Ultra HD Forum Guidelines

Black Book – Terms and Acronyms

Ultra HD Forum

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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 provide significant improvements in 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), Chris Johns (Sky UK), Katy Noland (BBC), Bill Redmann (InterDigital), Chris Seeger (Comcast/NBCUniversal), 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	Guidelines Index and References
Red Book	Introduction to Ultra HD
Orange Book	Foundational Technologies for Ultra HD
Yellow Book	Beyond Foundational Technologies
Green Book	Ultra HD Distribution
Blue Book	Ultra HD Production and Post Production
Indigo Book	Ultra HD Technology Implementations
Violet Book	Real World Ultra HD
Black Book	**Terms and Acronyms**

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.

Patrick Griffis, President, Ultra HD Forum
Sept 2023

1.1 Changes from version 3.0 to 3.1

What's new in the Spring 2023 version of the UHDF Guidelines Red Book, *Terms and Acronyms* (v3.0), 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 (v3.0), the information has been updated.

We hope this new format 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 2023

2. Acknowledgements

We would like to provide the acknowledgement to all the 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.
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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 adoption of these guidelines and accepts full responsibility for any damage and/or claims arising from the adoption of 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 that are brought to its attention.

Patent holders who believe that they hold patents which 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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4. Contents

5. Terms

This guideline contains the following terms and definitions:

Access Unit (AU)	Self-contained audio stream packet.
Adaptive Bit Rate	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.
Audio Objects	An audio element that consists of an audio signal and audio metadata, which includes rendering information (e.g., gain and position) that may dynamically change. Audio Objects with positional information that does not dynamically change are referred to as “static” objects.
Binaural Audio	Process that reproduces audio for headphones, including immersive audio.
Bit Depth	The number of bits used per component. It describes the number of increments for both brightness and color.
Color Gamut	The subset of colors that can be accurately represented within a given system colorimetry, or by a certain source or output device.

Color Volume	Combined color gamut and luminance characteristics.
Color Volume Transform	A technique used to map a coordinate in one color volume to a coordinate in another color volume.
Commentary	Audio program element assigned to voice/announcer information
Convergence/ Divergence	For audio object, the amount of the ‘spread’ of the audio in acoustic space
Core Decode	Minimal decode specification, usually limited to stereo or 5.1 audio programs.
DCI-P3	Color gamut defined in SMPTE RP 431-2 [30].
Dialog Enhancement	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 preference of the viewer.
Display Referred	A system where the video signals are referenced to the exact light values of a reference display (i.e. PQ SMPTE ST 2084 [9]).
Downmixing	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).
Electro-Optical Transfer Function	The transfer function that maps digital pixel values to values of display light. Abbreviated as **EOTF**.
Forensic Watermarking	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.
Foundation Ultra HD	Term used in this document for content that conforms to the parameters shown in Table 2 in the Red Book [R01].
Full Decode	Decode specification that provides for full immersive or higher spatial resolution sound program reproduction.
Gamut Mapping	Conversion of color from one system colorimetry to a different system colorimetry. As an example, gamut mapping can be used to convert from BT.2020 [3]/2100 [5] system colorimetry to BT.709 [2] system colorimetry and vice versa.

HLG10	HDR systems or content employing Hybrid Log-Gamma (HLG), the wide color gamut specified in BT.2100 [5] and 10-bit depth.[1] (see also Section 7.1.3 in the Blue Book [B01])
HDR10	HDR systems or content employing PQ10 and further including or capable of providing SMPTE ST 2086 [10], MaxFALL, and MaxCLL metadata (see also Section 7.1.2 of the Blue Book [B02]).
High Dynamic Range	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 BT. 2100 [5] (HLG and PQ).
High Frame Rate	Content with a relative rate greater than 24 frames per second for motion pictures and greater than 60 fps for television content.
Hybrid Log-Gamma	Hybrid Log-Gamma (HLG) OETF, EOTF, and OOTF transfer functions specified in BT.2100 [5].
Immersive Audio	An audio system that enables high spatial resolution in sound source localization in azimuth, elevation and distance, and provides an increased sense of sound envelopment.

[1] Note: HLG10, in some applications, e.g. DVB [12], is further limited to the Non-Constant Luminance $Y'C'_BC'_R$ signal format and narrow range quantization specified in BT.2100 [5].

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 '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).

Next Generation Audio	Immersive sound with dynamic and static objects, 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.
Nit	Unit of luminance measurement, weighted by the human visual system, formally specified in “candela per meter squared” (cd/m^2); the term “nits” is used in this document for convenience.
Opto-Electronic Transfer Function	The transfer function that maps scene light captured by the camera into digital pixel values.
Opto-optical Transfer Function	The overall transfer function that maps scene light captured by the camera to light values produced by the display.
Parametric	Audio encoding method that uses side-information to reconstruct the original audio information.
Perceptual Quantization	Perceptual Quantization (PQ) EOTF, OETF and OOTF transfer functions specified in BT.2100 [5].

PQ10	HDR systems or content employing Perceptual Quantization (PQ), the wide color gamut specified in BT.2100 [5], and 10-bit depth [2](see also Section 7.1.2 of the Blue Book [B02])
Preselection	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.
Random Access Point	A collection of audio or video data packets that allow entry into a content stream without restarting the decoding process.
Renderer	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.
Resolution	The number of vertical and horizontal pixels available on a display device.
Scene Referred	A system where the video signals are representative of relative light levels in a scene. (i.e. HLG [105] or ITU Rec 709 [2]).

[2] Note: PQ10, in some applications, e.g. DVB [12] is further limited to the Non-Constant Luminance $Y'C'_BC'_R$ signal format and narrow range quantization specified in BT.2100 [5].

