

JCTVC-E219: Robust solution for the AMVP parsing issue

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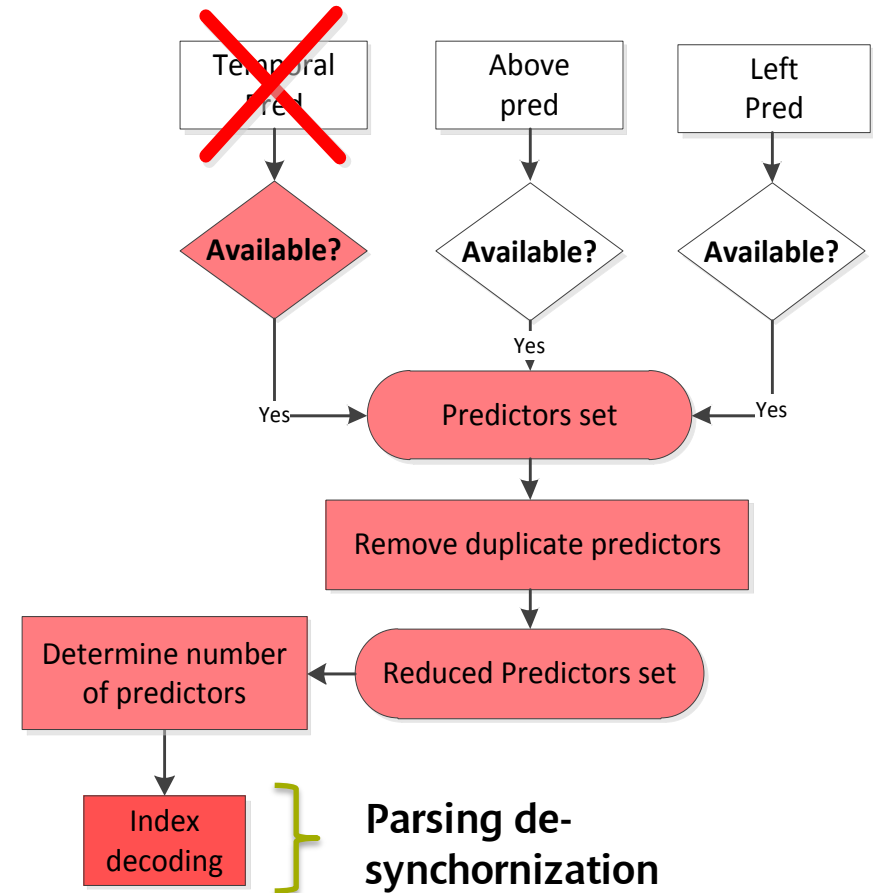
Introduction

- **Adaptive Motion Vectors Predictors (AMVP) scheme significantly improves the Inter modes:**
 - The efficiency comes from a variety of motion vector predictors which are competing with the RD criterion
- **To limit the predictor index signaling, the index coding depends on the number of predictors in the set where the duplicate candidates were removed.**
 - This offers an efficient use of bits dedicated to the predictor index
 - The predictor index could be inferred if all predictors were equal
- **This particular index signaling generates a parsing issue in case of loss and increases the parsing complexity compared to the previous standard.**

Parsing problems

- Parsing issue:
 - The amount of predictors in the set depends on data which come from **another slice**:
 - This causes de-synchronization between encoder and decoder in case of loss
- Parsing complexity:
 - All predictors need to be computed and the full motion vectors field needs to be entirely decoded to parse the bitstream
 - This complexity increase is related to every predictors (spatial and temporal)

HM2.0 Parsing process



Proposal

- Tool 1: Systematic temporal predictor...
 - The temporal predictor is always in the set of predictors even if it is not available.
 - For spatial predictors, the same HM2.0 derivation process is used
 - But the duplicate candidates are not taken into account to determine the number of predictors in the set

