



Qudelix-5K

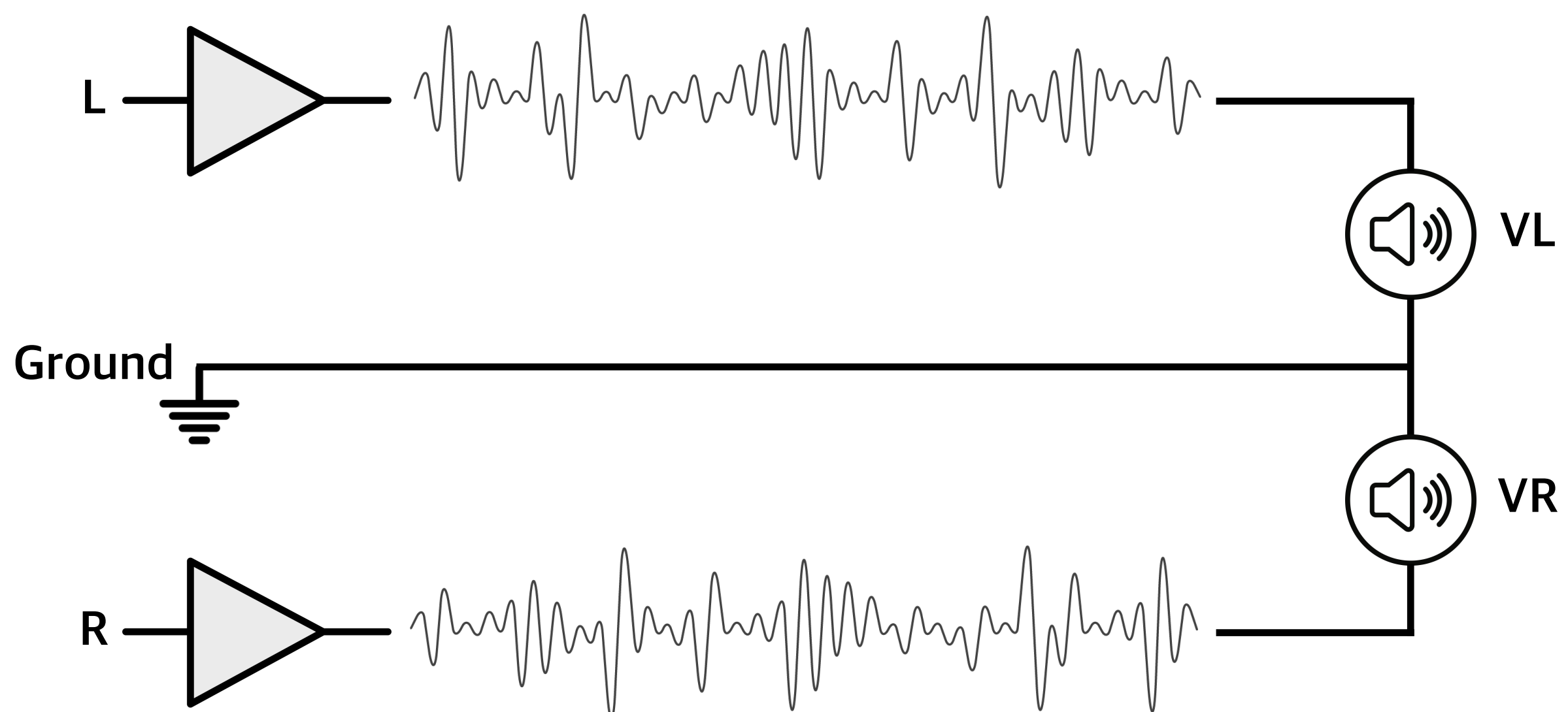
Application Note

AUG 2020

Copyright ©2020 by Qudelix, Inc. All rights reserved.

