
# Technical Document AESTD1006.1.17-10

# Loudness Guidelines for OTT and OVD Content

**October 2017**

Audio Engineering Society, Inc.
551 Fifth Avenue, Suite 1225
New York
NY 10179
USA
Tel: +1 212 661 2355. Email: hq@aes.org. Internet: http://www.aes.org


The Audio Engineering Society's Technical Council and its Technical Committees respond to the interests of the membership by providing technical information at an appropriate level via conferences, conventions, workshops, and publications. They work on developing tutorial information of practical use to the members and concentrate on tracking and reporting the very latest advances in technology and applications. This activity is under the direction of the AES Technical Council and its Committees.

The Technical Council and its first Technical Committees were founded by the Audio Engineering Society in 1979, and standing rules covering their activities were established in 1986, with the intention of defining and consolidating the technical leadership of the Society for the benefit of the membership. The Technical Council consists of the officers of the Technical Council, the chairs of the Technical Committees, the editor of the Journal, and as ex-officio members without vote, the other officers of the Society.

TECHNICAL COUNCIL
Francis Rumsey - Chair
Juergen Herre - Vice Chair
Robert Schulein - Vice Chair
Michael Kelly - Vice Chair

TECHNICAL COMMITTEES
Acoustics and Sound Reinforcement
Archiving, Restoration and Digital Libraries
Audio for Cinema
Audio for Games
Audio Forensics
Audio for Telecommunications
Automotive Audio
Broadcast and Online Delivery
Coding of Audio Signals
Fiber Optics for Audio
Hearing and Hearing Loss Prevention
High-Resolution Audio
Loudspeakers and Headphones
Microphones and Applications
Network Audio Systems
Perception and Subjective Evaluation of Audio Signals
Recording Technology and Practices
Semantic Audio Analysis
Signal Processing
Spatial Audio

www.aes.org/technical/

AES Technical Committee on Broadcast and Online Delivery
Technical Document

# Loudness Guidelines for OTT and OVD Content

2017-10-12

Prepared by the Audio Guidelines for Over the Top Television and Video Streaming (AGOTTVS) Study Group

Chairman and Editor: Jim Starzynski


**Writers:**
Frank Baumgarte
David Bialik
Tim Carroll
Roger Charlesworth
Jim DeFilippis
Chris Homer
Fabian Kuech
Thomas Lund
Scott Norcross
Kazuho Ono
Sean Richardson
Jeff Riedmiller
Steven A. Silva
Jim Starzynski
Jean-Michel Trivi
Adrian Wisbey

**With Additional Contributions by:**
Shujaat Ali
Leslie Gaston-Bird
Deborah Cornish
Terry Douds
Bob Katz
John Kean
Fadi Malak
Lon Neumann
Peter Poers
Jacalyn Schubring
Will Wolcott

**Additional Study Group Members:**
Eric Allamanche
Robert Bleidt
Manuel Briand
Andy Butler
Rob Byers
Dave Casey
Florian Camerer
Greg Coppa
Werner de Bruijn
Chris Fetner
Frank Foti
Ed Greene
Kimio Hamasaki
Clarence Hau
Alex Kosiorek
Andres A. Mayo
Schuyler Quackenbush
Matthieu Parmentier
Skip Pizzi
Nils Peters
Patrick Waddell
Ben Waggoner
Robert Weigand
Dave Wilson
Yongjun Wu

# Loudness Guidelines for OTT and OVD Content

## 0 Background

The AGOTTVS technical group was formed in early 2016 to study the many issues related to online audio Loudness[1] variations. Its goal is to develop comprehensive recommendations, providing effective guidelines for managing audio Loudness of soundtracks of television and video Content available to consumers by Over-The-Top (OTT)[2] and by Online Video Distributors (OVD)[3] [1] [4].

Comprehensive recommendations require a thorough process of user input, data collection, discussion and drafting on an ongoing basis.

In October of 2016 the group recognized an urgent need to publish "Preliminary Loudness Guidelines" [2] that addressed the fundamental concern of audio Loudness in the developing segment of on-line television and video Content delivery, from creation through distribution and to the consumer experience.

With the release of the "Preliminary Loudness Guidelines" the group raised awareness of more forthcoming, comprehensive and ongoing work and invited all interested parties to join the effort.

As a result, the AGOTTVS group increased in membership and met multiple times to continue their work drafting enhanced OTT and OVD "Loudness Guidelines" that are documented in this October 2017 release.

This group consists of volunteer members with expertise and/or interest in the creation, distribution and emission of professional audio. AGOTTVS membership is open to all stakeholders with a material interest in its work, regardless of AES membership status.

Professionals interested in joining AGOTTVS please contact: jim.starzynski@nbcuni.com or broadcast@aes.org

Jim Starzynski—Director and Principal Audio Engineer - NBCUniversal
*Chairman- AES AGOTTVS, Vice-Chairman of the AES Broadcast and Online Delivery Technical Committee*

David Bialik—Director of Stream Operations - CBS Radio
*Co-Chairman of the AES Broadcast and Online Delivery Technical Committee*

---

[1] A capitalization notes the term is defined in the document glossary
[2] Over the Top Television (OTT) For the purpose of this document OTT is defined as: The means to deliver video Content via Streaming, VOD, Pay TV, IPTV and Download via IP mechanisms
[3] Online Video Distributor (OVD), defined as any entity that offers video Content by means of the Internet or other Internet Protocol (IP)-based transmission path provided by a person or entity other than the OVD
[4] OTT and OVD do not include delivery of Content via means of traditional distribution e.g., broadcast TV, Cable TV, Satellite TV, and Telco Supplied TV Etc.