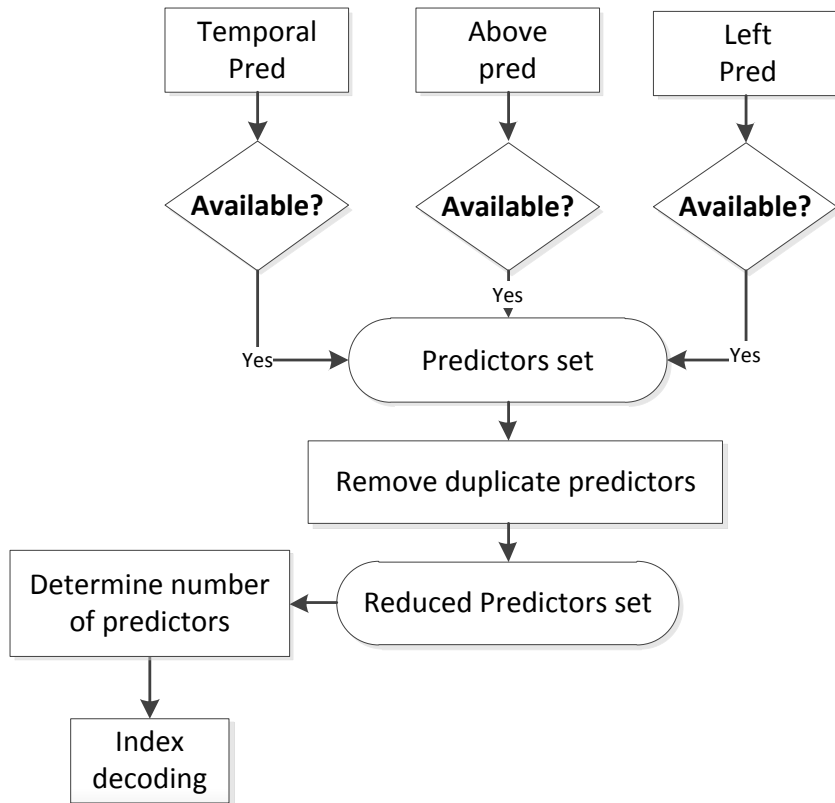


The amount of predictors in the set only depends data which come from the **CURRENT** slice

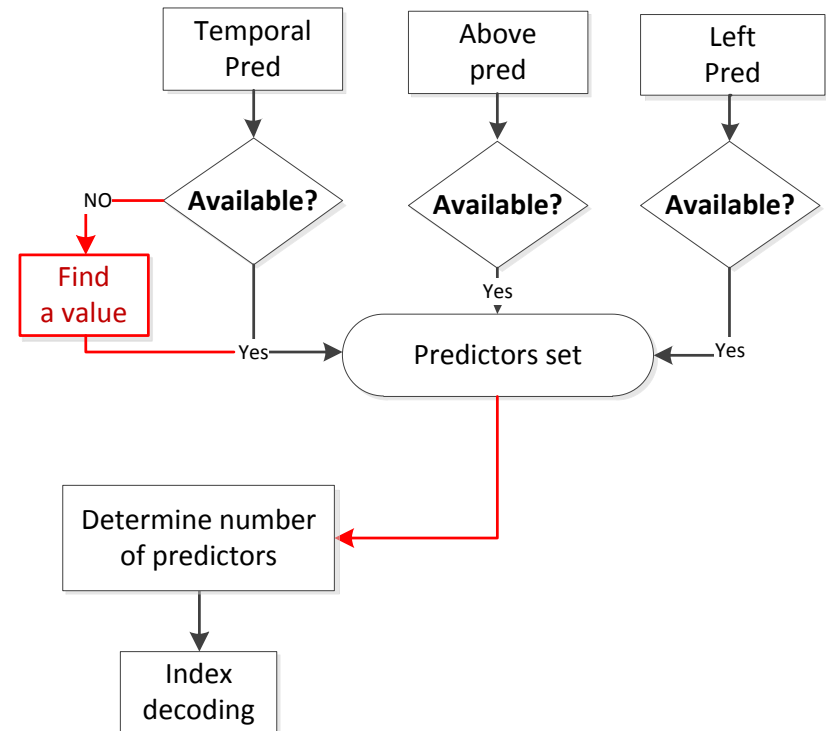
- Tool 2: Replacement of redundant candidates
 - To limit the impact of tool 1 on the index signaling, the duplicate candidates are changed by non duplicate candidates in order to efficiently use all the bits inserted in the bitstream.

