

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LENOVO (UNITED STATES), INC.,

Petitioner

v.

TELEFONAKTIEBOLAGET LM ERICSSON,

Patent Owner.

IPR2025-00177

U.S. PATENT NO. 10,708,618

PATENT OWNER'S PRELIMINARY RESPONSE

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LIST OF EXHIBITS

Exhibit No.	Description
Ex-2002	<i>Curriculum Vitae</i> of Dr. Iain Richardson
Ex-2003	Excerpts of Richardson, I., “The H.264 Advanced Video Compression Standard,” 2d Ed. (2010)
Ex-2004	Sjöberg and Samuelsson, “Absolute Signaling of Reference Pictures,” JCTVC-F493 (July 18, 2011)
Ex-2005	Sjöberg et al., “JCT-VC AHG Report: Reference Picture Buffering and List Construction (AHG21),” JCTVC-G021 (November 21, 2011)
Ex-2006	Intentionally Omitted
Ex-2007	ITU-T, “SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS Infrastructure of Audiovisual Services – Coding of Moving Video: High Efficiency Video Coding”, Recommendation ITU-T H.265 (November 2019)
Ex-2008	U.S. Appl. No. 61/503,019
Ex-2009	Complaint, <i>In the Matter of Certain Electronic Computing Devices, and Components and Modules Thereof</i> , 337-TA-1387 (U.S.I.T.C. December 12, 2023)
Ex-2010	Excerpts of Public Transcript from Evidentiary Hearing, <i>In the Matter of Certain Electronic Computing Devices, and Components and Modules Thereof</i> , 337-TA-1387 (U.S.I.T.C. Oct. 25, 2024) (Public Testimony of Patent Owner’s Expert, Dr. Richardson)
Ex-2011	Excerpts of Public Transcript from Evidentiary Hearing, <i>In the Matter of Certain Electronic Computing Devices, and Components and Modules Thereof</i> , 337-TA-1387 (U.S.I.T.C. Oct. 23-25, 2024) (Public Testimony of Petitioner’s Expert, Dr. Hu)
Ex-2012	Borgwardt, “Multi-picture Buffer Semantics for Interlaced Coding,” JVT-C049 (May 2002)
Ex-2013	Fröjd, “And the Emmy Goes to . . . HEVC,” Oct. 26, 2017 (available at https://www.ericsson.com/en/blog/2017/10/and-the-emmy-goes-to--hevc#:~:text=The%20Emmy%20for%20HEVC%20was,for%20more%20than%2020%20years)
Ex-2014	“HEVC Awarded Engineering Emmy,” Oct. 25, 2017 (available at https://www.ericsson.com/en/news/2017/10/hevc-awarded-engineering-emmy)

TABLE OF CLAIMS

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Claim 1	
1[pre]	A method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising:
1[a]	retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;
1[b]	determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises:
1[c]	(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and
1[d]	(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier; and
1[e]	updating a decoded picture buffer based on the reference picture identifier.
Claim 2	
2[pre]	The method according to claim 1, wherein: determining the reference picture identifier comprises determining, based on the buffer description information,
2[a]	i) a picture identifier identifying a respective reference picture among the plurality of reference pictures as the decoding reference for the picture and
2[b]	ii) a picture identifier identifying a respective reference picture among the plurality of reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video stream.
Claim 3	
3[pre]	The method according to claim 1, further comprising:
3[a]	determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and
3[b]	responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

Reference	Claim Limitation
Claim 4	
4[pre]	The method according to claim 3, wherein generating the non-existing picture with parameters comprises at least one of:
4[a]	setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;
4[b]	setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
4[c]	setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and
4[d]	marking the non-existing picture with a non-existing mark and a used for reference mark.
Claim 5	
5[pre]	A method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising:
5[a]	retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;
5[b]	determining, based on the buffer description information, a reference picture identifier that identifies a reference picture among the plurality of reference pictures that comprises a decoding reference for the picture;
5[c]	determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing;
5[d]	responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier; and
5[e]	updating a decoded picture buffer based on the reference picture identifier.
Claim 6	
6[pre]	The method according to claim 5, wherein generating the non-existing picture with parameters comprises at least one of:
6[a]	setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;
6[b]	setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
6[c]	setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and

Reference	Claim Limitation
6[d]	marking the non-existing picture with a non-existing mark and a used for reference mark.
Claim 7	
7[a]	The method according to claim 5, wherein determining the reference picture identifier comprises:
7[b]	(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and
7[c]	(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier.
Claim 8	
8[pre]	A decoder configured to decode an encoded representation of a picture in a video stream of multiple pictures, the decoder comprising:
8[a]	at least one processor; and
8[b]	a memory storing instructions which, when executed by the at least one processor causes the decoder to:
8[c]	retrieve buffer description information defining a plurality of reference pictures, wherein the buffer description information is retrieved from the encoded representation of the picture;
8[d]	determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein the decoder is configured to
8[e]	i) retrieve, based on the buffer description information, a respective delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, and
8[f]	ii) calculate the reference picture identifier based on the picture identifier and the respective delta identifier; and
8[g]	update a decoded picture buffer based on the reference picture identifier.
Claim 9	
9[pre]	The decoder according to claim 8, wherein the memory stores further instructions which, when executed by the at least one processor causes the decoder to:

Reference	Claim Limitation
9[a]	retrieve the buffer description information defining multiple reference pictures from the encoded representation of the picture; and
9[b]	determine, based on the buffer description information, i) a picture identifier identifying a respective reference picture among the multiple reference pictures as the decoding reference for the picture and
9[c]	ii) a picture identifier identifying a respective reference picture among the multiple reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video stream.
Claim 10	
10[pre]	The decoder according to claim 8, wherein the memory stores further instructions which, when executed by the at least one processor causes the decoder to further configured to:
10[a]	determine whether the reference picture identified by the reference picture identifier is one of missing or nonexisting; and
10[b]	responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generate a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.
Claim 11	
11[pre]	The decoder according to claim 10, wherein generating the non-existing picture with parameters comprises at least one of:
11[a]	setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;
11[b]	setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
11[c]	setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and
11[d]	marking the non-existing picture with a non-existing mark and a used for reference mark.
Claim 12	
12[pre]	A decoder configured to decode an encoded representation of a picture in a video stream of multiple pictures, the decoder comprising:
12[a]	a data retriever circuit configured to retrieve buffer description information defining a plurality of reference pictures, wherein the

Reference	Claim Limitation
	buffer description information is retrieved from the encoded representation of the picture;
12[b]	a picture identifier determiner circuit configured to: determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture;
12[c]	determine whether the reference picture identified by the reference picture identifier is one of missing or non-existing;
12[d]	responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generate a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier; and
12[e]	a buffer manager circuit configured to update a decoded picture buffer based on the reference picture identifier.
Claim 13	
13[pre]	The decoder according to claim 12, wherein generating the non-existing picture with parameters comprises at least one of:
13[a]	setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;
13[b]	setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
13[c]	setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and
13[d]	marking the non-existing picture with a non-existing mark and a used for reference mark.
Claim 14	
14[pre]	A receiver comprising:
14[a]	an input section circuit configured to receive encoded representations of multiple pictures in a video stream;
14[b]	a decoder circuit configured to decode the encoded representations of the multiple pictures; and
14[c]	an output section circuit configured to output decoded pictures of the video stream, wherein the decoder circuit comprises:
14[d]	a data retriever circuit configured to retrieve buffer description information defining a plurality of reference pictures, wherein the

Reference	Claim Limitation
	buffer description information is retrieved from the encoded representation of a picture;
14[e]	a picture identifier determiner circuit configured to determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein the picture identifier determiner is configured to
14[f]	(i) retrieve, based on the buffer description information, a respective delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, and
14[g]	ii) calculate the reference picture identifier based on the picture identifier and the respective delta identifier; and
14[h]	a buffer manager circuit configured to update a decoded picture buffer based on the reference picture identifier.
Claim 15	
15[pre]	The receiver according to claim 14, wherein the decoder circuit is further configured to perform operations comprising:
15[a]	determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and
15[b]	responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.
Claim 16	
16[pre]	The receiver according to claim 15, wherein generating the non-existing picture with parameters comprises at least one of:
16[a]	setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;
16[b]	setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
16[c]	setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and
16[d]	marking the non-existing picture with a non-existing mark and a used for reference mark.
Claim 17	
17[pre]	A computer program product comprising a non-transitory computer-readable medium storing program instructions for decoding an

Reference	Claim Limitation
	encoded representation of a picture in a video stream of multiple pictures, the program instructions when executed by a processor of a node in an access network cause the node to perform operations comprising:
17[a]	retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;
17[b]	determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises:
17[c]	(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and
17[d]	(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier and
17[e]	updating a decoded picture buffer based on the reference picture identifier.
Claim 18	
18[pre]	The computer program product according to claim 17, wherein the instructions comprise further instructions that are executable by the processor of the node in the access network to perform operations comprising:
18[a]	determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and
18[b]	responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.
Claim 19	
19[pre]	The computer program product according to claim 18, wherein generating the non-existing picture with parameters comprises at least one of:
19[a]	setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

Reference	Claim Limitation
19[b]	setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
19[c]	setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and
19[d]	marking the non-existing picture with a non-existing mark and a used for reference mark.

I. INTRODUCTION

The invention of U.S. Patent No. 10,708,618 (the “’618 Patent”) fundamentally changed how reference pictures are managed in video coding. Reference picture management is a critical process within video coding because, if performed correctly, it enables the use of prediction techniques that lead to significant compression and performance efficiencies. Prior to the ’618 Patent, reference picture management was implemented using relative signaling. When using relative signaling, identification of the reference pictures for a particular picture depends on the proper decoding of previously decoded pictures and commands. In the H.264 Standard, relative signaling was implemented using MMCO commands and a sliding window. These techniques are discussed in detail below, but, importantly, the inventors recognized that there were significant drawbacks associated with the use of relative signaling.

The inventors thus abandoned relative signaling in favor of an entirely new reference picture management that identifies which reference pictures to use for decoding in “an *absolute and explicit way* instead of a relative or implicit way” using “buffer description information” defining a plurality of reference pictures. Ex. 1001 at 4:39-48 (emphasis added). In other words, in contrast to the prior art, identification of reference pictures in the ’618 Patent does not depend on previously decoded pictures. Instead, the information identifying which reference pictures to use for the

current and subsequent pictures is encoded into the bitstream for that picture. The inventors then proposed the '618 Patent's absolute and explicit reference picture management to the standards group developing the H.265 standard. Despite being a fundamental shift in how reference pictures are managed, the invention was adopted into the H.265 standard due to its elegant and efficient design.

The Petition fails to set forth any prior art that discloses or renders obvious an absolute and explicit way of identifying reference pictures by using the claimed "buffer description information," let alone separate identifications for current and subsequent pictures. Instead, Mulroy proposes using the same relative and implicit application of the H.264 Standard that the '618 Patent expressly distinguishes. Thus, for the reasons stated below, Petitioner has failed to meet its burden to show a reasonable likelihood of unpatentability of any of the challenged claims, nor has it raised any issues not already considered and rejected by the Examiner. *See* 37 C.F.R. § 42.108(c); 35 U.S.C. § 325(d). Accordingly, Patent Owner requests that the Board deny institution of *inter partes* review.

The Board, however, need not even consider the substantive merits of the Petition and should exercise its discretion under *Fintiv* to deny institution. This Petition is merely an attempt to relitigate the *same* invalidity arguments that were presented in a prior ITC Investigation. The main difference between this proceeding and the ITC proceeding is that Lenovo replaced its ITC expert, Dr. Hu, with Dr.

Creusere. Notably, Dr. Hu acknowledged in the ITC that the inventors' ideas were a "major change to how reference pictures were managed previously" (Ex. 2011 at 881:8-14), and thus it is not surprising that Lenovo failed to inform the Board of the prior ITC arguments and testimony related to validity.¹ Institution of a proceeding to relitigate the same prior art grounds here is counter to the Board's guidance in *Fintiv*, and thus should be denied.

II. BACKGROUND

A. Prior Art Methods for Reference Picture Management Identified by the '618 Patent

The '618 Patent arose from problems that the inventors observed during development of the H.265 Standard (also referred to as the High Efficiency Video Codec or HEVC Standard). Ex. 1001 at 1:36-44, 1:58-62, 5:51-67, 18:48-59, 20:28-39, 29:25-30; Ex. 2001 ¶ 192. During development, the standards body was initially planning to incorporate the reference picture management processes from the H.264 Standard (also referred to as Advanced Video Coding or AVC) directly into H.265 without any substantial modifications. *Id.* at 1:58-62, 20:28-39. As described below, however, the inventors identified significant issues caused by using relative

¹ Patent Owner has attached the public ITC testimony related to the '618 Patent from Dr. Hu and Dr. Richardson as exhibits because that testimony directly bears on the issues presented to the Board. Ex. 2010; Ex. 2011. Patent Owner did not simply excerpt that testimony to ensure that the Board had access to the full testimony from the ITC experts regarding the issue of validity.

reference picture signaling in H.264, including the sliding window mechanism and Memory Management Control Operations (MMCO) commands, and thus proposed an entirely new solution that used absolute and explicit reference picture signaling, removing the need for sliding window and MMCO commands. Ex. 1001 at 2:14-3:24, 20:28-39; Ex. 2001 ¶¶ 143-57, 192-202. The following describes H.264 reference picture management and the problems identified by the inventors.

1. Use of Reference Pictures for Prediction

A video is a sequence of frames. Ex. 2001 ¶ 50. Each frame represents a snapshot in time and may be divided into smaller regions. *Id.* Video coding is the process by which a video is encoded (*i.e.* compressed), transmitted, and decoded (*i.e.* decompressed). *Id.* at ¶ 49. This is important because uncompressed video requires an impractical amount of storage space or bandwidth to transfer, whereas compressed video is much more manageable. *Id.* at ¶ 52. The desire for more compression (and thus more efficiency) must be weighed against the need for increased video quality and computation performance, which are also considered when designing a video coding system. Ex. 2001 at ¶¶ 53-58.

