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**Information technology — MPEG video  
technologies —**

**Part 4:  
Video tool library**

*Technologies de l'information — Technologies vidéo MPEG —  
Partie 4: Bibliothèque d'outils vidéo*

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Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
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Published in Switzerland

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## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 23002-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 23002 consists of the following parts, under the general title *Information technology — MPEG video technologies*:

- *Part 1: Accuracy requirements for implementation of integer-output 8×8 inverse discrete cosine transform*
- *Part 2: Fixed-point 8×8 inverse discrete cosine transform and discrete cosine transform*
- *Part 3: Representation of auxiliary video and supplemental information*
- *Part 4: Video tool library*

## Introduction

This part of ISO/IEC 23002 defines the MPEG video tool library, which contains tools drawn from existing MPEG coding standards, such as ISO/IEC 14496-2 and ISO/IEC 14496-10, and ISO/IEC 23001-4 defines the methods capable of describing codec configurations in the reconfigurable video coding (RVC) framework.

This part of ISO/IEC 23002 primarily addresses reconfigurable video aspects and will only focus on the description of representation of video codec configurations under the RVC framework, but could be extended to a more generic reconfigurable media coding (RMC) framework.

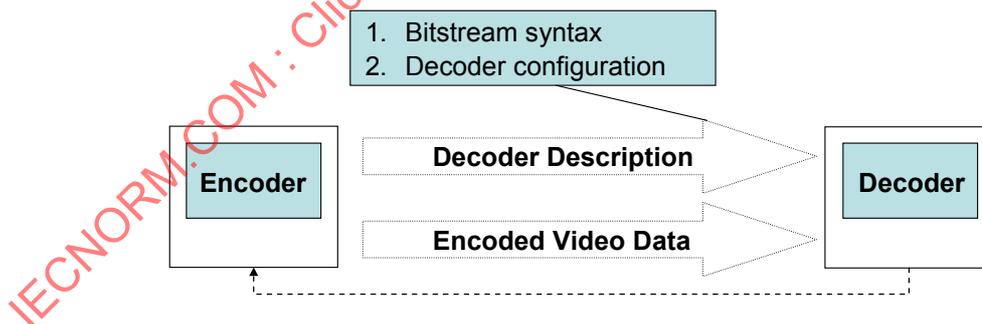
The objective of RVC is to offer a framework that is capable of configuring and specifying video codecs as a collection of “higher level” modules by using video coding tools. The video coding tools are defined in video tool libraries. This part of ISO/IEC 23002 defines the MPEG video tool library. The RVC framework principle could also support non-MPEG tool libraries, provided that their developers have taken care to obey the appropriate rules of operation.

For the purpose of framework deployment, an appropriate description is needed to describe configurations of decoders composed of or instantiated from a subset of video tools from either one or more libraries. As illustrated in Figure 1, the configuration information consists of

- bitstream syntax description, and
- network of functional units (FUs) description (also referred to as the decoder configuration)

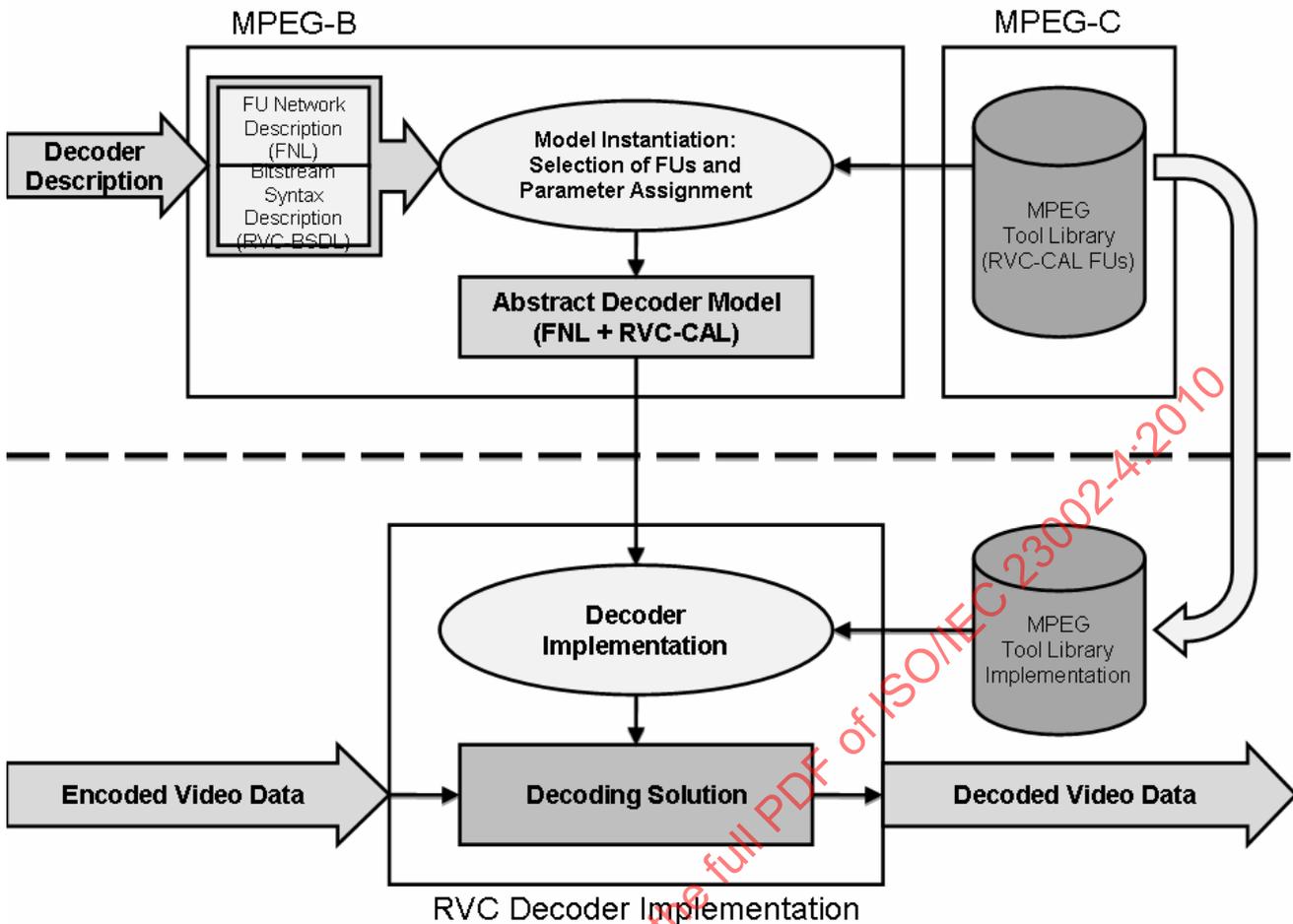
that together constitute the entire decoder description.

Bitstreams of existing MPEG standards are specified by specific syntax structures and decoders are composed of various coding tools. Therefore, RVC includes support for bitstream syntax descriptions as well as video coding tools. As depicted in Figure 1, a typical RVC decoder requires two types of information, namely the decoder description and the encoded media (e.g. video bitstreams) data.



**Figure 1 — Conceptual diagram of RVC**

A more detailed description of the RVC decoder is illustrated in Figure 2. As shown in Figure 2, the decoder description is required for the configuration of a RVC decoder. The Bitstream Syntax Description (BSD) and FU Network Description (FND) (which compose the Decoder Description) are used to configure or compose an abstract decoder model (ADM) which is instantiated through the selection of FUs from tool libraries optionally with proper parameter assignment. Such ADM constitutes the behavioral reference model used in setting up a decoding solution under the RVC framework. The process of yielding a decoding solution may vary depending on the technologies used for the desired implementations. Examples of the instantiation of an ADM and generation of proprietary decoding solutions can be found in ISO/IEC 23001-4.



**Figure 2 — Graphical representation of the process for setting up a decoding solution under the RVC framework**

Within the RVC framework, the decoder description describes a particular decoder configuration and consists of the FND and the BSD. The FND describes the connectivity of the network of FUs used to form a decoder whereas the parsing process for the bitstream syntax is implicitly described by the BSD. These two descriptions are specified using two standard XML-based languages or dialects:

- Functional unit network language (FNL) is a language that describes the FND, known also as “network of FUs”. The FNL specified normatively within the scope of the RVC framework is provided in ISO/IEC 23001-4.
- Bitstream syntax description language (BSDL), standardized in ISO/IEC 23001-5 (MPEG-B Part 5), describes the bitstream syntax and the parsing rules. A pertinent subset of this BSDL named RVC-BSDL is defined within the scope of the current RVC framework. This RVC-BSDL also includes possibilities for further extensions, which are necessary to provide complete description of video bitstreams. RVC-BSDL specified normatively within the scope of the RVC framework is provided in ISO/IEC 23001-4.

The decoder configuration specified using FNL, together with the specification of the bitstream syntax using RVC-BSDL fully specifies the ADM and provides an “executable” model of the RVC decoder description.

The instantiated ADM includes the information about the selected FUs and how they should be connected. As already mentioned, the FND with the network connection information is expressed by using FNL. Furthermore, the RVC framework specifies and uses a dataflow-oriented language called RVC-CAL for describing FUs’ behavior. The normative specification of RVC-CAL is provided in ISO/IEC 23001-4. The ADM is the behavioral model that should be referred to in order to implement any RVC conformant decoder. Any RVC compliant

decoding solution/implementation can be achieved by using proprietary non-normative tools and mechanisms that yield decoders that behave equivalent to the RVC ADM.

