

Demand is growing for both ANC and premium sound without sacrificing battery life, resulting in increasing adoption of balanced armatures in modern wireless earphones

For more than 20 years, balanced armature (BA) drivers have dominated the market for both musician in-ear monitors and audiophile earphones due to their excellent sound reproduction.

Today, consumers are also increasingly demanding premium sound in their wireless earphones. As TWS earphones explode in popularity, designers want to employ balanced armatures not only for their sound quality but also for their low power consumption and small size, often in combination with ANC.

BA brings value in three ways

Single BA

Down to 1/3 the size of a 6mm dynamic speaker, using a single BA allows room for more features by freeing room for other components, a larger battery, and/or smaller overall size. The BA's lower power consumption compared with typical 6mm dynamic speakers also results in a significant increase in battery life.

Hybrid

Implementing a hybrid configuration (dynamic speaker + BA tweeter), the dynamic speaker can be tuned specifically as a woofer. Such a design can use a smaller dynamic speaker than in a standalone single-driver setup. Hybrids are the fastest way to achieve premium sound while being compatible with existing ANC systems.

Hybrid earphones are well-suited to support increasingly-popular HD music streaming.

Two-way BA

A small woofer-tweeter BA combination is about the same size as a 6mm dynamic speaker, offers audiophile sound, and reduces power consumption. Two-way BA earphones are also ideal for streaming HD music.

Most ANC implementations in TWS earphones to date have used standalone dynamic speakers. However, both market examples and Knowles' internal testing prove that ANC with excellent performance can be achieved with BAs, utilizing their significant advantages without compromising ANC performance.

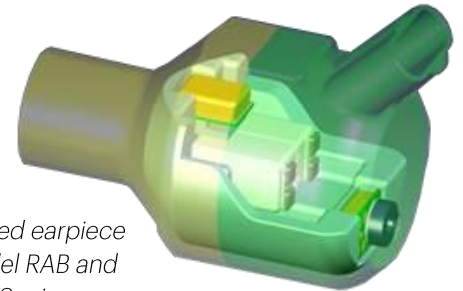
Examples of ANC earphones with BA

Effective ANC with BA is already available in the consumer marketplace. Many configurations are possible for ANC implementation, depending on component choices, ANC parameters, venting, microphone quantity and placement, EQ, limiting, amplification, etc. The possibilities are endless. Three examples are shown here:

- Hybrid (dynamic woofer and BA tweeter) in neckband configuration
- Hybrid TWS earphone
- Pure BA TWS earphone

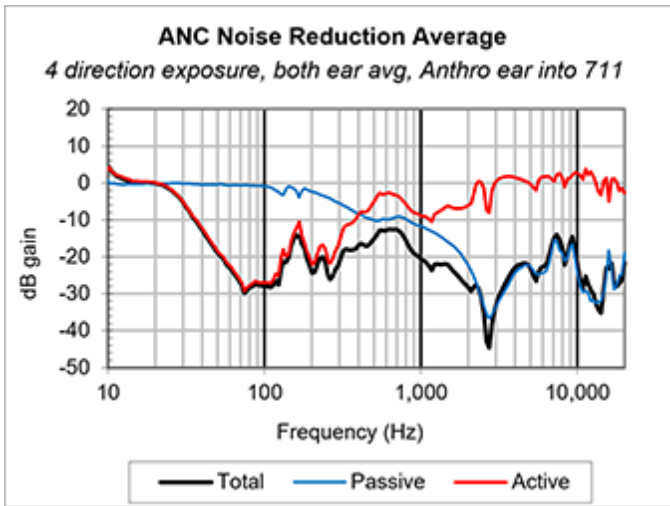
Knowles BA ANC Prototype

Knowles created several prototype earphones to gain ANC expertise and to develop functional BA-based ANC demonstration units in both pure BA and hybrid configurations. The earphone discussed here utilizes twin vented RAB series receivers that can be operated either singly or as