Predictor index parsing: HM2.0 vs Tool 1

HM2.0

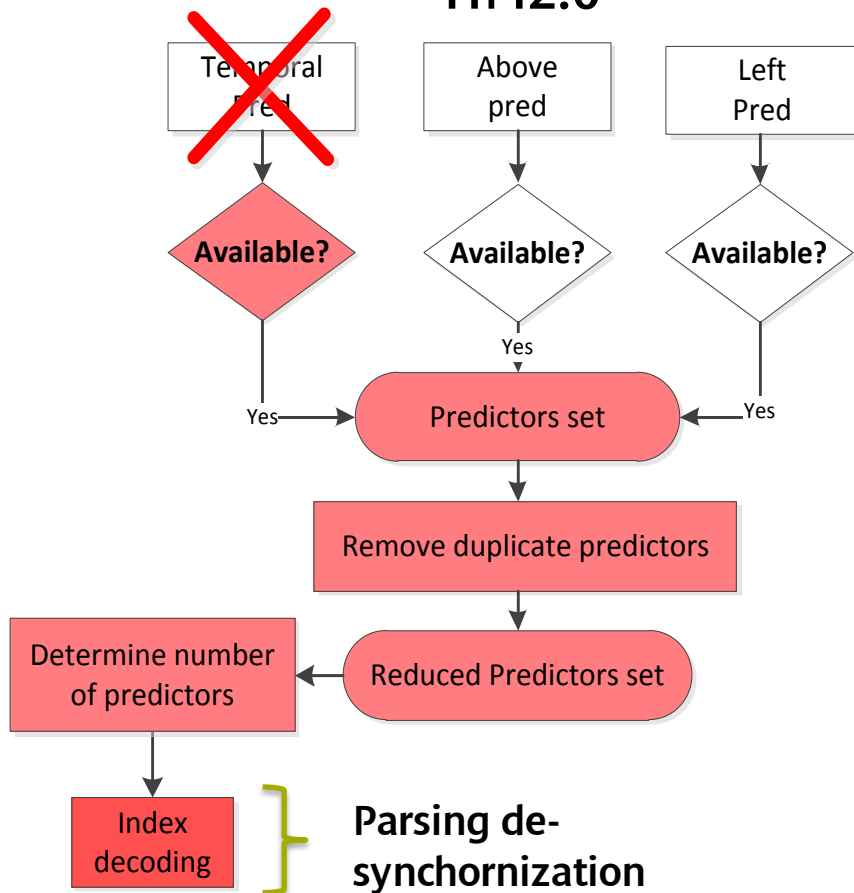


Tool 1

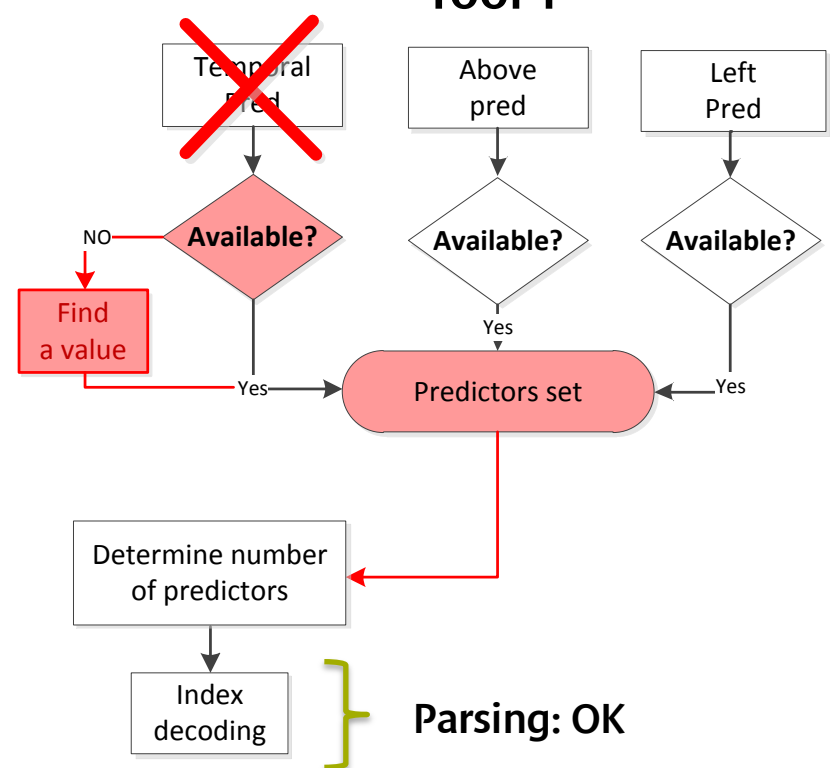


Predictor index parsing: HM2.0 vs Tool 1

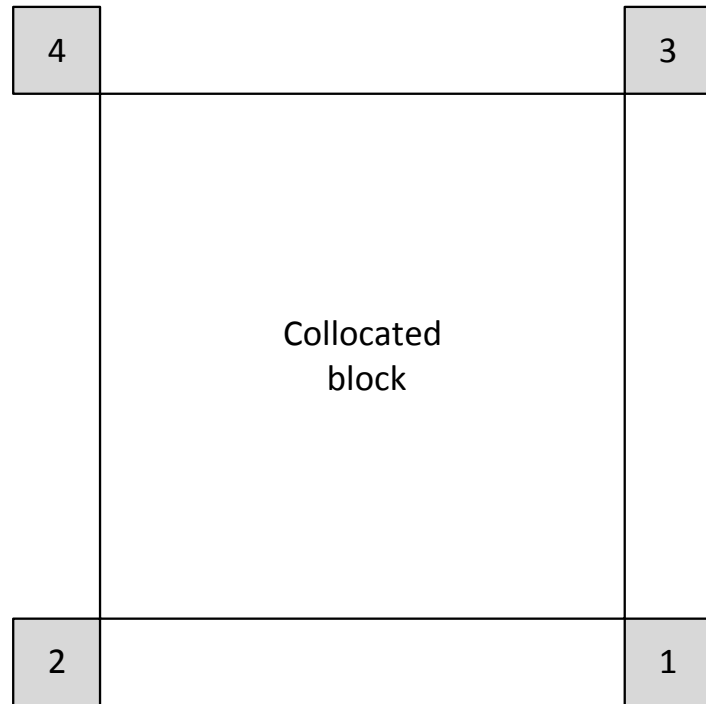
HM2.0



Tool 1



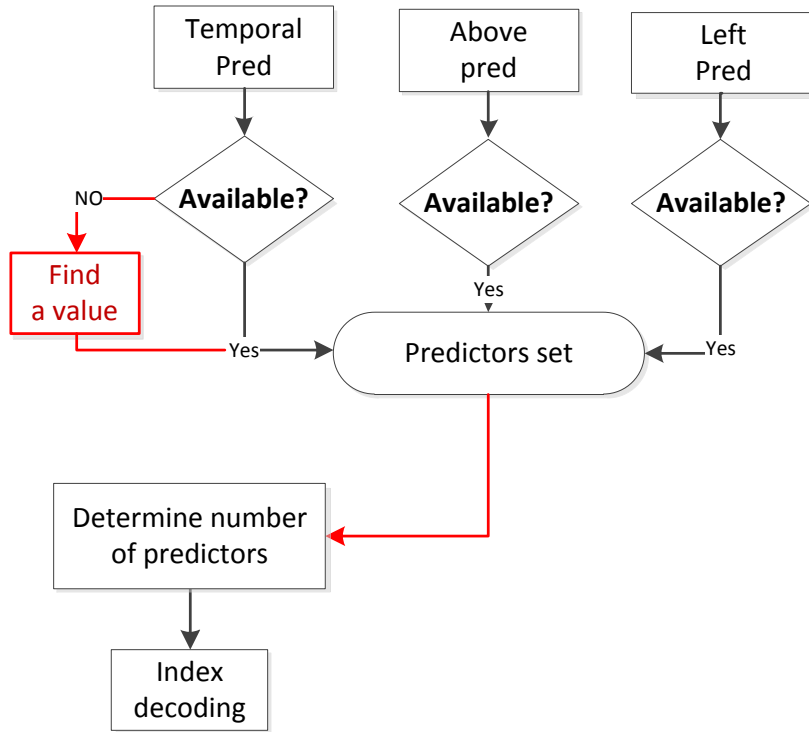
Tool 1: Temporal derivation process