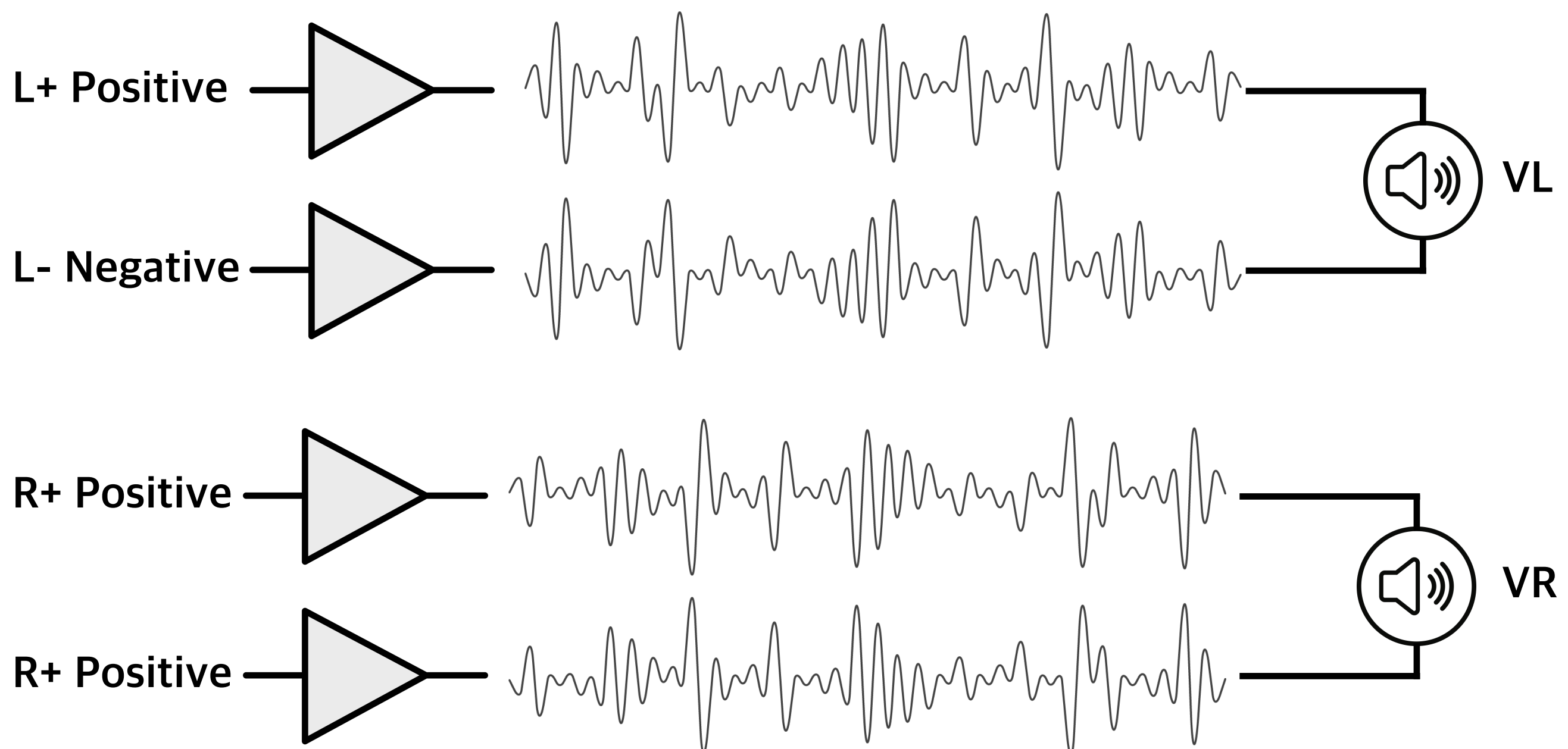
UNBALANCED (Single-Ended) 3.5mm

- 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)

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

BALANCED - HOW TO

- **Preliminary Requirements**

- DAC/AMP or DAP with Balanced Output
- Earphones or Headphones supporting detachable/replaceable cable
- Custom Balance Cable

- **DAC/AMP or DAP with Balanced Output**

- Many Hi-Fi Devices support Balance output mostly with 2.5mm 4-pin connector



- **Earphones or Headphones**

- Should have detachable/replaceable cable interface (i.e. MMCX earphones)

