वर्गीय आवश्यकताओं के लिए मानक

टीईसी ५७०६०:२०२४

STANDARD FOR GENERIC REQUIREMENTS

TEC 57060:2024

अल्ट्रा हाई डेफिनिशन (यूएचडी) और आभासी वास्तविकता के साथ हाइब्रिड सेट टॉप बॉक्स (एसटीबी)

HYBRID SET TOP BOX (STB) WITH SUPPORT FOR ULTRA HIGH DEFINITION (UHD) & VIRTUAL REALITY (VR)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-११०००१, भारत

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FOREWORD

Telecommunication Engineering Centre (TEC) is the technical arm of Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
- Formulation of Essential Requirements (ERs) under Mandatory Testing and Certification of Telecom Equipment (MTCTE)
- Field evaluation of Telecom Products and Systems
- Designation of Conformity Assessment Bodies (CABs)/Testing facilities
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DoT on technical/technology issues

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located in New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This Standard for Generic Requirements outlines the technical requirements of a Hybrid Set-Top Box (STB) with support for Ultra High Definition (UHD) and Virtual Reality (VR) capabilities. This standard outlines the important technical aspects such as UHD video rendering, immersive audio, low latency, advanced user interfaces, and virtual reality experience. These technical specifications aim to enhance the user experience, enabling viewers to enjoy UHD content while seamlessly transitioning into the immersive realms of VR and creating a new dimension in home entertainment.

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HISTORY SHEET

Sl. No.	**Standard / document *No.***	***Title***	***Remarks***
1.	Standard Number 57060:2024	Hybrid Set-Top Box (STB) with support for Ultra High Definition (UHD) and Virtual Reality (VR)	New Standard For GR
1.	Standard Number	Hybrid Set-Top Box (STB) with support for Ultra High Definition (UHD) and Virtual Reality (VR)	Revision Standard For GR

REFERENCES

S. No.	Document No.	Title/Document Name
(I): TEC GR/IR/SDs		
1.	TEC/SD/DD/EMC-221/05/OCT-16	Electromagnetic Compatibility Standard for Telecommunication Equipment
(II): ITU-T/ IEEE/ETSI/BIS/European Standard (To be updated)		
1.	BIS IS 15954: 2012	Digital Set Top Box for MPEG-4 DTH Services
2.	BIS IS 16128: 2013	Set Top Box for MPEG - 4 Digital Cable TV Services
3.	H.264/AVC	Advanced Video Coding
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5.	EN 300 421	Digital Video Broadcasting (DVB); Framing structure, channel coding, and modulation for 11/12 GHz satellite services
6.	EN 300 429	Digital Video Broadcasting (DVB); Framing structure, channel coding, and modulation for cable systems
7.	ETSI TS 101 154	Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications
8.	ISO/IEC 14496-10	Information Technology--Coding of audio-visual objects—Part 10: Advanced video coding
9.	ISO/IEC 11172-3	Information Technology - Coding of Moving Pictures and Associated Audio for Digital Storage Media at up to About 1,5 Mbit/s - Part 3: Audio
10.	IEEE 802.3	Ethernet Standard
11.	IEE 802.11	The set of standards that define communication for wireless LANs (wireless local area networks, or WLANs)
12.	ITU-T J.297	Requirements and functional specification of cable set-top box for 4K ultra high-definition television

13.	ITU-T J.298	Requirements and technical specifications of a cable TV hybrid set-top box compatible with terrestrial and satellite TV transport
14.	Recommendation ITU-T J.1292 (ex J.STB-UHDVR)	Functional requirements for cable Set-top Box supporting Ultra-High-Definition video and Virtual Reality services
15.	[ITU-T H.262]	Recommendation ITU-T H.262 (2012), Information technology – Generic coding of moving pictures and associated audio information: Video.
16.	[ITU-T H.264]	Recommendation ITU-T H.264 (2021), Advanced video coding for generic audiovisual services.
17.	[ITU-T H.265]	Recommendation ITU-T H.265 (2023), *High efficiency video coding*. ISO/IEC 23008-2:2023, Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 2: High efficiency video coding
18.	[ITU-T H.266]	Recommendation ITU-T H.266 (2023), Versatile video coding ISO/IEC 23090-3:2022, Information technology – Coded representation of immersive media – Part 3: Versatile video coding
19.	[ITU-T J.83]	Recommendation ITU-T J.83 (2007), *Digital multi-programme systems for television, sound and data services for cable distribution.*
20.	[ITU-T J.122]	Recommendation ITU-T J.122 (2007), *Transmission systems for interactive cable television services Annex B: Data-over-cable service interface specifications: Radio-frequency interface specification.*

21.	[ITU-T J.142]	Recommendation ITU-T J.142 (2000), *Methods for the measurement of parameters in the transmission of digital cable television signals.*
22.	*[ITU-T J.222.1]*	Recommendation ITU-T J.222.1 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems: Physical layer specification.*
23.	*[ITU-T J.222.2]*	Recommendation ITU-T J.222.2 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems: MAC and Upper Layer protocols Volume 1: Core Recommendation.*
24.	*[ITU-T J.296]*	Recommendation ITU-T J.296 (2012), *Specifications for a hybrid cable set-top box.*
25.	[ITU-T J.1631]	Recommendation ITU-T J.1631(2021), *Functional requirements of E2E network platforms to enhance the delivery of cloud-VR services over integrated broadband cable networks.*
26.	[ITU-R BT.2420-0]	Recommendation ITU-R BT.2420-0(2018), *Collection of usage scenarios and current statuses of advanced immersive audio-visual (AIAV) systems*
27.	[ISO/IEC 60958-1]	ISO/IEC 60958-1:2004, *Digital audio interface – Part 1: General*.
28.	[ISO/IEC 13818-3]	ISO/IEC 13818-3:1998, Information technology – Generic coding of moving pictures and associated audio information – Part 3: Audio
29.	[ISO/IEC 13818-7]	ISO/IEC 13818-7:2006, Information technology, Generic coding of moving pictures and associated audio information, Part 7: Advanced Audio Coding (AAC)

