Qudelix-5K

User Guide

JULY 2021

Key Specification

- **Bluetooth 5.0**
  - Class 2 (2.5mW 4dBm) up to 10m
  - 2.4GHz
- **Qualcomm QCC5124 Bluetooth Chipset**
- **Dual ES9218P SABRE HiFi® DAC**
  - 3.5mm output works with single DAC only.
  - Dual DAC is available with 2.5mm output.
- **High Precision MEMS Audio Clock**
- **aptX Adaptive, LDAC, AAC, aptX-HD, aptX, SBC**
- **High-Resolution USB DAC 96KHz / 24-bit**
  - USB Audio Class 1.0
  - Windows/MacOS/Linux (No Device Driver)
  - Android Device through C-to-C or OTG cable
- **10-band Double Precision GEQ/PEQ**
- **High Sensitivity 3-D LDS (Laser Direct Structuring) Antenna**
  - Bluetooth Range more than 10 meters
- **Qualcomm® cVc™ noise cancellation technology**
- **High Sensitivity MEMS Microphone**
- **Four Multi-functional Buttons & Two LEDs**
- **Over-the-Air firmware update**
- **Material**
  - Plastic Body (Black) with anti-scratch UV Coating
  - Aluminium Clip (Dark Gray)
- **52.8 x 26.7 x 15.6mm (including Clip)**
- **26 grams**

Key Specification

- **Output Power**
  - 3.5mm 80mW per channel
  - 2.5mm 240mW per channel

- **SNR (A-weighted)**
  - 3.5mm -118dB
  - 2.5mm -122dB

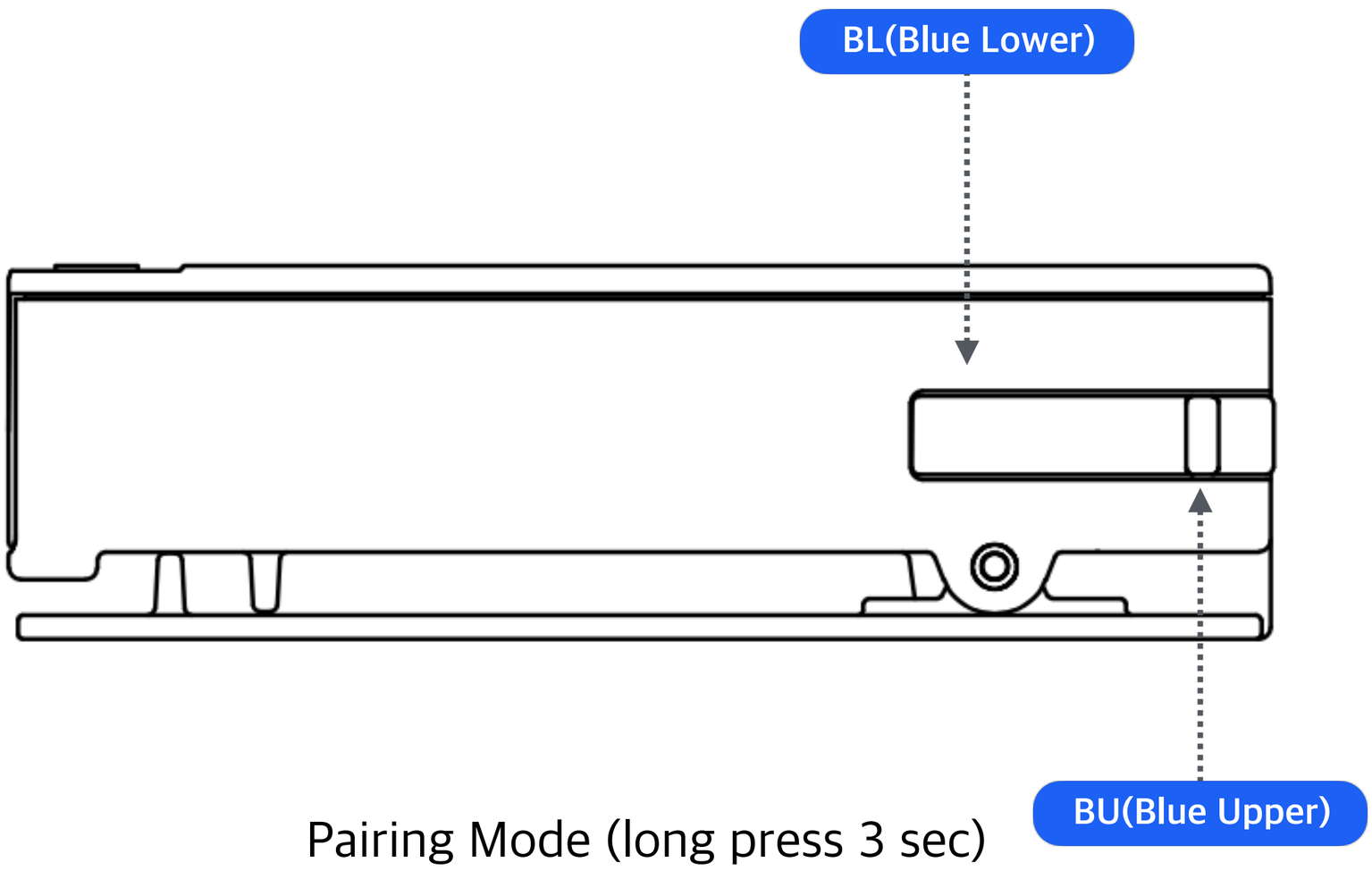
- **THD+N**
  - 3.5mm 0.004%
  - 2.5mm 0.002%

- **Separation**
  - 3.5mm 79dB
  - 2.5mm 117dB (1KHz/32-ohm)

- Output Impedance
  - Less than 1-ohm

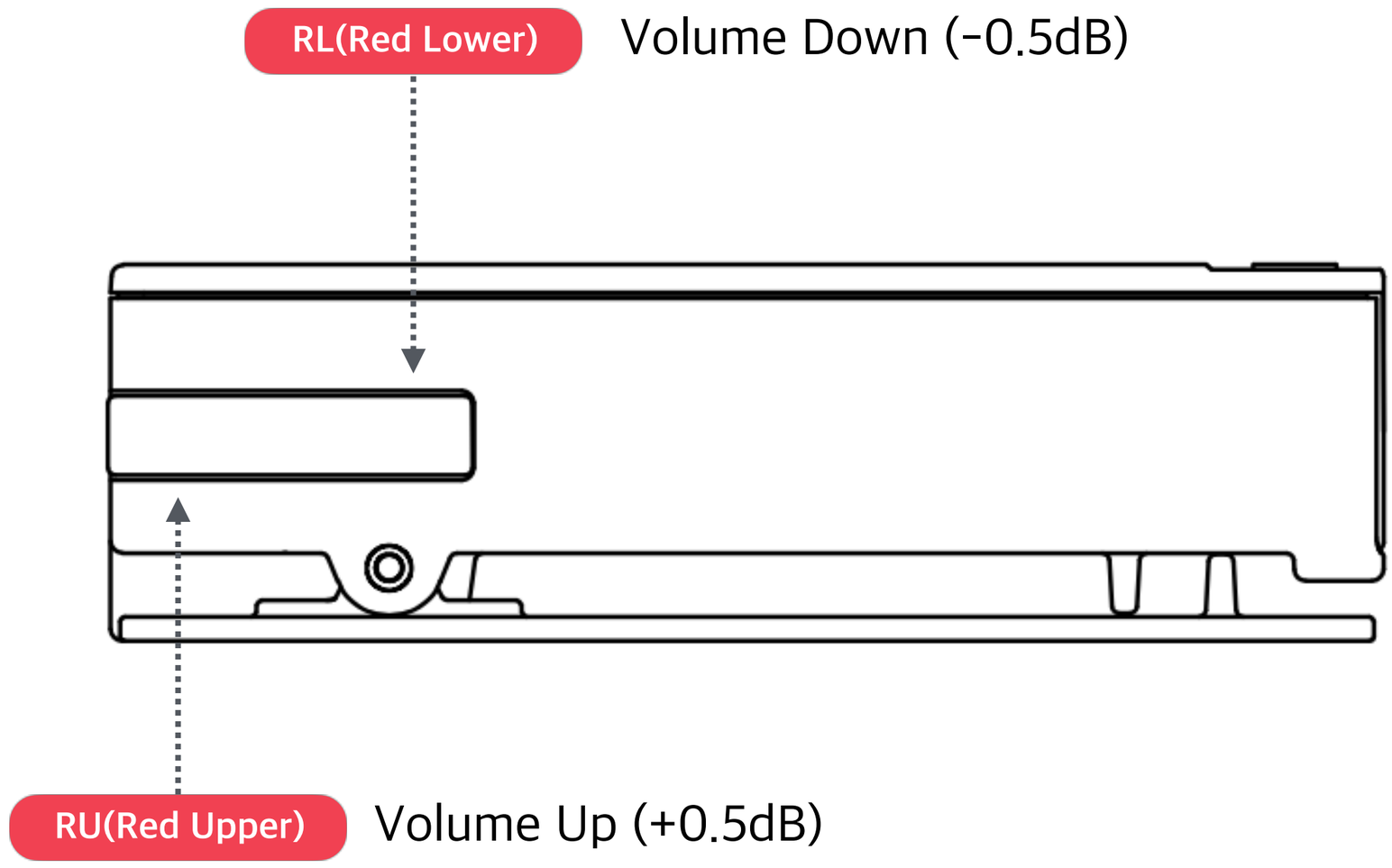
Buttons (with BLUE LED)

Power On/Off (long press 3 sec)
Previous Tack (Double Click)



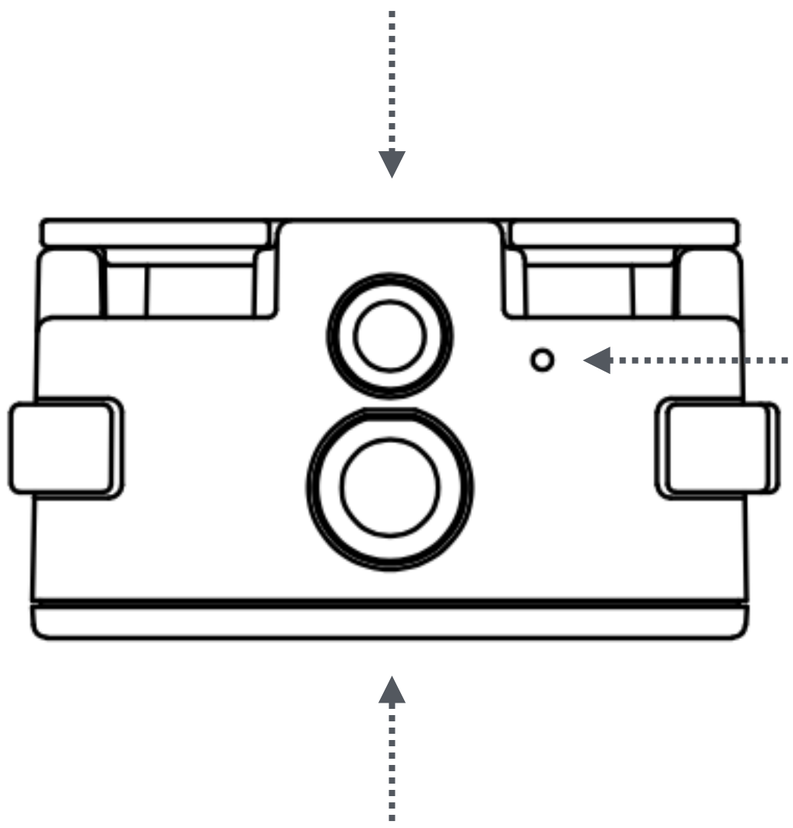
Pairing Mode (long press 3 sec)
Play/Pause (Single Click)
Next Track (Double Click)
Answer Incoming Call (Single Click)

Buttons (with RED LED)



Audio Output & Microphone

2.5mm Balanced Audio Output
Max. 4V RMS (240mWatt/Ch)



3.5mm Unbalanced Audio Output
Max. 2V RMS (80mWatt/Ch)

Pairing with Android

1. Power On 5K

- Press BL(Blue Lower) button for more than 3 sec.

2. Enter Pairing Mode

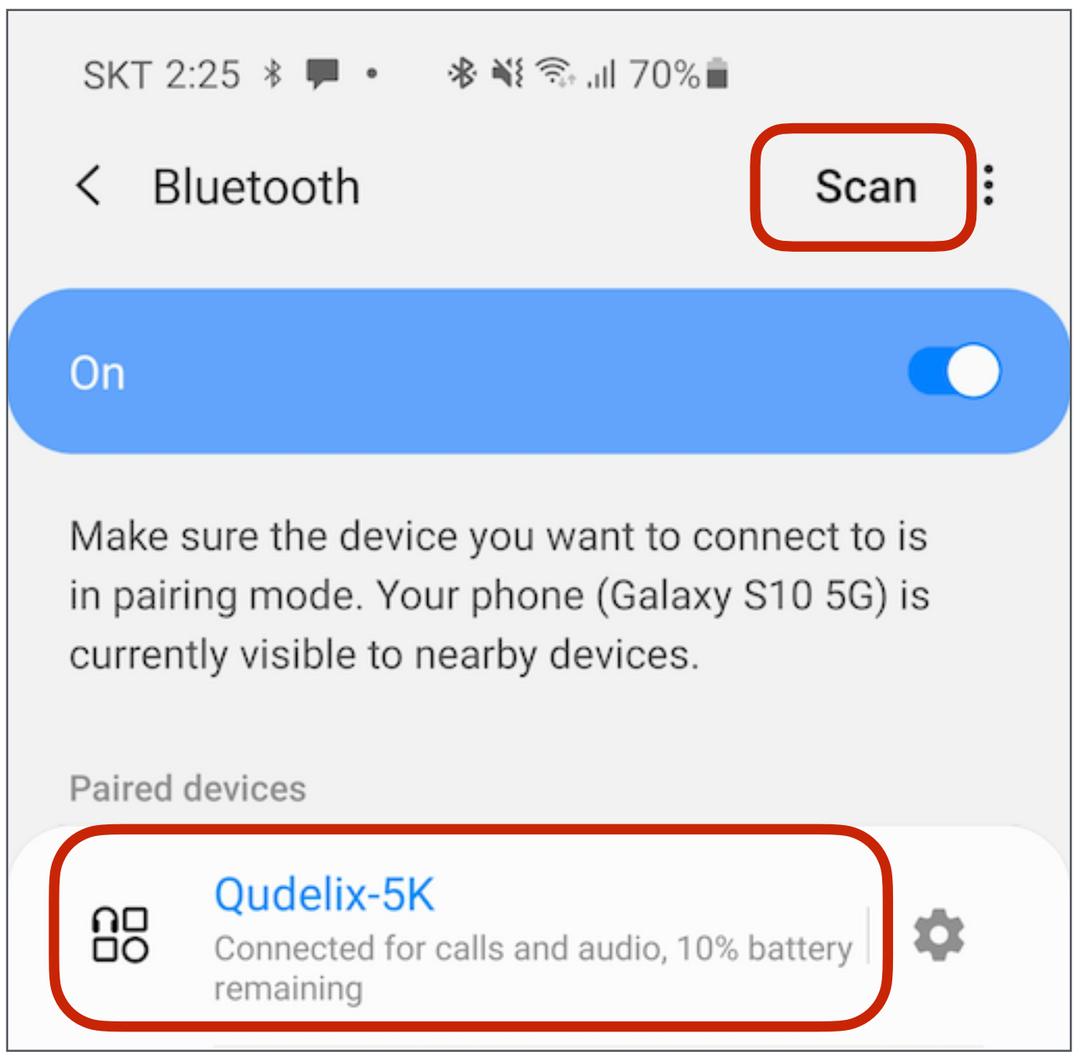
- Press BU(Blue Upper) button for more than 3 sec.
- Red, Blue LED blink when pairing mode.

3. Go to your Android Bluetooth menu

- Scan Bluetooth devices.
- Select Qudelix-5K in the Available devices list.

4. Paired

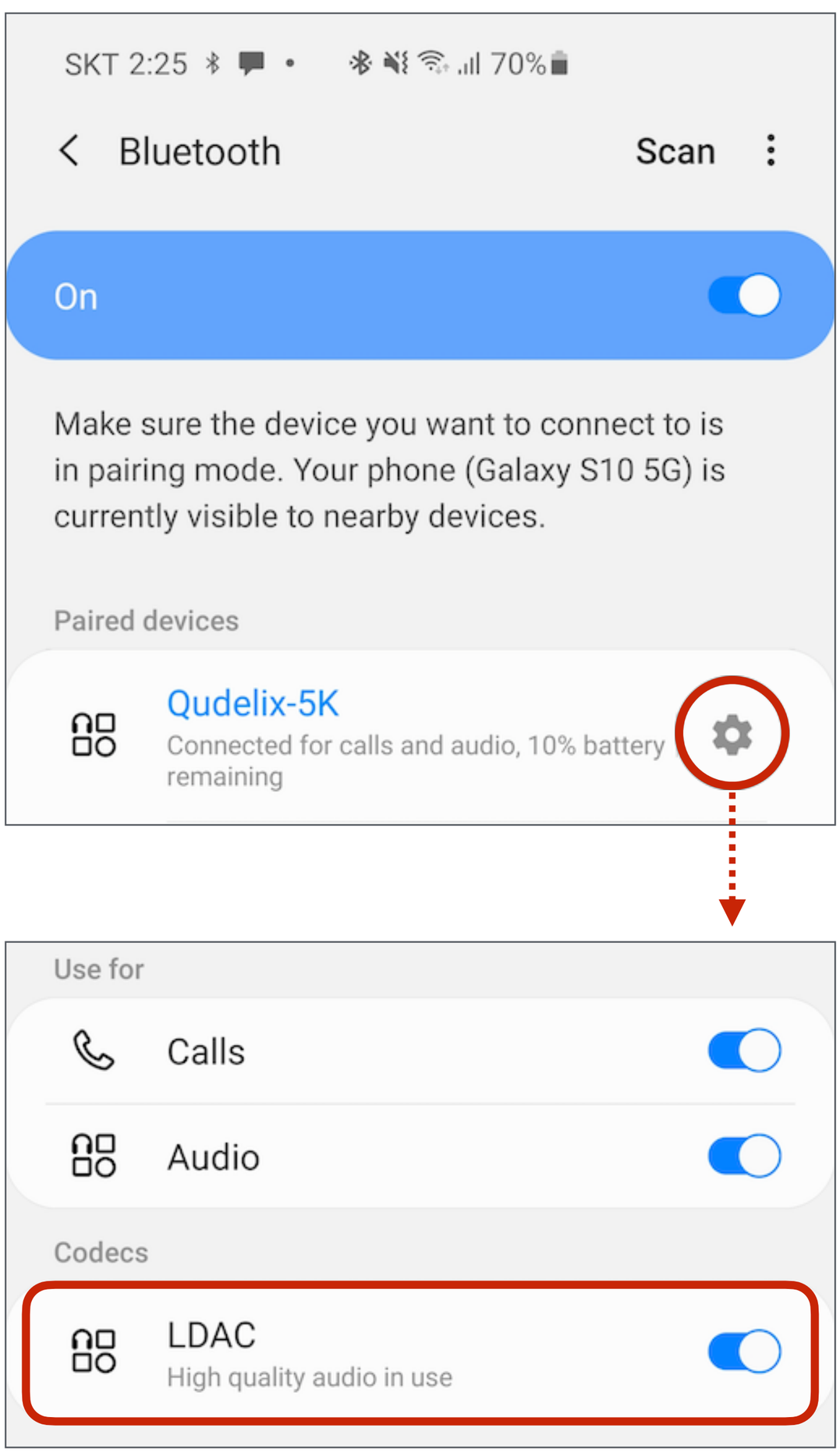
- Once paired successfully, you will see Qudelix-5K in the Paired devices list.