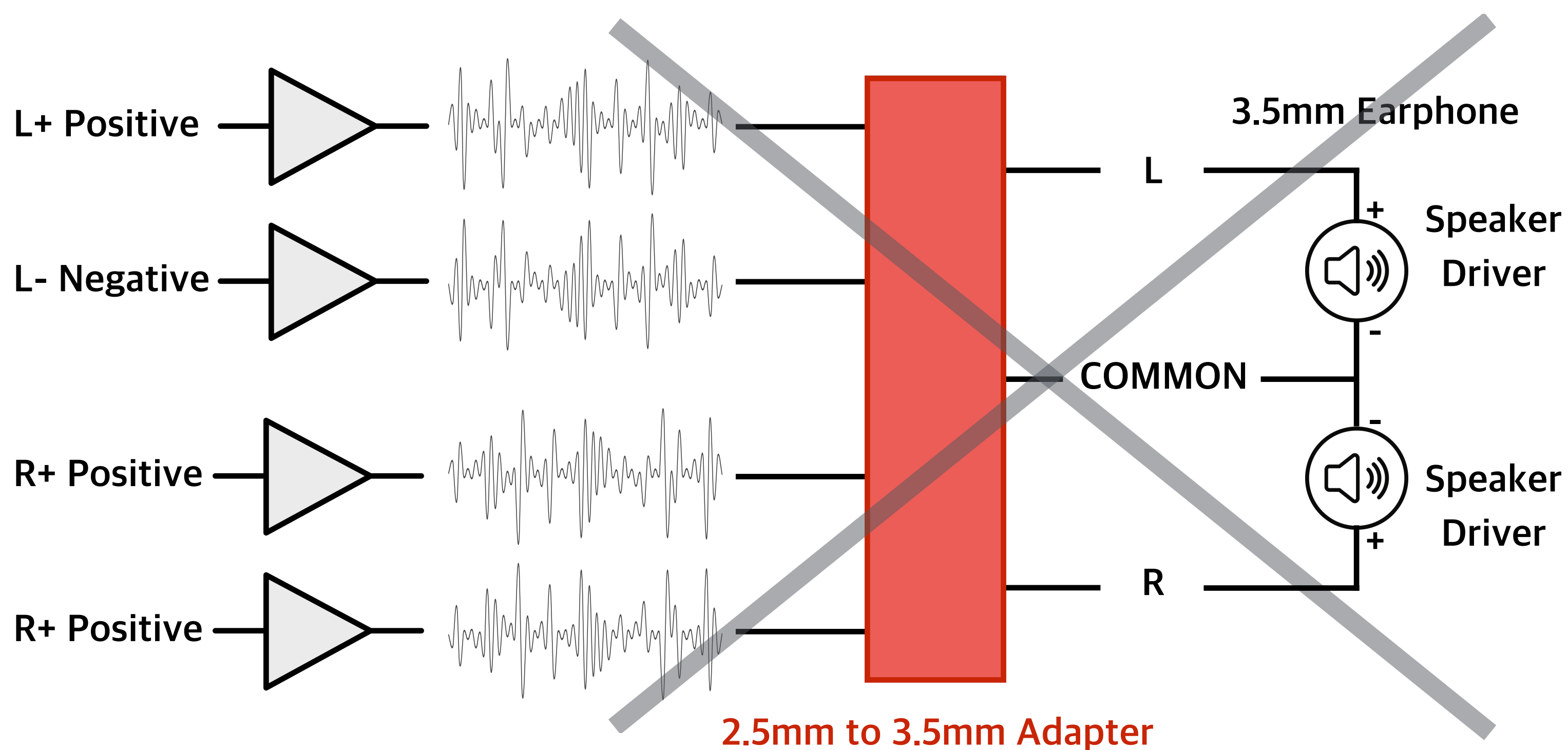


- **Custom Full Balance Cable**



BALANCED - DON'T

- Please DO NOT use any 2.5mm to 3.5mm Adapter
 - Full BALANCE can't be made with those adapter
 - 4-ch AMP Output eventually goes to 3-pin earphones wire



*Full-Balanced 4-wire interface is required from the device audio output to the earphones/headphones speaker units.

