# Column by Renzo van Riemsdijk (Masterenzo):

## To LUFS and beyond

Hearing this title as a rookie in audio land I would start to think this is some new talent, discovered by tv programme The Voice. Girl band LUFS conquers hearts from all over the world with their synthesizer pop influenced by eclectic trance from the middle eighties.

But no, LUFS stands for **L**oudness **U**nits **F**ull **S**cale. LUFS is used to measure program loudness and is measured in decibels (dB).

A (digital) volume measurement in a DAW (**D**igital **A**udio **W**orkstation, like Pro-Tools, Logic, Cubase) is often done using a peak meter and a RMS measurement. RMS stands for **R**oot **M**ean **S**quare. It's another way of measuring average program loudness.

When loudness normalization was introduced, the only loudness measurement available was RMS. Soon it appeared that songs normalized using the RMS value only were not all perceived as being equally loud.
Especially songs with a higher dynamic range were judged as being softer in volume than songs with less dynamics.

How can we prevent this?
Measuring RMS provides us with an average level of a song, related to the digital maximum level of 0dBFS. Measuring levels using LUFS does exactly the same but consists of multiple measurements: **I**ntegrated loudness (this is the actual LUFS value and is identical to RMS), **M**omentary loudness and **S**hort-term loudness. Each with their own dynamics (loudness range). It's this *loudness range* that sets LUFS apart from RMS.

Integrated loudness shows the average loudness of an entire track. When determining the loudness range of Integrated loudness the lowest 10% and highest 5% of the total loudness range are excluded from the measurement to prevent short dynamic events from having too much influence on the measurement.
Momentary and Short-term loudness show absolute values of loudness, measured in a time frame (400ms for Momentary and 3s for Short-term loudness).

Peak values also play a role in measuring loudness: a LUFS meter has a built in true-peak meter. True-peak is a measurement of absolute peak values and inter-sample peaks.
**Inter-sample peaks?** Certainly, inter-sample peaks are the peaks between the peaks. Let's say we measure two peaks (A and B) with a distance of one sample between them. Theoretically it's possible to measure another peak between these two points and there you have it: inter-sample peaks. Measuring true-peaks is important for broadcasting and for coding music to portable (streaming) formats like Ogg Vorbis (Spotify), AAC (iTunes/Apple Music) or good'ole mp3.

A little caution here: true-peak is just a more accurate way of is measuring. In compliance with the EBU R128 standard used for broadcasting a signal may not exceed the -1dBTP level. But for music your ears come first: when you feel you have to squeeze dynamics (limiting) too much to stay in range of the meters, trust your ears and say to yourself: "if it sounds great, don't lose yourself in measurements and let music be music."

Working with LUFS provides more accuracy than a single RMS measurement. Music streaming services like Deezer, Spotify and Apple Music thankfully use LUFS to let tracks sound equally loud in their playlists (loudness normalization, with a target level of -14LUFS).
Also in broadcasting (radio, tv, internet) LUFS are being used (-23LUFS, in compliance with EBU R128). The EBU R128 standard was introduced when there were substantial loudness differences between program material like tv series or films and commercial breaks. Using EBU R128 prevents commercial breaks from being almost twice as loud as program material.

Should we all install (plug-in) and use a LUFS meter? No, measuring LUFS can be very convenient but it's really a mastering tool.
More important during mixing and producing are peak levels. Make sure your peak values stay well below the 0dBFS ceiling (or -1dBTP if you want to be 100% sure). The rest is up to us, mastering engineers. Level is not a big issue when you're mixing.

Far more important during the production and mix stages is dynamic range and its influence on the sound of your final mixes. Also very important for the mastering process. And because it's so important my next column is about: . . . . . (eight letter word, it has everything to do with loudness, LUFS, mixing and mastering)

Until next month, I'm already looking forward to it!

Renzo

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