



Transcript of Dr. Iain Richardson, Volume 1

Date: February 26, 2025

Case: Amazon.com, Inc., et al. -v- Nokia Technologies Oy (PTAB)

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

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AMAZON.COM, INC. AND AMAZON.COM
SERVICES LLC,

Petitioner,

CASE.: IPR2024-00626

-against-

NOKIA TECHNOLOGIES OY,

Patent Owner.

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DEPOSITION OF
DR. IAIN RICHARDSON
NEW YORK, NEW YORK
FEBRUARY 26, 2025

REPORTED BY: KIARA MILLER

FILE NO.: 566944

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Deposition of DR. IAIN RICHARDSON, taken on
behalf of PETITIONER, at 1301 AVENUE OF THE
AMERICAS, New York, New York, commencing at
9:08 A.M., FEBRUARY 26, 2025, before Kiara
Miller.

1 A P P E A R A N C E S:

2

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21 BY: MITCH VERBONCOEUR, ESQ.
22 ERIC S. HANSEN, ESQ.

1 DR. I A I N R I C H A R D S O N, after having first
2 been duly sworn by a Notary Public of the State of
3 New York, was examined and testified as follows:

4 EXAMINATION BY

5 MR. LIANG:

6 Q Good morning, Dr. Richardson.

7 A Good morning.

8 Q So we're here regarding two IPR
9 proceedings today, right; IPR2024-00206 and
10 also 2024-0026 -- or 627; is that correct?

11 A I think you might have missed a six in
12 the first one.

13 Q 2024-626 and 2024-627.

14 A Yes. That's my understanding.

15 Q Okay. And you submitted a declaration
16 in both of these proceedings, right?

17 A Yes.

18 Q And you submitted the same declaration
19 in both of these proceedings, right?

20 A I think I submitted two declarations to
21 date, and in each the same declaration, it's
22 the same declaration for each of the

1 proceedings.

2 Q Great. You've given many depositions
3 before, right?

4 A I've been deposed, yeah, quite a number
5 of times.

6 Q How many times.

7 A I think it's over 20 now, I don't have
8 the exact number in my mind.

9 Q I'm also going to go over some of ground
10 rules, even though you, I'm sure heard of
11 them before.

12 A That's fine.

13 Q So you understand that you're under oath
14 today to tell the truth?

15 A Yes.

16 Q And since we do have a court reporter
17 here, we'll need verbal responses for the
18 court reporter to transcribe.

19 A Yes.

20 Q You can take a break whenever you want,
21 but I do ask that there's no question
22 pending.

1 A Okay.

2 Q Now, you understand you're not allowed
3 to discuss your testimony today with your
4 counsel during breaks, right?

5 A Yes.

6 MR. VERBONCOEUR: And I'll just
7 clarify for the record, there are
8 several depositions back to back. And
9 so I understand that to refer to --
10 during this deposition, he's not going
11 to discuss his testimony, if there's a
12 break between depositions we can talk
13 about other matters.

14 MR. LIANG: Right. If there's a
15 break, but basically for other
16 proceedings.

17 Q Yeah, but during the deposition for this
18 proceeding, you're not allowed to the talk to
19 your counsel.

20 A About this proceeding?

21 Q Correct, yes.

22 Okay. And you have to answer my

1 questions unless your attorney instructs you
2 otherwise, right?

3 A Okay.

4 Q Are you on any medication today?

5 A No.

6 Q Is there any reason you can't provide
7 truthful and accurate testimony today?

8 A Nope.

9 Q Now, you have some documents in front of
10 you.

11 A I do.

12 Q What are those documents?

13 A So they're all documents that relate to
14 these two proceedings. I have two binders;
15 I'll start with the one on my left. In here,
16 I have a printout of the patent owners
17 preliminary response, POPR. The patent
18 owners surreply to preliminary response. The
19 patent owner's response, the POR. Copies of
20 the two declarations that I mentioned, the
21 Richardson POPR declaration, which I might
22 call my first declaration; the Richardson POR

1 declaration, which I might call my second
2 declaration.

3 And then in the other binder, I have a
4 copy of the petition as filed for the '626
5 proceeding. The petition as filed for the
6 '627 proceeding. The petitioner's
7 preliminary reply to the POPR. The notice of
8 decision to institute IPR. And, finally, a
9 copy of four of the exhibits that are in play
10 or involved Exhibit 1001, which is the patent
11 ending in number '267.

12 Exhibit 1004, which is a patent
13 publication to Walker.

14 Exhibit 1005, which is a patent
15 publication to Karczewicz, which I think
16 we -- I and petitioner -- describe as
17 Karczewicz 1.

18 And, finally, Exhibit 1006, which is a
19 patent publication to Karczewicz, which I
20 believe the parties and myself refer to as
21 Karczewicz 2.

22 Q Are all of the copies in front of clean

1 copies?

2 A Yes.

3 Q Are there any markings or annotations in
4 them?

5 A Not as far as I'm aware, and I haven't
6 added any.

7 Q Are there any errors in your
8 declaration?

9 A I don't recall noticing any errors.

10 Q Is there anything in your declaration
11 that you'd like to change today?

12 A Not that I recall.

13 Q What did you review before putting
14 together your declaration?

15 A Which declaration?

16 Q Well, your declarations are the same in
17 the both of the -- of these proceedings,
18 right?

19 A Sorry. My confusion was I have two
20 declaration that I've submitted.

21 Q Ah, okay. So I'm talking about your
22 declaration that you submitted with a patent

1 owner response?

2 A Okay. So and if I call that my second
3 declaration, that's just to keep myself
4 straight.

5 Q And just to be on the same page, I
6 believe we're talking about Exhibit 2015,
7 correct?

8 A Yes. That's my understanding.

9 Q Okay. So -- and today when I'm
10 referring to your declaration, I'll be
11 referring to Exhibit 2015.

12 Does that make sense to you?

13 Dr. Richardson, yes?

14 A Yes. I'm checking something before I
15 answer.

16 So I don't recall whether I stated it
17 explicitly, but when I wrote the
18 declaration -- what you're describing as my
19 declaration -- the declaration in support of
20 the patent owner's response, my intention was
21 that this -- I intended this to be cumulative
22 for my first declaration, which I submitted

1 in support of the patent owner's preliminary
2 response.

3 Q Okay. Understood. And if there's a
4 time you want to refer to the preliminary
5 response declaration, feel free to specify
6 that.

7 But I think otherwise, for purposes of
8 today, when talking about your declaration,
9 I'm referring to Exhibit 2015 in IPR
10 2024-00626?

11 A I will try and keep that in mind, yes.

12 Q Okay. And if at any time your answer
13 may vary, just let me know, and tell me which
14 different declaration you might talk about.

15 A Okay. Again, I'll do my best, yes.

16 Q Okay. What did you review before
17 putting together your declaration,
18 Exhibit 2015?

19 A So I have a list of materials on Pages 5
20 and 6 of that declaration, Paragraph 19, of
21 my second declaration. And I've listed there
22 documents that I reviewed, specifically

1 whilst putting together this declaration, as
2 I also explained the opinions in the
3 declaration are based on my professional
4 judgment, education, experience, and
5 knowledge regarding the video technology --
6 video code and technologies discussed in the
7 '267 Patent, so this is not an exhaustive
8 list, because what I've written in here is
9 based on all of those things.

10 Q Did you review any other documents in
11 preparation -- when you were preparing your
12 declaration?

13 A I don't recall whether I might have
14 looked other documents during the period, but
15 these are the ones, you know, these are the
16 ones that I felt appropriate to list, and
17 that I specifically recall reviewing.

18 Q So you don't recall reviewing any other
19 documents beyond the one's listed in
20 Paragraph 19 of your declaration?

21 A That's not strictly true. So I prepared
22 this declaration over a period of time. The

1 nature of what I do is that I'm constantly
2 reviewing documents relating to video coding.

3 Q So what other documents do you recall
4 reviewing for this declaration?

5 A I don't recall any other specific
6 documents, but I would almost certainly
7 have -- yeah, as a matter of course, if I'm
8 spending, for example, a few weeks working on
9 a document, I'm reviewing and reading video
10 coding-related materials on a daily basis.

11 Q Are you aware that the '267 Patent was
12 also asserted in a co-pending ITC proceeding?

13 A What do you mean by "co-pending"?

14 Q That there is an ITC proceeding
15 involving this '267 Patent.

16 Are you aware of that, or not?

17 A I think it might have been mentioned to
18 me. Yeah, so I think that have been -- yeah,
19 said to me by attorneys.

20 Q Have you reviewed any materials from the
21 ITC proceeding regarding the '267 Patent?

22 A My recollection is within the last two

1 or three weeks that I was given a copy of a
2 post-hearing brief, and I reviewed that
3 briefly.

4 Q Did you review any other materials from
5 the ITC proceeding?

6 A I don't recall reviewing anything else
7 from that proceeding. And unless it's
8 something that I've referred to, but I
9 don't -- again, that's not my recollection
10 that I referred to any documents in my first
11 or second declarations.

12 Q Have you reviewed the board's
13 institution decision in this proceeding?

14 A I have, yes.

15 Yeah, it's not listed on Page 5 and 6,
16 but that's -- actually, I would say -- yeah,
17 I definitely reviewed it. It's in one of my
18 binders here.

19 Q So why didn't you list it in -- why
20 didn't you list the board's institution
21 decision in your list of materials
22 considered?

1 A I don't recall.

2 Q Were there any exhibits that you
3 reviewed for this proceeding that you did not
4 understand?

5 A Not that I recall. I would add, you
6 know, with regard to, for example, the
7 institution decision, clearly I'm not a
8 patent attorney; so to the extent there are
9 any legal arguments in there or, indeed, in
10 the petition, they are not necessary in my
11 field.

12 Q Regarding the post-hearing brief from
13 the ITC that you reviewed.

14 A Yes.

15 Q Is that the post-hearing brief from
16 Nokia?

17 A That's my recollection.

18 Q Did you review a post-hearing brief from
19 Amazon?

20 A I don't actually recall.

21 Q Did you review public versions of the
22 post-hearing briefs?

1 A That's my understanding, the document
2 was provided by attorneys.

3 Q Have you signed a protective order for
4 the ITC?

5 A What do you mean "for the ITC"?

6 Q Did you sign the ITC protective order?

7 A With regard to what?

8 Q With regard to the ITC proceeding for
9 this '267 Patent, did you sign the protective
10 order in that matter?

11 A Not that I recall.

12 MR. VERBONCOEUR: I'll object to
13 scope. And I'll just clarify for the
14 record, Dr. Richardson has not been
15 given access to any confidential
16 information. He's only been given
17 documents that are publicly available.

18 Q And did you review the final initial
19 determination in the ITC proceeding for the
20 '267 Patent?

21 A Not that I recall.

22 Q Who wrote your declaration?

1 A I wrote the declaration.

2 I worked with counsel on some of the --
3 in finalizing the declaration, but it's my
4 declaration.

5 Q You wrote every single word in it?

6 A I would hesitate to say I wrote "every
7 single word," but, yeah. I worked with
8 counsel to produce a declaration, but it's my
9 declaration.

10 Q All right. So it's your declaration,
11 but counsel helped you by writing some of the
12 words in the declaration?

13 A That's not what I said.

14 Q Well, then --

15 A Sorry, what's the question?

16 Q I'm asking you: Did you write every
17 word in your declaration?

18 A I don't recall that I wrote every word
19 in the declaration.

20 Q Okay. So it's possible that someone
21 else wrote some of the words in your
22 declaration?

1 A In the normal process of going through
2 revisions, working with counsel on these type
3 of documents, it's possible that somebody
4 changed a word and I changed it back, or
5 something like that. But, yeah, I don't
6 recall.

7 Q How much time did you spend preparing
8 for this deposition?

9 A I actually don't know. I don't have a
10 figure in mind.

11 Q I mean, just ballpark 10 hours? 20?

12 A Do you know what? It's really hard to
13 answer because we have three depositions this
14 week and I'm preparing for all of them. I've
15 been preparing for all of them pretty much in
16 parallel, so it's really hard for me to --
17 without consulting notes, to workout how much
18 time I spent preparing for this deposition.

19 Q Well, what technical area is your
20 bachelor's degree in? I noticed your CV
21 doesn't say.

22 A It should do. I don't actually have a

1 copy of my CV in front of me. But I think
2 the title was master of engineering in
3 electronic and electrical engineering, or
4 perhaps electrical and electronic engineer.
5 So that's the subject area.

6 Q That's your master's degree?

7 A So it's a particular type of degree;
8 it's called a master of engineering. And
9 it's a five-year degree. So it includes the
10 bachelor and master's -- oh, so maybe that's
11 the confusion.

12 Q When did you start working as an expert
13 witness in litigation matters?

14 A So my recollection is that maybe
15 around 2005, 2006, around that time period
16 was the first time I remember being contacted
17 by a law firm to ask me to provide
18 consultancy or services related to a patent
19 matter. Yeah, okay.

20 Q How many times have you been hired as an
21 expert in litigation matters?

22 A I don't know.

1 Q What about a ballpark?

2 A I honestly don't know.

3 Q More than 10?

4 A Pretty sure it's more than 10 times,
5 yes.

6 Q More than 15?

7 A Sorry, just so I can be clear in my
8 answer, do you, so for instance, this week
9 I'm giving testimony on three different IPR
10 proceedings, in fact, five different IPR
11 proceedings, but my recollection is I was
12 hired once, so you're asking matters, number
13 of contracts or something else.

14 Q The number of proceedings. So I guess
15 in this case, I would consider these three
16 proceedings that you're about to give
17 depositions for this week to be three
18 matters.

19 How many proceedings have you been an
20 expert for?

21 A Sorry, proceedings also include, for
22 example ITC.

1 Q Yeah, ITC and district court?

2 A And non-US or US only.

3 Q Let's just stick with US only?

4 A Okay. I really don't know, it's more
5 than 10.

6 Q Okay. More than 15?

7 A So for example, a few years ago I
8 remember working on something like six or
9 seven IPR proceedings more or less
10 contemporaneously, so a similar way to this.
11 So it's six or seven plus three that gets us
12 to ten. I worked in a number of other IP0
13 proceedings, I've testified I think maybe
14 five or six times at the ITC. I've testified
15 two or three times in district court
16 proceedings, so I think we're already up to
17 more than 20.

18 Q Okay.

19 Do you ever -- do you have research
20 publications?

21 A I do, yes.

22 Q How many publications have you had

1 since 2006, roughly?

2 A I don't have a copy of my CV in front of
3 me, so I don't recall.

4 Q Do you perform research in the field of
5 video, and coding and decoding?

6 A Yes.

7 Q Do you have any patents yourself?

8 A I'm named as an author on a number of
9 patents.

10 Q How many patents are you a named
11 inventor on?

12 A I think that's in my CV, but I actually
13 don't recall. Unless I summarized it here.
14 Oh yeah, Paragraph 16 of my second
15 declaration, I'm a named inventor on 11
16 patents or patent applications.

17 Q When you write a patent application, do
18 you write down everything you know about the
19 field?

20 MR. VERBONCOEUR: Object to the form
21 of the question.

22 A Which patent application are you

1 referring to, are you asking me personally in
2 general.

3 Q No, you personally.

4 MR. VERBONCOEUR: Same objection.

5 A It's actually quite a while since I
6 wrote a patent application or contributed to
7 a patent application.

8 Q For the last patent application that you
9 recall drafting, did you write down
10 everything that you know about the field?

11 A Which patent application are we talking
12 about? I don't have a copy of my CV in front
13 of me.

14 Q What was the last -- do you recall
15 drafting a patent application?

16 A I recall being involved in the drafting
17 of a patent application.

18 Q Did you provide input to the drafting of
19 that patent application?

20 A That's my recollection, yes.

21 Q And for that patent application that you
22 recall, did you -- did you write down

1 everything that you know about the field?

2 MR. VERBONCOEUR: Objection to the
3 form of the question.

4 A I didn't say I recall a particular
5 patent application.

6 Q Oh, okay. So you don't recall any
7 particular patent applications that you've
8 had input to?

9 A Okay. I can recall, for example, one I
10 think it was more than one patent application
11 relating to configurable video coding.

12 Q Okay.

13 A That's in my head, for example.

14 Q So for the patent application that you
15 recall about configurable video and coding,
16 did you write down everything you know about
17 configurable video decoding?

18 A I'm sorry. I just said -- I'm not
19 trying to be difficult, I just said I recall
20 more than one application.

21 Q Let's pick one.

22 A I don't actually have a specific one.

1 Q You recall more than one, why don't you
2 pick one of them. So do you have in your
3 mind an application that you contributed to
4 for configurable video decoding?

5 MR. VERBONCOEUR: Dr. Richardson, I
6 apologize for the interpretation,
7 let's just try to give a pause between
8 question and answer so we have a clean
9 transcript.

10 A Okay. I think I just said I recall
11 maybe two or three applications relating to
12 configurable video coding. I don't at this
13 point recall the details of them.

14 Q So you don't recall whether for any of
15 those three configurable video decoding
16 patent applications whether you wrote down
17 everything you knew about the field?

18 A Um, for those particular applications, I
19 don't recall writing down everything I knew
20 about the field.

21 Q For your patent applications, are you
22 more likely or less likely to include obvious

1 details in your patents?

2 MR. VERBONCOEUR: Object to the form
3 of the question.

4 A What do you mean by the obvious details.

5 Q Well, little details relevant to your
6 patent, if those details are obvious, does
7 that make it more likely or less likely that
8 you'll explicitly write about them in your
9 patent?

10 MR. VERBONCOEUR: Same objection.

11 A Okay. So I'm honestly confused by your
12 question. So I'm a technical expert, I
13 mentioned in my second declaration around
14 Paragraph 33, that the word "obvious" has a
15 specific meaning in patent law, but I'm not a
16 patent lawyer; so I really don't understand
17 what you're asking me.

18 Q So you don't understand the word
19 obvious?

20 MR. VERBONCOEUR: Object to the form
21 of the question.

22 A That's not what I said.

1 Q What about the question do you not
2 understand?

3 A You used the word "obvious," which I
4 understand to have a very specific and
5 particular meaning.

6 Q Right. Do you understand what that --

7 A Sorry, I haven't finished my answer.

8 MR. VERBONCOEUR: Please let the
9 witness finish.

10 A I understand the word obvious has a
11 specific particular meaning which is actually
12 a legal term in the context of the proceeding
13 that I'm answering questions about. So I
14 don't know when you're asking about in the
15 context of Paragraph 33, to -- sorry,
16 Paragraph 33 to 40 in my second declaration
17 or in another context.

18 Q So I'm asking you to apply -- did you
19 apply, did you provide opinions about
20 obviousness in this matter for your
21 declaration?

22 A I set out in Paragraphs 33 to 40 of my

1 second declaration my general understanding
2 of obviousness in the context of a patent
3 claim and whether a patent claim can be found
4 invalid as obvious. And I provided opinions
5 throughout both of my declarations with
6 regards to whether or not a certain patent is
7 obvious.

8 Q And so you have an understanding of
9 obvious that you applied when providing your
10 opinions in your declaration, is that fair?

11 A I think that's reasonable, yes, but
12 again, I'm not a patent lawyer, so I wouldn't
13 like to go beyond the understanding that I
14 summarized in the paragraphs that I just
15 mentioned.

16 Q Applying your understanding of
17 obviousness, the same one you applied when
18 forming your opinions for this declaration,
19 are you more likely or less likely to include
20 obvious details in patent applications where
21 you are a named inventor?

22 MR. VERBONCOEUR: Objection to the

1 form of the question.

2 A I don't understand the question.

3 Q What don't you understand about the
4 question?

5 A So my understanding of obviousness as I
6 used it in my second declaration, for
7 example, relates to whether or not a patent
8 claim can be found invalid. So I don't
9 understand -- I'm not a patent lawyer, I
10 don't understand how that applies to an
11 engineer involved --

12 Q Okay.

13 A -- I'm not finished. An engineer
14 involved in drafting a patent application.

15 Q Well, let's just apply the word, the
16 vernacular meaning of obvious, right. Before
17 you became an expert, you had -- you've heard
18 of the word obvious before, right?

19 A In many contexts, yes.

20 Q Okay. So just in the plain vernacular
21 meaning of the word obvious, all right, you
22 understand what that means?

1 A I'm really confused now, because I
2 don't, yeah, you have to give me some context
3 here because there is a context, which I just
4 pointed you to, which I understand to be
5 relevant for invalidity in patent domain, I'm
6 not sure what the context is you're not
7 asking.

8 Q I'm asking you beyond the patent domain,
9 if somebody used the word obvious with you
10 tomorrow, would you be able to understand
11 them or would you say I don't understand what
12 you mean?

13 MR. VERBONCOEUR: Object to the form
14 of the question.

15 A In what context?

16 Q On the street, if someone said the word
17 obvious to you, are you going to behave the
18 same way you're behaving now?

19 A I'm not trying to be difficult, but what
20 is the context.

21 Q I mean, so you're saying -- you're
22 saying if you walk up to someone on the

1 street asked you and said the word obvious to
2 you, you would not understand what they mean,
3 you would have to ask for context?

4 A If they said the word in isolation and
5 I've never seen them before, I don't see what
6 this has to be with my report and what you're
7 asking me.

8 Q I'm asking you -- okay, when you're
9 writing your patent applications, do you
10 think there's some things that might be
11 obvious to you about the subject matter?

12 A Obvious in what sense, in the sense of
13 invalidity or something else.

14 Q Just in the sense that it's obvious.
15 Like, hey, you know what, I'm writing about a
16 car, maybe it's obvious that the car might
17 have wheels. Do you understand that concept?

18 MR. VERBONCOEUR: Object to the form
19 of the question.

20 A Of course I understand what you're
21 saying.

22 Q Okay. So then, when you're writing a

1 patent application, do you think there might
2 be some things that occur to you that might
3 be obvious details that you might include in
4 your patent application?

5 A I don't know what you want me to say
6 here because now you're using obvious and
7 patent application together. I'm not a
8 patent lawyer. I don't know whether there's
9 a meaning of obvious in patent law that is
10 separate to the one that I've set out here or
11 not.

12 Q Hmm.

13 So in a patent application that you
14 have, right, let's say, you've worked on
15 patent applications, do you think a person of
16 ordinary skill in the art reading one of your
17 patents might have found it obvious to use
18 pixels of eight bits, for example, that could
19 be potentially something obvious for a person
20 to do, right?

21 A Which patent application, which context?

22 Q Well, actually -- all right. I'm

1 handing you what's been marked as
2 Exhibit 1018.

3 (Whereupon, United States Patent
4 No. 8,995,534 Richardson, et al.
5 was marked as Exhibit 1018 for
6 identification as of this date.)

7 Q I'm handing you a copy of 1018.

8 So, Dr. Richardson, I've handed you
9 what's been marked as Exhibit 1018.

10 Do you recognize this document?

11 A I believe so, yes.

12 Q What is Exhibit 1018?

13 A So it appears to be a copy of the US
14 Patent No. 8,995,534.

15 Q Are you the first named inventor on the
16 patent on Exhibit 1018?

17 A Yes.

18 Q What is Exhibit 1018 about?

19 A The title is systems and and methods for
20 encoding and decoding.

21 Q Does Exhibit --

22 A Yeah, sorry, I'm not quite finished, and

1 as the patent sets out column one starting at
2 Line 17, it relates to systems and methods
3 for encoding and decoding audio/video and
4 other digital data, yeah, and it goes on to
5 give more details.

6 Q I believe this patent provides a
7 technique that enables decoders to decode
8 unsupported formats of audio and video; is
9 that right?

10 A That's broadly my recollection. I don't
11 actually recall exactly the details of what
12 was claimed in this patent.

13 Q And does this patent disclose all the
14 techniques that you were aware of for
15 decoding unsupported audio and video formats?

16 A At what time?

17 Q At the time you filed this patent, so
18 it's 2011?

19 A I recall being involved in drafting the
20 application. I'm not sure that I've
21 personally filed the patent. I think a
22 patent agent or attorney might have done that

1 for us. When I say "us" I mean myself and
2 the other named inventor.

3 Q Well, does this patent disclose all the
4 techniques that you were aware of for
5 decoding unsupported audio or video file
6 formats?

7 A I don't recall.

8 Q And does this patent disclose everything
9 you know about for decoding video files in
10 general?

11 MR. VERBONCOEUR: Object to the form
12 of the question.

13 A At what time?

14 Q In 2011?

15 A So my recollection is I wrote or
16 contributed to the writing of this in 2010.
17 My general recollection is that by 2010, I
18 had been working in the field of video coding
19 and decoding for certainly more than 15 years
20 and I've written, two, three books by this
21 date on the subject. So it certainly doesn't
22 disclose three books worth of text.

1 Q Now, this patent does deal with video
2 pixels, correct?

3 A I don't recall.

4 Q Well, it deals with video, correct?

5 A So in Columns 1 and 2 in the patent,
6 it's the description of related art, and
7 there's some discussion of video coding
8 formats. There's a discussion of some image
9 formats. So there's certainly some
10 discussion of, let's say, video at least in
11 the coded form.

12 Q Now, if you could turn to the very last
13 page of Exhibit 1018.

14 A Okay.

15 Q And you see Claim 1 that's written
16 there?

17 A Yes.

18 Q If somebody today were to file a patent
19 and they copied your Claim 1 exactly, but at
20 the very end they wrote a limitation, wherein
21 the video data includes pixels that are eight
22 bits, would you view that new claim to be

1 obvious?

2 A I'm not a patent lawyer. I'm not
3 trained in patent law. I don't know what a
4 person of ordinary skill in the art would
5 necessarily be for this patent, but assuming
6 a person of ordinary skill in the art, for
7 example, with some experience of working with
8 video compression, then, yeah, video pixels
9 comprising eight bits or whatever you said,
10 would probably not seem to be something novel
11 at this point in time, in the 2010 time
12 frame.

13 Q Are you familiar with the H.264
14 Standard?

15 A Yes, I am.

16 Q What is the H.264 Standard?

17 A It's a standard, an international
18 standard that relates to video compression.
19 It's a standard that is copublished by the
20 ITU-T and the ISO/IEC.

21 Q Did you participate in the development
22 of the H.264 Standard?

1 A I was, if you like, an accredited expert
2 at the time, with regard to the expert group
3 that was putting together the standard.

4 My recollection is I didn't attend any
5 standardization meetings, and I didn't submit
6 any technical proposals during the
7 development of the standard. And when I say
8 I didn't submit technical proposals, I mean,
9 I didn't submit any technical proposals to
10 the joint video team.

11 Q Did you keep track of the developments
12 of the H.264 Standard from the joint video
13 team as the joint video team was meeting and
14 drafting the standard?

15 A So my recollection is that in the time
16 frame around 2000 to 2003, the joint video
17 team met on a number of occasions. During
18 those meetings and between the meetings, the
19 draft H.264 Standard was being developed. My
20 recollection, I was generally keeping track
21 of those developments. And when I say that,
22 I mean I was regularly, during that period,

1 reviewing the contribution documents or
2 proposals on the JVT, I think it was an FTP
3 site in those days.

4 My recollection is also I was regularly
5 reviewing email discussions relating to the
6 development of the H.264 standard, which, if
7 I recall, appeared in one or more email lists
8 that I was subscribed to at the time.

9 Sorry, when I say "at the time," I mean
10 during that time period around 2000 to 2003.

11 Q What about H.265, were you involved the
12 development of the H.265 Standard?

13 A I did not submit any contribution
14 documents or proposals to the JCT-VC, which
15 was the working group responsible for
16 developing what became the H.265 Standard. I
17 did attend at least one of the meetings of
18 that working group.

19 Q Which meeting did you attend?

20 A I don't recall precisely. I think it
21 was possibly around 2012, and I think it was
22 in -- hang on. It was in the San Francisco

1 area, possibly San Jose.

2 Q Were you keeping track of the various
3 working drafts of the JCT-VC for H.265 as
4 they were being released?

5 A Generally, yes.

6 Q How would you keep track of the working
7 drafts from the JCT-VC for meetings that you
8 didn't attend?

9 A My recollection is that all of the
10 published working drafts -- yeah. All the --
11 that the working drafts were available, at
12 least on the website that working group
13 created and maintained.

14 My recollection is that I was also
15 subscribed to and regularly reviewing email
16 discussions relating to the development. I
17 don't recall whether the working draft
18 versions were circulated by email, but I
19 certainly recall reviewing the working drafts
20 that had been, let's say, uploaded to the
21 website of the working group.

22 Q And so you would go onto the website for

1 the JCT-VC working group and download the
2 working drafts that were put up on there?

3 A I recall doing that on a number of
4 occasions during the 2010 to 2013 time frame,
5 and after that as well.

6 Q Do you recall how you would find the
7 working drafts on the website?

8 A Broadly, yes. My recollection is that
9 the website, as the meetings progressed, each
10 meeting had a letter. First one was A,
11 second one was B, and so forth. And my
12 recollection is that the website -- which I
13 don't have in front of me, but my
14 recollection it is or it was organized by
15 meeting. And that in the page, if you like,
16 for each meeting, all of the contributions
17 relating to that meeting were listed and
18 could generally be downloaded. And my
19 recollection is that the working drafts which
20 were numbered, if I recall correctly, were
21 generally available as downloadable documents
22 on those meeting pages or meeting lists.

