

VORSIS Application Note

AN2008-09

Using the VP8 for Studio and STL Preprocessing

(Requires Software Version 1.50 and above)

October 2008 - J. Keith

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Background

With the introduction of Version 1.5.0 software Vorsis VP8 Audio Processors are equipped with four distinct operating modes with the two newest modes being FM-HD and AM-HD:

- "FM" equipped with lab-grade digital stereo generator;
- "AM" with fully capable back end limiting and low pass filters;
- "FM-HD" with look ahead final limiting;
- "AM-HD" with lookahead limiting and specialized codec pre-processing.

As several of our VP8 'four-mode beta testers' have already discovered a radio and television audio processing application that fits *perfectly* with one of the VP8's new modes is studio-based processing and/or pre-processing prior to a station's Studio to Transmitter Link (STL).

The processing structures and features generally required for applications like this are:

- Both digital and analog audio inputs and outputs;
- 20kHz or greater audio path bandwidth;
- High pass filtering to remove subsonic noise;
- High quality parametric equalization;
- Multiband compression/leveling;
- Intelligent stereo enhancement;
- Low distortion multiband limiting;
- Lookahead limiting (no clipping!)

The VP8's FM-HD mode has these tools (and more) making it perfectly suited to audio processing applications such as:

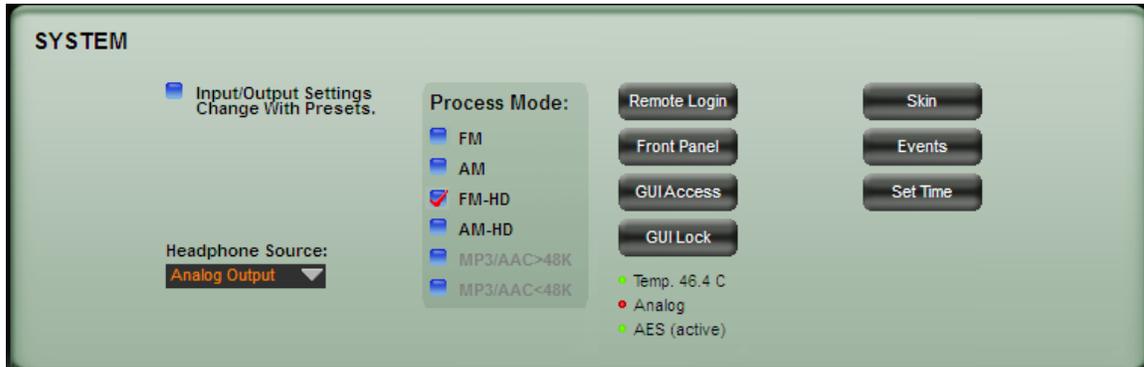
- Radio and television production audio sweetening;
- Long-form program content mastering;
- Pre-STL or satellite uplink protection;
- Talent headphone processing. *

* (The VP8's short five millisecond input/output latency in the FM-HD mode means that air talent can monitor themselves via headphones without disturbing time delay-based artifacts.)

In the following pages we will first look at entering the FM-HD processing mode, and then we'll review each processing control screen. Finally we'll visit each of the above applications in turn to demonstrate how the controls available in the VP8's FM-HD mode may be best tuned for each one.

Entering the FM-HD Mode

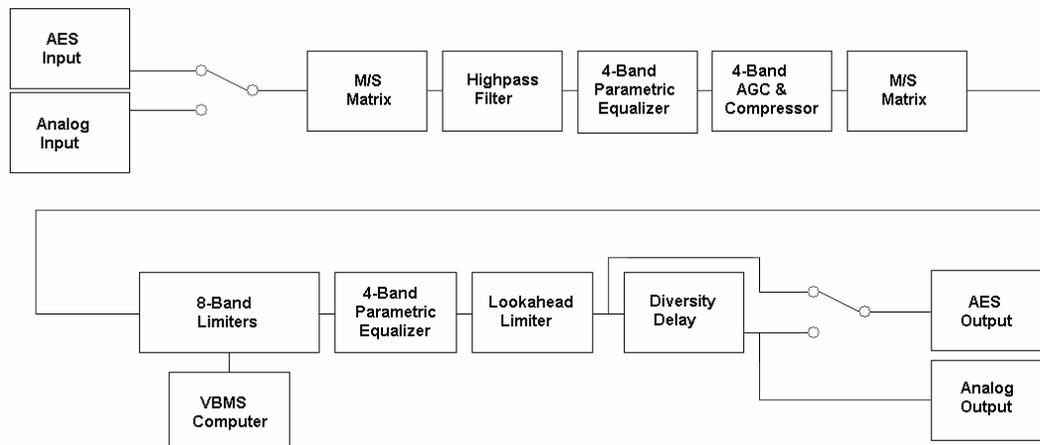
The first step for putting the VP8 into “Studio Processing” mode is to navigate to the GUI’s System Menu and select the FM-HD operating mode. The top half of the VP8 System Screen is shown below.