The decoder description, the MPEG tool library, and the associated instantiation of an ADM are normative. More precisely, the ADM is intended to be normative in terms of a behavioral model. In other words what is normative is the input/output behavior of the complete ADM as well as the input/output behavior of all the FUs that are included in the ADM.

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# Information technology — MPEG video technologies —

## Part 4: Video tool library

### 1 Scope

This part of ISO/IEC 23002 defines the description of the MPEG video tool library (VTL) based on the decoder description specified in ISO/IEC 23001-4. This tool library defines the specification of FUs, which are sufficient to build complete decoding solutions according to the following coding standards:

- ISO/IEC 14496-2 (MPEG-4 Simple Profile), and
- ISO/IEC 14496-10 (MPEG-4 AVC Constrained Baseline Profile).

The objective of ISO/IEC 23001-4 is to define the general framework principles, and this part of ISO/IEC 23002 defines the MPEG VTL that includes relevant tools (or FUs) from the existing MPEG coding standards. Each FU is defined in the form of a textual description, which can be found in 4.1. The input and output behavior follows the conventions described in Clause 5 (general-purpose FUs), Clause 6 (MPEG-4 FUs), and Clause 7 (MPEG-4 AVC FUs).

This part of ISO/IEC 23002 compliant implementations can be designed using any software or hardware language and components. The reference software for the textual specification of FUs is written in RVC-CAL language of which a formal syntax is provided in ISO/IEC 23001-4, and which will be defined in Amendment 1 to ISO/IEC 23002-4.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14496-2:2004, *Information technology — Coding of audio-visual objects — Part 2: Visual*

ISO/IEC 23001-4, *Information technology — MPEG systems technologies — Part 4: Codec configuration representation*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23001-4 apply.

## 4 FU description convention

### 4.1 FU interfaces

As shown in Table 1, each FU is described with the following elements;

- **FU Name:** Name to represent the functional unit in this specification. The name of the FU is normative and follows the naming convention described in Annex A.
- **Description:** Textual explanation to describe the functionality of the FU. The description must be concise. The precise normative behaviour of the algorithm (input/output, timing etc.) is specified by the the RVC-CAL reference code in Amendment 1.
- **Profiles@levels supported:** The profiles@level supported for this functional unit. It may append that a given range of values makes the FU behave for a given profile@level and another range of values makes the FU behave for another profile@level.
- **Input:** A token that is entering the FU through the designated input port. The token type refers to the token pool described in 4.3. The 'name' field indicates the input port.
- **Output:** A token that is coming out of the FU through the designated output port. The 'name' field indicates the output port.
- **Parameter (optional):** Parameters are optionally described to adjust the behavior of the FU. All the parameters must be specified with name, description and range.

**Table 1 — Template of description of an FU (example)**

<b>FU Name</b>	e.g. Algo_IDCT2D_ISOIEC_23002_1	
<b>Description</b>	<p>e.g. This module computes the 8x8 Inverse Discrete Cosine Transform (IDCT) defined as</p> $f(x, y) = \frac{2}{N} \sum_{u=0}^{N-1} \sum_{v=0}^{N-1} C(u)C(v)F(u, v) \cos \frac{(2x+1)u\pi}{2N} \cos \frac{(2y+1)v\pi}{2N}$ <p>with <math>u, v, x, y = 0, 1, 2, \dots, N-1</math>          where <math>x, y</math> are spatial coordinates in the sample domain  <math>u, v</math> are coordinates in the transform domain</p> $C(u), C(v) = \begin{cases} \frac{1}{\sqrt{2}} & \text{for } u, v = 0 \\ 1 & \text{otherwise} \end{cases}$ <p>It inputs a list of 64 coefficients and outputs a list of 64 decoded coefficients.</p>	
<b>Profiles@levels supported</b>	e.g. MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
e.g. X	e.g. BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
e.g. Y	e.g. BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

## 4.2 FU IDs

FU of the specific functionality is identified by its unique identification number. Table 2 lists IDs and names of all FUs in VTL. IDs and names are used in FND to select FUs.

**Table 2 — List of FUs and their IDs**

ID	FU Name
1	Algo_SynP_Generic
2	Algo_MVR_MedianOfThreeLeftAndTopAndTopRight
3	Algo_MVSequence_LeftAndTopAndTopRight
4	Mgnt_Splitter_420_TYPE
5	Algo_VLDtableB6_MPEG4Part2
6	Algo_VLDtableB7_MPEG4Part2
7	Algo_VLDtableB8_MPEG4Part2
8	Algo_VLDtableB12_MPEG4Part2
9	Algo_VLDtableB13_MPEG4Part2
10	Algo_VLDtableB14_MPEG4Part2
11	Algo_VLDtableB15_MPEG4Part2
12	Algo_VLDtableB16_MPEG4Part2
13	Algo_VLDtableB17_MPEG4Part2
14	Algo_IQ_QSAndQmatrixMp4vOrH263Scaler
15	Algo_DCRAddr_ThreeLeftTop_8x8
16	Algo_DCRAddr_ThreeLeftTop_16x16
17	Algo_DCRInvPred_CHROMA_8x8
18	Algo_DCRInvPred_LUMA_16x16
19	Algo_IS_ZigzagOrAlternateHorizontalVertical_8x8
20	Algo_IAP_AdaptiveHorizontalOrVerticalPred_8x8
21	Algo_IAP_AdaptiveHorizontalOrVerticalPred_16x16
22	Algo_IDCT2D_ISOIEC_23002_1
23	Mgnt_DCSplit
24	Mgnt_FBMgnt_FBAddr
25	Algo_PictureReconstruction_Saturation
26	Algo_Interp_HalfpelBilinearRoundingControl
27	Algo_NALU FU
28	Algo_Synp_AVC FU
29	Algo_BlockExpand_AVC FU
30	Algo_BlockSplit_AVC FU
31	Algo_IntraPred_Split FU
32	Algo_IS_Zigzag_4x4 FU
33	Algo_DCR_Hadamard_LUMA_IHT1d FU
34	Algo_Transpose4x4 FU
35	Algo_DCR_Hadamard_LUMA_Reordering FU
36	Algo_DCR_Hadamard_LUMA_Scaling FU
37	Algo_DCR_Hadamard_CHROMA FU
38	Algo_IT4x4_1d FU
39	Algo_IT4x4_Addshift FU
40	Algo_IntraPred_LUMA_16x16 FU
41	Algo_IntraPred_LUMA_4x4 FU
42	Algo_Merge_4x4_to_16x16 FU
43	Algo_IQ_QSAndSLAndIDCTScaler_4x4 FU
44	Mgnt_IQ_INTRA16x16 FU
45	Mgnt_Select_3

46	Algo_Merge_4x4_to_8x8 FU
47	Algo_IntraPred_Add FU
48	Algo_IntraPred_CHROMA FU
49	Mgnt_IntraMgnt_Intra4x4
50	Mgnt_IQ_Chroma FU
51	Mgnt_DBF FU
52	Algo_DBF_AdaptiveFilter_AVC FU
53	Algo_Interp_EighthPelBilinear FU
54	Algo_Interp_SeparableSixTapQuarterPelAVC FU
55	Algo_Interp_split_MB FU
56	Algo_Interp_split_MB_C FU
57	Algo_MVR_MultiFrameAdaptive FU
58	Mgnt_DPB_without_adaptiveFilter FU
59	Mgnt_Buffer_Neighbor_FullMb FU
60	Mgnt_Buffer_Neighbor_4x4 FU
61	Algo_MMCO
62	Mgnt_FBAddr_Chroma_MxN FU
63	Mgnt_Interp_FBAddr_Luma_MxN FU
64	Mgnt_POC FU
65	Mgnt_MVR FU
66	Algo_Add FU

### 4.3 Token pool

Every token is listed in the 'token pool' that is the table of managing all tokens used in VTL. To facilitate the feasibility of connections among input and output ports of different FUs described in this specification, Table 3 lists all data elements (called "token", which is used throughout this document). The ID field here is informative and used for easy lookup.

**Table 3 — List of all token types that are used in the descriptions of FUs in this section.**

<b>ID &amp; Name</b>	<b>Description</b>
<b>1 BIT</b>	Token which value is 0 or 1. The bits belongs to the non-decoded bitstream
<b>2 ACKNOWLEDGMENT</b>	Boolean token (True or False) indicating an acknowledgment. True means it is OK. False, it is not OK.
<b>3 MCBPC</b>	Token representing the MCBPC element of syntax
<b>4 CBPY</b>	Token representing the CBPY element of syntax
<b>5 DCT_DC_SIZE</b>	Token representing the element of syntax DCT_DC_SIZE
<b>6 DCT_DC_DIFF</b>	Token representing the element of syntax DCT_DC_DIFF
<b>7 RUN</b>	Token representing the RUN value in the decoding of the DCT coefficients
<b>8 VALUE</b>	Token representing the VALUE value in the decoding of the DCT coefficients
<b>9 LAST</b>	Token representing the LAST value in the decoding of the DCT coefficients
<b>10 MEM_ADDRESS</b>	Token representing an address in the memory of the frames
<b>11 MEM_DATA</b>	Token representing a data stored in the memory of the frames

