



# **Ultra HD Forum Guidelines**

## **Black Book – Terms and Acronyms**

**Ultra HD Forum**

**8377 Fremont Blvd., Suite 117**

**Fremont, CA 94538**

**UNITED STATES**

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# 1. Foreword

This new version v3 of the Ultra HD Forum Guidelines provides a holistic view of modern media systems, their mechanisms and workflows, and how those are impacted by the latest generation of improvements – the “Ultra HD” technologies, those that take media beyond the limits established at the start of this millennia, characterized in large part by the video resolutions and the dynamic range offered for media in “high definition”, i.e., ITU-R Rec. BT.709. The Forum considers Ultra HD to not only be any UHD media (i.e., 4K resolution, or higher), but also HD-resolution media with enhancements such as High Dynamic Range, Wide Color Gamut, etc. Ultra HD is a constellation of technologies that can significantly improve media quality and audience experience.

This work represents over eight years of collaborative effort. These new books would not have been possible without the leadership of Jim DeFilippis, who represents Fraunhofer and chairs our Guidelines Work Group with invaluable support from the co-chair, Pete Sellar of Xperi as well as technical assistance from Ian Nock of Fairmile West Consulting.

Our gratitude to all the companies listed in the Acknowledgments that have participated in this effort over the years and specifically to Nabajeet Barman (Brightcove), Andrew Cotton (BBC), Jean Louis Diascorn (Harmonic), Richard Doherty (Dolby), Felix Nemirovsky (Dolby), Chris Johns (Sky UK), Katy Noland (BBC), Bill Redmann (InterDigital), Chris Seeger (Comcast/NBCUniversal), Adrian Murtaza (Fraunhofer) and Alessandro Travaglini (Fraunhofer).

This document, *Terms and Acronyms* (Black Book), is one of a series of books, referred to as the Rainbow Books, that compose the Ultra HD Forum Guidelines. If any of these terms sound unfamiliar, follow the link below to the Black Book. If a particular standard is of interest, links such as the one above are available to take you to the White Book, where references are collected.



The Rainbow Books are, in their entirety:

White Book	<a href="#">Guidelines Index and References</a>
Red Book	<a href="#">Introduction to Ultra HD</a>
Orange Book	<a href="#">Foundational Technologies for Ultra HD</a>
Yellow Book	<a href="#">Beyond Foundational Technologies</a>
Green Book	<a href="#">Ultra HD Distribution</a>
Blue Book	<a href="#">Ultra HD Production and Post Production</a>
Indigo Book	<a href="#">Ultra HD Technology Implementations</a>
Violet Book	<a href="#">Real World Ultra HD</a>
<b>Black Book</b>	<a href="#"><b>Terms and Acronyms</b></a>

Updates in this new version of the Ultra HD Forum Guidelines are described on the following page.

I hope you will enjoy reading today.

If you want to know more about Ultra HD, and join our discussions on how it can be deployed, I invite you to join the Ultra HD Forum. You can start by visiting our website: [www.ultrahdforum.org](http://www.ultrahdforum.org).

Dr. Yasser Syed, President, Ultra HD Forum  
April 2024





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## 1.1 Changes from version 3.1 to 3.2

What's new in the Spring 2024 version of the UHDF Guidelines Red Book, *Terms and Acronyms* (v3.1), edited by Jim DeFilippis and Ian Nock.

The *Terms and Acronyms* is a reference book for the series of Rainbow Books on the Guidelines for Ultra HD. The scope and purpose of this book is to define the terms used within the Guidelines books as well as the acronyms in them.

While most of the information in this edition is material from the previous version of the Guidelines (v3.1), the information has been updated. *Display* and *Scene Referred* definitions have been updated, and two new terms, *Display Light* and *Scene Light*, have been added. The definition of *High Frame Rate* has been updated to reflect the use in UltraHD. A new acronym has been added, *HEIF, High Efficiency Image Format*.

We hope these changes will be helpful in understanding UHD technologies as well as planning for new or expanded Ultra HD services.

Jim DeFilippis and Pete Sellar,

Guidelines Working Group Co-Chairs, Ultra HD Forum, April 2024



## 2. Acknowledgements

We would like to acknowledge all member companies, past and present, of the Ultra HD Forum who have contributed in some small or large part to the body of knowledge that has been contributed to the Guidelines Color Books, including the specific subject of this book.