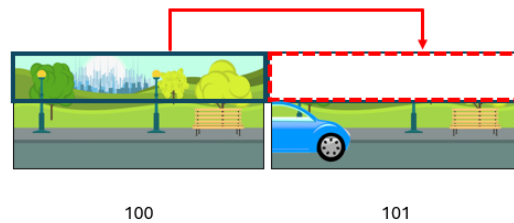
There is often significant redundancy between the pictures that make up a video. Ex. 2001 ¶ 65. For example, the illustration below shows six pictures that make up a video of a car driving across the screen. Ex. 2001 ¶ 66. The blue boxes at the top of each picture represent that the background of the pictures remains

constant. *Id.* The numbers below each picture represent the picture number of each picture (in this example, consistent with the order in which the pictures are displayed). *Id.*



Given this redundancy, reference pictures are a fundamental component of compression techniques in video coding, and in particular, inter prediction. Ex. 1001 at 5:51-67; Ex. 2001 ¶¶ 65-71. Inter prediction is a technique that takes advantage of the redundancy between pictures and achieves greater compression without having to include each entire picture in an encoded bitstream. Ex. 2001 ¶¶ 65, 67, 73. Instead, the bitstream will include one or more reference pictures and information that allows the decoder to predict or derive the other pictures in a video stream from the reference picture(s). *Id.* at ¶ 73.

In the illustration below, for example, Picture 100 is a reference picture for Picture 101. *Id.* at ¶¶ 68-69. The encoder will not code the top part of Picture 101 into the bitstream, but rather will copy the information from what was already coded for Picture 100. *Id.*



To fully leverage the benefits of reference pictures, video codecs often allow (i) using multiple reference pictures to decode a single picture, and (ii) using the same reference picture multiple times to decode multiple pictures. *Id.* at ¶¶ 70-71. Because the accuracy and reliability of decoding relies on reference pictures, errors can occur if the decoder uses the wrong reference picture or fails to decode a reference picture. *Id.* at ¶ 74. Thus, the way the encoder and decoder manage reference pictures is critical to compression efficiency and error reduction. *Id.*

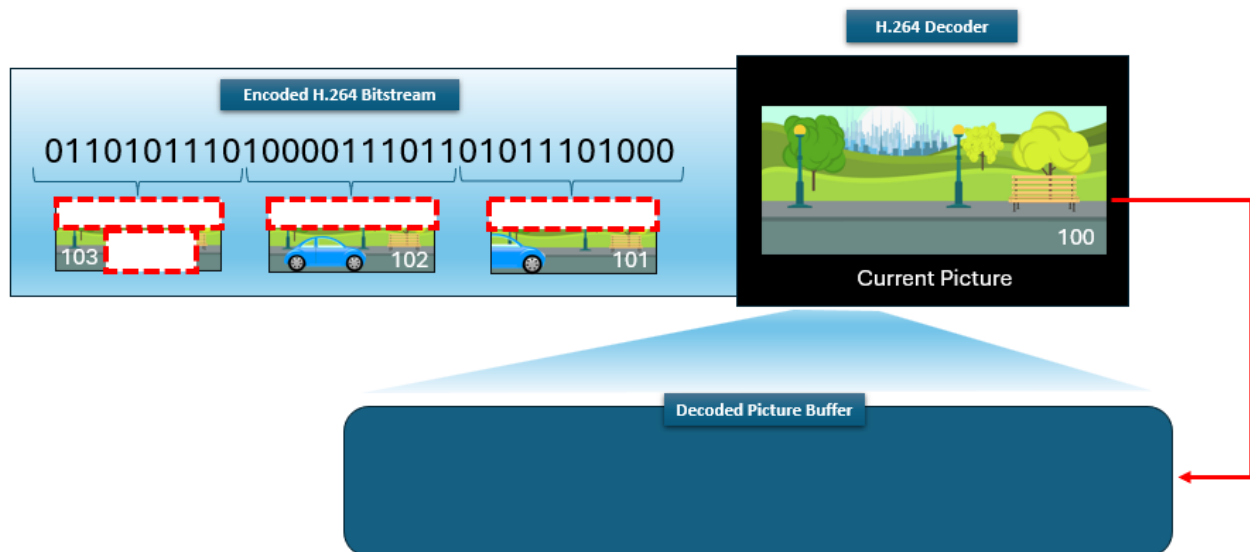
2. The Decoded Picture Buffer in H.264

a. DPB stores decoded pictures for use as reference pictures

In H.264, the decoder maintains a decoded picture buffer (“DPB”). Ex. 1001 at 5:59-62; Ex. 2001 ¶¶ 81-82. The DPB stores previously decoded pictures that are available to be used as reference pictures. Ex. 1001 at 5:59-62; Ex. 2001 ¶ 82. The DPB should include all reference pictures necessary to decode a particular picture. Ex. 1001 at 5:62-67; Ex. 2001 ¶ 91.

Dr. Richardson prepared a series of demonstratives that illustrate how a DPB is used in H.264. The following describes several of the demonstratives prepared by Dr. Richardson to illustrate how a DPB is updated when decoding pictures.

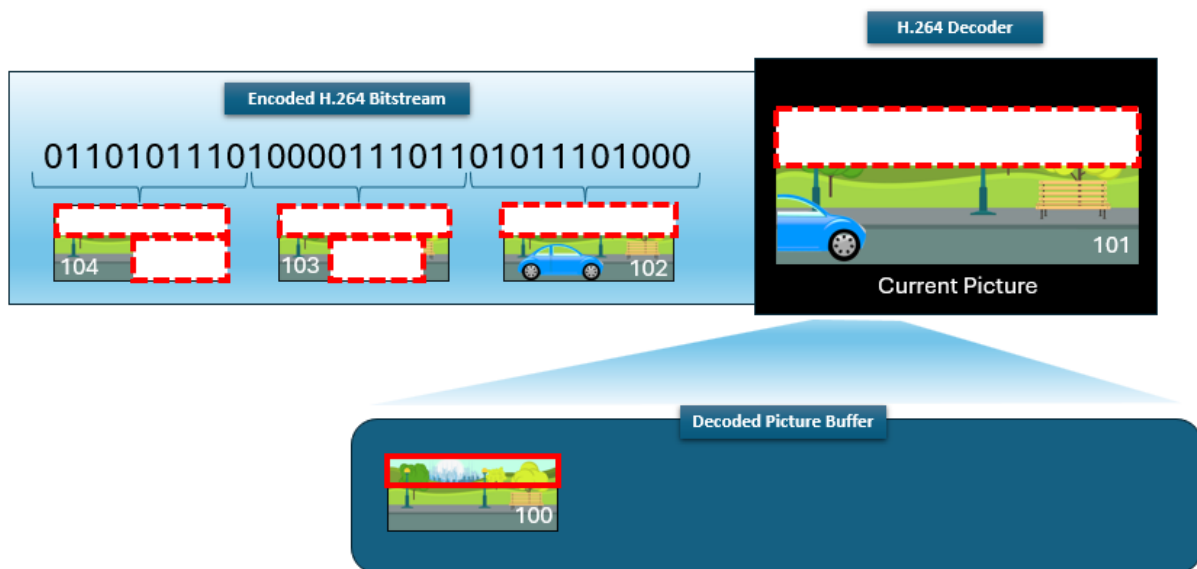
First, the demonstrative shown below illustrates an exemplary decoder at the point in time just before the first picture (Picture 100) is to be decoded by the decoder. Ex. 2001 ¶¶ 81-83.



The black box is the H.264 decoder. *Id.* at ¶ 79. Picture 100 is in the decoder because it is the picture about to be decoded. The DPB is illustrated at the bottom of the diagram using the dark blue box, but to be clear, it is actually part of the decoder. Ex. 2001 ¶ 81. At this point in our example, there are no pictures in the DPB because no pictures have been decoded. Ex. 2001 ¶ 83.

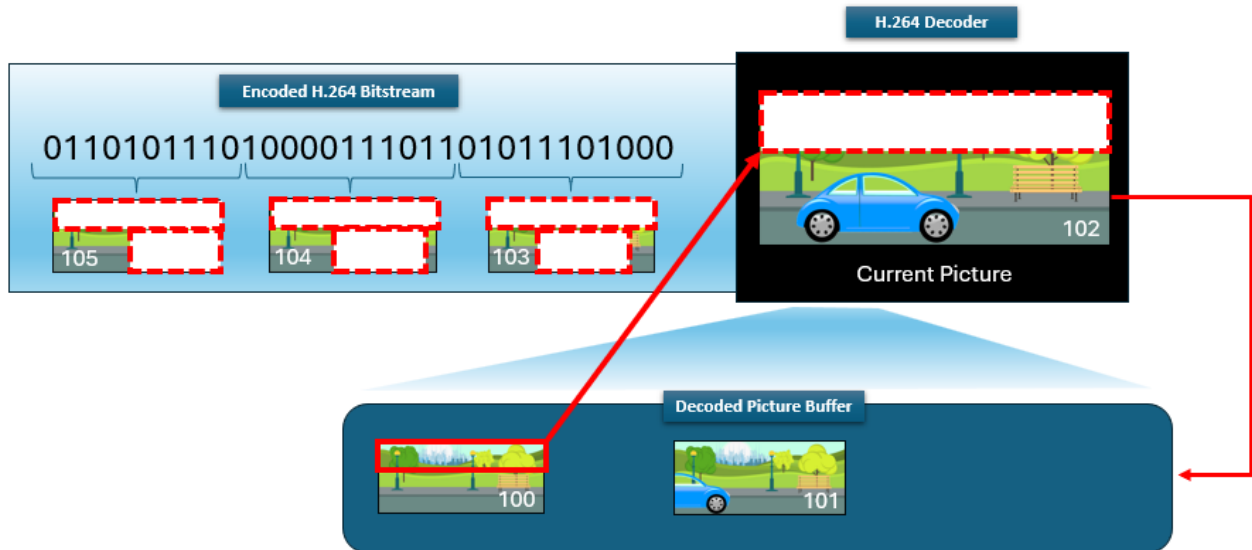
The 1s and 0s in the light blue box at the top left represent the encoded (i.e. compressed) bitstream that is transmitted from the encoder to the decoder. Ex. 2001 ¶ 78. These values represent the pictures (Pictures 101, 102, and 103) that make up the video. *Id.* at ¶¶ 75-78. The red-dotted boxes in Pictures 101, 102, and 103 represent the portions of the pictures that are redundant and will be predicted using reference pictures. *Id.* at ¶ 80.

Second, when Picture 100 is decoded, it is placed in the DPB as shown below. *Id.* at ¶ 84. Picture 100 is then available for use as reference picture for Picture 101, as shown below. *Id.* at ¶ 85.

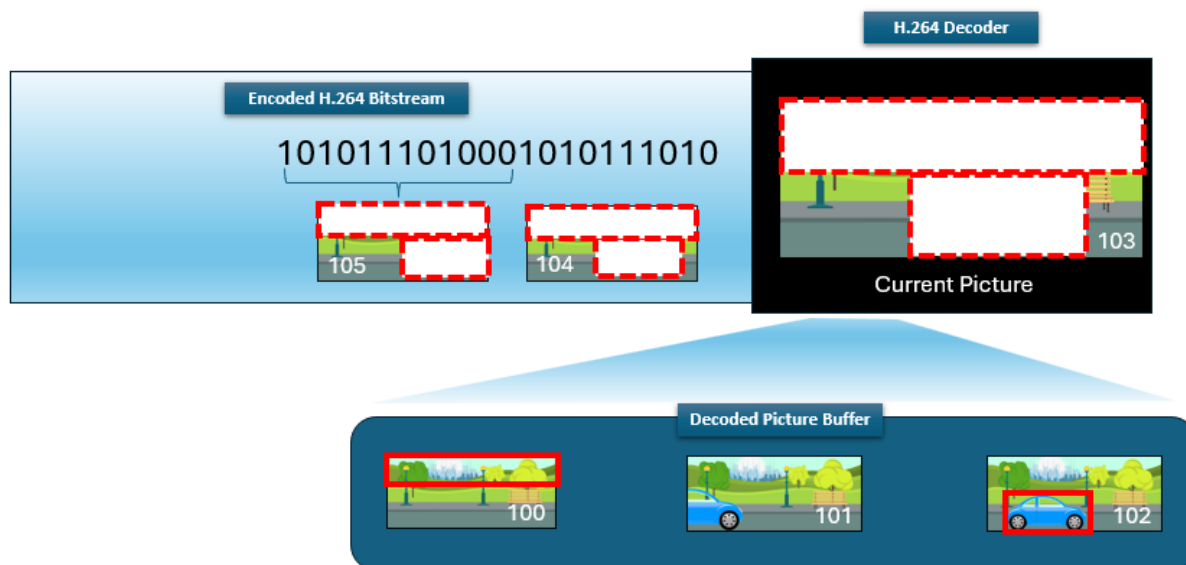


As shown above, during decoding, the overlapping background content (highlighted with a red box below) is copied from Picture 100 to Picture 101, rather

than repeating that information in the bitstream. *Id.* Once Picture 101 is decoded, it is added to the DPB as shown below. *Id.* at ¶ 86.



Now both Pictures 100 and 101 may be used as reference pictures for decoding Picture 102. Here, only Picture 100 is used as a reference for Picture 102. Once Picture 102 is decoded, it is placed in the DPB as well (as shown below). *Id.* at ¶ 87.



This process continues until all pictures in the bitstream are decoded. *Id.* at ¶ 88.

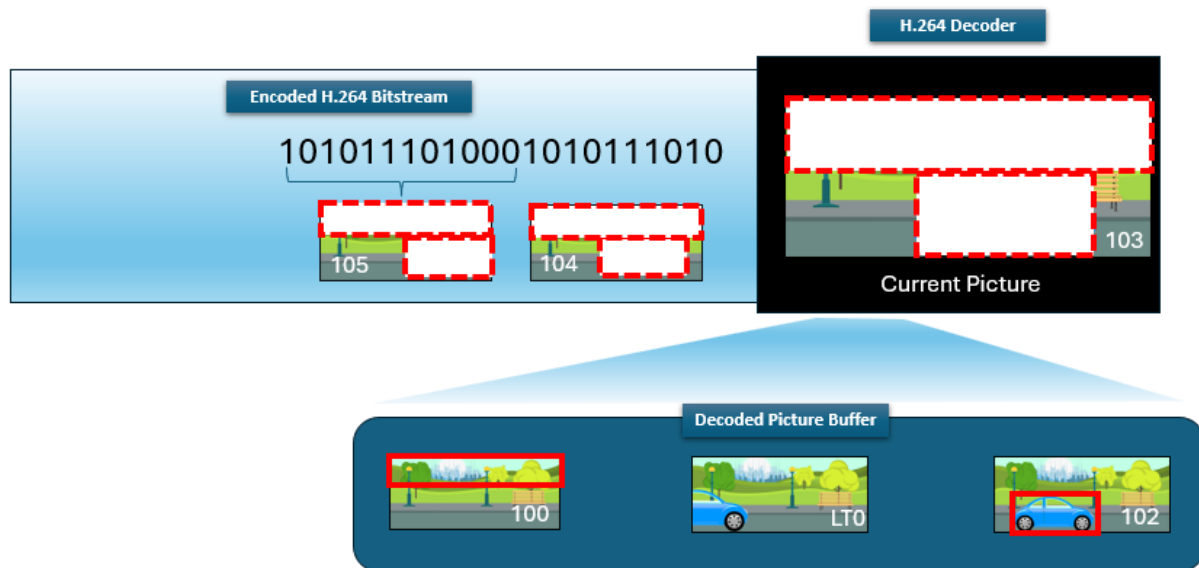
b. Use of Long-Term and Short-Term Reference Pictures.

