The 330B-SE amplifier, built to the wishes of Joop van Emden

In late 2019, Joop and I decided to team up to design and build an SE-300B amplifier. This was in response to the assignment from the 2016 Tube-Society course.
Joop had an article from Glass Audio (May 2019) in which Alan Kimmel described a MU-stage with a KT77. Joop liked that Mu-stage and had already purchased components that would be used in the amplifier.
After that, it took some time before construction could start. We exchanged ideas until mid-2021 and I 'measured' the Mu-stage for him.

Meanwhile, Joop was having a tough time with the chemo treatment. He also had to prioritise the transfer of the production and maintenance of the products he had developed to ensure continuity to his customers.
In 2022, together we adapted the cabinet for the amplifier and reviewed how it should be built. Finally in the summer of 2022, Joop ran out of energy for his last wish: finishing this amplifier. It was no longer possible! I then promised him to finish the amplifier for his wife and son.

Design

Amplifier circuit
Driver: Alan Kimmel Mu-stage with Pentode KT77 cathode follower as dynamic anode load for parallel-connected double-triode 6SL7
Endstage: Gold Lion PX-300B SE, negative bias voltage on Grid. Uak=385V, Ugk=-75V, Ia=80mA
Output transformer: Toroidy TTE-KT88SE (Zp=3000Ω, Zs=4 and 8Ω).
Special PCB design for VU-meter controllers
No feedback applied

Power supplies
Power transformer: TRAFCO VDV-POW80-t (all taps are used) connected to the PCB of the TS2019-PP80 project, see Birth of the TS2019-PP80 Amplifier and a 2nd transformer sec. 2x 9Vac/0.84Vac
Tentlab filament 5Vdc supply connected to POW80-t 6.3Vac tap; each 300B
Meanwell IRS-20-12, 12Vdc/1.8A coupled to TDK I3A4W DC/DC converter for filament 6.3Vdc; each 6SL7/KT77 combo
Rush-in circuit - Erwin Reins, See Link naar E. Reins

Cabinet
Cabinet for 300B project (TS season 2016-2017) was modified for 2 extra tube bases, 2 Vu meters, 3 more input and output terminals, 230Vac input with fuse holder and 2 fuse holders in the high voltage circuitry of the 300B anodes and additional holes in bottom panel for cooling
Front designed and ordered at Schaeffer AG Germany and a special design for transformers cap manufactured in stainless steel by Erwin Reins

Construction experiences and solutions:

