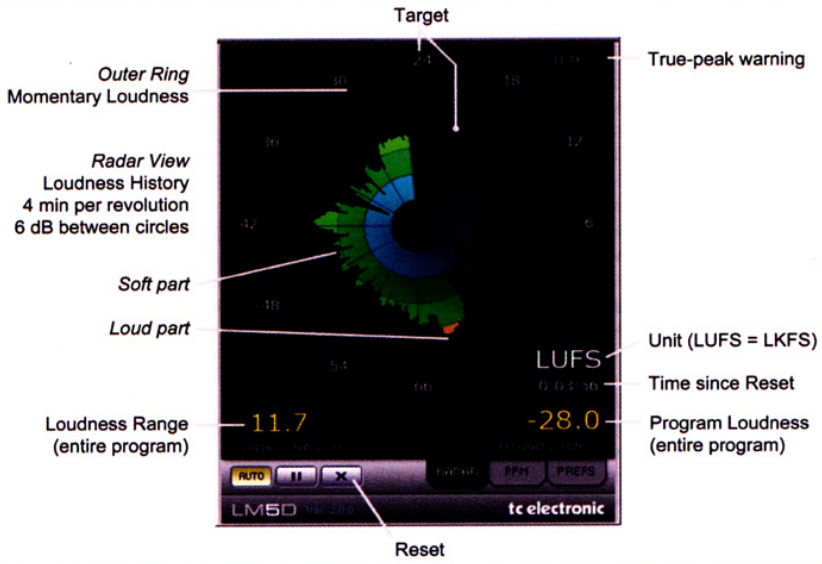
Bad news for the war

Loudness in television has become a subject of legislative regulation, but does that create a ripple effect outside broadcast stations or networks? THOMAS LUND, HD development manager at TC Electronic, says it does.

The Loudness War has been raging for two decades and, as in all wars, there are casualties. In this one, audio quality has suffered as absolute loudness has been more important than distortion. On top of the dynamic distortion deliberately inflicted on a programme to limit its Peak-to-Loudness Ratio (PLR), a further 20% of distortion is typically added to a pop/rock music track or to a commercial during distribution or reproduction. Distortion builds up in lossy data reduction codecs, in sample rate convertors and in consumer playback devices. Consequently, a generation of musical heritage has suffered irreversible damage. Because of remastering, marketed often falsely as being of higher quality, several classic rock albums have also gone down the drain in their latest incarnation. For the same reason, when tuning amplifiers, speakers or processors for pop/rock, I often use tracks mastered between 1975 and 1995.

With newer, hyper-distorted albums, it makes little difference whether you listen to a great speaker or to a lousy one. Transients have been killed and the imaging is so sloppy that you can't tell if it's stereo or just mono with occasional cartoonish LR effects. However, there's finally sound at the end of the tunnel because three trends now point in a sane direction: lossy data reduction is loosing its grip; a relevant peak level measure has been standardised; and loudness normalisation has made its way into broadcast and iTunes.



It's worth celebrating how the spread of lossy data reduction has been stemmed. Why risk quality, latency or not being able to decode audio when bandwidth and storage is 1000 times cheaper today than when the codecs were invented? It's also good news that the defunct sample peak measurement has been retired and replaced with the relevant true-peak measure coined by AES and standardised in ITU BS.1770-2. The rest of this article, however, will be mainly about the most important ripple-effect from broadcast standardisation that will help end the loudness wars, namely loudness based measurement and normalisation.

DISREGARD PEAK LEVEL; IT'S ALL ABOUT LOUDNESS — ITU-R BS.1770-2 and EBU R128 build on circumstantial research and independent verification. The standards are comprised of two parts: Measurement of Loudness and measurement of True-peak level. True-peak detection is a reasonable way of measuring peak level in the digital domain. However, true-peak metering is really only included to stay clear of overload. The loudness-part is the essential one, enabling calculations of Momentary Loudness, Short-term Loudness, Loudness Range and Integrated Loudness. All four measurements are useful in production, while Integrated Loudness also serves to normalise one programme against another, i.e. to establish transparent gain offsets between programmes so they appear of (averagely) the same loudness.

Turning the attention to loudness and away from peak level is the single most important aspect of this meter paradigm shift that already affects audio production of all genres.

NORMALISATION — Anyone who has ever created an iTunes playlist containing modern music productions and music from, say, the 70s or 80s has experienced systematic jumps in loudness between songs. Even if they are all pop or all rock, such level-jumps are evident. The Sound Check function in iTunes is an example of how normalisation can work wonders. Enable Sound Check in Prefs, and each track is assigned a static gain so that all tracks are reproduced at roughly the same loudness.

