IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner

v

YECHEZKAL EVAN SPERO,
Patent Owner

Case IPR2022-01586
US Patent No. 11,208,029 B2

WITNESS: MATTHEW A. TURK, PhD
DATE: Tuesday, October 17, 2023
TIME: 9:19 a.m.
LOCATION: BROOKS KUSHMAN, PC
1000 Town Center, 22nd Floor
Southfield, Michigan
REPORTER: Karen Fortna, CRR/RMR/RPR/CSR-5067
JOB NO: 26344

FORTZ Legal

Fortz Legal Support
www.FortzLegal.com
844.730.4066

FORTZ Legal

1
2 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD
4
5 VOLKSWAGEN GROUP OF AMERICA, INC.,
6 Petitioner
7
8 v
9
10 YECHEZKAL EVAN SPERO,
11 Patent Owner
12
13 Case IPR2022-01586
14 US Patent No. 11,208,029 B2
15
16
17 WITNESS: MATTHEW A. TURK, PhD
18 DATE: Tuesday, October 17, 2023
19 TIME: 9:19 a.m.
20 LOCATION: BROOKS KUSHMAN, PC
21 1000 Town Center, 22nd Floor
22 Southfield, Michigan
23 REPORTER: Karen Fortna, CRR/RMR/RPR/CSR-5067
24 JOB NO: 26344
25

1 APPEARANCES:
2
3 STERNE, KESSLER, GOLDSTEIN & FOX, PLLC
4 By: Mr. Jason A. Fitzsimmons
5 Mr. Ian Soule
6 1101 K Street, NW, Tenth Floor
7 Washington, DC 20005
8 202.371.2600
9 jfitzsimmons@sternekessler.com
10 isoule@sternekessler.com
11 Appearing on behalf of Petitioner
12
13 BROOKS KUSHMAN, PC
14 By: Ms. Sangeeta G. Shah
15 Mr. Andrew B. Turner
16 1000 Town Center, 22nd Floor
17 Southfield, Michigan 48075
18 248.358.4400
19 sshah@brookskushman.com
20 aturner@brookskushman.com
21 Appearing on behalf of Patent Owner
22
23
24
25

1 I N D E X
2
3 W I T N E S S
4
5 MATTHEW TURK, PhD PAGE
6
7 Examination by Mr. Fitzsimmons 5
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

1 E X H I B I T S
2
3 EXHIBIT DESCRIPTION PAGE
4
5 Exhibit A 1B reproduction 142
6
7 Exhibit 1001 US Patent No. 11,208,029 61
8 Exhibit 1005 US Patent No. 6,144,158 87
9 Exhibit 1010 International Publication No. . 128
10 WO 98/54030
11 Exhibit 1012 US Patent No. 5,588,733 124
12
13 Exhibit 2001 2-28-23 Declaration of Matthew . .23
14 A. Turk, PhD
15 Exhibit 2006 8-16-23 Second Declaration of . . .26
16 Matthew A. Turk, PhD
17 Exhibit 2017 International Publication No. . 148
18 WO 86/05147
19
20
21
22
23
24
25

1 Tuesday, October 17, 2023
2 Southfield, Michigan
3 9:19 a.m.
4 * * * *
5 MATTHEW TURK, PhD,
6 having first been duly sworn, was examined and
7 testified as follows:
8 MR. FITZSIMMONS: Good morning, Dr. Turk.
9 THE WITNESS: Good morning.
10 EXAMINATION
11 BY MR. FITZSIMMONS:
12 Q. Can you please state your full name for the record?
13 A. My name is Matthew Alan Turk.
14 Q. And do you know why you're here today?
15 A. I do, yes.
16 Q. And what's that?
17 A. To provide my opinions on my deposition, to answer
18 questions about my deposition -- sorry, my
19 declaration.
20 Q. And that declaration is an inter partes review
21 proceeding, correct?
22 A. Correct.
23 Q. And that, for the record, is IPR2022-01586. Does
24 that sound right?
25 A. That sounds right to me.

1 Q. And that relates to US Patent No. 11,208,029. Does
2 that sound right?
3 A. Yes.
4 Q. Okay. And is it okay if I refer to that as the
5 '029 patent today?
6 A. That sounds good.
7 Q. And you understand that you're under oath here
8 today?
9 A. Yes, I do.
10 Q. And is there any reason that would prevent you from
11 testifying truthfully and accurately today?
12 A. No.
13 Q. For example, is there any medication that you're
14 taking that would prevent you from testifying
15 truthfully and accurately today?
16 A. No.
17 Q. Any other reason that would prevent you from
18 testifying truthfully and accurately today?
19 A. No, there's not.
20 Q. And you've been deposed before, correct?
21 A. Yes, I have.
22 Q. About how many times?
23 A. I think around ten times or so.
24 Q. Okay. And so you understand that I'll be asking
25 you questions today and you agree to answer those

1 questions?
2 A. That's right.
3 Q. And there's a court reporter here, so I'll just
4 need you to please respond verbally so that they
5 can be -- your answers can be recorded for the
6 record. No nodding or head shaking. That won't be
7 able to be picked up on the record. Is that fair?
8 A. I understand, yes.
9 Q. And if you need a break, please just ask me. Is
10 that fair?
11 A. Yes.
12 Q. Okay. And if you don't understand a question, do
13 you agree that you'll ask me for clarification?
14 A. Yes.
15 Q. Okay. And so if you don't ask for clarification,
16 I'll assume you understood my question. Is that
17 fair?
18 A. Yes.
19 Q. All right. And how did you prepare for today's
20 deposition?
21 A. I reviewed my declaration and the materials that
22 were used for that declaration. I met with the
23 attorneys working on this case. Basically that.
24 Q. You said you reviewed the materials that were used
25 for the declaration. What do you mean by that?

1 A. The materials listed in my exhibit.
2 Q. So the documents listed in the exhibit list of your
3 declaration?
4 A. Yes, that's right.
5 Q. And you said you met with the attorneys in this
6 case. Who did you meet with?
7 A. The two that are here today.
8 Q. And when did you meet?
9 A. Last Friday remotely and yesterday in person.
10 Q. Now on Friday, about how long did you meet
11 remotely?
12 A. I'm not sure, but I'm guessing about two and a half
13 hours.
14 Q. And yesterday in person, about how long did you
15 meet?
16 A. Probably about five hours.
17 Q. And did you meet with anyone else to prepare for
18 the deposition today?
19 A. No, not specifically for preparing for the
20 deposition.
21 Q. You said, "Not specifically for preparing for the
22 deposition." What do you mean by that?
23 A. I've met with other attorneys discussing related
24 patents; I don't remember if any of those
25 discussions had to do with this patent or not

1 offhand.
2 Q. Do you know who those attorneys were?
3 A. David Bir, I believe, is one, and Jeff Szuma, I
4 believe, is another.
5 Q. Anyone else?
6 A. I don't think so.
7 Q. Have you met with anyone outside the Brooks Kushman
8 law firm regarding your deposition or declaration?
9 A. No, I haven't.
10 Q. And you've provided two declarations in this
11 proceeding; is that correct?
12 A. Yes.
13 Q. And did you review both of those declarations in
14 preparation for today?
15 A. Yes.
16 Q. Did you review any documents that are not listed in
17 your declaration in preparing for the deposition?
18 A. I don't believe so.
19 Q. And you mentioned that you've been deposed about
20 ten times before. Were those inter partes review
21 matters?
22 A. I believe some of them were; not all of them.
23 Q. And the ones that were not inter partes review
24 matters, were those for District Court cases?
25 A. I don't remember offhand what all my depositions

1 have been. It may have been; I'm not sure.
2 Q. Have you been deposed in any District Court case
3 previously?
4 A. I think so, but again, I don't remember exactly for
5 sure.
6 Q. Have you testified at trial before?
7 A. Yes, I have.
8 Q. You have. And what case or cases was that in?
9 A. It was a case related to automated parking lot
10 systems.
11 Q. And what party were you testifying on behalf of?
12 A. It's been a little while. I'm trying to remember.
13 On behalf of Indect, the company Indect.
14 Q. How do you spell that?
15 A. I-N-D-E-C-T.
16 Q. And for the times you've been deposed with respect
17 to inter partes reviews, what parties were you
18 testifying on behalf of in those matters?
19 A. The only one I can remember for sure was an IPR was
20 on behalf of Magna, the company Magna. I think
21 it's Magna International, perhaps.
22 Q. And are there matters where you've provided
23 declarations where you were not deposed?
24 A. Yes, I'm pretty sure.
25 Q. Do you know what matters those were?

1 A. Not offhand. I've been involved in quite a few
2 cases and I don't remember them all.
3 Q. About how many cases would you estimate you've been
4 an expert?
5 A. Thirty would be a very rough estimate.
6 Q. And what other parties have you been an expert for?
7 A. I don't remember them all.
8 Q. Can you tell me the ones that you do remember?
9 A. The company Facebook, the company Samsung, the
10 company Meta. There's quite a few others. I would
11 have to go through my list to remember them
12 offhand.
13 Q. Who's retaining you in this matter?
14 A. The patent owner.
15 Q. And who is that?
16 A. I believe the company is Torchlight.
17 Q. And so Torchlight is retaining you in this matter;
18 is that correct?
19 A. I don't recall exactly what the legal arrangements
20 are, but I believe that's the case.
21 Q. Is it your understanding that Torchlight is the
22 patent owner here of the '029 patent?
23 A. I think so, but I haven't thought about this for
24 awhile.
25 Q. And by Torchlight, you mean Torchlight Technologies

1 LLC; is that correct?
2 A. That's probably what Torchlight is referring to,
3 but I'm not 100 percent sure what its exact name
4 is.
5 Q. So when you were determining whether you had a
6 conflict in this matter, is the entity that you
7 thought about Torchlight Technologies?
8 A. Probably so. I expect that I wrote in my
9 declaration some of these details that we could
10 look at to confirm if you'd like.
11 Q. What's your process for determining whether or not
12 you have a conflict in a matter?
13 A. I consider expert engagements I've had, other
14 professional involvements I have or have had with
15 individuals, with entities, and see if there are
16 any relationships that could cause concern or could
17 cause undue influence in my opinion.
18 Q. Is that a process you went through here?
19 A. Yes.
20 Q. Who pays your bills in this matter?
21 A. I believe the company does.
22 Q. And when you say "the company," you're referring to
23 Torchlight; is that correct?
24 A. If I'm remembering correctly, yes.
25 Q. So according to your recollection, your invoices

1 are paid directly by Torchlight Technologies; is
2 that correct?
3 A. I don't actually recall if they're paid by the
4 company or by the law firm.
5 Q. Where do you send your invoices for this matter?
6 MS. SHAH: Objection. Relevance.
7 THE WITNESS: I believe I send them to
8 one of the attorneys.
9 BY MR. FITZSIMMONS:
10 Q. And how much are you charging for your work in this
11 matter?
12 A. I think my rate for this matter is $490 an hour.
13 Q. Is that your regular rate?
14 A. My regular rate for a new case now is higher than
15 that, but it's in the ballpark.
16 Q. And so since you began working on this matter,
17 you've increased your hourly rate; is that right?
18 A. Yes; that's right.
19 Q. And what's that new hourly rate?
20 MS. SHAH: Objection. Relevance.
21 THE WITNESS: It depends on the case.
22 BY MR. FITZSIMMONS:
23 Q. How does it depend on the case?
24 A. One of the ways it depends on the case is how busy
25 I am and how much time I have to allocate in my

1 schedule to it and how much time I think the case
2 is going to take and probably other factors as
3 well.
4 Q. Other factors like what?
5 MS. SHAH: Objection. Relevance.
6 THE WITNESS: How much I like the
7 material and think it would be interesting is one
8 of the factors.
9 BY MR. FITZSIMMONS:
10 Q. Were you familiar with Torchlight Technologies
11 before working on this matter?
12 A. I don't think so.
13 Q. Who approached you about providing a declaration in
14 this matter?
15 A. About the declaration specifically? The attorneys
16 that I was working with.
17 Q. Have you spoken with anyone at Torchlight
18 Technologies?
19 A. Not to my knowledge.
20 Q. When you say not to your knowledge, what do you
21 mean by that?
22 A. I speak to a lot of people and I don't know where
23 every one of them is from and what they're
24 associated with and if they're part of Torchlight
25 Technologies.

1 Q. Are you familiar with Curiam Capital LLC?
2 MS. SHAH: Objection. Relevance.
3 THE WITNESS: Will you spell that,
4 please?
5 MR. FITZSIMMONS: Curiam, C-U-R-I-A-M,
6 Capital.
7 THE WITNESS: It does not ring a bell.
8 BY MR. FITZSIMMONS:
9 Q. Did you consider Curiam Capital when determining
10 whether you had any potential conflicts in this
11 matter?
12 A. It's possible I could have, but I don't recall
13 looking at them at this point.
14 Q. Are you retained in any other matters relating to
15 the '029 patent?
16 MS. SHAH: Objection. Vague.
17 THE WITNESS: Can you explain what you
18 mean?
19 BY MR. FITZSIMMONS:
20 Q. Let me rephrase that. Are you retained in any
21 other matters where the '029 patent is the subject
22 of a dispute?
23 A. Are you asking about a separate retention?
24 Q. Correct.
25 A. No.

1 Q. You are retained in other matters where
2 Mr. Yechezkal Evan Spero is an inventor on the
3 patent, correct?
4 MS. SHAH: Objection. Vague.
5 THE WITNESS: I have one retention that
6 involves the '029 and other patents.
7 BY MR. FITZSIMMONS:
8 Q. And those other patents, Mr. Spero is an inventor
9 on those patents, correct?
10 A. Yes, I believe so.
11 Q. One of those is the '551 patent; does that sound
12 familiar?
13 A. It does, yes.
14 Q. And another is the '503 patent; does that sound
15 familiar to you?
16 A. Yes.
17 Q. What's your current employment role?
18 A. I'm the president of the Toyota Technological
19 Institute at Chicago, or TTIC.
20 Q. And you've been there since 2019; is that right?
21 A. That's correct.
22 Q. And what are your responsibilities there?
23 A. I report to the board of trustees and I manage or
24 run the institute, which is an academic research
25 institute.

1 Q. What type of research do you do at TTIC?
2 A. Personally, I do research related to computer
3 vision and imaging.
4 Q. And previously you were a professor at UC Santa
5 Barbara; is that correct?
6 A. That's right.
7 Q. And you started there in the year 2000; does that
8 sound right?
9 A. That's right.
10 Q. And you were a professor in the computer science
11 department?
12 A. Yes, in addition to the media arts and technology
13 program.
14 Q. Is that a separate department at the school?
15 A. Yes, essentially.
16 Q. You were also the director of the Four Eyes Lab; is
17 that correct?
18 A. That's correct.
19 Q. And that's a research lab for computer vision; is
20 that right?
21 A. Not only computer vision, but it includes computer
22 vision.
23 Q. What else does it include?
24 A. A range of areas related to imaging, to
25 human-computer interaction, to artificial

1 intelligence, machine learning and some other
2 related disciplines.
3 Q. What's human-computer interaction mean?
4 A. It's a study of how people interact with technology
5 in general and computer-based technology typically.
6 Q. Can you give me an example of what human-computer
7 interaction would include?
8 A. A simple example would be the laptops here or
9 tablets here, the way people interact with them by
10 typing, tapping, touching, speaking in some cases.
11 These are all ways that humans are interacting with
12 a computer, so principles and software and systems
13 related to those matters.
14 Q. Okay. You worked at Microsoft as well previously;
15 is that right?
16 A. Yes, I did.
17 Q. When did you work there?
18 A. 1994 to 2000.
19 Q. And at Microsoft, you did research in computer
20 vision as well; is that right?
21 A. Among some other things, but that's right.
22 Q. And what are those other things?
23 A. Some of the areas I've already mentioned, including
24 human-computer interaction and imaging and
25 artificial intelligence and machine learning.

1 Q. When you say "computer vision," would that be
2 identifying objects or people in images or video?
3 A. That's part of it. That's usually associated with
4 computer vision.
5 Q. How else would you define computer vision?
6 A. It's a wide range of problems and topics typically
7 related to images in some sense that could be taken
8 by a camera or other kinds of sensors and usually
9 to try to understand something about the scene.
10 Q. What other -- you mentioned cameras. What other
11 kinds of sensors are used in computer vision?
12 MS. SHAH: Objection. Relevance.
13 THE WITNESS: And excuse me, did you say
14 are used in computer vision?
15 MR. FITZSIMMONS: Yes.
16 THE WITNESS: There are really a wide
17 range of sensors that can be and are used in
18 computer vision, so for example, various medical
19 sensors that are not cameras. Even something as
20 large as astronomical -- I'm not sure how to phrase
21 it exactly. Astronomical sensors spread around the
22 earth can be used as input to computer vision.
23 BY MR. FITZSIMMONS:
24 Q. So computer vision focuses on the inputs from those
25 sensors; is that fair?

1 A. It does focus on the inputs of the sensors. It
2 also focuses on understanding the sensors and how
3 they work. And then there's a very close
4 relationship with a field of computer graphics,
5 which is basically about the other direction, how
6 the rays go out and go out into the world to form
7 images or to illuminate things or whatever.
8 Q. Your CV said you were also at Teleos, T-E-L-E-O-S;
9 is that correct?
10 A. That's correct.
11 Q. What's Teleos?
12 A. Teleos was a small company in the Bay Area of
13 California working on imaging, computer vision,
14 artificial intelligence, robotics, a range of
15 problems in domains like that.
16 Q. And your CV also says that you were at LIFIA-IMAG.
17 What does that stand for?
18 A. That is a university or part of a university in
19 France.
20 Q. And at MIT, your post-doc research was in facial
21 recognition; is that right?
22 A. That's correct.
23 Q. And you got your PhD at the MIT media lab; is that
24 right?
25 A. That's right.

1 Q. And your dissertation was in facial or object
2 recognition; is that right?
3 A. That's correct.
4 Q. And when you were working at Martin Marietta, you
5 were also doing research on computer vision
6 algorithms; is that right?
7 A. Among other things, yes.
8 Q. What other things?
9 A. I was working on a vehicle project, autonomous
10 vehicles, and that included computer vision work,
11 robotics work, various aspects of sensing and
12 imaging.
13 Q. And from your CV, I see that you've received a
14 number of awards for your work in computer vision
15 and facial recognition; is that right?
16 A. That's right.
17 Q. And you also have a number of papers on computer
18 vision and facial recognition; is that right?
19 A. Yes, I do.
20 Q. Do you have a sense of how many papers?
21 A. Do you mean just in those areas?
22 Q. Yes.
23 A. I would guess around 120, but I don't know exactly.
24 Q. And you've also done lectures on computer vision
25 and facial recognition, correct?

1 A. That's correct.
2 Q. Do you know about how many lectures in those areas?
3 A. No, I don't.
4 Q. You also have a few patents; is that correct?
5 A. That's right.
6 Q. And those patents relate to computer vision and
7 facial recognition; is that right?
8 A. Yes. They also relate to augmented reality.
9 Q. When you say "augmented reality," what do you mean
10 by that?
11 A. Augmented reality is a way of combining the real
12 world for a human with augmented information, so
13 information about the world, about various things,
14 so combining technology and reality.
15 Q. Would you say that you're an expert in computer
16 vision?
17 A. Yes.
18 Q. What makes you an expert in computer vision?
19 A. My education, my research background, my
20 involvement in professional societies; lots of
21 things.
22 Q. Would you say you're an expert in facial
23 recognition?
24 A. Yes.
25 Q. What makes you an expert in facial recognition?

1 A. I've studied and worked in facial recognition for a
2 long time.
3 Q. How long?
4 A. Some number of years. It's hard to say
5 specifically because it's not necessarily
6 contiguous, but for several years.
7 Q. Can you provide an estimate of how many years?
8 A. So do you mean -- would a year count if I worked
9 one day that year or only if I worked 365 days?
10 Just so I can understand your question.
11 Q. Let's say if you worked for the majority, so at
12 least half a year in that space.
13 A. I would guess very roughly there's maybe six years
14 for which that's the case.
15 Q. And you're a member of a number of organizations
16 and societies; is that right?
17 A. That's correct.
18 Q. And those are all listed on your CV?
19 A. There are certainly several listed on my CV; I
20 don't recall if it's all of them or not, but yes.
21 (Marked for identification:
22 Deposition Exhibit No. 2001.)
23 BY MR. FITZSIMMONS:
24 Q. Let's introduce Exhibit No. 2001. And this is your
25 first declaration in this proceeding. Do you

1 recognize this document, Dr. Turk?
2 A. Yes, I do.
3 Q. Okay. And what is this document?
4 A. This is my first declaration in this IPR case that
5 was submitted in February of this year.
6 Q. And is that your signature there on the last page?
7 A. Yes, it is.
8 Q. Did you place your signature there?
9 A. Yes, I did.
10 Q. When did you last review this document?
11 A. Briefly yesterday.
12 Q. What do you mean by "briefly"?
13 A. I looked over it yesterday.
14 Q. For about how long?
15 A. I don't recall specifically.
16 Q. More than an hour?
17 A. Yesterday? Probably less than an hour, just
18 guessing.
19 Q. Did you write this declaration?
20 A. I worked with the attorneys in coming up with it,
21 so we -- it was a joint effort.
22 Q. So you didn't write all the words in that
23 declaration?
24 A. I did not write every word in there.
25 Q. What was your process for preparing that

1 declaration?
2 A. Initially discussing the '029 patent, the petition
3 in this case, related work, the other things that
4 are in my list of exhibits, having many discussions
5 about various points and what I thought about this
6 thing or that thing, eventually starting with a
7 draft and discussing the key points in a draft --
8 in the draft, editing to come up with something
9 that I felt was indicative of my opinions, that
10 expressed my opinions specifically. That was the
11 process.
12 Q. You said you worked with the attorneys on it. Who
13 did you specifically work with?
14 A. It was primarily Ms. Shah in this room.
15 Q. You said "primarily," so was there anyone else?
16 A. Probably. I don't remember specifically who I
17 worked with regarding this patent only or regarding
18 this patent, but probably also Mr. Turner as well.
19 Q. About how much time did you spend preparing that
20 first declaration?
21 A. I don't remember.
22 Q. And do you still stand by the opinions expressed in
23 that first declaration, Exhibit 2001?
24 A. Yes, I do.
25 MR. FITZSIMMONS: And for ease, we'll

1 also just introduce your second declaration now as
2 well. That's Exhibit 2006.
3 (Marked for identification:
4 Deposition Exhibit No. 2006.)
5 BY MR. FITZSIMMONS:
6 Q. And do you recognize this document, Dr. Turk?
7 A. Yes, I do.
8 Q. And what is this document?
9 A. It's the second declaration I wrote for this case.
10 Q. And is that your signature on the last page?
11 A. It is, yes.
12 Q. And did you place your signature there?
13 A. Yes.
14 Q. When did you last review your second declaration?
15 A. Yesterday.
16 Q. And if I refer to these as your first and second
17 declaration, you'll understand I'm referring to
18 Exhibit 2001 and Exhibit 2006, respectively?
19 A. Yes, I do.
20 Q. I'll do my best to do that. If you're unclear
21 which declaration I'm referring to, please just
22 ask.
23 What was your process for preparing your
24 second declaration?
25 A. It was essentially the same as the process for the

1 first one.
2 Q. And who did you work with to prepare your second
3 declaration?
4 A. I believe it was the same people that I had
5 mentioned for the first declaration.
6 Q. Anyone else, to your recollection?
7 A. Not that I'm sure about.
8 Q. About how much time did you spend preparing your
9 second declaration?
10 A. I don't remember offhand.
11 Q. Can you provide an estimate?
12 A. Not really. I don't have a good sense to estimate
13 the amount of time.
14 Q. So you said you went through the same process as
15 your first declaration to prepare your second
16 declaration, so would that have involved multiple
17 drafts or revisions to it?
18 A. Yes, we did a lot of back and forth, updating,
19 editing.
20 Q. And you still stand by your opinions in your second
21 declaration, Exhibit 2006?
22 A. Yes, I do.
23 Q. Let's turn to page 67 of your second declaration
24 and start there. Exhibit 2006. Are you there?
25 A. Yes.

1 Q. And paragraphs 89 to 90, do you see those there?
2 Those are comparing the Karlsson reference,
3 Exhibit 1010, and the Flaaten reference,
4 Exhibit 2017; is that right?
5 A. Yes.
6 Q. And then if you turn to page 68, do you see
7 paragraphs 91 and 92 there?
8 A. Yes.
9 Q. And what do those say?
10 A. They say "Intentionally left blank."
11 Q. Did you remove those paragraphs?
12 A. Not that I recall, but I don't remember
13 specifically why we left those blank.
14 Q. Do you know what those paragraphs said before they
15 said intentionally left blank?
16 A. No, I don't.
17 Q. Have you ever intentionally left blank a paragraph
18 in a declaration before?
19 A. I believe so, yes.
20 Q. What was the purpose of that?
21 A. If I recall, there have been multiple purposes.
22 Sometimes we just didn't want to change the
23 numbering of paragraphs, so something we decided
24 didn't need to be there was replaced with an
25 "Intentionally left blank."

1 Q. Do you recall in this case you decided that there
2 was something that didn't need to be there in
3 paragraphs 91 or 92?
4 A. I don't recall.
5 Q. Let's turn back to page 7 of your declaration.
6 MS. SHAH: Objection. Vague.
7 MR. FITZSIMMONS: I'm sorry, I want to
8 make sure I'm clear. I said turn back to page 7.
9 MS. SHAH: No, I just -- so you will --
10 MR. FITZSIMMONS: Page 7 at the bottom is
11 there.
12 MS. SHAH: No, I understand. I'm sorry,
13 I just want to clarify. You're going to continue
14 with one declaration all the way through and then
15 switch to the other one, so this question is about
16 this document?
17 MR. FITZSIMMONS: Exhibit 2006. I'll try
18 to make it clear if I'm switching.
19 MS. SHAH: That's fine. I just wanted to
20 make sure the record was clear.
21 MR. FITZSIMMONS: I didn't know if I was
22 referring to a PDF page that was different.
23 MS. SHAH: No, this is perfect. Thanks.
24 BY MR. FITZSIMMONS:
25 Q. Page 7, Exhibit 2006. You see paragraph 2 there?

1 A. Yes.
2 Q. Can you read that for me, please?
3 A. It says, "I am making this second declaration at
4 the request of Yechezkal Evan Spero in the matter
5 of inter partes review of US Patent No. 11,208,029
6 (the '029 patent) to Yechezkal Evan Spero."
7 Q. Have you ever met Mr. Spero?
8 A. I don't believe so.
9 Q. Have you ever spoken to Mr. Spero?
10 A. Not that I'm aware of.
11 Q. Have you ever corresponded with Mr. Spero?
12 A. Not that I'm aware of.
13 Q. Have you ever emailed with Mr. Spero?
14 A. Not that I'm aware of.
15 Q. Your declaration says that you're making the second
16 declaration at the request of Mr. Spero. What do
17 you mean by "at the request of"?
18 A. I mean that was communicated to me by the attorneys
19 I'm working with in this case.
20 Q. So it's your understanding that Mr. Spero requested
21 that you prepare this declaration; is that correct?
22 A. I don't know exactly how the process went in terms
23 of who requested what, but I do believe that the
24 attorneys I worked with were requesting me to do
25 this on behalf of him.

1 Q. But you said your engagement is with Torchlight
2 Technologies; is that correct?
3 MS. SHAH: Objection. Relevance. I
4 object to this entire line of questioning. I just
5 want to state for the record, this has nothing to
6 do with this IPR proceeding, and if we continue
7 down the line, I will call the PTAB, so I'm stating
8 the objection for the record.
9 THE WITNESS: Will you repeat the
10 question, please?
11 BY MR. FITZSIMMONS:
12 Q. You said that your engagement is with Torchlight
13 Technologies; is that correct?
14 A. I don't remember exactly what I said earlier, but I
15 believe I indicated I don't remember, you know,
16 100 percent exactly how the engagement is specified
17 legally, but in general, that sounds right.
18 Q. Had you ever heard of Mr. Spero before working in
19 this proceeding?
20 A. Not that I recall.
21 Q. Did you do any research on Mr. Spero as part of
22 your preparation in this proceeding?
23 A. I don't think I did.
24 Q. So if my understanding is correct, you provided
25 your declaration at the request of Mr. Spero, but

1 you've never met him or spoken to him; is that
2 correct?
3 A. I believe that's correct.
4 Q. To your knowledge, did Mr. Spero review your
5 declaration?
6 A. I don't know.
7 Q. Do you know anything about Mr. Spero?
8 MS. SHAH: Objection. Relevance and
9 overly broad.
10 THE WITNESS: I know that he's the
11 inventor -- the author of this patent.
12 BY MR. FITZSIMMONS:
13 Q. Do you know who Joseph Stam is?
14 A. I recall hearing that name.
15 Q. Where do you recall hearing it?
16 A. In discussions in this case or another patent by
17 this inventor.
18 Q. Let's turn to paragraph 7 now of Exhibit 2006. And
19 do you see in paragraph 7(a) there, you say, "The
20 documents listed above" -- which I believe is
21 referring to your exhibit list -- and that you
22 considered additional patents and documents? Do
23 you see that?
24 A. Yes, I do.
25 Q. What are the additional patents and documents you

1 are referring to?
2 A. All of the patents and documents that are
3 referenced in this report that are not in the
4 exhibit list.
5 Q. Is there anything else you considered that's not
6 listed in your exhibit list recited in your
7 declaration that you considered?
8 A. I don't believe so.
9 Q. In looking at your exhibit list that's on pages 5
10 and 6 of your second declaration, there's several
11 documents from Dr. Jiao; is that correct?
12 A. Yes.
13 Q. And did you review his deposition transcript in
14 this proceeding?
15 A. I did.
16 Q. And that's Exhibit 2007, correct?
17 A. That's right.
18 Q. And did you review Dr. Jiao's declaration in this
19 proceeding related to the '029 patent?
20 A. I reviewed a declaration of Dr. Jiao; I don't
21 believe it was related to this patent, the Exhibit
22 2009, but I might be confused by the patent
23 numbering, the case numbering.
24 Q. Which document are you referring to in the exhibit
25 list?

1 A. 2009.
2 Q. And that's from IPR Proceeding 2023-00318, correct?
3 A. That's right.
4 Q. That is not from this proceeding, IPR2022-01586,
5 correct?
6 A. That's right.
7 Q. So is it my understanding that you did not review
8 Dr. Jiao's declaration in this proceeding,
9 IPR2022-01586?
10 A. So looking in my list of exhibits here, I can't
11 remember at the moment if I omitted that
12 accidentally or if there was not a declaration of
13 Dr. Jiao in this case. I definitely reviewed a
14 declaration of Dr. Jiao.
15 Q. In your exhibit list, you include several articles
16 by Dr. Jiao; is that correct?
17 A. That is correct, Dr. Jiao and co-author.
18 Q. So articles where Dr. Jiao is at least a co-author,
19 correct?
20 A. That's correct.
21 Q. And those are Exhibits 2010, 2012, 2013, 2014 and
22 2015; is that right?
23 A. That's right.
24 Q. Did you personally locate those articles?
25 A. I did locate them.

1 Q. You did? How did you locate those articles?
2 A. I located them online through these URLs.
3 Q. And how did you find those articles?
4 A. They were referred to me by the attorneys I'm
5 working with in this case.
6 Q. I see. So you didn't search for those articles
7 online; they were provided to you by the attorneys?
8 A. That's correct.
9 Q. Were any of the exhibits cited in your list here
10 that you personally found or were they all provided
11 to you?
12 A. I provided Exhibit 2002 and others were suggested
13 to me.
14 Q. And Exhibit 2002 is your CV, correct?
15 A. That's right.
16 Q. Let's go back to paragraph 7. Do you see 7(c)
17 there?
18 A. Yes.
19 Q. And so in 7(c), you're stating that you formed your
20 opinions by considering -- and 7(c) says -- "my
21 knowledge and experience based upon my work and
22 study in this area as described below," correct?
23 A. That's correct.
24 Q. What do you mean by "in this area" in that
25 paragraph?

1 A. I mean the area of the patent, '029.
2 Q. And what would you say that area of the patent --
3 of the '029 patent is?
4 A. Broadly, about lighting technology.
5 Q. In paragraph 7(b) there, same page, you say that
6 you considered "the relevant legal standards,
7 including the standard for obviousness provided in
8 what's known as the KSR case," correct?
9 A. That's correct.
10 Q. And have you read that case?
11 A. I've read summaries of the case; I've not read the
12 full case.
13 Q. What is your understanding of the standard for
14 obviousness?
15 MS. SHAH: Objection. Calls for a legal
16 conclusion.
17 THE WITNESS: Are you asking in general
18 or what KSR International specifically says about
19 it?
20 BY MR. FITZSIMMONS:
21 Q. You said you considered "the relevant legal
22 standards, including the standard for obviousness
23 provided in KSR," so I'm asking you what your
24 understanding of the standard for obviousness
25 provided in KSR is.

1 A. I don't know specifically what KSR describes as the
2 standard for obviousness.
3 Q. But you're saying here that you considered that
4 standard, right?
5 A. I did.
6 Q. But you don't know what that standard is?
7 A. I don't remember the specifics of how the KSR
8 International case describes it in detail.
9 Q. What's your understanding of obviousness?
10 A. My understanding of obviousness is written in my
11 declaration. Let me find it. It's written in
12 Section 2, "Relevant Legal Standards." It starts
13 on page 14.
14 Q. And so what's your understanding of obviousness?
15 A. What is written here in paragraphs 23 and 24.
16 Q. While we're here, let's go to paragraph 26,
17 page 16. Paragraph 26 and through to paragraph 28,
18 which is a bit further down -- it starts on page 20
19 and continues on to page 21, I believe -- you cite
20 some standards in that section; is that right?
21 A. I notice citing one standard generally in the first
22 paragraph and I cite the Michigan Vehicle Code Act
23 on page 21, so generally, yes.
24 Q. Okay. I'll take those one at a time. So in
25 paragraph 26, you reference the Federal Motor

1 Vehicle Safety Standards, FMVSS; is that right?
2 A. That's right.
3 Q. Okay. That's not included in your exhibits list,
4 correct?
5 A. I believe that is correct, yes.
6 Q. Did you review the FMVSS?
7 A. I looked at it. I've generally been aware of it,
8 so I didn't review it in much detail for this.
9 Q. What do you mean you've generally been aware of it?
10 A. I've known that there is a Federal Motor Vehicle
11 Safety Standards regulation in the US. I don't
12 recall how long I've known it or how I learned
13 about it.
14 Q. So in preparing this declaration, did you read --
15 excuse me -- did you read the entire FMVSS
16 document?
17 A. No, I didn't.
18 Q. Did you read parts of it?
19 A. I don't recall. I may have looked at parts of it.
20 Q. Which parts?
21 A. I don't recall.
22 Q. So you can't specifically recall reviewing any part
23 of the FMVSS in preparing your declaration?
24 A. I don't recall specifically what I knew generally
25 prior to this and what I looked at specifically for

1 the declaration with regard to that standard, those
2 standards.
3 Q. Who publishes the FMVSS?
4 A. I don't know for sure. My guess would be the US
5 government.
6 Q. Do you know which part of the FMVSS deals with
7 lamps, reflective devices and associated equipment?
8 A. No, not offhand.
9 Q. Do you know if motor vehicle standards ever change?
10 A. I'm almost sure that they do.
11 Q. And do you know if the FMVSS has ever changed?
12 A. I don't recall having specific knowledge of it, but
13 I presume it does.
14 Q. Generally, regulatory requirements change over
15 time; is that fair?
16 A. I think that's generally true.
17 Q. Did you consider the FMVSS in your obviousness
18 analysis in your declaration?
19 MS. SHAH: Objection. Vague.
20 THE WITNESS: I didn't compare to
21 specific things in the FMVSS in my analysis.
22 BY MR. FITZSIMMONS:
23 Q. But did you consider the FMVSS in your obviousness
24 analysis?
25 MS. SHAH: Objection. Asked and

1 answered.
2 THE WITNESS: I considered the
3 existence of regulations such as the FMVSS in my
4 analysis.
5 BY MR. FITZSIMMONS:
6 Q. How did the existence of regulations factor into
7 your obviousness analysis?
8 A. Generally as described in this paragraph 26, that
9 there are regulations about many aspects of vehicle
10 safety, including headlamps and illuminations, and
11 they regulate many things, several of which are
12 listed here, so an understanding that such
13 regulation exists and has existed for many years
14 was part of my analysis.
15 Q. So in that paragraph 26, you say, "The FMVSS in the
16 US specify requirements with respect to maximums"
17 -- excuse me -- "with respect to minimum/maximum
18 intensity, color and beam pattern and shape for
19 specific types of vehicle lights," is that correct?
20 A. That's correct.
21 Q. What do you mean by "shape" in that sentence?
22 A. In this sentence, generally I mean the boundary of
23 the light that is being emitted by a headlamp.
24 Q. What do you mean by the "boundary of the light"?
25 A. One way to think about this is if you have a wall

1 directly in front of a car with a light and you
2 shine it on that wall, you can draw a boundary of
3 what is illuminated on the wall, which describes --
4 it's one way of describing shape for a vehicle
5 light.
6 Q. Would it matter how far that wall is from the
7 vehicle?
8 MS. SHAH: Objection. Calls for
9 speculation. Vague.
10 THE WITNESS: It depends on what you mean
11 by it, but it wouldn't be exactly the same shape
12 and size and everything if the wall changed in
13 terms of distance.
14 BY MR. FITZSIMMONS:
15 Q. How would the shape change if the wall was further
16 away?
17 MS. SHAH: Objection. Calls for
18 speculation. Vague.
19 THE WITNESS: That can depend somewhat on
20 the details of the source, but it would at least
21 make the shape larger for walls further away.
22 May I add to that? When I said it would
23 make the shape larger, I mean specifically the
24 drawing on the wall that is our representation of
25 the shape.