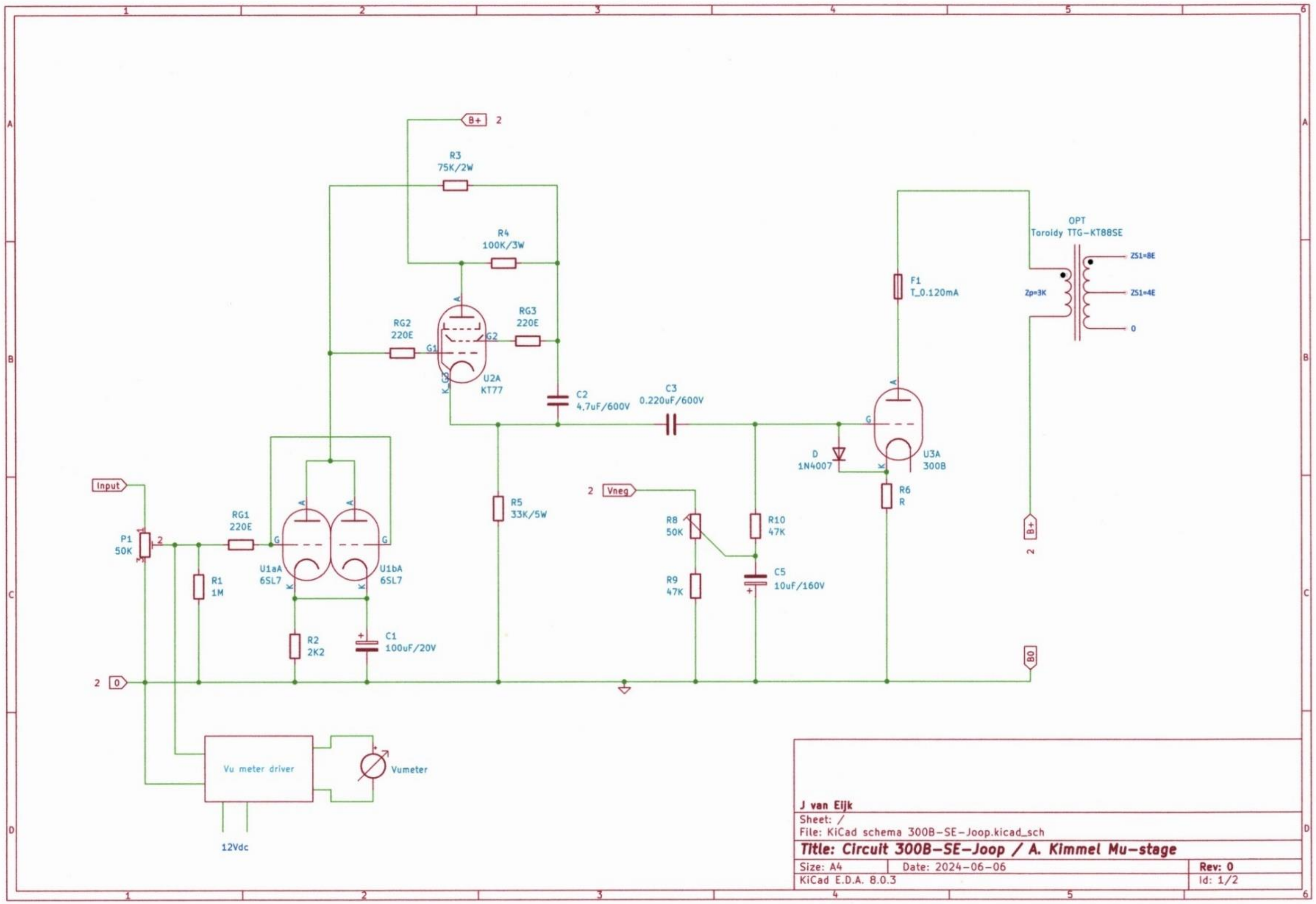
Filament Power Supplies
The filament power supply of the 300B is the most critical because that filament is also the cathode. Any interference signal on it is amplified along with it. For this purpose, the Tentlab 5Vdc filament power supplies are used. These must each be fed with a separate transformer tap, for which the two 6.3Vac taps of the POW80-t were used.
So a solution had to be found for the 6.3Vac/1.8A filament power supplies for 6SL7 - KT77 combo per channel.
For this some experiments were done with a Meanwell IRS-20-12 (12Vdc), first with a transistor TIP120 with 6.3V zener diode circuitry (which rattled); then a voltage divider (too hot: 130ºC) was tried and thereafter a cooled voltage regulator LM350 (also too hot 80^0C). Then the solution came through a tip from Jan Didden: the TDK I3A4W DC/DC converter so 12Vdc/6.3Vdc, connected to the Meanwell. Ripple voltage of 0.03Vtt @ 440kHz at T=32ºC.
The filaments of the KT77 had to be lifted to avoid exceeding the Vfk max of the KT77 (150Vdc). The voltage on the cathode is about 195Vdc . While the filament of the 6SL7 (Vfk max 100Vdc) is connected to the same power supply, it goes up with it. This is solved by a voltage divider from B+ to 76Vdc, this varies along with the B+ and also with the cathode voltage of the KT77.

