

EXHIBIT 2011

UNITED STATES INTERNATIONAL TRADE COMMISSION

In the Matter of:	)	Investigation No.
CERTAIN ELECTRONIC COMPUTING DEVICES,	)	337-TA-1387
AND COMPONENTS AND MODULES THEREOF	)	

OPEN SESSIONS

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1 UNITED STATES INTERNATIONAL TRADE COMMISSION
2 Washington, D.C.
3 BEFORE THE HONORABLE MONICA BHATTACHARYYA
4 Administrative Law Judge

5 _____
6 In the Matter of:) Investigation No.
7 CERTAIN ELECTRONIC COMPUTING DEVICES,) 337-TA-1387
8 AND COMPONENTS AND MODULES THEREOF)

9 _____
10
11
12 International Trade Commission
13 500 E Street, S.W.
14 Washington, D.C.

15
16 Wednesday, October 23, 2024

17
18 EVIDENTIARY HEARING - VOLUME III

19
20 The Hearing commenced in Courtroom A, pursuant to the
21 notice of the Judge, at 9:30 a.m. Eastern.

22

23

24 Reported by: Karen Brynteson, FAPR, RMR, CRR

25

1 JUDGE BHATTACHARYYA: Yes, please go ahead.

2 DIRECT EXAMINATION

3 BY MR. FARNOLY:

4 Q. Good morning, Dr. Hu.

5 A. Hi.

6 Q. Can you please introduce yourself.

7 A. Yes, of course. I am Dr. Jing Hu.

8 Q. Dr. Hu, have you prepared slides to aid your
9 testimony today?

10 A. Yes, I have.

11 Q. May we have up RDX-6C.1.

12 Are these the slides you prepared?

13 A. Yes, they are.

14 Q. Let's go to slide 2.

15 I see you have listed RX-118 at the bottom of
16 this slide. What is that?

17 A. That's the current version of my CV.

18 Q. What is your current position?

19 A. I'm the president of Shoreline Technology
20 Consulting, Inc.

21 Q. And what is Shoreline Technology Consulting,
22 Inc.?

23 A. It is my company that provides the consulting
24 services in patent litigation, patent portfolio evaluation,
25 and general technologies consulting.

1 Q. When did you start Shoreline Technology?

2 A. I started in early 2016. Prior to that I was a
3 consultant working in similar areas.

4 Q. Were any of the matters that you worked on since
5 2013 related to video coding and communication?

6 A. Yes, about 15 of them.

7 Q. And did you have any professional experience
8 prior to 2013?

9 A. Yes. Prior to that, in between the years of 2007
10 and 2013, I was a research scientist and embedded software
11 engineer at Cisco Systems.

12 Q. What did that position entail?

13 A. So with that, I was both a company-wide video
14 coding and communications expert, as well as a software
15 developer in my own department.

16 Q. During your time at Cisco, did you work on any
17 projects related to video coding and communications?

18 A. Yes, I did. I worked on different projects on
19 video coding, video conferencing systems, as well as video
20 quality estimation and assurance.

21 Q. Can you briefly describe your educational
22 background.

23 A. Of course. I hold three degrees. I have a
24 Bachelor's of Science from Tsinghua University in China, and
25 my major was precision instruments, which is an

1 interdisciplinary major covering electrical engineering,
2 computer engineering, and optical engineering.

3 I also have, as listed here, a Master's degree
4 and Ph.D., both in electrical and computer engineering, from
5 Rice University and UC Santa Barbara.

6 Q. Were any of your educational activities related
7 to video coding and communications?

8 A. Yes. For example, my Ph.D. thesis is on
9 fundamental limits on video compression and communication.

10 Q. Has any of your work or research been published
11 in the scientific literature?

12 A. Yes. I have about 17 peer-reviewed publications,
13 and some of them relate to video coding and communication.
14 For example, a paper of mine titled "Video Capacity of
15 Wireless LANs with a Perceptual Video Quality Constraint"
16 won the Best Paper Award in IEEE Transactions on Multimedia
17 between the years of 2007 and 2009.

18 Q. Are you listed as the named inventor on any
19 patents or patent publications?

20 A. Yes. I have four U.S. patents. And some of them
21 are directly related to video coding.

22 MR. FARNOLY: Your Honor, the Lenovo Respondents
23 offer Dr. Hu as an expert in electrical engineering, video
24 coding, and the subject matter of the '618 patent.

25 MR. HAYNES: No objection.

1 MR. FARNOLY: Let's go to slide 3.

2 JUDGE BHATTACHARYYA: At this time Dr. Hu is
3 admitted as an expert in electrical engineering, video
4 coding, and the subject matter of the '814 patent.

5 MR. FARNOLY: It is the '618 patent.

6 JUDGE BHATTACHARYYA: Sorry, the '618 patent.

7 MR. FARNOLY: Yes, Your Honor.

8 BY MR. FARNOLY:

9 Q. We're on RDX-6.3.

10 Dr. Hu, in forming your opinions in this
11 investigation, did you consider the credentials of a person
12 of ordinary skill in the art?

13 A. I did.

14 Q. Did you apply this definition in your analysis of
15 the asserted patents?

16 A. Yes.

17 Q. As of June 2011, were you a person of ordinary
18 skill in the art under the definition adopted by the Court?

19 A. Yes, I was.

20 Q. Dr. Hu, have you offered an analysis of any of
21 the asserted patents in this investigation?

22 A. Yes.

23 Q. Let's go to RDX-6.4.

24 Which of the asserted patents will you be opining
25 on today?

1 A. It will be the '618 patent.

2 Q. Generally, what does the '618 patent relate to?

3 A. It relates to signaling reference picture
4 identifiers for buffer management in video coding.

5 Q. Let's go to slide 5.

6 At a high level, what were you tasked with in
7 this investigation?

8 A. I was asked to evaluate if the asserted claim 9
9 of the '618 patent is valid. I was asked to evaluate
10 whether the accused products infringe and whether the DI
11 products practice claim 9. And also to evaluate Lenovo's
12 redesigned solution.

13 Q. What if any conclusions have you reached?

14 A. On a high level, I have concluded that the
15 asserted claim 9 of the '618 patent is invalid over the
16 prior art, the accused Lenovo products do not infringe claim
17 9, and the DI products do not practice claim 9.

18 With regard to the redesign aspect, I have
19 concluded that the redesigned product is sufficiently fixed
20 in design and it does not infringe claim 9.

21 Q. I see you have listed some exhibits at the bottom
22 of slide 5. What are those exhibits?

23 A. These are the lists of materials considered that
24 I have submitted with my various reports in this case.

25 Q. Let's go to RDX-6.6.

1 Now, I want to begin with your opinions related
2 to validity of the '618 patent.

3 Let's go to slide 7.

4 Have you been informed of the legal standard to
5 be applied when assessing obviousness of a patent?

6 A. Yes. And those would include the ones I have
7 listed on slide 7.

8 Q. And did you apply that legal standard in your
9 invalidity analysis?

10 A. Yes, I did.

11 Q. Let's go to RDX-6.8.

12 Have you applied a priority date in your analysis
13 of the '618 patent?

14 A. Yes, I have. And that would be June 30th, 2011.
15 And as I understand, that's the date the professional
16 application of the '618 patent was filed.

17 Q. Have you reviewed any prior art in forming your
18 opinion in this investigation?

19 A. Yes, I have.

20 Q. Let's go to slide 9.

21 What references will you be discussing today as
22 part of your obviousness analysis?

23 A. They would include the Mulroy reference; the
24 H.264 video coding standard, also referred to as advance
25 video coding standard, AVC; as well as the Lee reference.

1 And there were six editions of the H.264 standard
2 as of -- available to the public as of the priority date of
3 the '618 patent. And they were largely similar. And I have
4 mainly cited from Edition Number 2 of the H.264 standard.

5 Q. Let's go to RDX-6.10.

6 Are the Mulroy, H.264, and Lee references prior
7 art to the '618 patent?

8 A. Yes, they are.

9 Q. All right. Moving to slide 11.

10 Can you please briefly summarize your opinions
11 regarding the validity of claim 9 of the '618 patent?

12 A. Of course. My opinion is that the asserted claim
13 9 of the '618 patent is obvious based on Mulroy, in view of
14 H.264 and Lee. And, further, in view of the knowledge of a
15 POSITA.

16 Q. Looking at RDX-6.12, do you understand that the
17 parties have agreed to claim constructions for certain terms
18 of the '618 patent?

19 A. Yes, I do.

20 Q. Have you applied those agreed-upon constructions
21 in your analysis?

22 A. Yes, I have.

23 Q. And before we get into your analysis, I would
24 like to discuss the state of the art at the time of the '618
25 patent and some background principles that will be relevant

1 to understanding your opinions.

2 Have you prepared a series of slides that address
3 these technology concepts?

4 A. Yes.

5 Q. And let's go to slide 14.

6 At a very high level, what is video coding and
7 decoding?

8 A. As has been said a few times this week, video
9 coding and decoding is a technology that involves the
10 process of compressing and decompressing a video signal. It
11 starts with representing the video scene in a series of
12 frames or pictures.

13 And the system involves a complementary pair of
14 systems, an encoder and decoder. Collectively, they are
15 sometimes referred to as "codec."

16 Q. I see your technology background slides here
17 beginning on slide 14 list a number of exhibits at the
18 bottom of the slide. What are those?

19 A. These are some of the references that I have
20 relied on to explain the technology background with regard
21 to the '618 patent of this case.

22 Q. Let's go to RDX-6.15.

23 What are some of the techniques used to code and
24 decode video signals?

25 A. One that is most relevant to the '618 patent is

1 called interpredictive coding. It takes advantages of the
2 temporal redundancy between video frames. So when a
3 sequence of video frames are encoded, much of the scene
4 doesn't change from one frame to the next.

5 So the encoder only needs to code the difference,
6 and then sends an indication of which reference frames are
7 used.

8 Q. And you mentioned reference frames. What are
9 reference frames?

10 A. As I said, so these are references that have been
11 previously coded and decoded, and are used as reference for
12 the current picture.

13 Q. Is it possible to do interpredictive coding from
14 multiple reference pictures?

15 A. Yes. For example, on the three frames that I
16 show on this slide, frame 2 can reference frame 1, but frame
17 3 can choose to reference frame 1 or frame 2 or a
18 combination of frame 1 and frame 2.

19 And the encoder makes that decision and signals
20 to the decoder which frame or frames are to be used by the
21 current frame.

22 Q. Does the codec have a way of storing these
23 reference frames?

24 A. Yes. And the way to do that would be to utilize
25 a multi-picture buffer to keep those reference frames on the

1 encoder and on the decoder.

2 Q. Moving to slide 16.

3 Can you explain how this buffer is utilized in a
4 video codec?

5 A. Of course. As I just said, when the multi-frame
6 predictive coding is used, the encoder and decoder each keep
7 a buffer, often referred to as the decoded picture buffer,
8 to keep the reference frames. And the reference frames in
9 each buffer have to match with each other.

10 Q. Is there a limit to how many pictures can be
11 stored in a buffer?

12 A. Yes. And it is due to the fact that most codec
13 implementations will come with a memory constraint.

14 Q. Let's go to slide 17. I want to briefly just
15 talk about video coding standards.

16 At a high level, what are video coding standards?

17 A. Video coding standards essentially are a set of
18 agreed-upon techniques to be used in video coding. And
19 every decoder that conforms to a particular standard should
20 produce similar output, so that they can work together as an
21 end-to-end system.

22 But the video coding standards, like most other
23 technological standards, have a limited scope, so that they
24 make some recommendations but also allow individual
25 companies to innovate and implement the standards in

1 different fashions.