1 BY MR. FITZSIMMONS:
2 Q. And so the -- are you saying that the shape depends
3 on the distance you are away from the headlamp?
4 MS. SHAH: Objection. Vague.
5 THE WITNESS: What I'm saying is that the
6 outline we drew in the scenario does depend on the
7 distance.
8 BY MR. FITZSIMMONS:
9 Q. Is there a difference between beam pattern and
10 shape in your sentence there in paragraph 26?
11 A. Yes, I mean somewhat different things by those two
12 in the sentence.
13 Q. Can you explain to me what the difference is
14 between the beam pattern and shape?
15 A. By beam pattern, in the sentence, I basically mean
16 within that outline we drew on the wall in our
17 previous example, what parts are bright or dark or
18 in between or what is the pattern of light within
19 that outline of the shape on the wall?
20 Q. So what do you mean by -- let me try to break it
21 down. What do you mean by beam pattern?
22 A. I believe I just answered that question.
23 Q. So are you saying that beam pattern has to do with
24 how bright or dark an area of the light is?
25 MS. SHAH: Objection. Mischaracterizes

1 the witness' prior answer. Vague.
2 THE WITNESS: The way I'm using it here,
3 beam pattern is related to brightness and darkness
4 of illumination within the shape.
5 BY MR. FITZSIMMONS:
6 Q. Do you know if there's an FMVSS shape requirement
7 for high beams?
8 MS. SHAH: Objection. Vague.
9 THE WITNESS: I'm not sure.
10 BY MR. FITZSIMMONS:
11 Q. Do you know if there is a FMVSS shape requirement
12 for low beams?
13 A. I'm not sure.
14 Q. Do you know if there's a FMVSS shape requirement
15 for fog lamps?
16 A. I'm not sure.
17 Q. Do you know if there's a FMVSS shape requirement
18 for cornering lamps?
19 A. I'm not sure.
20 Q. Do you know if there's a FMVSS requirement for the
21 minimum intensity for high beams?
22 A. I'm not sure.
23 Q. Do you know if there's a FMVSS requirement for
24 minimum intensity of low beams or fog lamps or
25 cornering lamps?

1 A. As I said earlier, I don't know the FMVSS
2 regulations in all their detail, so I'm not sure.
3 Q. So I presume the answer is the same, but do you
4 know if there's a FMVSS requirement for maximum
5 intensity for high beams, low beams, fog lamps or
6 cornering lamps?
7 MS. SHAH: Objection. Asked and
8 answered.
9 THE WITNESS: I'm not sure.
10 BY MR. FITZSIMMONS:
11 Q. Do you know if there's an FMVSS requirement for the
12 color of high beams, low beams, fog lamps or
13 cornering lamps?
14 A. I'm not sure.
15 Q. Still paragraph 26, page 16 of Exhibit 2006,
16 towards the bottom, do you see where you say "a
17 POSA would not have considered combining features
18 from lamps having different functions"?
19 A. I do, yes.
20 Q. You see that's what you said?
21 A. Yes.
22 Q. What do you mean by "combining features from
23 lamps"?
24 A. I mean designing or building a lamp that has some
25 features from one design and other features from

1 another design.
2 Q. So in your opinion, you wouldn't design or build a
3 lamp that has some features from one design and
4 other features from another design?
5 A. I would not -- sorry, could you repeat the
6 beginning of that question?
7 Q. Sure. You said -- my question was, "What do you
8 mean by combining features from lamps?" And you
9 said, "I mean designing or building a lamp that has
10 some features from one design and other features
11 from another design." And then my question was,
12 "So in your opinion, you wouldn't design or build a
13 lamp that has some features from one design and
14 other features from another design?"
15 A. Thank you.
16 I wouldn't do that and expect it to work
17 necessarily without significant consideration,
18 perhaps experimentation, to convince myself that
19 the combination made sense.
20 Q. What do you mean by "features from one design and
21 features from another design" in your previous
22 response?
23 A. I guess I just mean what those words say.
24 Q. What does the phrase "optically combined" mean to
25 you?

1 A. In general, without any other context, I would say
2 it probably has something to do with directing
3 light of more than one sources or more than one
4 direction, but it could potentially mean a number
5 of things.
6 Q. Do you know if there's a definition of "optically
7 combined" in the FMVSS?
8 A. I don't know.
9 Q. Let's go to page 21 now, paragraph 28.
10 Paragraph 28 actually starts on page 20 and
11 continues on to page 21, but I will refer to
12 page 21.
13 You cite the Michigan Vehicle Code Act 300
14 of 1949, section 257.698(4), correct?
15 A. That's right.
16 Q. And that act is not listed in your exhibit
17 references list, correct?
18 A. I believe that's correct.
19 Q. Do you mind if I just call that the MVCA?
20 A. That's fine.
21 Q. Did you review the MVCA before preparing your
22 declaration there?
23 A. I did, yes.
24 Q. When did you review that?
25 A. It would have been sometime before mid August this

1 year.
2 Q. Was that the first time you have ever reviewed the
3 MVCA?
4 A. I'm not sure.
5 Q. You don't recall reviewing the MVCA before about
6 August of this year though?
7 A. I don't recall, but I could have.
8 Q. Who provided you with the MVCA document?
9 A. I believe one of the attorneys I've been working
10 with in this case provided me the link.
11 Q. Did you review the entire document?
12 A. I don't recall. I believe I -- yeah, I don't
13 recall.
14 Q. Has the MVCA been amended since 1949?
15 A. I don't know.
16 Q. Do you know which version you're citing in your
17 declaration?
18 A. What do you mean by which version?
19 Q. Do you know if there are multiple versions of the
20 MVCA?
21 A. I don't know for sure.
22 Q. Why do you cite the Michigan Vehicle Code Act as
23 opposed to some other state?
24 A. I don't recall if there was any particular reason
25 to use that one as opposed to others, but it was an

1 example.
2 Q. An example of what?
3 A. Going back to your earlier question in paragraph 26
4 where I start with "Regulations such as the FMVSS,"
5 this is an example of such a regulation.
6 Q. So you're saying the MVCA is an example of a
7 regulation such as the FMVSS; is that correct?
8 MS. SHAH: Objection. Mischaracterizes
9 the testimony.
10 THE WITNESS: I would say those two are
11 examples of regulations.
12 BY MR. FITZSIMMONS:
13 Q. Regulations of what?
14 A. Regulations related to motor vehicle safety design,
15 related to motor vehicles.
16 Q. In the paragraph there on page 21 above where
17 you have the MVCA citation, do you see where it
18 says, "The standards prescribed in 49 CFR
19 Section 571.108"?
20 A. Yes.
21 Q. That code is not listed in your exhibits reference
22 list, correct?
23 A. That is correct.
24 Q. Did you review 49 CFR Section 571.108?
25 A. I don't --

1 Q. Excuse me. Before preparing your declaration.
2 A. I don't believe so. That is quoted in the quote
3 from the MVCA.
4 Q. Do you know what 49 CFR Section 517.108 is?
5 A. Not offhand. I would have to look.
6 Q. Paragraphs 29 through 33, you discuss what's in the
7 heading there as design tradeoffs; is that right?
8 A. Yes.
9 Q. Are those part of what you considered in your
10 obviousness analysis?
11 A. It provides background for my obviousness analysis.
12 Q. What do you mean by background?
13 A. Generally understanding design aspects of a system
14 is important for a person of ordinary skill in the
15 art in order to know if something is obvious or
16 not.
17 Q. In your opinion, are design tradeoffs relevant in
18 determining whether there's a motivation to combine
19 references in obviousness analysis?
20 A. I think they could well be.
21 Q. You would agree that design tradeoffs do not
22 necessarily obviate a motivation to combine
23 references, correct?
24 MS. SHAH: Objection. Vague.
25 THE WITNESS: I think it would depend on

1 the specific tradeoff. Maybe a design tradeoff
2 could obviate motivation to combine; it probably
3 doesn't necessarily, so it maybe just depends.
4 MR. FITZSIMMONS: Let's go back to
5 paragraph 25.
6 MS. SHAH: Go ahead and finish your
7 question. I just was wondering if you want to take
8 a break.
9 MR. FITZSIMMONS: Maybe five minutes.
10 MS. SHAH: Yeah, fine.
11 BY MR. FITZSIMMONS:
12 Q. So on page 16, actually, but still paragraph 25, do
13 you see where you talk about design challenges --
14 excuse me -- "Challenges associated with use of
15 LEDs in these applications could be overcome to
16 meet government regulations and industry
17 standards"?
18 A. I see that, yes.
19 Q. In your opinion, if a prior art combination would
20 not meet government regulations or industry
21 standards, then it wouldn't render patent claims
22 obvious?
23 MS. SHAH: Objection. Vague.
24 THE WITNESS: I think it depends on the
25 specific combination and the specific regulations

1 involved. I don't think it's -- I think it depends
2 on that.
3 MS. SHAH: Is this a good breaking
4 point?
5 MR. FITZSIMMONS: A couple minutes here.
6 MS. SHAH: Okay.
7 BY MR. FITZSIMMONS:
8 Q. So based on that answer, is it fair to say that
9 there could be a prior art combination of
10 references that do not meet government regulations
11 for industry standards yet render patent claims
12 obvious?
13 MS. SHAH: Objection. Vague.
14 THE WITNESS: I think that's possible.
15 BY MR. FITZSIMMONS:
16 Q. The '029 patent claims recite using LEDs in vehicle
17 headlamps, correct?
18 A. That's right.
19 Q. The '029 patent doesn't purport to solve any
20 technical problem in order to meet government
21 regulations or industry standards, correct?
22 MS. SHAH: Objection. Vague.
23 THE WITNESS: I don't recall if that was
24 part of the motivation -- stated motivation of the
25 '029 or not.

1 BY MR. FITZSIMMONS:
2 Q. Did the system in the '029 patent meet government
3 regulations and industry standards at the time of
4 the alleged invention?
5 MS. SHAH: Objection. Vague.
6 THE WITNESS: I haven't analyzed that so
7 I'm not really sure.
8 BY MR. FITZSIMMONS:
9 Q. You agree that before the '029 patent, there were
10 prior art references that disclosed to use LEDs in
11 vehicle headlamps, correct?
12 A. Yes.
13 MR. FITZSIMMONS: Okay. Let's take a
14 break.
15 (Whereupon a break was taken
16 from 10:48 a.m. to 11:02 a.m.)
17 BY MR. FITZSIMMONS:
18 Q. Dr. Turk, have you ever designed a headlamp with
19 LED light sources?
20 A. I have not.
21 Q. Have you ever designed a headlamp for adaptive
22 front lighting systems or AFS?
23 A. No.
24 Q. Have you ever designed a vehicle forward lighting
25 system?

1 A. No.
2 MS. SHAH: Objection. Relevance.
3 BY MR. FITZSIMMONS:
4 Q. Have you ever worked in an industry where you were
5 involved in the area of automotive lighting and
6 lighting control systems?
7 A. A bit.
8 Q. What do you mean by "a bit"?
9 A. I worked for three years on a project about
10 autonomous vehicles, which included some work and
11 design considerations about the lighting of the
12 vehicle.
13 Q. And where were you working for that project?
14 A. At Martin Marietta.
15 Q. And you said it "included some work and design
16 considerations about the lighting of the vehicle."
17 What do you mean by that?
18 A. The goal of the project was to build an autonomous
19 vehicle that would drive by itself and part of that
20 was driving at dusk or at night and so designing
21 and thinking about the illumination for the
22 vehicle, of the vehicle, and how that would impact
23 the complete system as part of that project.
24 Q. How long were you working on that project?
25 A. I think it was almost three years.

1 Q. What portion of that project would you say was
2 focused on the illumination for the vehicle?
3 A. I don't know how to define "portion."
4 Q. Was the illumination of the vehicle the main focus
5 of that project?
6 A. The main focus, as I said, was to build an
7 autonomous vehicle and illumination was an
8 important part of it.
9 Q. Did you personally work on the illumination portion
10 of that project?
11 A. I did at times.
12 Q. And what did you specifically work on with regards
13 to the illumination?
14 A. It was a long time ago and I don't remember too
15 much detail about it, but certainly an important
16 question was how much and what kind of illumination
17 was necessary to be able to do what we needed to
18 do.
19 Q. And what was it that you would say you needed to
20 do?
21 A. We needed to sense and understand the world around
22 the vehicle so that it would know where to drive,
23 among other things.
24 Q. Have you ever worked for a vehicle headlamp
25 company?

1 A. No.
2 Q. Have you ever worked for an LED company?
3 A. No.
4 Q. Have you ever worked for what's known as a general
5 or interior lighting company?
6 A. No.
7 MS. SHAH: Objection. Vague.
8 BY MR. FITZSIMMONS:
9 Q. You're not an expert in vehicle forward lighting,
10 correct?
11 MS. SHAH: Objection. Vague.
12 THE WITNESS: I'm an expert in imaging
13 and vehicle forward lighting is one of many
14 components of imaging, so in general, I would say
15 yes, I am.
16 BY MR. FITZSIMMONS:
17 Q. But you've never designed a vehicle forward
18 lighting system, correct?
19 MS. SHAH: Objection. Relevance.
20 THE WITNESS: I've not personally
21 designed a full vehicle forward lighting system,
22 no.
23 BY MR. FITZSIMMONS:
24 Q. You don't have any patents for vehicle forward
25 lighting, correct?

1 A. No, I don't.
2 Q. You haven't received any awards for vehicle forward
3 lighting, correct?
4 A. Not specifically for that, no.
5 Q. You haven't written any papers on vehicle forward
6 lighting, correct?
7 A. I'm not sure. It may be that some of our papers
8 about this autonomous vehicle project I was
9 discussing include aspects of forward lighting, but
10 I would have to look back at them.
11 Q. Not that you can recall, though?
12 A. Not that I recall right now.
13 Q. So all of the things -- strike that.
14 So patents, awards, papers, things that
15 you said qualified you as an expert in computer
16 vision and facial recognition, you don't have
17 similar patents, awards or papers with respect to
18 vehicle forward lighting, correct?
19 MS. SHAH: Objection. Vague.
20 THE WITNESS: Those specific things were
21 examples of my expertise, things that came out of
22 my expertise; they were not what defined my
23 expertise. So the things that you've asked about
24 that I said no to, I don't have those things that
25 have come out of my expertise in lighting,

1 including vehicle lighting, but I'm an expert in
2 the areas that make up vehicle lighting.
3 BY MR. FITZSIMMONS:
4 Q. When you say "the areas that make up vehicle
5 lighting," what do you mean by that?
6 A. Vehicle lighting is fundamentally about the physics
7 and engineering aspects of optics and I'm an expert
8 on those things.
9 Q. Are you a member of the Society of Automotive
10 Engineers?
11 A. No, I'm not.
12 Q. Are you a member of the International Society for
13 Optical Engineering?
14 A. No, I'm not.
15 Q. Are you aware of the Illuminating Engineering
16 Society?
17 A. No.
18 Q. Dr. Turk, do you know who Dr. Jian Zhong Jiao is?
19 And I'll spell that for you. J-I-A-N, Z-H-O-N-G,
20 J-I-A-O. Do you know Dr. Jiao?
21 A. I know who he is.
22 Q. Did you know him before you were retained in this
23 matter?
24 A. I don't believe so.
25 Q. And again, you cite several articles that name

1 Dr. Jiao as an author, correct?
2 A. That's correct.
3 Q. And if I recall, you said you didn't personally
4 find those papers, though, right; they were
5 provided to you?
6 A. They were provided to me; that's correct.
7 Q. And did you read those papers in their entirety?
8 A. Yes, I did.
9 Q. And you would agree that Dr. Jiao is an expert in
10 vehicle forward lighting, right?
11 MS. SHAH: Objection. Relevance.
12 THE WITNESS: I believe I've read in his
13 declaration that he claims to be an expert and I
14 have no reasons to disagree with him, but I don't
15 know that personally.
16 BY MR. FITZSIMMONS:
17 Q. Would you agree that Dr. Jiao is an expert in LED
18 headlamps?
19 A. I would give the same answer.
20 MS. SHAH: Objection. Relevance.
21 THE WITNESS: I would give the same
22 answer to that.
23 BY MR. FITZSIMMONS:
24 Q. In paragraph 30 of your second declaration, so back
25 in Exhibit 2006. Page 23. You see there you say,

1 in paragraph 30, "experts in vehicle forward
2 lighting," correct?
3 A. I'm sorry, where are you pointing to?
4 Q. Paragraph 30. You say "experts in vehicle forward
5 lighting."
6 A. Oh, yes, I see it.
7 Q. And after that, in paragraph 30, you cite
8 Exhibit 2012, correct?
9 A. That's correct.
10 Q. And you also cite Exhibit 2010, correct, on the
11 next page?
12 A. That's correct.
13 Q. And those are both articles by Dr. Jiao where he's
14 an author, correct?
15 A. Yes; that's correct.
16 Q. And so here in your declaration, you agree that
17 Dr. Jiao is an expert in vehicle forward lighting,
18 correct?
19 A. I do state that, yes.
20 Q. Let's turn to paragraph 47, still in your second
21 declaration. In paragraph 47 there, you state, "I
22 have been asked to provide my opinion as to the
23 level of skill of a person having ordinary skill in
24 the art (POSA) of the '029 patent at the time of
25 the claimed invention," correct?

1 A. Yes.
2 Q. Then down towards the bottom of the page in
3 paragraph 48, you state, "I understand that
4 petitioner has proposed the following level of
5 ordinary skill," correct?
6 A. Yes, I see that.
7 Q. Can you please read that level of ordinary skill?
8 A. It says, "A POSA at the time of the alleged
9 invention would have had a bachelor's degree (BS)
10 in mechanical engineering, electrical engineering,
11 optical engineering, applied physics or an
12 equivalent field, as well as at least two years of
13 industry experience in the area of automotive
14 lighting and lighting control systems."
15 Q. In paragraph 49, you state, "I understand that
16 patent owner accepts petitioner's proposed level of
17 ordinary skill in the art," correct?
18 A. Yes.
19 Q. Do you also accept the petitioner's proposed level
20 of ordinary skill in the art?
21 MS. SHAH: Objection. Vague.
22 THE WITNESS: Yes.
23 BY MR. FITZSIMMONS:
24 Q. And so is the level of skill you read for me from
25 paragraph 48 the level of skill you applied in your

1 analysis in your declaration?
2 A. Yes.
3 (Marked for identification:
4 Deposition Exhibit No. 1001.)
5 BY MR. FITZSIMMONS:
6 Q. I'm going to hand you Exhibit 1001. This is the
7 '029 patent. You're familiar with this document,
8 Doctor?
9 A. Yes.
10 Q. And let's look at paragraph 37 of your declaration,
11 second declaration. Do you see in paragraph 37,
12 the first sentence there, where it says, "...years
13 after the earliest priority date of the '029
14 patent"?
15 A. Yes.
16 Q. In your opinion, what is the earliest priority date
17 of the '029 patent?
18 MS. SHAH: Objection. Calls for a legal
19 conclusion.
20 THE WITNESS: I'm trying to remember
21 offhand what I've been told about this. I
22 believe it was the year 2002 or somewhere around
23 there.
24 BY MR. FITZSIMMONS:
25 Q. And so how did you determine the year 2002 or

1 somewhere around there?
2 A. I didn't determine it myself; I was told what to
3 use as the priority date.
4 Q. So you didn't analyze the priority date of the '029
5 patent; is that correct?
6 A. That's correct.
7 Q. The '029 patent claims, do they require compliance
8 with government rules or regulations?
9 MS. SHAH: Objection. Vague.
10 THE WITNESS: Not to my knowledge.
11 BY MR. FITZSIMMONS:
12 Q. Do the '029 patents claims require any specific
13 intensity?
14 MS. SHAH: Same objection.
15 THE WITNESS: What do you mean by "any
16 specific intensity"?
17 BY MR. FITZSIMMONS:
18 Q. How would you define "intensity"?
19 A. Intensity is a broadly applied word that can mean
20 different things in different contexts. Generally,
21 it has something to do with brightness or energy or
22 energy per area or something like that of light and
23 is often also relative to the human observers, so
24 it generally is similar to the concept of
25 brightness.

1 Q. So based on your understanding of intensity, did
2 the '029 patent claims require any specific
3 intensity?
4 MS. SHAH: Objection. Vague.
5 THE WITNESS: Can you tell me what you
6 mean by "specific intensity"?
7 BY MR. FITZSIMMONS:
8 Q. Do they require any intensity?
9 A. Yes.
10 Q. What's that intensity?
11 A. It can't be all dark; it does require light.
12 Q. Is that the only requirement for intensity in the
13 '029 patent claims?
14 MS. SHAH: Objection. Vague.
15 THE WITNESS: I don't know offhand.
16 BY MR. FITZSIMMONS:
17 Q. Do the '029 patent claims require any particular
18 packaging size of the LEDs?
19 MS. SHAH: Objection. Vague.
20 THE WITNESS: I don't recall the claims
21 mentioning packaging size, but I could look.
22 MR. FITZSIMMONS: You can look.
23 THE WITNESS: In a quick look through
24 the claims, I don't see any mention of packaging
25 size.

1 BY MR. FITZSIMMONS:
2 Q. Do the '029 patent claims require any particular
3 beam pattern?
4 MS. SHAH: Objection. Vague.
5 THE WITNESS: I would have to check.
6 MR. FITZSIMMONS: You have the claims
7 there that you just reviewed. You can check them.
8 THE WITNESS: In quick look through, I
9 don't think they require a specific pattern.
10 BY MR. FITZSIMMONS:
11 Q. And maybe I asked this already, but did you review
12 the '029 claims in preparation for today's
13 deposition?
14 A. I did, yes.
15 Q. And did you review the '029 patent claims before
16 preparing your declaration, Exhibit 2006?
17 A. Yes.
18 Q. All right. Have you seen any commercially
19 available headlamps that would meet what's recited
20 in the '029 patent claims?
21 MS. SHAH: Objection. Relevance. Vague.
22 THE WITNESS: I've never thought about
23 that question. I don't know offhand.
24 BY MR. FITZSIMMONS:
25 Q. On page 30 now of your declaration, Exhibit 2006,

1 towards the bottom of the page, you have a quote
2 there that says, "To achieve high performance," and
3 then it goes on and says, "...sufficient lumen and
4 luminance of the light sources and sufficient
5 optical systems are always necessary and
6 important." Do you see that?
7 A. Yes.
8 Q. Do you still agree with that statement?
9 A. Yes. May I revise that answer? I agree that I
10 quoted the statement in my declaration.
11 Q. Would you also agree that at the time of the
12 purported invention of the '029 patent, a person
13 skilled in the art would have known that sufficient
14 lumen and luminance of light sources and sufficient
15 optical systems are always necessary and important
16 in vehicle headlamps?
17 A. I expect so, yes.
18 Q. I'll ask you to go back to the '029 patent itself
19 now, Exhibit 1001, and let's turn to column 11,
20 lines 5 through 8. Can you start there and read
21 starting with, "This invention..."?
22 A. "This invention comprises a different approach,
23 which is to provide the end user with the most
24 correct lighting solution not a new technology lamp
25 to replace the old one."

1 Q. And so the '029 patent doesn't claim to be
2 inventing any new hardware, correct?
3 MS. SHAH: Objection. Relevance. Calls
4 for a legal conclusion.
5 THE WITNESS: That sentence doesn't say
6 anything about hardware.
7 BY MR. FITZSIMMONS:
8 Q. The '029 patent isn't purporting to have invented
9 any new lamp, correct?
10 MS. SHAH: Objection. Vague. Calls for
11 a legal conclusion.
12 THE WITNESS: Are you referring to the
13 sentence we're at or the patent in general or what?
14 MR. FITZSIMMONS: The sentence you just
15 read.
16 THE WITNESS: Sorry, can you read the
17 question again?
18 BY MR. FITZSIMMONS:
19 Q. The '029 patent isn't purporting to have invented
20 any new lamp, correct?
21 MS. SHAH: Same objections.
22 THE WITNESS: The sentence is not saying
23 that it doesn't invent the new lamp, it's making
24 the point that it's not just replacing an old one
25 with a new one.

1 BY MR. FITZSIMMONS:
2 Q. From your review of the '029 patent, does it
3 disclose a new lamp for vehicle headlights?
4 MS. SHAH: Objection. Vague.
5 THE WITNESS: I don't recall opining
6 about that in my declaration. Would you like me
7 to point to somewhere where that might be
8 discussed?
9 BY MR. FITZSIMMONS:
10 Q. So you quote this passage in paragraph 42 of your
11 declaration and you underline "not a new technology
12 lamp." Do you see that?
13 A. Still getting there. I don't see an underlined
14 "not a new technology lamp." Forty-two?
15 Q. Paragraph 42. Sorry. You see the sentence there
16 the '029 patent describes?
17 A. Paragraph 42. I don't see it.
18 Q. Okay. Do you see the words there -- the quote that
19 we were just discussing from the '029 patent,
20 11:5-7?
21 A. Yes, I was looking for an underlined portion. It's
22 not underlined in my version. Sorry.
23 Q. Sorry, there's underlining further down. You see
24 where you quote that?
25 A. Yes, I see that.

1 Q. And the '029 patent proposes using LEDs in
2 headlamps, correct?
3 A. Yes.
4 Q. Does the '029 patent purport to have improved upon
5 existing LEDs for use in its headlamps?
6 MS. SHAH: Objection. Vague.
7 THE WITNESS: I don't recall if it does
8 and I don't think I commented on that in my
9 declaration.
10 BY MR. FITZSIMMONS:
11 Q. But you reviewed the '029 patent, correct?
12 A. I have, yes.
13 Q. And you don't recall the '029 patent purporting to
14 have improved upon existing LEDs, correct?
15 MS. SHAH: Objection. Asked and
16 answered.
17 THE WITNESS: It's a long patent, it's, I
18 believe, 99 columns plus all the figures and other
19 things, so I don't remember it word for word, so my
20 opinions are in the declaration and I don't
21 think -- I don't recall writing about that in my
22 declaration, but if you want to point me somewhere,
23 I'm happy to look.
24 BY MR. FITZSIMMONS:
25 Q. I'm asking about the '029 patent, which you said

1 you reviewed, correct?
2 A. Yes.
3 Q. And so you're telling me you don't recall the '029
4 patent purporting to have improved upon existing
5 LEDs, correct?
6 MS. SHAH: Objection. Vague. Asked and
7 answered.
8 THE WITNESS: That's what I'm saying.
9 BY MR. FITZSIMMONS:
10 Q. Does the '029 patent purport to have improved upon
11 LED packaging?
12 A. I don't recall it doing that, but I would still
13 give the same answer in that it's a long patent; I
14 don't remember everything in there. I don't think
15 I opined on that in my declaration, but if you'd
16 like to point me to somewhere relevant to the
17 question, I'll look over it.
18 Q. I'm talking about the '029 patent, which is the
19 subject of the proceeding here. Does the '029
20 patent purport to have improved upon heat
21 management systems for vehicle headlamps, to your
22 recollection?
23 MS. SHAH: Objection. Vague. Relevance.
24 THE WITNESS: I'll give you the same
25 answer I gave for the last question, which is it's

1 a long patent; I don't remember it word for word.
2 I provided my opinion of it in the declaration, so
3 if you want to point me to somewhere in there, I'll
4 look over that.
5 BY MR. FITZSIMMONS:
6 Q. And so to your recollection, the '029 patent does
7 not purport to have improved upon the heat
8 management system for vehicle headlamps, correct?
9 MS. SHAH: Objection. Mischaracterizes
10 the witness' testimony. Asked and answered.
11 THE WITNESS: Offhand, with the caveats
12 that I've already given you, I don't recall
13 discussing that.
14 BY MR. FITZSIMMONS:
15 Q. Let's go to column 19 of the '029 patent. Down
16 towards the bottom and then it continues -- so for
17 line 63 -- column 19 -- excuse me, line 64, that
18 is, starting with, "Based on progress to date...,"
19 and then through column 20, line 2. I'll give you
20 a second there to read those few lines.
21 A. I see that.
22 Q. Can you read for me the second sentence, starting
23 with, "This invention relates..."?
24 A. "This invention relates to technologies which are
25 feasible at the present state of the art l/W" --

1 which I believe is lumens per watts -- "as well
2 as those which will become feasible in the
3 future."
4 Q. So the '029 patent is stating that the disclosed
5 technologies are either feasible or will become
6 feasible, correct?
7 MS. SHAH: Objection. Vague. Asked and
8 answered.
9 THE WITNESS: Yeah, I think that's a
10 summary of that sentence. That's an accurate
11 description from the sentence.
12 BY MR. FITZSIMMONS:
13 Q. So the '029 patent isn't limiting its disclosure to
14 commercially viable embodiments, correct?
15 MS. SHAH: Objection. Vague.
16 THE WITNESS: I don't know if it's doing
17 that or not.
18 BY MR. FITZSIMMONS:
19 Q. To your recollection, is there anything in the '029
20 patent that states that its inventions are
21 commercially feasible?
22 MS. SHAH: Objection. Vague. Relevance.
23 THE WITNESS: I don't recall the word
24 "commercial," "commercially" at all in the patent,
25 but it might be in there.

1 BY MR. FITZSIMMONS:
2 Q. The '029 patent discusses adaptive frontal lighting
3 systems or AFS, correct?
4 A. I don't remember it using that phrase, but it may
5 well have, but in general, that seems correct.
6 Q. I'll point you to column 51, lines 54 to 55.
7 A. Which lines?
8 Q. Column 50, lines 54 and 55. You see it says
9 "adaptive frontal lighting systems" there. Excuse
10 me. It's 51. Maybe I misspoke. Column 51,
11 lines 54 to 55.
12 A. Got it. I see that.
13 Q. So the '029 patent discusses adaptive frontal
14 lighting systems, correct?
15 A. It does use that term, yes.
16 Q. What are adaptive frontal lighting systems?
17 MS. SHAH: Objection. Vague.
18 THE WITNESS: As discussed here, they're
19 systems that aid in seeing around curves and other
20 features in the road.
21 BY MR. FITZSIMMONS:
22 Q. Before being engaged in this proceeding, had you
23 heard of the term "adaptive frontal lighting
24 systems" previously?
25 A. I don't recall hearing that term specifically, but

1 I could have.
2 Q. Do you know if adaptive frontal lighting systems
3 were known prior to the '029 patent?
4 A. I don't know offhand.
5 Q. Let's turn to column 52 and really at the bottom of
6 51, last line there, up on to the top of column 52,
7 through line 2. Do you see where it says, "The
8 '029 patent lighting can be adapted to the optimal
9 operating regime"?
10 A. I see that.
11 Q. What does "optimal operating regime" mean?
12 MS. SHAH: Objection. Relevance.
13 THE WITNESS: I don't recall opining
14 about that in my declaration, but here it just
15 seems to me to be used generally as how a device
16 should be operating ideally.
17 BY MR. FITZSIMMONS:
18 Q. "How a device should be operating ideally." It
19 doesn't always mean the maximum amount of light at
20 every point, correct, of the vehicle headlamps?
21 MS. SHAH: Objection.
22 MR. FITZSIMMONS: Please let me finish my
23 question.
24 MS. SHAH: Sure. Are you done?
25 Objection. Vague. Relevance.

1 THE WITNESS: That general phrase you
2 used here in the sentence, it's unclear whether it
3 refers to that or not.
4 BY MR. FITZSIMMONS:
5 Q. Does an optimal operating regime as described in
6 the '029 patent include high beams?
7 MS. SHAH: Objection. Vague.
8 THE WITNESS: I don't believe I
9 thoroughly analyzed the phrase "optimal operating
10 regime." I don't recall discussing that in my
11 opinions in the declaration, so I really don't have
12 an opinion on that.
13 BY MR. FITZSIMMONS:
14 Q. So sitting here today, you don't have an
15 understanding of what the '029 patent means when
16 it says an "optimal operating regime," is that
17 correct?
18 MS. SHAH: Objection. Asked and
19 answered.
20 THE WITNESS: No, it's not. I told you
21 what I think that means here.
22 BY MR. FITZSIMMONS:
23 Q. And what do you think it means?
24 MS. SHAH: Objection. Asked and
25 answered.

1 THE WITNESS: Can you read back what I
2 said when you asked it earlier?
3 MR. FITZSIMMONS: I don't recall you
4 specifically saying what that means.
5 THE WITNESS: I believe I did. Can we
6 find that? I think I used the word "ideally" at
7 the end.
8 BY MR. FITZSIMMONS:
9 Q. So I said, "What does 'optimal operating regime'
10 mean?" And you said, "I don't recall opining on
11 that in my declaration, but here it just seems to
12 me to be used generally as how a device should be
13 operating ideally." So that's your understanding?
14 A. That's my response to your question of what it
15 seems to be referring to here in context.
16 Q. If we look just back over at column 51, line 63, do
17 you see the '029 patent refers to a GPS system?
18 A. Sorry, is that a question?
19 Q. I said, do you see where it refers to a GPS system
20 there?
21 A. I do. Sorry.
22 Q. And a GPS system will be a type of map data,
23 correct?
24 A. It can be referred to as that; maybe it's not a
25 very precise definition, but yes, it's

1 understandable.
2 Q. Column 52 of the '029 patent, line 38, do you see
3 where it says, "A possible control system for such
4 purposes is described in US Patent No. 6,281,632,
5 by Stam, et al, from August 28, 2001"?
6 A. I see that.
7 Q. Have you reviewed US Patent No. 6,281,632?
8 A. I'm familiar with the name Stam, which makes me
9 think I probably did review it, but I don't recall
10 at the moment.
11 Q. But here the '029 patent is acknowledging that the
12 Stam patent discloses a known control system for
13 continuously variable headlights, right?
14 A. It says "for such purposes," so let me look to
15 confirm what those purposes are. It's some kind of
16 automatic control of headlamps, yes.
17 Q. Let's turn to column 68, line 38. Can you read
18 that --
19 A. How far?
20 Q. The two sentences there, starting with, "In a
21 preferred..."
22 A. "In a preferred embodiment, the LED light fixture
23 system is provided with mechanical means 458 for
24 changing the structural shape which affects the
25 direction of the illumination produced by the LED

1 module 457. By re-aiming the light source, a new
2 fixture 450 light distribution pattern is
3 obtained."
4 Q. That's describing a mechanical means for changing
5 the structural shape of the illumination, correct?
6 A. It is discussing that, yes.
7 MR. FITZSIMMONS: And can you now go to
8 your first declaration? So this is Exhibit 2001.
9 And we'll go to paragraph 23, please.
10 THE WITNESS: And by the way, I could use
11 a quick bio break at some point.
12 BY MR. FITZSIMMONS:
13 Q. This is page 12. Paragraph 22 starts on page 11,
14 goes on to page 12, and at the end of that
15 paragraph there, you say that, "The '029 patent
16 describes a non-mechanical and non-movable system.
17 A non-mechanical and non-movable system as used in
18 this context refers to a system with no moving
19 parts or mechanisms to position the light beam."
20 Do you see that?
21 A. I do.
22 Q. But what you just read in column 68, lines 38 to
23 44, describes a mechanical system for changing the
24 structural shape of the illumination, correct?
25 A. Correct.

1 Q. And so your statement that the '029 patent
2 describes a non-mechanical and non-movable
3 system isn't accurate in your first declaration,
4 correct?
5 A. No, incorrect.
6 Q. How do you reconcile those two statements?
7 A. I did not say in my first declaration that a
8 mechanical system is never mentioned in the '029.
9 I say something declarative about what '029 does
10 teach, which is a non-mechanical and non-movable
11 system. I didn't list exhaustively everything that
12 the patent mentions here.
13 Q. And so the patents we read in column 68, lines 38
14 to 44, described a preferred embodiment where
15 there's a mechanical means 458 for changing the
16 structural shape of the illumination, though,
17 correct?
18 A. Which lines again?
19 Q. 38 to 44.
20 A. It does discuss mechanical embodiment here, but
21 this is not where it's talking about the vehicle
22 scenario claims that this patent are discussing.
23 This is about hallway lighting and similar kinds of
24 things.
25 Q. So are you saying that passage in column 68 is not

1 applicable to the vehicle description in the '029
2 patent?
3 MS. SHAH: Objection. Vague. Calls for
4 a legal analysis and conclusion.
5 THE WITNESS: Yeah, I have no opinion of
6 its applicability to the claims; I'm just saying
7 the context in which -- this statement is not
8 talking about the vehicle aspects of the patent.
9 BY MR. FITZSIMMONS:
10 Q. But the '029 patent describes both mechanical and
11 non-mechanical systems, correct?
12 A. It does describe a non-mechanical system here in
13 the context of -- I think it's hallway lighting and
14 other non-vehicle related things. And it does
15 describe non-mechanical as well, as we just pointed
16 out from my first declaration.
17 Q. I think you meant to say mechanical in the context
18 of hallway lighting, but you said non-mechanical,
19 so in the context of hallway lighting at least,
20 the '029 patent describes a mechanical system,
21 correct?
22 A. That's what I meant to say. It may also describe
23 non-mechanical, but here, as you pointed out, the
24 passage I read does mention mechanical.
25 Q. And I'll wrap up here in a minute for a break.

1 Paragraph 41 of your second declaration,
2 so this is Exhibit 2006.
3 A. Forty-eight?
4 Q. Paragraph 41.
5 A. Forty-one.
6 Q. You see where you say, "The direction of light
7 exiting from the DLF as a whole were from each SLS
8 individually is controllable by optical elements 6,
9 such as reflective surfaces and/or refractors and
10 maybe electronically variable optical elements"?
11 A. I do see that.
12 Q. And you cite the '029 patent at column 25, line 17
13 to 21, right?
14 A. Yes.
15 Q. Are the elements you note in that quote movable?
16 A. Is your question are the elements in this quote
17 movable?
18 Q. Right.
19 A. I don't think this quote states that they are
20 movable or not movable.
21 Q. In your understanding of the '029 patent, do you
22 have an understanding of whether they are movable
23 or non-movable?
24 A. I'm sorry, now I've lost the quote. At the end of
25 41? Is that where we were, paragraph 41?