<b>12 WIDTH</b>	Token representing the width value of video frame in pixels
<b>13 HEIGHT</b>	Token representing the height value of video frame in pixels
<b>14 SIZE</b>	Token representing the size of the current frame in macroblock
<b>15 DC</b>	Tokens representing the DC coefficients. Each token represent one coefficient
<b>16 AC</b>	Token representing AC coefficients without DC coefficients
<b>17 BLOCK</b>	Token representing BLOCK that consists of 8x8 pixels
<b>18 MB</b>	Token representing a macroblock that consists of BLOCKs
<b>19 MVD</b>	Tokens representing the motion vector differences decoded by the syntax parsing process
<b>20 MV</b>	Tokens representing the coordinates of the motion vectors
<b>21 QUANT</b>	Token representing the QUANT value of quantization
<b>22 COORDINATE</b>	Token representing coordinates of block or macroblocks
<b>23 DISPLACEMENT</b>	Token representing the displacement between pixels (e.g. half- or quarter-pixel)
<b>24 SIGN</b>	Token representing a sign.
<b>25 ROUND</b>	Boolean token (True or False) indicating whether rounding is to be made or not
<b>26 INTRA_MODE</b>	Boolean token (True or False) indicating INTRA or INTER
<b>27 ACCODED</b>	Boolean token (True or False) indicating whether AC is coded or not
<b>28 ACPRED</b>	Boolean token (True or False) indicating whether AC prediction is made or not
<b>29 ACPRED_DIR</b>	Token representing the order of prediction of the AC coefficients
<b>30 MOTION</b>	Boolean token (True or False) indicating whether motion predication is made or not
<b>31 FOURMV</b>	Boolean token (True or False) indicating whether FOURMV is to be used or not
<b>32 F_CODE</b>	Token representing a value of FCODE of VOP to specify the range of motion vectors
<b>33 RBSP</b>	Token representing the data in the Raw Byte Sequence Payload
<b>34 NAL_SIZE</b>	Token representing the size in byte of a Network Abstraction Layer unit
<b>35 PART_ID</b>	Token representing the identifier for a partition of a macroblock
<b>36 PART_WIDTH</b>	Token representing the width in pixel for a partition of a macroblock
<b>37 PART_HEIGHT</b>	Token representing the height in pixel for a partition of a macroblock
<b>38 PART_SIZE</b>	Token representing the size in pixel for a partition of a macroblock, first the width of the partition, then the height.
<b>39 REF_ID</b>	Token representing the identification of the decoded reference frame in memory

<b>40 MB_ID</b>	Token representing the number that identifies a macroblock in a frame. The macroblocks are counted in a frame using raster scan order.
<b>41 POC</b>	Token representing the index of the frame to display
<b>42 REF_ORDER</b>	Token representing the index of frames to store into long frame reference and short term reference
<b>43 MMCO</b>	Token representing the order of the index for frame to store in memory
<b>44 PRED_MODE_INTRA</b>	Token representing the prediction mode of an intra macroblock
<b>45 MB_TYPE</b>	Token representing the type of prediction used by a macroblock (Intra, Intra 4x4 or Inter)
<b>46 FRACTION</b>	Token representing the MV offset in quarter-pel unit
<b>47 ALPHA_OFFSET</b>	Token representing the offset used in accessing the $\alpha$ and tC0 deblocking filter tables for filtering operations
<b>48 BETA_OFFSET</b>	Token representing the offset used in accessing the $\beta$ deblocking filter table for filtering operations
<b>49 CBP_BLK</b>	Token representing which of the sixteen 4x4 luma blocks of a macroblock may contain non-zero transform coefficient levels
<b>50 SCALE</b>	Token representing scaling value for quantization
<b>51 DB_SAMPLE</b>	Token representing sample for deblocking filter
<b>52 BS</b>	Token representing boundary strength for deblocking filter

## 5 General-purpose FUs

### 5.1 Syntax parsing

#### 5.1.1 Generic syntax parser

<b>FU Name</b>	Algo_SynP_Generic	
<b>Description</b>	This is a generic syntax parser that needs BSD as an input. Input and output port will be defined as the information in the BSD.	
<b>Profiles@levels supported</b>		
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

## 6 FUs for MPEG-4 Simple Profile

### 6.1 Syntax parsing

#### 6.1.1 Algo\_MVR\_MedianOfThreeLeftAndTopAndTopRight

<b>FU Name</b>	Algo_MVR_MedianOfThreeLeftAndTopAndTopRight	
<b>Description</b>	This module computes the motion vectors from the motion vector differences and the type of encoding of the 8x8 block. The prediction of the motion vector is based on the median value of the motion of three previously decoded blocks (the left, top and top right blocks). The FOURMV, F_CODE, MOTION, VOPMODE and WIDTH indicate how the current 8x8 block is coded. The A tokens are indices indicating the coordinates of the blocks (top, left, top-right) used for the prediction. This FU inputs the motion vectors differences output by the parser and generates the value of the motion vectors (MV output) for each 8x8 block. For each block, the X coordinate followed by the Y coordinates are generated.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
A	COORDINATE token	
FOURMV	FOURMV token	
F_CODE	F_CODE token	
MOTION	MOTION token	
MVIN	MVD token	
VOPMODE	INTRA_MODE token	
WIDTH	WIDTH token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
MV	MV token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
MAXW_IN_MB	Maximum width of the frame in macroblock	
MB_COORD_SZ	Size in bits of some variables	[0..32]
MV_SZ	Size in bits of port MV	[0..32]
VOP_FCODE_FOR_L ENGTH	Size in bits of F_CODE	3
VOL_WIDTH_LENGTH	Size in bits of WIDTH	

6.1.2 Algo\_MVSequence\_LeftAndTopAndTopRight

<b>FU Name</b>	Algo_MVSequence_LeftAndTopAndTopRight	
<b>Description</b>	This module computes the sequence of coordinates of the different blocks necessary for the prediction of the motion vectors. From the type of encoding of the block (given by the FOURMV, MOTION, VOPMODE, and WIDTH), the FU generates the coordinates of the blocks (on the A port) which will be used by the FU charged of reconstructing the motion vectors for each 8x8 block.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
FOURMV	FOURMV token	
MOTION	MOTION token	
VOPMODE	INTRA_MODE token	
WIDTH	WIDTH token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
A	COORDINATE token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
MAXW_IN_MB	Maximum width of the frame in macroblock	
MB_COORD_SZ	Size in bits of some variables	[0..32]
VOL_WIDTH_LENGTH	Size in bits of WIDTH	

6.1.3 Mgnt\_Splitter\_420\_TYPE

<b>FU Name</b>	Mgnt_Splitter_420_TYPE	
<b>Description</b>	This module distributes each VOPMODE, ACCODED, ACPRED, and MOTION for each Y, U, and V components sequentially.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
VOPMODE	INTRA_MODE token	
MOTION	MOTION token	
ACCODED	ACCODED token	
ACPRED	ACPRED token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
VOPMODE	INTRA_MODE token	
MOTION	MOTION token	
ACCODED	ACCODED token	
ACPRED	ACPRED token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

## 6.1.4 Algo\_VLDtableB6\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB6_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the mcbpc element of syntax of a MPEG-4 conformant bitstream. It applies in the case of intra mode. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.6.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
DATA	MCBPC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]

## 6.1.5 Algo\_VLDtableB7\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB7_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the mcbpc element of syntax of a MPEG-4 conformant bitstream. It applies in the case of inter mode. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.7.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
DATA	MCBPC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]

## 6.1.6 Algo\_VLDtableB8\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB8_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the cbpy element of syntax of a MPEG-4 conformant bitstream. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.8.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
DATA	CBPY token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]

## 6.1.7 Algo\_VLDtableB12\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB12_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the elements of syntax relative to the motion vectors in a MPEG-4 conformant bitstream ("horizontal_mv_data" and "vertical_mv_data"). It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.12.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
DATA	MVD token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]

## 6.1.8 Algo\_VLDtableB13\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB13_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the “dct_dc_size” element of syntax in a MPEG-4 conformant bitstream. The decoding applies only for the luminance macroblocks. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.13.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
DATA	DCT_DC_SIZE token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]

## 6.1.9 Algo\_VLDtableB14\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB14_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the “dct_dc_size” element of syntax in a MPEG-4 conformant bitstream. The decoding applies only for the chrominance macroblocks. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.14.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
DATA	DCT_DC_SIZE token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]

## 6.1.10 Algo\_VLDtableB15\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB15_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the “dct_dc_diferencial” element of syntax in a MPEG-4 conformant bitstream. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.15.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
DATA	DCT_DC_DIFF token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]

## 6.1.11 Algo\_VLDtableB16\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB16_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the INTRA coefficients as elements of syntax in a MPEG-4 conformant bitstream. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.16.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
RUN	RUN token	
VALUE	VALUE token	
LAST	LAST token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]
SAMPLE_SZ	Size in bits of the data used inside	[0..32]
SAMPLE_COUNT_SZ	Size in bits of the data variable used inside	[0..32]

## 6.1.12 Algo\_VLDtableB17\_MPEG4Part2

<b>FU Name</b>	Algo_VLDtableB17_MPEG4Part2	
<b>Description</b>	This Functional Unit decodes the INTER coefficients as elements of syntax in a MPEG-4 conformant bitstream. It decodes the bits as specified in ISO/IEC 14496-2:2004, Table B.17.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
BITS	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
FINISH	ACKNOWLEDGMENT token	
RUN	RUN token	
VALUE	VALUE token	
LAST	LAST token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
VLD_DATA_SZ	Size in bits of the data used inside	[0..32]
VLD_ADDR_SZ	Size in bits of the address variable used inside	[0..32]
SAMPLE_SZ	Size in bits of the data used inside	[0..32]
SAMPLE_COUNT_SZ	Size in bits of the data variable used inside	[0..32]

