UHD World Association
世界超高清视频产业联盟

Technical requirements of programme broadcasting of UHD video and audio broadcasting system for "Bai Cheng Qian Ping"

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Contents

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1 Scope

This document specifies the technical requirements for programme signal broadcasting, file packaging format, programme metadata of UHD video and audio broadcasting system for "Bai Cheng Qian Ping ".
This document is applicable to the broadcasting and exchange of programme in the UHD video and audio broadcasting system for "Bai Cheng Qian Ping ".

2 Normative References

The contents in the following documents, through normative references in the text, constitute indispensable provisions of this document. Among them, the dated reference documents are only applicable to the version corresponding to that date; For undated references, the latest version (including all amendments) is applicable to this document.
GB/T 41808—2022 Image parameter values for high dynamic range television for use in production and programme exchange (ITU-R BT.2100-2:2018)
GB/T 41809—2022 Parameter values for ultra-high definition television systems for production and programme exchange (ITU-R BT.2020-2:2015)
GY/T 202.1-2004 Specification for Cataloging of Audio visual Materials of Radio and Television Part 1: Television Materials
GY/T 275-2013 Technical Specifications for Monitoring the Production and Broadcasting Quality of Radio Programme
GY/T 313-2017 High Definition Television Programme Recording Specification
GY/T 358-2022 Technical requirements for display adaptation metadata of high dynamic range television systems
SMPTE ST 377-2:2019 Material Exchange Format (MXF) - File Format Specification
SMPTE ST 378M:2004 Material Exchange Format (MXF) -Operational Pattern 1A (Single Item, Single Package)
SMPTE ST 379-2:2010 Material Exchange Format (MXF) - MXF Constrained General Container
T/UWA 009.1-2022 3D Audio Technology Specification: Part 1: Coding, Distribution and Presentation

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 Ultra high definition video and audio programme

UHD video and audio programme include 4K UHD video and audio programme and 8K UHD video and audio programme.

3.2 4K ultra high definition video and audio programme

The signal format conforms to HDR UHD TV programme specified in GB/T 41808—2022 or GB/T 41809—2022 , the image resolution is 3840 × 2160.

3.3 8K ultra high definition video and audio programme

The signal format conforms to HDR UHD TV programme specified in GB/T 41808—2022 or GB/T 41809—2022 , the image resolution is 7680 × 4320.

3.4 **Master control**

The source signal is controlled and processed to form a control system for TV programme broadcast signal.

3.5 **Terminal display system**

A system that receives signals from a transmission system and decodes them for display.

3.6 **HDR Vivid（High Dynamic Range Vivid）**

HDR technical specification specified in GY/T 358-2022, and the name of supporting derivative technology

3.7 **Audio Vivid**

Coding, distribution and presentation methods of audio technology specified in T/UWA 009.1-2022, including stereo, surround sound, 3D audio, etc.

3.8 **Bai Cheng Qian Ping**

'Bai Cheng Qian Ping' means 'a hundred cities and a thousand large screens', which is a public promotion project, refers to the 8K UHD HDR image and 3D audio played on over a thousand large screens at commercial streets in more than hundred major cities.

4 Abbreviations

The following abbreviations are applicable to this document.

AVS2 Information Technology-High Efficiency Media Coding Part 2: Video

AVS3 Information Technology Intelligent Media Coding Part 2: Video

HLG Hybrid Log Gamma

KLV Key-Length-Value

LKFS Loudness of K-weighted relative to Full Scale

LU Loudness Unit

MXF Material Exchange Format

OP1a Operational Pattern 1a

PCM Pulse Code Modulation

PQ Perceptual Quantization

TP True Peak

5 UHD Video and Audio Broadcasting System Workflow

4K UHD Video and Audio Broadcasting System Workflow is shown in Figure 1. 8K UHD Video and Audio Broadcasting System Workflow is shown in Figure 2.

