EBU
OPERATING EUROVISION AND EURORADIO

R 128

LOUDNESS NORMALISATION AND PERMITTED MAXIMUM LEVEL OF AUDIO SIGNALS

Status: EBU Recommendation

Loudness Normalisation and
Permitted Maximum Level of Audio Signals

EBU Committee	First Issued	Revised	Re-issued
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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 based on loudness measurement is needed.

The EBU recommends the measurement of the average loudness of a programme ('Programme Loudness') for the normalisation of audio signals.

The '*Maximum True Peak Level*' of an audio signal should be used to check compliance with the upper technical limit of the signal chain. The measures '*Loudness Range*', '*Maximum Momentary Loudness*' and '*Maximum Short-term Loudness*' can be used to further characterise an audio signal as well as to fulfil the aesthetic needs of each programme/station depending on the genre(s), the target audience and the distribution platform.

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 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 Units, referenced to Full Scale)[1];*

f) *and that the level-gated measurement of Programme Loudness defined in ITU-R BS.1770 Equation (7) (which hence measures foreground loudness) is advantageous to improve the loudness matching of programmes with a wide loudness range.*

Recommends:

g) that the measure **Programme Loudness** shall generally be used to normalise an audio signal;

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[1] 'LUFS' is equivalent to 'LKFS' (which is used in ITU-R BS.1770). The EBU uses 'LUFS', which is compliant with international naming conventions.

h)   that the **Programme Loudness Level** shall be normalised to a **Target Level** of **−23.0 LUFS**. Where attaining the Target Level is not achievable practically (for example, live programmes), a tolerance of **±1.0 LU** is permitted. A broadcaster should ensure that a deviation from the Target Level towards the limits of the tolerance does not become standard practice;

i)   that for the implementation of Loudness Levelling workflows (for example, in Quality Control environments) a tolerance of **±0.2 LU** is allowed in order to take account of measurement errors;

j)   that in special cases the Programme Loudness Level may be normalised to a Target Level lower than −23.0 LUFS on purpose. This exception shall be clearly indicated to ensure that such a lower Programme Loudness Level is not compensated;

k)   that the measurement shall be made with a loudness meter compliant with ITU-R BS.1770 (including the level-gating method described in equation (7)) and EBU Tech 3341 [4];

l)   that the audio signal shall generally be measured in its **entirety**, without emphasis on specific foreground elements such as speech, music or sound effects;

m)   and that the **True Peak Level** of a programme shall not exceed **−1 dBTP** (dB True Peak) during production (linear audio), measured with a meter compliant with ITU-R BS.1770 and EBU Tech 3341. The measurement tolerance is **±0.3 dB** (for signals with a bandwidth limited to 20 kHz). Permitted Maximum True Peak Levels may be lower for different distribution systems and data reduction rates. A broadcaster should check EBU Tech 3344 [5] for details;

The EBU further recommends:

n)   that the measure **Loudness Range** (measured in compliance with EBU Tech 3342 [6]) may be used to evaluate the loudness variation of a programme[2], its potential subsequent dynamic treatment and the dynamic integrity of a distribution path;

o)   that **Maximum Momentary Loudness** and **Maximum Short-term Loudness** (measured in compliance with EBU Tech 3341) may be used to determine if a programme exceeds the upper loudness tolerance limit of the target audience;

p)   that **Loudness Metadata** shall correctly indicate the actual Programme Loudness. Additional metadata may be used by the broadcaster to ensure a playback loudness level deviating from Target Level, for example, for programmes according to item *j)*;

q)   that production and normalisation of **short-form content** (adverts; promos etc.) should be made in compliance with EBU R 128 s1 [7];

r)   that guidance for the normalisation of **content** for **streaming** is given in EBU R 128 s2 [8];

s)   that audio processes, systems and operations concerning production of programmes should be made in compliance with EBU Tech 3343 [9];

t)   and that audio processes, systems and operations concerning distribution and reproduction of programmes should be made in compliance with EBU Tech 3344.

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[2] For programmes with a duration of less than 1 minute, the use of the measure Loudness Range is not recommended due to there being too few data points (Loudness Range is based on the Short-term-Loudness values (3-seconds-window)).

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 ("Short-form Content") is also 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):	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.

References

[1]   **EBU Tech 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 3341**   *'Loudness Metering: 'EBU Mode' metering to supplement loudness normalisation in accordance with EBU R 128'*

[5]   **EBU Tech 3344**   *'Guidelines for Distribution and Reproduction of Programmes in accordance with EBU R 128'*

[6]   **EBU Tech 3342**   *'Loudness Range: A measure to supplement loudness normalisation in accordance with EBU R 128'*

[7]   **EBU R 128 s1**   *'Loudness Parameters for Short-form Content (Adverts; Promos etc.)'* supplement 1 to EBU R 128

[8]   **EBU R 128 s2**   *'Loudness in Streaming'*; supplement 2 to EBU R 128

[9]   **EBU Tech 3343**   *'Guidelines for Production of Programmes in accordance with EBU R 128'*