

Qualcomm® Snapdragon Sound™ Technology



Qualcomm



Sound matters. It matters to anyone using a mobile phone or personal audio device for listening to music, watching videos, making voice calls, or gaming. Mobile sound is a large part of many people's lives, and personal audio devices, including truly wireless earbuds and headphones, need to connect seamlessly to mobile phones. Audio quality has a huge impact on the overall mobile user experience.

Findings from our 2020 State of Play survey showed that sound quality continues to be the single most important purchase driver in consumer audio. The use of wireless audio products has grown significantly, and the survey found that video consumption is now the second most popular use case for wireless headphones, and third most popular for earbuds. Also highlighted in the report is that almost half of all consumers surveyed reported using wireless audio products while gaming and that almost a quarter say that audio dropouts are a negative quality criterion when purchasing truly wireless earbuds.



Ensuring consistently high quality audio experiences across these many use cases and devices requires a comprehensive audio solution.

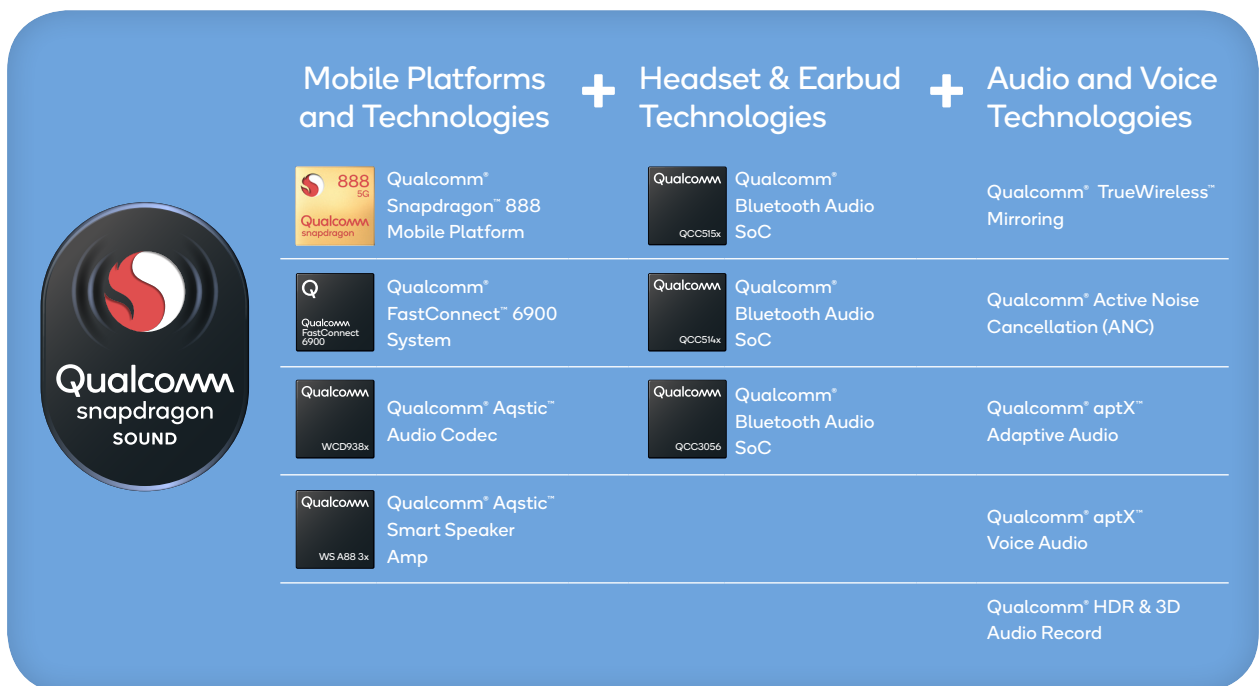
The Pursuit of High Quality Sound

Consumers are embracing wireless audio and adoption continues to ramp, particularly in the true wireless category—but the transition from wired to wireless can create challenges if wireless audio technologies are not implemented well.