# 1 Introduction

Television Content distributed as Over-the-Top-Television (OTT) or by Online Video Distribution (OVD) is prone to the same Loudness management problems as early Digital Television (DTV). All provided a substantial increase in audio dynamic range capability compared to their analog predecessor. This created an opportunity for severe Loudness variation between Programs, channels and commercial advertising Content. Where Loudness was not managed correctly, audiences became annoyed with the need to constantly adjust their listening volume.

Using the audio Loudness measurement recommendation, ITU-R BS.1770, organizations[5] [3] [4] [5] [6] around the world independently developed guidelines for TV engineers to follow. These guidelines focused on maintaining and improving DTV's sonic integrity and listening experience by managing the Loudness and Loudness Range of Program and Interstitial Content. Recognizing that devices can receive multiple services or use multiple audio CODECs, guidelines[6] [7] [8] were produced to align the playback Loudness of receiving devices by establishing suitable gain structures in the audio output paths.

# 2 Objectives

This AES document addresses OTT and OVD Loudness challenges by leveraging the established practices, noted above, providing new guidelines focused on the Loudness and Content Dynamic Range for connected set-top and mobile devices. When followed, these guidelines will:

- Provide consistent Loudness across different Programs, service providers and advertising Content
- Provide appropriate playback Loudness Range for different devices and listening conditions
- Prevent excessive Peak Limiting or other processing from degrading the audio quality
- Preserve the artistic intent of wide Content Dynamic Range (movies, drama, live music)
- Improve the listening experience

[5] The Advanced Television Systems Committee (ATSC) for North America, the European Broadcast Union, ARIB TR-B32 in Japan, Free-TV OP59 in Australia and efforts in New Zealand and Korea

[6] The Consumer Technology Association with CTA-CEB11-C and the European Broadcast Union with EBU Tech 3344

# 3 Guidelines

To preserve the original sonic integrity of OTT and OVD Content, to reduce annoying Loudness jumps when switching Content, to prevent clipping and to provide an appropriate listening level across different devices, it is recommended that Content providers and Content Distributors follow some basic guidelines. These vary based on the content being distributed and the application, as follows:

### 3.1 For delivery of Content between providers and Distributors it is recommended that:

a) Where there is no prior arrangement by the parties regarding Content delivery, the appropriate broadcast regional Content delivery and exchange recommendations should be followed (see Annex D, Tables 1 & 2)
b) An Anchor Element (for instance, dialog) should be used for the Integrated Loudness measurement, in lieu of a Full Program Mix Measurement, for conditions noted in the broadcast regional recommendations (see Annex D, Tables 1 & 2)
c) Loudness and dynamic range control Metadata that matches the Content should be included

### 3.2 For distribution of Content over systems with certain Metadata capability it is recommended that:

a) Where there is no prior arrangement by the parties regarding Content distribution, the appropriate broadcast regional Content delivery and exchange recommendations should be followed (see Annex D, Tables 1 & 2)
b) An Anchor Element (for instance, dialog) should be used for the Integrated Loudness measurement, in lieu of a Full Program Mix Measurement, for conditions noted in the broadcast regional recommendations (see Annex D, Tables 1 & 2)
c) Loudness and dynamic range control Metadata that matches the Content should be included

### 3.3 For distribution of Content over systems with unknown or uncertain Metadata capability it is recommended that:

a) Where there is no prior arrangement by the parties regarding Content distribution, the appropriate broadcast regional Content delivery and exchange recommendations should be followed (see Annex D, Tables 1 & 2)
b) An Anchor Element (for instance, dialog) should be used for the Integrated Loudness measurement, in lieu of a Full Program Mix Measurement, for conditions noted in the broadcast regional recommendations (see Annex D, Tables 1 & 2)

### 3.4 For distribution of Content for devices or listening conditions with limited dynamic range it is recommended that:

a) If the distribution system supports Metadata, ensure an appropriate DRC Profile is defined and Metadata included for limited dynamic range playback
b) If the distribution system does not support Metadata, application of Loudness and/or dynamic range control before encoding may be necessary to contour the audio

**3.5 For delivery or distribution of Content where prior arrangements exist it is recommended that:**

a) The maximum values for Loudness and True Peak are not exceeded (see Annex D, Table 3).
b) The Loudness and True Peak level of Content should be measured for compliance either with values agreed to by prior arrangement or with the appropriate regional broadcast recommendations (see Annex D, Tables 1 & 2)

**3.6 For delivery or distribution of non-conformant Content (Content created under no recommendations or standards):**

a) For distribution of Content over systems with certain Metadata capability the Loudness and True Peak level of Content should be measured for compliance either with values agreed to by prior arrangement or with the appropriate broadcast regional recommendations (see Annex D, Tables 1 and 2). Subject to contractual considerations, any non-compliant Content should be:

   i) Normalized to a value agreed to by prior arrangement and authored with Loudness and DRC Metadata matching the actual normalized Content

