

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Series H

Supplement 19

(04/2021)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Usage of video signal type code points

ITU-T H-series Recommendations – Supplement 19

ITU-T

ITU-T H-SERIES RECOMMENDATIONS
AUDIOVISUAL AND MULTIMEDIA SYSTEMS

CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.349
Directory services architecture for audiovisual and multimedia services	H.350–H.359
Quality of service architecture for audiovisual and multimedia services	H.360–H.369
Telepresence, immersive environments, virtual and extended reality	H.420–H.439
Supplementary services for multimedia	H.450–H.499
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
VEHICULAR GATEWAYS AND INTELLIGENT TRANSPORTATION SYSTEMS (ITS)	
Architecture for vehicular gateways	H.550–H.559
Vehicular gateway interfaces	H.560–H.569
BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES	
Broadband multimedia services over VDSL	H.610–H.619
Advanced multimedia services and applications	H.620–H.629
Ubiquitous sensor network applications and Internet of Things	H.640–H.649
IPTV MULTIMEDIA SERVICES AND APPLICATIONS FOR IPTV	
General aspects	H.700–H.719
IPTV terminal devices	H.720–H.729
IPTV middleware	H.730–H.739
IPTV application event handling	H.740–H.749
IPTV metadata	H.750–H.759
IPTV multimedia application frameworks	H.760–H.769
IPTV service discovery up to consumption	H.770–H.779
Digital Signage	H.780–H.789
E-HEALTH MULTIMEDIA SYSTEMS, SERVICES AND APPLICATIONS	
Personal health systems	H.810–H.819
Interoperability compliance testing of personal health systems (HRN, PAN, LAN, TAN and WAN)	H.820–H.859
Multimedia e-health data exchange services	H.860–H.869
Safe listening	H.870–H.879

For further details, please refer to the list of ITU-T Recommendations.

Usage of video signal type code points

Summary

Supplement 19 to ITU-T H-series Recommendations provides information on video signal property description code points and their combinations that are widely used in production and video content workflows.

This H-series supplement was developed collaboratively with ISO/IEC JTC 1/SC 29 and corresponds with ISO/IEC TR 23091-4 as a technically aligned twin text.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H Suppl. 19	2019-03-29	16	11.1002/1000/13895
2.0	ITU-T H Suppl. 19	2019-10-17	16	11.1002/1000/14096
3.0	ITU-T H Suppl. 19	2021-04-30	16	11.1002/1000/14652

Keywords

AVC, CICP, HEVC, baseband video, video coding, video content, video signal type code points, video production.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

This is an informative ITU-T publication. Mandatory provisions, such as those found in ITU-T Recommendations, are outside the scope of this publication. This publication should only be referenced bibliographically in ITU-T Recommendations.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this publication may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the publication development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents/software copyrights, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the appropriate ITU-T databases available via the ITU-T website at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2021

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

	<i>Page</i>
1 Scope	1
2 References	1
2.1 Identical Recommendations International Standards	1
2.2 Paired Recommendations International Standards equivalent in technical content	1
2.3 Additional references	1
3 Definitions	3
4 Abbreviations	4
5 Overview	5
6 Workflow domains	6
7 Common video signal type combinations	7
7.1 General	7
7.2 Colour coding characteristics	7
7.2.1 General	7
7.2.2 Colour properties	9
7.2.3 Common descriptions and carriage – standard dynamic range video with narrow colour gamut	10
7.2.4 Common descriptions and carriage – standard dynamic range video with wide colour gamut	11
7.2.5 Colour coding characteristics and carriage – high dynamic range video with wide colour gamut	12
7.2.6 Baseband carriage of colour coding characteristics descriptions	13
7.3 Mastering display colour volume descriptions	15
7.3.1 Mastering display colour volume properties	15
7.3.2 Common descriptions and carriage – mastering display colour volume descriptions	15
Annex A Additional combinations not specified as industry standards	18
Annex B Relevance of system identifier tags in consumer distribution specifications	20