1 Q. Yes.
2 A. I don't recall offhand if this quote is discussing
3 a particular embodiment, but in general, the claims
4 of the '029 patent refer to a non-movable --
5 non-movable elements.
6 MR. FITZSIMMONS: Okay. Let's take a
7 break.
8 (Whereupon a break was taken
9 from 12:05 p.m. to 12:14 p.m.)
10 BY MR. FITZSIMMONS:
11 Q. Let's open up the '029 patent, Dr. Turk, and let's
12 go to the claims. So starting at column 96.
13 Sorry, they actually start on 95 at the bottom and
14 go on to column 96. And you see claim 1 there of
15 the '029 patent, Dr. Turk?
16 A. I do.
17 Q. So at the top of column 96 in claim 1, line 3, you
18 see where it says "shaping light"?
19 A. Yes.
20 Q. What does "shaping light" mean in claim 1 of the
21 '029 patent?
22 MS. SHAH: Objection. Calls for a legal
23 conclusion.
24 THE WITNESS: The way I understand it in
25 this context is modifying the shape of the light

1 coming out of the headlamp, as we had discussed
2 earlier today.
3 BY MR. FITZSIMMONS:
4 Q. You said, "The way I understand it." What's that
5 understanding based on?
6 A. All the things listed in my declaration in terms of
7 background and prior art and such.
8 Q. And then claim 3, column 96, you see where it says
9 "reshape light"?
10 A. Yes.
11 Q. What does "reshape light" mean in claim 3 of the
12 '029 patent to you?
13 MS. SHAH: Same objection.
14 THE WITNESS: I think here it means to
15 possibly change the shape of the light.
16 BY MR. FITZSIMMONS:
17 Q. You said "possibly change the shape of the light."
18 So does claim 3 not require the shape of the light
19 to change?
20 MS. SHAH: Objection. Calls for a legal
21 conclusion.
22 THE WITNESS: Well, the context here is
23 reshaping light based on the road curvature, and I
24 would guess there might be some scenario in which
25 that causes no change, but I think most of the time

1 that you would expect, in this scenario, the shape
2 of the light to change.
3 BY MR. FITZSIMMONS:
4 Q. What scenario would cause no change, in your
5 opinion?
6 A. Well, I haven't thought about this before, but off
7 the top of my head, a very subtle road curve,
8 perhaps, but I don't know.
9 Q. In column 96 still, line 1 there, do you see the
10 term "spatial distribution"?
11 A. Yes.
12 Q. What's your understanding of the term "spatial
13 distribution" in claim 1 of the '029 patent?
14 MS. SHAH: Objection. Calls for a legal
15 conclusion.
16 THE WITNESS: In this context, I think it
17 means a possible change in the brightness levels at
18 various points of the light shape that's coming out
19 of the headlamp.
20 BY MR. FITZSIMMONS:
21 Q. Did you consider the meaning of the term "spatial
22 distribution" in claim 1 of the '029 patent before
23 providing your opinions in your second declaration?
24 A. Yes.
25 Q. And same line, column 96, line 1, you see the term

1 "intensity"?
2 A. Yes.
3 Q. What's your understanding of the term "intensity"
4 in claim 1 of the '029 patent?
5 A. I think it means what intuitively we think of as
6 brightness.
7 Q. Is there a difference between intensity and
8 brightness?
9 A. There can be in different contexts. These words
10 can be very technical, can be more colloquially
11 applied, so yes, there can be.
12 Q. And what would that difference be?
13 MS. SHAH: Objection. Vague.
14 THE WITNESS: In general, when people use
15 those two terms, they can have subtly different
16 implications regarding whether it's purely physics
17 or physics and human perception or other aspects of
18 this kind of very complicated set of physical
19 energy and human perception when they use these
20 terms, so they can have different implications at
21 times.
22 BY MR. FITZSIMMONS:
23 Q. As it's used in the '029 patent, claim 1, is it
24 your opinion that intensity means the same thing as
25 brightness?

1 MS. SHAH: Objection. Calls for a legal
2 conclusion.
3 THE WITNESS: I would say they used the
4 word intensity, they mean intensity. Again, I
5 think it's reasonable to think about that as
6 brightness here, but there could be some
7 distinctions that people would make between the
8 term brightness and between intensity and how it's
9 used here.
10 BY MR. FITZSIMMONS:
11 Q. What are some of the distinctions that people could
12 make between the term brightness and intensity as
13 it's used here?
14 A. Well, for example, if you were to replace the word
15 intensity with the word brightness, that could
16 bring in human perception aspects of this that
17 might have not been intended originally.
18 Q. Still claim 1, column 96, lines 1 to 2, do you see
19 the term "increase light in a direction"?
20 A. Yes.
21 Q. Is that a term that you considered when providing
22 your opinions in your second declaration?
23 A. Yes.
24 Q. And what does the term "increase light in a
25 direction" of claim 1 of the '029 patent mean to

1 you?
2 A. It means what it says, to increase the amount of
3 light in a certain direction. That has something
4 to do with the road curvature ahead.
5 Q. How do you increase the amount of light in a
6 certain direction with a vehicle headlamp?
7 A. In this context, you determine a change and that
8 may be a change in color or change in intensity or
9 change in spatial distribution and then you effect
10 that change.
11 Q. And any one of those three things you listed,
12 color, intensity or spatial distribution, can cause
13 an increase in light and direction; is that
14 correct?
15 MS. SHAH: Objection. Vague.
16 THE WITNESS: Any of those three can
17 cause increase in light and direction, yes.
18 BY MR. FITZSIMMONS:
19 Q. Let's turn back to your second declaration now,
20 Exhibit 2006, paragraph 52. You state that Beam
21 provides a non-movable AABH system; is that
22 correct?
23 A. Yes.
24 Q. And AABH stands for adaptive anti-blinding
25 headlights; is that right?

1 A. I believe that's correct.
2 Q. And does your statement about being non-movable
3 pertain to Beam's Optical System 106?
4 THE WITNESS: I don't know offhand what
5 106 specifically is referring to. May I see that?
6 MR. FITZSIMMONS: Yeah, let's grab it.
7 Beam is Exhibit No. 1005.
8 (Marked for identification:
9 Deposition Exhibit No. 1005.)
10 BY MR. FITZSIMMONS:
11 Q. And are you familiar with the Beam Patent
12 No. 6,144,158, which is Exhibit 1005, Dr. Turk?
13 A. Yes.
14 Q. And you reviewed this document previously?
15 A. Yes.
16 Q. And you reviewed it before providing your opinions
17 in your second declaration; is that right?
18 A. Yes.
19 Q. So I'll go back to your statement in paragraph 52
20 of your declaration about Beam providing a
21 non-movable AABH system. Does that statement about
22 non-movable pertain to Beam's Optical System 106?
23 A. I believe it includes the optical system 106.
24 Q. Does that statement of non-movable also include the
25 spatial light modulator or SLM203 in Beam?

1 A. As a device, yes.
2 Q. What do you mean "as a device"?
3 A. Some spatial light modulators have tiny movable
4 mirrors, but the device itself, the fixture, does
5 not move.
6 Q. So when you say "tiny movable mirrors," that would
7 be a device like a digital mirror device, also
8 known as a DMD; is that correct?
9 A. That sounds right. I'm not as familiar with that
10 term.
11 Q. Okay. So you consider a digital mirror device to
12 be non-movable?
13 A. As described in my quote in my declaration that you
14 pointed to, yes.
15 Q. Were digital mirror devices known prior to the '029
16 patent?
17 A. Again, I'm not too familiar with that particular
18 phrase, but spatial light modulators were known.
19 Q. Is there another phrase that you're more familiar
20 with as it relates to, I think you said, "tiny
21 movable mirrors"? Is there another term that you
22 are more familiar with?
23 A. Spatial light modulator -- one kind of spatial
24 light modulator is a good way -- that's what I'm
25 most familiar with.

1 Q. You're most familiar with the term "spatial light
2 modulator," is that right?
3 A. Yes.
4 Q. There are different kinds of spatial light
5 modulators; is that fair?
6 A. That's correct.
7 Q. Okay. And one of those types, as you characterized
8 it, are tiny movable mirrors; is that accurate?
9 A. That's accurate.
10 Q. And you saw the Beam reference there in front of
11 you, right?
12 A. Yes.
13 Q. Let's go to the claims of Beam. If you go toward
14 the end of the document. Have you seen column 8,
15 claim 4 of the Beam patent?
16 A. Yes.
17 Q. Claim 4 recites, "Said light source includes an
18 array of individual independently controllable
19 microbeam sources," correct?
20 A. Yes.
21 Q. And claim 4 recites that those microbeam sources
22 can be light-emitting diodes, correct?
23 A. It says that, yes.
24 Q. Claim 4 also recites a spatial light modulator,
25 correct?

1 A. Yes.
2 Q. And claim 4 recites that digital mirrored devices
3 are a type of spatial light modulator that could be
4 used, correct?
5 A. Yes.
6 Q. So claim 4 recites a system that can include both
7 an array of light-emitting diodes and a spatial
8 light modulator, correct?
9 A. Claim 4 does say that, but the patent does not
10 teach that, I would say. There's no teaching that
11 I found in the patent that shows how all of those
12 combinations can work.
13 Q. By that, do you mean there's no figure showing that
14 combination?
15 A. I mean there's no discussion of that in the patent,
16 in the specification.
17 Q. But you agree that claim 4 recites a system that
18 includes both an array of LEDs and a spatial light
19 modulator, correct?
20 A. Claim 4 does seem to recite that, which I find,
21 again, puzzling since the patent itself does not
22 discuss those combinations.
23 Q. Let's be clear. You agree that claim 4 recites a
24 system that includes both an array of LEDs and a
25 spatial light modulator, correct?

1 MS. SHAH: Objection. Asked and
2 answered.
3 THE WITNESS: Well, it does not say
4 specifically LEDs.
5 BY MR. FITZSIMMONS:
6 Q. It says light-emitting diodes, correct?
7 A. There you go. I'm sorry. I missed that. It does,
8 yes.
9 Q. Can you turn to the abstract of Beam, which is on
10 the first page there? The abstract describes that
11 the invention determines "the location of light
12 sources forward of the apparatus and using that
13 information to control the intensity and/or the
14 angular position of one or more narrow-angle
15 microbeams." Do you see that?
16 A. Yes.
17 Q. And in the context of Beam, the reference Beam, a
18 microbeam can be an LED, correct?
19 A. I believe so, in one of their embodiments.
20 Q. What does it mean to control the angular position
21 of a microbeam as disclosed in this passage of the
22 abstract?
23 A. It means to effect the direction that the beam
24 emits from the headlamp.
25 Q. How does Beam control the angular position of the

1 microbeams?
2 A. Well, in one of the two Beam embodiments, it
3 controls those angles based on where the light
4 source is, where the spatial light modulator is,
5 the tiny mirrors on the spatial light modulator and
6 the optics in front. The other embodiment, it
7 controls that just by the positions of the LEDs.
8 Q. Referring to tiny mirrors on the spatial light
9 modulator, how do those tiny mirrors of a spatial
10 light modulator work?
11 A. There may be different versions that work somewhat
12 differently, but what I'm most familiar with is a
13 mirror that very quickly goes from one set position
14 where it reflects light into typically a lens and
15 another set position where it reflects light away
16 from the lens, typically into the body of the SLM.
17 Q. So the SLM, using these tiny mirrors or digital
18 mirrors, can change the direction of output of
19 light; is that correct?
20 A. No, not really. The output will only go in one
21 direction.
22 Q. What do you mean by "The output will only go in one
23 direction"?
24 A. There are only two settings of the mirror. One
25 setting will make the light go out, another will

1 keep the light -- will divert the light and keep it
2 inside and will never go out.
3 Q. So is it your understanding that those digital
4 mirrors only have two positions?
5 A. Generally, yes, and I think particularly in this
6 timeframe.
7 Q. If we're looking at the Beam reference, column 4,
8 line 46 to 48, do you see where it says, "The
9 angular position or attenuation of each of these
10 microbeams is independently set by the
11 controller 108"?
12 A. Yes.
13 Q. And so this passage in Beam is describing that both
14 angular position and attenuation are independently
15 set by the controller, right?
16 MS. SHAH: Objection. Vague.
17 THE WITNESS: No, it says "or
18 attenuation," not "and."
19 BY MR. FITZSIMMONS:
20 Q. So this passage describes that the angular position
21 of the microbeam can be independently set by the
22 controller; is that correct?
23 A. That's right, set to either of those two positions.
24 Q. And this is also saying that the attenuation of
25 the microbeam can be independently set by the

1 controller; is that correct?
2 A. It's the same thing, so yes.
3 Q. What's the same thing? I'm sorry.
4 A. Moving the position from one mirror setting to the
5 other can attenuate the light. These aren't
6 describing two different processes; it's two words
7 for the same process.
8 Q. So your understanding is that angular position --
9 the term "angular position" and the term
10 "attenuation" are the same thing --
11 MS. SHAH: Objection.
12 Mischaracterizes --
13 MR. FITZSIMMONS: -- as described here?
14 MS. SHAH: Go ahead.
15 MR. FITZSIMMONS: I want to -- I want to
16 make sure my question is clear on the record.
17 BY MR. FITZSIMMONS:
18 Q. So your understanding from this passage of Beam is
19 that the angular position -- excuse me. Let me
20 strike that.
21 So your understanding from this passage of
22 Beam is that the term "angular position" and the
23 term "attenuation" are the same thing; is that
24 correct?
25 MS. SHAH: Objection. Vague.

1 Mischaracterizes the witness' prior testimony.
2 THE WITNESS: In the context of this
3 sentence, the angular position of each microbeam is
4 equated to the attenuation of each microbeam.
5 BY MR. FITZSIMMONS:
6 Q. How is the angular position equated to the
7 attenuation of each microbeam?
8 A. It's what I just described. There are two angular
9 positions that either can provide output or not.
10 If you provide output, you are at full strength; if
11 you don't, you have attenuated that signal.
12 Q. So what does "attenuation" mean in this context?
13 MS. SHAH: Objection. Asked and
14 answered.
15 THE WITNESS: Generally, it means
16 decreased.
17 BY MR. FITZSIMMONS:
18 Q. And what's decreased?
19 A. Each of the microbeams in this case.
20 Q. What about the microbeams is decreased?
21 A. The output -- the light output associated with a
22 microbeam is decreased if it is directed into the
23 device rather than going out.
24 Q. Just below the passage that we were looking at,
25 still column 4 -- I believe we're at column 4,

1 lines 48 to about 54 -- 48 to 50 or so. It says,
2 "Controller 108 selectively commands reduction of
3 the energy of the microbeams falling on a
4 particular object or objects." Do you see that?
5 A. Yes.
6 Q. How does the angular position of a microbeam relate
7 to it falling on a particular object or objects for
8 a headlamp beam pattern?
9 MS. SHAH: Objection. Vague.
10 THE WITNESS: The geometry between the
11 source and the mirror and the object of interest
12 here defines the angular position.
13 BY MR. FITZSIMMONS:
14 Q. So for a particular detected object within the
15 headlamp beam pattern, how would its location be
16 determined?
17 A. What do you mean by its location?
18 Q. Where it is in the field of view.
19 A. Its 3D location?
20 Q. If that's how you would define it.
21 A. The question is to me, so ask me what you want.
22 Q. How would you determine -- excuse me. How would
23 Beam's system determine the location of an object
24 within its field of view?
25 MS. SHAH: Objection. Vague.

1 THE WITNESS: I believe I give some
2 detail about that in my declaration, so it would be
3 easiest for me to look at that right now.
4 MR. FITZSIMMONS: Sure.
5 THE WITNESS: If I can find it.
6 I'm not remembering how much detail I put
7 in there about it, but in paragraph 55 of my
8 declaration.
9 MR. FITZSIMMONS: And just again, this is
10 Exhibit 2006, your second declaration?
11 THE WITNESS: That's correct.
12 MR. FITZSIMMONS: And paragraph 55, you
13 said?
14 THE WITNESS: Yes. The second sentence
15 there describes this process. "Headlights of an
16 oncoming vehicle 102 and/or taillights of a
17 preceding vehicle 103 are transmitted through
18 optical system 106 and detected by a sensor
19 (camera)." That data then is used by the
20 controller to map the angular position of vehicles
21 ahead, which I believe is what you were asking.
22 BY MR. FITZSIMMONS:
23 Q. Okay. And right above paragraph 55, there's a
24 figure -- an annotated figure that includes
25 Figures 1C and 1D. And do you see there's vehicles

1 102 and 103 in what is that field of view?
2 A. I do.
3 Q. And in that field of view, would those vehicles 102
4 and 103 generally be moving within the field of
5 view?
6 MS. SHAH: Objection. Vague.
7 THE WITNESS: I can't speak for that
8 figure and what went behind its creation, but in
9 general, when I look at the figure, that seems to
10 make sense.
11 BY MR. FITZSIMMONS:
12 Q. Generally, in the field of view of Beam's system,
13 when it's detecting vehicles, would they be moving
14 along the road?
15 MS. SHAH: Objection. Vague.
16 THE WITNESS: I don't know if they would
17 be in all cases, but it seems like generally they
18 would be, yes.
19 BY MR. FITZSIMMONS:
20 Q. And if those vehicles were moving along the road,
21 the shaded areas, which are indicated in the
22 annotated figure arrows that have a label "Reduced
23 intensity," that shaded area would track those
24 vehicles; is that right?
25 MS. SHAH: Objection. Vague.

1 THE WITNESS: The camera sensor system
2 would be locating the vehicles, so the shaded area
3 wouldn't be tracking anything on its own.
4 BY MR. FITZSIMMONS:
5 Q. Would the sensors be tracking the location of
6 those -- the vehicles within the field of view?
7 A. In Beam, not necessarily. I think the goal of
8 Beam is to try do that, but it's doing it by
9 looking for lights, not by identifying vehicles, so
10 it's not necessarily a vehicle that Beam is
11 responding to.
12 Q. In the example here in the annotated drawing above
13 paragraph 55, it's showing an example of the
14 detected objects being vehicles, correct?
15 A. That's correct.
16 Q. Let's look into Beam, column 7 now. Sorry, I think
17 I have the wrong column number. Column 5, lines 61
18 to 64. Do you see where it says, "The AABH
19 produces a multiplicity of individually directed
20 narrow angle beams which are herein referred to as
21 microbeams, each being controlled by a processor
22 responsive to incoming data from an imaging
23 sensor"?
24 A. Yes.
25 Q. So microbeams are narrow angled beams as described

1 here in the Beam reference, correct?
2 A. That's correct.
3 Q. What does "narrow angle" mean?
4 A. In this context here, I believe it means not widely
5 disbursed.
6 Q. What do you mean "by not widely disbursed"?
7 A. I guess I mean narrow angle.
8 Q. Is there a threshold for determining whether
9 something is a narrow angle beam?
10 MS. SHAH: Objection. Vague.
11 THE WITNESS: In general, I'm not aware
12 of any such thing.
13 BY MR. FITZSIMMONS:
14 Q. This passage also describes that the microbeams are
15 individually directed, right?
16 A. Yes.
17 Q. What is "directed" in this context?
18 A. I believe this, in this context, it's describing
19 the modulator embodiment and so direction of the
20 microbeams refers to as -- either the mirror
21 positioned to send the light out or the mirror
22 positioned to not send the light out.
23 Q. Each of the microbeams can be directed, correct?
24 A. That's right.
25 MS. SHAH: Objection. Vague.

1 THE WITNESS: That's correct, in one of
2 those two directions.
3 BY MR. FITZSIMMONS:
4 Q. Okay. Let's go to column 4 in Beam, lines 41
5 through 44. Can you read those for me, please?
6 A. Starting with "Thus"?
7 Q. Yes. Thanks.
8 A. "Thus we produced an overall beam pattern
9 comprising many (in this embodiment, about 300,000)
10 individual narrow angle microbeams of light as
11 contrasted with conventional headlights, which
12 produce only a single beam."
13 Q. Does this passage mean that there will be 300,000
14 LEDs in the headlamp?
15 A. No, I believe this passage is describing the SLM
16 embodiment, spatial light modulator.
17 Q. And how would -- so what is your understanding of
18 what this passage you just read is describing?
19 MS. SHAH: Objection. Vague.
20 THE WITNESS: In general, my
21 understanding is how we've described how spatial
22 light modulators work; that's what this is
23 describing.
24 BY MR. FITZSIMMONS:
25 Q. Based on your understanding, how would a beam

1 pattern comprising of about 300,000 individual
2 narrow angle microbeams be achieved?
3 A. With a spatial light modulator.
4 Q. And how does that spatial light modulator achieve
5 300,000 narrow angle microbeams?
6 A. From its 300,000 small mirrors and the light source
7 shining on them.
8 Q. So in your understanding, the spatial light
9 modulator would have approximately 300,000 small
10 mirrors?
11 A. That's correct.
12 Q. And according to your understanding, each of those
13 300,000 small mirrors can change position, correct?
14 A. That's right; they can either point the reflection
15 in one direction or another direction.
16 MS. SHAH: Is this a good breaking point?
17 MR. FITZSIMMONS: Almost, yeah.
18 BY MR. FITZSIMMONS:
19 Q. In your opinion, does diverting a microbeam mean
20 the same thing as attenuating a microbeam?
21 MS. SHAH: Objection. Asked and
22 answered.
23 THE WITNESS: In general, the words don't
24 mean exactly the same thing; in this context, they
25 are used to describe the same process.

1 MR. FITZSIMMONS: Let's take a lunch
2 break.
3 (Whereupon a break was taken
4 from 1:01 p.m. to 2:05 p.m.)
5 MR. FITZSIMMONS: Welcome back, Dr. Turk.
6 BY MR. FITZSIMMONS:
7 Q. Let's go to Exhibit 2006, your second declaration,
8 paragraph No. 52. And you're referring to the Beam
9 reference. And do you see where you indicate that
10 Beam has a multiplicity of microbeams that "will
11 operate at maximum intensity at all times"?
12 A. Yes.
13 Q. What does "maximum intensity" mean in the context
14 of automotive lighting?
15 MS. SHAH: Objection. Vague. Calls for
16 speculation.
17 THE WITNESS: In general, I don't know.
18 In this context, I think it means you can't make
19 it any brighter, any higher in terms of its
20 intensity.
21 BY MR. FITZSIMMONS:
22 Q. You said, though, that you don't know in general
23 what "maximum intensity" means in the context of
24 automotive lighting?
25 A. Not as a general term in all circumstances, no.

1 Q. So you don't know if there are standards that apply
2 to the maximum intensity of automotive headlamps?
3 MS. SHAH: Objection. Vague.
4 THE WITNESS: I think there probably are.
5 BY MR. FITZSIMMONS:
6 Q. But you don't know what those standards for maximum
7 intensity in automotive headlamps would be; is that
8 fair?
9 A. I certainly don't opine about them here.
10 Q. How would maximum intensity be measured for
11 automotive headlamps?
12 MS. SHAH: Objection. Vague.
13 THE WITNESS: In general, I don't know if
14 there's one specific technique that they're all
15 measured for. Any kind of measurement would be
16 some sort of light energy measurement regarding the
17 intensity.
18 BY MR. FITZSIMMONS:
19 Q. What do you mean by "light energy measurement"?
20 A. Using some kind of sensor that reacts to light
21 energy.
22 Q. Can you give me an example of a kind of sensor that
23 reacts to light energy?
24 A. Well, I don't opine on that here in my report, but
25 just off the top of my head, a room like this might

1 have a sensor that turns the lights on or turns
2 lights on at particular time of day when it gets
3 dark outside. That would be an example of
4 responding to light intensity.
5 Q. As it pertains to automotive headlamps, does the
6 maximum intensity depend on an angle of the beam
7 spread?
8 MS. SHAH: Objection. Vague.
9 THE WITNESS: That is a hard question to
10 answer because it does seem very vague to me. I'd
11 need a more specific question.
12 BY MR. FITZSIMMONS:
13 Q. So sitting here, you can't answer my question, does
14 maximum intensity depend on an angle of the beam
15 spread?
16 MS. SHAH: Objection. Vague.
17 THE WITNESS: I can't answer that because
18 it's not specific enough to require a specific
19 answer.
20 BY MR. FITZSIMMONS:
21 Q. What's not specific enough about it?
22 A. Can you repeat the question, please?
23 Q. What's not specific enough about it?
24 A. Can you repeat the former question, the "it"?
25 Q. Does maximum intensity depend on angular beam

1 spread -- depend on the angle of beam spread?
2 A. I don't know maximum intensity of what, I don't
3 know which angle, what kind of beam. There's
4 several terms in there that can be fairly broad,
5 can be specific, depends in what context one
6 asks it, so it's hard to answer just out of
7 context.
8 Q. And so then in different contexts, maximum
9 intensity can mean different things; is that
10 correct?
11 A. Yes.
12 Q. Let's turn to paragraph 115 of your second
13 declaration. And it starts on page 76 and carries
14 on to page 77, and we'll look at page 77.
15 And you state that, "Beam is already
16 putting high beam or brighter light everywhere
17 light could be needed." Do you see that?
18 A. Yes.
19 Q. What do you mean by "high beam or brighter light"?
20 A. Well, in the context of general automobile
21 lighting, people tend to think of high beams and
22 low beams as two main categories, and high beam is
23 the brighter of the two, so basically I mean bright
24 light by that phrase.
25 Q. Bright light as compared to what?

1 MS. SHAH: Objection. Vague.
2 THE WITNESS: I guess as compared to
3 lesser amounts of light, particularly as an example
4 of that, light that could be considered a low-beam
5 light.
6 BY MR. FITZSIMMONS:
7 Q. Is it your understanding that automotive headlamps
8 can output light that can be brighter than
9 high-beam light?
10 MS. SHAH: Objection. Vague. Calls for
11 speculation.
12 THE WITNESS: I imagine there are
13 situations where light sources could be overdriven
14 to produce a scenario like that, at least for a
15 period of time until they burn out quickly, but I'm
16 not really sure.
17 BY MR. FITZSIMMONS:
18 Q. Would a headlamp that outputs light that is
19 brighter than high-beam lights comply with
20 government regulations?
21 MS. SHAH: Objection.
22 THE WITNESS: In general, I don't know.
23 It depends on a lot of things, like which
24 regulations you might be talking about.
25 MS. SHAH: Sorry. Objection. Vague.

1 Calls for speculation.
2 BY MR. FITZSIMMONS:
3 Q. Before we discussed the FMVSS regulations, correct?
4 A. Yes.
5 Q. Would a headlamp that outputs light that is
6 brighter than high-beam lights comply with the
7 FMVSS regulations?
8 A. I don't know specifically.
9 Q. How would light that -- headlamp light that is
10 brighter than high-beam light affect the headlamp
11 beam pattern?
12 A. You know, I've never really thought about light
13 that is brighter than high-beam light coming from
14 headlights, so I have no idea really.
15 Q. Right here in your declaration, paragraph 115, you
16 say that, "Since Beam is already putting high beam
17 or brighter light everywhere light could be
18 needed...," correct?
19 A. Yeah, and then I explained what that means.
20 Q. So what did you mean by brighter light? You're
21 saying you didn't -- you said, "I've never really
22 thought about light that is brighter than high-beam
23 light coming from headlights."
24 A. That's right. And this doesn't describe light that
25 is brighter than high-beam light.

1 Q. What does this describe?
2 A. As I said before, it's high beam, which can also be
3 thought of as brighter, compared to, for example,
4 low beams.
5 Q. So your sentence here, you're saying, does not
6 refer to light that is brighter than high beam,
7 right? Is my understanding correct?
8 MS. SHAH: Objection. Mischaracterizes
9 the witness' testimony. Vague.
10 THE WITNESS: It is not intended to
11 describe just light that is brighter than high-beam
12 lights.
13 BY MR. FITZSIMMONS:
14 Q. If it's not intended to describe just light that is
15 brighter than high-beam lights, what else does it
16 include?
17 A. Like I said originally, that phrase is essentially
18 referring to bright light.
19 Q. What do you consider to be bright light?
20 A. In this context, lights that are similar to the
21 high-beam light would be considered bright.
22 Q. Do you consider light that is somewhere between
23 low-beam and high-beam light to be brighter light?
24 MS. SHAH: Objection. Vague.
25 THE WITNESS: Brighter than what? It

1 depends on the frame of reference, I guess, for a
2 question like that.
3 MR. FITZSIMMONS: Brighter than low beam.
4 THE WITNESS: So yes, I do think that
5 light that is brighter than low-beam light would be
6 considered brighter than low beam, if I understand
7 your question.
8 BY MR. FITZSIMMONS:
9 Q. Does your term here, "brighter light," encompass
10 light that is between low-beam and high-beam light?
11 MS. SHAH: Objection. Vague.
12 THE WITNESS: This phrase is not
13 dictating a specific level of light. As I said,
14 the phrase "high beam" or "brighter light"
15 describes bright light, as intended here.
16 BY MR. FITZSIMMONS:
17 Q. So you can't quantify bright light; is that
18 correct?
19 MS. SHAH: Objection. Mischaracterizes
20 the witness' testimony. Vague.
21 THE WITNESS: Offhand, I can't
22 specifically quantify it, no.
23 BY MR. FITZSIMMONS:
24 Q. So you can't put a bound on what you mean by bright
25 light; is that correct?

1 A. I am not here putting a bound specifically; I'm not
2 referring to an exact level of light, so no, I'm
3 talking about bright light as understood in the
4 context of this declaration.
5 Q. So your statement here, "Beam is already putting
6 high beam or brighter light everywhere" -- so is it
7 your understanding that Beam did not provide
8 low-beam light?
9 MS. SHAH: Objection. Vague.
10 THE WITNESS: Are you asking if this
11 statement is saying that, stating that, or separate
12 from the statement, if I have an understanding
13 about that?
14 BY MR. FITZSIMMONS:
15 Q. Is there a distinction in your mind between those
16 two?
17 A. Yes.
18 Q. What would that be? Let's start with the statement
19 here.
20 A. Your question was about low-beam light, I believe,
21 and the statement doesn't say anything about
22 low-beam light, so it doesn't restrict that, so
23 that's the specific response about the statement.
24 And about Beam in general, I don't believe
25 that I provide any opinions in here about Beam and

1 low-beam beam, the reference on low-beam light, so
2 I have no real opinion about it.
3 Q. You've reviewed the Beam reference, correct?
4 A. I have, yes.
5 Q. And you can't tell me whether the Beam reference
6 can provide low-beam light; is that what you're
7 telling me?
8 A. I don't recall offhand right now if Beam refers to
9 low-beam lights. If there's someplace here where I
10 discuss it, let's go to it.
11 Q. In your opinion, is Beam also providing light that
12 is equivalent to high-beam light?
13 A. Beam says it will operate in maximum intensity at
14 all times. I don't recall if Beam itself equates
15 that to high-beam light or not, so I'm not sure.
16 Q. So is it your position that Beam never operates at
17 something lower than maximum intensity?
18 MS. SHAH: Objection. Asked and
19 answered.
20 THE WITNESS: There are aspects of Beam
21 that do because of the anti-glare capability of
22 Beam, but otherwise, it operates at maximum
23 intensity at all times.
24 BY MR. FITZSIMMONS:
25 Q. "There are aspects of Beam that do." That do

1 what?
2 A. Can you repeat your question to me that that was in
3 response to, please?
4 Q. My question was, "Is it your position that Beam
5 never operates at something lower than maximum
6 intensity?"
7 A. And then that's the "do," operating at lower than
8 maximum intensity in the anti-glare regions.
9 Q. And so then is your opinion that Beam operates at
10 lower than maximum intensity in the anti-glare
11 regions? Is that correct?
12 A. Yeah, Beam blanked is lower than maximum intensity,
13 so I would agree with that yeah.
14 Q. So when you were considering the term "maximum
15 intensity," you believed that to be a regional term
16 where certain regions of the beam pattern can be at
17 maximum intensity and other regions of the beam
18 could not be at maximum intensity?
19 MS. SHAH: Objection. Vague.
20 THE WITNESS: I think those are two
21 different things, what maximum intensity is and
22 what various things can do. So maybe could you
23 restate the question?
24 BY MR. FITZSIMMONS:
25 Q. What do you mean, those are two different things?

1 A. I believe your question started with something
2 about maximum intensity, then I believe your
3 question went on to talk about some things doing
4 one thing and some things doing another, so maybe
5 you can just re-read the question.
6 Q. Sure. So when you're considering the term "maximum
7 intensity," do you believe there are parts of the
8 beam pattern that can be a maximum intensity and
9 other parts of the beam pattern that can be at
10 lower than maximum intensity?
11 A. Yes, the part of the beam that is doing the
12 anti-glare is not at maximum intensity, it's
13 blanked.
14 Q. So when you're considering the term "maximum
15 intensity," it's not with respect to the entire
16 beam pattern, correct?
17 MS. SHAH: Objection. Vague.
18 THE WITNESS: The term is with respect to
19 the whole pattern. The whole pattern may not be
20 issuing beams that are maximum intensity if some of
21 it is being used for anti-glare.
22 BY MR. FITZSIMMONS:
23 Q. And so it's your position that the whole beam
24 pattern can be at maximum intensity even if there
25 are beams within that pattern that are not at

1 maximum intensity; is that correct?
2 MS. SHAH: Objection. Vague.
3 THE WITNESS: I don't think I said that.
4 BY MR. FITZSIMMONS:
5 Q. You agree -- or you stated that the term "maximum
6 intensity" is with respect to the whole beam
7 pattern, correct?
8 MS. SHAH: Objection. Mischaracterizes
9 the witness' testimony.
10 THE WITNESS: I don't remember exactly
11 what I said, but the term itself can be applied to
12 anything related to the beam. You can talk about
13 any part of the beam being at maximum intensity or
14 not.
15 BY MR. FITZSIMMONS:
16 Q. Still in paragraph 115 of your declaration, again,
17 when you say, "Since Beam is already putting high
18 beam or brighter light everywhere" --
19 A. Excuse me, can you tell me where you are?
20 Q. That same sentence, paragraph 115 of your
21 declaration.
22 A. How far down?
23 Q. Page 77, a couple sentences down.
24 A. Okay. Thank you.
25 Q. So, "Since Beam is already putting high beam or

1 brighter light everywhere..." Do you see that?
2 A. Yes.
3 Q. What do you mean in that sentence by "light
4 everywhere"?
5 A. I mean everywhere that Beam's device can shine
6 light.
7 Q. Would that shine light outside of a typical
8 high-beam pattern?
9 MS. SHAH: Objection. Vague. Calls for
10 speculation.
11 THE WITNESS: Do you mean outside
12 geometrically, physically? Maybe I'm not clear on
13 your question.
14 BY MR. FITZSIMMONS:
15 Q. Do you draw a distinction between geometrically and
16 physically disposing the light?
17 A. In general, out of context, out of any particular
18 context, I think there are two ways to describe the
19 same thing.
20 Q. So when you say that Beam puts light everywhere,
21 would that shine light geometrically outside of a
22 typical high-beam pattern?
23 MS. SHAH: Objection. Vague. Calls for
24 speculation.
25 THE WITNESS: Yeah, I don't know what

1 typical high-beam pattern you're referring to. I
2 know about Beam's system.
3 BY MR. FITZSIMMONS:
4 Q. So you're not familiar with what a typical
5 high-beam pattern would entail for vehicle
6 headlamps?
7 MS. SHAH: Objection. Mischaracterizes
8 the witness' testimony.
9 THE WITNESS: That's not what I said. I
10 do have some understanding of that, but I thought
11 your question was about Beam. I'm just trying to
12 understand it.
13 BY MR. FITZSIMMONS:
14 Q. My question was, was Beam relative to a typical
15 high-beam pattern? So let's start with that.
16 What's your understanding of a typical high-beam
17 pattern?
18 MS. SHAH: Objection. Vague.
19 MR. FITZSIMMONS: For vehicle headlamps.
20 MS. SHAH: Objection. Vague.
21 THE WITNESS: I didn't opine on typical
22 high-beam patterns. I have a general sense of, you
23 know, outside of the context of this case, if there
24 are such patterns, regulations and such, but I
25 don't know them in detail offhand.

1 BY MR. FITZSIMMONS:
2 Q. Okay. So your understanding is that there are
3 regulations which govern high-beam patterns; is
4 that correct?
5 A. I expect that some of the regulations we've already
6 discussed touch on those, but again, I just -- I've
7 not opined on that, so I'm not 100 percent sure at
8 this moment.
9 Q. So you're not sure if there is regulations which
10 govern high-beam patterns then; is that correct?
11 MS. SHAH: Objection. Asked and
12 answered.
13 THE WITNESS: I'm not sure of any
14 specific ones at the moment, no.
15 BY MR. FITZSIMMONS:
16 Q. At the end of paragraph 115 and before
17 paragraph 116, page 78 of your declaration, you
18 see you provide an annotated drawing there of
19 Beam's Figure 1 with your -- are those your
20 annotations?
21 A. This is from Exhibit 105 and I would need to remind
22 myself what that exhibit is.
23 MR. FITZSIMMONS: That is the Beam
24 reference.
25 THE WITNESS: My exhibits start with two,

1 so...
2 MR. FITZSIMMONS: You have the Beam
3 reference over there, I believe. You can check and
4 you'll see that's Exhibit 1005.
5 THE WITNESS: Okay. Gotcha. So I'm
6 sorry, what was the question?
7 BY MR. FITZSIMMONS:
8 Q. So the drawing that's here before paragraph 116,
9 that's an annotated version of Beam's Figure 1,
10 correct?
11 A. That's correct.
12 Q. And you provided those annotations, correct?
13 A. Yes.
14 Q. Those aren't in the Beam reference, correct?
15 A. They are not; that's correct.
16 Q. 101 in that annotated drawing, is that the field of
17 view in Beam's Figure 1?
18 A. It is the field of view of the headlamp, yes.
19 Q. Could you light outside of that field of view to
20 light a curve?
21 A. With Beam? No.
22 Q. So your opinion is that Beam can -- is not capable
23 of lighting anything outside of that field of view;
24 is that correct?
25 A. That's correct.

1 Q. But you could modify Beam to light outside of that
2 field of view, correct?
3 MS. SHAH: Objection. Vague. Calls for
4 speculation.
5 THE WITNESS: I suppose there are some
6 modifications that could do that.
7 BY MR. FITZSIMMONS:
8 Q. What does the term "forward illumination" mean to
9 you?
10 A. To me, it means illuminating generally in front of
11 the vehicle.
12 Q. Does forward illumination include low beams?
13 A. I don't think that I discussed that here and
14 haven't thought much about it, but I would expect
15 generally, yes.
16 Q. Does forward illumination include high beams?
17 A. Again, I don't think I've thought too much about
18 the term in the context of this, but I think in
19 general, yes.
20 Q. Does forward illumination include fog lamps?
21 MS. SHAH: Objection. Relevance.
22 THE WITNESS: I don't say anything about
23 fog lamps here and I've not really considered fog
24 lamps in much detail in this, so I just don't
25 know.

