

# Superlux HD681... revisited... yet again.



On the left the current (2018) HD681 which is sold for over 10 years now. In that time it seems to have undergone some changes on the outside and it seems also slight changes on the inside as well.

Below the early version (on the left) and a 2018 version on the right. The red rings have been changed from bright red to a dark red. The print on the headphones has changed as well. The cable and the construction as well as the driver and the pads appear to be unchanged at first sight. The components that tend to break over time (the plastic bit that couples the rods to the headphone) is unchanged... alas. The pads also could have been changed instead of cosmetics only.



Comfort wise these aren't that great and they feel a bit cheap.

That may be because they are really cheap.

They sell for € 19.- to € 25.- which is a bargain.

One can bend the headphones in all directions which does contribute to the cheap feel. However, this is more of a feature (AKG copy) than because of the price.

The pads and headband are not comfortable. The pads are of the stiffer pleather (PVC based fake leather) kind with a limited depth. Slightly protruding ears may be touching the foam on the drivers.

The headband is not padded but does not cause soar spots because of the light weight and low pressure.

Adjust-ability is good though and will fit most head sizes.

Clamping force is pleasant. Not too loose and not clamping hard.

## specifications:

**Type:** over ear, semi-open

**Usage:** studio usage, home and portable

**Driver type:** dynamic

**Pads:** replaceable, pleather pads

**Inner pad dimensions:** Ø 55mm, depth = 15mm

**Collapsible:** No

**Cable entry:** single sided (Left)

**Cable:** fixed, 2.5m. with 3.5mm TRS jack and screw-on 6.3mm adapter

**Driver size:** 50mm

Nom. **power rating:** 0.3W

Nom. **voltage:** 3.1 Vrms

Nom. **current:** 100 mA

Max. **S.P.L.:** 122 dB

**Impedance:** 32 Ω

**Efficiency:** 98 dB/1mW (113 dB SPL/V)

**Isolation:** medium (semi-open)

**Weight:** 276 g.

**Clamping force:** low

**Accessories:** 6.3mm TRS adapter, pouch.

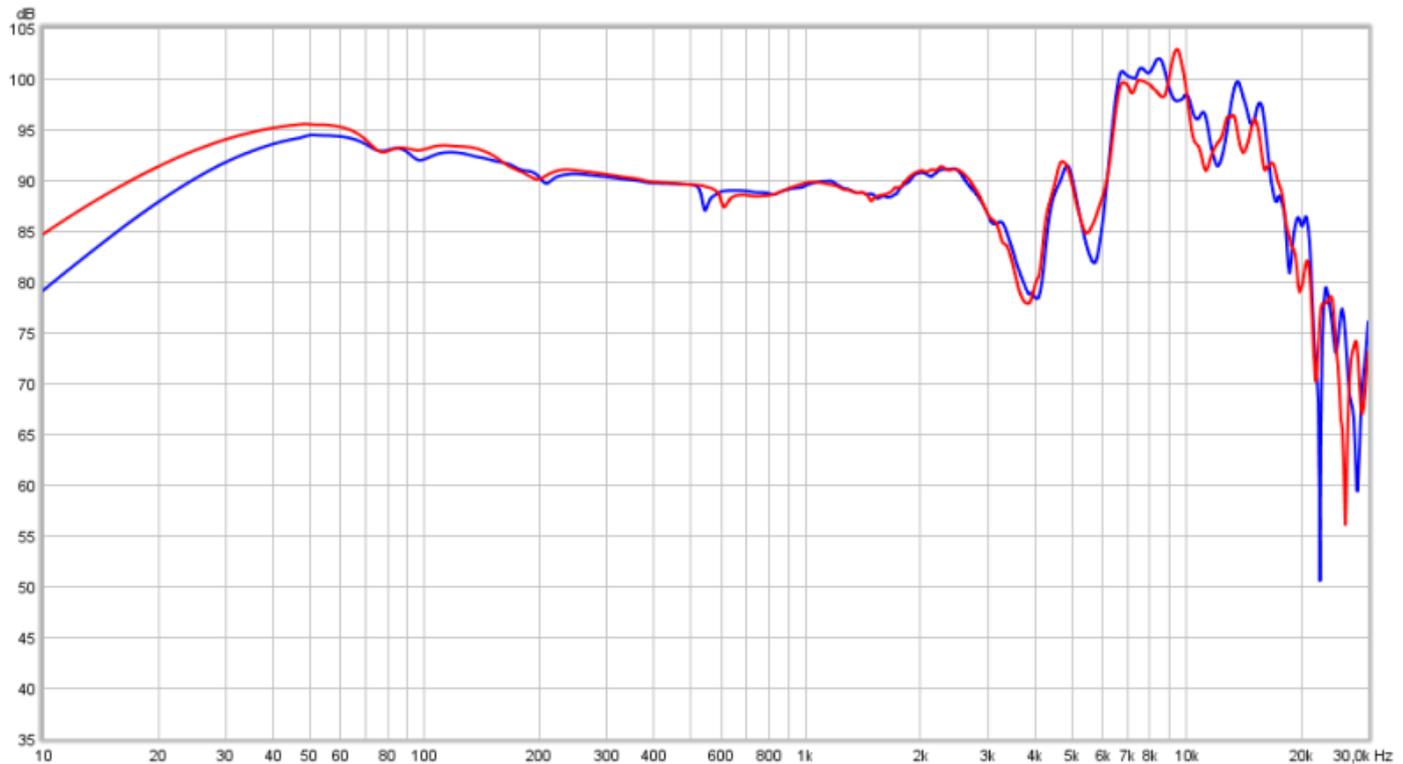
## Sound description:

This headphone is quite bassy and reaches down very deep. The bass does not bleed into the mids. The mids themselves are clear and open sounding but not 'refined' they have a coarseness about it, especially at higher levels. There is good clarity/presence.

The treble is .. well... elevated and can sound harsh and filled with 'fake detail'.

For its price it does not sound bad at all and it has the potential to sound a lot better with some modifications. Those modifications require some soldering and taking the headphone apart.

Below the FR plot of the 2018 **Superlux HD681** in **stock** form (pleather pads) **Right, Left**.