2 Q. Let's go to slide 18.

3 In going back to the decoded picture buffer,
4 according to the H.264 standard, what if anything happens
5 when the buffer runs out of storage space?

6 A. In that situation, two operations can be used.
7 And we have been hearing about them a bit this week as well.

8 The first one is called sliding window. And the
9 second operation is called adaptive memory control, which
10 uses the MMCO commands, which stand for memory management
11 control operation commands.

12 Q. Have you prepared a series of slides
13 demonstrating how these two operations work?

14 A. Yes, I have.

15 Q. Let's go to slide 18.

16 Beginning on this slide, can you please explain
17 what you're showing?

18 A. Of course. This set of animations demonstrates
19 the decoded picture buffer, DPB, management using the first
20 operation called sliding window. And in that sliding window
21 operation, the pictures are removed on a first in/first out
22 basis.

23 Q. Okay. Pictures are going to start moving on this
24 slide, so I will take it one piece at a time.

25 Moving to slide 20.

1 Using sliding window, what happens on the encoder
2 side when, in this case, picture number 5 is encoded?

3 A. So here in this example, I'm showing an encoder
4 and decoder pair with a capacity of up to 4 reference
5 pictures stored in their own buffers. So on the encoder
6 side, when the encoder needs to store frame number 5, it
7 moves out the oldest picture in the buffer, which was
8 picture number 1.

9 Q. Moving to slide 22.

10 After the encoded image is transmitted, what does
11 the decoder do?

12 A. The decoder performs the same operation. First
13 in/first out.

14 Q. Finally, at slide 23, what is the result after
15 the decoder performs the sliding window process?

16 A. As a result of that, the encoder and decoder
17 buffers will contain the same reference pictures for
18 subsequent decoding, such as for picture number 6.

19 Q. And let's go to slide 24 and talk about buffer
20 management using MMCO commands.

21 Can you explain what you're showing here
22 beginning on slide 24?

23 A. Here, I show the second operation, adaptive
24 memory management, using the MMCO commands, where the code
25 words provide specific control of buffer status. And those

1 code words are sent by the encoder to the decoder.

2 Q. And moving to slide 25.

3 How does MMCO commands provide specific control
4 of buffer status?

5 A. So here, the encoder decides to remove picture
6 number 3 from its buffer, instead of the oldest picture,
7 which is picture number 1.

8 Q. And moving to slide 27.

9 What if anything happens on the decoder side?

10 A. And after the decoder receives the bitstream
11 containing the MMCO command from the encoder, the decoder
12 knows that picture number 3 has been marked as unused for
13 reference, so to remove picture number 3 before it adds
14 picture number 5.

15 Q. Finally, on RDX-6.29, what is the result of the
16 MMCO process?

17 A. As the result of a successful MMCO process, the
18 encoder and decoder buffers will contain the same reference
19 pictures for subsequent decoding.

20 Q. Let's go to RDX-6.30.

21 Are there any potential problems with managing
22 the decoded picture buffer using MMCO commands?

23 A. Yes. When the MMCO commands themselves are lost
24 in the communication channel, there can be a mismatch
25 between the encoder and decoder buffers.

1 Q. Why is that a problem?

2 A. This will be a problem because the reference
3 picture subtracted at the encoder might be different from
4 the reference picture added back at the decoder. So the
5 picture would not look good. And the error will propagate
6 because now the current picture will be used as reference
7 for future pictures.

8 Q. Were you in the courtroom during the testimony of
9 Mr. Sjoberg, the named inventor of the '618 patent?

10 A. Yes, I was.

11 Q. Did you hear his testimony that he and his
12 colleagues at Ericsson submitted a proposal numbered F-493
13 during the development of the HEVC standard related to the
14 '618 patent?

15 A. Yes.

16 Q. Did you review that proposal in connection with
17 your work in this case?

18 A. Yes, I did.

19 Q. And did you hear Mr. Sjoberg's testimony that he
20 and his colleagues identified a problem with MMCO commands;
21 specifically, that a loss of MMCO commands would lead to
22 buffer mismatch?

23 A. Yes.

24 Q. Was that problem known in the art prior to the
25 '618 patent?

1 A. Yes, in fact, it was. For example, it was known
2 at least as early as February 2007, when the Mulroy
3 reference's patent application was filed.

4 Q. And have you prepared a series of slides
5 demonstrating the problem identified by Mulroy?

6 A. Yes.

7 And before we get into that here, I want to point
8 out that in paragraph 27 of Mulroy, it states specifically
9 that the problem is if the decoder loses a set of MMCO
10 commands, there will be mismatch between the contents of
11 encoder and decoder buffers.

12 Q. Let's go to slide 31.

13 Can you explain what you're showing beginning on
14 this slide?

15 A. Yes. Here, similar to the previous example when
16 the MMCO commands were successfully received, the encoder
17 set operation is the same. So the encoder decides to remove
18 picture number 3 and adds picture number 5. And it is the
19 encoder's intention to send that information in MMCO
20 commands to the decoder.

21 Q. Moving to slide 32.

22 What if anything happens if the picture carrying
23 that MMCO command is lost?

24 A. When those MMCO commands are lost, the decoder
25 wouldn't know that the picture number 3 is to be removed

1 from its buffer. So picture number 3 remains. And when it
2 comes time to encode and decode a subsequent picture, such
3 as picture number 6 that I'm showing here on slide 33, the
4 encoder and decoder buffers contain different reference
5 pictures for subsequent decoding.

6 Q. Now I want to talk about the asserted patent in
7 the '618 patent. Let's go to RDX-6.34.

8 At a high level, what does the '618 patent relate
9 to?

10 A. On a very high level, the '618 patent is related
11 to reference picture signaling and buffer management in
12 video coding and decoding.

13 Q. What are you showing on slide 34 in Figures 9 and
14 10?

15 A. Here, I'm showing Figures 9 and 10 from the '618
16 patent that generally describes what is claimed by the '618
17 patent. So it involves retrieve buffer description
18 information; determine picture identifier, which includes
19 retrieving a delta identifier and calculate the picture
20 identifier; and then update the decoded picture buffer based
21 on the information.

22 Q. Now, going back to Mr. Sjoberg's testimony, did
23 you hear Mr. Sjoberg testify that his proposal was a big
24 change over the H.264 standard because it removed the use of
25 MMCO commands?

1 A. Yes.

2 Q. Do the claims of the '618 patent mention MMCO
3 commands?

4 A. They don't.

5 Q. More specifically, do the claims of the '618
6 patent state that the steps must be performed in a decoder
7 that does not also use MMCO commands?

8 A. No, they don't.

9 Q. Do the claims state that the alleged invention
10 must be performed without any elements of the H.264
11 standard?

12 A. No, they don't.

13 Q. And did you hear Mr. Sjoberg testify that his
14 proposal described the use of picture order count, or POC?

15 A. Yes.

16 Q. Do the claims of the '618 patent mention the term
17 "picture order count" or "POC"?

18 A. No, they don't.

19 Q. In your opinion, are all of the so-called
20 improvements from Mr. Sjoberg's F-493 proposal reflected in
21 the asserted claim of the '618 patent?

22 A. In my opinion, they're not.

23 Q. Why not?

24 A. Because, as we are seeing here, these concepts,
25 retrieving buffer description information and so on, are

1 fairly high-level and broad. And these concepts have been
2 known in the art for quite some time before the '618 patent.

3 Q. You understand that Ericsson's validity expert,
4 Dr. Richardson, has offered opinions in this case, correct?

5 A. Yes.

6 Q. Where, if anywhere, does Dr. Richardson opine
7 these so-called improvements are included in the claims?

8 A. Dr. Richardson's opinion is that he adds these
9 meanings to the buffer description information. And he
10 opines that the buffer description information, by itself,
11 has to be an unambiguous indication of what -- what frames
12 are in the reference picture buffers for the decoding of the
13 current and subsequent pictures, without using MMCO
14 commands.

15 Q. But to be clear, are those requirements stated in
16 the claims?

17 A. No, they are not.

18 Q. I now want to discuss your opinion that the
19 asserted claim of the '618 patent is obvious over the prior
20 art.

21 JUDGE BHATTACHARYYA: Mr. Farnoly, I think we
22 need to take our lunch break now so we can begin promptly at
23 1:45.

24 MR. FARNOLY: Yes, Your Honor.

25 JUDGE BHATTACHARYYA: Thank you. We will resume

1 at 1:45 with Mr. Mulgrew and then get back to Dr. Hu.

2 THE WITNESS: Thank you.

3 (The witness stood down.)

4 (Whereupon, at 12:44 p.m., a lunch recess was
5 taken.)

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1 O P E N S E S S I O N

2 JUDGE BHATTACHARYYA: And we're proceeding with
3 Dr. Hu.
4 Whereupon--

5 JING HU,
6 having been previously duly sworn/affirmed, was examined and
7 testified as follows:

8 DIRECT EXAMINATION -- Resumed
9 BY MR. FARNOLY:

10 Q. Dr. Hu, before the break, you testified earlier
11 about Dr. Richardson's opinion about the meaning of the term
12 "buffer description information." Do you recall that?

13 A. Yes, I do.

14 Q. Your answer was transcribed in part as: "The
15 buffer description information has to be an ambiguous
16 indication of what frames are in the reference picture
17 buffer."

18 Just to be clear, was that your testimony?

19 A. No. What I said was "unambiguous".

20 Q. Thank you for that clarification.

21 A. Sure.

22 Q. May we have RDX-6.35.

23 And I want to discuss your opinion that the
24 asserted claim of the '618 patent is obvious over the prior
25 art. Let's go to slide 36.

1 Can you remind the Court your opinion regarding
2 obviousness of claim 9 of the '618 patent?

3 A. Of course. My opinion is that claim 9 of the
4 '618 patent is invalid based on the Mulroy reference in view
5 of H.264, the Lee reference, and knowledge of a POSITA.

6 Q. Okay. Let's take a closer look at the Mulroy
7 reference. Go to slide 37.

8 Can you give a brief overview of Mulroy?

9 A. Yes. Mulroy is also in the field of interframe
10 different coding in video coding and talks about this
11 complementary pair of encoders and decoders that we were
12 talking about. So the encoder has the predictor buffer,
13 which is this decoded picture buffer 3. And decoder has its
14 own DPB 3 prime.

15 And Mulroy teaches those of the H.264 standard
16 can be used. Mulroy also discusses the MMCO commands being
17 used.

18 Q. All right. Can I have RDX-6.38.

19 You mentioned that Mulroy identified problems
20 with MMCO commands.

21 A. Yes --

22 Q. How does the problem --

23 A. -- I did.

24 Q. Sorry. How does the problem identified by Mulroy
25 compare to the problem identified in the '618 patent?

1 A. Mulroy identified the same problem as the '618
2 patent.

3 Q. Let's take a closer look. What problem was
4 identified by the '618 patent?

5 A. The '618 patent identified the problems as -- for
6 example, it discloses that the prior art techniques may
7 suffer from problems with regard to using incorrect
8 reference pictures when the picture carrying MMCO
9 information is unintentionally lost. And when that happens,
10 for example, the encoder and decoder will contain a
11 different number of short-term pictures.

12 Q. Now, looking at slide 40, how does Mulroy -- how
13 does the identification of the problem in Mulroy compare to
14 the '618 patent?

15 A. Mulroy identified exactly the same problem. It
16 discloses that if the decoder loses a set of MMCO commands,
17 there will be mismatch between the contents of the encoder
18 and decoder buffers.

