# PDM MIC Filter Comparison

PDM MIC

MP34DTX

Adafruit: https://learn.adafruit.com/adafruit-pdm-microphone-breakout

**platform**

**STM32H747**
Portenta H7

**STM32U5A5**
own PCB

filter options

software
**PDM2PDM**

hardware
**ADF**

ext. hardware
TI PCMD3180

native

HP Filter
+ SW LP Filter

test parameters

similar PCM signal level (-8.3dB on analyzer tool)
48KHz, 3.072MHz PDM clock
decimation: 64
16bit signed PCM out
audio via USB

**results**

***quite similar***

*preference*

**worst**

high MCU load

*best*
**but just with heavy post processing (SW)**

very high MCU load

**nice**

low MCU load

**HP filter on: or high DC offset**

**good**
**a bit processor load, further optimization possible**

lowest MCU load

**“channel summing” can improve SNR +6dB**

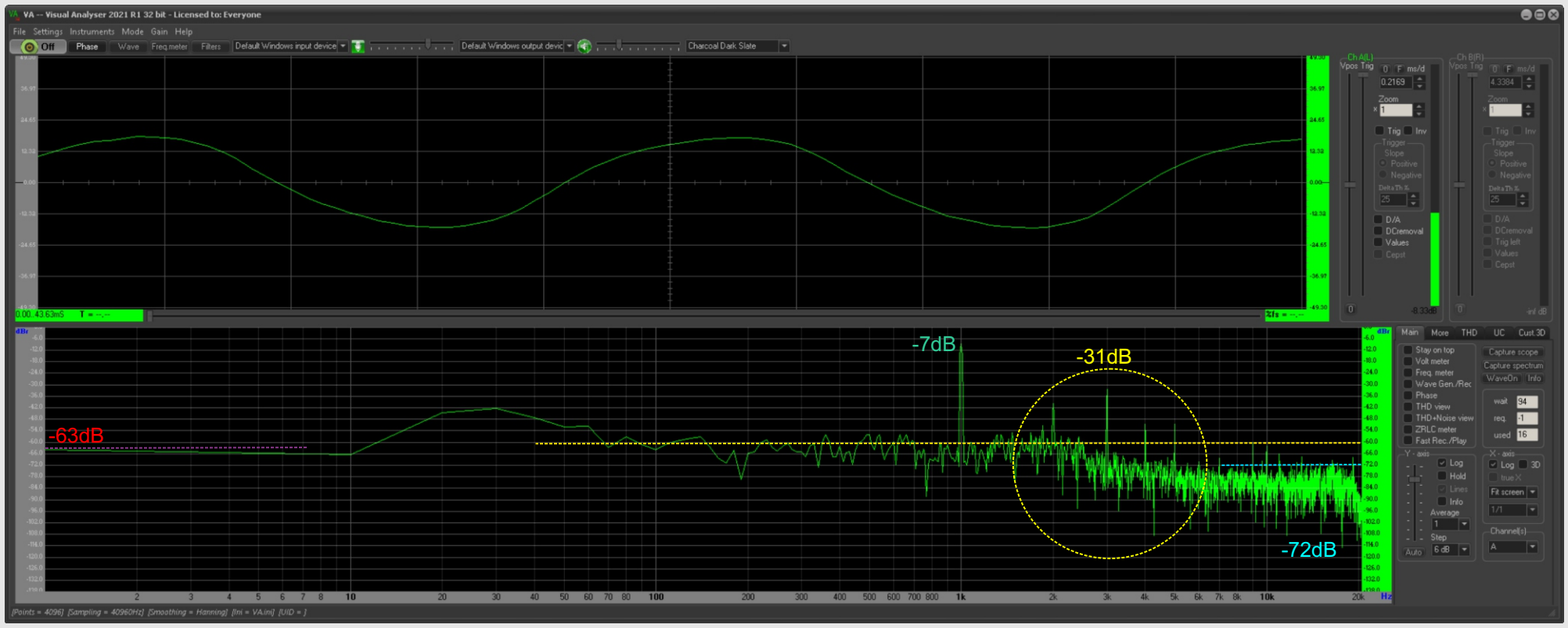


Figure 1: PDM MIC on PCMD3180 - 1KHz via smartphone

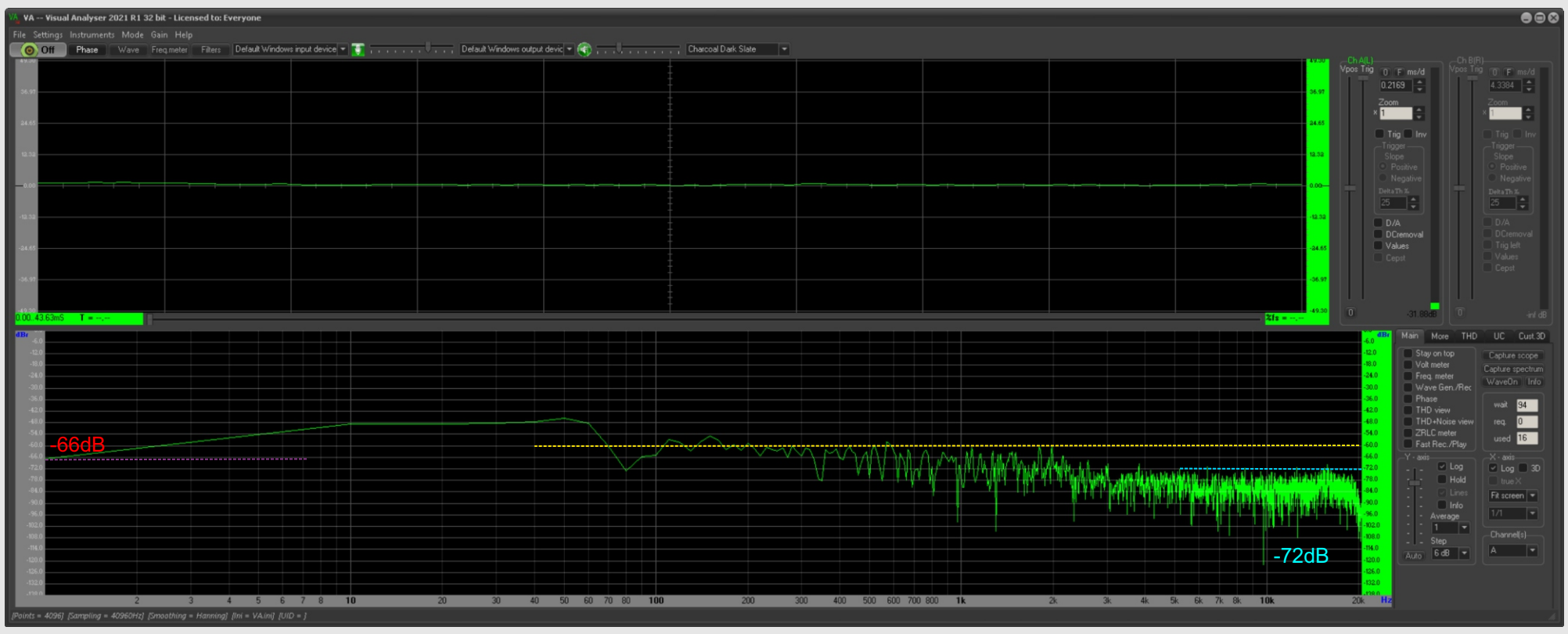


Figure 2: PDM MIC on PCMD3180 - noise level (ambient) **-60dB**

The PCMD3180 doing the PDM-to-PCM conversion shows:

- a large DC offset (or very low frequency amplitudes)
- a high noise level still in higher frequency range (above 10KHz)