Interfacing to Amp or Speaker - Cable

- **UNBALANCE**
 - 3.5mm Male to 3.5mm Male cable
 - 3.5mm Male to RCA cable
- **BALANCE**
 - 2.5mm Male to XLR cable



3.5mm Aux-In Speaker



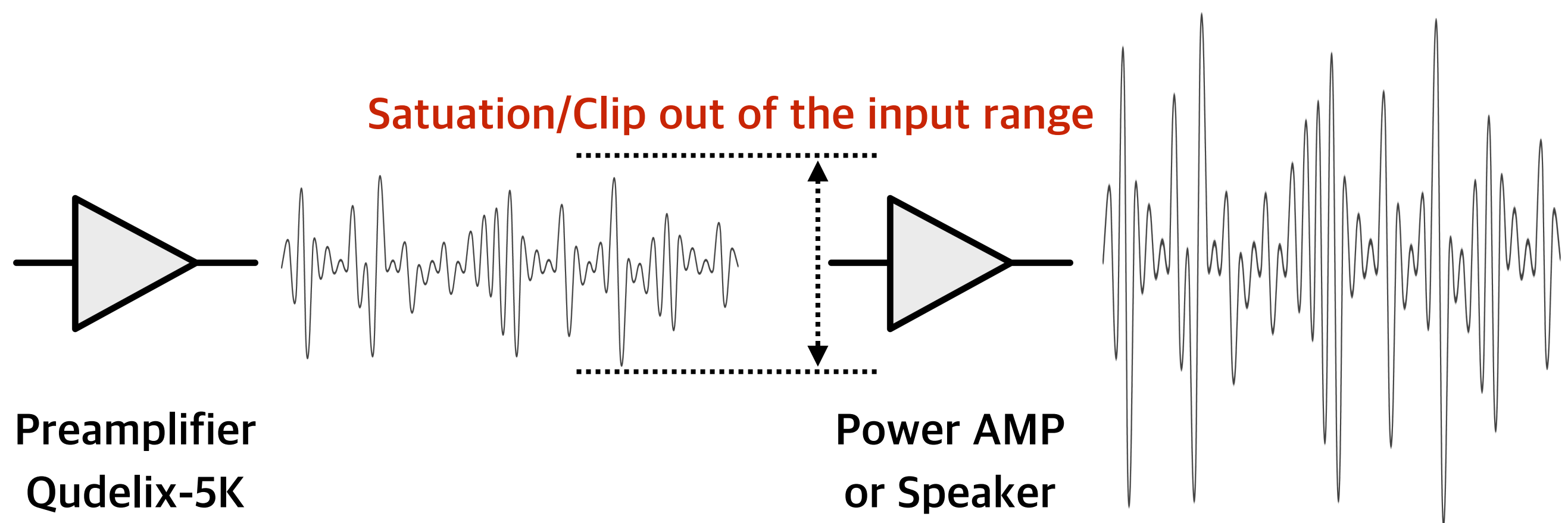
RCA Input Power Amplifier



XLR(BAL) Input Power Amplifier

Interfacing to Amp or Speaker - Gain Optimization

- Please check the below three wave files
 - 997KHz 0dBFS.wav (Full Scale, No Overdrive)
 - 997KHz +3dB Overdrive.wav
 - 997KHz +6dB Overdrive.wav
- You can easily listen to the tonal differences.
- Overdrive (saturation/clipping) makes the harmonics, resulting in an audible sound difference that is easily distinguishable.
- Remember the difference.
- **Power Amplifier (or Speaker with Built-in AMP)**
 - Every Amplifier analog input has a limited input voltage level.
 - https://en.wikipedia.org/wiki/Line_level
 - Any input signal higher than the input range will be clipped/saturated.