19 Q. Did Mulroy propose a solution to this problem?

20 A. Mulroy did.

21 Q. Let's go to RDX-6.41.

22 How does Mulroy's solution compare to the
23 solution proposed in the '618 patent?

24 A. On the left-hand side of this slide is the '618's
25 solution to the problem, which is the buffer description

1 information.

2 Q. And what is Mulroy's solution to the problem?

3 A. Mulroy's solution, on the right-hand side of the
4 slide, is using the reference picture list reordering
5 commands, which is a form of buffer description information.

6 Q. Let's move to slide 43.

7 How does the '618 patent's buffer description
8 information compare to Mulroy's solution using reference
9 picture list reordering commands?

10 A. They are the same solution.

11 Q. Can you explain?

12 A. Of course. As we can see, that the '618 patent
13 describes its buffer description information as information
14 to indicate which pictures to be used for reference
15 pictures, i.e., stored in the decoded picture buffer, DPB.

16 And on the other hand, Mulroy proposed the same
17 solution, which is reference picture list reordering
18 commands. Mulroy described it as a signal to signal exactly
19 which frames should be in the decoder buffer at that time,
20 and specifically the frames are identified by their frame
21 numbers.

22 Q. Moving to slide 44, how does the '618 patent
23 describe its solution?

24 A. The '618 patent describes its solution as an
25 absolute or explicit way instead of a relative or implicit

1 way.

2 Q. And how does that compare to Mulroy's solution?

3 A. It's the same as Mulroy's solution, which Mulroy
4 describes it as exactly which frames should be in the
5 decoder buffer at that time and also the remapping
6 instructions, which is just another way that Mulroy
7 references the reference picture list reordering commands,
8 and that remapping instructions are defined as an explicit
9 mapping from frame number to the remapped index.

10 Q. Let's go to RDX-6.45.

11 Does the '618 patent specify how the buffer
12 description information is sent to the decoder?

13 A. It does.

14 Q. And how is that?

15 A. The '618 patent discloses that the buffer
16 description information is inserted in the bitstream encoded
17 by an encoder.

18 Q. And how does that compare to the Mulroy solution?

19 A. That's exactly the same as Mulroy's solution.
20 Mulroy's solution discloses that its buffer description
21 information, which is the reference picture list reordering
22 commands are to be inserted in every slice/NAL unit that
23 reference all frames in its buffer.

24 And the slice is just a segment of the bitstream
25 encoded by an encoder for a picture. And NAL unit -- well,

1 NAL stands for network abstraction layer. And the NAL unit
2 is a network data packet that encapsulates a slice. So
3 Mulroy's way of inserting the buffer description information
4 is also exactly the same as that of the '618 patent.

5 Q. Let's go to slide 46.

6 You mentioned that Mulroy proposes to use
7 reference picture list reordering commands. What are
8 reference picture list reordering commands?

9 A. That is a technique that's already proposed or
10 defined in the H.264 standard.

11 Q. And how is it used in the H.264 standard?

12 A. In the H.264 standard, it's disclosed to be used
13 when the default order of the reference pictures in the
14 reference picture list needs to be changed, so that the
15 entropy coding is more efficient.

16 Q. What does that mean, entropy coding could be more
17 efficient?

18 A. Basically, we've been talking about the
19 multi-frame interprediction and the encoder has to tell
20 decoder which reference frame to use. So to use fewer bits
21 to indicate that information will save more bits to be -- to
22 be used to encode the rest of the pictures.

23 So the initial purpose in the H.264 standard of
24 these reordering commands is so that the encoder can tell
25 the decoder to put the most frequently used reference

1 picture at index 1 -- index 0 of the reference picture list
2 and so on.

3 Q. Moving to slide 47, does Mulroy propose using the
4 reordering commands for a different or an additional
5 purpose?

6 A. Mulroy discloses to honor the initial purpose of
7 these reordering commands in H.264. And, in addition to
8 that, Mulroy discloses to use these reordering commands for
9 the additional purpose of indicating to the decoder which
10 frames by their frame numbers should be in the -- in its
11 buffer. In other words, that -- in other words, the Mulroy
12 reference teaches that, okay, to use the first few
13 reordering commands to indicate which reference pictures are
14 to be used by the current picture, but also to take
15 advantage of the remaining slots in the reordering commands
16 to indicate what other frames need to be in the buffer.

17 Q. And now I want to take a look at the asserted
18 claim of the '618 patent. Let's go to slide 48.

19 What are you showing on this slide?

20 A. Here on this slide, I'm showing the claim
21 language of the asserted claim 9 of the '618 patent. And
22 it's a dependent claim that depends from the independent
23 claim, claim number 8.

24 Q. Let's go to RDX-6.49 and take a look at the
25 individual claim limitations.

1 What limitation have you highlighted here?

2 A. Here I highlighted the preamble of claim 8 that
3 states "a decoder configured to decode an encoded
4 representation of a picture in a video stream of multiple
5 pictures, the decoder comprising."

6 Q. Does Dr. Richardson dispute that this claim
7 element is disclosed by the Mulroy H.264 and Lee
8 combination?

9 A. He does not.

10 Q. In your opinion, does the prior art disclose this
11 limitation?

12 A. Yes.

13 Q. How so?

14 A. For example, as I was discussing, in at least the
15 abstract, paragraphs 18, 22, and Figure 2B of the Mulroy
16 reference, Mulroy teaches an encoder and decoder pair that
17 performs the interframe differential coding. So Mulroy
18 discloses a decoder configured to decode an encoded
19 representation of a picture. And that -- that includes --
20 that's -- that includes in a video stream of multiple
21 pictures.

22 Q. Let's go to slide 50.

23 What have you highlighted as claim 8[a]?

24 A. Here I highlighted claim 8[a]. That states "at
25 least one processor, and a memory storing instructions which

1 when executed by the at least one processor causes the
2 decoder to."

3 Q. Does Dr. Richardson dispute that this claim
4 element is disclosed by the Mulroy, H.264, and Lee
5 combination?

6 A. No, he does not.

7 Q. In your opinion, does the prior art disclose this
8 limitation?

9 A. Yes.

10 Q. How so?

11 A. The Mulroy reference teaches exactly what syntax
12 elements to use from H.264 to implement its modified
13 decoder. And a POSITA at the time and now would understand
14 that a video decoder, such as that of the H.264, with
15 Mulroy's modification can be implemented in a variety of
16 ways, including an implementation that includes one
17 processor and the memory storing instructions as required by
18 claim 8[a].

19 Q. Have you identified this claim element in any
20 prior art?

21 A. Yes. That's where I relied on the Lee reference,
22 which explicitly discloses an implementation, for example,
23 in paragraph 179 that says if implemented in software, the
24 techniques may be realized, at least in part, by a
25 computer-readable medium, comprising instructions that when

1 executed cause a processor to perform one or more of the
2 methods described above.

3 And the Lee reference is in the general field of
4 using the multi-frame interpredictive coding and also takes
5 care of the situation when there is error in the
6 communication channel.

7 Q. Other than claim 8[a], which cites -- recites the
8 implementation with a processor and memory storing
9 instructions, are you relying on the Lee reference for any
10 other purpose?

11 A. No.

12 Q. Okay. Then let's focus our discussion on Mulroy
13 and H.264. Let's go to slide 51.

14 What have you highlighted as claim 8[b]?

15 A. Here I highlighted claim 8[b]. That states,
16 "retrieve buffer description information defining a
17 plurality of reference pictures, wherein the buffer
18 description information is retrieved from the encoded
19 representation of the picture."

20 Q. Is claim element 8[b] disclosed by the Mulroy,
21 H.264, and Lee combination?

22 A. Yes, it is.

23 Q. Can you please explain.

24 A. Yes. The Mulroy reference, for example, in
25 paragraph 27, discloses that it proposes to use the

1 reference picture list reordering commands to indicate from
2 the encoder to the decoder as to exactly which frames should
3 be in the decoder buffer at that time, and it discloses to
4 use the frame number to indicate those reference frames.

5 Q. Does Mulroy disclose retrieving the reordering
6 commands from an encoded representation of a picture?

7 A. Yes.

8 Q. How so?

9 A. Mulroy discloses, for example, in paragraph 28,
10 to insert remapping instructions, which, again, is just
11 another name that Mulroy uses to refer to these reordering
12 commands. Mulroy teaches to insert its solution of the
13 buffer description information in every slice/NAL unit that
14 reference all frames in its buffer. And slice, again, it's
15 just a segment of the encoded bitstream.

16 Q. Moving to slide 52, are you aware that
17 Dr. Richardson has opined that Mulroy does not disclose the
18 claimed buffer description information?

19 A. I'm aware of that.

20 Q. And do you understand that Dr. Richardson has
21 opined that the reordering commands disclosed by Mulroy
22 cannot be the claimed buffer description information because
23 the commands are not an unambiguous determination of the
24 relevant reference pictures?

25 A. I'm aware of that opinion.

1 Q. Do you agree?

2 A. I do not.

3 Q. Why not?

4 A. Again, Mulroy discloses explicitly that these
5 reordering commands indicate from the encoder to the decoder
6 as to exactly which frames should be in the decoder buffer
7 at that time.

8 Q. Are you aware that Dr. Richardson has opined that
9 the reordering commands cannot be the buffer description
10 information because they can only reorder pictures and
11 cannot be used to remove pictures from the buffer?

12 A. I'm aware of that opinion.

13 Q. Moving to slide 54, do you agree with
14 Dr. Richardson's opinion?

15 A. I do not.

16 Q. Why not?

17 A. For example, Dr. Richardson has ignored this
18 explicit disclosure in the Mulroy reference, for example,
19 here shown on this slide, that these remapping instructions
20 can be used for the decoder to determine which frame to
21 remove from its buffer.

22 Q. And do you understand that Dr. Richardson has
23 opined that the reordering commands cannot be the buffer
24 description information because Mulroy still uses MMCO
25 commands as a first choice for signaling reference pictures?

1 A. I'm aware of that opinion.

2 Q. Do you agree?

3 A. I do not.

4 Q. Why not?

5 A. Because Mulroy reference discloses to use these
6 reordering commands, i.e., the remapping instructions,
7 again, to indicate from the encoder to decoder exactly which
8 reference frames are to be kept and, hence, others to be
9 removed from the decoded picture buffer on the decoder side,
10 independent of whether the MMCO commands are used.

11 As we know, the MMCO commands are used in the
12 H.264 standard to indicate what buffer operations are to
13 come for the subsequent pictures. So Mulroy allows still
14 using that for the error resilience mode in the video
15 decoding.

16 Q. Let's go to slide 55.

17 Now, focusing on the reordering commands, how
18 does H.264 send reordering commands from the encoder to the
19 decoder?

20 A. The H.264 standard defines, for example, in
21 Section 7.3.3.1, the reference picture list reordering
22 syntax. This defines the parameters that are encoded in the
23 bitstream.

24 Q. Let's go to slide 56.

25 What element have you highlighted as claim 8[c]?

1 A. Claim 8[c] states that "determine, based on the
2 buffer description information, a reference picture
3 identifier that identifies a respective reference picture
4 among the plurality of reference pictures, the respective
5 reference picture comprising a decoding reference for the
6 picture, wherein the decoder is configured to."

7 Q. Is claim element 8[c] disclosed by the Mulroy,
8 H.264, and Lee combination?

9 A. Yes, it is.

10 Q. How so?

11 A. Again, as we have been discussing with other
12 elements of claim 8, the reordering commands, i.e., the
13 remapping instructions as disclosed by Mulroy, is a buffer
14 description information that is a message informing the
15 decoder as to exactly which frames should be in the decoder
16 buffer at that time.