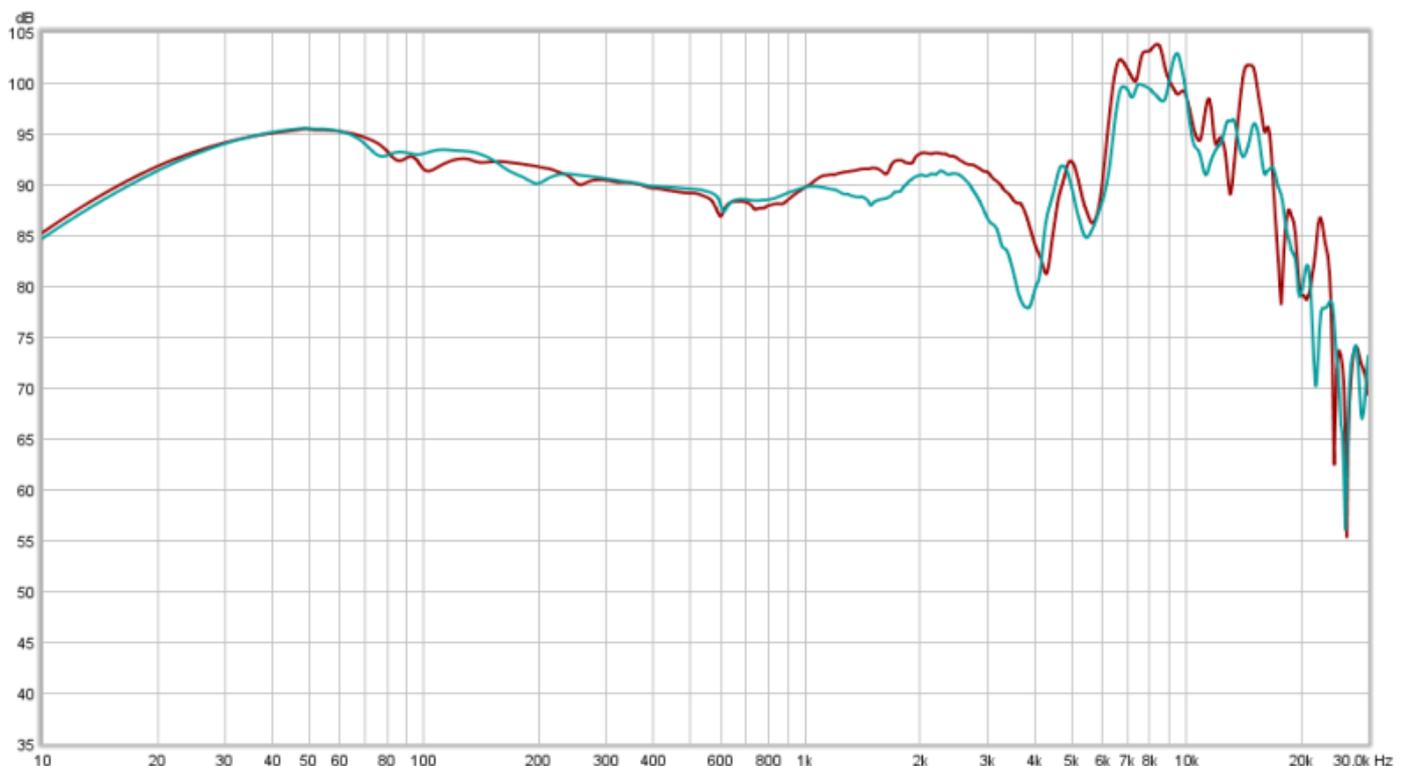
Bass extension is excellent. The bass is somewhat raised (+5dB) which some will like and others may find over the top. There is a slight imbalance below 50Hz but this is not audible.

The response is impressively flat (within 3dB) from 100Hz to 2.5kHz. Because of this the sound is very neutral and realistic. Around 4kHz there is a dip. It is narrow but not innocent.

The treble is raised. +10dB means it is reproduced 2x as loud as the bass to mids which is very audible. For older folks (65+) this may be welcome, for the rest of the public it is a bit too much.

EQ or modifications can help greatly here.

To see if the sound has changed over the years as well below the **2011 HD681** versus the **current (2018) HD681**.



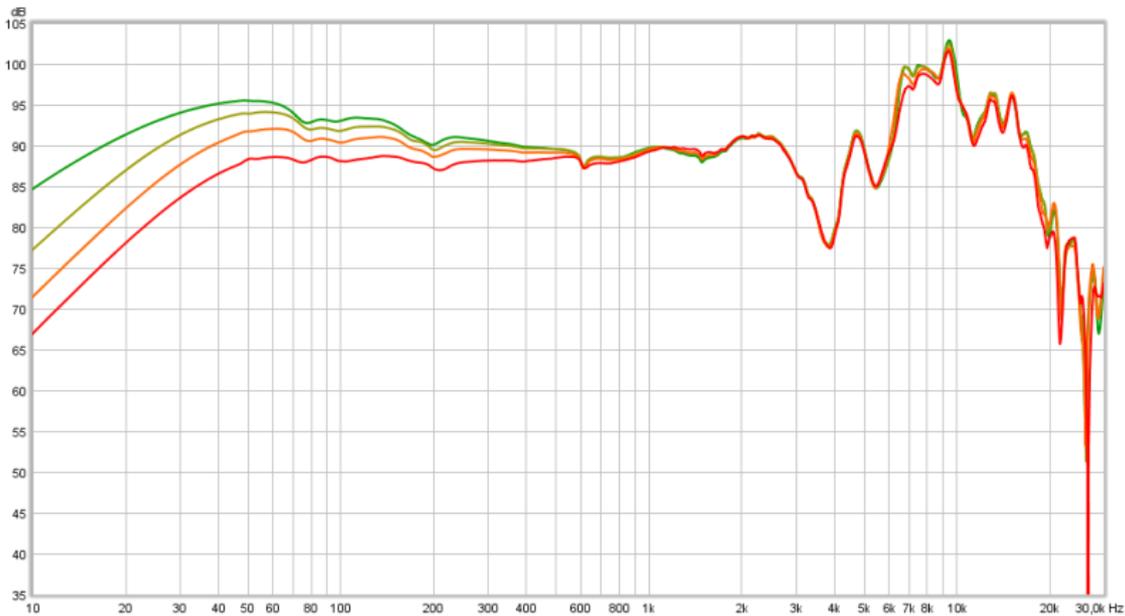
They certainly are quite similar up to 1kHz. Above 1kHz the old version has quite a few dB more upper mids and treble. While the drivers appear to be the same (when looking at them) they seem to be improved over the years as well. This makes the 2018 version (no idea when these changes were made) more neutral. The old version was a bit 'shouty' and too 'forward' in the mids. Also the treble is a bit better in quality and somewhat lower in amplitude.

## seal

As the seal of this headphone is of importance (pads touching the skin everywhere) some experiments showing the effect of a loss of seal.

(Lots of) hair between the headphone and ear or head shape and (reading) glasses can break the seal and will affect the tonal balance.

Below: **Perfect seal**, a small seal breach caused by hair or **thin armed (reading) glasses** that sit just above the skin, **glasses with thicker arms** and a **big seal breach** (6.3mm plug).