To assist in managing the DPB, the pictures in the DPB are characterized as either short-term pictures or long-term pictures. *Id.* at ¶ 89; *see also* Ex. 1001 at 2:14-66 (distinguishing between short-term and long-term pictures); Ex. 1005 at 86. A short-term picture will usually not remain in the DPB for as long as a long-term picture, but it may still be used as a reference picture for multiple pictures. Ex. 2001 at ¶ 89.

Short-term pictures in H.264 are indexed based on their picture number (PicNum), which relates to the encoding and decoding order of frames. Ex. 1005 at 112-13; Ex. 2001 ¶ 90. Long-term pictures, in contrast, are indexed by LongTermFrameIndex or LongTermPicNum, which represent a long-term frame

index that is not based on coding order or display order of frames. Ex. 1005 at 112-13; Ex. 2001 ¶ 90. As explained below, a long-term picture starts as a short-term picture but is changed to a long-term picture based on a certain type of MMCO command. Ex. 2001 ¶ 90.

In our example above, all three pictures in the DPB are short-term pictures and are indexed by picture number (100, 101, and 102). *Id.* If Picture 101 were a long-term picture instead, it would be given an index “slot” denoted by LongTermFrameIndex, such as Index 0. *Id.*; Ex. 1005 at 112-13. In this case, the DPB would look like the below illustration (with “LT” standing for “long-term”). Ex. 2001 ¶ 90.



The long-term index value starts at 0 (for the first long-term picture in the DPB) and increases by one for every additional long-term picture that gets added to the DPB.

Ex. 2001 ¶ 126. In our example, the largest long-term picture index value would be two because the DPB can only hold three pictures at a time. If all three were long-term pictures, they would be LT0, LT1, and LT2.

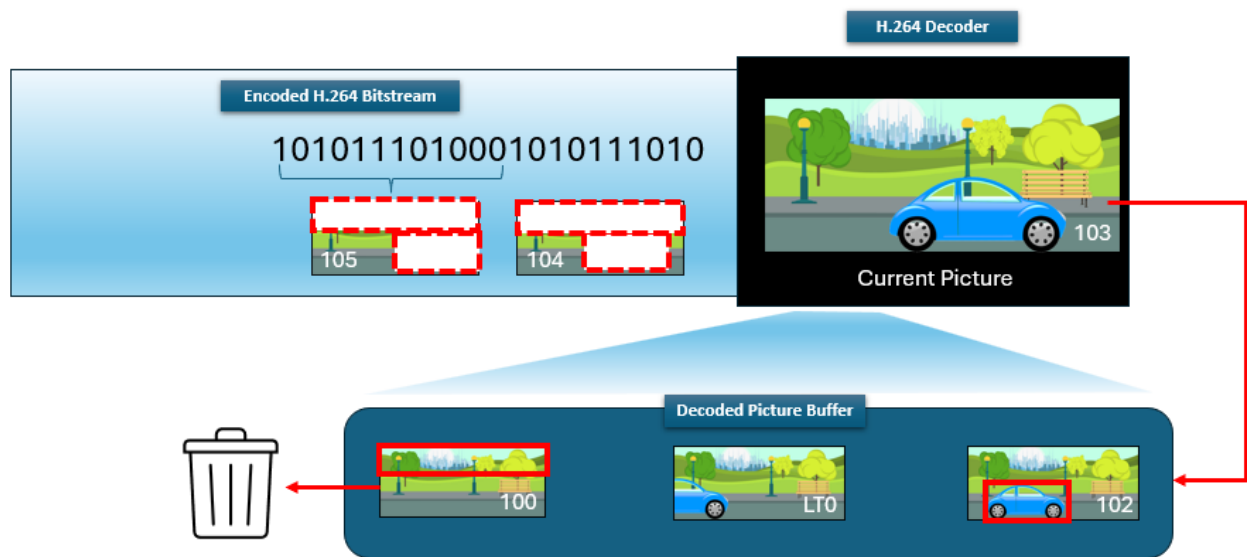
3. Relative Signaling of H.264 using Sliding Window and MMCO Commands

While the DPB should store all pictures necessary to decode a given picture, the DPB cannot store *all* previously decoded pictures because there is a finite memory. Ex. 1001 at 14:52-55; Ex. 2001 ¶ 91. In our example, the maximum number of pictures that can be stored in the DPB is three. *Id.* at ¶ 92. Once a fourth picture is decoded, the decoder will have to choose which picture to remove from the DPB. *Id.* In H.264, once a picture is removed from the DPB, it cannot be added back and is no longer available for use as a reference picture. *Id.* at ¶ 94.

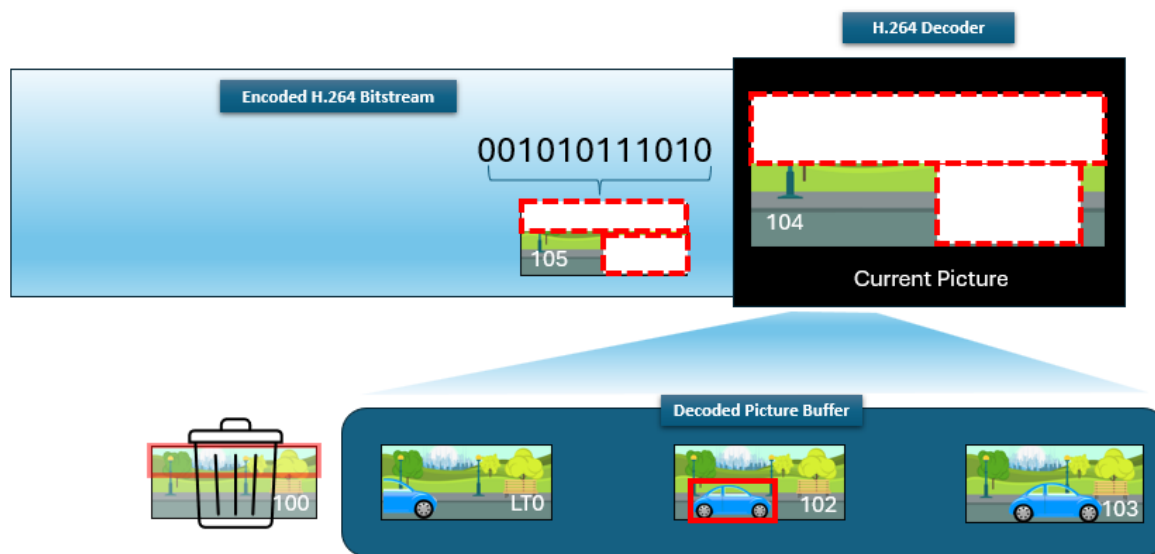
Given this restriction, there are two ways H.264 manages the reference pictures in the DPB: (i) a sliding window and (ii) MMCO commands. Ex. 1001 at 2:3-13, 2:56-3:6; Ex. 2001 ¶ 95.

Sliding Window. The default in H.264 is that, when the DPB is full, the oldest short-term reference picture in the DPB slides out and the newest picture slides in. Ex. 1001 at 2:3-13; Ex. 2001 ¶ 96. This is known as the sliding window process. Ex. 1001 at 2:3-13; Ex. 2001 ¶ 96. Long-term reference pictures are not removed from the DPB by the sliding window process. Ex. 2003 at 107; Ex. 2001 at ¶ 96.

An example of the sliding window process is shown below. Here, the DPB is full, as there are three pictures in the DPB. Once Picture 103 is decoded, one of the existing pictures in the DPB will need to be removed to make room for Picture 103.



As shown below, in this example, short-term Picture 100 is removed from the DPB because it is the oldest short-term reference picture, and Picture 103 is added to the DPB. Ex. 2001 at ¶ 97.



MMCO Commands. The other way the DPB is managed in H.264 is by using what are called Memory Management Control Operations (MMCO) commands. Ex. 1001 at 2:3-13; Ex. 2001 ¶ 98. The possible MMCO commands are limited to the numbers 0 through 6, and they convey information to the decoder about how to change its DPB relative to what is already in the buffer. Ex. 1001 at 2:14-41; Ex. 2001 ¶¶ 98-99. The MMCO commands available in H.264 are provided below.

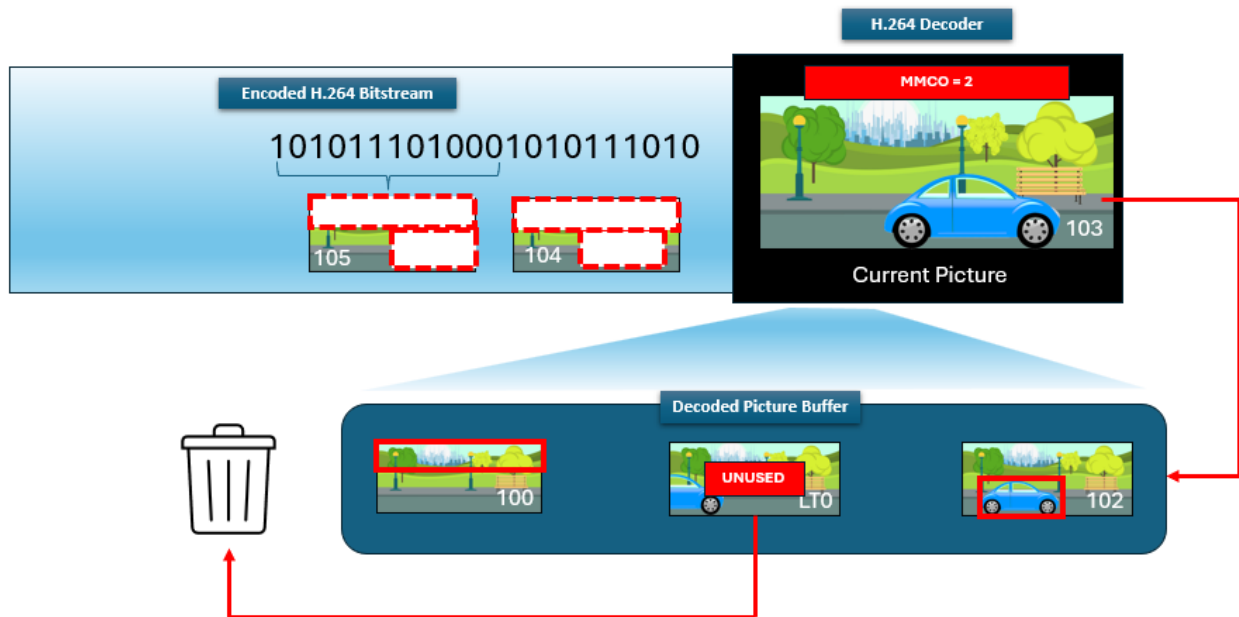
Table 7-9 – Memory management control operation (memory_management_control_operation) values

memory_management_control_operation	Memory Management Control Operation
0	End memory_management_control_operation syntax element loop
1	Mark a short-term reference picture as “unused for reference”
2	Mark a long-term reference picture as “unused for reference”
3	Mark a short-term reference picture as "used for long-term reference" and assign a long-term frame index to it
4	Specify the maximum long-term frame index and mark all long-term reference pictures having long-term frame indices greater than the maximum value as "unused for reference"
5	Mark all reference pictures as "unused for reference" and set the MaxLongTermFrameIdx variable to "no long-term frame indices"
6	Mark the current picture as "used for long-term reference" and assign a long-term frame index to it

Ex. 1005 at 88; Ex. 1001 at 2:14-41.

An MMCO command of 2, for example, would indicate to the decoder that a particular reference picture in the DPB should be marked as “unused for reference.” Ex. 1001 at 2:27-29; Ex. 2001 ¶ 100. When a picture is marked “unused for reference,” it is removed from the DPB instead of the picture that would be removed using a sliding window. Ex. 1001 at 2:3-13; Ex. 2001 ¶¶ 100-103.

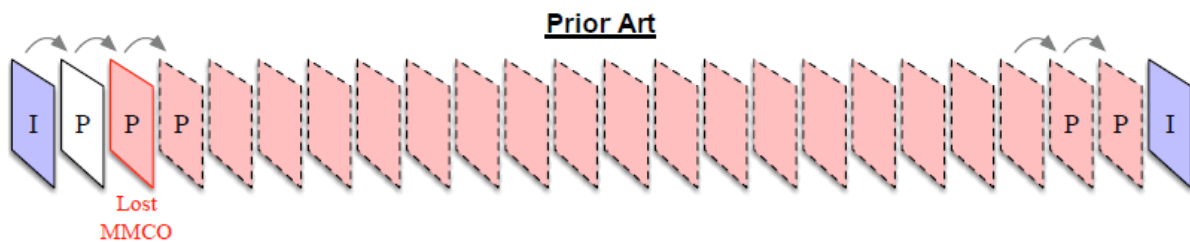
This example is shown below. If Picture 103 was sent with an MMCO command of 2, for example, the decoder would know to remove Picture LT0 from the DPB instead of applying the sliding window and removing Picture 100. Ex. 2001 ¶¶ 100-103.