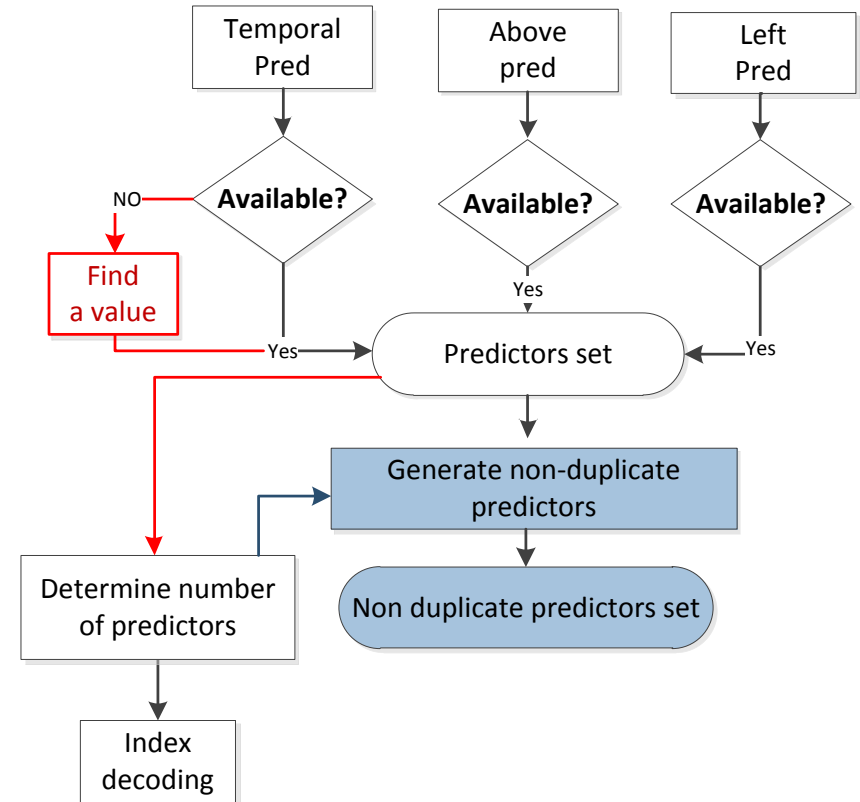
- Temp MV can be equal to:
 - Collocated
 - 1: Bottom right corner
 - 2: Bottom left corner
 - 3: Top right corner
 - 4: Top left corner
 - (0,0)
- But it is allways in the set

Tool 1 + Tool2

Tool 1

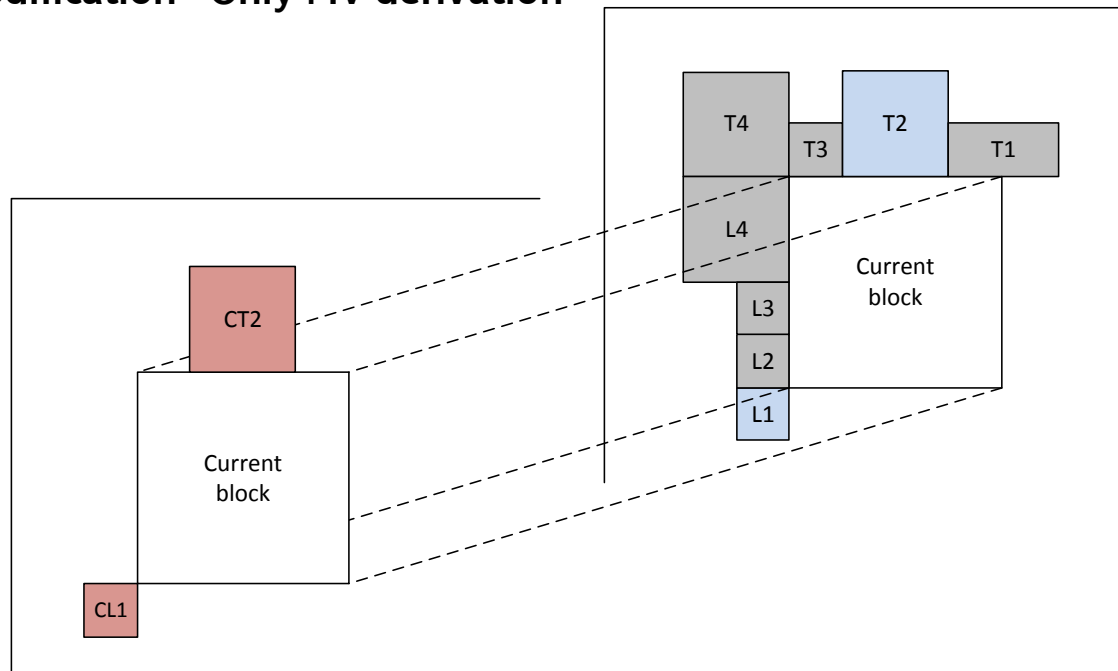


Tool 1 + Tool 2



Tool 2: Replacement of redundant candidates

- Aim: Use efficiently the bits dedicated to the predictor index
- The value of the duplicate candidates are changed by non-duplicate values
 - For AMVP, only the spatial predictor are checked.
 - The non duplicate values are selected among neighbor spatio/temporal MV
 - No parsing modification –Only MV derivation