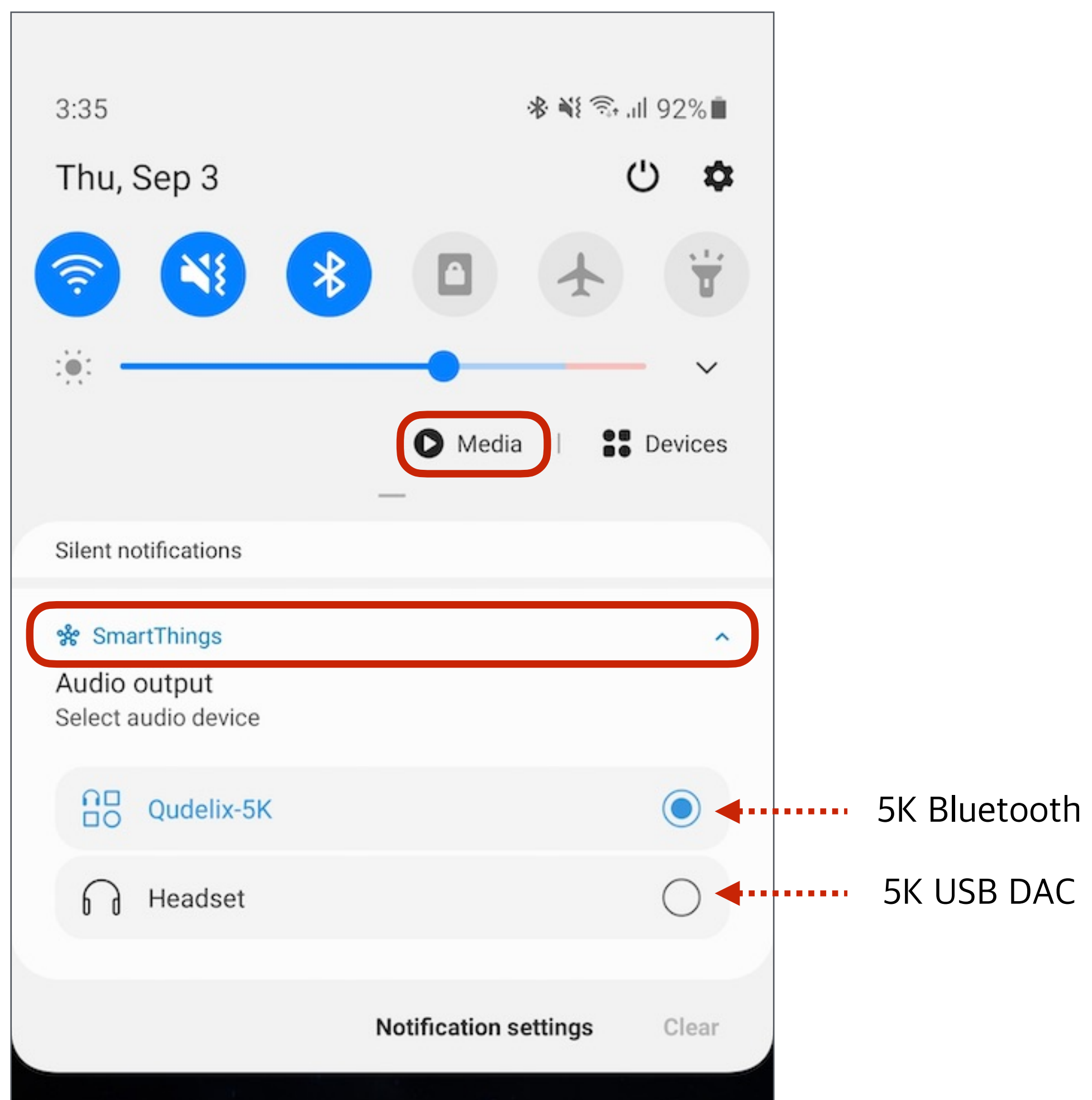


- Optimize 5K Gain Setting
 - APP → DAC/AMP → MODE → OUTPUT POWER → set **NORMAL** (for the lower noise level)
 - Set Source Device (Smartphone) Volume at the maximum
 - Set Qudelix-5K Volume at -40dB
 - Play 997KHz 0dBFS.wav
 - Adjust Power AMP or Speaker Volume to a moderate level
 - Increase Qudelix-5K Volume step-by-step until you notice the sound difference. (Remember the tonal difference with 997KHz +3dB/+6dB Overdrive.wav)
 - Your ear can detect an audible difference upon the clipping/saturation at the amplifier input.
 - Mark the Qudelix-5K volume level and APP → VOLUME → OPTION → set **VOLUME LIMIT**