1 Q Did you also look at any proposals that
2 were made at meetings that you didn't attend?

3 A I recall that I did, yes.

4 Q And how would you access the proposals
5 at meetings that you didn't attend?

6 A Well, the same -- actually, the same way
7 I would access proposals at meeting or
8 meetings that I did attend, which is via the
9 same website. That's certainly one way of
10 accessing those proposals.

11 My recollection is that, as I said, for
12 each meeting, there was a list of proposals
13 of contribution documents provided on the
14 website and, in general, they were
15 downloadable.

16 Q Do you recall if you had to have a
17 password or anything like that to go download
18 it, or could you just go on -- could anybody
19 just go on and download from that website?

20 A My recollection -- sorry, I apologize if
21 I spoke over you.

22 My recollection for the JCT-VC

1 contributions proposals website was that
2 there was no password required and no access
3 restrictions issued.

4 I should maybe say at the time, my
5 recollection is that I was also a member of
6 the MPEG group, and there were contributions
7 there which did require password to download,
8 but my recollection is specific JCT-VC
9 contributions didn't require password.

10 Q If you could turn to Paragraph 34 of
11 your declaration. I believe that's one of
12 the paragraphs you've been indicating.

13 Do you see it? Let me know when you get
14 there.

15 A I see it.

16 Q Okay. Now, Paragraph 34 says:

17 "I have been informed that to be
18 obvious in light of a single prior art
19 reference or multiple prior art
20 references, there must be a reason
21 either to modify the single prior art
22 reference or to combine the two or more

1 prior art references to achieve the
2 claimed invention."

3 Do you see that?

4 A Yes.

5 Q And the next sentence reads:

6 "I've been informed by counsel
7 that this reason may come from a
8 teaching suggestion or motivation to
9 combine which may come from the
10 reference or references themselves."

11 Do you see that?

12 A Yes.

13 Q What would it look like for a motivation
14 to combine to come from one of the references
15 themselves?

16 MR. VERBONCOEUR: Object to the form.

17 A I don't know what you mean by "What
18 would it look like."

19 Q Do you have in your mind any vision of
20 what -- any examples of what it might look
21 like for a motivation teaching suggestion or
22 motivation combined to come from one of the

1 references?

2 MR. VERBONCOEUR: Object to the form.

3 A I'd rather not speculate on that. I
4 think later in the same declaration I recall
5 talking about this question with regard to
6 two specific references.

7 Q If you were writing a paper today and
8 you wanted to provide a teaching suggestion
9 or motivation to combine your paper with
10 other things that you know about, how would
11 you do it?

12 A Are you asking --

13 MR. VERBONCOEUR: I'll object to the
14 form of the question. I apologize,
15 Dr. Richardson.

16 A Sorry. Are you asking about motivation
17 to combine in terms of obviousness in patent
18 invalidity or some other context?

19 Q I'm talking about Paragraph 34 of your
20 declaration. Right?

21 A Okay.

22 Q So, based on your understanding of

1 Paragraph 34, if you wanted to provide a
2 teaching suggestion or motivation in a paper
3 that you were writing today, how might you go
4 about that?

5 MR. VERBONCOEUR: Object to the form
6 of the question.

7 A Do you mean in the context of patent
8 invalidity or some other context?

9 Q Right. In terms of patent invalidity,
10 in terms of Paragraph 34, right, in terms of
11 you personally writing a paper, if you wanted
12 to write a paper today and you thought, I
13 want to provide a teaching suggestion or
14 motivation to use this paper that I'm writing
15 with something else that I know about, how
16 would you go about doing that?

17 A I don't know how I would go about doing
18 that in the context of patent invalidity,
19 because I'm not a patent lawyer. So I'm sort
20 of confused.

21 Q Okay.

22 A I can talk about technical aspects of

1 writing a paper and how I refer to the prior
2 art, but that might not be the same as what
3 you're asking me.

4 Q Right. So if you were writing a paper
5 and you wanted to prevent somebody else from
6 patenting something that you think, it's just
7 a very obvious variation of what you're
8 writing, so you want to provide a teaching
9 suggestion or motivation to combine your
10 paper with something else that you know, can
11 you identify a single way that you might
12 provide that teaching suggestion or
13 motivation in your paper?

14 A I don't understand the part of your
15 question when you say, I want to prevent
16 somebody from patenting a paper. I don't
17 know what you mean.

18 Q Yeah. So you don't understand the idea
19 that if you write a paper, you might want to
20 disclose the things in it so that someone
21 else can't take your paper, make a slight
22 modification, and then patent that

1 modification?

2 MR. VERBONCOEUR: Object to the form
3 of the question.

4 A I don't ever recall writing a paper for
5 those reasons.

6 Q Do you ever recall writing a patent
7 where you might decide that, I want to
8 include some additional teaching suggestion
9 or motivation to combine this patent with
10 something else that I know about?

11 A Not really, no.

12 Q Have you ever heard of incorporation by
13 reference?

14 A In what context?

15 Q If the context of patents.

16 A Yes, I think so. Yes.

17 Q What does incorporation by reference
18 mean?

19 MR. VERBONCOEUR: Object to the form
20 of the question.

21 A So my recollection is that I talk about
22 this later in my report with regard to a

1 specific paragraph, Karczewicz 1 and
2 Karczewicz 2. Unless I've sort of set it out
3 as part of my understanding of legal
4 standards, then I wouldn't like to volunteer
5 legal standard for incorporation by
6 reference. But if you could -- you know,
7 certainly happy to talk about any reference I
8 might -- any use I might have made in my
9 second declaration of incorporation by
10 reference. And I recall there is one, but
11 you can probably find it quicker than I can.

12 Q I'd like to just ask you some background
13 questions about the technology of video and
14 coding. And I know some of these things
15 might be very basic to you, but I still just
16 want to cover them, these fundamentals, to
17 make sure that we're all on the same page.

18 So if we have a decimal number, what
19 does each digit mean?

20 A So, for example, the decimal number,
21 102, and this is -- I'm not talking about
22 video coding necessarily here. I'm talking

1 about in basic mathematical, arithmetic
2 concepts, and the number -- the digit two
3 represents two things. The zero represents
4 that there are no additional tens, if you
5 like, and the one that the most significant
6 digit place indicates that there's a single
7 hundred.

8 So 102 in decimal, if I say I've got 102
9 apples, then -- yeah. I've got 100 apples
10 from one and I've got two apples from the
11 two. So I've got 102.

12 Q What is a binary number?

13 A A binary number is, generally speaking,
14 it's a representation of a number where each
15 digit can be one or zero.

16 Q So for the binary number 011, what would
17 that be in decimal?

18 A That would, unless there's -- yeah. I
19 guess it depends on -- it depends on the
20 mapping, but the most straightforward mapping
21 is going to be the decimal number 3.

22 Q Okay. And, then, the number, this is

1 just another example, what would the decimal
2 number six be in binary?

3 A As I'm sure you're aware, you can use
4 different numbers of -- any different numbers
5 of bits to represent that. So, for example,
6 you said 011, you used three bits there for
7 three. The decimal number six in a
8 representation I'm very familiar with, a
9 binary representation I'm familiar with,
10 could be represented as 110.

11 Q Is it correct that every time you append
12 a zero at the end of a decimal number, it
13 makes that number twice as big?

14 A A decimal number, no.

15 Q What happens with decimal number when
16 you append a zero at the end?

17 A So if you mean -- when I write out a
18 decimal number, if you mean at the end, if
19 you mean the right-hand side, the least
20 significant decimal digit, if I took the
21 number 102 and wrote it out and then appended
22 a zero, if that was understood to be the

1 decimal number, 1020, then the relationship
2 between the two is that 1020 is ten times
3 102.

4 Q What happens if you append a zero to the
5 right side of a binary number?

6 A So, for example, if the decimal number 6
7 was represented as binary 110. If I wrote
8 down 110, assuming that the binary
9 representation, and appended a zero, so that
10 I've now written down 1100, in a conventional
11 binary representation that could represent --
12 would represent the decimal number 12.

13 And so I'm representing a different
14 decimal number that is two times the decimal
15 number I started from.

16 Q So what is bit shifting in the context
17 of binary numbers?

18 A So, generally, my understanding of bit
19 shifting is it's an operation or a class of
20 operations in which the bits of a binary
21 number are -- yeah. Kind of struggle to get
22 that high level -- for example, what I just

1 describe with taking the binary number 110,
2 appending a zero at the right-hand side so I
3 now have 1100, I would, generally, understand
4 that to be a left shift. So that's a form of
5 bit shift.

6 And if I took the binary number 110 and
7 shifted it to right, there's actually at
8 least a couple of things that I could end up
9 with. But if I did that, and ended up with
10 11, that would be a form of right shift.
11 There's at least one other form of right
12 shift, both of those, I think, are examples
13 of the bit shifting in my knowledge and
14 experience. And examples that I've used in,
15 for example, systems that I've developed or
16 software that I have written.

17 Q So each time you bit shift a number left
18 one bit, that's equivalent to multiplying
19 that binary number by two, correct?

20 A In a common binary representation such
21 as the one I had in mind when I gave you the
22 example of 6 in binary, append the zero at

1 the right-hand side, you get 12 represented
2 in binary. That would be an example of a
3 left shift.

4 In that example, because I have appended
5 a zero, I've effectively multiplied the
6 decimal equivalent number by two.

7 Q And then correspondingly, if you left
8 shift a number by two bits, then that would
9 be equivalent to multiplying that number by
10 four?

11 A If I'm doing the left shift in such a
12 way that I'm filling the spaces on the
13 right-hand side with zeros, then, for
14 example, starting with decimal six, which I
15 represented as 110, if I left shift that by
16 two places, and fill those places with zeros,
17 I end up with the number 11000.

18 And in decimal terms, I've multiplied
19 six by four to get 24.

20 Q How did you shift a binary number to the
21 right?

22 Well, let me rephrase that.

1 What is a right shift in the context of
2 binary numbers?

3 A Generally speaking, it's a little bit
4 hard to generalize. But generally speaking,
5 the binary digits that you started with --
6 well, let me give you an example.

7 If I started with 6 represented as 110,
8 if I did one form of right shift and ended up
9 with 11, then that gives me the binary number
10 11, which, depending on the representation,
11 can correspond to decimal three. So that
12 would be an example of a right shift. The
13 reason I say "an example" is because there
14 are different types of right shift in my
15 experience of implementing right shifts.

16 Q A common version of right shift is to
17 move the digits of a binary number right by
18 one bit and to fill a zero on the left side;
19 is that fair?

20 A So my recollection is that would be
21 consistent with a logical right shift, I
22 think I've got that the right way around.

1 And that's quite a common form of right shift
2 in my field. I've used it many times in
3 software and I think in hardware.

4 Q So each time you perform a logical right
5 shift that is equivalent to dividing a number
6 by two?

7 A So at least for a positive decimal
8 number represented binary such as positive 6
9 represented in binary as 110. If I do a
10 single right shift, logical right shift, I
11 end up with the binary number 11. And that's
12 consistent with decimal three. So that's
13 divide six by two.

14 If I start with other numbers there I
15 get different results, which are not
16 necessarily divisions by two.

17 Q So for the number 10, if you do a
18 logical right shift, it becomes 11, and that
19 would be binary number three?

20 A That would be 11, as binary 11.

21 Q Right. Binary 11 is decimal number 3,
22 right?

1 A In a common representations. There are
2 other representations.

3 Q Does shifting values to the left,
4 increase the number of possible values?

5 A Of what?

6 Q Does left shifting binary numbers
7 increase the number of possible values for
8 those binary numbers?

9 A I need to be like -- I need to have
10 specific context now to answer that question.

11 Q So there are some context where left
12 shifting a number will increase the number of
13 possible values.

14 A No. All I'm saying is there are some
15 context where it's kind of a meaningless
16 question. In my mind, for example --

17 Q Well --

18 MR. VERBONCOEUR: Hang on. The
19 witness isn't done.

20 A Yeah, for example, if it's a number,
21 it's three and it's a constant, then it only
22 has one possible value. So changing a

1 representation of that one possible value
2 doesn't give me more possible values. It's
3 kind of a weird counterexample, but it's sort
4 of meaningless question, I think in that
5 context.

6 Q If you have a variable that's not a
7 constant value --

8 A Okay.

9 Q -- does left shifting a variable
10 increase the number of possible values?

11 MR. VERBONCOEUR: I'll object to the
12 form of the question.

13 A For example, if I have a variable and I
14 know that it only has 16 possible values, and
15 I can represent that as an unsigned binary as
16 4 zeros up to 4 ones. If I left shift the
17 variable, and it's still defined to have 16
18 possible values, then it still has 16
19 possible values; I've just chose a way to
20 represent it.

21 Q If you have a four bit variable and you
22 left shift that variable one bit, did you

1 increase the number of possible values for
2 the variable?

3 MR. VERBONCOEUR: Object to the form
4 of the question.

5 A By the left shift or by something else?

6 Q By using the left shift, did you
7 increase the number of the possible values
8 for the variable?

9 A Yeah, let me think about this. If I
10 have a variable, call it A, it's got 16
11 possible possibilities -- I actually have a
12 diagram that's relevant to this.

13 Yeah, for example, just above
14 Paragraph 70 of my second declaration, I show
15 a Variable P, which has 10 possible values,
16 and I chose to multiply that by four, it
17 still has 10 possible values. So if I
18 achieve this multiplication or implemented
19 that multiplication by left shifting two
20 places, P still has 10 possible values.

21 So in that example, there's no increase
22 in possible values.

1 Q Can you think of any example where left
2 shifting a variable increases the number of
3 the possible values for that variable?

4 A Absent something else happening, to be
5 honest, I can't sitting here. If you give me
6 an example, I can tell you whether it works
7 or not, but I can't think of one.

8 Yeah, again, looking at my example on
9 Page 31 in my second declaration, P had 10
10 possibilities before -- and there's lots of
11 cases, for example, in the context of video
12 coding where we define something or a
13 standard defines something that has a certain
14 number of possible values. It can either,
15 then, represented in binary then left shift.
16 I haven't changed that variable, I've just
17 changed the representation.

18 Q I'd like you turn to Page 46 of your
19 declaration.

20 As I said before, I know this is very
21 basic, but I just want to cover some of the
22 fundamentals of video coding.

1 So in Paragraph 46 you just have a
2 high-level overview of video encoder and
3 video decoder; is that fair?

4 It's the diagram -- you're looking at it
5 there.

6 A Sorry, yes. I thought you were on
7 Page 46 --

8 Q Oh, I'm looking at Paragraph 46,
9 Page 16.

10 A Okay. Paragraph 46, Page 16 of my
11 second declaration. Okay.

12 Q Yeah, so in Paragraph 46, you have some
13 high-level representations of video encoder
14 and a video decoder; is that fair?

15 A A video encoder, yeah. Not every video
16 encoder, but -- yeah, a video encoder, a
17 video decoder, yes.

18 Q And in particular, these would be
19 representations of H.264 video encoder and
20 decoders, correct?

21 A Not that I recall, no.

22 Q But what it says, if you read

1 Paragraph 46, that this is in reference --
2 that these diagrams are in reference to
3 H.264?

4 A That's not what I say in Paragraph 46.

5 Q Okay. So what is Figure 3.51, then?

6 A It's a block diagram of a video encoder.
7 It's from my 2010 book.

8 Q Okay. But does Figure 3.51 reflect how
9 high-level operations of video encoder for
10 H.264?

11 A Which video encoder?

12 Q The one shown in the Figure 3.51.

13 A Sorry. You said -- no. What's the
14 video encoder you want me to ask -- imagine
15 reflecting?

16 Q Yeah, does Figure 3.51 reflect, at all,
17 H.264 operations?

18 A What do you mean by "H.264 operations"?

19 Q Well, okay. Is Figure 3.51 consistent
20 with H.264?

21 A It doesn't come from H.264. It's my
22 figure. I created this figure.

1 Q Okay. It doesn't reflect how H.264
2 operates?

3 A What do you mean "how H.264 operates"?
4 I'm confused.

5 Q What was your purpose of making figure
6 3.51?

7 A You should probably look at the book and
8 look at the context, Figure 3.51, it's a
9 block diagram of a video encoder.

10 Q And what is -- so starting on the left
11 side, what is the -- what is FN current?

12 A So I don't have my 2010 book in front of
13 me. And I, obviously, wrote it a while ago,
14 I think I can roughly remember the full
15 context. But for full context, I look at my
16 book.

17 Without looking at my book, my
18 recollection is that F subscript N, in my
19 Figure 3.51, is meant to illustrate a current
20 video frame, it could represent a field. I
21 can't remember. I think it was meant to
22 represent a frame.

1 Q Well, I'm handing you what's been marked
2 as -- actually, this one has already been
3 marked as Exhibit 1012.

4 (Whereupon, The H.264 Advanced
5 Video Compression Standard,
6 Second Edition, Iain E
7 Richardson was previously marked
8 as Exhibit 1012.)

9 Q And it's your book. Well -- thank you.
10 Do you recognize Exhibit 1012 as a book
11 that you wrote?

12 A I'm not sure that I do. Let me explain
13 why. It's a -- I think I mentioned this to
14 Counsel, at the time when I first saw this
15 exhibit.

16 I'm not sure that this is a -- let's say
17 a legal or valid copy of my book, so it's not
18 a bound book. It doesn't look like a
19 photocopy, and it doesn't look like the way
20 that I happened to know that the electronic
21 versions, electronic copies of this book
22 looked like. I don't see any copyright

1 information. So I actually don't know.

2 Q Isn't the copyright information on the
3 page -- the stamped Page 006?

4 A So let me explain again. If you or
5 anyone else were to buy a copy of my book,
6 which I hope you did, it would either be a
7 physical bound copy, or it would be an
8 electronic copy. And all of the electronic
9 copies, that I've seen, have forms of
10 watermark and a different presentation.

11 So this doesn't look like either of
12 those things. And I suspect, because this
13 has happened to me before, this is -- I am
14 aware that there are hacked copies, hacked
15 PDFs of my 2010 book in circulation on the
16 internet. The publisher hasn't been able to
17 take them down.

18 And to be honest, this looks like one of
19 those. So I hope you bought a copy of this.

20 Q Yeah, I'm not sure where this version
21 came from.

22 But are the contents of this document

1 consistent with your recollection of your
2 book?

3 A I have no idea. If it's the hacked PDF
4 copy, which it looks like to me, I have no
5 idea what process that went through to get to
6 this, this stage. The only people who have a
7 clean PDF copy of my book are myself and
8 publishers, anything else, I'm not aware. I
9 don't know where it came from.

10 Q Hmm. Well, if you can turn to page --

11 THE WITNESS: Sorry. Is there a
12 convenient time for a break? I think
13 I could do with a break.

14 MR. VERBONCOEUR: Now's a good time.

15 (Whereupon, a recess was taken
16 from 10:22 AM until 10:39 AM.)

17 Q So, Dr. Richardson, we were looking in
18 your declaration on Page 16, Paragraph 46.

19 Do you see that?

20 A My second declaration, yes.

21 Q Okay. What is the FN current, the box
22 on the top left of Figure 3.51?

1 A So I don't have what I believe to be a
2 correct copy of my -- or a valid copy of my
3 book in front of me, but my recollection is
4 that it is either describing a frame or a
5 field. And the subscript N, in my
6 recollection, is that's meant to denote a
7 current frame of field, possibly a frame, at
8 this point, I can't remember.

9 Q Right. But you did put this in your
10 declaration for your IPR?

11 A Sure.

12 Q What did you intend to convey with the
13 box FN current?

14 A So my recollection of why I put this in
15 my declaration, was that it's in the public
16 domain, it's in my 2010 book, these two
17 diagrams. And it's to illustrate the first
18 sentence of Paragraph 46, this is my
19 recollection, that certain common
20 architectures for video coding systems have
21 been established over the years. So these
22 are example of known video compression or

1 video coding architectures, that's what I
2 recall.

3 Q Right, that common architecture, FN
4 current would be the current frame or field,
5 right?

6 A In the illustration Figure 3.51 from
7 my 2010 book, that's my recollection, that's
8 what I was illustrating there. In block
9 diagram form, obviously this is not an actual
10 implementation, it's an illustration.

11 Q Okay, then we get to a box motion
12 estimation, what is that?

13 A Motion estimate generally in known
14 architectures or systems for video coding,
15 one can have a process of motion estimation
16 where in an encoder, an encoder attempts to
17 find a block or region or, yeah, a block or
18 region in a different video frame that could
19 be used to predict a block or region in a
20 current video frame.

21 Q Okay. Then you have a box that says
22 motion compensation, what is that?

1 A My recollection is that there I'm
2 illustrating the process of generating a, I
3 think in this diagram a prediction labeled P.

4 Q How does motion prediction relate to
5 these boxes?

6 A What do you mean by motion prediction.

7 Q Are you familiar -- what is motion
8 prediction.

9 A In what context?

10 Q For video coding?

11 A Do you mean motion compensated
12 prediction or something else.

13 Q Right. Motion compensated predictions,
14 what is that?

15 A Generally motion compensated prediction
16 is, I guess you could characterize it in
17 different ways, but it's broadly consistent
18 with what I'm illustrating here where a
19 prediction is created based on typically
20 other video frames from the current -- a
21 current video frame. And the term motion
22 compensation is known in the field to broadly

1 refer to the fact that an encoder and/or a
2 decoder can compensate for motion in that
3 process and I think to somebody of skill in
4 the art that would be consistent with
5 offsetting a region using a motion vector.
6 Something like that.

7 Q Have you heard motion compensated
8 prediction referred to in the shorthand as
9 motion prediction?

10 A I can't remember.

11 Q What is D.C.T?

12 A In the context of video coding and
13 decoding it would often mean -- be shorthand
14 for a discrete cosine transform or a
15 practical implementation of a discrete cosine
16 transform.

17 Q And then what is quant?

18 A My recollection is that what I'm
19 illustrating here is a quantize process, a
20 forward quantize process or forward
21 quantization.

22 Q I think the next box here is reorder,

1 what is reorder?

2 A My recollection is that I was
3 illustrating a process such as taking a block
4 or blocks of coefficients and organizing them
5 in a certain way prior to entropy coding.

6 Q What is entropy coding?

7 A Generally in the context of video coding
8 it's a process of producing a compressed or
9 encoded bit stream that represents values to
10 be communicated in an efficient form,
11 typically in some sort of binary form.

12 Q And then in this common architecture
13 that you're representing in Paragraph 46,
14 entropy encoding is the last stage before the
15 coded bit stream?

16 A In this block diagram of Figure 3.51
17 from my 2010 book, yes.

18 Q And then, if we go to the figure 3.52,
19 the coded bit stream -- actually, let me ask
20 you, what is the coded bit stream?

21 A In this context, in the context of video
22 coding, it's a representation of video data

1 in a compressed form.

2 Q Okay. So in Figure 3.52, the coded bit
3 stream comes into the set up from the right
4 side; is that right?

5 A In the way I've illustrated it in the
6 block diagram of my original Figure 3.52,
7 yes.

8 Q Okay. So then the first stage here is
9 entropy decode, what does that do?

10 A Generally in this context it decodes
11 from the coded bit stream values and those
12 values are typically then further processed
13 during the video decoding process. So
14 generally, in this context entropy decode
15 effectively reverses the operations of the
16 entropy encoder that I illustrated above.

17 Q So the output of the entropy decode is
18 no longer compressed?

19 A No. Not correct.

20 Q Okay. The output of the entropy decode
21 is still compressed?

22 A The output of entropy decode step is

1 what it is, it's a set of values.

2 Q Is that set of values compressed?

3 A So the context here is video encoding
4 which is also often described as video
5 compression and video decoding, which is
6 often described as video decompression. So
7 if you consider the video decoder, the coded
8 bit stream which I illustrated on the
9 right-hand side, that is a compressed
10 representation of video data. And way over
11 on the left-hand side of my Figure 3.52 I
12 have an F, an FN or an F prime N and that is
13 a decoded video frame. So by the time you
14 get to the left there video has been decoded
15 and decompressed.

16 Q If we go back and look at Figure 3.51,
17 for the encoder, is it correct that the F on
18 the left side is uncompressed?

19 A So at the top left of my Figure 3.51, FN
20 which illustrates a current frame, I think it
21 would be reasonable to describe that as an
22 uncompressed video frame in the context of

1 this video compression process.

2 Q And the one below it, we'll call it F
3 prime N minus one reference, do you see this
4 block?

5 A Yes.

6 Q Would it also be reasonable to describe
7 that as uncompressed video frame?

8 A I would say, so yes.

9 Q Now, do -- how do motion vectors play
10 into motion compensation?

11 A So in the typical video codec such as
12 the typical video codecs I've attempted to
13 illustrate here, video encoder and decoder.
14 In video encoder, the motion estimation
15 process will or can identify a motion vector
16 and a motion vector is a term that's often
17 used in this field to describe an offset
18 between a block or region that we're trying
19 to predict or the encoder is trying to
20 predict in current frame and the block or
21 region in a previously coded or reference
22 frame.

1 So the offset or distance often in XY
2 terms between those two, that would often be
3 described as motion vector.

4 In these diagrams, you'll see that in
5 Figure 3.51, there's an arrow saying vectors
6 and headers going into the entropy encoder
7 and what I'm trying to illustrate there is it
8 was known around this time to encode that
9 motion vector or motion vectors, as part of
10 the compressed or coded bit stream and to
11 decode them at the decoder side. And then
12 the decoder would, again, in known video
13 codecs, the decoder could use those motion
14 vectors to carry out the motion compensate
15 process that I've also illustrated. And it
16 doesn't have to be, but often in practical
17 systems or codecs, the motion compensate or
18 the encode side and the decode side should
19 mirror each other. So the decoder will often
20 attempt to create the same prediction as the
21 encoder using the same motion vector or
22 motion vectors.

1 Q If you could turn to Exhibit 1012. And
2 if you could turn to Page 58 of Exhibit 1012.

3 A Okay.

4 Q So I'm going to read some portions of
5 Exhibit 1012 and I want you to let me know if
6 you agree with these statements that they are
7 accurate or if you disagree with them. Okay.
8 So starting below Section 3.2, it says.

9 "Video codec, Figure 3.3, encodes
10 a source image or video sequence into
11 compressed form and decodes this to
12 produce a copy or approximation of the
13 source sequence. If the decoded video
14 sequence is identical to the original
15 then the coding process is lossless.
16 If the decoded sequence differs from
17 the original then the process is
18 lossy."

19 Do you agree with that statement?

20 A I think that's a reasonable summary at
21 the time I wrote it, in the context that I
22 wrote it. Again, assuming that this is an

1 accurate reflection of my 2010 book and I'm
2 not sure that it is.

3 Q I'm just asking just sitting here today,
4 you know, reading this, if that is a
5 reasonable statement to you?

6 A I think in the context of a high level
7 overview of video coding, which is what I
8 recall I wrote in chapter three of my 2010
9 book, I think it's reasonable.

10 Q Okay. And do you recall any differences
11 between what is written here and what you
12 believe is in your 2010 book?

13 A I don't recall.

14 Q Okay. And looking at Figure 3.3, would
15 you consider Figure 3.3 to be a reasonable
16 representation of a video encoder block
17 diagram?

18 A It's a very high level video encoder
19 block diagram as we've already discussed. In
20 my 2010 book I recall providing more detailed
21 block diagrams which are also reasonable. So
22 at a high level, it's one way to, if you

1 like, understand some of the concepts of
2 video coding.

3 Q Okay. And do you recall any differences
4 between Figure 3.3 of Exhibit 1012 and
5 your 2010 book?

6 A I don't recall.

7 Q I'm going to read the next paragraph to
8 you:

9 "The codec represents the
10 original video sequence by a model in
11 an efficient coded representation that
12 can be used to reconstruct an
13 approximation of the video data.
14 Ideally, the model should represent the
15 sequence using as few bits as possible
16 with as high a fidelity as possible.
17 These two goals, compression efficiency
18 and high quality, are usually
19 conflicting, i.e., lower compressed bit
20 rate typically produces reduced image
21 quality at the decoder."

22 Is that a reasonable statement?

1 A I would say at this very high level that
2 I was -- I recall writing about in my 2010
3 book, yes.

4 Q Do you recall any differences between
5 what I just read and your 2010 book?

6 A I don't recall.

7 Q Okay. So the next paragraph reads:

8 "A video encoder, Figure 3.3,
9 consists of three main functional
10 units. A prediction unit, a spatial
11 model and an entropy encoder. The
12 input to the prediction model is an
13 uncompressed raw video sequence, a
14 prediction model attempts to reduce
15 redundancy by exploiting the
16 similarities between neighboring video
17 frames and/or neighboring image samples
18 typically by constructing a prediction
19 of the current frame or block of video
20 data. In H.264/ADC. the prediction is
21 formed from data in the current frame
22 and one of the previous and/or future

1 frames."

2 So pausing there, would you
3 consider what I just read to be a
4 reasonable statement?

5 A I think at the very high level overview,
6 which is what this I recall writing in
7 chapter three of my 2010 book, I think all of
8 that is reasonable.

