



# **Commercial Requirements for AV1 Addition to the DVB Toolbox**

**DVB Document C106**

**April 2023**

**DVB<sup>®</sup>**

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# Intellectual Property Rights

Please refer to the IPR policy of DVB Project available at: <https://dvb.org/about/policies-procedures/>

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## Foreword

DVB is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulators and others from around the world committed to designing open, interoperable technical specifications for the global delivery of digital media and broadcast services. DVB specifications cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. DVB dominates the digital broadcasting environment with thousands of broadcast services around the world using DVB specifications. There are hundreds of manufacturers offering DVB-compliant equipment. To date, there are over 1 billion DVB receivers shipped worldwide.

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## Executive summary

An opportunity has been identified to extend coverage for internet service delivery through addition of the AV1 video codec to the DVB toolbox. The addition of the AV1 codec could increase the flexibility and interoperability of DVB solutions in internet streaming applications.

DVB has recently developed commercial requirements for addition of next generation video codecs. Although the requirements for the AV1 internet delivery video codec application differ, the core requirements can be derived directly as a subset of the existing NGVC requirements with the following key adjustments:

- Streaming applications only (VOD, multicast, live linear over broadband)
- Modified performance requirement
- Optional requirements for user accessibility and user personalization are removed
- Modified timeline requirements

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# 1 Introduction

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DVB has recently developed commercial requirements for addition of next generation video codecs. Although the requirements for the AV1 internet delivery video codec application differ, the core requirements can be derived directly as a subset of the existing NGVC requirements with the following key adjustments:

- Streaming applications only (VOD, multicast, live linear over broadband)
- Modified performance requirements
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- Modified timeline requirements

## 1.1 Scope

The present document defines commercial requirements for AV1 addition to the DVB toolbox:

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## 2 References

[1]	ETSI TS 101 154 V2.7.1	Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications
[2]	<a href="#">CMAVC0652_NGV_Core_C Rs_r0.docx</a>	Digital Video Broadcasting (DVB); Core Commercial Requirements for Next Generation Video Codecs and Consideration for Codec Entry Selection Process

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## 3 Definitions and conventions

### 3.1 Terms

For the purposes of the present document, the following terms apply:

Term	Meaning
<b>Commercial Requirement (CR)</b>	Normative text clauses in the present document that are provided in order to guide the specification work on next generation video codecs in the Technical Module.
<b>CE Device</b>	TV set, STB with display or any other digital TV receiver
<b>DVB delivery systems</b>	DVB defined systems for the delivery of AV content (i.e. Terrestrial, Cable, Satellite and IP)

## 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

Abbreviation	Meaning
<b>HDR</b>	High Dynamic Range
<b>BT.2020</b>	ITU-R Recommendation BT.2020
<b>BT.709</b>	ITU-R Recommendation BT.709
<b>DVB delivery systems</b>	DVB defined systems for the delivery of AV content (i.e. Terrestrial, Cable, Satellite and IP)
<b>UHDTV</b>	ultra-high definition television
<b>SDR</b>	Standard Dynamic Range
<b>HDR</b>	High Dynamic Range

## 3.3 Conventions

Commercial Requirement tagging scheme:

Req x. [y].z.	Name	Status	Priority	Use case
<p>Numeric requirement ref.</p> <p>x = section y = subsection(s) z = sequence number</p> <p>This is a unique id within the document that could be used to refer to a requirement within a specific version of this document.</p> <p>Note that this id. is not strictly coupled to the particular requirement, could vary across different versions of this document</p>		<p>This status field can have the following states:</p> <p><b>Draft</b> = work in progress</p> <p><b>Complete</b> = completed and agreed in task force</p> <p><b>Agreed</b> = agreed within CM-XYZ</p> <p><b>Accepted</b> = accepted by CM</p>	<p>This field is the associated priority set by the CM to the requirement.</p> <p>1→ Must have</p> <p>2→ Recommended to have</p> <p>3→ Nice to have</p>	<p>Identifies the use cases that relate to this commercial requirement, if applicable.</p> <p>[UC]</p>