Android - LDAC

- Android 8.0 or higher supports **SONY LDAC**, a high-quality audio codec.

- After pairing the device with an Android smartphone, please enable LDAC in the Android Bluetooth menu.
  - Go to Paired devices list
  - Select option button for Qudelix-5K



***Enable Sony LDAC after pairing**

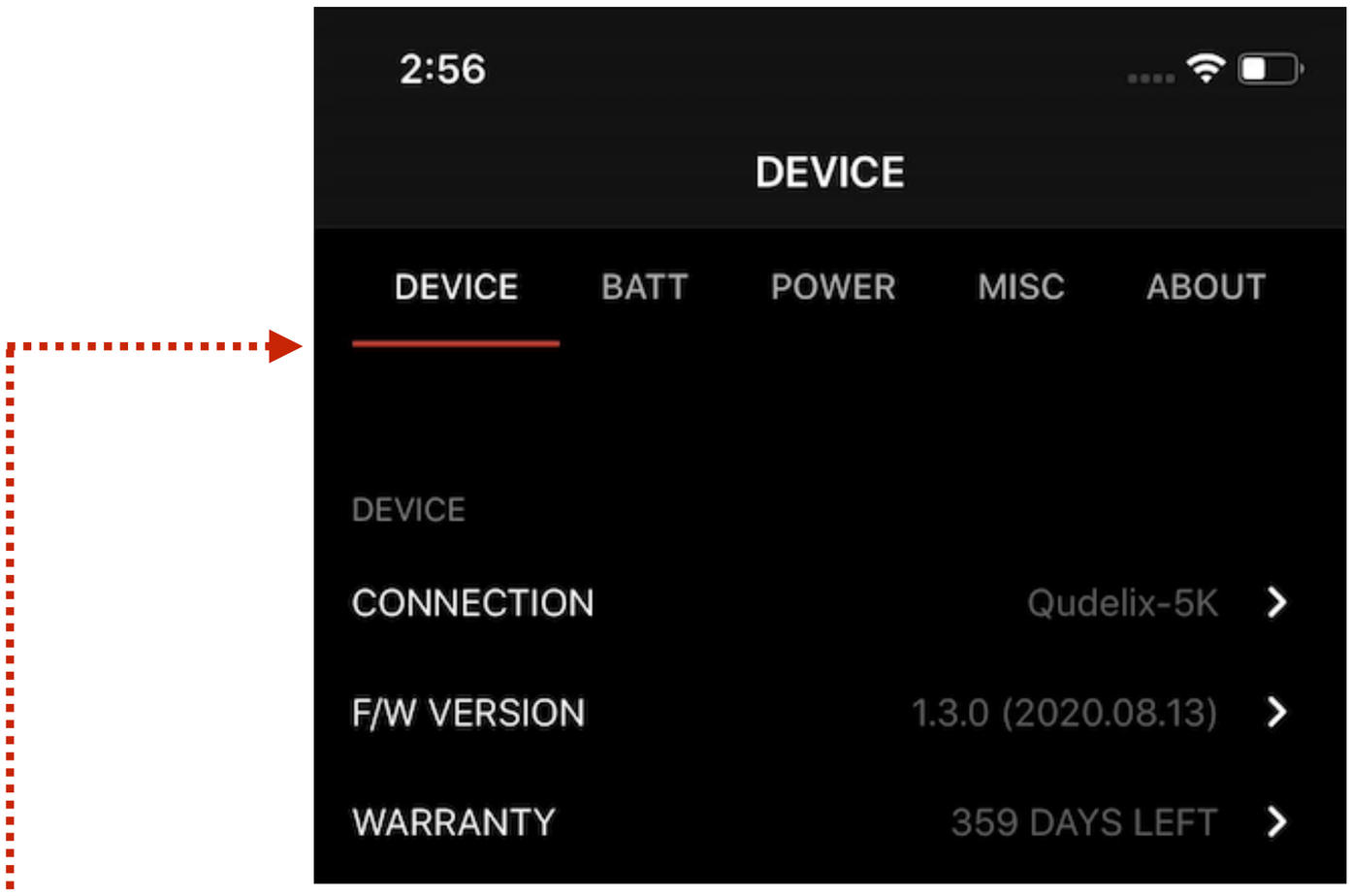
Mobile App - Android

- Install Android Mobile App (requires Android 8.0 or higher)
  - https://play.google.com/store/apps/details?id=com.qudelix.qudelix&hl=en_US

- The Qudelix App has nothing to do with Bluetooth Audio Streaming. You can get audio streaming over Bluetooth without Qudelix App. However, we strongly recommend installing and using the app to experience the feature-rich nature of Qudelix-5K fully.

- 5K allows the APP connection with **one device at a time.**

- Android App uses the BR/EDR link. So, Android requires the 5K device paired to the system before making the app connection.



*The Red Bar indicates the app is connected to the device, gray otherwise.

Pairing with iOS

1. Power On 5K

- Press BL(Blue Lower) button for more than 3 sec.

2. Enter Pairing Mode

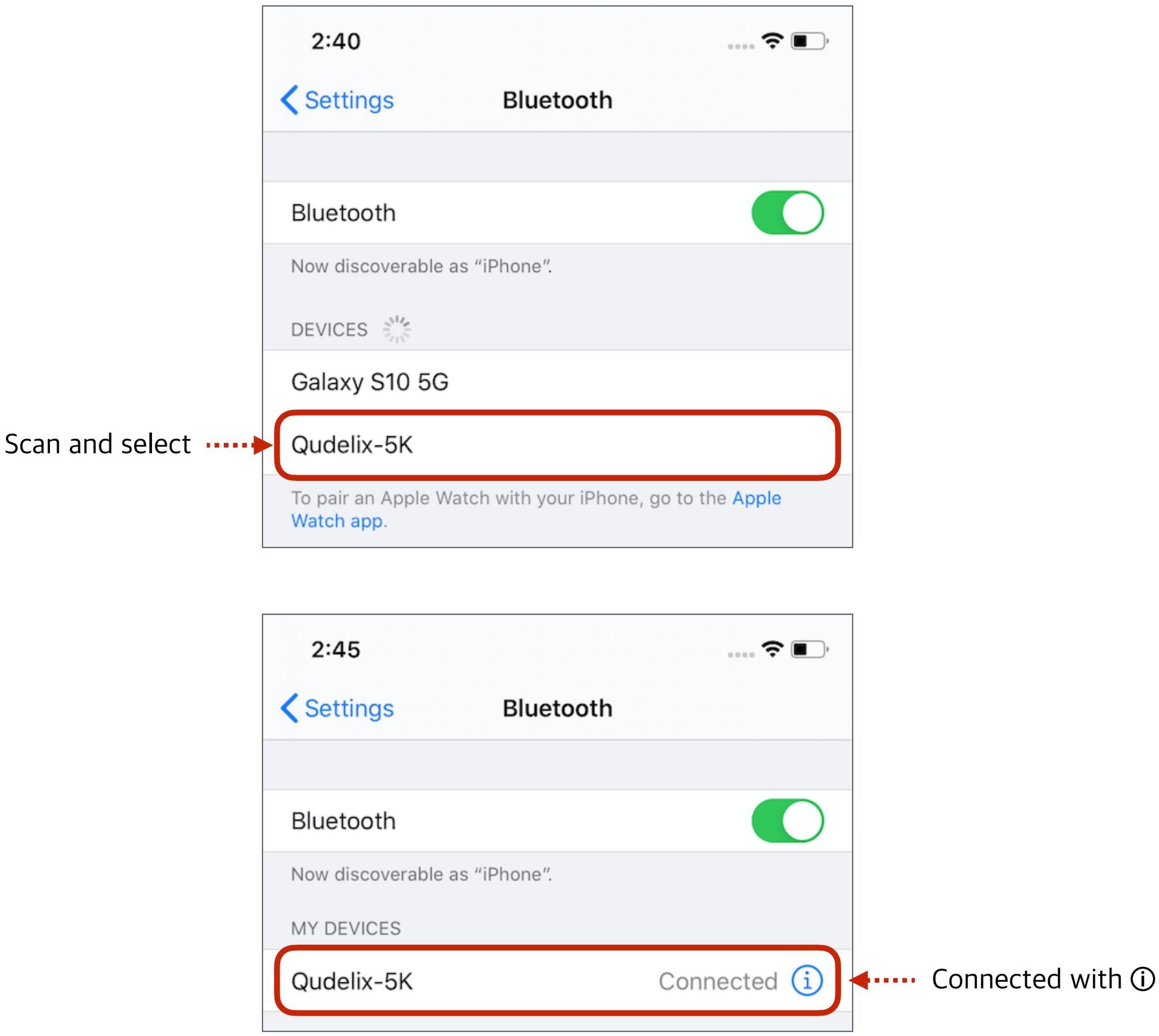
- Press BU(Blue Upper) button for more than 3 sec.
- Red, Blue LED blink when pairing mode.

3. Go to your iOS Bluetooth menu

- Scan Bluetooth devices.
- Select Qudelix-5K in the Available devices list.

4. Paired

- Once paired successfully, you will see **Qudelix-5K Connected** ⓘ in the MY DEVICES list.



Qudelix 5K Bluetooth Audio Connection

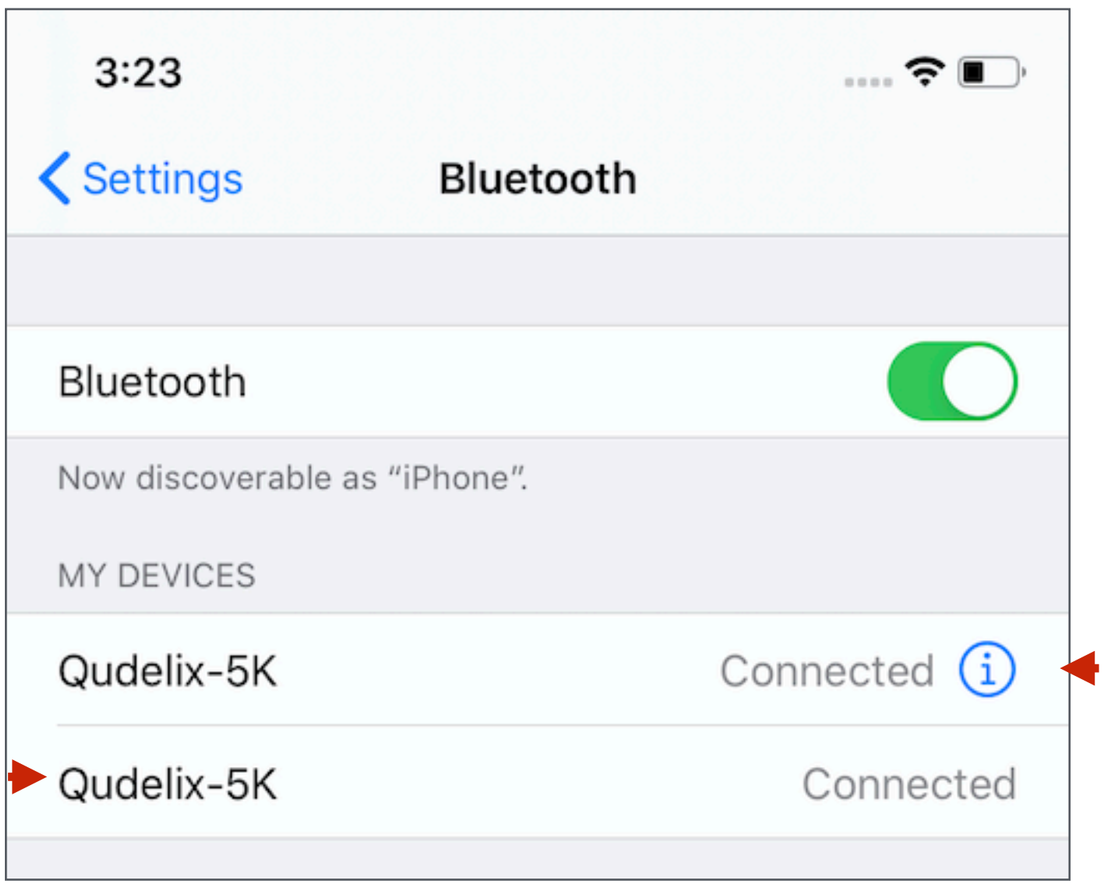
Mobile App - iOS

- Install iOS Mobile App
  - https://apps.apple.com/kr/app/qudelix/id1515641059?l=en

- The Qudelix App has nothing to do with Bluetooth Audio Streaming. You can get audio streaming over Bluetooth without Qudelix App. However, we strongly recommend installing and using the app to experience the feature-rich nature of Qudelix-5K fully.

- 5K allows the APP connection with **one device at a time.**

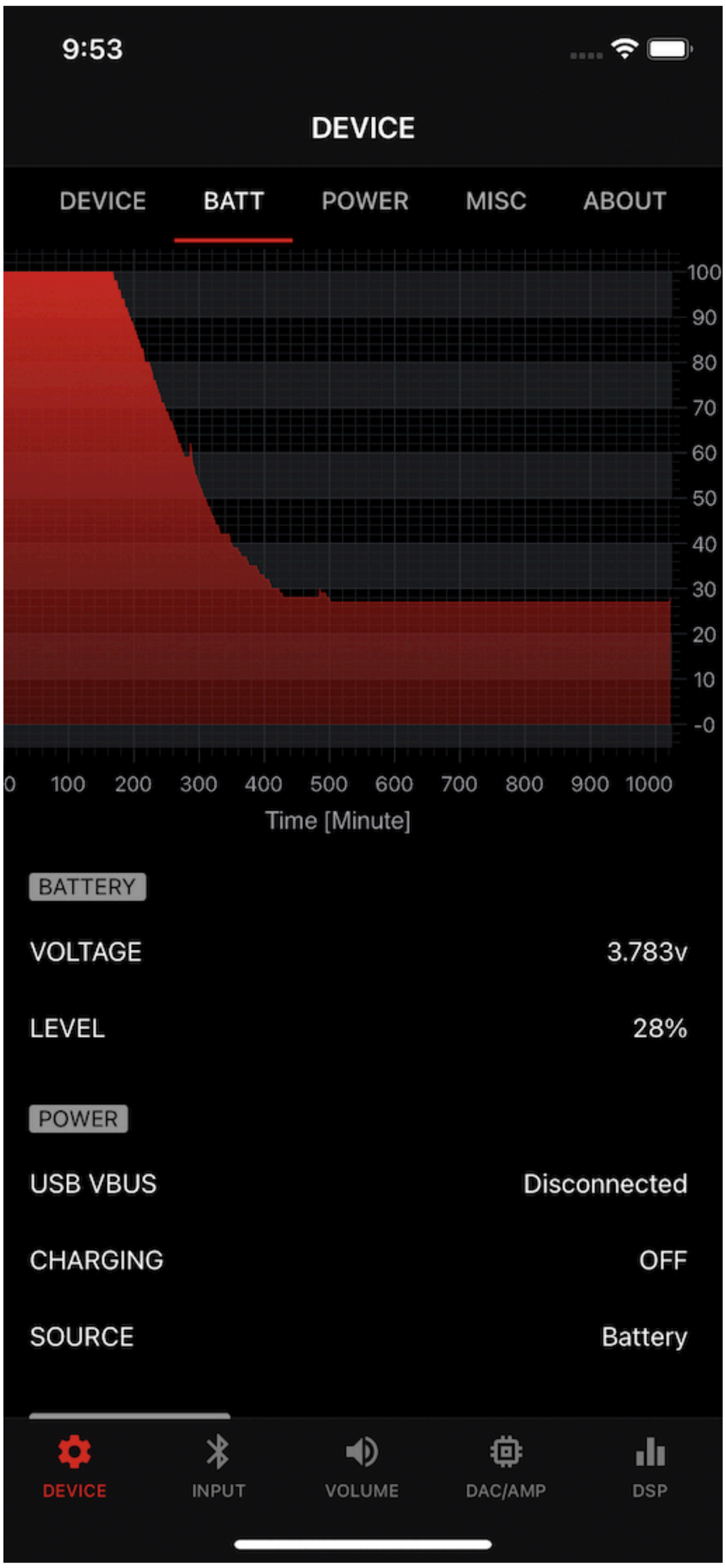
- iOS App uses the BLE(Bluetooth Low Energy) link.
  - So, you will see **Qudelix-5K Connected without** ⓘ when the app is connected.