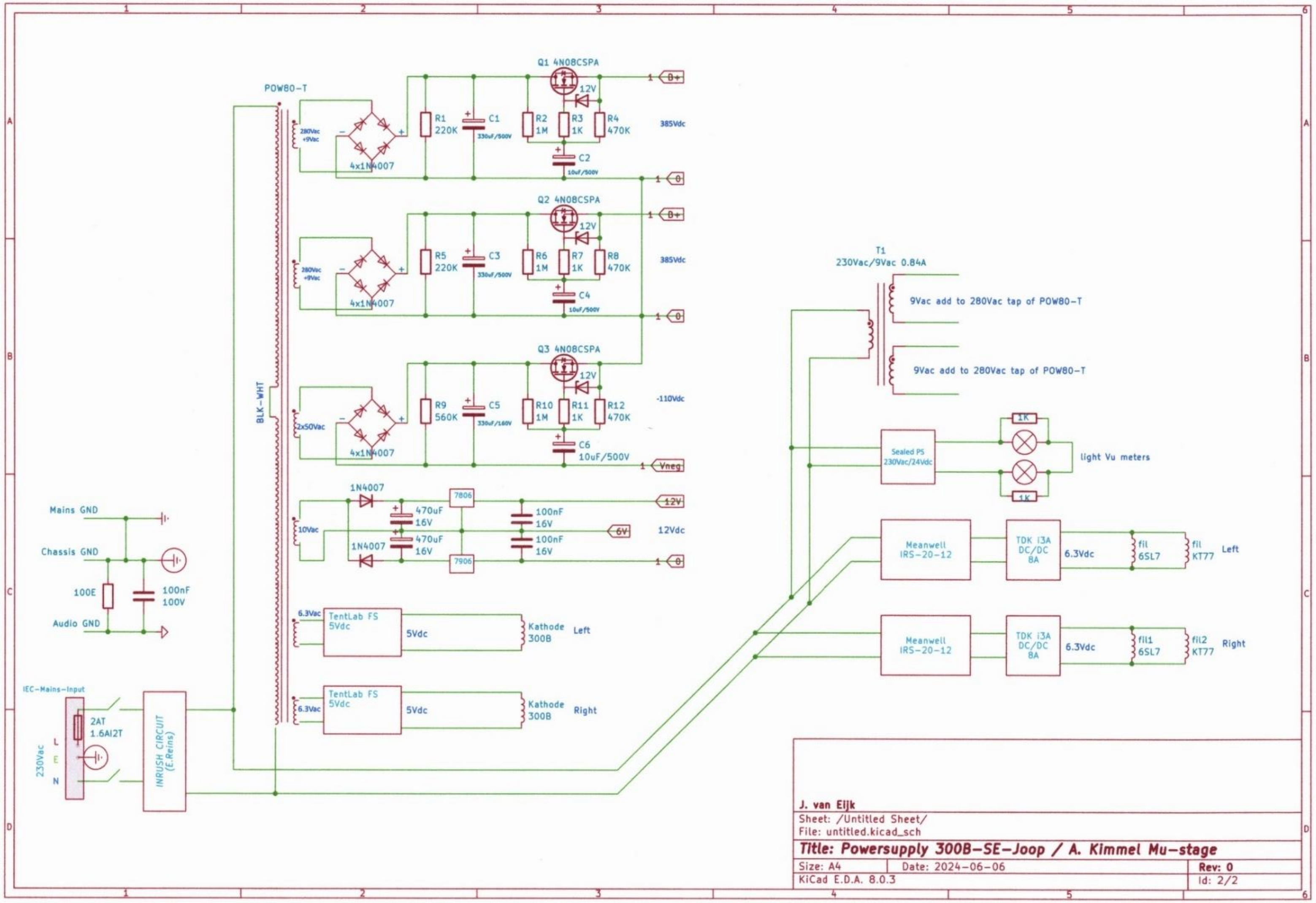
Negative grid voltage for the 300Bs
Twice this negative voltage had to come from one rectified power supply (on TS2019-PP80 PCB) connected to the single POW80-t 0-50-100Vac/0.1A tap. Furthermore, the left and right channel signals should be kept as separate as possible, so direct connection of the two 300B grids should be prevented.
This was realized by applying two equal voltage dividers with Elco after the rectifier/super-C circuit for Vneg. By including a trimmer in the voltage dividers, the quiescent current per channel could also be set properly.

