Decoder EQ as of V2.1.2X1
UPDATE 1
11 Mar 2021

Definition: 'Layer' means each DolbyA decoding step, usually 7.

Calibration of each layer, sequentially:
NdB, N+10dB, N+20dB, N+30dB, N+40dB, N-10dB, NdB
('N' is the calibration offset, calculated from –coff=x)

Note: all Eqs below are done with distortion cancellation. EQ can be done more simply, but with 'special sauce' disabled.

ALL EQs assume 'special sauce' fully enabled.

There are potentially 4 phases of EQ and/or level manipulation:

1) First step before anything else

2) At the beginning of each **layer**: 0, 1, 2, 3, 4, 5, 6

3) At the ending of each **layer**: 0, 1, 2, 3, 4, 5, 6

4) FINAL EQ and 'special sauce' after **last layer**

FA decoding looks generally like this:

FIRST EQ(**1**) →
BEGIN EQ(**2**,0) → DA decode(0,N dB) → END EQ(**3**,0) →
BEGIN EQ(**2**,1) → DA decode(1,N+10 dB) → END EQ(**3**,1) →
BEGIN EQ(**2**,2) → DA decode(2,N+20 dB) → END EQ(**3**,2) →
BEGIN EQ(**2**,3) → DA decode(3,N+30 dB) → END EQ(**3**,3) →
BEGIN EQ(**2**,4) → DA decode(4,N+40 dB) → END EQ(**3**,4) →
BEGIN EQ(**2**,5) → DA decode(5,N-10 dB) → END EQ(**3**,5) →
BEGIN EQ(**2**,6) → DA decode(6,N dB) → END EQ(**3**,6) →
FINAL EQ(**4**)

First step(1) before anything else:

* Any needed CD EQ

At the beginning of each layer (2)
ALL 1st order

Each EQ below is an HF shelf.

(LF side of the 1kHz→ 3kHz band)
MFLFbasefreq = 1000Hz
MFLFoffset = 250Hz
MFLFadoffset = 25Hz

-3dB shelf at (MFLFbasefreq - MFLFoffset) - MFLFadoffset
-3dB shelf at (MFLFbasefreq - MFLFoffset)
-3dB shelf at (MFLFbasefreq - MFLFoffset) + MFLFadoffset

+3dB shelf at (MFLFbasefreq) - MFLFadoffset
+3dB shelf at (MFLFbasefreq)
+3dB shelf at (MFLFbasefreq) + MFLFadoffset

-3dB shelf at (MFLFbasefreq + MFLFoffset) - MFLFadoffset
-3dB shelf at (MFLFbasefreq + MFLFoffset)
-3dB shelf at (MFLFbasefreq + MFLFoffset) + MFLFadoffset

(HF side of the 1kHz→3kHz band)
MFHFbasefreq = 3000Hz
MFHFoffset = 250Hz
MFHFadoffset = 50Hz

+3dB shelf at (MFHFbasefreq - MFHFoffset) - MFHFadoffset
+3dB shelf at (MFHFbasefreq - MFHFoffset)
+3dB shelf at (MFHFbasefreq - MFHFoffset) + MFHFadoffset

-3dB shelf at (MFHFbasefreq) - MFHFadoffset
-3dB shelf at (MFHFbasefreq)
-3dB shelf at (MFHFbasefreq) + MFHFadoffset

+3dB shelf at (MFHFbasefreq + MFHFoffset) - MFHFadoffset
+3dB shelf at (MFHFbasefreq + MFHFoffset)
+3dB shelf at (MFHFbasefreq + MFHFoffset) + MFHFadoffset

At the end of each layer(3):

gain +3dB

After the end of dynamics processing part of decoding (4)

LF band EQ for between 1kHz → DC.

This example is based on NORMAL recordings. Modified for some recordings

LFbasemultfreq = 50
LFoffset = 20

1kHz, -1.5dB:

-1.5dB shelf at (LFbasemultfreq * 40) + LFoffset
1.5dB shelf at (LFbasemultfreq * 40)
-1.5dB shelf at (LFbasemultfreq * 40) - LFoffset

750Hz, -1.5dB:

-1.5dB shelf at (LFbasemultfreq * 30) + LFoffset
1.5dB shelf at (LFbasemultfreq * 30)
-1.5dB shelf at (LFbasemultfreq * 30) - LFoffset

500Hz, -6.0dB:

-6.0dB shelf at (LFbasemultfreq * 20) + LFoffset
6.0dB shelf at (LFbasemultfreq * 20)
-6.0dB shelf at (LFbasemultfreq * 20) - LFoffset

250Hz, -6.0dB:

-6.0dB shelf at (LFbasemultfreq * 10) + LFoffset
6.0dB shelf at (LFbasemultfreq * 10)
-6.0dB shelf at (LFbasemultfreq * 10) - LFoffset

200Hz, -6.0dB:

-6.0dB shelf at (LFbasemultfreq * 8) + LFoffset
6.0dB shelf at (LFbasemultfreq * 8)
-6.0dB shelf at (LFbasemultfreq * 8) - LFoffset

100Hz, -6.0dB:

-6.0dB shelf at (LFbasemultfreq * 4) + LFoffset
6.0dB shelf at (LFbasemultfreq * 4)
-6.0dB shelf at (LFbasemultfreq * 4) - LFoffset

50Hz, -6.0dB:

-6.0dB shelf at (LFbasemultfreq * 2) + LFoffset
6.0dB shelf at (LFbasemultfreq * 2)
-6.0dB shelf at (LFbasemultfreq * 2) - LFoffset

25Hz, -6.0dB:

-6.0dB shelf at (LFbasemultfreq * 1) + LFoffset
6.0dB shelf at (LFbasemultfreq * 1)
-6.0dB shelf at (LFbasemultfreq * 1) - LFoffset

-6dB shelf at 20Hz
-6dB shelf at LFbasemultfreq * 0.50
-6dB shelf at 10Hz

4 (four) EA of:
2nd order 0.75dB LF shelf at 80Hz/Q=1.0

HF side of required EQ (9kHz→21kHz)

HFhighbase = 21kHz
HFlowbase = 9kHz
HFoffset0 = 1.5kHz
HFoffset1 = 500Hz

Final rolloff:
All are 1st order, defined by begin/end freq.

Need three EACH of the following group delimited by "+" (sequentially):

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HF downward shelf between: (HFlowbase - HFoffset0) - HFoffset1 -> (HFhighbase - HFoffset0) - HFoffset1
HF upward shelf between: (HFlowbase - HFoffset0) -> (HFhighbase - HFoffset0)
HF downward shelf between: (HFlowbase - HFoffset0) + HFoffset1 -> (HFhighbase - HFoffset0) + HFoffset1

HF upward shelf between: HFlowbase - HFoffset1 -> HFhighbase - HFoffset1
HF downward shelf between: HFlowbase -> HFhighbase
HF upward shelf between: HFlowbase + HFoffset1 -> HFhighbase + HFoffset1

HF downward shelf between: (HFlowbase + HFoffset0) - HFoffset1 -> (HFhighbase + HFoffset0) - HFoffset1
HF upward shelf between: (HFlowbase + HFoffset0) -> (HFhighbase - HFoffset0)
HF downward shelf between (HFlowbase + HFoffset0) + HFoffset1 -> (HFhighbase + HFoffset0) + HFoffset1

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Optional ‘Special Sauce’ layer (4)

This below is a semi optional layer, enabled only during ‘special sauce’ to get rid of lingering modulation of the signal. Helps to purify sibilance.

The list of "offset frequencies" are, as follows, relative to 18kHz:
All numbers in Hz!!! (read carefully, some calculations in there – lazy as I didn’t do the calculations myself).

> 11.71875, 23.4375, 46.875, 93.75, 187.5, 375, 750, 1500, 3000, 6000, 9000, 12000, 15000, -11.71875, -23.4375, -46.875, -93.75, -187.5, -375, -750, -1500, -2250, -2625, -2625 - 187.5, -2625 - (187.5 + 93.75), -2625 - (187.5 + 93.75 + 46.875), -2625 - (187.5 + 93.75 + 46.785 + 23.4375), -2625 - (187.5 + 93.75 + 46.785 + 23.4375 + 11.71875)

For **each** of the above frequencies -- do the following variable set-up:

> Variable “offset” used below is EACH of the above frequencies in the list.

```
Variable fbase = 18kHz - offset
Variable fbm = fbase - HFoffset1
Variable fbp = fbase + HFoffset1
Variable hfm = HFhighbase - HFoffset1
Variable hfp = HFhighbase + HFoffset1
Variable r0m = fbm / hfm;
Variable r0p = fbp / hfp;
Variable ror = HFhighbase / fbase;
Variable correction = 1.0 / sqrt(r0m * r0p * r0r * ror);
```

Here are the EQ filters FOR EACH 'offset frequency' above:
(this produces A LOT of cancellation EQ, but work super well to add on to the anti-MD and anti-IMD in the DA portion of the decoder).

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HF downward shelf frequencies from fbm to hfm
HF downward shelf frequencies from fbp to hfp
HF upward shelf frequencies from fbase to fbase * ror * correction
HF upward shelf frequencies from fbase to fbase * ror * correction

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