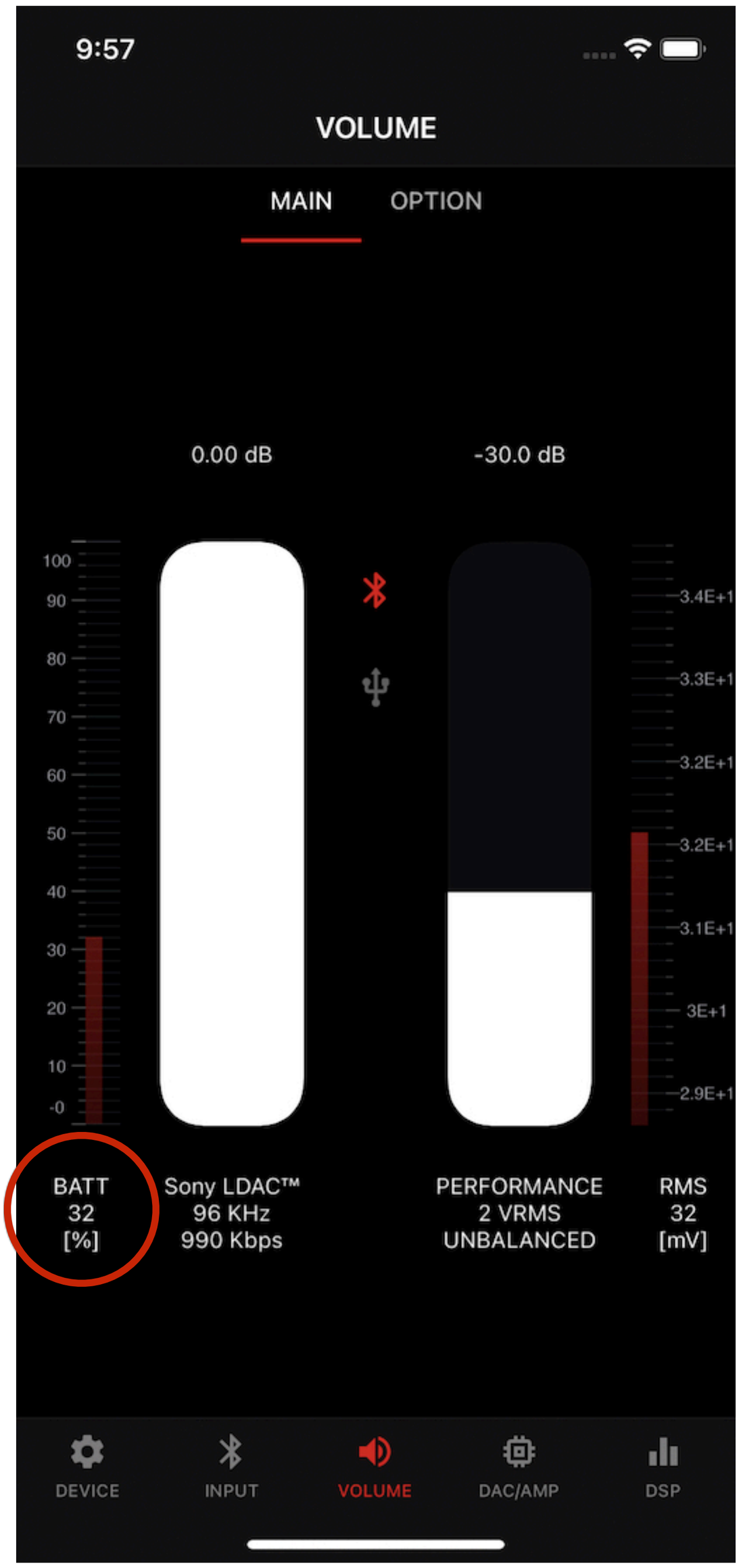


Battery

- The app displays the current battery and charger status.
  - Battery Log Graph
  - Instantaneous battery level
- The battery voltage is just for reference.

- **Use a standard 5V charger or PC USB only. (Do NOT use a high-speed charger)**
  - The 5K built-in charger will limit the maximum charging current to 200mA.
  - 500mA Battery / 2H 30MIN charging time from empty to full





Battery - Safety Warning

- Always remember that heat is the number one enemy of LiPo batteries. The hotter your batteries get, the shorter their lifespan will be.

- Do not leave the battery in a hot temperature environment. Especially for the use case with car aux-in, do not leave the 5K in a car. If the car is parked in the sun, the average temperature inside rises. It could reach nearly 120 ~160 degrees Fahrenheit. It would kill not only the battery life but also cause the battery in serious FIRE HAZARD.

- Please use 5V(1~2A) standard charger or PC USB port only for charging 5K. Do NOT use a high-speed charger. It would cause permanent damage to the unit.

- Please note that, if improperly used, Rechargeable Lithium-ion polymer batteries are potentially hazardous and can present a severe FIRE HAZARD, SERIOUS INJURY, and PROPERTY DAMAGE.

- Do not use a high-speed charger.
  - Use a standard 5V charger or PC USB only.
  - Warranty void for any permanent damage caused by using a high-speed charger.

Battery Time

- **Please note that the battery times may differ across each use case.**
  - The battery time varies across the codec, sample rate, power profile, and the output mode.
  - The sensitivity of the connected earphones/headphones and the output volume level also can make the battery time longer or shorter.

AAC 44.1KHz

	Standard Mode		Performance Mode	
	Current Avg. [mA]	Time [Hour]	Current Avg. [mA]	Time [Hour]
Balanced 4V Dual DAC	51.30	8.77	66.80	7.49
Balanced 2V Dual DAC	40.00	12.50	51.90	9.63
Unbalanced 2V Single DAC	30.60	16.34	38.00	13.16
Unbalanced 1V Single DAC	25.00	20.00	30.40	16.45

LDAC 44.1KHz @ 909Kbps

	Standard Mode		Performance Mode	
	Current Avg. [mA]	Time [Hour]	Current Avg. [mA]	Time [Hour]
Balanced 4V Dual DAC	55.00	9.09	70.20	7.12
Balanced 2V Dual DAC	42.70	11.71	55.40	9.03
Unbalanced 2V Single DAC	33.00	15.15	40.50	12.35
Unbalanced 1V Single DAC	27.20	18.38	32.80	15.24

LDAC 96KHz @ 990Kbps

	Standard Mode		Performance Mode	
	Current Avg. [mA]	Time [Hour]	Current Avg. [mA]	Time [Hour]
Balanced 4V Dual DAC	59.20	8.45	74.50	6.71
Balanced 2V Dual DAC	46.90	10.66	59.70	8.38
Unbalanced 2V Single DAC	35.40	14.12	43.10	11.60
Unbalanced 1V Single DAC	29.80	16.78	36.10	13.85

ES9218P DAC/AMP - Amplifier Gain

- **User-selectable amp gain mode**
  - Normal 1V RMS
  - High 2V RMS
  - Both provide the same sound performance.
  - They could sound a little different from each other. But, it doesn't mean that which one is better.

- **Normal 1V RMS mode**
  - Recommended for the most IEMs
  - Longer battery time and the lower noise floor

- **High 2V RMS mode**
  - 6dB higher maximum output level
  - Recommended for headphones

- Auto Volume Correction
  - The firmware adjusts the volume and keeps the current output level when switching the gain mode.
  - You will experience no difference in loudness when switching the mode to 2VRMS. But you will have the max volume extended by +6dB.

ES9218P - DAC Operating Profile

- **Qudelix's proprietary software drives ES9218p DAC in two different ways to trade off the battery time and sound quality.**

- **Standard Profile (ECO mode)**
  - Standard DAC Operating Clock
  - Standard Output Bias Current
  - Best Efficiency
  - Best trade-off for battery time and sound quality
  - Suitable for mobile and outdoor use cases

- **Performance Profile (SPORT mode)**
  - Highest DAC Operating Clock
  - High Output Bias Current
  - Best Performance
  - Best Sound Quality with lesser battery time

- **USB powering to the device overrides the current profile and switches it to PERFORMANCE automatically.**

UNBALANCED (Single-Ended) 3.5mm

- Works with Single ES9218p
  - Max. 2V RMS output

- 3-Wire Output from Source Device
  - 2 ch DAC/AMP for Stereo Audio
  - 1-pin Ground

- Common Ground
  - Ground Pin goes to both Speaker-L and Speaker-R
  - Ground ripple(noise) affects both L & R channel

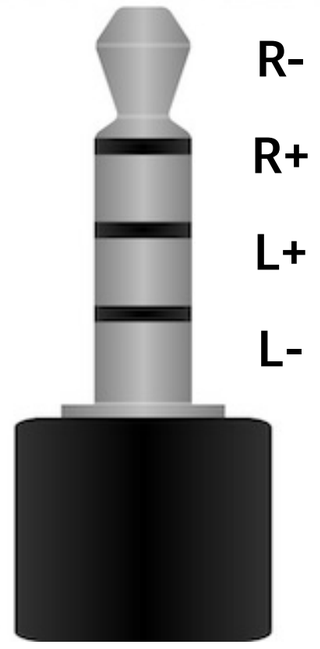
- Both AMP_NOISE and GROUND_NOISE affects the Sound Quality
  - VL = L + AMP_NOISE + GROUND_NOISE
  - VR = R + AMP_NOISE + GROUND_NOISE

BALANCED (Full-Differential) 2.5mm

- Works with Dual ES9218p
  - Max. 4V RMS output

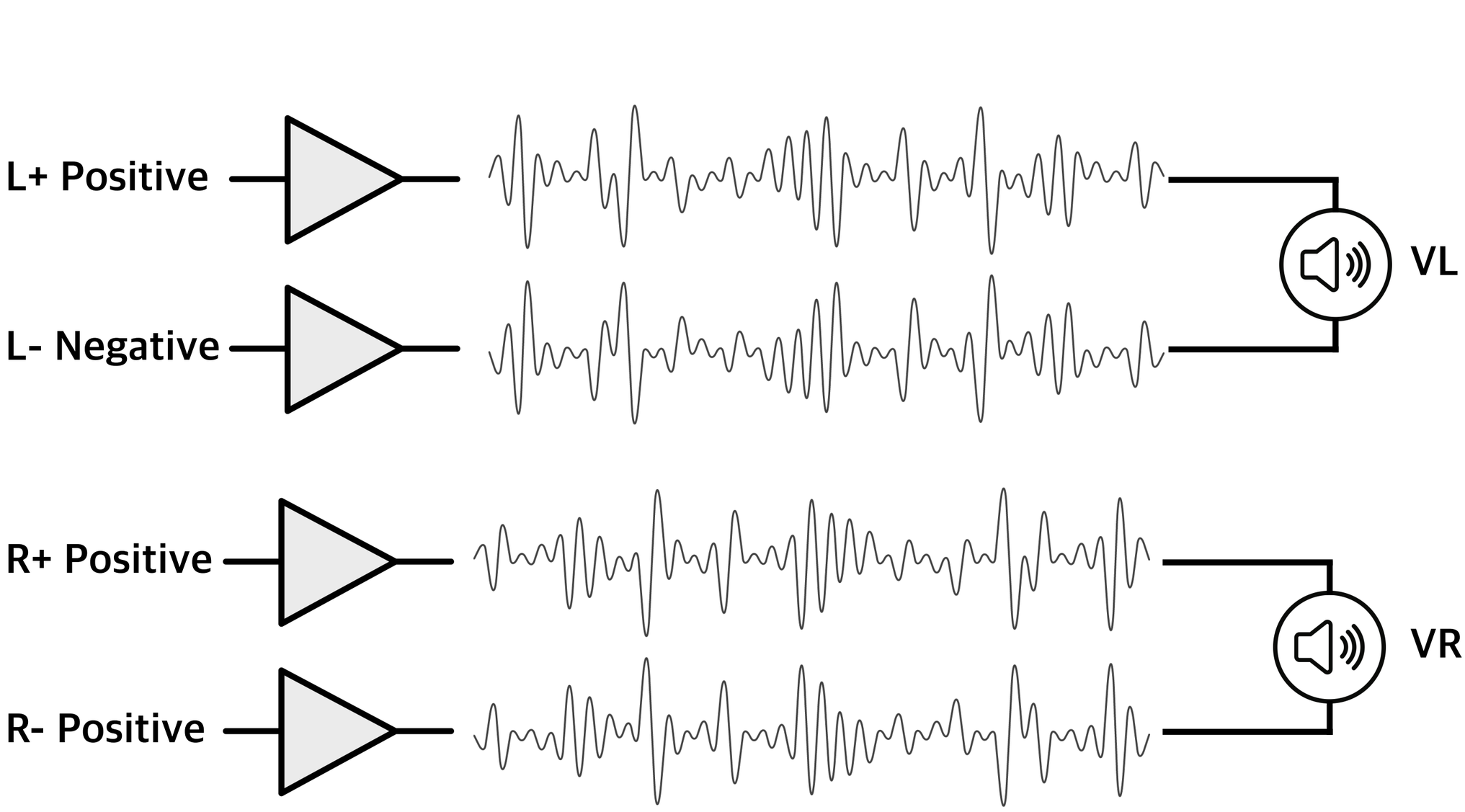
- 4-Wire Output from Source Device
  - 4ch DAC/AMP required for Stereo Audio
  - Original Signal (L+/R+) and Inverted(Negative) Signal (L-/R-)

- Free from Ground Noise



- Common Mode Noise Reduction
  - Common AMP_NOISE is canceled out easily
  - VL = (LP+ AMP_NOISE) – (LN+AMP_NOISE) = LP-LN = 2L
  - VR = (RP+ AMP_NOISE) – (RN+AMP_NOISE) = RP-RN = 2R

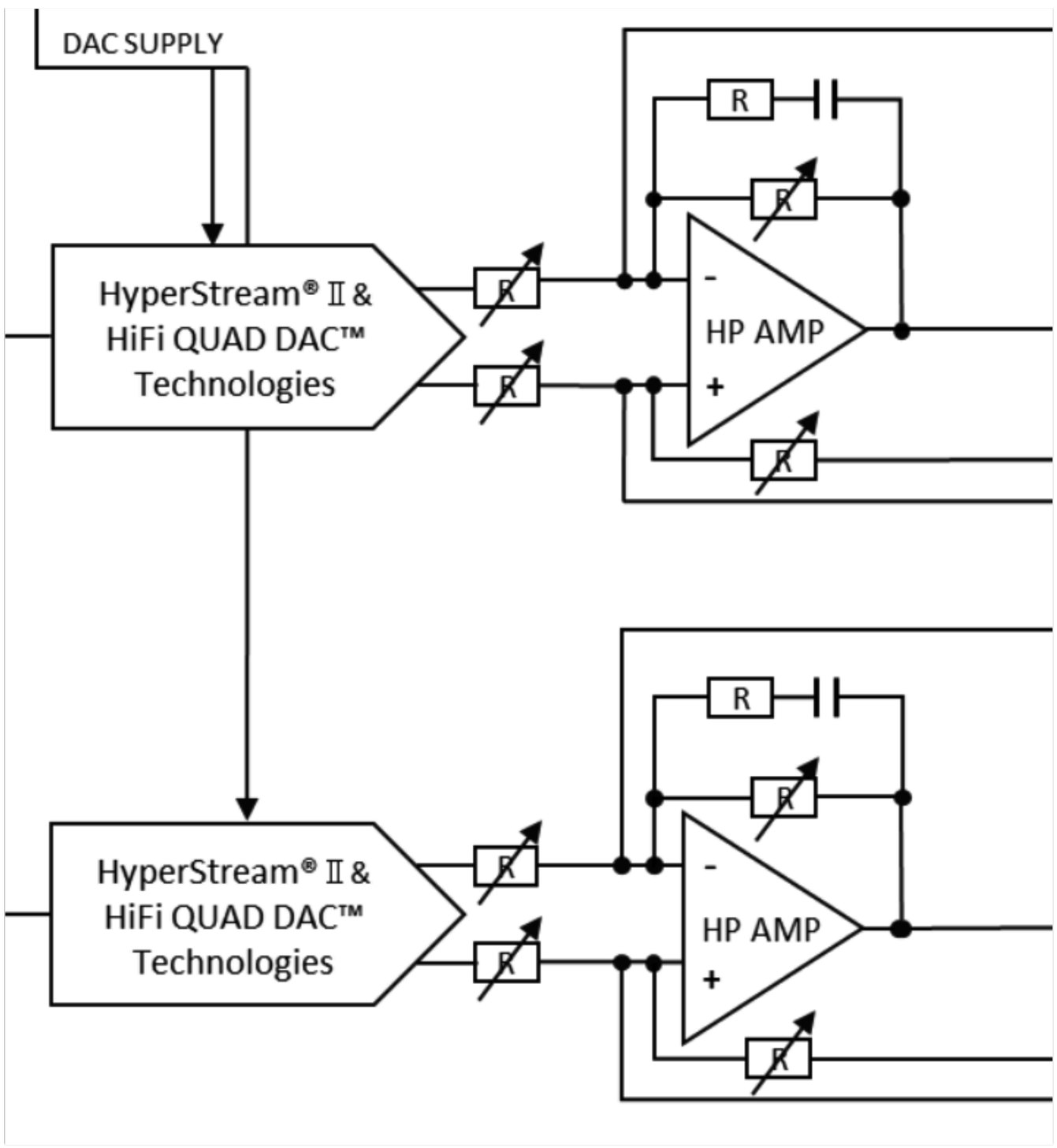
- Relatively better Sound Quality
  - Better Linearity
  - Better Channel Separation
  - 2x more power and driving capability



*With any given hardware device, supporting both UNABL and BAL, BAL always provides relatively better performance than UNBAL.

ES9218P Built-In PGA (Programmable Gain Amp)

- Analog Volume Control
  - Integrated PGA(Programmable Gain Amp)
  - 0dB ~ -24dB Range
  - 1dB Step
  - Provides the best sound quality at any volume level
  - Noise level gets lowered as the volume level gets reduced.

