DROffline

User Manual

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Introduction

Dear User,

Thanks for installing your copy of MAAT's DROffline utility, and congratulations on committing yourself to maintaining and preserving dynamic contrasts in music!

MAAT is happy to announce that, going forward, we will maintain and further develop the plug–in and utility formerly known as the TT DR Meter and TT DR Offline on behalf of the Pleasurize Music Foundation. MAAT carries on the heritage of this popular metering and measurement system, which has transformed the way the music industry views dynamic range.

The MAAT DROffline utility, and companion MAAT DRMeter plug–in, is an almost one–to–one replica of the original. We've done a lot of testing and tweaking to make sure that you get the same familiar and much loved ballistics of the now legendary original TT DR Meter, which has already helped to preserve dynamics for thousands of modern pop releases and multimillions of records sold within the past eight years.

All of DROffline's functionality is wrapped in an information rich yet visually unobtrusive user interface that occupies only a small portion of vertical screen real estate. The utility is also "light weight," demanding a minimum of CPU resources so it won't slow down your host. We've worked hard to make this an exceptionally useful and usable tool for measuring official DR Dynamic Range values.

Specifications

System Requirements

- Mac: OSX 10.8 and newer, 32 & 64 bit
- Win: Windows 7 and newer, 32 & 64 bit
- 4GB RAM minimum

Installation & Setup

In preparation, we recommend that you quit all audio applications prior to installing. After downloading but prior to installation, we also recommend that you disable all anti–malware measures you may have running on your host computer.

Product Installation

macOS

To install DRMeter, simply double click on the downloaded Installer for your particular operating system. The installation process will guide you through the install procedure. After the installer completes, restart your host to allow all background processes to restart.

Windows

Find the location where you saved the downloaded DRMeter installer file. Right-click the dot EXE installer file, and select "Run as admin". Follow the normal installation instructions.

License Installation

As with all of MAAT paid products, DRMeter is licensed with Wibu–Systems's CodeMeter framework. Whether you choose a file–based license residing on your local host, or a hardware–based license residing on a portable dongle, we've got your investment covered with the most secure fraud protection scheme in the industry.

Our hardware–resident licenses require the current generation of Cm-Stick. 3 Series Sticks have a 3 after the hyphen.

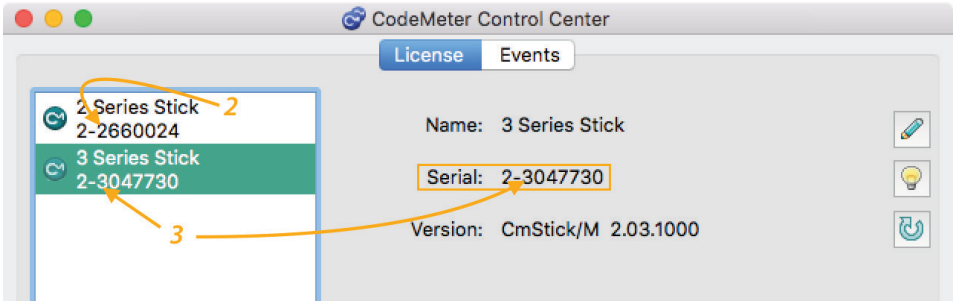

Figure 1: In this CodeMeter Control Center example, the Series 3 Stick is selected

You will need to install your license before using DRMeter. Unplug all CodeMeter device(s) if any, including CmDongles, then:

1) Download your license by visiting:

   http://lc.codemeter.com/83343/depot/index.php

2) Start license "binding" by entering the 25 digit Product Key, that you received in your Avangate purchase confirmation e-mail, into the Ticket field. Click Next to move to license activation.

3) Your license should appear in the My Licenses list. Click Activate Licenses to move to the license type di-alog. If you have a Wibu dongle. plug it in now.

4) In the Select the binding for Your Licenses dialog, you can choose either a soft or file–based "CmActLicense" license residing on a particular host computer, or a more porta-ble "CmDongle" hardware license on a Wibu dongle.

