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| *Title:* | Weak compatible profiles | | |
| *Status:* | Input document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

Divining the correct constraints to apply to a profile is a difficult matter and there are choices that have been taken that, with the consideration of time, might be viewed as overly restrictive. Fixing these issues essentially requires the creation of a new profile\_idc value that relaxes the constraint, thereby being immediately opaque to pre-existing decoders even if they are able to comply with the new constraint. A method is proposed to predefine compatible profile\_idc values that guarantee syntax compatibility, but when encountered by an older decoder do not provide a constraint based decodability guarantee.

# Background

An example issue in AVC is the introduction of constraint A.3.3.k which requires a minimum number of slices per picture in sequences conforming to that profile:

* The constraint was not in the initial published version that introduced the profile, but was subsequently introduced later. There are therefore decoders and encoders that exceed the current specified capability.
* Others [1] have, later, asserted that this constraint is excessive and that decoders are able to handle a relaxed version.
* The proposed solution for addressing this in AVC was to introduce a new profile\_idc that is incompatible with all existing decoders.

If one considers the same situation in the context of HEVC, the creation of a new profile\_idc and use of the general\_profile\_compatibility\_flag[] to signal compatibility might seem attractive. However, the current semantics of the compatibility flags state:

**general\_profile\_compatibility\_flag**[ i ] equal to 1, when general\_profile\_space is equal to 0, indicates that the coded video sequence conforms to the profile indicated by general\_profile\_idc equal to i as specified in Annex A. When general\_profile\_space is equal to 0, general\_profile\_compatibility\_flag[ general\_profile\_idc ] shall be equal to 1. The value of general\_profile\_compatibility\_flag[ i ] shall be equal to 0 for any value of i that is not specified as an allowed value of general\_profile\_idc in Annex A.

In other words, a sequence conforming to multiple profiles must conform to the constraints of all the signalled compatible profiles.

# Proposal

A possible resolution is to introduce the notion of two profiles being weakly compatible, in the sense that while being syntactically compatible, there is no guarantee that one does not violate the constraints of the other.

Let any initial profile\_idc , we declare that any other profile\_idc is weakly compatible with . A possible value for might be 4. The following table illustrates the behaviour of such a system.

|  |  |  |  |
| --- | --- | --- | --- |
| Decoder Conformance | Bitstream Conformance | Decodability Guarantee | Behaviour |
|  |  | Y | Strict conformance guaranteed |
|  |  | N | Syntax compatible, decoder uses old constraints |
|  |  | N | Syntax compatible, decoder uses new constraints |
|  |  | Y | Strict conformance guaranteed |
|  |  | Y | Strict conformance guaranteed |

## Alternative representation

In essence, the effective profile\_idc is derived from the bitstream by dividing by . However, it is also possible to consider having profile\_idc being derived modulo some number, given that the compatibility flag mechanism implies a limit of 32 profiles that may use it, we could instead declare that a profile P’ is weakly compatible with if .

## Comment on levels

It should be noted that the above process is equally applicable to levels, although the author does not suggest that this is pursued.

# Draft Text

The current HEVC draft text [2] has been modified below with the required changes in marked in red to represent a possible manifestation of the proposal.

### Profile, tier and level semantics

**general\_profile\_compatibility\_flag**[ i ] equal to 1, when general\_profile\_space is equal to 0, indicates that the coded video sequence conforms to the profile indicated by general\_profile\_idc equal to 4 \* i as specified in Annex A. When general\_profile\_space is equal to 0, general\_profile\_compatibility\_flag[ general\_profile\_idc / 4 ] shall be equal to 1. The value of general\_profile\_compatibility\_flag[ i ] shall be equal to 0 for any value of i that is not specified as an allowed value of general\_profile\_idc in Annex A.

1. Annex A  
     
   Profiles and levels

(This annex forms an integral part of this Recommendation | International Standard)

* 1. Requirements on video decoder capability

Capabilities of video decoders conforming to this Recommendation | International Standard are specified in terms of the ability to decode video streams conforming to the constraints of profiles and levels specified in this annex. For each such profile, the level supported for that profile shall also be expressed.

Specific values are specified in this annex for the syntax elements general\_profile\_idc, general\_tier\_flag, and general\_level\_idc. All other values of profile\_idc, general\_tier\_flag, and level\_idc are reserved for future use by ITU-T | ISO/IEC.