1 BY MR. FITZSIMMONS:
2 Q. So you don't know whether forward illumination
3 would include fog lamps?
4 MS. SHAH: Objection. Asked and
5 answered.
6 MR. FITZSIMMONS: Is that correct?
7 THE WITNESS: Again, I've not really
8 considered fog lamps in any detail or that term in
9 too much detail, so I don't really have an opinion
10 about it.
11 BY MR. FITZSIMMONS:
12 Q. Which term have you not considered in too much
13 detail?
14 A. Forward illumination.
15 Q. Can you go to paragraph 124 of your second
16 declaration, please? Are you there?
17 A. Yes.
18 Q. Do you see the second sentence there where you
19 state, "Beam's AABH system is directed to
20 high-intensity forward illumination"?
21 A. Yes.
22 Q. You just told me, "I don't think I've thought too
23 much about the term in the context of this,"
24 referring to forward illumination; is that correct?
25 A. Yeah, and here it's used as just a general phrase.

1 It's illuminating and it's illuminating forward;
2 it's not used as a particular phrase of art.
3 Q. So to you, forward illumination in this context
4 means illuminating forward; is that correct?
5 A. Yes, in a sense, that's what I mean by it.
6 Q. Is there a difference between forward illumination
7 and intense forward illumination?
8 MS. SHAH: Objection. Vague. Calls for
9 speculation.
10 MR. FITZSIMMONS: Let me rephrase that.
11 BY MR. FITZSIMMONS:
12 Q. You used the term here or you state here, "Beam is
13 directed to high-intensity forward illumination,"
14 correct?
15 A. Yes.
16 Q. Is high-intensity forward illumination, as you use
17 it here in your declaration at paragraph 124,
18 different than forward illumination?
19 A. As used here, high intensity is modifying forward
20 illumination, so yes, there could be extremely low
21 intensity forward illumination, for example.
22 Q. How do you characterize high-intensity forward
23 illumination as you refer to it here in your
24 declaration?
25 A. Illumination that is generally in a forward

1 direction that is of generally high intensity.
2 Q. What does "high intensity" mean to you?
3 A. It means something that is likely to be perceived
4 as bright.
5 Q. How do you determine what is perceived as bright?
6 MS. SHAH: Objection. Asked and
7 answered.
8 THE WITNESS: That's generally a human
9 judgment.
10 BY MR. FITZSIMMONS:
11 Q. So what's perceived as bright could vary from
12 person to person, is that correct?
13 A. In general, brightness is subjective and so by
14 definition it does vary from person to person
15 somewhat.
16 Q. Going back to the concept of forward illumination.
17 Does forward illumination include light from
18 cornering lamps?
19 A. As a general phrase, I think it could.
20 Q. In what context can it?
21 MS. SHAH: Objection. Calls for
22 speculation.
23 THE WITNESS: I suppose if some of the
24 light goes forward of the vehicle, then it would
25 be appropriate to consider it as forward

1 illumination.
2 BY MR. FITZSIMMONS:
3 Q. What do you mean by "forward of the vehicle"?
4 A. In front of the vehicle.
5 (Marked for identification:
6 Deposition Exhibit No. 1012.)
7 BY MR. FITZSIMMONS:
8 Q. Dr. Turk, I'm going to take you to the Gotou
9 records. It's Exhibit 1012, US Patent
10 No. 5,588,733. Are you familiar with this exhibit?
11 A. Yes, I am.
12 Q. And Gotou is used as the primary reference in one
13 of the petition combinations, correct?
14 A. I believe that's right.
15 Q. And Gotou discloses using mapped information to
16 direct the light from the headlamps to light curves
17 along a road, correct?
18 MS. SHAH: Objection. Vague.
19 THE WITNESS: I think that's a reasonable
20 general explanation of it.
21 BY MR. FITZSIMMONS:
22 Q. And let's go to column 8 of Gotou and lines 15 or
23 16 through, say, 19 there. Could you read those?
24 A. "There is also another method in which two bulbs
25 are installed in one headlight and the light

1 distribution is changed by separately using
2 one-bulb illumination and two-bulb illumination,
3 respectively."
4 Q. And so this section in Gotou expressly discloses
5 using one or two bulbs, correct?
6 A. Yes.
7 Q. And whether you use one or two bulbs in a headlamp
8 would change the shape of the beam pattern,
9 correct?
10 MS. SHAH: Objection. Vague. Calls for
11 speculation.
12 THE WITNESS: I think that would depend
13 on the design of the headlamp.
14 BY MR. FITZSIMMONS:
15 Q. What do you mean by, "It would depend on the design
16 of the headlamp"?
17 A. I could imagine a design where the two bulbs are
18 essentially redundant and end up producing the same
19 output as a single bulb of brighter illumination
20 might have.
21 Q. In your opinion, do you think Gotou is disclosing
22 two bulbs that are essentially redundant here?
23 A. I don't have an opinion about that.
24 Q. You've reviewed Gotou previously, correct?
25 A. Yes.

1 Q. And you reviewed Gotou before this deposition
2 today?
3 A. Yes.
4 Q. And you just reviewed column 8, lines 15 to 19,
5 correct?
6 A. That's right.
7 Q. And you don't have an opinion about whether Gotou
8 is disclosing two bulbs that are essentially
9 redundant in that passage; is that correct?
10 A. I don't recall if Gotou talks more about this
11 possible two-bulb configuration, so off the top of
12 my head, I don't know.
13 Q. This sentence right here says, "The light
14 distribution is changed by separately using
15 one-bulb illumination and two-bulb illumination,
16 correct?
17 MS. SHAH: Objection. Vague.
18 THE WITNESS: This passage says there's
19 another method in which what you just said happens.
20 I don't know if there's any detail of that method
21 or if that's even what Gotou is claiming offhand.
22 I would have to refresh myself on that.
23 BY MR. FITZSIMMONS:
24 Q. You agree Gotou discloses right here that, "There
25 is also another method in which two bulbs are

1 installed in one headlight and the light
2 distribution is changed by separately using
3 one-bulb illumination and two-bulb illumination,
4 respectively," correct?
5 A. Gotou does state that sentence, yes.
6 Q. And so Gotou states that there's another method
7 where there are two bulbs installed, correct?
8 A. That's what that first sentence says, yes.
9 Q. And in that method, Gotou states that the light
10 distribution is changed by separately using
11 one-bulb illumination and two-bulb illumination,
12 correct?
13 A. That's what the sentence says, yes.
14 Q. So according to Gotou, light distribution is
15 different when using one-bulb illumination versus
16 using two-bulb illumination, correct?
17 A. Gotou says that there is a method in which that can
18 be the case.
19 Q. When going from one bulb to two bulbs, that would
20 increase light in certain directions, correct?
21 MS. SHAH: Objection. Vague. Calls for
22 speculation.
23 THE WITNESS: Are you asking what Gotou
24 teaches about that or in general independent of
25 Gotou?

1 MR. FITZSIMMONS: What's your
2 understanding?
3 THE WITNESS: Independent of Gotou? It
4 would depend on the brightnesses of the bulbs.
5 BY MR. FITZSIMMONS:
6 Q. What about with respect to Gotou?
7 A. I don't think Gotou says anything about that.
8 Q. If you have two lightbulbs in a headlamp side by
9 side and one is lit and one is off and then you
10 light the second one, would that -- that would
11 increase light in a certain direction, correct?
12 MS. SHAH: Objection. Vague.
13 THE WITNESS: In that hypothetical
14 situation and if they're side by side, as you
15 described, which they wouldn't have to be, but
16 that probably would -- I forget how you ended it --
17 but brighten, increase illumination, with some
18 caveats, depending on how the optics is designed
19 and other things, so it somewhat depends, but
20 probably.
21 MR. FITZSIMMONS: Let's take a break.
22 (Whereupon a break was taken
23 from 3:00 p.m. to 3:19 p.m.)
24 (Marked for identification:
25 Deposition Exhibit No. 1010.)

1 BY MR. FITZSIMMONS:
2 Q. Dr. Turk, I'm going to now hand you Exhibit 1010.
3 This is the Karlsson reference. It's International
4 Publication No. WO 98/54030.
5 Are you familiar with Exhibit 1010?
6 A. Yes, I am.
7 Q. Okay. Page 14 at the top in Karlsson. Can you
8 read lines 1 through 4, the first paragraph for me,
9 please?
10 A. "The spotlight beams 34 can be obtained, for
11 example, by using a light source 2 which is
12 composed of a grid of separate light sources such
13 as LEDs, which can preferably be controlled either
14 individually or in groups."
15 Q. So Karlsson discloses using LEDs for its headlamps,
16 correct?
17 A. Not in all of its embodiments, but it does have
18 such a disclosure, yes.
19 Q. So Karlsson discloses that you can use LEDs for its
20 headlamps, correct?
21 A. Yes.
22 Q. And Karlsson also discloses that those LEDs can be
23 controlled individually or in groups, correct?
24 MS. SHAH: Objection. Vague. Calls for
25 speculation.

1 THE WITNESS: Yes, in the sentence, yes.
2 BY MR. FITZSIMMONS:
3 Q. Let's go to page 4 of Karlsson, and starting on
4 page 4, line 17, where it says, "In a preferred
5 embodiment..." Do you see that paragraph?
6 A. Yes.
7 Q. Could you read that first sentence for me, please?
8 A. "In a preferred embodiment of the invention, the
9 average intensity of the light emitted by the
10 lighting means is controlled such to provide a
11 light beam, the intensity of which is optimally
12 adapted to the road and to the ambient light,
13 thereby increasing the driving comfort and road
14 safety."
15 Q. And so Karlsson discloses that its headlamp has an
16 intensity which is optimally adapted to the road
17 and to the ambient light, correct?
18 A. Karlsson discloses different headlights, and in a
19 preferred embodiment as described here, it says it
20 can be controlled that way.
21 Q. And by "controlled that way," you mean that the
22 intensity is optimally adapted to the road and to
23 the ambient light, correct?
24 A. Yes.
25 Q. And so in a preferred embodiment of Karlsson,

1 the intensity of the light beam is optimally
2 adapted to the road and to the ambient light,
3 correct?
4 A. That's what that statement says, yes. I don't
5 believe Karlsson gives any teaching of how that
6 would be accomplished, but that's what that
7 statement says, yeah.
8 Q. And that concept, that's similar to the concept
9 we discussed earlier in the day with respect to
10 the '029 patent having an optimal operating regime,
11 correct?
12 MS. SHAH: Objection. Calls for
13 speculation. Vague.
14 THE WITNESS: It uses the word optimal or
15 a deviation of that word. I'm not sure exactly how
16 similar those two are otherwise.
17 BY MR. FITZSIMMONS:
18 Q. In your opinion, is there a distinction between
19 those two concepts?
20 A. I haven't compared those two concepts before, so I
21 don't really have an opinion offhand about it.
22 Q. In your declaration, Exhibit 2006, your second
23 declaration, paragraph 83. In paragraph 83, you're
24 discussing Karlsson's Figure 14, correct?
25 A. Yes.

1 Q. And towards the bottom of the page there, you cite
2 Exhibit 1010, which is Karlsson, column 19,
3 lines 29 through 33, correct?
4 A. Yes.
5 Q. Let's go to Karlsson to page 19, lines 29 to 33,
6 please. And can you read those lines for me?
7 Again, that's page 19, lines 29 through 33.
8 A. "The emitted light beam 50 is represented as a
9 window which can shift in the plane of the drawings
10 from left to the right and from the top to the
11 bottom, if desired, and vice versa, and which may
12 vary as regards its shape and dimensions and
13 dependence on the desired pattern and direction of
14 the beam."
15 Q. And so Karlsson is disclosing here that that window
16 can vary as regards to its shape and dimension,
17 correct?
18 A. Yes.
19 Q. And so Karlsson's describing the shape can vary
20 depending on the desired pattern and direction of
21 the beam, correct?
22 A. That's what it says there, yes.
23 Q. And Karlsson's describing that the dimension can
24 vary depending on the desired pattern and direction
25 of the beam, correct?

1 MS. SHAH: Objection. Asked and
2 answered.
3 THE WITNESS: It says it may vary in --
4 sorry, did you say direction or dimension?
5 MR. FITZSIMMONS: Dimension.
6 THE WITNESS: Okay. It says it can vary
7 in dimension, yes.
8 BY MR. FITZSIMMONS:
9 Q. And so Figure 14 of Karlsson, that window 50 is an
10 example of the emitted light beam from Karlsson's
11 headlamp, correct?
12 MS. SHAH: Objection. Vague.
13 THE WITNESS: In my view, it's a
14 conceptual diagram of some light coming from
15 Karlsson in some situation.
16 BY MR. FITZSIMMONS:
17 Q. And what Karlsson's disclosing here -- we're
18 talking page 19, lines 29 through 33 -- that window
19 50, that can shift in the plane from the left to
20 the right, correct?
21 MS. SHAH: Objection. Vague.
22 THE WITNESS: Yes, that's what it states
23 here in that -- in these few lines, which is the
24 only time in Karlsson that the window 50 is
25 mentioned.

1 BY MR. FITZSIMMONS:
2 Q. And it also states that it can shift in the plane
3 from the top to the bottom, correct?
4 A. That's what it says there, yes.
5 Q. And it also says that window 50 can vary in its
6 shape and dimension, correct?
7 A. That's what it says, yes.
8 Q. So that window 50, will it always be a square as
9 represented there in Karlsson?
10 MS. SHAH: Objection. Calls for
11 speculation. Vague.
12 THE WITNESS: Karlsson does not teach
13 directly, but my best understanding of this window
14 given what Karlsson does say, is that it wouldn't
15 necessarily always be square.
16 BY MR. FITZSIMMONS:
17 Q. Could it be a rectangle?
18 MS. SHAH: Objection. Calls for
19 speculation.
20 THE WITNESS: Well, a square is a
21 rectangle, so yes.
22 BY MR. FITZSIMMONS:
23 Q. Could it be a non-regular quadrilateral?
24 MS. SHAH: Objection. Vague. Calls for
25 speculation.

1 THE WITNESS: I'm not sure what that --
2 what you mean by that, "non-regular quadrilateral."
3 BY MR. FITZSIMMONS:
4 Q. So a square would be a regular quadrilateral with
5 all equal sides, correct?
6 A. Okay.
7 Q. So could it be a rectangular -- could it be a
8 rectangle without equal sides?
9 A. A non-square rectangle, for example?
10 Q. Sure, a non-square rectangle, however you would
11 like to term it. Could that window 50 be a
12 non-square rectangle?
13 A. I think this one sentence about the window 50 is
14 intended to include that, yes.
15 Q. Could window 50 be some other polygon shape?
16 MS. SHAH: Objection. Calls for
17 speculation.
18 THE WITNESS: I don't think this one
19 sentence where Karlsson discusses the window says
20 anything about that, so I don't know.
21 BY MR. FITZSIMMONS:
22 Q. Could there be a hole in the center of that
23 window 50 where there's LEDs that aren't emitting
24 light?
25 MS. SHAH: Objection. Calls for

1 speculation. Vague.
2 THE WITNESS: Given that Karlsson just
3 has one sentence, which we've already read, about
4 that light beam 50, Karlsson does not say anything
5 about the subject of your question, so I don't
6 know.
7 BY MR. FITZSIMMONS:
8 Q. So in your declaration, Exhibit 2006, between
9 paragraphs 77 and 78, you include an annotated
10 figure, page 61 of your declaration. Do you see
11 that?
12 A. Yes.
13 Q. That's an annotated version of Figure 14, correct?
14 A. Correct.
15 Q. And you've drawn a red box around an area sort of
16 in the upper half of that diagram and you have a
17 label that says, "'I' marked LEDs," there, do you
18 see that?
19 A. Yes.
20 Q. And in towards the bottom half of the annotated
21 drawing, you have a box and that's labeled "'D'
22 marked LEDs," correct?
23 A. Yes.
24 Q. Is it your understanding that Karlsson can light
25 only the LEDs in the box that you have marked "I"?

1 MS. SHAH: Objection. Calls for
2 speculation.
3 THE WITNESS: I don't believe Karlsson
4 states that specifically. There's a lot of things
5 Karlsson doesn't state specifically, so I'm not
6 really sure -- I'm not 100 percent sure what
7 Karlsson would say about that.
8 BY MR. FITZSIMMONS:
9 Q. Would a person of ordinary skill in the art
10 understand that only the LEDs in the box you have
11 labeled as "I" could be lit in a headlamp?
12 A. In Karlsson's embodiments that this figure
13 represents, I don't think there's any detail about
14 what the possible lighting options are, so I don't
15 know if a person of ordinary skill in the art would
16 be able to conclude for sure if Karlsson's system
17 could do that or not.
18 Q. In your opinion, would a person of ordinary skill
19 in the art understand that only the LEDs in the box
20 you have labeled "D" could be lit in the headlamp?
21 MS. SHAH: Objection. Calls for
22 speculation. Vague.
23 THE WITNESS: Yeah, I would respond the
24 same way to your last question. I don't believe
25 there's any detail about that in Karlsson and also

1 about how they're connected specifically in
2 Karlsson, so I don't think a person of ordinary
3 skill in the art would know how to interpret that
4 according to Karlsson.
5 BY MR. FITZSIMMONS:
6 Q. Let's turn to paragraph 80 of your declaration. On
7 page 62, there's a diagram labeled 1A. Do you see
8 that?
9 A. Yes.
10 Q. And that's a diagram that you created?
11 A. I don't think I created the original, but I
12 certainly collaborated on the creation of the final
13 version of this diagram.
14 Q. That's not a diagram from Karlsson, though,
15 correct?
16 A. Not directly; not the whole diagram.
17 Q. What portion of the diagram is not from Karlsson?
18 A. The portions aside from all of the dots in the
19 rectangle is not from Karlsson.
20 Q. And where you're talking about dots and the
21 rectangle, that's labeled 7, correct?
22 A. Yes.
23 Q. And that's similar to Figure 14 of Karlsson,
24 correct?
25 A. Yes.

1 Q. But that removes the window 50 from Karlsson's
2 Figure 14, correct?
3 A. That's correct.
4 Q. And below that there's a diagram labeled 2A. Do
5 you see that?
6 A. Yes.
7 Q. And that diagram is not in Karlsson, correct?
8 A. That's right.
9 Q. Okay. No portion of that diagram is in Karlsson,
10 correct?
11 A. That's correct.
12 Q. That's your speculation as to what Karlsson's
13 disclosing; is that fair?
14 MS. SHAH: Objection.
15 THE WITNESS: It's my speculation as to
16 how the LED array in Karlsson can be similar to the
17 incandescent headlamp.
18 BY MR. FITZSIMMONS:
19 Q. If we go down to page 64, there's a diagram
20 labeled 1B right before paragraph 85. Do you see
21 that?
22 A. Yes.
23 Q. And it's a diagram that you created?
24 A. Similar to the other one, I collaborated in the end
25 result of this diagram, but I didn't provide the

1 first draft.
2 Q. So this diagram is not in the Karlsson reference
3 itself, correct?
4 A. The full figure there is not; that's correct.
5 Q. What portion of this diagram 1B is from Karlsson?
6 A. The dots, again, come from Figure 14, Karlsson, the
7 array of dots.
8 Q. And the box that's outlined on the right-hand side
9 with the number 50 pointing to it, do you see that?
10 A. Yes.
11 Q. That's not where the window 50 in Karlsson's
12 Figure 14 is shown, correct?
13 A. That's right. That's showing my understanding of
14 where the window would be in the scenario to the
15 left.
16 Q. And so for this diagram, 1B, this is your
17 speculation as to Karlsson's -- where the window
18 would be in Karlsson's scenario shown on the left;
19 is that correct?
20 A. It's my expectation, my best guess, given that
21 Karlsson says very little about the window. It's
22 my understanding of how putting together various
23 aspects of Karlsson would make sense for that.
24 Q. On the next page, page 65, there's a diagram
25 labeled 1C right above paragraph 86. Do you see

1 that one?
2 A. Yes.
3 Q. And again, this is a diagram that you or counsel
4 have collaborated on to create; is that correct?
5 A. That's correct.
6 Q. And the box 50 noted on the right-hand side. Do
7 you see that?
8 A. I do, yes.
9 Q. And that's not where the window 50 in Karlsson's
10 Figure 14 is shown, correct?
11 A. That's correct. Like before, it's my best estimate
12 of where the window would be in the scenario shown
13 to the left.
14 Q. If you go back up to the diagram 1B. And this
15 illustrates a vehicle taking a right-hand turn; is
16 that correct?
17 A. I would call it a curve to the right.
18 Q. So this illustrates a vehicle taking a
19 right-hand -- scratch that.
20 So your diagram 1B illustrates a vehicle
21 taking a curve to the right; is that fair?
22 A. Yes, and that's what I say in paragraph 84.
23 Q. And your diagram shows what you believe to be the
24 beam pattern from the left headlamp; is that
25 correct?

1 A. Yes.
2 Q. And can you describe for me what the dotted red
3 line is in that drawing 1B?
4 A. On the left side?
5 Q. Correct.
6 A. The dotted red curve is where -- approximately
7 where the light would hit the road or ground in
8 front of the car, the headlamp.
9 Q. And what is the portion shown in yellow?
10 A. That is the portion that the window 50 on the right
11 would be illuminating.
12 Q. So in your opinion, the portion of that dotted red
13 cone would not be lit to the left of that yellow
14 area; is that correct?
15 A. Not by that headlamp; that's correct.
16 MR. FITZSIMMONS: This is an exhibit we
17 can mark as Deposition Exhibit A, please.
18 (Marked for identification:
19 Deposition Exhibit No. A.)
20 BY MR. FITZSIMMONS:
21 Q. And I'm handing you the exhibit that's marked as
22 Exhibit A. And this exhibit is a reproduction of
23 your drawing 1B and it adds a second red dotted
24 line for a potential beam pattern for the right
25 headlamp like the one that you have for the left

1 headlamp. Is that a fair representation of what
2 this Exhibit A shows, Dr. Turk?
3 A. It looks right, yes.
4 Q. I would like you to shade in blue -- here's a blue
5 marker. I would like you to shade in blue where
6 you believe Karlsson's right headlight would
7 project onto the road in the hypothetical vehicle
8 in your Figure -- your drawing 1B, please.
9 MS. SHAH: Objection. Incomplete
10 hypothetical. Calls for speculation.
11 THE WITNESS: This Figure 1B here is not
12 intended to be technically accurate, it's an
13 example, sort of a -- yeah, just an example, and so
14 similarly, I don't know if that's exactly where it
15 would be, but that would be a reasonable guess from
16 my perspective.
17 BY MR. FITZSIMMONS:
18 Q. Can you describe for me in words the area that you
19 shaded there, outlined it with the blue marker and
20 have blue cross lines there?
21 A. It's similar to the shading in Figure 1B, just
22 shifted over into the right headlamp and perhaps
23 oriented a little more towards the centerline
24 ahead.
25 Q. What do you mean by the centerline?

1 A. The imaginary line that goes through the center of
2 the car from behind to forward.
3 Q. Could you draw the centerline for me here in pen?
4 A. Something like that.
5 Q. Okay. I'll ask you to use that pen, Dr. Turk, and
6 please sign and date that for me.
7 A. (The witness complies.)
8 Q. And so what you've annotated here, Dr. Turk, is
9 what you believe to be a representation of the
10 right headlamp beam pattern in this scenario of
11 drawing 1B; is that fair?
12 A. I think that would be a reasonable thing for the
13 right headlamp to do. I don't know exactly what it
14 would do, and again, it's not meant to be
15 technically precise, but yes.
16 Q. Now I would like you to take back out your first
17 declaration that was Exhibit 2001, and if you could
18 please turn to paragraphs 84 and 85. And you see
19 between 84 and 85 on page 49 -- again, this is
20 Exhibit 2001 this time -- there is an annotated
21 drawing in the center of the page.
22 A. I see that.
23 Q. Did you create this annotated drawing?
24 A. I don't remember who created the first one, first
25 draft, but I collaborated with my colleagues to

1 come up with it.
2 Q. Can you describe what's shown here in the diagram
3 right before paragraph 85?
4 A. Yes, it was an attempt to show that there are
5 differences in a beam coming out of an LED array --
6 of a full LED array, which is what the blue dotted
7 line is, and a less than full rectangular LED
8 array, which is what the red dotted line is.
9 Q. And is it your opinion still that this is an
10 accurate representation of potential beam patterns
11 in Karlsson?
12 A. Well, it was never intended to be technically
13 accurate, precise in terms of the optics and where
14 the beam would go -- beam would go exactly; it's
15 sort of a characterization that there would be
16 different portions of the array illuminating
17 forward, but to the -- for what it was intended
18 for, it is accurate in the sense that it makes the
19 point.
20 Q. So you stand by your characterization here in your
21 first declaration; is that correct?
22 A. I stand by my general point in making this, which
23 is the beams would be somewhat different as shown
24 by the difference in the red dotted line and the
25 blue dotted line.

1 Q. Let's take Karlsson back out. So Exhibit 1010, the
2 Karlsson reference. Let's go to page 20. And I'll
3 have you just refer to lines 16 through 32. I'll
4 give you a moment to review that.
5 A. Okay.
6 Q. Do you see in lines 26 through 27 on page 20 there
7 of Karlsson, it says, "...that the light beam 7 to
8 be emitted is adapted to the respective regulations
9 at all times"?
10 A. I see that line, yes.
11 Q. And so Karlsson is disclosing that it's taking into
12 account regulations with respect to its emitted
13 light beam 7, correct?
14 MS. SHAH: Objection. Vague. Calls for
15 speculation.
16 THE WITNESS: I think Karlsson is stating
17 that Karlsson would like to do that. There's no
18 teaching of it or describing how it is done, so
19 it's hard to say much beyond that statement is
20 there.
21 BY MR. FITZSIMMONS:
22 Q. Okay. And the statement that's in Karlsson is that
23 the light beam 7 to be emitted is adapted to the
24 respective regulations at all time, correct?
25 A. Yeah, that's what it says without describing

1 anything about how that would happen.
2 Q. Would a person of ordinary skill in the art
3 understand how to make that happen?
4 A. Not particularly, not for any given system. Some
5 systems cannot be adapted to the regulations at the
6 time.
7 Q. But Karlsson says that it intends for its light
8 beam 7 to be adapted to the respective regulations
9 at all times, correct?
10 A. It has a statement there which makes me think that
11 it wants to be, but it doesn't say actually how
12 that would happen.
13 Q. So you agree that a person skilled in the art
14 reading this passage of Karlsson would understand
15 that it wants to be in compliance with the
16 respective regulations at all times, correct?
17 MS. SHAH: Objection. Mischaracterizes
18 the witness' testimony. Vague.
19 THE WITNESS: A person would probably
20 understand that and then would start to think
21 about, "What kind of experimentation would I need
22 to do in order to make that happen?"
23 BY MR. FITZSIMMONS:
24 Q. And a person skilled in the art would understand
25 how to undertake that kind of experimentation,

1 correct?
2 MS. SHAH: Objection. Mischaracterizes
3 the witness' testimony. Vague.
4 THE WITNESS: I think they would
5 understand generally how to carry out that kind of
6 thing, but a lot of it would depend on the details
7 of the system -- there's not many details in
8 here -- and there would be no guarantee of actually
9 getting the result that is hoped for here.
10 MR. FITZSIMMONS: Let's take a short
11 break.
12 (Whereupon a break was taken
13 from 4:06 p.m. to 4:29 p.m.)
14 (Marked for identification:
15 Deposition Exhibit No. 2017.)
16 BY MR. FITZSIMMONS:
17 Q. This is Exhibit 2017, the Flaaten reference,
18 Dr. Turk. Are you familiar with this reference?
19 A. Yes, I am.
20 Q. If you go to paragraph 89 of your second
21 declaration, Exhibit 2006, paragraphs 89 and 90,
22 you discuss the Flaaten reference, correct?
23 A. Yes, yes.
24 Q. Does Flaaten use LEDs in its headlamps?
25 A. I don't recall stating that specifically in my

1 declaration, but to my recollection, Flaaten uses
2 photoelectric sensors that are not necessarily the
3 same thing as LEDs -- or I'm sorry, not electric
4 sensors. I'm trying to find the right phrase.
5 Let me say I don't recall talking about
6 this in my declaration, but I will look and provide
7 you an answer if you want me to take the time to do
8 that.
9 Q. No, that's okay.
10 Paragraphs 89 and 90 of your declaration
11 discuss the Karlsson reference and the Flaaten
12 reference, correct?
13 A. That's correct.
14 Q. And the Karlsson reference does disclose using LEDs
15 for its headlamps, correct?
16 A. For one of the embodiments it does, yes.
17 Q. Doctor, are you familiar with the Eureka Project?
18 A. It does not ring a bell at the moment.
19 Q. Are you familiar with the Progress in Automobile
20 Lighting Conference, also referred to as PAL?
21 MS. SHAH: Objection. Relevance.
22 THE WITNESS: I don't recall that
23 conference at the moment, no.
24 BY MR. FITZSIMMONS:
25 Q. Can you please take back out the '029 patent, and

1 can you turn to claim 5, please? Can you read
2 claim 5 for me, please?
3 A. "The system of claim 1, wherein the increase of
4 light in the direction of the road curvature
5 includes at least an increase of light emitted at a
6 level below high-beam light and directed in the
7 direction of the road curvature."
8 Q. What's your understanding of what claim 5 requires?
9 MS. SHAH: Objection. Calls for a legal
10 conclusion.
11 THE WITNESS: My understanding off the
12 top of my head at the moment is that it requires
13 all of the elements of claim 1 and additionally the
14 increase of light mentioned in claim 1 includes
15 some that is at a level below the high-beam light
16 and that increase being in the direction of the
17 road curvature.
18 BY MR. FITZSIMMONS:
19 Q. What does it -- what's your understanding of what
20 claim 5 means by "emitted at a level below
21 high-beam light"?
22 MS. SHAH: Same objection.
23 THE WITNESS: My understanding is that
24 the intensity of the light or some way of measuring
25 the light energy or the rate of light energy or

1 something like that has a lower reading than
2 typical high-beam light measurement.
3 BY MR. FITZSIMMONS:
4 Q. What do you mean by "a lower reading than typical
5 high-beam light measurement"?
6 A. A measurement would typically return a numeric
7 value and so a lower numeric value.
8 Q. And so are you saying that high-beam light would
9 have a numeric value associated with it?
10 A. I'm saying one could measure a high-beam light at a
11 particular location and that would result in a
12 numeric value.
13 Q. How would you know what location to measure the
14 high beam light at?
15 A. In order to do what?
16 Q. To determine what the typical high-beam light
17 measurement is, as you refer to it.
18 MS. SHAH: Objection. Vague.
19 THE WITNESS: I don't think I referred to
20 a typical -- specific typical high-beam level
21 measurement.
22 BY MR. FITZSIMMONS:
23 Q. You said "typical high-beam light measurement."
24 What did you mean by "typical high-beam light
25 measurement"?

1 A. To me, that means take a typical high-beam light
2 from some automobile, perhaps, and measure that.
3 Q. What is a typical high-beam light?
4 A. What I mean by typical high-beam light is finding a
5 common car, for example, that has commonly used
6 headlamps and uses high beams.
7 Q. Are there atypical high-beam lights?
8 A. In the way I was using the word typical, yes, I
9 guess a car that -- it's a hypothetical, but a car
10 that was not meeting standards, for example, would
11 be an atypical high-beam light.
12 Q. So for the typical high-beam light measurement that
13 you described, how would you know where to take
14 that measurement to measure the high-beam light?
15 A. It depends on what my purpose in the measurement
16 is. Can you clarify what that would be?
17 Q. I'm trying to understand how you would determine
18 where to measure high beam -- the high-beam light.
19 A. I'm trying to remember how that came up in our
20 string of questions and answers, but I believe I
21 was saying that one could measure, and that if one
22 did measure a level below high-beam light that it
23 would be smaller, but that's sort of general. I
24 don't know what context in particular you're
25 referring to in terms of measurement.

1 Q. I'm trying to understand what you mean by that.
2 You used the term "measurement," so I'm trying to
3 understand how you would go about measuring a
4 high-beam light.
5 MS. SHAH: Objection. Calls for
6 speculation.
7 THE WITNESS: I don't know in general how
8 I would do it. I suppose I could walk outside my
9 car, turn on the high beams, have some light meter
10 with me, walk in front of that particular location
11 and measure the reading of the light meter.
12 BY MR. FITZSIMMONS:
13 Q. Is there a unit of measurement that you would use
14 for that?
15 A. Yeah, the measurement would be in some units.
16 Q. What units would it be in?
17 A. It depends on what the sensor is, I guess. It's a
18 hypothetical situation, so I'm not sure.
19 Q. It's your hypothetical situation, so I'm trying to
20 understand what you would do.
21 MS. SHAH: Objection. Calls for
22 speculation. Objection. Relevance.
23 THE WITNESS: I've never said I would do
24 this. You're saying, you know, describe what this
25 phrase could be mean in a way to perhaps

1 distinguish levels of light, and so off the top of
2 my head I'm saying that's perhaps a way, but I'm
3 not proposing anything specific.
4 BY MR. FITZSIMMONS:
5 Q. So you don't have a specific understanding of what
6 claim 5 of the '029 patent means when it says
7 "light emitted at a level below high-beam light"?
8 MS. SHAH: Objection. Mischaracterizes
9 the witness' testimony.
10 THE WITNESS: I didn't say I don't
11 understand that phrase. What I said was that to
12 determine that, you have to perhaps make a
13 measurement, but it's not a specific technical
14 suggestion or experiment that I was proposing.
15 BY MR. FITZSIMMONS:
16 Q. Is there a standard methodology that you're aware
17 of for measuring high-beam light?
18 A. I think there is; I don't recall the details of
19 it.
20 Q. Do you think a person of ordinary skill in the art
21 would know what the standard methodology for
22 measuring high-beam light is?
23 MS. SHAH: Objection. Calls for
24 speculation.
25 THE WITNESS: I think a POSA could find

1 that out.
2 BY MR. FITZSIMMONS:
3 Q. What would a POSA do to find that out?
4 MS. SHAH: Objection. Calls for
5 speculation.
6 THE WITNESS: Off the top of my head,
7 perhaps talk to people who have done it, perhaps
8 look at some of the standards to see if they
9 dictate specific ways to do it, but I'm not sure.
10 BY MR. FITZSIMMONS:
11 Q. Which standards would a person skilled in the art
12 look to?
13 MS. SHAH: Objection. Calls for
14 speculation.
15 THE WITNESS: I don't know specifically.
16 BY MR. FITZSIMMONS:
17 Q. In your declaration, you opine on certain things
18 that a person of ordinary skill in the art would
19 know, correct, Dr. Turk?
20 A. Yes. And just to be clear, I would say would be
21 likely to know.
22 Q. But you don't know what standard a person skilled
23 in the art would look to to measure high-beam
24 light, correct?
25 MS. SHAH: Objection. Calls for

1 speculation.
2 THE WITNESS: I don't know that
3 specifically, no.
4 BY MR. FITZSIMMONS:
5 Q. If you go to paragraph 100 of your declaration.
6 Exhibit 2006. You see you group claims 5 and 16
7 together?
8 A. Yes.
9 Q. And if you go to paragraph 105, you discuss
10 claim 27 separately, correct?
11 A. Yes.
12 Q. Do you see in paragraph 105 where you say
13 "alternative language of claim 27"?
14 A. Yes.
15 Q. Can you explain to me what you believe to be the
16 difference between claim 5 and claim 27 of the '029
17 patent?
18 MS. SHAH: Objection. Calls for a legal
19 conclusion.
20 THE WITNESS: There are various
21 differences in the wordings of the two. I would
22 say the main difference is that claim 27 builds off
23 of independent claim 23, which is about a method,
24 and claim 5 builds off independent claim 1, which
25 is about a system.

1 BY MR. FITZSIMMONS:
2 Q. Other than that, are there any differences between
3 claim 5 and claim 27 in your opinion?
4 MS. SHAH: Same objection.
5 THE WITNESS: There are several
6 differences in terms of the words that are written
7 to describe them. I've not compared them and
8 studied a comparison to form my opinions in my
9 declaration, but we can go through the wording
10 differences if you'd like.
11 BY MR. FITZSIMMONS:
12 Q. What are the differences that you find?
13 A. Claim 5 talks about "increase of light in the
14 direction of the road curvature" whereas claim 27
15 talks about the "increase of light in the direction
16 associated with a shape change."
17 Claim 5 talks about "at least an increase
18 of light emitted," and claim 27 talks about "at
19 least light output that increases the light
20 emitted."
21 Claim 5 uses the phrase "emitted at a
22 level below high-beam light" and claim 27 uses that
23 same phrase.
24 And the last phrase, again, has this
25 difference "associated with shape change" in

1 claim 27 and "in the direction of the road
2 curvature" in claim 5.
3 Q. And do any of those differences in the wording
4 affect your analysis with respect to the
5 obviousness of claims 5 and 27?
6 MS. SHAH: Objection. Calls for a legal
7 conclusion. Vague.
8 THE WITNESS: I would just say that since
9 I have not compared these directly before that I
10 can recall, and I did state in my declaration my
11 rationale for claim 5 and separately for claim 27,
12 I would just stick with the words that are there
13 that are my opinion.
14 BY MR. FITZSIMMONS:
15 Q. Is a road curvature in claim 5 analogous to a shape
16 change in 27, in your opinion?
17 MS. SHAH: Objection. Calls for a legal
18 conclusion.
19 THE WITNESS: Again, I have not compared
20 those claims and the language in them, so I can't
21 really comment or don't have an opinion at the
22 moment of whether those two are associated or not
23 or how they're associated.
24 BY MR. FITZSIMMONS:
25 Q. Paragraph 105 of your declaration, though, refers

1 to alternative language of claim 27. Is that not
2 in comparison to claim 5?
3 A. Yes, it is different language from claim 5.
4 Q. But you say you didn't compare claim 5 and 27
5 directly, correct?
6 A. I noted that they're different and they use
7 different language; I don't have a specific
8 comparison word for word or point for point of
9 them.
10 Q. If you look at claim 9 of the '029 patent, please.
11 Do you see claim 9, column 97, and line 20 uses the
12 term "non-camera sensor"?
13 A. Yes.
14 Q. As it pertains to claim 9 of the '029 patent, what
15 is a non-camera sensor, according to your
16 understanding?
17 MS. SHAH: Objection. Calls for a legal
18 conclusion.
19 THE WITNESS: I don't recall stating any
20 opinions about this in my declaration, but off the
21 top of my head right now, I believe that a
22 non-camera sensor would be some other sensor
23 that's not a camera that could perhaps be
24 associated with a steering wheel direction or some
25 other thing that can be measured with a device

1 besides a camera.
2 BY MR. FITZSIMMONS:
3 Q. So it could be any sensor that's not a camera?
4 MS. SHAH: Objection. Mischaracterizes
5 the witness' testimony. Calls for a legal
6 conclusion.
7 THE WITNESS: I expect that it means
8 something specific, but like I said, I don't
9 believe that I made an opinion about this in my
10 declaration, so I'm not sure at the moment how to
11 best interpret this.
12 BY MR. FITZSIMMONS:
13 Q. You reviewed the claims of the '029 patent,
14 correct?
15 A. Yes.
16 Q. And that includes claim 9?
17 A. Yes.
18 Q. And do you understand what claim 9 is reciting?
19 A. Yes, I believe so.
20 Q. And did you understand what the term "non-camera
21 sensor" means when you were providing your
22 obviousness analysis?
23 A. I did have a understanding of all of the terms in
24 these, and the things that I thought were important
25 to the matter at hand, I wrote down in my

1 declaration, but I don't remember right now, days,
2 weeks, months afterwards, exactly what everything
3 in there meant, so I wrote down the important
4 parts.
5 Q. So in your opinion, the term "non-camera sensor" is
6 not important to claim 9 of the '029 patent then?
7 MS. SHAH: Objection. Mischaracterizes
8 the witness' testimony.
9 THE WITNESS: I didn't say it's not
10 important to the claim; I said since I didn't write
11 it down in my opinions about this matter, I
12 probably didn't consider it important to those
13 particular opinions.
14 BY MR. FITZSIMMONS:
15 Q. So then you did not consider the term "non-camera
16 sensor" important to the particular opinions in
17 your declaration, correct?
18 MS. SHAH: Objection. Mischaracterizes
19 the witness' testimony.
20 THE WITNESS: That's not specifically
21 correct. I did not think it was important to write
22 about that in my opinions expressed in my
23 declaration.
24 BY MR. FITZSIMMONS:
25 Q. Why wasn't it important to write about that?