Experimental Results

Configuration	Tool 1 Forced temporal	Tool 2 Redundant cands replacement		Average BD-rate	Average BD-rate Wo Class E	Enc time variation	Dec time variation
		Inter + Skip	Merge				
1	✓			1.3%	1.0%	101%	100%
2	✓	✓		0.8%	0.6%	104%	102%
3	✓	✓	✓	0.4%	0.2%	109%	105%

- Cross-checked by INRIA JCTVC-E261: Configuration 1 and 3

Experimental Results: Additional Results

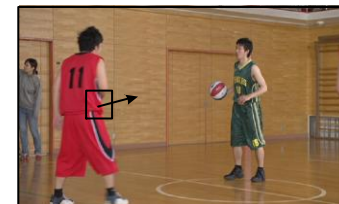
- Proposed Scheme + JCTVC-E221 on memory compression (ratio 52x)

Configuration	Tool 1 Forced temporal	Tool 2 Redundant cands replacement		Average BD-rate	Average BD-rate Wo Class E	Enc time variation	Dec time variation
		Inter + Skip	Merge				
1	✓			0.9%	0.6%	99%	98%
-	-	-	-	-	-	-	-
3	✓	✓	✓	0.0%	-0.2%	109%	105%

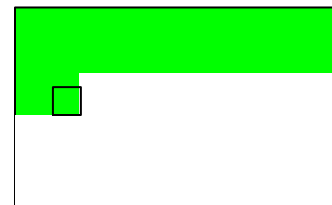
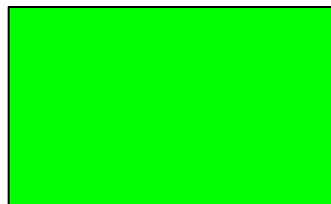
Parsing Check

- Re-initialization of the reference frames:
 - MV,
 - Refindexes
 - Modes
 - Pixel values
 - CU/PU partitioning
 - Slice header
 - Etc.
- Except POC (Same issue in H.265/AVC)

Decoding process



Parsing check



Cross-checked by INRIA
JCTVC-E261

Canon



All bitstreams are fully parsed

Conclusion

- **Proposed solutions**
 - Solve parsing issue
 - Reduce parsing complexity
- **Tool 1**
 - Same spatial derivation process as HM2.0
 - Simple modifications
 - Small impact on coding complexity
- **Tool 2**
 - Reduce the impact on coding efficiency
 - The complexity can be reduced at encoder and decoder side
 - Only an MV derivation process
 - Further coding efficiency and complexity reduction are expected

Propose to adopt tool 1 in the HM design
And to study tool 2 in a CE

ANNEX: more detailed results

Results Tool 1 - Configuration 1

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.5	0.4	0.2	0.6	0.1	0.0
Class B	0.7	0.5	0.4	1.1	0.6	0.6
Class C	0.7	0.5	0.6	0.9	0.6	0.6
Class D	0.8	0.7	0.6	1.0	0.6	0.7
Class E						
All	0.7	0.5	0.4	0.9	0.5	0.5
Enc Time[%]	101%			102%		
Dec Time[%]	99%			101%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	1.2	1.0	0.9	1.6	0.6	0.8
Class C	1.1	1.0	1.0	1.2	0.6	0.4
Class D	1.2	0.8	0.6	1.3	0.4	0.2
Class E	2.2	1.8	1.9	5.8	4.2	4.6
All	1.4	1.1	1.0	2.2	1.2	1.3
All – {Class E}	1.1	1.0	0.9	1.4	0.7	0.7
Enc Time[%]	100%			101%		
Dec Time[%]	100%			99%		

