



**BBE High Definition Sound Process  
Digital Harmonics Enhancement and Restoration  
Professional Grade 3-Band Compressor/Limiter/AGC**

**For Car Audio Applications**  
Car Audio, Car DVD, Navigation System

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*The BBE Optima is designed to improve the car audio performance in very noisy environments and in abnormal sitting layouts.*

*The BBE Optima is an integration of the BBE, 3-band-compressor/AGC and MP (Minimized Polynomial Non-linear Saturation) processes.*

*BBE's 3-band-compressor-based AGC increases the volume level of the soft part of music while safely holding the loud part's level below saturation. This makes the sound level consistent and lets the listeners comfortably listen to the music without adjusting volume levels.*

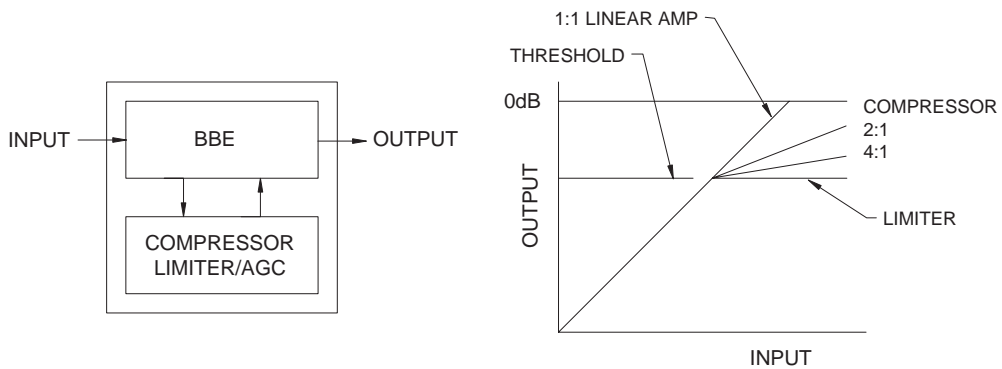
*The BBE MP process dramatically improves the sound of any digitally compressed audio including MP3 and the other compressed sounds by re-generating the lost harmonics through digital compression. It is equally effective with digital broadcast including the satellite radio.*

*The BBE process effectively enhances the clarity of sound by a frequency-dependent high-frequency boost and phase advance. Unlike equalizers, BBE provides equally clear sound to all passengers in a car regardless of their sitting locations.*

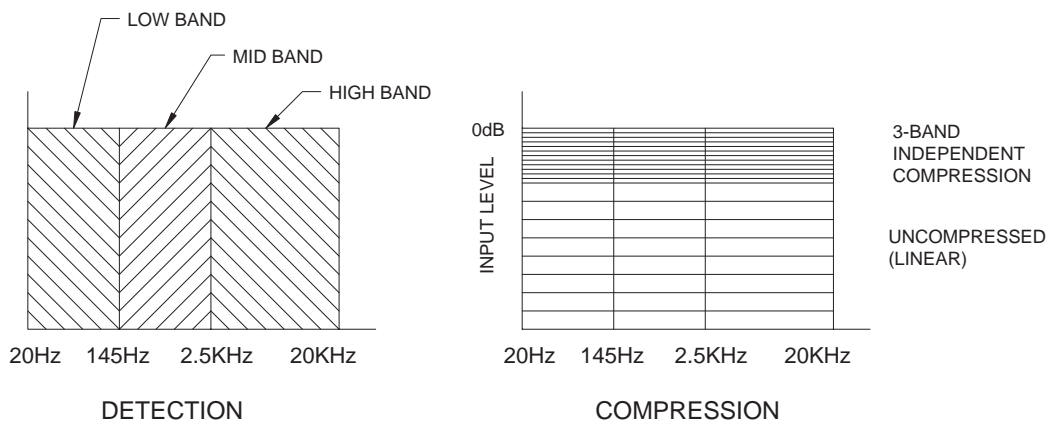
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# 1. 3-Band Compressor/Limiter/AGC (Automatic Gain Control)

- Automatically adjust the audio level fluctuation between different recordings and broadcast channels.
- Consistent loudness playback of the unrestrained MP3 recordings by inexperienced user.
- Raise the gain of softer part of music while keeping the louder part's volume level unchanged. (Suitable for noisy listening environment, such as car audio or portable personal audio.)
- BBE's unique 3-band compressor/AGC provides audiophile quality performance with a dramatically simplified software.