17 And also this message identifies a plurality of
18 reference frames to be used. And the encoder may also
19 indicate how many reference frames are to be used. And the
20 frame numbers explicitly disclosed by Mulroy is the claimed
21 reference picture identifier.

22 Q. I want to take a closer look at the claim, the
23 reference picture identifier. Let's go to RDX-6.57.

24 You mentioned that Mulroy discloses indicating a
25 reference picture by its frame number. Do the reference

1 picture list reordering commands provide a method of
2 signaling a reference picture identifier?

3 A. Yes.

4 Q. Can you please explain.

5 A. Of course. For example, in Section 8.2.4.3.1 of
6 the H.264 standard, it defines a parameter called
7 picNumLXNoWrap. That is the frame number derived for the
8 reference picture. And after it's derived, it's assigned to
9 another parameter called picNumLX. And H.264 standard
10 defines the picNumLX shall be equal to the picNum, so the
11 picture number of a reference picture that is marked as used
12 for short-term reference.

13 Q. Let's go to RDX-6.48.

14 What claim element have you highlighted as 8[d]?

15 A. Here I highlighted claim 8[d]. That states,
16 "retrieve, based on the buffer description information a
17 respective delta identifier comprising the difference
18 between the reference picture identifier and the picture
19 identifier identifying the picture."

20 Q. In the claim, what does the term "a picture
21 identifier identifying the picture" refer to?

22 A. That would be the last term mentioned in claim
23 8[d]. And it means that a picture identifier identifying
24 the current picture that's about to be decoded.

25 Q. Is claim element 8[d] disclosed by the Mulroy,

1 H.264, and Lee combination?

2 A. Yes.

3 Q. How so?

4 A. The respective delta identifier required by claim
5 8[d] is disclosed by the parameter Abs_diff_pic_num_minus1
6 plus 1. And I will refer to the "Abs" -- the parameter that
7 starts with "Abs_" as the Abs_minus1 parameter.

8 Q. I see in the callout at the top of slide 58 you
9 have included a plus 1 with a syntax element. What is that?

10 A. As we can see in Section 7.4.3.1 of the H.264
11 standard, and also that's how a POSITA would understand, is
12 that the standard treats this parameter plus 1 as one
13 parameter. That specifies the difference.

14 And the reason that video coding standards does
15 that in general is because this parameter Abs_diff_pic_num
16 can only be a number, an integer number that's 1 or bigger.
17 So to save, again, more bits in coding, it codes the number
18 minus1, but the "1" is added back to the parameter
19 immediately.

20 Q. Let's go to slide 59.

21 Does the value Abs_diff_pic_num_minus1 plus 1
22 meet the claimed delta identifier?

23 A. Yes, it does.

24 Q. How so?

25 A. Here I tried to color-code the various aspects of

1 this claim and the Mulroy's disclosure of it using the H.264
2 standard. So the Abs_minus1 plus 1 parameter is the claimed
3 delta identifier highlighted in yellow.

4 And it is the absolute difference between the
5 picture number of the picture being moved to the current
6 index, which is the claimed reference picture identifier
7 highlighted in green.

8 And the difference is also between the picture
9 number prediction value, which is the claimed picture
10 identifier identifying the picture highlighted in pink of
11 claim 8[d], and, in particular, the last term, the picture
12 number prediction value is defined in the standard to be
13 equal to the current picture number for the first reordering
14 command of a slice among a sequence of reordering commands.

15 Q. You mentioned that the picture number prediction
16 value is equal to the current picture number in the first
17 reordering command.

18 For subsequent reordering commands within a
19 slice, what is the picture number prediction value set to?

20 A. That would be the value calculated for the
21 previous index. So when the reordering commands are parsed
22 for index 1, the picture number prediction value is the
23 reference picture identifier derived for index 0 and so on.

24 Q. But just to be clear, for every set of reordering
25 commands within a slice, will there be a delta identifier

1 retrieved that is equal to the difference between the
2 reference picture identifier and the picture identifier
3 identifying the current picture?

4 A. Yes. And that, as I said, will be the first
5 reordering command of a sequence of reordering commands for
6 each slice.

7 Q. Let's go to slide 60. What claim element have
8 you highlighted as claim 8[e]?

9 A. Claim 8[e] states that "calculate the reference
10 picture identifier based on the picture identifier and the
11 respective delta identifier."

12 Q. Is claim 8[b] disclosed by the Mulroy, H.264, and
13 Lee combination?

14 A. Yes, it is.

15 Q. How so?

16 A. It is disclosed by at least Section 8.2.4.3.1,
17 and the required calculation is carried out by equations
18 8-35 and 8-36.

19 Q. And I see here you've called out the parameter
20 picNumLXNoWrap. Let's go to slide 61. Does the calculation
21 for picNumLXNoWrap meet the claimed calculation?

22 A. Yes.

23 Q. Can you please explain?

24 A. Of course. The parameter picNumLXNoWrap
25 highlighted in green is the claimed reference picture

1 identifier. And the picNumLXPred is the required picture
2 identifier highlighted in pink. And it is either added or
3 subtracted with the parameter Abs_minus1 plus 1, which is
4 the claimed respective delta identifier highlighted in
5 yellow.

6 Q. And let's go to RDX-6.62.

7 What claim element have you highlighted as claim
8 8[f]?

9 A. Claim 8[f] states that "update a decoded picture
10 buffer based on the reference picture identifier."

11 Q. Is claim 8[f] disclosed by the Mulroy, H.264, and
12 Lee combination?

13 A. Yes, it is.

14 Q. Can you please explain?

15 A. Of course. As we've been talking a few times,
16 the Mulroy reference discloses through the remapping
17 instructions, which is how Mulroy also referred to for the
18 reordering commands, is to indicate which frames by their
19 frame numbers should be in its buffer. And Mulroy also
20 discloses that the reordering commands are used for the
21 decoder to determine which frame to remove from its buffer.

22 Q. Does this operation, removing frames from the
23 buffer, comprise an update to the decoded picture buffer
24 based on the reference picture identifier?

25 A. It certainly does.

1 Q. Let's go to slide 63.

2 Are you aware that Dr. Richardson has opined that
3 Mulroy teaches away from the update claim limitation because
4 Mulroy teaches updating the decoded picture buffer based on
5 other rules, rather than updating it based on the picture
6 signalled in the reordering commands?

7 A. I'm aware of that opinion.

8 Q. Do you agree with that opinion?

9 A. I do not.

10 Q. Why not?

11 A. Because, as we have been talking about all along,
12 Mulroy discloses to use these reordering commands for the
13 encoder to signal to the decoder which frames to keep in the
14 buffer and which frames to remove.

15 But how does Mulroy teach how the encoder itself
16 select the reference pictures? This is where all these
17 rules, that starting at paragraph 47 and end at paragraph
18 51, come in. And these rules as taught by Mulroy is an
19 alternative method for the decoder when the reordering
20 commands are absent, because these rules are designed by
21 Mulroy to be used to add the coder, hence, the encoder for
22 selecting pictures to be deleted.

23 Q. Okay, Dr. Hu, we've reached the end of claim 8.
24 Have you prepared a series of slides showing the operation
25 of Mulroy's modified decoder using reference picture list

1 reordering commands?

2 A. Yes.

3 Q. Okay. Beginning on slide 65, what are you
4 showing?

5 A. Here I'm trying to follow the same example that I
6 used in the background section of this testimony. The
7 encoder wants to remove frame number 3 from its buffer and
8 put in frame number 5.

9 Q. And moving to slide 65, according to Mulroy, what
10 information does the encoder send to the decoder?

11 A. Mulroy will send, along with the encoded
12 bitstream of picture 5 in the slices, the three sets of
13 reordering commands indicating to the decoder which three
14 frames to keep in the decoder buffer and, hence, which frame
15 to take out.

16 Q. And can you explain what you're showing on slide
17 67 as to the first reordering command?

18 A. Of course. Within the first set of the
19 reordering command, the middle part, the Abs_minus1
20 parameter is zero, retrieved from the -- from the buffer
21 description information. And number 5 in the bottom of
22 this, the commands, is the picture identifier identifying
23 the current picture. And the claimed calculation is carried
24 out by 5 minus 0 plus 1 equals to 4, and that value is
25 assigned to picNumLX0. And that is the claimed reference

1 picture identifier calculated based on the buffer
2 description information.

3 Q. Moving to slide 68, how will the decoder
4 interpret that command?

5 A. In plain English, the decoder, after parsing the
6 commands that I just talked about, understands that the
7 reordering command, in particular, the first one in a
8 sequence of three, is for the encoder to tell decoder to put
9 picture 4 at index 0.

10 Q. Let's go to slide 69.

11 How are the subsequent reordering commands
12 calculated?

13 A. They are calculated in the same way. And in
14 plain English, what decoder understands is that picture
15 number 2 is to be put at index 1, and picture number 1 is to
16 put at index number 2.

17 Q. And moving to slide 70, how does Mulroy propose
18 to use these reordering commands?

19 A. After parsing the reordering commands, Mulroy's
20 modification of the decoder then can determine to keep
21 pictures number 4, 2, and 1 in its buffer and remove picture
22 number 3.

23 Q. Let's go to slide 73. What are you showing on
24 this slide?

25 A. Here we moved on to claim 9. And on this slide,

1 I try to show through color coding that preamble and
2 elements A to C of claim 9 match up to those of claim 8. So
3 for the same reasons that we've been discussing that those
4 elements are obvious of claim 8, those elements are obvious
5 in claim 9 as well.

6 Q. Let's go to slide 74 and look at the last
7 limitation of claim 9.

8 What have you highlighted as claim 9[d]?

9 A. Here, as we have seen, the previous part of claim
10 9, as well as those matching elements of claim 8, focus on
11 "determine, based on the buffer description information, a
12 reference picture identifier for the current picture." And
13 claim 9[d], that states "a picture identifier identifying a
14 respective reference picture among the multiple reference
15 pictures as a decoding reference for subsequent, according
16 to a decoding order, picture in the video stream," which
17 means that now we're talking about identifying a reference
18 picture identifier to decode a subsequent picture.

19 Q. Is claim 9[d] disclosed by the Mulroy, H.264, and
20 Lee combination?

21 A. Yes.

22 Q. How so?

23 A. It is disclosed, for example, by Mulroy in the
24 way that Mulroy teaches that the encoder has a set of
25 reference frames, plural, and we know that the remapping

1 instructions or the reordering commands will indicate to the
2 decoder what those reference frames are. And Mulroy
3 discloses that the encoder may choose to use one, some, or
4 all of these when encoding a frame.

5 So a POSITA would understand that when the
6 decoder receives the plurality of reference frames, one,
7 some, or all of those are used to decode the current frame,
8 and the rest indicated in the remapping instructions are for
9 decoding the subsequent frames.

10 Mulroy also teaches about long-term frames. So a
11 POSITA would understand that long-term frame, in general, is
12 used to decode frames that come much later than the current
13 frame. And Mulroy further teaches that the main purpose of
14 this order is to facilitate the use of entropy coding for
15 identifying the reference frames to be used. And this
16 purpose is the initial purpose of these reordering commands
17 in H.264.

18 And Mulroy discloses, to honor that initial
19 purpose, to put the reference pictures that are used by the
20 current picture on the lower indexed end of the reordering
21 commands. And then the last but not least, Mulroy, for
22 example, discloses that the encoder may also indicate how
23 many references are to be used. So that's an explicit way
24 to tell the decoder how many references, and because they
25 are put at the lower end of the reordering commands, the

1 decoder knows exactly which reference frames are for the
2 current picture and then the rest in the remapping
3 instructions are used for subsequent pictures only.