5) Once you have selected where your license will reside, click on Activate Selected Licenses Now to complete the process.

If you experience any issues with the DRMeter, contact us at support@maat.digital.

Introduction

The Interface

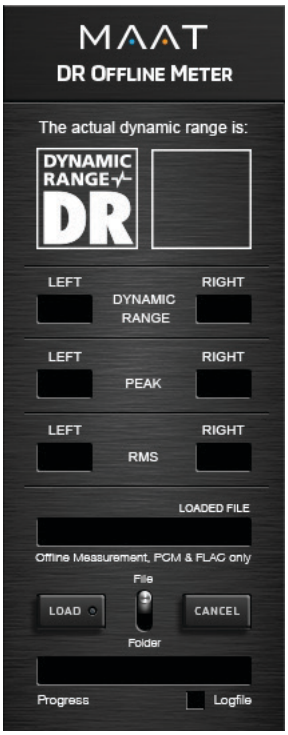

Figure 2: DROffline's user interface

The straightforward DROffline user interface contains three numeric fields for each channel, plus a large DR display at top. The LOADED FILE field display the name of the most recently measured file, and the Progress bar at bottom displays measurement progression.

The bottom right contains the Logfile check box. This option, enabled by default, forces DROffline to generate a plain text log file for each file or directory it processes.

Quick Start — PLEASE READ

We know, reading is old school and such an easy tool to use as the DROffline would seem to be self evident, wouldn't you think? However, before you dive in with this tool, we want to make a few things clear so you will get the best use out of your DROffline. Thanks for struggling through this part!

Our Goal

Our clearly defined goal is to discover and categorize aggressive amplitude compression and to prevent signal "overs" with reliable peak metering. The DR system supplies an easy to understand, integer number, from DR4 to DR14, which defines the dynamic quality of a recording at a glance.

We can´t point that out often enough: The aim of the DR toolset is to generate an easy to understand, whole number value, which describes the degree of dynamic reduction vs. the amount of inherent dynamics. It does this by focusing on the top 20% of loudness events, and counting the average of those 20% against peak amplitude. Designed as a motivation to back away from loudness war–driven mastering decisions, the DR measurement system is best suited to all modern and popular mainstream music genres. Due to the natural obstacles of dynamics measurement in general, DR values are more precise for smaller values, where there is little contrast between loud and soft, and may deviate more the higher the DR value. Read further to understand the obstacles of dynamic measurement in general.

In Use

Let´s start with a few important rules to properly measure and interpret your DR measurements:

1. For "official" DR values, always use your DROffline measurement utility. The real time DRMeter plug-in is not capable of exact measurements. Official DR values are cumulative, over the entire length of a song, from start to end.
2. If you also own the DRMeter, use it to get a feel for the approximate DR value as you work on a song or album. To do this, go to the loudest spot(s) in your program, play that material and read out the value with the DRMeter set to "Link" mode.
3. Here are two scenarios for potentially misleading meter readings and the requirement for sensible interpretation:

a) A pure tone or sustained note has almost zero dynamic range without anything to contrast it to. So, A sine wave measures 0 DR because peak equals loudness. Now, imagine a relatively dynamic jazz song, with a great lead singing a pretty loud, long *ff* note at a spot with almost no back beat. This will show almost zero Dynamic Range because the plug–in is measuring the contrast between louder events, mostly percussive transients, and lower events, mostly less percussive harmonic content. If most of the song fits the above description, you'd possibly arrive at a DR of 3 or 4 despite the song not necessarily being hyper–compressed. The nature of dynamic measurement can be cruel, so skillful interpretation of real time results is essential.

b) Another example: Imagine receiving a mix for mastering with a kick proportionally 4 dB too loud. That is, the kick is "sticking out" of the mix by 4 dB. You ask the mixing engineer to deliver an alternative mix with the kick reduced by 4 dB. That second mix would likely read 3 to 4 dB smaller DR than the balanced mix. So, which mix is better? Certainly, the second one with a better balanced kick but a lower DR value!