4. Problems with Reference Picture Management in H.264 Identified by the '618 Patent

As the '618 Patent explains, “[a] problem with H.264/AVC is its vulnerability to losses of pictures that contains [sic] MMCO of type 2, 3, 4, 5, or 6.” Ex. 1001 at 2:14-16; Ex. 2001 ¶ 105. “[I]f a picture containing MMCO of type 2, 3, 4, 5, or 6 is lost there is a risk that the number of long term pictures in the DPB is different from what it would have been if the picture was received, resulting in an ‘incorrect’ sliding window process for all the following pictures.” Ex. 1001 at 2:56-60. And “the encoder and decoder will contain a different number of short-term pictures resulting in out-of-sync behavior of the sliding window process.” *Id.* at 2:60-63. As the '618 Patent explains, “[w]hat makes the situation even worse is that a decoder will not necessarily know that the sliding window process is out-of-sync and thus cannot

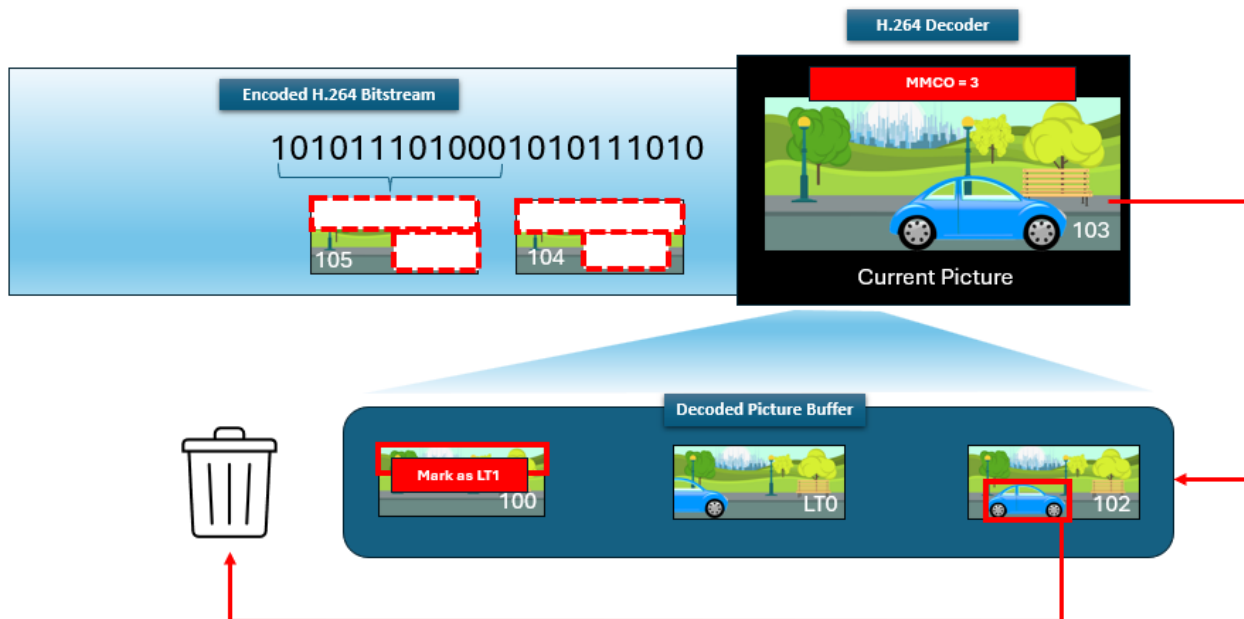
report the problem to the encoder or request an IDR picture even in applications where a feedback channel is available.” *Id.* at 3:2-6. Thus, an error resulting in the DPB not having the correct reference pictures propagates until the DPB can be reset. Ex. 2001 at ¶¶ 106-07 (describing that a reset would not happen H.264 until the next IDR picture); see Ex. 1001 at 2:56-3:2. This is illustrated below, with the purple pictures representing IDR pictures (i.e. the point at which the DPB can be reset) and the red pictures illustrating the corrupted pictures. Ex. 2001 ¶ 107 (describing that the damaged or blank image could appear on a screen for seconds or more).



As the '618 Patent makes clear, the relative signaling of H.264 is especially problematic for MMCO commands that affect long-term pictures. Ex. 1001 at 2:14-16; Ex. 2001 ¶ 108. MMCO commands are not only used to remove short and long-term pictures from the DPB, but also to change a short-term picture to a long-term picture. Ex. 2001 ¶ 108; Ex. 1005 at 88. Long-term pictures are not identified by frame number, but rather are assigned an index. Ex. 1005 at 112; Ex. 2001 ¶ 90. The way an MMCO command changes a short-term picture to a long-term picture is by informing the decoder which short-term picture in the DPB should be moved to the

next available long-term index. Ex. 2001 ¶ 108; Ex. 1005 at 88. This type of MMCO command is referred to as Type 3. Ex. 2001 ¶ 108; Ex. 1005 at 88.

An example of how a Type 3 MMCO command works is shown below. Here, an MMCO command Type 3 is sent with Picture 103 and instructs the decoder to change the short-term picture, Picture 100, to a long-term picture with the next available LongTermFrameIndex: 1. Ex. 2001 ¶ 109.

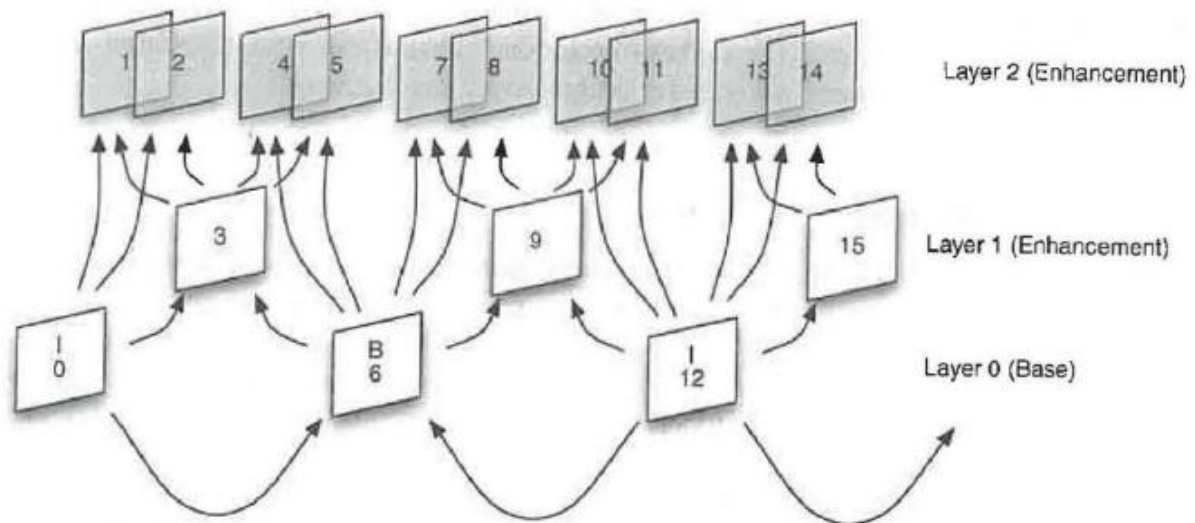


Because what was previously short-term Picture 100 is now long-term Picture LT1, the sliding window mechanism does not remove it from the DPB. *Id.* at ¶ 110; Ex. 2003 at 107. Instead, the next short-term picture (Picture 102) is removed using sliding window to make room for Picture 103 in the DPB. *Id.*

If a Type 3 MMCO command is lost, then the short-term picture is never switched to a long-term index. Ex. 2001 ¶ 112. In our example, that would mean that

short-term Picture 100 would never have been switched to LT1, and thus would have been treated as a short-term picture and removed from the DPB using sliding window. *Id.*; Ex. 2003 at 107. This shows how the long-term picture index is a relative index that depends on a correctly received MMCO command. Ex. 2001 ¶ 111.

The '618 Patent also identifies an additional problem with lost MMCO commands that has to do with temporal scalability. Ex. 1001 at 13:44-14:20; Ex. 2001 ¶ 113. Temporal scalability is when there are multiple temporal layers of pictures transmitted, leaving the option of decoding only some of the layers. Ex. 2001 ¶ 113; Ex. 2003 at 290-93. An illustration of different temporal layers is provided below.



Ex. 2003 at 293.

With temporal scalability, the decoder can choose to only decode the base layer or fewer than all the layers. Ex. 2001 ¶ 113; Ex. 2003 at 290. This allows for compression savings because while decoding more layers means better quality, each additional layer that is decoded requires more bits. Ex. 2001 ¶¶ 114-15; Ex. 2003 at 290.

The '618 Patent recognizes that the relative signaling model of the H.264 Standard presents a problem for temporal scalability. Ex. 1001 at 13:44-14:20; Ex. 2001 ¶ 116. If a temporal layer is removed (e.g. by a network mode that is designed to only decode certain temporal layers), there will be gaps in frame_num. Ex. 1001 at 13:44-14:20; Ex. 2001 ¶ 116. Not only will those pictures not be sent, but their MMCO commands along with them will be cut, potentially affecting the decoding of the other layers. Ex. 1001 at 13:44-14:20; Ex. 2001 ¶ 116. “Thus, prior art solutions have problems with temporal scalability for certain coding structures since the information about the reference pictures for the current picture is affected by the removal of a previous picture from the bitstream as the reference picture information is signaled in a relative way.” Ex-1001 at 14:15-20; Ex. 2001 ¶ 116.

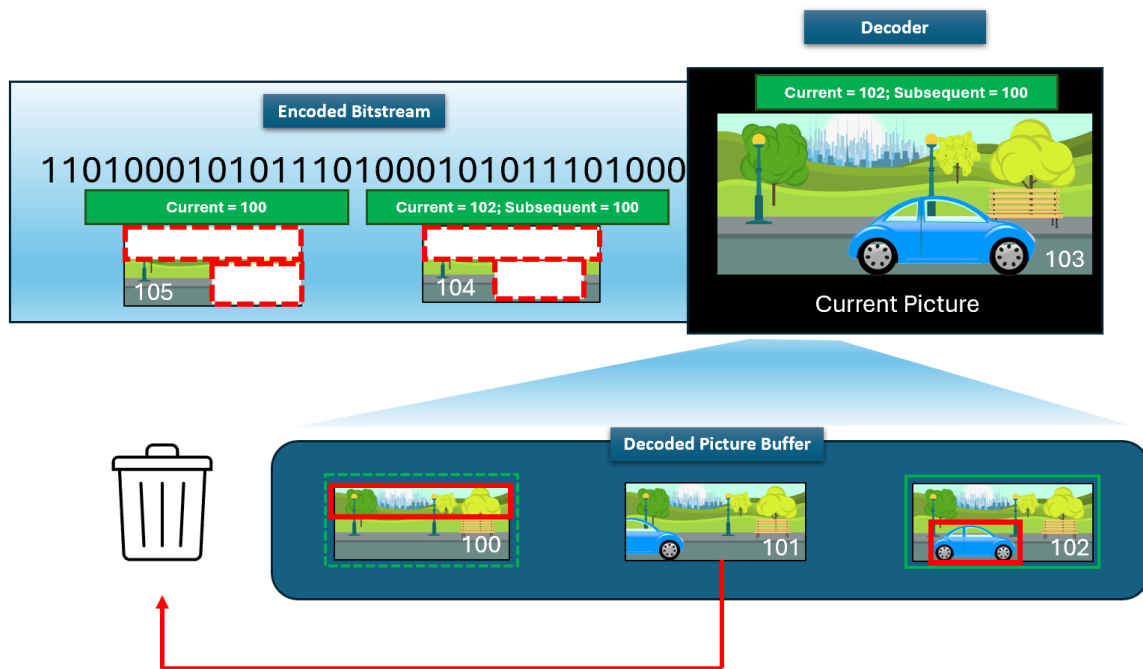
B. The '618 Patent Solved the Prior Art Problems By Replacing the Prior Art Reference Picture Management Methods Entirely

The '618 Patent identified and solved the problems associated with relative reference picture signaling. Ex. 2001 at ¶¶ 142-78. “In clear contrast to the prior art solutions in which correct reference picture management is dependent on that

previously encoded pictures have been correctly received and decoded, the embodiments [of the '618 Patent] provide buffer description information that is used for reference pictures in an ***absolute and explicit*** way instead of a relative or implicit way.” Ex. 1001 at 4:39-44 (emphasis added); Ex. 2001 at ¶ 148. Because of this, “the encoded representation of a picture contains the information about which reference pictures to use for reference during decoding independent of the encoded representation of previous pictures in the video stream.” Ex. 1001 at 4:44-48; Ex. 2001 at ¶ 148.

To achieve this absolute and explicit signaling, the '618 Patent describes replacing the sliding window approach and MMCO commands from H.264 entirely, and instead using a Reference Picture Set (RPS), which is referred to in the patent as “buffer description information.” Ex. 1001 at 8:22-25; *see also, e.g., id.* at 6:38-44 (“The present embodiments do not have these problems of the prior art techniques by using a ***fundamentally different approach*** for signaling reference pictures as compared to the prior art.”) (emphasis added); *id.* at 20:40-44 (“This means that each picture will have an absolute description of the reference pictures ***instead of*** a relative description as in H.264/MEPG-4 AVC where delta information is retrieved from MMCO or from using the sliding window process.”) (emphasis added); Ex. 2001 ¶ 149.