4 Q. Have you prepared a series of slides
5 demonstrating this disclosure of Mulroy?

6 A. Yes, I have.

7 Q. Okay. Beginning on slide 75, what are you
8 showing here?

9 A. Here I'm showing the disclosure of Mulroy, in
10 particular, to claim 9. And the encoder side is very
11 similar as before. The encoder has decided to remove
12 picture number 3 from the buffer. And the encoder knows,
13 because it did the encoding, that pictures number 4 and 2
14 are reference pictures for the current picture and picture
15 number 1 is the reference for the subsequent picture.

16 Q. How does Mulroy propose to use those reordering
17 commands?

18 A. Mulroy proposes to signal, in addition to the
19 reordering commands, so that the decoder knows to keep
20 frames 4, 2, 1, and remove frames or pictures 3. The
21 decoder also knows through that number of reference frames
22 that's also signaled to use the first two pictures to
23 predict the current picture. And the picture number 1 is
24 kept in the decoder buffer to decode for subsequent picture
25 and not for current picture.

1 Q. Let's go to slide 80.

2 Focusing on the specification of the '618 patent,
3 how does the '618 patent propose to identify reference
4 pictures as potentially used for subsequent pictures?

5 A. There isn't much disclosure about that, but when
6 it is discussed, the '618 patent's specification teaches
7 marking a picture in the buffer description information as
8 used for reference or marked as "used for prediction."

9 And the '618 patent's spec discloses that this is
10 used to indicate that this reference picture is to be used
11 as decoding reference or prediction for the current picture
12 and/or any subsequent picture. But the spec of the '618
13 patent doesn't make a distinction as to which ones are used
14 for the current picture and which ones are used for the
15 subsequent picture.

16 Q. According to the '618 patent, is marking a
17 reference picture as "used for reference" or "used for
18 prediction" an explicit signaling of which reference
19 pictures are used for the current picture and which are used
20 for a subsequent picture?

21 A. It's not.

22 Q. In your opinion, is Mulroy's method of signaling
23 pictures for use by a subsequent picture more explicit or
24 less explicit than what is described in the '618 patent?

25 A. The disclosure in the Mulroy reference about this

1 particular aspect is more explicit than the '618 patent.
2 The Mulroy's disclosure is as explicit as it can get because
3 it tells you exactly which ones to use.

4 Q. Let's go to slide 81.

5 Would the POSITA have been motivated to combine
6 Mulroy and H.264?

7 A. Yes.

8 Q. Why?

9 A. The loss of the MMCO commands was a known problem
10 in multi-frame predictive coding, and Mulroy has disclosed
11 to use a known technique, which is the H.264 reordering
12 commands, in a new way to modify the decoder but teaches
13 exactly how to modify it to improve error resilience in
14 decoding.

15 And the POSITA would have a reasonable
16 expectation of success because Mulroy has provided a roadmap
17 of how to implement its modification using the already
18 defined syntax elements of the coding standard, H.264.

19 Q. Would Mulroy's proposed modification have
20 required undue experimentation?

21 A. No.

22 Q. Go to slide 82.

23 Dr. Hu, in forming your opinion on obviousness of
24 claim 9 of the '618 patent, did you consider any secondary
25 considerations of non-obviousness?

1 A. Yes, I did.

2 Q. And which factors did you consider?

3 A. I'm sorry, can you repeat your question?

4 Q. Generally, which factors did you consider?

5 A. I considered what Dr. Richardson has opined in
6 his opening report, but as I understand, Dr. Richardson
7 hasn't provided a direct testimony in this trial yet. And I
8 will have chance to respond to his testimony at a later time
9 this week.

10 Q. Did the secondary considerations that you did
11 consider in your expert report affect your conclusion that
12 the asserted claims are obvious?

13 A. They did not affect my opinion.

14 Q. Dr. Hu, I now want to discuss your opinions on
15 infringement and technical DI.

16 JUDGE BHATTACHARYYA: Counsel, could we take a
17 quick break at this point?

18 MR. FARNOLY: Yes, Your Honor.

19 JUDGE BHATTACHARYYA: Since we already took a
20 five-minute break earlier, this will be a 10-minute break.

21 (A recess was taken at 3:54 p.m., after which the
22 proceedings resumed at 4:04 p.m.)

23 JUDGE BHATTACHARYYA: Please be seated.

24 BY MR. FARNOLY:

25 Q. Dr. Hu, I now want to discuss your opinions on

1 infringement and technical DI. Let's go to slide 84.

2 Have you been informed of the legal standard to
3 be applied when assessing infringement of a patent?

4 A. Yes, including those shown on this slide.

5 Q. And did you apply that legal standard in your
6 infringement analysis?

7 A. Yes, I did.

8 Q. Let's go to slide 85.

9 What conclusions, if any, have you reached
10 regarding the accused and DI products?

11 A. I have concluded that the accused products and
12 the DI products do not include the claimed delta identifier.
13 And Dr. Xiong has not shown that Lenovo's Chromebooks
14 infringe, and he has not shown that Lenovo products with
15 MediaTek chips infringe.

16 Q. Let's take a closer look at the claimed delta
17 identifier. We're on RDX-6.86.

18 What does independent claim 8 require with regard
19 to the delta identifier?

20 A. It requires the same delta identifier to be
21 retrieved based on the buffer description information and
22 used as a basis to calculate the reference picture
23 identifier.

24 Q. Were you in the courtroom during Dr. Xiong's
25 direct testimony?

1 A. Yes, I was.

2 Q. Let's go to slide 87.

3 What has Dr. Xiong opined as meeting the claimed
4 delta identifier in the accused and DI products?

5 A. His opinion appears to have evolved. I believe
6 in his report he has pointed to both the small
7 delta_poc_s0_minus1 plus 1 parameter as the delta
8 identifier, as well as the big DeltaPocS0 as the delta
9 identifier, but I heard in his direct testimony he is only
10 opining that the big Delta parameter satisfies the claimed
11 delta identifier.

12 Q. What does Dr. Xiong -- excuse me -- what else has
13 Dr. Xiong opined?

14 A. He has also opined that each accused and DI
15 product includes an HEVC-compliant decoder, and he has
16 analyzed source code for the Intel, AMD, NVIDIA, Qualcomm,
17 Microsoft, Apple, and Samsung products to have corresponding
18 values to those defined in the HEVC standard.

19 Q. Let's go to slide 88.

20 Do you agree with Dr. Xiong's opinion that the
21 accused and DI products include the claimed delta
22 identifier?

23 A. No, I don't agree with that.

24 Q. Why not?

25 A. The big Delta parameter DeltaPocSo at most is

1 used as a basis to calculate the reference picture
2 identifier in the HEVC standard, but it's not retrieved
3 based on the buffer description information.

4 Q. What, if any, of these values is retrieved based
5 on the buffer description information?

6 A. That would be the small delta_minus1 parameter
7 and equivalently that plus 1.

8 Q. Is that value used to calculate a reference
9 picture identifier?

10 A. No, it's not. It's the big Delta parameter that
11 is used to calculate the reference picture identifier.

12 Q. Is that value, the big DeltaPoc, retrieved based
13 on the buffer description information?

14 A. No, it's not.

15 Q. So does either value on its own satisfy the
16 claimed delta identifier?

17 A. No.

18 Q. How, if at all, are the two delta parameters
19 related?

20 A. The big Delta parameter is calculated from a
21 sequence of the small delta parameters.

22 Q. Are they the same parameter?

23 A. They're not.

24 Q. Let's go to slide 89.

25 Do you understand that Dr. Xiong has opined that

1 Lenovo's Chromebook products infringe claim 9 of the '618
2 patent?

3 A. Yes.

4 Q. Do you agree?

5 A. I do not.

6 Q. Why not?

7 A. First of all, Dr. Xiong has not analyzed any
8 Chrome source code, and also he has not identified any
9 configuration in the Chromebook that shows that the HEVC
10 video can actually be decoded on a Chromebook.

11 He has not shown any appropriate interface, API,
12 and driver, for example, so that -- to prove that the
13 relevant hardware implementations can be called, and will be
14 called, to execute successfully to decode HEVC videos.

15 Q. Let's go to slide 90.

16 Do you understand that Dr. Xiong has opined that
17 the Lenovo products with MediaTek chips infringe claim 9 of
18 the '618 patent?

19 A. That's right.

20 Q. Do you agree?

21 A. I do not.

22 Q. Why not?

23 A. Because Dr. Xiong has not analyzed any MediaTek
24 source code, so he did not show that MediaTek's
25 implementation of the HEVC satisfies every limitation in

1 claim 9.

2 Q. Is it possible to implement HEVC without
3 practicing claim 9?

4 A. It is.

5 Q. I now want to switch gears and discuss Lenovo's
6 redesigned product.

7 MR. FARNOLY: Your Honor, we will need to go on
8 the confidential record for Lenovo CBI.

9 JUDGE BHATTACHARYYA: We're moving to the Lenovo
10 confidential record.

11 (Whereupon, the hearing proceeded in confidential
12 session.)

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1 O P E N S E S S I O N

2 MR. HAYNES: Your Honor, I am going to pick up
3 right where they left off. So we can probably just stay on
4 the confidential record and hopefully knock out the
5 confidential part right at the beginning.

6 JUDGE BHATTACHARYYA: All right. That's fine.
7 We are moving back to the confidential -- which
8 confidential? To the Lenovo confidential record?

9 MR. HAYNES: Yes.
10 (Whereupon, the hearing proceeded in confidential
11 session.)

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1 O P E N S E S S I O N

2 BY MR. HAYNES:

3 Q. Now, you would agree with me that in HEVC, these
4 picture order count identifiers identify a set of reference
5 pictures to be retained for interprediction that is referred
6 to as the reference picture set, or RPS, correct?

7 A. Could you repeat your question?

8 Q. Sure. You would agree with me that the set of
9 reference pictures to be retained for interprediction is
10 referred to as a reference picture set, or RPS?

11 A. Yes, RPS is created on the decoder side to
12 contain some of the reference pictures.

13 Q. Okay. I have got a lot of sort of short, factual
14 statements that I think will be easy to confirm. So I am
15 going to ask my questions yes or no. If you're able to
16 answer them yes or no, please do. If you can't answer them
17 yes or no, let me know, and I will try to speed through and
18 maybe ask a slightly different question.

19 A. Okay. I can do that.

20 Q. Okay. Now, you would agree with me that the
21 reference picture set concept from HEVC was new, correct?

22 A. Sorry, I will have to ask you to repeat your
23 question.

24 Q. Sure. You would agree with me that the reference
25 picture set concept from HEVC was new, as compared to H.264?

1 A. It's a complicated question I cannot say yes or
2 no to.

3 Q. Okay. Let's bring up your infringement rebuttal
4 report at paragraph 41. That's the redesign report. I need
5 the infringement rebuttal report.

6 I will move on while he searches for that.

7 You would agree with me that the reference
8 picture set in HEVC is more explicit, rather than depending
9 on a stored internal state of the DPB being signalled by
10 MMCO commands from prior pictures, correct?

11 A. I can't agree to that.

12 Q. I direct your attention to where my finger is
13 right here. This is paragraph 40 of your infringement
14 rebuttal report.

15 There you say -- state that "The syntax for
16 identifying the RPS in HEVC is more explicit, rather than
17 depending on the stored internal state of the DPB being
18 signalled by MMCO commands from prior pictures."

19 That's what you said in your report, correct?

20 A. That's correct.

21 Q. Okay. You would also agree with me that the HEVC
22 syntax for identifying reference picture sets and
23 establishing the reference picture lists of interprediction
24 was adopted to be more robust to data losses than in the
25 prior H.264 AVC design, correct?