List of Tables

	<i>Page</i>
Table 1 – SD, HD, and UHD video colour coding characteristics properties	8
Table 2 – Source format data (resolution) carriage over broadband SDI connections	8
Table 3 – Video colour description properties and their common usage	9
Table 4 – Code point values widely used for colour coding characteristics properties	10
Table 5 – SDR NCG colour coding characteristics descriptions	11
Table 6 – SDR WCG common colour coding characteristics descriptions	12
Table 7 – HDR WCG colour coding characteristics descriptions	13
Table 8 – Baseband carriage of colour coding characteristics descriptions for SDR NCG and SDR WCG	14
Table 9 – Baseband carriage of colour coding characteristics descriptions for HDR-WCG	14
Table 10 – HDR mastering display colour volume descriptions	16
Table 11 – SDR mastering display colour volume descriptions	17
Table A.1 – Additional colour coding characteristics descriptions	18
Table B.1 – Relevant tags in consumer distribution formats	20

List of Figures

	<i>Page</i>
Figure 1 – Video workflows through different carriage domains	6

Introduction

This document discusses video signal property description code points and their combinations that are widely used in production and video content workflows. Video properties and values are usually expressed in "metadata" that can exist across production and distribution workflows. Knowledge of these properties and their combinations has value as content is processed in the end-to-end production-to-distribution workflow chain.

The combinations of all possible expressible video properties as code point values could hypothetically result in hundreds or thousands of permutations; but many of those combinations are rarely or never used in practice. For example, it is highly unlikely that perceptual quantization (PQ) transfer characteristics function specified in Rec. ITU-R BT.2100 would be combined with the colour primaries specified in Rec. ITU-R BT.601. Only a small subset of the possible combinations is used in practice.

This document is written to provide information to help the producers of various content processing tools to avoid processing mistakes that can cause video quality degradation due to having incorrect assumptions made about video property combinations. There are only a few limited sets of video property combinations that are widely used in present-day video production and distribution equipment chains. This document describes these limited sets of combinations that are currently widely used and describes how the associated signal type metadata is carried to aid in the automation of content workflows across various domains of capture, production, and distribution. Lastly, this document aims to help its readers, especially toolset developers, to repurpose tools to work properly across several domains (e.g., capture, production, production distribution, and service distribution) where similar video conversion functions (e.g., chroma subsampling or colour space conversions) can be performed.

This document is the third edition of this Supplement. In the third edition, changes have been introduced to improve clarity and terminology and to correct minor errors.

Usage of video signal type code points

1 Scope

This Supplement describes common industry representation practices for the usage of video signal type code points, as these properties are conveyed across video content production and distribution carriage systems.

2 References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

2.1 Identical Recommendations | International Standards

- Recommendation ITU-T H.222.0 | ISO/IEC 13818-1 *Information technology – Generic coding of moving pictures and associated audio information – Part 1: Systems*.
- Recommendation ITU-T H.262 | ISO/IEC 13818-2 *Information technology – Generic coding of moving pictures and associated audio information – Part 2: Video*.

2.2 Paired Recommendations | International Standards equivalent in technical content

- Recommendation ITU-T H.264, *Advanced video coding for generic audiovisual services*.
ISO/IEC 14496-10, *Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding Advanced Video Coding*.
- Recommendation ITU-T H.265, *High efficiency video coding*.
ISO/IEC 23008-2, *Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 2: High efficiency video coding*.
- Recommendation ITU-T H.273, *Coding-independent code points for video signal type identification*.
ISO/IEC 23091-2, *Information technology – Coding-independent code points – Part 2: Video*.