1 A. I don't recall at this point.
2 Q. Is a GPS a non-camera sensor?
3 A. Generally, GPS is a term used to describe the
4 satellites and not a sensing capability, but it
5 sort of depends on the context into how someone
6 uses it.
7 Q. Is a speed sensor a non-camera sensor?
8 MS. SHAH: Objection. Calls for a legal
9 conclusion for this whole line of questioning.
10 THE WITNESS: A speed sensor can be a
11 non-camera sensor.
12 BY MR. FITZSIMMONS:
13 Q. Is a rain sensor a non-camera sensor?
14 A. It can be.
15 Q. Is radar a non-camera sensor?
16 A. It can be.
17 Q. Is a steering angle sensor a non-camera sensor?
18 A. Can be.
19 Q. Is a range finder a non-camera sensor?
20 A. It would depend on how it works.
21 Q. Can a range sensor be a non-camera sensor?
22 A. It can be.
23 Q. Is an elevation sensor a non-camera sensor?
24 A. It can be.
25 MS. SHAH: I'll just maintain my

1 objection for those seven or eight different
2 questions.
3 BY MR. FITZSIMMONS:
4 Q. To your recollection, does the '029 patent use the
5 term "non-camera sensor" anywhere outside of its
6 claims?
7 A. I don't recall offhand.
8 Q. Are you familiar with the term "optical control
9 element," Dr. Turk?
10 A. In general, yes.
11 Q. Are reflectors an optical control element?
12 MS. SHAH: Objection. Vague. Calls for
13 speculation.
14 THE WITNESS: I think different people
15 would interpret that phrase differently, so some
16 might include reflectors, some might not.
17 BY MR. FITZSIMMONS:
18 Q. Are lenses an optical control element?
19 MS. SHAH: Same objection.
20 THE WITNESS: I don't opine about optical
21 control elements that I recall in my declaration,
22 so I just don't have any opinion.
23 BY MR. FITZSIMMONS:
24 Q. Can you go to paragraph 154, please, of your
25 declaration? Do you see where it says, "Claim 10

1 is representative of claims 21 and 32 and further
2 requires one or more optical control elements"? Do
3 you see that?
4 A. Yes.
5 Q. So you do discuss optical control elements in your
6 declaration, correct?
7 A. I do discuss them, yes; I don't provide definitions
8 or opine in that sense.
9 Q. Did you understand the term "optical control
10 elements" in claims 10, 21 and 32?
11 A. Generally, yes.
12 Q. What does the term "optical control element" mean
13 to you?
14 A. In those claims?
15 Q. Correct.
16 A. Generally, elements that control the direction of
17 light through optics.
18 Q. So are lenses optical control elements?
19 MS. SHAH: Objection. Calls for a legal
20 conclusion.
21 THE WITNESS: I think in this context,
22 they can be.
23 BY MR. FITZSIMMONS:
24 Q. And are reflectors optical control elements in this
25 context?

1 MS. SHAH: Same objection.
2 THE WITNESS: In this context, yes.
3 MR. FITZSIMMONS: Let's take maybe a
4 five-minute break.
5 (Whereupon a break was taken
6 from 5:05 p.m. to 5:17 p.m.)
7 MR. FITZSIMMONS: I have no further
8 questions.
9 MS. SHAH: I have no redirect.
10
11 (Deposition concluded at 5:17 p.m.)
12
13
14
15
16
17
18
19
20
21
22
23
24
25

1 STATE OF MICHIGAN)
2 COUNTY OF OAKLAND)
3
4 Certificate of Notary Public
5 I do hereby certify the witness, whose attached
6 testimony was taken in the above matter, was first duly
7 sworn to tell the truth; the testimony contained herein
8 was reduced to writing in the presence of the witness, by
9 means of stenography; afterwards transcribed; and is a
10 true and complete transcript of the testimony given. I
11 further certify that I am not connected by blood or
12 marriage with any of the parties, their attorneys or
13 agents, and that I am not interested directly, indirectly
14 or financially in the matter of controversy.
15 In witness whereof, I have hereunto set my hand
16 this day at Clarkston, Michigan, State of Michigan.
17 I hereby set my hand this day, October 22, 2023.
18
19
20 Karen Fortna
21
22 Karen Fortna, CRR/RMR/RPR/CSR-5067
23 Notary Public, Oakland County, Michigan
24 My Commission expires 4/30/2025
25

Exhibits

Exhibit 1001 4:7 61:4,6 65:19

Exhibit 1005 4:8 87:7,9,12 119:4

Exhibit 1010 4:9 28:3 128:25 129:2,5 132:2 146:1

Exhibit 1012 4:11 124:6,9

Exhibit 2001 4:13 23:22,24 25:23 26:18 77:8 144:17,20

Exhibit 2006 4:15 26:2,4,18 27:21,24 29:17,25 32:18 44:15 58:25 64:16,25 80:2 86:20 97:10 103:7 131:22 136:8 148:21 156:6

Exhibit 2017 4:17 28:4 148:15,17

Exhibit A 4:5 142:17,19,22 143:2

$

$490 13:12

0

029 6:5 11:22 15:15,21 16:6 25:2 30:6 33:19 36:1,3 51:16, 19,25 52:2,9 59:24 61:7,13,17 62:4,7,12 63:2,13,17 64:2,12, 15,20 65:12,18 66:1,8,19 67:2, 16,19 68:1,4,11,13,25 69:3,10, 18,19 70:6,15 71:4,13,19 72:2, 13 73:3,8 74:6,15 75:17 76:2, 11 77:15 78:1,8,9 79:1,10,20 80:12,21 81:4,11,15,21 82:12 83:13,22 84:4,23 85:25 88:15 131:10 149:25 154:6 156:16 159:10,14 160:13 161:6 163:4

1

1 81:14,17,20 83:9,13,22,25 84:4,23 85:18,25 118:19 119:9,17 129:8 150:3,13,14 156:24

10 163:25 164:10

100 12:3 31:16 118:7 137:6 156:5

1001 61:4,6 65:19

1005 87:7,9,12 119:4

101 119:16

1010 28:3 128:25 129:2,5 132:2 146:1

1012 124:6,9

102 97:16 98:1,3

103 97:17 98:1,4

105 118:21 156:9,12 158:25

106 87:3,5,22,23 97:18

108 93:11 96:2

10:48 52:16

11 65:19 77:13

11,208,029 6:1 30:5

115 106:12 108:15 115:16,20 118:16

116 118:17 119:8

11:02 52:16

11:5-7 67:20

12 77:13,14

120 21:23

124 121:15 122:17

12:05 81:9

12:14 81:9

14 37:13 129:7 131:24 133:9 136:13 138:23 139:2 140:6,12 141:10

15 124:22 126:4

154 163:24

16 37:17 44:15 50:12 124:23 146:3 156:6

17 5:1 80:12 130:4

19 70:15,17 124:23 126:4 132:2,5,7 133:18

1949 46:14 47:14

1994 18:18

1:01 103:4

1A 138:7

1B 139:20 140:5,16 141:14,20 142:3,23 143:8,11,21 144:11

1C 97:25 140:25

1D 97:25

2

2 29:25 37:12 70:19 73:7 85:18 129:11

20 37:18 46:10 70:19 146:2,6 159:11

2000 17:7 18:18

2001 23:22,24 25:23 26:18 76:5 77:8 144:17,20

2002 35:12,14 61:22,25

2006 26:2,4,18 27:21,24 29:17,25 32:18 44:15 58:25 64:16,25 80:2 86:20 97:10 103:7 131:22 136:8 148:21 156:6

2007 33:16

2009 33:22 34:1

2010 34:21 59:10

2012 34:21 59:8

2013 34:21

2014 34:21

2015 34:22

2017 28:4 148:15,17

2019 16:20

2023 5:1

2023-00318 34:2

21 37:19,23 46:9,11,12 48:16 80:13 164:1,10

22 77:13

23 37:15 58:25 77:9 156:23

24 37:15

25 50:5,12 80:12

257.698(4) 46:14

26 37:16,17,25 40:8,15 42:10 44:15 48:3 146:6

27 146:6 156:10,13,16,22 157:3,14,18,22 158:1,5,11,16 159:1,4

28 37:17 46:9,10 76:5

29 49:6 132:3,5,7 133:18

2:05 103:4

2A 139:4

3

3 81:17 82:8,11,18

30 58:24 59:1,4,7 64:25

300 46:13

300,000 101:9,13 102:1,5,6,9,13

32 146:3 164:1,10

33 49:6 132:3,5,7 133:18

34 129:10

365 23:9

37 61:10,11

38 76:2,17 77:22 78:13,19

3:00 128:23

3:19 128:23

3D 96:19

4

4 89:15,17,21,24 90:2,6,9,17,20,23 93:7 95:25 101:4 129:8 130:3,4

41 80:1,4,25 101:4

42 67:10,15,17

44 77:23 78:14,19 101:5

450 77:2

457 77:1

458 76:23 78:15

46 93:8

47 59:20,21

48 60:3,25 93:8 96:1

49 48:18,24 49:4 60:15 144:19

4:06 148:13

4:29 148:13

5

5 33:9 65:20 99:17 150:1,2,8,20 154:6 156:6,16,24 157:3,13,17,21 158:2,5,11,15 159:2,3,4

5,588,733 124:10

50 72:8 96:1 132:8 133:9,19,24 134:5,8 135:11,13,15,23 136:4 139:1 140:9,11 141:6,9 142:10

503 16:14

51 72:6,10 73:6 75:16

517.108 49:4

52 73:5,6 76:2 86:20 87:19 103:8

54 72:6,8,11 96:1

55 72:6,8,11 97:7,12,23 99:13

551 16:11

571.108 48:19,24

5:05 165:6

5:17 165:6,11

6

6 33:10 80:8

6,144,158 87:12

6,281,632 76:4,7

61 99:17 136:10

62 138:7

63 70:17 75:16

64 70:17 99:18 139:19

65 140:24

67 27:23

68 28:6 76:17 77:22 78:13,25

7

7 29:5,8,10,25 32:18 35:16 99:16 138:21 146:7,13,23 147:8

7(a) 32:19

7(b) 36:5

7(c) 35:16,19,20

76 106:13

77 106:14 115:23 136:9

78 118:17 136:9

8

8 65:20 89:14 124:22 126:4

80 138:6

83 131:23

84 141:22 144:18,19

85 139:20 144:18,19 145:3

86 140:25

89 28:1 148:20,21 149:10

9

9 159:10,11,14 160:16,18 161:6

90 28:1 148:21 149:10

91 28:7 29:3

92 28:7 29:3

95 81:13

96 81:12,14,17 82:8 83:9,25 85:18

97 159:11

98/54030 129:4

99 68:18

9:19 5:3

A

a.m. 5:3 52:16

AABH 86:21,24 87:21 99:18 121:19

able 7:7 54:17 137:16

about 5:18 6:22 8:10,12,14,16 9:19 11:3,23 12:7 14:13,15

15:23 19:9 20:5 22:2,13 24:14 25:5,19 27:7,8 29:15 32:7 36:4,18 38:13 40:9,25 47:5 50:13 53:9,11,16,21 54:15 56:8,23 57:6 61:21 64:22 66:6 67:6 68:21,25 69:18 73:14 78:9,21,23 79:8 83:6 85:5 87:2,20,21 95:20 96:1 97:2,7 101:9 102:1 104:9 105:21,23 107:24 108:12,22 111:3,13,20, 21,23,24,25 112:2 114:2,3 115:12 117:2,11 120:14,17,22 121:10,23 125:23 126:7,10 127:24 128:6,7 131:21 135:13, 20 136:3,5 137:7,13,25 138:1, 20 140:21 147:1,21 149:5 153:3 156:23,25 157:13,15,17, 18 159:20 160:9 161:11,22,25 163:20

above 32:20 48:16 97:23 99:12 140:25

abstract 91:9,10,22

academic 16:24

accept 60:19

accepts 60:16

accidentally 34:12

accomplished 131:6

according 12:25 102:12 127:14 138:4 159:15

account 146:12

accurate 71:10 78:3 89:8,9 143:12 145:10,13,18

accurately 6:11,15,18

achieve 65:2 102:4

achieved 102:2

acknowledging 76:11

act 37:22 46:13,16 47:22

actually 13:3 46:10 50:12 81:13 147:11 148:8

adapted 73:8 130:12,16,22 131:2 146:8,23 147:5,8

adaptive 52:21 72:2,9,13,16, 23 73:2 86:24

add 41:22

addition 17:12

additional 32:22,25

additionally 150:13

adds 142:23

affect 108:10 158:4

affects 76:24

AFS 52:22 72:3

after 59:7 61:13

afterwards 161:2

again 10:4 57:25 66:17 78:18 85:4 88:17 90:21 97:9 115:16 118:6 120:17 121:7 132:7 140:6 141:3 144:14,19 157:24 158:19

ago 54:14

agree 6:25 7:13 49:21 52:9 58:9,17 59:16 65:8,9,11 90:17, 23 113:13 115:5 126:24 147:13

ahead 50:6 86:4 94:14 97:21 143:24

aid 72:19

Alan 5:13

algorithms 21:6

alleged 52:4 60:8

allocate 13:25

almost 39:10 53:25 102:17

along 98:14,20 124:17

already 18:23 64:11 70:12 106:15 108:16 111:5 115:17, 25 118:5 136:3

also 17:16 20:2,8,16 21:5,17, 24 22:4,8 25:18 26:1 59:10 60:19 62:23 65:11 79:22 87:24 88:7 89:24 93:24 100:14 109:2 112:11 124:24 126:25 129:22 134:2,5 137:25 149:20

alternative 156:13 159:1

always 65:5,15 73:19 134:8, 15

am 13:25 30:3 55:15 111:1 124:11 129:6 148:19

ambient 130:12,17,23 131:2

amended 47:14

among 18:21 21:7 54:23

amount 27:13 73:19 86:2,5

amounts 107:3

analogous 158:15

analysis 39:18,21,24 40:4,7, 14 49:10,11,19 61:1 79:4 158:4 160:22

analyze 62:4

analyzed 52:6 74:9

and/or 80:9 91:13 97:16

angle 99:20 100:3,7,9 101:10 102:2,5 105:6,14 106:1,3 162:17

angled 99:25

angles 92:3

angular 91:14,20,25 93:9,14, 20 94:8,9,19,22 95:3,6,8 96:6, 12 97:20 105:25

annotated 97:24 98:22 99:12 118:18 119:9,16 136:9,13,20 144:8,20,23

annotations 118:20 119:12

another 9:4 16:14 32:16 45:1, 4,11,14,21 88:19,21 92:15,25 102:15 114:4 124:24 126:19, 25 127:6

answer 5:17 6:25 43:1 44:3 51:8 58:19,22 65:9 69:13,25 105:10,13,17,19 106:6 149:7

answered 40:1 42:22 44:8 68:16 69:7 70:10 71:8 74:19, 25 91:2 95:14 102:22 112:19 118:12 121:5 123:7 133:2

answers 7:5 152:20

anti-blinding 86:24

anti-glare 112:21 113:8,10 114:12,21

any 6:10,13,17 8:24 9:16 10:2 12:16 15:10,14,20 31:21 35:9 38:22 46:1 47:24 51:19 55:24 56:2,5 62:12,15 63:2,8,17,24 64:2,18 66:2,9,20 86:11,16 100:12 103:19 104:15 111:25 115:13 116:17 118:13 121:8

126:20 131:5 137:13,25 147:4 157:2 158:3 159:19 160:3 163:22

anyone 8:17 9:5,7 14:17 25:15 27:6

anything 32:7 33:5 66:6 71:19 99:3 111:21 115:12 119:23 120:22 128:7 135:20 136:4 147:1 154:3

anywhere 163:5

apparatus 91:12

applicability 79:6

applicable 79:1

applications 50:15

applied 60:11,25 62:19 84:11 115:11

apply 104:1

approach 65:22

approached 14:13

appropriate 123:25

approximately 102:9 142:6

area 20:12 35:22,24 36:1,2 42:24 53:5 60:13 62:22 98:23 99:2 136:15 142:14 143:18

areas 17:24 18:23 21:21 22:2 57:2,4 98:21

aren't 94:5 119:14 135:23

around 6:23 19:21 21:23 54:21 61:22 62:1 72:19 136:15

arrangements 11:19

array 89:18 90:7,18,24 139:16 140:7 145:5,6,8,16

arrows 98:22

art 49:15 50:19 51:9 52:10 59:24 60:17,20 65:13 70:25 82:7 122:2 137:9,15,19 138:3 147:2,13,24 154:20 155:11,18,23

articles 34:15,18,24 35:1,3,6 57:25 59:13

artificial 17:25 18:25 20:14

arts 17:12

aside 138:18

ask 7:9,13,15 26:22 65:18 96:21 144:5

asked 39:25 44:7 56:23 59:22 64:11 68:15 69:6 70:10 71:7 74:18,24 75:2 91:1 95:13 102:21 112:18 118:11 121:4 123:6 133:1

asking 6:24 15:23 36:17,23 68:25 97:21 111:10 127:23

asks 106:6

aspects 21:11 40:9 49:13 56:9 57:7 79:8 84:17 85:16 112:20,25 140:23

associated 14:24 19:3 39:7 50:14 95:21 151:9 157:16,25 158:22,23 159:24

assume 7:16

astronomical 19:20,21

attempt 145:4

attenuate 94:5

attenuated 95:11

attenuating 102:20

attenuation 93:9,14,18,24 94:10,23 95:4,7,12

attorneys 7:23 8:5,23 9:2 13:8 14:15 24:20 25:12 30:18,24 35:4,7 47:9

atypical 152:7,11

augmented 22:8,9,11,12

August 46:25 47:6 76:5

author 32:11 58:1 59:14

automated 10:9

automatic 76:16

automobile 106:20 149:19 152:2

automotive 53:5 57:9 60:13 103:14,24 104:2,7,11 105:5 107:7

autonomous 21:9 53:10,18 54:7 56:8

available 64:19

average 130:9

awards 21:14 56:2,14,17

aware 30:10,12,14 38:7,9 57:15 100:11 154:16

away 41:16,21 42:3 92:15

awhile 11:24

B

bachelor's 60:9

back 27:18 29:5,8 35:16 48:3 50:4 56:10 58:24 65:18 75:1,16 86:19 87:19 103:5 123:16 141:14 144:16 146:1 149:25

background 22:19 49:11,12 82:7

ballpark 13:15

Barbara 17:5

based 35:21 51:8 63:1 70:18 82:5,23 92:3 101:25

basically 7:23 20:5 42:15 106:23

Bay 20:12

beam 40:18 42:9,14,15,21,23 43:3 64:3 77:19 86:20 87:7,11,20,25 89:10,13,15 91:9,17,23,25 92:2 93:7,13 94:18,22 96:8,15 99:7,8,10,16 100:1,9 101:4,8,12,25 103:8,10 105:6,14,25 106:1,3,15,16,19,22 108:11,16 109:2,6 110:3,6,14 111:5,6,7,24,25 112:1,3,5,8,11,13,14,16,20,22,25 113:4,9,12,16,17 114:8,9,11,16,23 115:6,12,13,17,18,25 116:20 117:11,14 118:23 119:2,14,21,22 120:1 122:12 125:8 130:11 131:1 132:8,14,21,25 133:10 136:4 141:24 142:24 144:10 145:5,10,14 146:7,13,23 147:8 151:14 152:18

Beam's 87:3,22 96:23 98:12 116:5 117:2 118:19 119:9,17 121:19

beams 43:7,12,21,24 44:5,12 74:6 99:20,25 106:21,22 109:4 114:20,25 120:12,16 129:10 145:23 152:6 153:9

because 23:5 105:10,17 112:21

become 71:2,5

been 5:6 6:20 9:19 10:1,2,12, 16 11:1,3,6 16:20 28:21 38:7,9 46:25 47:9,14 59:22 61:21 85:17

before 6:20 9:20 10:6 14:11 28:14,18 31:18 46:21,25 47:5 49:1 52:9 57:22 64:15 72:22 83:6,22 87:16 108:3 109:2 118:16 119:8 126:1 131:20 139:20 141:11 145:3 158:9

began 13:16

beginning 45:6

behalf 10:11,13,18,20 30:25

behind 98:8 144:2

being 40:23 72:22 87:2 99:14, 21 114:21 115:13 150:16

believe 9:3,4,18,22 11:16,20 12:21 13:7 16:10 27:4 28:19 30:8,23 31:15 32:3,20 33:8,21 37:19 38:5 42:22 46:18 47:9, 12 49:2 57:24 58:12 61:22 68:18 71:1 74:8 75:5 87:1,23 91:19 95:25 97:1,21 100:4,18 101:15 111:20,24 114:1,2,7 119:3 124:14 131:5 137:3,24 141:23 143:6 144:9 152:20 156:15 159:21 160:9,19

believed 113:15

bell 15:7 149:18

below 35:22 95:24 139:4 150:6,15,20 152:22 154:7 157:22

besides 160:1

best 26:20 134:13 140:20 141:11 160:11

between 42:9,14,18 84:7 85:7,8,12 96:10 109:22 110:10 111:15 116:15 122:6 131:18 136:8 144:19 156:16 157:2

beyond 146:19

bills 12:20

bio 77:11

Bir 9:3

bit 37:18 53:7,8

blank 28:10,13,15,17,25

blanked 113:12 114:13

blue 143:4,5,19,20 145:6,25

board 16:23

body 92:16

both 9:13 59:13 79:10 90:6,18, 24 93:13

bottom 29:10 44:16 60:2 65:1 70:16 73:5 81:13 132:1,11 134:3 136:20

bound 110:24 111:1

boundary 40:22,24 41:2

box 136:15,21,25 137:10,19 140:8 141:6

break 7:9 42:20 50:8 52:14,15 77:11 79:25 81:7,8 103:2,3 128:21,22 148:11,12 165:4,5

breaking 51:3 102:16

briefly 24:11,12

bright 42:17,24 106:23,25 109:18,19,21 110:15,17,24 111:3 123:4,5,11

brighten 128:17

brighter 103:19 106:16,19,23 107:8,19 108:6,10,13,17,20, 22,25 109:3,6,11,15,23,25 110:3,5,6,9,14 111:6 115:18 116:1 125:19

brightness 43:3 62:21,25 83:17 84:6,8,25 85:6,8,12,15 123:13

brightnesses 128:4

bring 85:16

broad 32:9 106:4

broadly 36:4 62:19

Brooks 9:7

BS 60:9

build 45:2,12 53:18 54:6

building 44:24 45:9

builds 156:22,24

bulb 125:19 127:19

bulbs 124:24 125:5,7,17,22 126:8,25 127:7,19 128:4

burn 107:15

busy 13:24

C

C-U-R-I-A-M 15:5

California 20:13

call 31:7 46:19 141:17

Calls 36:15 41:8,17 61:18 66:3,10 79:3 81:22 82:20 83:14 85:1 103:15 107:10 108:1 116:9,23 120:3 122:8 123:21 125:10 127:21 129:24 131:12 134:10,18,24 135:16, 25 137:1,21 143:10 146:14 150:9 153:5,21 154:23 155:4, 13,25 156:18 158:6,17 159:17 160:5 162:8 163:12 164:19

came 56:21 152:19

camera 19:8 97:19 99:1 159:23 160:1,3

cameras 19:10,19

can 5:12 7:5 10:19 11:8 15:17 18:6 19:17,22 23:7,10 27:11 30:2 41:2,19 42:13 56:11 60:7 62:19 63:5,22 64:7 65:20 66:16 70:22 73:8 75:1,5,24 76:17 77:7 84:9,10,11,15,20 86:12,16 89:22 90:6,12 91:9, 18 92:18 93:21,25 94:5 95:9 97:5 100:23 101:5 102:13,14 104:22 105:22,24 106:4,5,9 107:8 109:2 112:6 113:2,16,22 114:5,8,9,24 115:11,12,19 116:5 119:3,22 121:15 123:20 127:17 129:7,10,13,19,22 130:20 132:6,9,16,19,23 133:6,19 134:2,5 136:24 139:16 142:2,17 143:18 145:2 149:25 150:1 152:16 156:15 157:9 158:10 159:25 162:10, 14,16,18,21,22,24 163:24 164:22

can't 34:10 38:22 63:11 98:7 103:18 105:13,17 110:17,21,

24 112:5 158:20

cannot 147:5

capability 112:21 162:4

capable 119:22

Capital 15:1,6,9

car 41:1 142:8 144:2 152:5,9 153:9

carries 106:13

carry 148:5

case 7:23 8:6 10:2,8,9 11:20 13:14,21,23,24 14:1 23:14 24:4 25:3 26:9 29:1 30:19 32:16 33:23 34:13 35:5 36:8, 10,11,12 37:8 47:10 95:19 117:23 127:18

cases 9:24 10:8 11:2,3 18:10 98:17

categories 106:22

cause 12:16,17 83:4 86:12,17

causes 82:25

caveats 70:11 128:18

center 135:22 144:1,21

centerline 143:23,25 144:3

certain 86:3,6 113:16 127:20 128:11 155:17

certainly 23:19 54:15 104:9 138:12

CFR 48:18,24 49:4

challenges 50:13,14

change 28:22 39:9,14 41:15 82:15,17,19,25 83:2,4,17 86:7, 8,9,10 92:18 102:13 125:8 157:16,25 158:16

changed 39:11 41:12 125:1 126:14 127:2,10

changing 76:24 77:4,23 78:15

characterization 145:15,20

characterize 122:22

characterized 89:7

charging 13:10

check 64:5,7 119:3

Chicago 16:19

circumstances 103:25

citation 48:17

cite 37:19,22 46:13 47:22 57:25 59:7,10 80:12 132:1

cited 35:9

citing 37:21 47:16

claim 66:1 81:14,17,20 82:8, 11,18 83:13,22 84:4,23 85:18, 25 89:15,17,21,24 90:2,6,9,17, 20,23 150:1,2,3,8,13,14,20 154:6 156:10,13,16,22,23,24 157:3,13,14,17,18,21,22 158:1,2,11,15 159:1,2,3,4,10, 11,14 160:16,18 161:6,10 163:25

claimed 59:25

claiming 126:21

claims 50:21 51:11,16 58:13 62:7,12 63:2,13,17,20,24 64:2, 6,12,15,20 78:22 79:6 81:3,12 89:13 156:6 158:5,20 160:13 163:6 164:1,10,14

clarification 7:13,15

clarify 29:13 152:16

clear 29:8,18,20 90:23 94:16 116:12 155:20

close 20:3

co-author 34:17,18

code 37:22 46:13 47:22 48:21

collaborated 138:12 139:24 141:4 144:25

colleagues 144:25

colloquially 84:10

color 40:18 44:12 86:8,12

column 65:19 70:15,17,19 72:6,8,10 73:5,6 75:16 76:2,17 77:22 78:13,25 80:12 81:12, 14,17 82:8 83:9,25 85:18 89:14 93:7 95:25 99:16,17 101:4 124:22 126:4 132:2 159:11

columns 68:18

combination 45:19 50:19,25 51:9 90:14

combinations 90:12,22 124:13

combine 49:18,22 50:2

combined 45:24 46:7

combining 22:11,14 44:17,22 45:8

come 25:8 56:25 140:6 145:1

comfort 130:13

coming 24:20 82:1 83:18 108:13,23 133:14 145:5

commands 96:2

comment 158:21

commented 68:8

commercial 71:24

commercially 64:18 71:14, 21,24

common 152:5

commonly 152:5

communicated 30:18

company 10:13,20 11:9,10,16 12:21,22 13:4 20:12 54:25 55:2,5

compare 39:20 159:4

compared 106:25 107:2 109:3 131:20 157:7 158:9,19

comparing 28:2

comparison 157:8 159:2,8

complete 53:23

compliance 62:7 147:15

complicated 84:18

complies 144:7

comply 107:19 108:6

components 55:14

composed 129:12

comprises 65:22

comprising 101:9 102:1

computer 17:2,10,19,21 18:12,19 19:1,4,5,11,14,18,22,

24 20:4,13 21:5,10,14,17,24 22:6,15,18 56:15

computer-based 18:5

concept 62:24 123:16 131:8

concepts 131:19,20

conceptual 133:14

concern 12:16

conclude 137:16

concluded 165:11

conclusion 36:16 61:19 66:4, 11 79:4 81:23 82:21 83:15 85:2 150:10 156:19 158:7,18 159:18 160:6 162:9 164:20

cone 142:13

conference 149:20,23

configuration 126:11

confirm 12:10 76:15

conflict 12:6,12

conflicts 15:10

confused 33:22

connected 138:1

consider 12:13 15:9 39:17,23 83:21 88:11 109:19,22 123:25 161:12,15

consideration 45:17

considerations 53:11,16

considered 32:22 33:5,7 36:6,21 37:3 40:2 44:17 49:9 85:21 107:4 109:21 110:6 120:23 121:8,12

considering 35:20 113:14 114:6,14

context 46:1 75:15 77:18 79:7,13,17,19 81:25 82:22 83:16 86:7 91:17 95:2,12 100:4,17,18 102:24 103:13,18, 23 106:5,7,20 109:20 111:4 116:17,18 117:23 120:18 121:23 122:3 123:20 152:24 162:5 164:21,25 165:2

contexts 62:20 84:9 106:8

contiguous 23:6

continue 29:13 31:6

continues 37:19 46:11 70:16

continuously 76:13

contrasted 101:11

control 53:6 60:14 76:3,12,16 91:13,20,25 163:8,11,18,21 164:2,5,9,12,16,18,24

controllable 80:8 89:18

controlled 99:21 129:13,23 130:10,20,21

controller 93:11,15,22 94:1 96:2 97:20

controls 92:3,7

conventional 101:11

convince 45:18

cornering 43:18,25 44:6,13 123:18

correct 5:21,22 6:20 9:11 11:18 12:1,23 13:2 15:24 16:3, 9,21 17:5,17,18 20:9,10,22 21:3,25 22:1,4 23:17 30:21 31:2,13,24 32:2,3 33:11,16 34:2,5,16,17,19,20 35:8,14,22, 23 36:8,9 38:4,5 40:19,20 46:14,17,18 48:7,22,23 49:23 51:17,21 52:11 55:10,18,25 56:3,6,18 58:1,2,6 59:2,8,9,10, 12,14,15,18,25 60:5,17 62:5,6 65:24 66:2,9,20 68:2,11,14 69:1,5 70:8 71:6,14 72:3,5,14 73:20 74:17 75:23 77:5,24,25 78:4,17 79:11,21 86:14,22 87:1 88:8 89:6,19,22,25 90:4, 8,19,25 91:6,18 92:19 93:22 94:1,24 97:11 99:14,15 100:1, 2,23 101:1 102:11,13 106:10 108:3,18 109:7 110:18,25 112:3 113:11 114:16 115:1,7 118:4,10 119:10,11,12,14,15, 24,25 120:2 121:6,24 122:4,14 123:12 124:13,17 125:5,9,24 126:5,9,16 127:4,7,12,16,20 128:11 129:16,20,23 130:17, 23 131:3,11,24 132:3,17,21,25 133:11,20 134:3,6 135:5 136:13,14,22 138:15,21,24 139:2,3,7,10,11 140:3,4,12,19 141:4,5,10,11,16,25 142:5,14, 15 145:21 146:13,24 147:9,16 148:1,22 149:12,13,15 155:19, 24 156:10 159:5 160:14 161:17,21 164:6,15

correctly 12:24

corresponded 30:11

could 12:9,16 15:12 19:7 45:5 46:4 47:7 49:20 50:2,15 51:9 63:21 73:1 77:10 85:6,11,15 90:3 106:17 107:4,13 108:17 113:18,22 119:19 120:1,6 122:20 123:11,19 124:23 125:17 130:7 134:17,23 135:7, 11,15,22 137:11,17,20 144:3, 17 151:10 152:21 153:8,25 154:25 159:23 160:3

counsel 141:3

count 23:8

couple 51:5 115:23

court 7:3 9:24 10:2

create 141:4 144:23

created 138:10,11 139:23 144:24

creation 98:8 138:12

cross 143:20

Curiam 15:1,5,9

current 16:17

curvature 82:23 86:4 150:4,7, 17 157:14 158:2,15

curve 83:7 119:20 141:17,21 142:6

curves 72:19 124:16

CV 20:8,16 21:13 23:18,19 35:14

D

D' 136:21

dark 42:17,24 63:11 105:3

darkness 43:3

data 75:22 97:19 99:22

date 61:13,16 62:3,4 70:18 144:6

David 9:3

day 23:9 105:2 131:9

days 23:9 161:1

deals 39:6

decided 28:23 29:1

declaration 5:19,20 7:21,22, 25 8:3 9:8,17 12:9 14:13,15 23:25 24:4,19,23 25:1,20,23 26:1,9,14,17,21,24 27:3,5,9, 15,16,21,23 28:18 29:5,14 30:3,15,16,21 31:25 32:5 33:7, 10,18,20 34:8,12,14 37:11 38:14,23 39:1,18 46:22 47:17 49:1 58:13,24 59:16,21 61:1, 10,11 64:16,25 65:10 67:6,11 68:9,20,22 69:15 70:2 73:14 74:11 75:11 77:8 78:3,7 79:16 80:1 82:6 83:23 85:22 86:19 87:17,20 88:13 97:2,8,10 103:7 106:13 108:15 111:4 115:16,21 118:17 121:16 122:17,24 131:22,23 136:8,10 138:6 144:17 145:21 148:21 149:1,6,10 155:17 156:5 157:9 158:10,25 159:20 160:10 161:1,17,23 163:21,25 164:6

declarations 9:10,13 10:23

declarative 78:9

decreased 95:16,18,20,22

define 19:5 54:3 62:18 96:20

defined 56:22

defines 96:12

definitely 34:13

definition 46:6 75:25 123:14

definitions 164:7

degree 60:9

department 17:11,14

depend 13:23 41:19 42:6 49:25 105:6,14,25 106:1 125:12,15 128:4 148:6 162:20

dependence 132:13

depending 128:18 132:20,24

depends 13:21,24 41:10 42:2 50:3,24 51:1 106:5 107:23 110:1 128:19 152:15 153:17 162:5

deposed 6:20 9:19 10:2,16,23

deposition 5:17,18 7:20 8:18, 20,22 9:8,17 23:22 26:4 33:13 61:4 64:13 87:9 124:6 126:1 128:25 142:17,19 148:15 165:11

depositions 9:25

describe 79:12,15,22 102:25 108:24 109:1,11,14 116:18 142:2 143:18 145:2 153:24 157:7 162:3

described 35:22 40:8 74:5 76:4 78:14 88:13 94:13 95:8 99:25 101:21 128:15 130:19 152:13

describes 37:1,8 41:3 67:16 77:16,23 78:2 79:10,20 91:10 93:20 97:15 100:14 110:15

describing 41:4 77:4 93:13 94:6 100:18 101:15,18,23 132:19,23 146:18,25

description 71:11 79:1

design 44:25 45:1,2,3,4,10, 11,12,13,14,20,21 48:14 49:7, 13,17,21 50:1,13 53:11,15 125:13,15,17

designed 52:18,21,24 55:17, 21 128:18

designing 44:24 45:9 53:20

desired 132:11,13,20,24

detail 37:8 38:8 44:2 54:15 97:2,6 117:25 120:24 121:8,9, 13 126:20 137:13,25

details 12:9 41:20 148:6,7 154:18

detected 96:14 97:18 99:14

detecting 98:13

determine 61:25 62:2 86:7 96:22,23 123:5 151:16 152:17 154:12

determined 96:16

determines 91:11

determining 12:5,11 15:9 49:18 100:8

deviation 131:15

device 73:15,18 75:12 88:1,2, 4,7,11 95:23 116:5 159:25

devices 39:7 88:15 90:2

diagram 133:14 136:16 138:7, 10,13,14,16,17 139:4,7,9,19, 23,25 140:2,5,16,24 141:3,14, 20,23 145:2

dictate 155:9

dictating 110:13

did 7:19 8:6,8,10,14,17 9:13, 16 15:9 18:16,17,19 19:13 24:8,9,10,19,24 25:13,19 26:12,14 27:2,8,18 28:11 31:21,23 32:4 33:13,15,18 34:7,24,25 35:1,3 37:5 38:6, 14,15,18 39:17,23 40:6 46:21, 23,24 47:11 48:24 52:2 54:9, 11,12 57:22 58:7,8 61:25 63:1 64:11,14,15 75:5 76:9 78:7 83:21 108:20 111:7 133:4 144:23 151:24 152:22 158:10 160:20,23 161:15,21 164:9

didn't 24:22 28:22,24 29:2,21 35:6 38:8,17 39:20 58:3 62:2,4 78:11 108:21 117:21 139:25 154:10 159:4 161:9,10,12