30.	[ISO/IEC 14496-2]	ISO/IEC 14496-2:2004 - Information technology - Coding of audio-visual objects -- Part 2: Visual
31.	[ISO/IEC 14496-3]	ISO/IEC 14496-3:2019, Information technology – Coding of audio-visual objects – Part 3: Audio.
32.	[ISO/IEC 23001-7]	ISO/IEC 23001-7:2023, Information technology - *MPEG systems technologies* — Part 7: Common encryption in ISO base media file format files
33.	[ISO/IEC 23003-3]	ISO/IEC 23003-3:2020, Information technology – *MPEG audio technologies – Part 3: Unified speech and audio coding*
34.	[ISO/IEC 23003-4]	ISO/IEC 23003-4:2020, Information technology – *MPEG audio technologies – Part 4: Dynamic range control*
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(III): Other Standards		
1.	CISPR 32(2015)/ EN 55032	Limits and methods of measurement of radio disturbance characteristics of ITE (Information Technology Equipment)
2.	IEC/EN 61000-4-2	Testing and measurement techniques– Electrostatic discharge immunity test
3.	IEC/EN 61000-4-3	Testing and measurement techniques – Radiated, Radio-frequency electromagnetic field immunity test
4.	IEC/EN 61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques –Electrical fast transient/burst immunity test
5.	IEC/EN 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques – Surge immunity test

6.	IEC/EN 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio frequency fields
7.	IEC/EN 61000-4-11	Electromagnetic compatibility (EMC) Part 4- 11: Testing and measurement techniques Voltage dips, short interruptions, and voltage variations immunity tests
8.	IEC/EN 61000-4-29	Testing and measurement techniques – Voltage dips, short interruptions, and voltage variations on DC input power port immunity tests
9.	IS 13252 / IEC 60950	Information Technology Equipment -- Safety, Part 1: General Requirements
10.	IEC 62368-1	Audio/video, information, and communication technology equipment-Part1 : Safety requirements

CHAPTER-1

1.1 Introduction

1.1.1 Hybrid Set-Top Box (STB) with support for Ultra High Definition (UHD) and Virtual Reality (VR) is a set-top box that supports UHD decoding and seamless integration of Virtual Reality (VR) capabilities. This STB supports Ultra High Definition (UHD) format and Virtual Reality (VR) services. These technologies have revolutionized the consumer experience of interacting with digital content. UHD and VR technologies have led to significant advancements in the entertainment and immersive content consumption industry. This Standard explores the technical requirements for set-top boxes that support UHD and virtual reality systems. This technical requirement will help consumers and industry in delivering superior audiovisual experiences and making UHD reception and Virtual Reality a reality in our lives.

1.1.2 As per the specification of ITU [ITU-R BT.2020], *Ultra-High Definition Television (UHDTV) provides viewers with an enhanced visual experience primarily by a wider field of view that covers a considerable part of the human natural visual field with appropriate screen sizes relevant to usage at home and in public places. Signal formats contributing to increasing compression efficiency are desirable for UHDTV systems as they have a larger number of pixels than HDTV systems.*

1.1.3 As per ITU specification of ITU [b-ITU-R BT.2420-0], *VR is a technology that replicates an environment, real or imagined, and simulates a user's physical presence and environment to allow for user interaction. Virtual reality artificially creates a sensory experience, which can include sight, touch, hearing, and smell. The current VR devices primarily present content to the visual and auditory systems. On occasion, haptics information is also included.*

1.2 Description

This section describes the block diagram and functional introduction of the UHD-STB.

1.2.1 **UHD -** Ultra High-Definition set-top boxes are electronic devices that are used to receive and decode UHD television signals. Through these boxes, users can access UHD content, which provides significantly better resolution and image quality than standard HD. UHD-STB may be available with various features such as internet connectivity, app support, and recording capabilities, enhancing the viewing experience. UHD-STB can have applications such as gaming in 4K, 8K or above resolution and play more applications, audio, videos, music, movies, etc. By using an Ethernet cable/Wi-Fi connection to connect to an internet server, user can surf the internet by using a web browser, etc.

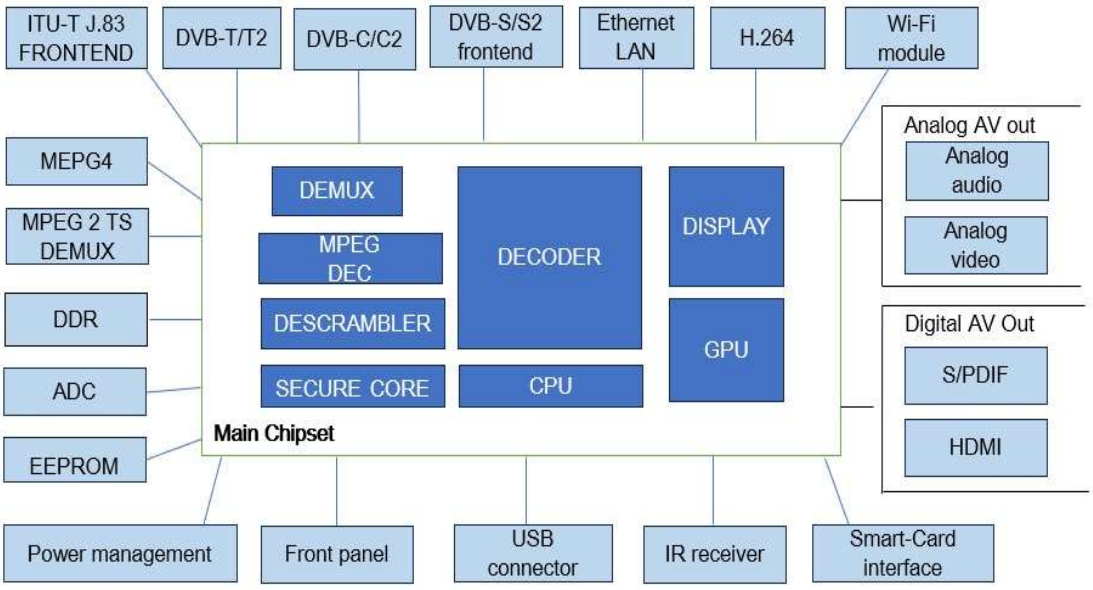

Fig 1: Block diagram of ultra-high definition (UHD) set-top box
(Ref: ITU-T J.298)

This architecture combines the high-performance UHD AVC decoding back-end and the internet connectivity through Ethernet/Wi-Fi.

