

Spatial Audio Dynamic Head Tracking with Ultrasonics

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GH Solution & Technology

Ultrasonic emitter &
Receiver/MIC to determine
distance, and motion.

Ultrasonic
emitter



Embed with ultrasonic emitters, the specified signals have presented the distance and motion.

Receiver/MIC



The smartphone mic will receive the sound intensity and frequency as the IMU data.

Determination &
EQ Response



Use the algorithm to identify dynamic head motion tracking, and adjust the EQ in differential ears to mimic the real-world sounds



Demand

- Realistic Experiences
- Recommendation system

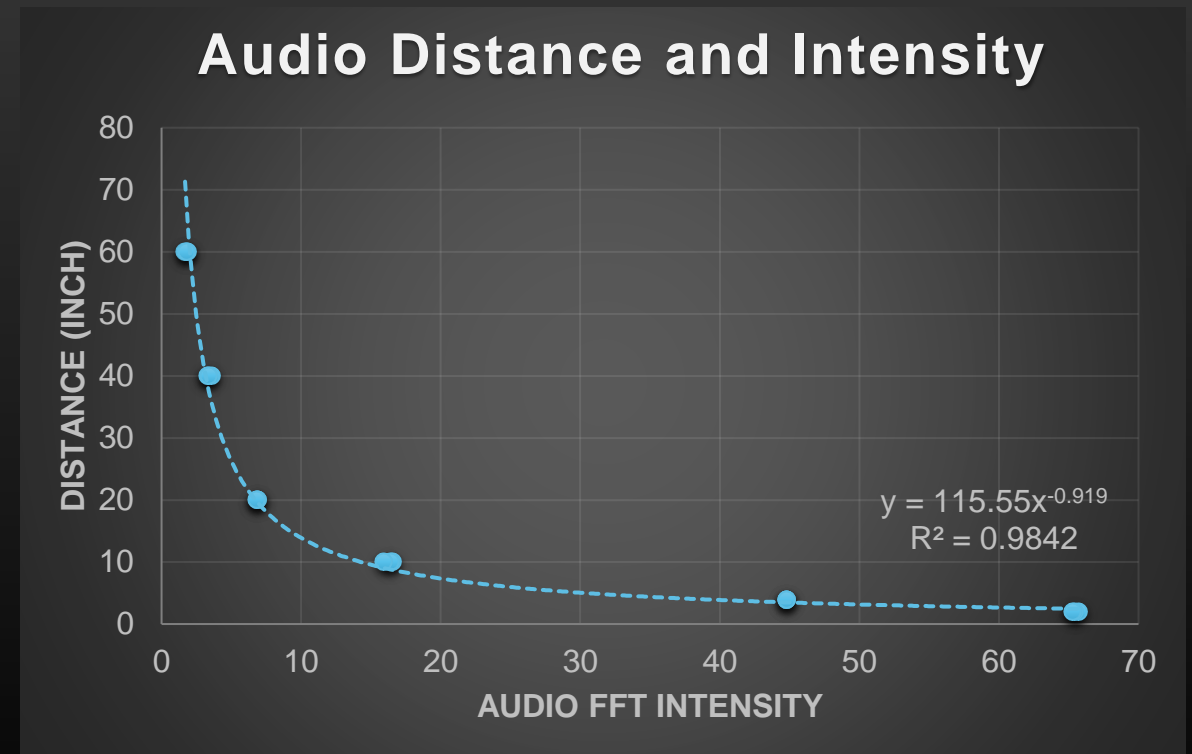
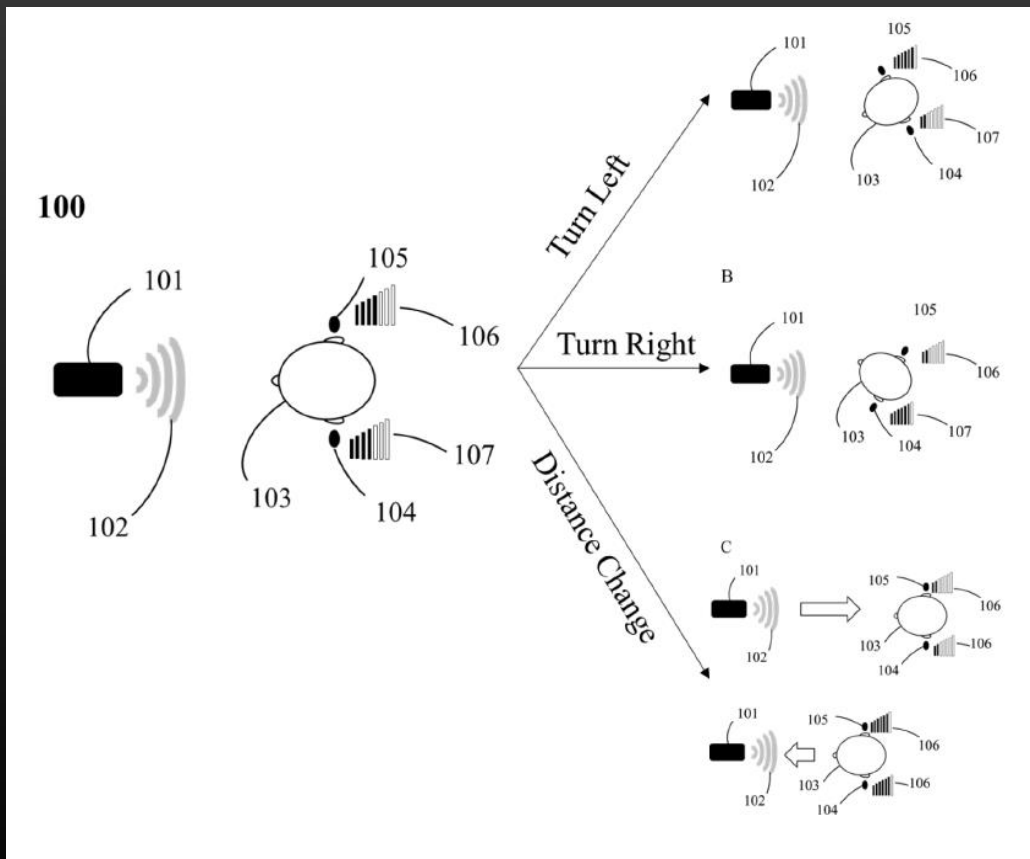
People like to have the better opinions to select, more realistic media entertainments in vision and auditory, even more.