Average	
Y BDRarte	1.3%
Y BDRate – {Class E}	1.0%
Enc Times	101%
Dec Time	100%

Results Tool 1 + Tool 2 - Configuration 2

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.3	0.2	0.0	0.0	-0.1	-0.3
Class B	0.5	0.3	0.3	0.7	0.4	0.4
Class C	0.5	0.4	0.4	0.5	0.3	0.3
Class D	0.7	0.4	0.4	0.7	0.2	0.3
Class E						
All	0.5	0.3	0.2	0.5	0.2	0.2
Enc Time[%]	104%			106%		
Dec Time[%]	102%			103%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	1.0	0.6	0.3	0.5	0.2	0.5
Class C	0.7	0.6	0.6	0.4	0.0	0.0
Class D	0.8	0.8	0.5	0.7	0.4	0.4
Class E	1.8	1.0	1.6	4.3	3.6	4.0
All	1.0	0.7	0.7	1.2	0.8	1.0
All – {Class E}	0.8	0.6	0.9	0.5	0.2	0.3
Enc Time[%]	102%			104%		
Dec Time[%]	101%			103%		

Average	
Y BDRarte	0.8%
Y BDRate – {Class E}	0.6%
Enc Times	104%
Dec Time	102%

Results Tool 1 + Tool 2 - Configuration 3

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.1	0.1	-0.1	-0.3	-0.4	-0.3
Class B	0.2	0.1	0.1	0.3	0.2	0.2
Class C	0.2	0.0	-0.1	0.3	0.0	0.0
Class D	0.4	0.2	0.2	0.5	0.2	0.1
Class E						
All	0.2	0.1	0.0	0.2	0.0	0.0
Enc Time[%]	110%			110%		
Dec Time[%]	104%			107%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.4	0.2	0.0	-0.1	-0.3	0.1
Class C	0.4	0.3	-0.1	0.0	-0.2	-0.4
Class D	0.5	0.4	0.3	0.3	-0.3	-0.3
Class E	1.3	1.0	1.8	3.8	3.2	4.2
All	0.6	0.4	0.4	0.8	0.4	0.7
All – {Class E}	0.3	0.2	-0.1	0.0	-0.3	-0.1
Enc Time[%]	107%			107%		
Dec Time[%]	104%			105%		

Average	
Y BDRarte	0.4%
Y BDRate – {Class E}	0.2%
Enc Times	109%
Dec Time	105%

Results Tool 1 - Configuration 1 + JCTVC-E221

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.4	0.3	0.1	0.5	0.1	0.2
Class B	0.3	0.2	0.1	0.9	0.5	0.4
Class C	0.0	0.0	0.0	0.4	0.2	0.3
Class D	0.1	-0.1	-0.2	0.6	0.1	0.2
Class E						
All	0.2	0.1	0.0	0.6	0.3	0.3
Enc Time[%]	99%			100%		
Dec Time[%]	100%			98%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.9	0.7	0.5	1.3	0.4	0.4
Class C	0.6	0.6	0.4	0.6	0.1	-0.2
Class D	0.7	0.2	0.4	0.8	0.0	0.1
Class E	1.5	1.4	2.2	5.2	3.3	4.0
All	0.9	0.7	0.8	1.7	0.8	0.8
All-{Class E}	0.7	0.5	0.4	0.9	0.2	0.1
Enc Time[%]	99%			99%		
Dec Time[%]	98%			98%		

Average	
Y BDRarte	0.9%
Y BDRate - {Class E}	0.6%
Enc Times	99%
Dec Time	98%

Results Configuration 3 + JCTVC-E221

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.1	-0.1	-0.3	-0.3	-0.3	-0.4
Class B	-0.2	-0.2	-0.2	0.1	0.1	0.1
Class C	-0.4	-0.5	-0.5	-0.2	-0.4	-0.3
Class D	-0.4	-0.5	-0.6	0.0	-0.3	-0.3
Class E						
All	-0.2	-0.3	-0.4	-0.1	-0.2	-0.2
Enc Time[%]	110%			110%		
Dec Time[%]	102%			106%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	-0.1	-0.1	-0.4	-0.5	-0.2
Class C	-0.2	-0.5	-0.6	-0.6	-0.7	-1.0
Class D	0.0	0.2	-0.4	-0.3	-0.5	-0.3
Class E	0.7	0.6	0.9	3.3	3.1	3.8
All	0.1	0.0	-0.1	0.3	0.1	0.3
All -{Class E}	-0.1	-0.1	-0.3	-0.4	-0.5	-0.5
Enc Time[%]	108%			106%		
Dec Time[%]	104%			107%		

Average	
Y BDRarte	0.0%
Y BDRate - {Class E}	-0.2%
Enc Times	109%
Dec Time	105%