difference 42:9,13 84:7,12 122:6 145:24 156:16,22 157:25

differences 145:5 156:21 157:2,6,10,12 158:3

different 29:22 42:11 44:18 62:20 65:22 84:9,15,20 89:4 92:11 94:6 106:8,9 113:21,25 122:18 127:15 130:18 145:16, 23 159:3,6,7 163:1,14

differently 92:12 163:15

digital 88:7,11,15 90:2 92:17 93:3

dimension 132:16,23 133:4, 5,7 134:6

dimensions 132:12

diodes 89:22 90:7 91:6

direct 124:16

directed 95:22 99:19 100:15, 17,23 121:19 122:13 150:6

directing 46:2

direction 20:5 46:4 76:25 80:6 85:19,25 86:3,6,13,17 91:23 92:18,21,23 100:19 102:15 123:1 128:11 132:13, 20,24 133:4 150:4,7,16 157:14,15 158:1 159:24 164:16

directions 101:2 127:20

directly 13:1 41:1 134:13 138:16 158:9 159:5

director 17:16

disagree 58:14

disbursed 100:5,6

disciplines 18:2

disclose 67:3 149:14

disclosed 52:10 71:4 91:21

discloses 76:12 124:15 125:4 126:24 129:15,19,22 130:15, 18

disclosing 125:21 126:8 132:15 133:17 139:13 146:11

disclosure 71:13 129:18

discuss 49:6 78:20 90:22 112:10 148:22 149:11 156:9 164:5,7

discussed 67:8 72:18 82:1 108:3 118:6 120:13 131:9

discusses 72:2,13 135:19

discussing 8:23 25:2,7 56:9 67:19 70:13 74:10 77:6 78:22 81:2 131:24

discussion 90:15

discussions 8:25 25:4 32:16

disposing 116:16

dispute 15:22

dissertation 21:1

distance 41:13 42:3,7

distinction 111:15 116:15 131:18

distinctions 85:7,11

distinguish 154:1

distribution 77:2 83:10,13,22 86:9,12 125:1 126:14 127:2, 10,14

District 9:24 10:2

divert 93:1

diverting 102:19

DLF 80:7

DMD 88:8

Doctor 61:8 149:17

document 24:1,3,10 26:6,8 29:16 33:24 38:16 47:8,11 61:7 87:14 89:14

documents 8:2 9:16 32:20, 22,25 33:2,11

does 5:23 6:1 12:21 13:23 15:7 16:11,13,14 17:7,23 20:1, 17 39:13 42:6 45:24 63:11 67:2 68:4,7 69:10,19 70:6 72:15 73:11 74:5 75:9 78:9,20 79:12,14,24 81:20 82:11,18 85:24 87:2,21,24 88:4 90:9,20, 21 91:3,7,20,25 95:12 96:6 100:3 101:13 102:4,19 103:13 105:5,10,13,25 109:1,5,15 110:9 120:8,12,16,20 123:2, 14,17 127:5 129:17 134:12,14 136:4 148:24 149:14,16,18 150:19 163:4 164:12

doesn't 50:3 51:19 66:1,5,23 73:19 108:24 111:21,22 137:5 147:11

doing 21:5 69:12 71:16 99:8 114:3,4,11

domains 20:15

don't 7:12,15 8:24 9:6,18,25 10:4 11:2,7,19 13:3 14:12,22 15:12 21:23 22:3 23:20 24:15 25:16,21 27:10,12 28:12,16 29:4 30:8,22 31:14,15,23 32:6 33:8,20 37:1,6,7 38:11,19,21, 24 39:4,12 44:1 46:8 47:5,7, 12,15,21,24 48:25 49:2 51:1, 23 54:3,14 55:24 56:1,16,24 57:24 58:14 63:15,20,24 64:9, 23 67:5,13,17 68:7,8,13,19,20, 21 69:3,12,14 70:1,12 71:16, 23 72:4,25 73:4,13 74:8,10,11, 14 75:3,10 76:9 80:19 81:2 83:8 87:4 95:11 98:16 102:23 103:17,22 104:1,6,9,13,24 106:2 107:22 108:8 111:24 112:8,14 115:3,10 116:25 117:25 120:13,17,22,24 121:2, 9,22 125:23 126:7,10,12,20 128:7 131:4,21 135:18,20 136:5 137:3,13,14,24 138:2,11 143:14 144:13,24 148:25 149:5,22 151:19 152:24 153:7 154:5,10,18 155:15,22 156:2 158:21 159:7,19 160:8 161:1 162:1 163:7,20,22 164:7

done 21:24 73:24 146:18 155:7

dots 138:18,20 140:6,7

dotted 142:2,6,12,23 145:6,8, 24,25

down 31:7 37:18 42:21 60:2 67:23 70:15 115:22,23 139:19 160:25 161:3,11

Dr 5:8 24:1 26:6 33:11,18,20 34:8,13,14,16,17,18 52:18 57:18,20 58:1,9,17 59:13,17 81:11,15 87:12 103:5 124:8 129:2 143:2 144:5,8 148:18 155:19 163:9

draft 25:7,8 140:1 144:25

drafts 27:17

draw 41:2 116:15 144:3

drawing 41:24 99:12 118:18 119:8,16 136:21 142:3,23 143:8 144:11,21,23

drawings 132:9

drawn 136:15

drew 42:6,16

drive 53:19 54:22

driving 53:20 130:13

duly 5:6

dusk 53:20

E

each 80:7 93:9 95:3,4,7,19 99:21 100:23 102:12

earlier 31:14 44:1 48:3 75:2 82:2 131:9

earliest 61:13,16
earth 19:22
ease 25:25
easiest 97:3
editing 25:8 27:19
education 22:19
effect 86:9 91:23
effort 24:21
eight 163:1
either 71:5 93:23 95:9 100:20 102:14 129:13
electric 149:3
electrical 60:10
electronically 80:10
element 163:9,11,18 164:12
elements 80:8,10,15,16 81:5 150:13 163:21 164:2,5,10,16, 18,24
elevation 162:23
else 8:17 9:5 17:23 19:5 25:15 27:6 33:5 109:15
emailed 30:13
embodiment 76:22 78:14,20 81:3 92:6 100:19 101:9,16 130:5,8,19,25
embodiments 71:14 91:19 92:2 129:17 137:12 149:16
emits 91:24
emitted 40:23 130:9 132:8 133:10 146:8,12,23 150:5,20 154:7 157:18,20,21
emitting 135:23
employment 16:17
encompass 110:9
end 65:23 75:7 77:14 80:24 89:14 118:16 125:18 139:24
ended 128:16
energy 62:21,22 84:19 96:3 104:16,19,21,23 150:25
engaged 72:22
engagement 31:1,12,16
engagements 12:13
engineering 57:7,13,15 60:10,11
Engineers 57:10
enough 105:18,21,23
entail 117:5
entire 31:4 38:15 47:11 114:15
entirety 58:7
entities 12:15
entity 12:6
equal 135:5,8
equated 95:4,6
equates 112:14
equipment 39:7
equivalent 60:12 112:12
essentially 17:15 26:25 109:17 125:18,22 126:8
estimate 11:3,5 23:7 27:11,12 141:11
et al 76:5
Eureka 149:17
Evan 16:2 30:4,6
even 19:19 114:24 126:21
eventually 25:6
ever 28:17 30:7,9,11,13 31:18 39:9,11 47:2 52:18,21,24 53:4 54:24 55:2,4
every 14:23 24:24 73:20
everything 41:12 69:14 78:11 161:2
everywhere 106:16 108:17 111:6 115:18 116:1,4,5,20
exact 12:3 111:2
exactly 10:4 11:19 19:21 21:23 30:22 31:14,16 41:11 102:24 115:10 131:15 143:14 144:13 145:14 161:2
EXAMINATION 5:10
examined 5:6
example 6:13 18:6,8 19:18 42:17 48:1,2,5,6 85:14 99:12, 13 104:22 105:3 107:3 109:3 122:21 129:11 133:10 135:9 143:13 152:5,10
examples 48:11 56:21
excuse 19:13 38:15 40:17 49:1 50:14 70:17 72:9 94:19 96:22 115:19
exhaustively 78:11
exhibit 8:1,2 23:22,24 25:23 26:2,4,18 27:21,24 28:3,4 29:17,25 32:18,21 33:4,6,9,16, 21,24 34:15 35:12,14 44:15 46:16 58:25 59:8,10 61:4,6 64:16,25 65:19 77:8 80:2 86:20 87:7,9,12 97:10 103:7 118:21,22 119:4 124:6,9,10 128:25 129:2,5 131:22 132:2 136:8 142:16,17,19,21,22 143:2 144:17,20 146:1 148:15, 17,21 156:6
exhibits 25:4 34:10,21 35:9 38:3 48:21 118:25
existed 40:13
existence 40:3,6
existing 68:5,14 69:4
exists 40:13
exiting 80:7
expect 12:8 45:16 65:17 83:1 118:5 120:14 160:7
expectation 140:20
experience 35:21 60:13
experiment 154:14
experimentation 45:18 147:21,25
expert 11:4,6 12:13 22:15,18, 22,25 55:9,12 56:15 57:1,7 58:9,13,17 59:17
expertise 56:21,22,23,25
experts 59:1,4
explain 15:17 42:13 156:15
explained 108:19

explanation 124:20

expressed 25:10,22 161:22

expressly 125:4

extremely 122:20

Eyes 17:16

F

Facebook 11:9

facial 20:20 21:1,15,18,25 22:7,22,25 23:1 56:16

factor 40:6

factors 14:2,4,8

fair 7:7,10,17 19:25 39:15 51:8 89:5 104:8 139:13 141:21 143:1 144:11

fairly 106:4

falling 96:3,7

familiar 14:10 15:1 16:12,15 61:7 76:8 87:11 88:9,17,19,22, 25 89:1 92:12 117:4 124:10 129:5 148:18 149:17,19 163:8

far 41:6 76:19 115:22

feasible 70:25 71:2,5,6,21

features 44:17,22,25 45:3,4,8, 10,13,14,20,21 72:20

February 24:5

Federal 37:25 38:10

felt 25:9

few 11:1,10 22:4 70:20 133:23

field 20:4 60:12 96:18,24 98:1, 3,4,12 99:6 119:16,18,19,23 120:2

figure 90:13 97:24 98:8,9,22 118:19 119:9,17 131:24 133:9 136:10,13 137:12 138:23 139:2 140:4,6,12 141:10 143:8,11,21

figures 68:18 97:25

final 138:12

find 35:3 37:11 58:4 75:6 90:20 97:5 149:4 154:25 155:3 157:12

finder 162:19

finding 152:4

fine 29:19 46:20 50:10

finish 50:6 73:22

firm 9:8 13:4

first 5:6 23:25 24:4 25:20,23 26:16 27:1,5,15 37:21 47:2 61:12 77:8 78:3,7 79:16 91:10 127:8 129:8 130:7 140:1 144:16,24 145:21

FITZSIMMONS 5:8,11 13:9, 22 14:9 15:5,8,19 16:7 19:15, 23 23:23 25:25 26:5 29:7,10, 17,21,24 31:11 32:12 36:20 39:22 40:5 41:14 42:1,8 43:5, 10 44:10 48:12 50:4,9,11 51:5, 7,15 52:1,8,13,17 53:3 55:8, 16,23 57:3 58:16,23 60:23 61:5,24 62:11,17 63:7,16,22 64:1,6,10,24 66:7,14,18 67:1,9 68:10,24 69:9 70:5,14 71:12, 18 72:1,21 73:17,22 74:4,13, 22 75:3,8 77:7,12 79:9 81:6,10 82:3,16 83:3,20 84:22 85:10 86:18 87:6,10 91:5 93:19 94:13,15,17 95:5,17 96:13 97:4,9,12,22 98:11,19 99:4 100:13 101:3,24 102:17,18 103:1,5,6,21 104:5,18 105:12, 20 107:6,17 108:2 109:13 110:3,8,16,23 111:14 112:24 113:24 114:22 115:4,15 116:14 117:3,13,19 118:1,15, 23 119:2,7 120:7 121:1,6,11 122:10,11 123:10 124:2,7,21 125:14 126:23 128:1,5,21 129:1 130:2 131:17 133:5,8,16 134:1,16,22 135:3,21 136:7 137:8 138:5 139:18 142:16,20 143:17 146:21 147:23 148:10, 16 149:24 150:18 151:3,22 153:12 154:4,15 155:2,10,16 156:4 157:1,11 158:14,24 160:2,12 161:14,24 162:12 163:3,17,23 164:23 165:3,7

five 8:16 50:9

five-minute 165:4

fixture 76:22 77:2 88:4

Flaaten 28:3 148:17,22,24 149:1,11

FMVSS 38:1,6,15,23 39:3,6, 11,17,21,23 40:3,15 43:6,11, 14,17,20,23 44:1,4,11 46:7 48:4,7 108:3,7

focus 20:1 54:4,6

focused 54:2

focuses 19:24 20:2

fog 43:15,24 44:5,12 120:20, 23 121:3,8

following 60:4

follows 5:7

forget 128:16

form 20:6 157:8

formed 35:19

former 105:24

forth 27:18

Forty-eight 80:3

Forty-one 80:5

Forty-two 67:14

forward 52:24 55:9,13,17,21, 24 56:2,5,9,18 58:10 59:1,4,17 91:12 120:8,12,16,20 121:2, 14,20,24 122:1,3,4,6,7,13,16, 18,19,21,22,25 123:16,17,24, 25 124:3 144:2 145:17

found 35:10 90:11

Four 17:16

frame 110:1

France 20:19

Friday 8:9,10

from 6:10,14,17 14:23 19:24 21:13 33:11 34:2,4 41:6 42:3 44:18,22,25 45:3,4,8,10,11,13, 14,20,21 49:3 52:16 60:24 67:2,19 71:11 76:5 79:16 80:7 81:9 91:24 92:13,16 94:4,18, 21 99:22 102:6 103:4 108:13, 23 111:12 118:21 123:11,14, 17 124:16 127:19 128:23 132:10 133:10,14,19 134:3 138:14,17,18,19 139:1 140:5,6 141:24 143:15 144:2 148:13 152:2 159:3 165:6

front 41:1 52:22 89:10 92:6

120:10 124:4 142:8 153:10

frontal 72:2,9,13,16,23 73:2

full 5:12 36:12 55:21 95:10 140:4 145:6,7

functions 44:18

fundamentally 57:6

further 37:18 41:15,21 67:23 164:1 165:7

future 71:3

G

gave 69:25

general 18:5 31:17 36:17 46:1 55:4,14 66:13 72:5 74:1 81:3 84:14 98:9 100:11 101:20 102:23 103:17,22,25 104:13 106:20 107:22 111:24 116:17 117:22 120:19 121:25 123:13, 19 124:20 127:24 145:22 152:23 153:7 163:10

generally 37:21,23 38:7,9,24 39:14,16 40:8,22 49:13 62:20, 24 73:15 75:12 93:5 95:15 98:4,12,17 120:10,15 122:25 123:1,8 148:5 162:3 164:11,16

geometrically 116:12,15,21

geometry 96:10

gets 105:2

getting 67:13 148:9

give 18:6 58:19,21 69:13,24 70:19 97:1 104:22 146:4

given 70:12 134:14 136:2 140:20 147:4

gives 131:5

go 11:11 20:6 35:16 37:16 46:9 50:4,6 65:18 70:15 77:7,9 81:12,14 87:19 89:13 91:7 92:20,22,25 93:2 94:14 101:4 103:7 112:10 121:15 124:22 130:3 132:5 139:19 141:14 145:14 146:2 148:20 153:3 156:5,9 157:9 163:24

goal 53:18 99:7

goes 65:3 77:14 92:13 123:24 144:1

going 14:2 29:13 48:3 61:6 95:23 123:16 124:8 127:19 129:2

good 5:8,9 6:6 27:12 51:3 88:24 102:16

got 20:23 72:12

Gotcha 119:5

Gotou 124:8,12,15,22 125:4, 21,24 126:1,7,10,21,24 127:5, 6,9,14,17,23,25 128:3,6,7

govern 118:3,10

government 39:5 50:16,20 51:10,20 52:2 62:8 107:20

GPS 75:17,19,22 162:2,3

grab 87:6

graphics 20:4

grid 129:12

ground 142:7

group 156:6

groups 129:14,23

guarantee 148:8

guess 21:23 23:13 39:4 45:23 82:24 100:7 107:2 110:1 140:20 143:15 152:9 153:17

guessing 8:12 24:18

H

had 8:25 12:5,13,14 15:10 27:4 31:18 60:9 72:22 82:1

half 8:12 23:12 136:16,20

hallway 78:23 79:13,18,19

hand 61:6 129:2 160:25

handing 142:21

happen 147:1,3,12,22

happens 126:19

happy 68:23

hard 23:4 105:9 106:6 146:19

hardware 66:2,6

has 31:5 39:11 40:13 42:23 44:24 45:3,9,13 46:2 47:14 60:4 62:21 86:3 103:10 130:15 136:3 147:10 151:1 152:5 157:24

have 6:21 9:7 10:1,2,6,7,8 11:6,11 12:12,14 13:25 14:17 15:12 16:5 21:17,20 22:4 27:12,16 28:17,21 30:7,9,11, 13 36:10 38:19 40:25 44:17 46:25 47:2,7 48:17 49:5 52:18, 20,21,24 53:4 54:24 55:2,4,24 56:10,16,24,25 58:14 59:22 60:9 64:5,6,18 65:1,13 66:8,19 68:4,12,14 69:4,10,20 70:7 72:5 73:1 74:11,14 76:7 79:5 80:22 84:15,20 85:17 88:3 89:14 93:4 95:11 98:22 99:17 102:9 105:1 108:14 111:12 112:2,4 117:10,22 119:2 121:9,12 125:20,23 126:7,22 128:8,15 129:17 131:21 136:16,21,25 137:10,20 141:4 142:25 143:20 146:3 151:9 153:9 154:5,12 155:7 158:9, 19,21 159:7 160:23 163:22 165:7,9

haven't 9:9 11:23 52:6 56:2,5 83:6 120:14 131:20

having 5:6 25:4 39:12 44:18 59:23 131:10

he's 32:10 59:13

head 7:6 83:7 104:25 126:12 150:12 154:2 155:6 159:21

heading 49:7

headlamp 40:23 42:3 52:18, 21 54:24 82:1 83:19 86:6 91:24 96:8,15 101:14 107:18 108:5,9,10 119:18 125:7,13,16 128:8 130:15 133:11 137:11, 20 139:17 141:24 142:8,15,25 143:1,22 144:10,13

headlamps 40:10 51:17 52:11 58:18 64:19 65:16 68:2, 5 69:21 70:8 73:20 76:16 104:2,7,11 105:5 107:7 117:6, 19 124:16 129:15,20 148:24 149:15 152:6

headlight 124:25 127:1 143:6

headlights 67:3 76:13 86:25

97:15 101:11 108:14,23 130:18

heard 31:18 72:23

hearing 32:14,15 72:25

heat 69:20 70:7

here 5:14 6:7 7:3 8:7 11:22 12:18 18:8,9 34:10 35:9 37:3, 15,16 40:12 43:2 51:5 59:16 69:19 72:18 73:14 74:2,14,21 75:11,15 76:11 78:12,20 79:12,23,25 82:14,22 85:6,9, 13 94:13 96:12 99:12 100:1,4 104:9,24 105:13 108:15 109:5 110:9,15 111:1,5,19,25 112:9 119:8 120:13,23 121:25 122:12,17,19,23 125:22 126:13,24 130:19 132:15 133:17,23 143:11 144:3,8 145:2,20 148:8,9

here's 143:4

herein 99:20

high 43:7,21 44:5,12 65:2 74:6 106:16,19,21,22 108:16 109:2, 6 110:14 111:6 115:17,25 120:16 122:19 123:1,2 151:14 152:6,18 153:9

high-beam 107:9,19 108:6, 10,13,22,25 109:11,15,21,23 110:10 112:12,15 116:8,22 117:1,5,15,16,22 118:3,10 150:6,15,21 151:2,5,8,10,16, 20,23,24 152:1,3,4,7,11,12,14, 18,22 153:4 154:7,17,22 155:23 157:22

high-intensity 121:20 122:13,16,22

higher 13:14 103:19

hit 142:7

hole 135:22

hoped 148:9

hour 13:12 24:16,17

hourly 13:17,19

hours 8:13,16

how 6:22 7:19 8:10,14 10:14 11:3 13:10,23,24,25 14:1,6 18:4 19:5,20 20:2,5 21:20 22:2 23:3,7 24:14 25:19 27:8 30:22 31:16 35:1,3 37:7 38:12 40:6 41:6,15 42:24 53:22,24 54:3, 16 61:25 62:18 73:15,18 75:12 76:19 78:6 85:8 86:5 90:11 91:25 92:9 95:6 96:6,15,20,22 97:6 101:17,21,25 102:4 104:10 108:9 115:22 122:22 123:5 128:16,18 131:5,15 138:1,3 139:16 140:22 146:18 147:1,3,11,25 148:5 151:13 152:13,17,19 153:3,7 158:23 160:10 162:5,20

however 135:10

human 22:12 62:23 84:17,19 85:16 123:8

human-computer 17:25 18:3,6,24

humans 18:11

hypothetical 128:13 143:7,10 152:9 153:18,19

I

I' 136:17

I'D 105:10

I'LL 6:24 7:3,16 26:20 29:17 37:24 57:19 65:18 69:17,24 70:3,19 72:6 79:25 87:19 144:5 146:2,3 162:25

I'M 8:12 10:1,12,24 12:3,24 16:18 19:20 26:17,21 27:7 29:7,8,12,18 30:10,12,14,19 31:7 35:4 36:23 39:10 42:5 43:2,9,13,16,19,22 44:2,9,14 47:4 52:7 55:12 56:7 57:1,7, 11,14 59:3 61:6,20 68:23,25 69:8,18 76:8 79:6 80:24 88:9, 17,24 91:7 92:12 94:3 97:6 100:11 107:15 111:1,2 112:15 116:12 117:11 118:7,13 119:5 124:8 129:2 131:15 135:1 137:5,6 142:21 149:3,4 151:10 152:17,19 153:1,2,18,19 154:2 155:9 160:10

I'VE 8:23 11:1 12:13 18:23 23:1 36:11 38:7,10,12 47:9 55:20 58:12 61:21 64:22 70:12 80:24 108:12,21 118:6 120:17, 23 121:7,22 153:23 157:7

I-N-D-E-C-T 10:15

idea 108:14

ideally 73:16,18 75:6,13

identification 23:21 26:3 61:3 87:8 124:5 128:24 142:18 148:14

identifying 19:2 99:9

illuminate 20:7

illuminated 41:3

illuminating 57:15 120:10 122:1,4 142:11 145:16

illumination 43:4 53:21 54:2, 4,7,9,13,16 76:25 77:5,24 78:16 120:8,12,16,20 121:2, 14,20,24 122:3,6,7,13,16,18, 20,21,23,25 123:16,17 124:1 125:2,19 126:15 127:3,11,15, 16 128:17

illuminations 40:10

illustrates 141:15,18,20

images 19:2,7 20:7

imaginary 144:1

imagine 107:12 125:17

imaging 17:3,24 18:24 20:13 21:12 55:12,14 99:22

impact 53:22

implications 84:16,20

important 49:14 54:8,15 65:6, 15 160:24 161:3,6,10,12,16, 21,25

improved 68:4,14 69:4,10,20 70:7

incandescent 139:17

include 17:23 18:7 34:15 56:9 74:6 87:24 90:6 109:16 120:12,16,20 121:3 123:17 135:14 136:9 163:16

included 21:10 38:3 53:10,15

includes 17:21 87:23 89:17 90:18,24 97:24 150:5,14 160:16

including 18:23 36:7,22 40:10 57:1

incoming 99:22

Incomplete 143:9

incorrect 78:5

increase 85:19,24 86:2,5,13, 17 127:20 128:11,17 150:3,5, 14,16 157:13,15,17

increased 13:17

increases 157:19

increasing 130:13

Indect 10:13

independent 127:24 128:3 156:23,24

independently 89:18 93:10, 14,21,25

indicate 103:9

indicated 31:15 98:21

indicative 25:9

individual 89:18 101:10 102:1

individually 80:8 99:19 100:15 129:14,23

individuals 12:15

industry 50:16,20 51:11,21 52:3 53:4 60:13

influence 12:17

information 22:12,13 91:13 124:15

Initially 25:2

input 19:22

inputs 19:24 20:1

inside 93:2

installed 124:25 127:1,7

institute 16:19,24,25

intelligence 18:1,25 20:14

intended 85:17 109:10,14 110:15 135:14 143:12 145:12, 17

intends 147:7

intense 122:7

intensity 40:18 43:21,24 44:5 62:13,16,18,19 63:1,3,6,8,10, 12 84:1,3,7,24 85:4,8,12,15 86:8,12 91:13 98:23 103:11, 13,20,23 104:2,7,10,17 105:4, 6,14,25 106:2,9 112:13,17,23 113:6,8,10,12,15,17,18,21 114:2,7,8,10,12,15,20,24 115:1,6,13 122:19,21 123:1,2 130:9,11,16,22 131:1 150:24

intentionally 28:10,15,17,25

inter 5:20 9:20,23 10:17 30:5

interact 18:4,9

interacting 18:11

interaction 17:25 18:3,7,24

interest 96:11

interesting 14:7

interior 55:5

International 10:21 36:18 37:8 57:12 129:3

interpret 138:3 160:11 163:15

introduce 23:24 26:1

intuitively 84:5

invent 66:23

invented 66:8,19

inventing 66:2

invention 52:4 59:25 60:9 65:12,21,22 70:23,24 91:11 130:8

inventions 71:20

inventor 16:2,8 32:11,17

invoices 12:25 13:5

involved 11:1 27:16 51:1 53:5

involvement 22:20

involvements 12:14

involves 16:6

IPR 10:19 24:4 31:6 34:2

IPR2022-01586 5:23 34:4,9

isn't 66:8,19 71:13 78:3

issuing 114:20

it's 10:12,21 13:15 15:12 18:4 19:6 23:4,5,20 26:9 30:20 37:11 41:4 51:1 66:23,24 67:21 68:17 69:13,25 71:16 72:10 74:2,20 75:24,25 76:15 78:21 79:13 84:16,23 85:5,8, 13 94:2,6 95:8 98:13 99:8,10, 13 100:18 105:18 106:6 109:2, 14 114:12,15,23 121:25 122:1, 2 124:9 129:3 133:13 139:15, 23 140:20,21 141:11 143:12, 21 144:14 145:14 146:11,19 152:9 153:17,19 154:13 161:9

itself 53:19 65:18 88:4 90:21 112:14 115:11 140:3

J

J-I-A-N 57:19

J-I-A-O 57:20

Jeff 9:3

Jian 57:18

Jiao 33:11,20 34:13,14,16,17, 18 57:18,20 58:1,9,17 59:13, 17

Jiao's 33:18 34:8

joint 24:21

Joseph 32:13

judgment 123:9

just 7:3,9 21:21 23:10 24:17 26:1,21 28:22 29:9,13,19 31:4 42:22 45:23 46:19 50:3,7 64:7 66:14,24 67:19 73:14 75:11,16 77:22 79:6,15 92:7 95:8,24 97:9 101:18 104:25 106:6 109:11,14 114:5 117:11 118:6 120:24 121:22,25 126:4,19 136:2 143:13,21 146:3 155:20 158:8,12 162:25 163:22

K

Karlsson 28:2 129:3,7,15,19, 22 130:3,15,18,25 131:5 132:2,5,15 133:9,15,24 134:9, 12,14 135:19 136:2,4,24 137:3,5,7,25 138:2,4,14,17,19, 23 139:7,9,16 140:2,5,6,21,23 145:11 146:1,2,7,11,16,17,22 147:7,14 149:11,14

Karlsson's 131:24 132:19,23

133:10,17 137:12,16 139:1,12 140:11,17,18 141:9 143:6

keep 93:1

key 25:7

kind 54:16 76:15 84:18 88:23 104:15,20,22 106:3 147:21,25 148:5

kinds 19:8,11 78:23 89:4

knew 38:24

know 5:14 9:2 10:25 14:22 21:23 22:2 28:14 29:21 30:22 31:15 32:6,7,10,13 37:1,6 39:4,6,9,11 43:6,11,14,17,20, 23 44:1,4,11 46:6,8 47:15,16, 19,21 49:4,15 54:3,22 57:18, 20,21,22 58:15 63:15 64:23 71:16 73:2,4 83:8 87:4 98:16 103:17,22 104:1,6,13 106:2,3 107:22 108:8,12 116:25 117:2, 23,25 120:25 121:2 126:12,20 135:20 136:6 137:15 138:3 143:14 144:13 151:13 152:13, 24 153:7,24 154:21 155:15,19, 21,22 156:2

knowledge 14:19,20 32:4 35:21 39:12 62:10

known 36:8 38:10,12 55:4 65:13 73:3 76:12 88:8,15,18

KSR 36:8,18,23,25 37:1,7

Kushman 9:7

L

l/w 70:25

lab 17:16,19 20:23

label 98:22 136:17

labeled 136:21 137:11,20 138:7,21 139:4,20 140:25

lamp 44:24 45:3,9,13 65:24 66:9,20,23 67:3,12,14

lamps 39:7 43:15,18,24,25 44:5,6,12,13,18,23 45:8 120:20,23,24 121:3,8 123:18

language 156:13 158:20 159:1,3,7

laptops 18:8

large 19:20

larger 41:21,23

last 8:9 24:6,10 26:10,14 69:25 73:6 137:24 157:24

law 9:8 13:4

learned 38:12

learning 18:1,25

least 23:12 34:18 41:20 60:12 79:19 107:14 150:5 157:17,19

lectures 21:24 22:2

LED 52:19 55:2 58:17 69:11 76:22,25 91:18 139:16 145:5, 6,7

LEDS 50:15 51:16 52:10 63:18 68:1,5,14 69:5 90:18,24 91:4 92:7 101:14 129:13,15,19,22 135:23 136:17,22,25 137:10, 19 148:24 149:3,14

left 28:10,13,15,17,25 132:10 133:19 140:15,18 141:13,24 142:4,13,25

legal 11:19 36:6,15,21 37:12 61:18 66:4,11 79:4 81:22 82:20 83:14 85:1 150:9 156:18 158:6,17 159:17 160:5 162:8 164:19

legally 31:17

lens 92:14,16

lenses 163:18 164:18

less 24:17 145:7

lesser 107:3

let 15:20 37:11 42:20 73:22 76:14 94:19 122:10 149:5

let's 23:11,24 27:23 29:5 32:18 35:16 37:16 46:9 50:4 52:13 59:20 61:10 65:19 70:15 73:5 76:17 81:6,11 86:19 87:6 89:13 90:23 99:16 101:4 103:1,7 106:12 111:18 112:10 117:15 124:22 128:21 130:3 132:5 138:6 146:1,2 148:10 165:3

level 59:23 60:4,7,16,19,24,25 110:13 111:2 150:6,15,20 151:20 152:22 154:7 157:22

levels 83:17 154:1

LIFIA-IMAG 20:16

light 40:23,24 41:1,5 42:18,24 46:3 52:19 62:22 63:11 65:4, 14 73:19 76:22 77:1,2,19 80:6 81:18,20,25 82:9,11,15,17,18, 23 83:2,18 85:19,24 86:3,5,13, 17 87:25 88:3,18,23,24 89:1,4, 17,24 90:3,8,18,25 91:11 92:3, 4,5,8,10,14,15,19,25 93:1 94:5 95:21 100:21,22 101:10,16,22 102:3,4,6,8 104:16,19,20,23 105:4 106:16,17,19,24,25 107:3,4,5,8,9,13,18 108:5,9, 10,12,13,17,20,22,23,24,25 109:6,11,14,18,19,21,22,23 110:5,9,10,13,14,15,17,25 111:2,3,6,8,20,22 112:1,6,11, 12,15 115:18 116:1,3,6,7,16, 20,21 119:19,20 120:1 123:17, 24 124:16,25 126:13 127:1,9, 14,20 128:10,11 129:11,12 130:9,11,12,17,23 131:1,2 132:8 133:10,14 135:24 136:4, 24 142:7 146:7,13,23 147:7 150:4,5,6,14,15,21,24,25 151:2,5,8,10,14,16,23,24 152:1,3,4,11,12,14,18,22 153:4,9,11 154:1,7,17,22 155:24 157:13,15,18,19,22 164:17

light-emitting 89:22 90:7 91:6

lightbulbs 128:8

lighting 36:4 52:22,24 53:5,6, 11,16 55:5,9,13,18,21,25 56:3, 6,9,18,25 57:1,2,5,6 58:10 59:2,5,17 60:14 65:24 72:2,9, 14,16,23 73:2,8 78:23 79:13, 18,19 103:14,24 106:21 119:23 130:10 137:14 149:20

lights 40:19 99:9 105:1,2 107:19 108:6 109:12,15,20 112:9 152:7

like 12:10 14:4,6 20:15 62:22 67:6 69:16 88:7 98:17 104:25 107:14,23 109:17 110:2 135:11 141:11 142:25 143:4,5 144:4,16 146:17 151:1 157:10 160:8

likely 123:3 155:21

limiting 71:13

line 31:4,7 70:17,19 73:6,7 75:16 76:2,17 80:12 81:17 83:9,25 93:8 130:4 142:3,24 144:1 145:7,8,24,25 146:10 159:11 162:9

lines 65:20 70:20 72:6,7,8,11 77:22 78:13,18 85:18 96:1 99:17 101:4 124:22 126:4 129:8 132:3,5,6,7 133:18,23 143:20 146:3,6

link 47:10

list 8:2 11:11 25:4 32:21 33:4,6,9,25 34:10,15 35:9 38:3 46:17 48:22 78:11

listed 8:1,2 9:16 23:18,19 32:20 33:6 40:12 46:16 48:21 82:6 86:11

lit 128:9 137:11,20 142:13

little 10:12 140:21 143:23

LLC 12:1 15:1

locate 34:24,25 35:1

located 35:2

locating 99:2

location 91:11 96:15,17,19,23 99:5 151:11,13 153:10

long 8:10,14 23:2,3 24:14 38:12 53:24 54:14 68:17 69:13 70:1

look 12:10 49:5 56:10 61:10 63:21,22,23 64:8 68:23 69:17 70:4 75:16 76:14 97:3 98:9 99:16 106:14 149:6 155:8,12,23 159:10

looked 24:13 38:7,19,25

looking 15:13 33:9 34:10 67:21 93:7 95:24 99:9

looks 143:3

lost 80:24

lot 10:9 14:22 27:18 107:23 137:4 148:6

lots 22:20

low 43:12,24 44:5,12 106:22 109:4 110:3,6 120:12 122:20

low-beam 107:4 109:23 110:5,10 111:8,20,22 112:1,6,9

lower 112:17 113:5,7,10,12 114:10 151:1,4,7

lumen 65:3,14

lumens 71:1

luminance 65:4,14

lunch 103:1

M

machine 18:1,25

made 45:19 160:9

Magna 10:20,21

main 54:4,6 106:22 156:22

maintain 162:25

majority 23:11

make 29:8,18,20 41:21,23 57:2,4 85:7,12 92:25 94:16 98:10 103:18 140:23 147:3,22 154:12

makes 22:18,25 76:8 145:18 147:10

making 30:3,15 66:23 145:22

manage 16:23

management 69:21 70:8

many 6:22 11:3 21:20 22:2 23:7 25:4 40:9,11,13 55:13 101:9 148:7

map 75:22 97:20

mapped 124:15

Marietta 21:4 53:14

mark 142:17

marked 23:21 26:3 61:3 87:8 124:5 128:24 136:17,22,25 142:18,21 148:14

marker 143:5,19

Martin 21:4 53:14

material 14:7

materials 7:21,24 8:1

matter 11:13,17 12:6,12,20 13:5,11,12,16 14:11,14 15:11 30:4 41:6 57:23 160:25 161:11

matters 9:21,24 10:18,22,25 15:14,21 16:1 18:13

Matthew 5:5,13

maximum 44:4 73:19 103:11,13,23 104:2,6,10 105:6,14,25 106:2,8 112:13,17,22 113:5,8,10,12,14,17,18,21 114:2,6,8,10,12,14,20,24 115:1,5,13

maximums 40:16

may 10:1 38:19 41:22 56:7 65:9 72:4 79:22 86:8 87:5 92:11 114:19 132:11 133:3

maybe 23:13 50:1,3,9 64:11 72:10 75:24 80:10 113:22 114:4 116:12 165:3

mean 7:25 8:22 11:25 14:21 15:18 18:3 21:21 22:9 23:8 24:12 30:17,18 35:24 36:1 38:9 40:21,22,24 41:10,23 42:11,15,20,21 44:22,24 45:8,9,20,23,24 46:4 47:18 49:12 53:8,17 57:5 62:15,19 63:6 73:11,19 75:10 81:20 82:11 85:4,25 88:2 90:13,15 91:20 92:22 95:12 96:17 100:3,6,7 101:13 102:19,24 103:13 104:19 106:9,19,23 108:20 110:24 113:25 116:3,5,11 120:8 122:5 123:2 124:3 125:15 130:21 135:2 143:25 151:4,24 152:4 153:1,25 164:12

meaning 83:21

means 74:15,21,23 75:4 76:23 77:4 78:15 82:14 83:17 84:5,24 86:2 91:23 95:15 100:4 103:18,23 108:19 120:10 122:4 123:3 130:10 150:20 152:1 154:6 160:7,21

meant 79:17,22 144:14 161:3

measure 151:10,13 152:2,14,18,21,22 153:11 155:23

measured 104:10,15 159:25

measurement 104:15,16,19 151:2,5,6,17,21,23,25 152:12,14,15,25 153:2,13,15 154:13

measuring 150:24 153:3 154:17,22

mechanical 60:10 76:23 77:4,23 78:8,15,20 79:10,17, 20,24

mechanisms 77:19

media 17:12 20:23

medical 19:18

medication 6:13

meet 8:6,8,10,15,17 50:16,20 51:10,20 52:2 64:19

meeting 152:10

member 23:15 57:9,12

mention 63:24 79:24

mentioned 9:19 18:23 19:10 27:5 78:8 133:25 150:14

mentioning 63:21

mentions 78:12

met 7:22 8:5,23 9:7 30:7 32:1

Meta 11:10

meter 153:9,11

method 124:24 126:19,20,25 127:6,9,17 156:23

methodology 154:16,21

Michigan 5:2 37:22 46:13 47:22

microbeam 89:19,21 91:18, 21 93:21,25 95:3,4,7,22 96:6 102:19,20

microbeams 91:15 92:1 93:10 95:19,20 96:3 99:21,25 100:14,20,23 101:10 102:2,5 103:10