FIGURE 1

Flow Diagram of 4K UHD Video and Audio Broadcasting System

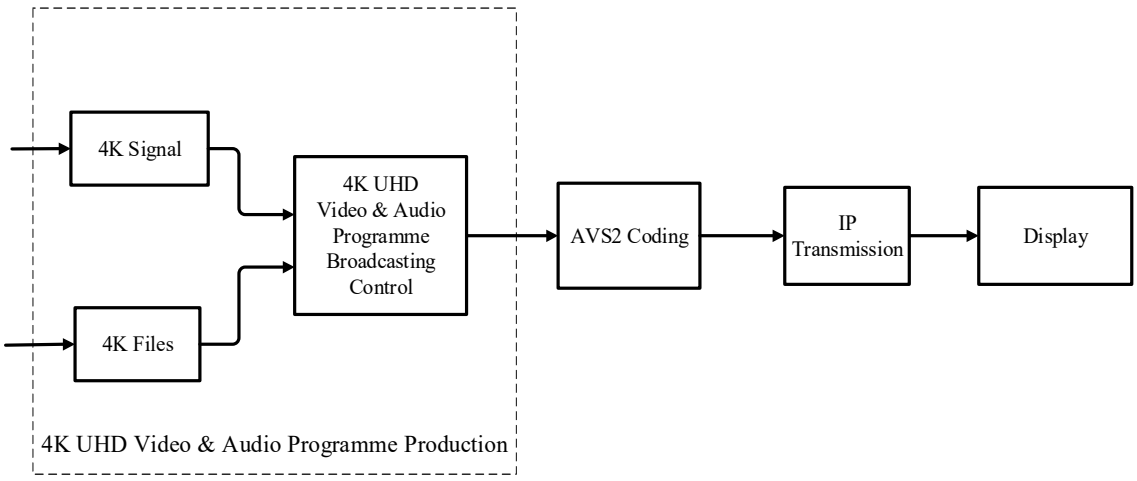
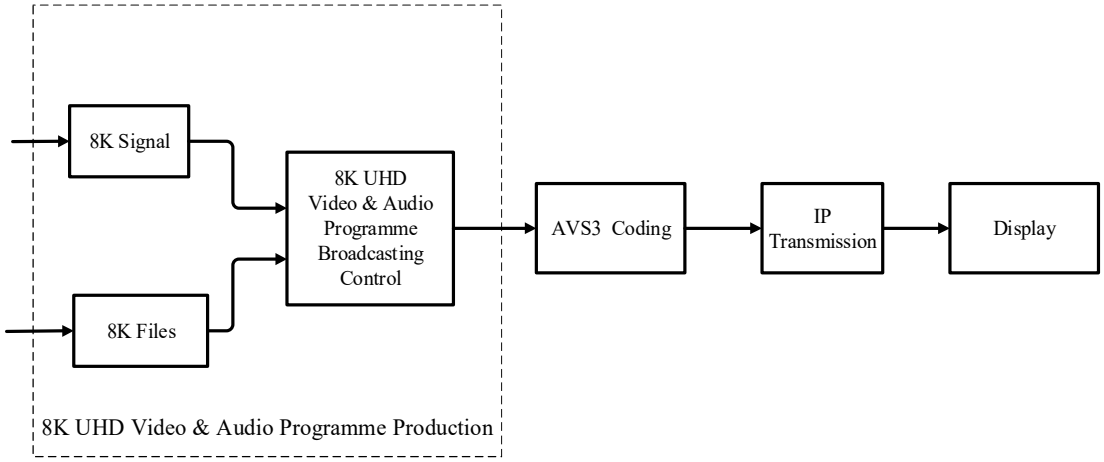


FIGURE 2

Flow Diagram of 8K UHD Video and Audio Broadcasting System



6 Technical specifications for UHD programme video

6.1 Technical specifications for 4K UHD programme video

Technical specifications for 4K UHD programme video refers to Table 1.