9 Q Do you recall any differences between
10 what I just read and your 2010 book?

11 A Not that I recall.

12 Q Do you disagree with any statements that
13 I just read?

14 A What do you mean by disagree?

15 Q Disagree with them? Do you think
16 they're inaccurate?

17 A They're high level as I've explained and
18 I think is very, very, clear from reading the
19 book. I think all of these concepts are
20 explained in a lot more detail later in the
21 book, but as an attempt to provide this
22 really high level summary of some of the

1 concepts that I explore in the book, I can't
2 think of how I might do it differently today.

3 Q Now, can motion vectors point to a
4 sub-pixel?

5 A In what context?

6 Q Let's say for the H.264 context, can
7 motion vectors point to a sub-pixel?

8 A So in the H.264 Standard, as I recall,
9 specifies that motion vectors, MV or motion
10 vector components can point to integer or
11 sub-pixel positions in a reference frame or
12 reference picture.

13 Q And what is a reference frame?

14 A In what context?

15 Q In the context you just explained, so
16 motion vector in the context of motion
17 vectors, what's a reference frame?

18 A I don't understand the question.

19 Q Well, you just used -- in your answer
20 you just mentioned reference frame, I was
21 just asking, well, what's a reference frame?

22 A I was talking about the context of H.264

1 which I think you asked me about.

2 Q Right. What's a reference frame in the
3 context of H.264?

4 A I think actually the term is reference
5 picture and the standard defines what that
6 is.

7 Q Right. What is that?

8 A I don't have the standard in front of
9 me.

10 Q Okay. So without the standard you can't
11 explain to me what a reference picture is?

12 A So you asked me about the context of
13 H.264, and it's my understanding is that
14 you're asking me what is a reference picture
15 in H.264, it has a very specific meaning in
16 H.264. I recall that it's defined in H.264,
17 I don't recall the wording of the definition.

18 Q So when I asked you to explain motion
19 vectors in the context of H.264, you used in
20 your answer, reference frame, so I'm just
21 wondering why you would use that word if you
22 can't explain what it means?

1 A Multiple problems with your question.

2 Could you break it down a bit, please.

3 Q Right. I'm just asking you why did you
4 use the word reference frame in your earlier
5 answer if you can't explain what it means?

6 MR. VERBONCOEUR: Object to the form
7 of the question.

8 A I actually can't remember the earlier
9 answer. I don't agree with premise of your
10 question.

11 Q You don't agree that you used the word
12 reference frame in an earlier answer?

13 A That's not what I said.

14 Q What do you disagree with about the
15 premise of my question?

16 A I think this is sounding a little bit
17 argumentative with respect. I think you said
18 I can't explain something. I don't recall.

19 Q Right --

20 A Sorry, I finished my answer. I don't
21 recall at any point saying I cannot explain
22 whatever it was that you're asking about.

1 Q To be honest, I'm just asking about what
2 I thought would be just some basic
3 background. And so it does surprise me that
4 you refused to answer the earlier question
5 about what a reference frame is. I guess
6 I'll ask again.

7 What's a reference frame in the context
8 of H.264?

9 MR. VERBONCOEUR: I'll object to the
10 characterization and the form of the
11 question.

12 A Yeah. So H.264 is a standard. H.264
13 uses very -- some specific terminology, uses
14 the terminology reference picture, if I
15 remember correctly.

16 H.264, as a standard, has a definition
17 of exactly what it means by reference
18 picture. So if that's what you're asking me,
19 I would refer to the definition in the
20 standard.

21 Q And --

22 A If you're asking me something else, then

1 I'm not clear what it is.

2 Q Right. So you can't describe to me how
3 you understand a reference picture in H.264
4 without having the standard in front of you?

5 A I disagree.

6 Q Okay. Then please provide me with your
7 understanding of a reference picture in
8 H.264.

9 A My understanding covers a lot of
10 different concepts.

11 What are you asking?

12 Q I'm asking if you can provide any
13 explanation of what you understand a
14 reference picture to be in the context of
15 H.264.

16 A There's many aspects to it. It's
17 something that's stored, for example, in a
18 decoded picture buffer.

19 Q Okay. Is there anything else that
20 you're able to say about a reference picture
21 if the context of H.264?

22 MR. VERBONCOEUR: I'll object to the

1 form of the question.

2 A Yes.

3 Q Okay. And what is that?

4 A Lots of things.

5 Q Give me an example.

6 A My recollection is that H.264 defines
7 reference pictures. My recollection is that
8 H.264 goes into a great deal of detail as to
9 how reference pictures are to be used in a
10 conforming decoder.

11 My recollection is that H.264 specifies,
12 for example, how predictions are to be formed
13 involving reference pictures. My
14 recollection includes that H.264 defines that
15 reference pictures are -- can be stored
16 after, at the end of decoding pictures and so
17 on. But there's literally, as I recall, tens
18 of pages in the standard, maybe hundreds of
19 pages that relate to reference pictures.

20 Q In H.264, can motion vectors point to
21 sub-pixel positions?

22 A I think you answered -- you asked me

1 that already. So I refer you to my previous
2 answer.

3 Q Well, I assume the answer is yes, right?

4 A I think I gave you an answer already. I
5 don't want to give you the same question
6 multiple times. I don't have a transcript in
7 front of me. I'm not trying to be unhelpful,
8 but I want to be as precise as I can with my
9 answers.

10 Q So what are sub-pixels?

11 A In what context?

12 Q In the H.264 context.

13 A I don't recall whether sub-pixels
14 themselves are defined in the standard.

15 Q So you don't recall if H.264 allows for
16 sub-pixels?

17 MR. VERBONCOEUR: Object to the form
18 of the question and characterization.

19 A Well, what do you mean by a sub-pixel in
20 this -- in that question?

21 Q A location that is not an integer pixel
22 location.

1 A Okay. I still don't know what you're
2 referring to in H.264 with that question.

3 Q So, in your view, H.264 does not discuss
4 sub-pixels?

5 MR. VERBONCOEUR: Object to the form
6 of the question.

7 A I didn't say that.

8 Q Okay. H.264 does discuss sub-pixels?

9 A I'm assuming you're perfectly aware that
10 the H.264 standard has at least 600 pages. I
11 think it's maybe quite a few more by now. I
12 don't know every word that's used in the
13 H.264. I don't actually know what you mean
14 by "sub-pixel" in that question.

15 Q So you don't know if the H.264 standard
16 uses the term "sub-pixels" or not?

17 A I don't know what you mean by a
18 sub-pixel -- what do you mean by a sub-pixel
19 in that question?

20 Q So by sub-pixel, I'm referring to pixel
21 locations that are not in an integer pixel
22 location, right. So half pixel location or a

1 quarter pixel location.

2 A I'm confused why you think those are
3 pixel locations.

4 Q Okay. What is a half pixel to you,
5 then?

6 A A half pixel or a half pixel location or
7 something else?

8 Q What's a half pix pixel location?

9 A In what context?

10 Q Have you ever heard that used before?

11 A Yes.

12 Q In what context have you heard it used
13 before?

14 A I think I probably used it myself in
15 high level descriptions, for example,
16 interpolation to sub-pixel positions in video
17 coding processes.

18 Q And in terms of sub-pixel interpolation,
19 you've heard of the terms quarter pixel, half
20 pixel, center pixel, correct?

21 A In what context?

22 Q In the context of sub-pixel

1 interpolation.

2 A I've certainly heard of, you've probably
3 used the term such as half pixel location,
4 but you said half pixel. Do you mean without
5 the word "location" or do you mean something
6 else?

7 Q All right. So in the context of
8 sub-pixel interpolation, you are familiar
9 with the term half pixel location, correct?

10 A I recall that term. I think I probably
11 used that term myself, a half pixel location,
12 in the context of sub-pixel interpolation, in
13 the context of video coding.

14 Q Right. In the context of sub-pixel
15 interpolation, what is a half pixel location?

16 A In general, with respect to a particular
17 standard or something else?

18 Q In general.

19 A I can't remember if I wrote about this.

20 Yeah. And, for example, in my first
21 declaration, it's a declaration that I
22 submitted, as I recall, alongside or together

1 with the patent owner's preliminary response.
2 So I call that my first declaration.
3 Roundabout Paragraph 67 of that declaration,
4 I talk about sub-pixel interpolation in video
5 coding in general.

6 And I talk about full pixel values,
7 interpolated values in Paragraph 68. I can't
8 remember if I used the word "half pixel
9 location" in that section. And I've
10 forgotten the question, sorry.

11 Q In the context of sub-pixel
12 interpolation, what is a half pixel location?

13 A So, for instance, if you look at Page 32
14 of my first declaration, which is a figure
15 from the H.264 Standard, it shows integer
16 sample locations, and I think the person of
17 ordinary skill in the art, and certainly me,
18 we would sometimes use sample and pixel
19 somewhat interchangeably. Technically, they
20 are not necessarily the same thing.

21 But if we consider, for example,
22 uppercase G and uppercase H to be integer

1 pixel positions, or integer sample positions,
2 then lowercase "b" in that figure, I think a
3 person of ordinary skill in the art, and also
4 me, you would sometimes refer to that as a
5 half pixel position. Even though in the
6 standard, as I said, it talks about sample
7 positions and interpolated positions,
8 colloquially, I think it would be reasonable
9 to describe B as a half pixel location.

10 So that is a position in this example
11 equally distanced between two integer pixel
12 or integer sample positions.

13 Q What is a quarter pixel location?

14 A So with the same preface that,
15 colloquially, in the field, if uppercase G
16 and uppercase H were considered integer pixel
17 or integer sample locations, then lowercase A
18 and C, for example, in this figure on Page 32
19 of my first declaration, these might be
20 described as a quarter pixel positions, or
21 you could describe A as one quarter and C as
22 three quarter.

1 So I think all of these might be terms
2 that would at least generally be used in the
3 art. They're not necessarily in the H.264
4 Standard itself.

5 Q What is a center pixel position?

6 A I'm not sure that that's a widely used
7 term in this context.

8 Q I think you're looking at the figure on
9 top of or below Paragraph 49 in your
10 declaration, correct?

11 A No. I'm at the first declaration,
12 Page 32.

13 Q Okay. So looking at that figure --
14 okay. So looking at the figure on Page 32 of
15 your declaration, is there a center pixel
16 depicted on Page 32?

17 A Page 32 of my first declaration is a
18 figure from H.264. I don't see any labels in
19 that figure that say center pixel, and I
20 don't recall any labels, any use in the
21 surrounding text of H.264 that says center
22 pixel. Though, I don't have the standard in

1 front of me.

2 Q Okay. So if I were -- but -- so looking
3 on Page 32 of your declaration, you wouldn't
4 be able to identify what the center pixel is?

5 A So Page 32 is a figure from H.264
6 showing samples, not necessarily pixels.

7 Q Right. So looking at Page 32 of your
8 declaration, are you able to identify what
9 the center pixel position is?

10 A What do you mean by "center pixel
11 position" in this context?

12 Q Well, I'm asking you. In your --
13 hearing the term "center pixel position," are
14 you able to point to any pixel on Page 32 of
15 your declaration?

16 A There's no pixel in the center of that
17 diagram. There is no pixel in the center of
18 that diagram. If that's what you're asking
19 me.

20 Q I'm going to ask my question, right. I
21 didn't say pixel, I said pixel position. So
22 I'll rephrase the question and give you a

1 chance to answer.

2 On Page 32 of your declaration, are you
3 able to point to anything on Page 32 that
4 would indicate a center pixel position?

5 MR. VERBONCOEUR: Object to the form
6 of the question.

7 A With respect, I think you said center
8 pixel, not center pixel position, but maybe
9 I'm remembering wrong.

10 Page 32 is a figure from H.264, which
11 specifies integer sample positions shaded
12 with upper case letters and fractional sample
13 positions. That's what it represents. It's
14 a specific figure with a specific context.
15 It doesn't use the word "center pixel" in the
16 diagram of what I've shown here.

17 My recollection of H.264 is that section
18 doesn't use center pixel either or center
19 pixel position.

20 Q Earlier you described to me the
21 reference Karczewicz 2.

22 Do you recall that? It's in your

1 binder.

2 A Yeah. I think I was referring to
3 Exhibit 1006.

4 Q Correct. Does Exhibit 1006, Karczewicz
5 2, does it use the term "center pixel"?

6 A I'm not sure.

7 Q Let me ask you this. Let's go back
8 to -- let's go back to your third paragraph
9 here on Page 32 of your declaration.

10 Can you turn to that, please.

11 A Page 32 of my first declaration. Got
12 it.

13 Q Okay. Now, what would you describe to
14 be indicated by J?

15 A Uppercase or lower case?

16 Q Lowercase J.

17 A So lowercase J is on the following page,
18 is also an extract of H.264, is described as
19 a final prediction value. And is also
20 described on the same extract of H.264 as a
21 half sample position labeled as J.

22 I think both of those are consistent

1 with my recollection of the standard and
2 reasonable in this context.

3 Q On Page 32 of your declaration, J is an
4 average of two half pixel locations, correct?

5 A J is just a letter on Page 32. There's
6 some text on the following page from the
7 standard which talks about how J can be
8 calculated.

9 Q In the deposition, if I refer to the
10 pixel position indicated by lowercase J as
11 the center pixel position, will you
12 understand that I'm referring to the pixel
13 position indicated by lowercase J?

14 A I'm not comfortable with that because
15 this is a figure from the H.264 Standard.
16 I'm very familiar with the standard. It's
17 described as half sample position labeled as
18 J.

19 Q All right. The half sample position --

20 A Sorry. I'm not finished. It's
21 described as that in the standard. If you
22 start calling it something else, I might get

1 confused in my answers. So I'm not happy
2 with that.

3 Q If you want to call it --

4 A I'm not --

5 MR. VERBONCOEUR: Hang on a second.

6 Please let the witness finish his
7 answers before asking the next
8 question.

9 A So with respect, I'm not comfortable
10 with that way of referring to it, I would
11 find it confusing.

12 Q So you want to refer to J as the half
13 pixel position at location J?

14 A I'm not comfortable with that either.

15 Q Okay. How would you refer to the pixel
16 location J on Page 32?

17 A With respect to Page 32 and Figure 8.4
18 or 8-4 from the H.264 Standard, I would or
19 would be comfortable referring to J today as
20 a half sample position labeled as J.

21 Q Okay. So H.264 includes fractional
22 pixel positions, correct?

1 A What do you mean by that question?

2 Q H.264 allows fractional pixel positions,
3 correct?

4 A In what context? In what aspect of
5 H.264?

6 Q Well, they're discussed in the standard,
7 right?

8 A So there's an interpolation process in
9 H.264 discussed that includes the generation
10 of fractional sample positions.

11 Q And those fractional sample positions
12 would include the positions indicated or
13 shown on Page 32 of your declaration,
14 correct?

15 A So interpolated fractional sample
16 positions for luma interpolation in H.264
17 include the positions illustrated on that
18 page of my first declaration.

19 Q Page 32, correct?

20 A Yes.

21 Q What is bi-prediction?

22 A In what context?

1 Q In the context of video encoding, what
2 is bi-prediction generally?

3 A So, generally, the term "bi-prediction"
4 I've heard it used a lot, and I've used it
5 myself, to describe constructing a prediction
6 from -- to reference areas or reference
7 blocks.

8 Q Does bi-prediction involve two motion
9 vectors?

10 A It can be.

11 Q In H.264, does bi-prediction involve two
12 motion vectors?

13 A So I think I talk about this. So I talk
14 in the general about the bi-prediction at,
15 for example, my first declaration around
16 Paragraph 62. My recollection is I also talk
17 about some of the specifics of, you know,
18 specific types of the bi-prediction, such as,
19 I think explicit and implicit, I forgot the
20 exact terminology I use. Yeah, it's a
21 long-winded answer.

22 My recollection is H.264 supports

1 bi-prediction where two motion vectors are
2 sent for a particular block. My recollection
3 is that it also supports bi-prediction where
4 no motion vectors are sent for a particular
5 block.

6 Q Does the H.264 support bi-prediction to
7 where the motion vectors point to fractional
8 sample positions?

9 A My recollection is yes, it does in
10 respect, you know, in the situation where
11 motion vectors are actually transmitted for a
12 block.

13 Q Does H.264 support each motion vector
14 pointing to a different fractional pixel
15 position?

16 MR. VERBONCOEUR: I'll object to the
17 form of the question.

18 A Okay. So my recollection is that H.264
19 supports bi-prediction of a block, in which
20 two motion vectors can be transmitted for
21 that block. Each motion vector can -- each
22 of those two motion vectors can point to a

1 reference area in two different reference
2 frames. And those vectors can be constructed
3 independently of each other by an encoder, if
4 the encoder choses to do that. And each of
5 those vectors could point to an integer or
6 fractional sample position in the respective
7 reference picture.

8 Q So, for example, in H.264, when you have
9 bi-prediction, how are the two -- scratch
10 that. Let me rephrase.

11 Does H.264 bi-prediction average two
12 predictions together?

13 A Okay. Now we need to get into the
14 standard, if you want me to sort of go
15 through an answer to that question.

16 Q Do you recall in H.264 if there's a
17 default case of averaging two predictions
18 together that are based on two reference
19 areas?

20 A I don't recall that wording in H.264
21 default case, with respect to bi-prediction,
22 if it's there, I just don't remember.

1 Q Is that consistent with how you
2 understand H.264 to work?

3 A I understand H.264 bi-prediction, I've
4 analyzed it. I've been through, if you like,
5 that section of the specification, many
6 times. My recollection's quite a large and
7 complex part of the specification. I don't
8 recall whether I've described any aspect of
9 it as a default case, but I think -- you
10 know, I think you're asking me about
11 standard?

12 Q Well, maybe we can shortcut it. If we
13 can turn to Exhibit 1012, and you turn to the
14 stamped page at the bottom, 0195. Let me
15 know when you get there.

16 Well, actually, let's go to 194.

17 If you could review, on Page 194, the
18 section starting 6.4.5.2, and let me know
19 when you're ready for questions.

20 A Okay.

21 Okay.

22 Q Does the section including the diagram

1 and the text on Page 194, Section 6.4.5.2 of
2 Exhibit 1012, does it accurately reflect a
3 depiction of bi-prediction?

4 A It is a depiction of bi-prediction.

5 Q If you look at the next page, 195, if
6 you see the Section 6.4.5.3, "Weighted
7 Prediction."

8 Do you see that?

9 A Yes.

10 Q If you could read the text on Page 195
11 for the section titled "Weighted Prediction,"
12 and let me know when you're ready for
13 questions.

14 A Okay.

15 Q Does the Section 6.4.5.3 in
16 Exhibit 1012, accurately reflect the types of
17 weighted predictions in H.264?

18 A I think it's a reasonable summary. It
19 doesn't let H.264, as I recall, takes a
20 number of pages to define and specify
21 weighted predictions. So this section of my
22 book, if this is accurate, doesn't define

1 weighted prediction in H.264. It's -- it
2 was, when I wrote it, if I wrote the
3 description in my 2010 book, as I recall, I
4 intended to provide a reasonable summary of
5 some aspects of H.264, but it's not a
6 complete reflection of what's -- the
7 standard, which I think goes to many pages.

8 Q Have you seen anything on Pages 194 or
9 195 that you believe are inaccurate?

10 A As a high-level summary of a pretty
11 complex part of the H.264, I don't see
12 anything that's inaccurate as a summary.

13 Q Okay. If we turn back a few pages to
14 Page 184, let me know when you get there.

15 A Okay.

16 Q Actually, if we could go back one page
17 to 183, and you see there's a Section 6.4.1,
18 "Reference Pictures."

19 Do you see that?

20 A Okay.

21 Q Okay. If you could review this
22 Section 6.4.1 on Pages 183 and 184, and let

1 me know if you have questions, or let me know
2 when you're ready for questions.

3 A Okay.

4 Go ahead.

5 Q Okay. Did you see anything in your
6 review of Pages 183 and 184 that you viewed
7 to be inaccurate?

8 A "Inaccurate" with respect to what?

9 Q With description of how reference
10 pictures are used for video encoding.

11 A Well, this is a description of how
12 reference pictures -- a summary of how
13 certain aspects of how reference pictures are
14 used in -- or described in the H.264
15 Standard. So I think it's a reasonable
16 high-level summary, but it's certainly not
17 complete, with respect to the standard.

18 And the terminology is my terminology,
19 not necessarily the specific terminology of
20 the standard. But I don't see anything
21 that's inaccurate as a high-level summary.

22 Q So if we could turn back to your

1 declaration, and back to Page 32, there's
2 this diagram about H.264.

3 Let me know when you get there.

4 A Okay. I'm looking at Page 32 of my
5 first declaration.

6 Q In H.264, how would the Pixel Position B
7 be interpolated -- let me rephrase the
8 question.

9 How does H.264 calculate the pixel value
10 for Pixel Position B, as shown on Page 32 of
11 your declaration?

12 A Okay. H.264 doesn't calculate anything.
13 It's a document. And B, there's no Pixel
14 Position B shown on this page.

15 Q Pixel Position B on Page 32?

16 A I think I've explained at some length
17 this shows integer and fractional sample
18 positions, not necessarily pixel positions.

19 Q Okay. So how does the H.264 Standard
20 calculate the fractional sample position
21 shown as lowercase B on Page 32 of your
22 declaration?

1 A Okay. The H.264 Standard doesn't
2 calculate anything. It's a document written
3 on paper.

4 Q How does the H.264 Standard instruct one
5 to calculate fractional sample position,
6 lowercase B on Page 32 of your declaration?

7 A It specifies across several pages how to
8 do exactly that. And this is an extract from
9 that specification shown on Page 33 of my
10 declaration, but my recollection is not the
11 whole thing.

12 So to answer your question, I would need
13 the standard in front of me and then I can
14 step you through it.

15 Q So without the standard in front of you,
16 are you able to provide any explanation for
17 how the sample position B, lowercase B, on
18 Page 32 would be calculated?

19 A By what?

20 Q Well, let me ask you: In the context of
21 H.264, can you give me any explanation of how
22 the sample position, lowercase B, would be

1 calculated?

2 A By what? I'm now confused. Are you
3 asking me about the standard, or about a
4 device, or something else?

5 Q I'm asking you about the standard.

6 If you are operating in accordance with
7 the standard, how do you calculate lowercase
8 "b" for -- on Page 32?

9 A Okay. If a decoder is operating in
10 accordance with or conforming to the H.264
11 Standard, then the decoder has to go through
12 a decoding process that has to produce the
13 same result as the decoding process specified
14 in the H.264 Standard. That's how a decoder
15 gets to fractional sample position B, it
16 follows a process that produces the same
17 result as the process that's specified in the
18 standard. That's how it works, that's what
19 the standard says.

20 Q How does the process that's specified in
21 the H.264 Standard calculate lowercase B on
22 Page 32 of your declaration?

1 A The standard tells a decoder or the
2 developer of a decoder exactly how that
3 process works.

4 Q Right. And how does the process work?

5 A The standard tells you.

6 Q Are you able to describe it at all?

7 A Yes. I can describe it as it's three or
8 four pages of standard, it's text. I don't
9 have the text in front of me. I think I've
10 said that about, you know, however many times
11 already.

12 Q So without the text in front of you, are
13 you able to provide even just a high-level
14 explanation of how the process that's
15 specified in the H.264 Standard calculates
16 lowercase B?

17 MR. VERBONCOEUR: I'll object to the
18 form of the question.

19 A I could, but, you know, if you -- I
20 could, for example, refer you to the extract
21 on Page 33 of my first declaration, which
22 states the samples -- and it's partial, so I

1 don't have the piece immediately before it,
2 but it states here, the samples of half
3 sample position is labeled B. And I think,
4 although, I don't have it in front of me, my
5 recollection is that's referring to
6 Figure 8.4 of the H.264 Standard.

7 And then it says how these samples are
8 derived, and then it gives a number of steps
9 that specify the derivation of half sample
10 positions labeled B, ending up with equation
11 8-245.

12 Q Would you agree that the H.264 Standard
13 uses interpolation?

14 A The H.264 Standard specifies, as part of
15 its specification, the interpolation of luma
16 samples and chroma samples at fractional
17 sample position. But that's a form of
18 interpolation or -- yeah.

19 Q Would you agree the H.264 Standard
20 specifies the interpolation of samples to
21 calculate the fractional sample position B on
22 Page 32?

1 A I'm not sure I would use those exact
2 words. The standard is deliberately,
3 logically clear, for example, of the partial
4 extract shown on my Page 33 of my first
5 declaration, describes a process that derives
6 or calculates fractional sample positions
7 with an input of integer sample positions.
8 And I think the text starts before this and
9 goes beyond this standard. I don't know if
10 that answers your question or not.

11 Q Would you consider -- on Page 32, you
12 see in values lowercase A, B, C, D, E, F, G,
13 all the way through Q.

14 Do you see that?

15 A Yes.

16 Q Would your consider those to be
17 sub-pixel interpolated values?

18 A It's just a diagram.

19 Q It wouldn't make sense for you to refer
20 to lowercase letters A through R as sub-pixel
21 interpolated values?

22 MR. VERBONCOEUR: Object to the form

1 of the question.

2 A I didn't say it wouldn't make sense, but
3 this is a diagram with description. I think
4 we've been around, you know, discussed
5 already that the description is -- describes
6 the positions labeled A through R as
7 fractional sample positions. That's
8 different from what you just said.

9 Q So you wouldn't call lowercase A through
10 R on Page 32, sub-pixel interpolated values.

11 A I didn't say that.

12 Q Okay. So we can just call values A
13 through R sub-pixel interpolated values; that
14 would be fair, right?

15 A We could. But if we're referring to
16 Figure 8-4 of the H.264 Standard and
17 discussing the standard itself, I would find
18 it more convenient, or less confusing, in our
19 discussions to use the terminology of this
20 figure.

21 Q Okay. So it would be confusing to you
22 if we referred to values A through R on

1 Page 32 of your declaration as sub-pixel
2 interpolated values?

3 MR. VERBONCOEUR: Object to the form
4 of the question.

5 A I did not say that. So, no, I disagree
6 with that.

7 MR. VERBONCOEUR: I can take a break
8 when it's convenient, in the near
9 future.

10 MR. LIANG: Let me just finish this
11 line of questions real quick.

12 Q Circling back around, it sounds like, in
13 fact, it does make sense to call lowercase A
14 through R on Page 32 of your declaration,
15 sub-pixel interpolated values?

16 A What do you mean "makes sense"? I
17 didn't use those words.

18 MR. LIANG: All right. We can take a
19 break.

20 MR. VERBONCOEUR: And lunch is here.
21 So partially my motivation for asking
22 for the break.

1 (Whereupon, a recess was taken
2 from 11:46 AM until 12:31 PM.)

3 Q Dr. Richardson, did you speak with your
4 counsel at all during the break we just had?

5 A Not about this.

6 Q Nothing about this IPR proceeding at
7 all?

8 A No.

9 Q Okay. So I'd like you turn to, I
10 believe you have in your binder, I can give
11 you a copy as well, but Exhibit 1006, which I
12 believe we are referring to as Karczewicz 2,
13 correct?

14 (Whereupon, Karczewicz 2 was
15 previously marked as Exhibit
16 1006.)

17 Q Okay. If we can turn to Figure 4B.

18 A Okay.

19 Q Would you agree that, okay, pixel
20 lowercase B here, do you see the pixel
21 lowercase B in Figure 4B?

22 A Yes, I do.

1 Q Would you agree pixel lowercase B refers
2 to a half pixel position?

3 A So Paragraph 70 of this reference,
4 that's Exhibit 1006, describes B as I think a
5 half pixel interpolation of a pixel location.
6 It says half pixel interpolations of pixel
7 locations B and H. I'm not quite sure
8 whether the author -- yeah, pixel location B,
9 so they described it as pixel location B in
10 the context of Figure 4B.

11 Q Right. So lowercase B in Figure 4B is a
12 half pixel location; is that fair?

13 A The author of this exhibit describe it
14 to, as an interpolated value of a pixel
15 location or a pixel location B, so yeah, I
16 think I'm happy with the way the author --
17 the author described it the way they wanted
18 to describe it.

19 Q And lowercase H in Figure 4B, would also
20 be a half pixel position, correct?

21 A It's described in a similar way as
22 Paragraph 70 of this exhibit. Half pixel

1 interpolation of pixel location H.

2 Q So B and H in Figure 4B are half pixel
3 interpolations of pixel locations, correct?

4 A That's the way the authors of this
5 document describe it, which is slightly
6 different example from the way the authors of
7 the H.264 Standard describe that figure.

8 Q Now, if you could turn to Paragraph 93
9 of Karczewicz 2, this Exhibit 1006?

10 A Okay.

11 Q What does Paragraph 93 describe?

12 A He's talking about sub-pixel motion
13 vectors. It's talking about what the authors
14 describe as an interpolation process for
15 sub-pixels, they're describing this in the
16 context of H.264 as I understand it. And
17 then there's the beginnings of a description
18 of calculating what the authors of this
19 exhibit describe as sub-pixels B and H.

