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| *Title:* | **Chroma Deblocking for Screen Content Coding** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

This contribution proposes extending the deblocking process for any new Screen Content Coding profile with 2 additional deblocking modes. In the first mode, it is suggested that deblocking of chroma edges is extended to also cover edges with boundary strength equal to 1. In the second mode, which only applies to 4:4:4 encoding, chroma deblocking is performed using the luma deblocking filter process. These extensions are motivated primarily from additional observations on the quality of the chroma components after HEVC decoding, as well as due to the unification of the intra block copy mode with inter prediction.

# Introduction

Contribution JCTVC-N0263 [2] suggested that HEVC [1][5] deblocking might be inadequate to handle 4:4:4 video content because of their potentially different characteristics versus 4:2:0 material. In particular, it was pointed out that deblocking was only performed on chroma edges corresponding to one or more intra partitions and, unlike luma, blocking artifacts could occur in areas with considerable motion and high texture characteristics. Two alternative solutions were proposed. Enabling the luma deblocking process for chroma planes, or extending the chroma deblocking process to also accommodate edges with boundary strength equal to 1. Such proposal was unfortunately not adopted at that point.

In additional experiments that were performed more recently and during the MPEG HDR/WCG activity, it was observed that blockiness could also occur in 4:2:0 encodings [3]. The problems were again related to the inadequate deblocking performed on the chroma components, i.e. on inter edges. It was suggested that a possible solution could be the use of an out of loop chroma deblocker, which was shown to improve performance both objectively and subjectively.

Unfortunately, we have observed that the problems identified in [2] and [3] still persist in the Screen Content Coding profiles [5] currently developed by the JCT-VC. In fact, due to the unification of the Intra Block Copy technique and Inter prediction, it is quite possible that the problems with the less efficient chroma deblocking may be further aggravated in these profiles. Although one could potentially reduce those problems using slice or block level chroma QP offsets and post-loop deblocking schemes as suggested in [3], having a better solution in these profiles would be highly recommended.

# Proposal

Very similar in spirit to JCTVC-N0263 [2] it is proposed that 2 additional deblocking modes are introduced in the Screen Content Profiles of HEVC. These two modes can be switched on and off at the PPS level, i.e. with a new parameter named use\_alternate\_chroma\_deblocking. These two modes are described in the subsequent sections. It should be pointed out that the modifications in the specification, as well as in both software and hardware implementations to support these alternative modes are relatively trivial. In addition, since the current deblocking mode is also alternative, there should not, ideally be any negative visual quality performance over the existing behaviour of HEVC.

## Method 1: Chroma deblocking when Bs >0

In this mode, i.e. use\_alternate\_chroma\_deblocking = 1, chroma deblocking is performed for all edges that have a Bs value larger than 0. The same deblocking filter as is currently specified in the HEVC specification for edges with a Bs value equal to 2 is reused. This mode applies to all chroma formats.

## Method 2: Chroma deblocking as luma

In this mode, i.e. use\_alternate\_chroma\_deblocking = 2, chroma deblocking is performed using exactly the same process and filters as specified for the luma component. This mode only applies to 4:4:4 formats.

# Conclusion

This contribution proposes adding two additional deblocking modes for chroma samples in the Screen Content Coding profiles of HEVC. Consideration of these new modes is performed at the PPS level. It is suggested that these new modes could considerably improve the objective and subjective performance of Screen Content material but also natural video material in general.

# References

1. ISO/IEC 230082:2014 HEVC Second Edition
2. W-S. Kim, W. Pu, J. Sole, M. Karczewicz, “AhG5: Deblocking Filter in 4:4:4 Chroma Format,” JCTVC document JCTVC-N0263, July 2013
3. A. M. Tourapis, Y. Su, D. Singer, J. Sole, D. Rusanovskyy, M. Karczewicz, C. Fogg, A. Duenas, F. Bossen, “Deblocking in HEVC: Some observations from the HDR/WCG CfE”, JCTVC document JCTVC-U0043, June 2015
4. Call for Evidence (CfE) for HDR and WCG Video Coding, MPEG document M36131, Switzerland, Feb.2015
5. JCTVC-T1005, “High Efficiency Video Coding (HEVC) Screen Content Coding: Draft 3,” 20th Meeting: Geneva, CH, 10 February – 17 February 2015.

# Patent rights declaration(s)

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