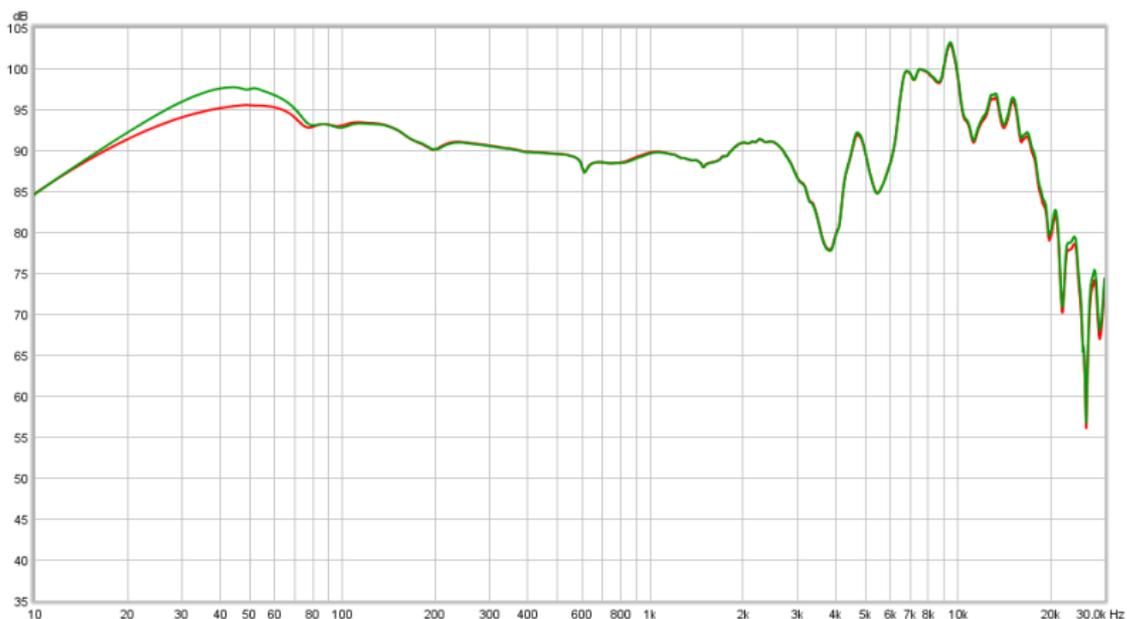
A small seal breach isn't really problematic. In fact it is even welcome and makes the headphone a bit 'more linear' sounding. Even a substantial seal breach is not very problematic but the sound is a bit 'thinner' though.

## output resistance / damping-factor

As this is a dynamic headphone the frequency response might be amplifier output resistance dependent when certain higher output resistance amplifiers are used.

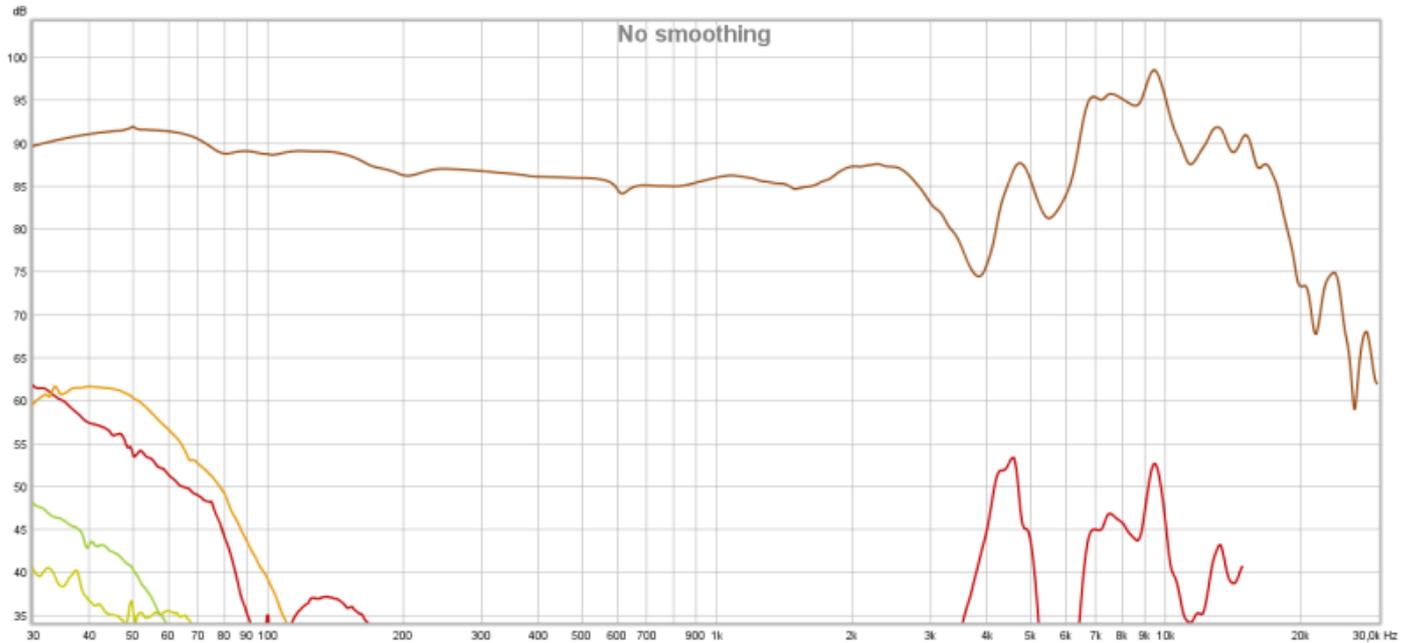
To test this the headphone is measured via a low impedance amplifier (**0.2Ω**) and a high impedance amplifier (**120Ω**).

On a higher output resistance amplifier the output level will be considerably lower. To compensate for this the amplifier is cranked up to the same level (14dB at 1kHz) as the low impedance amplifier. This way the plots are overlay-ed and it is easier to show the tonal balance differences.

