

Loudness normalisation and permitted maximum level of audio signals



Status: EBU Recommendation

Geneva
30 August 2010

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<i>EBU Committee</i>	<i>First Issued</i>	<i>Revised</i>	<i>Re-issued</i>
Technical Committee	2010		

Keywords: Audio levels, loudness, normalisation, permitted maximum level

The EBU has studied the needs of audio signal levels in production, distribution and transmission of broadcast programmes. It is of the opinion that an audio-levelling paradigm is needed based on **loudness** measurement.

In addition to the average loudness of a programme ('*Programme Loudness*') the EBU recommends that the descriptors '*Loudness Range*' and '*Maximum True Peak Level*' be used for the normalisation of audio signals, and to comply with the technical limits of the complete signal chain as well as the aesthetic needs of each programme/station depending on the genre(s) and the target audience.

The EBU, considering;

- a) *that peak normalisation of audio signals has led to considerable loudness differences between programmes and between broadcast channels;*
- b) *that the resulting loudness inconsistencies between programmes and between channels are the cause of the most viewer/listener complaints;*
- c) *that, when used to read peaks in the usual way, the QPPM (Quasi-Peak Programme Meter) specified in EBU Tech Doc 3205-E [1] does not reflect the loudness of an audio signal, and that the QPPM is not designed to indicate a long-term average;*
- d) *that with the proliferation of digital production, distribution and transmission systems, the permitted maximum level of an audio signal specified in ITU-R BS.645 [2] is no longer appropriate;*
- e) *that an international standard for measuring audio programme loudness has been defined in ITU-R BS.1770 [3], introducing the measures LU (Loudness Unit) and LUFS (Loudness Unit, referenced to Full Scale)¹;*
- f) *that a gated measurement of Programme Loudness (hence measuring 'Foreground Loudness') is advantageous to improve the loudness matching of programmes with a wide loudness range;*
- g) *and that the descriptor 'Loudness Range' can be used to assess the need for loudness-range reduction to fit programmes to the tolerance window of the target audience;*

¹ 'LUFS' is equivalent to 'LKFS' (which is used in ITU-R BS.1770-1). An input document has been submitted to the ITU requesting it to change its nomenclature to 'LUFS' (which is compliant with international naming conventions).

recommends (see Note):

- h) that the descriptors **Programme Loudness**, **Loudness Range** and **Maximum True Peak Level** shall be used to characterise an audio signal;
- i) that the **Programme Loudness Level** shall be normalised to a **Target Level** of **-23 LUFS**. The permitted deviation from the Target Level shall generally not exceed **±1 LU** for programmes where an exact normalisation to Target Level is not achievable practically (for example, live programmes);
- j) that the audio signal shall generally be measured in its entirety, without emphasis on specific elements such as voice, music or sound effects;
- k) that the measurement shall be made with a loudness meter compliant with both ITU-R BS.1770 and EBU Tech Doc 3341 [4];
- l) that this measurement shall include a **gating** method with a relative threshold of **8 LU** below the ungated LUFS loudness level as specified in EBU Tech Doc 3341;
- m) that **Loudness Range** shall be measured with a meter compliant with EBU Tech Doc 3342 [5];
- n) that the **Maximum Permitted True Peak Level** of a programme during production shall be **-1 dBTP** (dB True Peak), measured with a meter compliant with both ITU-R BS.1770 and EBU Tech Doc 3341.

The EBU further recommends

- o) that loudness metadata shall be set to indicate **-23 LUFS** for each programme that has been loudness normalised to the Target Level of -23 LUFS;
- p) that loudness metadata shall always correctly indicate the actual programme loudness, even if for any reason a programme may not be loudness normalised to -23 LUFS;
- q) that audio processes, systems and operations concerning production and implementation should be made in compliance with EBU Tech Doc 3343 [6];
- r) that audio processes, systems and operations concerning distribution should be made in compliance with EBU Tech Doc 3344 [7].

Definitions:

Programme:	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 programme in this context;
Programme Loudness:	The integrated loudness over the duration of a programme - Programme Loudness Level is the value (in LUFS) of Programme Loudness;
Loudness Range (LRA):	This describes the distribution of loudness within a programme;
Maximum True Peak Level:	The maximum value of the audio signal waveform of a programme in the continuous time domain.

Note

At the publication time of this recommendation, measurement instruments compliant with ITU-R BS.1770 [3] and EBU Tech Doc 3341 [4] have only recently become available. As the switch to loudness normalisation is a substantial change in audio signal levelling, aligning procedures as described in the EBU Tech Docs 3343 [6] and 3344 [7] will have an economical and organisational impact. Therefore a **transition phase** may be necessary by some broadcasters before this recommendation can be fully implemented; Broadcasters should in any case aim to make the transition as quickly as is practically possible.

References

- [1] **EBU Tech Doc 3205-E** 'The EBU standard peak-programme meter for the control of international transmissions'
- [2] **ITU-R BS.645** 'Test signals and metering to be used on international sound programme connections'
- [3] **ITU-R BS.1770** 'Algorithms to measure audio programme loudness and true-peak audio level'
- [4] **EBU Tech Doc 3341** 'Loudness Metering: 'EBU Mode' metering to supplement loudness normalisation in accordance with EBU R 128'
- [5] **EBU Tech Doc 3342** 'Loudness Range: A descriptor to supplement loudness normalisation in accordance with EBU R 128'
- [6] **EBU Tech Doc 3343** 'Practical Guidelines for Production and Implementation in accordance with EBU R 128'
- [7] **EBU Tech Doc 3344** 'Practical Guidelines for Distribution of Programmes in accordance with EBU R 128'