Or

   ii) Normalized to the appropriate broadcast regional recommendations (see Annex D, Tables 1 and 2) and authored with Loudness and DRC Metadata matching the actual normalized Content

Or

   iii) Unaltered and authored with the Loudness and DRC Metadata, matching the actual non-compliant Content

b) For distribution of Content over systems with unknown or uncertain Metadata capability where there is no prior arrangement by the parties regarding Content distribution, the Loudness and True Peak level of Content should be measured for compliance with the appropriate broadcast regional recommendations (see Annex D, Tables 1 and 2). Subject to contractual considerations, any non-compliant Content should be normalized to these recommendations

# Loudness Guidelines for OTT and OVD Content

## Annex A – Content Considerations

### A.1 Loudness

Loudness is a subjective measurement of the perceived audio level of a Program or other piece of Content. Program Loudness is the Integrated Loudness (as defined by ITU-R BS1770) measured across the entire Program mix or the Anchor Element (such as dialog). Content having the same Program Loudness will have the same perceived Loudness to the listener.

Loudness Normalization achieves equal average Loudness of Programs while allowing the peak level to vary depending on the Content and the artistic and technical needs. Generally, the higher the Target Program Loudness the lower the dynamic range of the Program as a result of Peak Limiting and dynamic range compression to fit the audio signal within digital full-scale.

There are two ways to achieve Loudness Normalization for the listener, one is to actually normalize the audio signal, and the other is to use Loudness Metadata to describe how loud a Program is. Not all consumer devices support the Metadata solution and so the former method is recommended, with appropriate Metadata, to provide the best compatibility across consumer devices.

### A.2 Peak Level

Peaks in the audio signal generally do not affect the Loudness. They do, however, have a significant effect on perceived audio quality. A Program with a high peak to Loudness ratio is often perceived as sounding clearer and less fatiguing than one that has been excessively peak limited.

The ITU-R BS.1770 defines True Peaks as the maximum peak level taking into account the fact that the actual audio peak may occur between digital samples and so be higher than any digital sample in the program and may even be above 0 dB FS. It is advisable to author Content with a True Peak level below 0 dB FS (see Annex D) to avoid clipping in decoding and playback systems.

The lower the Target Program Loudness the less likely peak control will be required. Programs that require the audio level to be increased to meet the required Target Program Loudness will need to have special attention paid to the maximum True Peak levels.

### A.3 Dynamic Range

It is strongly encouraged that the original dynamic range of a Program be maintained to preserve the sonic integrity and artistic intent of the Content. However it is recognized that there are situations where this may not be possible or desirable:

a) The required distribution Loudness is higher than the delivered Program Loudness
b) The delivered Content Dynamic Range exceeds the consumer's system dynamic range
c) The consumer is in a noisy environment such as an aircraft

System dynamic range is the ratio between the minimum and maximum signal level a system can convey at a certain precision. In some countries (due to government regulations), smartphone outputs may have a lower dynamic range than outputs of laptops or stationary devices, including wireless streaming interfaces.
Some Programs may exceed the dynamic range of typical broadcast Content. Examples may include cinema derived or premium episodic material created in cinema-style mixing environments where a

lower target Loudness value is common. In these cases, an anchor- element (for instance, dialog) should be used for Integrated Loudness measurement, in lieu of a Full Program Mix Measurement for conditions noted in the regional recommendations.

**A.4 Content Type**

*Short Form Content*

Care should be taken when measuring Short Form Content such as advertisements, promotional items and interstitials. An infinite term measurement of all channels for the entirety of the Content should be taken or refer to regional guidelines for measurement of Short Form Content.

In all cases, for all regions, see table 1.

*Long Form Content*

Care should be taken when measuring the Loudness of Long Form Content such as typical TV Programs (news, sports, variety shows, drama and movies).

For ATSC Regions, the Anchor Element (typically dialog) or a representative sample of the Anchor Element should be measured using BS.1770. If the Anchor Element cannot be isolated and measured, then the long term integrated or average Loudness of the Contents full Program mix, over its entire duration, should be measured and reported. [3]

For EBU Regions, an infinite term measurement of all channels of the entirety of the Content is the most general measurement method and appropriate for the vast majority of broadcast Content. For audio Programs that have wide dynamic range where the LRA is greater than 20 LU (see EBU Tech 3343 sect 4.1) or where the Voice Loudness Level is more than 3–5 LU different than the Loudness measurement of the Program Loudness Level then Anchor Based Loudness Normalization may be used.[4]

In all cases, for all regions, see table 2

*System Generated Sounds:*

These guidelines focus on television and video Content from creation through distribution to the consumer. However, the Loudness of other audio sources on both fixed and mobile streaming devices are part of the full listening experience. Application Developers should strive to match the Loudness of system generated sounds to T.V. or video Content to achieve a pleasing experience whenever appropriate.

Notwithstanding, it is understood that Loudness plays an important part in distinguishing incoming “rings” over Content, localization of sound to picture, the delivery of Content to the impaired and the alerting and delivery of important emergency information (e.g., Wireless Emergency Alerts-WEA), etc. when necessary. An increase in the Loudness of system generated sounds and related Content above other sounds, in these and other similar situations when appropriate, is expected.