## 6.2 Texture decoding

## 6.2.1 Algo\_IQ\_QSAndQmatrixMp4vOrH263Scaler

<b>FU Name</b>	Algo_IQ_QSAndQmatrixMp4vOrH263Scaler	
<b>Description</b>	This module computes inverse quantization of AC for 8x8 blocks. Supports both MPEG and H.263 Inverse Quantization modes.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
DC	DC token	
AC	AC token	
QP	QUANT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
OUT	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
QUANT_SZ	Size in bits of the QP port	[0..32]
SAMPLE_SZ	Size in bits of the DC, AC and OUT ports	[0..32]

6.2.2 Algo\_DCRAddr\_ThreeLeftTop\_8x8

<b>FU Name</b>	Algo_DCRAddr_ThreeLeftTop_8x8	
<b>Description</b>	This module calculates the addresses of the three neighboring blocks for the current 8x8 block used for DC prediction. If any of the neighbor is not coded for some reason (either outside frame boundaries or skipped by encoder), the address is set as zero. Otherwise the lowest two bits specify the 8x8 component in the macroblock and the other higher order bits specify the macroblock index using circular buffer addressing.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
VOPMODE	INTRA_MODE token	
WIDTH	WIDTH token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
A	COORDINATE token	
B	COORDINATE token	
C	COORDINATE token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
MB_COORD_SZ	Size in bits of the token ADDR	[0..32]
MAXW_IN_MB	Maximum width of the frame in macroblock	
VOL_WIDTH_LENGTH	Size in bits of WIDTH	

6.2.3 Algo\_DCRAddr\_ThreeLeftTop\_16x16

<b>FU Name</b>	Algo_DCRAddr_ThreeLeftTop_16x16	
<b>Description</b>	<p>This module calculates the addresses of the three neighboring blocks for the current 8x8 block used for DC prediction. This module manages groups of four 8x8 blocks as follows:</p> <pre> +---+   0   1   +---+   2   3   +---+</pre> <p>If any of the neighbor is not coded for some reason (either outside frame boundaries or skipped by encoder), the address is set as zero. Otherwise the lowest two bits specify the 8x8 component in the macroblock and the other higher order bits specify the macroblock index using circular buffer addressing.</p>	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
VOPMODE	INTRA_MODE token	
WIDTH	WIDTH token	

Output		
Name	Token	
A	COORDINATE token	
B	COORDINATE token	
C	COORDINATE token	
Parameter		
Name	Description	Range
MB_COORD_SZ	Size in bits of the token ADDR	[0..32]
MAXW_IN_MB	Maximum width of the frame in macroblock	
VOL_WIDTH_LENGTH	Size in bits of WIDTH	

#### 6.2.4 Algo\_DCRInvPred\_CHROMA\_8x8

<b>FU Name</b>	Algo_DCRInvPred_CHROMA_8x8	
<b>Description</b>	This module reconstructs the DC coefficient of the current 8x8 block based on the gradients between neighboring block DC coefficients (see ISO/IEC 14496-2). This module also forwards the decoded prediction direction to the inverse AC prediction (IAP) module and a pointer to the neighboring block used for the prediction. Since inverse quantization is necessary to reconstruct the DC coefficient, the decoded quantization parameter is forwarded to the inverse quantization module. This FU applies for 8x8 blocks of chrominance.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
A	COORDINATE token	
B	COORDINATE token	
C	COORDINATE token	
ACCODED	ACCODED token	
ACPRED	ACPRED token	
QFS_DC	DC token	
QUANT	QUANT token	
VOPMODE	INTRA_MODE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
QF_DC	DC token	
PTR	COORDINATE token	
AC_PRED_DIR	ACPRED_DIR token	
SIGNED	SIGN token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
DCVAL	Size in bits of the QFS_DC and QF_DC ports	
MAXW_IN_MB	Maximum width of the frame in macroblock	
SAMPLE_SZ	Size in bits of the A, B, C, and PTR ports	[0..32]
QUANT_SZ	Size in bits of QUANT	[0..32]

6.2.5 Algo\_DCRInvPred\_LUMA\_16x16

<b>FU Name</b>	Algo_DCRInvPred_LUMA_16x16	
<b>Description</b>	This module reconstructs the DC coefficient of the current 8x8 block based on the gradients between neighboring block DC coefficients (see ISO/IEC 14496-2). This module also forwards the decoded prediction direction to the inverse AC prediction (IAP) module and a pointer to the neighboring block used for the prediction. Since inverse quantization is necessary to reconstruct the DC coefficient, the decoded quantization parameter is forwarded to the inverse quantization module. This FU applies for four 8x8 blocks of luminance.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
A	COORDINATE token	
B	COORDINATE token	
C	COORDINATE token	
ACCODED	ACCODED token	
ACPRED	ACPRED token	
QFS_DC	DC token	
QUANT	QUANT token	
VOPMODE	INTRA_MODE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
QF_DC	DC token	
PTR	COORDINATE token	
AC_PRED_DIR	ACPRED_DIR token	
SIGNED	SIGN token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
DCVAL	Size in bits of the QFS_DC and QF_DC ports	
MAXW_IN_MB	Maximum width of the frame in macroblock	
SAMPLE_SZ	Size in bits of the A, B, C, and PTR ports	[0..32]
QUANT_SZ	Size in bits of QUANT	[0..32]

6.2.6 Algo\_IS\_ZigzagOrAlternateHorizontalVertical\_8x8

<b>FU Name</b>	Algo_IS_ZigzagOrAlternateHorizontalVertical_8x8	
<b>Description</b>	This module inverts the one-dimensional array of coefficients ordered in zigzag (AC_PRED_DIR=0), alternate vertical (AC_PRED_DIR=1) or alternate horizontal (AC_PRED_DIR=2) scan to 2D raster order. It inputs a list of 64 integer coefficients (one per 8x8 block) and outputs the ordered list of integer according to the value of the token AC_PRED_DIR.	
<b>Profiles@levels supported</b>	MPEG-4 SP	

Input		
Name	Token	
AC_PRED_DIR	ACPRED_DIR token	
QFS_AC	AC token	
Output		
Name	Token	
PQF_AC	AC token	
Parameter		
Name	Description	Range
SAMPLE_SZ	Size in bits of the QFS_AC and PQF_AC ports	[0..32]

### 6.2.7 Algo\_IAP\_AdaptiveHorizontalOrVerticalPred\_8x8

<b>FU Name</b>	Algo_IAP_AdaptiveHorizontalOrVerticalPred_8x8	
<b>Description</b>	<p>This module computes inverse AC prediction for specific AC coefficients of 8x8 blocks that have been flagged in the bitstream as coded in this fashion. It inputs a list of 63 AC coefficients received in a horizontal raster manner after being re-ordered by the inverse scan block and the addresses of the 8x8 block used for the prediction in the encoder. It outputs a list of 63 reconstructed AC coefficients sent in a horizontal raster man. The AC_PRED_DIR token communicates the direction of prediction:</p> <ul style="list-style-type: none"> <li>• AC_PRED_DIR = -2: NEWVOP flag</li> <li>• AC_PRED_DIR = -1: An uncoded block so skip inverse AC prediction</li> <li>• AC_PRED_DIR = 0: No inverse AC prediction but use zigzag inverse scan</li> <li>• AC_PRED_DIR = 1: Prediction form the left and use alternate vertical scan</li> <li>• AC_PRED_DIR = 2: Prediction form the top and use alternate horizontal scan</li> </ul>	
<b>Profiles@levels supported</b>	MPEG-4 SP	
Input		
Name	Token	
PQF_AC	AC token	
PTR	COORDINATE token	
AC_PRED_DIR	ACPRED_DIR token	
Output		
Name	Token	
QF_AC	AC token	
Parameter		
Name	Description	Range
SAMPLE_SZ	Size in bits of the QF_AC port	[0..32]
MAXW_IN_MB	Maximum width of the frame in MB	
MB_COORD_SZ	Size in bits of the variables PTR port	[0..32]

6.2.8 Algo\_IAP\_AdaptiveHorizontalOrVerticalPred\_16x16

<b>FU Name</b>	Algo_IAP_AdaptiveHorizontalOrVerticalPred_16x16	
<b>Description</b>	<p>This module computes inverse AC prediction for specific AC coefficients of a 16x16 blocks that have been flagged in the bitstream as coded in this fashion. It inputs four lists of 63 AC coefficients received in a horizontal raster manner after being re-ordered by the inverse scan block and the addresses of the four 8x8 block used for the prediction in the encoder. It outputs four lists of 63 reconstructed AC coefficients sent in a horizontal raster man. The AC_PRED_DIR token communicates the direction of prediction:</p> <ul style="list-style-type: none"> <li>• AC_PRED_DIR = -2 =&gt; NEWVOP flag</li> <li>• AC_PRED_DIR = -1 =&gt; An un-coded block so skip inverse AC prediction</li> <li>• AC_PRED_DIR = 0 =&gt; No inverse AC prediction but use zigzag inverse scan</li> <li>• AC_PRED_DIR = 1 =&gt; Prediction form the left and use alternate vertical scan</li> <li>• AC_PRED_DIR = 2 =&gt; Prediction form the top and use alternate horizontal scan</li> </ul>	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
PQF_AC	AC token	
PTR	COORDINATE token	
AC_PRED_DIR	ACPRED_DIR token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
QF_AC	AC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the QF_AC port	[0..32]
MAXW_IN_MB	Maximum width of the frame in MB	
MB_COORD_SZ	Size in bits of the variables PTR port	[0..32]