Once the VP8 is in its FM-HD mode the signal flow proceeds through a processing chain consisting of the following:

- Input selector and high pass filter;
- Four band parametric equalizer;
- Four band AGC/Compressor;
- Eight band limiter;
- Lookahead limiter.

A very simplified block diagram of the VP8’s FM-HD mode’s signal processing flow is shown below.



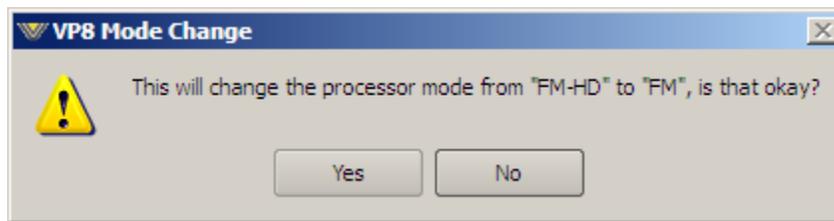
Each of the processing structures shown in the block diagram can be enabled or disabled at-will in order to customize the signal flow for a particular application. When a processing structure is disabled its DSP algorithm is completely turned off.

Select a Starting Preset

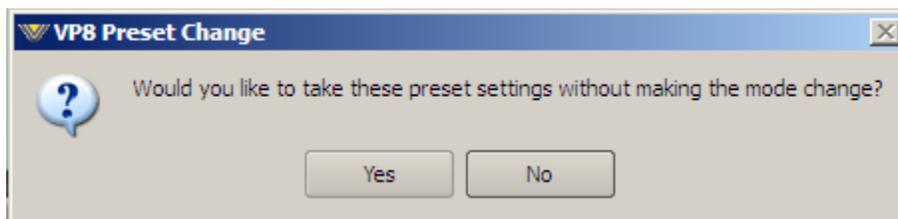
Next, select an appropriate starting preset from the FM-HD list (we always recommend starting with our Quick Start presets).

If the sound created by one of the Factory presets is not the sound you want, please feel free to experiment with the other VP8 presets or those that can be downloaded from our website. On that site we have Factory built presets for each of the VP8's modes as well as a plethora of presets created by our loyal customers wishing to share their tweaking expertise with other Vorsis VP8 audio processor owners.

Note also that you can use presets from other VP8's operating modes by selecting the other mode's preset while in HD-FM mode. When you do so you will see the following prompts:



Answer "NO" to this prompt!



And then answer "YES" to this prompt!

The following pages will serve as a quick review of the controls on various processing screens while the VP8 operating manual should serve as a source for deeper information about the subtleties of each of the processing section's controls and their interactions with other controls.

The High Pass Filter

In the majority of audio processing applications it is advisable to perform high pass filtering of the program content prior to processing in order to remove subsonic 'garbage' that may not be related to the incoming program material. Not only does high pass filtering remove or render inaudible such low frequency energy, it also makes the job of the processing easier as well as the resulting processed audio cleaner.

The High Pass Filter is found in the Input screen of the VP8 GUI as shown below.



The High Pass Filter can be operated in its normal Left/Right mode where the same filter frequency is applied to both channels, or, in the sum and difference (L+R/L-R) mode with different cutoff frequencies. The former option works best for material that has digital originations while the latter is preferable for material that may have come from vinyl at some point in its history.

Good starting point settings for the High Pass Filter are as follows:

Stereo Mode: 20Hz to 35Hz

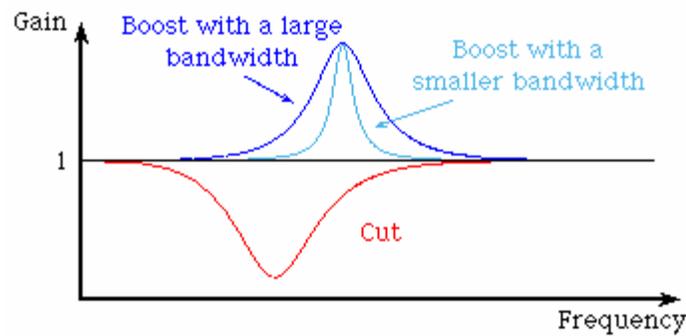
Sum/Diff Mode: 20Hz to 35Hz for Sum and 80Hz to 300Hz for Diff.