The use of standard audio codecs across some wireless networks and devices can lead to inferior sound quality when making voice calls or listening to music. Interference can cause choppy audio and dropped calls, and high latency codecs can cause audio/video to be out of sync and adversely affect the user experience when gaming. Wireless earbuds also can be frustrating to set up and pair with mobile phones. The use of suboptimal and disjointed wireless audio technologies across mobile phones and wireless headsets can not only exacerbate these issues but also lead to shorter battery life.

Qualcomm Snapdragon Sound

Snapdragon Sound is an optimized chain of audio technologies and software that is designed to deliver seamless, immersive audio across mobile devices and wireless audio accessories. It brings together Qualcomm Technologies leading audio, connectivity and mobile technologies, which have been optimized to work better together to solve some of the most common wireless audio issues including consistent sound quality, reliable connectivity and low-latency. Devices optimized for Snapdragon Sound are designed to deliver premium performance across these key metrics while also ensuring interoperability end-to-end.



Optimized for high-resolution music listening:

Snapdragon Sound utilizes proven Qualcomm® aptX™ Adaptive technology which is designed to support 24-bit word depth and sampling frequencies of 44.1kHz, 48kHz, and 96kHz. aptX technology delivers premium Bluetooth audio experiences and Qualcomm supports this end-to-end between Qualcomm® FastConnect™ mobile connectivity systems and low power Bluetooth audio SoCs.

Snapdragon Sound is not only designed to deliver amazing wireless audio experiences when using earbuds and other wireless audio accessories, it can also deliver HD audio quality from the mobile device itself. Utilizing the Qualcomm® Aqstic™ audio codecs Snapdragon Sound is designed to deliver audiophile-grade playback all the way up to 32-bit 384kHz PCM and supports native Direct-Stream Digital (DSD) Hi-Fi audio playback with load equalization. The latest Aqstic™ smart speaker amplifiers WSA883xx deliver 7.3W output power, almost doubling the previous generation of smart speakers, with an extremely low THD+N of -88dB.

Optimized for crystal clear voice calls:

Snapdragon Sound also utilizes Qualcomm® aptX™ Voice technology for super-wideband voice end-to-end over Bluetooth to provide wire-equivalent calls, wirelessly. Today, super wideband voice codecs are used by providers to enhance call quality on mobile networks, which means that many consumers are already enjoying high quality voice calls on their mobile devices. However, when they connect accessories that support the Bluetooth Handsfree Profile to make and receive voice calls, they aren't experiencing the same super wideband voice quality.

aptX Voice is designed to deliver 32kHz sampled audio with a flat 16kHz frequency response, providing HD quality voice audio to Bluetooth earbuds and headsets. 32kHz speech encoded by the network using the EVS codec is transcoded to aptX Voice within the mobile phone and decoded in the headphone or earbud. The benefit of Qualcomm aptX Voice in audio frequency response is shown below with aptX Voice achieving a flat 16kHz frequency response against 4kHz for POTS and 8kHz for mSBC. mSBC is a modified SBC codec that is the default codec used in Bluetooth devices that support the Hands-Free Profile. The result using Qualcomm aptX Voice is greater voice clarity and speech intelligibility as well as clearer overall sound quality.

Comparison of voice codecs



POTS (Plain Old Telephone System) legacy landline voice quality.

Sampled at 8kHz, 4kHz frequency response.



mSBC Standard Bluetooth voice call quality.

Sampled at 16kHz, 8kHz frequency response.



Qualcomm® aptX™ Voice.

Sampled at 32kHz, with a flat 16kHz frequency response.

Additionally, Snapdragon Sound harnesses all of the features of the Qualcomm Technologies audio and voice communication suite, designed to deliver crystal clear mobile calls when using a mobile device to make calls. These pre- and post-processing features include multi-mic echo cancellation and noise suppression technology that uses AI to isolate noisy environments from voice signals and adaptive active noise cancellation technology. In addition our High Dynamic Range (HDR) recording that lets users capture sounds which were previously impossible to hear in smartphone recordings, allowing us to record sound just as we hear, from the loudest concerts to the most delicate ambient sounds.

Optimized for low latency:

Great sound is a vitally important part of the mobile gaming experience, it needs to be highly responsive and in-sync with what the gamer sees on their mobile device. Snapdragon Sound is optimized for fully synchronized video and audio and is designed to deliver latencies as low as 82 milliseconds for stereo headsets and 89 milliseconds for earbuds for immersive gaming experiences.

