

EIGHT KHZ, LLC
v.
META PLATFORMS, INC.; META PLATFORMS TECHNOLOGIES, LLC

Case No. 6:22-cv-00575-ADA

Asserted U.S. Patent No. 10,368,179
“Switching Binaural Sound”

Plaintiff’s Infringement Contentions
Exhibit 22

March 3, 2023

This claim chart is based on publicly available literature regarding Defendants' products. Plaintiff will be seeking Defendants' internal documentation, including technical documentation such as schematics and datasheets, in discovery and therefore Plaintiff reserves the right to amend or further supplement this claim chart.

The term "Accused Products" herein refers to all products manufactured, used, tested, imported, or sold by or on behalf of Defendants practicing the Asserted Claims of the '179 Patent, and all processes employed by Defendants that practice the Asserted Claims of the '179 Patent, consisting of at least Defendants' products that support Oculus, including by way of example and without limitation the Oculus Quest product lines. On information and belief, such Accused Products include without limitation the following: Oculus Go, Oculus Rift S, Oculus Quest, and Oculus Quest 2. To the extent Defendants have substituted the name "Meta" or "Reality Labs" for "Oculus" in any of the above products, such products are also included in the Accused Products.

This claim chart specifically addresses infringement of Claim 14 ("Asserted Claim") of the '179 Patent by Defendants' Oculus Quest 2 product. Defendants' Oculus Quest 2 product is representative of Defendants' infringement of the Asserted Claim. While this chart specifically addresses the functionality of the Oculus Quest 2, these infringement contentions are illustrative rather than exhaustive and they are representative of, and apply to, all Accused Products based on the fact that all the Accused Products infringe in the same general way.

A method executed by one or more electronic devices, the method comprising:

- The Accused Products include one or more electronic devices capable of performing the patented method.
- By way of example, the Quest 2 provides all-in-one virtual reality (VR) through its headset and hand-held controllers. These electronic devices perform the claimed method.



Source: <https://store.facebook.com/quest/products/quest-2/>



Source: <https://store.facebook.com/quest/products/quest-2/tech-specs/#tech-specs>

¹By charting the preamble, we do not concede that the preamble is a limitation and reserve the right to contend that the preamble is not a limitation of the claim.

storing head-related transfer functions (HRTFs) in memory;

- Defendants' public literature confirms the Accused Products utilize HRTFs to localize sound and create 3D Audio spatialization.

3D Audio Spatialization

An essential element of VR audio is spatialization: the ability to play a sound as if it is positioned at a specific point in three-dimensional space. Spatial audio is essential to deliver an immersive experience because it provides powerful cues that make the user feel they are actually in the 3D environment.

The Audio Localization page discussed how humans localize audio sources in three dimensions, we will now explore methods to synthesize those localization cues, to produce spatial audio.

The two key components to spatialization are direction and distance, in this guide we'll cover both of these topics, and the technologies which enable them.

Directional Spatialization with Head-Related Transfer Functions (HRTFs)

The sounds we experience are directly impacted by the shape and geometry of our body (especially our ear), as well as direction of the incoming sound. These two elements: our body + the direction of the audio source, form the basis of HRTFs which are filters we use to localize sound.

Applying HRTFs

Given an HRTF set, if we know the direction we want a sound to appear to come from, we can select an appropriate HRTF and apply it to the sound. This is usually done either in the form of a time-domain convolution or a frequency domain convolution using FFT. If you don't know what these are, don't worry - those details are only relevant if you are implementing the HRTF system yourself. Our discussion glosses over a lot of the implementation details (e.g., how we store an HRTF, how we use it when processing a sound). For our purposes, what matters is the high-level concept: we are simply filtering an audio signal to make it sound like it's coming from a specific direction.