ARRIS	ATEME	ATT DIRECTV
British Broadcasting Corporation	BBright	Beamr
Brightcove Inc.	Broadcom	B<>COM
Comcast / NBC Universal LLC	Comunicare Digitale	Content Armor
CTOiC	Dolby	DTG
Endeavor Streaming	Eurofins Digital Testing	Fairmile West
Fraunhofer IIS	Harmonic	Huawei Technologies
InterDigital	LG Electronics	Mediakind
MovieLabs	NAB	Nagra, Kudelski Group
NGCodec	Sky UK	Sony Corporation
Xperi	Technicolor SA	Verimatrix Inc.
V-Silicon		



### 3. Notice

The Ultra HD Forum Guidelines are intended to serve the public interest by providing recommendations and procedures that promote uniformity of product, interchangeability, and ultimately the long-term reliability of audio/video service transmission. This document shall not in any way preclude any member or nonmember of the Ultra HD Forum from manufacturing or selling products not conforming to such documents, nor shall the existence of such guidelines preclude their voluntary use by those other than Ultra HD Forum members, whether used domestically or internationally.

The Ultra HD Forum assumes no obligations or liability whatsoever to any party who may adopt the guidelines. Such an adopting party assumes all risks associated with adopting these guidelines and accepts full responsibility for any damage and/or claims arising from such guidelines.

Attention is called to the possibility that implementation of the recommendations and procedures described in these guidelines may require the use of subject matter covered by patent rights. By publication of these guidelines, no position is taken with respect to the existence or validity of any patent rights in connection therewith. Ultra HD Forum shall not be responsible for identifying patents for which a license may be required or for conducting inquiries into the legal validity or scope of those patents brought to its attention.

Patent holders who believe that they hold patents that are essential to the implementation of the recommendations and procedures described in these guidelines have been requested to provide information about those patents and any related licensing terms and conditions.

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## 5. Terms

This guideline contains the following terms and definitions:

<b>Access Unit (AU)</b>	Self-contained audio stream packet.
<b>Adaptive Bit Rate</b>	A technique used in streaming multimedia over computer networks, in which multiple versions of a single content source are provided, each encoded at different bitrates; the client device monitors the available bandwidth and CPU capacity in real time, and switches between streaming the different encodings, choosing the highest bitrate (i.e., highest quality) according to available resources.
<b>Audio Objects</b>	An audio element consists of an audio signal and audio metadata, including rendering information (e.g., gain and position) that may change dynamically. Audio Objects with positional information that does not change dynamically are called “static” objects.
<b>Binaural Audio</b>	Process that reproduces audio for headphones, including immersive audio.
<b>Bit Depth</b>	The number of bits used per component. It describes the number of increments for both brightness and color.
<b>Color Gamut</b>	The subset of colors that can be accurately represented within a given system colorimetry or by a certain source or output device.



<b>Color Volume</b>	Combined color gamut and luminance characteristics.
<b>Color Volume Transform</b>	A technique used to map a coordinate in one color volume to a coordinate in another.
<b>Commentary</b>	Audio program element assigned to voice/announcer information
<b>Convergence/ Divergence</b>	For audio objects, the amount of the 'spread' of the audio in acoustic space
<b>Core Decode</b>	Minimal decode specification, usually limited to stereo or 5.1 audio programs.
<b>DCI-P3</b>	Color gamut defined in <a href="#">SMPTE RP 431-2 [30]</a> .
<b>Dialog Enhancement</b>	Feature for the hearing-challenged viewer or where there is high ambient noise to enhance the intelligibility of the dialog or commentary audio or for the viewer's preference.
<b>Display-Referred</b>	An image state associated with image data that represents the color-space coordinates of the elements of an image that has undergone color-rendering appropriate for a specified display and viewing conditions [ISO-22028-5:2023 Terms 3.9].



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<b>Display-Light</b>	Image values that result from applying the reference EOTF to the encoded image signal values [ISO-22028-5:2023 Terms 3.7]
<b>Downmixing</b>	For Channel-based audio formats, the ability for the decoder to reproduce the higher order speaker channel arrangement to a lesser speaker channel arrangement (i.e., 5.1 to 2.0).
<b>Electro-Optical Transfer Function</b>	The transfer function that maps digital pixel values to values of display light. Abbreviated as <b>EOTF</b> .
<b>Forensic Watermarking</b>	Forensic Watermarking is a technology that modifies multimedia content (e.g., a video, a song, a piece of text) to encode a Watermark Identifier without introducing artifacts that would be perceptible by a human being. The Watermark Identifier encoded by a Forensic Watermark can be recovered even if the content is altered after the watermarking operation.
<b>Foundation Ultra HD</b>	Term used in this document for content that conforms to the parameters shown in <a href="#">Table 2 in the Red Book [R01]</a> .
<b>Full Decode</b>	Decode specification that provides for full immersive or higher spatial resolution sound program reproduction.
<b>Gamut Mapping</b>	Conversion of color from one system colorimetry to a different system colorimetry. As an example, gamut mapping can be used to convert from <a href="#">BT.2020</a>



[\[3\]/2100 \[5\]](#) system colorimetry to [BT.709 \[2\]](#) system colorimetry and vice versa.

