly the way
18 that a person of ordinary skill in the art could
19 implement this.

20 MR. SAUNDERS: And I'll object as
21 nonresponsive.

22 BY MR. SAUNDERS:

23 Q Let's move on to paragraph 29 of your
24 declaration, and -- let's see.

25 So do you see paragraph 29 of your

1 Supplemental Declaration there's a sentence that
2 starts on page 12 and then continues on to page 13
3 that says, "The LUT 475 is not a conversion
4 factor, but rather is created using light
5 intensity sensor characterization 275," do you see
6 that?

7 A I see that.

8 Q So in your opinion, LUT 475 is not a
9 characterization profile; is that correct?

10 A If you turn to the patent and Figure 7 on
11 page 10 of the patent, the Intensity Sensor
12 Characterization is an input to the Look-Up-Table.
13 The two of them are not identical.

14 THE WITNESS: I'm on page 10 of the
15 patent. No, not of --

16 MR. SAUNDERS: I apologize for
17 interrupting.

18 Mr. Clervil, could you take the screen
19 share down unless either Michael or the
20 witness request it? I find it a little
21 distracting.

22 ZOOM TECHNICIAN: Apologize, Counsel.

23 MR. SAUNDERS: Yeah, I'm fine with that.

24 A So do you see what I'm looking at on
25 Figure 7?

1 BY MR. SAUNDERS:

2 Q Yes.

3 A There is an Intensity Sensor
4 Characterization, which is one input into the
5 Look-Up-Table.

6 Q And so what is your understanding of what
7 Intensity Sensor Characterization 257 is?

8 MR. HIGH: Objection. Form.

9 A Well, that's what we've been talking
10 about, how complicated does that have to be.

11 BY MR. SAUNDERS:

12 Q So you say in your next sentence of
13 paragraph 29, "In other words, the LUT 475
14 digitally stores values resulting from converting
15 light intensity values to corresponding luminance
16 values for a given color based on, for example,
17 conversion factors." Do you see that?

18 A I see that.

19 Q Okay. So where is the -- when you say the
20 light intensity values, is that, for example, 470
21 and 480 in Figure 7?

22 A Those are labeled as intensity.

23 Q And you think that those get converted
24 into a luminance value and then stored in LUT 475?

25 MR. HIGH: Objection. Form.

1 A The Luminance value 500 is an output from
2 this process.

3 BY MR. SAUNDERS:

4 Q In that sentence there you say "stores
5 values resulting from converting light intensity
6 values to corresponding luminance values." Do you
7 see that?

8 A Yes.

9 Q So is LUT 475 storing 500 and 510 in
10 Figure 7?

11 MR. HIGH: Objection. Form.

12 A No. I am describing the process by which
13 I believe the look-up-table is built.

14 BY MR. SAUNDERS:

15 Q So the look-up-table gets input in
16 intensity sensor characterization as part of being
17 built; is that right?

18 A That is my understanding.

19 Q And is it your opinion that there's a
20 separate intensity sensor characterization for
21 each different potential color of a sign?

22 A "Uses the indexes of intensity and
23 sheeting color to determine the luminance."

24 "Built out for the relevant intensity and
25 color values."

1 So my understanding is this is where the
2 different conversion factors for the different
3 colors would have to be stored.

4 Q So how does Intensity Sensor
5 Characterization 275, how is that used to build up
6 different conversion factors for different colors?

7 MR. HIGH: Objection. Form.

8 A Can you point me to where in the patent
9 that process is described?

10 BY MR. SAUNDERS:

11 Q I think you have a cite in your
12 paragraph 29 to column 11, around line 53.

13 A Thank you. "The look-up-table shown in
14 Figure 7 is a digital table stored in memory that
15 uses the indices of intensity (a single gray level
16 value from the intensity measurement 300) and
17 sheeting color to determine the luminance. The
18 light intensity sensor characterization is
19 empirical information about the light intensity
20 sensor that is used to create the look-up-table."

21 So, that is a little bit vague. It says
22 it's empirical information. It is not detailed
23 enough that I would want to specify what algorithm
24 is used.

25 Q So in your view, does LUT 475 store

1 multiple different characterization profiles?