6.2.9 Algo\_IDCT2D\_ISOIEC\_23002\_1

<b>FU Name</b>	Algo_IDCT2D_ISOIEC_23002_1	
<b>Description</b>	<p>This module computes the 8x8 Inverse Discrete Cosine Transform (IDCT) defined as</p> $f(x, y) = \frac{2}{N} \sum_{u=0}^{N-1} \sum_{v=0}^{N-1} C(u)C(v)F(u, v) \cos \frac{(2x+1)u\pi}{2N} \cos \frac{(2y+1)v\pi}{2N}$ <p>with <math>u, v, x, y = 0, 1, 2, \dots, N-1</math>          where <math>x, y</math> are spatial coordinates in the sample domain  <math>u, v</math> are coordinates in the transform domain</p> $C(u), C(v) = \begin{cases} \frac{1}{\sqrt{2}} & \text{for } u, v = 0 \\ 1 & \text{otherwise} \end{cases}$ <p>It inputs a list of 64 coefficients and outputs a list of 64 decoded coefficients.</p>	

<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

### 6.2.10 Mgnt\_DCSplit

<b>FU Name</b>	Mgnt_DCSplit	
<b>Description</b>	This module separates the DC coefficient from the AC coefficients. It takes as an input a list of 64 tokens and outputs on the DC port the DC coefficient (the first one) and the AC coefficient (the other 63) on the AC port.	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
IN	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
AC	AC token	
DC	DC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the AC, DC and IN ports	[0..32]

## 6.3 Motion compensation

### 6.3.1 Mgnt\_FB

<b>FU Name</b>	Mgnt_FB	
<b>Description</b>	This module is a frame buffer. It saves data WD at address WA. It outputs the data RD located at address RA	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
WA	MEM_ADDRESS token	
WD	MB token	
RA	MEM_ADDRESS token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
RD	MB token	

Parameter		
Name	Description	Range
BUF_SZ	Size in bits of the AC, DC and IN ports	[0..32]
ADDR_SZ	Size in bits of the addresses ports (RA and WA)	[0..32]
PIX_SZ	Size in bits of the data ports (WD and RD)	[0..32]

### 6.3.2 Mgnt\_FBAddr

<b>FU Name</b>	Mgnt_FBAddr	
<b>Description</b>	<p>This module generates addresses for the frame buffer block. Write addresses are used to save the current pixels for retrieval and read addresses are used to retrieve interpolation pixel values. This FU supports the following layouts:</p> <ul style="list-style-type: none"> <li>- if LAYOUT = 0, it supports 8x8 blocks</li> <li>- If LAYOUT = 1, it supports 16x16 blocks</li> </ul>	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
HEIGHT	HEIGHT token	
MOTION	MOTION token	
MV	MV token	
ROUND	ROUND token	
VOPMODE	INTRA_MODE token	
WIDTH	WIDTH token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
RA	MEM_ADDRESS token	
WA	MEM_ADDRESS token	
HALFPEL	DISPLACEMENT token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SEARCHWIN_IN_MB	Size of the search window in macroblock	
MAXW_IN_MB	Width of the frame in macroblock	
MAXH_IN_MB	Height of the frame in macroblock	
ADDR_SZ	Number of bits used to represent the “address” data type	[0..32]
FLAG_SZ	Number of bits used to represent the “flag” data type	[0..32]
MV_SZ	Number of bits used to represent the “motion vectors” data type	[0..32]
MB_COORD_SZ	Number of bits used to represent the “macroblock coordinates” data type	[0..32]
LAYOUT	Number indicating a layout (see Description)	
VOL_WIDTH_LENGTH	Size in bits of WIDTH	
VOL_HEIGHT_LENGTH	Size in bits of HEIGHT	

## 6.3.3 Algo\_PictureReconstruction\_Saturation

<b>FU Name</b>	Algo_PictureReconstruction_Saturation	
<b>Description</b>	<p>This module adds texture pixels (TEX) and MC prediction pixels (MOT) in order to output the decoded pixels. For each ACCODED and WIDTH token inputted and according to the type of encoding of the block under consideration, the FU consumes either:</p> <ul style="list-style-type: none"> <li>- one token from the MOT input if the block is only a “motion” block</li> <li>- one token from the TEX input if the block is only “texture” block</li> <li>- one token from TEX input and one token from MOT input otherwise</li> </ul>	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
MOT	MB token	
TEX	MB token	
ACCODED	ACCODED token	
VOPMODE	INTRA_MODE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
VID	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
PIX_SZ	Size in bits of the pixels data	[0..32]

## 6.3.4 Algo\_Interp\_HalfpelBilinearRoundingControl

<b>FU Name</b>	Algo_Interp_HalfpelBilinearRoundingControl	
<b>Description</b>	<p>This module interpolates the pixels in case of a displacement between two frames of half a pixel. This is done according to the following scheme:</p> <p style="text-align: center;"> <math>a = A,</math>  <math>b = (A + B + 1 - \text{rounding\_control}) / 2</math>  <math>c = (A + C + 1 - \text{rounding\_control}) / 2,</math>  <math>d = (A + B + C + D + 2 - \text{rounding\_control}) / 4</math> </p>	
<b>Profiles@levels supported</b>	MPEG-4 SP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
RD	MB token	
halfpel	DISPLACEMENT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
MOT	MB token	

Parameter		
Name	Description	Range
FLAG_SZ	Number of bits used to represent the “ <i>flag</i> ” data type	[0..32]
PIX_SZ	Number of bits used to represent the “ <i>pixels</i> ” data type	[0..32]

## 7 FUs for MPEG-4 AVC Constrained Baseline Profile

### 7.1 Syntax parsing

#### 7.1.1 Algo\_NALU FU

<b>FU Name</b>	Algo_NALU	
<b>Description</b>	This module removes emulation_prevention_three_byte (0x03) and sends to its output RBSP bytes and the number of rbsp bytes between 2 NALs.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
bits8	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Bits_rbsp8	RBSP token	
Nb_rbsp_byte	NAL_SIZE token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

#### 7.1.2 Algo\_Synp\_AVC FU

<b>FU Name</b>	Algo_Synp_AVC	
<b>Description</b>	This module analyzes a sequence of tokens and realizes Parsing for MPEG-4 AVC syntax	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
Bits_rbsp8	RBSP token	
Nb_rbsp_byte	NAL_SIZE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Cbp_blk	CBP_BLK token	
CurrMbAddr	MB_ID token	
pix_I_PCM	BIT token	
IntraPredMode	BIT token	
IntraPredModeC	BIT token	
LAST	LAST token	

LFDisable	BIT token	
MMCO	MMCO token	
MbIntraFlag	BIT token	
MbPartHeight	PART_HEIGHT token	
MbPartIdx	PART_ID token	
MbPartWidth	PART_WIDTH token	
MvRes	MVD token	
POC	POC token	
PicSizeInMb	SIZE token	
PicWidthInMb	WIDTH token	
QP	QUANT token	
QP_Cb	QUANT token	
QP_Cr	QUANT token	
RUN	RUN token	
RefIdx	REF_ID token	
RefReordering	BIT token	
ScalingList	SCALE token	
VALUE	VALUE token	
Alpha_offset	ALPHA_OFFSET token	
Beta_offset	BETA_OFFSET token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the VALUE and Block ports	[0..16]

### 7.1.3 Algo\_BlockExpand\_AVC FU

<b>FU Name</b>	Algo_BlockExpand_AVC	
<b>Description</b>	This module decodes the DCT coefficients as elements of syntax in a MPEG-4 AVC Constrained BP conformant bitstream.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
LAST	LAST token	
RUN	RUN token	
VALUE	VALUE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Block	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the VALUE and Block ports	[0..16]

7.1.4 Algo\_BlockSplit\_AVC FU

<b>FU Name</b>	Algo_BlockSplit_AVC	
<b>Description</b>	This module splits DCT coefficient from LUMA/CHROMA into the DC and AC CHROMA/LUMA coefficients.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
Block	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Block_U_AC	AC token	
Block_U_DC	DC token	
Block_V_AC	AC token	
Block_V_DC	DC token	
Block_Y_AC	AC token	
Block_Y_DC	DC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the Block, AC and DC coefficient ports	[0..16]

7.1.5 Algo\_IntraPred\_Split FU

<b>FU Name</b>	Algo_IntraPred_Split	
<b>Description</b>	This module sends information token of the prediction type (Mb_Type for LUMA and Mb_TypeC for CHROMA) and mode (PredMode) used by the current macroblock according to MbIntraFlag and IntraPredMode Input.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
IntraPredMode	PRED_MODE_INTRA token	
CurrMbAddr	MB_ID token	
MbIntraFlag	BIT token	
PicWidthInMb	WIDTH token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Mb_Type	MB_TYPE token	
Mb_TypeC	MB_TYPE token	
PredMode	PRED_MODE_INTRA token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

## 7.2 Texture decoding

### 7.2.1 Algo\_IS\_Zigzag\_4x4 FU

<b>FU Name</b>	Algo_IS_Zigzag_4x4	
<b>Description</b>	This module inverts the one-dimensional array of coefficients ordered in zigzag scan to 2D raster order. It inputs a list of 16 integer coefficients (one per 4x4 block) and outputs the ordered list of integer values.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
levarr	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Lev2d	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the levarr and Lev2d ports	[0...16]

### 7.2.2 Algo\_DCR\_Hadamard\_LUMA\_IHT1d FU

<b>FU Name</b>	Algo_DCR_Hadamard_LUMA_IHT1d	
<b>Description</b>	This module computes 1 dimensional 4x4 Inverse Hadamard Transform for DC luminance coefficients of an intra_16x16 prediction block as a part of 2 dimensional 4x4 Inverse Hadamard Transform.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	DC token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	DC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X and Y ports	[0...16]