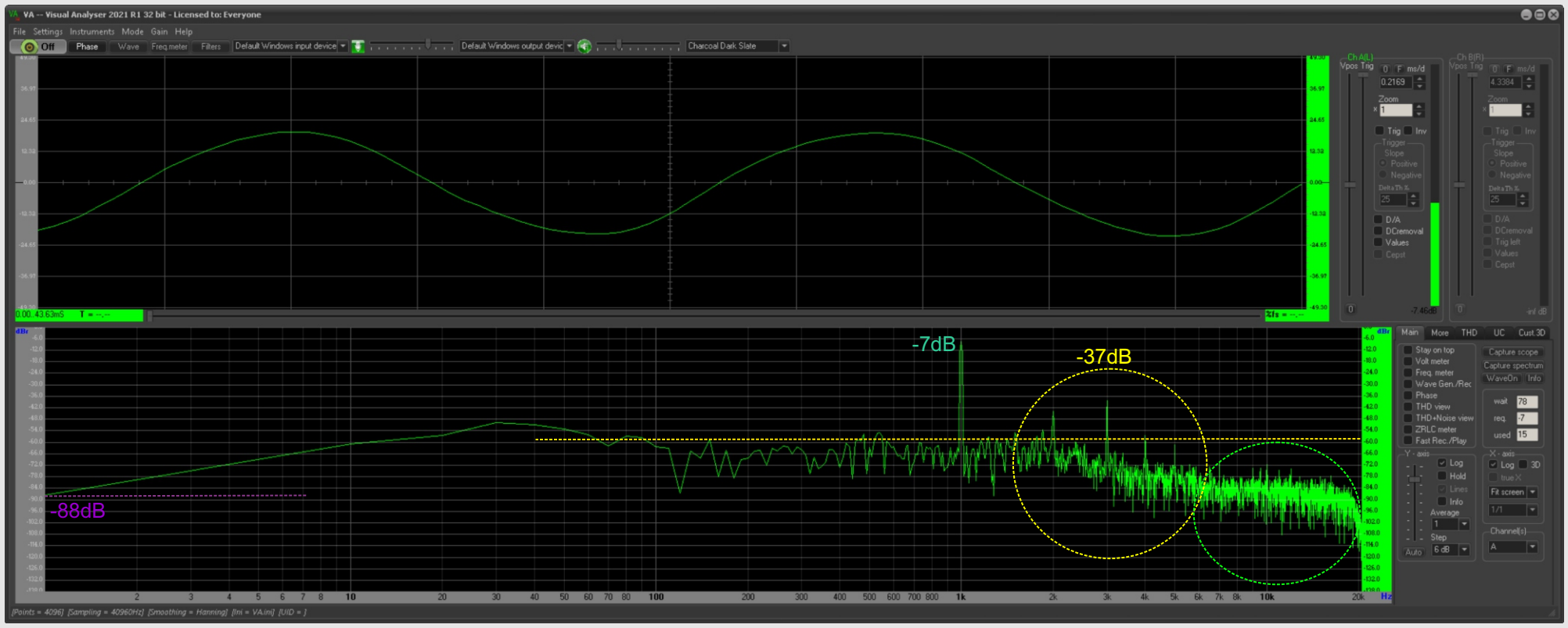


Figure 3: PDM MIC on STM32U5A5 ADF - 1 KHz via smartphone

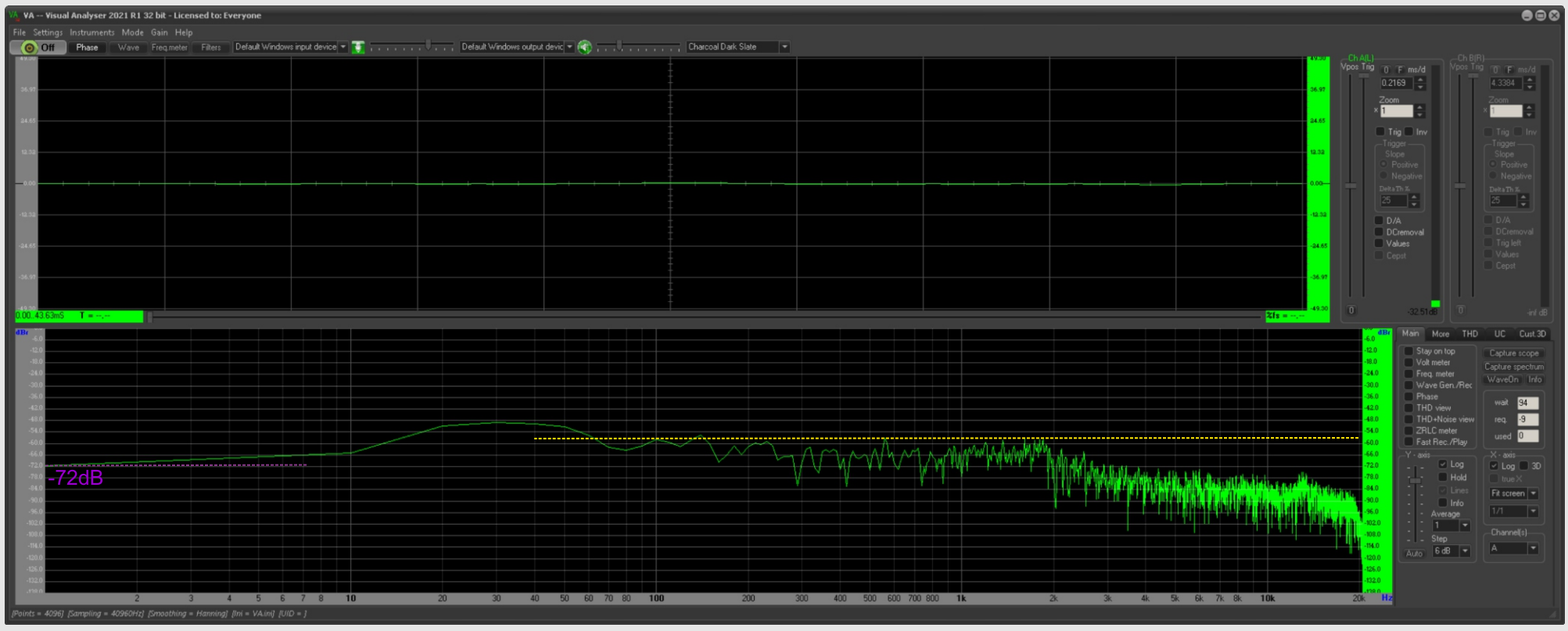


Figure 2: PDM MIC on STM32U5A5 ADF - noise level (ambient) **-58dB**

The STM32U5A5 with ADF for PDM-to-PCM conversion looks pretty good:
- it has a lower DC level, but just if the HP filter is also enabled
- it shows smaller harmonics on higher frequencies
- the lowest nois in high frequency spectrum (above 10 KHz)

