

D :
Transfer function between driver and artificial ear. This is the headphone frequency response

G :
Transfer function between driver and feedback microphone. Also called the feedback system 'Plant'

H :
Transfer function of external noise signals from feedforward microphone to artificial ear. This represents the affect of the acoustic system on noise from the external environment. Note H is dependent on the directionality of the external noise and other environmental effect.

K :
Transfer function between driver and feedforward microphone.

Feedforward

$$o = i_f H + i_f (FF \cdot D)$$

we want $o = 0$ so

$$i_f H = -i_f (FF \cdot D)$$

therefore FF filter is given by

$$FF = \frac{-H}{D}$$

Feedback

$$o = i_b G + o (FB \cdot G)$$

closed loop is therefore

$$\frac{o}{i_b} = \frac{G}{1 + G \cdot FB}$$

open loop is

$$OL = G \cdot FB$$

noise reduction is

$$NC = \frac{1}{1 + G \cdot FB}$$

System Design

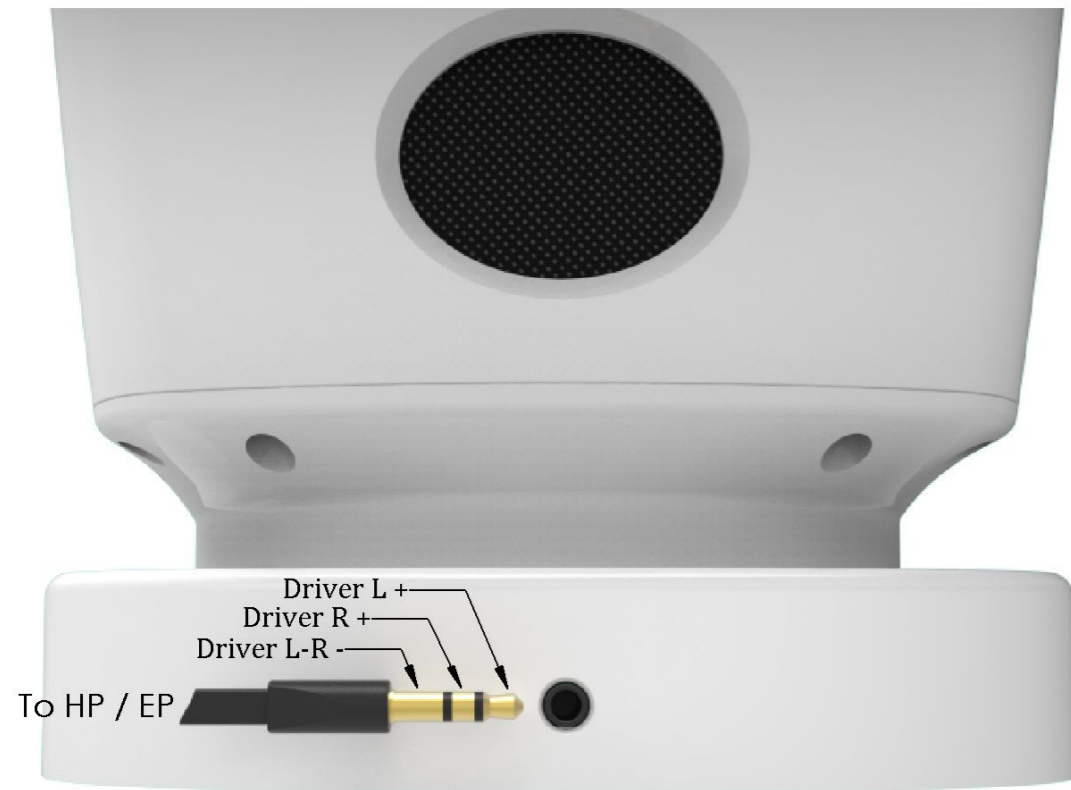
Feedforward:

- Measure H and D
- calculate FF.
- Develop a filter that matches FF as closely as possible
- Ensure $K \times FF$ has a large negative gain at all frequencies