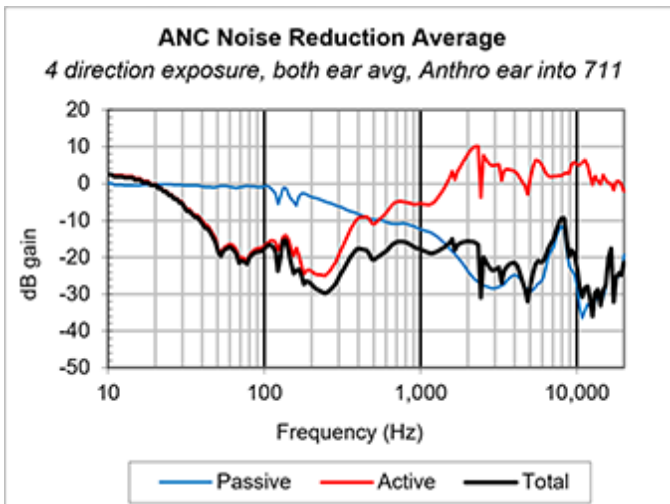


Knowles-developed earpiece with twin BA model RAB and two SiSonic MEMS mics

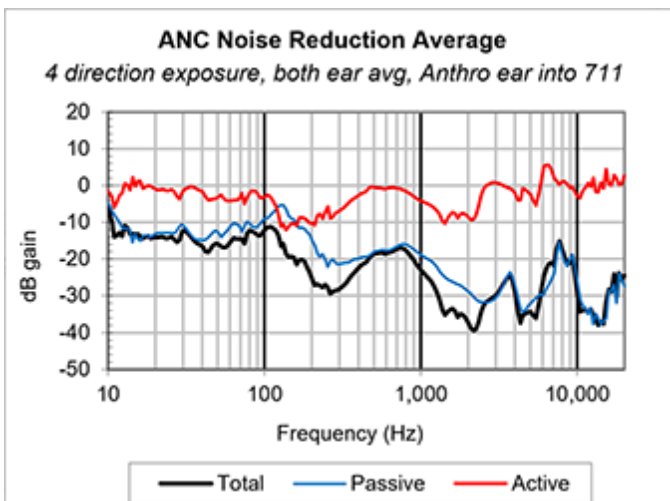
a pair. Knowles SiSonic™ MEMS microphones are used for feedback and feedforward ANC. The earphone is attached to an external PCB with Analog Devices ADAU 1772 digital signal processor. A connected PC is used to load filter parameters. The prototype earphone layout is optimized for ANC with talk-through functionality, occlusion reduction, and high fidelity music reproduction.



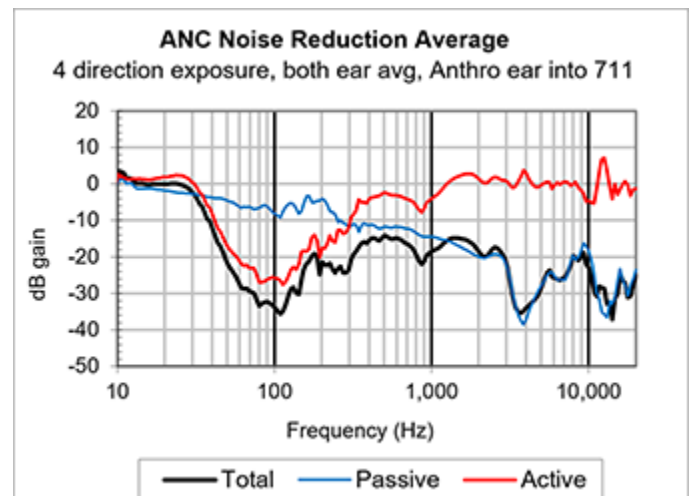
Market neckband hybrid earphone, Japan



Market TWS hybrid earphone, China



Market TWS 2-way BA earphone, USA



Knowles ANC results, twin BA model RAB



ANC performance of the Knowles demonstration unit exceeds many commercially available products, especially in the feedback loop. The system proved stable and reliable when tested on 11 different users.

Conclusion

Because balanced armatures have different characteristics compared to dynamic speakers, some designers are unsure how to make ANC work with BA drivers. Nonetheless, the desire to incorporate BA into wireless and TWS earphones has led several earphone brands to tackle the issues and successfully design products. Models on the market include earphones with single BA, 2-way BA, and hybrid drivers, the latter two of

which are also well-suited for satisfying the growing demand for HD audio streaming. In addition, Knowles' own developments show that excellent ANC performance can be obtained using either pure BA or hybrid configurations. Therefore two of the inherent advantages of BA, small size and power savings, can also be exploited in combination with ANC while delivering premium sound.

Implementing ANC with BA will not be difficult for engineers with experience using dynamic speakers, perhaps with some guidance from Knowles. When you are ready to get going, contact your local Knowles representative for more information.

More information on Knowles balanced armature drivers for hearables & music earphones can be found at www.KnowlesPremiumSound.com

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