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| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  27th Meeting: Hobart, AU, 31 March – 7 April 2017 | Document: JCTVC-AA0043\_r1 |

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| *Title:* | **Unified adaptive search range setting in HM and JEM** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | Tomohiro Ikai  Yukinobu Yasugi  1-9-2, Nakase, Mihama-ku, Chiba, Japan | Tel: Email: | +81-43-299-8526  ikai.tomohiro@sharp.co.jp yasugi.yukinobu@sharp.co.jp |
| *Source:* | Sharp Corporation | | |

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# Abstract

In HM CTC, the adaptive search range with 64 and 256 in minimum search range and maximum search range respectively. In JEM CTC, constant search range with 256 and 25ea6 is used. This proposal is related to JVET-F0044, which proposes adaptive search range usage in JEM. In this contribution, it is suggested to consider the possibility of the unified (same) adaptive search range in both HM and JEM, pending the decision of JVET, which will revisits JVET-F0044 in terms of JEM and HM results. The suggested range is 96\_384 (min\_max range).

In HM 16.15, the suggested range of 96\_384 shows 0.06 % bdrate gain with 6 % encoding time increase (anchor is 64\_256 range), up to 0.99 % bdrate gain in Rollercoaster.

In HM 16.15, the suggested range of 96\_384 shows 0.02 % bdrate gain with 7 % encoding time reduction (anchor is 256\_256 range)

In JEM 5.0.1, the suggested range of 96\_384 shows 0.05 % bdrate gain with 2 % encoding time reduction (anchor is 256\_256 range)

It is asserted that although the suggested range may be not a very good trade-off which needs 6 % encoding time increase with a little gain but the impact is large in 4K sequences in class A2. In addition, the authors also consider the following points.

* With the suggested range, both HM and JEM shows encoding time reduction and coding gain when compared to the current JEM CTC (So clearly better than the current JEM CTC). Other search ranges, e.g. the current HM CTC of 64\_256, shows performance loss which is asserted not negligible in terms of JEM development.
* 4K CTC test sequences can be changed in the future and a number of unknown 4K sequences can be tested with HM and JEM in other tests and occasions. Thus a larger range would be safer.
* The suggested range is kind of between (better than between) the current HM CTC range and JEM CTC range. Thus the impact of changes would be minimum compared to use of either HM CTC range or JEM CTC range.

# HM results

The parameters of 128\_256, 256\_256, 96\_384, 64\_512 (min\_max range) were tested. And we suggest the range of 96\_384 for a unified adaptive search range.

In HM 16.15, as Figure 1, the blue curve (adaptive search range) shows better performance encoding time balance compared to the constant range (256\_256) of JEM CTC. The suggested point of 96\_384 shows 0.02 % bdrate gain with 7 % encoding time reduction.