At this point it might be good to mention the Phase Rotator option that is also present in the Input screen. The Phase Rotator's task is to rearrange the phase vs. frequency relationships in the incoming program material to make the waveforms more symmetrical. The Phase Rotator does not change the frequency response but it does skew the phase response in a way that makes audio waveforms have more uniform positive and negative going excursions.

The Phase Rotator is especially effective on voice energy and therefore should always be used when 'voice' is part of the incoming program material.

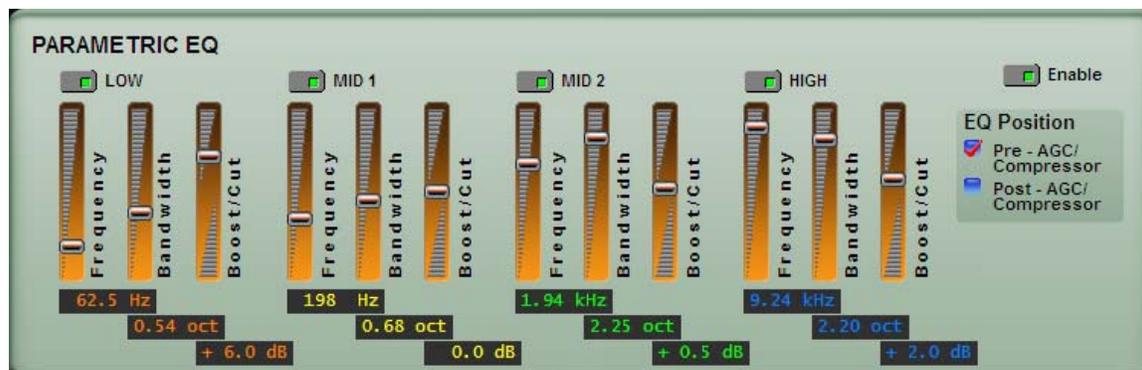
The Parametric Equalizer

The VP8 is equipped with four identical fully parametric equalization sections. By 'parametric' we mean that each equalizer can change not only its operating frequency and the amount of boost or cut, but also its bandwidth. The graphic below shows this more clearly.



The most powerful advantage that a parametric equalizer has over its graphic and shelving counterparts is the ability to be tuned to control a *selectable amount* of the audio frequency spectrum. Parametric equalizers are very well suited to removing narrow sounds such as hum while leaving the rest of the audio untouched.

Below are the controls for the VP8's parametric equalizer.



The resulting frequency response is shown as shaded areas (below).



The VP8's parametric equalizer is an especially effective tool for sweetening voice. In the curve shown on the previous page we've adjusted it to warm up the sound of a popular mid-priced microphone by increasing the amount of energy at the lower extremes of male voice while also giving it a bit of 'air' by slightly increasing the gain near 9kHz.