High voltage B+
Together with the POW80-t 2x 280Vac/0.22A taps, a 2^{nd} transformer with 2x9Vac/0.84A taps is used raise the HT to 385Vdc (loaded).
For safety reasons 500Vdc Elco's are applied for HT rectifiers on the TS2019-PP80 PCB.

Vu meters
Control circuitry: see VU meter - Circuits Online. For which a 12Vdc power supply is required.
This is obtained by applying linear voltage regulators for + and - 6Vdc instead of 8Vdc on the TS2019-PP80 PCB.
Lighting: A 230Vac/24Vdc sealed-in power supply is used, which feeds the 12V light of both the Vu meters in series.

Rush-in circuit and on/off switch
The red LED in the switch is powered from 12Vdc outlet of the rush-in circuit.


B+ 2
R3
75K/2W
R4
100K/3W
RG2
220E
RG3
220E
G1
G2
U2A
KT77
C2
4.7uF/600V
C3
0.220uF/600V
OPT
Toroidy TTG-KT88SE
Zp=3K
ZS1=8E
ZS1=4E
0
F1
T_0.120mA
U3A
300B
D
1N4007
R6
R
B+ 2
Input
P1
50K
RG1
220E
U1aA
6SL7
U1bA
6SL7
R1
1M
R2
2K2
C1
100uF/20V
R5
33K/5W
2 Vneg
R8
50K
R9
47K
R10
47K
C5
10uF/160V
2 0
B0
Vu meter driver
Vumeter
12Vdc
J van Eijk
Sheet: /
File: KiCad schema 300B-SE-Joop.kicad_sch
Title: Circuit 300B-SE-Joop / A. Kimmel Mu-stage
Size: A4
Date: 2024-06-06
Rev: 0
KiCad E.D.A. 8.0.3
Id: 1/2


POW80-T
Q1 4N08CSPA
Q2 4N08CSPA
Q3 4N08CSPA
R1 220K
C1 330uF/500V
R2 1M
R3 1K
R4 470K
C2 10uF/500V
385Vdc
R5 220K
C3 330uF/500V
R6 1M
R7 1K
R8 470K
C4 10uF/500V
R9 560K
C5 330uF/160V
R10 1M
R11 1K
R12 470K
C6 10uF/500V
-110Vdc
Vneg
12V
280Vac +9Vac
2x50Vac
10Vac
4x1N4007
1N4007
470uF 16V
100nF 16V
7806
7906
12Vdc
6V
BLK-WHT
Mains GND
Chassis GND
100E
100nF 100V
Audio GND
6.3Vac
TentLab FS 5Vdc
5Vdc
Kathode 300B
Left
Right
IEC-Mains-Input
2AT 1.6AI2T
L
E
N
230Vac
INRUSH CIRCUIT (E.Reins)
T1
230Vac/9Vac 0.84A
9Vac add to 280Vac tap of POW80-T
Sealed PS 230Vac/24Vdc
1K
light Vu meters
Meanwell IRS-20-12
TDK i3A DC/DC 8A
6.3Vdc
fil 6SL7
fil KT77
fil1 6SL7
fil2 KT77
J. van Eijk
Sheet: /Untitled Sheet/
File: untitled.kicad_sch
Title: Powersupply 300B-SE-Joop / A. Kimmel Mu-stage
Size: A4
Date: 2024-06-06
Rev: 0
KiCad E.D.A. 8.0.3
Id: 2/2