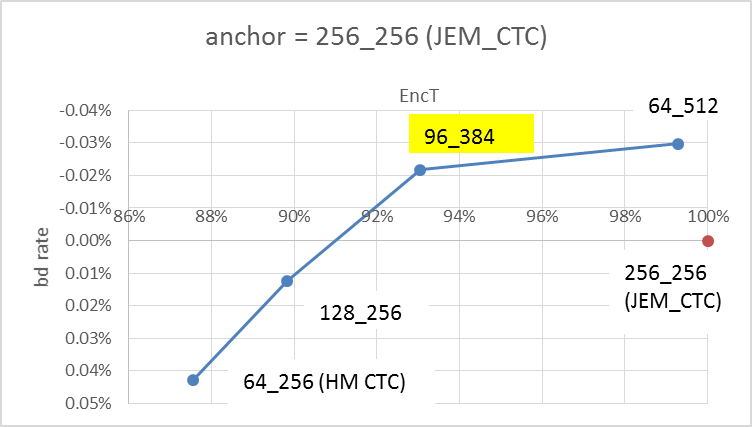
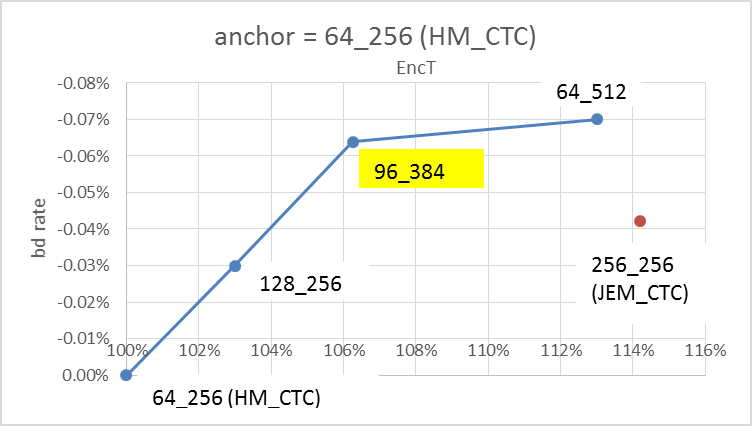
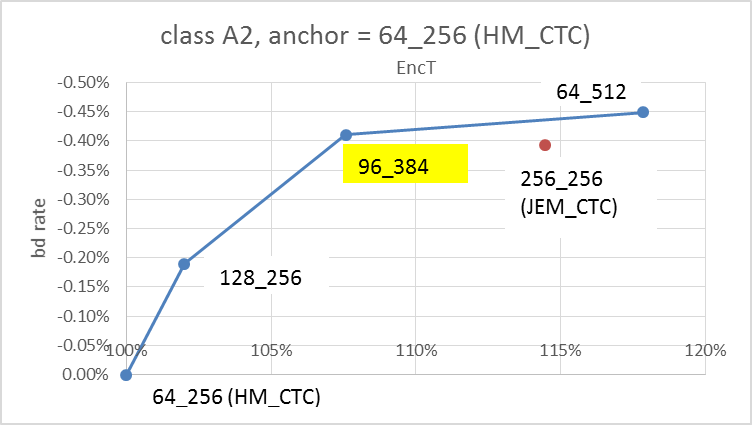


Figure 1. Performance and encoding time relationship in RA10 (anchor is JEM CTC of 256\_256)

With the same data, we can look it in other way. If compared to HM CTC(64\_256), the suggested point shows 0.06% coding gain with 6% encoding time reduction.