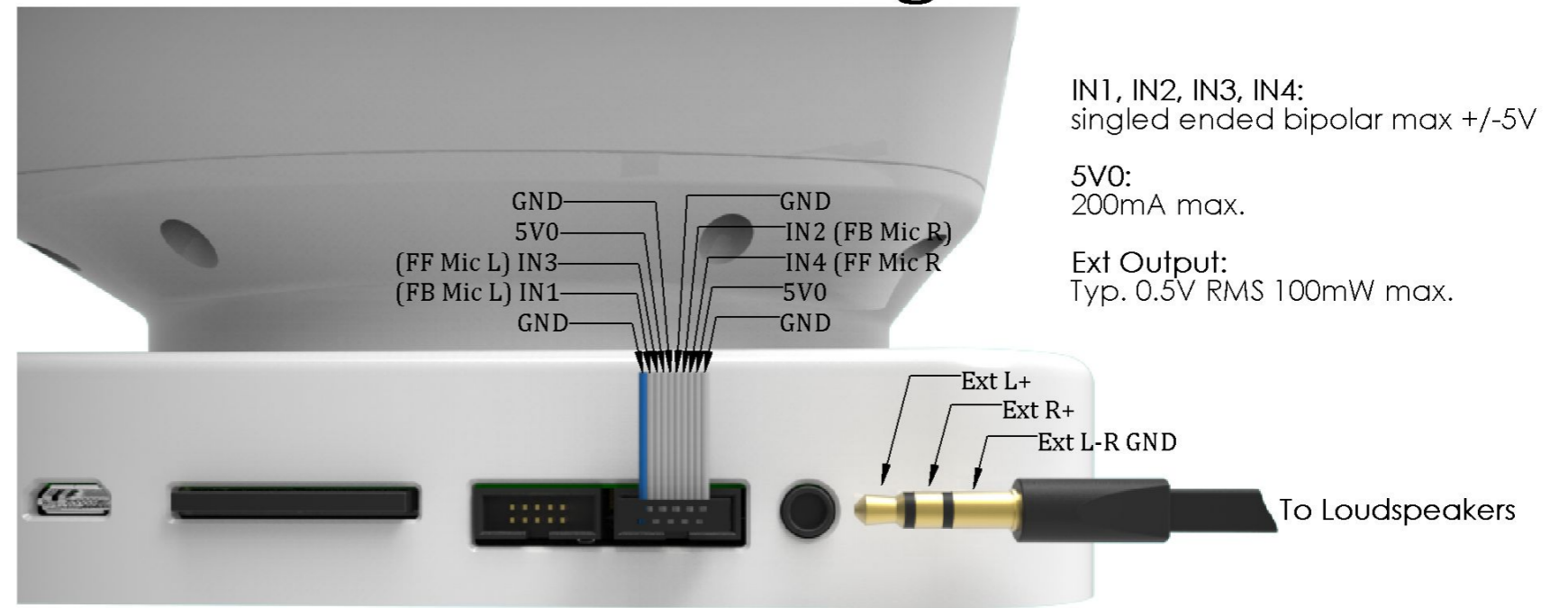
Feedback:

- Measure G
- Calculate a filter FB that satisfies stability criteria and provides a satisfactory level of NC

Feedforward Feedback ANC Characterisation Connection Diagram



Front Side Connection



IN1, IN2, IN3, IN4:
singled ended bipolar max +/-5V

5V0:
200mA max.

Ext Output:
Typ. 0.5V RMS 100mW max.