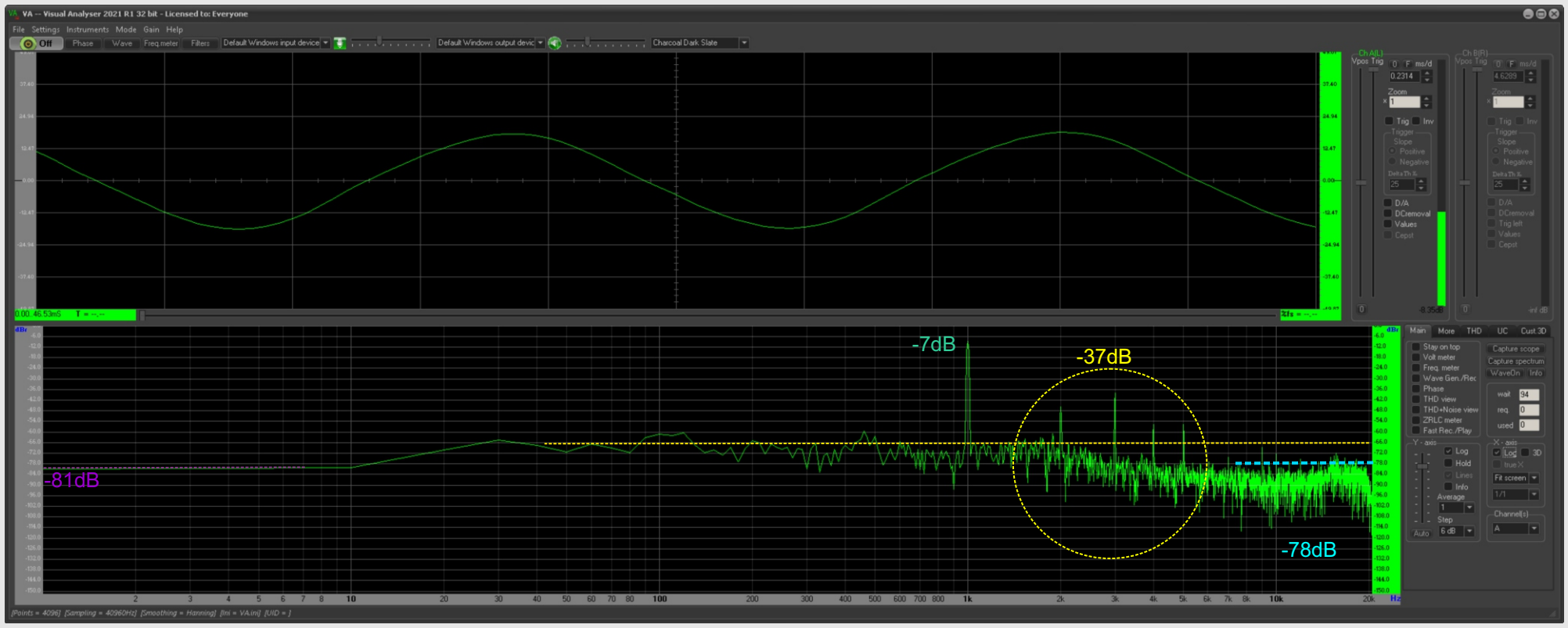


Figure 3: PDM MIC on Portenta H7 - 1 KHz via smartphone

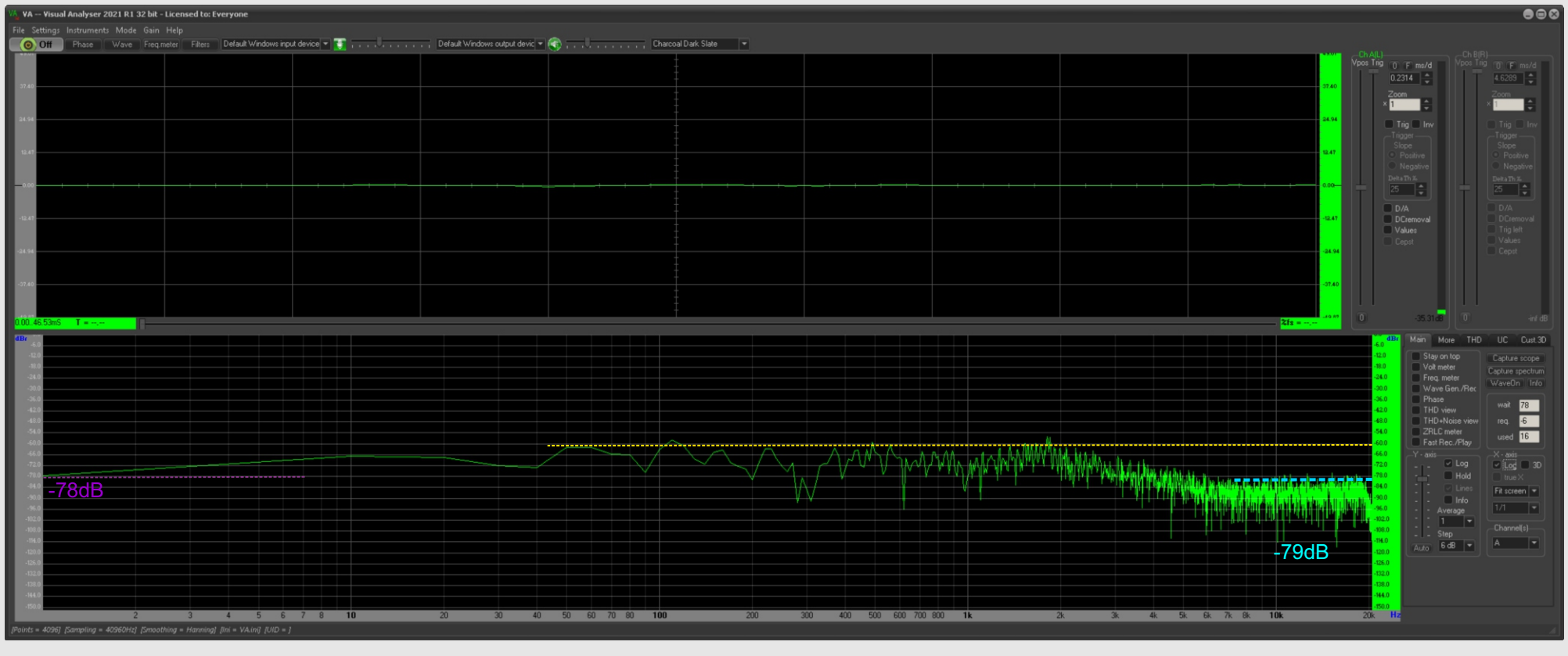


Figure 2: PDM MIC on Portenta H7 - noise level (ambient)

-60dB

# The SW based PDM-to-PCM filter on Portenta H7

(libPDMFilter_CM7_GCC_wc32.a) shows:
- an acceptable DC level (or smaller low frequency amplitudes)
- but large harmonics
- and a high noise level in high frequency region (above 10 KHz)

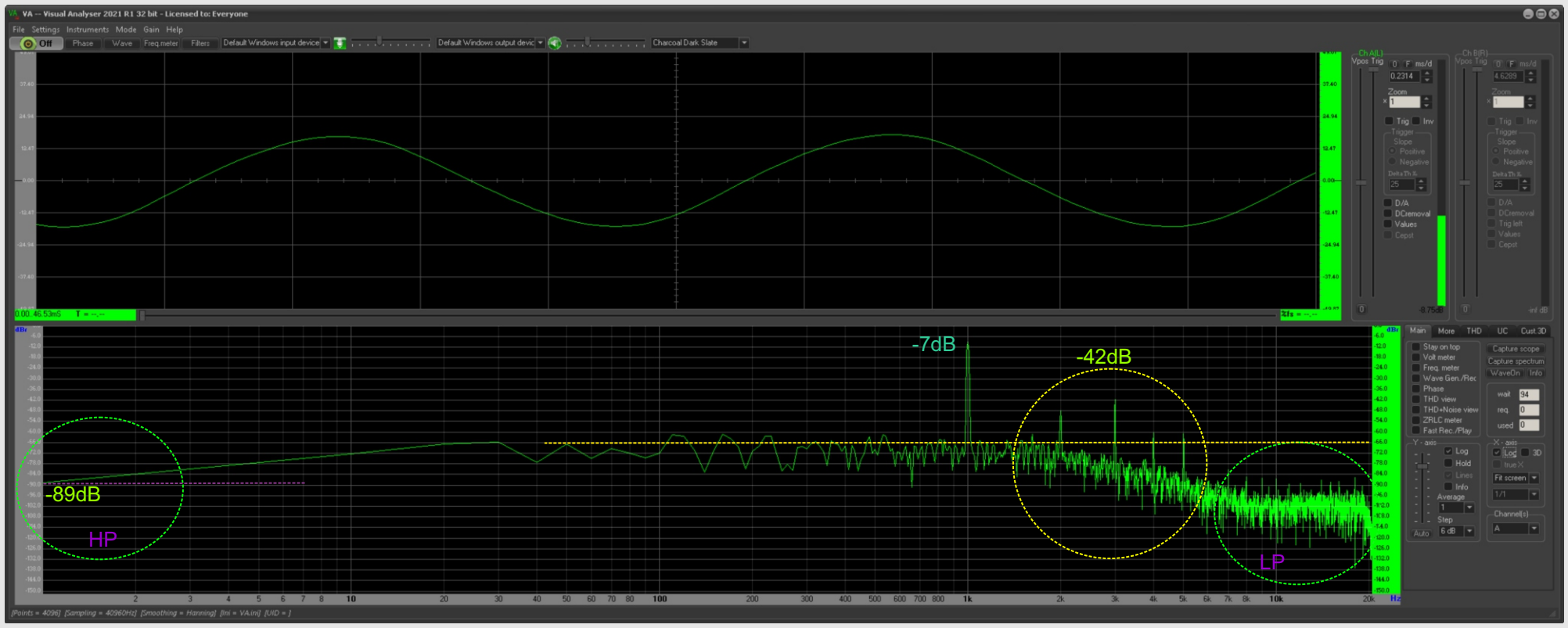


Figure 3: PDM MIC on Portenta H7 - 1 KHz via smartphone + HP filter + post LP filter