For the purpose of this document, the following normative conventions are used in the Commercial Requirements text:

Convention	Meaning
<b>shall enable</b>	The functionality shall be specified but its support is optional.
<b>shall support</b>	The functionality shall be specified and its support is mandatory.
<b>should enable</b>	The functionality is recommended to be specified and its support is optional.
<b>should support</b>	The functionality is recommended to be specified and supported.
<b>may enable</b>	The functionality may be specified and if it is then its support is optional, and it shall not have any weight in the selection or exclusion of any particular solution.
<b>may support</b>	The functionality may be specified and if it is then its support is recommended but it shall not have any weight in the selection or exclusion of any particular solution.
<b>shall not preclude</b>	The functionality shall not be prevented.
<b>should not preclude</b>	It is recommended not to prevent the functionality.

## 4 Commercial requirements

### 4.1 UHD and 8K Commercial Requirements

#### 4.1.1 Video Baseline

Req 4.1.1-1	Baseline	Agreed	1	NA
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The new video codec(s) shall support as baseline the same video format parameters as specified for HEVC IRDs and bitstreams in Annex L clause 2.8 to 2.17 and 3.3 for DASH delivery of TS 101 154 [1] excluding:

- Interlaced scan
- Non square pixels except 1440x1080

Solutions that are capable of providing backwards compatible (BC) HFR shall provide a BC HFR bitstream interoperability point that enables an SFR IRD to produce an equitable SFR video from an HFR bitstream with the same service reception logic (e.g. decoding, parsing) that the SFR IRD uses to receive an SFR service.

The specification shall not require an SFR IRD to differentiate between BC HFR bitstreams and SFR bitstreams.

The specification shall not place any BC HFR requirements on an IRD that does not support HFR (i.e. SFR IRD, supporting frame rates up to 60Hz).

The solution shall enable an equivalent IRD interoperability conformance point to the HEVC HDR UHD TV profile (TS 101 154 clause 5.14.4), including both PQ10 (with optional DMI) and HLG10.

NOTE: Specific applications of the new video codec(s), as described in subsequent CRs in the present document, can require the support of certain additional video format parameters that go beyond those specified in clause 5.14 of TS 101 154 [1].

NOTE: It is left to the discretion of TM-AVC as to how to specify the support of the legacy HEVC IRD and bitstream video parameters, in terms of the specification of equivalent profiles using the new video codec(s). This includes consideration of potentially excluding legacy parameters.

NOTE: This CR is a modified version of NGVC phase 1 [2] REQ4.1.1-1

Req 4.1.1 -3	Mobile interoperability for DVB-I	Agreed	2	5.3.4 (see [2])
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To enable DASH delivery to mobile devices where relevant industry organizations have profiled DASH delivery to mobile devices using the new codec solution:

- The solution conformance points shall be compatible with profiles adopted by relevant industry organisations to the largest extent possible.
- The solution shall include at least one conformance point compatible with profiles adopted by relevant industry organisations.

NOTE: To achieve this, DVB TM may collaborate with other relevant industry organizations such as 3GPP, MPEG CMAF, CTA WAVE, DASH-IF or ATSC to come to a common set of profiles. The timeline for the above requirement is not bounded by the timelines agreed for the DVB solution, but rather agreement in the industry. As such, it is accepted that while the DVB solution will take this into account to the extent possible within the available timeframe, a later addition to the DVB solution may be needed to reflect the industry consensus.

NOTE: This CR is identical to NGVC phase 1 [2] REQ4.1.1-3

Req 4.1.1 -3b	Mobile interoperability for DVB-I	Agreed	2	5.3.4 (see [2])
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To enable DASH delivery to mobile devices where relevant industry organisations have not yet profiled DASH delivery to mobile devices using the new codec solution:

Subject to SBs' approval, DVB shall take active role so that the conformance points adopted by the relevant industry organizations will be aligned with DVB conformance points to the largest extent possible.