Table 1

Technical specifications for 4K UHD programme video

NO.	Item	Parameter
1	Pixel count Horizontal × vertical	3840×2160
2	Picture aspect ratio	16: 9
3	Frame frequency	50Hz、100Hz
4	Scan mode	Progressive
5	Color gamut	BT.2020
6	HDR	HLG or PQ[a] (in accordance with GB/T 41808—2022)
7	Sampling	4: 2:2 or 4:4:4
8	Quantization levels	10bit or 12bit
9	Sampling lattice	Orthogonal
10	Pixel aspect ratio	1:1 (square pixels)
11	Pixel addressing	Pixel ordering in each row is from left to right, and rows are ordered from top to bottom.
12	Coding format	XAVC-I Intra Class 300
13	Bitrate	Not less than 500Mbps
14	File format	MXF OP1a
a: HDR Vivid can be used if dynamic metadata is provided for broadcast programme.		

6.2 Technical specifications for 8K UHD programme video

Technical specifications for 8K UHD programme video refers to Table 2.

Table 2

Technical requirements for video signal of 8K UHD broadcast programme

NO	Item	Parameter
1	Pixel count Horizontal × vertical	7 680×4 320
2	Picture aspect ratio	16: 9
3	Frame frequency	50Hz、100Hz
4	Scan mode	Progressive
5	Color gamut	BT.2020
6	HDR	HLG or PQ[a] (in accordance with GB/T 41808—2022)
7	Sampling	4: 2:2 or 4:4:4
8	Quantization levels	10bit or 12bit
9	Sampling Lattice	orthogonal
10	Pixel aspect ratio	1:1 (square pixels)
11	Pixel addressing	Pixel ordering in each row is from left to right, and rows are ordered from top to bottom.
12	Coding format	JPEG XS High 444 12 Profile as defined by ISO/IEC 21122-2
13	Bitrate (Intra-frame compression)	2073.6Mbps
14	File format	MXF OP1a
a: HDR Vivid can be used if dynamic metadata is provided for broadcast programme.		

6.3 Image quality requirements

The programme image is clear (including static definition and dynamic definition), the main focus is accurate;

Natural color restoration, normal skin color, good color saturation;

Rich image layers and moderate contrast;

The overall image brightness of the programme is controlled, and there is no flickering phenomenon in the same scene, and the brightness matches the scene;

The dynamic range of image brightness is used reasonably, and the light and dark details of the picture are fully displayed;

The images of different planes in the same programme and images of different scenes have good consistency in brightness, color, contrast, etc;

The image is free of obvious noises and interference;

The position of programme subtitles and graphics in the screen is appropriate, clear without flicker, with appropriate brightness and font size.

The following pictures shall not appear in the finished programme:

1) Black field pictures that have nothing to do with programme content and whose full frame luminance signal sample values are lower than 72 (10bit)/288 (12bit);

2) The monochrome picture that has nothing to do with the programme content and the difference between the sample values of full frame color difference signals (C_B, C_R) is less than 40 (10bit)/160 (12bit);

3) Color bar pictures unrelated to programme content;

4) The still frame picture irrelevant to the programme content.

6.4 Signal range

The Signal representations should be narrow range. The Quantization levels assignment of R, G, B or Y is generally within the nominal range of the signal specified in Table 3. Considering that there may be a certain fluctuation when the signal is produced, the expandable signal range is within the expandable signal range specified in Table 3, but should not exceed the whole signal range specified in Table 3.

Table 3

Quantization levels assignment

Quantization levels	Nominal range of signal	Expandable signal range	Whole signal range
10bit	64~940	20~984	4~1019
12bit	256~3760	80~3936	16~4079

6.5 Nominal signal level

When the nominal signal level is used to facilitate the system line-up, the HDR reference white signal level is 75%HLG or 58%PQ, and the nominal luminance is 203 cd/m^2 (Peak luminance is 1000 cd/m^2). In order to ensure a better presentation effect of the "Bai Cheng Qian Ping ", the HDR reference white signal level is 79%HLG or 60.7%PQ, and the nominal luminance is 260 cd/m^2 (Peak luminance is 1000 cd/m^2).