2 MR. HIGH: Objection. Form.

3 A In my view, the look-up-table is
4 constructed from a different intensity sensor
5 characterization for each color.

6 BY MR. SAUNDERS:

7 Q Okay. Let's go to paragraph 30 of your
8 Supplemental Declaration. Let me know when you're
9 there.

10 A I am there.

11 Q Do you see it says, "Claim 15 says nothing
12 about multiple conditions. The only sensor
13 claimed is a light intensity sensor." And then
14 you go on and say, "In the embodiment of the
15 '255 Patent that Patent Owner and
16 Dr. Papanikolopoulos point to, the light sensor is
17 a black-and-white camera, which lacks the ability
18 to determine colors." Do you see that?

19 A I see that.

20 Q And then you go on and you say, "While the
21 '255 Patent discloses embodiments that factor in
22 the color of a road sign, those embodiments rely
23 on components not claimed in claim 15, such as the
24 color image capture system." Do you see that?

25 A I see that.

1 Q I'm a little confused, because we just
2 talked about you have opinions about LUT 475, and
3 we're talking about colors, but now you're in
4 paragraph 30 and you're saying that claim 15 --
5 you know, you're emphasizing that it doesn't
6 require the ability to determine color.

7 So, is -- in your view, is there a
8 connection in claim 15's characterization profile
9 and the LUT 475 of the specification of the
10 '255 Patent or not?

11 MR. HIGH: Objection. Form.

12 A What I am saying is in Figure 7 the
13 background sheeting color and the foreground
14 sheeting color are inputs to the intensity LUT and
15 nowhere in claim 15 does it discuss those inputs.
16 Since claim 15 is using a black-and-white camera,
17 those inputs must come from someplace else in the
18 patent not referenced in claim 15.

19 BY MR. SAUNDERS:

20 Q You'd agree with me you can calibrate a
21 black-and-white camera for converting an intensity
22 value to a luminance value based on the color of a
23 sign without that camera itself being able to
24 determine the color of a sign, right?

25 MR. HIGH: Objection. Form.

1 A Lumia uses a black-and-white camera and
2 clearly has a conversion factor for red and a
3 separate conversion factor for white.

4 BY MR. SAUNDERS:

5 Q All right. I guess I'll have to ask the
6 question. Why do you believe that Lumia has a
7 separate conversion factor for red and white?

8 A Two reasons. One reason is in his
9 Figure 3(a) and 3(b) -- this is the stop sign and
10 the histogram of the stop sign -- the perceived
11 brightness is different on the red than on the
12 white.

13 The other reason is basic physics, that
14 the different colors will be sensed differently by
15 the same black-and-white sensor.

16 Q When you're referring to conversion
17 factors in Lumia, are you referring to the same
18 thing that Lumia is talking about on page 15 in
19 the Experimental Results section when it refers to
20 a scale factor?

21 MR. HIGH: Objection. Form.

22 A Where in particular do you see "scale
23 factor"?

24 BY MR. SAUNDERS:

25 Q So under the Experimental Results heading,

1 I think it's the -- one, two -- the third sentence
2 starting with, "Calibration of the system."

3 A Very good. "Scale factor." And that's
4 what Lumia is illustrating in Figure 11(a), is
5 that a single scale factor for his system is
6 sufficient.

7 Q Okay. So you're saying a single scale
8 factor for his system is sufficient, but is there
9 somewhere where he's disclosing more than one
10 scale factor?

11 A His Experimental Results, he's doing this
12 for a white background simply to determine, first
13 of all, a scale factor and, secondly, determine
14 whether it is indeed representable as a single
15 linear scale factor.

16 Since the purpose of Lumia is to look at
17 different color of signs, a person of ordinary
18 skill in the art would easily understand that a
19 different scale factor is required for different
20 colors.

21 Q Do you understand the Experimental Results
22 section that results are depicted in Figures 11(a)
23 and 11(b) of Lumia, do you understand those as
24 only being testing of a single sign?

25 A He says under "Experimental Results,"

1 "Sixteen image samples were obtained for each sign
2 using an observation angle of 0.2 degrees and a
3 distance of 200 feet. The same signs [...],"
4 plural.