20 Q Would you agree that K2 provides a
21 method for calculating the interpolation
22 process for sub-pixels B and H?

1 A So Paragraphs 93 and 94 of K2 that's
2 Exhibit 1006.

3 I think they're intended to summarize
4 the H.264 interpolation process for what
5 these authors describe as sub-pixels B and H,
6 which I think they're talking about H.264
7 describes in Figure 8.4 we talked about
8 earlier as fractional sample positions B and
9 H, and my understanding is these two
10 Paragraphs 93 and 94 of Exhibit 1006 are
11 summarizing that H.264 process, which is a
12 process for interpolating to obtain values
13 lowercase B and lowercase H.

14 Q In Karczewicz 2, the interpolation
15 method for calculating B and H is described
16 in Paragraphs 93 and 94, correct?

17 A I think there are other -- that is a
18 process for calculating what Karczewicz
19 describes as sub-pixel positions or sub-pixel
20 locations B and H. My recollection is that
21 there are other descriptions in Karczewicz
22 that also refer to sub-pixel or sub sample or

1 fractional sample values B and H and the
2 calculations of these.

3 Q Can you point me to another location in
4 Exhibit 1006 where Karczewicz 2 provides a
5 method for interpolating sub-pixels B or H?

6 A Paragraph 103 of this exhibit,
7 Exhibit 1006, around half way down the
8 paragraph there's a sentence in the
9 interpolation of B and H, lowercase B and
10 lowercase H, may be the same if not defined
11 above. So I think it's actually saying, I'm
12 paraphrasing, use that same process in
13 Paragraphs 93 and 94, but it's a reference,
14 yeah, so I might have said there's a
15 reference there to interpolation B and H, but
16 it seems to be talking about the same process
17 when it says above.

18 Q If you go back to Paragraph 93, do you
19 see there's an equation for B1?

20 A I do, yes.

21 Q If B1 is the equation Karczewicz 2 uses
22 for calculating sub-pixel B, when a motion

1 vector points to a location that falls in
2 between two integer pixels horizontally?

3 A It's an equation, it's not the -- at
4 least the second part of that process, which
5 is in Paragraph 94, which involves taking B1
6 and then doing something further to it to
7 generate B.

8 Q Karczewicz 2 only discloses one equation
9 for calculating B1, right?

10 A I'm not sure.

11 Q Are you able to point to any other
12 equations in Karczewicz 2 for calculating B1?

13 A Yeah, I'm looking quickly and I can't
14 see another equation. Maybe there is one,
15 but I don't see one.

16 Yeah, so far I've just seen the one
17 equation for the B1 in Paragraph 93 of
18 Karczewicz 2.

19 Q Karczewicz 2 only discloses one equation
20 for calculating H1, correct?

21 A Similar answer, there's an equation in
22 Paragraph 93 of Karczewicz 2, which discloses

1 calculating an intermediate value H1. I
2 don't recall whether there's another equation
3 for H1 and I don't see one looking through
4 just now.

5 Q We can go back to Figure 4B.

6 A Figure 4B, okay, yeah, got it.

7 Q Do you see how there's also a lowercase
8 BB box, lowercase double B box?

9 A Oh, yes, I do. In Figure 4B of
10 Karczewicz 2, yeah.

11 Q Would you agree that lowercase BB is
12 also a half pixel interpolation of pixel
13 locations?

14 A I see it referred in text Paragraph 95
15 as a position, BB. I think given the way 4B
16 is laid out and describes, I think BB would
17 be -- yeah, I think that would be consistent
18 with Karczewicz and her coauthors description
19 of what she calls sub-pixel B in Figure 4B.
20 so BB is a corresponding value in between
21 integer pixel positions or sample positions
22 B3 and B4, but B3 is uppercase, B4 is

1 lowercase.

2 Q Did you review Dr. Freedman's
3 declaration?

4 A Yes. Sorry, declaration, yes I did,
5 yes.

6 Q In the IPR, yeah?

7 A Yeah, in the IPR.

8 Q Is it in front of you?

9 A I don't think it is. Let me just check.

10 Q In any case, I'm handing it to you.

11 What I'm handing is Exhibit 1003,

12 Dr. Freedman's declaration.

13 Have you ever seen this document before?

14 (Whereupon, Dr. Freedman's
15 Declaration was previously
16 marked as Exhibit 1003.)

17 A Yes. I believe so, yes.

18 Q So I'd like you to turn to
19 Paragraph 151.

20 A Okay.

21 Q Do you see that there's a scenario one?

22 A Yes, I do, yes.

1 Q And Dr. Freedman discussed three
2 scenarios in his declaration, right, you
3 recall that?

4 A I do and I think I talk about it
5 starting at Paragraph 141 of my second
6 declaration, I talk about Dr. Freedman's
7 three distinct scenarios.

8 Q Okay. In scenario one, the first motion
9 vector points to a half pixel position and
10 second motion vector points to an integer
11 pixel position, correct?

12 A That's the way Dr. Freedman seems to
13 describe it in his Paragraph 151.

14 Q And that's the scenario that you analyze
15 for providing opinion in this IPR, correct?

16 A I certainly provide some analysis of
17 that, for example, in Paragraph 141 of my
18 second declaration onwards.

19 Q Okay. Then if you look at scenario two
20 on Paragraph 157 of Dr. Freedman's
21 declaration. Scenario two, in scenario two
22 the first motion vector points to a second

1 pixel position and the second motion vector
2 points to a half pixel position.

3 Do you see that?

4 A I see that in Dr. Friedman's
5 declaration.

6 Q Did you understand the scenario that
7 Dr. Freedman was describing in Paragraph 157?

8 A My recollection is that I did in the
9 context of Dr. Freedman's declaration. I'm
10 just, yeah, I don't recall precisely whether
11 he used this word center pixel position
12 earlier, but my recollection is that in the
13 context I understood it.

14 Q Okay. And you see in Paragraph 157 he
15 does use the word center pixel position?

16 A He uses that the term, yes.

17 Q Did you understand what he meant by
18 center pixel position?

19 A In the context of his declaration, my
20 recollection is I did understand it, yes.

21 Q If we look at the Karczewicz Figure 4B,
22 Karczewicz 2 Figure 4B let me know when you

1 get there?

2 A Yes.

3 Q Looking at Karczewicz Exhibit 4B, that's
4 the Exhibit 1006, what is your understanding
5 of what Dr. Freedman meant by a center pixel
6 position?

7 A Well, for example, Dr. Freedman at
8 Paragraph 158 describes the center pixel
9 value e.g. lowercase J and he's referring to
10 Karczewicz 4D, Figure 4D, of Exhibit 1006.
11 So he's saying lowercase J, I'm paraphrasing,
12 lowercase J in Figure 4B is what he's
13 describing as the center pixel. That's my
14 understanding. He's saying -- I don't think
15 it's Karczewicz's terminology, not that I
16 remember anyway. But he's using the
17 terminology center pixel as a shorthand for
18 fractional pixel position J in Karczewicz 4B,
19 that's what I understand.

20 Q If you turn to the next page,
21 Paragraph 163, you see there's a description
22 of scenario three?

1 A I see that, yes.

2 Q Would you agree that all three of the
3 scenarios described by Dr. Freedman involve a
4 half pixel prediction location?

5 A A half pixel prediction location, what
6 do you mean by that?

7 Q Well, they all involve predictions with
8 half pixel locations, correct?

9 A Scenario three I'm looking at the moment
10 describes motion vectors pointed to half
11 pixel locations or half pixel positions. I
12 don't see the word prediction there.

13 Q In your understanding, scenario three
14 does not involve motion prediction?

15 MR. VERBONCOEUR: Object to the form
16 of the question.

17 A That's not what I said. I'm not sure
18 what you're asking me now.

19 Q That was my previous question.

20 So my question was: Do you agree that
21 all three scenarios described by Dr. Freedman
22 include motion vectors pointing to half pixel

1 positions?

2 A That seems to be a different question.

3 Q Can you answer the question?

4 A Okay. So scenario three proposed by
5 Dr. Freedman talks about, as he put it, both
6 motion vectors pointed to half pixel
7 positions, so he's talking about half pixel
8 positions there. Scenario two, talks about a
9 second motion vector pointing to a half pixel
10 position according to Dr. Freedman. Scenario
11 one, talks about the first motion vector
12 pointing to a half pixel position; so in all
13 three of his scenarios that Dr. Freedman
14 proposes at least one of the motion vectors
15 points to, as he puts it, a half pixel
16 position.

17 Q Now, all three of these scenarios
18 described by Dr. Freedman, would involve a
19 half pixel interpolation of either pixel
20 location B or H, correct?

21 A Could you just ask the question one more
22 time?

1 Q All three of the scenarios described by
2 Dr. Freedman, would involve a half pixel
3 interpolation of either pixel location B or
4 pixel location H, correct?

5 A Not necessarily. If we're talking about
6 lowercase B, lowercase H as in Karczewicz
7 Figure 4s, which refer you to half sample
8 positions with those labels, so not
9 necessarily.

10 Q Okay. What situations would a scenario
11 involve -- or strike that.

12 In what situation would one of these
13 scenarios not involve half pixel
14 interpolation of B or H, lowercase B or H?

15 A Well, as I understand it, Dr. Freedman
16 describes his scenario one as the first
17 motion vector pointed to a half pixel
18 position, but he doesn't limit that as I
19 understand it to B and H, so for example,
20 using Karczewicz Figure 4D, there's a
21 position lowercase J that's, that has a half
22 pixel horizontal and vertical component. So

1 I think that's consistent with the half pixel
2 position in his terminology. I think we're
3 all using slightly different terminology here
4 trying to keep it straight, so in terms of
5 his terminology -- yeah, sorry, just to --
6 and again, Dr. Freedman uses the term center
7 pixel position in Paragraph 146, for example.
8 But he does describe that as a half pixel
9 position. So I think that's all consistent.
10 And this is his terminology not my
11 terminology, so I apologize to Dr. Freedman
12 if I'm misunderstanding him, but...

13 Q Following Dr. Freedman's terminology,
14 would you agree that all three of his
15 scenarios described by Dr. Freedman involve a
16 half pixel prediction?

17 A So I don't think he ever gets a half
18 pixel prediction, but he certainly talks
19 about a half pixel position in each scenario.
20 His prediction and maybe this is part of my
21 confusion, for example, 156 he does talk
22 about a prediction as a result of scenario

1 one, but that prediction equation in
2 Paragraph 156 that's not in Karczewicz 1
3 that's not in Karczewicz 2, so that doesn't
4 seem to be in his combination.

5 Q Let me ask it a different way, following
6 Dr. Freedman's terminology, would you agree
7 that all three of the scenarios described by
8 Dr. Freedman involve interpolation for a half
9 pixel position?

10 A If I understand his scenarios, and I'm
11 not sure I completely understand them, for at
12 least the reason I just discussed, he
13 certainly talks about in Paragraph 152, I
14 think he's talking about his scenario one.
15 And he's talking about Karczewicz 2 using a
16 calculation to interpolate, I know that's a
17 quarter pixel position. So that's something
18 else.

19 I actually don't know if he gets to the
20 half pixel interpolation in scenario one.
21 It's kind of confusing the way it's set out.
22 For example, the equations, I pointed you to,

1 the pred equation, which are not in either
2 reference. Is he actually outputting a half
3 pixel interpolation position, I'm not sure.

4 He starts with a motion vector pointing
5 to half pixel position. The second motion
6 vector pointing to an integer pixel position.
7 That's Freedman's declaration of 151. And he
8 talks in Paragraph 156 about keeping a half
9 pixel prediction at a higher non-rounded
10 position. I'm just quoting Dr. Freedman
11 here.

12 Then he says, "This combination results
13 in the following equation," then he gives an
14 equation which isn't in either reference.
15 I'm not actually sure if he generates a half
16 pixel, half sample position or a half pixel
17 position. Maybe I'm missing something.

18 Q Does Karczewicz 2 provide a teaching in
19 the context of H.264?

20 A I guess H.264 is part of the context of
21 Karczewicz. If by that, you mean the
22 background and the technical field, H.264 is

1 mentioned in the background as are other
2 standards. I think Karczewicz was filed
3 on -- in May 2008. And by that time H.264
4 was certainly available.

5 And my recollection is that Karczewicz
6 give -- the authors give their own summary or
7 description of things that happened in the
8 H.264 Standard. It's not necessarily the way
9 I would describe things, but, you know, it's
10 their -- I guess their attempt to summarize
11 what happens in H.264.

12 So certainly -- it's certainly relevant,
13 if you like. It's part of it's -- H.264 is
14 discussed several times in Karczewicz 2.

15 Q If you could turn to Karczewicz 1, which
16 is Exhibit 1005.

17 A Yeah. Got it.

18 Q Would you agree that Karczewicz 1 also
19 provides its teachings in the context of
20 H.264?

21 A So I didn't use the words -- well, no,
22 sorry, I did, I did actually. So Karczewicz

1 2, in a similar way -- Karczewicz 1, sorry.

2 I'll start again.

3 Karczewicz 1, in a similar way to
4 Karczewicz 2, mentions the H.264 Standard in
5 the background, and I think in one or two
6 points or several points after that. So it's
7 certainly part of the context or the
8 background to the disclosure of Karczewicz 1.

9 Q Do you see on Paragraph 60 of Karczewicz
10 1, there's a default weighted prediction for
11 bi-prediction?

12 Do you see that?

13 A I see those words. I see default
14 weighted prediction. I see the sentence:

15 "Default weighted prediction may be
16 defined by the following equations for
17 unidirectional prediction and bidirectional
18 prediction."

19 Q And do you see for the equation for
20 bidirectional prediction, there's a value
21 (pred0) and a function of I and J.

22 Do you see that?

1 A Yes.

2 Q In Paragraph 60 of Karczewicz 1, that's
3 Exhibit 1005, how is (pred0) calculated?

4 A It doesn't actually say. It describes
5 pred0 as prediction data from list zero to
6 list one.

7 Q What --

8 A Sorry, just to finish. It doesn't say
9 how it's calculated from list zero to list
10 one.

11 Q Would a person of ordinary skill in the
12 art have been able to follow the teachings of
13 Karczewicz 1 and calculate (pred0)?

14 A I think a person of ordinary skill in
15 the art, reading Paragraph 60 of Karczewicz,
16 would probably read it in context as part of
17 a description that starts at Paragraph 55,
18 which is a summary -- Karczewicz authors a
19 summary of certain things that happen
20 according to the H.264 Standard.

21 So a person of ordinary skill picking up
22 Karczewicz would be able to follow or

1 understand or work through the connection
2 between what's being described in Karczewicz
3 1, Paragraph 60, and, for example, the H.264
4 Standard.

5 Q So with that in mind, how would a person
6 of ordinary in the skill in the art have
7 calculated (pred0)?

8 A They would probably look at the
9 standard, the H.264 Standard, and I'm
10 summarizing a lot, but the standard specifies
11 how a decoder can construct a prediction for
12 a pixel or sample within a block of pixels
13 and samples, and that would include the
14 calculation such as the -- calculating pred0,
15 calculating (pred1) as listed in Paragraph 60
16 of Karczewicz 1.

17 Q Now, if we could go back to Karczewicz
18 2, which is Exhibit 1006.

19 Let me know when you get there.

20 A Okay. Yep.

21 Q Would you agree that Karczewicz 2 is
22 directed to sub-pixel interpolation?

1 A So Karczewicz 2, Paragraph 2, this
2 disclosure relates to digital video coding,
3 and more particularly, fractional
4 interpolations of predictive data used in
5 video coding. And I think that's consistent
6 with Karczewicz 2 talking later on about half
7 pixel interpolation, quarter pixel
8 interpolation, and most likely talking about
9 sub-pixel interpolation. I think I'm pretty
10 sure that terminology is used later.

11 So, yeah, it's a long way of saying is
12 directed to fractional interpolation, which I
13 think would be consistent with sub-pixel
14 interpolation.

15 Q When applied to H.264, would the
16 fractional pixel calculation of Karczewicz 2
17 end up being carried out millions of times
18 per second?

19 A How would you apply them to H.264?

20 MR. VERBONCOEUR: I'll object to the
21 form of the question.

22 Q When you apply the teachings of

1 Karczewicz 2 to a decoder that implements its
2 process in accordance with the H.264
3 Standard, would the fractional pixel
4 calculations taught by Karczewicz 2 end up,
5 in most cases, getting carried out millions
6 of times per second?

7 MR. VERBONCOEUR: Object to the form
8 of the question.

9 A So my recollection is that Karczewicz 2
10 discloses calculations that are not --
11 certainly some calculations that are not in
12 accordance with the H.264 Standard.

13 So you're asking me to consider a
14 decoder that maybe, let's say, was designed
15 to implement H.264 decoding, and then,
16 subsequently, was modified according to
17 Karczewicz 2.

18 Q Correct.

19 A Okay. And what else do you want me to
20 consider about the decoder?

21 Q That's it.

22 A Okay. So if I remember your question, I

1 think the answer is not necessarily.

2 Q Okay. Why not?

3 A Well, I could implement an H.264 decoder
4 that goes very, very slowly, for example.

5 Q Um-hmm.

6 A I could decode, implement an H.264
7 decoder that decodes -- the first video code
8 that I ever implemented decoded one frame in
9 about 30 minutes.

10 Q And that first one was many decades ago,
11 right?

12 A It was a few decades ago, yeah.

13 Q Let's talk about the 2010 time frame.

14 A Okay.

15 Q And we're just talking about typical
16 decoders, not ones that are made
17 intentionally slow or something like that,
18 right?

19 A So with that in mind, the 2010 time
20 frame, there was still a massive range in
21 terms of decoders that I was familiar with,
22 that were capable of decoding H.264 bit

1 stream, so it's a massive range of
2 capabilities in terms of the rate of
3 decoding.

4 Q So in 2010 -- in 2010, the use of
5 Karczewicz 2's teachings would have resulted
6 in millions of calculations per second on
7 some decoders but not on others?

8 MR. VERBONCOEUR: Object to the form
9 of the question.

10 A I don't know the video resolution for
11 the frame rate we're discussing. So I can't
12 answer that without going to a specific or at
13 least a ballpark range of video resolution,
14 frame rate, decoder capabilities, whether
15 it's realtime or non-realtime, et cetera.

16 Q Okay. So you agree that -- but in 2010
17 there are some realtime decoders that
18 existed, right?

19 A So in 2010 there was certainly decoder
20 implementations capable of decoding at least
21 certain resolutions of video conforming to
22 H.264 and decoding in realtime, say, frame

1 rates of 25, 30 or more frames per second.

2 Q Were there some decoders in 2010 that
3 were not implemented to decode those same
4 frame rates in realtime?

5 A Yes.

6 Q Okay. And then --

7 A And, sorry, I have in mind like
8 resolutions up to, for example, high
9 definition video, just to give a ballpark.

10 Q Okay. Let's keep that in mind then,
11 resolutions up to high definition video.

12 For those resolutions, in the 2010 time
13 frame, realtime decoders using the teachings
14 of Karczewicz 2 would have ended up carrying
15 out Karczewicz 2 sub-pixel calculations
16 millions of times per second, correct?

17 A I'm not aware of any realtime decoder
18 from that time frame that implemented the
19 teachings of Karczewicz 2. I'm not saying
20 they didn't exist, but I'm not aware of any.

21 Q Right. So I'm asking you to consider if
22 a decoder had, in fact, implemented the

1 teachings of Karczewicz 2, would you know one
2 way or the other whether a decoder, in
3 the 2010 time frame, for resolutions up to,
4 say, 1080P would have ended up calculating
5 Karczewicz 2's sub-pixel calculations
6 millions of times per second?

7 A I don't know if such a decoder existed.
8 If a decoder implementing Karczewicz 2
9 existed, and I think at least one probably
10 did exist, but it wasn't necessarily a
11 realtime decoder, if such a decoder existed,
12 I could work it out. But I'd need to be able
13 to measure the decoder performance or know
14 the decoder performance with the proposed
15 non-H.264 aspects of Karczewicz 2
16 implemented. So I need to know what the
17 decoder was.

18 Q What aspects of the decoder would you
19 need to know to make the calculation?

20 A How many macro blocks is it processing
21 per second.

22 Q That's it?

1 A I'd need to know whether or not it was
2 actually implementing these calculations --
3 applying these calculations.

4 So, for example, if you gave me such a
5 decoder as a piece of software or hardware as
6 a way to interface to it, I could -- I'm
7 speculating a little bit, but I could
8 probably feed in a video, an H.264 -- it's
9 not an H.264 sequence, though, is it?

10 Okay. I need a decoder, I also need an
11 encode video sequence with these
12 modifications in place during encoding, I
13 think, or do I?

14 Yeah. There's probably a few variables
15 I'd have to consider.

16 Q Would you have to actually run the test
17 to figure it out or could you just ballpark
18 it?

19 A If I had enough performance data, then I
20 could -- and I knew that -- and I was
21 confident in the source of the data, I could
22 probably give a ballpark estimate, but I

1 would need to know the -- for example, the
2 interpolation calculations disclosed in
3 Karczewicz 2 were actually being carried out.

4 So if I had like enough data and enough
5 confidence and enough information about how
6 the data was generated, speed measurements or
7 whatever, throughput measurements, then I
8 could give you a ballpark answer, yes.

9 Q So, obviously, sitting here today, we're
10 not going to run tests or create
11 measurements. So without those tests or
12 measurements, would you be able to give me
13 any kind of ballpark analysis of whether
14 Karczewicz 2's sub-pixel calculations would
15 end up getting carried out millions of times
16 a second?

17 A I just -- I just don't know if such a
18 decoder actually ever existed. So Karczewicz
19 2 if -- let me see if I got this right way
20 round.

21 Yeah. I write something that's
22 relevant, I think, to these questions. Let

1 me just find it.

2 Yeah. Paragraph 136 of my second
3 declaration. Karczewicz 2 and the disclosure
4 of the aspects of Karczewicz 2 that are not
5 in H.264, my recollection is that disclosure
6 is also in a standards documents, VCEG-AI33.
7 And I have read that document, but I don't
8 recall it, as I sit here, but to the extent
9 that described tests carried out with the
10 reference software, then that would be
11 Karczewicz and her coauthors describing an
12 implementation, but the reference software is
13 not realtime. It's not fast. It wasn't fast
14 at the time.

15 So that's going to be like the only base
16 point that I can think of at the moment. If
17 somebody had implemented a realtime version,
18 then I don't know what that is, and I don't
19 know how fast it's running. So it's a lot of
20 hypotheticals here.

21 Q Right. And you know that I'm asking a
22 hypothetical question, if somebody had

1 implemented Karczewicz 2, I'm not asking
2 whether someone actually did it, right.

3 I'm just asking you do you understand
4 this question. For the purpose of this
5 hypothetical, do you understand the question
6 that I'm asking is to assume that somebody
7 had implemented Karczewicz 2, and then I'm
8 going to ask you some questions about that.

9 A Okay. If, for example, you're asking me
10 to assume that somebody had implemented
11 Karczewicz 2, and had managed to successfully
12 make it run at -- managed to successfully
13 implement it in a video decoder with decoded
14 30 frames per second at high definition
15 resolution, then, you know, I can assume all
16 of that. I don't know that occurred, but I
17 could answer a hypothetical like that, if
18 that's helpful.

19 Q So let's assume all of that, right?

20 A Okay.

21 Q So in that hypothetical decoder that's
22 been implemented, to decode high resolution

1 at 30 frames per second, following the
2 teachings that are described in Karczewicz 2,
3 would you agree that the sub-pixel
4 calculations taught by Karczewicz 2 would end
5 up getting carried out millions of times per
6 second?

7 A And one further assumption is that the
8 video that's being processed is actually
9 being decoded using the sub-pixel positions,
10 you know, motion vector point to the
11 sub-pixel positions articulated in Karczewicz
12 2.

13 Assuming all of that, then calculations
14 such as the set of calculations outlined in
15 Table 5 of Karczewicz 2, Table 6 of
16 Karczewicz 2, Table 7 of Karczewicz 2, would,
17 I think, be implemented, I think it would be
18 millions of times per second, yes.

19 Q Was Marta Karczewicz a highly regarded
20 person in the field of video encoding?

21 A Did you say "is" or "was"?

22 Q Is, is.

1 A Yes. She's still alive, I hope. Yes,
2 yes. Indeed.

3 Q Why?

4 A So I summarize this in Paragraph 135. I
5 don't want to read my summary. Going back
6 before the development of H.264. I know
7 because I kept track of standards
8 contributions that Marta Karczewicz made many
9 contributions to -- was a coauthor of many
10 such contributions around the time of H.264
11 development, also around the time H.265 HEVC
12 development. I'm aware that she's been a
13 recipient of an award from the European
14 Patent Office, as I state in my Paragraph 135
15 of my second declaration.

16 My recollection is that she chaired or
17 cochaired at least ad hoc groups of the H.264
18 and H.265 development efforts. I'm aware
19 that she attends and contributes to MPEG
20 meetings. And I'm aware that she's, as I
21 understand it, currently a vice president of
22 technology at Qualcomm and her

1 responsibilities, as far as I'm aware, relate
2 very closely to video coding.

3 So yeah, put all of that together, and
4 I've been familiar with her work for many
5 years. Would regard her as having made a
6 significant contribution to the field.

7 Q Would a POSITA have known about Marta
8 Karczewicz's patents?

9 A At which time?

10 Q In the 2010 to 2011 time frame, would a
11 POSITA have known about Marta Karczewicz's
12 patents?

13 A I don't know that they would necessarily
14 have come across her patents. If they were
15 working reasonably closely with video coding
16 standards, for example, H.264, which was very
17 well-known at the time, and if they read one
18 of my books on H.264, they would see -- I
19 think pretty sure citations to at least
20 papers and contributions by Marta Karczewicz.

21 I couldn't say whether or not they'd be
22 familiar with the patents. They might be

1 familiar with the technical papers and
2 standards contributions authored by
3 Dr. Karczewicz.

4 Q For the opinions you provided in this
5 case, did you envision the POSITA having
6 knowledge of Marta Karczewicz's patents?

7 A I'm not a patent lawyer, but I don't
8 think that's the standard, as I necessarily
9 recall.

10 So I talk about my understanding of a
11 person of ordinary skill in the art around
12 Paragraphs 41 and 42 of my second
13 declaration.

14 I don't recall the statement that you
15 just put to me as part of any assumptions or
16 bases for my opinions.

17 Q Now, let's look Exhibit 1006. That's
18 Karczewicz 2, right?

19 A Okay.

20 Q Would a POSITA have known about
21 Karczewicz 2?

22 A What do you mean "known about"?

1 Q Let me ask a different question. Given
2 Marta Karczewicz's stature in the field of
3 video encoding, would a POSITA have been
4 motivated to apply the teachings of
5 Karczewicz 2?

6 A To what?

7 Q So video decoders.

8 A Not necessarily.

9 Q Why not?

10 A So a POSITA, as I think -- as I set out
11 in my -- Paragraph 41 of my second
12 declaration, they'd have a bachelor degree in
13 a relevant field, familiarity with the
14 relevant video coding standards, at least
15 two years of work experience in matters
16 relating to video coding hardware and/or
17 software. But Karczewicz 2 proposes
18 something that's not in the H.264 Standard,
19 and that was maybe the dominant standard by
20 about 2010.

21 So put it another way, I could imagine
22 somebody who satisfied all the requirements

1 of a POSITA, maybe even somebody familiar
2 with implementing standards in hardware or
3 software who doesn't have a need to improve
4 upon the standard and to do something that's
5 not in the standard at the time.

6 Q So if we think about the other way, can
7 you think of -- can you imagine somebody who
8 is a POSITA that might read Karczewicz 2 and
9 think, "I really like Marta Karczewicz. I
10 respect her. And so I want to use what she
11 is saying and apply the teachings of
12 Karczewicz 2"?

13 A So if, for example, a person of ordinary
14 skill wanted to, in the scenario you just
15 described, try and implement Karczewicz 2, I
16 think they could at least attempt to do that,
17 based on the disclosure. I haven't tried it
18 myself, so I don't know whether there are any
19 kind of uncertainties in the disclosure.

20 But it does describe for example in --
21 yeah, some of the paragraphs we've been
22 discussing, how to generate interpolated

1 pixel positions in the way the authors of
2 Karczewicz 2 intended, which is different
3 from the way H.264 does it. So one could --
4 I could imagine somebody trying to implement
5 these in software or hardware, if that's what
6 you're asking.

7 Q And given your respect for Marta
8 Karczewicz, you would except that, in fact,
9 the teachings of Karczewicz 2 are functional,
10 that they work as she describes them?

11 MR. VERBONCOEUR: Object to the form
12 of the question.

13 A Could I just ask for clarification, does
14 "functional" have a specific meaning in this
15 sort of context?

16 Q Do the teachings work as she describes
17 them, that somebody could take them and use
18 them?

19 A I honestly don't know if there is enough
20 information in this patent application itself
21 to successfully implement the teachings.
22 It's not a standards document. There are

1 fairly expensive tables of showing certain
2 register operations, if I recall correctly.
3 Whether that's enough information, I'm just
4 not sure.

5 Q Do you believe a POSITA would have been
6 able to make and use the teachings of
7 Karczewicz 2?

8 A Based on what?

9 Q Just reading Karczewicz 2.

10 A They'd probably have to have a starting
11 point, so fully working video decoder, that
12 didn't use Karczewicz 2. I'm speculating
13 here. And then the question would be whether
14 the -- there's enough information here to,
15 for example, implement the tables and the
16 description around the tables in that
17 decoder. So I think it would depend on their
18 starting point.