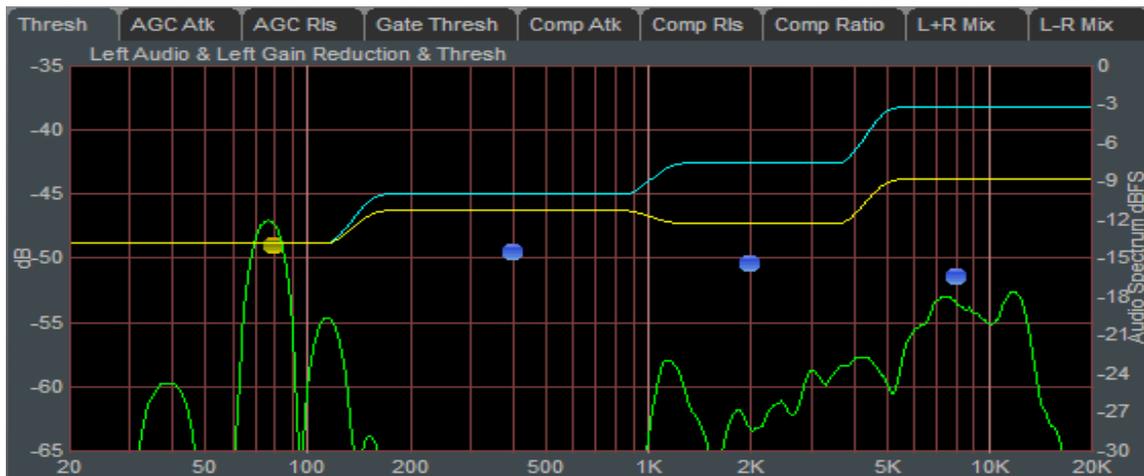
The AGC and Compressor

The purpose of Automatic Gain Control (AGC) and Compression is to reduce the dynamic range of audio signals. It may be done for effect or to simply to squeeze more audio into a smaller dynamic range in order to maximize signal to noise ratio or signal chain headroom limitations.

The VP8's main AGC/Compressor controls are shown below.



The individual adjustments for each band's attack and release times, compression ratios, and band gate thresholds, etc. are shown by the blue dots on the graphic below.

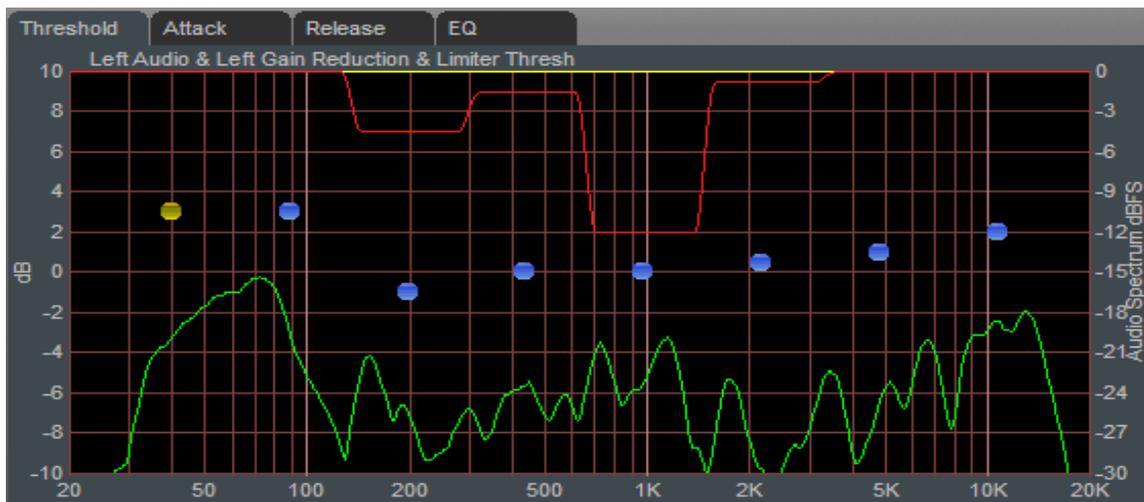


The Eight Band Limiter

The VP8 is equipped with an eight band *low distortion* limiter that has been carefully designed for absolutely transparent operation as well as *near-perfect* post limiter band summation. The main controls of the eight band limiter are shown below, to the left of the black vertical line.



Each of the eight bands' attack, release, threshold, and other parameters may be adjusted by way of the blue dots in the graphical area shown below.



There is also a four-section parametric equalizer following the eight band limiter. While this may seem odd (equalization after a limiter) rest assured that it is a powerful tool that can be used to make *subtle* adjustments to the overall sound of the VP8 once all of the dynamics controls have been set as desired.

Note that the boost control range of the equalizers has been limited in software in order to help the end user resist the temptation to utilize large amounts of boost equalization at this point in the signal chain where it is the least appropriate!

The Lookahead Limiter

The VP8's HD-FM mode is equipped with a final lookahead limiter that has been carefully designed for minimum audible artifacts while performing its job of peak limiting the audio that the previous processing functions have created. The limiter's "lookahead time" is one-half millisecond (500µSec).

The Lookahead limiter control screen is shown below with the controls for the Lookahead limiter located to the *right* of the black vertical line.



Notice that this is the same screen as that shown previously – because the two limiters can interact both limiters share a common control screen.

An operational reminder may be in order...

The purpose of the AGC and Compressor is to reduce the dynamic range of the program material by increasing gain when the audio levels are low and decreasing gain when the audio levels are high. The purpose of the limiters on the other hand is to reduce or eliminate the short term (inaudible or nearly so) program volume excursions and/or signal peaks that the AGC and compressors purposely miss in order to sound 'musical'.