**A.5 Dynamic Range and Loudness Control**

*Production & Distribution Environment*

It is strongly encouraged to always include Loudness and dynamic range control Metadata that matches the Content when the distribution system supports it. This practice permits Content to be contoured, in

a non-destructive manner, for different devices and listening scenarios during playback. The use and support of Loudness and dynamic range control Metadata, including support in audio CODECs is addressed and documented in ATSC A/85 [3] and EBU Tech Doc 3344 [8]. A CODEC agnostic method of carrying Loudness and dynamic range control Metadata is documented in MPEG-D DRC (ISO/IEC 23003-4). [9]

The use of defined DRC characteristics or profiles is encouraged when authoring Content Metadata for distribution. This practice provides the opportunity to properly adjust the target Loudness and dynamic range DRC Profile on the playback device when necessary to account for limitations of the device, user preferences, Loudness or the listening environment.

*Playback Environment*

It is recognized that there currently is a large population of devices that use multiple CODECs. One or more of these CODECs may not support Metadata. While many of these devices have successfully addressed this issue by adherence to the recommendations in CTA CEB11 [7] and EBU R-128 / Tech 3344, [8] where applicable, not all are universally applied, and can result in Content being reproduced at differing target Loudness depending on the device and its method of connection.

# Loudness Guidelines for OTT and OVD Content

## Annex B – OTT and OVD Device Considerations

Portable devices are used in many different locations that have many diverse environmental conditions. Most engaged listeners use headphones for every day Content exhibition. In noisy environments Dynamic Range Control can be used to hear quiet passages. At home, consumers can also directly attach their devices to a TV or an AVR via HDMI or cast via different wireless technologies. All of these scenarios create major challenges for quality reproduction of the audio.

Content distributed with a CODEC using correct Metadata benefits from the communication of device capabilities over media interfaces. HDMI handshaking and the EDID data field can identify CODEC compatibility between devices that facilitates, for example, content and listener specific adjustment of target loudness and DRC. Content distributed with a CODEC not using Metadata will be dependent on fixed, non-content specific onboard device software, hardware, or combinations of both, to process the audio which leads to unpredictable presentation when connected to another device.

### B.1 Fixed Devices

Home playback environments vary greatly. The noise level from external and internal sources like nearby traffic, appliances, other family members, distance from the sound source, room reverberation, quality of speakers, speaker placement and quality of mix greatly influence what the listeners hears. In all scenarios, mix intelligibility is an important factor for the listener.

*Applications:*

Fixed devices are generally intended for media playback in a home or other indoor environment e.g.: living rooms, hotel rooms, office spaces, classrooms etc.

*Typical Capabilities:*

Fixed Devices are intended to be paired with televisions, sound bars, or audio-video receivers.

Content is streamed via:

- Over The Top Television (OTT) application
- Online Video Distribution (OVD) or live streaming service
- Over the Air traditional broadcast
- MVPD (Cable, Satellite, Telco) Transport Stream or IP services

Some fixed devices use internal hard drives to store (via Download or side-load) or record Programming for playback over extended periods of time. Many devices also support Blu-ray Disc or DVD playback.

These devices have the capability to reproduce the full audio dynamic range of Content as supplied in the incoming audio stream. Devices also contain hardware and software Digital Signal Processing (DSP) and decoding, capable of contouring the audio to the listener's needs. Examples of these are:

- Speaker/room equalization systems
- added room reverberation
- Metadata enabled decoder Loudness Normalization and dynamic range control

- independent dynamic range control compression

These features can be used independently or in combination and are designed to provide flexibility to the consumer to fine tune their listening experience.

**B.2 Portable Devices**

Loudness and DRC Applications in Typical Playback Environments

Similar to the features of fixed devices, portable devices may offer different audio Loudness and dynamic range processing configurations. This adaptability is a key to optimizing the sound of the personal streaming player for the constraints posed by challenging acoustic listening environments.

*Applications:*

These devices support in-home and outdoor use. Most handhelds and tablets began as personal media audio players and developed to fully functioning personal communication devices with advanced video and audio playback capabilities. The smartphone is the dominant consumer device in this category.

*Typical Capabilities*

Handheld and tablet devices can be used as personal players accessing locally stored files or streaming Content via Wi-Fi or cellular connection to the internet.

Content can be:

- Downloaded for later playback
- Side loaded for later playback
- Streamed using adaptive bitrate profiles

Multiple factors influence the quality of the audio from portable devices:

- Available bandwidth when the Content is acquired
- Available local storage on the portable device
- DSP and/or CODEC support on the portable device
- Processing power of the portable device for app based decoding and DSP
- The maximum quality made available in the adaptive bitrate stream

Additional factors are the output configurations of the portable device. Most can support two or more of the following:

- Internal mono or stereo micro speaker(s) with limited dynamic range and frequency response
- Connected devices (e.g.: headphones) with limited range (compared to connected devices in full range mode) and varied frequency response
- Bluetooth devices including headphones, speakers, and AVR's. Dynamic range and frequency response of Content can be limited by the Bluetooth version, profile (CODEC) and available bandwidth.