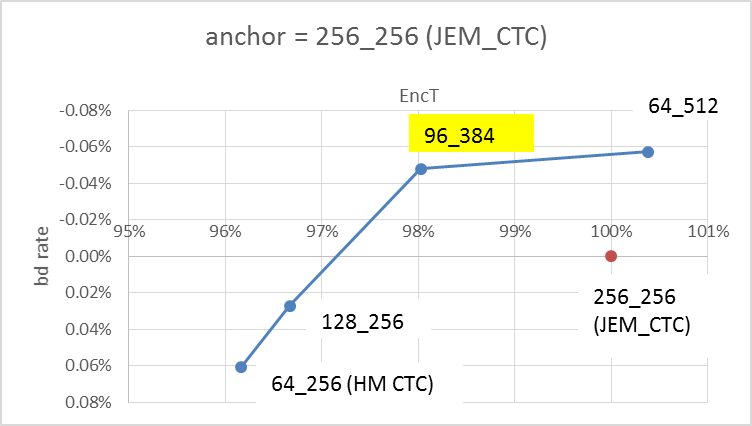


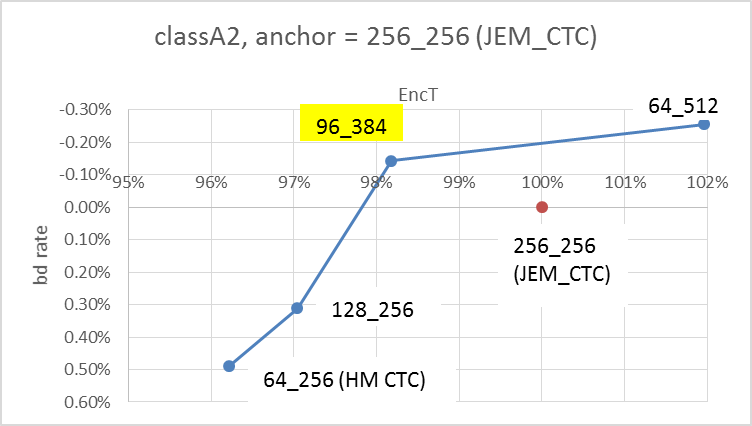
The gain of the search range looks small on all average where class A1, A2, B, C, D are included. However if we look at class A2 which is a set of 4K sequences with relatively large motion, i.e. TrafficFlow and RollerCoaster, the impact is not small.



# JEM results

In JEM 5.0.1, the suggested range of 96\_384 shows clearly better performance and encoding time balance, i.e. 0.06 % bdrate gain with 2 % encoding time reduction. And if we look at class A2, the suggested range shows 0.14 % bdrate gain with 2 % encoding time reduction.





# Experimental results

96\_384 / RandomAccess Main10 / HM16.15

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Over HM-16.15 64\_256 (parallel, Sharp)** | | | | |
|  | Y | U | V | EncT | DecT |
| Class A1 | -0.02% | 0.00% | -0.06% | 111% | 99% |
| Class A2 | -0.41% | -0.43% | -0.49% | 108% | 98% |
| Class B | 0.03% | 0.08% | 0.03% | 105% | 99% |
| Class C | 0.04% | 0.04% | 0.11% | 105% | 98% |
| Class D | 0.02% | -0.01% | 0.00% | 103% | 100% |
| Class E |  |  |  |  |  |
| **Overall (Ref)** | -0.06% | -0.06% | -0.08% | 106% | 99% |
| Class F (optional) | -0.13% | -0.20% | -0.20% | 104% | 97% |

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| --- | --- | --- | --- | --- | --- |
|  | **Over HM-16.15 256\_256 (parallel, Sharp)** | | | | |
|  | Y | U | V | EncT | DecT |
| Class A1 | 0.02% | 0.03% | 0.07% | 86% | 100% |
| Class A2 | -0.02% | 0.04% | -0.02% | 94% | 101% |
| Class B | -0.01% | -0.03% | -0.04% | 94% | 100% |
| Class C | -0.05% | -0.07% | -0.04% | 93% | 101% |
| Class D | -0.05% | -0.05% | -0.01% | 98% | 105% |
| Class E |  |  |  |  |  |
| **Overall (Ref)** | -0.02% | -0.02% | -0.01% | 93% | 101% |
| Class F (optional) | 0.15% | 0.05% | 0.06% | 92% | 100% |

96\_384 / RandomAccess Main 10 / JEM 5.0.1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Over HM-16.6-JEM-5.0.1 (parallel, Sharp)** | | | | |
|  | Y | U | V | EncT | DecT |
| Class A1 | -0.04% | -0.18% | -0.06% | 96.3% | 101.9% |
| Class A2 | -0.14% | -0.26% | -0.37% | 98.2% | 101.0% |
| Class B | -0.01% | 0.15% | 0.04% | 98.3% | 103.7% |
| Class C | -0.02% | 0.09% | 0.02% | 98.7% | 99.6% |
| Class D | -0.04% | -0.01% | -0.08% | 98.5% | 100.0% |
| Class E |  |  |  |  |  |
| **Overall (Ref)** | -0.05% | -0.03% | -0.08% | 98.0% | 101.3% |
| Class F (optional) | #VALUE! | #VALUE! | #VALUE! | #NUM! | #NUM! |

# Conclusion

The adaptive search range of 96\_384 is suggested to unify the adaptive search range between JEM and HM.

In HM, the suggested range shows 0.10 % bdrate gain with 6 % encoding time reduction (anchor is 64\_256 range)

In JEM, the suggested range shows 0.06 % bdrate gain with 2 % encoding time reduction (anchor is 256\_256 range)

# Patent rights declaration(s)

**Sharp Corporation may have current or pending patent rights relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**