***Qudelix-5K output will be saturated/clipped at the amplifier input stage, if 5K volume is too high.**

Android Audio Output Device

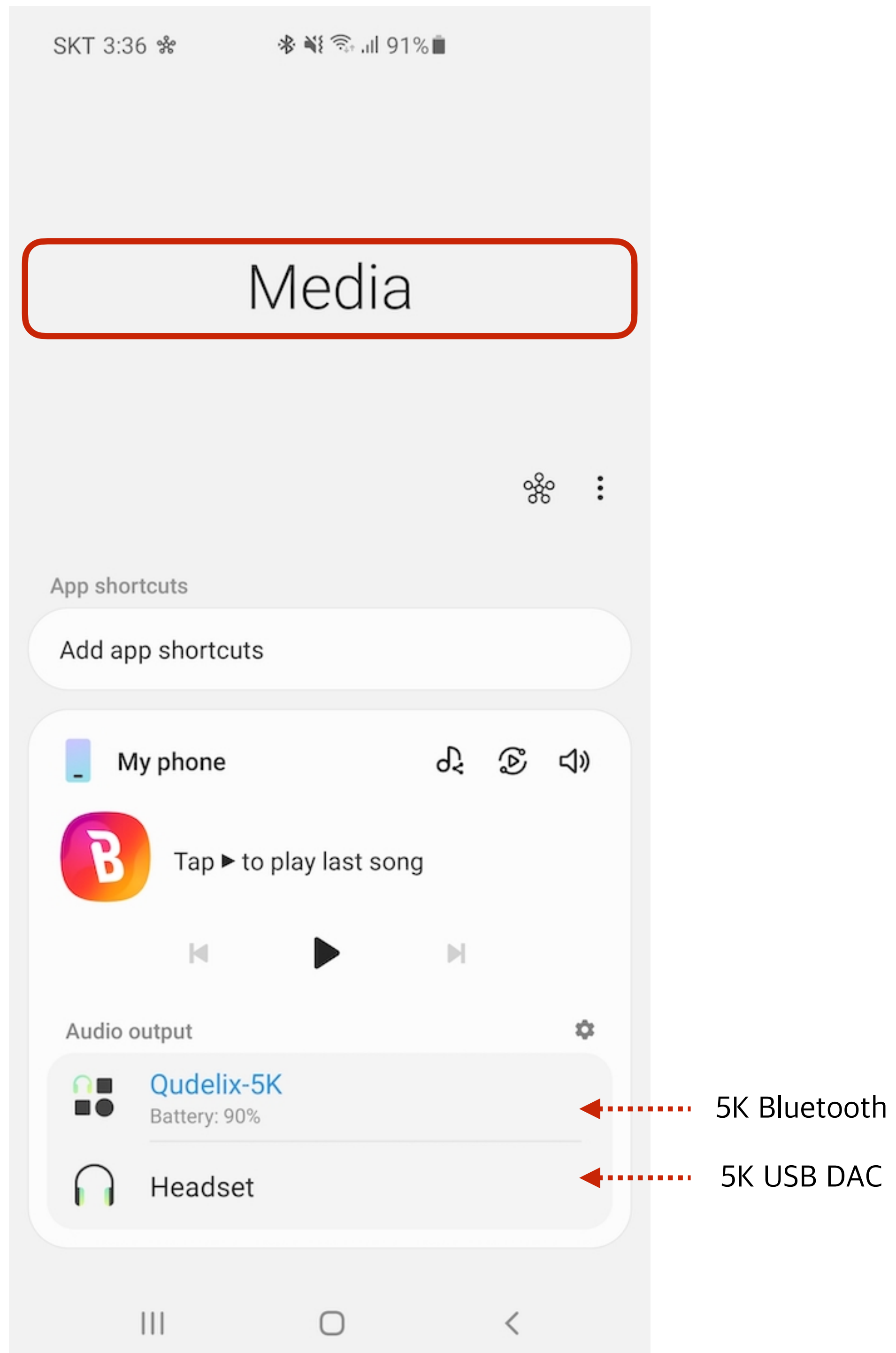
- 5K Can be connected to Android both through Bluetooth and USB DAC (C-to-C) at the same time.
- In that case, the Android device detects multiple audio output devices. And the Android selects the active output device exclusively.
- *With some specific Android devices, **SONY Android App** sometimes 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