### 7.2.3 Algo\_Transpose4x4 FU

<b>FU Name</b>	Algo_Transpose4x4	
<b>Description</b>	This module transposes 4x4 integer array.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	DC token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	DC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X and Y ports	[0...16]

7.2.4 Algo\_DCR\_Hadamard\_LUMA\_Reordering FU

<b>FU Name</b>	Algo_DCR_Hadamard_LUMA_Reordering	
<b>Description</b>	<p>This module reorders 4x4 DC luminance coefficients of an intra 16x16 prediction macroblock from raster scan order to the order of block number specified in MPEG-4 AVC specification.</p> <p>The order of block number in a MB</p> <pre> +---+---+---+---+   0   1   4   5   +---+---+---+---+   2   3   6   7   +---+---+---+---+   8   9  12  13   +---+---+---+---+  10  11  14  15   +---+---+---+---+</pre>	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	DC token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	DC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X and Y ports	[0...16]

7.2.5 Algo\_DCR\_Hadamard\_LUMA\_Scaling FU

<b>FU Name</b>	Algo_DCR_Hadamard_LUMA_Scaling	
<b>Description</b>	This module computes inverse quantization of DC luminance coefficients for intra 16x16 prediction macroblock.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
I	DC token	
QP	QUANT token	
Scalinglist	SCALE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
O	DC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
QUANT_SZ	Size in bits of the QP and Scalinglist ports	[0...8]
SAMPLE_SZ	Size in bits of the I and O ports	[0...16]

## 7.2.6 Algo\_DCR\_Hadamard\_CHROMA FU

<b>FU Name</b>	Algo_DCR_Hadamard_CHROMA	
<b>Description</b>	This module computes 2 dimensional 2x2 Inverse Hadamard Transform and inverse quantization for DC chrominance coefficients of a macroblock.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
levarr	DC token	
QP	QUANT token	
Scalinglist	SCALE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Cof	DC token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
QUANT_SZ	Size in bits of the QP and Scalinglist ports	[0...8]
SAMPLE_SZ	Size in bits of the I and O ports	[0...16]

## 7.2.7 Algo\_IT4x4\_1d FU

<b>FU Name</b>	Algo_IT4x4_1d	
<b>Description</b>	This module computes 1 dimensional 4x4 Inverse Integer Transform for 4x4 block coefficients according to MPEG-4 AVC specification as a part of 2 dimensional 4x4 Inverse Integer Transform.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X and Y ports and internal data	[0...16]

7.2.8 Algo\_IT4x4\_Addshift FU

<b>FU Name</b>	Algo_IT4x4_Addshift	
<b>Description</b>	This module computes right shifting of input integer value after adding value of 32 as a part of 2 dimensional 4x4 Inverse Integer Transform specified in MPEG-4 AVC specification.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X and Y ports and internal data	[0...16]

7.2.9 Algo\_IntraPred\_LUMA\_16x16 FU

<b>FU Name</b>	Algo_IntraPred_LUMA_16x16	
<b>Description</b>	This module computes intra 16x16 predicted block for a 16x16 luminance block according to MPEG-4 AVC intra 16x16 prediction.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
Y_LEFT	COORDINATE token	
Y_UP	COORDINATE token	
Y_UP_LEFT	COORDINATE token	
AVAIL	ACKNOWLEDGMENT token	
PredMode	PRED_MODE_INTRA token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
MPR	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
PIX_SZ	Size in bits of the decoded pixel	8

7.2.10 Algo\_IntraPred\_LUMA\_4x4 FU

<b>FU Name</b>	Algo_IntraPred_LUMA_4x4	
<b>Description</b>	This module computes intra 4x4 predicted block for a 4x4 luminance block according to MPEG-4 AVC intra 4x4 prediction.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
Y_LEFT	COORDINATE token	
Y_UP	COORDINATE token	

Y_UP_LEFT	COORDINATE token	
AVAIL	ACKNOWLEDGMENT token	
PredMode	PRED_MODE_INTRA token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
MPR	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
PIX_SZ	Size in bits of the decoded pixel	8

## 7.2.11 Algo\_Merge\_4x4\_to\_16x16 FU

<b>FU Name</b>	Algo_Merge_4x4_to_16x16	
<b>Description</b>	This module merges 4x4 blocks send in raster scan order into a 16x16 macroblocks.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	MB token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X and Y ports	[0...16]

## 7.2.12 Algo\_IQ\_QSAndSLAndIDCTScaler\_4x4 FU

<b>FU Name</b>	Algo_IQ_QSAndSLAndIDCTScaler_4x4	
<b>Description</b>	This module computes inverse quantization of 16 luminance (4x4 block) and 4 chrominance (4x4 block) for Cb and Cr components within a macroblock.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
Lev2d	BLOCK token	
QP	QUANT token	
intra_DC_flag	INTRA_MODE token	
ScalingList	SCALE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Cof	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
QUANT_SZ	Size in bits of the QP and Scalinglist ports	[0...8]
SAMPLE_SZ	Size in bits of the I and O ports	[0...16]
PREDTYPE_SZ	Size in bits of the intra_DC_flag port	[0...2]
NB_4x4	Size in bits of the number of 4x4 blocks in a macroblock for the processing component	[0...4]

7.2.13 Mgnt\_IQ\_INTRA16x16 FU

<b>FU Name</b>	Mgnt_IQ_INTRA16x16	
<b>Description</b>	This module combines DC coefficients, if available, with AC coefficients within a 16x16 block	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
CoefDCR_L	BLOCK token	
Intra_DC_flag	INTRA_MODE token	
CoefAC_L	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Lev2d	BLOCK token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the DC, AC and OUT ports	[0..16]
PREDTYPE_SZ	Size in bit of the Intra_DC_flag	[0..2]

7.2.14 Mgnt\_Select\_3

<b>FU Name</b>	Mgnt_DemuxIntraInter	
<b>Description</b>	This module selects data from one of its input (X0, X1, and X2) and sends it to its output (X) according to Mb_Type.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X0	MB token	
X1	MB token	
X2	MB token	
MbType	MB_TYPE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
X	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
MB_WIDTH	Size in pixel of macroblocks	[8;16]
SAMPLE_SZ	Size in bits of data in X0, X1, X2 and X ports	[0..16]

## 7.2.15 Algo\_Merge\_4x4\_to\_8x8 FU

<b>FU Name</b>	Algo_IntraPred_4x4_to_8x8	
<b>Description</b>	This module merges 4x4 blocks send in raster scan order into an 8x8 macroblocks.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	MB token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X and Y ports	[0..16]

## 7.2.16 Algo\_IntraPred\_Add FU

<b>FU Name</b>	Algo_IntraPred_Add	
<b>Description</b>	This module produces to its Z output an addition of prediction macroblock from X with residual macroblock from Y. Negative results are set to 0 and results higher than 255 are set to 255.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	MB token	
Y	MB token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Z	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the X, Y and Z ports	8

## 7.2.17 Algo\_IntraPred\_CHROMA FU

<b>FU Name</b>	Algo_IntraPred_CHROMA	
<b>Description</b>	This module computes an intra chroma predicted block for a chrominance block according to MPEG-4 AVC intra chroma prediction.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
C_LEFT	COORDINATE token	
C_UP	COORDINATE token	
C_UP_LEFT	COORDINATE token	
AVAIL	ACKNOWLEDGMENT token	
PredMode	PRED_MODE_INTRA token	

Output		
Name	Token	
MPR	MB token	
Parameter		
Name	Description	Range
PIX_SZ	Size in bits of the decoded pixel	8

7.2.18 Mgnt\_Intra

<b>FU Name</b>	Mgnt_Intra	
<b>Description</b>	This module activates and sends the value of pixels needed for a full macroblock intra prediction to output Y_LEFT, Y_UP, Y_UP_LEFT, the available edge for intra prediction to output AVAIL, the prediction mode to output PredMode_I and the error of the prediction to output Coef_ACR_I. Value of needed pixels are receive from EDGE input.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
Input		
Name	Token	
CurrMbAddr	MB_ID token	
FirstMbInSlice	BIT token	
PicWidthInMb	WIDTH token	
EDGE	MB token	
PredMode	PRED_MODE_INTRA token	
Coef_ACR	MB token	
Output		
Name	Token	
AVAIL	BIT token	
Y_LEFT	COORDINATE token	
Y_UP	COORDINATE token	
Y_UP_LEFT	COORDINATE token	
PredMode_I	PRED_MODE_INTRA token	
Coef_ACR_I	MB token	
Parameter		
Name	Description	Range
SAMPLE_SZ	Size of RD, C_LEFT, C_UP and C_UP_LEFT ports	[0..16]
MB_WIDTH	Width and height in pixel of macroblock	[8;16]