Microsoft 18:14,19

mid 46:25

might 33:22 67:7 71:25 82:24 85:17 104:25 107:24 125:20 163:16

mind 46:19 111:15

minimum 43:21,24

minimum/maximum 40:17

minute 79:25

minutes 50:9 51:5

mirror 88:7,11,15 92:13,24 94:4 96:11 100:20,21

mirrored 90:2

mirrors 88:4,6,21 89:8 92:5,8, 9,17,18 93:4 102:6,10,13

Mischaracterizes 42:25 48:8 70:9 94:12 95:1 109:8 110:19 115:8 117:7 147:17 148:2 154:8 160:4 161:7,18

missed 91:7

misspoke 72:10

MIT 20:20,23

modifications 120:6

modify 120:1

modifying 81:25 122:19

modulator 87:25 88:23,24 89:2,24 90:3,8,19,25 92:4,5,9, 10 100:19 101:16 102:3,4,9

modulators 88:3,18 89:5 101:22

module 77:1

moment 34:11 76:10 118:8,14 146:4 149:18,23 150:12 158:22 160:10

months 161:2

more 24:16 46:3 84:10 88:19, 22 91:14 105:11 126:10 143:23 164:2

morning 5:8,9

most 65:23 82:25 88:25 89:1 92:12

motivation 49:18,22 50:2 51:24

motor 37:25 38:10 39:9 48:14, 15

movable 80:15,17,20,22 88:3, 6,21 89:8

move 88:5

moving 77:18 94:4 98:4,13,20

Mr 5:8,11 13:9,22 14:9 15:5,8, 19 16:2,7,8 19:15,23 23:23 25:18,25 26:5 29:7,10,17,21, 24 30:7,9,11,13,16,20 31:11, 18,21,25 32:4,7,12 36:20 39:22 40:5 41:14 42:1,8 43:5, 10 44:10 48:12 50:4,9,11 51:5, 7,15 52:1,8,13,17 53:3 55:8, 16,23 57:3 58:16,23 60:23 61:5,24 62:11,17 63:7,16,22 64:1,6,10,24 66:7,14,18 67:1,9 68:10,24 69:9 70:5,14 71:12, 18 72:1,21 73:17,22 74:4,13, 22 75:3,8 77:7,12 79:9 81:6,10 82:3,16 83:3,20 84:22 85:10 86:18 87:6,10 91:5 93:19 94:13,15,17 95:5,17 96:13 97:4,9,12,22 98:11,19 99:4 100:13 101:3,24 102:17,18 103:1,5,6,21 104:5,18 105:12, 20 107:6,17 108:2 109:13 110:3,8,16,23 111:14 112:24 113:24 114:22 115:4,15 116:14 117:3,13,19 118:1,15, 23 119:2,7 120:7 121:1,6,11 122:10,11 123:10 124:2,7,21 125:14 126:23 128:1,5,21 129:1 130:2 131:17 133:5,8,16 134:1,16,22 135:3,21 136:7 137:8 138:5 139:18 142:16,20 143:17 146:21 147:23 148:10, 16 149:24 150:18 151:3,22 153:12 154:4,15 155:2,10,16 156:4 157:1,11 158:14,24 160:2,12 161:14,24 162:12 163:3,17,23 164:23 165:3,7

Ms 13:6,20 14:5 15:2,16 16:4 19:12 25:14 29:6,9,12,19,23 31:3 32:8 36:15 39:19,25 41:8, 17 42:4,25 43:8 44:7 48:8 49:24 50:6,10,23 51:3,6,13,22 52:5 53:2 55:7,11,19 56:19 58:11,20 60:21 61:18 62:9,14 63:4,14,19 64:4,21 66:3,10,21 67:4 68:6,15 69:6,23 70:9 71:7,15,22 72:17 73:12,21,24 74:7,18,24 79:3 81:22 82:13, 20 83:14 84:13 85:1 86:15 91:1 93:16 94:11,14,25 95:13 96:9,25 98:6,15,25 100:10,25 101:19 102:16,21 103:15 104:3,12 105:8,16 107:1,10, 21,25 109:8,24 110:11,19 111:9 112:18 113:19 114:17 115:2,8 116:9,23 117:7,18,20 118:11 120:3,21 121:4 122:8 123:6,21 124:18 125:10

126:17 127:21 128:12 129:24 131:12 133:1,12,21 134:10,18, 24 135:16,25 137:1,21 139:14 143:9 146:14 147:17 148:2 149:21 150:9,22 151:18 153:5, 21 154:8,23 155:4,13,25 156:18 157:4 158:6,17 159:17 160:4 161:7,18 162:8,25 163:12,19 164:19 165:1,9

much 13:10,25 14:1,6 25:19 27:8 38:8 54:15,16 97:6 120:14,17,24 121:9,12,23 146:19

multiple 27:16 28:21 47:19

multiplicity 99:19 103:10

MVCA 46:19,21 47:3,5,8,14, 20 48:6,17 49:3

my 5:13,17,18 7:16,21 8:1 9:25 11:11 12:8,17 13:12,14, 25 14:19 22:19 23:19 24:4 25:4,9,10 26:20 31:24 34:7,10 35:20,21 37:10 39:4,21 40:3, 14 45:7,11 49:11 56:21,22,25 59:22 62:10 65:10 67:6,22 68:8,19,21 69:15 70:2 73:14, 22 74:10 75:11,14 78:7 79:16 82:6 83:7 88:13 94:16 97:2,7 101:20 104:24,25 105:13 109:7 113:4 117:14 118:25 126:12 133:13 134:13 139:15 140:13,20,22 141:11 143:16 144:25 145:22 148:25 149:1,6 150:11,12,23 152:15 153:8 154:2 155:6 157:8 158:10,13 159:20,21 160:9,25 161:11,22 162:25 163:21

myself 45:18 62:2 118:22 126:22

N

name 5:12,13 12:3 32:14 57:25 76:8

narrow 99:20,25 100:3,7,9 101:10 102:2,5

narrow-angle 91:14

necessarily 23:5 45:17 49:22 50:3 99:7,10 134:15 149:2

necessary 54:17 65:5,15

need 7:4,9 28:24 29:2 105:11 118:21 147:21

needed 54:17,19,21 106:17 108:18

never 32:1 55:17 64:22 78:8 93:2 108:12,21 112:16 113:5 145:12 153:23

new 13:14,19 65:24 66:2,9,20, 23,25 67:3,11,14 77:1

next 59:11 140:24

night 53:20

no 6:1,12,16,19 7:6 8:19 9:9 15:25 22:3 23:22,24 26:4 28:16 29:9,12,23 30:5 38:17 39:8 52:23 53:1 55:1,3,6,22 56:1,4,24 57:11,14,17 58:14 61:4 74:20 76:4,7 77:18 78:5 79:5 82:25 83:4 87:7,9,12 90:10,13,15 92:20 93:17 101:15 103:8,25 108:14 110:22 111:2 112:2 118:14 119:21 124:6,10 128:25 129:4 139:9 142:19 146:17 148:8,15 149:9,23 156:3 165:7,9

nodding 7:6

non-camera 159:12,15,22 160:20 161:5,15 162:2,7,11, 13,15,17,19,21,23 163:5

non-mechanical 77:16,17 78:2,10 79:11,12,15,18,23

non-movable 77:16,17 78:2, 10 80:23 81:4,5 86:21 87:2,21, 22,24 88:12

non-regular 134:23 135:2

non-square 135:9,10,12

non-vehicle 79:14

note 80:15

noted 141:6 159:6

nothing 31:5

notice 37:21

number 21:14,17 23:4,15 46:4 99:17 140:9

numbering 28:23 33:23

numeric 151:6,7,9,12

O

oath 6:7

object 21:1 31:4 96:4,7,11,14, 23

objection 13:6,20 14:5 15:2, 16 16:4 19:12 29:6 31:3,8 32:8 36:15 39:19,25 41:8,17 42:4, 25 43:8 44:7 48:8 49:24 50:23 51:13,22 52:5 53:2 55:7,11,19 56:19 58:11,20 60:21 61:18 62:9,14 63:4,14,19 64:4,21 66:3,10 67:4 68:6,15 69:6,23 70:9 71:7,15,22 72:17 73:12, 21,25 74:7,18,24 79:3 81:22 82:13,20 83:14 84:13 85:1 86:15 91:1 93:16 94:11,25 95:13 96:9,25 98:6,15,25 100:10,25 101:19 102:21 103:15 104:3,12 105:8,16 107:1,10,21,25 109:8,24 110:11,19 111:9 112:18 113:19 114:17 115:2,8 116:9, 23 117:7,18,20 118:11 120:3, 21 121:4 122:8 123:6,21 124:18 125:10 126:17 127:21 128:12 129:24 131:12 133:1, 12,21 134:10,18,24 135:16,25 137:1,21 139:14 143:9 146:14 147:17 148:2 149:21 150:9,22 151:18 153:5,21,22 154:8,23 155:4,13,25 156:18 157:4 158:6,17 159:17 160:4 161:7, 18 162:8 163:1,12,19 164:19 165:1

objections 66:21

objects 19:2 96:4,7 99:14

observers 62:23

obtained 77:3 129:10

obviate 49:22 50:2

obvious 49:15 50:22 51:12

obviousness 36:7,14,22,24 37:2,9,10,14 39:17,23 40:7 49:10,11,19 158:5 160:22

October 5:1

off 83:6 104:25 126:11 128:9 150:11 154:1 155:6 156:22,24 159:20

offhand 9:1,25 11:1,12 27:10 39:8 49:5 61:21 63:15 64:23 70:11 73:4 81:2 87:4 110:21 112:8 117:25 126:21 131:21 163:7

often 62:23

Oh 59:6

okay 6:4,24 7:12,15 18:14 24:3 37:24 38:3 51:6 52:13 67:18 81:6 88:11 89:7 97:23 101:4 115:24 118:2 119:5 129:7 133:6 135:6 139:9 144:5 146:5,22 149:9

old 65:25 66:24

omitted 34:11

oncoming 97:16

one 9:3 10:19 13:8,24 14:7,23 16:5,11 23:9 27:1 29:14,15 37:21,24 40:25 41:4 44:25 45:3,10,13,20 46:3 47:9,25 55:13 65:25 66:24,25 86:11 88:23 89:7 91:14,19 92:2,13, 20,22,24 94:4 101:1 102:15 104:14 106:5 114:4 124:12,25 125:5,7 127:1,19 128:9,10 135:13,18 136:3 139:24 141:1 142:25 144:24 149:16 151:10 152:21 164:2

one-bulb 125:2 126:15 127:3, 11,15

ones 9:23 11:8 118:14

online 35:2,7

only 10:19 17:21 23:9 25:17 63:12 92:20,22,24 93:4 101:12 133:24 136:25 137:10,19

onto 143:7

open 81:11

operate 103:11 112:13

operates 112:16,22 113:5,9

operating 73:9,11,16,18 74:5, 9,16 75:9,13 113:7 131:10

opine 104:9,24 117:21 155:17 163:20 164:8

opined 69:15 118:7

opining 67:5 73:13 75:10

opinion 12:17 45:2,12 49:17 50:19 59:22 61:16 70:2 74:12 79:5 83:5 84:24 102:19 112:2, 11 113:9 119:22 121:9 125:21, 23 126:7 131:18,21 137:18 142:12 145:9 157:3 158:13,16, 21 160:9 161:5 163:22

opinions 5:17 25:9,10,22 27:20 35:20 68:20 74:11 83:23 85:22 87:16 111:25 157:8 159:20 161:11,13,16,22

opposed 47:23,25

optical 57:13 60:11 65:5,15 80:8,10 87:3,22,23 97:18 163:8,11,18,20 164:2,5,9,12, 18,24

optically 45:24 46:6

optics 57:7 92:6 128:18 145:13 164:17

optimal 73:8,11 74:5,9,16 75:9 131:10,14

optimally 130:11,16,22 131:1

options 137:14

order 49:15 51:20 147:22 151:15

ordinary 49:14 59:23 60:5,7, 17,20 137:9,15,18 138:2 147:2 154:20 155:18

organizations 23:15

oriented 143:23

original 138:11

originally 85:17 109:17

other 6:17 8:23 11:6 12:13 14:2,4 15:14,21 16:1,6,8 18:1, 21,22 19:8,10 20:5 21:7,8 25:3 29:15 44:25 45:4,10,14 46:1 47:23 54:23 68:18 72:19 79:14 84:17 92:6 94:5 113:17 114:9 128:19 135:15 139:24 157:2 159:22,25

others 11:10 35:12 47:25

otherwise 112:22 131:16

outline 42:6,16,19

outlined 140:8 143:19

output 92:18,20,22 95:9,10,21 107:8 125:19 157:19

outputs 107:18 108:5

outside 9:7 105:3 116:7,11,21 117:23 119:19,23 120:1 153:8 163:5

over 24:13 39:14 69:17 70:4 75:16 119:3 143:22

overall 101:8

overcome 50:15

overdriven 107:13

overly 32:9

own 99:3

owner 11:14,22 60:16

P

p.m. 81:9 103:4 128:23 148:13 165:6,11

packaging 63:18,21,24 69:11

page 24:6 26:10 27:23 28:6 29:5,8,10,22,25 36:5 37:13,17, 18,19,23 44:15 46:9,10,11,12 48:16 50:12 58:25 59:11 60:2 64:25 65:1 77:13,14 91:10 106:13,14 115:23 118:17 129:7 130:3,4 132:1,5,7 133:18 136:10 138:7 139:19 140:24 144:19,21 146:2,6

pages 33:9

paid 13:1,3

PAL 149:20

papers 21:17,20 56:5,7,14,17 58:4,7

paragraph 28:17 29:25 32:18, 19 35:16,25 36:5 37:16,17,22, 25 40:8,15 42:10 44:15 46:9, 10 48:3,16 50:5,12 58:24 59:1, 4,7,20,21 60:3,15,25 61:10,11 67:10,15,17 77:9,13,15 80:1,4, 25 86:20 87:19 97:7,12,23 99:13 103:8 106:12 108:15 115:16,20 118:16,17 119:8 121:15 122:17 129:8 130:5 131:23 138:6 139:20 140:25 141:22 145:3 148:20 156:5,9, 12 158:25 163:24

paragraphs 28:1,7,11,14,23 29:3 37:15 49:6 136:9 144:18 148:21 149:10

parking 10:9

part 14:24 19:3 20:18 31:21 38:22 39:6 40:14 49:9 51:24 53:19,23 54:8 114:11 115:13

partes 5:20 9:20,23 10:17 30:5

particular 47:24 63:17 64:2 81:3 88:17 96:4,7,14 105:2 116:17 122:2 151:11 152:24 153:10 161:13,16

particularly 93:5 107:3 147:4

parties 10:17 11:6

parts 38:18,19,20 42:17 77:19 114:7,9 161:4

party 10:11

passage 67:10 78:25 79:24 91:21 93:13,20 94:18,21 95:24 100:14 101:13,15,18 126:9,18 147:14

patent 6:1,5 8:25 11:14,22 15:15,21 16:3,11,14 25:2,17, 18 30:5,6 32:11,16 33:19,21, 22 36:1,2,3 50:21 51:11,16,19 52:2,9 59:24 60:16 61:7,14,17 62:5,7 63:2,13,17 64:2,15,20 65:12,18 66:1,8,13,19 67:2,16, 19 68:1,4,11,13,17,25 69:4,10, 13,18,20 70:1,6,15 71:4,13,20, 24 72:2,13 73:3,8 74:6,15 75:17 76:2,4,7,11,12 77:15 78:1,12,22 79:2,8,10,20 80:12, 21 81:4,11,15,21 82:12 83:13, 22 84:4,23 85:25 87:11 88:16 89:15 90:9,11,15,21 124:9 131:10 149:25 154:6 156:17 159:10,14 160:13 161:6 163:4

patents 8:24 16:6,8,9 22:4,6 32:22,25 33:2 55:24 56:14,17 62:12 78:13

pattern 40:18 42:9,14,15,18, 21,23 43:3 64:3,9 77:2 96:8,15 101:8 102:1 108:11 113:16 114:8,9,16,19,24,25 115:7 116:8,22 117:1,5,15,17 125:8 132:13,20,24 141:24 142:24 144:10

patterns 117:22,24 118:3,10 145:10

pays 12:20

PDF 29:22

pen 144:3,5

people 14:22 18:4,9 19:2 27:4 84:14 85:7,11 106:21 155:7 163:14

per 62:22 71:1

perceived 123:3,5,11

percent 12:3 31:16 118:7 137:6

perception 84:17,19 85:16

perfect 29:23

performance 65:2

perhaps 10:21 45:18 83:8 143:22 152:2 153:25 154:2,12 155:7 159:23

period 107:15

person 8:9,14 49:14 59:23 65:12 123:12,14 137:9,15,18 138:2 147:2,13,19,24 154:20 155:11,18,22

personally 17:2 34:24 35:10 54:9 55:20 58:3,15

perspective 143:16

pertain 87:3,22

pertains 105:5 159:14

petition 25:2 124:13

petitioner 60:4

petitioner's 60:16,19

Phd 5:5 20:23

photoelectric 149:2

phrase 19:20 45:24 72:4 74:1, 9 88:18,19 106:24 109:17 110:12,14 121:25 122:2 123:19 149:4 153:25 154:11 157:21,23,24 163:15

physical 84:18

physically 116:12,16

physics 57:6 60:11 84:16,17

picked 7:7

place 24:8 26:12

plane 132:9 133:19 134:2

please 5:12 7:4,9 15:4 26:21 30:2 31:10 60:7 73:22 77:9 101:5 105:22 113:3 121:16 129:9 130:7 132:6 142:17 143:8 144:6,18 149:25 150:1,2 159:10 163:24

plus 68:18

point 15:13 51:4 66:24 67:7 68:22 69:16 70:3 72:6 73:20 77:11 102:14,16 145:19,22 159:8 162:1

pointed 79:15,23 88:14

pointing 59:3 140:9

points 25:5,7 83:18

polygon 135:15

portion 54:1,3,9 67:21 138:17 139:9 140:5 142:9,10,12

portions 138:18 145:16

POSA 44:17 59:24 60:8 154:25 155:3

position 77:19 91:14,20,25 92:13,15 93:9,14,20 94:4,8,9, 19,22 95:3,6 96:6,12 97:20 102:13 112:16 113:4 114:23

positioned 100:21,22

positions 92:7 93:4,23 95:9

possible 15:12 51:14 76:3 83:17 126:11 137:14

possibly 82:15,17

post-doc 20:20

potential 15:10 142:24 145:10

potentially 46:4

preceding 97:17

precise 75:25 144:15 145:13

preferably 129:13

preferred 76:21,22 78:14 130:4,8,19,25

preparation 9:14 31:22 64:12

prepare 7:19 8:17 27:2,15

30:21

preparing 8:19,21 9:17 24:25 25:19 26:23 27:8 38:14,23 46:21 49:1 64:16

prescribed 48:18

present 70:25

president 16:18

presume 39:13 44:3

pretty 10:24

prevent 6:10,14,17

previous 42:17 45:21

previously 10:3 17:4 18:14 72:24 87:14 125:24

primarily 25:14,15

primary 124:12

principles 18:12

prior 38:25 43:1 50:19 51:9 52:10 73:3 82:7 88:15 95:1

priority 61:13,16 62:3,4

probably 8:16 12:2,8 14:2 24:17 25:16,18 46:2 50:2 76:9 104:4 128:16,20 147:19 161:12

problem 51:20

problems 19:6 20:15

proceeding 5:21 9:11 23:25 31:6,19,22 33:14,19 34:2,4,8 69:19 72:22

process 12:11,18 24:25 25:11 26:23,25 27:14 30:22 94:7 97:15 102:25

processes 94:6

processor 99:21

produce 101:12 107:14

produced 76:25 101:8

produces 99:19

producing 125:18

professional 12:14 22:20

professor 17:4,10

program 17:13

progress 70:18 149:19

project 21:9 53:9,13,18,23,24 54:1,5,10 56:8 143:7 149:17

proposed 60:4,16,19

proposes 68:1

proposing 154:3,14

provide 5:17 23:7 27:11 59:22 65:23 95:9,10 111:7,25 112:6 118:18 130:10 139:25 149:6 164:7

provided 9:10 10:22 31:24 35:7,10,12 36:7,23,25 47:8,10 58:5,6 70:2 76:23 119:12

provides 49:11 86:21

providing 14:13 83:23 85:21 87:16,20 112:11 160:21

PTAB 31:7

Publication 129:4

publishes 39:3

purely 84:16

purport 51:19 68:4 69:10,20 70:7

purported 65:12

purporting 66:8,19 68:13 69:4

purpose 28:20 152:15

purposes 28:21 76:4,14,15

put 97:6 110:24

puts 116:20

putting 106:16 108:16 111:1,5 115:17,25 140:22

puzzling 90:21

Q

quadrilateral 134:23 135:2,4

qualified 56:15

quantify 110:17,22

question 7:12,16 23:10 29:15 31:10 42:22 45:6,7,11 48:3 50:7 54:16 64:23 66:17 69:17, 25 73:23 75:14,18 80:16 94:16 96:21 105:9,11,13,22,24 110:2,7 111:20 113:2,4,23 114:1,3,5 116:13 117:11,14 119:6 136:5 137:24

questioning 31:4 162:9

questions 5:18 6:25 7:1 152:20 163:2 165:8

quick 63:23 64:8 77:11

quickly 92:13 107:15

quite 11:1,10

quote 49:2 65:1 67:10,18,24 80:15,16,19,24 81:2 88:13

quoted 49:2 65:10

R

radar 162:15

rain 162:13

range 17:24 19:6,17 20:14 162:19,21

rate 13:12,13,14,17,19 150:25

rather 95:23

rationale 158:11

rays 20:6

re-aiming 77:1

re-read 114:5

reacts 104:20,23

read 30:2 36:10,11 38:14,15, 18 58:7,12 60:7,24 65:20 66:15,16 70:20,22 75:1 76:17 77:22 78:13 79:24 101:5,18 124:23 129:8 130:7 132:6 136:3 150:1

reading 147:14 151:1,4 153:11

real 22:11 112:2

reality 22:8,9,11,14

really 19:16 27:12 52:7 73:5 74:11 92:20 107:16 108:12,14, 21 120:23 121:7,9 131:21 137:6 158:21

reason 6:10,17 47:24

reasonable 85:5 124:19 143:15 144:12

reasons 58:14

recall 11:19 13:3 15:12 23:20 24:15 28:12,21 29:1,4 31:20 32:14,15 38:12,19,21,22,24 39:12 47:5,7,12,13,24 51:23 56:11,12 58:3 63:20 67:5 68:7, 13,21 69:3,12 70:12 71:23 72:25 73:13 74:10 75:3,10 76:9 81:2 112:8,14 126:10 148:25 149:5,22 154:18 158:10 159:19 162:1 163:7,21

received 21:13 56:2

recite 51:16 90:20

recited 33:6 64:19

recites 89:17,21,24 90:2,6,17, 23

reciting 160:18

recognition 20:21 21:2,15, 18,25 22:7,23,25 23:1 56:16

recognize 24:1 26:6

recollection 12:25 27:6 69:22 70:6 71:19 149:1 163:4

reconcile 78:6

record 5:12,23 7:6,7 29:20 31:5,8 94:16

recorded 7:5

records 124:9

rectangle 134:17,21 135:8,9, 10,12 138:19,21

rectangular 135:7 145:7

red 136:15 142:2,6,12,23 145:8,24

redirect 165:9

Reduced 98:22

reduction 96:2

redundant 125:18,22 126:9

refer 6:4 26:16 46:11 81:4 109:6 122:23 146:3 151:17

reference 28:2,3 37:25 48:21 89:10 91:17 93:7 100:1 103:9 110:1 112:1,3,5 118:24 119:3, 14 124:12 129:3 140:2 146:2 148:17,18,22 149:11,12,14

referenced 33:3

references 46:17 49:19,23 51:10 52:10

referred 35:4 75:24 99:20 149:20 151:19

referring 12:2,22 26:17,21 29:22 32:21 33:1,24 66:12 75:15 87:5 92:8 103:8 109:18 111:2 117:1 121:24 152:25

refers 74:3 75:17,19 77:18 100:20 112:8 158:25

reflection 102:14

reflective 39:7 80:9

reflectors 163:11,16 164:24

reflects 92:14,15

refractors 80:9

refresh 126:22

regard 39:1

regarding 9:8 25:17 84:16 104:16

regards 54:12 132:12,16

regime 73:9,11 74:5,10,16 75:9 131:10

regional 113:15

regions 113:8,11,16,17

regular 13:13,14 135:4

regulate 40:11

regulation 38:11 40:13 48:5,7

regulations 40:3,6,9 44:2 48:4,11,13,14 50:16,20,25 51:10,21 52:3 62:8 107:20,24 108:3,7 117:24 118:3,5,9 146:8,12,24 147:5,8,16

regulatory 39:14

relate 22:6,8 96:6

related 8:23 10:9 17:2,24 18:2,13 19:7 25:3 33:19,21 43:3 48:14,15 79:14 115:12

relates 6:1 70:23,24 88:20

relating 15:14

relationship 20:4

relationships 12:16

relative 62:23 117:14

Relevance 13:6,20 14:5 15:2 19:12 31:3 32:8 53:2 55:19 58:11,20 64:21 66:3 69:23 71:22 73:12,25 120:21 149:21 153:22

relevant 36:6,21 37:12 49:17 69:16

remember 8:24 9:25 10:4,12, 19 11:2,7,8,11 25:16,21 27:10 28:12 31:14,15 34:11 37:7 54:14 61:20 68:19 69:14 70:1 72:4 115:10 144:24 152:19 161:1

remembering 12:24 97:6

remind 118:21

remotely 8:9,11

remove 28:11

removes 139:1

render 50:21 51:11

repeat 31:9 45:5 105:22,24 113:2

rephrase 15:20 122:10

replace 65:25 85:14

replaced 28:24

replacing 66:24

report 16:23 33:3 104:24

reporter 7:3

representation 41:24 143:1 144:9 145:10

representative 164:1

represented 132:8 134:9

represents 137:13

reproduction 142:22

request 30:4,16,17 31:25

requested 30:20,23

requesting 30:24

require 62:7,12 63:2,8,11,17 64:2,9 82:18 105:18

requirement 43:6,11,14,17, 20,23 44:4,11 63:12

requirements 39:14 40:16

requires 150:8,12 164:2

research 16:24 17:1,2,19 18:19 20:20 21:5 22:19 31:21

reshape 82:9,11

reshaping 82:23

respect 10:16 40:16,17 56:17 114:15,18 115:6 128:6 131:9 146:12 158:4

respective 146:8,24 147:8,16

respectively 26:18 125:3 127:4

respond 7:4 137:23

responding 99:11 105:4

response 45:22 75:14 111:23 113:3

responsibilities 16:22

responsive 99:22

restate 113:23

restrict 111:22

result 139:25 148:9 151:11

retained 15:14,20 16:1 57:22

retaining 11:13,17

retention 15:23 16:5

return 151:6

review 5:20 9:13,16,20,23 24:10 26:14 30:5 32:4 33:13, 18 34:7 38:6,8 46:21,24 47:11 48:24 64:11,15 67:2 76:9 146:4

reviewed 7:21,24 33:20 34:13 47:2 64:7 68:11 69:1 76:7 87:14,16 112:3 125:24 126:1,4 160:13

reviewing 38:22 47:5

reviews 10:17

revise 65:9

revisions 27:17

right 5:24,25 6:2 7:2,19 8:4 13:17,18 16:20 17:6,8,9,20 18:15,20,21 20:21,24,25 21:2, 6,15,16,18 22:5,7 23:16 28:4 31:17 33:17 34:3,6,22,23 35:15 37:4,20 38:1,2 46:15 49:7 51:18 56:12 58:4,10 64:18 76:13 80:13,18 86:25 87:17 88:9 89:2,11 93:15,23 97:3,23 98:24 100:15,24 102:14 108:15,24 109:7 112:8 124:14 126:6,13,24 132:10 133:20 139:8,20 140:13,25 141:17,21 142:10,24 143:3,6, 22 144:10,13 145:3 149:4 159:21 161:1

right-hand 140:8 141:6,15,19

ring 15:7 149:18

road 72:20 82:23 83:7 86:4 98:14,20 124:17 130:12,13,16, 22 131:2 142:7 143:7 150:4,7, 17 157:14 158:1,15

robotics 20:14 21:11

role 16:17

room 25:14 104:25

rough 11:5

roughly 23:13

rules 62:8

run 16:24

S

safety 38:1,11 40:10 48:14 130:14

said 7:24 8:5,21 20:8 25:12,15 27:14 28:14,15 29:8 31:1,12, 14 36:21 41:22 44:1,20 45:7,9 53:15 54:6 56:15,24 58:3 68:25 75:2,9,10,19 79:18 82:4, 17 88:20 89:17 97:13 103:22 108:21 109:2,17 110:13 115:3, 11 117:9 126:19 151:23 153:23 154:11 160:8 161:10

same 26:25 27:4,14 36:5 41:11 44:3 58:19,21 62:14 66:21 69:13,24 82:13 83:25 84:24 94:2,3,7,10,23 102:20, 24,25 115:20 116:19 125:18 137:24 149:3 150:22 157:4,23 163:19 165:1

Samsung 11:9

Santa 17:4

satellites 162:4

saw 89:10

say 12:22 14:20 19:1,13 22:9, 15,22 23:4,11 28:9,10 32:19 36:2,5 40:15 44:16 45:23 46:1 48:10 51:8 54:1,19 55:14 57:4 58:25 59:4 66:5 77:15 78:7,9 79:17,22 80:6 85:3 88:6 90:9, 10 91:3 108:16 111:21 115:17 116:20 120:22 124:23 133:4 134:14 136:4 137:7 141:22 146:19 147:11 149:5 154:10 155:20 156:12,22 158:8 159:4 161:9

saying 37:3 42:2,5,23 48:6 66:22 69:8 75:4 78:25 79:6 93:24 108:21 109:5 111:11 151:8,10 152:21 153:24 154:2

says 20:16 30:3,15 35:20 36:18 48:18 60:8 61:12 65:2,3 72:8 73:7 74:16 76:3,14 81:18 82:8 86:2 89:23 91:6 93:8,17 96:1 99:18 112:13 126:13,18 127:8,13,17 128:7 130:4,19 131:4,7 132:22 133:3,6 134:4, 5,7 135:19 136:17 140:21 146:7,25 147:7 154:6 163:25

scenario 42:6 78:22 82:24 83:1,4 107:14 140:14,18 141:12 144:10

scene 19:9

schedule 14:1

school 17:14

science 17:10

scratch 141:19

search 35:6

second 26:1,9,14,16,24 27:2, 9,15,20,23 30:3,15 33:10 58:24 59:20 61:11 70:20,22 80:1 83:23 85:22 86:19 87:17 97:10,14 103:7 106:12 121:15, 18 128:10 131:22 142:23 148:20

section 37:12,20 46:14 48:19, 24 49:4 125:4

see 12:15 21:13 28:1,6 29:25 32:19,23 35:6,16 44:16,20 48:17 50:13,18 58:25 59:6 60:6 61:11 63:24 65:6 67:12, 13,15,17,18,23,25 70:21 72:8, 12 73:7,10 75:17,19 76:2,6 77:20 80:6,11 81:14,18 82:8 83:9,25 85:18 87:5 91:15 93:8 96:4 97:25 99:18 103:9 106:17 116:1 118:18 119:4 121:18 130:5 136:10,18 138:7 139:5, 20 140:9,25 141:7 144:18,22 146:6,10 155:8 156:6,12 159:11 163:25 164:3

seeing 72:19

seem 90:20 105:10

seems 72:5 73:15 75:11,15 98:9,17

seen 64:18 89:14

selectively 96:2

send 13:5,7 100:21,22

sense 19:7 21:20 27:12 45:19 54:21 98:10 117:22 122:5 140:23 145:18 164:8

sensing 21:11 162:4

sensor 97:18 99:1,23 104:20, 22 105:1 153:17 159:12,15,22 160:3,21 161:5,16 162:2,7,10, 11,13,15,17,19,21,23 163:5

sensors 19:8,11,17,19,21,25 20:1,2 99:5 149:2,4

sentence 40:21,22 42:10,12, 15 61:12 66:5,13,14,22 67:15 70:22 71:10,11 74:2 95:3 97:14 109:5 115:20 116:3 121:18 126:13 127:5,8,13 130:1,7 135:13,19 136:3

sentences 76:20 115:23

separate 15:23 17:14 111:11 129:12

separately 125:1 126:14 127:2,10 156:10 158:11

set 84:18 92:13,15 93:10,15, 21,23,25

setting 92:25 94:4

settings 92:24

seven 163:1

several 23:6,19 33:10 34:15 40:11 57:25 106:4 157:5

shade 143:4,5

shaded 98:21,23 99:2 143:19

shading 143:21

Shah 13:6,20 14:5 15:2,16 16:4 19:12 25:14 29:6,9,12,19, 23 31:3 32:8 36:15 39:19,25 41:8,17 42:4,25 43:8 44:7 48:8 49:24 50:6,10,23 51:3,6,13,22 52:5 53:2 55:7,11,19 56:19 58:11,20 60:21 61:18 62:9,14 63:4,14,19 64:4,21 66:3,10,21 67:4 68:6,15 69:6,23 70:9 71:7,15,22 72:17 73:12,21,24 74:7,18,24 79:3 81:22 82:13, 20 83:14 84:13 85:1 86:15 91:1 93:16 94:11,14,25 95:13 96:9,25 98:6,15,25 100:10,25 101:19 102:16,21 103:15 104:3,12 105:8,16 107:1,10, 21,25 109:8,24 110:11,19 111:9 112:18 113:19 114:17 115:2,8 116:9,23 117:7,18,20 118:11 120:3,21 121:4 122:8 123:6,21 124:18 125:10 126:17 127:21 128:12 129:24 131:12 133:1,12,21 134:10,18, 24 135:16,25 137:1,21 139:14 143:9 146:14 147:17 148:2 149:21 150:9,22 151:18 153:5, 21 154:8,23 155:4,13,25 156:18 157:4 158:6,17 159:17 160:4 161:7,18 162:8,25 163:12,19 164:19 165:1,9

shaking 7:6

shape 40:18,21 41:4,11,15,21, 23,25 42:2,10,14,19 43:4,6,11, 14,17 76:24 77:5,24 78:16 81:25 82:15,17,18 83:1,18 125:8 132:12,16,19 134:6 135:15 157:16,25 158:15

shaping 81:18,20

shift 132:9 133:19 134:2

shifted 143:22

shine 41:2 116:5,7,21

shining 102:7

short 148:10

should 73:16,18 75:12

show 145:4

showing 90:13 99:13 140:13

shown 140:12,18 141:10,12 142:9 145:2,23

shows 90:11 141:23 143:2

side 128:8,9,14 140:8 141:6 142:4

sides 135:5,8

sign 144:6

signal 95:11

signature 24:6,8 26:10,12

significant 45:17

similar 56:17 62:24 78:23 109:20 131:8,16 138:23 139:16,24 143:21

similarly 143:14

simple 18:8

since 13:16 16:20 47:14 90:21 108:16 115:17,25 158:8 161:10

single 101:12 125:19

sitting 74:14 105:13

situation 128:14 133:15 153:18,19

situations 107:13

six 23:13

size 41:12 63:18,21,25

skill 49:14 59:23 60:5,7,17,20, 24,25 137:9,15,18 138:3 147:2 154:20 155:18

skilled 65:13 147:13,24 155:11,22

SLM 92:16,17 101:15

SLM203 87:25

SLS 80:7

small 20:12 102:6,9,13

smaller 152:23

so 6:23,24 7:3,4,15 8:2 9:6,18

10:4 11:17,23 12:5,8,25 13:16 14:12 16:10 18:12 19:18,24 22:12,14 23:8,10,11 24:21,22 25:15 27:14,16 28:19,23 29:9, 15 30:8,20 31:7,24 33:8 34:7, 10,18 35:6,19 36:23 37:14,23, 24 38:8,14,22 40:12,15 42:2, 20,23 44:2,3 45:2,12 48:6 49:2 50:3,12 51:8 52:6 53:20 54:22 55:14 56:13,14,23 57:24 58:24 59:16 60:24 61:25 62:4,23 63:1 65:17 66:1 67:10 68:19 69:3 70:2,6,16 71:4,13 72:13 74:11,14 75:9,13 76:14 77:8 78:1,13,25 79:19 80:2 81:12, 17 82:18 84:11,20 87:19 88:6, 11 90:6 91:19 92:17 93:3,13, 20 94:2,8,18,21 95:12 96:1,14, 21 97:2 99:2,9,25 100:19 101:17 102:8 104:1 105:13 106:6,8,23 108:14,20 109:5 110:4,17,24 111:2,5,6,22 112:1,15,16 113:9,13,14,22 114:4,6,14,23 115:25 116:20 117:4,15 118:2,7,9 119:1,5,8, 22 120:24 121:2,9 122:3,20 123:11,13 125:4 126:11 127:6, 14 128:19 129:15,19 130:15, 25 131:20 132:15,19 133:9 134:8,21 135:4,7,20 136:5,8 137:5,14 138:2 140:2,16 141:18,20 142:12 143:13 144:8 145:20 146:1,11,18 147:13 151:7,8 152:12 153:2, 18,19 154:1,5 158:20 160:3, 10,19 161:3,5,15 163:15,22 164:5,18

societies 22:20 23:16

Society 57:9,12,16

software 18:12

solution 65:24

solve 51:19

some 9:22 12:9 18:1,10,21,23 19:7 23:4 37:20 44:24 45:3,10, 13 47:23 53:10,15 56:7 76:15 77:11 82:24 85:6,11 88:3 97:1 104:16,20 114:3,4,20 117:10 118:5 120:5 123:23 128:17 133:14,15 135:15 147:4 150:15,24 152:2 153:9,15 155:8 159:22,24 163:15,16

someone 162:5

someplace 112:9

something 19:9,19 25:8 28:23 29:2 46:2 49:15 62:21, 22 78:9 86:3 100:9 112:17 113:5 114:1 123:3 144:4 151:1 160:8

sometime 46:25

Sometimes 28:22

somewhat 41:19 42:11 92:11 123:15 128:19 145:23

somewhere 61:22 62:1 67:7 68:22 69:16 70:3 109:22

sorry 5:18 29:7,12 45:5 59:3 66:16 67:15,22,23 75:18,21 80:24 81:13 91:7 94:3 99:16 107:25 119:6 133:4 149:3

sort 104:16 136:15 143:13 145:15 152:23 162:5

sound 5:24 6:2 16:11,14 17:8

sounds 5:25 6:6 31:17 88:9

source 41:20 77:1 89:17 92:4 96:11 102:6 129:11

sources 46:3 52:19 65:4,14 89:19,21 91:12 107:13 129:12

Southfield 5:2

space 23:12

spatial 83:10,12,21 86:9,12 87:25 88:3,18,23 89:1,4,24 90:3,7,18,25 92:4,5,8,9 101:16,21 102:3,4,8

speak 14:22 98:7

speaking 18:10

specific 39:12,21 40:19 50:1, 25 56:20 62:12,16 63:2,6 64:9 104:14 105:11,18,21,23 106:5 110:13 111:23 118:14 151:20 154:3,5,13 155:9 159:7 160:8

specifically 8:19,21 14:15 23:5 24:15 25:10,13,16 28:13 36:18 37:1 38:22,24,25 41:23 54:12 56:4 72:25 75:4 87:5 91:4 108:8 110:22 111:1 137:4,5 138:1 148:25 155:15 156:3 161:20

specification 90:16

specifics 37:7

specified 31:16

specify 40:16

speculation 41:9,18 103:16 107:11 108:1 116:10,24 120:4 122:9 123:22 125:11 127:22 129:25 131:13 134:11,19,25 135:17 136:1 137:2,22 139:12, 15 140:17 143:10 146:15 153:6,22 154:24 155:5,14 156:1 163:13

speed 162:7,10

spell 10:14 15:3 57:19

spend 25:19 27:8

Spero 16:2,8 30:4,6,7,9,11,13, 16,20 31:18,21,25 32:4,7

spoken 14:17 30:9 32:1

spotlight 129:10

spread 19:21 105:7,15 106:1

square 134:8,15,20 135:4

Stam 32:13 76:5,8,12

stand 20:17 25:22 27:20 145:20,22

standard 36:7,13,22,24 37:2, 4,6,21 39:1 154:16,21 155:22

standards 36:6,22 37:12,20 38:1,11 39:2,9 48:18 50:17,21 51:11,21 52:3 104:1,6 152:10 155:8,11

stands 86:24

start 27:24 48:4 65:20 81:13 111:18 117:15 118:25 147:20

started 17:7 114:1

starting 25:6 65:21 70:18,22 76:20 81:12 101:6 130:3

starts 37:12,18 46:10 77:13 106:13

state 5:12 31:5 47:23 59:19,21 60:3,15 70:25 86:20 106:15 121:19 122:12 127:5 137:5 158:10

stated 51:24 115:5

statement 65:8,10 78:1 79:7 87:2,19,21,24 111:5,11,12,18,

21,23 131:4,7 146:19,22 147:10

statements 78:6

states 71:20 80:19 127:6,9 133:22 134:2 137:4

stating 31:7 35:19 71:4 111:11 146:16 148:25 159:19

steering 159:24 162:17

stick 158:12

still 25:22 27:20 44:15 50:12 59:20 65:8 67:13 69:12 83:9 85:18 95:25 115:16 145:9

strength 95:10

strike 56:13 94:20

string 152:20

structural 76:24 77:5,24 78:16

studied 23:1 157:8

study 18:4 35:22

subject 15:21 69:19 136:5

subjective 123:13

submitted 24:5

subtle 83:7

subtly 84:15

such 40:3,12 48:4,5,7 76:3,14 80:9 82:7 100:12 117:24 129:12,18 130:10

sufficient 65:3,4,13,14

suggested 35:12

suggestion 154:14

summaries 36:11

summary 71:10

suppose 120:5 123:23 153:8

sure 8:12 10:1,5,19,24 12:3 19:20 27:7 29:8,20 39:4,10 43:9,13,16,19,22 44:2,9,14 45:7 47:4,21 52:7 56:7 73:24 94:16 97:4 107:16 112:15 114:6 118:7,9,13 131:15 135:1,10 137:6,16 153:18 155:9 160:10

surfaces 80:9

switch 29:15

switching 29:18

sworn 5:6

system 49:13 52:2,25 53:23 55:18,21 70:8 75:17,19,22 76:3,12,23 77:16,17,18,23 78:3,8,11 79:12,20 86:21 87:3, 21,22,23 90:6,17,24 96:23 97:18 98:12 99:1 117:2 121:19 137:16 147:4 148:7 150:3 156:25

systems 10:10 18:12 52:22 53:6 60:14 65:5,15 69:21 72:3, 9,14,16,19,24 73:2 79:11 147:5