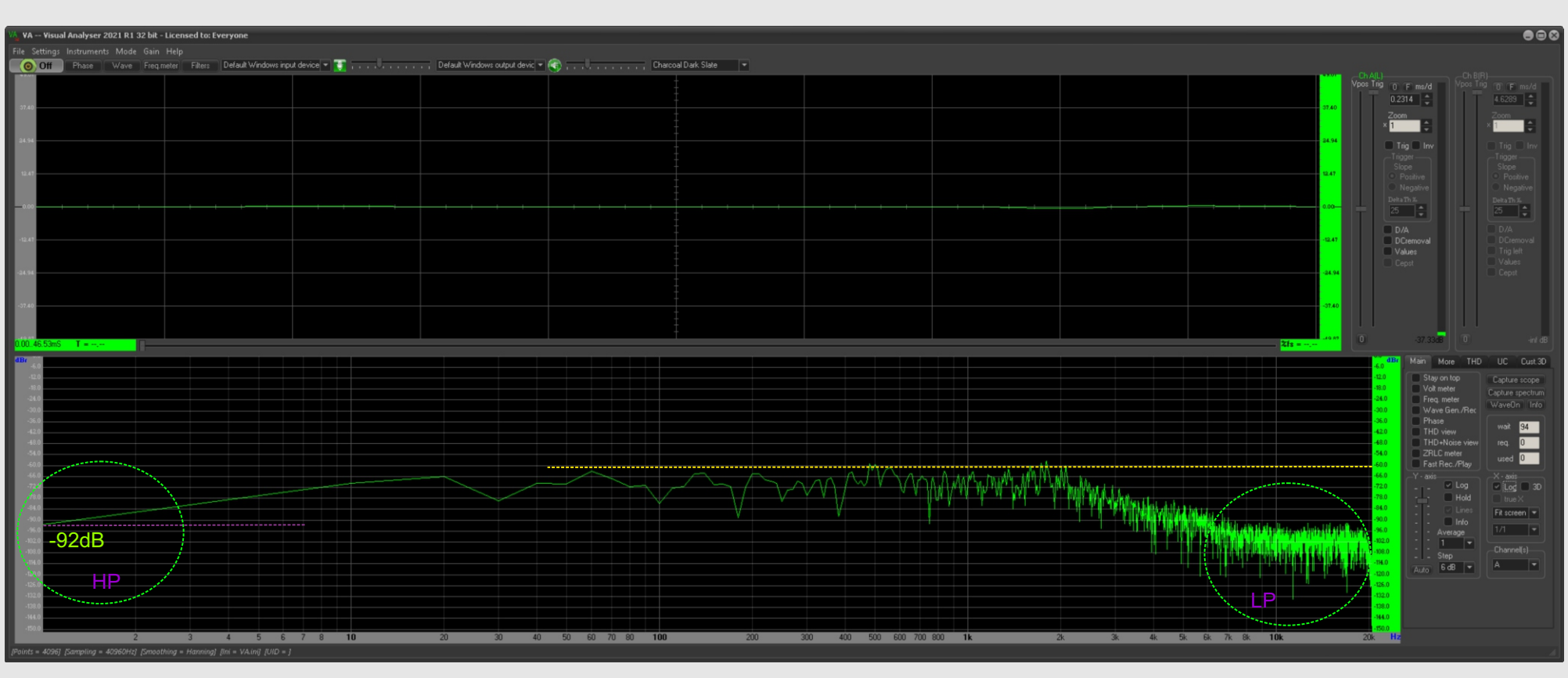


Figure 2: PDM MIC on Portenta H7 - noise level (ambient) + HP filter + post LP filter **-60dB**

The SW based PDM-to-PCM filter on Portenta H7 (libPDMFilter_CM7_GCC_wc32.a) can be improved by:
- add a DC Blocker filter
- add a Low Pass FIR filter (9 taps, 10KHz cutoff)

It results in:
- much lower DC level (or smaller low frequency amplitudes)
- reduces harmonics level
- and a smaller noise level in high frequency region (above 10 KHz)