Optimized for robust connectivity:

Snapdragon Sound is designed to deliver robust connectivity with a 4dB gain using Qualcomm® High Speed Link modulation and a further 2dB gain using Qualcomm® aptX Adaptive. Fewer retries and less time on the radio supports better Wi-Fi coexistence and a more robust overall connection. Advanced modulation and coding also help to deliver increased end-to-end Bluetooth link robustness, improving range and stability, despite interference.

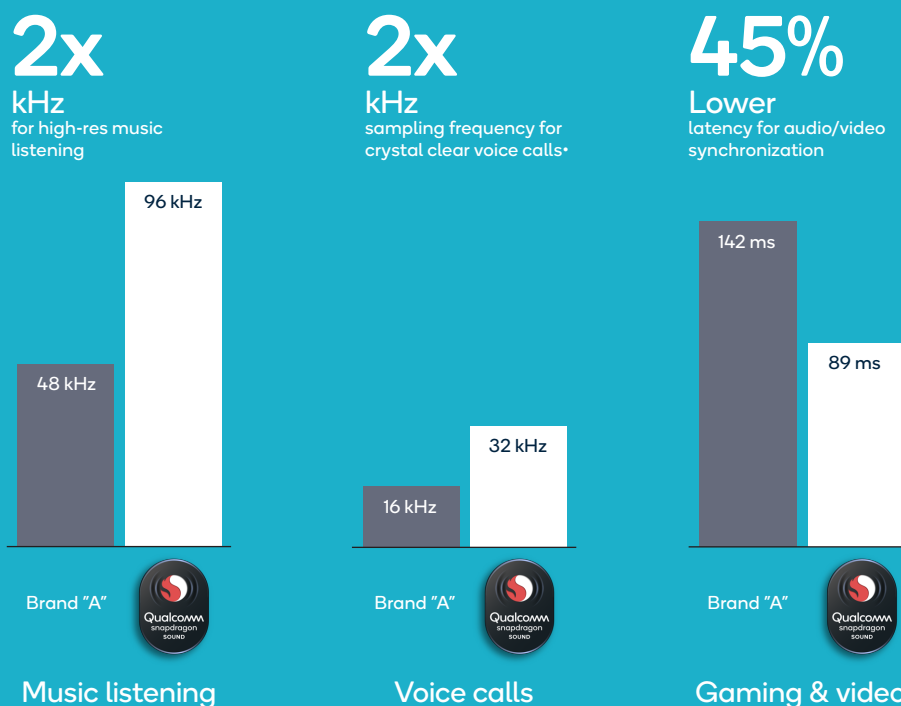
Optimized for more seamless user experiences:

Snapdragon Sound has support for Google FastPair for easy pairing, supports a range of voice assistants and is designed to support the forthcoming LE Audio standard. It is also optimized for lowest power consumption on both phone and earbud with reduced time on air and support for DSP tunnelling.

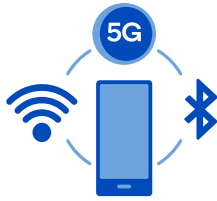
Performance benchmarking:

When tested in-house against a leading competitor phone and earbud solution Snapdragon Sound performs better across key metrics including music quality, voice quality and latency.

Benefits of Qualcomm® Snapdragon Sound™ vs. leading competitor phone + earbud solution (Bluetooth link)

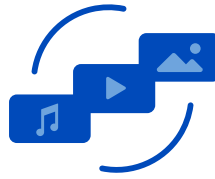


*Qualcomm aptX Voice vs. mSBC. Test conducted by Qualcomm Technologies International, Ltd. Battery life varies significantly with settings, usage and other factors. Qualcomm Snapdragon Sound is a product of Qualcomm Technologies, Inc. and/or its subsidiaries.