19 Q So you aren't sure whether a POSITA
20 would have been able to make and use the
21 teachings of Karczewicz 2?

22 A Well, for example, you know, I've

1 employed people who pretty much met the
2 definition here of a person of ordinary skill
3 in the art around that time period.

4 I've supervised -- I've supervised, I
5 guess, research assistants a few years
6 previous but with sort of similar backgrounds
7 with a relevant degree, a couple of years of
8 experience. Not all of them, in my mind,
9 would necessarily have been able to implement
10 this. Some of them probably would if there's
11 enough information disclosure in this
12 document to do so.

13 Q So you haven't applied an assumption
14 that a POSITA would be able to make and use
15 the teachings of Karczewicz 2?

16 A I don't recall writing those words or
17 necessarily relying on that assumption.

18 Q So given how well-known Marta Karczewicz
19 was, would you agree that there would have
20 been at least some POSITAs out there that
21 would have some motivation to apply the
22 teachings of Karczewicz 2 to calculate

1 sub-pixel positions?

2 A Motivations, what do you mean by
3 motivations?

4 Q A motivation, right, you understand
5 motivation?

6 A Generally, yes, yes.

7 What's the motivation here, sorry?

8 Q Well, I'm asking you that would there be
9 at least some POSITAs out there, given the
10 stature of Marta Karczewicz in the field of
11 video encoding, would there have been some
12 POSITAs that would have some motivation to
13 take the teachings of Karczewicz 2 and to use
14 them to calculate sub-pixel positions?

15 MR. VERBONCOEUR: I'll object to the
16 form of the question.

17 A I'm not quite sure what the motivation
18 would -- I'd have to sort of speculate as to
19 what motivation might be because, like in
20 many, many applications of video encoding,
21 the motivation -- a common motivation is to
22 use and follow standards.

1 Q And so --

2 A And so many -- yeah, many POSITAs that I
3 can think of would not necessarily have a
4 need or a requirement to change the way
5 interpolation is done unless there's some
6 benefit to doing it. I know Karczewicz talks
7 about a benefit, but is that a benefit from
8 the perspective of a typical POSITA?

9 If they're a researcher, do they want to
10 duplicate somebody else's research? What
11 does that buy them? If they're in the
12 commercial domain, do they want to implement
13 something nonstandard? What's the advantage
14 of that? So I'm not actually sure.

15 Q So you can't imagine a single POSITA
16 reading Karczewicz 2 would feel any
17 motivation to just follow Karczewicz 2, these
18 teachings, as written in the reference?

19 A I could imagine it, but I have to
20 speculate where that motivation comes from.

21 Q And where would that motivation come
22 from then?

1 A I don't know. That's what I'm saying.

2 I have to speculate.

3 I could speculate, for example, a POSITA
4 who's a research assistant and their
5 professor says to them, "I want you to come
6 up with some new interpolation methods. Why
7 don't you start by implementing what
8 Karczewicz, Ye and Chen did in this document?
9 Why don't you try that?"

10 MR. VERBONCOEUR: I'll object to the
11 form.

12 Sorry, Dr. Richardson.

13 I'll object to the form on that as
14 well.

15 Q And why would a professor direct his or
16 her research assistants to look at teachings
17 of Karczewicz 2?

18 MR. VERBONCOEUR: I'll object to the
19 form. And characterization.

20 A I have no idea.

21 Q Okay. So in the end, I think, it sounds
22 like you really can't imagine a POSITA would

1 have read Karczewicz 2 and been motivated to
2 follow its teachings?

3 A With respect, you're saying the exact
4 opposite of what I just said. I just
5 imagined a scenario. I just imagined a
6 scenario.

7 Q Now, I would like to go to Paragraph 142
8 of your declaration.

9 THE WITNESS: Can we get a break soon
10 or now if it's convenient to you?

11 MR. LIANG: Yeah. We can take a
12 break.

13 MR. VERBONCOEUR: Five, ten minutes?

14 THE WITNESS: Five minutes is fine.
15 Thank you.

16 (Whereupon, a recess was taken
17 from 1:34 PM until 1:50 PM.)

18 Q I think -- so we were on Paragraph 142
19 of your declaration.

20 A Sure.

21 Q So Paragraph 142 describes some steps
22 taken by a video encoder, correct?

1 A Yeah. If a video encoder is carrying
2 out motion-compensated -- yeah, motion
3 estimation for the purposes of
4 motion-compensated prediction, yeah.

5 Q And here you're describing a process
6 where the encoder will repeatedly test
7 possible pairs of motion vectors to determine
8 which pair minimizes the residual error; is
9 that fair?

10 A I don't think I talk about repeatedly
11 testing pairs of motion vectors.

12 Q Okay. Well, what is Paragraph 142
13 describing?

14 A So an encoder determining a motion
15 vector. Finding a block or a region in a
16 frame which closely matches a macroblock.
17 Searching for a block of pixels to minimize a
18 matching criteria. And for bi-prediction
19 doing that two times.

20 So -- yeah, so searching, you know,
21 fairly often -- searching previously coded
22 video frames very often means doing it

1 multiple times, and that can be the case.
2 But there's also ways of, depending on your
3 criteria, for example, minimizing the
4 complexity and limiting your number of
5 searches so that it's a smaller number.
6 There are situations where you could try and
7 get to the vector as quickly as possible.

8 So it's certainly well-known by the 2010
9 time frame to do this searching by checking
10 multiple positions and evaluating each one.
11 That's well-known, yeah.

12 Q And you'd agree that the decoder carries
13 out this same process from Paragraph 142?

14 A No. No, the decoder doesn't do any
15 searching. The decoder would -- in a typical
16 video encoder around this time, the decoder
17 would use a motion vector supplied by the
18 encoder.

19 Q In your opinions that you've provided in
20 these IPRs, what meaning of prediction did
21 you use to formulate your opinions?

22 MR. VERBONCOEUR: Object to the form

1 of the question.

2 A So Paragraph 1 -- sorry. Paragraph 66
3 of my second declaration, I talk about my
4 understanding of how prediction is used in
5 the context of the '267 Patent. A prediction
6 is a value or set of values that is intended
7 to approximately represent pixel values for a
8 block. I'm paraphrasing there.

9 Q So the construction explained in
10 Paragraph 66 and 67 of your declaration,
11 Exhibit 2015, is the construction that you
12 applied for purposes of your opinions?

13 A I would hesitate to use the word
14 "construction." I know it has a legal
15 meaning in this context. I'm not a lawyer.

16 So I don't recall offering -- I could be
17 wrong because it's three IPRs on the go. But
18 for this proceeding, I don't recall offering
19 an opinion on construction in particular
20 terms other than just the plain or plain and
21 ordinary meaning.

22 Yeah. Paragraph 29, this is my

1 understanding of claim construction. The
2 words of the claim are given their ordinary
3 and customary meaning, as would have been
4 understood by a person of ordinary skill in
5 the art. So I haven't, as far as I recall,
6 given a particular claim construction opinion
7 if that's what you're asking.

8 Q So you haven't given an opinion about
9 how the term "prediction" should be
10 construed?

11 MR. VERBONCOEUR: I'll object to the
12 form of the question.

13 A It sounds like quite a legal question,
14 to be honest. It's not a -- I don't have a
15 section proposing a claim construction for
16 that term if that's what you mean.

17 Q Let's go back to Paragraph 66 of your
18 declaration.

19 A Sure.

20 Q Is the description in Paragraph 66 to 67
21 of your declaration, is that reflective of
22 your understanding of how the term

1 "prediction" should be understood?

2 A "Prediction" is a word that's used a lot
3 in video coding. Certainly by the 2010 time
4 frame, it was -- I probably used it many
5 hundreds of times in my books. I think it
6 comes up many, many times in the known
7 standards, such as H.264.

8 So it's certainly not the entirety of my
9 understanding, if that's what you mean. But
10 I'm just trying to summarize what I believe
11 to be the way the word "prediction" is --
12 aspects of the way the word "prediction" is
13 used within the '267 Patent. In -- sorry --
14 used in the context of the '267 Patent.

15 Q The -- these Paragraphs 66 and 67, they
16 reflect your understanding of how the claim
17 term prediction in the context of '267
18 Patent, how that claim term should be
19 understood?

20 A That's not what I said and that's not
21 the way I would put it, no.

22 Q What's wrong -- why wouldn't you put it

1 that way?

2 A The way you put it just now seems to
3 sort of limit it or something like that.
4 Again, I'm not a patent lawyer. But my
5 understanding of prediction in this context,
6 a POSITA's understanding of a prediction in
7 this context is not entirely captured by
8 Paragraphs 66 and 67.

9 Q Is there somewhere else in your
10 declaration where you provided an
11 understanding of how a POSITA would have
12 understood prediction in the context of the
13 '267 Patent?

14 A Yeah, throughout my declaration. I mean
15 you've just got to go pages before
16 prediction, prediction, prediction it's on
17 almost every page of the declaration, right.

18 Q So those other pages, are they
19 consistent with your description of
20 prediction in Paragraphs 66 through 67?

21 A I don't recall a place where I've been
22 inconsistent with that. But 66 and 67

1 doesn't understand, doesn't comprise the
2 entirety of my understanding of prediction in
3 this context and I don't think it would
4 comprise the entirety of a POSITA's
5 understanding, but it would be it's a
6 summary, if you like, of what it means to be
7 a prediction in this context.

8 Q So do you understand one of things that
9 the board is going to do is come up with a
10 construction for prediction, and to do that
11 they're going to analyze, well, what should
12 prediction mean in the context of the '267
13 Patent. So we've looked at Paragraphs 66 and
14 67 of your declaration, is there anything
15 else in your declaration that you think the
16 board should consider when formulating the
17 construction for prediction?

18 A I have no knowledge of whether or not
19 the board formulates a construction
20 prediction, I don't know how they operate.

21 Q Is there any other paragraph of your
22 declaration that you would like the board to

1 consider when they decide the meaning of the
2 word prediction?

3 A I don't know whether or not the board
4 decides the meaning of the word prediction in
5 this context.

6 Q Are there any other paragraphs of your
7 declaration that you would like to identify
8 for the board regarding the meaning of the
9 word prediction?

10 MR. VERBONCOEUR: Object to the form
11 of the question.

12 A What do you mean would like to identify
13 for the board. I'm just getting my technical
14 opinions in the document.

15 Q I'm giving you an opportunity right now,
16 if you want the board to consider another
17 paragraph of your declaration when thinking
18 about, hey, what does prediction mean, this
19 is your chance to point those paragraphs out?

20 MR. VERBONCOEUR: I will object to the
21 form of the question.

22 A I haven't been asked to make a

1 recommendation to the board as I recall, if
2 that's what you're describing, if I was asked
3 by counsel to do so, I would take my time. I
4 don't recall being asked to offer such a
5 recommendation to the board and, yeah, I just
6 stand by my declaration.

7 Q Did you consider -- so did you review
8 the board's institution decision?

9 A I did, yes. I think it's in one of my
10 binders, yeah.

11 Q Do you have an opinion as to whether the
12 board's analysis regarding the term
13 prediction as that term is used in the '267
14 Patent whether the board's analysis is
15 correct?

16 A Where is that analysis, sorry?

17 Q Well, I'm asking you not to form -- I'm
18 just asking you whether you have an opinion?

19 A I'm asking -- yeah, I'm not sure what
20 analysis you're asking about.

21 Q Do you recall ever reviewing a claim
22 construction analysis in the board's

1 institution decision regarding the claim term
2 prediction?

3 MR. VERBONCOEUR: I'll object to the
4 form of the question.

5 A So I've read the institution decision,
6 I'm not a lawyer, so I wouldn't claim to
7 understand, for example, references to
8 federal circuit citations, yeah, if you want
9 to point me to it, I'll look at it, if not,
10 I'll try and find it.

11 Q Dr. Richardson --

12 A I see we provide a preliminary
13 construction for the term prediction. Yeah,
14 you can probably point me to it quicker than
15 I can find it.

16 Q Dr. Richardson, do you recall having
17 formed any opinion regarding points of
18 board's analysis and the institution decision
19 that you disagree with regarding the meaning
20 of the term prediction?

21 A I don't fully agree with the board's
22 analysis, if that's what you're asking me.

1 I'm trying to find whether they had a
2 particular discussion of prediction. You can
3 point me to it or I can try and find an easy
4 reference. 2D2A whatever that is. Where is
5 that.

6 Two -- slightly confused by the headings
7 and sub headings.

8 Q Why don't you try looking at Page 16 of
9 the institution decision.

10 A Thank you.

11 Okay, which part.

12 Q Do you see the part that says, "The term
13 prediction encompasses values used for
14 prediction that are calculated by
15 mathematical operations including multiplying
16 pixel values in reference blocks with
17 weights."

18 Do you see that?

19 A The term prediction encompasses. Okay,
20 I see that, yep, I see that.

21 Q Do you agree or disagree with that
22 statement from the board?

1 A The term prediction encompasses, so it
2 doesn't have to be entirely limited to -- I'm
3 just sort of trying to parse this again. As
4 of right now I don't see anything I
5 necessarily disagree with in that sentence.
6 For example, my Paragraph 66, the value or
7 set of values generated through some coding
8 process is a mathematical operation including
9 multiplying pixel values and reference blocks
10 with weights and generally is consistent
11 with, for example, weighted at least part of
12 a weighted prediction process, so I don't
13 think -- I don't see anything I disagree
14 with.

15 Q Can you turn Exhibit 1001 Column 2,
16 that's the '267 patent by the way. Column 2.

17 A Yeah, just a second.

18 Okay.

19 Q Do you see the sentence that says around
20 Line 51, it says, "It should be noted here
21 that one picture may include different types
22 of blocks, i.e., blocks in the picture that

1 may be interblocks, uni-predicted blocks
2 and/or by-predicted blocks."

3 Do you see that?

4 A Yes.

5 Q Oh, I'm sorry. I'm looking at the wrong
6 place. Okay. Do you see around Line 20, let
7 me see. Okay, Column 2, Line 23, it says,
8 "In MCP prediction for a current frame is
9 formed using a previously encoded frame where
10 only the difference between the original
11 prediction and prediction signals
12 representative of the current and predictive
13 frames is encoded and sent to the decoder"?

14 A Okay, yeah, I see that.

15 Q The next part says, "A prediction signal
16 representative of a current frame is formed
17 by first providing the current in two blocks
18 e.g. macro blocks, searching for a best match
19 in the reference frame for each block. In
20 this way the motion of a block relative to
21 the reference frame is determined and the
22 motion information is coded into bit stream."

1 Do you see that?

2 A You didn't finish the sentence and I
3 think you misread, sorry, representative of a
4 prediction frame, I think you said current
5 frame, but otherwise I see that, yes.

6 Q All right. So the portion back around
7 Line 24 that says.

8 "Where only the difference
9 between the original and prediction
10 signals."

11 Do you see that phrase?

12 A Yes.

13 Q So this is referring to, this is
14 comparing the original signal to the
15 prediction signal to determine the residual,
16 correct?

17 A Yes. Where signal in this context could
18 be, for example, original pixel or sample
19 values.

20 Q And the difference that's referred to in
21 Line 24 of Column 2 is the residual, correct?

22 A Yeah, the words difference and residual

1 here are some what interchangeable.

2 Q So what's being described here is that
3 you subtract the prediction signal on the
4 original signal and that gives you the
5 residual, correct?

6 A Yes. And residual difference error is a
7 word I've used and used in the art in my
8 Paragraph 66.

9 Q And then on the decoding side you add
10 the residual to the prediction signal to get
11 the reconstructed original signal, correct?

12 A Where do you get reconstructed original
13 signal or are you just paraphrasing?

14 Q I'm just paraphrasing.

15 Is that accurate to how you understand
16 what's being described in Column 2?

17 A It's certainly a reconstructed version
18 of the original signal, in lossy coding it's
19 typically not the original signal.

20 Q Now, let's take a look at Claim 7 of --
21 so if you turn to the end of the '267 Patent,
22 I just want to look at Claim 7.

1 A Okay.

2 Q What is -- do you see that there is a
3 reference to the first prediction?

4 A Yes.

5 Q Would you agree that in Claim 7, the
6 first prediction is not subtracted from the
7 original signal to get the residual?

8 MR. VERBONCOEUR: Object to the form
9 of the question.

10 A I don't see the claim excluding the
11 first prediction being subtracted, but in the
12 element that begins -- you said first
13 reference block to -- sorry. Yeah, you said
14 first reference block to obtain first
15 prediction.

16 Q What about the last --

17 A Yeah, I'm sorry not quite finished,
18 there's another element that says, yeah, and
19 that first prediction, paraphrasing, is used
20 to obtain a combined prediction, which is
21 right shifted and a residual is determined
22 based on the shifted combined prediction and

1 the block of pixels.

2 Q If you look at the last step, it says,
3 the last step that begins with encode, do you
4 see that?

5 A Yes.

6 Q In the last step the combined prediction
7 is compared with the original block of pixels
8 to form the residual, correct?

9 A You could describe it that way. It's
10 slightly different in the way it describes it
11 here is based on a difference between, which
12 is consistent with, for example, subtracting
13 the combined prediction from the block of
14 pixels that would give you a difference
15 between those two things.

16 Q So Claim 7 subtracts the combined
17 prediction from the block of pixels to obtain
18 the residual, correct?

19 A So Claim 7 is an apparatus for encoding
20 a block of pixels and one of the elements of
21 that claim states that residual data is
22 determined based on, and I'll paraphrase

1 here, could be based on subtracted and
2 combined prediction from a block of pixels.
3 I mean, technically the way the claim is
4 written it could be the other way around, it
5 just has a difference between the two.

6 Q So Claim 7 requires encoding the
7 residual data either by subtracting the
8 combined prediction from the block of pixels
9 or subtracting the block of pixels from the
10 combined prediction; is that fair?

11 A Sorry, what does it mean for the claim
12 to require in that context.

13 Q It requires like it must happen in order
14 for the claim to be satisfied.

15 A Okay.

16 Again, my understanding of the way the
17 claim works is that all the elements need to
18 be satisfied to satisfy the claim. I'm not
19 sure if that's the right terminology and
20 there's an element of the claim here where
21 residual data is encoded, and it's obtained
22 or determined at least based on the

1 difference between two things, which are the
2 two things we discussed. The combined
3 prediction and the block of pixels.

4 Q So this last step of Claim 7 compares
5 the combined prediction with the block of
6 pixels to obtain the residual data, correct?

7 A It doesn't use the word compare.

8 Q Oh, okay.

9 This last encode step of Claim 7
10 calculates a difference between the combined
11 prediction and the block of pixels to create
12 the residual data; is that fair?

13 A It doesn't say calculated difference.
14 It just stays determine something, residual
15 data based on a difference between the
16 combined prediction and the block of pixels.

17 Q In your opinion Claim 7 doesn't require
18 calculating a difference?

19 A I haven't been asked to make that
20 determination, I'm just reading out the
21 language of the claim. I haven't actually
22 asked what this claim element requires.

1 Q Are you able --

2 MR. VERBONCOEUR: Hang on one second.

3 A As I recall I haven't been asked to
4 determine or give an opinion on that.

5 Q Sitting here today, are you aware of a
6 way for Claim 7 to function if it never
7 calculates a difference between the combined
8 prediction and the block of pixels?

9 A Do you mean the apparatus doesn't
10 calculate a difference?

11 Q Right.

12 A I haven't thought about that, I haven't
13 been asked to think about that. Yeah, I'd
14 want to consider that question.

15 Q So you would agree then that in Claim 7
16 the residual is based on a difference between
17 the combined prediction and the block of
18 pixels?

19 A I just see the words in the claim, the
20 residual data is determined based on a
21 difference between the combined prediction
22 and the block of pixels. I would certainly

1 agree that those words are in the language of
2 Claim 7.

3 Q If we go back to your Paragraph 66.

4 A Okay.

5 Q Do you see how you use the term
6 "approximately represent" in that first
7 sentence?

8 A Yes.

9 Q How close does something have to be to
10 approximately represent another value?

11 A I don't think I formed an opinion on
12 that. I think, with respect, you're taking
13 words out of context there.

14 It's my understanding, prediction in
15 this context is something that's intended to
16 approximately represent. So predictions
17 don't always get it right. Prediction can be
18 really close or not so close. You can have a
19 really bad prediction, but it's intended to
20 approximately represent.

21 As I explain in the final sentence
22 there, in this context, the efficiency of a

1 prediction method is correlated with the
2 extent to which it minimizes the residual
3 value. So there's an underlying assumption
4 in this aspect of video coding that a better
5 prediction in one sense is one that gets
6 closer to.

7 So I think if you compare two
8 predictions, say one gets closer to the block
9 I'm trying to predict, it minimizes the
10 residual more than another prediction.

11 Q Would a value of five approximately
12 represent a pixel value that is actually
13 eight?

14 A If that value of five was developed with
15 the intention of approximately representing
16 that pixel block, then that's how it was
17 developed. It was -- yeah, intended to
18 approximately represent the pixel, that pixel
19 value.

20 Q Would a value of five approximately
21 represent a pixel value that is actually 500?

22 A So if I have a -- let's say -- let's say

1 I'm generating prediction values by a motion
2 search, the point of that process is that the
3 intention of each step is to try to
4 approximate the pixel values that I'm trying
5 to predict. Actually, it might even be part
6 of a good prediction because in this context,
7 I'm talking about blocks, not individual
8 pixels.

9 So the question that -- the practical
10 question for video coding is, does the
11 prediction minimize the residual for the
12 block of pixels. And so if five was
13 generated in the process that is intended to
14 approximately represent the pixel values for
15 the block, then that's consistent with the
16 prediction, forming a prediction in video
17 coding.

18 Q Does a value of five approximately
19 represent a pixel value that has actually
20 32,000?

21 A 32,000, how many pixels is that?

22 That's a lot of bit depth, possibly.

1 Possibly, a lot of bit depth, depending,
2 assuming that all pixel values are possible.

3 Again, it could be part of a process
4 that is intended to approximately represent
5 the pixel values of a complete block. The
6 block, by the way, in some video coding
7 standards can be 128 pixels by 128 pixels.

8 So you can get anomalies in that block,
9 but if the process is intending to
10 approximately represent the pixel values of
11 the block and to minimize residual value,
12 that's consistent with the way we generate
13 predictions in video coding. And I think, in
14 my opinion, it's consistent with the way
15 predictions used in the '267 Patent for the
16 block.

17 Q So there's no line you can draw to say
18 that a value is close enough or too far away
19 to approximately represent a pixel value?

20 A Well, I can find you values or blocks
21 that I don't think, in my view, are not
22 predictions because they are not intended to

1 approximately represent blocks of pixel
2 values.

3 For example, if I take -- and I say this
4 in my report, if I take the Walker reference
5 pred0, which is a prediction, and is intended
6 to approximately represent a pixel or a pixel
7 in a block, if I multiply that by a factor
8 W0, and the factor happens to be a hundred,
9 those two things together are not intended to
10 represent approximately or otherwise pixels
11 of a block. So, in my view, that's not a
12 prediction.

13 Q So it's based more on the intention than
14 the actual value?

15 A Is it generated through a coding process
16 that is intended to approximately represent
17 pixel values for a block. If it is, then in
18 this context that meets the way the
19 prediction is used in the '267 Patent, in my
20 opinion.

21 Q And whose intention would we be looking
22 at?

1 A I think it's kind of clear in the
2 context of the patent and the person of
3 ordinary skill reads a document like this, or
4 if they read the Walker patent and they look
5 at pred0, which is a prediction intended to
6 represent pixel values within a block, and
7 they look at in Walker again the final
8 prediction, which is a prediction intended
9 and described as such in Walker to represent
10 the pixel values of the block.

11 And then they look at some intermediate
12 value such as (pred0)xw0, in my view, a
13 person of ordinary skill in the art knows
14 which of those things are intended to
15 represent pixel values, intended to act as
16 predictions, and which are not.

17 Q Does Walker's intention control whether
18 the -- withdrawn.

19 Walker is the named inventor of Walker,
20 correct?

21 A Okay. When I say "Walker," I'm
22 referring to Exhibit 1004, which is a patent

1 application publication to two inventors, one
2 of them is Walker.

3 Q Okay. Does Gordon Kent Walker's
4 intention control whether values in the
5 Walker patent are predictions?

6 A I don't even think we need to look at
7 Gordon Kent Walker's intentions. We just
8 need to look at the disclosure of Walker.
9 For example -- let me see.

10 Yeah. Walker, Paragraph 59, final_pred
11 equals, and then it's an equation to generate
12 a value final pred. Final_pred,
13 Paragraph 60, is the result in prediction
14 which will be used in pixel reconstruction.

15 So it's very clear to a POSITA reading
16 that, the final_pred is intended to predict
17 pixel values. Whether it's -- how accurate
18 it is, that's what it's intended to do.

19 The plus 1 in that equation, Walker,
20 that's not intended to represent or describe
21 or however you want to put it, to represent
22 pixel values. I mean, a POSITA can work this

1 out pretty easy without having to know what's
2 going on in the head of Gordon Walker.

3 Q And if Gordon Walker disagreed with your
4 analysis, would that change whether
5 predictions discussed in Walker are, in fact,
6 predictions in the context of the '267
7 Patent?

8 A I really don't think it would. I think,
9 from the perspective of a POSITA, POSITA
10 doesn't need to know Gordon Walker's opinions
11 or thoughts at a particular point in time,
12 they just need to read the document. And
13 equation eight is pretty clear, final_pred is
14 a prediction. It's used -- it's set out in
15 the document here as a prediction for pixel
16 values. Terms of that equation are just
17 terms of the equation.

18 Q What if Gordon Walker, when he was
19 writing his patent, had in his mind, you know
20 what, I want -- I want (pred0) times w0 to be
21 a prediction, not a good prediction, but a
22 prediction, would Gordon Walker's intention

1 mean that (pred0) times w0 is a prediction?

2 A I think a POSITA in the skill of the art
3 would see that as a ridiculous suggestion,
4 with respect. Because they would read the
5 document -- now, this is a patent
6 application -- patent application
7 publication, so I guess -- I don't know.

8 I'm not that familiar, but I think you
9 can always write anything you like in an
10 application. It might not become a patent.
11 But, to me, for example, when I read this I'm
12 a POSITA, I was a POSITA at the time of our
13 patent's invention, when I read this, I
14 understand, by the context and the
15 description, that Paragraph 74, final_pred
16 is intended to represent a prediction. It's
17 an equation that represents a prediction.
18 Paragraph 60 says, final_pred is the result
19 of prediction.

20 You can read this document and you know
21 what's a prediction and what's not a
22 prediction because of the context and the

1 description in the document.

2 Q So Gordon Walker's actual intention is
3 irrelevant to our analysis because your
4 construction depends on your interpretation
5 of what he intended, correct?

6 MR. VERBONCOEUR: Object to the form
7 of the question.

8 A What do you mean by my construction?

9 Q Your proposed -- in your view, whether a
10 value is a prediction in the context of the
11 '267 Patent, is governed by how you interpret
12 the intent of the Walker patent rather than
13 the actual intention of Gordon Walker,
14 correct?

15 A No. No. I don't agree with that.

16 Q So the actual intention of Gordon Walker
17 does matter for whether values in the Walker
18 patent are predictions?

19 A I don't agree with that. I don't agree
20 with that, sorry.

21 Q Okay. Then the actual intention of
22 Gordon Walker does not matter for determining

1 whether values in the Walker patent are
2 predictions, correct?

3 MR. VERBONCOEUR: Object to the form
4 of the question.

5 A I have no opinion on that. I've given
6 no opinion on that.

7 Q Are you taking back your earlier
8 answer -- so you're saying you have no
9 opinion. Are you taking back your earlier
10 answer that the actual intention of Gordon
11 Walker does not matter?

12 A With respect, it's a bizarre question.
13 I don't recall expressing an opinion on that.
14 If I did, I was thrown by the question. It's
15 not a relevant question.

16 In my opinion, in terms of what does
17 prediction -- how does the '267 Patent use
18 the term "prediction." And it's important to
19 know, and for me to talk about how, in my
20 view, the patent uses the term "prediction,"
21 because it's at the heart of some of the
22 disputes. And I've set that out in my

1 declaration.

2 Q So if we're trying to figure out, well,
3 what's the intent of a particular value in
4 Walker, wouldn't it make sense to find out
5 what Gordon Walker intended when he wrote
6 this document?

7 A Why do I need to do that? Why does a
8 POSITA need to do that?

9 Q Whose intent are we looking at, then?

10 A Let's consider final_pred, Equation 8,
11 Paragraph 59, of the Walker reference.
12 Paragraph 60 says:

13 "Final_pred is the result in prediction
14 which will be used in pixel reconstruction."

15 It's the value or set of values
16 generated through a coding process,
17 final_pred, I mean. It's intended to
18 approximately represent the pixel values for
19 that block. That's what that value is.

20 Yes. It's my way of describing it, but
21 I think a POSITA reading what I say and
22 reading Walker, gets what's going on. They

1 understand the final_pred is a prediction.