1 A. Sorry, are you reading from this paragraph again?

2 Q. Right now I'm asking you a question, but I will
3 give you a preview. I may be relying on something.

4 So my question is just -- I just want to see if
5 we can have a conversation about what you know. And then if
6 I don't -- if you say something that I think may be wrong, I
7 may show you something, okay?

8 A. Okay.

9 Q. All right. So let me ask the question again.
10 And, again, if you could answer it yes or no.

11 You agree that the HEVC syntax for identifying
12 reference picture sets and establishing the reference
13 picture lists of interprediction was adopted to be more
14 robust to data losses than in the prior H.264 AVC design,
15 correct?

16 A. It's correct for that usage of reference picture
17 set. Reference picture set has multiple meanings. For
18 example, in the '618 patent itself, it describes the buffer
19 description information as reference picture set. So that's
20 clearly said in the '618 patent to be something sent from
21 the encoder to decoder.

22 And what the context that we're talking about
23 with regard to that part of my report is talking about
24 another interpretation of the reference picture set when
25 it's an entity or data structure created inside the decoder

1 to hold reference pictures.

2 So there are multiple contexts for this term
3 "reference picture set."

4 Q. Dr. Hu, I don't want to speak over you, but I
5 would ask you to focus on the question I'm asking.

6 My question wasn't about the patent. It started
7 with "in HEVC." So if we can answer them yes or no, I'll
8 ask each one yes or no. If you can't answer it that way,
9 let me know, because I have limited time. Okay?

10 A. Okay.

11 Q. Now, you would agree with me that in -- well, yes
12 or no, you would agree with me in HEVC, the reference
13 picture set contains the status of all reference pictures in
14 the decoder picture buffer?

15 A. Yes, for the context that I just clarified.

16 Q. Now, you testified on direct about -- that you
17 were here when Mr. Sjoberg testified about his proposal to
18 the HEVC development group. Do you recall that?

19 A. Yes, I do.

20 Q. And you were here when Mr. Sjoberg described that
21 proposal to the HEVC development group for reference picture
22 management as being a major change. You were here for that,
23 right?

24 A. Yes, I was.

25 Q. Okay. And during your direct, you didn't dispute

1 that at least as with respect to that proposal that
2 Mr. Sjoberg made to the HEVC development group, that was a
3 major change to reference picture management at the time,
4 correct?

5 A. Are you asking about reference picture set by
6 itself or the F-493 proposal that Mr. Sjoberg testified
7 about as a whole?

8 Q. I'm specifically asking about Mr. Sjoberg's
9 proposal to the HEVC development group that proposed
10 modifying how you manage reference pictures.

11 You would agree with me that that was a major
12 change to how reference pictures were managed previously,
13 correct?

14 A. I would agree to that, about the proposal.

15 Q. Okay. And some of the reasons why that was a
16 major change is Mr. Sjoberg proposed getting rid of MMCO
17 commands, correct?

18 A. I don't agree with that.

19 Q. Is it your testimony that Mr. Sjoberg's solution
20 for reference picture management did not get rid of MMCO
21 commands?

22 A. His proposal was about adding the explicit
23 signaling. It's not about preventing usage of MMCO command.
24 It is to use that explicit signaling. And it doesn't say
25 you cannot also use relative predictive signaling that can

1 be carried out by MMCO commands.

2 Q. Let me ask you this question. When you formed
3 your opinions in this case, did you assume that reference
4 picture management as described in the '618 patent would
5 still use MMCO commands?

6 A. The claims and the specs don't prevent usage of
7 MMCO commands. And I didn't imagine those to be prohibited
8 somehow, because the '618 patent doesn't teach not to use
9 MMCO command at all.

10 Q. Do you understand the '618 patent proposed
11 replacing MMCO commands and sliding window with buffer
12 description information for reference picture management?

13 A. It doesn't propose to use -- to only use the
14 proposed buffer description information.

15 Q. Okay. Let me ask you this question. Would you
16 consider MMCO commands to be buffer description information
17 in the context of the claims of the '618 patent?

18 A. I would not.

19 Q. But you would agree with me that MMCO commands do
20 contain information about which reference pictures should be
21 in the decoder picture buffer, correct?

22 A. It's a relative signaling, yes.

23 Q. Okay. And you would agree that the buffer
24 description information in the patent is absolute signaling,
25 right?

1 A. That's correct.

2 Q. And you would agree with me that the buffer
3 description information in the patent provides unambiguous
4 identification of the reference pictures that should be
5 contained in the decoder picture buffer, correct?

6 A. To the extent that -- to the extent that's
7 relevant to my obviousness analysis, because as I testified
8 today, Mulroy also discloses that, I would agree that that
9 is one interpretation of the claimed invention of the '618
10 patent. But it doesn't prohibit usage of other signaling
11 methods in addition to the buffer description information,
12 such as MMCO commands.

13 Q. You would agree with me that in the '618 patent,
14 the buffer description information does not depend on
15 pictures that have been previously received and decoded by
16 the decoder, correct?

17 A. Could you repeat your question?

18 Q. You would agree with me that the buffer
19 description information of the '618 patent does not depend
20 on pictures that have been previously received and decoded
21 by the decoder, correct?

22 A. I would agree with that.

23 Q. And you would also agree with me that at the time
24 of the '618 patent, reference picture reordering commands
25 were part of the H.264 standard, correct?

1 A. That's correct.

2 Q. And you would also agree with me that the '618
3 patent does not describe those reference picture reordering
4 commands as buffer description information, correct?

5 A. That's correct.

6 Q. And you would also agree with me that in H.264,
7 the reference picture reordering commands as used in H.264
8 are not buffer description information, correct?

9 A. If we disregard Mulroy's invention that -- how it
10 uses the reordering commands, if we are looking at the H.264
11 standard alone, I would agree with your statement.

12 Q. Okay. So let me see if I can carve that up, and
13 what I want to focus on, in the H.264 standard, you would
14 agree that reference picture reordering commands are not
15 buffer description information, as that term is used in the
16 '618 patent, correct?

17 A. I agree with that statement, if we take out
18 Mulroy.

19 Q. Fair enough. Good transition. Let's talk about
20 Mulroy.

21 Now, you understand that what Mulroy did was -- I
22 think you testified on direct, he identified a problem with
23 the MMCO commands and the fact that if you lose some of
24 those, you end up with a buffer mismatch, right?

25 A. That's correct. That's why Mulroy said you

1 cannot rely on the MMCO commands.

2 Q. Right. And Mulroy, you would agree with me, that
3 patent is really about dealing with -- you know, coming up
4 with ways to solve errors that might come about through
5 things like lost MMCO commands in H.264, correct?

6 A. I wouldn't agree with that.

7 Q. You would agree with me that in Mulroy, MMCO
8 commands were still used, along with sliding window, for
9 reference picture management, correct?

10 A. That's not correct.

11 Q. Is it your testimony that in Mulroy, it's your
12 view that the -- his technique for using the reference
13 picture reordering commands replaced MMCO commands in
14 sliding window?

15 A. No. My opinion is that Mulroy proposed using the
16 reordering commands of the H.264 standard as the explicit
17 signaling message, that is the claimed buffer description
18 information.

19 In terms of the MMCO commands, I already
20 testified that Mulroy discloses you can use that in addition
21 to reordering commands to preview, from the encoder to
22 decoder, kind of what signaling is to come. And also that's
23 a way for the decoder to find out if any pictures have been
24 lost.

25 In terms of sliding window, I already testified

1 that Mulroy discloses to use an enhanced version of that as
2 part of the -- I don't know if Mulroy uses the same words,
3 but among those rules that are designed for the encoder.
4 And the sliding window is, at most, used by the decoder if
5 the reordering commands themselves are lost.

6 Q. So is it your testimony that Mulroy -- in Mulroy,
7 the reordering commands -- well, let me withdraw that and
8 try again.

9 You understand that in Mulroy, it proposes
10 sending MMCO commands and sliding window of H.264 and adding
11 to that reference picture reordering commands that are being
12 used for an additional purpose? Is that fair?

13 A. That's not fair.

14 Q. Not fair, okay.

15 Let me ask you this: When you formed your
16 opinions on invalidity in this case, did you base them on
17 your conclusion that Mulroy does not add reference picture
18 reordering on top of the MMCO and sliding window structure
19 of H.264?

20 A. Sorry, your question is really long. But as I
21 already said, Mulroy teaches to use reordering commands as
22 the definitive explicit signaling. And that's independent
23 of whether the MMCO commands are also used.

24 And sliding window, itself, is not a signal that
25 is sent from the encoder to the decoder. It's an operation

1 that both sides have used in H.264, for example, knows,
2 that's a simple first in/first out method. And Mulroy
3 teaches an enhanced version of that for the encoder buffer
4 management.

5 Q. Let me ask you this question: If I took the MMCO
6 commands and sliding window out of Mulroy, would it still
7 work?

8 A. Yes.

9 Q. And in forming your opinions on validity on this
10 case, you based it on the assumption that in Mulroy,
11 reordering picture commands could be used all by themselves
12 for reference picture buffer management; is that fair?

13 A. For the decoder buffer management, that is fair.

14 MR. HAYNES: Your Honor, I am mindful it is 5:15,
15 which is our cutoff today. And this would be a great time
16 to stop, if it is okay.

17 JUDGE BHATTACHARYYA: Very well.

18 Thanks, everybody. We will adjourn for today. I
19 will see you again tomorrow morning.

20 (Whereupon, at 5:15 p.m., the evidentiary hearing
21 adjourned, to reconvene at 9:30 a.m. on Thursday, October
22 24, 2024.)

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1 JUDGE BHATTACHARYYA: Okay. We're on the public
2 record.

3 THE WITNESS: Good morning, Your Honor.

4 JUDGE BHATTACHARYYA: Welcome back.

5 THE WITNESS: Thank you.

6 Whereupon--

7 JING HU,
8 having been previously duly sworn/affirmed, was examined and
9 testified as follows:

10 CROSS-EXAMINATION -- resumed

11 BY MR. HAYNES:

12 Q. Good morning, Dr. Hu.

13 A. Good morning.

14 Q. I'm going to pick up sort of right where we left
15 off yesterday afternoon. And I want to start with one of
16 your slides, RDX-6.51.

17 Now, here this is your analysis with respect to
18 the first "retrieve" step in claim 8 and what you've
19 identified from the Mulroy reference that you believe
20 renders obvious that step. Is that fair?

21 A. This slide includes the evidence. I don't recall
22 if I have slides following this that also support this claim
23 element.

24 Q. Fair enough. Now, this first step that you have
25 highlighted here requires that the decoder retrieve buffer

1 description information defining a plurality of reference
2 pictures, right?

3 A. That's correct.

4 Q. And that plurality of reference pictures refers
5 to the reference pictures that are stored in the decoder
6 picture buffer, or DPB, as I think you called it yesterday?

7 A. The concept is -- is right, but here the claim
8 talks about buffer description information that defines the
9 reference picture. So essentially this is defining within
10 the buffer description information, but the reference
11 pictures are used -- are stored in the DPB on the decoder
12 side.

13 Q. Okay. I think we can agree on that. Let's go to
14 CDX-47.5.

15 And this is just claim 9 of the '618 patent, and
16 I've just added some highlighting to it, referring to two
17 steps that follow on to the steps that are set forth in
18 claim 8. All right?

19 A. That's correct.

20 Q. Now, in these steps, claim 9 requires that "the
21 decoder determine, based on the buffer description
22 information, a picture identifier identifying a respective
23 reference picture among the multiple reference pictures as
24 the decoding reference for the picture."