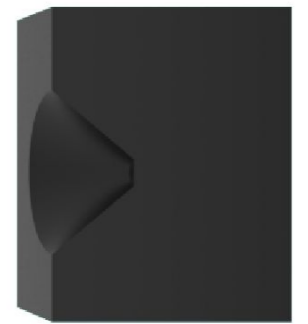
Rear Side Connection



Headphone / Earphone Connections



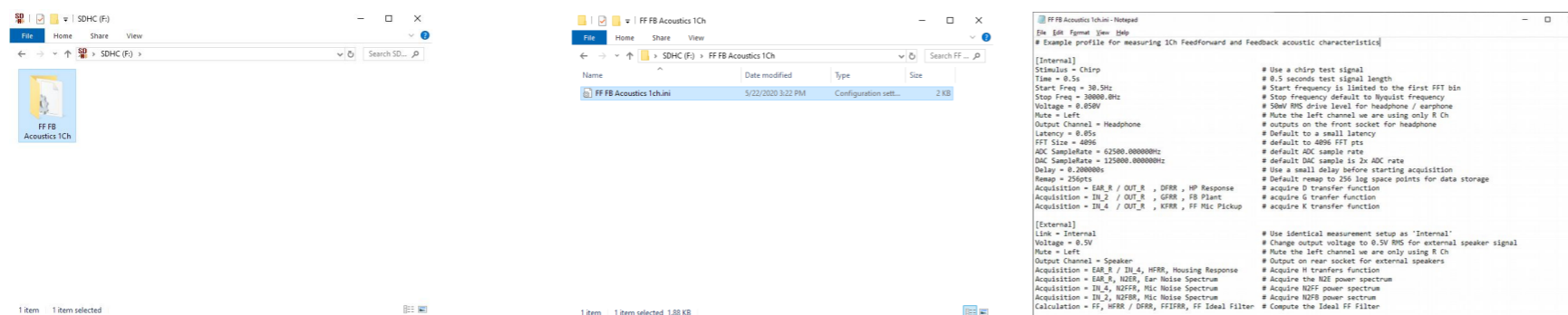
Overall Setup



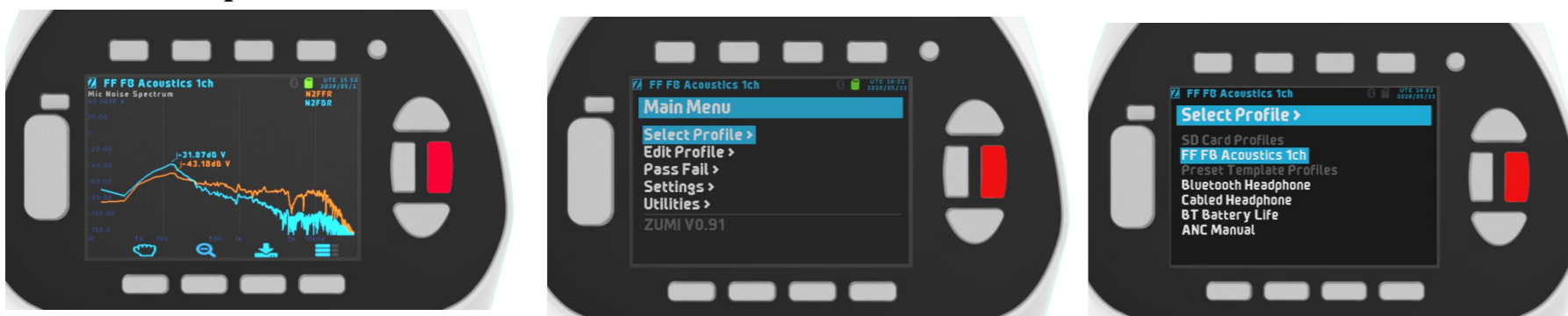
When using MEMS microphones the 5V0 supply should be used to power a voltage regulator that in turns provides Vcc to the mic.

When using Electret microphones the 5V0 supply can be used directly as the bias supply.