<b>HLG10</b>	HDR systems or content employing Hybrid Log-Gamma (HLG), the wide color gamut specified in <a href="#">BT.2100 [5]</a> and 10-bit depth. <sup>1</sup> (see also <a href="#">Section 7.1.3 in the Blue Book [B01]</a> )
<b>HDR10</b>	HDR systems or content employing PQ10 and further including or capable of providing <a href="#">SMPTE ST 2086 [10]</a> , MaxFALL, and MaxCLL metadata ( <a href="#">see also Section 7.1.2 of the Blue Book [B02]</a> ).
<b>High Dynamic Range</b>	An image dynamic range that provides a dynamic range larger than SDR, capturing and displaying increased highlight and shadow details. Use of tone curves as referenced in <a href="#">BT. 2100 [5]</a> (HLG and PQ).
<b>High Frame Rate</b>	Content with a relative rate greater than 24 frames per second for motion pictures and greater than 60 fps for television content.
<b>Hybrid Log-Gamma</b>	Hybrid Log-Gamma (HLG) OETF, EOTF, and OOTF transfer functions specified in <a href="#">BT.2100 [5]</a> .
<b>Immersive Audio</b>	An audio system that enables high spatial resolution in sound source localization in azimuth, elevation,

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<sup>1</sup> Note: HLG10, in some applications, e.g. DVB [12], is further limited to the Non-Constant Luminance Y'C<sub>B</sub>C<sub>R</sub> signal format and narrow range quantization specified in [BT.2100 \[5\]](#).



and distance and provides an increased sense of sound envelopment.

**Inverse Tone Mapping**

Process to increase the dynamic range of images. Inverse tone mapping may be used to convert from SDR to HDR. Also referred to as 'up-mapping'

**ISO Base Media File Format**

File format for media as defined by [ISO/IEC 14496-12 \[68\]](#)

**Loudness Normalization**

Process within the audio codec that ensures consistent audio loudness across all renders, downmixes, and preselections.

**MaxCLL**

Maximum Content Light Level – Represents the brightest pixel in the entire video stream ([CTA 861-H \[31\]](#))

**MaxFALL**

Maximum Frame-Average Light Level – Represents the maximum frame average pixel light value per frame of the entire video stream ([CTA 861- H \[31\]](#)).

**Modulation Transfer Function**

The contrast performance of an optical system such as a lens as a function of spatial frequency.

**Multichannel Video Programming Distributor**

A service provider that delivers video programming services, usually for a subscription fee (pay television).



<b>Next Generation Audio</b>	Immersive sound with dynamic and static objects, an interactive and personalized audio delivery system with improved audio compression quality. NGA supports three fundamental audio element formats: Channel Sets, Audio Objects (static and/or dynamic), and Scene-based audio.
<b>Nit</b>	Unit of luminance measurement, weighted by the human visual system, formally specified in “candela per meter squared” ( $\text{cd/m}^2$ ); the term “nits” is used in this document for convenience.
<b>Opto-Electronic Transfer Function</b>	The transfer function that maps scene light captured by the camera into digital pixel values.
<b>Opto-optical Transfer Function</b>	The overall transfer function that maps scene light captured by the camera to light values produced by the display.
<b>Parametric</b>	Audio encoding method that uses side-information to reconstruct the original audio information.
<b>Perceptual Quantization</b>	Perceptual Quantization (PQ) EOTF, OETF and OOTF transfer functions specified in <a href="#">BT.2100 [5]</a> .