2.3 Additional references

- ITU-T H-Suppl. 15, *Conversion and coding practices for HDR/WCG Y'CbCr 4:2:0 video with PQ transfer characteristics*.
- ISO/IEC TR 23008-14, *Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 14: Conversion and coding practices for HDR/WCG Y'CbCr 4:2:0 video with PQ transfer characteristics*.
- ITU-T H-Suppl. 18, *Signalling, backward compatibility and display adaptation for HDR/WCG video coding*.
- ISO/IEC TR 23008-15, *Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 15: Signalling, backward compatibility and display adaptation for HDR/WCG video*.
- Apple Developer, *AVCaptureColorSpace*,
<https://developer.apple.com/documentation/avfoundation/avcapturecolorspace>.
- ARIB STD-B32 Version 3.11 *Video Coding, Audio Coding, and Multiplexing Specifications for Digital Broadcasting*.
- ATSC A/341 ATSC Standard: Video – HEVC.
- Blu-ray Disc White Paper (Ultra HD Blu-ray) *Audio Visual Application Format Specifications for BD-ROM Version 3.2*.
- CTA 861.4 *Extension – Updates to Dynamic HDR Metadata Signaling*.
- ETSI TS 101 154, *Digital Video Broadcasting (DVB): Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications*.

- ISO/IEC 14496-12, *Information technology – Coding of audio-visual objects – Part 12: ISO base media file format.*
- ISO/IEC 14496-14, *Information technology – Coding of audio- visual objects – Part 14: MP4 file format.*
- ISO/IEC 14496-15, *Information technology – Coding of audio-visual objects – Part 15: Carriage of network abstraction layer (NAL) unit structured video in ISO base media file format.*
- Recommendation ITU-R BT.601, *Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios.*
- Recommendation ITU-R BT.656, *Interface for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of Recommendation ITU-R BT.601.*
- Recommendation ITU-R BT.709, *Parameter values for the HDTV standards for production and international programme exchange.*
- Recommendation ITU-R BT.1120, *Digital interfaces for studio signals with 1920x1080 image formats.*
- Recommendation ITU-R BT.1886, *Reference electro-optical transfer function for flat panel displays used in HDTV studio production.*
- Recommendation ITU-R BT.2020, *Parameter values for ultra-high definition television systems for production and international programme exchange.*
- Recommendation ITU-R BT.2077, *Real-time serial digital interfaces for UHD TV Signals.*
- Recommendation ITU-R BT.2100, *Image parameter values for high dynamic range television for use in production and international programme exchange.*
- SMPTE Registration Authority,
https://registry.smpite-ra.org/view/published/elements_by_group_view.html.
- SMPTE ST 259, *For Television – SDTV1 Digital Signal/Data – Serial Digital Interface.*
- SMPTE ST 292-1, *1.5 Gb/s Signal Data Serial Interface.*
- SMPTE ST 298, *Universal Labels for Unique identification of Digital Data.*
- SMPTE ST 335, *Metadata Element Dictionary Structure.*
- SMPTE ST 336, *Data Encoding Protocol using Key-Length-Value.*
- SMPTE ST 372, *Dual Link 1.5 Gb/s Digital Interface for 1920 x 1080 and 2048 x 1080 Picture Formats.*
- SMPTE ST 377-1, *Material Exchange Format (MXF) – File Format Specification.*
- SMPTE ST 395, *Television – Metadata Groups Register Structure.*
- SMPTE ST 424-3, *Image Format and Ancillary Data Mapping for the Dual Link 3 Gb/s Serial Interface.*
- SMPTE ST 425-1, *Source Image Format and Ancillary Data Mapping for the 3 Gb/s Serial Interface.*
- SMPTE ST 425-5, *Image Format and Ancillary Data Mapping for the Quad Link 3 Gb/s Serial Interface.*
- SMPTE ST 2003, *Types Dictionary Structure.*
- SMPTE ST 2022-6, *Transport of High Bit Rate Media Signals over IP Networks (HBRMT).*
- SMPTE ST 2036-3, *Ultra High Definition Television – Mapping into Single-link or Multilink 10 Gb/s Serial Signal/Data Interface.*
- SMPTE ST 2067-20, *Interoperable Master Format- Application #2.*
- SMPTE ST 2067-21, *Interoperable Master Format- Application #2E.*
- SMPTE ST 2081-10, *2160-line and 1080-line Source Image and Ancillary Data Mapping for Single-Link 6G-SDI.*
- SMPTE ST 2081-11, *2160-line and 1080-line Source Image and Ancillary Data Mapping for Dual-link 6G-SDI.*
- SMPTE ST 2081-12, *4320-line and 2160-line Source Image and Ancillary Data Mapping for Quad-link 6G-SDI.*
- SMPTE ST 2082-10, *2160-Line Source Image and Ancillary Data Mapping for 12G-SDI.*
- SMPTE ST 2082-11, *4320-line and 2160-line Source Image and Ancillary Data Mapping for Dual-link 12G-SDI.*
- SMPTE ST 2082-12, *4320-line and 2160-line Source Image and Ancillary Data Mapping for Quad-link 12G-SDI.*

