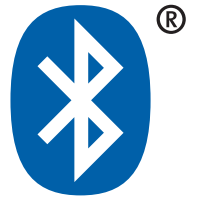


## 1. What is *Bluetooth*® wireless technology?



*Bluetooth* wireless technology is the global short-range wireless standard for personal connectivity of a broad range of electronic devices. The technology continues to evolve, building on its inherent strengths – small-form factor radio, low power, low cost, built-in security, robustness, ease-of-use, and ad hoc networking abilities. More than nine new *Bluetooth* enabled products are qualified every working day and 18 million *Bluetooth* units are shipping per week. There are over two billion *Bluetooth* devices in the marketplace and that number climbs daily.

## 2. How do two *Bluetooth* devices interact?

*Bluetooth* devices deal with each other by using profiles. The supported profiles defining the capabilities of a product. It's important that two devices which should interact with each other supporting the same profile, otherwise they will not be able to establish a connection.

When talking about headphones and headsets, we are dealing with three major profiles. These are:

### a. A2DP (Advanced Audio Distribution Profile):



The A2DP profile enables the streaming of stereo audio via *Bluetooth* wireless technology. Only devices supporting this profile are capable to stream music in high quality and in stereo. This is important to know, as e.g. some old mobile phones do not support A2DP and can not connect for this reason.

### b. AVRCP (Audio Video Remote Control Profile):

This profile is closely linked to the A2DP profile, as it is often supported together. This profile enables the user of a *Bluetooth* device to control the audio source by some commands like "play", "pause" and "skip".

c. HSP/HFP (Headset / Handsfree Profile):



The two profiles are often mentioned together as they nearly describing the same. Basically these are the profiles to perform telephone calls via *Bluetooth* wireless technology (by communicating with a mobile phone with Bluetooth capabilities). They are only supporting low quality mono audio, but in a bidirectional way (microphone and speaker). In addition to audio transmission, basic telephone controls are implemented as e.g. “pick-up” or “hang-up”.

Remark: Bluetooth devices can support more than one profile.

### 3. What are codecs? Are there differences streaming via A2DP profile?

As the bandwidth of *Bluetooth* wireless transmission is limited, the audio data is transferred compressed through the link. The compression is done by a so called “codec”. All *Bluetooth* enabled devices with A2DP capability are supporting the mandatory codec SBC (Low Complexity Subband Codec). This compression algorithm is comparable with a low quality mp3-compression. The problem when using this codec is, that the delay generated by coding and decoding the audio data gives the user a major “lip-sync error” when e.g. viewing videos or playing computer games. Also, the sound quality is not the best due to low quality encoding, giving especially some kind of high hiss-noise while playback.

To improve all the deficits there are alternative codec available. This is where the apt-X® audio codec comes in...

### 4. What is apt-X? How is it better?

Back in late 1980's an electronics company called APTX began developing the apt-X® brand of low-latency codecs for high-quality audio, especially for then-emerging professional applications for multi-channel, high-resolution digital audio broadcasting, multi-track digital recording studios, and 5.1 surround-sound post production for movies. Since then, APTX has constantly enhanced and expanded its apt-X brand of high-performance audio codecs to serve new applications, especially in consumer electronics: apt-X has now been skillfully re-engineered and code-optimised for *Bluetooth*® A2DP devices in order to deliver the ultimate wireless

stereo audio experience – greatest dynamic range (dB), widest frequency response (kHz), lowest time delay ( $\Delta T$ ) – for music, movies and games. Sennheiser *Bluetooth* headphone users are the first to enjoy the sonic benefits of apt-X.

#### 5. What are the capabilities of Sennheiser's new PX headphones?

The headphones PX 210 BT and PXC 310 BT are supporting A2DP profile for streaming stereo audio via *Bluetooth* wireless technology. In addition to this they are enabling the control of the audio source by supporting AVRCP profile.

The headphones support the apt-X codec to achieve Sennheiser sound quality by evening out the disadvantage of standard SBC codec. In order to achieve the improved sound quality, not only the headphones but also the audio source must support the apt-X codec. For this reason Sennheiser is introducing beside the headphones three *Bluetooth* dongles (BTD 300 USB, BTD 300i and BTD 300 Audio) for all common audio interfaces. They are also a good choice, if your audio device does not support *Bluetooth* wireless technology.

Remark: These two headphones are not capable for receiving telephone calls.

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**Is apt-X already present in current market? Are there other vendors producing headphones with apt-X?**

Sennheiser is the first company introducing headphones with apt-X. For achieving the benefit of apt-X, the Sennheiser dongle is mandatory at the moment. Nevertheless there will be support of apt-X by other devices, especially sound sources, in near future.

**What are the benefits of using apt-X via Bluetooth A2DP profile in comparison with Klear-technology?**

The Bluetooth wireless technology is widely spread over the world and supported by many devices. The benefit of using Bluetooth is that even if your sound source isn't able to provide apt-X codec sound, you will be able to hear music (via less quality SBC codec). So using apt-X via A2DP Bluetooth link gains flexibility, but supports still the high-quality sound, which Sennheiser stands for.

In comparison to Bluetooth Klear enables broadcasting of uncompressed audio data to more than one device with only one transmitter. As Klear technology is optimized for stereo audio transmission only, the power consumption is also lower than with Bluetooth technology. But these benefits make the usage of Sennheiser transmitter mandatory and the latency of the Klear audio link is higher.

So there are pros and cons for both solutions and the usage is depending on the customer demands. For this reason Sennheiser is using both technologies in there product portfolio.