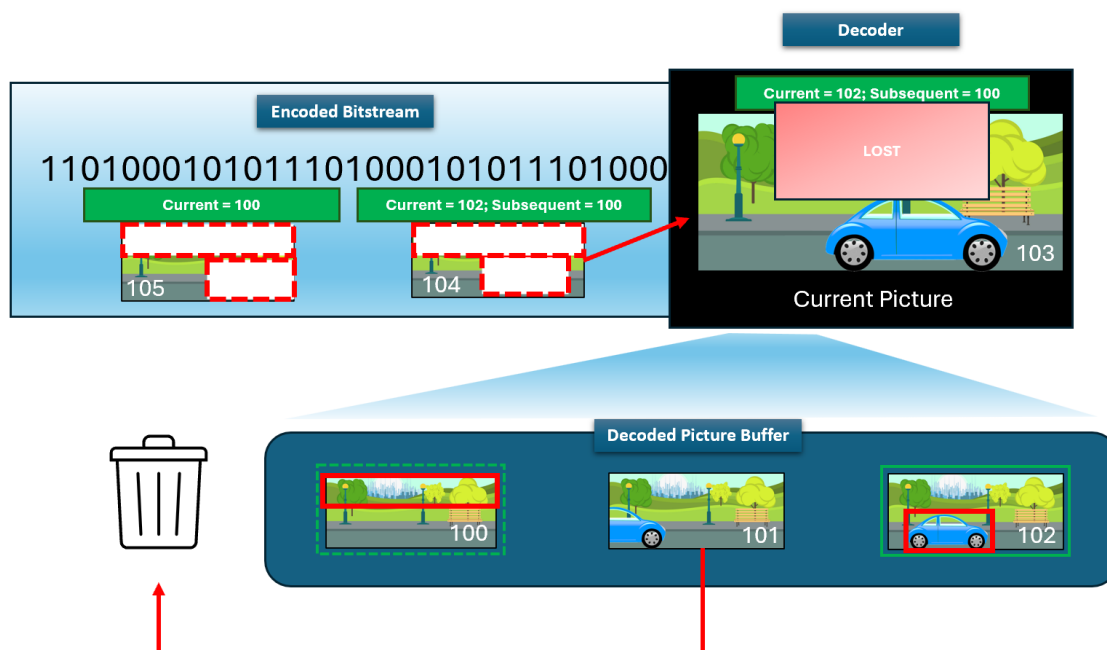
The following illustrates how buffer description information in the '618 Patent explicitly identifies the reference pictures for a particular picture. Ex. 2001 ¶ 150. In the demonstrative, the green boxes represent the buffer description information. *Id.* at ¶ 151. For example, the buffer description information included with Picture 103 identifies that Picture 102 is a reference picture for the current picture (i.e. Picture 103), and Picture 100 is used as reference picture for a subsequent picture. *Id.*



Because the identification of which reference pictures to be used for decoding a particular picture is absolute within the encoded representation of that picture, instead of relative, the '618 Patent eliminated the problems associated with relative signaling and lost MMCO commands: “instead of relying on correctly delivered and

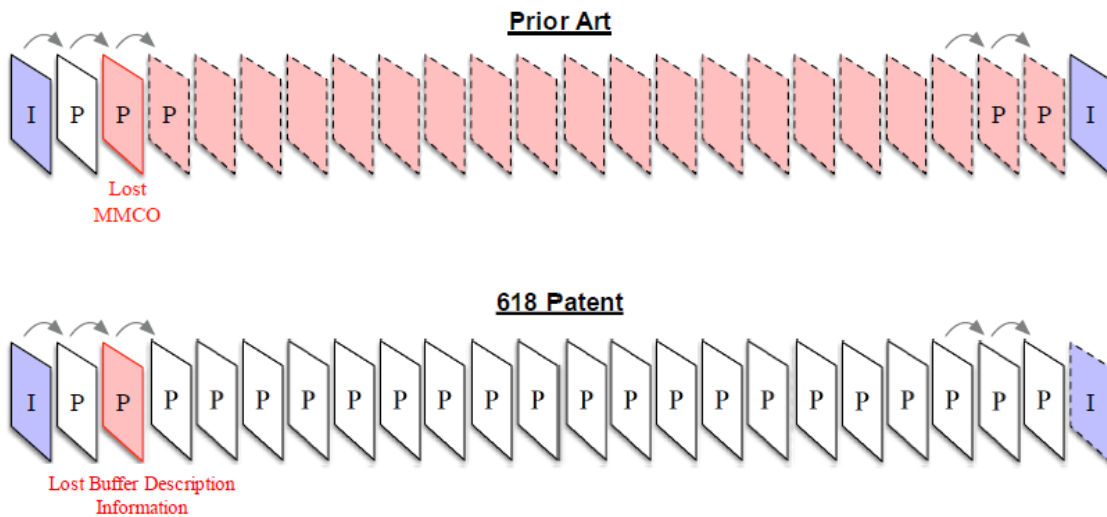
interpreted buffer operations in previous pictures, the decoder will only have to rely on information contained in the encoded representation of the current picture.” Ex. 1001 at 9:8-18; Ex. 2001 ¶ 152.

For example, if Picture 103 is lost, and its buffer description information lost along with it, the DPB is simply updated at the next picture based on that picture’s buffer description information. Ex. 2001 ¶¶ 152-54. Specifically, when Picture 104 is decoded, its buffer description information would identify explicitly which reference pictures to be used for decoding the current or subsequent pictures. *Id.* at ¶¶ 153-54. And again, the decoder would know that Picture 101 could be removed because it is not needed for decoding the current picture or any subsequent pictures.



Thus, unlike the prior art, the effects of lost information in the '618 Patent can be recovered with the next picture that is decoded, rather than having to wait for an

IDR picture to reset the buffer. Ex. 2003 ¶ 155. This quick recovery in contrast to the prior art is illustrated below. The top illustration shows what happens in the prior art if an MMCO command is lost, with the purple pictures indicating IDR pictures (when the DPB can next be reset) and the red pictures indicating corrupted pictures. Conversely, the illustration below that shows what happens in the '618 Patent if buffer description information is lost. In this case, there is only one corrupted picture (the red picture, the one that was lost), and the decoder recovers at the very next picture. It does not have to wait until the IDR picture (purple picture). *Id.*



The '618 Patent also explains that replacing the relative signaling of H.264 with absolute signaling via buffer description information solves the problems associated with temporal scalability. Ex. 1001 at 14:20-24; Ex. 2001 ¶ 156. It states that: “[u]sing the embodiments, temporal scalability will not be restricted as in the prior [art] since the reference picture for the current picture is not affected by

removal of previous pictures from the bitstream since it is signaled in an absolute way.” Ex. 1001 at 14:20-24.

C. The Inventions of the '618 Patent Were Adopted Into the H.265 Standard

Prior to the work by the inventors, the original draft of the H.265 standard copied the reference management techniques from H.264. Ex. 1001 at 1:36-44, 1:58-62, 20:28-39; Ex. 2001 ¶ 192. During the standardization process, however, the inventors of the '618 Patent submitted a proposal in July 2011 (the “F493 proposal”), titled “Absolute signaling of reference pictures,” which proposed incorporating the invention of the '618 Patent into the H.265 standard. See Ex. 2004; Ex. 2001 ¶ 192.

The F493 proposal explained the benefits of encoding reference pictures “in an absolute manner in the slice header of a picture instead of in a relative manner (through MMCO and sliding window process).” Ex-2004 at 1; Ex. 2001 ¶ 193. This was accomplished by adding “explicit signaling of the reference pictures, using a Buffer Description, in each slice header, containing information to deduce POC and temporal_id of all reference pictures marked as ‘used for reference’ in the DPB.” Ex-2004 at 1; Ex. 2001 ¶ 195. Thus, the F493 proposal provided the core idea of using buffer description information defining a plurality of reference pictures, referred to as the “Reference Picture Set” or RPS in the H.265 Standard. Ex. 2007; Ex. 2001 ¶ 199.

Indeed, in defining RPS, the H.265 Standard uses the same language as the patent uses to describe “buffer description information.” Compare Ex-1001 at 8:45-51 (“The buffer description information can therefore be regarded as information identifying a buffer description that is a set of reference pictures associated with a current picture. It consists of all reference pictures that are prior to the current picture in decoding order and that may be used for inter prediction of the current picture or any picture following the current picture in decoding order.”) with Ex-2007 at 29 (“[R]eference picture set (RPS): A set of reference pictures associated with a picture, consisting of all reference pictures that are prior to the associated picture in decoding order, that may be used for inter prediction of the associated picture or any picture following the associated picture in decoding order.”).

In addition, F493 proposed removing “all MMCO commands as the functionality provided by them is covered by Buffer Descriptions,” and “the sliding window operation as this functionality is provided by Buffer Descriptions.” Ex. 2004 at 6; Ex. 2001 ¶ 195. The F493 proposal explains how these changes were a fundamental shift from how reference pictures were managed previously:

It can be noted that the proposal implies conceptual changes to the decoding process. In H.264/AVC and current design of HEVC, operations are given to the decoder either implicitly (sliding window) or explicitly (MMCO) and the decoder is responsible of [sic] applying these operations and keeping track of the reference pictures (i.e. which

pictures can be used for reference). In the proposed scheme the reference pictures (i.e. which pictures can be used for reference) is [sic] signaled within the current picture (in the slice header) thus removing the need of implicitly and explicitly signaled operations. *This means that each picture will have an absolute description of the reference pictures instead of a relative description as in H.264/AVC (where delta-information is retrieved from MMCO or from the standard text, i.e. sliding window process).*

Ex. 2004 at 6 (emphasis added); *see also* Ex. 2001 ¶ 197. The inventors' contribution described their proposal as "improv[ing] error resilience, simplify[ing] temporal scalability and enabl[ing] decoding at a minimum number of decoded picture buffer slots." Ex. 2004 at 1; Ex. 2001 ¶ 193. The inventors' proposal was so well-received by the standards body that it formed a working group to implement the changes proposed by the inventors. Ex. 2005; Ex. 2001 ¶ 198. The key ideas of buffer description information and using an absolute and explicit reference picture signaling were then adopted into the H.265 Standard. Ex. 2007; Ex. 2001 ¶¶ 199-202.

III. PETITIONER'S ASSERTED PRIOR ART REFERENCES

A. Mulroy (U.S. 2009/0052531, Ex. 1004)

Mulroy teaches methods for detecting and concealing errors that occur because of relative reference picture signaling. Ex. 2001 ¶¶ 204-05, 268; Ex. 2010 at 1337:2-6. This is fundamentally different than the '618 Patent, which claims

methods for preventing those errors from happening in the first place by using absolute and explicit signaling. Ex. 2001 ¶¶ 254-55, 306.

Specifically, Mulroy proposes a modification to the existing H.264 reference picture signaling that attempts to make it easier to detect errors that occur when MMCO commands are lost. Ex. 1004 at [0027]-[0029]; Ex. 2010 at 1337:21-38:21. For example, Mulroy suggests using preexisting “reference picture list reordering” commands defined by H.264,” which it also refers to as “remapping instructions,” to detect an error when an MMCO command is lost. Ex. 1004 at [0027], [0029]; Ex. 2001 ¶¶ 211; Ex. 2010 at 1337:21-38:21, 1339:1-9, 1343:9-1344:9, 1347:2-14; Ex. 2011 at 819:6-10, 840:8-18. While Mulroy suggests that the H.264 reordering instructions can be used to indicate “to the decoder which frames (by their frame numbers) should be in its buffer” when that information is otherwise unavailable (i.e., when an MMCO command is lost), Ex. 1004 at [0027]-[0028], Mulroy uses the relative signaling structure that the ’618 Patent’s solution replaced (MMCO and sliding window), and does not explain how to use the reordering instructions to identify the reference pictures for a current or subsequent picture, or how to use those instructions to update a decoding picture buffer. Ex. 2001 at ¶¶ 204, 207; Ex. 1010 at 1343:9-1344:9. Instead, the focus of Mulroy’s limited disclosure (which spans three paragraphs) is on how to initiate an error recovery process when a missing MMCO command is detected. Ex. 2001 at ¶¶ 208-212. This error recovery process

uses “*further messages*” from the encoder that dictate how to resolve the error. Ex. 1004 at [0029] (emphasis added); Ex. 2001 ¶¶ 211-13.

Because Mulroy relies on further messaging from the encoder to address an error, Mulroy does not disclose updating the DPB using information in a reordering instruction. Ex. 2001 ¶¶ 211-13. Instead, Mulroy describes a separate set of “rules for the reference buffer management:”

- 1) Do not remove a frame unless the buffer is full
- 2) Always keep the two most recent frames, i.e. ages 1 and 2
- 3) Subject to the $2m+2$ limit, always keep the oldest frame
- 4) Keep sufficient frames that when the oldest frame ages beyond the ‘old’ window there is still a frame in this ‘old’ window. This implies that a frame shall not be removed from the buffer if the time difference between the next oldest frame in the buffer and the next youngest frame in the buffer exceeds the size of the ‘old’ window (i.e. m). Where, as here, the intermediate and ‘old’ windows are the same size, this requires at least one frame always in the intermediate window.

Id. at [0047]-[0051]; Ex. 2001 ¶¶ 214-216.

B. H.264 (Ex. 1005)

The Petition relies on the 2007 edition of H.264. Pet. at 22. As discussed above, the H.264 Standard has two methods of reference picture management: MMCO commands and sliding window. Ex. 1001 at 2:3-13; Ex. 2001 ¶ 95; Ex. 2003

at 107. A detailed discussion of the use of these reference picture management techniques is discussed in Section II.A above.

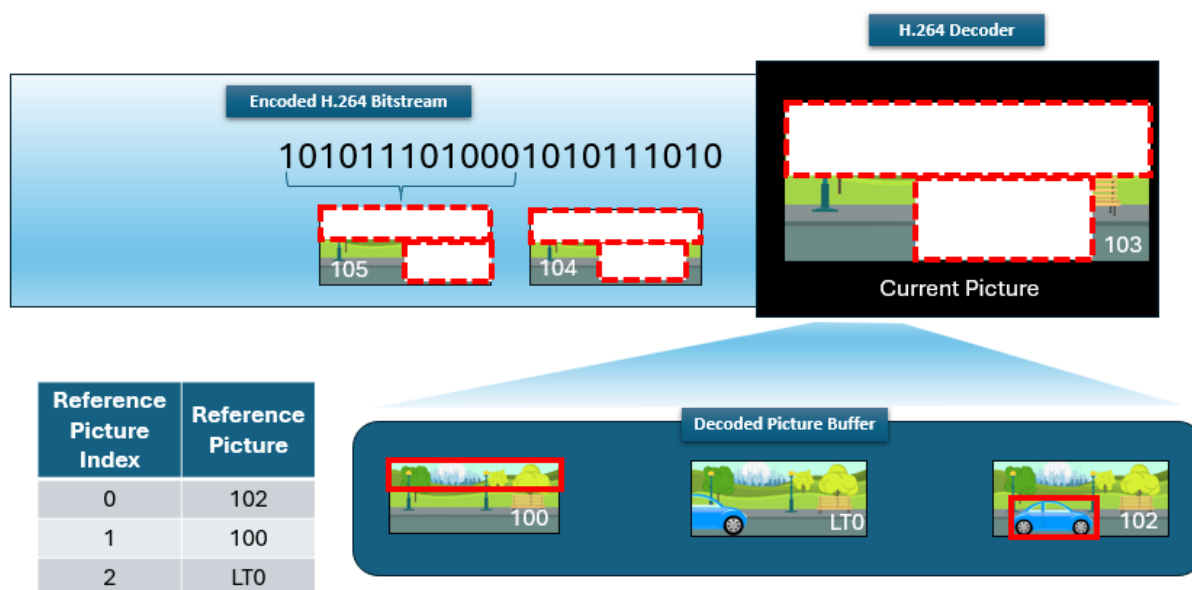
Separate from reference picture management for the decoded picture buffer, an H.264 decoder also uses reference picture lists during the decoding process. Ex. 2001 ¶ 117. The reordering commands described in Mulroy related to how pictures are stored in these reference picture lists. Thus, the following describes the use of reference picture lists in H.264.