- SMPTE ST 2086, *Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images*.
- SMPTE ST 2110-20, *Professional Media Over Managed IP Networks: Uncompressed Active Video*.
- SMPTE ST 2113, *Colorimetry of P3 Color Spaces*.

3 Definitions

For the purposes of this Supplement, the following definitions and the definitions in the high efficiency video coding (HEVC) specifications (Rec. ITU-T H.265 | ISO/IEC 23008-2), advanced video coding (AVC) specifications (Rec. ITU-T H.264 | ISO/IEC 14496-10), and coding-independent code points (CICP) specifications (Rec. ITU-T H.273 | ISO/IEC 23091-2) apply.

3.1 3G-SDI: Serial digital interface with a transport capacity of 2.970 Gbit/s and 2.970/1.001 Gbit/s for transporting uncompressed digital video signals.

3.2 6G-SDI: Serial digital interface with a transport capacity of 5.94 Gbit/s and 5.94/1.001 Gbit/s for transporting uncompressed digital video signals.

3.3 10G-SDI: Serial digital interface with a transport capacity of 10.692 Gbit/s for transporting uncompressed digital video signals.

3.4 12G-SDI: Serial digital interface with a transport capacity of 11.88 Gbit/s and 11.88/1.001 Gbit/s for transporting uncompressed digital video signals.

3.5 colour coding characteristics: Combination of colour gamut, colour primaries, dynamic range, transfer function, colour representation, video range, and chroma sample location.

3.6 colour volume: Space of all colours and intensities that a device or signal can reproduce or convey.

3.7 creative intent: Desired vision of the content creator (e.g., a director, cinematographer, videographer, editor, or colourist) who adjusts and approves the appearance of rendered content in the production process.

3.8 dual-link SDI: Two parallel serial digital interfaces for transporting uncompressed video signals.

3.9 electro-optical transfer function (EOTF): Function to map a non-linear video signal to display linear light.

3.10 full range: Range in a fixed-point (integer) representation such that the active video range spans the full range of values that could be expressed with that bit depth.

3.11 HD-SDI: Serial digital interface for transporting uncompressed digital HD video signals.

3.12 inverse electro-optical transfer function (inverse EOTF): Function that is the inverse of an EOTF.

3.13 inverse opto-electrical transfer function (inverse OETF): Function that is the inverse of an OETF.

3.14 narrow range: Range in a fixed-point (integer) representation such that the active video range does not span the full range of values that could be expressed with that bit depth, although the remaining range could potentially be used for undershoot or overshoot processing artefacts and sync.

NOTE – Narrow range is, in some applications, referred to by synonyms such as: "limited range", "video range", "legal range", "SMPTE range" or "standard range".

3.15 opto-electrical transfer function (OETF): Function to map relative scene linear light to a non-linear video signal.

3.16 opto-optical transfer function (OOTF): Function to map relative scene linear light to display linear light.

3.17 quad-link SDI: Four parallel serial digital interfaces for transporting uncompressed video signals.

3.18 random access point access unit (RAPAU): Access unit in a video bitstream containing an intra-coded picture with the property that all pictures following the intra-coded picture in output order can be correctly decoded without using any information preceding it in the bitstream.

3.19 SDI: Serial digital interface for transporting uncompressed video signals.

3.20 SD-SDI: Signal digital interface for transporting uncompressed digital SD video signals.

3.21 transfer function: Function among any of the following: EOTF, inverse EOTF, OETF, inverse OETF, OOTF, or inverse OOTF.