

<i>Title:</i>	AHG Report: Software development and HM software technical evaluation	
<i>Status:</i>	Input Document to JCT-VC	
<i>Purpose:</i>	Ad-hoc group report	
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## Abstract

This report summarises the activities of the AhG on Software development and HM software technical evaluation that have taken place between the 10th and 11th JCT-VC meetings. Activities focused on integration of tools adopted at the 10th meeting into a common code base.

## Introduction

The mandates given to the AhG are as follows

- Coordinate development of the HM software and its distribution to JCT-VC members
- Produce documentation of software usage for distribution with the software
- Prepare and deliver HM 8.0 software version and the reference configuration encodings according to JCTVC-J1100 [1] based on common conditions suitable for use in most core experiments (expected within 3 weeks after the meeting).
- Prepare and deliver HM 8.1 software (and additional “dot” version software releases as appropriate) and appropriate software branches that include additional items not integrated into the 8.0 version (expected within three weeks after the 8.0 software release).
- Perform analysis and reconfirmation checks of the behaviour of technical changes adopted into the draft design, and report the results of such analysis.
- Suggest configuration files for additional testing of tools.
- Coordinate with HEVC Draft and Test Model editing AhG to identify any mismatches between software and text.

A brief summary of activities related to each mandate is given below.

1. Development of the software was co-ordinated with the parties needing to integrate changes. A single track of development was pursued. The distribution of the software was made available through the SVN servers set up at HHI and the BBC, as announced on the JCT-VC email reflector.
2. The HM user manual has been updated and a version controlled copy is now included in the doc directory of the repository. A PDF version has been produced and is included in the same location prior to each HM release.
3. Version 8.0 of the software was delivered to schedule and reference configuration encodings were provided according to the common test conditions through an ftp site hosted by the BBC.

<ftp://ftp.kw.bbc.co.uk/hevc/hm-8.0-anchors/>

4. Version 8.1 of the software was delivered ahead of the 10th JCT-VC meeting.

Table 1: HM-8.0 versus HM-7.0

(a) All Intra Main				(b) All Intra HE10			
	Y' BD-rate	U BD-rate	V BD-rate		Y' BD-rate	U BD-rate	V BD-rate
<b>Class A</b>	0.0%	0.5%	0.4%	<b>Class A</b>	3.5%	34.7%	23.8%
<b>Class B</b>	0.2%	0.3%	0.3%	<b>Class B</b>	2.1%	10.8%	6.6%
<b>Class C</b>	0.3%	0.3%	0.3%	<b>Class C</b>	2.4%	11.1%	12.9%
<b>Class D</b>	0.3%	0.1%	0.2%	<b>Class D</b>	1.2%	8.2%	9.0%
<b>Class E</b>	0.4%	0.2%	0.0%	<b>Class E</b>	2.4%	11.1%	12.4%
<b>Class F</b>	-6.6%	-6.2%	-6.7%	<b>Class F</b>	3.5%	10.1%	10.5%
<b>All (A-E)</b>	0.2%	0.3%	0.2%	<b>All (A-E)</b>	2.3%	15.2%	12.7%
<b>Enc. Time</b>		110%		<b>Enc. Time</b>		80%	
<b>Dec. Time</b>		101%		<b>Dec. Time</b>		90%	

  

(c) Random Access Main				(d) Random Access HE10			
	Y' BD-rate	U BD-rate	V BD-rate		Y' BD-rate	U BD-rate	V BD-rate
<b>Class A</b>	-0.1%	0.2%	-0.1%	<b>Class A</b>	4.3%	47.6%	35.7%
<b>Class B</b>	-0.2%	0.9%	0.1%	<b>Class B</b>	3.1%	16.7%	8.9%
<b>Class C</b>	-0.4%	0.2%	0.0%	<b>Class C</b>	2.4%	10.4%	10.7%
<b>Class D</b>	-0.9%	0.2%	-0.1%	<b>Class D</b>	2.6%	6.5%	5.9%
<b>Class F</b>	-6.6%	-6.1%	-6.7%	<b>Class F</b>	0.9%	9.3%	8.4%
<b>All (A-E)</b>	-0.4%	0.4%	0.0%	<b>All (A-E)</b>	3.1%	20.1%	14.9%
<b>Enc. Time</b>		105%		<b>Enc. Time</b>		101%	
<b>Dec. Time</b>		98%		<b>Dec. Time</b>		89%	