4. Always judge DR in conjunction with the program you are measuring. A trance track at DR5 can sound incredibly good, as opposed to many DR2 to DR3 competitors, while a rock song would most likely sound squashed and distorted at DR5. Use the following table as a rough guide:

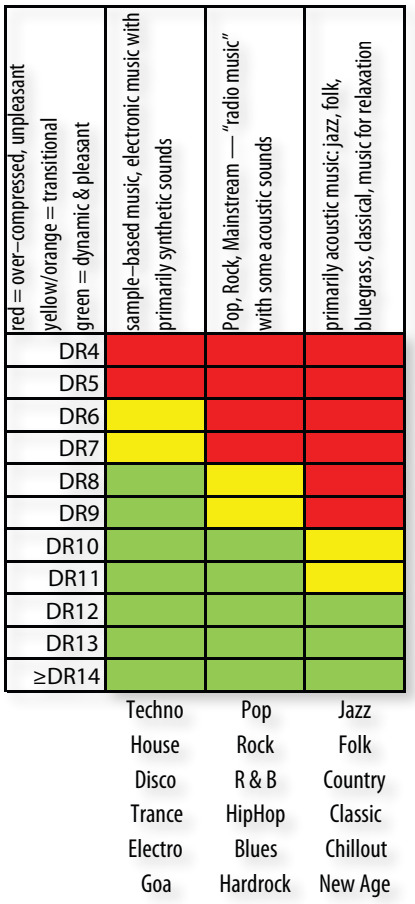

Table 1: Genre vs DR

5. Dynamic contrast is an important factor for musical expression. To judge how much dynamic reduction doesn't harm dynamic integrity, focus on dynamic events in the mix when doing loudness–compensated A/B comparisons.

6. The DR algorithm has been designed and crafted to deliver easy to digest measurement of hyper–compressed main stream music releases. The aim is to bring back, for general music releases, more dynamic contrast and listening pleasure with less fatigue. It was not meant to measure the dynamics of an *a capella* Gregorian choir. It wouldn't make sense as, due to the absence of transients, the DR meter would show misleading lower results. Frankly, we haven´t found a satisfying solution to solve that issue yet, though there isn't a huge demand.

Results Count

So far, the DROffline has helped to create more transparency and awareness about the "dynamic quality" of music releases. DROffline was and

is not meant to create a meaningless anti–loudness contest based on the largest DR values in the universe. This simply makes no sense for the majority of music releases. Also, average listening situations, with some degree of background noise, will rob you of perceptual dynamic range. Nowadays, we have smart technology to control dynamic so that the musical impact of dynamics can be preserved while creating results which translate well to radio, streaming and other common distribution methods. This is especially true as loudness normalization becomes ever more accepted, which destroys the impetus for any loudness wars. Spotify, iTunes Music, even YouTube are now loudness–normalized, though to different target loudness levels, so material mastered with compromised dynamic contrast will actually be amplitude–reduced, made quieter, without your client's knowledge or consent.

Here's a last suggestion for the impatient: Go to pleasurizemusic.com and have a look at the tutorials, and maybe gain some knowledge about metering. Working smarter helps to create outstanding results.

PCM versus MP3 DR

We can´t resist adding this information because thousands of users have asked…We had been reluctant to allow DR measurement of MP3 files and other lossy formats for a specific reason. It's not because of a technical problem, it's simply that a quirk of lossy encoding cause erroneous measurements.

For MP3 files, you typically see a measured increase in peak values and a small decrease in RMS as a logical result of the processing which is applied to the source PCM files during encoding. This can be a very subtle peak–to–loudness increase of 0.1 to 0.5 dB, but in some cases it can be an increase of up to 3 dB and thus can cause an MP3 to show a far higher DR value as it´s source PCM, up to 3DR. This certainly doesn't mean that lossy files would sound better or be more dynamic. It´s just that MP3 encoding blurs the signal so drastically that we want to encourage the audio community to use DR only for PCM or lossless files.