NOTE: To achieve this, DVB TM may collaborate with other relevant industry organizations such as 3GPP, MPEG CMAF, CTA WAVE, DASH-IF or ATSC to come to a common set of profiles. The timeline for the above requirement is not bounded by the timelines agreed for the DVB solution, but rather agreement in the industry. As such, it is accepted that while the DVB solution will take this into account to the extent possible within the available timeframe, a later addition to the DVB solution may be needed to reflect the industry consensus.

NOTE: This CR is identical to NGVC phase 1 [2] REQ4.1.1-3

Req 4.1.1 -3c	Mobile interoperability for DVB-I	Agreed	2	5.3.4 (see [2])
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Candidate video codecs for use-cases including IP-delivery shall have an ISOBMFF binding (whether published by MPEG or someone else) that can be referenced by DVB by the date of publication of the specification.

Candidate video codecs for use-cases including IP-delivery shall have a CMAF binding (whether published by MPEG or someone else) that can be referenced by DVB by the date of publication of the specification.

(i) the previous CR is a pre-requisite for this one

Candidate video codecs for use-cases including IP-delivery shall not be precluded from use in targeted advertising according to the DVB commercial requirements for targeted advertising in DVB-DASH and DVB-I (CM-TA0059r23).

(i) the two previous CRs are both pre-requisites for this one

NOTE 1: "use-cases including IP-delivery" includes OTT streaming, native IP and DVB-I+5G

NOTE 2: "CMAF binding" means a description of how the codec fits into the structural constraints of CMAF (clauses 7 and 9 of CMAF). Restrictions on formats, profiles, options (etc) are outside the scope of these requirements but are instead addressed by 4.1.1-3 and 4.1.1-3b.



NOTE 3: This CR is identical to NGVC phase 1<sup>1</sup> REQ4.1.1-3c

Req 4.1.1-4	LL-DASH live edge catch-up	Agreed	1	N/A
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The solution shall enable decoding at playback rates different than real-time (1.0) under the complexity and decoding constraints of the conformance point, to enable catching-up with the live edge in low latency DASH or to support slowed down playback to avoid buffer underrun.

NOTE: This CR is identical to NGVC phase 1 [2] REQ4.1.1-4

Req 4.1.1-5	Implementation	Agreed	2	N/A
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Candidate new video codecs shall bring evidence on the solution suitability to be implemented for consumer high volume products.

NOTE 1: Information includes preferably information comparing the solution with implemented DVB UHD phase 1/2 interoperability points.

NOTE 2: This CR is identical to NGVC phase 1 [2] REQ4.1.1-5

Req 4.1.1-6	Implementation encoder	Agreed	2	N/A
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Candidate new video codecs should bring information about their operational impact on existing workflows.

NOTE 1: Information may include (a) details of where existing workflows or hardware may need to be modified or changed to facilitate implementation of media processing with comparable throughput and/or (b) publicly available data about performance and implementation of different codecs.

NOTE 2: Encoders are not specified in codec specifications and their implementation is fully left to industry competition. Early information on implementations are to be taken with caution and improvements can be expected over time.

NOTE 3: This CR is identical to NGVC phase 1 [2] REQ4.1.1-6

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<sup>1</sup> [CMAVC0652 NGV Core CRs r0.docx](#)

## 4.1.2 8K delivery

Req 4.1.2 -1	8K delivery: increased resolution	Agreed	1	5.2.1 (see [2])
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In addition to the luminance resolutions included in ETSI TS 101 154 in clause 5.14 of TS 101 154 [1], the specification shall support 16:9 aspect ratio and luminance resolution up to 7680x4320 pixels, including 5120 x 2880 pixels.

NOTE 1: Reducing the number of luminance resolutions is beneficial to reduce testing of IRDs

NOTE 2: This CR is identical to NGVC phase 1 [2] REQ4.1.2-1

Req 4.1.2-2	8K delivery: interoperability points	Agreed	1	5.2.1 (see [2])
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The solution shall enable interoperability point(s) in order to address implementation concerns.

