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| *Title:* | **On reference picture marking** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

This document proposes some changes to the reference picture marking process. Specifically, it is proposed that, at any access unit, only reference pictures with an identical or greater value of temporal\_id may be marked as “unused for reference”. When “non-existing” pictures are involved, it is assumed that “non-existing” pictures have the greatest possible value of temporal\_id, i.e., 7.

# Introduction

Temporal scalability is supported in HEVC WD3, wherein the field temporal\_id (3 bits) is present in NAL unit header of the VCL NAL units (with NAL unit type 1, 4, or 5). In a temporally scalable bitstream, some high temporal layers (of greater temporal\_id values) can be discarded to generate a bitstream subset with a lower frame rate, and gaps in frame\_num may be present in the bitstream subset. In this case, the current HEVC decoding process generates short-term “non-existing” pictures having the missing frame\_num values. Such “non-existing” pictures are handled in a similar way as normal short-term reference pictures in the DPB management process. And the reference picture list construction process excludes “non-exiting” pictures from being included in a reference picture list.

However, currently, it is possible that after decoding of a coded picture of a particular value of temporal\_id, reference pictures with smaller values of temporal\_id may be marked as “unused for reference” and get removed from the DPB. This creates the following problem. When the temporal layer containing such a coded picture and all higher temporal layers are discarded, decoding of another coded picture of a smaller value of temporal\_id may become incorrect due to that the reference picture index value of one or more reference pictures used for inter prediction is different compared to when decoding the entire bitstream. Such an incorrect decoding may seriously degrade the quality of that picture itself and also many future pictures that directly or indirectly use that picture for inter prediction reference.

Therefore, it is beneficial to restrict the reference picture marking process such that only reference pictures with identical or greater values of temporal\_id may be marked as “unused for reference” after decoding of any particular access unit.

This document proposes text changes for such a restriction.

# Proposed changes

The changes, in relative to HEVC WD3d8, provided below are proposed.

# 8.2.3.2 Decoding process for gaps in frame\_num

[Ed. (TW): insert text]

For each generated short-term reference picture marked as "non-existing", temporal\_id is set to 7.

# 8.2.3.3 Sliding window decoded reference picture marking process

This process is invoked when adaptive\_ref\_pic\_marking\_mode\_flag is equal to 0.

Depending on the properties of the current picture as specified below, the following applies.

1. Let numShortTerm be the total number of reference pictures that are marked as "used for short-term reference". Let numLongTerm be the total number of reference pictures that are marked as "used for long-term reference".
2. When numShortTerm + numLongTerm is equal to Max( max\_num\_ref\_frames, 1 ), the condition that numShortTerm is greater than 0 shall be fulfilled. The short-term reference picture that has the smallest value of FrameNumWrap among those short-term reference pictures that have temporal\_id not less than that of the current picture is marked as "unused for reference".

# 8.2.3.4.1 Marking process of a short-term reference picture as "unused for reference"

This process is invoked when memory\_management\_control\_operation is equal to 1.

Let picNumX be specified by

picNumX = CurrPicNum − ( difference\_of\_pic\_nums\_minus1 + 1 ). (8‑13)

The value of picNumX is used to mark the corresponding short-term reference picture as "unused for reference". The short-term reference picture having PicNum equal to picNumX shall either have temporal\_id not less than that of the current picture.

# 8.2.3.4.2 Marking process of a long-term reference picture as "unused for reference"

This process is invoked when memory\_management\_control\_operation is equal to 2.

The value of LongTermPicNum is used to mark the corresponding long-term reference picture as "unused for reference". The long-term reference picture identified by LongTermPicNum shall have temporal\_id not less than that of the current picture.

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