While it is sometimes tempting to use the multiband limiters to audibly reduce the dynamic range through deep and aggressive high-ratio dynamics control, unless it is being done for a special effect such operation should be avoided because it can be tiring to a listener. Limiter algorithms having more than six bands are *extremely* efficient at reducing short term audio energy, so much so that *very little* gain reduction is typically required in order to keep the audio peaks under control.

Unless very loose (>30mS) attack time constants have been used in the previous Compressor section the VP8's multiband limiter will normally only need to perform 4dB to 6dB of occasional limiting to be effective, and only on peaks.

Radio and Television Production Room Audio Sweetening

(all VP8 Processing Structures Enabled)

When processing audio for Radio and Television production three main goals are usually involved:

- Automatic correction of the medium and long term audio levels;
- Automatic correction of the overall spectral balance;
- Unobtrusive control of short term audio peaks.

The correction of average audio levels is accomplished by the VP8's four-band AGC with help for controlling the short term peaks from the eight band limiter. Final peak control is accomplished by the lookahead limiter.

Typical control settings for this application are as follows:

High pass filter = 20Hz to 35Hz	VBMS Drive = +3.0dB
Phase Scrambler = IN	VBMS Style = Hard
Equalization = "adjusted to taste"	VBMS Output = -4.0dB
AGC Attack Times = >500mS	VBMS Freq. = 118Hz
AGC Release Times = >5 Seconds	Multiband Drive = 94.0%
Compressor Attack Times = <30mS	Lim/Clip Drive = +1.5dB
Compressor Release Times = > 200mS	Multiband Knee = Hard
Compressor Ratios = ~3:1	Thresh Trim = -1.5dB
Gain Reduction = ~ 6dB to 10dB	Attack = 0.5mS
Backoff Control = -1.0dB	Release = 60.0mS
B1/B2 Crossover = 112 Hz	Delayed Release = IN
B2/B3 Crossover = 648 Hz	Delayed Release = 270.0mS
B3/B4 Crossover = 3.46 kHz	Clip Style = OFF
AGC Gate Delay = 86.0 mS	Limiter Enable = IN
Coupling = -3.0dB	L/R Linked = IN
Gate Threshold = -44.5dB	Multiband Enable = IN
Gated Mode = Ooze	MB Limiter Attack Times = <10mS
L-R Controls = "adjusted to taste"	MB Limiter Release Times = ~100mS
Makeup Gain = +26.5dB	MB Limiter Thresholds = 0
Compressor = Enabled	Post MB Limiter EQ = Not Used
AGC = Enabled	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Radio and Television Production Room Audio Sweetening

(Level Control using only the 4 band AGC and Compressor)

This configuration uses a subset of the VP8 features to fulfill three main goals:

- Automatic correction of the long term average audio levels;
- Moderate automatic correction of the overall spectral balance;
- No control of short term audio peaks.

The management of average audio levels is accomplished by the VP8's four-band AGC with no peak limiting being performed.

Typical control settings for this application are as follows:

High pass filter = 20Hz to 35Hz	VBMS Drive = +2.0dB
Phase Scrambler = IN	VBMS Style = Hard
Equalization = "adjusted to taste"	VBMS Output = -3.5dB
AGC Attack Times = >500mS	VBMS Freq. = 125Hz
AGC Release Times = >5 Seconds	Multiband Drive = N/A
Compressor Attack Times = <15 mS	Lim/Clip Drive = N/A
Compressor Release Times = <100 mS	Multiband Knee = N/A
Compressor Ratios = ~2:1 to 4:1	Thresh Trim = N/A
Gain Reduction = <10dB	Attack = N/A
Backoff Control = -1.0dB	Release = N/A
B1/B2 Crossover = 150 Hz	Delayed Release = Unchecked
B2/B3 Crossover = 1.00 kHz	Delayed Release = N/A
B3/B4 Crossover = 4.99 kHz	Clip Style = OFF
AGC Gate Delay = 100.0 mS	Limiter Enable = Unchecked
Coupling = -1.5 dB	L/R Linked = Unchecked
Gate Threshold = -46.5dB	Multiband Enable = Unchecked
Gated Mode = "Hold"	MB Limiter Attack Times = N/A
L-R Controls = "adjusted to taste"	MB Limiter Release Times = N/A
Makeup Gain = +24.0 dB	MB Limiter Thresholds = N/A
Compressor = Enabled	Post MB Limiter EQ = Not Used
AGC = Enabled	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Radio and Television Production Room Audio Sweetening

(Compression using only the 4 band Compressor)

This configuration uses a subset of the VP8 features to fulfill three main goals:

- Rapid automatic correction of the short to medium term average audio levels;
- Some automatic correction of the overall spectral balance;
- No control of short term audio peaks.

