Bass Equalization Filtering - BEQ

Some movie and television series releases intentionally limit the level of low frequencies compared to the original movie theater release.

The BEQ Catalogue project aims to determine how this is performed and create filter settings to compensate, bringing low frequencies back to their original level as much as possible. This is done individually for each movie or television series and is a subjective process.

ShakEQ™ can read these filter settings from from USB memory during wakeup to correct the response of the audio content before it goes to shaker processing and to subwoofer. The file for these filter settings is named DSPEAKER.BEQ .

The file format and the available options are described on the next pages, but you don't really need to get into details yourself to take advantage of the feature.

You can use our BEQ Catalogue exporter: https://www.dspeaker.com/beqdatabase to create a DSPEAKER.BEQ file in the correct format. Save the exported file on a USB memory stick, plug it into ShakEQ, then restart ShakEQ to load the settings.

ShakEQ™ Feedback

If any BEQ (input) filters are active, the defined title or the default title is shown 3 times before entering home screen. This can be skipped by pressing any key on the remote.

If only subeq's are defined for ShakEQ, then "=EQ=" is shown shortly before entering home screen.

The defined BEQ (input) filters are applied to both input signals before other processing, so their effect is reflected in level monitor and can produce a clip warning. In other words, the BEQ (input) filters are correcting the input signal, and ShakEQ processing and equalization, Anti-Mode correction, and subeqs are correcting the respective output signals.

DSPEAKER.BEQ File Format

The file format consists of a version line and optional title and filter specification lines.

An example dspeaker.beq file:

```
shakeqbeq 1
title: Ahsoka
# Ahsoka (2023) (Season 01) BEQ Atmos
filter: lowshelf freq: 10 gain: 2 q: 0.75
filter: lowshelf freq: 25 gain: 5.5 q: 0.75
filter: lowshelf freq: 25 gain: 5.5 q: 0.75
filter: peq freq: 38 gain: -1.4 q: 3
```

Maximum line length is 255 characters. White spaces at the start of a line are skipped, comments start with #. Empty and comment lines are skipped.

The first line must start with "**shakeqbeq**" and version number, currently 1.

"**title**" sets text which is shown during startup for a valid .beq file. Using title is optional. If there is no title defined, the default title text is "BEQ ON". If there are multiple title lines, the last one encountered is used. Only the first 100 characters of the title are currently used.

Up to 10 BEQ (input) filters can be defined using the "**filter**" keyword. The filter's parameters given must be specified in the order: type, freq, gain, q.

Possible filter types are: **lowshelf**, **highshelf**, **lowpass**, **highpass**, and **peq**. "**freq**" defines the center or transition frequency F_c in Hz, "**gain**" defines the gain in decibels, and "**q**" defines the Q value (inversely proportional to filter bandwidth, $Q=F_c/BW$, $BW=F_c/Q$). Gain is not used for lowpass and highpass filters and can be omitted for those filter types. For shelving filters the maximum supported positive gain is about +19.084dB, a larger value is automatically limited to the maximum value.

Listing more than 10 filters is not considered an error, any extra filters are ignored. However, any syntax error results in no filters to be designed. In this case the title text won't be shown during startup.

DSPEAKER.SUB File

Because the contents of dspeaker.beq is intended to change per what you're watching and its filters modify the input signal, another file dspeaker.sub is also read. This one is intended to be fixed and to adjust the subwoofer output signal only.

One possible use is to design parametric equalization filters (PEQ) to reduce room resonances (room modes) with the conjunction of a tool such as Room EQ Wizard. However, with a measurement microphone ShakEQ can perform automatic Anti-Mode™ calibration, so the manual process is not needed.

Another use is to add a lowpass filter for a sub that does not have its own lowpass control, or highpass filter to limit the low frequencies (e.g. for a bass reflex sub).

The file format is the same as dspeaker.beq , but instead of **"filter"** to set filters on the input signal, you use **"subeq"** to set filters on the subwoofer output.

"filter" and **"subeq"** are allowed in both files, so if need arises it is possible to define additional BEQ filters in dspeaker.sub and subeq's in dspeaker.beq.

An example dspeaker.sub file:

```
shakeqbeq 1
subeq: lowpass freq: 100 q: 0.7071
```

This creates a lowpass filter with -3dB point at 100Hz with a slope of -6dB per octave.

You can stack filters to get a steeper slope. To get the -3dB point at a desired frequency for a stacked 2nd order lowpass (-12dB per octave), multiply the frequency value by 1.25. E.g. 100 Hz * 1.25 = 125 Hz

```
shakeqbeq 1
subeq: lowpass freq: 125 q: 0.7071
subeq: lowpass freq: 125 q: 0.7071
```

To get the -3dB point at a desired frequency for a stacked 3rd order lowpass (-18dB per octave), multiply the frequency value by 1.4. E.g. 100 Hz * 1.4 = 140 Hz

```
shakeqbeq 1
subeq: lowpass freq: 140 q: 0.7071
subeq: lowpass freq: 140 q: 0.7071
subeq: lowpass freq: 140 q: 0.7071
```

To get the -3dB point at a desired frequency for a stacked 4th order lowpass (-24dB per octave), multiply the frequency value by 1.5. E.g. 100 Hz * 1.5 = 150 Hz

```
shakeqbeq 1
#lowpass -24dB per octave, -3dB at 100Hz
subeq: lowpass freq: 150 q: 0.7071
subeq: lowpass freq: 150 q: 0.7071
subeq: lowpass freq: 150 q: 0.7071
subeq: lowpass freq: 150 q: 0.7071
```

A highpass filter can be used to suppress the lowest frequencies. A second-order -12dB per octave highpass with -3dB point at 20Hz (divide the target 20Hz by 1.25 = 16Hz):

```
shakeqbeq 1
#highpass -12dB per octave, -3dB at 20Hz
subeq: highpass freq: 16 q: 0.7071
subeq: highpass freq: 16 q: 0.7071
```