5 My understanding of 11(a) is that each of
6 those squares corresponds to the average of a
7 number of measurements of one sign, and he is
8 using signs of different retroreflectance to
9 establish his range and to establish the slope of
10 his line.

11 Q Do you understand Figures 11(a) and 11(b)
12 of Lumia as just testing -- testing plain white
13 sheets or do you understand them as testing actual
14 traffic signs?

15 MR. HIGH: Objection. Form.

16 A Again, reading: Obtaining an image of a
17 calibrated white sheeting material, samples for
18 each sign, the same signs.

19 So Lumia is talking about measuring signs
20 and he's talking about calibrated white sheeting
21 material.

22 BY MR. SAUNDERS:

23 Q Well, I'll read a few parts of Lumia to
24 you and I'll tell you how I interpret it and then
25 I'm going to ask you whether you disagree with me.

1 All right?

2 A Okay.

3 Q So looking under the Experimental Results
4 section of Lumia, I see that he says there's ten
5 signs in his first sentence. I see in his second
6 sentence that he says the signs had a white
7 background color with background R-prime
8 retroreflectivity values ranging from
9 approximately 4 to 350. To me, that says that
10 he's testing the system on a variety of real
11 traffic signs that have a white background color
12 but may have a variety of different foreground
13 colors. Do you agree or disagree with that
14 interpretation?

15 A I don't believe he is specific. I don't
16 believe he is specific as to whether these are
17 actual signs with foreground and background or if
18 these are signs made up for the purposes of this
19 paper which are just uniform.

20 Q You'd agree with me, going back to
21 Figure 3(a) on page -- page 8 of 17, that's a real
22 stop sign, right?

23 A That is a real stop sign.

24 Q Okay. And going back to the Experimental
25 Results section on page 15 of 17, you would agree

1 with me that the -- when he's talking about
2 calibration of a system, he's referring to
3 calibrated white sheeting material rather than a
4 sign, right?

5 A That's the calibration of the system.

6 Q Now, how I interpret this Experimental
7 Results section of Lumia is that he is doing one
8 calibration procedure to create a scale factor
9 using calibrated white sheeting and then applying
10 that one scale factor to a variety of signs that
11 have real foreground and background colors, not
12 just uniform white signs. Do you agree or
13 disagree with that?

14 MR. HIGH: Objection. Form.

15 A I don't believe he's specific. He says
16 ten signs were measured without saying are those
17 real signs or are those made-up posters of a
18 uniform sign.

19 BY MR. SAUNDERS:

20 Q Is there somewhere in Lumia that tells one
21 of skill in the art how to choose among multiple
22 different scale factors?

23 MR. HIGH: Objection. Form.

24 A In my paragraph 33, "Patent Owner and
25 Dr. Papanikolopoulos argue that Lumia cannot teach

1 a characterization profile, as Lumia only
2 describes computing its scale factor with a
3 single-color sheeting material. I disagree.
4 Lumia contemplates the use of its system and
5 taking measurements for 'typical two-color signs'
6 that, when the system is properly calibrated, give
7 readouts for the average luminance values across
8 each corresponding color. These calculations can
9 then be used through Lumia's Equation 2 to
10 determine retroreflectance. Lumia even discusses
11 its approach through the use of a typical stop
12 sign, depicted in Figure 3(a)," et cetera.

13 BY MR. SAUNDERS:

14 Q So are you saying you understand Lumia to
15 disclose a different scale factor for a foreground
16 and background of a sign?

17 A I'm saying to a person of ordinary skill
18 in the art it is clear that you need a different
19 scale factor for each color. Since the foreground
20 and the background of the sign are different
21 colors, you need different scale factors.

22 Q Well, I'm going to give you another
23 interpretation of Lumia and ask whether you agree
24 it's plausible or not. How I interpret Lumia is
25 it's choosing to infer the overall

1 retroreflectivity of the sign in its current
2 condition based on the white background color
3 without separately testing the foreground color.