The rapid correction of average audio levels is accomplished by the VP8's four-band Compressor. No Final peak control is used in this mode.

Typical control settings for this application are as follows:

High pass filter = 20Hz to 35Hz	VBMS Drive = +2.0dB
Phase Scrambler = IN	VBMS Style = Hard
Equalization = "adjusted to taste"	VBMS Output = -3.0dB
AGC Attack Times = N/A	VBMS Freq. = 125Hz
AGC Release Times = N/A	Multiband Drive = N/A
Compressor Attack Times = <15 mS	Lim/Clip Drive = N/A
Compressor Release Times = <100 mS	Multiband Knee = N/A
Compressor Ratios = ~2:1 to 4:1	Thresh Trim = N/A
Gain Reduction = <10dB	Attack = N/A
Backoff Control = N/A	Release = N/A
B1/B2 Crossover = 150 Hz	Delayed Release = Unchecked
B2/B3 Crossover = 1.00 kHz	Delayed Release = N/A
B3/B4 Crossover = 4.99 kHz	Clip Style = OFF
AGC Gate Delay = N/A	Limiter Enable = Unchecked
Coupling = -1.5 dB	L/R Linked = Unchecked
Gate Threshold = -46.5dB	Multiband Enable = Unchecked
Gated Mode = N/A	MB Limiter Attack Times = N/A
L-R Controls = "adjusted to taste"	MB Limiter Release Times = N/A
Makeup Gain = +24.0 dB	MB Limiter Thresholds = N/A
AGC = Unchecked	Post MB Limiter EQ = Not Used
Compressor = Enabled	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Radio and Television Production Room Audio Sweetening

(Leveling using only the 4 band AGC)

This configuration uses a subset of the VP8 features to fulfill three main goals:

- Correction of the long term average audio levels;
- Moderate correction of the overall spectral balance;
- No control of short term audio peaks.

The correction of average audio levels is accomplished by the VP8's four-band AGC. No final peak control is accomplished in this configuration.

Typical control settings for this application are as follows:

High pass filter = 20Hz to 35Hz	VBMS Drive = +2.0dB
Phase Scrambler = IN	VBMS Style = Hard
Equalization = "adjusted to taste"	VBMS Output = -3.5dB
AGC Attack Times = <100mS	VBMS Freq. = 125Hz
AGC Release Times = >5 Seconds	Multiband Drive = N/A
Compressor Attack Times = N/A	Lim/Clip Drive = N/A
Compressor Release Times = N/A	Multiband Knee = N/A
Compressor Ratios = ~2:1 to 4:1	Thresh Trim = N/A
Gain Reduction = <10dB	Attack = N/A
Backoff Control = -0.0dB	Release = N/A
B1/B2 Crossover = 150 Hz	Delayed Release = Unchecked
B2/B3 Crossover = 1.00 kHz	Delayed Release = N/A
B3/B4 Crossover = 4.99 kHz	Clip Style = OFF
AGC Gate Delay = 100.0 mS	Limiter Enable = Unchecked
Coupling = -1.5 dB	L/R Linked = Unchecked
Gate Threshold = -46.5dB	Multiband Enable = Unchecked
Gated Mode = "Hold"	MB Limiter Attack Times = N/A
L-R Controls = "adjusted to taste"	MB Limiter Release Times = N/A
Makeup Gain = +24.0 dB	MB Limiter Thresholds = N/A
AGC = Enabled	Post MB Limiter EQ = Not Used
Compressor = Unchecked	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Long Form Program Content Mastering

This configuration uses a subset of the VP8 features to fulfill three main goals:

- Subtle correction of the average audio levels;
- Minor correction of the overall spectral balance;
- Completely unobtrusive control of short term audio peaks.

The correction of average audio levels is accomplished by the VP8's four-band AGC with help for controlling the short term levels from the eight band limiter. Final peak control is accomplished by the lookahead limiter.