In broadcast, many very different soundtracks have to coexist — not just music, but also talk shows, news reports, films, and commercials. It's tricky to normalise such a variety of content, even by ear, but thanks to an adaptive measurement gate, BS.1770-2 provides the best generic solution yet identified. BS.1770-2 normalisation has actually proven efficient not only when aligning broadcast programmes but also when covering the wide range from mobile TV over game production and music playback all the way to IMAX theatre playback level.

Where old normalisation attempts based on peak level or dialog level are easy to fool, it's a challenge to find examples where the Integrated Loudness measure of BS.1770-2 returns an unreasonable answer. Furthermore, transparent BS.1770-2 and EBU R128 normalisation is fully based on open standards and isn't just a proprietary method devised for commercial reasons.

TARGET LOUDNESS — Absolute Loudness is measured with a unit called LUFS or LKFS. The two are identical, so a reading of -23 LUFS is precisely the same as one of -23 LKFS. However, in countries taking notice of ISO, LUFS is preferred.

Normalisation is aimed at a certain Target Loudness, which in DTV is -24 or -23 LUFS, depending on the country or region. If Integrated Loudness for a certain programme is measured to be, for instance, -21.4 LUFS, a static gain offset of -1.6dB would put it on the -23 LUFS target specified in EBU R128 (a -2.6dB gain offset would be required if the target was -24 LUFS).

Adhering to EBU R128, headroom can be regarded as the true-peak to loudness ratio, or PLR, which is significantly higher in television now than ever before, up from around 10dB to 22dB. In fact, you may broadcast Ravel's Bolero or a Pirates movie normalised at -23 LUFS without any need for processing, such as compression or peak limiting.

The standard generally also provides a higher and more predictable headroom than speech-based normalisation. According to extensive listening tests conducted recently, the major DTV audio quality bottleneck is now its lossy data reduction rather than compromised headroom.

Finally, it should be noted how the optimum Target Loudness depends on the broadcast platform. For instance, -23 LUFS is too soft for the gain structure in mobile TV, IPTV or iPods, but a quality conscious level-conversion is easy in a fixed Target Loudness system. Most loudness meters may have the display switched between LUFS and LU (or LKFS and LU). The LU unit is relative, so 0 LU by definition denotes Target Loudness. It's down to a question of user preference whether '0' is at the top of the meter or at standard level. The same mixing or normalising result may be obtained regardless of which display mode is used.

LOUDNESS RANGE — EBU R128 allows for plenty of loudness variation inside a TV programme, and it even includes a way of assessing such variations, namely through another programme duration measurement called Loudness Range. This measurement is very useful in production because it tells the operator if the mix is too wide range, like a movie, or if the opposite is the case, that it's an 'audio sausage'. Once a mix with a reasonable Loudness Range has been performed, no further processing is indicated downstream of the studio, at least not when the programme is aired on DTV.

EBU R128 therefore also facilitates a transparent loop from production over ingest to transmission and logging, and it's completely against the spirit of the standard to insert unconscious sausage processing for transmission. On the contrary, programmes with a reasonable Loudness Range, should be transmitted without processing, as long as they are prenormalised to -23 LUFS.

USING A LOUDNESS METER — It was EBU's precise definition of a useful meter that made the loudness concept really take off, replacing the uncertainty that had prevailed. EBU R128 defines the criteria a meter has to meet for it to be 'EBU Mode' compliant. Criteria include what is measured, and the way measurements are done, but not how they are displayed. Consequently, EBU meters may look different yet indicate the same numbers. Besides displaying Integrated Loudness and Loudness Range, EBU meters must also show Short-term Loudness, Momentary Loudness and True-peak level.

Here are some hints for using an EBU loudness meter in production. When mastering music, once Integrated Loudness is around -16 LUFS, it's futile to make the track louder. Every extra dB will be counteracted by normalisation in iTunes or during broadcast, but every dB will still cost irreversible distortion. If you want the track to cut through without further processing even under difficult reproduction conditions, keep Loudness Range at 6 LU or lower. On the other hand, there's no technical reason to make Loudness Range lower. If mixing classical or other 'epic' music, a higher Loudness Range such as 10 or even 20 LU should not be avoided. However, such mixes would be prone to downstream processing when broadcast to certain platforms.

As a mastering engineer, keep in mind how Loudness Range is distinctively different from Peak to Average Ratio or Peak to Loudness Ratio. In several recent

pro audio articles, writers have confused the two. Squashing peaks doesn't help the track, it only makes it sound worse on fine speakers. Preventing Loudness Range from becoming too high is what will decide if that track will be subject to downstream processing or not.