25 Did I read that right?

1 A. I believe so.

2 Q. So what is happening in this step is, we looked
3 at earlier, you retrieve from the buffer description
4 information, which defines a plurality of pictures. And now
5 I am determining from that buffer description information
6 certain pictures that are going to be used as a decoding
7 reference for the current picture, right?

8 A. That's correct.

9 Q. And then in the green step, the second -- under
10 Romanette ii, I'm also going to determine a picture
11 identifier identifying a respective reference picture from
12 among that plurality that is going to be used as a decoding
13 reference for a subsequent picture, right?

14 A. I wouldn't characterize it as two steps. These
15 are two elements within claim 9.

16 Q. Okay. Fair enough.

17 Now, you agree with me that both of those -- that
18 "determine" step, both of those have to be based on the
19 buffer description information, right?

20 A. That's what the claim says, but the claim doesn't
21 say that it cannot be based on other information either.

22 Q. Okay. Fair enough.

23 Now, with respect to your opinions on Mulroy,
24 what you point to as the buffer description information are
25 those reordering instructions from H.264 as modified by

1 Mulroy. Is that fair?

2 A. That's part of it. And for claim 9, clearly I
3 also pointed to the number of reference pictures that Mulroy
4 teaches that the encoder can also signal to the decoder as
5 to how many reference pictures are used for the current
6 picture.

7 Q. You would agree with me that the reordering
8 instructions in H.264 and in Mulroy do not specifically
9 identify which reference pictures are for a current picture
10 as opposed to which reference pictures are for a subsequent
11 picture, correct?

12 A. I wouldn't agree with that.

13 Q. You disagree with that?

14 A. That's correct.

15 Q. You believe the syntax for the reordering
16 instructions in H.264 identifies which reference pictures
17 are for a current picture and which reference pictures are
18 for a subsequent picture; is that right?

19 A. Could you repeat your question?

20 Q. You believe that the reordering instructions
21 themselves identify which reference pictures are for a
22 current picture as opposed to which reference pictures are
23 for a subsequent picture?

24 A. If we are looking at H.264 standard alone,
25 without Mulroy, it does not indicate that. But Mulroy's

1 modified version of the reordering commands, as Mulroy
2 discloses, includes the number of reference frames used for
3 the current picture as disclosed by Mulroy.

4 Q. Okay. So let me just be clear. Are you
5 suggesting that Mulroy modifies the instruction itself from
6 H.264?

7 A. You can think of it that way.

8 Q. I'm not -- I don't want to think of it that way.
9 What is your opinion?

10 A. A POSITA would understand it that way.

11 Q. Okay. But you would agree with me that Mulroy
12 itself doesn't actually say anything about modifying the
13 actual picture ordering instructions; it says use those same
14 instructions that are already in H.264, correct?

15 A. For indicating which frames are to be kept in the
16 decoded picture buffer at the decoder, that's correct. The
17 Mulroy, as we've been discussing, also discloses sending the
18 number of reference pictures to the decoder as well.

19 Q. Now, one of the things you considered in forming
20 your opinions was a book on H.264 that was written by Iain
21 Richardson; is that fair?

22 A. I reviewed that book in the process of my
23 analysis for this case; that's fair.

24 Q. Okay. Let's bring up CX-5434. Does this look
25 familiar, like the book from Mr. Richardson that you

1 reviewed?

2 A. I think so.

3 Q. You have no reason to doubt that this book by
4 Mr. Richardson accurately describes how H.264 works?

5 A. As a whole, I wouldn't doubt that, but I haven't
6 carefully reviewed every page of it, so I cannot speak to
7 the absolute detail of that.

8 Q. Let's turn to page 70 of Mr. Richardson's book.
9 And I want to look -- down in the lower right,
10 there's a Section 5.3.3.2, which refers to "changing the
11 reference picture list order." Do you see that?

12 A. Sorry, which line are you pointing me to?

13 Q. I was referring to the section title.

14 A. Oh. Yes.

15 Q. Okay. Now, what the picture reordering
16 instructions do is they change the list order of the
17 reference picture list in H.264, right?

18 A. That's fair.

19 Q. Okay. And if you look at the second sentence
20 here, when it refers to "these commands are initiated by the
21 syntax element ref_pic_list_reordering_flag and change the
22 list order for the current slice only." Do you see that?

23 A. I see that. That's how it's used in H.264
24 without Mulroy's invention.

25 Q. That's right. So in H.264, you would agree with

1 me that that's an accurate description of how the picture
2 reordering commands work, correct?

3 A. Yes, I would agree with that.

4 Q. Would you also agree with me that there is no
5 statement in Mulroy that suggests that the reordering
6 instructions from H.264 are modified to identify or to
7 distinguish between reference pictures for our current
8 picture versus reference pictures for a subsequent picture?

9 A. I don't agree with that.

10 Q. Okay. And if Mulroy actually disclosed that, I
11 would expect that's something you identified in your direct
12 testimony?

13 A. Mulroy identified the number of reference frames
14 used, signaled from the encoder to decoder to signal the
15 information that we've been talking about. Yes, that's part
16 of my direct testimony.

17 Q. Right. But you would agree with me that the
18 number of reference frames used does not specify which
19 reference frames are for the current picture versus
20 subsequent picture?

21 A. By itself, that might be hard to understand, but
22 Mulroy also teaches, as I have testified, to honor the first
23 purpose, that part of what you were showing me, that's from
24 H.264, to put the reference pictures used by the current
25 picture at the lower end of the decoded picture buffer for

1 coding efficiency.

2 So combining that disclosure with the number of
3 reference pictures used by the current picture, which is
4 also disclosed by Mulroy, you know exactly, according to
5 Mulroy, which pictures are used by the current picture for
6 prediction and which reference pictures are used by the
7 subsequent picture.

8 Q. Okay. I just want to be very clear, it's a
9 yes-or-no question. You would agree with me that the number
10 of reference pictures used does not distinguish between
11 reference pictures for a current picture versus reference
12 pictures for a subsequent picture? Yes or no?

13 A. If you take that out of the rest of Mulroy, the
14 answer is yes.

15 Q. Okay. All right. Let me shift gears a little
16 bit. Let's look at your slide RDX-6.48. And this is just
17 the claim language. Again, I want to focus in on the
18 retrieval step. And there's two retrieval steps in claim 8,
19 correct?

20 Maybe we can highlight the very first "retrieve"
21 step at the top underneath where it says "a memory" and then
22 there's a retrieve? Keep going down.

23 A. That's correct.

24 Q. Below that, the "retrieve" step. And so I've got
25 this first "retrieve" step where I retrieve buffer

1 description information, correct?

2 A. Yes.

3 Q. And that first "retrieve" step, I'm retrieving
4 the buffer description information from the encoded
5 bitstream. The claim specifically says that, right?

6 A. Yes.

7 Q. Okay. And then there's a later "retrieve" step
8 down below under Romanette i. Do you see that?

9 A. Yes, I do.

10 Q. And in that Romanette i, I am retrieving based on
11 the buffer description information, correct?

12 A. That's correct.

13 Q. But with respect to that "retrieve" step, it
14 doesn't specify where I'm retrieving the information from,
15 as long as I'm basing it on the buffer description
16 information; is that right?

17 A. That's fair.

18 Q. Okay. And for invalidity, you relied on the
19 reference picture list reordering commands as what is
20 retrieved from the bitstream, and then information contained
21 within that to get to the second "retrieve" step. Is that
22 right?

23 A. On a high level, that's correct.

24 Q. And then let's bring up your RDX-6.55.

25 This is the parameter within the reference

1 picture reordering instruction that you rely on as being the
2 information that's retrieved from the bitstream, this
3 abs_diff_pic_num_minus1, right?

4 A. For the second retrieve, yes.

5 Q. Okay. But you would agree this -- that
6 abs_diff_pic_num is actually in the bitstream, right?
7 That's retrieved from the bitstream, right?

8 A. Its binary representation is in the bitstream.
9 And then when you parse that, you get this parameter. And
10 that's retrieved from the encoded bitstream.

11 Q. Right. And then to get to the delta identifier
12 that is required by the second "retrieve" step, you look at
13 the parameter that comes from the bitstream, the
14 abs_diff_pic_num_minus1, and then add 1 to it, correct?

15 A. That's fair to say, except that just one tiny
16 detail is the plus 1 is added automatically to the minus1,
17 because that's how the syntax is defined.

18 Q. That's right. So it's very common when you're
19 signaling information in encoders that rather than signaling
20 a value, you will signal that value minus 1 on the encoder
21 side, and then the decoder will automatically add a plus 1
22 to that to get back to the initial value in order to save
23 bits?

24 A. Yeah, that's fair to say.

25 Q. Okay. Now, you understand that when you looked

1 at invalidity, you applied a standard for determining
2 whether a claim element was met, you had to apply that same
3 standard for determining whether the claim element was met
4 with respect to infringement, right?

5 A. Of course.

6 Q. You wouldn't want to apply a double standard
7 where you said something invalidated the claims on one hand
8 but did not infringe on the other, right?

9 A. That's correct.

10 Q. Okay. So let's look at your infringement opinion
11 on the second "retrieve" step, if we could bring up your
12 slide RDX-6.88. So this was your slide on non-infringement.
13 Do you recall that generally?

14 A. Yeah, this is one of them.

15 Q. Okay. Now, you would agree with me that that top
16 value, delta_poc_s0_minus1, that value is in the bitstream
17 in HEVC, right?

18 A. That's correct.

19 Q. Okay. And your opinion was that the delta_poc_s0
20 value that's shown in blue on your slide 6.88 was not a
21 delta identifier because it was not based on buffer
22 description information from the bitstream. Is that fair?

23 A. You missed the word "retrieved," but I agree with
24 that.

25 Q. I'm glad you corrected that. So your theory is,

1 for infringement, this delta_poc_s0 value is not retrieved
2 based on buffer description information because the
3 delta_poc_s0 value is not in the bitstream; is that fair?
4 Or at least not retrieved from the bitstream?

5 A. That's correct.

6 Q. Okay. And I noticed you didn't actually put on
7 your slide what delta_poc_s0 is. And I don't see the
8 formula for how I get to delta_poc_s0 on here, right?

9 A. I think that's correct.

10 Q. Okay. Let's take a look and see what that
11 actually is. If we could go to RDX-6. -- sorry, CDX-47.8.

12 Your slide is on the left. I shrunk it down a
13 little bit so I could get what's on the right here. But on
14 the right, I've got that delta_poc_s0 value in blue, and
15 I've got the formula for what that is on the right there.
16 Do you see that? And my question is just do you see it?

17 A. I do. I'm trying to compare if they are because
18 the first --

19 Q. I'll get to another question --

20 A. Okay.

21 Q. -- if you'll just let me get a question out
22 first. Okay? And my question for you is delta_poc_s0 is
23 calculated by taking little delta_poc_s0_minus1 and adding 1
24 to it, at least when i is equal to 0, correct?

25 A. That's correct.

1 Q. Let's go to CDX-47.6. What I did here is I took
2 your invalidity view with what's in H.264, which is
3 abs_diff_pic_num_minus1 plus 1 is retrieved from the bit --
4 based on buffer description information, and then put on the
5 right your opinion that DeltaPocS1, capital D Delta, is not
6 a delta identifier that is retrieved from the bitstream
7 because it is based on delta_poc_s1_minus1, plus 1? Do you
8 see that?