Typical control settings for this application are as follows:

High pass filter = 20Hz to 35Hz	VBMS Drive = +0.0dB
Phase Scrambler = "IN"	VBMS Style = Hard
Equalization = "OUT"	VBMS Output = -3.0dB
AGC Attack Times = >130mS	VBMS Freq. = 144Hz
AGC Release Times = >6 Seconds	Multiband Drive = 92.0%
Compressor Attack Times = <15mS	Lim/Clip Drive = +1.0dB
Compressor Release Times = < 200mS	Multiband Knee = Hard
Compressor Ratios = ~2:1	Thresh Trim = -0.5dB
Gain Reduction = <6dB	Attack = 3.6mS
Backoff Control = -0.0dB	Release = 50.0mS
B1/B2 Crossover = 150 Hz	Delayed Release = IN
B2/B3 Crossover = 1.0 kHz	Delayed Release = 660.0mS
B3/B4 Crossover = 5.99 kHz	Clip Style = OFF
AGC Gate Delay = 100.0 mS	Limiter Enable = IN
Coupling = -0.0dB	L/R Linked = IN
Gate Threshold = -44.5dB	Multiband Enable = IN
Gated Mode = "Ooze"	MB Limiter Attack Times = <10mS
L-R Controls = In=0.0dB, Out= 0.0dB	MB Limiter Release Times = ~100mS
Makeup Gain = +24.0dB	MB Limiter Thresholds = 0
Compressor = Enabled	Post MB Limiter EQ = Not Used
AGC = Enabled	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Talent Headphone Processing

When processing audio for talent headphones the goal is usually a bit more aggressive processing than the other specialized modes we've previously covered with the main goals being:

- Aggressive correction of the average audio levels;
- Obvious correction of the overall spectral balance;
- Mildly aggressive control of short term audio peaks.

The correction of average audio levels is primarily accomplished by the VP8's four-band AGC with short term levels managed by the eight band limiter. Final peak control is accomplished by the lookahead limiter although in this application peak control is either unimportant or can be rather "loose".

Typical control settings for this application are as follows:

High pass filter = 20Hz to 35Hz	VBMS Drive = +4.5 dB
Phase Scrambler = "IN"	VBMS Style = Soft
Equalization = "adjust to taste"	VBMS Output = -5.5 dB
AGC Attack Times = >600mS	VBMS Freq. = 118 Hz
AGC Release Times = ~3.2 Seconds	Multiband Drive = 95.0%
Compressor Attack Times = <10mS	Lim/Clip Drive = +1.6dB
Compressor Release Times = < 100mS	Multiband Knee = Soft
Compressor Ratios = ~4:1 to 6:1	Thresh Trim = -0.5dB
Gain Reduction = > 10 dB	Attack = 16.0 mS
Backoff Control = -2.0dB	Release = 50.0mS
B1/B2 Crossover = 108 Hz	Delayed Release = IN
B2/B3 Crossover = 728 Hz	Delayed Release = 240.0mS
B3/B4 Crossover = 4.24 kHz	Clip Style = OFF
AGC Gate Delay = 160.0 mS	Limiter Enable = IN
Coupling = -6.0 dB	L/R Linked = IN
Gate Threshold = -46.5dB	Multiband Enable = IN
Gated Mode = "Hold"	MB Limiter Attack Times = <10mS
L-R Controls = In=0.0dB, Out= +1.5dB	MB Limiter Release Times = ~50mS
Makeup Gain = +27.0dB	MB Limiter Thresholds = 0
Compressor = Enabled	Post MB Limiter EQ = Not Used
AGC = Enabled	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Pre-STL or Satellite Uplink Processing

(with mild dynamics control and peak limiting)

When processing audio for application to an STL system or satellite uplink there are usually two possible tuning options. The first is very mild processing combined with invisible control of absolute peak levels where the goals are:

- Moderate correction of the average audio levels;
- Moderate modification of the overall spectral balance;
- Invisible control of short term audio peaks.

Correction of average audio levels is accomplished by the four-band AGC with the short term peaks controlled by the eight band limiter. Final peak control is accomplished by the lookahead limiter.