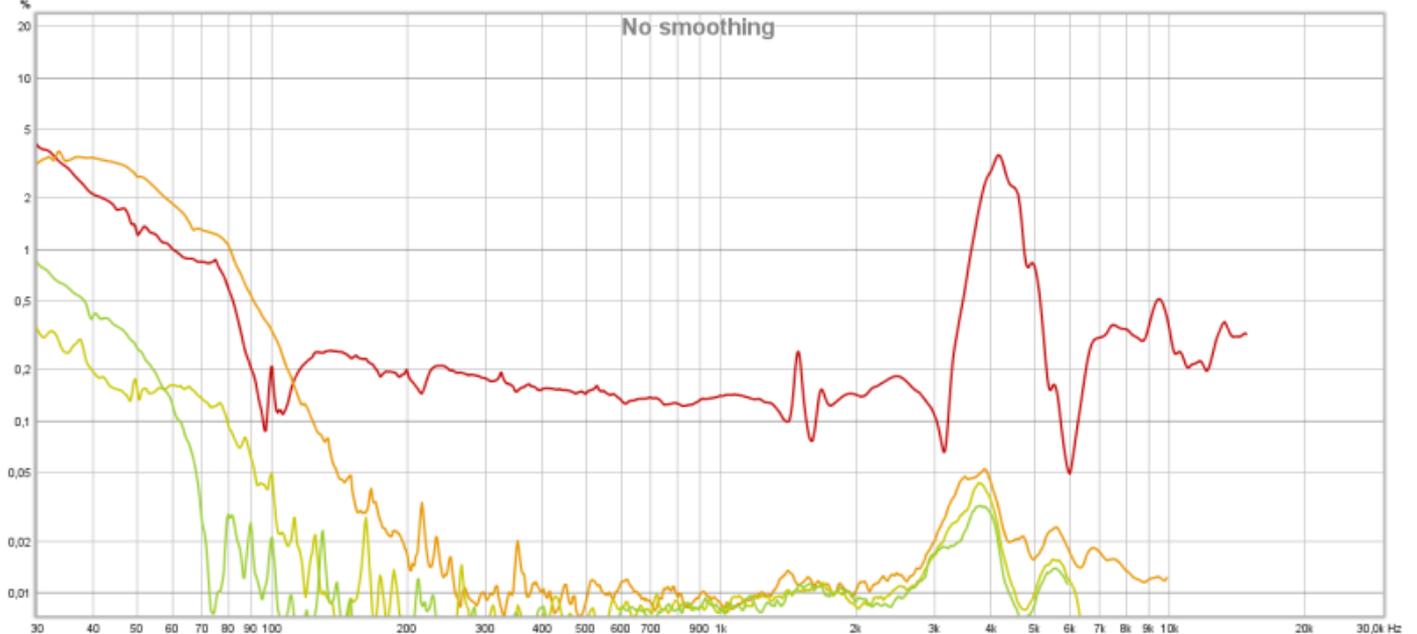


The headphone does not react that much to higher output resistances. There is about 2.5dB more subbass only. The rest remains unaffected. No reason to worry about output resistances with this headphone. The plot shows the resonance frequency of this driver is unusually low in frequency (around 40Hz) and quite narrow as well.

Below the **distortion** measurements of the **HD681** (Right channel)



Below the same distortion plot but with the vertical scale in percentages



instead of level differences. The **3rd harmonic distortion** around 40Hz is reaching 3.5% and is indicative of 'clipping' alike non-linear behavior. From 120Hz up the **distortion** is well below 0.1%.

Higher distortion levels at lower frequencies are not really that audible as such so everything below 1% is good so the distortion is somewhat on the high side. **2nd harmonic distortion** in the lows is also on the high side 2% around 40Hz. Above 60Hz it drops below 1%.

*The **2nd harmonic distortion** is probably lower than shown, as lower limits of the test rig are around 0.15%.*

From 150Hz to 3kHz the distortion is low.

The elephant in the room sticks out like a soar thumb though.

There is something quite 'wrong' around 4kHz.

This is also seen in the frequency plots as a dip. At that frequency the signal/distortion distance is only 25dB and thus reaching audible levels.

As this is around a frequency where the ear is extra sensitive (ear canal resonance) this is audible as a slight 'coarseness' in the upper mids. A loss of 'smoothness' in the sound with certain recordings.

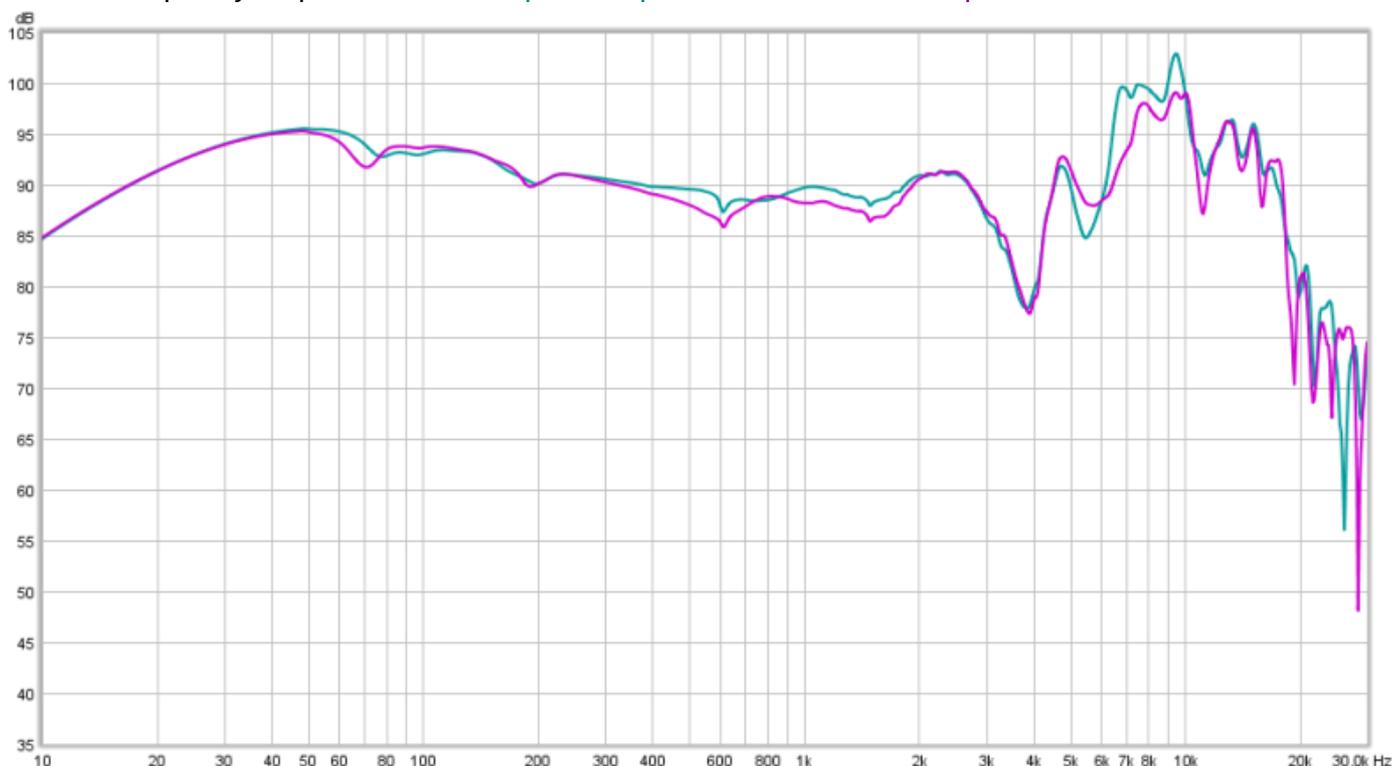
It IS a cheap headphone after all so it is not strange to see something like this.