At a minimum, the following interoperability conformance points shall be defined:

1. 8K 24 000/1 001, 24, 25, 30 000/1 001, 30Hz, 50, 60 000/1 001, 60Hz
2. Including #1 and additionally 8K 100, 120 000/1 001, 120Hz

The specifications shall support conformance points with 10-bit BT.2020 non-constant luminance colorimetry. There is no requirement for 8-bit only conformance point.

Conformance points shall not require the IRD to decode and process bit streams with more than 10-bit video sampling.

Conformance points shall support SDR and HDR transfer characteristics, as defined in the video baseline (see clause 4.1.1) and specifically in the HEVC HDR UHD TV profile (TS 101 154 clause 5.14.4), including both PQ10 (with optional DMI) and HLG10.

NOTE 1: Conformance point 1 does not preclude 4K HFR support according to HFR conformance point as referenced in 4.1.1-1

NOTE 2: This CR is identical to NGVC phase 1 [2] REQ4.1.2-2

Req 4.1.2-3	8K delivery: signalling	Agreed	1	5.2.1 (see [2])
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The specification shall support signalling of 8K within DVB mechanisms (DVB-I and DVB-DASH).

NOTE: This CR is a modified version of NGVC phase 1 [2] REQ4.1.2-3

Req 4.1.2-4	8K delivery: transport	Agreed	1	5.2.1 (see [2])
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The specification shall support DVB-DASH delivery of 8k in order to reach all device types (from fixed TV sets to mobile devices accessing these services).

NOTE: This CR is a modified version of NGVC phase 1 [2] REQ4.1.2-4

Req 4.1.2-5	Suitability for Linear & non-linear delivery for 8K	Agreed	1	5.2.1 (see [2])
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The solution shall enable encoding for DVB live linear 8k services and non-linear DVB 8K services. Candidate technology shall provide credible evidence of feasibility.

NOTE: This CR is identical to NGVC phase 1 [2] REQ4.1.2-6

### 4.1.3 4K Streaming

Req 4.1.3-1	Efficient 4K streaming	Agreed	1	5.2.4 (see [2])
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The technical solution shall enable efficient high quality 4K streaming, i.e. delivering a 4K SDR/HDR with minimized bitrate and allowing to minimize down switching during adaptive streaming sessions.

Candidate new video codecs should bring credible evidence that the solution is on average at least 20% more efficient than HEVC as defined in 5.14 of TS 101 154 [1] for similar content.

NOTE 1: HEVC anchors may not be DVB compliant if this doesn't affect a meaningful comparison. TM-AVC to judge.

NOTE 2: This CR is a modified version of NGVC phase 1 [2] REQ4.1.2-2

### 4.1.4 Efficient Multicast

Req 4.1.4-1	Efficient Multicast	Agreed	2	5.3.6 (see [2])
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The solution shall not preclude multicast delivery as defined in A176.

NOTE 1: As A176 is targeted to distribute DVB-DASH formats over multicast, it is beneficial to not preclude that the encodings generated for DVB-DASH unicast distribution can also be used for A176-based distribution.

NOTE 2: This CR is identical to NGVC phase 1 [2] REQ4.1.5-1

### 4.1.5 Sub UHD Resolution

Req 4.1.5-1	Sub UHD Resolution	Agreed	2	5.3.4 (see [2])
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The solution shall improve compression efficiency at the same video quality for lower resolutions than 4K.

NOTE 1: Such bitstreams may for example be used in DASH when down switching is needed to maintain service continuity or by small screen devices to reduce environmental impact of media services on these devices where lower resolutions than 4K offer the same quality of experience than 4K or higher resolutions.

NOTE 2: This CR is identical to NGVC phase 1 [2] REQ4.1.6-1

Req 4.1.5-2	Resolution Switching	Agreed	2	5.3.4 (see [2])
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The solution shall allow to seamlessly switch across different spatial resolutions. At the minimum the resolutions defined in TS 103 285 shall be supported.