The basic hardware diagram for the UHD STB is shown in Figure 1, which contains the following modules:

i. The main chipset, the core module of the UHD STB, contains the central processing unit (CPU), graphics processing unit (GPU), audio and video decoder and all the relevant processors
ii. Memory, which contains double data rate (DDR) for software execution
iii. Frontend which includes at least one of ITU-T J.83, DVB-S/S2 and DVB C/C2
iv. MPEG 2/MPEG4/H.264 /H.265 TS DEMUX for DVBS/S2 and DVBC/C2
v. Power module
vi. Ethernet interface
vii. USB interface
viii. Wi-Fi 6 module
ix. Audio and video output interface
x. Conditional access system (CAS) / DRM
xi. Keyboard interface
xii. Bluetooth Interface for Headset Connectivity/ or game controller/ remote connectivity.
xiii. For DVBS/DVBS2 services the STB will meet the standards as per BIS IS15954:2012 Digital Set Top Boxes for MPEG 4 DTH- Specification and for DVB C IS16128: 2013 Set TOP Boxes for MPEG 4 Digital Cable TV Services-Specification.

1.2.2 **VR -** Virtual reality uses computer technology to create a realistic, immersive digital environment that integrates visual, auditory, tactile, olfactory, and gustatory sensations. Users interact with this environment through input and output devices, simulating natural interactions with virtual objects and resulting in a realistic sensory experience.

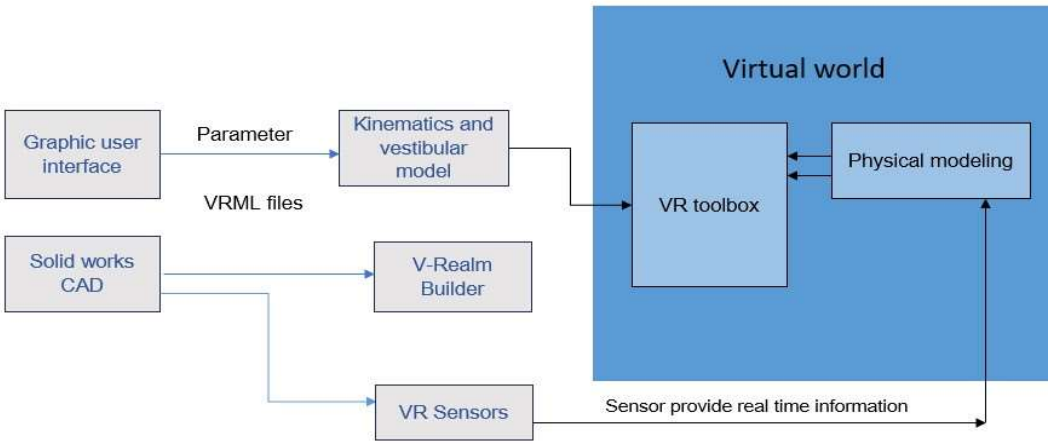

Fig 2: Block diagram of Virtual Reality Box

The basic hardware diagram for the VR is shown in Figure 2, contains the following modules:

i. Head-mounted display (HMD).
ii. The physical modeling module extends the capabilities of the virtual world and related software supports virtual reality graphics design.
iii. V realm builder is a feature of VR that allows you to design and customize your virtual reality world.
iv. VR Sensors are embedded in the VR and provide real-time information and other data to the VR system.
v. Wireless Module allows the VR system to connect to external devices, such as smartphones or tablets, enabling remote control, content sharing, and other features.
vi. Graphical User Interface (GUI) in the VR box is the system of buttons, icons, and other graphical elements that allow users to interact with the interface.
vii. The Main Processing Unit (CPU) is the brain of the system, responsible for executing commands.
viii. Controllers: Devices that user can hold in their hands to interact with the virtual world.

1.2.3 UHD Cable STB with VR service system

Fig. 3 shows the system overview for cable network-based service system supporting VR service with integrated UHD STB. it consists of content, Service head-end, Optical fiber network, Optical Node and UHD cable STB device.

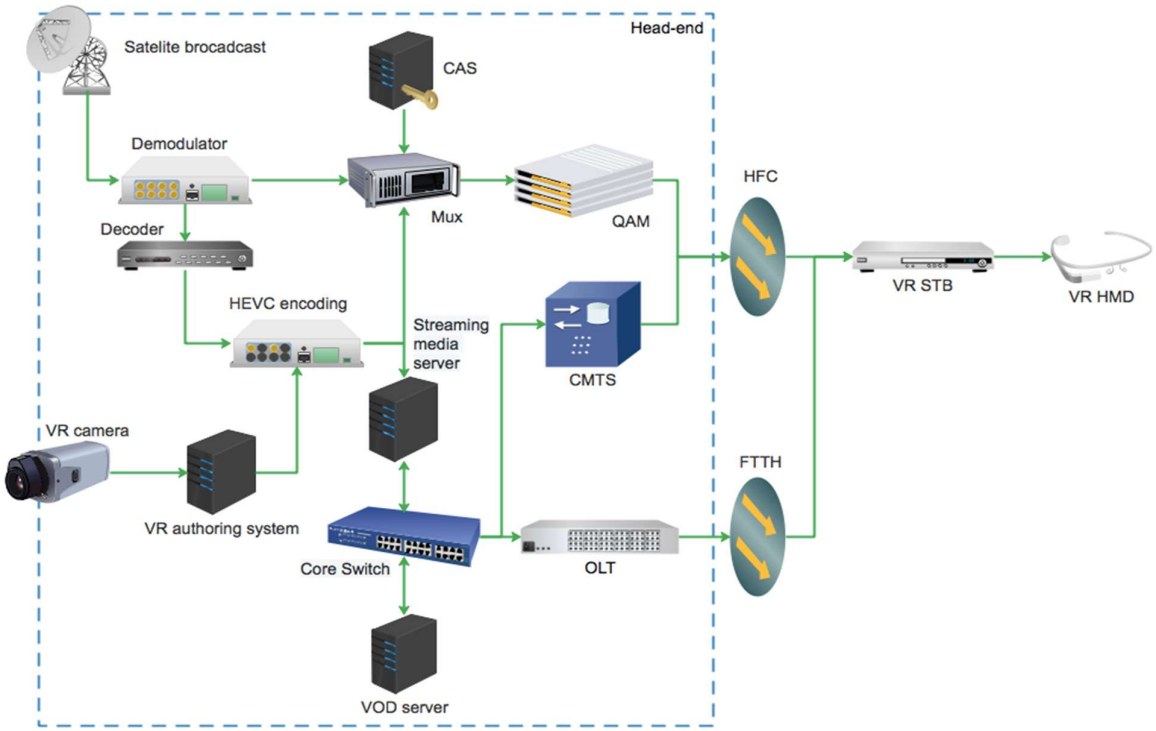

Fig 3 – UHD Cable STB with VR service system overview

(Ref: New Recommendation ITU-T J.1292 (ex J.STB-UHDVR))

1.2.4 Hardware architecture of the UHD STB with VR service

As mentioned in [3], VR glasses or HMD are connected to the UHD Set-top box, which enables the Set-top box to support VR services and bring better user experience. This contribution try to propose the functional requirements of UHD Cable Set-top box supporting VR business. Figure 4 shows the hardware architecture of the Set-Top box.