Superlux also sells velour (they call it velvet) pads for the HD681. This includes the foam discs, order code: **EPK681-V**. These are not that expensive (around € 10.-). A more expensive alternative are AKG K240 velour pads. I would stay away from Chinese replacement pads of e-bay etc. These sound substantially different and not for the better.

The velvet pads have a slightly smaller opening for the ears. The diameter is 50mm instead of 55mm. Depth is slightly better at 17mm.

Below the frequency response with **stock pleather pads** and with the **velvet pads**.

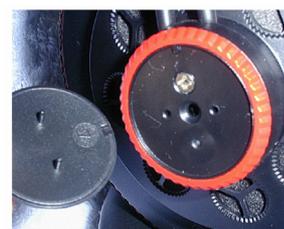


Bass response isn't changed. Mids are slightly lower in level (driver is a tiny bit further away from the ear). Treble response is improved by a few dB and less 'grainy'.

Those finding the somewhat elevated bass a bit too much there is an easy to perform modification that lowers the bass to more neutral territory. It requires opening up the headphone.

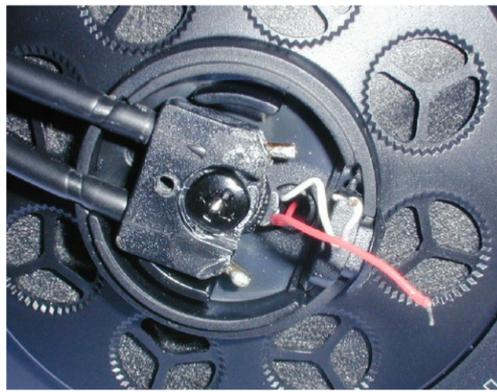
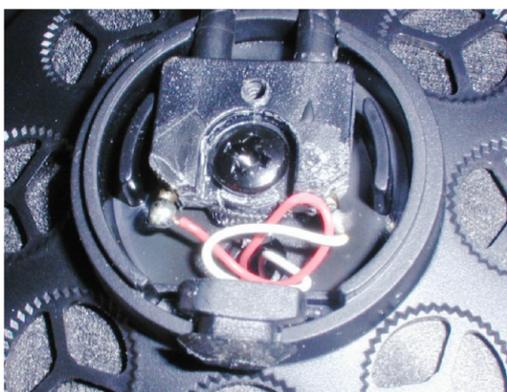


Remove the shield by sticking a utility knife under it and prying it outwards. It holds itself with 2 small pins. When the small screw is removed the cap can be removed. In this case it is the side without the cable entry.



Underneath there is a big screw that connects the rods (which double as connection wire) to the cups.

These wires need to be removed. Remember or write down which rod the wires were soldered to.





When the wires are removed the big screw must be removed. The middle part can now be removed by pulling it out. There is a paper dust filter tucked loosely in there. Once the top part is removed one ends up with the situation as shown below.



The next part is a bit tricky to do and in one occasion I broke of a pinion. (Replaced that with an M3 screw so was fixable).

It requires removing the plastic "bridge". That bridge can be bent outwards a little and is held in place by 2 pinions on the ring.



It is probably not needed to remove it and when one is handy enough the modification can be done with the 'bridge' still in place. It can be tilted to one side far enough to have good access.

To better show what needs to be done the following pictures are taken with the 'bridge' removed.

Make a ring of double-sided tape so the hole is not covered. Cut a small disc of foam the size of the magnet and stick it onto the double-sided tape as shown below.

On the right, the pinions where the 'bridge' rotates on can be seen.



One at 5 o'clock and the second one at 11 o'clock (harder to see).



The foam used is quite open and is 5mm thick. Any open cell foam can be used. The used foam is very easy and soft to compress. The openness of the used foam (and thickness) will have an effect. Thicker foam = less bass, more dense foam = less bass.

It may be a case of trial and error but this foam is what I had and gave the effect I wanted so did not experiment with other types of foam.

Re-assemble the headphone and perform the same modification on the other cup. Ensure the red and white wire are soldered to the correct rods. I recommend to apply some fresh solder to the rods and wires when soldering the wires ! Use at least a 40W iron.

The side with the cable entry opens up the same way but there is also the headphone wire which needs to be de-soldered.

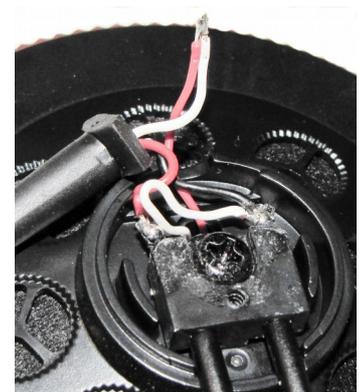
Note how the wires are soldered. The white one from the driver is connected to one rod together with the black wire from the cable. (see picture on the right).

The white wire from the cable (right channel) to the red wire from the driver.