Geek Alert ⛑ : High PLR or Peak–to–Loudness Ratio increases can happen if the input level of an MP3 encoder has been reduced to prevent overload and distortion. If no level reduction had been applied prior to encoding, the increased peak values of the decoded MP3 will become True Peak (TP) "over" values higher than 0 dB Full Scale. TP overs are not considered in the DR algorithm, as that makes no sense at all.

BTW, thank you for reading that far! We are not done quite yet, and there's more interesting and important information to come. So, please stay with us for a tiny bit more…

#1 Rule of Audio Metering

Metering is only as good as the knowledgeable interpretation of the measured values. So, a solid understanding of dynamic measurement is essential.

Despite the relatively new ITU BS1770–based global standards for various audio metering metrics, the world of dynamic metering is still very adventurous. We have LRA or Loudness Range, and you often hear about PLR as mentioned above. Unfortunately, there are a lot of other difficult to understand algorithms for measuring dynamics.

Terminology & Dynamic Range Basics

To understand the general topic of "Dynamic Range" measurements, we need to think about that phrase for a moment, Because of the inherent imprecision of this term, conversations can quickly get a bit weird…

You could think of Dynamic Range as the total variation of dynamic expression within a piece of music. And if we simply measure the range from the quietest event and the loudest event of a recorded performance we would almost always end up close to the System Dynamic Range or dynamic range of the encoding method. Compact discs have a roughly 96 dB of system dynamic range. Almost every digital release contains full scale events, hitting the "digital ceiling." In contrast, within an fade out to digital black, we find musical information getting as low in amplitude as our System Dynamic Range permits. For a CD, that would be -96 dBFS.

At this point we already have two variations of the term Dynamic Range:

A. Perceptible Dynamic Range, the dynamic range of our listening environment which, in turn, depends on the quality of the playback system plus acoustical background noise.

B. System Dynamic Range, which describes the technical dynamic range of a system, such as 144 dB for 24 bit fixed point linear PCM.

Furthermore, the System Dynamic Range has two subgroups: the theoretical digital dynamic range of a system, the 144 dB dB mentioned above for 24 bit LPCM, or the dynamic range of a signal sub–system, such as a DAC or amplifier. That sub–system dynamic range is usually labeled as SNR or Signal–to–Noise Ratio. We think you'd agree that, though both of the above system dynamic range concepts are useful, they're meaningless for our purposes.

Before digging into more meaningful systems to describe music–oriented dynamic variations, we'd like to point out a major problem which is inherent to measurement and subjective perception. Within the audio technology community, you'll find a lot of research about dynamic range and associated topics, and many studies are unfortunately based on erroneous assumptions. Recent research of the PMF (Pleasurize Music Foundation) led by Mr. MAAT, Friedemann Tischmeyer, revealed the inability of the listener for clear and repetitive subjective evaluation of dynamics and the vitality of the transient structure. Even a group of skilled professional listeners proved this inability of the human ear to properly evaluate dynamic quality and transient vitality.

In conclusion, this simply means that our hearing apparatus had not been trained to distinguish this parameter due to evolutionary requirements. Because the "Loudness War" was the first opportunity to learn and adapt to hyper–compression, our hearing has not been able to evolve. But, don´t worry, this doesn´t mean that DR or Transient Vitality is irrelevant for our hearing pleasure. Research also shows that the most important part of our hearing process happens in the brain on a completely subconscious level. And here DR and Transient Vitality really matters, allowing "easy" or relaxed processing of consumed music by our brains. The PMF, with the help of MAAT, will undertake further and more in–depth fundamental neuroscience research to provide more profound insight into our subconscious hearing abilities and functions.

Getting Your Geek On

Now let´s look into the technical principles behind DR and dynamic range measurement algorithms…Technically you will find two basic principles being used for dynamics measurement:

A. Deviation of loudness distribution within a complete song from top to tail

B. Difference between average and peak loudness within a complete song from beginning to end

All popular measurement methods or standards are based on, or derived from, either method A or B.