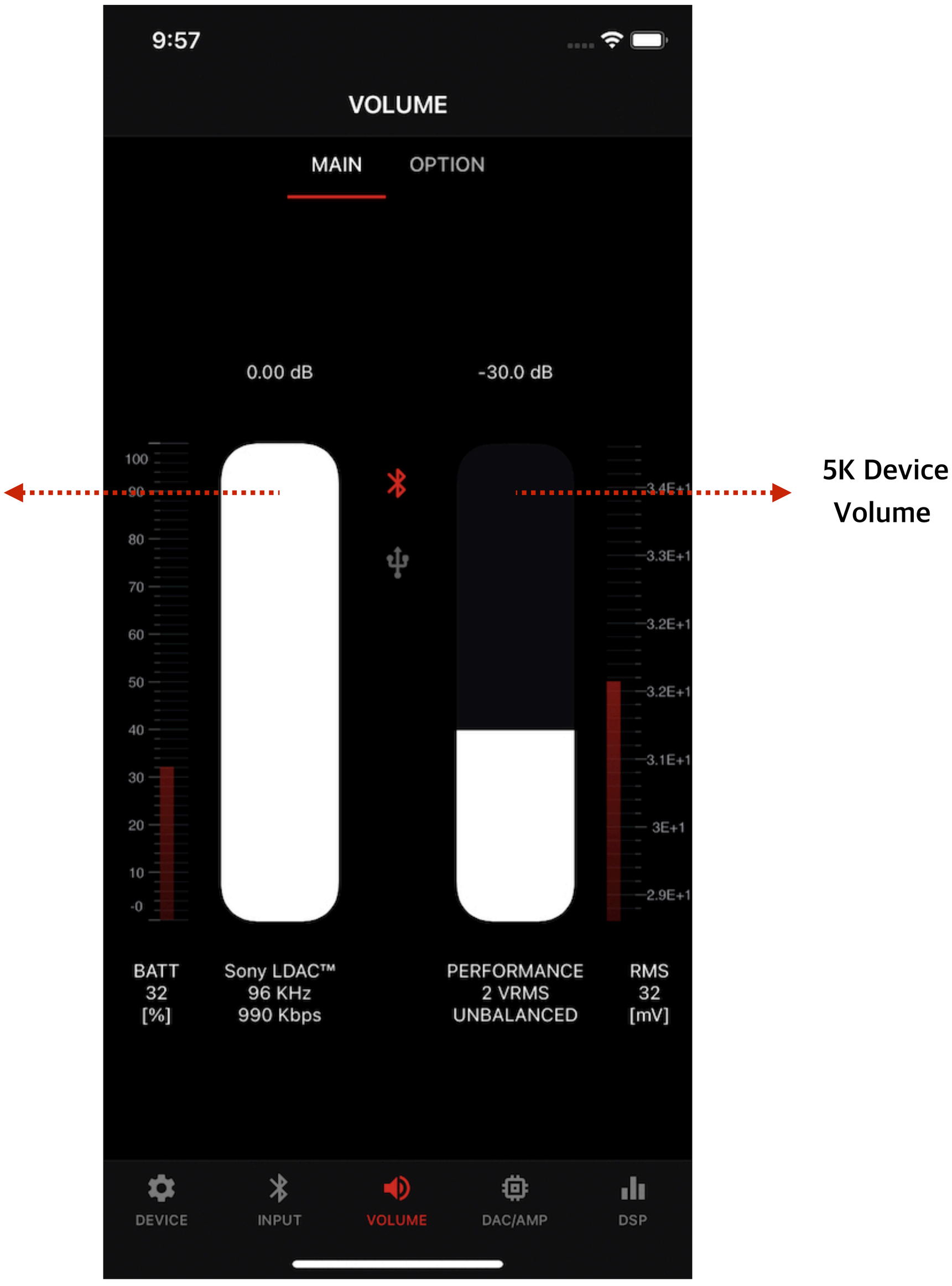


ES9218P DAC & HPAMP

with PGA(Programmable Gain Amplifier)

Volume

- 5K offers 2-way associative volume control for optimal sound quality. It always keeps and guarantees the full-scaled audio stream over Bluetooth or USB. In either way, you can control the loudness level via smartphone source volume or 5K device volume without any loss.



2-way Associative Absolute Volume

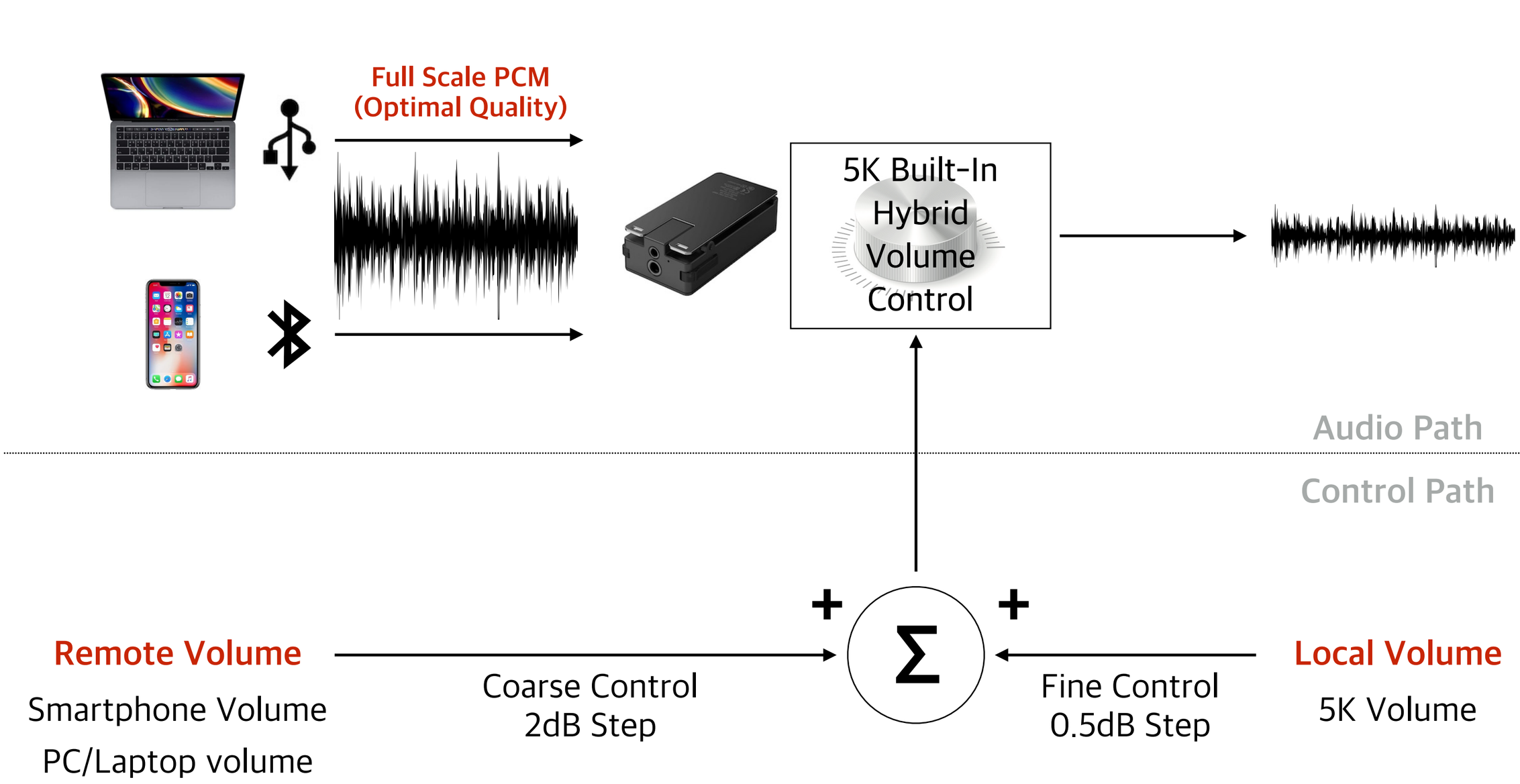
- Qudelix's proprietary 2-way associative absolute control provides optimal sound quality at any source or device volume level. With this scheme, the source device always delivers the audio stream at the maximum precision as the original.

- You can control volume in whatever comfortable way, either smartphone buttons or Qudelix-5K buttons without any sound quality loss. It always keeps and guarantees the best sound quality over Bluetooth or USB.

- **Smartphone, PC/Laptop volume control**
  - Remotely adjusts 5K built in Volume Controller
  - 2dB step Coarse Control

- **5K Device Volume Control**
  - 0.5dB step Fine Control

- **Optimal sound quality at any given volume level**
  - No need to care for smartphone volume.
  - Any smartphone volume level keeps the best sound quality (Bluetooth and USB)

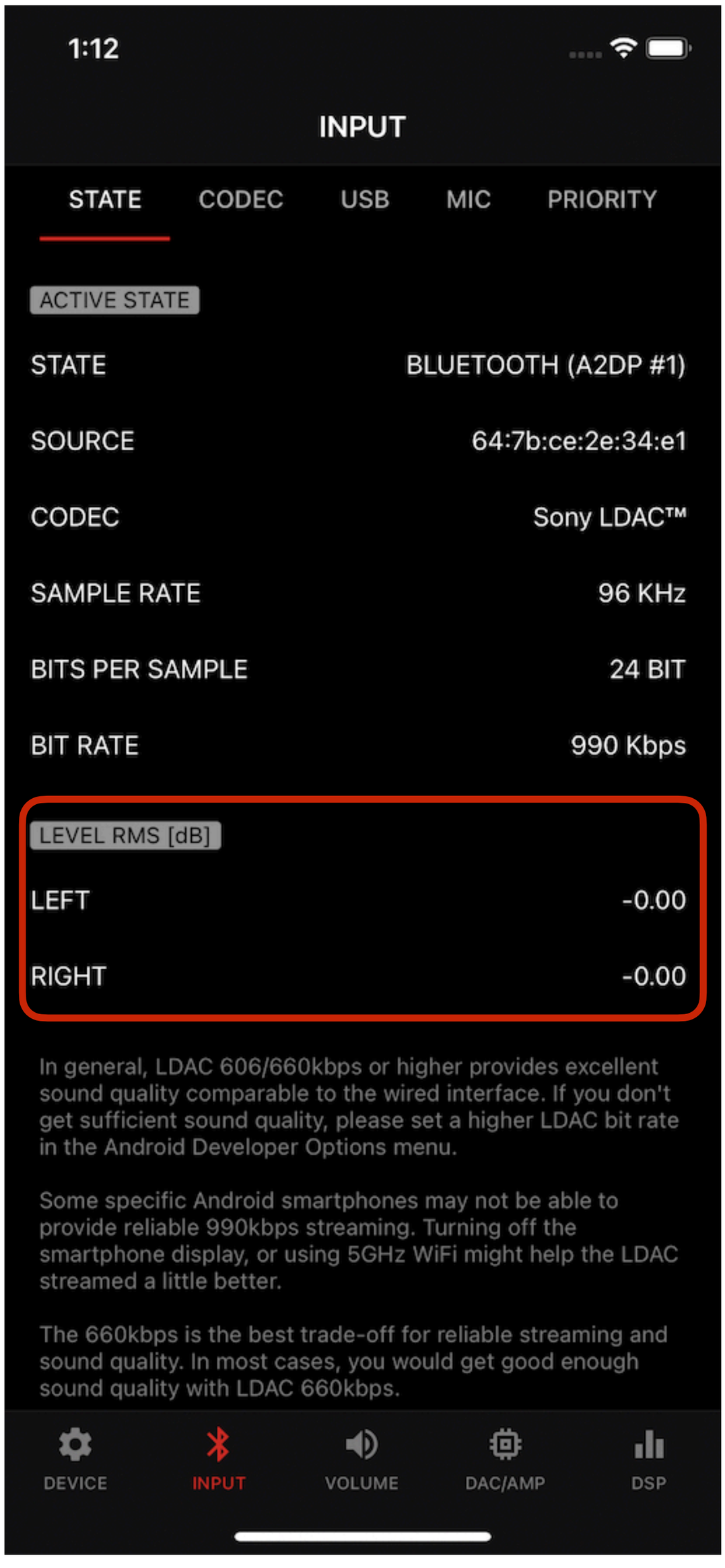


*Android USB Audio doesn't support Absolute Volume Control. For the optimal sound quality with Android USB DAC, you need to set the maximum smartphone volume.

Volume & Input RMS

- The input RMS displays the audio signal level that 5K receives from the source device.

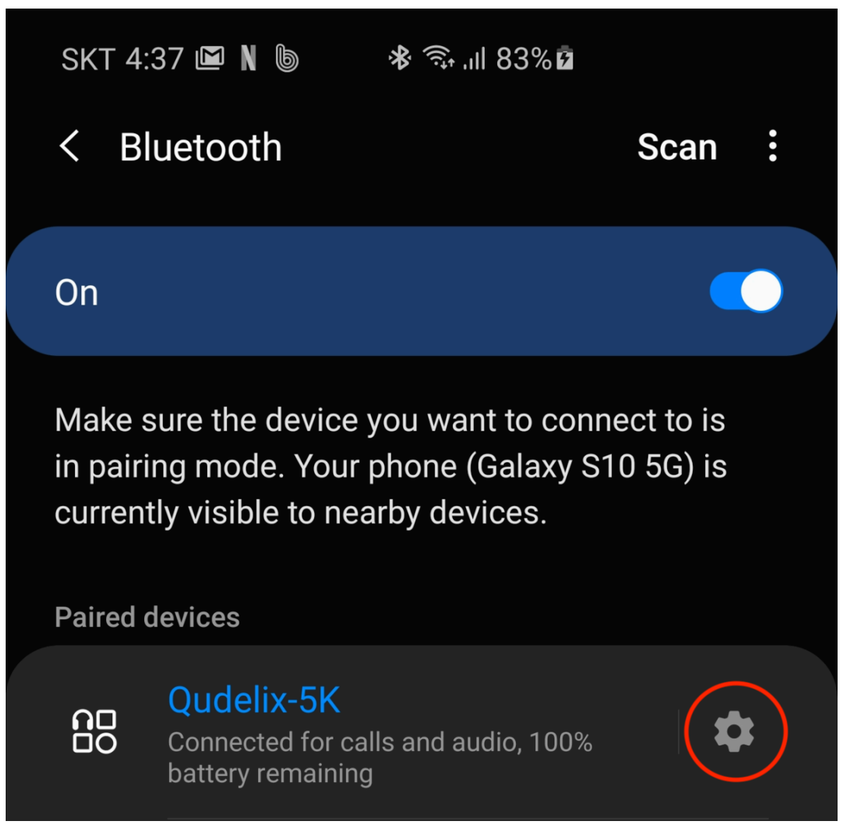
- With 2-way absolute volume, the input RMS should stay at the same level across all source volume levels.



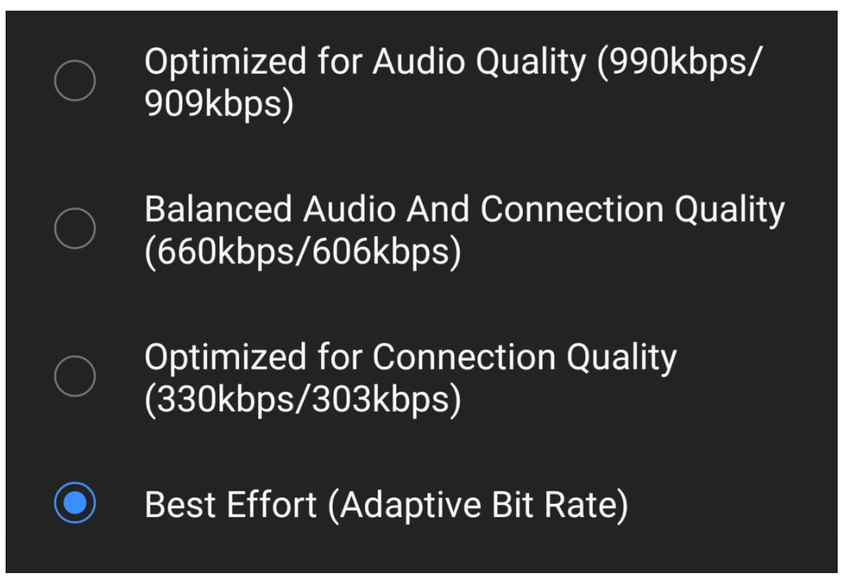
Bluetooth Codec

- **SONY LDAC**
  - Available with Android 8.0 or higher.
  - In general, LDAC 606/660kbps or higher provides excellent sound quality comparable to the wired interface. If you don't get sufficient sound quality, please set a higher LDAC bit rate in the Android Developer Options menu.
  - Some specific Android smartphones may not be able to provide reliable 990kbps streaming. Turning off the smartphone display, or using 5GHz WiFi might help the LDAC streamed a little better.
  - The LDAC 660kbps is the best trade-off for reliable streaming and sound quality. In most cases, you would get good enough sound quality with LDAC 660kbps.