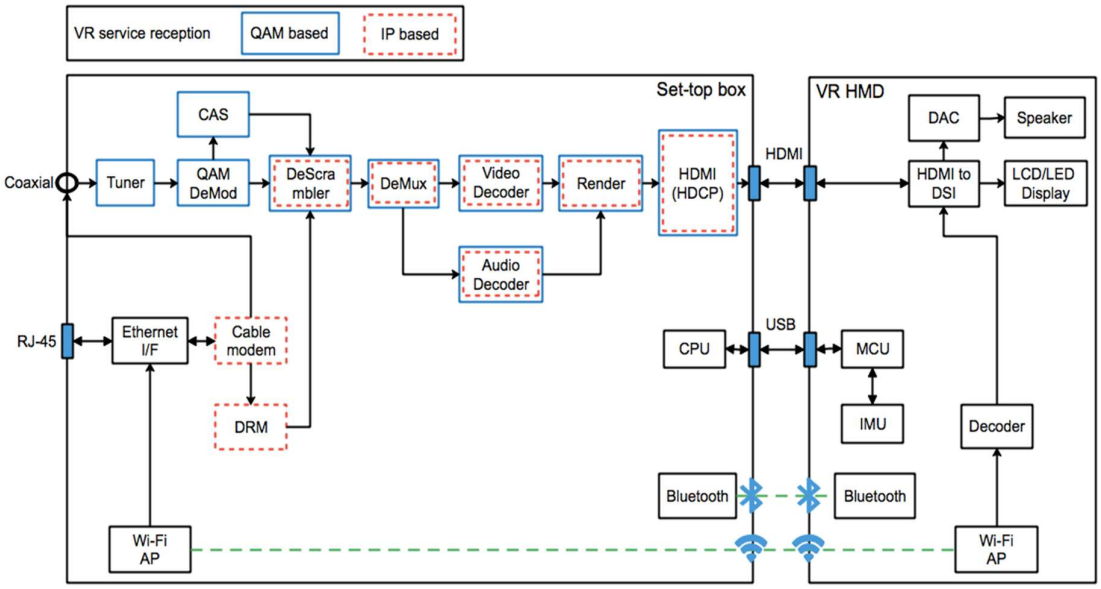

Fig 4– Hardware architecture of the UHD STB with VR service
(Ref: New Recommendation ITU-T J.1292 (ex J.STB-UHDVR))

The hardware architecture consists of the following modules, Computing unit: CPU, GPU, RAM and FLASH; the media and peripherals: Tuner, DEMUX, HDMI, USB; wireless interfaces: Wi-Fi, Bluetooth; the VR device can be connected to the STB via Type-C interface, the video will be transmitted via HDMI interface, version 1.4 or above is pReferred, the IMU data and control information in VR Glasses is transmitted via USB protocol. Optionally, the video and VR Interactive data can be transmitted via the high-speed 802.11ax network.

1.3 Definitions

1.3.1 Terms defined

This GR uses the following terms :

i. Cable Television [b-ITU-T J.142]: Communications systems distributes broadcast and non- broadcast signals, as well as a multiplicity of satellite signals originating programming and other signals by means of coaxial cable and/or optical fiber.

ii. 4K UHDTV [b-ITU-T J.297]: Supports 3,840 x 2,160 resolution and 60p frame frequency specified in [b-ITU-R BT.2020].

iii. 4K video [b-ITU-T J.482], [b-ITU-T J.483]: A video that supports 3 840 × 2 160 resolution and ~60p frame frequency.

iv. 8K UHD [b-ITU-T F.780.1 (V3)]: A video format in which the horizontal screen resolution is 7 680 and the vertical screen resolution is 4 320 pixels (4320p).

v. Content [b-ITU-R BT.1852-1]: This is any form of digital data that can be acquired and presented by a device.

vi. Motion-to-photon latency [b-ITU-T G.1035]: The time it takes between the user moving their head and this motion being Reflected on the screen of the head-mounted display (HMD)

vii. Service [b-ITU-R BT.1852-1]: This is one or more data flows intended to be presented together.

viii. Ultra-high definition [b-ITU-T F.780.1 (V3)]: A video format of digital display and camera in which the horizontal screen resolution is on the order of over 4 000 pixels.

ix. Full-view transmission [b-ITU-T J.1631]: Involves sending 360° images to terminals. When users turn their heads and images they see, are switched according to their Field of View (FOV), and terminals perform just-in-time processing on images, such as bit stream parsing, video decoding and image rendering.

x. DOF (Degree of Freedom): The number of independent coordinates in a mechanical system. In addition to translational degrees of freedom, there are rotational and vibration degrees of freedom. In statistics, the degree

of freedom Refers to the number of independent or freely changing data in the sample, which is called the degree of freedom of the statistic, when the statistics of the sample are used to estimate the parameters of the population.

xi. Render: Rendering is the process of using software to generate images from a model. A model is a description of a three-dimensional object in a rigorously defined language or data structure, including geometry, viewpoint, texture, and lighting information. The process of 2D projection of 3D scene model into digital image according to the set environment, lighting, material and rendering parameters. Rendering is also used to describe "the process of calculating effects in a video edit file to produce the final video output."

xii. IMU (Inertial Measurement Unit): An Inertial Measurement Unit is a device that measures the three-axis attitude Angle (or angular velocity) and acceleration of an object. Gyroscope and accelerometer are the main components of IMU, and their precision directly affects the precision of inertial system. An innovative application includes three single-axis accelerometers and a single-axis gyroscope to detect objects in the vehicle coordinate system independent triaxial acceleration signal, and the coordinate system of the angular velocity gyroscope detection vector relative to the navigation signal, measuring angular velocity and acceleration of objects in three-dimensional space, calculated and objects.

xiii. Head Tracking: It is the process in which the virtual reality device adjusts the output of images and sounds according to the movement of the user's head.

xiv. Position Tracking: The process in which the virtual reality device adjusts the output of images and sounds according to the user's position.