- Wi-Fi and Bluetooth casting (E.g.: AirPlay, Chromecast) can support quality playback depending on the available bandwidth
- HDMI (direct wired connection) can provide an unaltered, coded audio stream that is intended to be decoded downstream by a device with enhanced audio capability; or a decoded PCM version of the audio, subject to Metadata enhanced audio processing or internal processing

# Loudness Guidelines for OTT and OVD Content

## Annex C – Glossary

**Anchor Element**
The perceptual Loudness reference point or element around which other elements are balanced in producing the final mix of the Content, or that a reasonable viewer would focus on when setting the volume control. [3] It is typically speech or dialog in broadcast or movie Content.

**AVR**
**Audio Video Receiver**
A combination audio amplifier and audio/video switching device for a home theater. It contains inputs for all the audio and video sources and outputs to one or more sets of speakers and one or more monitors (without a tuner) or TVs. [10]

**Blu-ray**
A digital optical disc data storage format supporting HD and UHD (2160p) resolution.

**BS.1770**
**ITU-R BS.1770**
Specifies an algorithm that provides a numerical value that estimates the perceived Loudness of the Content that is measured. Loudness meters and measurement tools which have implemented the BS.1770 algorithm will report Loudness in units of "LKFS" [3] or "LUFS". [4]

**CODEC**
Coder-Decoder. A device (or software implementation thereof) which converts a signal into another format and converts the coded signal back to the original format.

**Content**
Material or essence used for distribution by an operator. [3]

**Content Distributor**
An operator that distributes Content to other operators, Programmers or consumers.

**Content Dynamic Range**
The difference between the maximum and minimum Loudness level in an audio Program or piece of Content. It should be noted that a large difference between the Loudness of the dialog and the Loudness of the Full Program Mix Measurement may be an indication of wide Content Dynamic Range. Similarly, large values of LRA may be an indication of wide Content Dynamic Range.

**dB FS**
Amplitude expressed as a level in decibels relative to 100% full-scale. [11]

**Dialog Level**
The Loudness, in LKFS units, of the Anchor Element. [3]

**Download**
The process of receiving data from a remote system, typically a server such as a web server, an FTP server, an email server, or other similar systems. [12]

**DRC**
Dynamic range control. The process of continually adjusting audio signal level to control the level difference between loud and soft passages according to some desired objective.

**DRC Profile**
A collection of parameters that describe how dynamic range control Metadata is calculated. [3]

**DVR**
**Digital Video Recorder**
An electronic device that records video in a digital format to a disk drive, USB flash drive, SD memory card, SSD or other local or networked mass storage device. [13]

**EDID**
Extended Display Identification Data (EDID) is a data structure provided by a display or other device to describe its capabilities to a video source device (e.g. graphics card or set-top box). [14]

**File-Based-Scaling Device**
A device used to apply an overall gain correction to audio Content stored as files. [3]

**Fixed Device**
A set-top box type or plug-in stick type unit capable of supporting streaming media playback services via Ethernet and/or Wi-Fi Internet access.

**Full Program Mix Measurement**
The Integrated Loudness measurement using the BS.1770 algorithm, in units of LKFS or LUFS based on all channels and all elements of the audio Content, over the duration of the Program.

**Game Console**
A computer system that enables playing video games via a connection to a television or other display device with internal or external speakers. Most Game Consoles also support streaming internet video/audio over Ethernet/Wi-Fi or via internal disk player (Blu-ray, DVD) or removable digital media flash storage (SD card).

**HDMI Stick**
A plug-in device (via HDMI) for TV or AVR and supports streaming internet video/audio over Wi-Fi.

**Integrated Loudness**
An objective measurement of audio loudness of a program averaged over the entire length of the program.

**Interstitial Content**
Advertising, commercial, promotional or public service related material or essence. The typical duration is less than approximately two to three minutes. [3] Synonymous with Short Form Content.

**ITU**
International Telecommunication Union. An organization which coordinates electronic communications across national boundaries and issues recommendations supporting those activities.

**LKFS**
Unit of Loudness, K-weighted, relative to full scale, measured with equipment that implements the algorithm specified by BS.1770. A unit of LKFS is equivalent to a decibel. [3]

**Long Form Content**
Show or Program related material or essence. The typical duration is greater than approximately two to three minutes. [3]

**Loudness**
A perceptual quantity; the magnitude of the physiological effect produced when a sound stimulates the ear. [3]

**Loudness Normalization**
The process of applying a global offset, based on the measured Integrated Loudness of an audio Program, such that after the offset is applied, the audio Program will be at the desired target Loudness.

**Loudness Range**
**LRA**
Quantifies the variation in a time-varying Loudness measurement. [15]

**LU**
**Loudness Unit**
Relative Loudness is expressed as a logarithmic ratio, 1 dB increase in level equals 1 LU increase in Loudness. [16]

**LUFS**
Unit of Loudness, K-weighted, expressed as a level in LU relative to 100% full-scale. [4]

**Maximum True Peak Level**
The maximum absolute value of the audio signal waveform of a Program in the continuous time domain. [3]

**Measured Loudness**
The value reported, in units of LKFS or LUFS, when an audio signal is measured with equipment that implements the algorithm specified by BS.1770. It is an approximation of perceived Loudness.

**Media Streamer**
Streaming Media Set Top Box
Modern set-top boxes that deliver Internet streaming Content directly to a T.V. Many media streamers are also capable of storing Content on a hard drive, computer or Network attached Storage.