2 They also would understand that taking
3 Equation A and picking out one term from that
4 equation, such as a +1 on its own, without
5 other information, that's not a prediction.
6 That's not intended to represent any pixel
7 values, that +1.

8 Q So whether a value as a prediction is
9 governed by our interpretation of what was
10 intended by the Walker document, rather than
11 what the author of the document actually
12 intended; is that fair?

13 A I'm getting confused by that question.

14 I think it's going way beyond what a
15 POSITA needs to know and would understand
16 from reading Walker or indeed from reading my
17 declaration.

18 Q I see. So you're looking at -- well,
19 what's the intention of the document, not
20 what's the intention of the author.

21 Is that fair?

22 A I would agree that one would look at

1 context in the document. For example, when
2 considering final_pred, Equation A --
3 actually, a better one to consider, a more
4 complicated equation is, final_pred,
5 Equation 14, at Paragraph 74 of Walker.

6 A POSITA reading Walker, reads the
7 entirety of the document, they already know
8 what final_pred is, it's a prediction, and
9 they know that Equation 14 in this context is
10 intended to, is directed to, whatever
11 terminology you want to use, forming a
12 prediction that is going to -- is intended to
13 be, it's going to represent pixel values for
14 a block, it's going to be used to form a
15 residual. That's the purpose of final_pred
16 in this context. Purpose, intention, that's
17 what it's there for. That's what it does.
18 That's a thing that it does.

19 Q Can you turn to Paragraph 102 of your
20 declaration.

21 Are you there?

22 A Yes.

1 Q So you have this formula here. You see
2 in parenthesis, there's something on the left
3 side, five times (pred0) plus 11 times
4 (pred1), plus eight, correct?

5 A Okay. I see the pieces of an equation.

6 Q Okay. And those pieces of an equation
7 are in between parenthesis, correct?

8 A Yes.

9 Q Okay. And then, the portion of the
10 equation in between parenthesis is then,
11 right shifted by four to result in 118; is
12 that correct?

13 A Yes.

14 Q Before right-shifting, the value on the
15 left side of the equation is 1881; is that
16 correct?

17 A I'm willing to take that representation
18 or I can sit and work it out.

19 Q I think down below, or in the
20 hypothetical -- or, no, right above it, it
21 says, the current pixel value is 120. So
22 that is the actual pixel value that we are

1 working with in Paragraph 102, correct?

2 A In this example, yes.

3 Q Can a value of 1881 approximately
4 represent 120?

5 A What's the 120 in that example? What
6 does 120 represent in that example?

7 Q I'm talking about your example in
8 Paragraph 102. In your Paragraph 102, can a
9 value of 1881 approximately represent 120?

10 A That's not in my example. So tell me
11 what the example is.

12 Q Yeah. I'm asking whether, in your
13 example in Paragraph 102, can the value
14 that's in between parenthesis be a prediction
15 for the current pixel value?

16 A What's the current pixel value?

17 Q So you need to know what the current
18 pixel value is in order to answer the
19 question?

20 A No. I'm just asking you to clarify your
21 question, because you're asking me about the
22 example of 102, but you're, I think, giving

1 me a different example.

2 Q No. I'm just asking about
3 Paragraph 102. Does your Paragraph 102 have
4 a current pixel value?

5 A Yes. I talk about a current pixel value
6 of 120.

7 Q All right. So I'm asking you about this
8 example in Paragraph 102, right.

9 A Okay. Go ahead. Ask away.

10 Q All right. So in this example that you
11 provided in Paragraph 102, can the value
12 that's in between parentheses on the left
13 side of the right shift in your equation, can
14 that value be a prediction for the current
15 pixel value?

16 A That's not my example. You just created
17 a new example.

18 Q So you don't know whether the portion of
19 your equation that's in between parentheses
20 in Paragraph 102, whether that portion on the
21 left side of the right shift operation, you
22 don't have an opinion about whether that can

1 be a prediction for the current pixel value?

2 A That's a different question. Which
3 question do you want me to answer?

4 Q The question that I just asked you.

5 A Okay.

6 Yeah, you've taken me out of the
7 scenario that's here in the question, so I
8 don't quite understand the question.

9 Q Well, I'm asking -- okay. So do you
10 think the value -- in your example in
11 Paragraph 102 do you think the value 118 is a
12 prediction for the current pixel value?

13 A It is a prediction for the current pixel
14 value in this context, specifically taken
15 from at least a -- sorry. Let me start over
16 again.

17 It's represent -- it's my representation
18 of Walker's combined prediction in slightly
19 simplified terminology. It's described in
20 Walker as final underscore prediction. It's
21 intended to be a prediction. It's designed
22 to be a prediction, if you'd like. And

1 that's what Walker says you do. And in fact,
2 that's an equation that's based on the H.264
3 Standard, as I recall, a part of the standard
4 that's creating a prediction.

5 Q Okay. So then in your Paragraph 102
6 example -- I'm just asking about this
7 particular example, right, the value from 5
8 times (pred0) plus 11 times (pred1) plus 8,
9 that value is also a prediction for the
10 current pixel value, correct?

11 A It's not Walker's combined prediction
12 value in this equation.

13 Q I'm not talking about -- I'm just asking
14 about this example in Paragraph 102, okay?

15 (Crosstalk.)

16 A -- you are not. You are taking my
17 example; you are changing it to something
18 else and then asking me about that other
19 thing.

20 Q I'm not changing anything. I'm
21 asking -- you understand that I'm asking you
22 about the portion that you've written down in

1 parentheses? I didn't change that at all.
2 I'm just asking about this portion between
3 parentheses.

4 Do you understand that?

5 A I'm not trying to be argumentative, but
6 how does removing a right shift mean --
7 equate to not changing?

8 Q Okay.

9 A How does that equate to not changing?
10 That's what I don't understand.

11 Q Let me ask you this then: This equation
12 you have in Paragraph 102, you'd agree it is
13 definitely a prediction after you perform the
14 right shift and you get the result of 118,
15 correct?

16 A The equation is a prediction.

17 Q Okay. Before you get the right shift,
18 right, before you do the right shift, is this
19 value that's on the left also a prediction?

20 A Of what?

21 Q The current pixel value.

22 A Which current pixel value?

1 Q The one you have in example -- in
2 Paragraph 102, the current pixel value of
3 120.

4 A Okay. You're asking me to consider a
5 new example where I or somebody creates
6 something that's called a prediction, it's
7 the same equation without the right shift by
8 four --

9 Q No.

10 A -- and that --

11 Q No --

12 A Sorry. That equation is applied to a
13 pixel value of 120.

14 Q That is not my question.

15 A What is your question?

16 Q I didn't say "new equation." I'm just
17 asking about this exact equation in this
18 exact example that you have in Paragraph 102.

19 So you keep asking, like, "What's the
20 current pixel value?" I mean, it's right
21 here in Paragraph 102. You understand that
22 it says it in your own declaration, right,

1 current pixel value is 120? Do you see that?

2 A I see that.

3 Q Okay. So in this example of
4 Paragraph 102, I'm not changing this
5 equation, I'm asking -- do you see how
6 there's an equation written in Paragraph 102?

7 A Yes. I wrote it.

8 Q Okay. Do you agree that this equation
9 would be calculated by doing the operation 5
10 times (pred0) plus 11 times pred1 plus 8, and
11 then after you have made that calculation,
12 you right shift the whole thing by four bits,
13 and you get the result of 118; is that
14 correct?

15 A That's broadly correct.

16 Q Okay. So while you're doing this
17 calculation that you've written out, when you
18 do the calculation on the left side of the
19 right shift, 5 times pred0 plus 11 times
20 pred1 plus 8, at that point -- I'm about to
21 do the right shift, but I haven't done it
22 yet -- is the thing on the left a prediction?

1 A It's a new equation. You've now -- we
2 are in a different head space here. You're
3 saying it's not a new equation. It's a new
4 equation.

5 Q Now, I'm about to do the right shift,
6 but I haven't done it yet, so I'm just acting
7 like this intermediate value that I've
8 created by -- before I do the right shift by
9 four bits, is that value a prediction?

10 MR. VERBONCOEUR: I'll object to the
11 form of the question.

12 A So you've created a new equation. Is
13 that equation created in the context of an
14 intention to approximately represent the
15 pixel value of 120?

16 Q I have not created a new equation. Do
17 you understand I'm following the equation?

18 A No. I do not understand, and I do not
19 agree that you have not created a new
20 equation.

21 Q Is your equation in Paragraph 102, the
22 right shift operation happens last, correct?

1 A Says who?

2 Q Oh. Okay. In your view, the right
3 shift operations cannot be done last in this
4 equation?

5 A I didn't express that view.

6 Q Okay.

7 A I didn't express any order of steps in
8 this. I'm just providing an equation as
9 I'm -- in this, as a mathematical equation.
10 It's an equation.

11 Q Right.

12 A It's a unit. I mean, actually, this is
13 really similar to something that I talk about
14 at length in my report. That if we take
15 Equation 14 and take out of Walker and take
16 one term (pred0) times w0 out, that's not the
17 same equation. It's a term. You've just
18 taken a term of the equation out, and you
19 keep saying it's the same equation.

20 Q Right. You agreed earlier -- so let's
21 just make sure we're all clear -- I can
22 perform this equation from Paragraph 102 by

1 doing the following calculations in sequence
2 5 plus pred0 -- sorry. Let me restart. 5
3 times (pred0) plus the result of 11 times
4 (pred1) plus 8. And after I have an
5 intermediate value that's -- that reflects
6 that calculation, I can take the whole thing
7 and right shift it by four bits to get 118;
8 is that accurate?

9 MR. VERBONCOEUR: I'll object to the
10 form of the question.

11 A One can calculate 5 times (pred0), add
12 it to 11 times (pred1), add 8 and take the
13 result of that, right shift by 4, and one
14 gets to 118.

15 Q Okay. And during that calculation, you
16 agree that there's a point where we have run
17 the calculation, and we're right about to do
18 the right shift by four bits; is that
19 correct?

20 A One could calculate it that way.

21 Q Okay. And at that point right before
22 one has -- is about to do the right shift, is

1 the value that has been calculated a
2 prediction of the current pixel value 120?

3 A Not according to Walker. Walker says
4 that it's the entire equation. Walker says
5 that final_pred, Equation 14 is the whole
6 thing.

7 Q Okay. So then the value before
8 conducting a left shift in this equation --
9 or sorry. A right shift -- let me rephrase.

10 The value before conducting a right
11 shift in your equation in Paragraph 102 would
12 not be a prediction as "prediction" is used
13 by the '267 Patent?

14 MR. VERBONCOEUR: Object to the form
15 of the question.

16 A It's not Walker's prediction. It's not
17 Walker's prediction. I'm talking about
18 Walker's prediction.

19 Q So I'm going to give you --

20 A You can point me --

21 MR. VERBONCOEUR: Hold on.

22 A Yeah. Sorry. Go ahead.

1 MR. VERBONCOEUR: No. I'm letting you
2 finish.

3 A All right. You can point to me
4 something else, but this is Walker's combined
5 prediction. I don't know how many times I
6 need to say that same thing. It's Walker's
7 combined prediction.

8 Q So I'm going to give you one opportunity
9 to provide an answer to the board to this
10 question: In your equation that you have in
11 Paragraph 102 of your declaration, is the
12 value between parentheses, which is 5 times
13 (pred0) plus 11 times (pred1) plus 8, is that
14 value in your example a prediction as that
15 term is used by the '267 Patent?

16 A I do not know the context anymore. It's
17 not Walker's prediction anymore. I don't
18 know what the context that you're applying --
19 or asking me to apply that parenthetical to.
20 I do not know what that context is. It could
21 be some other context in video coding, you
22 know, hypothetically where it's used to

1 predict something in a different way. But
2 it's not Walker's prediction.

3 Q So you're unwilling to exclude the fact
4 that the value in parentheses could in fact
5 be a prediction under the '267 Patent?

6 MR. VERBONCOEUR: Object to the form
7 of the question.

8 A I didn't say anything about being
9 willing or unwilling to include or exclude.
10 I'm just explaining what I'm saying in
11 Paragraph 102. It has a context. It's my --
12 an illustration of Walker's combined
13 prediction.

14 MR. VERBONCOEUR: Jeff, when you reach
15 a good breaking point, I think we've
16 been going about an hour 15 minutes.
17 Just let us know.

18 MR. LIANG: All right. We'll stop.

19 (Whereupon, a recess was taken
20 from 2:56 PM until 3:13 PM.)

21 Q So how do you determine how many bits
22 are needed to represent a number?

1 A So generally, in this field, the number
2 of bits needed to represent a number -- or in
3 this context, the number of bits needed to
4 represent a variable, for example, depends on
5 the number of values that variable can take.

6 Q And how many bits do you need to
7 represent the number 1,000?

8 A So to answer that question, I need to --
9 assuming that's it a value of a variable, I
10 need to know how many possible values that
11 variable has.

12 Q How many bits do you need to represent
13 the number 9,288?

14 A Again, if it's a -- assuming that it's a
15 variable, I need to know what are the
16 possibilities. How many -- what's the range
17 of possible values that number has -- that
18 variable has, sorry.

19 Q So you wouldn't be able to tell, just
20 based on the value alone, how many bits are
21 needed to represent 9,288?

22 A So particularly in the context of the

1 '267 Patent, you know, I've stated in my
2 Paragraph 68, the number of the bits needed
3 to represent possible values, I think that's
4 critical to our discussions about
5 prediction -- precision -- sorry. Our
6 dispute, discussions about precision.

7 So possible values would be, like I just
8 said, the number you've given, assuming it's
9 the value of a variable, what are the
10 possible values that variable can take? Does
11 it have four possible values? Does it have
12 16? Does it have 1,024 possible values?

13 Q How many bits do you need to represent
14 the number 9,312?

15 A And same answer.

16 Q Would it be fair to say that the values
17 9,288 and 9,312 require 14 bits and,
18 therefore, have a higher precision than a
19 10-bit number?

20 A I think I'm missing information to
21 answer that question. So again, assuming
22 that we're talking about a variable -- in

1 fact, I gave an example in Paragraph 172 of
2 my second declaration.

3 If we had a variable that could only
4 take one of those two values that you
5 suggested, I could actually represent it
6 using a single bit. My example was a
7 variable that can take a value of 0 or a
8 variable that can take a value of a million.
9 I can represent that number of bits needed to
10 represent that variable as 1.

11 Q Would you disagree with an analysis
12 that, okay, 2 to the 13 equals 8,192 and 2 to
13 the 14 is 16,384 so, therefore, in order to
14 represent the value of 9,288, since it falls
15 between those ranges, I need 14 bits?

16 A And again, you're making, I think,
17 assumptions there. You're assuming -- I
18 think there's a tacit assumption that this is
19 a variable that can take all the other values
20 in that range. I think that seems to be an
21 assumption in your question.

22 As I explained in Paragraph 72, if your

1 variable can only take two values, you'll
2 need a single bit to represent it. All of my
3 discussion in these paragraphs relates to
4 precision, which is, I think, an important
5 matter for the board to understand.

6 Q So in your view, it would be incorrect
7 to just look at the values, in this case,
8 let's say, 9,288 and 9,312, figure out, okay,
9 you know, because 2 to the 13 is 8,192 and 2
10 to the 14 is 16,384, I'm going to conclude,
11 because it falls in that range, I need 14
12 bits and, therefore, these values have higher
13 precision than a 10-bit number?

14 MR. VERBONCOEUR: Object to the scope
15 and form and characterization.

16 A Yeah, I think you've made a lot of
17 assumption or there's a lot of gaps in that
18 question. I can turn it around and let's say
19 you're a POSITA and I'm your supervisor and I
20 say, right, I want you to design a circuit to
21 store either 9328 or whatever the number is
22 or 9713 and you infer from that that you need

1 14 bits precision and I give the same problem
2 to somebody else and say I can do that with a
3 single bit value of 0 represents the first
4 number, value of one represents the second
5 number. So the second solution is certainly
6 more elegant and in my scenario where a
7 variable can only take those two values it
8 can be represented with a single bit as I
9 explain in my Paragraph 72.

10 Q Let's assume I was conducting a test and
11 I have some testing equipment that
12 demonstrated that a product contained
13 prediction from reference blocks and that
14 those predictions exceed the range of a ten
15 bit number and therefore required 14 bits to
16 represent, so those values include the
17 numbers 9288 and 9312.

18 Would it be erroneous to conclude that
19 the 14 bit values have higher precision than
20 10 bit values.

21 MR. VERBONCOEUR: I will object to the
22 scope and the form of the question and

1 characterization.

2 A So in the context of this patent, you're
3 still giving me an example that actually fits
4 with my example of, I believe of
5 Paragraph 72. If your apparatus can only
6 give those two numbers as an output, that I
7 only need one bit to represent those
8 predictions.

9 Q So then it would be erroneous to
10 conclude that you need 14 bits to represent
11 those values 9312 and 9288?

12 MR. VERBONCOEUR: Same objections.

13 A If your hypothetical apparatus output,
14 if we consider that as a variable and if that
15 variable can only take two values, I only
16 need one bit to represent that variable.

17 Q So to figure out the number of bits
18 needed you have to go back and see, okay, for
19 this particular calculation here are all the
20 possible resulting values and I'm going to
21 figure out the minimum number of bits in some
22 kind of a scheme to represent them?

1 MR. VERBONCOEUR: Object to the form
2 of the question.

3 A We're talking about, I believe, the '267
4 Patent and we're talking about, as I
5 understand it, the precision in the context
6 of the '267 Patent. The '267 Patent is --
7 relates to video coding, relates to
8 predictions, it relates to systems where
9 variables at each stage in the system the
10 number of possibilities are known.

11 Q In your opinion, when two numbers
12 with -- withdrawn.

13 In your opinion, when two variables have
14 the same number of possible values, those two
15 variables always have the same precision,
16 correct?

17 A If I consider a first variable and I
18 consider the definition -- that I understand
19 the petitioner, the patent owner,
20 Dr. Freedman and myself all agree that the
21 definition of precision is that a number of
22 bits needed to represent possible values,

1 then, yeah, if two variables each have the
2 same number of possible values the number of
3 bits needed to represent those two variables
4 is going to be the same.

5 Q If you have two rulers --

6 A Sure.

7 Q The first ruler can measure 10 possible
8 lengths one centimeter, two centimeters,
9 three, four and so on up to 10 centimeters.
10 You follow me so far?

11 A Sure.

12 Q Your second ruler can also measure 10
13 possible lengths except they are one
14 millimeter, two millimeters,
15 three millimeters and so on up to
16 10 millimeters, do these two rulers have the
17 same precision?

18 A So in the context of the '267 Patent
19 precision relates to a number of bits; so
20 where are the bits in this example? What are
21 the bits, do they encode? Are the bits used
22 to store, transmit whatever those

1 measurements.

2 Q Okay. So in your view a ruler analogy
3 has no relevance in the '267 Patent because
4 that's talking about distances and things and
5 not about bits, like we're dealing with in
6 the '267 Patent?

7 MR. VERBONCOEUR: Object to the form
8 of the question.

9 A Yeah, so I didn't say that. I didn't
10 say it has no relevance, I just asked for
11 clarification.

12 Q Okay. So let me ask again.

13 If you have the first ruler that's 10
14 possible lengths one centimeter through 10
15 centimeters, your second ruler has 10
16 possible lengths one millimeter through
17 10 millimeters, do the rulers have the same
18 precision?

19 A So the precision relates to possible
20 values in the context of the '267 Patent,
21 what's the number of bits needed to represent
22 possible values. All the parties as I

1 understand it, agree on that definition,
2 Paragraph 68 of my second declaration.

3 So in your analogy if we want to
4 represent the possible values from ruler one
5 or represent the possible values from ruler
6 two, in each case we're gonna need, let's say
7 four bits for the sake of convenience.

8 Let's say we had 16 possible values on
9 each, one to 16 centimeters on the first
10 ruler, one to 16 millimeters on the second
11 ruler and we want to represent a value
12 measured by ruler one, a value measured by
13 ruler two and then without other constraints
14 we would use four bits for each. They would
15 have the same precision in terms of number of
16 bits, which is the same precision as it's
17 used in the '267 Patent.

18 If I could just add to that very close
19 analogy to my example of Paragraph 69 of my
20 report, where I compare P in my diagram,
21 which has 10 possible values and $P \times 4$ which
22 also has 10 possible values and in my view in

1 the context of the '267 Patent, P and Px4 can
2 be represented with the same precision.

3 Q If I understand you correctly, then, in
4 my example of two rulers, one that measures
5 in centimeters, one to 10 centimeters and the
6 other one that measures in millimeters, one
7 to 10 millimeters, those two rulers have the
8 same precision?

9 A The values, so the ruler is just a piece
10 of wood or metal or plastic. Just a piece of
11 wood or metal or plastic, but we use a ruler
12 to measure things, I think you said assuming
13 we're using the rulers to the measure things,
14 if I tell somebody use the first ruler and
15 take a series of measurements, they're going
16 to measure something in millimeters. And the
17 measurement could have 10 possible values,
18 maybe it's 11 if you go from zero to 10, I'm
19 not sure. If I tell somebody else to use the
20 second ruler to measure, make a series of
21 measurements, the measurements are also going
22 to have 10 or 11 possible values. The number

1 of possible value in each case is the same,
2 so if we want to represent the measurements
3 in bits we need the same number of bits. We
4 could use more, but we need the same number
5 of bits.

6 It's very analogous to my Page 31
7 example in my second declaration, in fact,
8 you can say that P can be your millimeter
9 ruler and Px4 can be getting close to a
10 centimeter ruler. But there's still only 10
11 possible measurements that each ruler can
12 provide.

13 So the precision of the ruler I think in
14 terms of the '267 Patent is how many possible
15 measurement values does that ruler produce.

16 Q Now, let's look at the example that
17 you've been referring to. I believe it's on
18 Page 31 of Exhibit 2015; is that correct?

19 A Yes. That's what I'm looking at.

20 Q Okay. So on the left here of your
21 example on Page 31, you have a variable with
22 P with possible value 0 through nine?

1 A Yes. Integer value 0 to nine.

2 Q So in the Px4 here you still, in your
3 view, there are still 10 possible values; is
4 that accurate?

5 A Not in my view, there are. You can't
6 argue with that, sorry, there are still 10
7 possible values.

8 Q Okay. And so --

9 A And so just to clarify my previous
10 answer. I'm not disagreeing with you, I'm
11 saying this is not just my view, this is very
12 basic arithmetic.

13 Q So therefore in Paragraph 70, you're
14 explaining how you can use four bits to
15 represent Px4 rather than six bits from just
16 a conventional binary representation; is that
17 right?

18 A I don't talk about four bits or six bits
19 or conventional binary representation, none
20 of that's in this paragraph.

21 Q Well, how many bits do you need to
22 represent PX4?

1 A In terms of information content it's
2 somewhere between three and four, but in
3 terms of whole numbers of bits, you need four
4 bits.

5 Q How many bits do you need to represent
6 Q?

7 A More than that. Again, speaking in
8 whole bits you would need six bits. The
9 reason I say that is that with five bits I
10 could represent a number in the range number
11 0 to 31, with six bits I could represent a
12 number in the range 0 to 63, Q in my example
13 is in the range 0 to 36. If I want to use
14 whole bits then six bits would suffice.

15 Q So it is possible to use six bits to
16 represent the range of possible values in
17 Px4?

18 A That is not the number of bits needed,
19 that is more than the number of bits need.

20 Q It is possible to use six bits to
21 represent the range, correct?

22 A Yeah, if I need for example four bits to

1 represent a number. I can represent it with
2 five bits or 100 bits, but I only need four
3 bits.

4 Q So by knowing the number of actual
5 possible values, you've compressed the number
6 of bits you need from instead of using six
7 bits to use four bits in this example?

8 MR. VERBONCOEUR: I'll object to the
9 form of the question.

10 A I would not characterize it that way.

11 Q So you're not using -- you're not going
12 from six bits to four?

13 MR. VERBONCOEUR: Same objection.

14 A Going from where to where, sorry.

15 Q Well, from Q, right, you have six bits
16 for Q, but instead because you know how many
17 values you have for Px4, you're going to use
18 four bits instead?

19 A I need six bits to represent Q, if I'm
20 using whole number of bits, I need four bits
21 to represent Px4.

22 Q In your example here in this Px4 example

1 in the middle column, your first bit -- let's
2 say you have a value, right, you talk about
3 four bits, you have a value of 01, in your
4 scheme for Px4, what is the decimal value for
5 01?

6 MR. VERBONCOEUR: Objection. Form.

7 A I don't understand the question.

8 Q Okay. So we talked before about using
9 four bits for Px4, correct?

10 A Yeah.

11 Q So let's say those four bits are 0001.

12 A Okay.

13 Q What would that mean in decimal?

14 A So you're confusing a few things here.
15 So how many bits do I need to represent Px4?
16 I could chose for example to assign the bit
17 pattern 0000 to represent the value of 0.

18 I could chose to use the bit pattern
19 0001 to represent the value of four and so on
20 up to the bit pattern, yeah, whatever, yeah,
21 whatever the bit pattern, 1010, I think, to
22 represent 36. If I make those choices then

1 0001 represents the value four.

2 Q In your view, other choices could be
3 made so in anything that maps these 10 values
4 in Px4 to the four bits that you've allocated
5 to it, correct?

6 A I'll give you another example. If I'm
7 working with H.264 and I want to represent a
8 motion vector of plus 0.25, I would
9 represent -- or a difference, a motion vector
10 difference of 0.25, I could represent that
11 for H.264, I think tells me to represent that
12 with a bit ends in a single one, a lot of 0s
13 ending in a one.

14

15 If I were to represent -- sorry, I'm
16 just creating a really bad example, I'll just
17 drop that.

18 I think what I was trying to get at is
19 that the steps between possible motion vector
20 values is each one-quarter and each one is
21 represented by a unique bit pattern. But
22 that's a bad example because the

1 representation is also variable length coded
2 which adds confusion.

3 Q For your example in Px4. Let me back up
4 for one moment -- strike that.

5 What is variable length coding?

6 A Okay. I introduced it. That's
7 something that is -- it's a type of entropy
8 coding, we talked briefly about entropy
9 coding earlier.

10 Q For this example, in Px4, you know what
11 you said before the value four could be
12 represented by 0001 --

13 A Yes.

14 Q But it could also be other values as
15 well?

16 A Yeah, for example, if we're using four
17 bits to represent Px4, then I can assign 1110
18 to represent four, that's also available to
19 me.

20 Q Is there any limitation in terms of what
21 numbers you can use to represent four in this
22 Px4 example?

1 A Well, going back to the number of
2 possible values, what is the number of bits
3 needed to represent the possible values, so.
4 If I'm using whole values then, I'm -- in our
5 example, we're using four bits, what the
6 mapping is doesn't really affect what the
7 mapping from four bit value to a value of Px4
8 or vice versa, doesn't really affect the
9 precision as that term is used as we all I
10 think agree is used in the '267 Patent.

11 Q So in your view -- in your example here,
12 on Page 31, Px4 could be represented in those
13 four bits followed with the mapping where
14 one, 0001 is four. 0010 is eight. 0011 is
15 12 and so on?

16 A Um-hmm.

17 Q Is that a yes?

18 A Yes, yes you could rep -- yes.

19 Q But alternatively, you -- it's your view
20 that you can map the 10 values, the 10
21 possible values of Px4, to the four bits that
22 you're using any way that you would like?

1 A If the question is how many bits do you
2 need to represent the range of values, the
3 answer is still four regardless of, you know,
4 we use, for example, different encoding
5 different representation schemes for positive
6 and negative numbers and two's compliment. I
7 think Dr. Freedman talks about and there's
8 alternative ways of representing negative
9 numbers. You can represent negative numbers
10 as two compliment number or as an unsigned
11 number with a separate sign bit. You end up
12 with the same number of bits, you know, if
13 you have the same number of possible values.

14 Q So in the example on Page 31, what if
15 instead of multiplying by four, I multiplied
16 by five?

17 A Okay.

18 Q Then how many bits would I need to
19 represent the final result?

20 A So, once again, assuming that every time
21 we consider a value of -- every time a value
22 of -- let's say it's a, for the sake of

1 argument, P sits in a register somewhere, and
2 I've got a process and I generate $P \times 5$, and I
3 know that I'm always multiplying by a
4 constant value of five, regardless of the
5 value of P, then I still have ten possible
6 values of $P \times 5$.

7 So I can still represent those ten
8 values in the new part of my process,
9 whatever it is, this new system, using the
10 same number of bits, four bits. Or if I
11 have -- or if you go -- if you start with the
12 one millimeter ruler with 10 one millimeter
13 placings, and then go to a ruler with ten,
14 two centimeter placings, that still only can
15 measure ten possible values. I still require
16 the same number of bits. The number of bits
17 needed does not change.

18 Q In your example here, you multiply P by
19 a constant value four, correct?

20 A Yes.

21 Q What happens instead if you multiply P
22 by a two bit variable? You don't know what

1 the variable is, it could be anything, zero,
2 one, two or three.