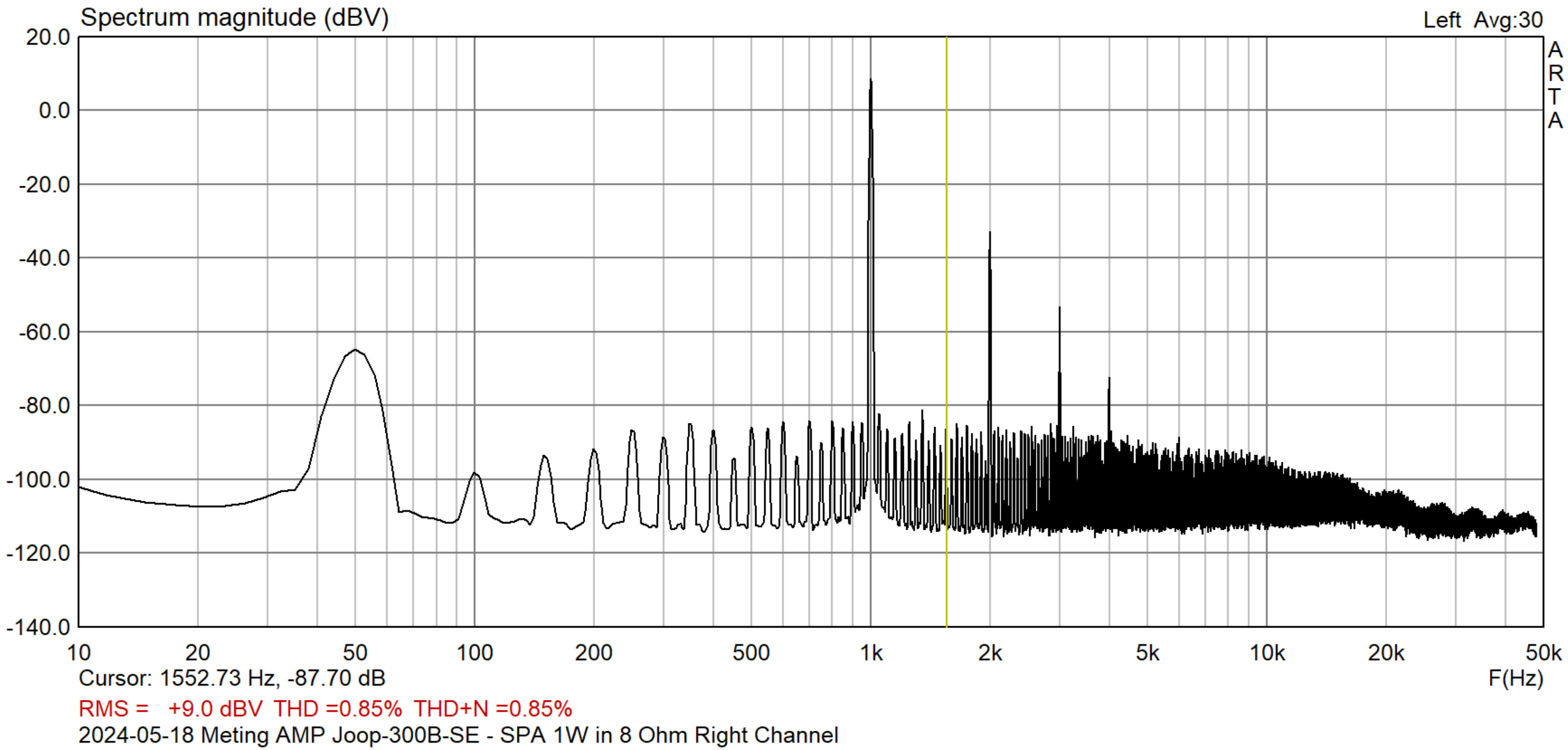
Measurements on 8 Ohm terminals