## 7.2.19 Mgnt\_Intra4x4

<b>FU Name</b>	Mgnt_Intra4x4	
<b>Description</b>	This module activates and sends the value of pixels needed for a 4x4 macroblock intra prediction to output Y_LEFT_4, Y_UP_4, Y_UP_LEFT_4, the available edge for intra prediction to output AVAIL, the prediction mode to output PredMode_4x4 and the error of the prediction to output Coef_ACR_4x4. Value of needed pixels are receive from EDGE for neighboring 16x16 pixels and MB4x4 input for neighboring 4x4 pixels.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
CurrMbAddr	MB_ID token	
FirstMbInSlice	BIT token	
PicWidthInMb	WIDTH token	
EDGE	MB token	
PredMode	PRED_MODE_INTRA token	
Coef_ACR	MB token	
MB_4X4	MB token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
AVAIL	BIT token	
Y_LEFT_4	COORDINATE token	
Y_UP_4	COORDINATE token	
Y_UP_LEFT_4	COORDINATE token	
PredMode_4x4	PRED_MODE_INTRA token	
Coef_ACR_4x4	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size of RD, C_LEFT, C_UP and C_UP_LEFT ports	[0..16]
MB_WIDTH	Width and height in pixel of macroblock	[8;16]

## 7.2.20 Mgnt\_IQ\_Chroma FU

<b>FU Name</b>	Mgnt_IQ_Chroma	
<b>Description</b>	This module adds the DC coefficient to the AC coefficients	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
CoefDCR_C	BLOCK token	
CoefAC_C	BLOCK token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Lev2d	BLOCK token	
intra_DC_flag	INTRA_MODE token	

Parameter		
Name	Description	Range
SAMPLE_SZ	Size in bits of the DC, AC and OUT ports	[0..16]
PREDTYPE_SZ	Size in bit of the Intra_DC_flag	[0...2]

### 7.3 Motion compensation

#### 7.3.1 Mgnt\_DBF FU

<b>FU Name</b>	Mgnt_DBF	
<b>Description</b>	This module manages pixels to be deblocked for the deblocking filter FU on the basis of 20x20 or 12x12 blocks for luma and chroma samples, respectively. In addition, it sends the boundary strengths for the deblocking filter FU and eventually outputs the deblocked macroblocks to the decoded picture buffer.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
MB_in	MB token	
DB_O	DB_SAMPLE token	
CurrMbAddr	MB_ID token	
PicWidthInMb	WIDTH token	
MbType	MB_TYPE token	
Cbp_blk	CBP_BLK token	
Alpha_offset	ALPHA_OFFSET token	
Beta_offset	BETA_OFFSET token	
QP	QUANT token	
MV	MV token	
RefIdx	REF_ID token	
LFDisable	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
BS	BS token	
DB_I	DB_SAMPLE token	
MB_OUT	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
LUMA_CHROM	Luma or chroma	[0, 1]
QUANT_SZ	Size in bits of the QP and Scalinglist ports	[0...32]

## 7.3.2 Algo\_DBF\_AdaptiveFilter\_AVC FU

<b>FU Name</b>	Algo_DBF_AdaptiveFilter_AVC	
<b>Description</b>	This FU implements deblocking filter without supporting MBAFF	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
DB_I	DB_SAMPLE token	
BS	BS token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
DB_O	DB_SAMPLE token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
LUMA_CHROME	Luma or chroma	[0,1]

## 7.3.3 Algo\_Interp\_EighthPelBilinear FU

<b>FU Name</b>	Algo_Interp_EighthPelBilinear	
<b>Description</b>	This FU performs fractional chroma sample interpolation with bilinear filter. Interpolating a sample in a fractional position requires at most 2x2 integer samples around the interpolated location.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
RD	MEM_DATA token	
PartSZ	PART_SIZE token	
Frac	FRACTION token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
INTERP	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

## 7.3.4 Algo\_Interp\_SeparableSixTapQuarterPelAVC FU

<b>FU Name</b>	Algo_Interp_SeparableSixTapQuarterPelAVC	
<b>Description</b>	This FU performs fractional luma sample interpolation with separable 6-tap FIR linear phase filter. Interpolating a sample in a fractional position requires at most 6x6 integer samples around the interpolated location:	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
RD	MEM_DATA token	
PartSZ	PART_SIZE token	
Frac	FRACTION token	

Output		
Name	Token	
INTERP	MB token	
Parameter		
Name	Description	Range

7.3.5 Algo\_Interp\_split\_MB FU

<b>FU Name</b>	Algo_Interp_split_MB	
<b>Description</b>	This module reconstructs a 16x16 inter prediction macroblock from the partition of inter prediction.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
Input		
Name	Token	
INTERP	MB token	
MbPartHeigth	PART_HEIGHT token	
MbPartIdx	PART_ID token	
MbPartWidth	PART_WIDTH token	
Output		
Name	Token	
MBPred	MB token	
Parameter		
Name	Description	Range
SAMPLE_SZ	Size in bits of INTERP, MBPred ports	[0..16]

7.3.6 Algo\_Interp\_split\_MB\_C FU

<b>FU Name</b>	Algo_Interp_split_MB_C	
<b>Description</b>	This module reconstructs an 8x8 inter prediction macroblock from the partition of inter prediction.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
Input		
Name	Token	
INTERP	MB token	
MbPartHeigth	PART_HEIGHT token	
MbPartIdx	PART_ID token	
MbPartWidth	PART_WIDTH token	
Output		
Name	Token	
MBPred	MB token	
Parameter		
Name	Description	Range
SAMPLE_SZ	Size in bits of INTERP, MBPred ports	[0..16]

## 7.3.7 Algo\_MVR\_MultiFrameAdaptive FU

<b>FU Name</b>	Algo_MVR_MultiFrameAdaptive	
<b>Description</b>	This FU finds a motion vector predictor by using reference index and MV of neighboring blocks (left, top, top right). This process is adaptively switched according to the partition size of the current block and the availability of the neighbouring blocks.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
mbPartIdx	MB_ID token	
PartS	COORDINATE token	
RefIdxLX	REF_ID token	
RefIdxLXN	REF_ID token	
mvLX	MV token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
mvpLX	MV token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

## 7.3.8 Mgnt\_DPB\_without\_adaptiveFilter FU

<b>FU Name</b>	Mgnt_DPB_without_adaptiveFilter	
<b>Description</b>	This module stores decoded pictures input from WD port according to the macroblock address (CurrMbAddr), and sends parts of a selected stored picture output through RD port for inter prediction, according to the prediction type (Mb_Type), current position of the macroblock (CurrMbAddr), a motion vector (MV) and an ID of frame (RefIdx). This module also reorganizes and erases the picture stored into its internal memory according to RefList input.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
PicSizeInMb	SIZE token	
PicWidthInMb	WIDTH token	
RefIdx	REF_ID token	
RefList	REF_ORDER token	
CurrMbAddr	MB_ID token	
WD	MB token	
MV	MV token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
RD	MEM_DATA token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of INTERP, MBPred ports	[0..16]
NB_PIC	Maximum number of frame stored in memory	[0..16]
MB_WIDTH	Width and Height in pixel of a macroblock	[8;16]

7.3.9 Mgnt\_Buffer\_Neighbor\_FullMb FU

<b>FU Name</b>	Mgnt_Buffer_intra	
<b>Description</b>	This module stores bottom and right edge from macroblock receive in input MB_IN and send to EDGE according to CurrMbAddr and Mb_Type when full macroblock intra-prediction is needed.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
CurrMbAddr	MB_ID token	
MB_IN	MB token	
Mb_Type	MB_TYPE token	
PicWidthInMb	WIDTH token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
EDGE	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of data in MB_IN and EDGE ports	[0..16]
MB_WIDTH	Size in pixel of macroblocks	[8;16]

7.3.10 Mgnt\_Buffer\_Neighbor\_4x4 FU

<b>FU Name</b>	Mgnt_Buffer_intra	
<b>Description</b>	This module stores bottom and right edge from macroblock receive in input MB_IN and send to EDGE according to CurrMbAddr and Mb_Type when 4x4 macroblock intra-prediction is needed.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
CurrMbAddr	MB_ID token	
MB_IN	MB token	
Mb_Type	MB_TYPE token	
PicWidthInMb	WIDTH token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
EDGE	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of data in MB_IN and EDGE ports	[0..16]
MB_WIDTH	Size in pixel of macroblocks	[8;16]

## 7.3.11 Algo\_MMCO

<b>FU Name</b>	Algo_MMCO	
<b>Description</b>	This module marks the index of frames to store as long term reference, short term reference, to delete or reorganize in memory. RefReordering indicates whether or not a reordering of the frame stored in memory is necessary.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
MMCO	MMCO token	
RefReordering	BIT token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
RefList	REF_ORDER token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
NB_PIC	Maximum number of frames that can be stored in memory	[0..16]

## 7.3.12 Mgnt\_FBAddr\_Chroma\_MxN FU

<b>FU Name</b>	Mgnt_FBAddr_Chroma_MxN	
<b>Description</b>	This FU activate (according to value in input MB_TYPE) inter prediction issues a reference frame ID to the chroma frame buffer to fetch necessary data for the chroma fractional sample interpolation. It also notifies the chroma fractional sample interpolation FU, which mode is selected via context information Frac. It also provides the error of the current prediction.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
MV	MV token	
RefIdx	REF_ID token	
Location	COORDINATE token	
PartSZ	PART_SIZE token	
PicWidthInMb	WIDTH token	
PicSizeInMb	SIZE token	
Coef_ACR	MB token	
MB_TYPE	MB_TYPE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Frac	FRACTION token	
Refbuf	REF_ID token	
Coef_ACR_P	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
MB_WIDTH	Width and Height in pixel of a macroblock	[8;16]
SAMPLE_SZ	Size in bits of INTERP, MBPred ports	[0..16]