Robust connectivity

Designed to minimize dropouts and glitching even in the busiest RF environments



Dynamic adaptation

Designed to seamlessly adapt in presence of interference or weak signal to ensure best possible performance



Long battery life

Industry leading power consumption for real world use cases including those with ANC and always-on-voice activated

Delivering Real World Performance

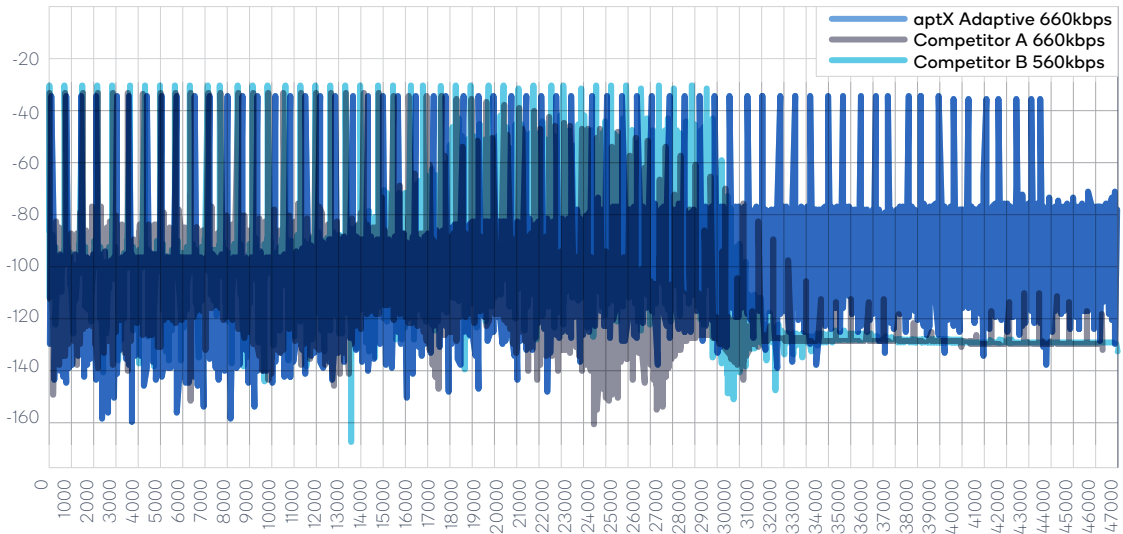
aptX Adaptive technology is one of the key components of Snapdragon Sound, helping to deliver industry leading music and voice quality and helping drive down latencies. Analysing its performance across some key audio metrics provides good insight into some of the core benefits that Snapdragon Sound is designed to deliver.

Real-world audio performance

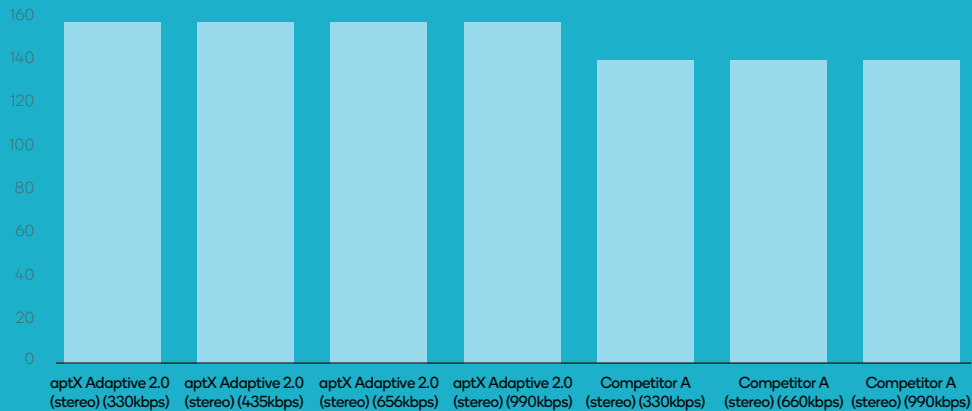
Multitone analysis provides a good estimate of real-world audio codec performance as a typical music audio stream will consist of multiple tones. In this case a multitone source is applied to a codec and the resulting output is analysed.

The chart below shows the 96kHz performance of Qualcomm aptX Adaptive against competing codecs at 660 kbps or 560 kbps. We can see that Qualcomm aptX Adaptive performance is relatively flat up to 43kHz and then drops off. This indicates the performance that can be achieved in real world audio applications. The performance of Competitor A drops off at approximately 30kHz and Competitor B drops off at 27 or 28kHz.