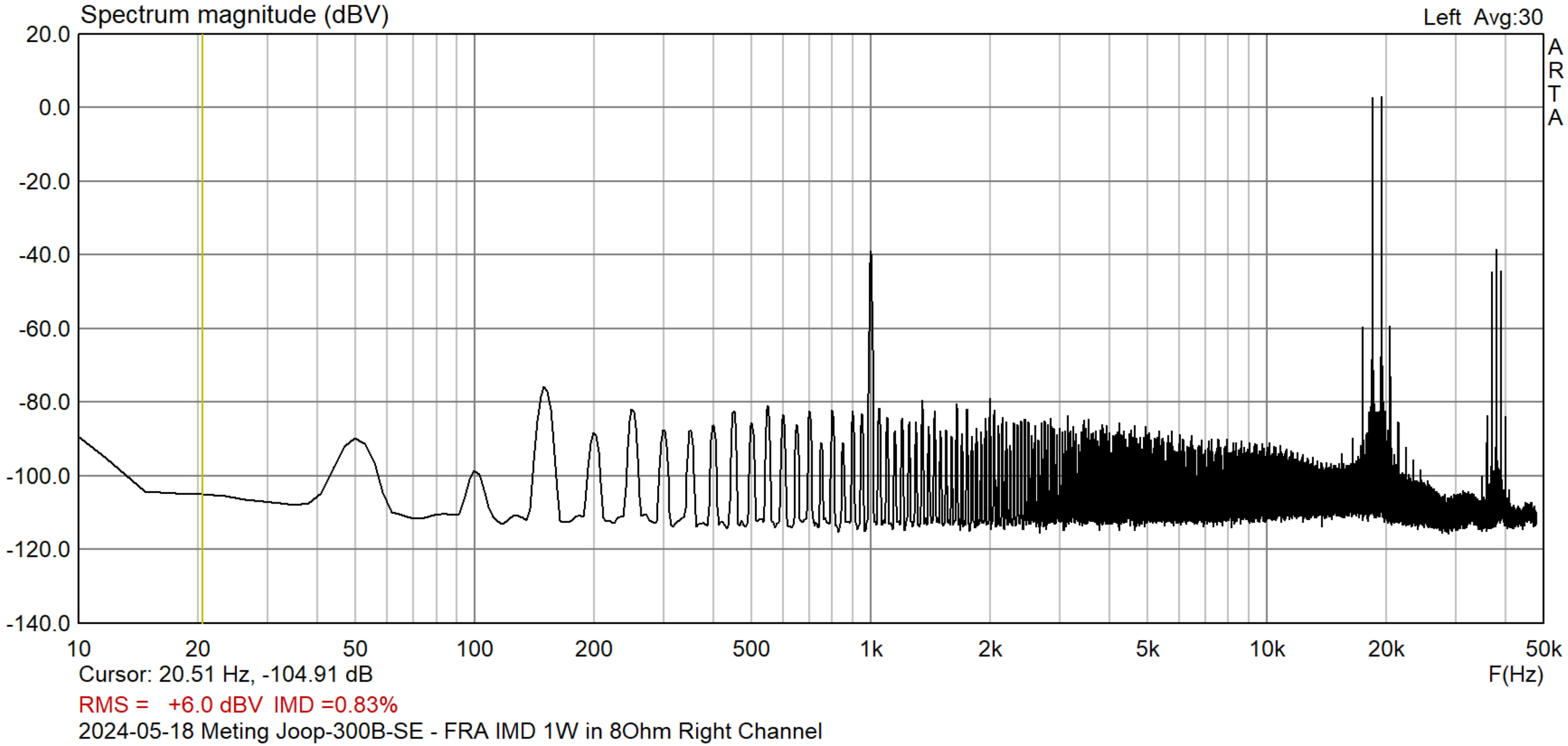
Amplification
loaded: 20.4 dBV/V;
A=10.5x
no-load: 22.8 dBV/V;
A=13.7x