1.4 Functional/Operational Requirements

1.4.1 The STB shall support the reception and playback of AV programmes via cable/satellite/terrestrial/IP transport (can be max two services as in a hybrid STB (DVB S+IP or DVB C+IP + IP).

1.4.2 The STB shall support descrambling or decryption by integrating CAS and DRM solutions from qualified CAS and DRM solution providers and will meet the requirements as per the extant regulations.

1.4.3 The UHD set-top box shall serve as an enabling device between the streaming server and the user's display screen.

1.4.4 The STB shall be capable of running the SD/HD/UHD (4k, 8k, or above) video content after performing the following actions:

i. Verifies the authenticity of the content to ensure its legitimacy and reliability.
ii. Decodes the video content, which is in a compressed format, to be displayable by the set-top box.
iii. Processes the audio content of the video in a similar manner.
iv. Scales the decoded video content to fit the screen size of the user's display screen, such as an HDTV or a monitor.
v. Delivers the decoded and processed video and audio content to the user's display screen through a display output port, such as an HDMI port.

1.4.5 **Functional Specifications**

i. For UHD STB WITH VR SERVICE- The following is recommended for experiencing Full view transmission for good viewing and interaction experience:-
   a) 360-degree 3D-Video
   b) Resolution: 4k, 8k
   c) Frame rate: 90 to 120 fps
   d) Color depth: 10 to 12 b/pixel
ii. Network performance
   a) Data rate > 250Mbps
   b) Latency < 50ms
   c) Packet loss rate < 1e -5

1.4.6 **Minimum system**

i. **CPU**: The UHD STB with VR service is recommended to be independent of any specific type of central processing unit (CPU) architecture. The CPU performance of the UHD STB WITH VR SERVICE is required to be more than 8-core and 64bits for execution of the applications, for sufficient computing power and a smooth user experience. The selection of CPU architecture is not limited and could be defined by the operators and the STB vendors.

ii. **GPU**: The UHD STB with VR service is recommended to be independent of any specific type of graphics processing unit (GPU) architecture. The UHD STB WITH VR SERVICE is recommended to implement 3D graphic accelerator supporting OpenGL ES3.0 or above. The Floating-point capability of the GPU should be greater than 500 Gflops

iii. **NPU**: The UHD STB with VR service is optionally required to support a neural processing unit (NPU) to provide edge computing capability. The NPU performance of the UHD STB WITH VR SERVICE is required to be more than 8 TOPS for execution of the applications.

iv. **Memory**: For the supporting web browser and IP related features, the following memory capacity of the STB is required:
- Flash: 16 GBytes as minimum
- DDR: 4 GBytes as minimum

1.4.7 **Decoders**

The system shall support several common audio and video codecs.

A. Video Decoders

i. The UHD STB shall be required to support the following video codecs:

- Up to 8k:-

S. No.	Resolutions	Video Codec	Supported Resolution	Codec Compression Ratio	Latency
1	UHD 8k	H.265 8K	8K UHD(7680x4320)	2.5:1	6-10 ms
		H.265 8K	8K UHD (7680x4320)	3.0:1	3-6 ms
2	UHD 4k	H.265	4K UHD (3840x2160)	1.7:1	3-4 ms
3	FHD	H.264	1080p (1920x1080)	1.8:1	1-2 ms
4	FHD	H.262	720p (1280x720)	2.3:1	0.5-1 ms

- Up to 4k:-

S. No.	Resolutions	Video Codec	Supported Resolution	Codec Compression Ratio	Latency
1	UHD 4k	GGH.265	4K UHD (3840x2160)	1.7:1	3-4 ms
2	FHD	H.264	1080p (1920x1080)	1.8:1	1-2 ms
3	FHD	H.262	720p (1280x720)	2.3:1	0.5-1 ms

ii. The system shall also support VP9 and AV1 codecs for lower latency and better video quality:

S. NO.	Video Codec	Resolutions	Supported Resolution	Codec Compression Ratio	Latency
1	VP9	UHD 8k	8KUHD (7680x4320)	2.0:1	2-5 ms
		UHD 4k	4KUHD (3840x2160)	1.5:1	1-3 ms
2	AV1	UHD 8k	8K UHD (7680x4320)	1.5:1	1-3 ms
		UHD 4k	4K UHD (3840x2160)	1.0:1	0.5-2 ms

iii. The following aspect ratios shall also be supported: 4:3 with center cut (cropped) 16:9, 4:3 with letterboxed 16:9, 16:9 with pillar boxed 4:3, 16:9 with zoomed 4:3 and Zoom.

iv. The STB shall at least simultaneous dual video decoding is recommended for a picture in picture (PIP) or fast channel change (FCC) application.

v. The STB shall support to switch between aspect ratios of 4:3 and 16:9 (and do suitable conversion in case of receiving an anamorphic video.

vi. VP9 [b-VP9], AV1 [b-AV1], and H.266/VVC [ITU-T H.266]

vii. The hybrid STB is recommended to support the following audio coding technologies:

- MPEG-1 and MPEG-2 audio as specified in [ISO/IEC 13818-3] and [ISO/IEC 13818-7]
- MPEG-4 AAC and High Efficiency AAC as specified in [ISO/IEC 14496-3]
- MPEG-H 3D audio as specified in [ISO/IEC 23008-3]
- AC-3, E-AC-3 as specified in [ETSI TS 102 366]
- AC-4 as specified in [ETSI TS 103 190-1] and [ETSI TS 103 190-2]
- Supports maximum 8K@60 FPS decoding
- The following video resolutions are required to be supported by the UHD STB WITH VR SERVICE:

- 4320p
- 2160p
- 1080p
- 1080i
- 720p
- 576p
- 576i

B. Audio Decoders :

STB should be capable to decompress/decode Audio compressed in accordance with:

i. Capability to decompress and decode Audio using MPEG-1 Layer

ii. Capability to pass through the multichannel audio formats over compatible outputs such as HDMI, ARC, S/PDIF, etc.