Now, you can just have a new ultrasonic headphone with dynamic head tracking system.

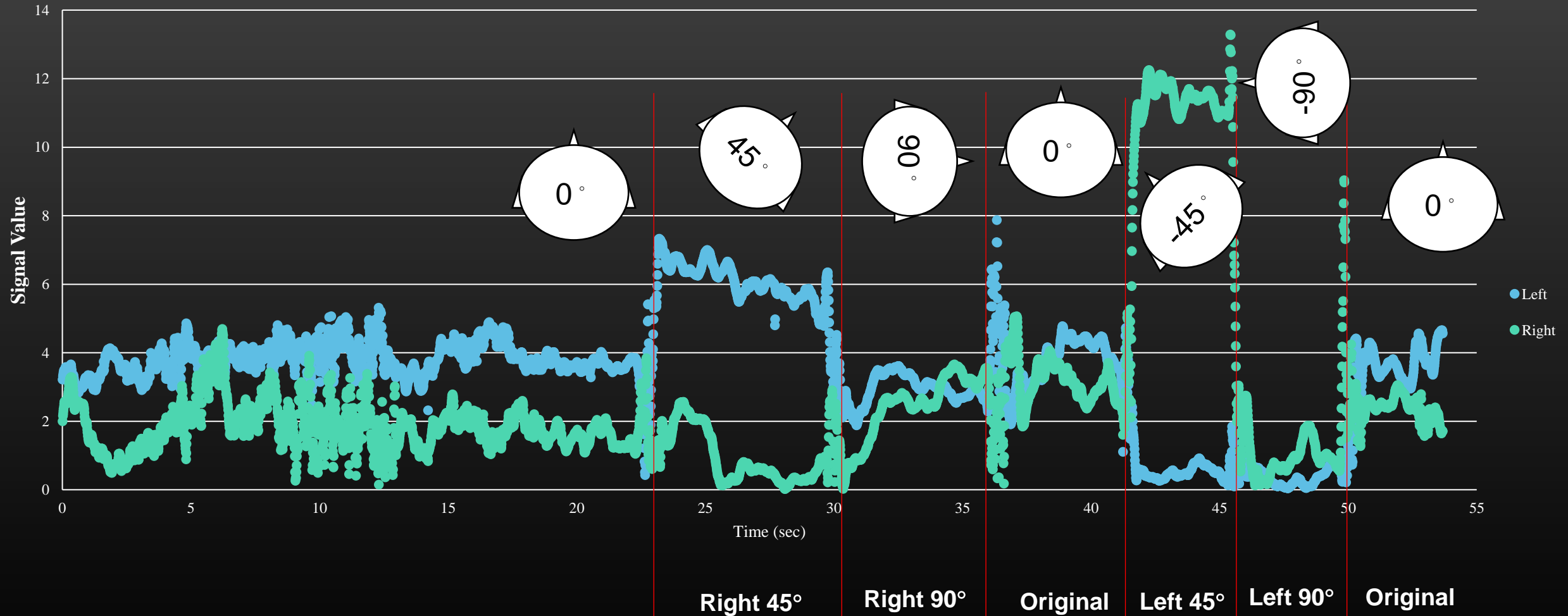


Solution & Technology

Ultrasonic emitter & Receiver/MIC to determine distance, and motion.



SNR of Dynamic Head Tracking



Current Speaker/Headphone

Audio Simulation

- 1st Generation: Audio play by stereo, subwoofer, even multiple channels, such as 2.1 channels, 5.1 channels, or 9.1 channels.
- 2nd Generation: Software that emulates stereo, such as Dolby Atmos, DTS Sound Unbound, etc.
- 3rd Generation: Dynamic Head Tracking to adjust volume, only Apple Gyro/accelerator Spatial Audio patents.



There is **NO** Android, Windows, or Linux version to provide dynamic head tracking function in headphones with Spatial Audio.

Spatial Audio Comparison

Company	Core Tech	Advantage	Limitation
Apple	Using gyroscope and accelerometer to determine dynamic head tracking and transfer head motion by Bluetooth protocol.	Apple System Support. ✓ OS: iOS 15 later, ✓ Hardware: AirPods Pro, AirPods 3, ✓ AirPods Max, and Beats Fit Pro.	Apple Core Patent: US 11, 102,578 B1 Patent exclusive in Apple ecosystem
Genius	Using ultrasonics to provide distance and motion by determining the change of the intensity and frequencies.	Use SDK/API to support any OS, save Bluetooth transmission capacity, cost-effective, etc.	App or software installation necessary.

Recommendation System

Application

E-commerce, advertise, entertainment service (OTT and streaming), search engine, etc.

Current solution

- Software: Keywords, photo, eye tracking, analysis with AI
- Gyroscope and accelerator to determine motion
- Combination analysis with personal profiles, and timepoints

NETFLIX

Apple tv+



Dynamic head tracking is not just provided spatial audio guiding but also relates to the users' attention, feelings, and favor.



Recommendation System and Spatial Audio

01 Dynamic Head Tracking

Dynamic head tracking is not just provided spatial audio guiding but also relates to the users' attention and favor.

02 User Action Analysis

Within headphones, it could provide more detailed content analysis than smartphones especially when users see the video, etc.

Market Leader- Sales of AirPods

Year	Sales	Products
2017	15 million	AirPods 1st
2018	35 million	AirPods 1st
2019	60 million	AirPods 1st , 2nd, Pro
2020	114 million	AirPods 2nd, Pro, Max
2021	85 million	AirPods 2nd, 3rd Pro, Max

No ANC No Spatial Audio

- AirPods 1st: 20 Dec 2016
- AirPods 2nd: 20 Mar 2019

Spatial Audio Version

- AirPods Pro: 20 Oct 2019 (ANC)
- AirPods Max: 15 Dec 2020 (ANC)
- AirPods 3rd: 18 Oct 2021