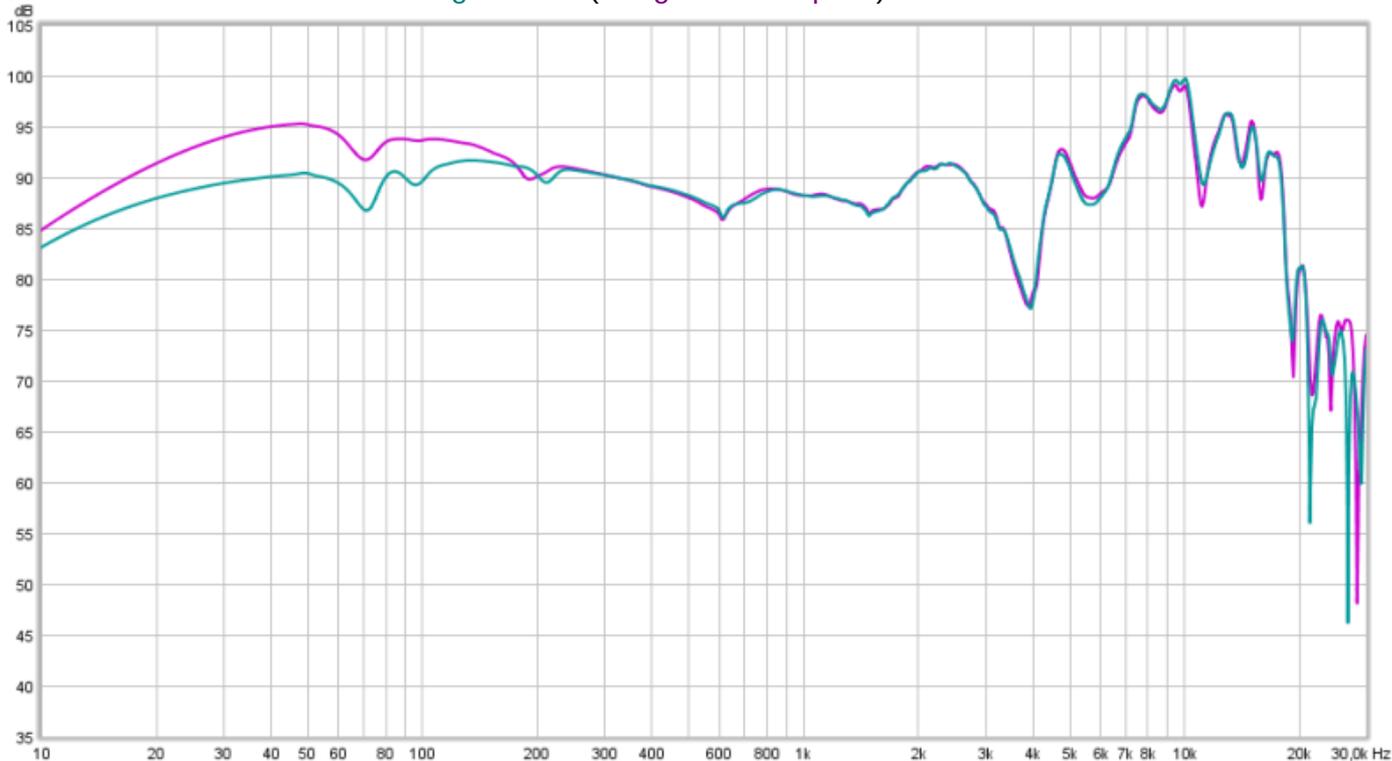
The red wire from the driver is connected to the other rod.

**Note:** the wire colors in the cable deviate from the consensus, in this case red=Left, white=Right, black=Common return wire.

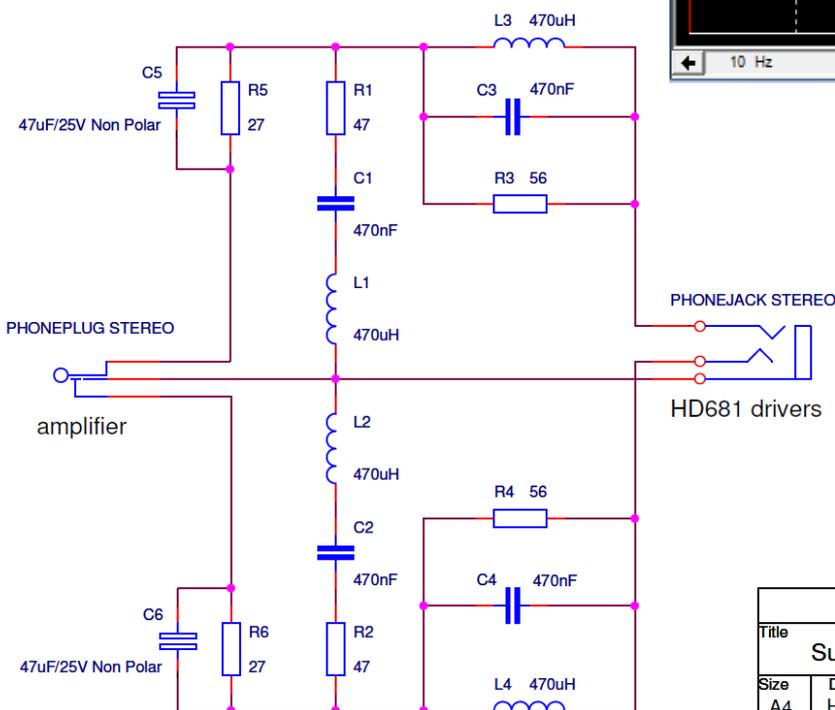
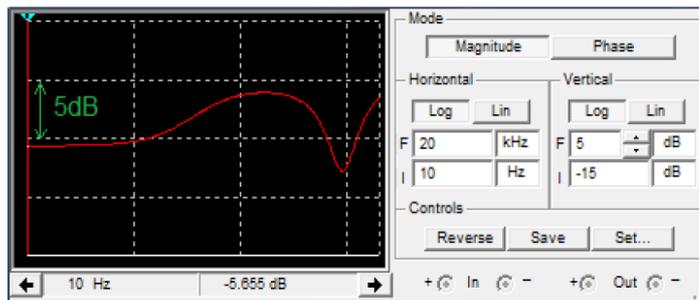
The driver wires are red=plus, white=minus.



Below the effect of the foam covering the hole (using the velvet pads)

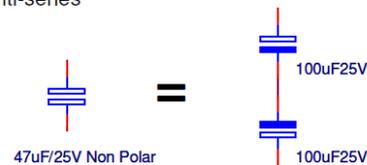


This filter ONLY works correctly when driven from players/amplifiers with low Ohmic output resistances. An amplifier output resistance of 10 Ohm or lower is recommended. When amplifiers are used with higher output resistances the bass reduction will be less and the sound will 'warm' up.



Component properties:

- L1 - L4:  $R_{dc} < 2.6$  Ohms, Current  $> 0.4A$
- R1 - R6: metalfilm rated between 0.4W & 0.6W
- C1 - C4: Ceramic multilayer NP0/C0G or X7R or film type. Do NOT use electrolytic, ceramic disc or tantalum capacitors.
- C5 - C6: 47uF/25V NonPolar (Bipolar) electrolytic or 2x100uF/25V Polar electrolytic in anti-series