Szuma 9:3

T

T-E-L-E-O-S 20:8

tablets 18:9

taillights 97:16

take 14:2 37:24 50:7 52:13 81:6 103:1 124:8 128:21 144:16 146:1 148:10 149:7,25 152:1,13 165:3

taken 19:7 52:15 81:8 103:3 128:22 148:12 165:5

taking 6:14 141:15,18,21 146:11

talk 50:13 114:3 115:12 155:7

talking 69:18 78:21 79:8 107:24 111:3 133:18 138:20 149:5

talks 126:10 157:13,15,17,18

tapping 18:10

teach 78:10 90:10 134:12

teaches 127:24

teaching 90:10 131:5 146:18

technical 51:20 84:10 154:13

technically 143:12 144:15 145:12

technique 104:14

Technological 16:18

technologies 11:25 12:7 13:1 14:10,18,25 31:2,13 70:24 71:5

technology 17:12 18:4,5 22:14 36:4 65:24 67:11,14

Teleos 20:8,11,12

tell 11:8 63:5 112:5 115:19

telling 69:3 112:7

ten 6:23 9:20

tend 106:21

term 72:15,23,25 83:10,12,21, 25 84:3 85:8,12,19,21,24 88:10,21 89:1 94:9,22,23 103:25 110:9 113:14,15 114:6, 14,18 115:5,11 120:8,18 121:8,12,23 122:12 135:11 153:2 159:12 160:20 161:5,15 162:3 163:5,8 164:9,12

terms 30:22 41:13 82:6 84:15, 20 103:19 106:4 145:13 152:25 157:6 160:23

testified 5:7 10:6

testifying 6:11,14,18 10:11, 18

testimony 48:9 70:10 95:1 109:9 110:20 115:9 117:8 147:18 148:3 154:9 160:5 161:8,19

than 13:14 24:16,17 46:3 95:23 107:8,19 108:6,10,13, 22,25 109:6,11,15,25 110:3,5, 6 112:17 113:5,7,10,12 114:10 122:18 145:7 151:1,4 157:2

Thank 45:15 115:24

Thanks 29:23 101:7

that 5:16,20,23,24,25 6:1,2,4, 6,7,10,13,14,17,24 7:4,6,7,10, 13,16,21,22,23,24,25 8:7,22 9:11,16,19,23 10:8,14 11:8,15, 18,21 12:1,6,8,9,16,18,23 13:2,13,15,17,19 14:16,21 15:3,20 16:5,11,14,20 17:5,7, 14,17,20 18:11,15,20 19:1,7, 17,19,25 20:9,15,16,17,18,21, 23 21:2,6,10,13,15,18 22:4,7, 10,15 23:9,12,16 24:4,6,22,25

25:3,6,9,10,19,23 26:10,20 27:4,7,16 28:4,12,20 29:1,2,22 30:2,10,12,14,15,18,20,21,23 31:2,12,13,17,20 32:1,10,14, 21,23 33:2,3,7,11 34:4,7,11, 16,17,22 35:10,19,24 36:2,5, 10 37:3,6,20 38:1,5,10 39:1, 10,15 40:8,12,15,19,21,23 41:2,6,19,22,24 42:2,5,16,19, 22,23 44:24 45:3,6,9,13,16,18 46:16,19,24 47:2,25 48:7,21, 23 49:2,7,21 50:18 51:2,8,10, 23 52:6,9,10 53:13,17,19,22, 23,24 54:1,5,10,19,22 56:4,7, 11,12,13,14,21,23,24 57:2,4,5, 19,25 58:9,13,15,17,22 59:7, 16,19 60:3,6,7,15 62:5,19,22 63:10,12 64:7,19,23 65:2,6,8, 9,11,13 66:5,23,24 67:6,7,12, 18,24,25 68:8,21 69:12,13,15 70:4,12,13,17,21 71:4,10,17, 20 72:4,5,12,15,19,25 73:10, 14 74:1,3,10,12,16,21 75:4,6, 11,18,24 76:6,11,18 77:6,14, 15,20 78:1,7,11,22,25 80:11, 15,19,25 82:4,25 83:1 84:12, 24 85:5,7,11,15,16,21 86:3,7, 10,13,20,21,25 87:5,17,21,24 88:6,8,9,13,17,19,21 89:2,5,8, 21,23 90:2,3,6,9,10,11,13,15, 17,20,23,24 91:7,10,12,15,23 92:7,11,13,19 93:3,13,20,22, 24 94:1,8,19,20,22,23 95:9,11, 24 96:4 97:2,3,19,24 98:1,3,7, 9,22,23,24 99:8,10 100:14 101:13 102:4 103:9,10,22 104:1,7,14,20,22,24 105:1,3,9, 17 106:4,9,15,17,24 107:4,7,8, 14,18 108:5,9,13,16,19,22,24 109:6,11,14,17,20,22 110:2,4, 5,10,17,25 111:7,11,13,18,22, 25 112:6,11,15,16,21,25 113:2,4,9,11,13,15 114:8,9,11, 20,23,25 115:1,3,5,20 116:1,3, 5,7,20,21 117:10,15 118:2,4,5, 7,10,22,23 119:16,19,22,23,24 120:1,6,13 121:6,8,24 122:4, 10,25 123:1,3,12 125:12,22,23 126:8,9,20,22,24 127:5,6,8,9, 17,19,24 128:7,10,13,16 129:19,22 130:5,7,15,20,21 131:4,5,6,8,15 132:15,23 133:9,18,19,23,24 134:2,5,8, 14 135:1,2,11,14,20,22,23 136:2,4,11,16,17,18,24,25 137:4,7,10,12,17,19,25 138:3, 8,10 139:1,4,5,7,9,13,21,23 140:9,19,20,23 141:1,3,4,7,16, 19,21,24 142:3,10,12,13,14, 15,25 143:1,15,18 144:1,4,5,6, 11,12,17,22 145:4,9,15,18,21 146:4,7,10,11,17,19,22 147:1, 3,7,10,12,13,15,20,22,25 148:5,9,25 149:2,8,22 150:12, 15,16,23 151:1,8,11 152:1,2,5, 9,10,12,14,16,19,21,22 153:1, 10,13,14 154:11,12,14,16 155:1,3,18 156:2,22 157:2,6, 12,19,22 158:8,9,12,13 159:1, 6,21,23,25 160:7,9,16,24 161:22,25 163:15,21 164:3,8, 16

that's 7:2 8:4 11:20 12:2 13:18 16:21 17:6,9,18,19 18:21 19:3 20:10,22,25 21:3,16 22:1,5 23:14,17 26:2 29:19 32:3 33:5, 9,16,17 34:2,3,6,20,23 35:8, 15,23 36:9 38:2,3 39:16 40:20 44:20 46:15,18,20 51:14,18 58:2,6 59:9,12,15 62:6 69:8 71:9,10 75:13,14 77:4 79:22 83:18 87:1 88:24 89:6,9 93:23 96:20 97:11 99:15 100:2,24 101:1,22 102:11,14 108:24 111:23 113:7 117:9 119:4,8,9, 11,15,25 122:5 123:8 124:14, 19 126:6,21 127:8,13 131:4,6, 8 132:7,22 133:22 134:4,7 136:13,21 138:10,14,21,23 139:3,8,11,12 140:4,8,11,13 141:5,9,11,22 142:15,21 143:14 146:22,25 149:9,13 152:23 154:2 159:23 160:3 161:20

their 44:2 58:7 91:19

them 9:22 11:2,7,11 13:7 14:23 15:13 18:9 23:20 34:25 35:2 56:10 64:7 102:7 104:9 117:25 157:7 158:20 159:9 164:7

then 20:3 28:6 29:14 45:11 50:21 60:2 65:3 70:16,19 82:8 86:9 97:19 106:8 108:19 113:7,9 114:2 118:10 123:24 128:9 147:20 161:6,15

there 6:10,13 10:22 12:15 16:20,22 17:7 18:17 19:16 23:19 24:6,8,24 25:15 26:12 27:24 28:1,7,21,24 29:1,2,11, 25 32:19 33:5 34:12 35:17 36:5 38:10 40:9 42:9,10 43:11 46:22 47:19,24 48:16 49:7 51:9 52:9 58:25 59:21 61:12, 23 62:1 64:7 65:2,20 67:13,15, 18 69:14 70:3,20 71:19,25 72:9 73:6 75:20 76:20 77:15 81:14 82:24 83:9 84:7,9,11 85:6 88:19,21 89:4,10 91:7,10 92:11,24 95:8 97:7,15 100:8 101:13 104:1,4 106:4 107:12 111:15 112:20,25 114:7,24 116:18 117:23 118:2,9,18 119:3 120:5 121:16,18 122:6, 20 124:23,24 126:24 127:7,17 131:18 132:1,22 134:4,9 135:22 136:17 140:4 143:19, 20 144:20 145:4,15 146:6,20 147:10 148:8 152:7 153:13 154:16,18 156:20 157:2,5 158:12 161:3

there's 6:19 7:3 11:10 20:3 23:13 33:10 43:6,14,17,20,23 44:4,11 46:6 49:18 67:23 78:15 90:10,13,15 97:23,25 104:14 106:3 112:9 126:18,20 127:6 135:23 137:4,13,25 138:7 139:4,19 140:24 146:17 148:7

thereby 130:13

these 12:9 18:11 26:16 35:2 50:15 84:9,19 92:17 93:9 94:5 133:23 158:9 160:24

they 7:4 20:3 22:8 28:10,14 35:4,7,10 39:10 40:11 49:20 56:22 58:4,6 62:7 63:8 64:9 80:19,22 81:13 84:15,19,20 85:3,4 98:13,16,17 102:14,24 107:15 119:15 128:15 148:4 155:8 159:6 164:22

they're 13:3 14:23,24 72:18 104:14 128:14 138:1 158:23 159:6

thing 25:6 84:24 94:2,3,10,23 100:12 102:20,24 114:4 116:19 144:12 148:6 149:3 159:25

things 18:21,22 20:7 21:7,8 22:13,21 25:3 39:21 40:11 42:11 46:5 54:23 56:13,14,20, 21,23,24 57:8 62:20 68:19 78:24 79:14 82:6 86:11 106:9

107:23 113:21,22,25 114:3,4 128:19 137:4 155:17 160:24

think 6:23 9:6 10:4,20 11:23 13:12 14:1,7,12 31:23 39:16 40:25 49:20,25 50:24 51:1,14 53:25 64:9 68:8,21 69:14 71:9 74:21,23 75:6 76:9 79:13,17 80:19 82:14,25 83:16 84:5 85:5 88:20 93:5 99:7,16 103:18 104:4 106:21 110:4 113:20 115:3 116:18 120:13, 17,18 121:22 123:19 124:19 125:12,21 128:7 135:13,18 137:13 138:2,11 144:12 146:16 147:10,20 148:4 151:19 154:18,20,25 161:21 163:14 164:21

thinking 53:21

Thirty 11:5

this 7:23 8:5,25 9:10 11:13,17, 23 12:6,20 13:5,10,12,16 14:11,14 15:10,13 23:24,25 24:1,3,4,5,10,19 25:3,5,14,17, 18 26:6,8,9 29:1,15,16,23 30:3,19,21,25 31:4,5,6,19,22 32:11,16,17 33:3,14,18,21 34:4,8,13 35:5,22,24 38:8,14, 25 40:8,22,25 46:25 47:6,10 48:5 51:3 56:8 57:22 61:6,7,21 64:11 65:21,22 67:10 70:23,24 72:22 77:8,13,18 78:21,22,23 79:7 80:2,16,19 81:2,25 83:1, 6,16 84:18 85:16 86:7 87:14 91:21 93:5,13,20,24 94:18,21 95:2,12,19 97:9,15 100:4,14, 17,18 101:9,13,15,18,22 102:16,24 103:18 104:25 108:24 109:1,20 110:12 111:4, 10 117:23 118:8,21 120:18,24 121:23 122:3 124:10 125:4 126:1,10,13,18 129:3 134:13 135:13,18 137:12 138:13 139:25 140:2,5,16 141:3,14,18 142:16,22 143:2,11 144:10,19, 20,23 145:9,22 147:14 148:17, 18 149:6 153:24 157:24 159:20 160:9,11 161:11 162:1, 9 164:21,24 165:2

thoroughly 74:9

those 6:25 8:24 9:2,13,20,24 10:18,25 16:8,9,11 18:13,22 19:24 21:21 22:2,6 23:18 28:1, 2,9,11,13,14 34:21,24 35:1,3,6 37:24 39:1 42:11 45:23 48:10 49:9 56:20,24 57:8 58:4,7 59:13 70:20 71:2 76:15 78:6 84:15 86:11,16 89:7,21 90:11, 22 92:3,9 93:3,23 98:3,20,23 99:6 101:2,5 102:12 104:6 111:15 113:20,25 118:6,19 119:12,14 124:23 129:22 131:16,19,20 132:6 158:3,20, 22 161:12 163:1 164:14

though 47:6 56:11 58:4 78:16 103:22 138:14 158:25

thought 11:23 12:7 25:5 64:22 83:6 108:12,22 109:3 117:10 120:14,17 121:22 160:24

three 53:9,25 86:11,16

threshold 100:8

through 11:11 12:18 27:14 29:14 35:2 37:17 49:6 63:23 64:8 65:20 70:19 73:7 97:17 101:5 124:23 129:8 132:3,7 133:18 144:1 146:3,6 157:9 164:17

Thus 101:6,8

time 13:25 14:1 23:2 25:19 27:8,13 37:24 39:15 47:2 52:3 54:14 59:24 60:8 65:11 82:25 105:2 107:15 133:24 144:20 146:24 147:6 149:7

timeframe 93:6

times 6:22,23 9:20 10:16 54:11 84:21 103:11 112:14,23 146:9 147:9,16

tiny 88:3,6,20 89:8 92:5,8,9,17

today 5:14 6:5,8,11,15,18,25 8:7,18 9:14 74:14 82:2 126:2

today's 7:19 64:12

together 140:22 156:7

told 61:21 62:2 74:20 121:22

top 73:6 81:17 83:7 104:25 126:11 129:7 132:10 134:3 150:12 154:1 155:6 159:21

topics 19:6

Torchlight 11:16,17,21,25 12:2,7,23 13:1 14:10,17,24 31:1,12

touch 118:6

touching 18:10

toward 89:13

towards 44:16 60:2 65:1 70:16 132:1 136:20 143:23

Toyota 16:18

track 98:23

tracking 99:3,5

tradeoff 50:1

tradeoffs 49:7,17,21

transcript 33:13

transmitted 97:17

trial 10:6

true 39:16

trustees 16:23

truthfully 6:11,15,18

try 19:9 29:17 42:20 99:8

trying 10:12 61:20 117:11 149:4 152:17,19 153:1,2,19

TTIC 16:19 17:1

Tuesday 5:1

Turk 5:5,8,13 24:1 26:6 52:18 57:18 81:11,15 87:12 103:5 124:8 129:2 143:2 144:5,8 148:18 155:19 163:9

turn 27:23 28:6 29:5,8 32:18 59:20 65:19 73:5 76:17 86:19 91:9 106:12 138:6 141:15 144:18 150:1 153:9

Turner 25:18

turns 105:1

two 8:7,12 9:10 42:11 48:10 60:12 76:20 78:6 84:15 92:2, 24 93:4,23 94:6 95:8 101:2 106:22,23 111:16 113:20,25 116:18 118:25 124:24 125:5,7, 17,22 126:8,25 127:7,19 128:8 131:16,19,20 156:21 158:22

two-bulb 125:2 126:11,15 127:3,11,16

type 17:1 75:22 90:3

types 40:19 89:7

typical 116:7,22 117:1,4,14,16,21 151:2,4,16,20,23,24 152:1,3,4,8,12

typically 18:5 19:6 92:14,16 151:6

typing 18:10

U

UC 17:4

unclear 26:20 74:2

under 6:7

underline 67:11

underlined 67:13,21,22

underlining 67:23

understand 6:7,24 7:8,12 19:9 23:10 26:17 29:12 54:21 60:3,15 81:24 82:4 110:6 117:12 137:10,19 147:3,14,20,24 148:5 152:17 153:1,3,20 154:11 160:18,20 164:9

understandable 76:1

understanding 11:21 20:2 30:20 31:24 34:7 36:13,24 37:9,10,14 40:12 49:13 63:1 74:15 75:13 80:21,22 82:5 83:12 84:3 93:3 94:8,18,21 101:17,21,25 102:8,12 107:7 109:7 111:7,12 117:10,16 118:2 128:2 134:13 136:24 140:13,22 150:8,11,19,23 154:5 159:16 160:23

understood 7:16 111:3

undertake 147:25

undue 12:17

unit 153:13

units 153:15,16

university 20:18

until 107:15

up 7:7 24:20 25:8 57:2,4 73:6 79:25 81:11 125:18 141:14 145:1 152:19

updating 27:18

upon 35:21 68:4,14 69:4,10,20 70:7

upper 136:16

URLS 35:2

US 6:1 30:5 38:11 39:4 40:16 76:4,7 124:9

use 47:25 50:14 52:10 62:3 68:5 72:15 77:10 84:14,19 122:16 125:7 129:19 144:5 148:24 153:13 159:6 163:4

used 7:22,24 19:11,14,17,22 73:15 74:2 75:6,12 77:17 84:23 85:3,9,13 90:4 97:19 102:25 114:21 121:25 122:2,12,19 124:12 152:5 153:2 162:3

user 65:23

uses 131:14 149:1 152:6 157:21,22 159:11 162:6

using 43:2 51:16 68:1 72:4 91:12 92:17 104:20 124:15 125:1,5 126:14 127:2,10,15,16 129:11,15 149:14 152:8

usually 19:3,8

V

vague 15:16 16:4 29:6 39:19 41:9,18 42:4 43:1,8 49:24 50:23 51:13,22 52:5 55:7,11 56:19 60:21 62:9 63:4,14,19 64:4,21 66:10 67:4 68:6 69:6,23 71:7,15,22 72:17 73:25 74:7 79:3 84:13 86:15 93:16 94:25 96:9,25 98:6,15,25 100:10,25 101:19 103:15 104:3,12 105:8,10,16 107:1,10,25 109:9,24 110:11,20 111:9 113:19 114:17 115:2 116:9,23 117:18,20 120:3 122:8 124:18 125:10 126:17 127:21 128:12 129:24 131:13 133:12,21 134:11,24 136:1 137:22 146:14 147:18 148:3 151:18 158:7 163:12

value 151:7,9,12

variable 76:13 80:10

various 19:18 21:11 22:13 25:5 83:18 113:22 140:22 156:20

vary 123:11,14 132:12,16,19,24 133:3,6 134:5

vehicle 21:9 37:22 38:1,10 39:9 40:9,19 41:4,7 46:13 47:22 48:14 51:16 52:11,24 53:12,16,19,22 54:2,4,7,22,24 55:9,13,17,21,24 56:2,5,8,18 57:1,2,4,6 58:10 59:1,4,17 65:16 67:3 69:21 70:8 73:20 78:21 79:1,8 86:6 97:16,17 99:10 117:5,19 120:11 123:24 124:3,4 141:15,18,20 143:7

vehicles 21:10 48:15 53:10 97:20,25 98:3,13,20,24 99:2,6,9,14

verbally 7:4

versa 132:11

version 47:16,18 67:22 119:9 136:13 138:13

versions 47:19 92:11

versus 127:15

very 11:5 20:3 23:13 75:25 83:7 84:10,18 92:13 105:10 140:21

viable 71:14

vice 132:11

video 19:2

view 96:18,24 98:1,3,5,12 99:6 119:17,18,19,23 120:2 133:13

vision 17:3,19,21,22 18:20 19:1,4,5,11,14,18,22,24 20:13 21:5,10,14,18,24 22:6,16,18 56:16

W

walk 153:8,10

wall 40:25 41:2,3,6,12,15,24 42:16,19

walls 41:21

want 28:22 29:7,13 31:5 50:7 68:22 70:3 94:15 96:21 149:7

wanted 29:19

wants 147:11,15

was 5:6 10:8,9,19 14:16 20:12, 20 21:1,9 24:5,21,25 25:9,10, 14,15 26:23,25 27:4 28:20,24 29:2,20,21,22 30:18 33:21 34:12 40:14 41:15 45:7,11 47:2,24,25 50:7 51:23 52:15 53:18,20,25 54:1,4,6,7,14,16, 17,19 56:8 61:22 62:2 67:21 81:8 103:3 111:20 113:2,4 117:11,14 119:6 128:22 144:17 145:4,12,17 148:12 152:8,10,21 154:11,14 161:21 165:5

wasn't 161:25

watts 71:1

way 18:9 22:11 29:14 40:25 41:4 43:2 77:10 81:24 82:4 88:24 130:20,21 137:24 150:24 152:8 153:25 154:2

ways 13:24 18:11 116:18 155:9

we'll 25:25 77:9 106:14

we're 37:16 66:13 93:7 95:25 133:17

we've 101:21 118:5 136:3

weeks 161:2

Welcome 103:5

well 14:3 18:14,20 25:18 26:2 49:20 60:12 71:1 72:5 79:15 82:22 83:6 85:14 91:3 92:2 104:24 106:20 134:20 145:12

went 12:18 27:14 30:22 98:8 114:3

were 7:22,24 9:2,20,22,23,24 10:11,17,23,25 12:5 14:10 17:4,10,16 20:8,16 21:4,5 30:24 35:4,7,9,10,12 52:9 53:4,13,24 56:20,22 57:22 58:4,6 67:19 73:3 80:7,25 85:14 88:15,18 95:24 97:21 98:20 113:14 160:21,24

what 7:25 8:22 9:25 10:8,11, 17,25 11:6,19 12:2,3 14:4,20, 23 15:17 16:22 17:1,23 18:6, 22 19:10 20:17 21:8 22:9,18, 25 24:3,12,25 25:5 26:8,23 28:9,14,20 30:16,23 31:14 32:25 35:24 36:2,13,18,23 37:1,6,15 38:9,24,25 40:21,24 41:3,10 42:5,13,17,18,20,21 44:20,22 45:7,20,23,24 47:18 48:2,13 49:4,9,12 53:8,17 54:1,12,16,17,19 56:22 57:5 61:16,21 62:2,15 63:5 66:13 69:8 72:16 73:11 74:15,21,23 75:1,4,9,14 76:15 77:22 78:9 79:22 81:20 82:11 83:4 84:5, 12 85:11,24 86:2 87:4 88:2,24 91:20 92:12,22 95:8,12,20 96:17,21 97:21 98:1,8 100:3,6, 17 101:17,18,22 103:13,23 104:6,19 106:2,3,5,19,25 108:19,20 109:1,15,19,25 110:24 111:18 112:6 113:1,21, 22,25 115:11 116:3,25 117:4,9 118:22 119:6 120:8 122:5 123:2,5,20 124:3 125:15 126:19,21 127:8,13,23 128:6 131:4,6 132:22 133:17,22 134:4,7,14 135:1,2 137:6,14 138:17 139:12 140:5 141:22, 23 142:2,9 143:1,25 144:8,9, 13 145:6,8,17 146:25 147:21 150:8,19 151:4,13,15,16,24 152:3,4,15,16,24 153:1,16,17, 20,24 154:5,11,21 155:3,22 156:15 157:12 159:14 160:18, 20 161:2 164:12

what's 5:16 12:11 13:19 16:17 18:3 20:11 36:8 37:9,14 49:6 55:4 63:10 64:19 82:4 83:12 84:3 94:3 95:18 105:21,23 117:16 123:11 128:1 145:2 150:8,19

whatever 20:7

wheel 159:24

when 8:8 12:5,22 14:20 15:9 18:17 19:1 21:4 22:9 24:10 26:14 41:22 46:24 57:4 74:15 75:2 84:14,19 85:21 88:6 98:9, 13 105:2 113:14 114:6,14 115:17 116:20 127:15,19 154:6 160:21

where 10:22,23 13:5 14:22 15:21 16:1 32:15 34:18 44:16 48:4,16,17 50:13 53:4,13 54:22 59:3,13 61:12 67:7,24 73:7 75:19 76:3 78:14,21 80:6, 25 81:18 82:8 92:3,4,14,15 93:8 96:18 99:18 103:9 107:13 112:9 113:16 115:19 121:18 125:17 127:7 130:4 135:19,23 138:20 140:11,14,17 141:9,12 142:6,7 143:5,14 145:13 152:13,18 156:12 163:25

whereas 157:14

wherein 150:3

whereupon 52:15 81:8 103:3 128:22 148:12 165:5

whether 12:5,11 15:10 49:18 74:2 80:22 84:16 100:8 112:5 121:2 125:7 126:7 158:22

which 16:24 20:5 23:14 26:21 32:20 33:24 37:18 38:20 39:6 40:11 41:3 47:16,18 53:10 65:23 68:25 69:18,25 70:24 71:1,2 72:7 76:8,24 78:10,18 79:7 82:24 87:12 90:20 91:9 97:21 98:21 99:20 101:11 106:3 107:23 109:2 118:3,9 121:12 124:24 126:19,25 127:17 128:15 129:11,13 130:11,16 132:2,9,11 133:23 136:3 145:6,8,22 147:10 155:11 156:23,24

while 10:12 37:16

who 8:6 9:2 11:15 12:20 14:13 25:12,16 27:2 30:23 32:13 39:3 47:8 57:18,21 144:24 155:7

Who's 11:13

whole 80:7 114:19,23 115:6 138:16 162:9

why 5:14 28:13 47:22 161:25

wide 19:6,16

widely 100:4,6

window 132:9,15 133:9,18,24 134:5,8,13 135:11,13,15,19,23 139:1 140:11,14,17,21 141:9, 12 142:10

within 42:16,18 43:4 96:14,24 98:4 99:6 114:25

without 45:17 46:1 135:8 146:25

witness 5:9 13:7,21 14:6 15:3, 7,17 16:5 19:13,16 31:9 32:10 36:17 39:20 40:2 41:10,19 42:5 43:2,9 44:9 48:10 49:25 50:24 51:14,23 52:6 55:12,20

56:20 58:12,21 60:22 61:20 62:10,15 63:5,15,20,23 64:5,8, 22 66:5,12,16,22 67:5 68:7,17 69:8,24 70:11 71:9,16,23 72:18 73:13 74:1,8,20 75:1,5 77:10 79:5 81:24 82:14,22 83:16 84:14 85:3 86:16 87:4 91:3 93:17 95:2,15 96:10 97:1, 5,11,14 98:7,16 99:1 100:11 101:1,20 102:23 103:17 104:4, 13 105:9,17 107:2,12,22 109:10,25 110:4,12,21 111:10 112:20 113:20 114:18 115:3, 10 116:11,25 117:9,21 118:13, 25 119:5 120:5,22 121:7 123:8,23 124:19 125:12 126:18 127:23 128:3,13 130:1 131:14 133:3,6,13,22 134:12, 20 135:1,18 136:2 137:3,23 139:15 143:11 144:7 146:16 147:19 148:4 149:22 150:11, 23 151:19 153:7,23 154:10,25 155:6,15 156:2,20 157:5 158:8,19 159:19 160:7 161:9, 20 162:10 163:14,20 164:21 165:2

witness' 43:1 70:10 95:1 109:9 110:20 115:9 117:8 147:18 148:3 154:9 160:5 161:8,19

WO 129:4

won't 7:6

wondering 50:7

word 24:24 62:19 68:19 70:1 71:23 75:6 85:4,14,15 131:14, 15 152:8 159:8

wording 157:9 158:3

wordings 156:21

words 24:22 45:23 67:18 84:9 94:6 102:23 143:18 157:6 158:12

work 13:10 18:17 20:3 21:10, 11,14 25:3,13 27:2 35:21 45:16 53:10,15 54:9,12 90:12 92:10,11 101:22

worked 18:14 23:1,8,9,11 24:20 25:12,17 30:24 53:4,9 54:24 55:2,4

working 7:23 13:16 14:11,16 20:13 21:4,9 30:19 31:18 35:5 47:9 53:13,24

works 162:20

world 20:6 22:12,13 54:21

would 6:10,14,17 11:3,5,10 14:7 18:7,8 19:1,5 21:23 22:15,22 23:8,13 27:16 36:2 39:4 41:6,15,20,22 44:17 45:5 46:1,25 48:10 49:5,21,25 50:19 53:19,22 54:1,19,22 55:14 56:10 58:9,17,19,21 60:9 62:18 64:5,19 65:11,13 67:6 69:12 82:24 83:1,4 84:12 85:3,7 88:6 90:10 96:15,20,22 97:2 98:3,13,16,18,23 99:2,5 101:17,25 102:9 104:7,10,15 105:3 107:18 108:5,9 109:21 110:5 111:18 113:13 116:7,21 117:5 118:21 120:14 121:3 123:24 125:8,12,15 126:22 127:19 128:4,10,16 131:6 135:4,10 137:7,9,15,18,23 138:3 140:14,18,23 141:12,17 142:7,11,13 143:4,5,6,15 144:12,14,16 145:14,15,23 146:17 147:1,2,12,14,19,20, 21,24 148:4,6,8 151:6,8,11,13 152:10,13,16,17,23 153:3,8, 13,15,16,20,23 154:21 155:3, 11,18,20,23 156:21 158:8,12 159:22 162:20 163:15

wouldn't 41:11 45:2,12,16 50:21 99:3 128:15 134:14

wrap 79:25

write 24:19,22,24 161:10,21, 25

writing 68:21

written 37:10,11,15 56:5 157:6

wrong 99:17

wrote 12:8 26:9 160:25 161:3

Y

yeah 47:12 50:10 71:9 79:5 87:6 102:17 108:19 113:12,13 116:25 121:25 131:7 137:23 143:13 146:25 153:15

year 17:7 23:8,9,12 24:5 47:1, 6 61:22,25

years 23:4,6,7,13 40:13 53:9, 25 60:12 61:12

Yechezkal 16:2 30:4,6

yellow 142:9,13

yes 5:15 6:3,9,21 7:8,11,14,18 8:4 9:12,15 10:7,24 12:19,24 13:18 16:10,13,16 17:12,15 18:16 19:15 21:7,19,22 22:8, 17,24 23:20 24:2,7,9 25:24 26:7,11,13,19 27:18,22,25 28:5,8,19 30:1 32:24 33:12 35:18 37:23 38:5 42:11 44:19, 21 46:23 48:20 49:8 50:18 52:12 55:15 58:8 59:6,15,19 60:1,6,18,22 61:2,9,15 63:9 64:14,17 65:7,9,17 67:21,25 68:3,12 69:2 72:15 75:25 76:16 77:6 80:14 81:1,19 82:10 83:11,24 84:2,11 85:20, 23 86:17,23 87:13,15,18 88:1, 14 89:3,12,16,20,23 90:1,5 91:8,16 93:5,12 94:2 96:5 97:14 98:18 99:24 100:16 101:7 103:12 106:11,18 108:4 110:4 111:17 112:4 114:11 116:2 119:13,18 120:15,19 121:17,21 122:5,15,20 124:11 125:6,25 126:3 127:5,8,13 129:6,18,21 130:1,6,24 131:4, 25 132:4,18,22 133:7,22 134:4,7,21 135:14 136:12,19, 23 138:9,22,25 139:6,22 140:10 141:2,8,22 142:1 143:3 144:15 145:4 146:10 148:19, 23 149:16 152:8 155:20 156:8, 11,14 159:3,13 160:15,17,19 163:10 164:4,7,11 165:2

yesterday 8:9,14 24:11,13,17 26:15

yet 51:11

you'd 12:10 69:15 157:10

you'll 7:13 26:17 119:4

you're 5:14 6:7,13 12:22 22:15,22 23:15 26:20 29:13 30:15 35:19 37:3 47:16 48:6 55:9 61:7 69:3 88:19 89:1 103:8 108:20 109:5 112:6 114:6,14 117:1,4 118:9 131:23 138:20 152:24 153:24 154:16

you've 6:20 9:10,19 10:16,22 11:3 13:17 16:20 21:13,24

32:1 38:9 55:17 56:23 112:3 125:24 136:15 144:8

your 5:12 7:5 8:2 9:8,17 11:21 12:11,20,25 13:5,10,13,17 14:20 16:17,22 20:8,16,20,23 21:1,13,14 23:10,18,24 24:6,8, 25 26:1,10,12,14,16,23 27:2,6, 8,15,20,23 29:5 30:15,20 31:1, 12,22,25 32:4,21 33:6,9,10 34:15 35:9,14,19 36:13,23 37:9,14 38:3,23 39:17,18,23 40:7 42:10 45:2,12,21 46:16, 21 47:16 48:3,21 49:1,9,17 50:6,19 58:24 59:16,20 60:25 61:1,10,16 63:1 64:16,25 67:2, 10 69:21 70:6 71:19 75:13,14 77:8 78:1,3 80:1,16,21 83:4, 12,23 84:3,24 85:22 86:19 87:2,16,17,19,20 93:3 94:8,18, 21 97:10 101:17,25 102:8,12, 19 103:7 106:12 107:7 108:15 109:5 110:7,9 111:5,7,15,20 112:11,16 113:2,4,9 114:1,2, 23 115:16,20 116:13 117:11, 16 118:2,17,19 119:22 121:15 122:17,23 125:21 128:1 131:18,22 136:5,8,10,24 137:18,24 138:6 139:12 140:16 141:20,23 142:12,23 143:8 144:16 145:9,20 148:20 149:10 150:8,19 153:19 155:17 156:5 157:3 158:4,16, 25 159:15 160:21 161:5,17 163:4,24 164:5

Z

Z-H-O-N-G 57:19

Zhong 57:18