3 A Okay.

4 Q Then, how many -- what would be the
5 number of possible values that result?

6 A So if P is a value that can take 10 --
7 is a variable that can take 10 possible
8 values, let's call it Q, is a variable that
9 can take four possible values, and you're
10 asking me how many bits required to represent
11 P times Q; is that right?

12 Q Yes.

13 A Okay. So P times Q could take 40
14 possible values. So using whole numbers or
15 bits, we're up to six bits.

16 But now we're not -- the question is not
17 how many bits does P require, the question is
18 how many bits does this new variable, P times
19 Q require, and it now has a greater number of
20 possible values.

21 Q So when you multiply the variable P by a
22 constant, that never changes the number of

1 possible values of P, fair?

2 A Yes.

3 Q But if you multiply P by a variable,
4 then that can change the number of possible
5 values for the result?

6 A P from the start up was a variable.
7 Multiplying a variable by another variable
8 gives us a third variable. So the question
9 is, how many possible values can -- it's the
10 same question. How many possible values can
11 our variable take, whether that variable was
12 P, whether it's (pred0), whether it's PQ or
13 something else.

14 Q You'd agree that multiplying a variable
15 that can take the full range of its possible
16 values, by another variable that can take
17 it's range of possible values, increases the
18 number of possible values for the resulting
19 product?

20 A Assuming those two variables that you
21 started with are independent of each other, I
22 think could, would, it depends on the range

1 of the second one, but it could increase the
2 number of possible values.

3 Q So if we have an example where P --
4 let's give it a different number. Let's say
5 we have an example where the variable X
6 ranges from 0 to 3. Follow me?

7 A Yeah. Sure.

8 Q How many possible values does it have?

9 A If they're integers, then it's four.

10 Q So if we multiply our variable X by
11 four, how many possible values does it have?

12 A Assuming that X is a variable and four
13 is a constant, then it still has four
14 possible values.

15 Q And just for the transcript to be clear,
16 let's assume that I'm talking about uppercase
17 X for this variable. Okay? All right.

18 A Yes, sure.

19 Q So if I want to take my variable of X
20 times four, and I want to add that to the
21 variable $P \times 4$ that you've described here in
22 Page 31 of your declaration, how do I do

1 that?

2 A You just add them.

3 Q Okay. So, for example, your value of
4 four in $P \times 4$, right, your example, that would
5 be 0001, correct?

6 A Hang on. Hang on. Maybe the choice
7 isn't correct.

8 What are you talking about? Are you
9 talking about the constant of four that I
10 multiply P by or the result of that as being
11 equal four?

12 Q Okay. So let's -- yes, let's use --

13 A If P equals one and constant is four,
14 then $P \times 4$ is four. Is that what you mean?

15 Q Right. So let's go back to the X
16 example. Right. We've got X times four. We
17 started out with 0 to 3, we multiplied that
18 by four, so the resulting possible values
19 would be 4, 8, 12 and 0?

20 A 0, 4, 8, 12, yes, okay.

21 Q So 0, 4, 8, 12. So then in our X times
22 four example, the value of say 0001 would be

1 four. The value of -- well, withdrawn.

2 Let me ask you another example. Let's
3 say a length is expressed as 150 centimeters.
4 All right. Would you agree that 150
5 centimeters could be alternatively expressed
6 as 15 centimeters?

7 A For length, no.

8 Q Why not?

9 A 150 centimeters has -- the centimeter is
10 defined -- is it the French who defined it
11 first? I think they did. I think they
12 defined a centimeter as a particular length.

13 A centimeter is a centimeter. It's -- like a
14 centimeter is a constant.

15 Q Okay. Let me ask this question again.

16 150 millimeters could alternatively be
17 expressed as 15 centimeters, correct?

18 A Yes.

19 Q So if you read a measurement and it says
20 150 millimeters, would you take that to mean
21 that the measured length is somewhere between
22 149.5 to 150.4 millimeters?

1 MR. VERBONCOEUR: Object to the form
2 of the question.

3 A Logically, 150 is between -- did you say
4 145 and 154? So 150 is between those two
5 numbers.

6 Q Right. So when you look at -- if you
7 see that there's a measurement, right, a
8 reported measurement, and this is
9 150 millimeters.

10 A Um-hmm.

11 Q Remember in school we were taught, okay,
12 you have this measurement, it's like 150, it
13 may not be exactly, it might actually be
14 149.99, but because we -- if we are only
15 going with integers, it gets rounded, so it's
16 150 centimeters.

17 Do you recall -- so with that
18 understanding, when you see a measurement is
19 150 millimeters, would it be reasonable to
20 think, okay, this measurement is somewhere
21 between 149.5 to 150.4?

22 A 150 is somewhere between 149.5 and

1 150.4. That's a logical proposition I agree
2 with.

3 Q When you see a measurement of 15
4 centimeters, would it be reasonable to
5 conclude that the measured length is
6 somewhere between 140 -- withdrawn.

7 When you read a measurement of 15
8 centimeters, would it logical and reasonable
9 to conclude that the measured length is
10 somewhere between 14.5 to 15.4 centimeters?

11 A The number 15 is between -- exists
12 between 14.5 and 15.4.

13 Q Right. So if the measurement says 15,
14 you'd conclude, well, that measurement is
15 going to fall somewhere in that range of 14.5
16 to 15.4 centimeters, correct?

17 A I would say the measurement -- a
18 measurement of 15 is in the range, exists in
19 the range 14.5 to 15.4. It's a specific
20 point.

21 Q So if you read a measurement and it says
22 15.0 centimeters.

1 A Okay.

2 Q That the extra .0 tells us that a
3 measured value is not, for example, 15.1,
4 correct?

5 A But I already knew that with your
6 previous example. I didn't need any
7 information to tell me. I already knew that
8 15 is 15.

9 Q What if a measurement reports 15.0, the
10 reason that has the extra .0 is to let you
11 know that, in fact, hey, we did measure that
12 with .1 level, right, and it came out as 0.
13 Is that a notation that you're familiar with?

14 A I think you're inferring way too much
15 without some other kind of information about
16 accuracy bounds or what is doing the
17 measuring. You are asking me whether 15 is
18 between 14.5 and 15.4. It is.

19 It's also between 14.1 and 15.0. It's
20 also between 14.9999 and 15.0001. 15 is
21 between those two things.

22 Q Have you ever seen a measurement result

1 that ends in .0?

2 A Sure. I have -- pretty sure that my
3 kitchen scales give me a .0, if not my
4 bathroom scales. Actually, I just bought
5 some new bathroom scales, the old ones went
6 to .0, went to -- sorry, one decimal point,
7 the new ones go to two decimal points.

8 Q Have you ever gone to IKEA?

9 A The old ones came from IKEA.

10 Q If you go and you look and you say, hey,
11 this table, and there's a table and it says,
12 this thing is like 15.0 meters long, it's a
13 really long table. Okay?

14 A Yeah.

15 Q In your view, it would be entirely
16 redundant to have a .0 at the end, it
17 shouldn't just say 15 meters, correct?

18 MR. VERBONCOEUR: Object to the form
19 of the question.

20 A No. No, it's -- I can express 15 meters
21 in a lot of different ways. It's not
22 redundant. It's just how somebody choses to

1 label it. If it's 50 meters, it's 50 meters.

2 Q So why would IKEA ever tell you that a
3 table is like 2.0 meters as opposed to just
4 saying 2 meters? Is that even a possible
5 thing?

6 A I have no idea. Yeah. We get the
7 measurements -- yeah, I --

8 Q So you've never seen a time when
9 somebody tells you -- you've never seen an
10 example where something reports a measurement
11 of, say, 2.0 to let you know that, in fact,
12 that extra tenth was measured and it came out
13 as zero, you've never seen that notation
14 before?

15 A I don't know what you're asking me to
16 assume, to be honest. Two is two. Whether I
17 express it as 2.0 or 10 divided by five, it's
18 still two.

19 Q So you never had in a science class
20 where you were told, hey, you know what, you
21 should use your -- the number of -- the
22 number of digits that's appropriate to show

1 the precision of your measurement?

2 A Okay. What are we talking about now?

3 This is different.

4 Q I'm just talking about science class.

5 You never heard of this idea that you
6 should use significant digits to represent
7 the precision of your measurements?

8 A I've used -- yeah. I've used different
9 numbers of significant digits in my education
10 and career. If that's what you're asking me.

11 Q Why do you use different number of
12 significant digits?

13 A Can we go to a specific example. This
14 is like a little bit vague.

15 I mean, maybe we can talk about my
16 Paragraph 78, if you want to talk about that,
17 significant digits.

18 Q Would you agree the number two and 2.0
19 are different because the number two only has
20 one significant digit and the number 2.0 has
21 two significant digits?

22 A The representation of the quantity two

1 is -- you're representing it in two different
2 ways, but it's still the quantity two.

3 Q But you agree that there is a difference
4 in that the number two has a single
5 significant digit, but the number 2.0 has two
6 significant digits, correct?

7 A So I could express the number 2.0 as 2.0
8 or I could express it as two. It's still the
9 number 2.0.

10 Q It's the same thing in your mind?

11 A The number hasn't changed. The number
12 hasn't changed. The representation has
13 changed, if that's what you're asking. I
14 think that's what you're talking about.

15 Conversely, as I say in Paragraph 78 of
16 my declaration, the value 8582.2 could be
17 expressed with less precision, but 8582.2 is
18 not the same number as 8582. There's kind of
19 a counter example to the one, it's not quite
20 what you're asking me.

21 Q So if you're reading a scientific
22 paper --

1 A Yes.

2 Q -- and it reports a measured value of 2
3 meters, in your view, is that exactly the
4 same as if it had reported a measured value
5 of 2.5 meters?

6 A No. Of course not.

7 Q Why not?

8 A One is two, one is 2.5.

9 Q If you had read a scientific paper and
10 it reported a measured value of 2 meters,
11 would that be exactly the same as if it had
12 reported a measured value of 2.0 meters?

13 A The value itself is two in each case.
14 The way it's being represented is different.
15 It might tell me something about the
16 measurement, it might simply be a choice of a
17 person writing the number.

18 Q So if you see that the reported value is
19 2.0, would you think that maybe the actual
20 value still might be 2.1?

21 A If the reported value is 2.0, then it's
22 not 2.1.

1 Q But if you see in a paper a reported
2 value of 2 meters, is it possible that the
3 actual value might be 2.1 meters?

4 A Well, 2 and 2.1 are not the same number.
5 If it's a measurement of something, then 2.1
6 measured to the nearest meter is two, for
7 example.

8 Q And if you see a measurement in a paper
9 and it reports 15 centimeters, then all you
10 know is that they measured 15 centimeters,
11 you don't know if the actual value might be
12 say 15.1, correct?

13 A Well, if it's a measurement of 15
14 centimeters, it's a measurement of 15
15 centimeters.

16 If it's in a paper and it's describing
17 measuring an IKEA table with a ruler, I don't
18 know how they did it unless they describe how
19 they did it and explain the accuracy of their
20 process.

21 Q In a scientific paper, if you see a
22 measurement that reports 15 centimeters, that

1 tells you that they at least measured down to
2 the closest centimeter; is that fair?

3 MR. VERBONCOEUR: Object to the form
4 of the question.

5 A They measured down to the closest
6 centimeter. Well --

7 Q Let me rephrase the question.

8 A Could have been nearest five
9 centimeters, context matters.

10 Q Um-hmm. So in a paper, if you see a
11 measured value of 15 centimeters, that paper
12 is telling you a measurement -- withdrawn.
13 Let me rephrase.

14 You're reading a scientific paper and it
15 reports a measurement value of 12
16 centimeters, then the reasonable inference is
17 that it is reporting a value to the closest
18 centimeter, correct?

19 A I could turn it around and say, if it
20 was a table of values and every value is an
21 even number, then I might wonder if they
22 measured to the nearest two centimeters.

1 Q Okay. And if you see in a paper that a
2 measured value was reported as 12.0
3 centimeters, would it be reasonable to
4 conclude that the paper is reporting a value
5 down to the nearest tenth of a centimeter?

6 A Not if, for example, it was sitting in a
7 table of values which included 11.0, 15.0,
8 19.0, but never included anything that didn't
9 end in a .0. Context matters, I think, in
10 this type of question.

11 Q So in that table, you wouldn't -- your
12 conclusion would be, hey, everything ends in
13 zero, they're just rounding to the nearest
14 centimeter, your conclusion wouldn't be, hey,
15 they're reporting a .0 because they want to
16 tell us that they measured that extra tenth
17 of a centimeter?

18 A To be honest, if it's a well written
19 paper, I should know without having to make
20 those guesses.

21 Q Looking at this example here in your,
22 you know, on Page 31. We talked before that

1 Px4 needs four bits to -- be to represent it,
2 correct?

3 A In this scenario, yes, with P as a
4 variable, four as a constant, yes.

5 Q If you left shift Px4 in your example on
6 Page 31, does this increase the number of
7 possible values?

8 A Do you mean the binary representation
9 that -- such as the one we discussed earlier?

10 Q Correct. The four bits, you take the
11 four bits that you used, right --

12 A Okay.

13 Q -- for the Px4, and you left shift it,
14 does that increase the number of possible
15 values?

16 A Without doing anything else? No, it
17 doesn't.

18 Q So let me ask you a question about --
19 let me ask you a question about Walker. So
20 if you could turn to Walker, please.

21 A I'm on it, yeah.

22 Q Okay. And if you look at Table 2.

1 A Yeah. Sure.

2 Q Okay. You see in the first row
3 (pred0)w0, Walker uses 16 bits, correct?

4 A In the --

5 Q Table 2.

6 A Yeah. In Table 2 of Walker, Walker
7 chooses to use 16 bits at this point.

8 Q Okay. So the -- for the variable
9 (pred0)w0, Walker uses bit depth of 16 bits,
10 correct?

11 A Walker chooses to use -- yeah, for
12 the -- call it variable or term -- (pred0)w0,
13 yes.

14 Q So the result of the values of (pred0)w0
15 are 16-bit numbers, correct?

16 A Sorry. Say that again.

17 Q In Walker Table 2, the value of the
18 variable (pred0)w0 are 16 bits, correct?

19 A The term (pred0)w0 is stored or
20 represented using 16 bits at this point in
21 Walker's Table 2.

22 Q Why does Walker use 16 bits instead of 8

1 bits?

2 A So w_0 , when we're predicting a block in
3 H.264, w_0 -- when we're predicting -- w_0 is
4 constant for the slice, as I recall. So
5 slice is a set of macroblocks. So when we're
6 predicting a block in H.264, w_0 doesn't
7 change. It's constant for the block; it's
8 constant for the slice.

9 I have to speculate as to why Walker
10 chose these numbers. I would speculate that
11 Walker is considering, "Well, I'll use the
12 same circuit for the next slice," which can
13 have a different constant w_0 . So it's kind
14 of analogous to -- you asked me earlier, you
15 know, I gave the example Px_4 where 4 was
16 constant. Does Px_4 have 10 possible values?
17 Yes. Does Px_5 have 10 possible values? Yes,
18 but I'm now using a different constant.

19 So Walker -- and I explained this in
20 around Paragraphs 105 to 106. Walker is
21 choosing, I think, to use more bits than are
22 needed to represent $(pred_0)w_0$, which is

1 perfectly okay to do. If we need eight bits
2 to represent (pred0)w0 in an implementation,
3 I might chose to use or register more bits
4 than that. For example, I can use the same
5 pair of registers or the same circuitry when
6 I decode a different slice that's got a
7 different constant.

8 Q I want you to look at Walker Figure 5.
9 Do you see Walker Figure 5?

10 A Yes.

11 Q What are the boxes with numbers 520 and
12 580?

13 A So Walker describes Figure 5 starting at
14 Paragraph 34 of Walker. The box 520 is a
15 best-matching macroblock, and the box 580 is
16 another best matching macroblock. So 510
17 is -- sorry. I'm just thinking aloud here.
18 Previous reference picture 575 is a
19 subsequent reference picture, so each of
20 these is a best-matching macroblock,
21 according to Walker, in two separate
22 reference pictures.

1 Q What is a macroblock?

2 A Macroblock -- H.264 defines a
3 macroblock. I don't have the standard in
4 front of me. But my recollection is that it
5 is a 16-by-16 region of luma pics -- luma
6 samples along with -- for color source
7 material along with a region of chroma
8 samples, blue chroma samples and red chroma
9 samples. And those regions, in many
10 implementations, 8-by-8 samples.

11 So macroblock, one way of looking at it
12 in H.264 -- this is my high-level
13 explanation, not the way the standard defines
14 it -- is it's the data that comprises a
15 16-by-16 region in a frame or video.

16 Now, I think -- I might be stepping a
17 little bit out of the box here, but I think
18 Walker here is using the term "macroblock"
19 slightly loosely or it's slightly different
20 way from H.264.

21 In H.264 a macroblock is always aligned
22 to a 16-by-16 pixel grid, as I recall.

1 Whereas if you look at Figure 5 of Walker,
2 the positions of these best-matching regions
3 are not necessarily aligned to the 16-by-16
4 grid. So personally my opinion is that in
5 H.264 terminology, it might be more accurate
6 to say these are 16-by-16 matching regions.

7 That's a long answer, but I wanted to
8 try and be precise. If I wanted to be more
9 precise, I would take you through the
10 standard just to back up what I just said.

11 Q So in H.264 a macroblock is a 16-by-16
12 group of pixels that is a line on 16-pixel
13 boundaries?

14 A If you like, it's the data representing
15 the -- that would ultimately be displayed as
16 16-by-16 groups of pixels. And I'm working
17 from memory here. I don't have the standard
18 in front of me. But that, as I recall, is
19 the way the H.264 Standard uses the term
20 "macroblock."

21 Q And you think -- and so Walker is just
22 using the term a little more loosely just to

1 refer to a group of 16-by-16 pixels, not
2 necessarily aligned on those 16-pixel
3 boundaries, right?

4 A Well, so in the description of Figure 5,
5 Walker Paragraph 34, there's a description of
6 a current picture 505 made up of 5-times-5
7 macroblocks, and you can see a grid there.
8 And walker describes these as macroblocks.
9 And that would be broadly consistent with the
10 way H.264 uses the term "macroblock." And
11 then Walker also describes the boxes you
12 asked me about, 520 and 580, as best-matching
13 macroblocks.

14 Personally, if I was describing or
15 summarizing or trying to explain the
16 operation of an H.264 process, compatible or
17 compliant with H.264, I would probably call
18 these "regions" rather than "macroblocks."
19 But they're 16-by-16 regions.

20 Q Are there half pixels in Walker -- if
21 you turn to Walker Figure 9, please.

22 A Sure.

1 Q You see Figure 9?

2 A Yes.

3 Q Does Walker Figure 9 show half pixels?

4 A So Walker Figure 9 is described in
5 Walker at Paragraph 114. And it says,
6 Figure 9 is an illustration of an example of
7 half-pixel interpolation for use in motion
8 compensation. Integer pixels are depicted as
9 circles labeled as uppercase letters -- I'm
10 paraphrasing -- the interpolated or half
11 pixels, 920, are depicted as squares labeled
12 with lowercase letters.

13 So Walker Figure 9 is depicting integer
14 pixel positions capital A, B, C and so on and
15 also sub-pixel positions, which Walker
16 describes as half pixels. I would call them
17 probably sub-pixel positions labeled with
18 lowercase letters.

19 Q Are the half pixels in Walker Figure 9
20 interpolated?

21 A Walker in Paragraph 114 describes the
22 half pixel positions as interpolated, yes --

1 sorry. Sorry. Yes -- sorry. Maybe you're
2 going to ask me this. You go ahead.

3 Q How does Walker interpolate the
4 half-pixel values in Figure 9?

5 A Walker, Paragraph 114 -- this is what I
6 was just about to say -- says that half-pixel
7 interpolation can be carried out with a
8 bilinear filter such as, for example, a
9 two-tap FIR filter with particular weights.

10 Q So then Walker in that paragraph would
11 take a reference block and then use that with
12 an FIR filter to come up with the half pixels
13 shown in Figure 9?

14 A I think that's broadly consistent with
15 what Walker -- what Walker is saying is that
16 there are integer pixel positions
17 illustrated, uppercase letters, and there are
18 interpolated pixel positions illustrated with
19 lowercase letters, and those
20 interpolations -- yeah, it goes on to give an
21 example where an interpolated pixel can be
22 calculated as the average of two integer

1 pixels, and I think that's what you're
2 talking about.

3 So the integer pixels are from a
4 reference block of pixels. A sub-pixel
5 positions, such as lowercase A, Walker
6 describes as being interpolated from --
7 between neighboring integer pixel positions.

8 MR. LIANG: We've been going about an
9 hour. Let's take a break.

10 MR. VERBONCOEUR: Sure.

11 A Could I just finish my answer? Sorry.
12 It's just -- I'm just reading -- just to
13 fully answer your question, Walker does
14 happen to describe here that some of the
15 sub-pixel positions, such as lowercase D, are
16 interpolated between other sub-pixel
17 locations. Some are interpolated from
18 integer pixels; some are not, according to
19 Walker.

20 Done.

21 MR. LIANG: All right. So let's take
22 a break.

1 (Whereupon, a recess was taken
2 from 4:22 PM until 4:37 PM.)

3 Q So, Dr. Richardson, I'm handing you what
4 has been marked Exhibit 1019.

5 (Whereupon, Amazon Order for
6 "Coding Video: A Practical Guide
7 to HEVC and Beyond, Richardson,
8 Iain E." was marked as Exhibit
9 1019 for identification as of
10 this date.)

11 Q Now, the first page of Exhibit 1019 is
12 an Amazon order form. But if you skip past
13 that, a receipt, if you skip past that and
14 look at the rest of Exhibit 1019.

15 A Okay.

16 Q You recognize this as a book that you
17 wrote?

18 A It looks like a scan or a photocopy of
19 some pages from a book that I wrote, yeah.

20 Q Okay. And if you flip through
21 Exhibit 1019 and review. Can you let me know
22 if this looks like an accurate scan of

1 certain pages from your book?

2 A Yeah. It looks consistent with certain
3 pages from my book, yeah. Just a number of
4 pages. I'm not sure. And that's my coding
5 video book, which I think was published
6 in 2024.

7 Q So as far as you can tell, this looks
8 like a true and accurate copy of pages from
9 your book Coding Video?

10 A I don't have any reason to disagree with
11 that.

12 (Whereupon, "The H.264 Advanced
13 Video Compression Standard, 2nd
14 Edition, Iain E. Richardson" was
15 marked as Exhibit 1020 for
16 identification as of this date.)

17 Q So I'm handing you what's been marked as
18 Exhibit 1020. Is it correct that your book,
19 H.264 Advanced Video Compression Standard,
20 Second Edition, is offered for sale
21 electronically?

22 A Yes. I believe it is, yes.

1 Q And was your book, H.264 Advanced Video
2 Compression Standard, Second Edition,
3 published in August 2011?

4 A I think -- yeah, sir, I think my book,
5 The H.264 Advanced Video Compression
6 Standard, second edition, I think it was
7 published in -- the book was published
8 in 2010.

9 Q Okay. And Exhibit 1020 does reflect
10 what you're saying earlier that the publisher
11 does offer a version of your book on sale
12 digitally?

13 A Yes.

14 Q Now, I'd like to take a look at --
15 actually, let me ask: Have you ever heard of
16 John L Hennessy and David A Patterson?

17 A Not sure.

18 Q Well, have you ever heard of a computer
19 architecture book called Hennessy and
20 Patterson?

21 A Not sure.

22 Q So if we back up and just talk about

1 binary calculations, was the concept of
2 keeping higher precision intermediate values
3 a known method for reducing rounding errors
4 before 2011?

5 A So for example, Paragraph 93 of my
6 second declaration, I'm talking about the
7 Karczewicz 2 reference, and there I'm
8 explaining that in -- Karczewicz 2 suggests
9 that certain interpolated values could be
10 maintained at a high precision, and my
11 recollection is a higher precision than, for
12 example, the H.264 subsample interpolation
13 process, and that there were certain
14 advantages to that. And Karczewicz 2, I
15 understand, to have been published in 2009.

16 Q Would it surprise you if there are, in
17 addition, other references that teach the
18 idea of keeping higher precision intermediate
19 values to reduce rounding errors?

20 A It wouldn't necessarily surprise me. I
21 think it's a -- yeah, it's a concept that
22 was -- well, what I described happening in

1 Karczewicz 2 is happening in 2009. So, yeah,
2 it wouldn't necessarily surprise me.

3 Q So I'm handing you what's been marked as
4 Exhibit 1021.

5 (Whereupon, Textbook by Iain E.
6 Richardson was marked as Exhibit
7 1021 for identification as of
8 this date.)

9 Q And so Exhibit 1021 is a textbook. And
10 if you turn to page --

11 MR. VERBONCOEUR: Counsel, you may
12 clear this up with your questions, but
13 I'll just lodge an objection for now
14 that it doesn't appear there's any
15 title or date or other information
16 associated with the pages that have
17 just been handed out.

18 Q Have you ever done any assembly
19 programming before?

20 A Yes.

21 Q Have you ever done it on the Intel CPU
22 architecture?

1 A I can't remember.

2 Q Would you agree that the Intel CPU
3 architecture is a -- is also commonly known
4 as the X86 architecture?

5 A I think there are sort of multiple
6 generations of the Intel CPU architecture,
7 but X86, I think, is a sort of shorthand for
8 those generations. I'm familiar with that.

9 Q And is it correct that X86 is the most
10 common PC CPU architecture in the world?

11 A I don't know.

12 Q Could we turn to Exhibit 1012, which is
13 the --

14 A This one?

15 Q Correct.

16 Okay. So I'd like to turn to --

17 MR. LIANG: Can we go off the record
18 for a second?

19 MR. VERBONCOEUR: Sure.

20 (Whereupon, a recess was taken
21 from 4:48 PM until 4:53 PM.)

22 Q Okay. So could we turn to Exhibit 1012.

1 A Okay.

2 Q I'd like to direct you to the pages on
3 the bottom, a stamped Page 000187.

4 A Okay.

5 Q Okay. If you could look and just read
6 to yourself this page. It's titled
7 Section 6.4.2.1, Generating Interpolated
8 Sub-pixels, on stamped Page 187 of
9 Exhibit 1012.

10 Let me know when you're ready for
11 questions.

12 A Okay. Go ahead.

13 Q Does this page, 187, appear to you to be
14 a page from your book titled H.264 Advanced
15 Video Compression Standard?

16 A So as I said earlier, I don't recognize
17 it as either a photocopy or a scan of that
18 book or an e-book that was bought from the
19 publisher because they look different in
20 terms of -- yeah, the e-book versions that I
21 have seen. All that said, I don't see
22 anything on this particular page that is --

1 appears to be inconsistent with my 2010 book.

2 Q Okay. And if we could turn to stamped
3 page 225.

4 A Okay.

5 Q If you could review stamped page 225.
6 And let me know when you're ready for
7 questions.

8 A Okay.

9 Q Does Page 225 of Exhibit 1012 look
10 consistent with a page from your book?

11 A Yeah, again -- again, with the same
12 proviso I gave a moment ago, I don't see
13 anything here that I recall to be
14 inconsistent with my 2010 book.

15 Q Okay. If we can turn to Page 194 of
16 this, Exhibit 1012, go to stamped-Page 194.

17 A Yes.

18 Q And you look at --

19 A I'm sorry. Sorry. I was looking at the
20 top.

21 Q Yeah, if you looked at stamped-Page 194
22 to 195.

1 A Okay.

2 Q Do Pages 194 to 195 look consistent to
3 you with corresponding pages from your book
4 H.264 Advanced Video Compression Standard?

5 A Yeah, I think we might have already had
6 this discussion. I think the answer is, yes,
7 I don't see -- again, same provisos, but I
8 don't see anything that I recall to be
9 inconsistent with my 2010 book.

10 Q If we turn to Page 183,
11 stamped-Page 183.

12 A Okay.

13 Q And you review that through Page 185.

14 A Okay.

15 Q Do Pages 183 through 185 of Exhibit 1012
16 appear consistent to you with corresponding
17 pages from your book, The H.264 Advanced
18 Video Compression Standard?

19 A Yeah. Same proviso, same answer. And I
20 will point out that I don't have a -- I don't
21 have a copy of the book to compare it with.
22 But I don't see anything that I recall stands

1 out as different.

2 Q Okay. If we turn the page to Page 187.

3 If you could just review Page 187 to 188.

4 A Okay. Yes.

5 Q Do Pages 187 to 188 appear consistent to
6 you with corresponding pages from your book,
7 The H.264 Advance Video Compression Standard?

8 A I think you've already asked me this
9 one, and I already said -- gave the answer I
10 gave for these pages.

11 Q Which would be?

12 A Whatever I said, like, three minutes
13 ago. You've already taken me to these pages,
14 I think.

15 Q I see. So before I had asked you about
16 Page 187, but I just want to make sure you've
17 also reviewed Page 188, so --

18 A Okay. I have, and it would be a similar
19 answer, yes.

20 Q Okay. And if we then turn to
21 stamped-Page 205.

22 A Okay.

1 Q So reviewing -- if you review Page 205
2 of Exhibit 1012, does Page 205 appear to be a
3 page that corresponds to a page from your
4 book, The H.264 Advanced Video Compression
5 Standard?