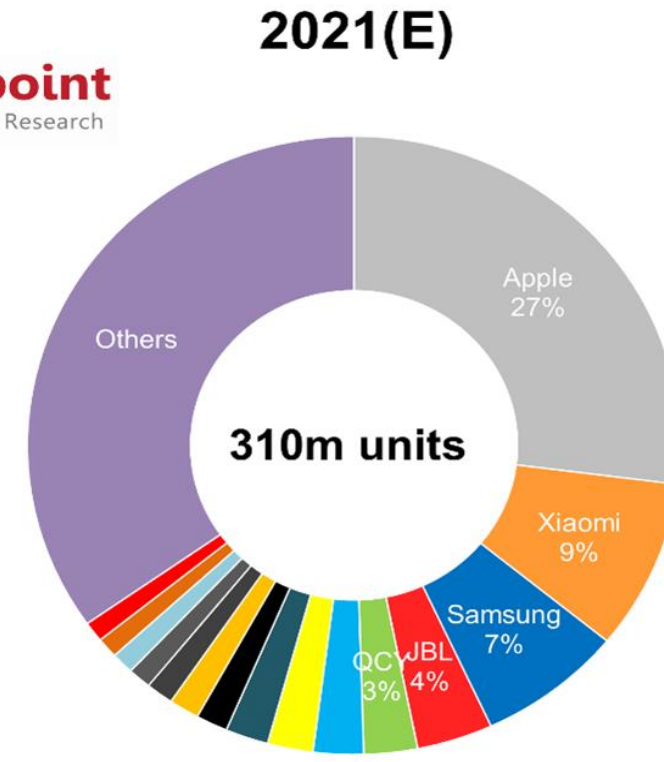
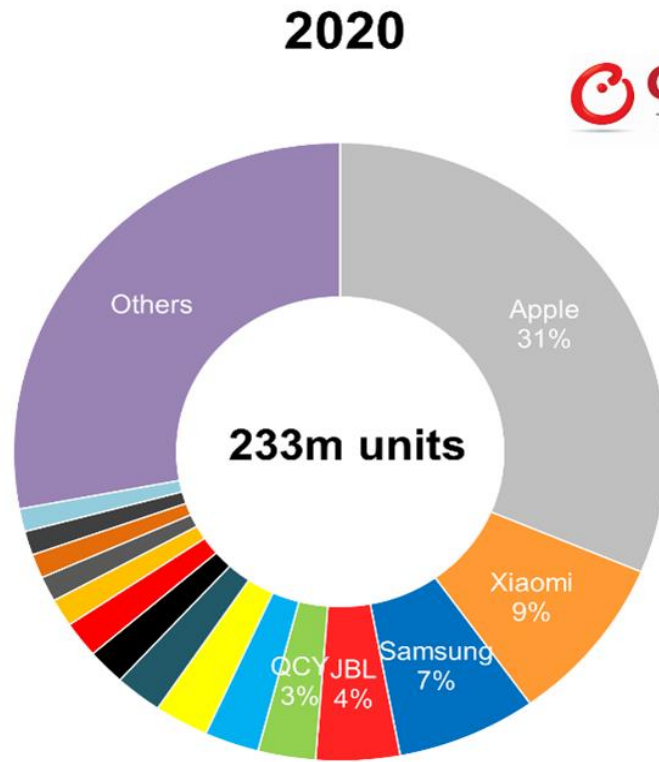
<https://www.businessofapps.com/data/apple-statistics/>

Sources: Counterpoint Research, TF International Securities, Strategy Analytics

Global TWS Markets by Brand

Spatial Audio is the most big thing of AirPods and Beats

(Beats Fit Pro launch on 24 January 2022)