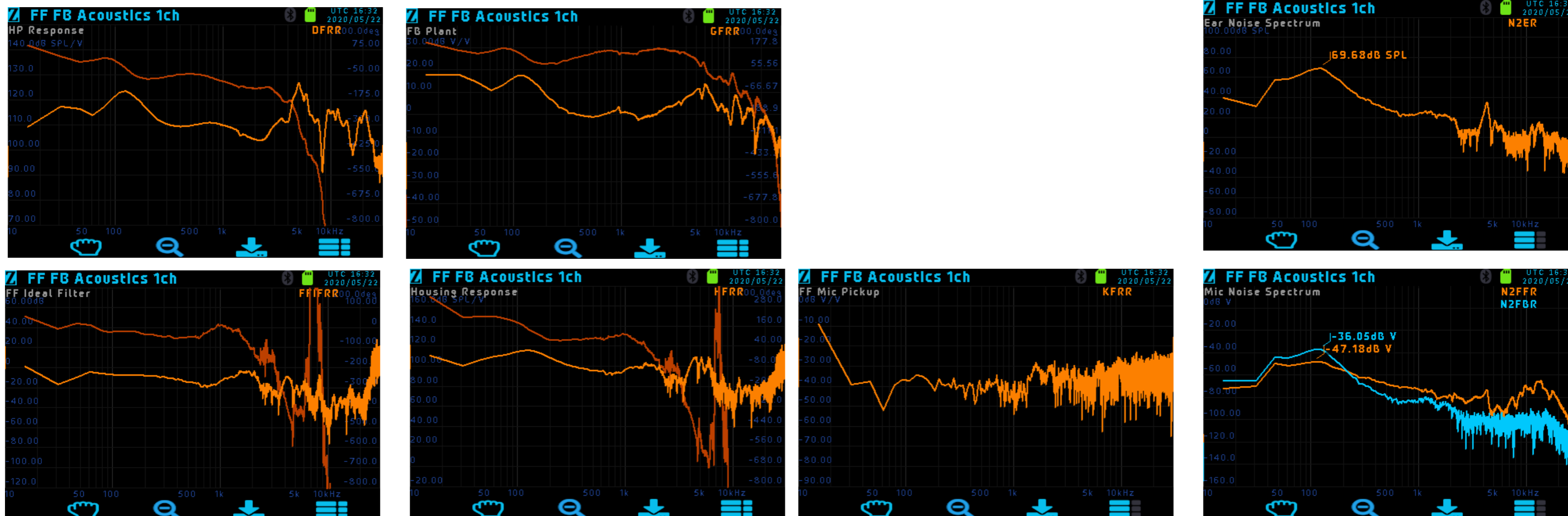
Copy test profile to SD Card

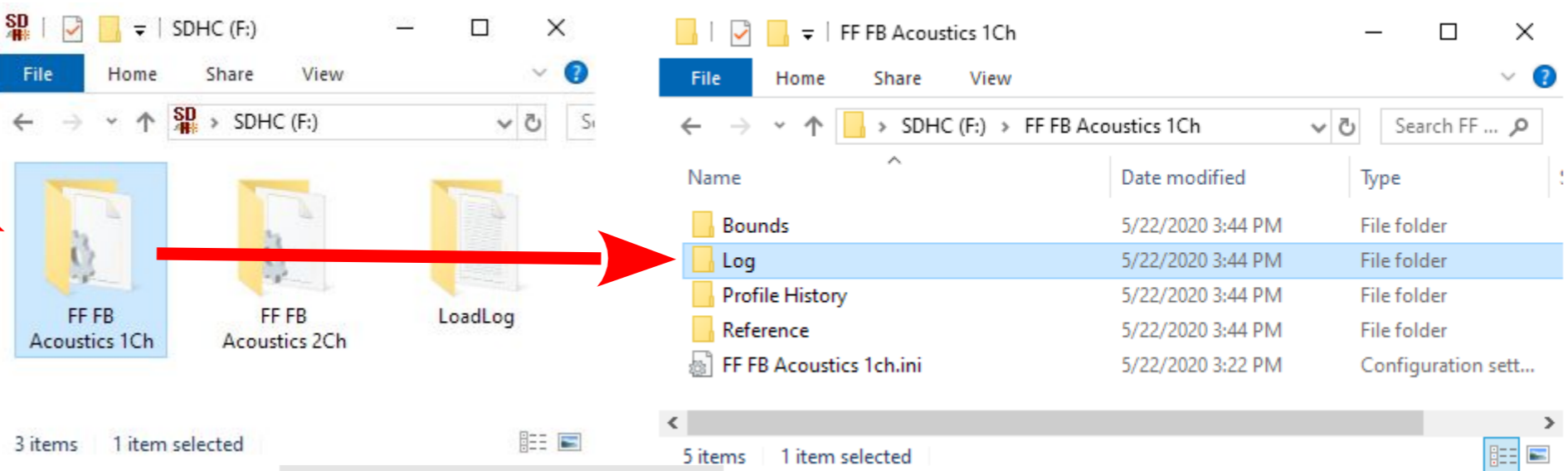
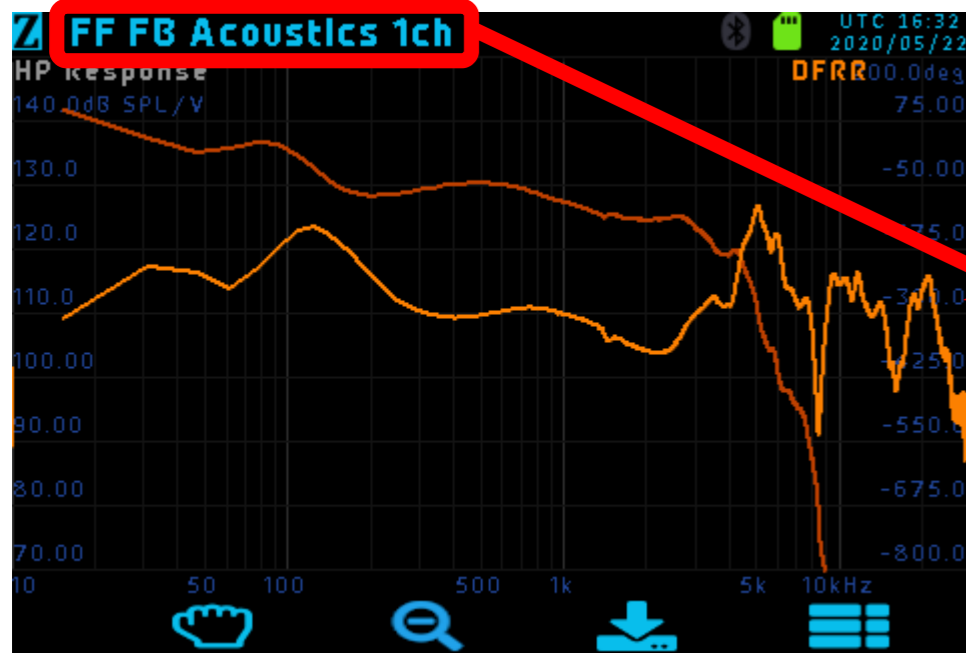