iii. Capability to decompress and decode using other audio codecs may be provided as per the choice of the STB manufacturers as per the operators choices.

a) The UHD STB shall support the following output mode for digital Audio:-

- PCM (should be switched ON by default)
- RAW bit-stream
- STB is recommended to Passthrough all audio formats to allow connectivity and decode with Home Theatre systems.
- Mono
- Dual mono
- Stereo

iv. The STB shall support demodulation and decoding as per EN 300421/EN 300429/ETSI TS 101 154 of the RF input stream.

v. The STB shall be capable of supporting the individual channels by performing the required de-multiplexing of the MPTS stream to support individual channels by the end users.

vi. The STB shall support output container formats such as flv, mkv, and mov etc.

vii. The STB shall support video streaming protocols such as MPEG-DASH & HLS to allow mobile browser compatibility and for audio/video playback on end-user devices.

viii. The STB shall support the hosting of live and static content through a web server.

ix. The STB shall support administrator authentication for the configuration of the STB.

x. The STB shall support Remote configuration and management. The STB shall also support configuration for the selection of frequency and streaming channels.

xi. The STB shall support alert services as and when mandated and have the capability of targeted advertisements etc. through the service provider.

xii. The STB shall allow the administrator to view viewership statistics.

xiii. The STB shall display the input and output streaming status and power ON/OFF status through LEDs.

xiv. The STB shall operate on power from 90V to 260V, 50Hz.

xv. The STB should be able to operate in the environment of 5deg C to 50deg C.

xvi. The system shall support DVB-S/S2 (950MHz-2150MHz) and DVB-C/C2 (48 MHz - 650 MHz).

xvii. The STB shall provide overload protection.

xviii. The STB shall support a smooth OTA upgrade procedure so that the service downtime is kept to a minimum.

xix. The STB shall require to support the CPU performance of the UHD STB by more than 2000DMIPS for execution of the application

xx. The system shall require to support GPU with a 3D graphic accelerator supporting Open GL ES2.0 or above.

xxi. The STB shall have integrate front panel button, IR receiver, etc.

xxii. The STB shall support web browser and IP-related features.

xxiii. The system shall require adequate flash memory.

xxiv. The VR STB is recommended to support the following mainstream audio codecs:

a) MPEG-D Extended High Efficiency AAC profile as specified in [ISO/IEC 23003-3], including loudness control profile and dynamic range control profile level 1 (or higher) as specified in [ISO/IEC 23003-4]

b) C-3 down mix to stereo for HDMI and S/PDIF as specified in [ISO/IEC 60958-1].

c) E-AC-3 down mix to stereo for HDMI and S/PDIF

d) E-AC-3 conversion to AC-3 for pass through HDMI and S/PDIF

e) AC-4 down mix to stereo for HDMI and S/PDIF

f) MPEG-H 3D audio down mix to stereo for HDMI and S/PDIF

1.4.8 **Picture**

The UHD STB with VR service is recommended to support the following mainstream picture compression formats:

- BMP
- GIF
- GIF w/ Animation
- JPEG up to 128M pixels

The UHD STB WITH VR SERVICE is required to support the following Graphics display processing performance:

- 8K@60 FPS display output
- 4K UI
- A variety of HDR（HDR/HDR10/HLG）
- HDR/SDR transfers

1.5 Interface Requirements

1.5.1 The STB shall support RF Interface as per the DVB-S/S2/DVB- C)// ITU-T J.83 input stream using 75 ohms F type connectors.

1.5.2 The STB shall require to integrate an Ethernet network interface like the RJ 45 connector, IEEE 802.3 10/100Mbase-T, IPv6 (recommended).

1.5.3 The STB shall also support Ethernet/Wireless interface (IEEE 802.11) to Wi-Fi access points as per network topology.

1.5.4 The STB shall support a USB interface for programming and debugging of STB's.

1.5.5 The STB shall optionally integrate an S/PDIF interface (either an optical or coaxial connector) for digital audio output.

1.5.6 The STB shall support to integrate of an HDMI connector for digital video/audio output.

1.5.7 The STB shall support interconnection with the headset via wired/wireless mode.

1.5.8 The STB should be able to display the finger printing.

1.5.9 **ITU-T J.222**: The UHD STB WITH VR SERVICE is recommended to equip a DOCSIS 3.0 [ITU-T J.222] or later version) modem or connect an external cable modem supporting 3.0 [ITU-T J.222],or later version) or connect an external ONU, in order to receive IP signals over Ethernet.

1.5.10 **Bluetooth**: A Bluetooth hardware module is recommended for connectin Bluetooth-based UHD STB WITH VR SERVICE. Bluetooth version 4.2 or above is recommended.

1.5.11 **Front panel**: The UHD STB WITH VR SERVICE is recommended to integrate a front panel with the following specifications:

- Front panel buttons: Power On/Off, Up, Down
- IR receiver
- Led light to indicate power status

1.5.12 **Power supply** :The power supply can be an internal integrated module or an external power adaptor. The external power adaptor is recommended, with external power adaptor, the DC power connector is required.

1.5.13 **IR/RCU** :The UHD STB WITH VR SERVICE is recommended to integrate an infrared receiver for STB operation via RCU. RCU is required to have buttons for selection of Input source i.e. to select IP or cable. RCU is recommended to have dedicated buttons to invoke Closed Captioning / Teletext / Subtitles, Audio language selection & one button to enable voice guided menu. The RCU is recommended to have Braille buttons also.

1.6 Basic software functions

1.6.1 Channel list

The capability of the channel list is recommended to support following specifications:

- At least 3000 TV and radio services from cable and IP frontend
- At least 8 groups for favourite channel lists

1.6.2 Subtitles

The UHD STB WITH VR SERVICE is recommended to support subtitles with the following specifications:

• [ITU-T J.83] Annex A (DVB-C) subtitle in accordance with [b-ETSI EN 300 743],

including characters from code table ISO/IEC 8859-2

• [ITU-T J.83] Annex C subtitle in accordance with [ARIB STD-B24].

• Teletext in accordance with [b-ETSI EN 300 706]

• Closed captions in accordance with CEA-608, CEA-708 and [ARIB STD-B24]

• Selection of substile languages and turning on/off of subtitles

1.6.3 Multiple languages

The UHD STB WITH VR SERVICE is recommended to support multiple

languages as specified below:

• Support multi-language for OSD menu, audio track and subtitles

•The language setting shall be used to define the default audio track and subtitle language

• Support minimum 2 multi-language tracks

1.6.4 **Media player**

The UHD STB WITH VR SERVICE is recommended to implement a media player for playing both local and cloud
media content with the following specifications.