4 Do you believe that that is a plausible
5 interpretation of Lumia's disclosures?

6 MR. HIGH: Objection. Form.

7 A I do not believe that Lumia says that. I
8 believe that Lumia has clearly in Figure 3(b)
9 separated out the pixels referring to the sign
10 background and the pixels referring to the sign
11 legend. It is then straightforward to apply a
12 different factor for each of those and therefore
13 understand whether the sign background is degraded
14 and understand whether the sign legend is
15 degraded.

16 BY MR. SAUNDERS:

17 Q But you said one of skill in the art would
18 know you'd need a different conversion factor for
19 the red foreground sign versus a yellow foreground
20 sign; is that correct?

21 A That is correct.

22 Q Okay. And so Lumia would have to have
23 some way of recognizing whether the sign is a red
24 foreground and a yellow foreground and then
25 choosing the appropriate conversion factor; is

1 that right?

2 MR. HIGH: Objection. Form.

3 A "Recognizing" is two strong of a word.
4 Lumia would have to know for a particular sign
5 what that sign is, whether that comes from a
6 database or whether that comes from some other
7 means. I think --

8 BY MR. SAUNDERS:

9 Q It's not going to come from Lumia's
10 black-and-white camera, right?

11 A Will not come from the black-and-white
12 camera.

13 Q So does Lumia have a way of telling one of
14 skill in the art a system that can automatically
15 determine a retroreflectivity of a foreground
16 image of a sign by choosing among one of multiple
17 conversion factors automatically?

18 MR. HIGH: Objection. Form.

19 A I'm not sure that's relevant to the
20 teachings of Lumia.

21 MR. SAUNDERS: All right. We've been
22 going for about an hour. Can we go off the
23 record?

24 THE COURT REPORTER: Off the record.

25 (A break was taken from 10:31 a.m. to

1 10:42 a.m.)

2 THE COURT REPORTER: Back on the record at
3 10:42.

4 BY MR. SAUNDERS:

5 Q All right. Dr. Thorpe, can you go to
6 paragraph 37 of your Supplemental Declaration.

7 A Can I add one more thing before we do
8 that?

9 Q If you have a question you believe you
10 need to provide the rest of an answer to, that's
11 fine.

12 A Well, I have additional information, but
13 that can wait.

14 So we are on page 37.

15 Q Paragraph 37.

16 A Yes.

17 Q All right. And, let's see. Do you see
18 the beginning of that paragraph, it says, "Lumia's
19 Equation 2 describes how each variable of the
20 equation (specifically, luminance and
21 retroreflectivity) can be measured in the context
22 of a mobile system. Lumia's teachings directly
23 benefit Gallagher for determining luminance." Do
24 you see that?

25 A Yes, I see that.

1 Q And then you note, "Gallagher discloses
2 that its system determines road markers by
3 measuring reflectance levels (e.g., intensity
4 values) of the road markers." Do you see that?

5 A Yes.

6 Q What are the units for retroreflectivity
7 that Lumia's Equation 2 provides?

8 A We've gone through this before. We can
9 look up the definition of the units. And it
10 refers to the ASTM and I believe that is not
11 something on which I opined in my Supplemental
12 Declaration.

13 Q Well, what I'm trying to get at is you
14 have this statement in your Supplemental
15 Declaration about the relevance of Equation 2 to
16 Gallagher.

17 A Yes.

18 Q I'm trying to understand are they even
19 trying to measure the same kind of thing. And so
20 my question in getting to that is, first of all,
21 what are the units that Equation 2 gives you for
22 coefficient of retroreflection?

23 A They are both measuring retroreflection.
24 Whether one of them does it in CIL units and the
25 other one does it in different units, those are

1 just straightforward conversion factors between
2 two different systems. That is not a difficult
3 matter.

4 Q What is the straightforward conversion
5 between those two different systems?

6 A I'm not going to try to say that -- a
7 person of ordinary skill in the art would know how
8 to look that up.

9 Q Now, Lumia's system is directed towards
10 measuring retroreflectivity of traffic signs,
11 correct?

12 A The particular implementation of Lumia is
13 looking at signs and looking at multicolored
14 signs. He says, "For a typical two-color sign,
15 these groups are expected to represent sign legend
16 and background. The average value of each group
17 corresponds to the average luminance, when
18 properly calibrated. Assuming the illumination is
19 known, the retroreflectance is readily obtained
20 using Equation 2."