**Metadata**
**Audio Metadata**
Information attached to the audio bitstream, for example, to describe the audio essence or to support DRC.

**MVPD**
Multichannel Video Programming Distributor (includes DBS service operators, local cable system operators, and cable multiple system operators).

**OTT**
**Over-the Top-Television**
The means to deliver video Content via Streaming, VOD, Pay TV, IPTV and Download via IP mechanisms.

**OVD**
**Online Video Distributor**
Any entity that offers video Content by means of the Internet or other Internet Protocol (IP)-based transmission path provided by a person or entity other than the OVD. [1]

**Peak Limiting - Limiting**
A process allowing signals below a specified input power or level to pass unaffected, while attenuating the peaks of stronger signals that exceed this threshold. Limiting is a type of dynamic range compression. Clipping is an extreme version of limiting. [17]

**Personal Computer**
A compact computer that uses a microprocessor and is designed for individual use, as by a person in an office or at home or school, for such applications as word processing, data management, financial analysis, streaming media or computer games. [18]

**PMP**
**Portable Media Player**
A portable consumer electronics device capable of storing and playing digital media such as audio, images, and video files. Some devices also support streaming internet video/audio over Wi-Fi.

**Portable Device**
Personal type units capable of supporting file and streaming media playback services via Wi-Fi and/or cellular data internet access.

**PPM**
Peak Program meter. A device which measures and displays or records the maximum excursion of an audio program.

**Program**
An individual, self-contained audio-visual or audio-only item to be presented in Radio, Television or other electronic media. An advertisement (commercial), trailer, promotional item ('promo'), interstitial or similar item shall be considered to be a Program in this context. [4]

**Program Loudness**
The Integrated Loudness over the duration of a Program. [4]

**Set Top Box**
A hardware device that allows a digital signal to be received, decoded and displayed on a television. The signal can be a television signal or Internet data and is received via an MVPD. [19]

**Short Form Content**
Advertising, commercial, promotional or public service related material or essence. The typical duration is less than approximately two to three minutes. [3] Synonymous with interstitial Content.

**Sideloading**
Media file transfer to a mobile device via USB, Bluetooth, Wi-Fi or by writing to a memory card for insertion into the mobile device. [20]

**Smart Phone**
A device that combines a cell phone with a hand-held computer and Portable Media Player capabilities. [21]

**Smart T.V.**
A digital television that has Fixed Device capabilities built in.

**SPL**
Sound pressure level in decibels referenced to 20 $\mu N/m^2$.

**Tablet Computer**
A very thin, portable computer, usually battery-powered, having a touchscreen as the primary interface and input device. Usually has Portable Media Player capabilities and may also support cellular data. [22]

**Target Program Loudness**
A specified Loudness value for the Anchor Element [3], Dialog Level or Program Loudness, established to facilitate Content exchange from a supplier to an operator.

**True Peak**
The maximum absolute level of the signal waveform in the continuous time domain, measured per BS.1770. [12] Its units are dB TP. [3]

# Loudness Guidelines for OTT and OVD Content

## Annex D – Tables

**Table 1 - Recommendations for Short Form Content:**

| Broadcast Region | Integrated Loudness | Maximum Short Term Loudness | Maximum True Peak | Anchor Based Measurement | Full Program Mix Measurement |
|---|---|---|---|---|---|
| North America [3] | –24 ± 2 LKFS | N/A | –2 dB TP | Not permitted | Recommended |
| Europe [4] | –23 ± 0.5 LUFS | –18 LUFS and + 5 LU relative to IL | –1 dB TP | Not permitted | Recommended |
| Japan [5] | –24 ± 1 LKFS | N/A | –1 dB TP | Not permitted | Recommended |
| Australia [6] | –24 ± 1 LKFS | N/A | –2 dB TP | Not permitted | Recommended |

**Table 2 - Recommendations for Long Form Content:**

| Broadcast Region | Integrated Loudness | Maximum Short Term Loudness | Maximum True Peak | Anchor Based Measurement | Full Program Mix Measurement |
|---|---|---|---|---|---|
| North America [3] | –24 ± 2 LKFS | N/A | –2 dB TP | Recommended | Conditionally Permitted[7] |
| Europe [4] | –23 ± 0.5 LUFS | N/A | –1 dB TP | Conditionally Permitted[8] | Recommended |
| Japan [5] | –24 ± 1 LKFS | N/A | –1 dB TP | Not permitted | Recommended |
| Australia [6] | –24 ± 1 LKFS | N/A | –2 dB TP | Permitted | Permitted |

**Table 3 - Recommendations for maximum Loudness: [23]**

| | Integrated Loudness | Maximum True Peak |
|---|---|---|
| Short Form Content | –16 ± 1 LKFS/LUFS[9] | –1 dB TP |
| Long Form Content | –16 ± 1 LKFS/LUFS[8] | –1 dB TP |

[7] If the Anchor Element cannot be isolated and measured [3]
[8] Permitted for wide dynamic range Content [4]
[9] Not applicable for Japan

# Loudness Guidelines for OTT and OVD Content

## Annex E - Mobile Loudness Pretesting Summary

The AGOTTVS group performed an informal Loudness survey that was carried out in August of 2017 with expert and non-expert listeners from various regions around the world and included several AGOTTVS members. The test was performed using seven selections of broadcast Content, provided by AGOTTVS members, and normalized to three different Loudness targets, –24, –20 and –16 LKFS to determine if the volume on typical portable devices could be set to produce intelligible results.