- **Enable SONY DAC**
  - Bluetooth Menu —> Paired Devices —> Qudelix-5K —> device option -> LDAC



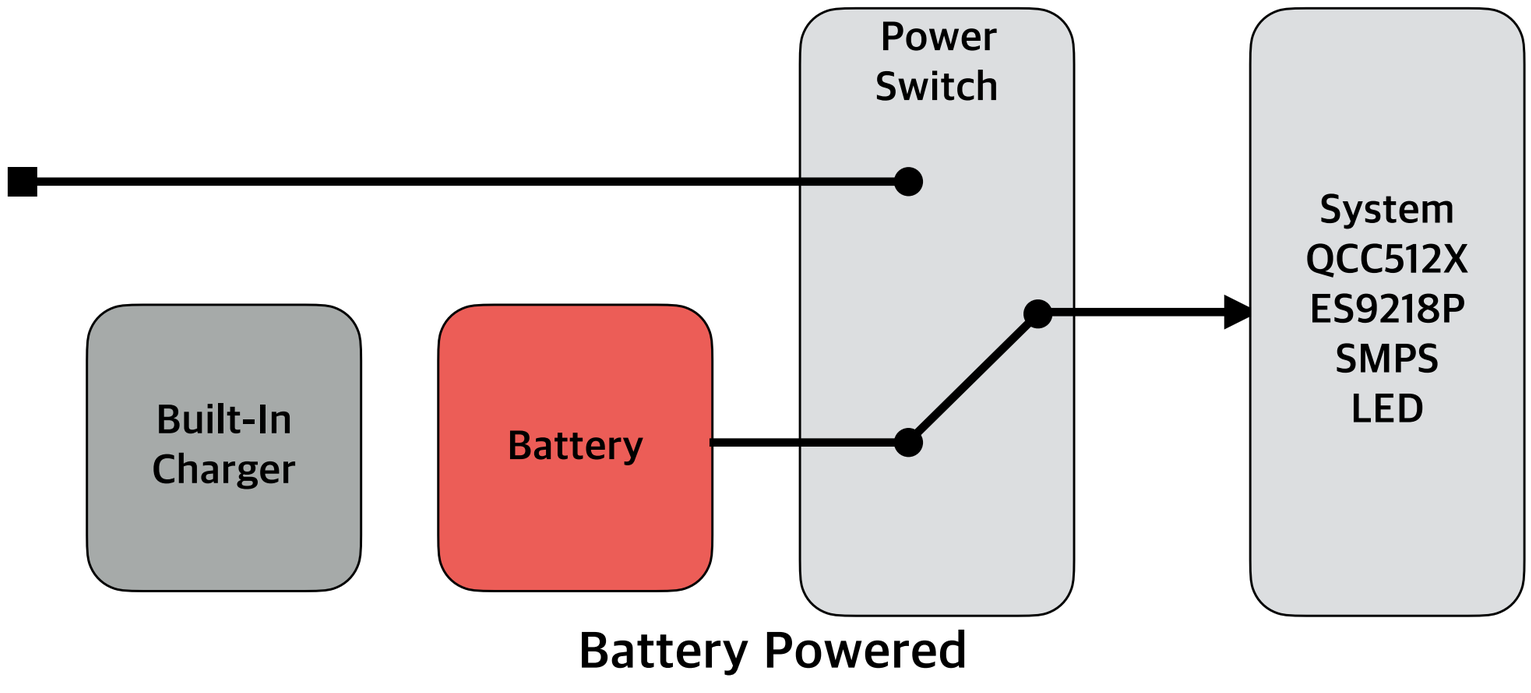
- **Setting LDAC Bitrate & Sample Rate**
  - Enable Android Developer Option
    - https://developer.android.com/studio/debug/dev-options?hl=en
    - Please refer the link above and enable the developer option menu.
  - System Setting —> Developer Option —> LDAC Quality



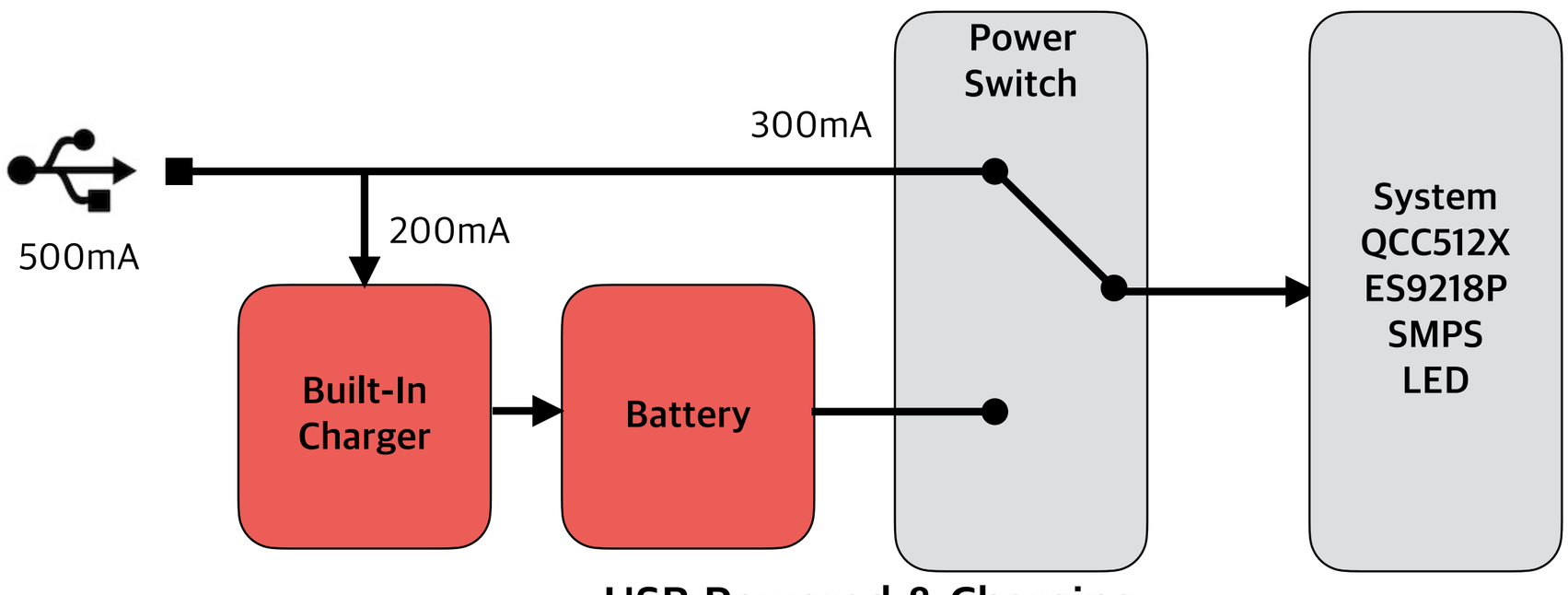
Power Source

- When powered with USB, the device gets the source power directly from the USB VBUS, not from the battery.

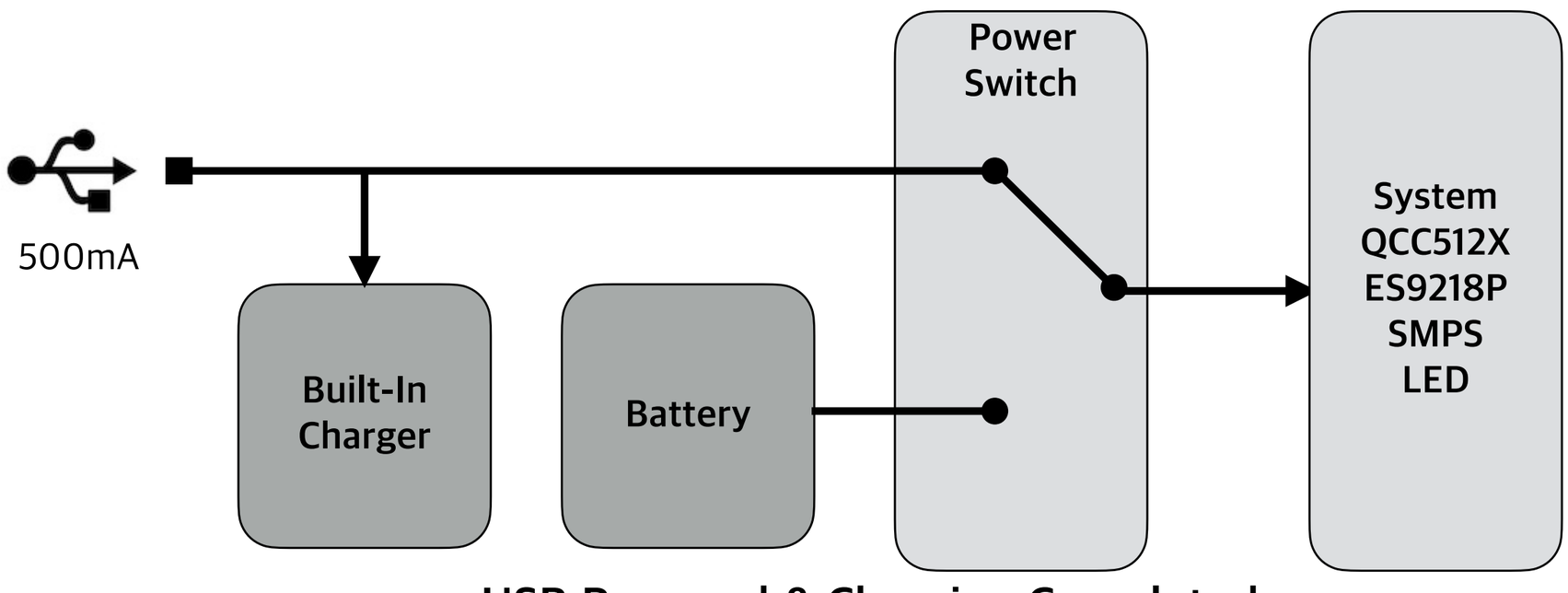
- The internal power switching keeps the battery life as long as possible.



Battery Powered



USB Powered & Charging



USB Powered & Charging Completed

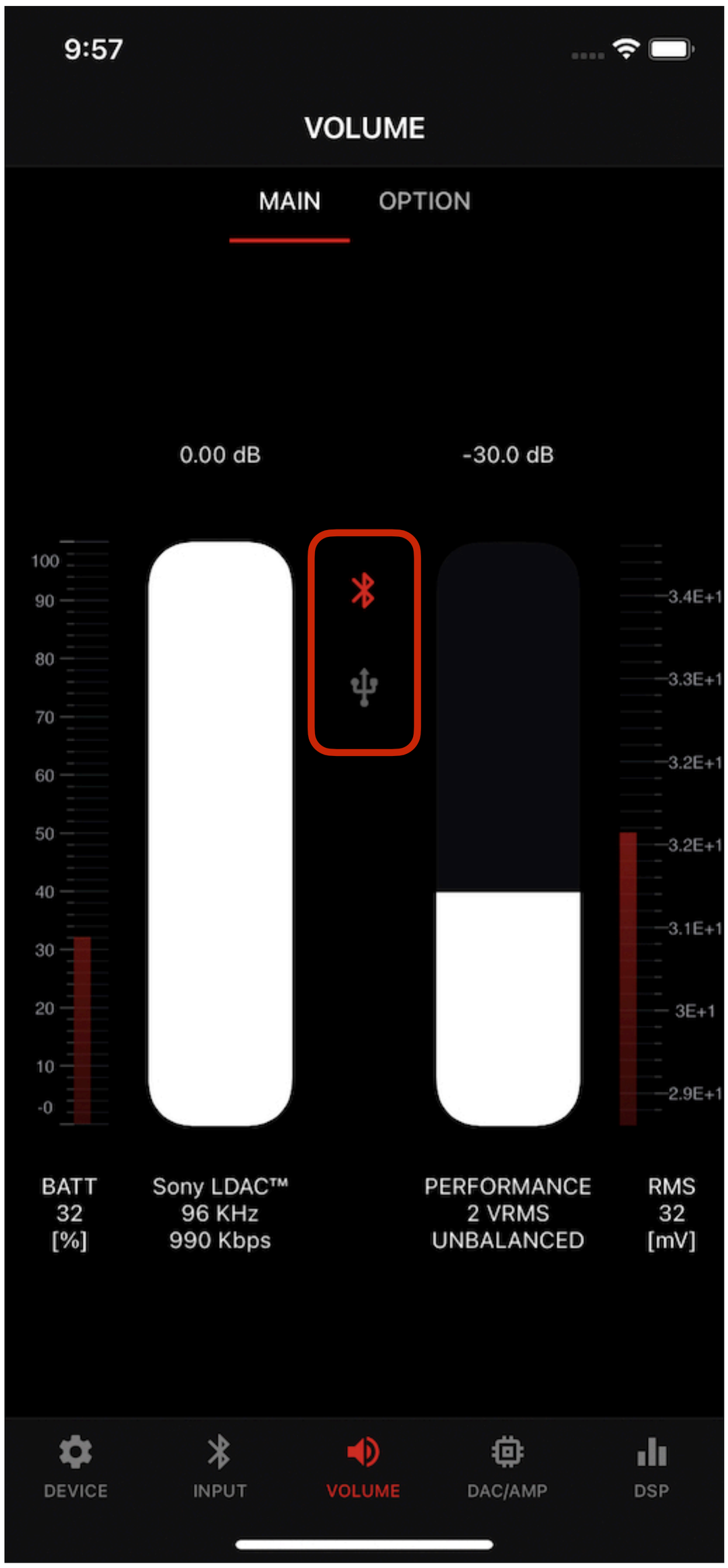
USB DAC & Bluetooth DAC

- **5K works as Bluetooth DAC & USB DAC simultaneously.**
  - Bluetooth DAC connected to Smartphone
  - USB DAC connected to PC/Laptop

- **Audio Streaming is exclusive to one source device at a time.**
  - Bluetooth and USB are automatically switched depending on whether audio is played.

Source Input Selection

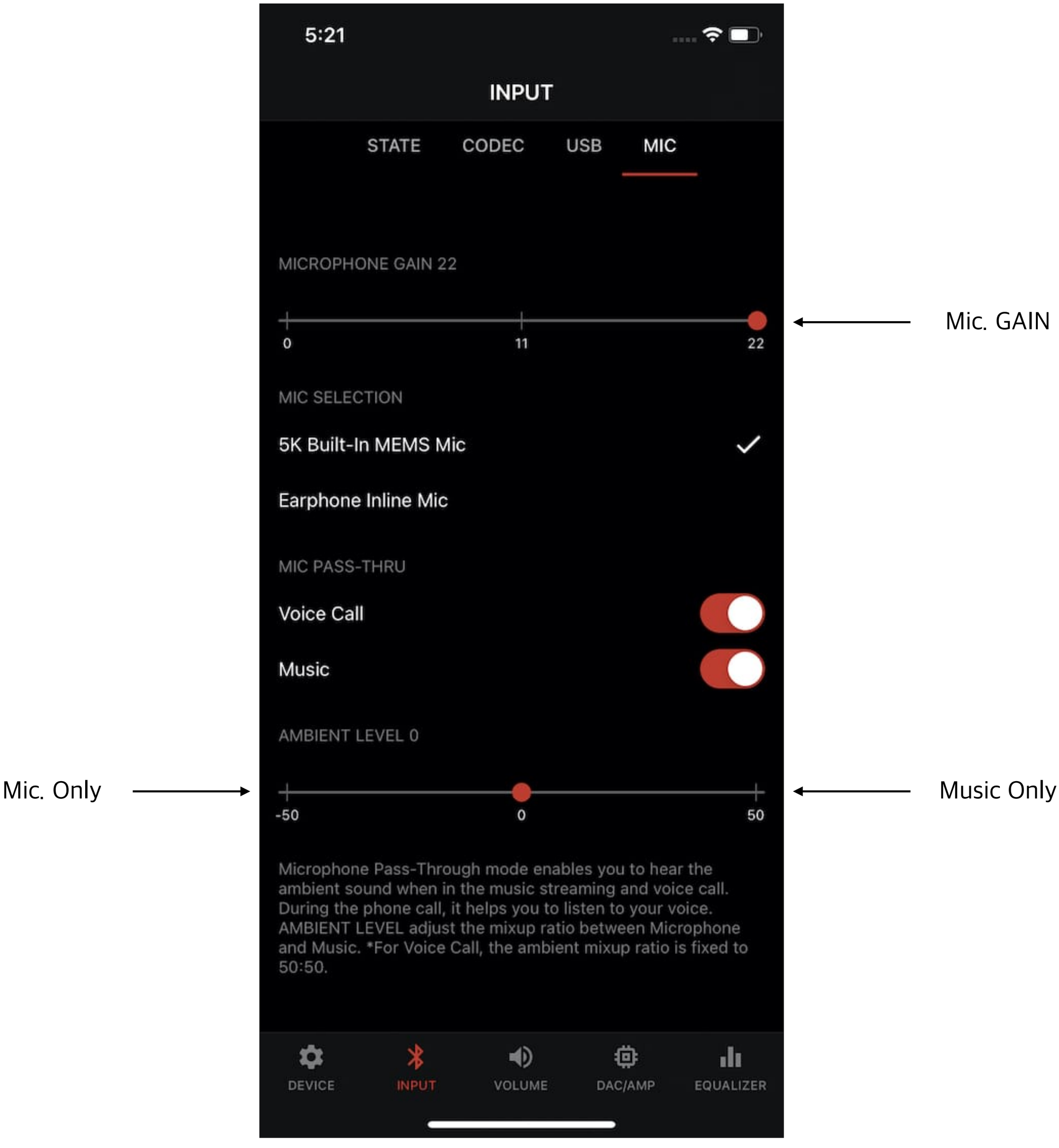
- 입력 소스의 우선 순위는 앱에서 설정이 가능합니다.
  - Press the Bluetooth or USB icon in the center of the volume screen to set.



Mic. Pass-Thru Mode

- **MIC PASS-THRU mode**
  - Adjust Mic. Gain
  - Adjust the mix-up ratio with AMBIENT LEVEL slider

- **If ABSOLUTE VOLUME is ON,**
  - The smartphone side-key volume adjusts the overall 5K device volume.
  - The smartphone side-key volume adjusts both microphone and music at the current mix-up ratio.