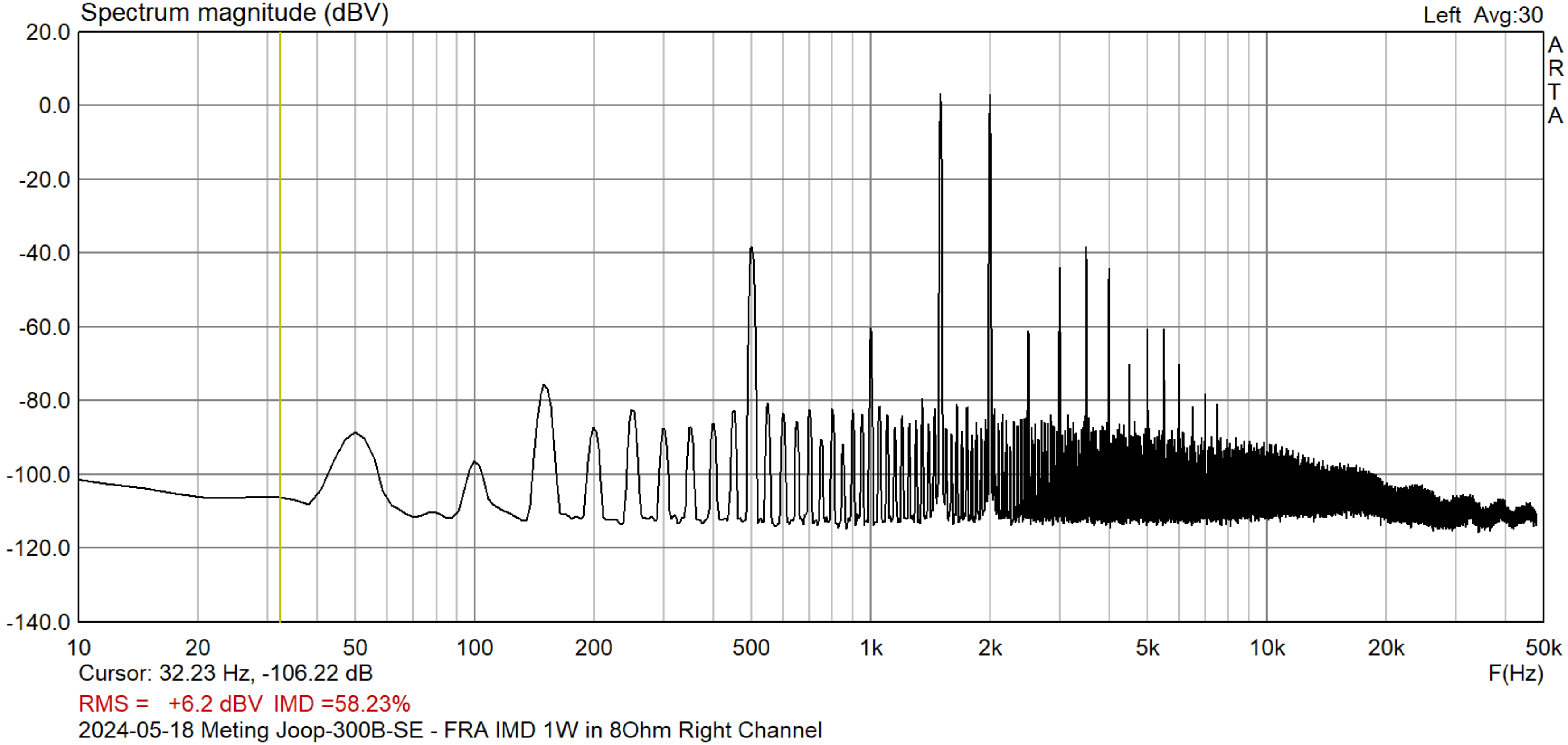
Power
approx. 8W

Bandwidth @ 1W
-1dB: 10Hz-48kHz
-3dB: 01Hz-85kHz