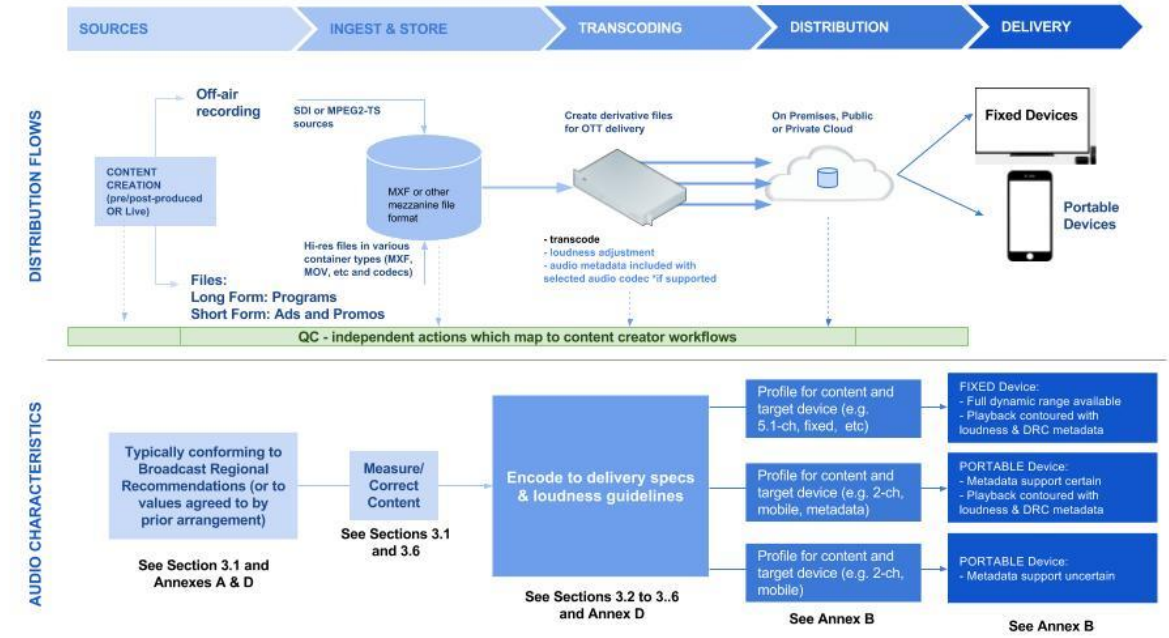
Participants listened to the audio clips in quiet and noisy environments over headphones and the internal loudspeaker of the device they were using. The results indicated that in quiet environments, all clips could be set to an intelligible level, though some clips were deemed to have parts reported as “too loud.” In noisy environments, most clips could be set to an intelligible level, though it resulted in an even higher quantity of parts reported as “too loud.”

In summary, this preliminary work gives confidence that while the three target levels are practical, dynamic range control of some sort will be required, particularly for noisy environments. It also clarifies the need for more detailed testing.

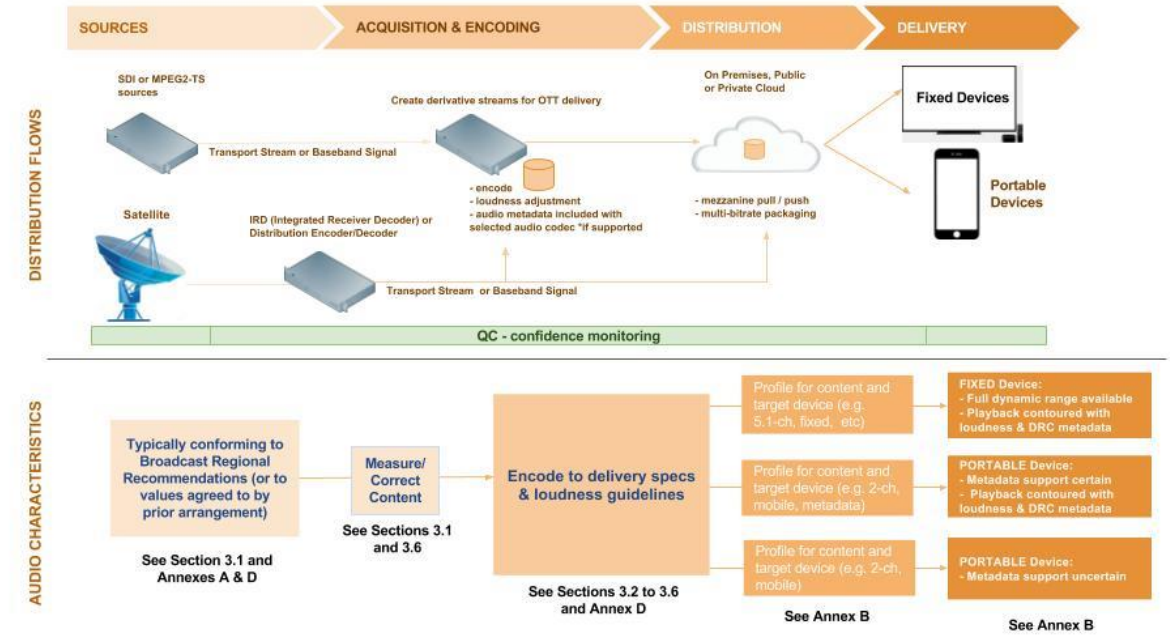
# Loudness Guidelines for OTT and OVD Content