Typical control settings for this application are as follows:

High pass filter = 20Hz	VBMS Drive = +2.0 dB
Phase Scrambler = "OUT"	VBMS Style = Hard
Equalization = "OUT"	VBMS Output = -3.0 dB
AGC Attack Times = >100mS	VBMS Freq. = 118 Hz
AGC Release Times = ~ 7.0 Seconds	Multiband Drive = 93.0%
Compressor Attack Times = <15mS	Lim/Clip Drive = +1.0 dB
Compressor Release Times = ~ 300mS	Multiband Knee = Hard
Compressor Ratios = ~ 3:1 to 4:1	Thresh Trim = -1.5 dB
Gain Reduction = NMT 6 dB	Attack = 0.2 mS
Backoff Control = -0.5dB	Release = 50.0mS
B1/B2 Crossover = 150 Hz	Delayed Release = IN
B2/B3 Crossover = 1.00 kHz	Delayed Release = 440.0mS
B3/B4 Crossover = 5.99 kHz	Clip Style = OFF
AGC Gate Delay = 60.0 mS	Limiter Enable = IN
Coupling = - 3.0 dB	L/R Linked = IN
Gate Threshold = -46.5dB	Multiband Enable = IN
Gated Mode = "Hold"	MB Limiter Attack Times = <10mS
L-R Controls = In=0.0dB, Out= +0.0dB	MB Limiter Release Times = ~50mS
Makeup Gain = +25.0dB	MB Limiter Thresholds = 0
Compressor = Enabled	Post MB Limiter EQ = Not Used
AGC = Enabled	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Pre-STL or Satellite Uplink Processing

(peak limiting only)

The following applies to an application where peak limiting only is desired. In this mode the goals are:

- No correction of the average audio levels;
- No obvious alteration of the overall spectral balance;
- Invisible control of short term audio peaks.

In this mode no correction is made for average audio levels. Short term peak levels are controlled by the eight band limiter with final peak control accomplished by the lookahead limiter.

Typical control settings for this application are as follows:

High pass filter = "OUT"	VBMS Drive = +1.5 dB
Phase Scrambler = "OUT"	VBMS Style = Hard
Equalization = "OUT"	VBMS Output = -4.5 dB
AGC Attack Times = N/A	VBMS Freq. = 125 Hz
AGC Release Times = N/A	Multiband Drive = 90.0%
Compressor Attack Times = N/A	Lim/Clip Drive = +0.0 dB
Compressor Release Times = N/A	Multiband Knee = Hard
Compressor Ratios = N/A	Thresh Trim = -1.0 dB
Gain Reduction = N/A	Attack = 0.6 mS
Backoff Control = N/A	Release = 50.0mS
B1/B2 Crossover = N/A	Delayed Release = IN
B2/B3 Crossover = N/A	Delayed Release = 440.0mS
B3/B4 Crossover = N/A	Clip Style = OFF
AGC Gate Delay = N/A	Limiter Enable = IN
Coupling = N/A	L/R Linked = IN
Gate Threshold = N/A	Multiband Enable = IN
Gated Mode = N/A	MB Limiter Attack Times = <10mS
L-R Controls = N/A	MB Limiter Release Times = ~50mS
Makeup Gain = N/A	MB Limiter Thresholds = 0
Compressor = Unchecked	Post MB Limiter EQ = Not Used
AGC = Unchecked	

The above settings are our suggestions for good starting points for the stated application. As with all audio processors your ears are *always* the best judge for how the resulting audio sounds.

Summary

As we have just demonstrated in this Vorsis Application Note the VP8 is an extremely powerful and effective tool for processing audio for a wide variety of uses. Not only is the VP8's HD-FM operating mode perfect for 'studio-side' applications like those presented in this paper, there are likely many others that we and our VP8 end users haven't even thought of yet.

The uncanny transparency of Vorsis audio processing algorithms, most operating at or above 192kHz, allows the VP8 to be utilized in quality-critical applications where no other audio processing product has been 'clean and transparent enough' to be applied before.

Great care has been taken in the design of our processing structures to use every available bit of the 144dB dynamic range available inside our DSP algorithms. Both fixed and floating point Digital Signal Processors are used and the benefits of each applied where it is most appropriate for achieving the highest accuracy audio performance.

Extremely high quality Crystal Semiconductor AES3 digital transceivers and Analog Devices sample rate converters (SRC's) handle the digital I/O while high dynamic range, very low noise 24-bit, 192kHz, 120dB dynamic range AKM analog to digital and digital to analog converters transport analog audio to and from the digital domain.

There are a variety of Vorsis Application Notes available for download from our Vorsis website that explain the nuances behind our audio processing features, inventions, philosophies and techniques. Please use the link below to navigate to the download page:

<http://www.vorsis.com/notes.html>

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