designed by: Solderdude, DIY-Audio-Heaven

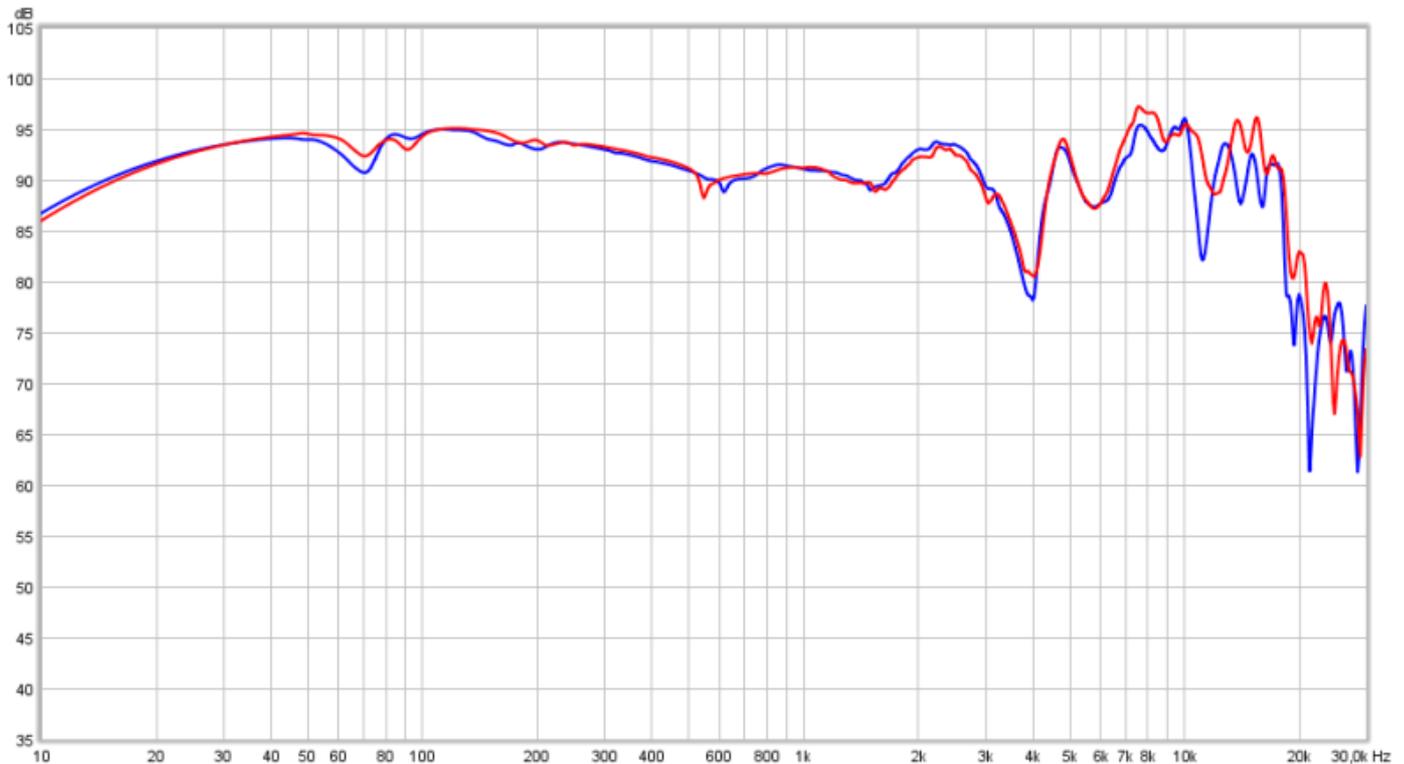
Title		
Superlux HD681 correction filter		
Size	Document Number	Rev
A4	HD681-IV-	1
Date:	Sheet	1 of 1

Those not willing to open up the HD681 but are handy with a soldering iron can also use an electronic passive filter built into a small extension cord. The schematic for the bass modification + treble filter is shown below.

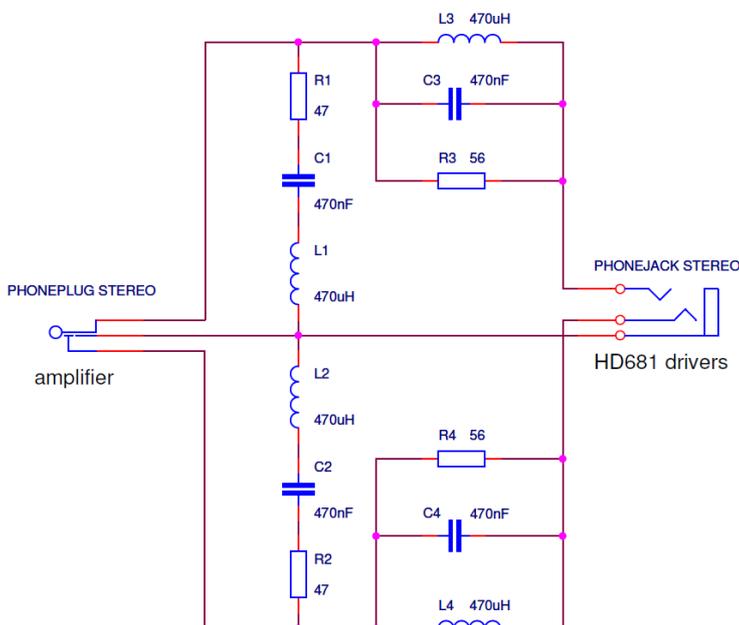
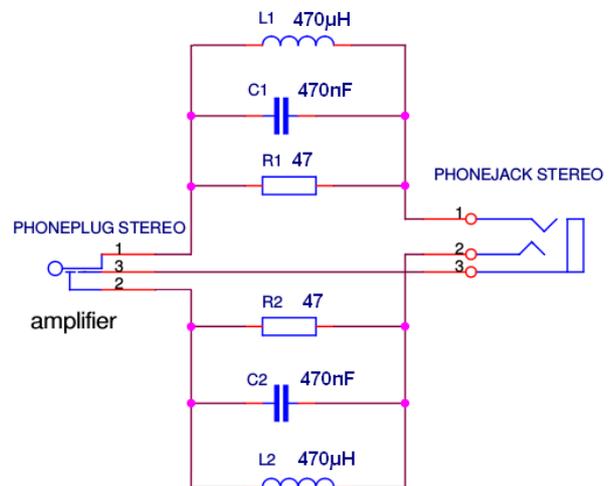
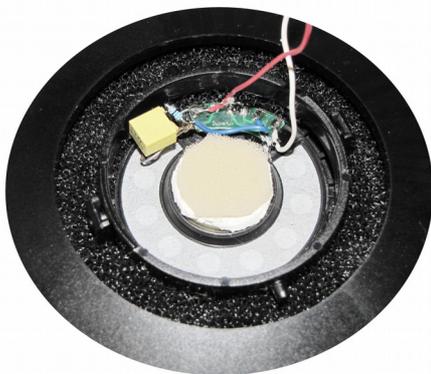
It can be constructed in a small box in series with the headphone cable. The amount of bass reduction can be changed. When R5 and R6 are made smaller in value (say 15Ω) less bass is removed.

In the schematic on the previous page an elaborate filter is shown. This is not without reason. The filter is suited for usage with all types of amplifiers and lowers the treble peak.

Below the frequency response of the modified HD681 (velvet pads + foam on driver magnet) with the (much simpler) treble filter shown below the frequency plot. (left, right)



The effect of this filter with the foam modification and using the velvet pads is shown in the plot below. The HD681 has improved in tonal balance (very neutral/realistic) and comfort (pads) and is quite 'flat' from 15Hz to 19kHz within a few dB.