## Annex F - OTT and OVD Ecosystem Diagrams

### OTT / OVD AUDIO WORKFLOW




### LINEAR STREAMING AUDIO WORKFLOW



# Loudness Guidelines for OTT and OVD Content

## Annex G - References


[1] Federal Communications Commission (FCC) "Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming" FCC 13-99 (July 22, 2013) https://www.fcc.gov/document/fcc-adopts-15th-report-video-competition

[2] Audio Engineering Society (AES) "Audio Guidelines for Over the Top Television and Video Streaming — Preliminary Loudness Guidelines" TD-1005 (September, 2016) http://www.aes.org/technical/documents/AESTD1005_1_16_09.pdf

[3] Advanced Television Systems Committee (ATSC) "Techniques for Establishing and Maintaining Audio Loudness for Digital Television" A/85-2013 (March, 2013) https://www.atsc.org/recommended-practice/a85-techniques-for-establishing-and-maintaining-audio-loudness-for-digital-television/

[4] European Broadcast Union (EBU) "Loudness Normalisation and Permitted Maximum Level of Audio Signals" R 128 s1 ver. 2.0 (June 2014) https://tech.ebu.ch/docs/r/r128.pdf

[5] Association of Radio Industries and Businesses (ARIB) "Operational Guidelines for Loudness of Digital Television Programs" TR-B32 (September, 2016) https://www.arib.or.jp/english/std_tr/broadcasting/tr-b32.html

[6] Free TV Australia "Measurement and Management of Loudness in Soundtracks for Television Broadcasting" OP-59 (Feb 2013) http://www.freetv.com.au/media/Engineering/Free_TV_OP59_Measurement_and_Managemnt_of_Loudness_for_TV_Broadcasting_Issue_3_July_2016.pdf

[7] Consumer Technology Association (CTA) "NTSC/ATSC Loudness Matching" CTA-CEB11-C (January 2015) https://www.cta.tech/Research-Standards/Standards-Listing.aspx

[8] European Broadcast Union (EBU) "Guidelines for Distribution and Reproduction in Accordance with EBU R 128" Tech 3344 version 2.1 (July 2016) https://tech.ebu.ch/docs/tech/tech3344.pdf

[9] International Organization for Standardization ISO/IEC JTC1/SC29/WG11 Coding of Moving Pictures and Audio "White Paper on MPEG-D Dynamic Range Control" N15071 (Feb 2015) http://www.mpeg-audio.org/docs/w15071_MPEG-D_DRC.pdf

[10] PC Magazine On-Line Encyclopedia Term 56280 "AV Receiver" https://www.pcmag.com/encyclopedia/term/56280/a-v-receiver

[11] Audio Engineering Society (AES) "AES Standard Method for Digital Audio Engineering - Measurement of Digital Audio Equipment" AES-17 2015 (September 2015) http://www.aes.org/standards/blog/2015/9/aes17-2015-measurement-digital-audio-150917

[12] Wikipedia -The Free Encyclopedia 'Download" Definition
https://en.wikipedia.org/wiki/Download

[13] Wikipedia -The Free Encyclopedia "Digital Video Recorder" Definition
https://en.wikipedia.org/wiki/Digital_video_recorder

[14] Wikipedia -The Free Encyclopedia "EDID" Definition
https://en.wikipedia.org/wiki/Extended_Display_Identification_Data

[15] European Broadcast Union (EBU) "Loudness Range: A Measure to Supplement EBU R 128 Loudness Normalization" Tech 3342 3.0 (January 2016)
https://tech.ebu.ch/docs/tech/tech3342.pdf

[16] International Telecommunications Union (ITU) "Requirements for Loudness and True-peak Indicating Meters" ITU-R BS.1771-1 (January 2012)
https://www.itu.int/dms_pubrec/itu-r/rec/bs/R-REC-BS.1771-1-201201-I!!PDF-E.pdf

[17] Wikipedia -The Free Encyclopedia "Limiter" Definition https://en.wikipedia.org/wiki/Limiter

[18] Dictionary.com "Personal Computer" Definition
http://www.dictionary.com/browse/personal-computer?s=t

[19] Techopedia.com "Set-Top-Box" Definition
https://www.techopedia.com/definition/2284/set-_top-box-stb

[20] Wikipedia -The Free Encyclopedia "Sideloading" Definition
https://en.wikipedia.org/wiki/Sideloading

[21] Dictionary.com "Smart Phone" Definition http://www.dictionary.com/browse/smartphone?s=t

[22] Dictionary.com "Tablet Computer" Definition http://www.dictionary.com/browse/tablet?s=t

[23] T. Lund, "Prevention of Hearing Loss from the Use of Personal Music Players", AES 58th International Conference, Aalborg, Denmark, (June 28–30 2015)
http://www.aes.org/e-lib/browse.cfm?elib=17796