In case the media player is applied in the UHD STB WITH VR SERVICE, the following features are required to be implemented:

• Play content from USB external storage devices

• Play content from IP network interface

In case the media player is applied in the UHD STB WITH VR SERVICE, the following codecs are recommended to be implemented:

•H.265/HEVC, H.266/VVC, AV1, VP9

• Media formats: AVI, MKV, MP4, TS20

• Video codecs: H.262/MPEG-2, MPEG-4 Part 2 (ASP)[ISO/IEC 14496-2], H.264/MPEG-4 AVC.

• Audio codecs at least: MP2, AAC

• Image formats at least: BMP, TIFF, PNG, JPEG

1.6.5 **Network**

The UHD STB WITH VR SERVICE is recommended to integrate a LAN interface, a Wi-Fi interface is recommended to be
integrated.

The UHD STB WITH VR SERVICE is required to support Internet protocol as specified below:

• IPv4, IPv6 (optional)

• IGMP v1, v2 and v3

• ICMP

• UDP, TCP, RTP, RTSP/RTCP, HTTP, SSL2.0/3.0
• DHCP

1.6.6 **IP streaming and service**

The UHD STB WITH VR SERVICE is recommended to support IP streaming as specified below:
• Unicast
• Multicast
The UHD STB WITH VR SERVICE is recommended to support at least one of the following dynamic adaptive streaming
standards:
• MPEG-DASH
• HLS
• Smooth Streaming

1.6.7 **VR Runtime**

The UHD STB WITH VR SERVICE is recommended to support head tracking and position tracking as specified below:
• 3DOF(6DOF) sensor fusion
The UHD STB WITH VR SERVICE is required to support image processing as specified below:
• Asynchronous timewarp
• Barrel distortion
• Chromatic aberration correction
• Display stabilization/reprojection
• Single buffered rendering
• Layering (masks/overlays)
The UHD STB WITH VR SERVICE is required to support functions as specified below:
• CPU/GPU power management
• OPENXR

1.6.8 **Over the air programming and firmware upgrade**

The UHD STB WITH VR SERVICE is required to support over the air (OTA) firmware upgrades for the STB and things connected to the UHD STB WITH VR SERVICE.

1.7 Quality Requirements

1.7.1 The manufacturer shall furnish the MTBF value. The minimum value of MTBF shall be 500,000 hours. The calculations shall be based on the guidelines given in either QA document No. QM-115 {January 1997} "Reliability Methods and Predictions" or any other international standards.

1.7.2 The equipment shall be manufactured in accordance with the international quality management system ISO 9001:2015 or any other equivalent ISO certificate for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system followed by the manufacturer would be required to be submitted.

1.7.3 The equipment shall conform to the requirements for the Environment specified in TEC QA standards TEC 14016:2010 (earlier QM-333) "Standard for Environmental testing of Telecommunication Equipment's or any other equivalent international standard, for operation, transportation, and storage. The applicable tests shall be for environmental category "D" including vibration and corrosion (salt mist).

1.8 EMI/EMC Requirements

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report from an accredited test lab shall be furnished by a testing agency.

1.8.1 **Conducted and radiated emissions (applicable to telecom equipment):**

Name of EMC Standard: "CISPR 32 (2015) with amendments - Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment".

Limits:-

i. To comply with Class B of CISPR 32 (2015) with amendments for indoor deployments and Class A of CISPR 32 (2015) with amendments for outdoor deployments.

1.8.2 **Immunity to Electrostatic discharge:**

Name of EMC Standard: IEC 61000-4-2 {2008) "Testing and measurement techniques of Electrostatic discharge immunity test".

Limits:-

i. Contact discharge level 2 {± 4 kV} or higher voltage;
ii. Air discharge level 3 {± 8 kV} or higher voltage;

1.8.3 **Immunity to radiated RF:**

Name of EMC Standard: IEC 61000-4-3 (2010) "Testing and measurement Techniques - Radiated RF Electromagnetic Field Immunity test".

Limits:-

For Telecom Equipment and Telecom Terminal Equipment without Voice interface (s)

Under Test level 2 {Test field strength of 3 V/m} for general purposes in the frequency range 80 MHz to 1000 MHz and protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

1.8.4 **Immunity to fast transients (burst):**

Name of EMC Standard: IEC 61000-4-4 {2012) "Testing and measurement techniques of electrical fast transients/burst immunity test".

Limits:-

Test Level 2 i.e.

i. 1 kV for AC/DC power lines;
ii. 0. 5 kV for signal/control/data/telecom lines;

1.8.5 **Immunity to surges:**

Name of EMC Standard: IEC 61000-4-5 (2014) “Testing & Measurement techniques for Surge immunity test".

Limits:-

i. For mains power input ports : (a) 2 kV peak open circuit voltage for the line to ground coupling (b) 1 kV peak open circuit voltage for the line-to-line coupling

ii. For telecom ports :

(a) 2kV peak open circuit voltage for the line to ground

(b) 2KV peak open circuit voltage for the line-to-line coupling.

1.8.6 **Immunity to conducted disturbance induced by Radio frequency fields:**

Name of EMC Standard: IEC 61000-4-6 (2013) with amendments) "Testing &measurement techniques-Immunity to conducted disturbances induced by radio frequency fields".

Limits:-

Under the test level 2 {3 V r.m.s.} in the frequency range 150 kHz-80 MHz for AC/ DC lines and Signal /Control/telecom lines.

1.8.7 **Immunity to voltage dips & short interruptions (applicable to only AC mains power input ports, if any):**

Name of EMC Standard: IEC 61000-4-11 (2004) "Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests".

Limits:-

i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500 ms)

ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms) and

iii. a voltage interruption corresponding to a reduction of the supply voltage of > 95% for 5s.

iv. a voltage interruption corresponding to a reduction of the supply voltage of >95% for 10s.

1.8.8 **Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any):**

Name of EMC Standard: IEC 61000-4-29:2000: Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions, and voltage variations on DC input power port immunity tests.