21 So he's talking right there on page 7
22 about using the general equations for calculating
23 retroreflectance either of sign foreground or of
24 sign background, doing both. Since he says
25 "properly calibrated," that is one of the places

1 where it must be a different calibration per
2 color.

3 If we take Lumia's teachings of how to
4 calibrate and then how to calculate, they are
5 directly applicable to Gallagher.

6 Q Now, Gallagher is measuring
7 retroreflectivity of raised pavement markers; is
8 that correct?

9 A Mischaracterization.

10 Q And why do you say that?

11 A The invention relates to reflectivity
12 measuring apparatus. More particularly, but not
13 exclusively, this invention relates to a method
14 and apparatus for assessing the integrity of road
15 markers and markings.

16 Gallagher is very clear that he is
17 detecting painted lines as well as taking -- as
18 measuring raised pavement markers.

19 Q Well, you agree with me in paragraph 33 of
20 Gallagher it says that, "The description of the
21 preferred embodiment of the invention will be
22 limited to raised pavement markers." Do you agree
23 with that?

24 A "For simplicity."

25 "However, it will be appreciated by those

1 skilled in the art that the apparatus can be
2 adapted to measure other types of reflective
3 markings on or adjacent the road."

4 Q And you'd agree with me that Gallagher is
5 measuring the retroreflectivity of raised pavement
6 markers in CIL?

7 A Can you point me where it says "CIL"?

8 Q Paragraph 67 of Gallagher.

9 A Very good. So he's using millicandela per
10 Lux, CIL.

11 Q And so how does one of skill in the art
12 using Equation 2 of Lumia measure a raised
13 pavement marker's retroreflectivity in CIL?

14 MR. HIGH: Objection. Form.

15 A The conversion between units is
16 straightforward. It requires looking things up in
17 tables that I don't have access to in the
18 documents in front of me. But Equation 2, it has
19 luminance, it has retroreflectivity, and has the
20 normal illumination. Gallagher has all of those.
21 Gallagher has a calibrated light sensor, he has a
22 known distance, he is measuring a brightness, he
23 is converting that into his retroreflectivity.

24 BY MR. SAUNDERS:

25 Q All right. Let's move down a little bit

1 further in paragraph 37. You have a sentence --
2 let's see. It's a pretty long sentence. It's the
3 sentence that begins on the top of page 18, but I
4 want to start asking you about the language I
5 guess on the fourth line. It says, "a person of
6 ordinary skill in the art would have understood
7 how to use the intensity values measured through
8 Gallagher's system to derive luminance and then
9 retroreflectivity values through Lumia's
10 Equation 2." Do you see that?

11 A I see that.

12 Q When I'm looking at Lumia's Equation 2, I
13 see three different parts of that equation: The
14 Coefficient of Retroreflection or prime R, dash,
15 L, luminance of reflected light, and En, which is
16 the normal illumination incident on the
17 retroreflector. Am I reading that right?

18 A Yes.

19 Q And so Lumia's Equation 2 let's you
20 calculate one of those three values if you know
21 the other two, right?

22 A Yes.

23 Q Okay. So if you want to calculate
24 luminance knowing -- with Equation Number 2 in
25 Lumia, you need to know the coefficient of

1 retroreflection, right?

2 MR. HIGH: Objection. Form.

3 A If you want to calculate L, you need to
4 know R-prime, and E.

5 BY MR. SAUNDERS:

6 Q And if you want --

7 A Gallagher knows those.

8 Q If you want to calculate R-prime, you need
9 to know luminance, if you want to calculate it
10 using Equation 2 in Lumia, right?

11 A If you need to go through that equation.

12 Q And so I don't understand when your
13 sentence says that a person skilled in the art
14 would have understood to use the intensity values
15 measured through Gallagher's system to derive
16 luminance and then retroreflectivity values
17 through Lumia's Equation 2, how are they going to
18 do that if deriving luminance requires you to
19 already know the coefficient of retroreflection if
20 you're using Lumia's Equation 2?