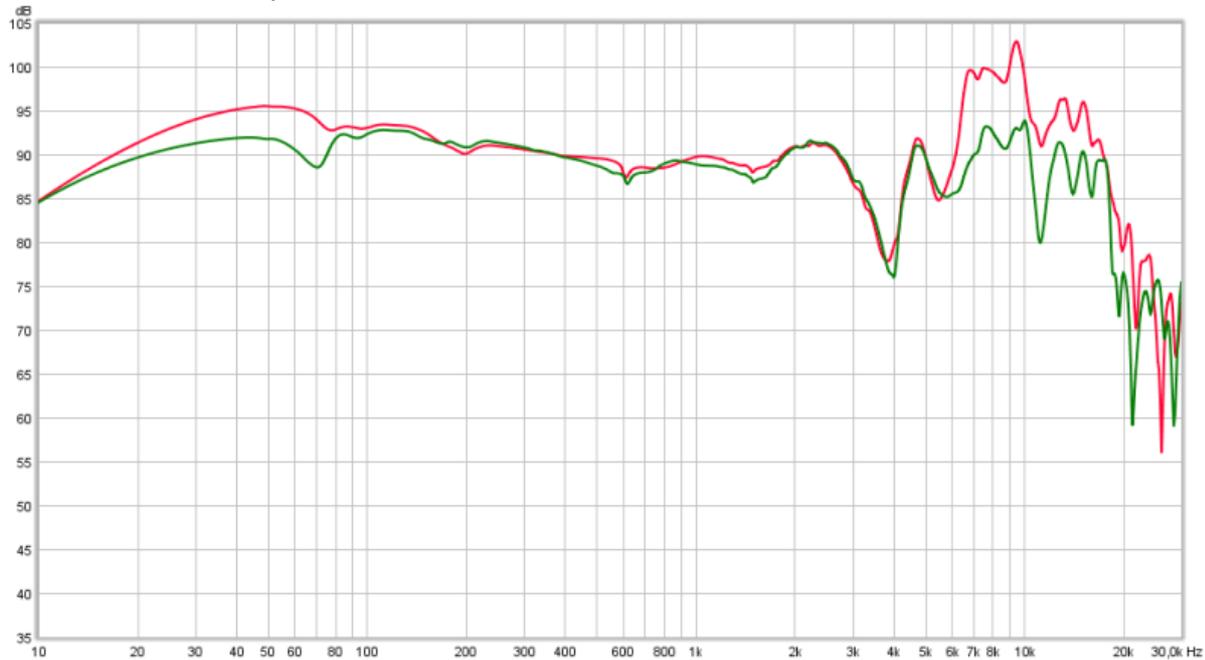
While the headphone was open anyway I built the filter above in the headphone cup. The filter schematic above is for both channels and the drawing shows how it should be connected in an external box that goes between a source (amplifier, phone or DAP) and the headphone cable.

It should be noted that the filter schematic above can ONLY be used with headphone amplifiers/sources that have a low output resistance.

The  $R_{OUT}$  should be lower than 10Ω when this filter is used.

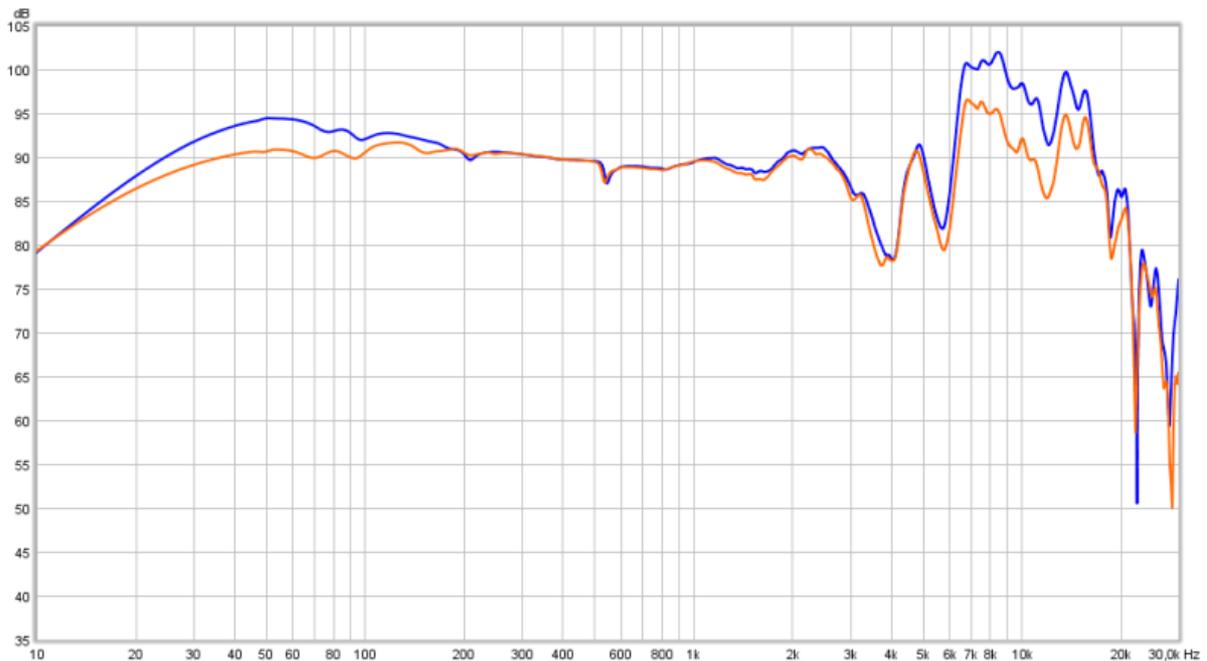
When the output resistance is higher than 10Ω or unknown the schematic on the left must be used.

Below the difference between the **stock HD681 (pleather pads)** versus the **modified HD681 (velvet pads, foam on driver, treble filter)**



The changes are quite audible. The bass modification (requiring opening the headphones) of course can be omitted and get a bit more lows in which case the green line (below 100Hz) will follow the red trace. To me the quality of the bass improved with the foam though. Right channel shown.

Those who want to use the filter and modify the driver but don't want to use velours pads can have the change shown below (Left channel shown) **original HD681** versus **modified using pleather pads**.



In stock form the HD681 is **cheap** but not very comfortable. It has a pleasantly raised bass with great extension. The treble is too much though and it sounds 'sharp' and can even be 'grating/harsh' with some recordings. It does not have smooth and soft treble.

Quality vs price is good but don't expect a sturdy headphone that won't break.

However, the velvet pads improve the comfort and sound.

The inline-filter removes the grating treble and while the headphone is not the most refined headphone around it still is quite enjoyable when modified. Certainly when not played very loud.

Lowering the bass is another option that improves its quality.

The extra pads (order them along with the HD681) and the electronic filter will of course add to the total costs and double the price. But despite the increase in costs it still has a high quality sound compared to the price. Modifications are highly recommended.