1. Reference Picture Lists

When decoding a picture (i.e. “the current picture”), the decoder must construct reference picture list(s). *Id.* at ¶¶ 117-18; Ex. 2003 at 107. Each set of reference picture lists is created for a particular picture and only used for that picture. Ex. 2001 at ¶ 118. Thus, a set of reference picture lists only applies to a single picture being decoded. *Id.*

In H.264, the reference pictures are organized into reference picture lists based on a set of default rules designed to place the pictures most likely to be used as a reference picture for the current picture at the top of the list. Ex. 2001 ¶¶ 119-21; Ex. 2003 at 107. The order of the reference picture list is important in H.264 because using a picture at the top of the list requires fewer bits than using a picture that is lower down on the list. Ex. 2001 ¶ 121; Ex. 2003 at 107.

Below is an example of a reference picture list created when decoding Picture 103:



Ex. 2001 at ¶¶ 122-23; see also *id.* at ¶¶ 124-26 (providing additional examples).

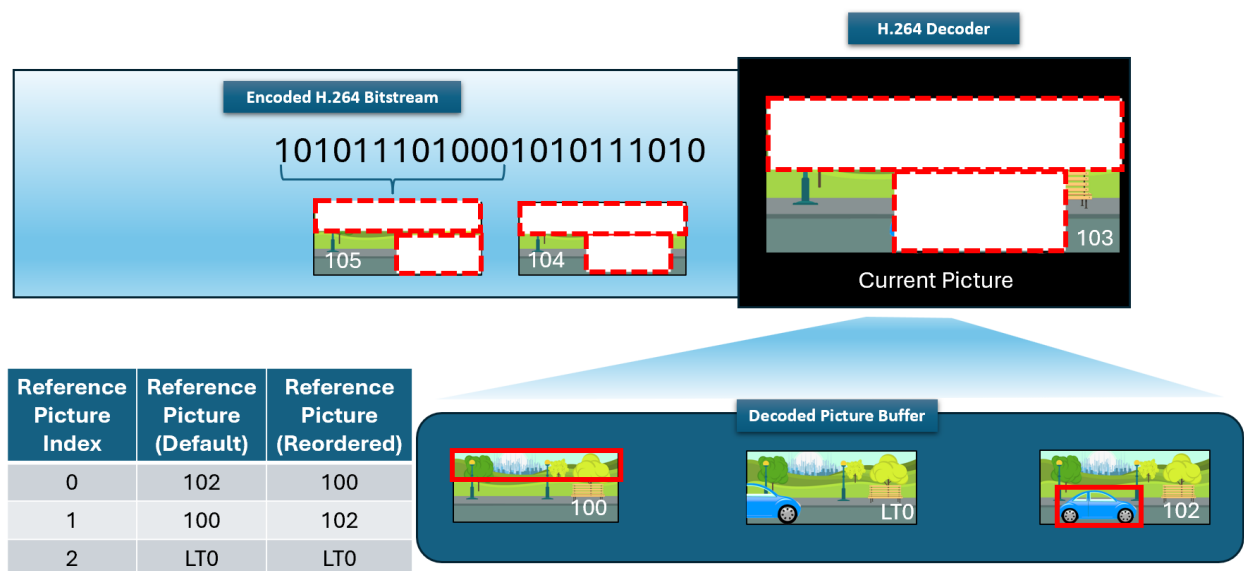
The reference picture list is shown on the bottom left and is maintained separate from the DPB, and, again, this list will only exist for Picture 103. A new list would have to be created for Pictures 104 and 105.

2. Reference Picture List Reordering Commands

The default order for the reference picture list is not always the most efficient order for encoding a particular frame. *Id.* at ¶ 127. To deal with this, the H.264 Standard provides syntax for “reference picture list reordering commands” that can change the order of the initial reference picture list for a current picture. *Id.* at ¶¶ 127-28; Ex. 1005 at 47 (§7.3.3.1), 85-86 (§ 7.4.3.1), 96. It is important to note that

the reference picture list reordering commands change the order of the *reference picture lists* and do not change the contents of the DPB. Ex. 2001 at ¶¶ 128-29, 135; Ex. 2003 at 107, 109; Ex. 1005 at 112 (§ 8.2.4).

As an example, building on the previous demonstrative, a reordering command could signal that Pictures 100 and 102 should swap places in the reference picture list, which is shown below.



Ex. 2001 at ¶ 134; *see also id.* at 136-39 (providing additional examples); Ex. 2003 at 109-10.

C. Raveendran (U.S. 2006/0165176, Ex. 1006)

The third reference cited in the Petition referred to as Raveendran is relied on exclusively to show that physical components of a decoding system (e.g. a processor) were known in the art.

IV. CLAIM CONSTRUCTION

Claim terms should be given their plain and ordinary meaning to a POSITA as of the earliest effective filing date. *See, e.g., Eon Corp. IP Holdings LLC v. Silver Spring Networks, Inc.*, 815 F.3d 1314, 1320 (Fed. Cir. 2016). “The ordinary meaning of a claim term is not ‘the meaning of the term in the abstract.’ Instead, ‘the ‘ordinary meaning’ of a claim term is its meaning to the ordinary artisan after reading the entire patent.’” *Id.* (internal citations omitted) (quoting *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc)).

Petitioner argues that the term “frame” and “picture” are interchangeable for purposes of its Petition. Pet. at 18. Though these two words may be used interchangeably in some circumstances, sometimes a distinction is necessary. Ex. 2001 ¶ 47. For example, a POSITA would have understood that the terms “frame” and “picture” are not used interchangeably throughout the H.264 Standard. *Id.* Rather, in H.264, “a ‘frame’ can be considered as a single progressive frame or a pair of interlaced fields, and a ‘picture’ can be a single frame or a single field. Compare Ex. 1005 at 7, § 3.55 with *id.* at 10, § 3.104.”; Ex. 2001 ¶ 47. This distinction is described in more detail below with respect to the relevant claim element and disclosure of H.264.

The Petition also notes that Petitioner and Patent Owner have proposed claim constructions before the International Trade Commission (ITC) for the “circuit”

term. Pet. at 18 (citing Ex. 1012 at 5). The ITC has not yet issued a claim construction, but for the purposes of this *inter partes* review, Patent Owner agrees that the Board need not construe the term and should apply the plain an ordinary meaning.

Construction of these terms and other claim terms may be relevant to issues in the related litigations, such as for resolving non-infringement disputes or to “clarify and when necessary to explain” terms for “determination of infringement” by the factfinder. *O2 Micro Int’l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1362 (Fed. Cir. 2008) (citation omitted). Thus, Patent Owner does not waive its right to raise additional issues of claim construction in any litigation, nor does it waive any argument in any litigation that claim terms are not indefinite or otherwise valid.

V. PETITIONER HAS FAILED TO ESTABLISH A REASONABLE LIKELIHOOD THAT ANY CHALLENGED CLAIM IS UNPATENTABLE UNDER 37 C.F.R. § 42.108(c).

Lenovo’s invalidity arguments in the ITC and in this Petition rely exclusively on the same reference picture signaling techniques previously used in H.264 and distinguished in the ’618 Patent as the problem the invention solved. Thus, as described below, none of the prior art references—whether considered alone, together, or in view of a POSITA’s knowledge—disclose or render obvious all elements of the challenged claims.

A. Petitioner Has Failed To Establish A Reasonable Likelihood That Mulroy In View Of H.264 Renders Obvious Claims 1-7 (Ground 1).

1. Ground 1 does not disclose or render obvious “buffer description information defining a plurality of reference pictures,” as required by claims 1-7.

Independent claims 1 and 5 (and thus dependent claims 2-4 and 6-7) require “retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures.” Petitioner has not shown—and cannot show—that Ground 1 discloses or renders obvious this limitation.

a. The Petition is inconsistent about which element in Mulroy discloses “buffer description information defining a plurality of reference pictures.”

As a threshold matter, institution should be denied because the Petition is inconsistent about which aspect of Mulroy constitutes the claimed “buffer description information.” *See, e.g., Google LLC v. Uniloc USA, Inc.*, 2018 Pat. App. LEXIS 5451, IPR No. 2017-02082, Paper 10 at 13 (P.T.A.B. Mar. 29, 2018) (denying institution because “Petitioner inconsistently maps the recited ‘instant voice message’ to different elements of Zydney without sufficient explanation for this incongruity”). First, the Petition equates “MMCO commands” or “sets of MMCO messages” with the claimed “buffer description information.” Pet. at 21 (“Mulroy makes use of the H.264/AVC tools, such as MMCO commands to delete pictures from the decoder’s reference picture buffer that the encoder has deleted (EX1004, ¶25), and ‘sets’ of MMCO messages, *i.e.*, *buffer description*

information.”) (emphasis added); *see also* Ex. 1003 ¶ 102 (same). But later, the Petition argues that this same limitation—the claimed “buffer description information”—is disclosed by a “message” sent in the slice header that “use[s]” the “reference picture list reordering commands defined by H.264.” Pet. at 35; *see also* Ex. 1003 ¶ 152. Still later, the Petition characterizes the claimed “buffer description information” as solely the reordering commands, not as part of a broader “message.” *See, e.g.*, Pet. at 37 (“Mulroy-H.264/AVC renders this element [determining, based on the buffer description information, . . .] obvious because Mulroy discloses a decoder determining, based on reordering commands in encoded data for a slice of a current picture . . .”). Thus, it is unclear whether the Petition relies on MMCO commands to disclose the claimed “buffer description information” (Pet. at 21), or some “message” that includes MMCO commands and reordering commands (Pet. at 35), or just the reordering commands themselves (Pet. at 37).

Petitioner’s inconsistency, or at best, lack of clarity, violates 35 U.S.C. § 312(a)(3) and 37 C.F.R. § 42.104(b)(4), and institution should be denied. *See* 35 U.S.C. § 312(a)(3) (stating a petition “may be considered only if . . . the petition identif[ies], in writing and *with particularity*, . . . the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim”) (emphasis added); 37 C.F.R. § 42.104(b)(4) (requiring the petition to “specify where each element of the claim is found in” the prior art); *see, also e.g.*,

Google LLC, IPR No. 2017-02082, Paper 10 at 14 (“[T]he Petition lacks clarity regarding precisely which element or portion of Zydney Petitioner is alleging discloses the ‘instant voice message’ of the challenged claims. The Petition, therefore, fails to ‘specify where each element of the claim is found in’ Zydney for the challenged claims—in violation of 37 C.F.R. § 42.104(b)(4).”); *Netflix, Inc. v. DivX, LLC*, 84 F.4th 1371, 1377 (Fed. Cir. 2023) (“Ultimately, it is the petitioner’s burden to present a clear argument.”).

Even more confusing, the Petition and Petitioner’s expert point to an entirely different paragraph in Mulroy ([0022]) as “defining a plurality of reference pictures” than they do for “buffer description information.” Pet. at 36. Paragraph 22 does not refer to MMCO commands, reordering commands, or a “message” that uses reordering commands. Ex. 1004 at [0022]. Instead, Paragraph 22 refers to “the reference indices of the predictor.” Ex. 1004 at [0022]. Even if the reference indices of the predictor defined a plurality of reference pictures, which they do not for reasons discussed below, Petitioner does not argue that it is these reference indices constitute the claimed buffer description information. The claims dictate that it is the “buffer description information” that must “defin[e] a plurality of reference pictures,” and Petitioner’s failure to point to the same element of Mulroy for “buffer description information” and “defining a plurality of reference pictures” is yet another reason to deny institution.

b. The Petition does not apply the plain and ordinary meaning of “buffer description information defining a plurality of reference pictures.”

Petitioner appears to argue that buffer description information is broad enough to cover any information that could possibly be used to determine or update the state of a buffer of what pictures are included in a buffer. This argument is contrary to plain meaning of “buffer description information” in the context of the ’618 Patent. For example, Petitioner’s interpretation is so broad that it would encompass virtually every kind of reference picture signaling, including relative signaling like MMCO commands. Petitioner’s ITC expert, Dr. Hu, and Dr. Richardson agree that MMCO Commands are **not** the claimed buffer description information. Ex. 2011 at 882:15-18; Ex. 2010 at 1323:25-1324:2.

In the context of the ’618 Patent, a POSITA would recognize that the plain meaning of “buffer description information defining a plurality of reference pictures” means information that defines the set of reference pictures, referred to in the ’618 Patent as a “Reference Picture Set (RPS),” or, at the very least, a form of absolute and explicit signaling that is not dependent on previous pictures being correctly decoded. Ex. 2001 ¶¶ 245, 254. This is dictated by the claim language itself, which requires that the buffer description information “defin[e] a plurality of reference pictures.” *Id.* at ¶¶ 243, 246. As Dr. Richardson explains, “[a] type of signaling that describes the state of a buffer, such as the DPB, but does so relative to

something else, such as a prior state of the DPB and/or a previously received MMCO command, does not define a reference picture.” *Id.* at ¶ 243.

Notably, in the ITC, Lenovo’s ITC expert agreed that, in the ’618 Patent, the term “buffer description information” is used synonymously with RPS. Ex. 2011 at 879:17-19 (“For example, in the ’618 patent itself, it describes the buffer description information as reference picture set.”); *see also id.* at 882:23-883:1 (Q: “And you would agree that the buffer description information in the patent is absolute signaling, right?” A: “That’s correct.”). Lenovo’s ITC expert also agreed that this means the claimed “buffer description information” must not depend on the previous state of the decoded picture buffer. Ex. 2011 at 883:18-22 (Q: “You would agree with me that in the 618 patent, the buffer description information does not depend on pictures that have been previously received and decoded by the decoder, correct?” A: “I would agree with that.”).