**BBE COMPRESSOR**

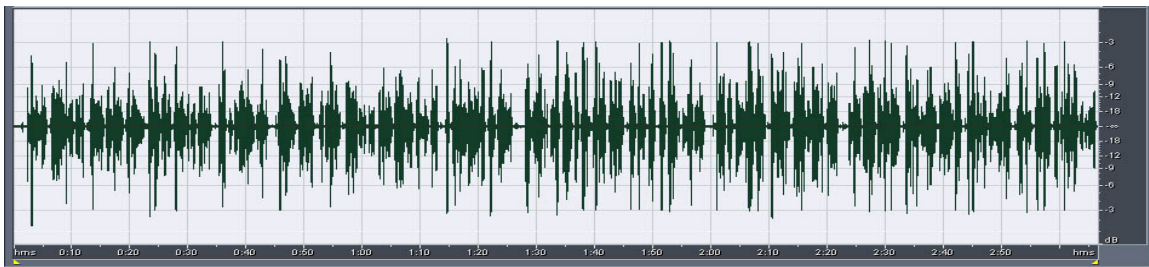


**BBE 3-BAND COMPRESSOR**

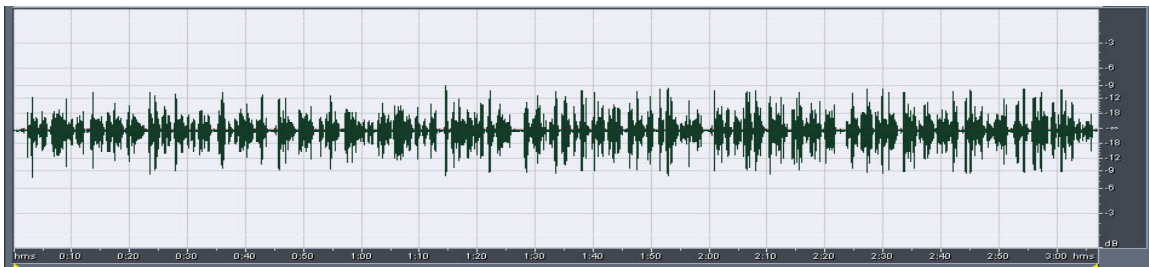
## 2. BBE Compressor/AGC Performance

The following three pictures illustrate the performance of the BBE 3-band compressor/AGC. The first picture is the waveform of the original 3-minute speech. The second picture is an intentionally -6dB attenuated original signal. The third picture shows the result of the BBE compressor/AGC applied on the attenuated signal. The loudness is recovered as strongly as the original.

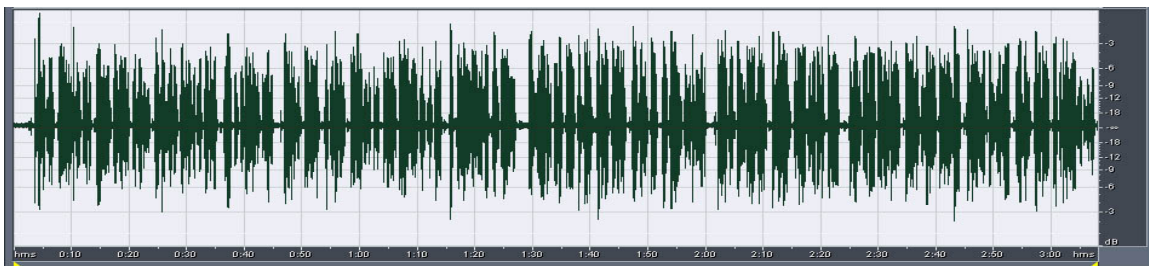
In the real world, broadcast and recorded audio fluctuates between 0 and -10dB across channels or programs. The BBE compressor/AGC equalizes these volume differences automatically.