The R128 LRA or Loudness Range standard is a derivative of method A. The name is descriptive, because LRA exactly describes a range of loudness. It does this by measuring weighted loudness values, then feeding that information into a histogram which compiles a history of how often particular values appear. The range in dB is then derived, in LU, between the estimates of the 10th and 95th percentiles of the distribution.

This is an oversimplification. You can read all the gory details by searching for the official ITU LRA technical spec. We simply want to point out the principle of using the difference range of loudness distribution. The practical conclusion is that LRA turns out to be useless for dynamic measurement of pop and MOR music genres. This is due to its inherent design, which ignores the top 5% of content, in terms of amplitude, so as to prevent extremely loud passages from affecting the overall result. Unfortunately, that top 5% of amplitude is where 90% of modern music lives! To be fair, LRA was designed to evaluate broadband material, of all types and styles, for broadcast purposes.

Another dynamic range measurement method is PLR, the oldest known technique based on method B above. PLR simply measures the difference between peak and average loudness. It´s also commonly known as crest factor, and is useful as a diagnostic but not as a gauge of subjective dynamic range or the degree of hyper–compression.

PLR has two disadvantages. It lacks standardization, as the peak measurement, loudness calculation and if weighting is applied are all not codified. PLR's second drawback is that it measures the overall loudness of a song and counts the overall average against the peak. This means that a song with a very mellow intro and soft verse but super heavily hyper–compressed chorus would show a more dynamic value than a constantly loud song which is less compressed then the chorus of the song with more overall macro–dynamics.

By now, you see that "dynamic range" measurement could cause all of us some headache. This is the reason why we offer the DR measurement system, because it's the only useful tool set available to reliably describe the "dynamic quality" or density of modern pop and MOR.

Tischmeyer purposefully designed the Dynamic Range metering system to create an easy to understand tool that displays the degree of dynamic reduction within the loudest portions of a program. The official DR value, as measured only with DROffline, focuses on "hot" spots of music releases, meaning the loudest portions such as choruses where severe dynamics processing is most relevant. When thoughtfully used , the companion DRMeter measures louder portions of the music rather than the overall macro–dynamics. DRMeter is the best real time measurement tool available on the market to fulfill this purpose, despite having some compromises stemming from the need for cumulative measurement to derive true DR values.

Technically, DROffline splits the loudness values of the measured song into 10,000 different quanta, and feeds that information into a histogram, which provides needed statistics about the loudness distribution. Then, it gates 80% of the material, taking the loudest 20% of the histogram or loudness events and measures the difference to the second loudest peak. Thus DR is a hybrid between methods A and B, and is a bit closer to PLR then to LRA.

As DR became broadly accepted and has turned into a de facto standard, we have decided to stick to the term DR rather than Dynamic Range which is a good way to distinguish DR from other derivatives of dynamic range measurement…Thanks for listening and now, on with the show!

General Use & Limitations

With its advantage of being able to measure an entire song or album, only DROffline generates "official" DR values. On the other hand, the complementary DRMeter plug–in is a real time dynamic density estimator designed to be used in conjunction with the DROffline app. For more information on our DRMeter, head to maat.digital and click on DRMeter in the Products section.

Warning

DROffline is designed to measure songs or albums, not spots, bumpers and other very short duration programs. Content under 10 seconds in length will produce inaccurate results.

Donations

Thank you for your purchase. On your behalf, MAAT will donate $5 for each sale to the Pleasurize Music Foundation to foster the awareness and importance of sound quality, and to support fundamental research in this area. Would you like to help the PMF? Any additional donations are greatly appreciated.

DR Logos

The DR logo pack and guidelines for use are included in the documentation directory of your DROffline installation.

In–Depth Usage

Launch the application, and decide whether you're measuring a file or a directory of files. Set the Measurement Mode switch, at center bottom, appropriately.

Click the LOAD button to open a single file when in File mode, or a directory of files in Folder mode.

DR Window

After the Progress Bar indicated that processing is complete, the DR window displays the signature, official DR integer value derived from the measured file or directory. Note that this value is a joint measurement derived from both left and right channels, akin to using the LINK mode in DRMeter.