Load test profile

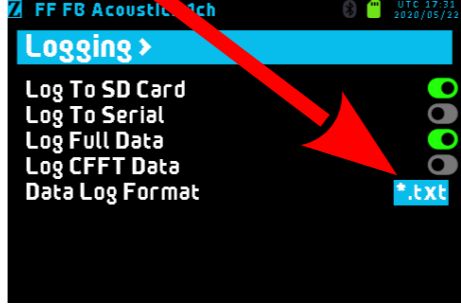
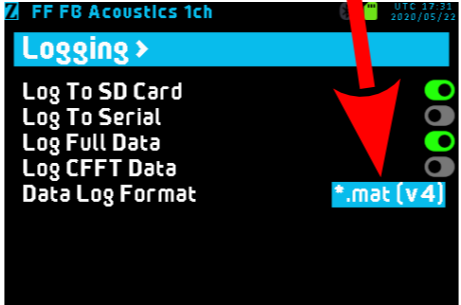
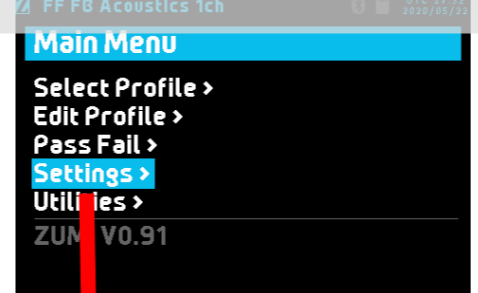


Example measurement data





Preferred data format is set through the menu



Data is stored as Freq, Mag, Phase

```

*200522174230_DATA_ZU...
File Edit Format View Help
# group: HP Response
# num_of_datasets: 1

# name: DFRR
# units: Hz      dB SPL/V      deg
# type: matrix
# rows: 2048
# columns: 3
0.000  123.333  179.546
15.259  86.781  14.064
30.518  81.777  -34.523
45.776  66.490  65.921
61.035  78.201  -92.377
76.294  75.441  -256.537
91.553  74.268  -325.028
106.812 57.481  -264.794
122.070 69.198  -242.660
137.329 23.983  -66.777
152.588 57.543  49.909
167.847 39.182  18.415
183.105 59.521  -40.578
198.364 67.206  -86.326
213.623 65.426  -6.753
228.882 71.806  -133.247
244.141 71.356  6.299
259.399 79.049  176.283
274.658 90.639  150.264
289.917 75.304  307.876
305.176 70.107  351.573
320.435 71.436  176.078
335.693 62.318  80.998
  
```

Each measurement run generates a log data file. By default the data is stored in MATLAB v4 format.

