

**Joint Video Experts Team (JVET)  
of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC  
29/WG 11**

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**Title:** AHG8: Fixing the forward transform matrices for high bit depth coding

**Status:** Input document to JVET

**Purpose:** Proposal

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**Source:** InterDigital

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Abstract

In High Bit-depth coding of VVC, the forward transform matrices are represented with higher precision than the standard coding. This modification is reported to alter the properties of DST-VII and DCT-VIII 4x4 transforms that leads to difference between matrix multiplication- and fast algorithm-based computation. This contribution proposes modifying these transform matrices such that both matrix multiplication and fast algorithm are identical and therefore restore the dual-implementation property.

Introduction / Problem Statement / ...

Similar to HEVC range extension, VVC forward transform matrices for High Bit-Depth (HBT) coding are extended 14 fractional bits instead of 6 in standard coding. The new matrices are computed as the inverse of the 6 fractional bits inverse transform. The DST-VII matrix of 4x4 is as follows:

DST7\_4x4 =

a, b, c, d

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**CARD**

<http://vexpertise.stbit.ru/documents/JVET-V0131>

The image shows a screenshot of the 'JVET Search' interface. At the top, there is a search bar containing the text 'AHG8: Fixing the forward transform matrices for high bit depth coding'. Below the search bar, the authors are listed: 'Karam Nasar', 'Franck Galpin', 'F. F. Le Léanec', and 'Philippe de Lagnan'. The title 'AHG8: Fixing the forward transform matrices for high bit depth coding' is displayed prominently. Below the title, the word 'Authors:' is followed by a list of the authors' names. The interface also features sections for 'ABSTRACT' and 'MEETING NOTES', each with a corresponding list of items. A QR code is located in the bottom right corner of the image.

[https://jvet-experts.org/doc\\_end\\_user/documents/22\\_Teleconference/wg11/JVET-V0131-v2.zip](https://jvet-experts.org/doc_end_user/documents/22_Teleconference/wg11/JVET-V0131-v2.zip)

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- DOC JVET-V0131-r1.docx
- XLS TrFix\_vs\_VTM\_low-QP.xlsm
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The screenshot displays the 'JVET Document Management System' interface. At the top, a dark blue header contains the system name and the subtitle 'Joint Video Experts Team'. Below the header, a light blue sidebar on the left lists navigation options: 'User' (highlighted with a dark blue background), 'Login', 'Create new user', 'Claim your password', and 'Contact'. The main content area has a light blue background and features a red title 'Preview document JVET-V0131'. Underneath, a section titled 'Document Information' is separated by a red horizontal line. This section includes the text 'Submitted by' followed by a link to 'Jens-Rainer Ohm', the title 'Title' followed by the text 'JVCGE: Finding the forward transform matrices for high bit depth coding', the authors 'Authors' followed by a link to 'V. Sotgiu', and the document name 'Document' followed by a link to 'JVET-V0131' and the text 'original document'. To the right of this section, the text 'Associated Resources' is visible. Below the 'Document Information' section, a red horizontal line precedes a 'Comments' section, which is currently empty. In the bottom right corner, there is a white rounded rectangle containing a QR code.

[http://vexpertise.stbit.ru/meeting-notes/source/meeting\\_22\\_v](http://vexpertise.stbit.ru/meeting-notes/source/meeting_22_v)

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## MEETING NOTES

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[JVET-V0131](#) AHG8: Fixing the forward transform matrices for high bit depth coding [K. Naser, F. Galpin, F. F. Le Léannec, P. De Lagrange (InterDigital)]

In High Bit-depth coding of VVC, the forward transform matrices are represented with higher precision than the standard coding. This modification is reported to alter the properties of DST-VII and DCT-VIII 4x4 transforms that leads to difference between matrix multiplication- and fast algorithm-based computation. This contribution proposes modifying these transform matrices such that both matrix multiplication and fast algorithm are identical and therefore restore the dual-implementation property.

The following experimental results of bdrate gain are reported:

### Low QP

- 0.00%, 0.00% and -0.01% in bdrateY in PQ, HLG and SVT in AI
- -0.01%, -0.01% and 0.00% in bdrateY in PQ, HLG and SVT in LDB
- X.XX%, X.XX% and X.XX% in bdrateY in PQ, HLG and SVT in RA

### Normal QP

- -0.07% and 0.00% in bdrateY in H1 and H2 in AI
- - 0.04% and X.XX% in bdrateY in H1 and H2 in RA

Presented in session 13 at 1405 UTC (chaired by JRO)

This does not have any impact on the spec, as the inverse transform does not require increased precision. It is however useful to have it in the software, as a reference for implementers.

Decision (SW): Adopt JVET-V0131

## CITATION

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K. Naser, F. Galpin, F. F. Le Léannec, P. De Lagrange, "AHG8: Fixing the forward transform matrices for high bit depth coding", JVET-V0131, 22nd Meeting: by teleconference, April 2021.

## REFERENCES

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1. [A. Browne, T. Ikai, D. Rusanovskyy, M. Sarwer, X. Xiu, "Common test conditions for high bit depth and high bit rate video coding", JVET-U2018, 21st Meeting: by teleconference, January 2021.](#)