Numeric Fields

After processing is complete, the individual channel fields display DR, Sample Peak and RMS to two decimal places.

SPPM & RMS

A note about our Sample Peak Program and RMS measurements…When close to full scale, peak measurement is particularly complex and critical. Fixed point AES/EBU digital audio can only show values up to full scale since, strictly from a numeric representation, no samples over full scale are possible. However, contiguous full scale data words create audible "overs," also known specifically as interleaved sample overs.‡ — see below.

Floating point calculations make it possible to represent values well over 0 dB. The measurement and display of peak values after 4 times over sampling leads to a display of overs so frequently that we made a compromise solution for DR. Peak values are measured "normally," and provided numerically. In the case where two contiguous bit words show full scale without oversampling, and at the same time a value over 0 dB is detected via oversampled metering running in parallel, then the peak display shows "OVER."

Values higher than -0.5dB will be displayed in red, to warn you to be cautious. The EBU recommends maintaining 1dB of True Peak headroom, which is too much for today's loudness driven music world. Having a peak headroom between -0.5 and -0.3dB will prevent your masters from subsequent clipping and will be, in most cases, already MfiT (Mastered for iTunes) compliant, so that 256kbps AAC files encoded from such masters won´t clip.

DROffline is an almost one for one reissue of the circa 2008, original TT DR Meter. Back in the day, before the establishment of the True Peak standard within R128 / BS 1770, it was too risky and presumptuous to release a meter showing values that would exceed digital full scale zero by a couple of decibels. The forthcoming DRMeterMkII will support all common BS 1770–based standards including Max Momentary, Short Term, integrated Loudness, TPL or True Peak and LRA or Loudness Range. DRMeterMkII will also display values over 0 dB, compliant with the R128/BS 1770 True Peak Metering standard.

‡ Interleaved Sample Overs, also known as inter-sample peaks, are digital overs which can be detected only after multiplying the sampling rate, or "over sampling," by a factor of 2 or 4. The values are not detected in Sample Peak Resolution (SPPM) because values only up to 0 dB can be represented in fixed point notation as mentioned above. An interleaved sample over can also occur when the peak headroom is 0.1 dB or more and creates distortion only after leaving the digital domain during conversion to analog or/and when encoded into lossy formats.

The idea behind the DR measurement is a simplified way of determining dynamic density, and is not a psycho–acoustically perfect loudness measurement algorithm. The RMS values created by DROffline is corrected by +3 dB so that sine waves have the same peak and RMS value, as is the case with most other RMS meters.

Log Files

DROffline produces two log file types, based on the Measurement Mode. Folder mode produces a slightly terse log, since more than one file is being measured. In File mode, the log is more detailed,