Set of Variants	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.
Signal Format	Describes a triplet-based system that use different perceptual elements when combined properly make a complete image color volume representation (color and light). Examples include Y'C_bC_r, RGB, IC_tC_p
Single-Master HDR/SDR Production	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.
Standard Dynamic Range	An image dynamic range using a gamma 2.4 tone curve, as specified in BT.1886 [4] and BT.709 [2].
System Colorimetry	Specifies chromaticity of the color primaries and white point, allowing for a consistent reproducible representation of images. BT.2020 [3] and BT.709 [2] are examples of system colorimetries
Tone Mapping	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'

Variant	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 size of the segment varies for different Forensic Watermarking technologies: a few bytes, a frame, a group of pictures, a video fragment.
Variant Sequence Generator	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.
Variant Sequence	A Variant Sequence is a sequence of Variants that encodes a desired Watermark Identifier.
UHD-1	UHD at resolution of 3840 H by 2160 V (this is a 4K resolution).
UHD-2	UHD at resolution of 7680 H by 4320 V (this is an 8K resolution).
Wide Color Gamut	Color gamut wider than the gamut of BT.709 [2].
Watermark Identifier	A serialization number that is embedded in a multimedia asset using a 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 referred to as the *payload* or the *message* in the

watermarking literature. See also Figure 6 in the Green Book.

6. Acronyms and Abbreviations

ABR	Adaptive Bit Rate
ACES	Academy Color Encoding System
AVC	Advanced Video Coding
AVR	Audio/Video Receiver
BL	Base Layer
CA	Conditional Access
CAE	Content Aware Encoding or Content Adaptive Encoding
CBA	Channel Based Audio
CBR	Constant Bit Rate

CDN	Content Delivery Network
CG	Character Generator
CGI	Computer Generated Imagery
CLLI	Content Light Level Information
CVBR	Capped Variable Bit Rate
DASH	Dynamic Adaptive Streaming over HTTP
DOCSIS	Data Over Cable Service Interface Specification
DRC	Dynamic Range Control
DRM	Digital Rights Management
DTT	Digital Terrestrial Transmission
DVE	Digital Video Effects

EL	Enhancement Layer
EMB	Watermark EMBedder
ENC	Video ENCoder
EOTF	Electro-Optical Transfer Function
EPB	Encoder Boundary Point
HD	High Definition
HDR	High Dynamic Range
HEVC	High Efficiency Video Coding
HFR	High Frame Rate
HLG	Hybrid Log-Gamma
HLS	HTTP Live Streaming
HOA	High Order Ambisonics

HTTP	Hyper Text Transfer Protocol
IP	Internet Protocol
IPTV	Internet Protocol Television
ISO	International Standards Organization
ISOBMFF	ISO Base Media File Format
ITM	Inverse Tone Mapping
JOC	Joint Object Coding
LUT	Look Up Table
MDCV	Mastering Display Color Volume
MPD	Media Presentation Description
MTF	Modulation Transfer Function
MVPD	Multichannel Video Programming Distributor

NALU	Network Abstraction Layer Unit
NGA	Next Generation Audio
OBA	Object Based Audio
OETF	Opto-Electronic Transfer Function
OOTF	Opto-Optical Transfer Function
OTT	Over-the-Top (i.e., Internet-based transmission of content)
PCM	Pulse-Code Modulation
PES	Packetized Elementary Stream
PQ	Perceptual Quantization
PVR	Personal Video Recorder
RTP	Real-Time Transport Protocol

SD	Standard Definition
SEI	Supplemental Enhancement Information
SDR	Standard Dynamic Range
SFR	Standard Frame Rate
SHVC	Scalable High-Efficiency Video Coding (see Annex H of [69])
STB	Set Top Box
TM	Tone Mapping
TSD	Transport Stream Decoder
UDP	User Datagram Protocol
UHD	Ultra High Definition (see “Foundation Ultra HD” definition above for use of this term within the scope of this document)
URI	Uniform Resource Identifier

VBR	Variable Bit Rate
VDS	Video Description Service
VSG	Variant Sequence Generator
VOD	Video-on-Demand
WCG	Wide Color Gamut
WM	WaterMark
WM ID	Watermark Identifier
xDSL	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

[3] Recommendation ITU-R BT.2020:2015, “Parameter values for ultra-high definition television systems for production and international programme exchange”, Oct 2015, ec/R-REC-BT.2020-2-201510-I/en

[4] Recommendation ITU-R BT.1886:2011, “Reference electro-optical transfer function for flat panel displays used in HDTV studio production”, March 2011, https://www.itu.int/dms_pubrec/itu-r/rec/bt/R-REC-BT.1886-0-201103-I!!PDF-E.pdf

[5] Recommendation ITU-R BT.2100, “Image parameter values for high dynamic range television for use in production and international programme exchange”, July 2018, http://www.itu.int/rec/R-REC-BT.2100

[9] SMPTE ST 2084:2014, “High Dynamic Range Electro-Optical Transfer Function of Mastering Reference Displays”, Aug 2014, https://ieeexplore.ieee.org/document/7291452

[10] SMPTE ST 2086:2018, “Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images”, April 2018, https://ieeexplore.ieee.org/document/8353899

[30] SMPTE RP 431-2:2011, “D-Cinema Quality — Reference Projector and Environment", April 2011, https://ieeexplore.ieee.org/document/7290729

[31] CTA 861-H, “A DTV Profile for Uncompressed High Speed Digital Interfaces”, Jan 2021, https://www.cta.tech/SearchResults?search=CTA+861

[68] ISO/IEC: 14496-12, “Information technology—Coding of audio-visual objects—Part 12: ISO base media file format”, December 2015, https://www.iso.org/standard/68960.html

[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

[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

(End of Black Book)