7 Technical specifications for UHD programme audio

Sound encoding of UHD programme is "Audio Vivid", that can be delivered in 3D sound, surround sound, or stereo modes depending on the platform.

7.1 Channel allocation

Channel distribution refer to Table 4.

Table 4

Channel distribution

Track	Channel
Track 1	3D audio/Surround sound Left（L）
Track 2	3D audio/Surround sound Right（R）
Track 3	3D audio/Surround sound Centre（C）
Track 4	3D audio/Surround sound Low frequency effects（LFE）
Track 5	3D audio/Surround sound Left surround（LS）
Track 6	3D audio/Surround sound Right surround（RS）
Track 7	Stereo Left（L）[a]
Track 8	Stereo right（R）
Track 9	3D audio Left top front（Ltf）
Track 10	3D audio Right top front（Rtf）
Track 11	3D audio Left top rear（Ltr）
Track 12	3D audio Right top rear（Rtr）
a: Consider adapting to 8K UHD, high standard definition, new media co broadcasting, and some broadcasting platforms that do not have 3D audio coding capabilities.	

7.2 Audio signal parameter requirements

The sampling frequency of audio signal shall not be less than 48 kHz, PCM linear quantization shall be adopted, and the quantization bits shall not be less than 16 bit.

7.3 **Audio level and loudness requirements**

The maximum true peak level shall not exceed -2 dBTP, the average loudness shall be -24LKFS, and the Variations of loudness shall be ±2 LU.

7.4 **Sound quality requirements**

The overall sound quality is good, including frequency response, clarity and intelligibility;
The overall balance is good, including loudness balance, timbre balance, audio pan balance, and dynamic balance;
Good artistic presentation, including appeal, sense of space, sense of presence, sense of encirclement, and sense of reality;
Each channel of the programme should have a good phase relationship. When downmix, there should be no missing content or obvious sound quality change;
There shall be no mute irrelevant to the programme content and the audio level is less than -60 dBFS;
There shall be no abnormal fluctuation, distortion, noise, breakpoint and other phenomena unrelated to the programme content.

8 **Relative timing of sound and vision for UHD programme**

UHD programme should keep sound and vision synchronized. Acceptability thresholds are about +20ms to -60ms on the average, a positive value indicates that sound is advanced with respect to vision. The phenomenon of sound and vision out of sync is subjectively imperceptible.

9 **File format requirements for UHD programme**

UHD programme files should be MXF , The MXF file format should be OP1a , and KLV data encoding is used. The files structure should comply with the requirements of SMPTE ST 377-1:2019; The container should comply with the requirements of SMPTE ST 379-2:2010; The operating mode should comply with the requirements of SMPTE ST 378M:2004.

10 **Basic requirements for metadata of UHD programme**

Programme layer metadata should be provided in accordance with GY/T 202.1-2004, and at least include: title (such as programme name), creator name (such as programme producer), creator responsibility mode (such as self-produced, cooperate produced or commissioned production), copyright owner name, production completion date, programme type (such as news, sports, variety arts, special topics, etc.), and programme duration.
Other options include: subject words, subject characters, event date, column name, audio surround sound metadata, internal audit or technical audit information, etc.

11 **Record requirements for UHD programme files**

Each programme file should not be recorded for more than one hour, and programme that exceed one hour should be divided into multiple file records.
For programmes with multiple episodes, each file record should not be more than one episode.
Only one programme file should be recorded in the same broadcast recording medium.

12 **UHD programme storage medium**

Digital storage media such as hard disk should be used for programme exchange.

References

GY/T 364—2023 Recording specification for 4K ultra high definition TV programmes