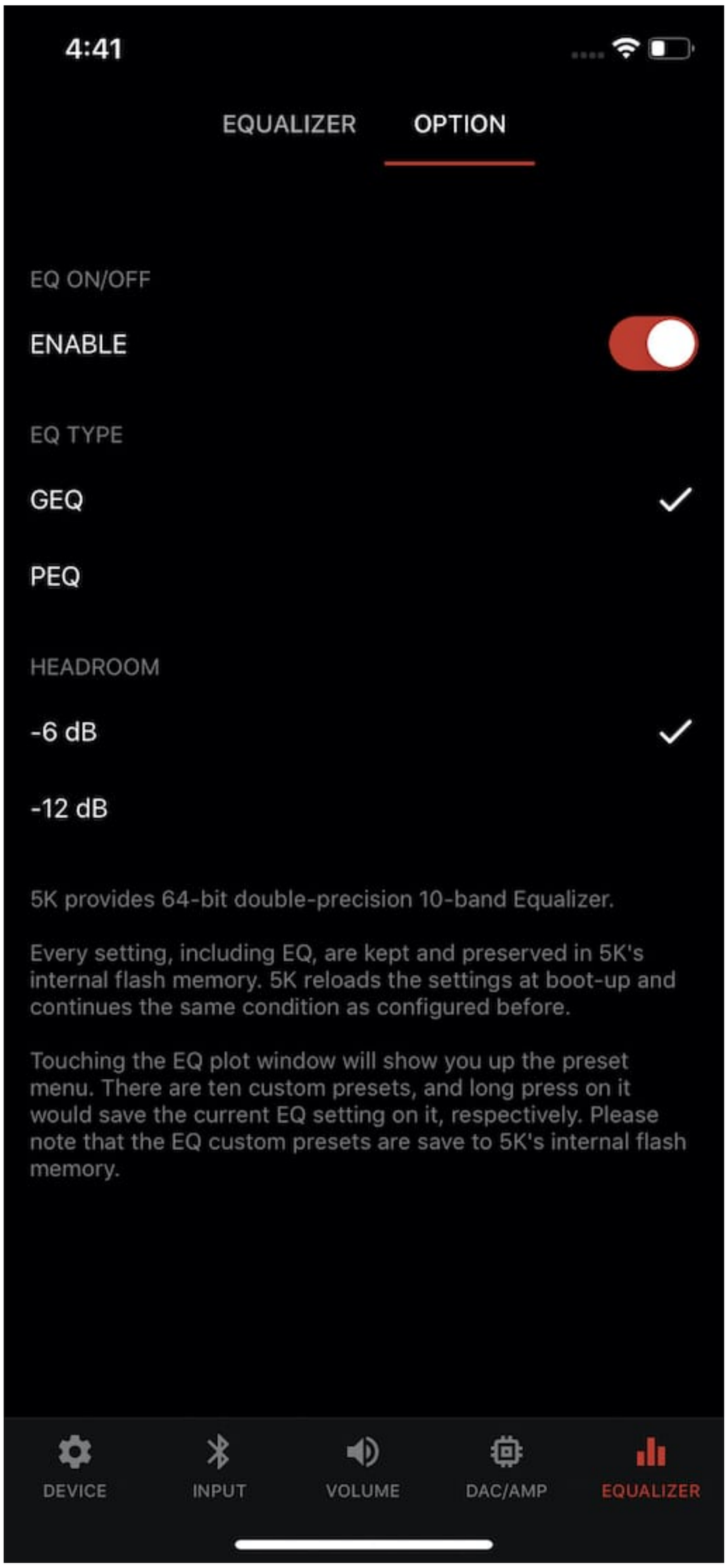


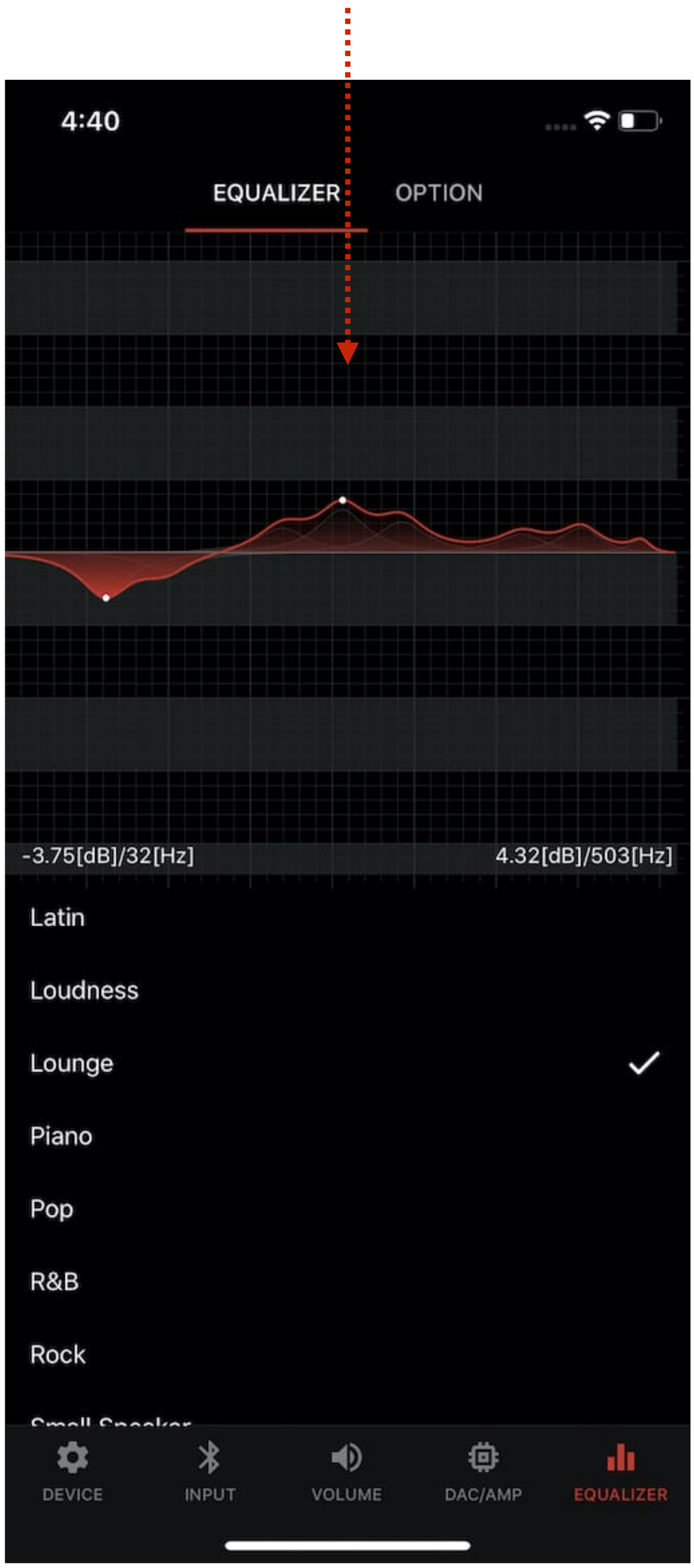
Equalizer

- 64-bit double-precision embedded 10-band Equalizer

- Every setting, including EQ, is kept and preserved in 5K's internal flash memory. 5K reloads the settings at boot-up and continues the same condition as configured before.

- Touching the EQ Graph plot window will display the preset menu.
  - Long-press to a preset would save the current EQ setting on each, respectively.
  - 5K internal flash memory stores all EQ presets.

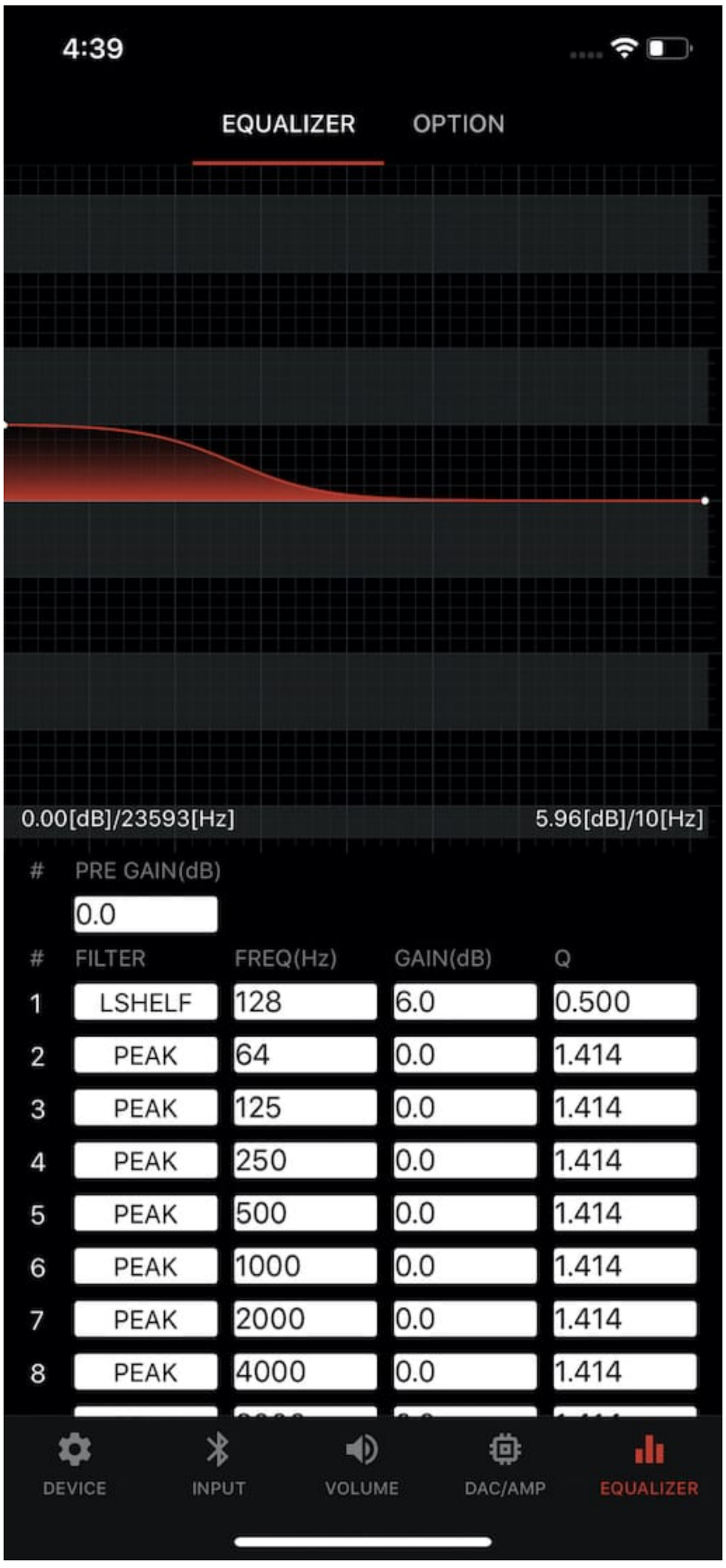




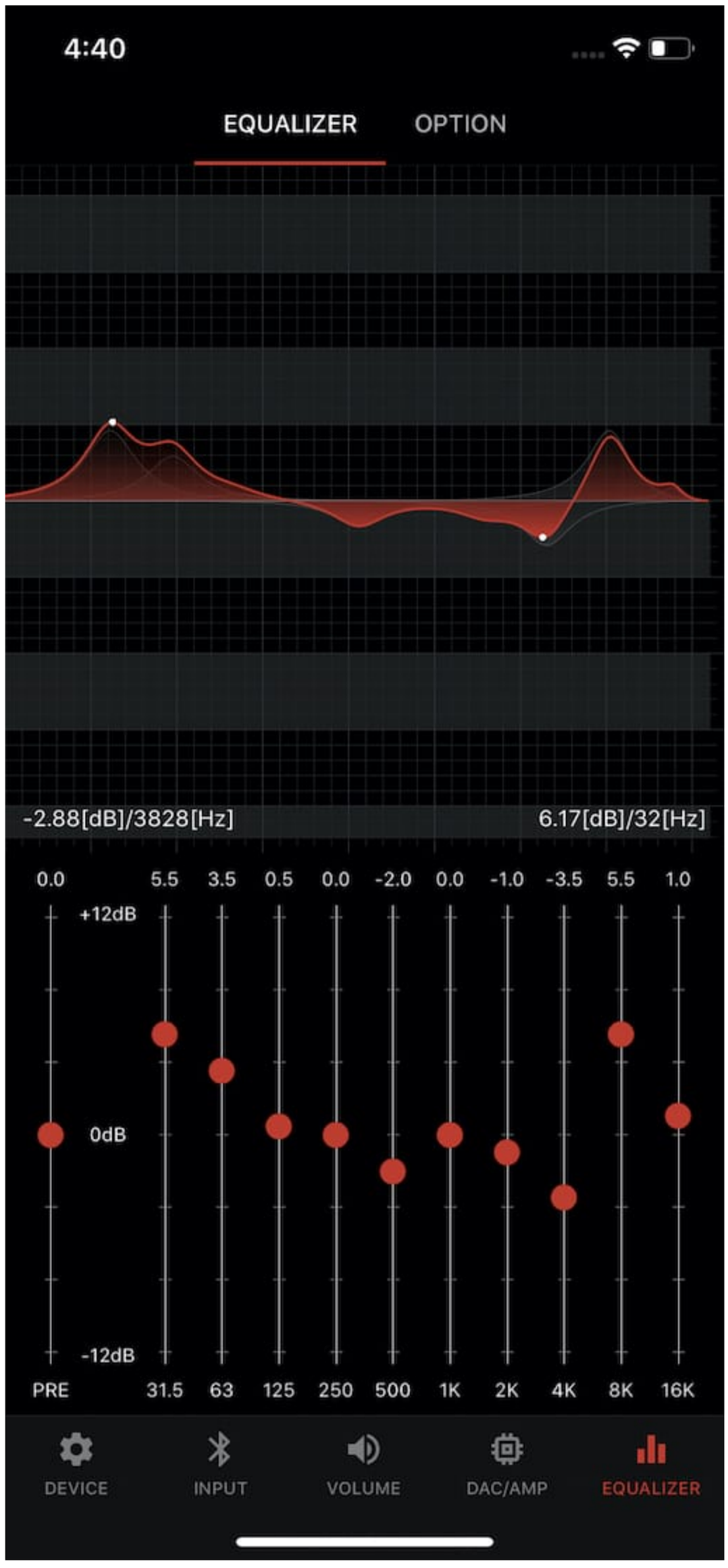
PEQ & GEQ

- 10-band PEQ or GEQ supported
- PEQ Filter Type
  - PEAK / LPF / HPF / LSHELF / HSHELF

PEQ



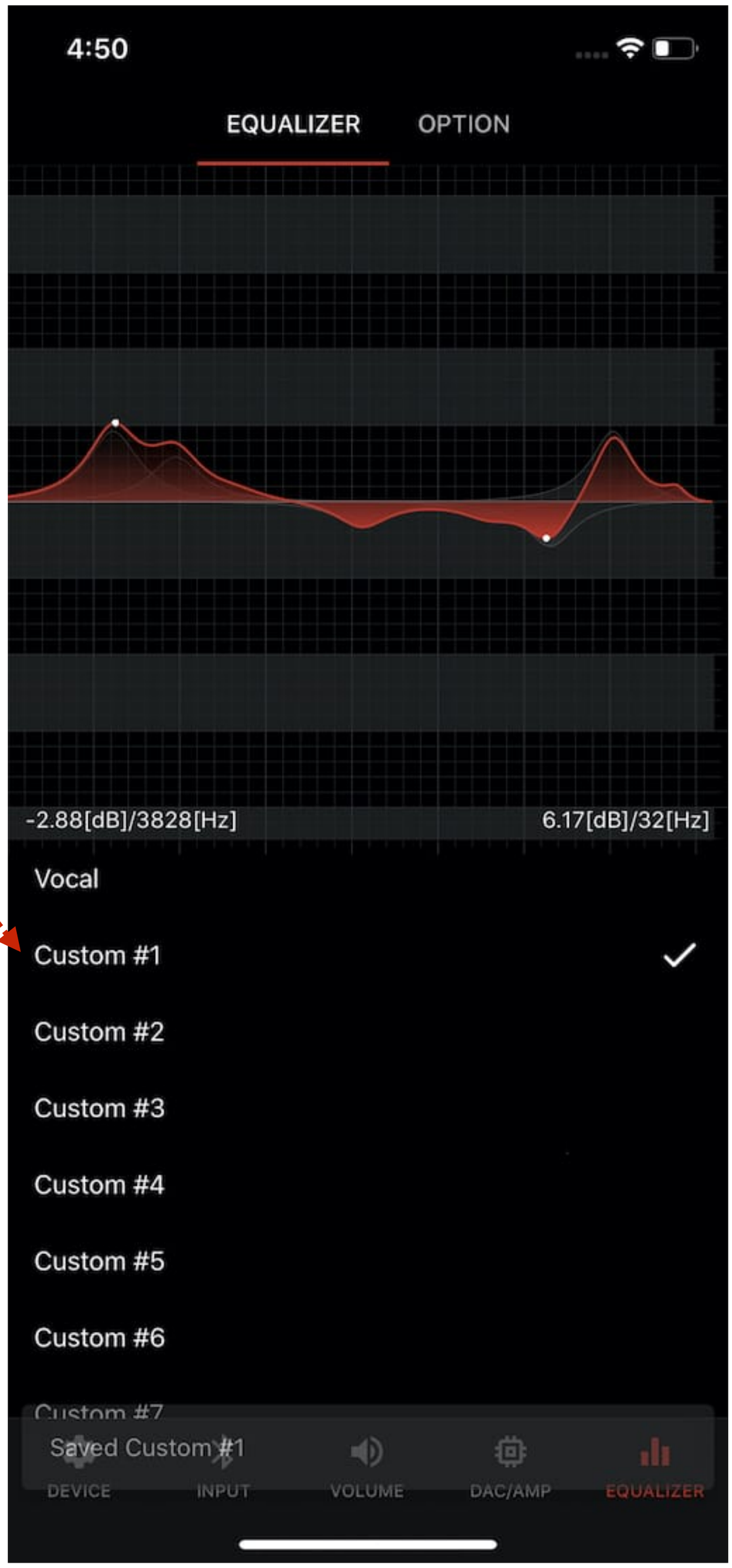
GEQ



EQ Preset

- 20 Custom User Presets
- All Presets are saved in the 5K’s internal flash memory.

Long Press to save the current EQ profile



Antenna

High Sensitivity 3-dimensional LDS Antenna is printed on the bottom case and is placed around the red LED button. 5K provides the best RF performance in most use cases. However, for the optimal performance, please keep this area away from any metallic objects.