When mixing regular programming for broadcast, the aim is to deliver a result with Integrated Loudness at Target Level. This would be -23 LUFS +/-1 LU in Europe and -24 LUFS +/-2 LU for most other countries. You may either mix with a loudness meter, or, based on Integrated Loudness, perform a gain offset of the entire mix at the end. EBU has a secondary requirement that true-peak level shouldn't exceed -1dB (sometimes written 'dBTP'), while ITU recommends keeping peak level below -2dBTP. Keep in mind that further peak limiting may be required during broadcast transmission where the AC3 codec is used. Though there are workarounds for the problem without engaging the codec's bad sounding DRC patch, AC3 suffers downmix distortion on the consumer side when peak level gets above -6dBTP.

Other EBU mode indicators, such as Loudness Range, Short-term Loudness and Momentary Loudness are merely used as guidelines when mixing regular programmes. In general, keep the Short-term loudness of regular speech between -26 and -23 LUFS, with foreground music 2-3 LU louder. For live mixing, though, extra attention should be paid to Short-term loudness, starting 1-2 LU lower than your actual target. Also, Loudness Range is a good, objective help when mixing or applying compression. For programmes to air on any platform without further processing, Loudness Range is kept around 5-8 LU, while drama could be allowed more range. Taking Desperate Housewives as an example, episodes have a Loudness Range of 14-15 LU at the mix stage, which is brought down to 11-12 LU during AC3 transmission with standard DRC settings.

For mixing commercials and promos, basic requirements are the same: don't exceed the Target (see regular programmes above), or your programme is subject to a foreseeable attenuation. Based on research, 95% of consumers can be expected to reach out for the remote if a commercial causes loudness to systematically jump up by 5dB relatively to a previous programme. Naturally, this is bound to happen sometimes if a commercial break is inserted at a quiet part of a drama or a movie, regardless of whether the commercial is loud or not. To further limit the risk, some countries have introduced a secondary line of defence against strident commercials. A rule based only on Integrated Loudness doesn't prevent a small part of a commercial from being annoyingly loud if the rest is relatively quiet. In England, for example, since 2008, BCAP rules on Short-term loudness in commercials even preceded the normalisation of regular programmes, and the results have still been encouraging. When mixing modern commercials or promos, therefore try to make it sound good rather than loud and distorted. Chances are 'loud and distorted' will be normalised to 'wimpy and distorted' based on Integrated Loudness and/or Short-term Loudness.

Regarding other EBU mode parameters, don't exceed the true-peak limit (see regular programming). Commercials and promos are so short that the Loudness Range measurement isn't worth paying attention to. Loudness Range needs a programme with a duration of more than one minute to become meaningful.

AT THE END OF THE DAY... — Compared to previous peak-based or speech-based attempts of controlling level, the ITU-R BS.1770-2 and EBU R128 standards are remarkable improvements. A fully transparent loop, based entirely on open technology, may now be created between production, ingest, transmission and the home listener. Consequently, 'sausage processing' at the point of transmission should be considered a thing of the past. Instead, EBU mode metering in production, and at subsequent stages, allows transparent handling and normalisation of audio in the chain.

For broadcast platforms based on AC3, Integrated Loudness even enables a more precise and cheaper setting of dialnorm metadata than ever before. Remember how AC3 decoders are not dialog specific, neither with regard to normalisation (dialnorm) nor with regard to processing (DRC).

FOR THE PLETHORA OF OTHER PLATFORMS — Mobile TV, IPTV, Podcast and counting — EBU R128 also provides easy and audio conscious answers. Under the new order, programmes remain untouched as long as their Loudness Range isn't excessive for the audience of a given platform. This is also an improvement over today, because AC3 processing (DRC) is typically routinely enabled during DTV transmission. Where this kind of domestic processing was supposed to be non-destructive, DRC has ironically become anything but; the home listener cannot turn off a primitive processor that even isn't BS.1770 compliant.

In an ideal world, no matter what the programme type, the perceived loudness level would stay averagely the same throughout a full day of broadcast, across channels, across platforms. Further complementary tools should not be dismissed, but the good news is that progress is being constantly made as users everywhere gain experience with this audio revolution taking place before our ears.

The mere fact that broadcasters, Apple and legislative assemblies across the globe are now focusing on loudness solutions is a positive and welcomed development that is sure to make the viewing, and the listening, experience more enjoyable for everyone. I can't wait for the profound ripple-effect this revolution will have on music production and mastering. ■