NOTE 1: This functionality is for example beneficial in Representation Switching in DASH, or when the stream requires adaptation to different content complexity.

NOTE 2: This CR is identical to NGVC phase 1 [2] REQ4.1.6-2

## 4.2 Timelines, Selection and Prioritization of codec solutions in application of DVB R & P 8.7 and CMAVC-0035

### 4.2.1 Selection

#### 4.2.1.1 General

Req 4.2.1.1-1	Codec acceptance criteria	Agreed		1	NA
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Each new video codec solution shall satisfy all acceptance criteria stated in document CM-AVC0035.

NOTE : This CR is identical to NGVC phase 1 [2] REQ4.3.1-1

Req 4.2.1.1-2	Toolbox considerations	Agreed		1	NA
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For the avoidance of doubts the DVB R & P 8.7 shall apply where “function” represent the set of CRs outlined in this document.

NOTE : This CR is identical to NGVC phase 1 [2] REQ4.3.1-2

### 4.2.2 Timeline

Req 4.2.2-1	Specification timeline	Agreed	1	NA
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DVB shall organize their work so that key video characteristics are documented and stable by 8 March 23 .

NOTE : This CR is a modified version of NGVC phase 1 [2] REQ4.3.2-1

Req 4.2.2-2	Specification timeline	Agreed	1	NA
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The following revised Specifications shall be delivered for approval at DVB-TM (i. e. Bluebook) on 22 March 2023

- Specifications for the use of Video and Audio Coding in Broadcast and Broadband Applications (ETSI TS 101 154),
- DVB-I Service Discovery (ETSI TS 103 770) and
- MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks (ETSI TS 103 285)

NOTE : This CR is a modified version of NGVC phase 1 [2] REQ4.3.2-2

## 4.3 Verification & Validation

Req 4.3-1	Test streams: bitstream profiles	Draft	1	NA
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Test bitstreams shall be provided that exercise the boundaries of each new bitstream profile defined, i.e. bitstreams with the relevant technical parameters determined by TM required to remain within the capability limits of IRDs compliant with a given profile.

NOTE : This CR is identical to NGVC phase 1 [2] REQ4.4-1

Req 4.3-2	Test streams: resolutions	Draft	1	NA
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Test bitstreams shall be provided at a minimum for 1920x1080,3840x2160 and 7680x4320 luminance resolution, using the appropriate bitstream profile.

NOTE : This CR is identical to NGVC phase 1 [2] REQ4.4-2

Req 4.3-3	Test streams: features	Draft	1	NA
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Test bitstreams shall be provided to exercise each new feature that is not covered by an IRD/bitstream profile requirement (as those will be tested by streams created to satisfy CR 4.3-1).

Separate bitstreams shall be provided for standalone features (as opposed to interdependent features that would need to be grouped within the same test bitstream).

NOTE : This CR is identical to NGVC phase 1 [2] REQ4.4-3

Req 4.3-4	Test streams: IP transport	Draft	1	NA
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DVB-DASH test content shall be provided for each of the bitstreams created for CRs 4.3-1, 4.3-2, 4.3-3.

DVB-DASH test streams shall be made available using the ISO BMFF test streams created (as an intermediate step).

NOTE : This CR is a modified version of NGVC phase 1 [2] REQ4.4-4

Req 4.3-5	Test streams: signalling	Draft	1	NA
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DVB-DASH test streams shall be created to exercise all new signalling defined (e.g. DASH MPD). Where possible, such streams should be combined with the streams created to satisfy CR 4.3-4.

NOTE : This CR is a modified version of NGVC phase 1 [2] REQ4.4-5

Req 4.3-6	DVB-I metadata	Draft	1	NA
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DVB-I service list and content guide metadata shall be created to exercise all new signalling defined. Such metadata shall reference the streams created to satisfy CRs 4.3-4 and 4.3-5.

NOTE : This CR is identical to NGVC phase 1 [2] REQ4.4-6

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## 5 History

Ref	Month Year	Milestone
C106	April 2023	BlueBook publication (Internal document CM2115)