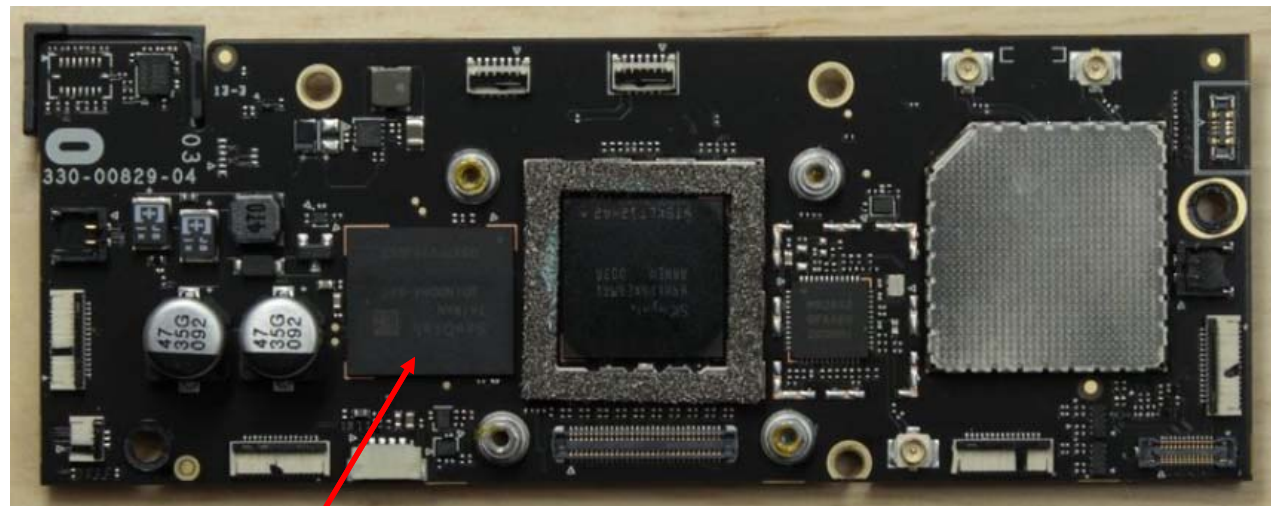
Since HRTFs take the listener's head geometry into account, it is important to use headphones when performing spatialization. Without headphones, you are effectively applying two HRTFs: the simulated one, and the actual HRTF caused by the geometry of your body.

Source: <https://developer.oculus.com/resources/audio-intro-spatialization/>

Claim 14, Element (A) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

storing head-related transfer functions (HRTFs) in memory;

- The Accused Product store head-related transfer functions.
- The Accused Products store HRTFs in their headsets.
- By way of example, the Quest 2 has a control board with a SanDisk SDINDDH4-64G flash storage memory for storing, among other things, HRTFs.



Source:

<https://www.ifixit.com/Guide/Oculus+Quest+2+Disassembly/139759>



Source: <https://guide-images.cdn.ifixit.com/igi/CjSJdC2aPnZfBKcK.huge>

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displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

- The Accused Products include a headset, which is a wearable electronic device (WED) worn on the head of a user, with a display.
- The headset/WED displays a virtual image in an environment.
- By way of example only, a virtual image in an environment is shown to the right. This image is taken from a video depicting the user experience with the “Bogo” application.



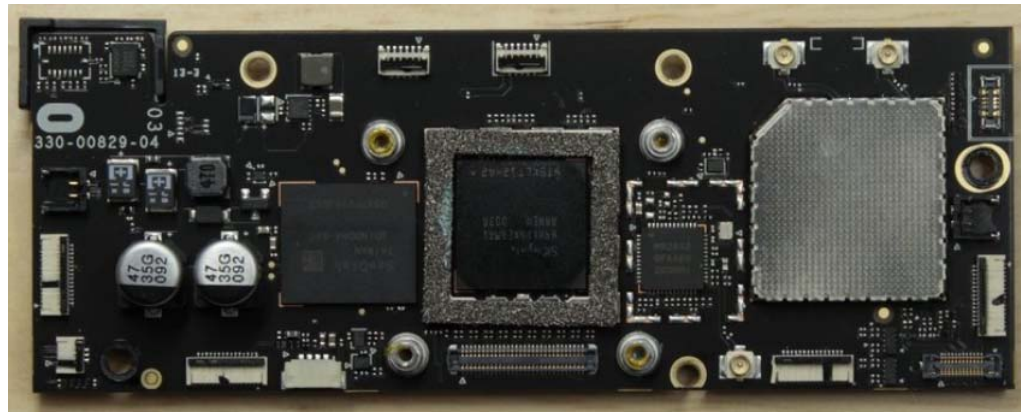
Source: <https://www.youtube.com/watch?v=sKDXksl7S6o> at 13:53

Claim 14, Element (B) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

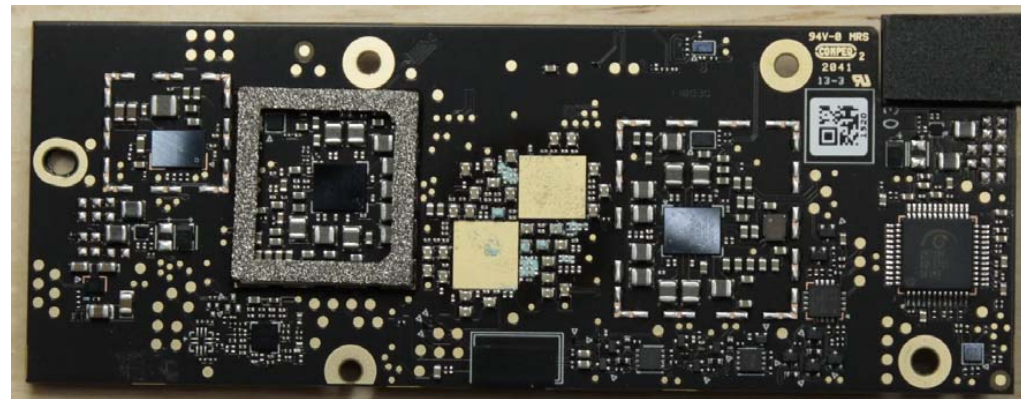
Claim: 14 – Element (C)

processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

- The Accused Products process sound using an DSP.
- By way of example, the Quest 2 includes a Qualcomm Snapdragon processor that processes the Accused Products' spatial audio, including the binaural sound that externally localizes in empty space to the user. See also <https://www.youtube.com/watch?v=VehZkzX4EcE&t=198s>
- By way of further example, the Accused Products include an integrated DSP chip. The screenshot on the right shows a CM7104 chip as a component within the Quest 2.



Source: <https://www.ifixit.com/Guide/Oculus+Quest+2+Disassembly/139759>



Source: <https://www.ifixit.com/Guide/Oculus+Quest+2+Disassembly/139759>

INTRODUCTION

CM7104 is a powerful 310MHz audio DSP with low power consumption. CM7104 DSP supports Cmedia Xear™ Surround Headphone, Dynamic Bass and parametric 10 bands equalizer for gaming solutions. It integrates 768KByte internal memory, I2C, SPI and 2-pair 24bit/8kHz~192kHz I2S digital I/O interface. It also integrates high-quality audio codec for audio playback and recording. CM7104 is a high performance and low power consumption for gaming applications.

Source: https://www.cmedia.com.tw/products/AUDIO_PROCESSOR/CM7104

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processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

- The Accused Products process, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment.
- Binaural sound is generated in the WED via a DSP that localizes to the user in empty space from the virtual image in the environment.

3D Audio Spatialization

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Applying HRTFs

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Source: <https://developer.oculus.com/resources/audio-intro-spatialization/>

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Claim: 14 – Element (C)

processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

- By way of example only, the video to the right shows the virtual environment, including a virtual image of a game character.
- As shown in the video, the Accused Products generate binaural sound that externally localizes to the user at the virtual image.
- Specifically, binaural sound is provided to the user such that the sound is externally localized as originating from the location of the game character.



Source: <https://www.youtube.com/watch?v=sKDXksl7S6o> at 7:04 and 7:37

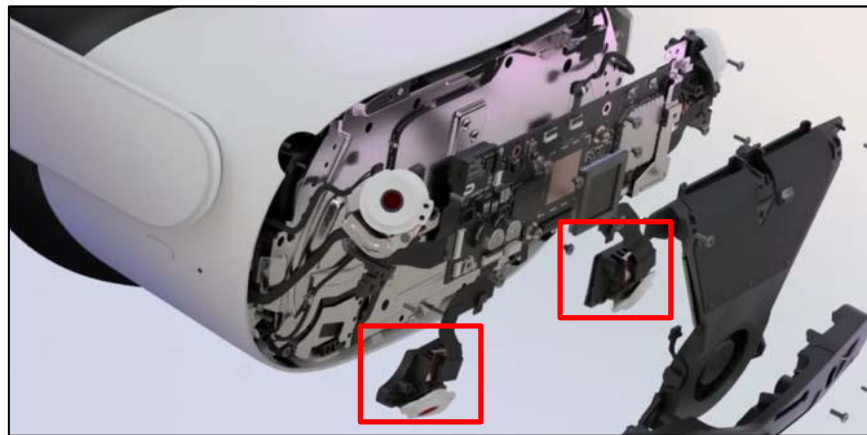
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determining, with the WED, when the user is leaving the environment; and

- The Accused Products, with the WED, determine when the user is leaving the environment.
- By way of example, the Quest 2 WED contains at least two infrared cameras that can detect infrared light emitted from the ring on each hand-held controller (PED), and this detection helps track the motion of the PED, including with the PED (and thus the user) is leaving the zone.



Source: <https://www.youtube.com/watch?v=GojevL05Avw> at 1:48 and 2:07



Source: <https://www.oculus.com/quest-2/>

Claim 14, Element (D) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

Claim: 14 – Element (E)

alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user.

- The Accused Products include speakers for audio playback.
- The Accused Products alert the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user.
- By way of example, the video to the right illustrates that when the user backs too far away from the virtual image of the game character and is therefore leaving the environment, the Accused Products alert the user by reducing the volume of the binaural sound.

SOUND

Positional Audio

3D positional audio is built directly into the headset, allowing you to hear what's all around you. The 3.5 mm audio port lets you play with or without headphones.

Source: <https://store.facebook.com/quest/products/quest-2/tech-specs/#tech-specs>



Source: <https://www.youtube.com/watch?v=sKDXksI7S6o> at 13:55

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