21 MR. HIGH: Objection. Mischaracterizes.

22 A Let's look at what Gallagher does.

23 Gallagher has his light source, and he
24 contemplates using a variety of light sources, but
25 it does not have to be a particularly fancy light

1 source. Gallagher is operating at a known
2 calibrated distance, so his illumination from his
3 light source is known and easily calculated.
4 Gallagher talks about calibrating a system a
5 variety of different ways, including using a
6 conveyer belt so that he gets precise measurements
7 and precise geometric arrangements of his light
8 source, of his sensors, and of his -- of his
9 target. Given all of that, you have all of the
10 parameters that you need to apply Equation 2 of
11 Lumia.

12 BY MR. SAUNDERS:

13 Q Well, if you have all of that, why do you
14 need Equation 2 of Lumia?

15 A Equation 2 of Lumia is illustrating the
16 very simple relationship between these.

17 Q Well, as I'm reading your paragraph 37, it
18 seems to me that you're saying that Lumia's
19 Equation 2 is helping someone use the intensity
20 values measured through Gallagher's system to
21 derive luminance and then retroreflectivity
22 values. And I already asked you questions that it
23 seemed like while we have this Equation 2 that is
24 giving you relationship between luminance and
25 retroreflectivity, it's not going to let you

1 derive luminance using Equation 2 and then derive
2 retroreflectivity using Equation 2 unless you
3 already know retroreflectivity. Is that right or
4 wrong?

5 A I think you're mischaracterizing.

6 MR. HIGH: Objection. Form.

7 A You are asking whether that equation can
8 be used to first calculate one of the variables
9 and then calculate a second one of the variables.

10 You can use that equation in the
11 calibration system, so you could use that when
12 calibrating Gallagher's system where you have a
13 known illumination and a retroreflectivity to
14 derive what the luminance must be. You can then
15 use that equation the other direction to say, oh,
16 if this is the derived luminance, here's the
17 retroreflectivity. This is not difficult.

18 MR. SAUNDERS: All right. Let's see.

19 All right. I'm going to pass the witness
20 to this deposition on the '255 Patent.

21 MR. HIGH: Do you mind if we go off the
22 record?

23 MR. SAUNDERS: Yeah, that's fine.

24 THE COURT REPORTER: Off the record at
25 10:58.

1 (A break was taken from 10:58 a.m. to
2 11:11 a.m.)

3 THE COURT REPORTER: Back on the record at
4 11:11.

5 MR. HIGH: No questions on redirect.

6 MR. SAUNDERS: Okay. We can close, then,
7 this deposition.

8 (Time Noted: 11:11 a.m.)
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1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

2
3 I, Linda Russell, Certified Reporter and
4 Notary Public within and for the State of Texas do
5 hereby certify:

6
7 That Charles E. Thorpe, Ph.D., the witness
8 whose deposition is hereinbefore set forth, was
9 duly sworn by me before the commencement of such
10 deposition and that such deposition was taken
11 before me and is a true record of the testimony
12 given by such witness.

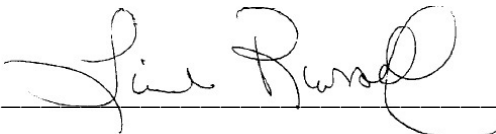
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14 I further certify that the adverse party,
15 FACET TECHNOLOGY CORP., was represented by counsel
16 at the deposition.

17
18 I further certify that the deposition of
19 Charles E. Thorpe, Ph.D., occurred virtually on
20 Tuesday, October 14, 2025 commencing at 9:31 a.m.
21 to 11:11 a.m.

22
23 I further certify the inspection, reading
24 and signing of said deposition was not waived on
25 the record by agreement of all parties.

1 I further certify that I am not related to
2 any of the parties to this action by blood or
3 marriage, I am not employed by or an attorney to
4 any of the parties to this action, and that I am in
5 no way interested, financially or otherwise, in the
6 outcome of this matter.

7
8 IN WITNESS WHEREOF, I have hereunto set my
9 hand this 15th day of October, 2025.

10
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14 Expiration Date: 04/30/27

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