The specification confirms this plain meaning of “buffer description information defining a plurality of reference pictures,” explaining: “step 3 S3 generates information of a buffer description, also referred to as a Reference Picture Set (RPS). This information is denoted buffer description information herein.” Ex. 1001 at 8:22-25; Ex. 2001 ¶ 250; Ex. 2010 at 1330:13-16. The specification further explains that the “buffer description information” “is used for reference pictures in an absolute and explicit way instead of a relative or implicit way,” and “[t]hus, the

encoded representation of a picture contains the information about which reference pictures to use for reference during decoding independent of the encoded representations of previous pictures in the video stream.” Ex. 1001 at 4:39-48; Ex. 2001 ¶ 248. The specification repeatedly makes clear that the claimed “buffer description information” replaces the “relative” signaling of the prior art (Ex. 1001 at 2:5-11, Ex. 2001 ¶ 247), and in fact, repeats the understanding that “buffer description information” is “absolute” and “explicit” at least nine more times. Ex. 1001 at 6:38-48; 6:57-64; 7:38-46; 12:27-35; 14:20-24; 15:5-13; 20:40-44; 20:45-49; 25:43-48; Ex. 2001 ¶ 249.

Thus, when considering whether the prior art discloses or renders obvious “buffer description information defining a plurality of reference pictures,” the proper inquiry is whether it discloses or renders obvious such absolute and explicit signaling. Because the Petition fails to address how Mulroy or H.264 render obvious absolute and explicit signaling, it necessarily fails.

c. Mulroy in view of H.264 does not render obvious “buffer description information defining a plurality of reference pictures”

Although inconsistent and unclear for the reasons described above, the crux of the Petition’s argument appears to be that either MMCO commands, reordering commands, or messages containing those commands are buffer description information. These arguments fail for the reasons stated below.

1) MMCO commands are not the claimed “buffer description information”

First, MMCO commands are not and cannot be the claimed buffer description information defining a plurality of reference pictures. Ex. 2001 ¶¶ 258-62. As the ’618 Patent explains, MMCO commands (and sliding window) are in “clear contrast” to the claimed “buffer description information” because MMCO commands and sliding window are relative processes, whereas the claimed invention requires an absolute and explicit form of signaling reference pictures. Ex. 1001 at 4:39-48, 9:8-10, 20:28-44; *see also* Ex. 2001 ¶ 259; Ex. 2010 at 1323:10-1324:2. Even Petitioner’s own experts—both in this proceeding and at the ITC—admit that MMCO commands are a form of relative signaling. Ex. 1003 at ¶ 54; Ex. 2011 at 882:19-22 (Q: “But you would agree with me that MMCO commands do contain information about which reference pictures should be in the decoder picture buffer, correct?” A: “It’s a relative signaling, yes.”). And as described above, Lenovo’s ITC expert also agreed that the MMCO commands of H.264 are not the claimed buffer description information. Ex. 2011 at 882:15-18.

The prosecution history drives this point home even further, making clear that the buffer description information does not include any relative processes—such as the MMCO commands or sliding window process of H.264. *See, e.g.*, Ex. 1002 at 135 (“For example, the MMC[O] values can specify that a short-term frame is marked as unused, mark a long-term frame as unused, assign a long-term index to a

frame, specify a maximum long term picture index, and reset. None of these values define buffer description information that define a plurality of reference pictures.”); Ex. 2003 ¶¶ 252-53. Indeed, during prosecution of the ’618 Patent, the Applicant distinguished the Borgwardt reference—which disclosed sending MMCO commands, along with other information—from the claimed “buffer description information.” Ex. 1002 at 135. The Examiner found this distinction “persuasive.” *Id.* at 148.

Because MMCO commands are relative to the previous state of the decoded picture buffer and do not define a plurality of reference pictures, they are not “buffer description information defining a plurality of reference pictures.” Ex. 2001 ¶ 261.

2) Reordering commands are not the claimed “buffer description information”

Second, reordering commands—even used in the way Mulroy suggests—are not and cannot be the claimed buffer description information defining a plurality of reference pictures. Ex. 2001 ¶¶ 263-83. The reference picture list reordering commands describe the order of the *reference picture list*, not the DPB. Ex. 2001 ¶¶ 117, 128, 135, 263. A reference picture list is not the decoded picture buffer. *Id.*; *see also id.* at ¶ 228. Thus, the reordering commands do not describe a buffer. For this reason alone, they cannot be the claimed “buffer description information.”

In addition, reordering commands cannot be the claimed “buffer description information” because, even as used in Mulroy and as suggested by Dr. Creusere, the

reordering commands are a form of relative signaling—not absolute and explicit signaling. Ex. 2001 at ¶ 263. The reordering commands do not “*define* a plurality of reference pictures” as is required by the claim language. Ex. 2001 at ¶ 283. Rather, reordering commands simply describe the change in order (or in Mulroy, lack thereof) of the reference picture list. *Id.*

The H.264 reordering commands indicate to the decoder where to place each picture in order in the reference picture list, *relative* to its default index (or position). *Id.* at ¶ 264. Indeed, as Dr. Richardson testified in the ITC proceeding, the reordering instructions work by “reordering an existing or known state of the decoded picture buffer,” and so are “relative to what the decoder worked out from previously decoded pictures.” Ex. 2010 at 1339:1-9. In other words, the reordering instructions track a change (or lack of change) from the previous state to the current state—to *reorder* the reference pictures, one must already have an existing order to use as a starting point. *Id.* at 1326:16-1327:24, 1339:1-9, 1341:17-1342:1. Thus, these reordering instructions depend on previous pictures being decoded correctly and are therefore relative. Ex. 2001 ¶ 265; Ex. 2010 at 1339:1-9.

Moreover, Mulroy and H.264 still require the use of relative MMCO commands. Ex. 2003 ¶¶ 204, 207-08, 267-82; Ex. 2010 at 1338:22-25; Ex. 2011 at 885:19-24 (“In terms of the MMCO commands, I already testified that Mulroy discloses you can use that *in addition* to reordering commands to preview, from the

encoder to decoder, kind of what signaling is to come.”) (emphasis added). Specifically, Mulroy teaches using MMCO commands and supplementing those commands with reordering commands to enable detection of errors when MMCO commands are lost. Ex. 1004 at [0025], [0027]; Ex. 2003 ¶¶ 204, 207-08, 267-82; Ex. 2010 at 1337:2-1338:25, 1343:6-8. This is in stark contrast with the ’618 Patent, which teaches that the whole point of the claimed buffer description information is to replace relative signaling using MMCO commands and sliding window of H.264 with absolute and explicit signaling that is not dependent on proper decoding of prior pictures. Ex. 1001 at 4:39-48, 20:28-44; Ex. 2003 ¶ 248; Ex. 2010 at 1329:16-19.

The Petition implies that, even though the reordering instructions as used in H.264 do not constitute the claimed buffer description information, Mulroy uses reordering commands in a different way—and it is that different way of using reordering commands that satisfies this limitation. Pet. at 35-36 (“Mulroy describes a ‘modified version [of H.264]. . .’”). This argument is misplaced. Mulroy describes using the exact same syntax and semantics as H.264, just more frequently. Ex. 1004 at [0027] (“One way of doing this is to make use of the ‘reference picture list reordering’ commands **defined by H.264.**”) (emphasis added); Ex. 2001 ¶ 266; Ex. 2011 at 819:6-10 (“Q: You mentioned that Mulroy proposes to use reference picture list reordering commands. What are reference picture list reordering commands? A: That is a technique that’s **already proposed or defined in the H.264 standard.**”)

(emphasis added); *see also id.* at 840:15-18 (“And the POSITA would have had a reasonable expectation of success because Mulroy has provided a roadmap of how to implement its modification using the ***already defined syntax elements*** of the coding standard, H.264.”) (emphasis added). A relative process used more frequently is still relative. Ex. 2001 ¶ 266; Ex. 2010 at 1339:1-9. Because Mulroy’s use of the reordering commands is still relative (i.e. dependent on previous pictures being decoded correctly), the reordering commands do not and cannot constitute the claimed buffer description information.

The Petition cursorily points the Board to hypothetical examples in Dr. Creusere’s declaration. As a preliminary matter, the Petition cannot incorporate by reference section of Dr. Creusere’s declaration. 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document.”); *see also, e.g., 3M Co. v. Evergreen Adhesives, Inc.*, 860 F. App’x 724, 728 (Fed. Cir. 2021). Even if the Board considers those examples, Dr. Richardson has provided a detailed explanation of the issues with those examples. Ex. 2003 ¶¶ 221-37, 267-83.

3) The “message” is not the claimed “buffer description information”

The Petition states that Mulroy describes a “modified version [of H.264] in which every slice contains a message informing the decoder as to exactly which frames should be in the decoder buffer at that time.” Pet. at 35 (citing Ex. 1004 ¶ 27). The Petition then states that, to accomplish this, the message can use reordering

commands to “indicat[e] to the decoder which frames (by their frame numbers) should be in its buffer.” *Id.* (citing Ex. 1004 ¶ 27).

The combination of MMCO commands and reordering commands in a broader “message” cannot be the claimed buffer description information. Ex. 2001 ¶¶ 284-85. Combining multiple reordering commands into a single message does not change the fundamental fact that the commands are relative and do not define reference pictures. Ex. 2001 ¶ 284.

4) Reference picture indices do not define a plurality of reference pictures

The Petition also states that the reference indices define a plurality of reference pictures. Pet. at 36 (citing Ex. 1004 ¶ 22). As a threshold matter, the Petition does not allege, and Mulroy does not disclose, that these indices are part of the MMCO or reordering commands.

Instead, “[r]eference indices are sent with a coded block such as a macroblock, selecting one or two specific reference pictures out of the set of available reference pictures already in the DPB.” Ex. 2001 ¶ 287. These indices are essentially “slots” in the DPB that may be associated with any reference picture. *Id.* The indices are *not* an identification of all the pictures used for reference and are dependent on the previously decoded pictures having been correctly received and decoded. *Id.* Thus, the indices are not an absolute and explicit form of signaling the reference pictures that should be in the DPB. *Id.*

As Dr. Richardson explains, “[w]hich reference picture is associated with which reference index changes as more pictures are decoded and therefore added and removed from the DPB (and reference picture list).” *Id.* at ¶ 288. This is apparent from the example below, taken from Dr. Richardson’s 2010 textbook on H.264. Here, index 0 in list 0 corresponds to frame 150 at first, but after frame 151 is encoded, index 0 then corresponds to frame 151 and frame 150 moves to index 1.

Reference Picture Order Example: P slices (list0)

The reference picture list is initially empty. The current *frame_num* is 150 and the maximum size of the DPB is 5 frames. Italics indicate a *LongTermPicNum*. Notice that by default, the first entry in list0 is the most recently coded frame. This is likely to be the ‘best’ prediction reference for the majority of macroblocks.

Operation	list0(0)	list0(1)	list0(2)	list0(3)	list0(4)
Initial state	-	-	-	-	-
Encode frame 150	150	-	-	-	-
Encode 151	151	150	-	-	-
Encode 152	152	151	150	-	-
Encode 153	153	152	151	150	-
Encode 154	154	153	152	151	150
Encode 155	155	154	153	152	151
Assign 154 to LongTermPicNum 3	155	153	152	151	3
Encode 156 and mark it as LongTermPicNum 1	155	153	152	1	3
Encode 157	157	155	153	1	3

Ex. 2003 at 107.

Accordingly, the Petition does not explain how the reference indices relate to the MMCO and reordering commands, and thus cannot rely on the use of those indices to define reference pictures.

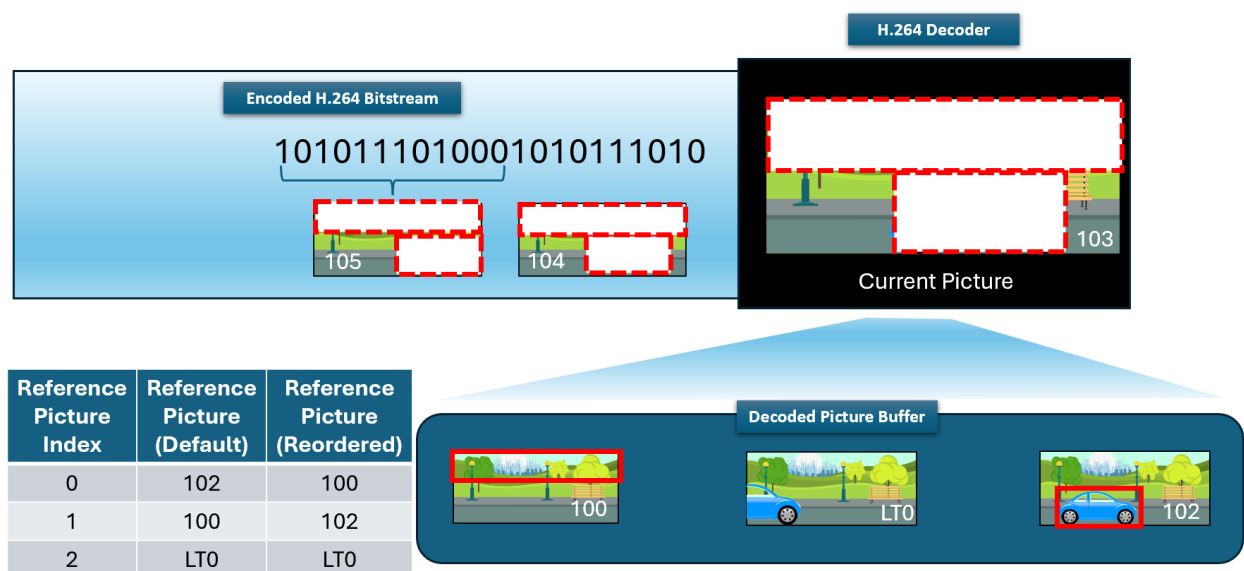
2. Ground 1 does not disclose or render obvious “a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture” as required by claims 1-7.

Petitioner has not shown—and cannot show—that Ground 1 discloses or renders obvious this limitation because the prior art does not teach the claimed “a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture.” Ex. 2001 ¶¶ 292-99. This limitation is found in independent claims 1 and 5 and thus also present in dependent claims 2-4 and 6-7.

The plain language of this claim requires identifying a “respective reference picture” as a decoding reference for the current picture. Ex. 2001 ¶ 292. It is not possible to tie a particular reference picture to the picture being decoded using the reference picture list reordering commands identified in Mulroy or in H.264. *Id.* at ¶ 275. A reordering command can identify a reference picture in a reference picture list, but it cannot identify *which* of those reference pictures should be used as a reference for a particular picture. *Id.* at ¶¶ 294-96.