Android Audio Output Device

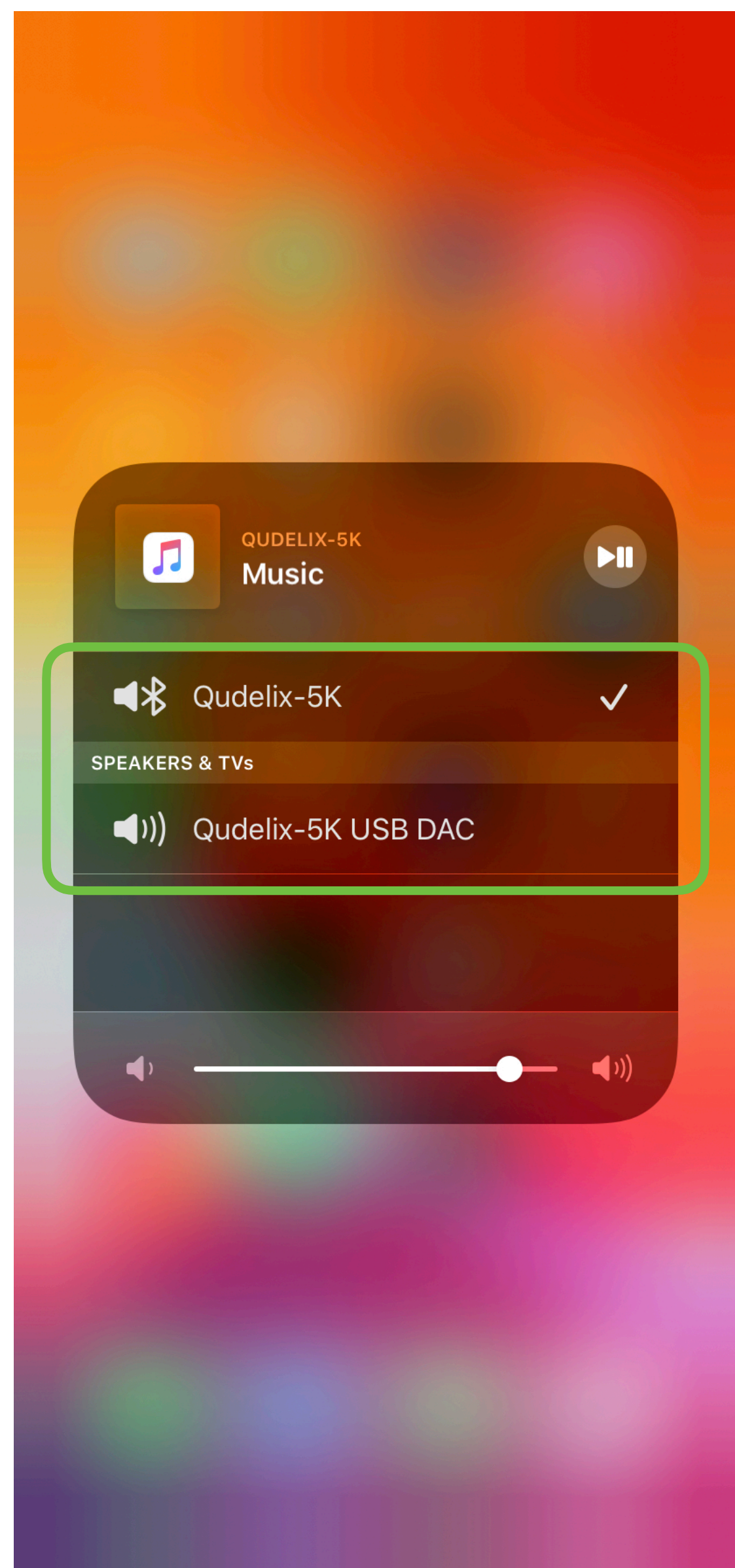
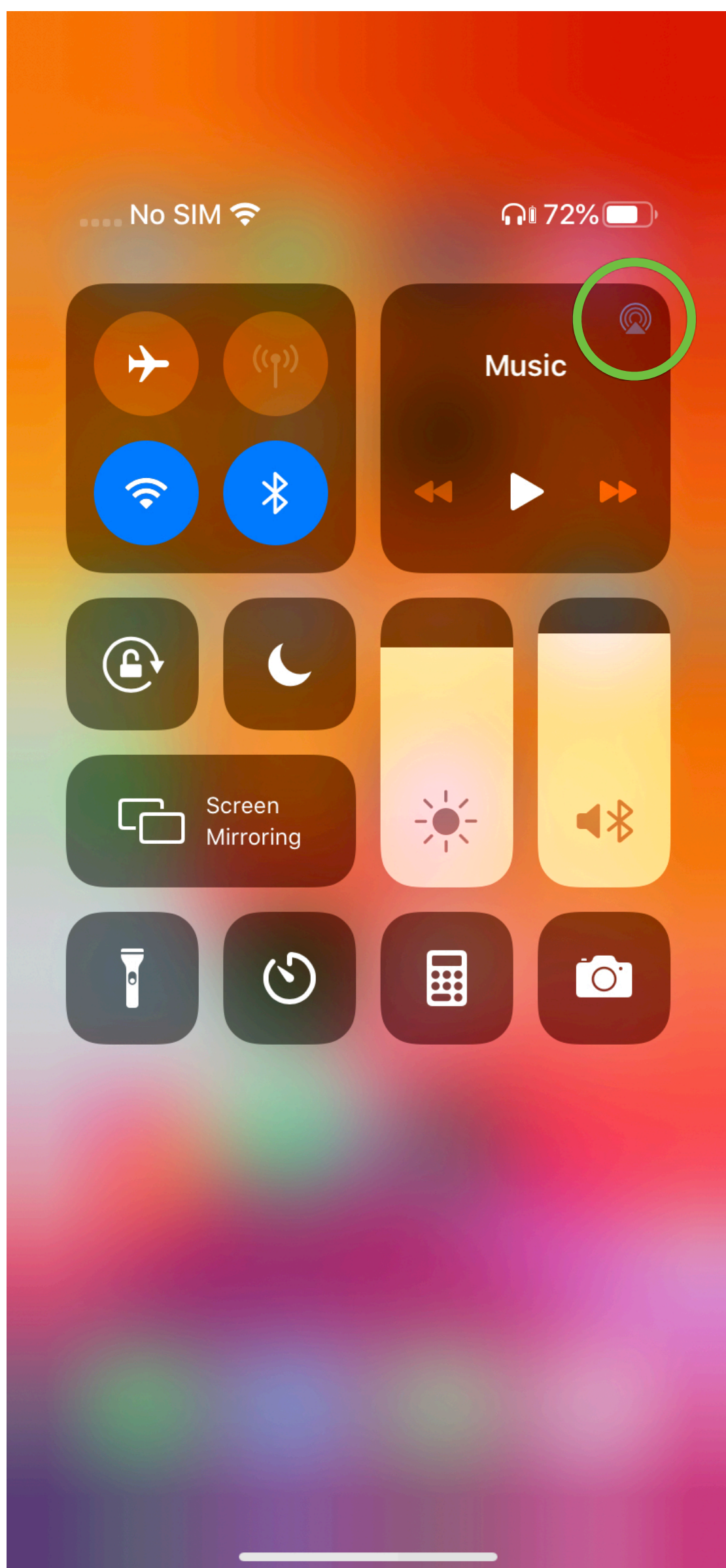
- In Android, Media → Audio Output, you can select the active device you want to use.
- The system menu for Audio Output may be different across smartphone manufacture.



Android Audio Output Galaxy S10

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.



Foobar2000 Setup

- Set 5K USB DAC supported sample rate
 - 5K APP → INPUT → USB → 44.1/48/88.2/96KHz
- Set Foobar2000 → Library → Configure → Playback → Output
 - WASAPI (push) or (event)
 - Output data format 24-bit