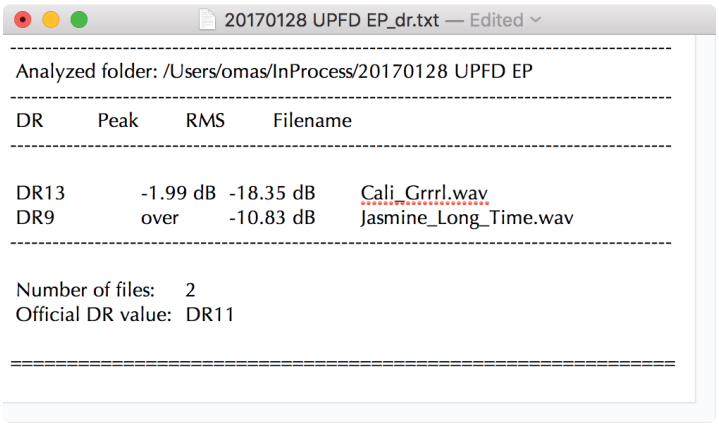

Figure 3: A Folder Log example

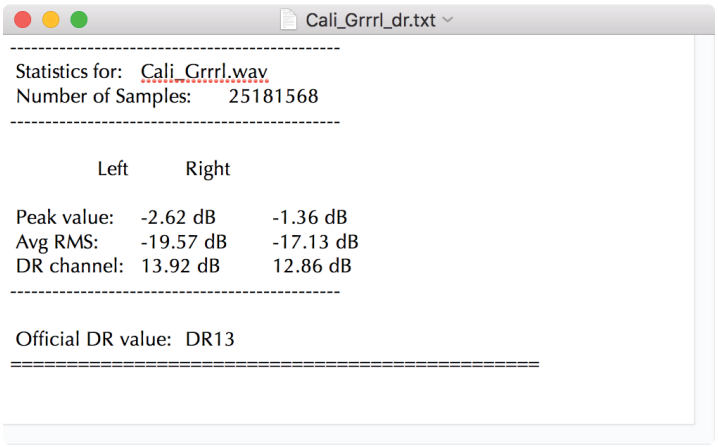

Figure 4: A File Log example

The Folder Log provides global values, including DR, peak and RMS for the track, plus directory path, file name, number of files and Official DR value for the entire directory. Typically, this would be an entire album or EP.

In comparison, the File Log documents the individual peak, RMS and DR for each channel, plus file name, sample count and DR for the song or file. Depending on the dynamic density of each constituent file in an album, the File DR can deviate significantly from the Album DR. DR displayed in or on album art should, of course, always represent the Album DR.

Using Limiters

Despite maintaining adequate headroom, please always use a professional brickwall limiter for mastering. There are many good brickwall limiters available on the market but, as with all gear for the "pro" market, also many poorly performing ones that don't deliver what they promise. Be an informed buyer, and verify your brickwall limiter. Hear with your ears and not with marketing messages!

A brickwall limiter's job is to make sure that no interleaved sample overs are produced, using the over sampling process described above. A brickwall limiter should process the sound in such a way that the actual level reduction is completely transparent and thus, inaudible.

Maintaining Headroom

Despite using a good brickwall limiter, there are three reasons for leaving some headroom:

Modern D/A converters use linear phase FIR or Finite Impulse Response reconstruction filters which are not always designed to process full scale signals without distortion. This is particularly true of steep-sloping, high slew rate signals which can produced by hard limiting or over–compressed music. Extra headroom significantly reduces this risk, while making any reduction in amplitude practically inaudible. (For more geeky fun, read about the Gibbs Phenomenon)

Additional headroom reduces artifacts used by all perceptual data compression schemes which employ the masking effect. The lower the data rate of the target format, the more headroom is necessary. For highly compressed music, 0.5 dB of headroom is not sufficient in order to avoid distortion. In this case, a headroom of up to 5 dB would be theoretically necessary. Recordings which have the DR logo are fortunately not so aggressively compressed; a headroom of 0.5 dB prevents unwanted artifacts in most cases for 256 bps or higher lossy data formats!

Research has shown that even EBU–compliant True Peak measurements with 4 times oversampling has an "under read" of potential inter–sample overs of 0.5 dB. For this reason, all television audio content requires, according to regulation, a peak headroom of 1dB in Europe and 2 dB in the US. As the music industry is not regulated and we haven´t completely escaped the reality distortion field of maximum loudness demand, 0.5 dB of headroom seems to be a workable and acceptable value to create more transparent results.

Why 0.5 dB?

In order to prevent any discussions among experts: Yes, the above headroom value of 0.5 dB is somewhat arbitrary. It could just as well be 0.353, 0.478, or 0.51 dB headroom, but 0.5 is a good rule of thumb.

Updates

Please always use the latest version of the software! Future optimization of the measurement algorithm could lead to slightly different results in the future.

Credits

DR idea, overall concept & realization:

Friedemann Tischmeyer, PMF & MAAT Inc.

Technical concept & project management:

Dr. Christoph Musialik, Algorithmix GmbH

Initial programming:

Dr. Ulrich Hatje, Algorithmix GmbH

Sir Duane Wise, Wholegrain Digital Systems LLC

Re-programming for MAAT:

Agent Tad Nicol, MAAT Inc.

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