Limits:-

i. Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. Applicable Performance Criteria shall be C.
ii. Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. Applicable Performance Criteria shall be B.
iii. Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000ms. Applicable Performance Criteria shall be C.
iv. Voltage variations correspond to 80% and 120%of supply for 100 ms to10s as per Table 1c of IEC 61000-4-29. Applicable Performance Criteria shall be B.
v. Voltage Interruption with 0% of supply for 10ms. Applicable Performance Criteria shall be B.

Note: - For checking compliance with the above EMC requirements, the method of measurement shall be in accordance with TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16 and the Referenced base standards i.e. IEC and CISPR standards and the References mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (h) and TEC Standard TEC/SD/DD/EMC-221/05/OCT-16.

The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	Euro Norm
CISPR 11	EN 55011
CISPR 32	EN55032
IEC 61000-4-2	EN 61000-4-2
IEC 61000-4-3	EN 61000-4-3

IEC 61000-4-4	EN 61000-4-4
IEC 61000-4-5	EN 61000-4-5
IEC 61000-4-6	EN 61000-4-6
IEC 61000-4-11	EN 61000-4-11
IEC 61000-4-29	EN 61000-4-29

1.9 Safety Requirements

1.9.1 The equipment shall conform to:

i. IS 13252 part 1: 2010 “Information Technology Equipment –Safety- Part 1: General Requirements” [equivalent to IEC 60950-1 {2005} “Information Technology Equipment –Safety- Part 1: General Requirements”]

OR

IEC 62368-1: 2018 “Audio/video, information and communication technology equipment - Part 1: Safety requirements”

2.0 Security Requirements

The UHD STB shall comply with the security requirements of the CAS provider and at least the following features shall be supported:

i. Embedded advanced security CAS which will be defined by CAS providers and operators
ii. Embedded DRM client system for OTT/IPTV streaming which will be defined by the operator.
iii. Contain a secure bootloader that shall be stored in write protected flash area, secure boot process with signature verification shall be applied during boot up process, only the signed software can be executed
iv. Support high-definition content protection (HDCP) copy protection on HDMI output

2.1 Others requirements (Maintenance)

The STB shall support following maintenance requirements for the software run in a UHD set-top box:

2.1.1 **Software upgrade**

The STB shall be required to provide a software download mechanism for upgrading software modules.

2.1.2 The STB shall require to support at least one of the following upgrade methods:

- OTA
- IP

2.1.3 **Security Updates**

The STB provider shall ensure security updates apply promptly to protect the set-top box from vulnerabilities and security threats. This includes updating the operating system, apps, and any built-in security features.

2.1.4 **App Maintenance**

The STB shall support third-party apps, regular updates and workability with these apps. The system shall update to the latest versions available through the app store or platformto ensure to functions properly and remains secure.

ABBREVIATIONS

For the purpose of this document the following abbreviations apply:

AES	Advanced Encryption Standard
API	Application Program Interface
AVC	Digital Audio Codec
BGA	Ball Grid Array
CAS	Conditional Access System
CISPR	International Special Committee on Radio Interference
CPU	Central Processing Unit
DC	Direct Current
DDR	Dial on Demand Routing
DEMUX	De-multiplexer
DHCP	Dynamic Host Configuration Protocol
DMA	Direct Memory Access
DRM	Digital Rights Management
DTCP	Digital Transmission Content Protocol
DTH	Direct to Home
DTT	Digital Terrestrial Television
DVB-S/S2	Digital Video Broadcasting – Satellite/ Satellite Second
DVB-T/T2	Digital Video Broadcasting – Second Generation Terrestrial
EIT	Event Information Table
EMC	Electromagnetic Compatibility
EMI	Electromagnetic interference
EPG	Electronic Programme Guide
FCC	Fast Channel Change
FEC	Forward Error Correction
FHD	Full High Definition
GPU	Graphics Processing Unit
GUI	Graphical User Interface
HDCP	High-Definition Content Protection
HDD	Hard Disk Drive

HDMI	High-Definition Multimedia Interface
HDR	High Dynamic Range
HEVC	High Efficiency Video Coding
HFC	Hybrid Fiber/Coax
HLS	HTTP Live Streaming
HMD	High Dynamic Range
HTML	Hypertext Mark-up Language
HTTP	Hyper Text Transport Protocol
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPTV	Internet Protocol Television
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
LAN	Local area network
LCN	Logical Channel Number
LNB	Low Noise Block
MPEG-1	Moving Picture Experts Group Phase 1
MTBF	Mean Time Between Failures
OS	Operating System
OSD	On Screen Display
OTA	Over the Air
OTT	Over-the-top
S/PDIF	Sony/Philips Digital Interface Format
PID	Packet Identifier
PIN	Personal Identification Number
PIP	Picture in Picture
PPV	Pay Per View
PSU	Power Supply Unit
PVR	Personal Video Recorder
QoS	Quality of Service
RAM	Random Access Memory
RCU	Remote Control Unit

RF	Radio Frequency
ROM	Read Only Memory
SDK	Software Development Kit
SDR	Standard Dynamic Range
SNMP	Simple Network Management Protocol
SNS	Social Network Service
SOC	System on a Chip
SSL	Secure Sockets Layer
SSU	System Software Update
STB	Set Top Box
TCP	Transmission Control Protocol
TDES	Triple Data Encryption Standard
TDT	Time Date Table
TOT	Time of Transmission
TP	Transponder
UHD	Ultra High Definition
UI	User Interface
UPnP	Universal Plug and Play
URI	User Right Information
USB	Universal Serial Bus
VOD	Video on Demand
VR	Virtual Reality
WAN	Wide Area Network
Wi-Fi	Wireless Fidelity
WLAN	Wireless local area network
IPTV	Internet Protocol Television

======== **End of the document**=======

Annexure

Template for submitting Comments or Feedback

[Comments on each section/sub section/table/figure etc. of the draft TEC 57060:2024 be stated in a fresh row. Information/comments should include reasons for comments and suggestions for modified wordings of the clause]

Name of Commentator/Organization …….

S. No.	Section of the Draft Standard	Clause/Para/Table/ Figure No. of draft Standard	Comments/ Suggested modified Wordings	Justification for proposed Change
1.				
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Note- a) Kindly insert more rows as necessary for each clause/table, etc.
b) Comments may be sent in electronic form to jto-cb@gov.in, with a copy to dircb2.tec-dot@gov.in. & ddgcb.tec@gov.in , by 28-09-2025 .

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