Bluetooth 2.4 GHz Class 2.5mW (4dBm)

3 Dimensional LDS (Laser Direct Structuring) Antenna

Warranty

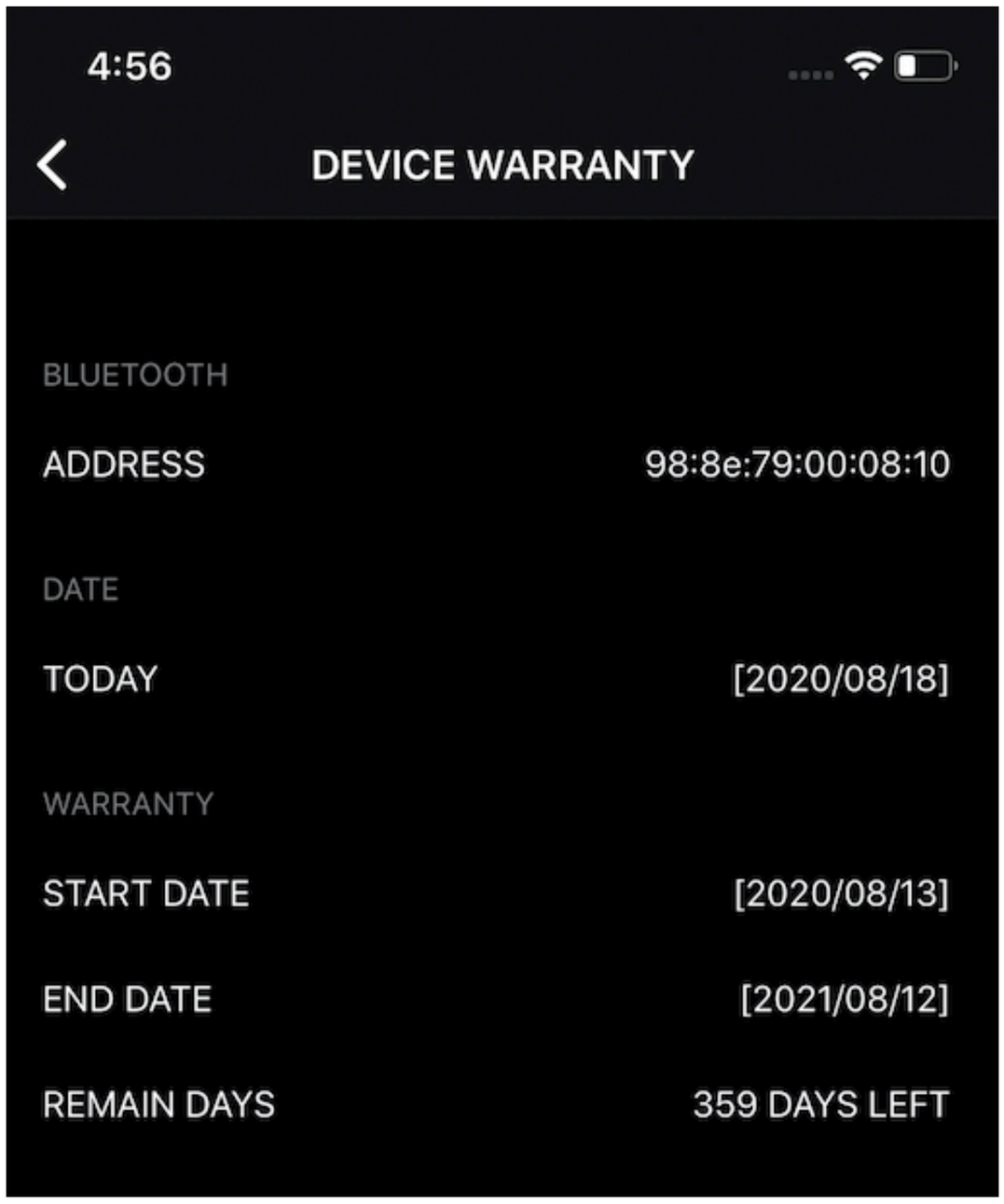
- **One year warranty**
  - From the date of the first app connection
  - Automatically activated from the first connection with the companion mobile app
  - Any problem caused due to a defect in manufacturing will be repaired or replaced
  - The warranty is transferable and is not limited to the original purchaser

- **Warranty is managed upon Bluetooth MAC address and serial number**
  - No need to keep the proof of the purchase
  - No receipt nor invoice requires for the warranty service

- **Any issue caused by accident or misuse**
  - Can be replaced with a refurbished product at customer's charge & shipping fee

- **For any purchase from local distributors**
  - The respective distributor is responsible for the warranty and will handle the case directly

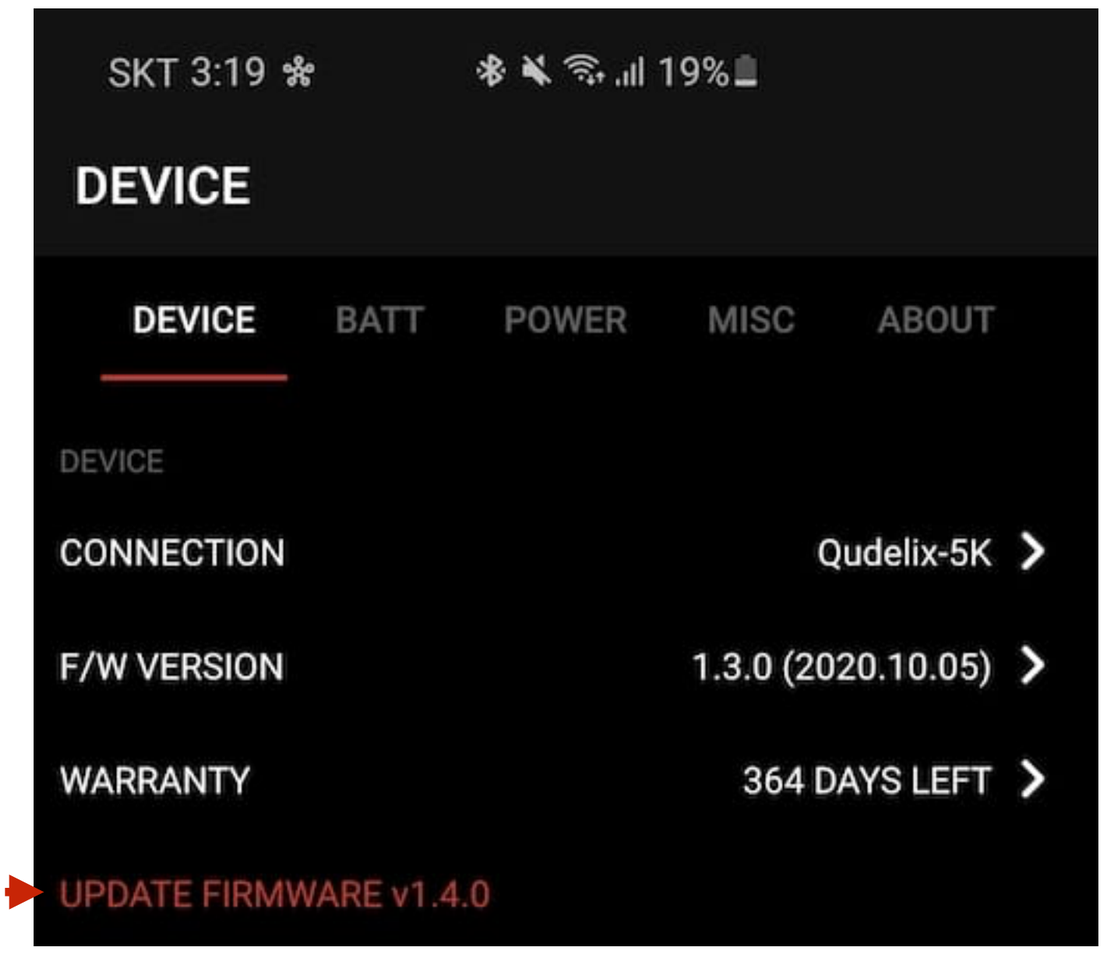
- **WARNING**
  - Warranty void if the case opened
  - DO NOT disassemble or open the case.
  - DO NOT use a high-speed charger. (Use a standard 5V charger or PC USB.)

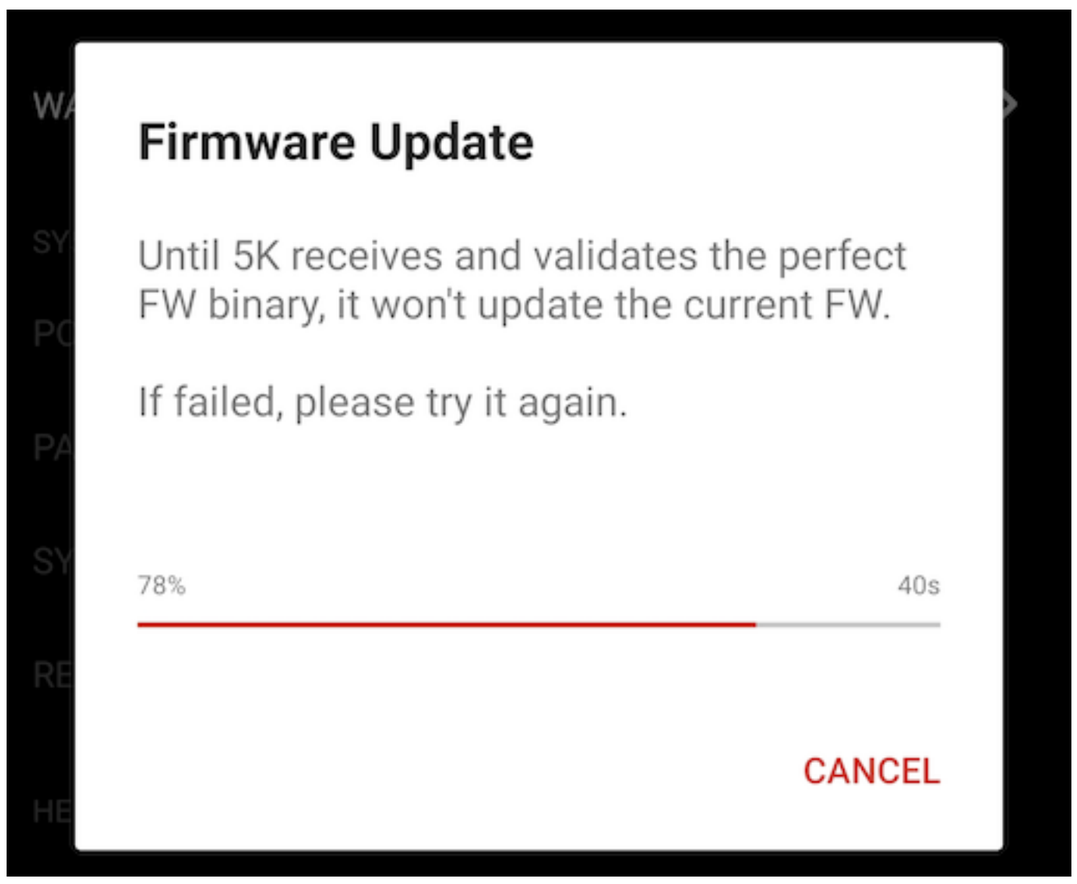


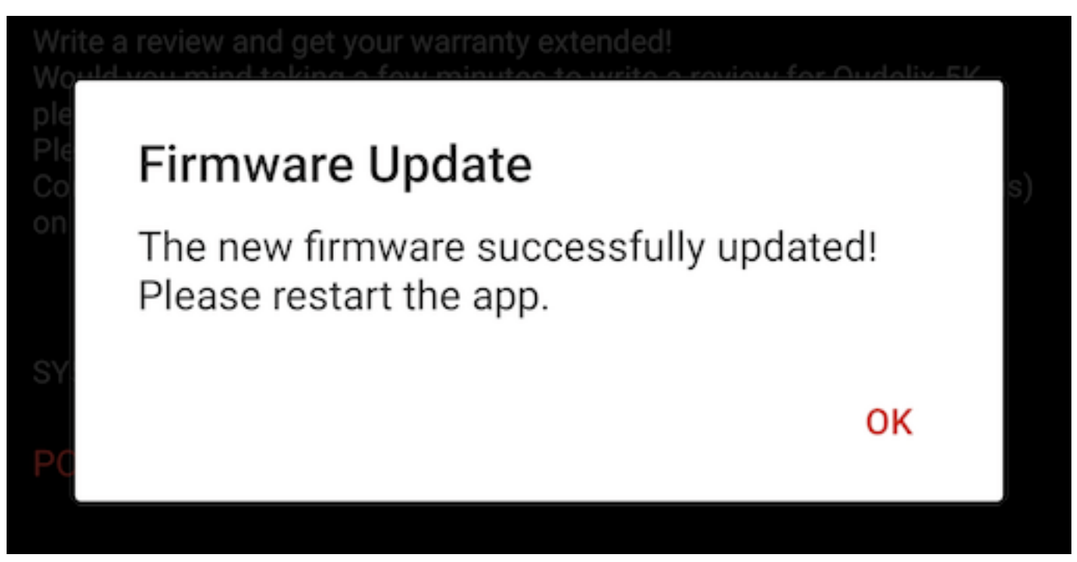
Firmware Update - OTA

- **OTA(Over The Air) Firmware Update**
  - The app updates the 5K firmware over the Bluetooth link.
  - **UPDATE FIRMWARE vX.X.X** will appear when a new FW is available.
  - Please keep the 5K close to the smartphone during the FW update.
  - Until 5K receives and validates the perfect FW binary, it won't update the current FW.
  - If failed, please try it again.

FW Update

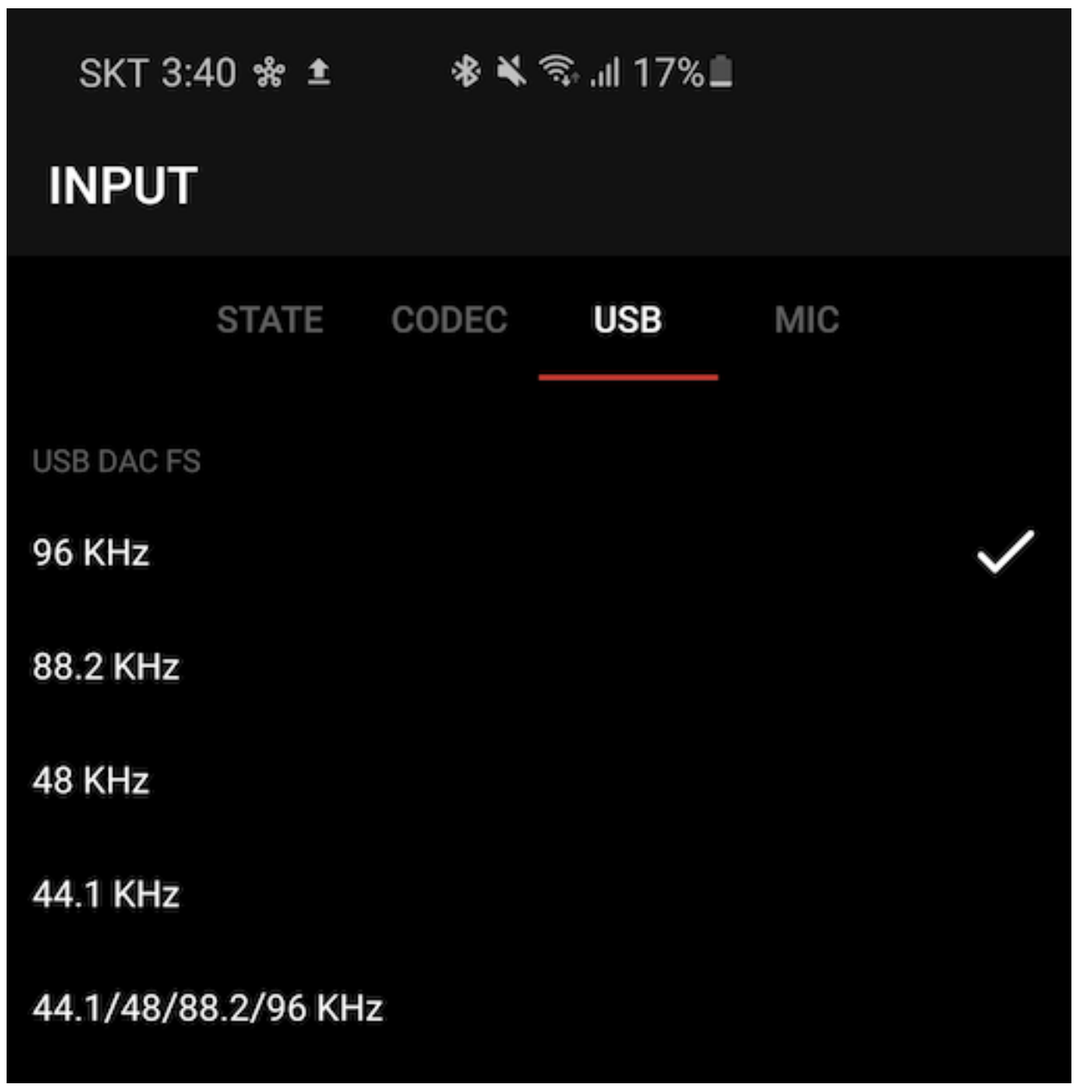




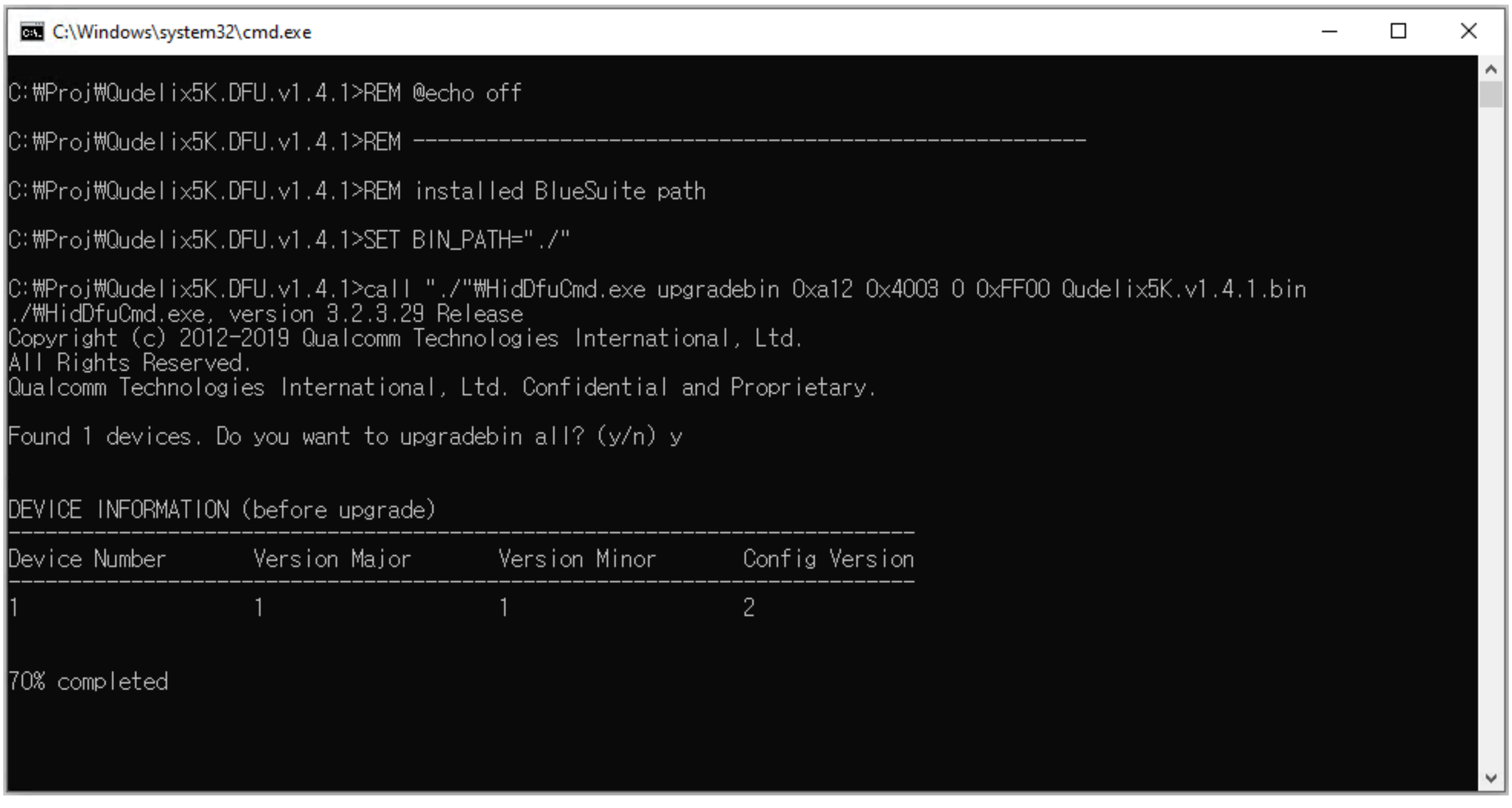


Firmware Update - DFU (Windows PC)

- **DFU through Windows PC USB**
  - USB DFU is also available with Windows PC.
  - **Unzip the DFU package to the local folder completely.** (ZIP Previewer won't work.)
  - Set USB DAC FS as 96KHz, before running the DFU.
  - Connect the 5K to Windows PC.
  - Execute **run_dfu.bat**
  - Wait until completed **(upgradebin succeeded)**



Select 96KHz
for USB DFU



Appendix - PCBA

5K has three BGA(Ball Grid Array) IC parts; QCC5124, and two ES9128p.