**Original 3 Minutes Speech**



**Original, -6dB Attenuated**

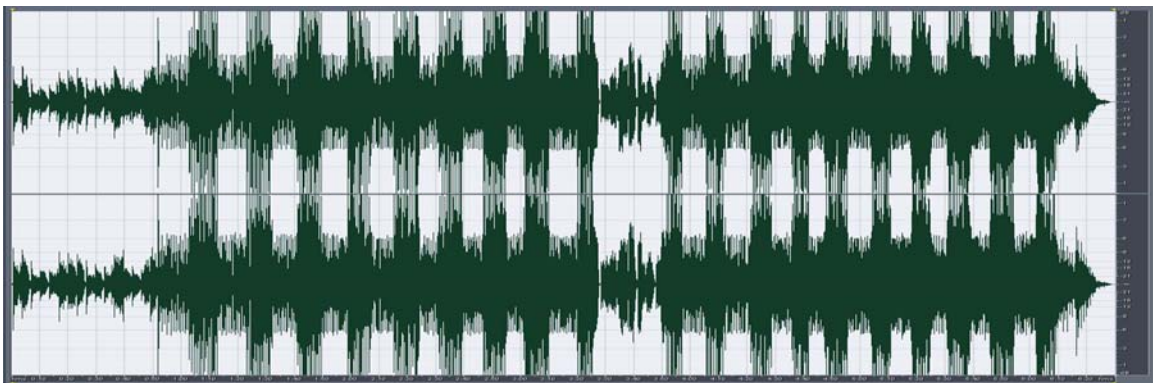


**BBE 3-Band-Compressor/AGC Applied**

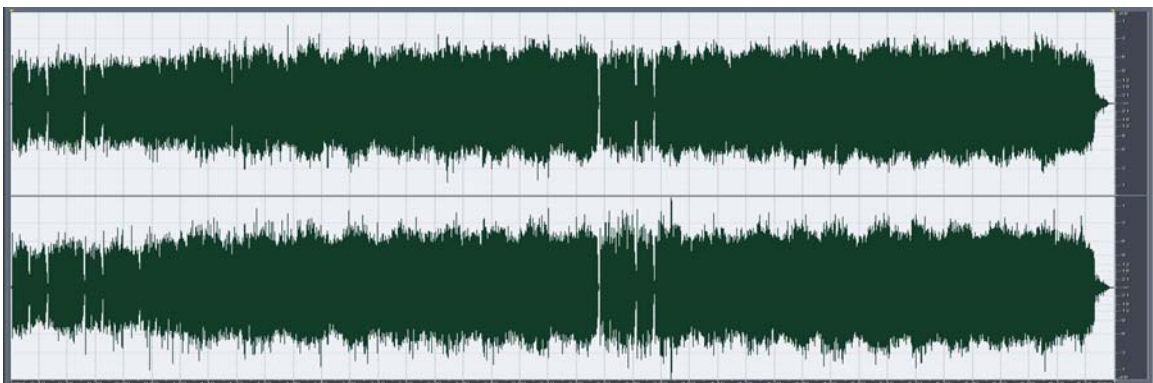
The three pictures on this page show the performance of BBE Optima. The first picture is the waveform of the original source material: "Hotel California" by Eagles. The second picture shows aggressively amplitude-modulated (0/-6dB every 10 seconds) test material. The third picture is the result of BBE Optima process applied on the modulated signal. The whole tune is consistently normalized by the AGC and dynamic range compression.