  

(e) Low delay B Main				(f) Low delay B HE10			
	Y' BD-rate	U BD-rate	V BD-rate		Y' BD-rate	U BD-rate	V BD-rate
<b>Class B</b>	-0.3%	0.3%	-0.5%	<b>Class B</b>	2.5%	12.6%	8.9%
<b>Class C</b>	-0.5%	0.0%	-0.1%	<b>Class C</b>	2.5%	8.1%	8.3%
<b>Class D</b>	-0.9%	0.2%	0.8%	<b>Class D</b>	1.3%	5.1%	4.0%
<b>Class E</b>	-0.5%	0.2%	-2.4%	<b>Class E</b>	3.2%	12.6%	13.1%
<b>Class F</b>	-6.7%	-6.4%	-6.2%	<b>Class F</b>	1.1%	6.5%	7.8%
<b>All (A-E)</b>	-0.5%	0.2%	-0.5%	<b>All (A-E)</b>	1.1%	6.5%	7.8%
<b>Enc. Time</b>		104%		<b>Enc. Time</b>		101%	
<b>Dec. Time</b>		99%		<b>Dec. Time</b>		90%	

## History of revisions

Multiple versions of the HM software were produced and announced on the JCT-VC email reflector. The following sections give a brief summary of the changes made for each version. A detailed history of all changes made to the software can be viewed at <http://hevc.kw.bbc.co.uk/trac/timeline>.

Released versions of the software are available on the SVN server at the following URL:

[https://hevc.hhi.fraunhofer.de/svn/svn\\_HEVCSoftware/tags/version\\_number](https://hevc.hhi.fraunhofer.de/svn/svn_HEVCSoftware/tags/version_number),

where version\_number corresponds to one of the versions described below (eg., HM-8.0). Intermediate code submissions can be found on a variety of branches available at:

[https://hevc.hhi.fraunhofer.de/svn/svn\\_HEVCSoftware/branches/branch\\_name](https://hevc.hhi.fraunhofer.de/svn/svn_HEVCSoftware/branches/branch_name),

where branch\_name corresponds to a branch (eg., HM-8.0-dev).

## Version 8.0

Version 8.0 was released on 7th August 2012. It includes all the changes adopted at the 10th JCT-VC meeting that affect the common test conditions[1]. This release was announced on the email reflector.

Table 1 shows the performance change since HM-7.0.

## Version 8.1

Version 8.1 was released on 2nd October 2012. It contains a number of bug fixes, cleanups and the adoptions from the 9th JCT-VC meeting that do not affect the common conditions. There is virtually no performance change between HM-8.0 and HM-8.1 under the common conditions.

This version also provides some previously missing high-level syntax functionality such as VUI support and Timing and Buffering SEI messages.

## Other branches

In addition to the regular HM development process, two branches were created to expose tools to a wider audience:

- HM-8.0-dev-ahg7, which contains contains modifications pertaining to non-4:2:0 chroma formats.
- HM-8.1-dev-ahg8, which contains contains modifications to the reference picture buffers and list construction.

## Recommendations

- Continue to develop reference software based on HM version 8.1 and improve its quality.
- Remove macros introduced in HM previous HM versions before starting integration towards HM 9.0 such as to make the software more readable
- Continue to identify bugs and discrepancies with text, and address them
- Test reference software more extensively outside of common test conditions
- Discuss future arrangements for hosting of JCT-VC issue tracker(s).

## References

- [1] F. Bossen, “Common test conditions and software reference configurations,” document JCTVC-J1100 of JCT-VC, Stockholm, Sweden, Jul. 2012.