To enhance the PCB reliability and durability, we did the epoxy underfills on those sensitive BGA parts, although having additional cost increase. Those parts are bonded twice with soldering and epoxy underfills.

Appendix - Size & Weight

Size

52.8(H) x 26.7(W) x 15.6(D) mm (including Clip)

Weight

25g

Appendix - Package

PACKAGE

91mm (L) x 55mm (W) x 55mm (H)

INCLUDED

USB C-to-C Cable (120mm)

USB C-to-A Cable (120mm)

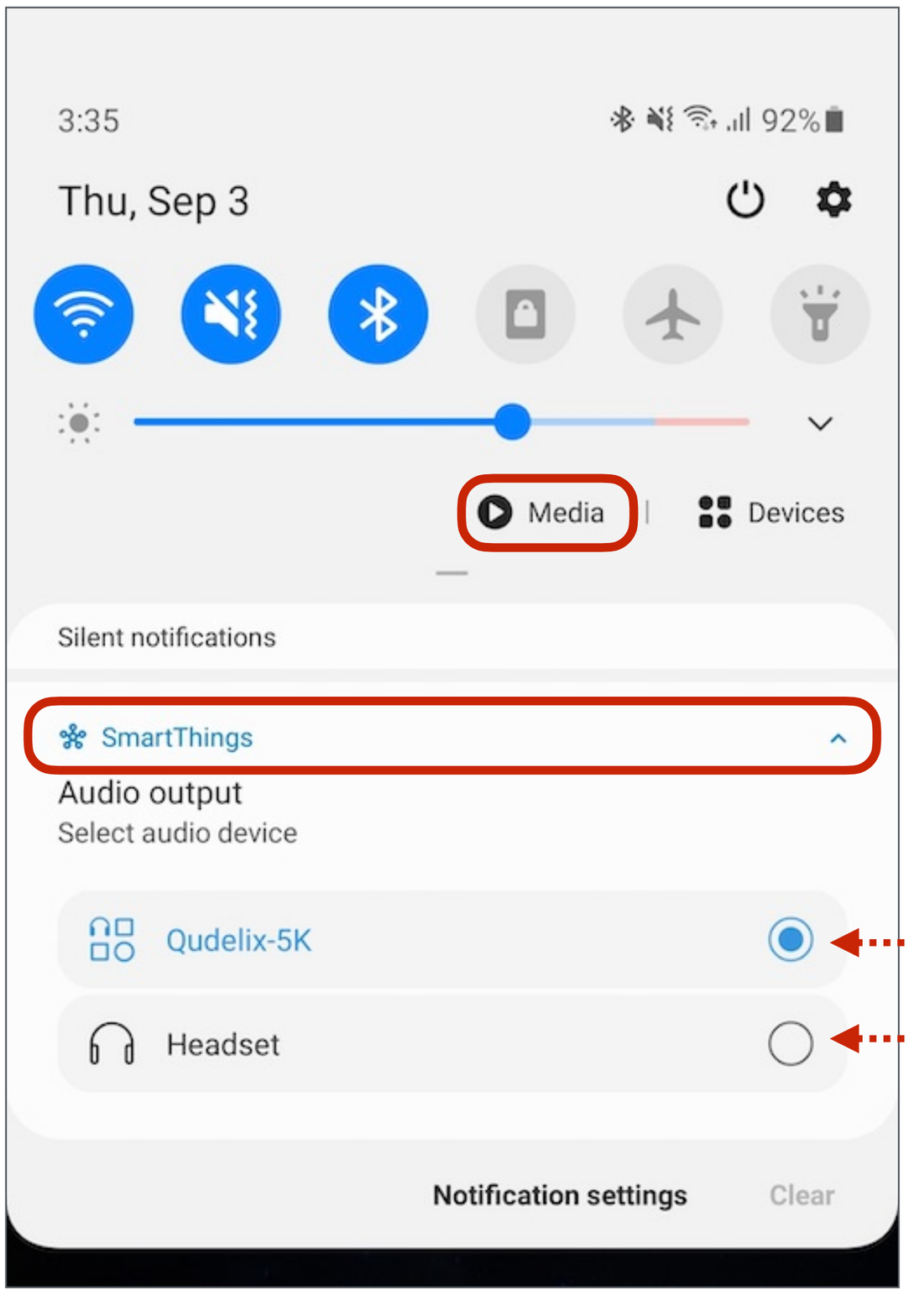
*No User Manual included in the package. Please refer this user guide.

Appendix - Android Audio Output Device

- **5K Can be connected to Android both through Bluetooth and USB DAC (C-to-C) at the same time.**

- In that case, the Android device detects multiple audio output devices. And the Android selects the active output device exclusively.

- *With some specific Android devices, **SONY Android App** sometimes overrides the system Audio Output selection to Bluetooth forcibly. If you don't get any sound through Android USB DAC, please try uninstalling SONY App.



Android Audio Output Galaxy S10

Appendix - Android Audio Output Device

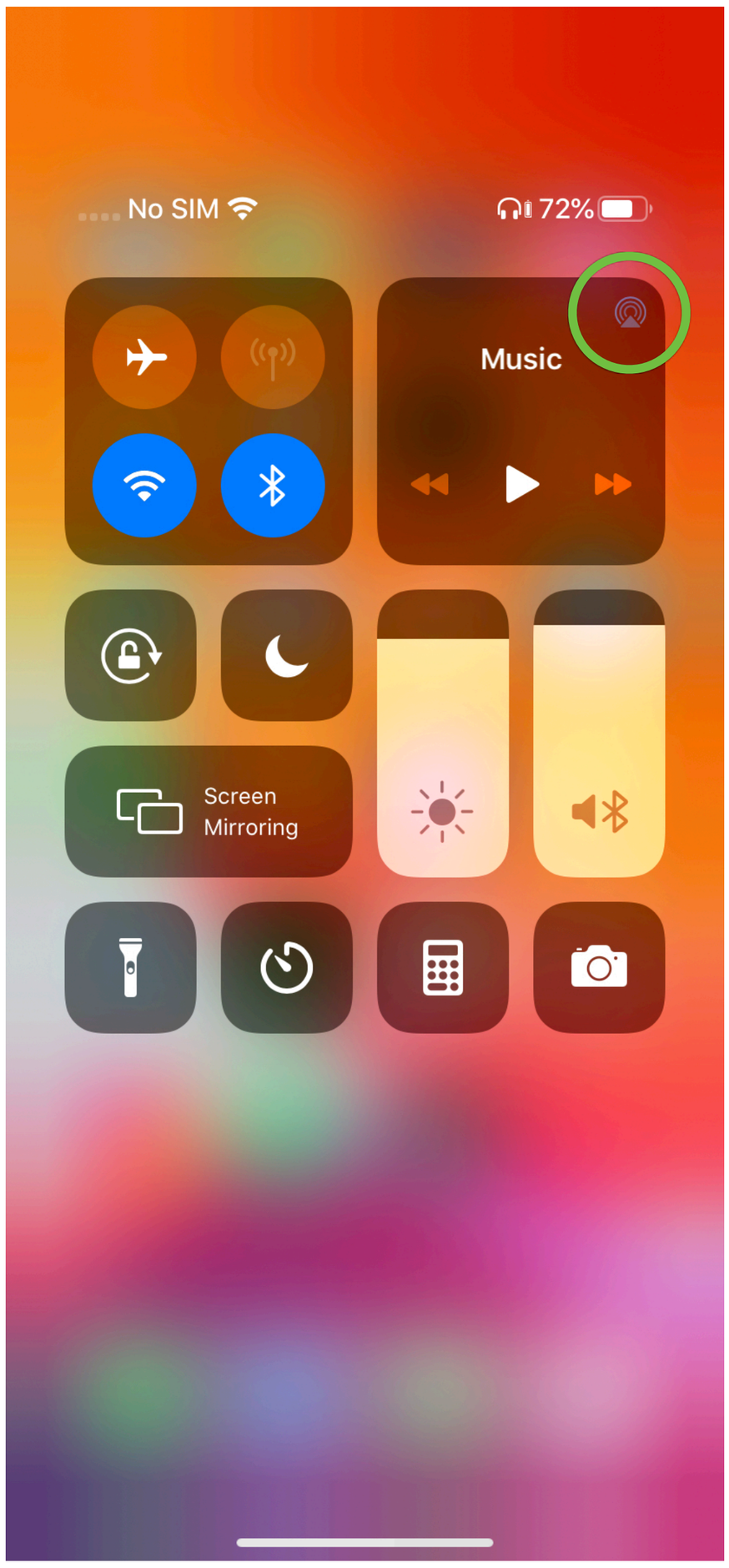
- In Android, Media —> Audio Output, you can select the active device you want to use.
- The system menu for Audio Output may be different across smartphone manufacture.

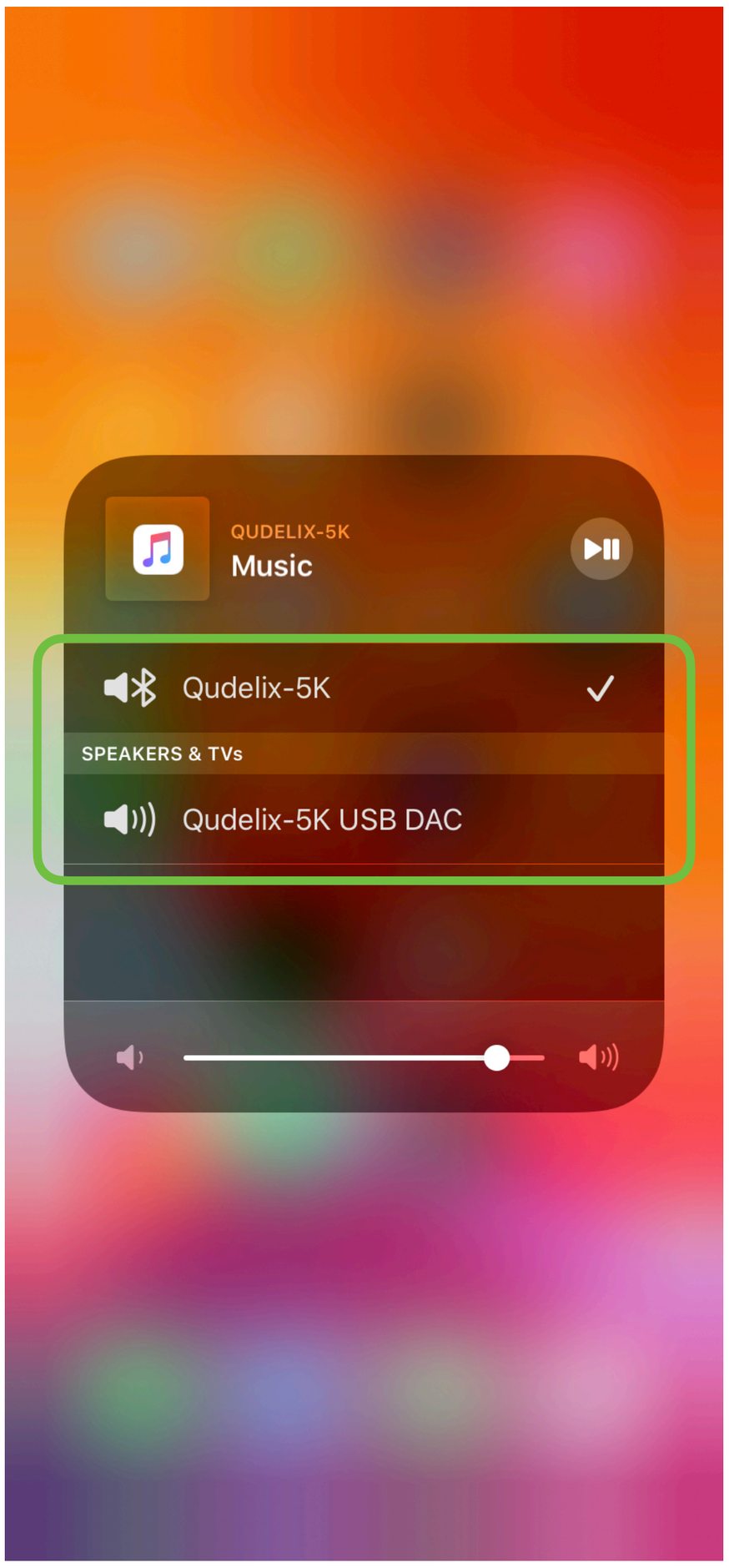
Android Audio Output Galaxy S10

Appendix - iOS Audio Output Device

- **5K Can be connected to iPhone both through Bluetooth and USB DAC (Apple Camera Kit) at the same time.**

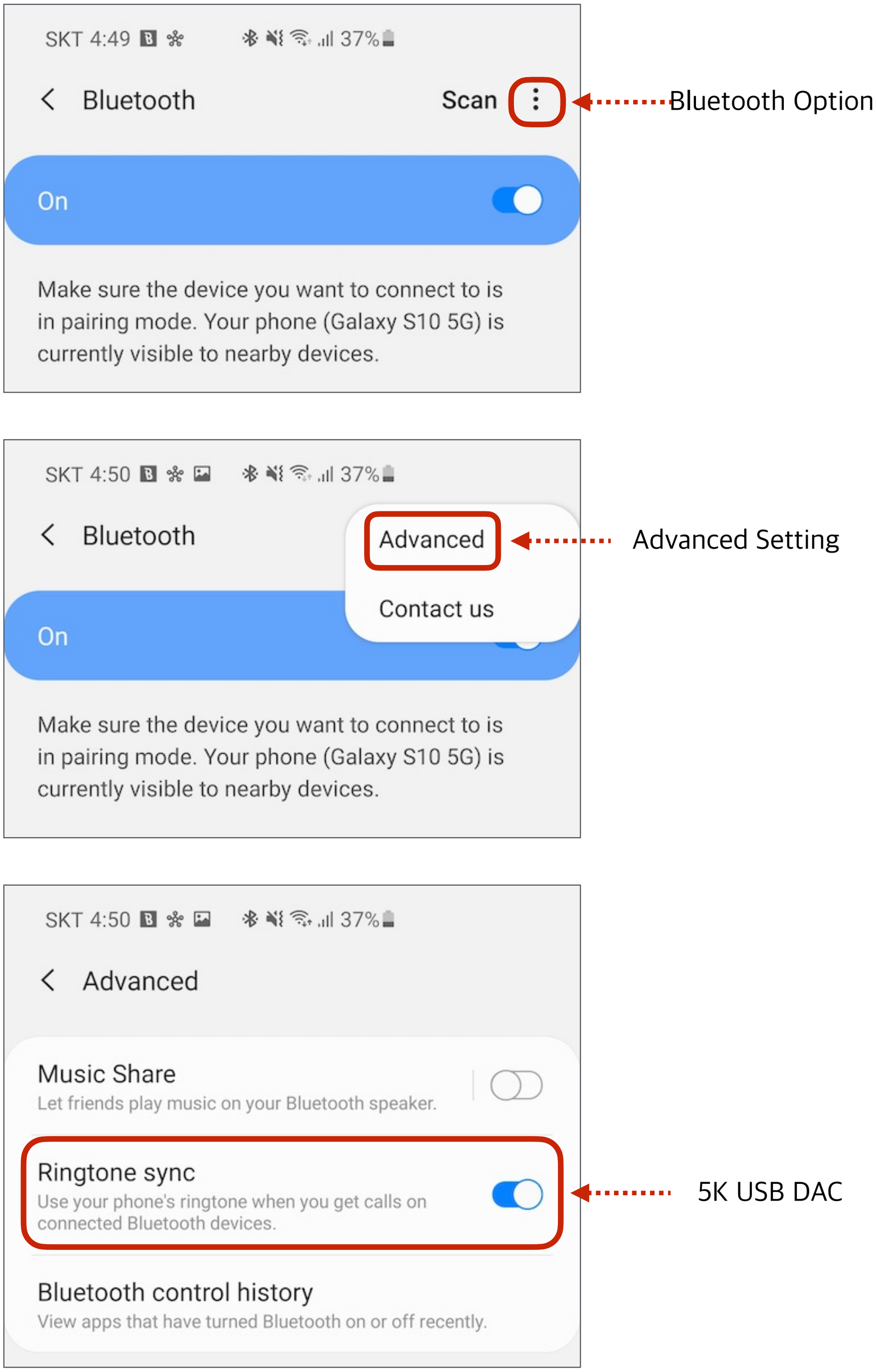
- In that case, the iPhone detects multiple audio output devices. And the iOS selects the active output device exclusively.





Appendix - Android In-Band Ringtone

- The way how the Bluetooth receiver plays the incoming call ringtone, Android OS selects.
- System Bluetooth —> Option (Top Right) —> Advanced —> Ringtone sync



Android In-Band Ringtone Galaxy S10