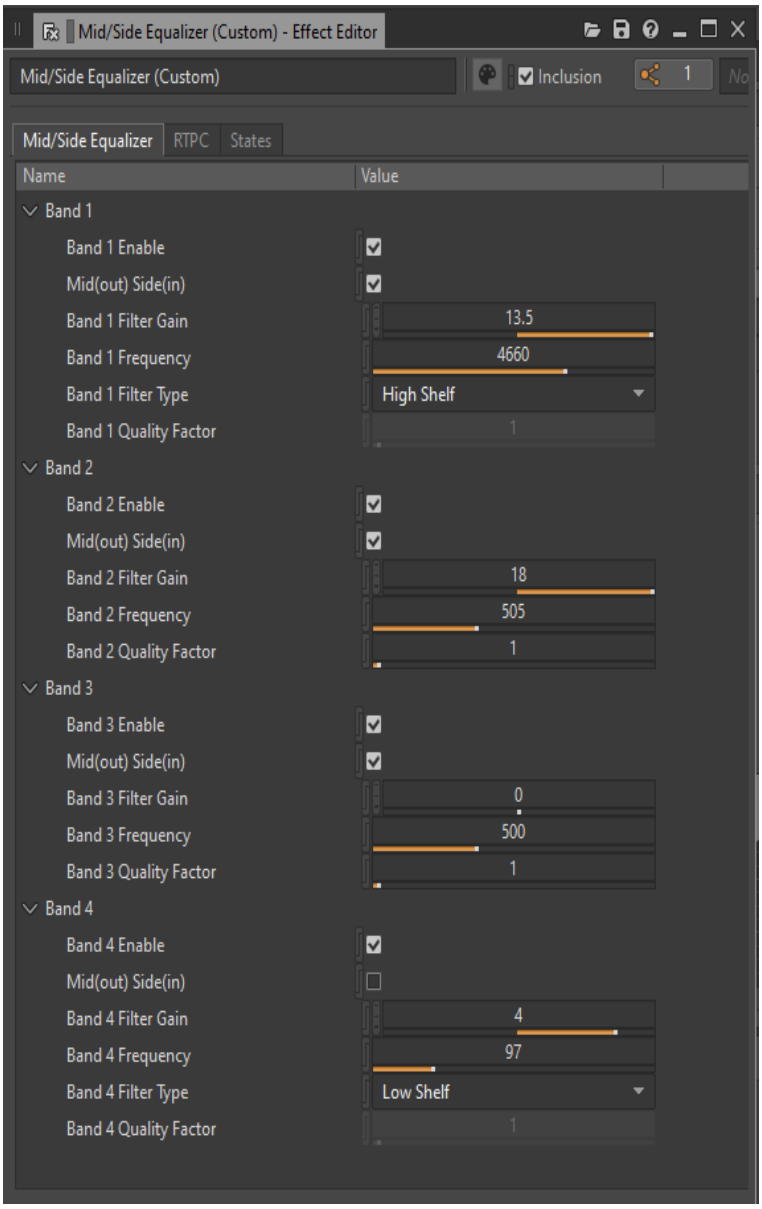
Jacob Wolfe

# Mid/Side Equalizer Audio Plug-in for Wwise Design Doc

**Problem:** Generally, humans perceive sounds to be more omnidirectional as frequency lowers, yielding a localization error for low frequency sounds. Wwise currently supports monaural low frequency sound as a low-frequency effects buffer (LFE), but control over the stereo width of frequency bands for a full-spectrum source is not supported.

**Solution:** Utilizing sum and difference signals, a 'mid/side' 4-band parametric equalizer is outlined. Bands 1 and 4 utilize a maximally flat passband (Butterworth) filter design with options for low pass, high pass, low shelf, and high shelf filter types. Inner bands 2 and 3 utilize a simple biquadratic peak design.

**Manual: *** Subject to change**




- **Each parameter supports RTPC control. Filter smoothing for parameter modulation is not yet supported.**
- **For gain of 0.0 on a given band, source audio is not run through corresponding filter (optimization).**

- Band one features a mid/side selection control, +/- 18dB of gain, a frequency range of 20hz to 20khz, and a selectable low pass, high pass, low shelf, and high shelf 20$^{th}$ order Butterworth filter.

- Band two features a mid/side selection control, +/- 18dB of gain, a frequency range of 20hz to 20khz, and 0.5 to 40.0 Q control. Biquadratic 5-coefficient Direct Form I Peak Filter.

- Band three features a mid/side selection control, +/- 18dB of gain, a frequency range of 20hz to 20khz, and 0.5 to 40.0 Q control. Biquadratic 5-coefficient Direct Form I Peak Filter.

- Band one features a mid/side selection control, +/- 18dB of gain, a frequency range of 20hz to 20khz, and a selectable low pass, high pass, low shelf, and high shelf 20$^{th}$ order Butterworth filter.

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**Further Description:** This plugin makes use of Vinnie Falco's DSP Filter states for bands 1 and 4 (https://github.com/vinniefalco/DSPFilters). Thanks Vinnie! For higher-order filters, and without re-inventing the wheel, Chebyshev, RBJ, elliptical, or Bessel designs can be configured.

**Uses:** A common use case for mid/side processing is audio mastering. Bands 1 and 4 are intended to be used on Wwise buses, with bands 2 and 3 on source content. Note that intent does not have to define use! A way to spatialize diegetic game audio could be to apply ~-2dB to a high-shelf filter in 'mid' mode at 2000hz to let the sides through, with ~-4dB to a low-shelf filter in 'side' mode at 200hz to reduce directional low frequency content.