6 A Same answer as before for the other
7 pages.

8 Q Okay. And if we turn to Page 224,
9 stamped-Page 224 of Exhibit 1012.

10 Does Page 224 appear to consistent with
11 the corresponding page from your book, The
12 H.264 Advanced Video Compression Standard?

13 A Same answer as before.

14 Q And just for the record, can you state
15 what your answer is?

16 A Sure. Stamped Page 224 of this exhibit,
17 once again, it doesn't look like I would
18 expect a photo copy, scanned copy or
19 purchased e-book page to look like, but I --
20 and I don't have a one of those
21 aforementioned versions of my book beside me
22 to compare it to, but I don't see anything on

1 this exhibit page that looks inconsistent --
2 that I remember to be inconsistent with
3 my 2010 book.

4 Q Have you ever written software programs
5 before?

6 A Yes.

7 Q What kind of programming languages have
8 you used to write software programs?

9 A Going way back basic, pascal, C, C++,
10 more than one type of assembly language.
11 Sorry, just say the question again. Software
12 program or did you say software program or
13 just program.

14 Q Software programming languages?

15 A Some Python, some JavaScript. Some Java
16 though not so much of those last three. I
17 don't recall whether there are others.

18 Q What are code branches?

19 A In what context?

20 Q The context of the C programming
21 language?

22 A Do you mean within a program or in terms

1 of, for example, version control.

2 Q Oh. So within a C program, within a
3 C -- withdrawn. Let me rephrase. Within a
4 software program written in the C programming
5 language --

6 A Okay.

7 Q -- what are code branches?

8 A It says C has certain, certain operators
9 and expressions, some of them cause program
10 execution to go in and out of functions, and
11 so forth and then you've got things, like, if
12 I remember correctly, case statements or, but
13 I'm not sure which of those might be termed
14 code branches, it's kind of a more generic
15 term.

16 Q Now, I'm sorry. I'm not sure if the
17 transcript is clear, so I just wanted to ask
18 you again, so you mentioned a few statements
19 in C that can cause code branches. So what
20 were those statements in C that caused code
21 branches?

22 A That wasn't what I said.

1 Q Oh, okay.

2 A There are statements -- I'll try and put
3 it slightly clearer. There are statements in
4 C that affect the execution flow or the order
5 in which operations are carried out. Whether
6 one could potentially call those code
7 branches, but code branches sounds to me like
8 a more generic term.

9 Q Do "if statements" cause code branches?

10 A Well, code branches is a somewhat
11 generic term. An "if statement" in C
12 language is or causes conditional execution,
13 so the lines of code following an "if
14 statement" may or may not be executed
15 depending on the result of the "if
16 statement."

17 Q So therefore "if statements" cause code
18 branches because they create conditional
19 portions of the code?

20 A "If statements" affect or -- "if
21 statements" typically cause -- can cause
22 conditional execution of portions of code. I

1 didn't call them code branches, you did.

2 Q Okay. Can you identify any programming
3 statements in the C programming language that
4 cause code branches?

5 A Okay. What do you mean by code
6 branches?

7 Q Well, does that term mean anything to
8 you in the context of software programming
9 language?

10 A One could use it as a fairly generic
11 term for something relating to the flow of
12 execution. One can also use it to describe
13 subsets of a larger program of some diversion
14 control, so a bit of context would be
15 helpful.

16 Where as if I talk about an "if
17 statement" in C it has a particular meaning,
18 if I talk about a "do while statement" in C,
19 that has a particular meaning.

20 Q But discussing code branches in the
21 context of this IPR doesn't have any
22 particular meaning to you?

1 MR. VERBONCOEUR: Object to the form
2 of the question.

3 A That's not at all what I said. That's
4 not at all what I said, point me to the
5 context and I'll talk about it.

6 Q Okay. I'm just going ask does an "if
7 statement" in -- would you agree or disagree
8 that an "if statement" in the C programming
9 language causes code branches?

10 A I don't recall whether I've put it that
11 way in the past. If I was, you know, I'm
12 trying to be precised today. I would use --
13 if you asked me to describe -- explain the
14 characteristics of an "if statement" in the C
15 programming language I would probably say
16 something like I've already said, that an "if
17 statement" can affect the sequence of
18 operations or the flow of operations. For
19 example, a block of code may or may not be
20 executed depending on the result of the "if
21 statement." So that's a relatively precise
22 statement in my view.

1 Q You would agree though that a POSITA
2 would be aware of significant computational
3 cost from adding code branches and would
4 therefore avoid using them?

5 A In what context?

6 Q I'm just asking you if you agree or
7 disagree with the statement that a POSITA
8 working a video coding would be aware of the
9 significant computational cost from adding
10 code branches that would have persuaded a
11 POSITA from using them?

12 MR. VERBONCOEUR: I would object to
13 the form of the question.

14 A I wouldn't agree with that without
15 context. For example, I can think of
16 a counter example.

17 Q What's the counter example?

18 A If I'm writing, I don't know a shell
19 script or a script that runs once per day and
20 a code branch makes my job slightly easier
21 when I'm writing, and testing that script and
22 the difference in execution time between

1 using a code branch, not adding a code branch
2 whatever you want to call it, adding
3 conditional execution or not adding
4 conditional execution, and that difference is
5 one second and I run that once a day, I don't
6 really care.

7 Q But for a video codec you would agree
8 that a POSITA would not use code branches
9 because they add significant computational
10 cost?

11 MR. VERBONCOEUR: Object to the form
12 of the question.

13 A I don't think I could write a video
14 codec even a very simple one without using
15 conditional execution. I don't think I
16 could.

17 Q Would you agree that it's always
18 important to have minimum computational
19 complexity for all video codec applications?

20 MR. VERBONCOEUR: Object to the form
21 of the question.

22 A So if you read my book, you will,

1 somewhere rather, see a discussion of
2 performance, I think it's in this book and I
3 probably explain in my book and I think a
4 POSITA would be aware of this, that if, for
5 example, wants to maximize compression
6 efficiency one might chose to do that at the
7 expense of increasing computational
8 complexity.

9 Q Would you agree that those of ordinary
10 skill in the art would understand that bit
11 shifting operations could be accomplished by
12 other methods such as applying a scaling
13 factor through multiplication or division?

14 A I think a person of ordinary skill in
15 the art would understand that in order to
16 achieve the same result as, for example, a
17 left shift by two binary places, one could
18 achieve the same numerical result by
19 multiplying by a factor of four. I think
20 that's an example of what you were just
21 asking.

22 Q So left shifting is mathematically

1 equivalent to multiplications by powers of
2 two, correct?

3 A Binary left shifting -- left shifting of
4 binary representation is, hang on, yeah,
5 depends what the binary number is
6 representing. So a binary representation of
7 a decimal number, for example, then left
8 shifting by a number of bit positions is
9 mathematically equivalent to multiplying by a
10 power of two.

11 Q So for shifting end bits to the left,
12 then that's the same as multiplying by a
13 scaling factor of two to the N?

14 A What does the N bits represent.

15 Q So if you have a number, a binary
16 number, you left shift it end bits, then
17 that's the same as multiplying by a scaling
18 factor of two to the N?

19 A What is my binary number? I mean what's
20 it representing.

21 Q Why do you have to know that?

22 A Well, I suppose if it's a binary number

1 to me implies that it is representing a
2 number, but if it's just a binary screen then
3 yeah, I was just trying to make sure that I
4 wasn't being imprecise in my answer to be
5 honest. So if, for example, we have a
6 decimal value and if I represent that as a
7 binary number, and I left shift that binary
8 number, that would in most context that I'm
9 aware of be equivalent to, mathematically
10 equivalent to multiplying it by a power of
11 two.

12 Q Would you agree that bit shifting a
13 binary number to the right is mathematically
14 equivalent to dividing by a factor?

15 A What factor?

16 Q Well, would you agree that bit shifting
17 a binary number to the right by one bit, is
18 that mathematically equivalent to dividing
19 that number by two?

20 A I think I have to play certain
21 constraints now. So, for example, a binary
22 number represented in twos complement form.

1 Yeah, so a binary number that is
2 representing a negative number in two's
3 compliment form if that is, and I think I got
4 this -- is the right way around it that is
5 arithmetically right shifted by one or more
6 bit positions, that is mathematically
7 equivalent to dividing the equivalent decimal
8 number or whatever representation we have by
9 a power of two with a rounding operation.

10 Q So computers in a CPU when it executes a
11 multiplying operation, what portion of the
12 CPU typically performs that operation?

13 A I'm familiar with sort of typical CPU
14 architectures where that would be done
15 something called an arithmetic logic unit,
16 ALU.

17 Q What steps would an ALU use to multiply
18 the number five with the number four?

19 A It depends on the ALU.

20 Q Can you give me an example way that an
21 ALU would multiply the number five with the
22 number four?

1 A I learned a few ways when I was a
2 student and I used a few ways since then.
3 I've used very specific ways in certain
4 architectures. My recollection is that there
5 are a lot of different hardware constructs,
6 or if we can call them hardware algorithms,
7 but for multiplication. A lot of different
8 ones, I think people are still inventing new
9 ones or proposing new ones.

10 Q In those ways that you learned as a
11 student, did they involve shifts and adds?

12 A I can't remember. That was a while ago.
13 I'm aware of lot of different ways of
14 multiplying. I designed, for example, more
15 than one transform implementation that
16 involved multiplication and I recall using
17 different methodologies.

18 Q Why are there so many ways that people
19 look into implementing multiplication on an
20 ALU?

21 A There are lots of ALUs, you mention the
22 X86 architecture, how many different

1 iterations have there been of the X86
2 architecture, are they the same, no. Does
3 each architecture do things in different
4 ways, yes. Do more recent architectures, for
5 example, have provisions for array
6 multiplications, I think they do, compared to
7 older versions of X86 architecture, and so on
8 and so forth. So the applications change,
9 the capabilities of the CPUs change, the
10 number of logic gates that might be practical
11 or available change. The constraints such as
12 parallelization, threading, pipelining,
13 execution, speed, applications, all of these
14 things change over time.

15 Q Multiplication is a relatively simple
16 operation in ALU right?

17 A Why do you say that.

18 Q Well, you would agree that
19 multiplication is far simpler to perform in
20 an ALU than say left shifting, right?

21 A Seriously?

22 Q I don't know?

1 A No, no. I hope that was a trick
2 question.

3 Q Do you know if any ALUs might replace
4 multiplication with left shifting if the left
5 shifting is --

6 A What do you mean by, sorry, sorry.

7 Q Are you aware of any ALUs that might see
8 a multiplication operation and then if -- and
9 then replace that with a left shift operation
10 instead as a shortcut?

11 A What do you mean by an ALU seeing a
12 left, seeing something, I don't understand.

13 Q Are you aware of any ALUs that would
14 replace multiplication by a power of two with
15 a left shift as a computational shortcut?

16 A I just don't know.

17 Q Are you aware of any compilers replacing
18 multiplication by a power of two with left
19 shifting?

20 A I haven't designed a compiler before, so
21 yeah, I just don't know.

22 Q So I'm handing you what's been marked as

1 Exhibit 1022.

2 (Whereupon, Pages from a
3 textbook, Hennessy and Patterson
4 Computer Architecture was marked
5 as Exhibit 1022 for
6 identification as of this date.)

7 Q Have you ever seen -- so Exhibit 1022 is
8 a, you know, some pages from the Hennessy and
9 Patterson Computer Architecture book.

10 Are you familiar with that textbook at
11 all, have you ever heard of it?

12 A I don't recall. I think I already said
13 that.

14 MR. VERBONCOEUR: I have the same
15 objection to this exhibit pending
16 further questions I lodged against the
17 others for the untitled, undated
18 exhibit.

19 Q So if you can go to Page 214 of this
20 exhibit?

21 A Okay.

22 Q And see this highlighted text, it says:

1 "Rounding sounds simple enough,
2 but to round accurately requires
3 hardware to include extra bits in a
4 calculation. The preceding examples,
5 we were vague on the number of bits
6 that intermediate representation can
7 occupy, but clearly if every
8 intermediate result had to be truncated
9 to the exact number of digits there
10 would be no opportunity to round. IEEE
11 754 therefore always keep two extra
12 bits on the right during intermediate
13 additions called garden round
14 respectively."
15 Do you see that?

16 A Yes.

17 Q Actually, I was thinking about turning
18 also to Page 181. So if you could turn to
19 Page 181 of this.

20 You see how this Page 181 is titled
21 faster multiplication?

22 A Sure.

1 Q In the highlighted portion it says:

2 "Summary, multiplication is
3 accomplished by simple shift and add
4 hardware derived from paper and pencil
5 method learned in grammar school.
6 Compilers even used shift instructions
7 for multiplications by power of two."
8 Do you see that?

9 A Yeah. Absolutely.

10 Q Do you have any reason to doubt that
11 compilers would use shift instructions for
12 multiplications by power of two?

13 A What's the date of this reference? And
14 what's the context of this chapter?

15 Q Well, feel free to review the reference.
16 I'm just asking if you have any reason to
17 doubt that statement.

18 MR. VERBONCOEUR: Sorry,
19 Dr. Richardson, I'll make the same
20 objection. This appears to be
21 incomplete and modified.
22 By "this," I'm referring to the

1 exhibit. It doesn't have a label for
2 me, but it's the one that's currently
3 subject to questioning.

4 A Yeah. What's this chapter about,
5 Chapter 3?

6 Q It's about faster multiplication, this
7 page.

8 A In what context?

9 Q In computer architecture. It's a
10 computer architecture textbook.

11 A It's talking about MIPS.

12 Q Do you know what MIPS is?

13 A Yeah. I kind of remember what it means.
14 It's like a specific architecture, it's quite
15 old.

16 Yeah. So what's the context of this
17 chapter or this section of the chapter?

18 Q You can read the reference.

19 A Well, no, I can't, because if I go back,
20 I'm still in 3.4, and then suddenly it shifts
21 to 1.2. So, no, I can't read it.

22 Q Okay. Well, I'm just asking if you have

1 any reason to dispute that statement we just
2 read?

3 A I don't know what the statement is
4 talking about. I mean, I don't know what the
5 scope is of this statement.

6 Does it mean -- are you suggesting this
7 is in every single instance of
8 multiplication? I don't agree, if that's the
9 case. And which compilers are we talking
10 about, and what's the date of this reference?
11 You haven't answered any of those questions.

12 Q Do you believe that some compilers could
13 replace multiplication by a power of two?

14 A Do I believe it?

15 Q Yeah. Do you have any understanding one
16 way or the other?

17 A I've never designed a compiler.

18 Q Okay.

19 A To be honest, I haven't spent a lot of
20 time on compilers in my career. I spent a
21 reasonable amount of time on multiplication.
22 And I disagree that all multipliers work the

1 same way in digital hardware. I mean, I can
2 point you to some of my publications and
3 things that I've built, I built a distributed
4 arithmetic array multiplier. It ended up
5 in several chip sets. It used distributed
6 arithmetic. It didn't use shift and add. I
7 built it.

8 Q Now, if you can put that exhibit aside.
9 In binary arithmetic, how do you tell if
10 a number is a power of two?

11 A What's the "you" in this context? What
12 is the context?

13 Q I'm just asking for you right now, are
14 you aware of how you would look at a binary
15 number to figure out if it's a power of two?

16 A So the binary representation of a
17 decimal number, if that decimal number is a
18 power of two, then the most straightforward
19 binary representation of a positive -- if
20 it's a positive decimal number, the most
21 straightforward representation I would
22 probably see in that number, that there is a

1 single one in a most significant bit
2 position, followed by zeros thereafter.

3 And so examples would be a single binary
4 one, that would represent decimal one, in,
5 you know, one common notation. Single binary
6 two represents decimal two that would be --
7 sorry. Single binary number one and zero can
8 represent decimal number two and so on.

9 Q So if you have a number eight
10 represented as 1000, and you subtract one
11 from it, what do you get?

12 A I don't understand the question.

13 Q So if you have a binary number eight
14 represented as 1000. Are you with me so far?

15 A Oh, I'm sorry. I think that -- yeah.
16 I'm with you. I thought you put an extra
17 zero in, but that's my mistake. Carry on.

18 Q If you have a binary number of eight
19 represented as 1000, you subtract one from
20 that, what's the result?

21 A So if I take the decimal number eight,
22 positive eight, if I represent that as a

1 binary number one followed by three zeros,
2 and I now consider that binary quantity one
3 followed by three zeros, if I subtract one
4 from that quantity, I end up with a binary
5 number 111. Of course, I can have zeros on
6 the left-hand, but they don't change
7 anything.

8 Q If you have the binary number four
9 represented as 0100, you subtract one from
10 it, what's the result?

11 A So if I take decimal four represented in
12 binary using four bits as 0100, subtract one
13 from that binary number, I get binary 11, I
14 can put bits in the left -- zero bits in
15 left-hand side, but they don't change the --
16 they don't change the magnitude or the value.

17 Q So subtracting one from the number
18 that's a power of two will set the single one
19 in that binary number to zero, and then flip
20 the subsequent bits on the right side to one,
21 correct?

22 A You had like a sequence of events in

1 your question, which I don't necessarily
2 agree with.

3 Q So I'm going to give you this blank
4 notepad.

5 Do you have a pen with you?

6 A Not on me. No.

7 Thank you. I have a pen.

8 Q So if you take the number four as a
9 binary representation of 100.

10 A If I take -- can I just suggest -- are
11 you asking me to take the binary number 100
12 as a representation of decimal four?

13 Q Correct.

14 A And I'm going to write down four to the
15 base ten and I'm going to write down on the
16 right-hand side -- what do you want me to
17 write down?

18 Q 0100.

19 A I'll write a small two to show that it's
20 a binary representation.

21 Q If you do a bit wise and with the binary
22 representation of three, which is 11, 0011.

1 A Which one? Which of those two?

2 Q Okay. So if you -- we talked about
3 before, right, the decimal number three
4 corresponds to a binary number of 0011,
5 right?

6 A It can be represented using four bits as
7 a binary number 0011.

8 Q So if you do a bit wise and of those two
9 numbers, what's the result?

10 A If I and binary 0100 with a binary
11 0011 --

12 MR. VERBONCOEUR: I'll object to the
13 scope on this line of questioning.

14 A I get binary 0000.

15 Q If we do the same exercise with the
16 numbers eight and seven, what would be the
17 result?

18 A So I take a decimal eight, if I
19 represent it using four bits as one followed
20 by three zeros, if I take decimal seven and I
21 represent it as binary 0111, if I add those
22 two together, I get the result 0000 in

1 binary.

2 Q So when a number is a power of two, if
3 we call that number N , then performing the
4 calculation N and N minus one, the result
5 will always be zero, correct?

6 MR. VERBONCOEUR: I'll object to the
7 form of the question.

8 A The result of the binary and will be a
9 number -- a set of zeros, but and is
10 something that's done with the binary digits,
11 not with decimal numbers.

12 So you're asking me to convert the
13 result of the and, which is like a logic
14 result, and determine a decimal
15 representation or what?

16 Q So when a binary number is a power of
17 two, then performing -- and if we call that
18 binary number N , then performing N bit wise
19 and with N minus one, the result is always
20 zero, correct?

21 A You're flipping in your question between
22 binary and decimal. So I want to be clear of

1 what you're asking me.

2 Q So I'm asking about binary numbers,
3 right, just binary calculations.

4 A You're asking me about arithmetic
5 calculations using binary numbers and, sorry,
6 but and, logical operations such as and with
7 binary numbers?

8 Q Well, bit wise and.

9 A Okay. Yeah. You're asking me about
10 arithmetic operations and bit wise
11 operations. And then you're saying zero, and
12 I don't know what domain we're in now.

13 So I've got the decimal domain, I've got
14 a binary domain, I've got binary arithmetic
15 operations, I've got bit wise operations, and
16 then you're saying zero. What domain are you
17 in when you say zero?

18 Q So in the calculations that you just
19 performed on the piece of paper, which we
20 will mark as Exhibit 1023, if you repeat
21 those calculations for any power of two, the
22 result is always zero, correct?

1 MR. VERBONCOEUR: Object to the form
2 of the question.

3 A Who says the result is zero? You did.
4 Did I agree to that?

5 Q Do you agree with it?

6 A The result is 0000 binary.

7 Q Okay. So then --

8 A You've jumped between three different
9 domains here.

10 Q So would you agree that for an eight bit
11 number, when a number N is power of two,
12 performing N bit wise and with N minus one
13 will always result in 0000000?

14 A If I take a decimal number, let's say
15 the range 0 to 255, if I express that decimal
16 number as a binary number, and I restrict
17 myself to decimal numbers that are powers of
18 two, if I take that decimal number minus one,
19 or I can do minus one in either form, of
20 course, if I subtract one, I get another
21 number, which I can represent in binary. If
22 I then do a logical operation bit wise and on

1 those two binary representations, I will get
2 a series of zeros in binary.

3 MR. LIANG: Let's take a quick break.

4 (Whereupon, a recess was taken
5 from 5:41 PM until 5:47 PM.)

6 (Whereupon, Handwritten piece of
7 paper by Dr. Iain Richardson was
8 marked as Exhibit 1023 for
9 identification as of this date.)

10 MR. LIANG: So we'll pass the witness.

11 MR. VERBONCOEUR: Okay. With that in
12 mind, I need a quick break to confirm
13 with Eric.

14 Can we go off the record briefly.

15 (Whereupon, a recess was taken
16 from 5:47 PM until 5:52 PM.)

17 EXAMINATION BY

18 MR. VERBONCOEUR:

19 Q All right. Dr. Richardson, I just have
20 a few questions for you on redirect. Okay?

21 A Okay.

22 Q The materials that are in front of you,

1 I believe that those include a Notice of
2 Decision to Institute?

3 A Yes.

4 Q And we can use the notice for the 626
5 IPR. Do you have that?

6 A Yes.

7 Q Okay. I'd like to ask you about
8 something that you were asked about earlier,
9 and if you could please turn to Page 16 of
10 that document. And I'm specifically looking
11 at the top of Page 16, and then the two
12 paragraphs, top of page seven -- sorry,
13 bottom of Page 16, two paragraphs at the top
14 of Page 17. Please review them and let me
15 know when you're ready for questions.

16 A Okay.

17 Q So the board gave some opinions about
18 the meaning of the term "prediction."

19 MR. LIANG: Objection to form,
20 leading.

21 A Okay. I mean, there's sentences you
22 asked me to review, the board is talking

1 about construing prediction, which I
2 understand to be giving -- yeah. Consistent
3 with giving opinions as to the meaning of
4 prediction, is my general understanding.

5 Q Okay. I'd like to ask for your opinions
6 about part of the '267 Patent, and rather
7 than turn to the '267 Patent we can look at
8 Page 15 of this Decision to Institute.

9 A Okay. I'm at Page 15.

10 Q And I'd like to get your view on the P1
11 and P2 shown here on Page 15 of the
12 institution decision.

13 Do you recognize those equations from
14 the '267 Patent?

15 A I think so, yes. It's talking -- yes.
16 It's citing -- it's citing portions of the
17 '267 Patent.

18 Q In your opinion, is P1 a prediction?

19 MR. LIANG: Objection to form.

20 A P1 in the '267 Patent, Column 3, Line
21 43, describes P1 as a prediction value.

22 Q What's your opinion about whether a

1 person of skill in the art would see P1 in
2 the '267 Patent as a prediction?

3 MR. LIANG: Objection to form.

4 A Well, a person of ordinary skill reading
5 Columns 13 and 14 of the '267 Patent would
6 see P1 described as a prediction value, and
7 then the reference to P1 in the equation
8 that, I think the board has excerpted on
9 Page 15 of the decision granting institution
10 that we discussed.

11 Q Do you have an opinion of whether a
12 person of ordinary skill in the art reading
13 the '267 Patent would see P2 as a prediction?

14 MR. LIANG: Objection to form.

15 A In a similar way, P2 with the equation,
16 which is -- expresses an equation in the '267
17 Patent, Column 14, Line 21, in the previous
18 Column 13, around Line 44, P2 is described as
19 a prediction value.

20 Q Now, I want to ask you about what
21 happens if we just take parts of the equation
22 out. So if I refer you to three, asterisk E,

1 subscript two, do you know what I'm referring
2 to here on Page 15 of the institution
3 decision?

4 A So that's part of an excerpted equation
5 for P2, which I think is the same as the
6 equation in the '267 Patent, Column 14, Line
7 21.

8 Q Do you have an opinion on whether a
9 person of ordinary skill in the art would see
10 three, asterisk E, subscript two as a
11 prediction?

12 MR. LIANG: Objection to form.

13 A In my opinion, they wouldn't. And I
14 explained this earlier with regard to other
15 expressions in, for example, the Walker
16 reference, three times E2 in this equation.
17 I think a person of ordinary skill in the art
18 would understand that three times E2 is a
19 term, almost a term or an operator in the
20 equation. It's not in itself a prediction
21 value.

22 Q Now what I want to do is ask you about,

1 I guess, a partial definition, so to speak, a
2 prediction given at the bottom of Page 16 of
3 the institution decision, and then it
4 continues on the top of Page 17. Just let me
5 know when you're there.

6 A Okay.

7 Q There's the text:

8 "So to determine whether to
9 institute here, we only determine that
10 the term prediction encompasses values
11 used for prediction that are calculated
12 by mathematical operations, including
13 multiplying pixel values in reference
14 blocks with weights."

15 Do you see that?

16 A Yes.

17 Q Looking at P1 and P2, do you think this
18 definition of prediction includes P1 and P2?

19 MR. LIANG: Objection to the form.

20 A So P1 and P2, as expressed in the
21 equations in the '267 Patent, Column 14,
22 Lines around 18 to 22, each of these is an

1 equation. Each of these is a prediction
2 value, described as a prediction value. P1
3 is described as a prediction value. P1 is
4 calculated in this equation as an equation.
5 It's the mathematical operation or a set of
6 mathematical operations which include
7 multiplying pixel values, such as E1, with
8 weights, such as normalized three in this
9 example.

10 Q Now I want to ask you about 3*E2?

11 A Okay.

12 Q Do you think this 3*E2 meets the
13 definition of "prediction" provided at the
14 bottom of Page 16, top of Page 17, in the
15 institution decision?

16 MR. LIANG: Objection to form.

17 A So as it appears in the equation for P2
18 at around Column 14, Line 21 or 22 of the
19 '267 Patent, I don't think it does because
20 it's not a value that's used for prediction.

21 MR. VERBONCOEUR: Okay. No further
22 questions.

1 EXAMINATION BY

2 MR. LIANG:

3 BY MR. LIANG:

4 Q Dr. Richardson, at any point today
5 during any of the breaks we've taken today,
6 did you discuss with your counsel anything
7 related to your declarations or this IPR that
8 we've -- the IPR proceedings that we've been
9 dealing with today?

10 A No.

11 MR. LIANG: Okay. So no further
12 questions from me. But before we go
13 off the record, I do want to state
14 that one item, for the record, that
15 came up in Dr. Richardson's testimony
16 and that counsel discussed
17 subsequently.

18 So Dr. Richardson testified this
19 morning that he reviewed a
20 post-hearing brief from the parallel
21 ITC proceeding as part of his
22 preparation for his deposition today.

1 Dr. Richardson is not admitted under
2 the protective order in the ITC
3 proceeding, and there are no public
4 versions of the post-hearing briefs in
5 the ITC proceeding.

6 We understand that Nokia's counsel is
7 investigating the issue and will
8 follow up in writing to explain how
9 Dr. Richardson was able to access
10 nonpublic post-hearing briefs. To the
11 extent that Dr. Richardson relied on
12 those materials at all for purposes of
13 his opinions in this IPR proceeding,
14 we request that Nokia provide a copy
15 of those materials to us.

16 MR. VERBONCOEUR: And just for clarity
17 of the record, we don't agree that
18 Dr. Richardson had any access to
19 nonpublic information. But as we
20 discussed over break several times, we
21 will follow up in writing just so
22 counsel is able to verify that.

1 Also point out I think the parties
2 have exchanged redactions for certain
3 post-hearing briefs, but we can follow
4 up in writing after investigation.

5 MR. LIANG: Okay. We're ready to
6 proceed with the next deposition for
7 the next IPR proceeding, which I
8 believe is for the '321 Patent, but
9 we're ready to proceed. We can go off
10 the record.

11 (Whereupon, a recess was taken
12 from 6:01 PM until 6:06 PM.)

13 COURT REPORTER: Do you all want a
14 rough draft from today's deposition?

15 ALL: Yes.

16 (Whereupon, this examination was
17 concluded at 6:07 PM.)

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DR. IAIN RICHARDSON

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Subscribed and sworn to
before me on this ____ day
of _____, _____.

Notary Public _____

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WITNESS: DR. IAIN RICHARDSON

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paper by Dr. Iain
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C E R T I F I C A T E

I, KIARA MILLER,
A Shorthand Reporter and Notary Public of the
State of New York, do hereby certify:

That the witness whose examination is
hereinbefore set forth, was duly sworn or
affirmed by me, and the foregoing transcript is
a true record of the testimony given by such
witness.

I further certify that I am not related to any
of the parties to this action by blood or
marriage, and that I am in no way interested in
the outcome of this matter.

Kiara Miller

KIARA MILLER

A			
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