SmartAudio™ 100

Innovative Sound and Voice Enhancement Technology

TECHNICAL BRIEF

INTRODUCTION

The BCM2044S is a monolithic 0.13 μm single-chip Bluetooth® wireless audio solution targeted for low cost mono headsets. SmartAudio™ 100 is developed specifically for BCM2044S silicon and provides true flexibility when setting up a Bluetooth headset. Each feature described is under software control, giving the user the ability to configure SmartAudio 100 features as required. In addition, each individual component of SmartAudio 100 can be turned on or off, depending on the headset developer's preference.

Features

- Noise suppression
- Automatic Volume Control (AVC)
- Microphone path equalization
- Echo suppression

Benefits

- Noise suppression achieves 10 to 15 dB improvement in signal-to-noise ratio (SNR) in noisy situations, depending on the noise source
- Automatic Volume Control (AVC) will boost the headset receive volume in noisy environments
- Highly configurable echo suppression for single- and double-talk situations
- Comfort noise generator provides more natural sound during echo suppression

- Microphone path equalization allows adjustment of frequency response for different headset designs

Applications

- Mono headset connected to a cell phone
- Mono headset connected to a PC for VoIP applications

NOISE SUPPRESSION

A Bluetooth headset user is in constantly changing environments—many with high background noise levels such as automobiles, outdoors on busy streets, in restaurants or clubs, or various office environments. The noise suppression technology included in SmartAudio 100 is designed to detect when the user is in a noisy environment, detect the noise separately from the user's speech, and reduce the noise component of the signal coming into the microphone without affecting the speech. The amount of noise reduction applied can be configured by the headset designer. Up to 15 dB of noise reduction can be applied, resulting in improvements in the SNR of 10 to 15 dB depending on the properties of the background noise. The SmartAudio 100 noise suppression algorithms are optimized to preserve the fidelity of speech even in the presence of strong background noise.

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AUTOMATIC VOLUME CONTROL

Automatic Volume Control (AVC) improves the listening experience in a noisy environment for the headset user. When the user experiences an increase in background noise, such as in airports and shopping malls, the speaker volume will automatically increase in proportion to the rise in the environmental noise level. This eliminates the need for the user to manually adjust the volume control. The BCM2044S uses AVC to compensate for any increase in the background noise by boosting the gain applied to the received signal.

ECHO SUPPRESSION

Echo suppression is often needed for Bluetooth headsets even though the cellular network usually provides some form of echo cancellation. Acoustic echo is introduced when the headset user is listening to a far-end caller, and the voice signal from the headset speaker is picked up by the headset microphone and retransmitted to the far-end caller through the network. The level of echo annoyance to the speaker on the other end of the connection depends on the amount of returned signal energy and the network delay, but under certain conditions, the echo can be very disruptive to the conversation. The BCM2044S echo suppression intelligently attenuates noticeable echo signals in the headset. The amount of echo reduction is quantified by the Echo Return Loss Enhancement (ERLE), measured in dB. The ERLE is the ratio of send input power to the power of the residual error signal immediately after echo cancellation. The echo suppression software parameters of SmartAudio 100 can be adjusted to account for the echo properties of a specific headset design.

MICROPHONE PATH EQUALIZATION

The microphone location on a Bluetooth headset can vary considerably depending on the mechanical design of the headset, which in turn can change the frequency response of the microphone path in relation to the acoustic characteristics of the sound coming from the user's mouth. The multiband microphone path equalizer provides a means to fine-tune the microphone path frequency response for optimum voice quality.

COMFORT NOISE GENERATION

When using echo suppression and/or noise suppression processing, the typical background noise experienced with Bluetooth headsets may be drastically reduced or disappear. This could sound very unnatural to the listener on the other end of the connection and potentially give the impression that the call was intermittent. Comfort noise generation adds a low level noise, whose properties are closely matched to the actual background noise, to reassure the listener that the connection is functioning normally.

SUMMARY

Many of the audio problems associated with using Bluetooth headsets can be eliminated by using SmartAudio 100 features. For more detailed information, refer to the BCM2044S Technical Documentation available on the Broadcom Corporation Customer Service Portal, or contact your Broadcom Corporation sales representative for assistance.

> **To achieve this breakthrough in audio clarity and quality, we've leveraged unique technologies from our deep communications portfolio, which, coupled with our considerable expertise in Bluetooth, has resulted in a powerful new platform that addresses existing audio headset deficiencies**
>
> *--Scott Bibaud, Vice President and General Manager, Wireless Personal Area Networking*