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<b>PQ10</b>	HDR systems or content employing Perceptual Quantization (PQ), the wide color gamut specified in <a href="#">BT.2100 [5]</a> , and 10-bit depth <sup>2</sup> (see also <a href="#">Section 7.1.2 of the Blue Book [B02]</a> )
<b>Preselection</b>	Set of Audio Program components representing a version of the Audio Program that may be selected for simultaneous decoding. An Audio Preselection is a subset of available Audio Program Components of one Audio Program.
<b>Random Access Point</b>	A collection of audio or video data packets that allow entry into a content stream without restarting the decoding process.
<b>Renderer</b>	A part of an NGA receive device, post decoding, that combines various sound program components (channels and objects) into the available reproduction channels while maintaining the original program intent and consistent audio loudness.
<b>Resolution</b>	The number of vertical and horizontal pixels available on a display device.
<b>Scene-Referred</b>	A system where the video signals represent relative light levels in a scene. (i.e. <a href="#">HLG [105]</a> or <a href="#">ITU Rec 709 [2]</a> ).

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<sup>2</sup> Note: PQ10, in some applications, e.g. DVB [12] is further limited to the Non-Constant Luminance Y'C<sub>B</sub>C<sub>R</sub> signal format and narrow range quantization specified in [BT.2100 \[5\]](#).



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<b>Scene-Light</b>	Image values resulting from applying the inverse reference OETF to the encoded image signal values [ISO-22028-5:2023 Terms 3.23].
<b>Set of Variants</b>	A Set of Variants is a collection of Variants for a given segment of a multimedia asset. Variants contain the same perceptual content but different marks and can be used interchangeably. Sets of Variants for a given asset are typically generated during the first step in a two-step watermarking system.
<b>Signal Format</b>	Describes a triplet-based system that uses different perceptual elements when combined properly to make a complete image color volume representation (color and light). Examples include $Y'C_bC_r$ , RGB, $IC_tC_p$
<b>Single-Master HDR/SDR Production</b>	A production or transmission workflow where all sources are conformed to a single HDR production format which generates derived SDR and native HDR outputs for distribution simultaneously.
<b>Standard Dynamic Range</b>	An image dynamic range using a gamma 2.4 tone curve, as specified in <a href="#">BT.1886 [4]</a> and <a href="#">BT.709 [2]</a> .
<b>System Colorimetry</b>	Specifies the chromaticity of the color primaries and the white point, allowing for a consistent, reproducible representation of images. <a href="#">BT.2020 [3]</a> and <a href="#">BT.709 [2]</a> are examples of system colorimetries.





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<b>Tone Mapping</b>	Process to reduce the dynamic range of images. Tone mapping may be used to convert from HDR to SDR/709. Also known as 'down-mapping'
<b>Variant</b>	A Variant is an alternative representation of a given segment of a multimedia asset. Typically, a Variant is a pre-watermarked version of the segment using a Forensic Watermarking technology. The segment size varies for different Forensic Watermarking technologies: a few bytes, a frame, a group of pictures, and a video fragment.
<b>Variant Sequence Generator</b>	A Variant Sequence Generator (VSG) selects a single Variant in each Set of Variants to produce a Variant Sequence. The VSG is part of the second step in a two-step watermarking system.
<b>Variant Sequence</b>	A Variant Sequence is a sequence of Variants that encodes a desired Watermark Identifier.
<b>UHD-1</b>	UHD at a resolution of 3840 H by 2160 V (this is a 4K resolution).
<b>UHD-2</b>	UHD at a resolution of 7680 H by 4320 V (this is an 8K resolution).
<b>Wide Color Gamut</b>	A color gamut wider than that of <a href="#">BT.709 [2]</a> .

**Watermark Identifier**

A serialization number that is embedded in a multimedia asset using Forensic Watermarking technology to make the asset unique. Examples of data used as a Watermark Identifier are session IDs, client IDs, device IDs, firmware versions, timestamps, etc. The Watermark Identifier is also routinely called the *payload* or the *message* in the watermarking literature. See also [Figure 6 in the Green Book](#).

## 6. Acronyms and Abbreviations

<b>ABR</b>	Adaptive Bit Rate
<b>ACES</b>	Academy Color Encoding System
<b>AVC</b>	Advanced Video Coding
<b>AVR</b>	Audio/Video Receiver
<b>BL</b>	Base Layer
<b>CA</b>	Conditional Access
<b>CAE</b>	Content Aware Encoding or Content Adaptive Encoding



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<b>CBA</b>	Channel Based Audio
<b>CBR</b>	Constant Bit Rate
<b>CDN</b>	Content Delivery Network
<b>CG</b>	Character Generator
<b>CGI</b>	Computer Generated Imagery
<b>CLLI</b>	Content Light Level Information
<b>CVBR</b>	Capped Variable Bit Rate
<b>DASH</b>	Dynamic Adaptive Streaming over HTTP
<b>DOCSIS</b>	Data Over Cable Service Interface Specification
<b>DRC</b>	Dynamic Range Control
<b>DRM</b>	Digital Rights Management