Multitone Analysis -6dB (96 kHz Codecs)



Signal to Noise Ratio (SNR)

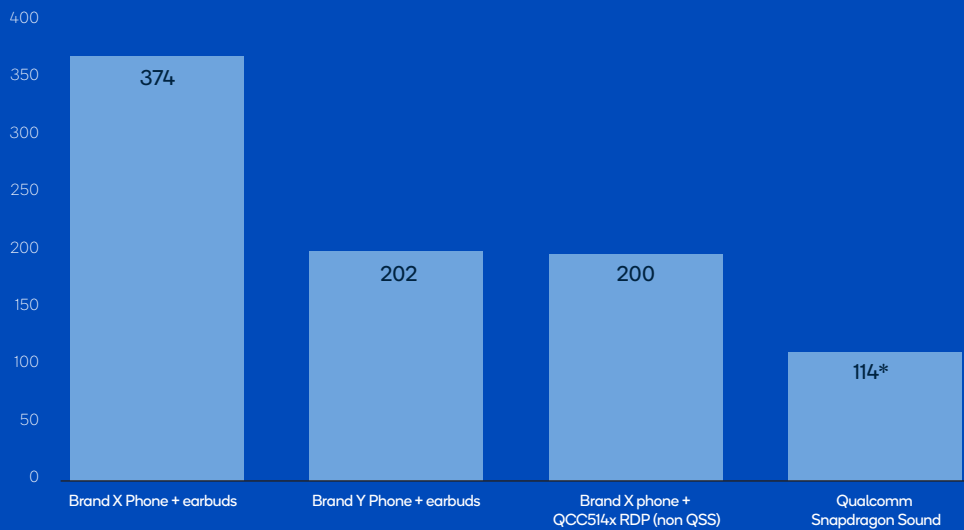


End-to-end system latency tests

Qualcomm Snapdragon Sound is designed to deliver significantly lower audio latencies than competing solutions. When tested by Qualcomm Technologies, a widely available phone and earbud combination recorded audio latencies of 374 milliseconds in a test rig designed to replicate mobile gaming mode. When the same phone was paired with earbuds using the Qualcomm® QCC514x audio SoC latency was reduced to 200 milliseconds, just below the 202 milliseconds achieved using a phone and earbud combination from a different competitor. With Snapdragon Sound and the same test set-up the audio latency was just 114ms.*

* This figure includes an additional approximate 30 milliseconds based on reaction times because these tests were performed using a prodder test mechanism.

Lowest Audio Latencies (milliseconds)



Conclusions

Sound matters and while sound quality continues to be the single most important purchase driver in consumer audio, latency and robust connectivity are growing in importance. By optimizing the interaction of Qualcomm Technologies-based components, Snapdragon Sound is designed to achieve robust and virtually seamless connectivity in congested and noisy environments, while also supporting high-resolution music, ultra-low latency for gaming, improved pairing and crystal-clear phone calls with super wideband voice.

For mobile OEMs Snapdragon Sound provides an opportunity to differentiate with high performing sound, coupled with seamless out of box experiences. Pre-certified solutions across device segments will also be available to help reduce development time and cost. For audio OEMs Snapdragon Sound offers an opportunity to compete with vertically integrated ecosystems, and there is massive potential to tap into the huge Android ecosystem.

For consumers Snapdragon Sound will make it easy to identify the products that sound best together while expanding their choice. Each device that is optimized for Snapdragon Sound and carries the brand will have completed rigorous testing by Qualcomm Technologies for performance across latency, voice call quality, music quality and robust connectivity.

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Qualcomm Snapdragon Sound, Qualcomm aptX, Qualcomm Aqstic, Qualcomm FastConnect, Qualcomm Bluetooth Audio SoC, Qualcomm TrueWireless, Qualcomm Active Noise Cancellation, Qualcomm WCD883x and Qualcomm QCC514x and Qualcomm High Speed Link are products of Qualcomm Technologies Inc. and/or its subsidiaries.

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