7.3.13 Mgnt\_Interp\_FBAddr\_Luma\_MxN FU

<b>FU Name</b>	Mgnt_Interp_FBAddr_Luma_MxN	
<b>Description</b>	This FU issues an address and a reference frame ID to the luma frame buffer to fetch necessary data for the luma fractional sample interpolation. It also notifies the luma fractional sample interpolation FU, which mode is selected via Frac.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
MV	MV token	
RefIdx	REF_ID token	
Location	COORDINATE token	
PartSZ	PART_SIZE token	
PicWidthInMb	WIDTH token	
PicSizeInMb	SIZE token	
Coef_ACR	MB token	
MB_TYPE	MB_TYPE token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Frac	FRACTION token	
Refbuf	REF_ID token	
Coef_ACR_P	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
MB_WIDTH	Width and Height in pixel of a macroblock	[8;16]
SAMPLE_SZ	Size in bits of INTERP, MBPred ports	[0..16]

7.3.14 Mgnt\_POC FU

<b>FU Name</b>	Mgnt_POC	
<b>Description</b>	This module selects the order of the frame to display according to POC input.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
CurrMbAddr	MB_ID token	
POC	POC token	
MB_IN	MB token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Display	MB token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
NB_PIC	Number of frame to store buffer display frames	[0..16]
MB_WIDTH	Width and Height in pixel of a macroblock	[8;16]
SAMPLE_SZ	Size in bits of display and MB_IN ports	[0..16]

## 7.3.15 Mgnt\_MVR FU

<b>FU Name</b>	Mgnt_MVR	
<b>Description</b>	This module sends the information of Location, Partition size (PartSZ), motion vector associated (mvLX) and the id of reference picture (refIdxLn) for each partition within an inter predicted macroblock.	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
CurrMbAddr	MB_ID token	
MV	MVD token	
MbPartHeight	PART_HEIGHT token	
MbPartIdx	PART_ID token	
MbPartWidth	PART_WIDTH token	
PicWidthInMb	WIDTH token	
RefIdx	REF_ID token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
LOCATION	COORDINATE token	
PartSZ	PART_SIZE token	
RefIdxLN	REF_ID token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>

## 7.3.16 Algo\_Add FU

<b>FU Name</b>	Algo_Add	
<b>Description</b>	This module adds 2 Motion vectors tokens	
<b>Profiles@levels supported</b>	MPEG-4 AVC Constrained BP	
<b>Input</b>		
<b>Name</b>	<b>Token</b>	
X	MV token	
<b>Output</b>		
<b>Name</b>	<b>Token</b>	
Y	MV token	
<b>Parameter</b>		
<b>Name</b>	<b>Description</b>	<b>Range</b>
SAMPLE_SZ	Size in bits of the VALUE and Block ports	[0..16]

## Annex A (normative)

### Naming convention of FU

#### A.1 Naming convention

This Annex introduces the convention used to name FUs. Each FU has a unique name in this part of ISO/IEC 23002.

The skeleton of FU name is in the following format:

**{Role}\_{Name}\_ [property1-property2-...-propertyN]\_ [size]\_ {STANDARD if exists}\_ [Ver\_ID]**

- |       |                            |
|-------|----------------------------|
| {...} | → compulsory               |
| [...] | → optional                 |
| -     | → inside field separator   |
| _     | → separator between fields |

Some examples:

- MGNT\_Address\_mpeg4\_16x16
- ALGO\_Interpolation\_halfpel-mpeg4
- ALGO\_DCRaddressing\_mpeg4\_8x8

#### A.2 Description of the fields

##### {Role}

This part is compulsory. It specifies if this Functional Unit implements a specific coding algorithm or not. If the FU is a video coding tool, the “ALGO” tag must be used (stands for “algorithmic content”). If not, the “MGNT” tag must be used (stands for “data management”).

##### {Name}

1. This part is compulsory. This field corresponds to the name of the Functional Unit. It must describe as much as possible the action performed by the Functional Unit. In case of an “ALGO” type it may be related to the standard sub-clause title or to the (shorter) common name to refer to such specific algorithm. For the other Functional Unit, one would try to put a name which can be understood by the entire MPEG community.

**[property]**

This part is optional. It provides additional information about the Functional Unit. Several properties can be mentioned in the name.

The property field can be used to specify:

- a given characteristic of the algorithm. Example: ALGO\_Interpolation\_halfpel, "Halfpel" being the property field.
- luminance of chrominance appliance: "LUMA" or "CHROMA". Example: ALGO\_Name\_Luma or ALGO\_Name\_Chroma
- an implementation: It provides any additional information about the implementation of the Functional Unit. If there are various algorithms for one Functional Unit, this field is used to distinguish them.

**[size]**

This part is optional. This field gives an indication concerning the amount of data the Functional Unit has been designed for. For example the MGNT\_Address\_16x16 Functional Unit deals with blocks of 16x16 pixels.

**{STANDARD if exists}**

This tag indicates which standard the Functional Unit is conformant with.

Example: algo\_Interpolation\_halfpel\_mpeg4 means this FU is conformant with MPEG4 Part 2. Thus, the algorithm is described in the corresponding official document.

- standard appliance: "mpeg" + {2,4,avc}. Example: "mpeg24avc", "mpeg4avc", "mpeg4".

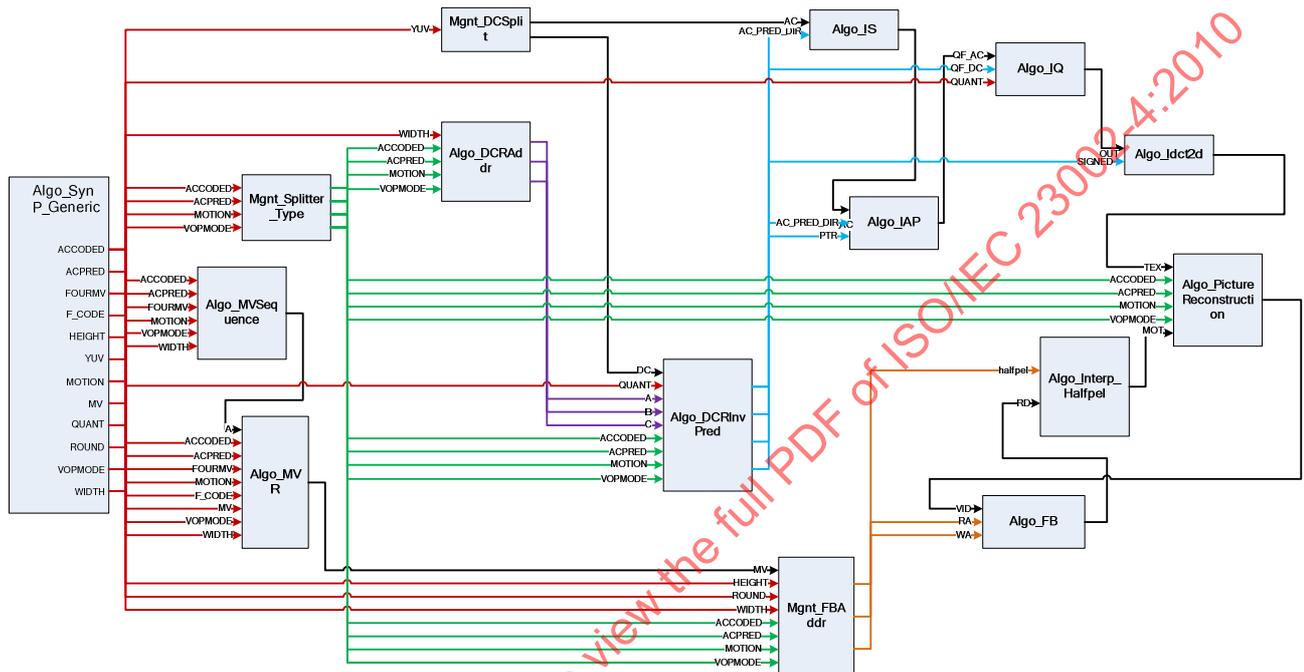
**[Ver\_ID]**

This tag is used for revision of FU description.

## Annex B (informative)

### FU Network Examples

#### B.1 MPEG-4 Simple Profile



A complete example is given as follows.

```

<?xml version="1.0" encoding="UTF-8"?><XDF name="Decoder">
  <!-- ***** -->
  <!-- Input ports of the Graph -->
  <!-- ***** -->
  <!-- ***** -->
  <!-- Output ports of the Graph -->
  <!-- ***** -->
  <!-- ***** -->
  <!-- Variables and Parameters of the Graph -->
  <!-- ***** -->
  <Decl kind="Variable" name="ADDR_SZ">
    <Expr kind="Literal" literal-kind="Integer" value="24"/>
  </Decl>
  <Decl kind="Variable" name="FLAG_SZ">
    <Expr kind="Literal" literal-kind="Integer" value="4"/>
  </Decl>
  <Decl kind="Variable" name="MAXH_IN_MB">
    <Expr kind="Literal" literal-kind="Integer" value="69"/>
  </Decl>
  <Decl kind="Variable" name="MAXW_IN_MB">
    <Expr kind="Literal" literal-kind="Integer" value="121"/>
  </Decl>
  <Decl kind="Variable" name="MB_COORD_SZ">
    <Expr kind="Literal" literal-kind="Integer" value="8"/>
  </Decl>
  <Decl kind="Variable" name="MEM_SZ">
    <Expr kind="Literal" literal-kind="Integer" value="16"/>
  </Decl>
  <Decl kind="Variable" name="MV_SZ">
    <Expr kind="Literal" literal-kind="Integer" value="9"/>
  </Decl>
  <Decl kind="Variable" name="OUT_SZ">
    <Expr kind="Literal" literal-kind="Integer" value="10"/>
  </Decl>

```