<b>DTT</b>	Digital Terrestrial Transmission
<b>DVE</b>	Digital Video Effects
<b>EL</b>	Enhancement Layer
<b>EMB</b>	Watermark EMBedder
<b>ENC</b>	Video ENCoder
<b>EOTF</b>	Electro-Optical Transfer Function
<b>EPB</b>	Encoder Boundary Point
<b>HD</b>	High Definition
<b>HDR</b>	High Dynamic Range
<b>HEIF</b>	High-Efficiency Image File Format
<b>HEVC</b>	High-Efficiency Video Coding
<b>HFR</b>	High Frame Rate



<b>HLG</b>	Hybrid Log-Gamma
<b>HLS</b>	HTTP Live Streaming
<b>HOA</b>	High Order Ambisonics
<b>HTTP</b>	Hyper Text Transfer Protocol
<b>IP</b>	Internet Protocol
<b>IPTV</b>	Internet Protocol Television
<b>ISO</b>	International Standards Organization
<b>ISOBMFF</b>	ISO Base Media File Format
<b>ITM</b>	Inverse Tone Mapping
<b>JOC</b>	Joint Object Coding
<b>LUT</b>	Look Up Table
<b>MDCV</b>	Mastering Display Color Volume



<b>MPD</b>	Media Presentation Description
<b>MTF</b>	Modulation Transfer Function
<b>MVPD</b>	Multichannel Video Programming Distributor
<b>NALU</b>	Network Abstraction Layer Unit
<b>NGA</b>	Next Generation Audio
<b>OBA</b>	Object Based Audio
<b>OETF</b>	Opto-Electronic Transfer Function
<b>OOTF</b>	Opto-Optical Transfer Function
<b>OTT</b>	Over-the-Top (i.e., Internet-based transmission of content)
<b>PCM</b>	Pulse-Code Modulation
<b>PES</b>	Packetized Elementary Stream



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<b>PQ</b>	Perceptual Quantization
<b>PVR</b>	Personal Video Recorder
<b>RTP</b>	Real-Time Transport Protocol
<b>SD</b>	Standard Definition
<b>SEI</b>	Supplemental Enhancement Information
<b>SDR</b>	Standard Dynamic Range
<b>SFR</b>	Standard Frame Rate
<b>SHVC</b>	Scalable High-Efficiency Video Coding (see Annex H of [69])
<b>STB</b>	Set Top Box
<b>TM</b>	Tone Mapping
<b>TSD</b>	Transport Stream Decoder



<b>UDP</b>	User Datagram Protocol
<b>UHD</b>	Ultra High Definition (see “ <a href="#">Foundation Ultra HD</a> ” definition above for use of this term within the scope of this document)
<b>URI</b>	Uniform Resource Identifier
<b>VBR</b>	Variable Bit Rate
<b>VDS</b>	Video Description Service
<b>VSG</b>	Variant Sequence Generator
<b>VOD</b>	Video-on-Demand
<b>WCG</b>	Wide Color Gamut
<b>WM</b>	WaterMark
<b>WM ID</b>	Watermark Identifier
<b>xDSL</b>	Digital Subscriber Line (x indicates any variety, e.g., ADSL, HDSL, SDSL, etc.)







## 7. References

- [2] Recommendation ITU-R BT.709-6:2015, “Parameter values for the HDTV standards for production and international programme exchange”, July 2015, <https://www.itu.int/rec/R-REC-BT.709-6-201506-I/en>
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- [31] CTA 861-H, “A DTV Profile for Uncompressed High Speed Digital Interfaces”, Jan 2021, <https://www.cta.tech/SearchResults?search=CTA+861>
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[105] ARIB STD-B67 Version 2.0, “Parameter Values for the Hybrid Log-Gamma (HLG) High Dynamic Range Television (HDR-TV) System for Programme Production”, January 2018, [https://www.arib.or.jp/english/std\\_tr/broadcasting/std-b67.html](https://www.arib.or.jp/english/std_tr/broadcasting/std-b67.html)

[R] **Red Book** - Introduction to UHD

[R01] Table 2, Foundation Ultra HD Content Parameters

[B] **Blue Book** – Ultra HD Production and Post Production

[B01] Section 7.1.3, Hybrid Log-Gamma (HLG) and HLG 10

[B02] Section 7.1.2, Perceptual Quantization (PQ) and PQ10 HDR

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(End of Black Book)