9 A. I do.

10 Q. Did I accurately reflect your two opinions here?

11 A. On a high level, yes.

12 MR. HAYNES: I'll pass the witness, Your Honor.

13 MR. FARNOLY: May I proceed, Your Honor?

14 JUDGE BHATTACHARYYA: Yes, please.

15 MR. FARNOLY: And we'll have to start on the
16 confidential record for Lenovo confidential information.

17 JUDGE BHATTACHARYYA: We're moving to the Lenovo
18 confidential record.

19 (Whereupon, the hearing proceeded in confidential
20 session.)

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1 O P E N S E S S I O N

2 BY MR. FARNOLY:

3 Q. Dr. Hu, switching gears just a bit, in reference
4 to the HEVC standard and the '618 patent, you were asked
5 about the reference picture set concept. Do you recall
6 that?

7 A. Yes, I do.

8 Q. Is the reference picture set, as used in the HEVC
9 standard, the same or is it different than the buffer
10 description information that is claimed in the '618 patent?

11 A. They are different.

12 Q. Why is that?

13 A. As I explained to the opposing counsel, there are
14 two contexts for the reference picture set in the HEVC
15 standard, it's a data structure that's created in the
16 decoder based on the information signaled from the encoder
17 to the decoder, but within the '618 patent specification, it
18 teaches the buffer description information -- one example
19 for buffer description information is the reference picture
20 set, using that exact term.

21 So within the context of '618 patent, the
22 reference picture set is taught as the information sent from
23 the encoder to the decoder. So those are two different
24 contexts; and, hence, the reference picture set means
25 different things in these two contexts.

1 Q. Do the claims of the '618 patent describe adding
2 pictures to a reference picture set after being decoded?

3 A. Not in its claims.

4 MR. FARNOLY: No further questions, Your Honor.

5 MR. HAYNES: No further questions, Your Honor.

6 JUDGE BHATTACHARYYA: Thank you, Dr. Hu.

7 (The witness stood down.)

24 MR. FARNOLY: Your Honor, Lenovo calls Dr. Jing
25 Hu.

1 Whereupon--

2 JING HU,

3 having been previously duly sworn/affirmed, was examined and
4 testified as follows:

5

6 JUDGE BHATTACHARYYA: Dr. Hu, do you understand
7 that you are still under oath?

8 THE WITNESS: Yes, I do.

9 MR. FARNOLY: May I proceed, Your Honor?

10 JUDGE BHATTACHARYYA: Yes. Please go ahead.

11 DIRECT EXAMINATION

12 BY MR. FARNOLY:

13 Q. Could we please have CDX-35.96.

14 Dr. Hu, do you recall this slide from
15 Dr. Richardson's testimony?

16 A. Yes, I do.

17 Q. Did you hear Dr. Richardson testify that
18 reordering commands are a type of relative signaling?

19 A. I remember that.

20 Q. Do you agree that reordering commands as
21 implemented by Mulroy are a type of relative signaling?

22 A. I do not.

23 Q. Why not?

24 A. Because the reordering commands as taught by
25 Mulroy, as I have testified earlier this week, are a type of

1 explicit signaling. And even used for the initial purpose
2 as is used in the H.264 standard, the reordering is not to
3 change the order from how the reference pictures are ordered
4 in the reordering commands that came before this picture.

5 Everything that the current picture needs for
6 calculating which frames should stay in the decoded picture
7 buffer or the decoder is already there in that set of
8 reordering commands with the current picture.

9 Q. As used in Mulroy, if a set of reordering
10 commands are lost, what effect will that have on the next
11 set of reordering commands?

12 A. It will have no effect, because as I just
13 explained, the next set of the reordering commands will come
14 with the next picture which is actually received.

15 Q. Can we have CDX-35.101.

16 And do you recall this slide from
17 Dr. Richardson's testimony?

18 A. Yes, I do.

19 Q. And this is a slide from your direct that
20 Dr. Richardson has made some additions to; is that right?

21 A. That appears to be the case.

22 Q. Do you recall Dr. Richardson testified that
23 Mulroy's actual modification is to order frames as 1, 2, 4,
24 if mismatch, apply error recovery techniques described at
25 length.

1 Do you recall that?

2 A. Yes, I do.

3 Q. Is this consistent with your understanding of
4 Mulroy's modification?

5 A. Part of it is. It appears that Dr. Richardson is
6 saying that the actual Mulroy modification will signal, in
7 this example, that the reference frames that should be kept
8 in the decoder buffer at the time are frames 1, 2, and 4.
9 So the decoder will know to remove frame number 3, based on
10 the information.

11 Q. And can we have CDX-35.83.

12 Do you recall this slide from Dr. Richardson's
13 testimony?

14 A. Yes, I do.

15 Q. Did you hear Dr. Richardson's description of the
16 '618 patent solution?

17 A. Yes.

18 Q. And do you see that Dr. Richardson includes what
19 he has labeled in green as buffer description information?

20 A. Yes.

21 Q. And do you see in this animation it states,
22 "current equals 2, subsequent equals 0"?

23 A. Yes, I see that.

24 Q. Is that solution as depicted by Dr. Richardson
25 disclosed in the specification of the '618 patent?

1 A. It's not.

2 Q. How, if at all, does the '618 patent describe
3 indicating if a picture will be used for the current picture
4 or a subsequent picture?

5 A. The '618 patent discloses to mark a picture as
6 used for reference. When it is marked that way, the picture
7 can be used as a reference for the current picture and/or
8 the next picture.

9 Q. And, in fact, the F493 proposal made that
10 proposed change to use reference picture marking technique?

11 A. No, it did not.

12 Q. And is that picture marking technique an explicit
13 signal of which pictures are for the current picture and
14 which pictures are for the subsequent picture?

15 A. No, it's not.

16 Q. Let me have CDX-35.97.

17 Did you hear Dr. Richardson's testimony that
18 Mulroy teaches the use of the syntax element frame_num?

19 A. I remember he testified that.

20 Q. Is that what Mulroy teaches?

21 A. No, it's not.

22 Q. What does Mulroy teach?

23 A. Mulroy teaches, as -- I believe this is another
24 one of Dr. Richardson's slides -- that to use the frame
25 numbers of the reference frames, to indicate which of them

1 should be kept in the buffer.

2 Q. How does the frame number relate to the variable
3 picNumLXNowrap from the H.264?

4 A. The frame number disclosed in Mulroy is the
5 parameter picNumLXNowrap, because Mulroy teaches to use the
6 reordering commands of the H.264 standard to signal this
7 information.

8 And I have shown in my direct testimony, also
9 part of it is shown on this slide as well, how the H.264
10 standard defines exactly which equations to use to calculate
11 the frame numbers for the reference frames, based on the
12 information signalled in the reordering commands.

13 Q. Can we have CDX-35.99.

14 Did you hear Dr. Richardson discuss the rules for
15 reference buffer management in Mulroy?

16 A. Yes.

17 Q. What applies these rules? Is it the encoder or
18 the decoder?

19 A. The encoder.

20 Q. And how does Mulroy propose signaling the state
21 of the updated buffer to the decoder?

22 A. Once encoder manages its buffer based on these
23 rules, the encoder tells the decoder through the modified
24 reordering commands and the number of reference frames to be
25 used for the current picture to signal the effect of

1 application of these rules at the encoder, then to the
2 decoder, so decoder knows how to update its buffer.

3 MR. FARNOLY: Thank you. Pass the witness.

4 MR. HAYNES: May I proceed, Your Honor?

5 CROSS-EXAMINATION

6 BY MR. HAYNES:

7 Q. Good afternoon, Dr. Hu.

8 A. Hello.

9 Q. I apologize to you for mis-speaking a couple of
10 times today and getting your name wrong. That was not
11 intentional.

12 A. No worries. I understand.

13 Q. Let's start with CDX-39.95.

14 Okay. Do you remember being asked questions just
15 a few seconds ago, some questions about -- I think you said
16 that the reordering commands are explicit signaling? Do you
17 recall that?

18 A. Yes.

19 Q. Now, when you said "explicit signaling," you
20 would agree with me that it matters in the context of the
21 patent what it is that's being explicitly signalled, right?

22 A. I believe that's the case.

23 Q. Okay. So with respect to defining what a
24 reference picture is, and keeping that in mind, what the
25 reordering command semantics in the H.264 standard states is

1 that those commands specify the change from the initial
2 reference picture lists to the reference picture lists to be
3 used for decoding the slice.

4 Do you see that?

5 A. Yes, I do.

6 Q. So what this is signaling is the relative change
7 between a picture list that already identifies reference
8 pictures, that the decoder already has, correct?

9 A. That's true, but that initial reference picture
10 list --

11 Q. Dr. Hu, I am sure they will let you explain on
12 redirect if they want.

13 A. Okay.

14 Q. But you agree, that's true, right?

15 A. Sure.

16 Q. Okay. All right. Let's go to CDX-35.97.

17 Do you see here, you were asked some questions
18 about this frame number that is referenced in Mulroy at the
19 bottom, right?

20 A. Yes.

21 Q. Okay. And what you have shown on the top is what
22 you pointed to in the H.264 standard to identify the
23 reference picture identifier from element 8[f], right?

24 A. The calculation is based on the syntax in the
25 reordering commands, that's correct.

1 Q. That's right. But you are aware, aren't you,
2 that in H.264, a frame number is a specifically defined
3 syntax in H.264, right?

4 A. It's a syntax that's defined to identify frame
5 numbers outside of the scope of the reordering commands.

6 Q. Right. And what you pointed to as the reference
7 picture identifier is not that syntax, right?

8 A. That's correct. It's the frame number taught by
9 the Mulroy.

10 Q. Right. Okay.

11 We also talked about the passage that refers
12 to where you can mark a picture as update as used. Do you
13 recall that?

14 A. I don't recall specifically what you're talking
15 about.

16 Q. Do you remember you were asked about where you
17 could mark a picture, like, mark as used in the context of
18 Dr. Richardson's slide?

19 A. From the '618 spec?

20 Q. Yes.

21 A. Yes.

22 Q. Okay. You understand that that passage you were
23 looking at, where it talks about mark as used, that is
24 referring to how you update the buffer at the decoder -- the
25 decoded picture buffer at the decoder, after you have

1 already received the buffer description information, right?

2 A. I don't recall that context.

3 Q. Okay.

4 MR. HAYNES: No further questions, Your Honor.

5 MR. FARNOLY: May I proceed, Your Honor?

6 JUDGE BHATTACHARYYA: Yes.

7 REDIRECT EXAMINATION

8 BY MR. FARNOLY:

9 Q. May we have CDX-35.95.

10 Do you recall on cross you were asked about this
11 slide?

12 A. Yes, I do.

13 Q. I believe you were cut off.

14 What is the reference picture list reordering
15 semantics in relation to your opinion that the reordering
16 commands are an explicit signaling of reference pictures?

17 A. I wasn't able to explain that the term "initial
18 reference picture lists" doesn't -- don't mean that any
19 reference picture lists that belong to previous pictures.
20 So there is a default order to be used in the reference
21 picture lists. If there are picture numbers 1, 2, 3, and 4,
22 the default list for picture number 5 will be 4, 3, 2, 1.

23 So that default list, "initial" meaning before
24 the reordering commands are applied. So if the reordering
25 commands is to change that default list, 4, 3, 2, 1, to 3,

1 4, 2, 1, then that's what this passage is talking about.
2 And this supports that -- my opinion that reordering
3 commands are, in fact, explicit.

4 MR. FARNOLY: No further questions, Your Honor.

5 JUDGE BHATTACHARYYA: Thank you, Dr. Hu.

6 THE WITNESS: Thank you, Your Honor.

7 (The witness stood down.)

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