For example, using the illustration earlier and repeated below, a reference picture list can include three pictures (Pictures 100, 102, and LT0). A reordering instruction can be used to change the order of those pictures in the reference picture

list (e.g. change the order of Pictures 100 and 102), but the reference picture list does not indicate which of the pictures are used to decode Picture 103. *Id.* at ¶¶ 294-96.



Accordingly, nothing in the reordering commands identifies for the decoder *which* of these three pictures are used as decoding references for the current picture—or if any of them are used as decoding references for the current picture at all. *Id.* at ¶ 296. Indeed, there can be instances in which the DPB includes exclusively pictures that are *not* used to decode the current picture (e.g. the reference pictures are only used in the decoding of subsequent pictures). *Id.* at ¶¶ 297-98.

Thus, as Dr. Richardson explains in his declaration, knowing which pictures “should” be in the DPB does not indicate to the decoder which of those pictures are used as a decoding reference for the current picture. Ex. 2001 ¶ 294. The fact that a picture is in the DPB only means that it is available to be used for reference, not that

it will necessarily be used for reference. *Id.* And certainly it does not disclose which pictures should be used as a reference for the current picture.

For these reasons, this limitation is not met or rendered obvious by Mulroy, H.264, or the combination of the two. *Id.* at ¶ 299.

3. Ground 1 does not disclose or render obvious “updating a decoded picture buffer based on the reference picture identifier,” as required by claims 1-7.

In just a single paragraph, the Petition alleges that Mulroy discloses “updating a decoded picture buffer based on the reference picture identifier” because it “discloses the decoder using the picture number of the reference picture (determined using ‘remapping instructions’ in the encoded data for the current picture) to update its buffer.” Pet. at 41 (citing Mulroy [0028] and [0033]). But Mulroy does not disclose using the picture number to update the DPB. Ex. 2001 ¶¶ 300-306.

First, Mulroy refers to the “frame number” *not* “picture number.” Ex. 1004 at [0027]; Ex. 2001 ¶ 301. The H.264 Standard, which Mulroy implements, does not use those two terms interchangeably. *Compare* Ex. 1005 at 46, 80-81 *with id.* at 47, 113; Ex. 2001 ¶ 301 (explaining that “‘frame number’ and ‘picture number’ are two different values in the H.264 standard, which is the standard Mulroy applies”). Thus, it is incorrect for the Petition and Dr. Creusere to equate the use of the term “frame number” in Mulroy to the “picture number” *in the H.264 Standard*.

Second, even if Mulroy referred to a picture number as a “frame number,” this limitation is still not rendered obvious. Instead of using the frame number to update the DPB, Mulroy discloses using reordering commands to detect an error, and then using “error recovery means operable to receive further messages, the further messages specifying which pictures which pictures should be in the store.” Mulroy at [0029]; Ex. 2001 ¶ 302. “Alternatively,” Mulroy discloses “using the same algorithm as used at the coder for selecting pictures to be deleted.” Mulroy at [0029]; Ex. 2001 ¶ 303. Later, Mulroy describes the “algorithm as used at the coder” by defining four “rules of buffer management.” Ex. 1004 at [0047]-[0051]; Ex. 2001 ¶ 304. Thus, Mulroy does not teach that the DPB is updated based on reordering instructions but instead based on “further messages” or the four default “rules for the reference buffer management,” and the DPB is also not updated based on a frame number or picture number.

Dr. Richardson explains why reordering commands cannot be used to update the buffer. For example, he explains that Mulroy’s use of the reordering commands can only indicate to the decoder that there is an error. Ex. 2001 ¶ 305. Mulroy cannot use the picture number to solve the error (i.e. update the DPB) because, in this scenario that Mulroy describes, the reference picture with the relevant picture number has already been erroneously removed from the DPB. *Id.* Thus, Mulroy requires fixing the error through other means, which are commonly referred to as

“error recovery means” or “error concealment techniques.” *Id.* This is in stark contrast with the ’618 Patent, which discloses a method of *preventing* the error (a lost MMCO command) from happening in the first place. Ex. 2001 ¶ 306. The ’618 Patent solves the problem of relative signaling by replacing it altogether with absolute signaling, which means that there will not be a situation in which the DPB cannot be updated based on the reference picture identifier. *Id.*

Thus, unlike the ’618 Patent, Mulroy does not—and cannot—update the DPB based on the reference picture identifier.

4. Ground 1 does not disclose or render obvious “i) a picture identifier identifying a respective reference picture among the plurality of reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the plurality of reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video,” as required by claim 2.

The plain meaning of Claim 2 requires (1) “identifying a respective reference picture . . . as the decoding reference” for the current picture and (2) separately “identifying a respective reference picture . . . as a decoding reference” for the subsequent picture. *Hayward Indus. v. Pentair Water Pool & Spa, Inc.*, 722 F. App’x 1049, 1050 (Fed. Cir. 2018) (non-precedential) (“We endeavor to give meaning to every limitation when construing claims.”) (citing *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004)); Ex. 2001 ¶ 307. In other words, the claim requires a method of distinguishing between which reference picture(s) in the

reference picture set will be used for reference for the current picture and which reference picture(s) will be used for subsequent pictures. Ex. 2001 ¶ 307. As Dr. Richardson explains, one benefit of this is that the decoder need only construct a reference picture list that has the pictures that will be used for decoding the current picture. *Id.* at ¶¶ 157, 308. Any pictures that are identified as solely in the DPB because they are for use for a subsequent picture do not need to be in the reference picture list for the current picture, therefore saving bits. *Id.*

Departing from its main theory at the ITC, the Petition relies only on the use of short-term and long-term reference pictures in H.264 to allege that these requirements are disclosed or rendered obvious. But indicating whether a picture is a short-term picture versus a long-term picture is not the same thing as *identifying* a respective reference picture *as the decoding reference* for the current picture or as a decoding reference for a subsequent picture. A short-term picture is a reference picture that will stay in the DPB for a short period of time, whereas a long-term reference picture is one that will stay in the DPB for longer. Ex. 2001 ¶ 89. But both short-term and long-term pictures may be used as a decoding references for the current picture, subsequent picture, or the current and subsequent pictures. Ex. 2001 ¶ 310.

Without identifying which pictures are the decoding reference(s) for the current picture, versus which are the decoding reference(s) for the subsequent

picture, the decoder cannot tell which pictures to place in the reference picture list for decoding the current picture. Ex. 2001 ¶ 310. Thus, an H.264 decoder must include all the pictures from the DPB in the reference picture list, taking up valuable bit space. Ex. 2001 ¶ 311. In contrast, in H.265, the decoder knows which pictures in the DPB are for decoding the current picture versus a subsequent picture, and therefore the reference picture lists need only contain the reference pictures for decoding the current picture. Ex. 2001 ¶ 157. This distinction makes clear that the mere use of short-term and long-term pictures does not constitute identifying a reference picture as the decoding reference for the current picture and identifying another reference picture as a decoding reference for a subsequent picture.

B. Petitioner Has Failed To Establish A Reasonable Likelihood That Mulroy In View Of H.264 and Raveendran Renders Obvious Claims 8-19 (Ground 2).

Ground 2 is the same as Ground 1, with the exception that it adds the Raveendran reference to disclose physical components of decoder, such as a processor and memory. But, for the common elements between claims 8-19 and claims 1-7, Ground 2 relies exclusively on the combination of Mulroy and H.264. Thus, Ground 2 fails for the same reasons as Ground 1.

1. Ground 2 does not disclose or render obvious “buffer description information defining a plurality of reference pictures,” as required by claims 8-19.

Like independent claims 1 and 5, independent claims 8, 12, 14, and 17 (and therefore dependent claims 9-11, 13, 15-16, and 18-19) require ““retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures.” The Petition does not argue that Raveendran discloses or renders obvious this limitation, and thus this limitation is not disclosed or rendered obvious by Ground 2 for the same reasons stated above with respect to Ground 1. Ex. 2001 ¶ 317.

2. Ground 2 does not disclose or render obvious “a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture” as required by claims 8-19.

Like independent claims 1 and 5, independent claims 8, 12, 14, and 17 (and therefore dependent claims 9-11, 13, 15-16, and 18-19) require “a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture.” The Petition does not argue that Raveendran discloses or renders obvious this limitation, and thus this limitation is not disclosed or rendered obvious by Ground 2 for the same reasons stated above with respect to Ground 1. Ex. 2001 ¶ 318.

3. Ground 2 does not disclose or render obvious “update a decoded picture buffer based on the reference picture identifier,” as required by claims 8-19.

Like independent claims 1 and 5, independent claims 8, 12, 14, and 17 (and therefore dependent claims 9-11, 13, 15-16, and 18-19) require the decoder to “update a decoded picture buffer based on the reference picture identifier.” The Petition does not argue that Raveendran discloses or renders obvious this limitation, and thus this limitation is not disclosed or rendered obvious by Ground 2 for the same reasons stated above with respect to Ground 1. Ex. 2001 ¶ 319.

4. Ground 2 does not disclose or render obvious “i) a picture identifier identifying a respective reference picture among the plurality of reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the plurality of reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video,” as required by claim 9.

Like Claim 2, Claim 9 requires “i) a picture identifier identifying a respective reference picture among the plurality of reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the plurality of reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video.” The Petition does not argue that Raveendran discloses or renders obvious these limitations, and thus this limitation is not disclosed or rendered obvious by Ground 2 for the same reasons stated above with respect to Ground 1. Ex. 2001 ¶ 320.

C. Objective Indicia of Non-Obviousness Demonstrate Non-Obviousness

Even if the Petition had established a *prima facie* case of obviousness, which it has not for at least the reasons discussed above, there are several strong objective indicia of non-obviousness that support the patentability of the challenged claims.

As discussed above in Section II.C, the inventors' ideas in the F493 proposal (which were claimed in the '618 Patent) is the reference picture management solution that was incorporated into the H.265 Standard. Also as discussed above, reference picture management is critical to operating an effective video codec. Thus, there is a nexus between the claimed invention of the '618 Patent and the success of the H.265 Standard described herein.

During the standardization process of the H.265 Standard, the brightest minds in the field recognized the value of the inventors' proposed shift to absolute and explicit reference picture signaling and incorporated it into the standard in place of the prior art methods, including MMCO commands and sliding window. Ex. 2001 ¶ 323.

The '618 Patent also had unexpected results when it came to efficiency as, although it proposes adding more information to the bitstream (i.e. the buffer description information), the design resulted in significant compression savings. *Id.* at ¶ 325. A POSITA would have expected that adding more information to the

bitstream would require more bits, but in fact it ended up being more efficient to replace MMCO commands and sliding window. *Id.*; Ex. 2004 at 13-14.

VI. THE BOARD SHOULD EXERCISE DISCRETIONARY DENIAL UNDER THE *FINTIV* FACTORS

The same prior art grounds in this Petition were already litigated at the ITC. A duplicative IPR proceeding on these same exact issues is not only unnecessary, but a waste of party and government resources, and all six *Fintiv* factors weigh in favor of discretionary denial.

A. ITC Background

On December 12, 2023, Ericsson filed a Complaint in the ITC against Lenovo, alleging that Lenovo infringes the '618 Patent (among other patents). Ex. 2009. At least by May 31, 2024, Lenovo argued that the challenged claims of the '618 Patent are invalid as obvious in view of the Mulroy/H.264 combination. The parties submitted expert reports addressing this same ground, and the experts (Dr. Hu and Dr. Richardson) were deposed on their reports. In October 2024, the ITC held an evidentiary hearing where evidence, including expert testimony, was submitted regarding the Mulroy/H.264 combination. *See, e.g.*, Exs. 2010, 2011. An initial determination is expected from the ITC by May 9, 2025. *See In the Matter of Certain Electronic Computing Devices, and Components and Modules Thereof*, Inv. No. 337-TA-1387, Order No. 36 (March 14, 2025).

B. The *Fintiv* Factors Weigh In Favor of Discretionary Denial

In deciding whether to grant discretionary denial when there is already a pending proceeding involving the same invalidity, the Board considers the following factors: (1) “whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;” (2) “proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision;” (3) “investment in the parallel proceeding by the court and the parties;” (4) “overlap between issues raised in the petition and in the parallel proceeding;” (5) “whether the petitioner and the defendant in the parallel proceeding are the same party;” and (6) “other circumstances that impact the Board’s exercise of discretion, including the merits.” *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020). Here, all six factors weigh in favor of denial.

First factor. the ITC has not granted a stay, and the Initial Determination is expected from the Administrative Law Judge is expected on May 9, 2025.

Second and third factors. the ITC has already held an evidentiary hearing on the same grounds presented in the Petition, and the parties and government have expended significant resources in the litigation of the same grounds.

Fourth factor. Ground 1 (Mulroy and H.264) is identical to the ground raised in the ITC. Ground 2 adds a new reference (Raveendran), but Petitioner does not rely on this reference for anything other than teaching the physical components, such

as a processor and memory, of a decoder. The crux of the parties' dispute has nothing to do with the disclosures of Raveendran. Instead, the dispute centers on the teachings of Mulroy and H.264. Thus, the addition of Raveendran does not alter the calculus. Moreover, at the ITC, Petitioner relied on another reference ("Lee) for the physical components of a decoder. Swapping Raveendran for Lee does not change the fact that the underlying invalidity arguments are the same as at the ITC.

Fifth factor. Lenovo is the Petitioner here and the Respondent at the ITC.

Sixth factor. As discussed at length above, the Petition is not compelling. The backdrop of the inventors work in developing H.265 and Lenovo's ITC expert recognition that the inventors' ideas were a "major change to how reference pictures were managed previously" lead to the inescapable conclusion that the Petition should fail. Ex. 2011 at 881:11-14.

For these reasons, the *Fintiv* factors weigh in favor of discretionary denial.

VII. CONCLUSION

For the foregoing reasons, institution should be denied.

Date: March 19, 2025

Respectfully Submitted

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Patent Owner's Response to Petition totals 12,375 which is less than the 14,000 allowed under 37 CFR § 42.24(b)(1).

Date: March 19, 2025

By: / David Frist /
David Frist (Reg. No. 60,511)

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e)(4), the undersigned certifies that on March 19, 2025, a complete and entire copy of this Patent Owner's Preliminary Response and its supporting exhibits were provided via email to the Petitioner by serving the email correspondence address of record as follows:

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