Appendix

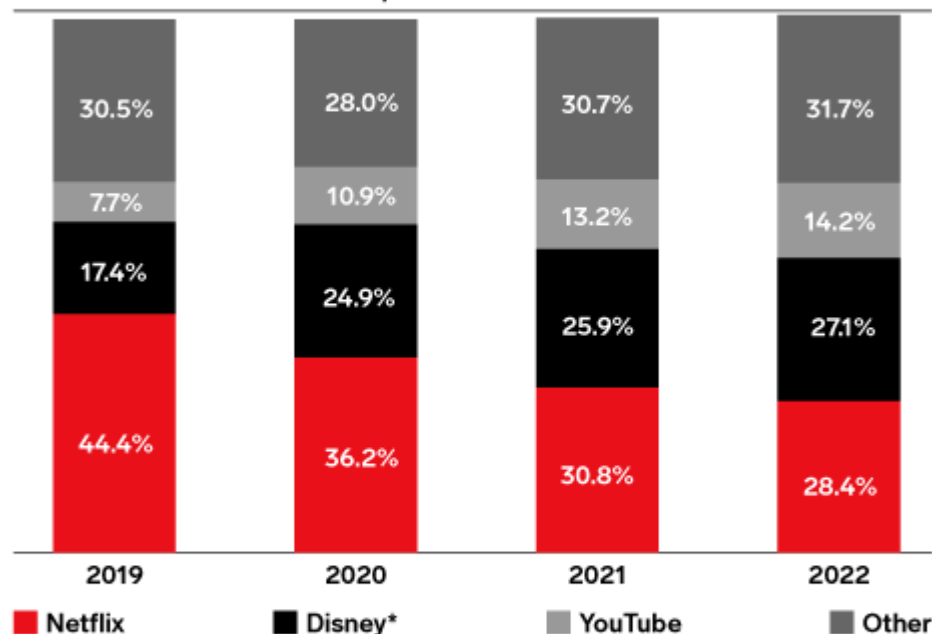
TWS (true wireless stereo) Function

- Voice play
- Low latency
- Low power consumption
- Quick connect
- Voice play quality (normal, HiFi 44.1kHz, Hi-Res 48 kHz, etc)
- Voice record quality
- ANC (25~40 dB)
- Spatial Audio (current only gyroscope/accelerator, Apple owns the application patents)

OTT and Video Streaming

US OTT Video Subscription Revenue Share, by Company, 2019-2022

% of total OTT subscription revenues



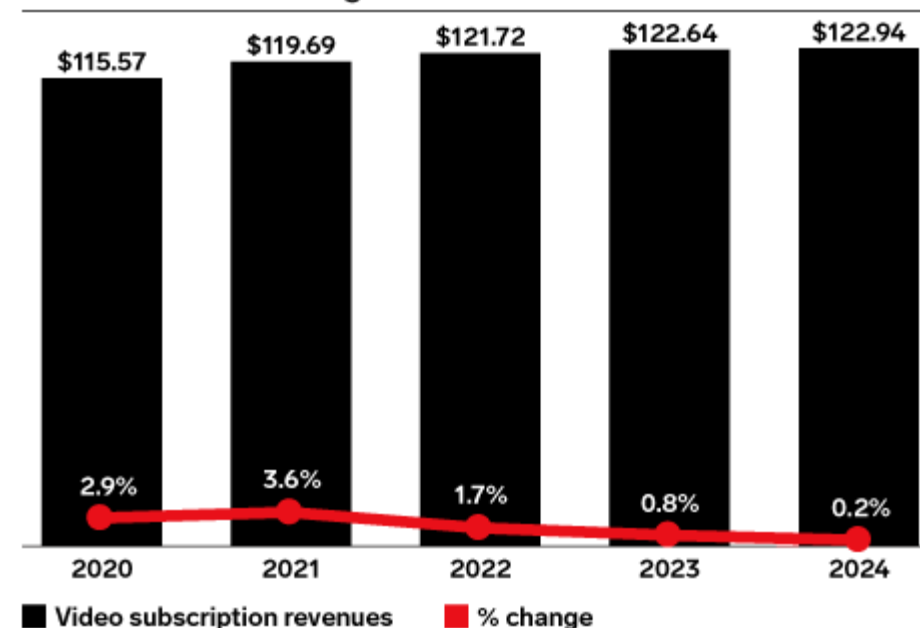
Note: includes revenues from regularly recurring fees for access to OTT video services charged either directly to consumers or via a third party on a consumer's behalf; third parties can include mobile carriers, pay TV providers, or electronics manufacturers; excludes revenues from advertising, pay-per-view, or other nonrecurring revenue streams; *includes subscription revenues for Disney+, ESPN+, and Hulu
Source: eMarketer, Dec 2020

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eMarketer | InsiderIntelligence.com

US Video Subscription Revenues, 2020-2024

billions and % change



Note: includes revenues from regularly recurring fees for access to video services charged either directly to consumers or via a third party on a consumer's behalf; third parties can include mobile carriers, pay TV providers, or electronics manufacturers; includes revenues from subscriptions to OTT or pay TV services; excludes revenues from advertising, pay-per-view, or other nonrecurring revenue streams; excludes subscription revenues from Amazon Prime
Source: eMarketer, Dec 2020

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<https://www.emarketer.com/content/netflix-receives-most-ott-subscription-revenues>

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