* + 1. Conformance to future editions of this Recommendation | International Standard

Each profile is known by four values of general\_profile\_idc that form a compatibility group. All values of general\_profile\_idc within a compatibility group permit the same subset of algorithmic features defined in this Recommendation | International Standard. Differing values of general\_profile\_idc within a compatibility group represent different applicable constraints. A video stream conforming to the constraints of a profile as defined by this Recommendation | International Standard is identified by a specific value of general\_profile\_idc. All other values of general\_profile\_idc that identify a profile are reserved for future use by ITU-T | ISO/IEC.

A decoder that encounters a bitstream with a value of general\_profile\_idc that is marked as reserved for future use and identifies a known compatibility group is not required to decode that video stream.

NOTE – Future editions of this Recommendation | International Standard that define an interpretation of a reserved general\_profile\_idc that identifies a known profile in this Recommendation | International Standard shall guarantee syntactic compatibility for decoders that comply with the profile in this Recommendation | International Standard. However, no such guarantee is provided as to the compatability of any constraints.

* 1. Profiles
     1. General

All constraints for picture parameter sets that are specified are constraints for picture parameter sets that are activated in the bitstream. All constraints for sequence parameter sets that are specified are constraints for sequence parameter sets that are activated in the bitstream.

* + 1. Main profile

Bitstreams conforming to the Main profile shall obey the following constraints:

* Sequence parameter sets shall have chroma\_format\_idc equal to 1 only.
* Sequence parameter sets shall have bit\_depth\_luma\_minus8 equal to 0 only.
* Sequence parameter sets shall have bit\_depth\_chroma\_minus8 equal to 0 only.
* Sequence parameter sets shall have seq\_parameter\_set\_id in the range of 0 to 15, inclusive.
* Log2CtbSizeY shall be in the range from 4 to 6, inclusive.
* Picture parameter sets shall have tiles\_enabled\_flag && entropy\_coding\_sync\_enabled\_flag equal to 0.
* Picture parameter sets shall have entropy\_slice\_enabled\_flag equal to 0.
* When tiles\_enabled\_flag is equal to 1, ColumnWidthInLumaSamples[ i ] shall be greater than or equal to 256 for all values of i in the range of 0 to num\_tile\_columns\_minus1, inclusive, and RowHeightInLumaSamples[ j ] shall be greater than or equal to 64 for all values of j in the range of 0 to num\_tile\_rows\_minus1, inclusive.
* The number of times read\_bits( 1 ) is called in subclauses 9.3.3.2.2 and 9.3.3.2.3 when parsing coding\_tree( ) data for any coding tree block shall not be greater than 768 \* ( bit\_depth\_luma\_minus8 + 8 ) \* ( 1 << ( Log2CtbSize − 4 ) ) \* ( 1 << ( Log2CtbSize − 4 ) ).
* Picture parameter sets shall have pic\_parameter\_set\_id in the range of 0 to 63, inclusive.
* The level constraints specified for the Main profile in subclause A.4 shall be fulfilled.

Conformance of a bitstream to the Main profile is indicated by general\_profile\_idc being equal to 4 or general\_profile\_compatibility\_flag[ 1 ] being equal to 1.

Conformance of a bitstream to the Main profile is indicated by general\_profile\_idc in the range 5 to 7 inclusive. These values are reserved for future use by ITU-T | ISO/IEC.

Decoders conforming to the Main profile at a specific level (identified by a specific value of general\_level\_idc) shall be capable of decoding all bitstreams for which the all of following conditions apply:

* general\_profile\_idc is equal to 4 or general\_profile\_compatibility\_flag[ 1 ] is equal to 1.
* general\_level\_idc represents a level lower than or equal to the specified level.
* general\_tier\_flag represents a tier lower than or equal to the specified tier.

# References

1. E.Pearson, L. Winger, “CAN NB Contribution: Comment on ISO/IEC 14496-10, A.3.3(k)”, ISO/IEC JTC1 SC29/WG11 m25352, 10th meeting, Stockholm, July 2012.
2. B. Bross *et. al*, “High Efficiency Video Coding (HEVC) text specification draft 8”, JCTVC-J1003, 10th meeting, Stockholm, July 2012.

# Patent rights declaration(s)

**Research In Motion Ltd. 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).**

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