**Hotel California, Original**



**10Sec/10Sec 0/-6dB Modulated**



**BBE Optima Processed**

## More About AGC

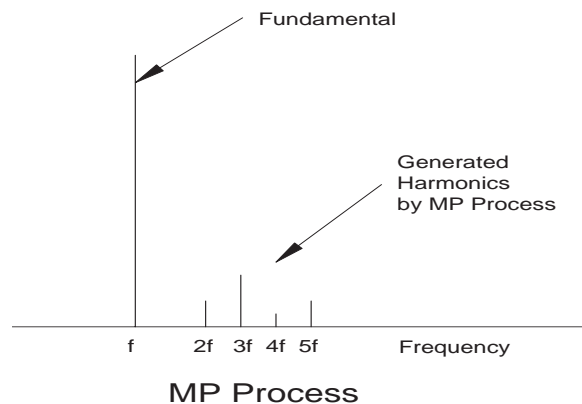
There are two types of AGCs. The regular AGC is referred to as “auto-volume” (or automatic volume control). It has a relatively short attack and very long release time-constants – as long as five seconds. It works in a wide AGC range, but it exhibits obvious artifacts which are unacceptable in any hi-fi or critical applications.

The second type, the compressor-based AGC, has a shorter attack and release just like BBE Compressor/AGC. It works very quickly and shows much fewer artifacts. Almost all music CDs are recorded using some kind of multi-band-compressor-based AGC. Its AGC range is generally narrower than the auto-volume type. When the application’s dynamic range is limited or known, the compressor-based AGC is the right choice for the better performance.

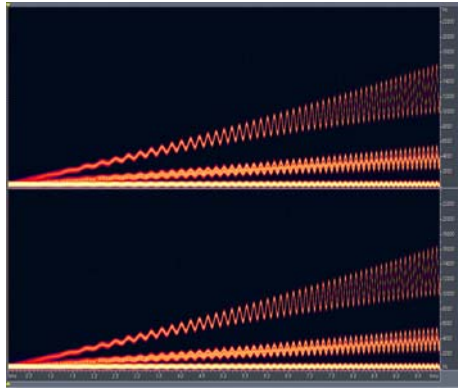
## 3. BBE MP Process

BBE MP (Minimized Polynomial Non-Linear Saturation) Process improves all digitally compressed sound (such as MP3) by restoring and enhancing the higher harmonics lost through digital compression. BBE MP works by generating the right amount of odd-order and even-order harmonics from the source material, effectively recovering warmth, details and nuance. This mechanism is similar to a vacuum tube amplifier which also tends to generate odd-order and even-order harmonics.

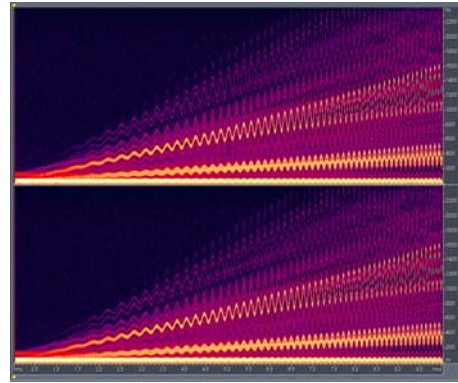
BBE MP extends the upper frequency range of MP3 and the other digitally compressed sounds to CD or DVD-range. (Refer to “BBE MP White Paper” for more details.)



The following pictures visualize the actual operation of the BBE MP process on a test signal. The first picture is a multiple-modulation-sweep test signal (X: Time, Y: Frequency). The second picture is the result of the BBE MP process applied to the same signal. A series of harmonics are generated covering the wide frequency range.



**Test Signal**



**BBE MP Processed**

#### **4. Improved Stereo Image (*BBE Optima3*)**

Simple yet very effective 3-dimensional sound field process recovers the lost stereo image (lost by the digital compression, especially the background landscape of music).

#### **5. Solution**

Digital

**BBE Sound, Inc. August 30, 2004**

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