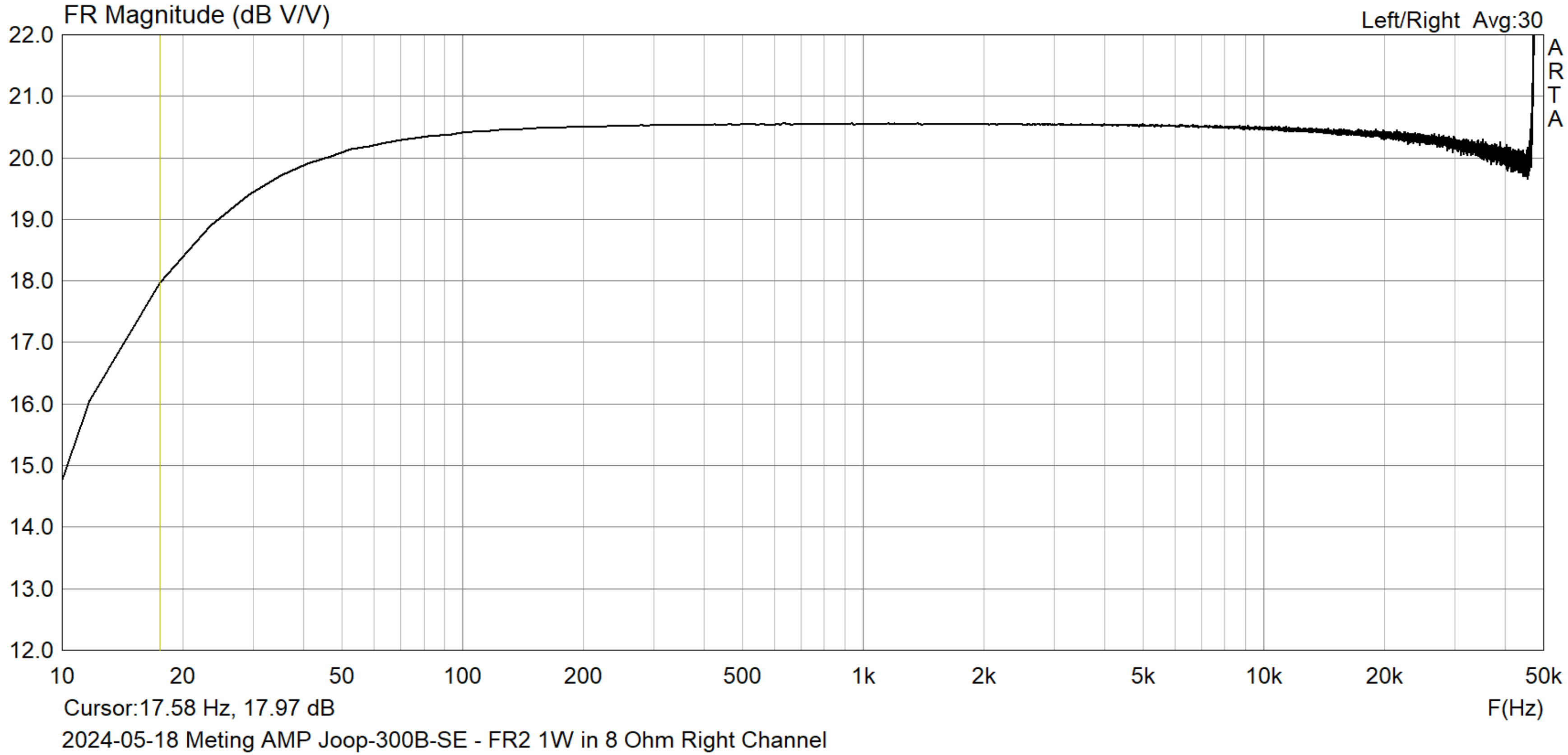
Damping factor
Zout= 2.4Ω
Damping factor is 8/2.4 = 3.3

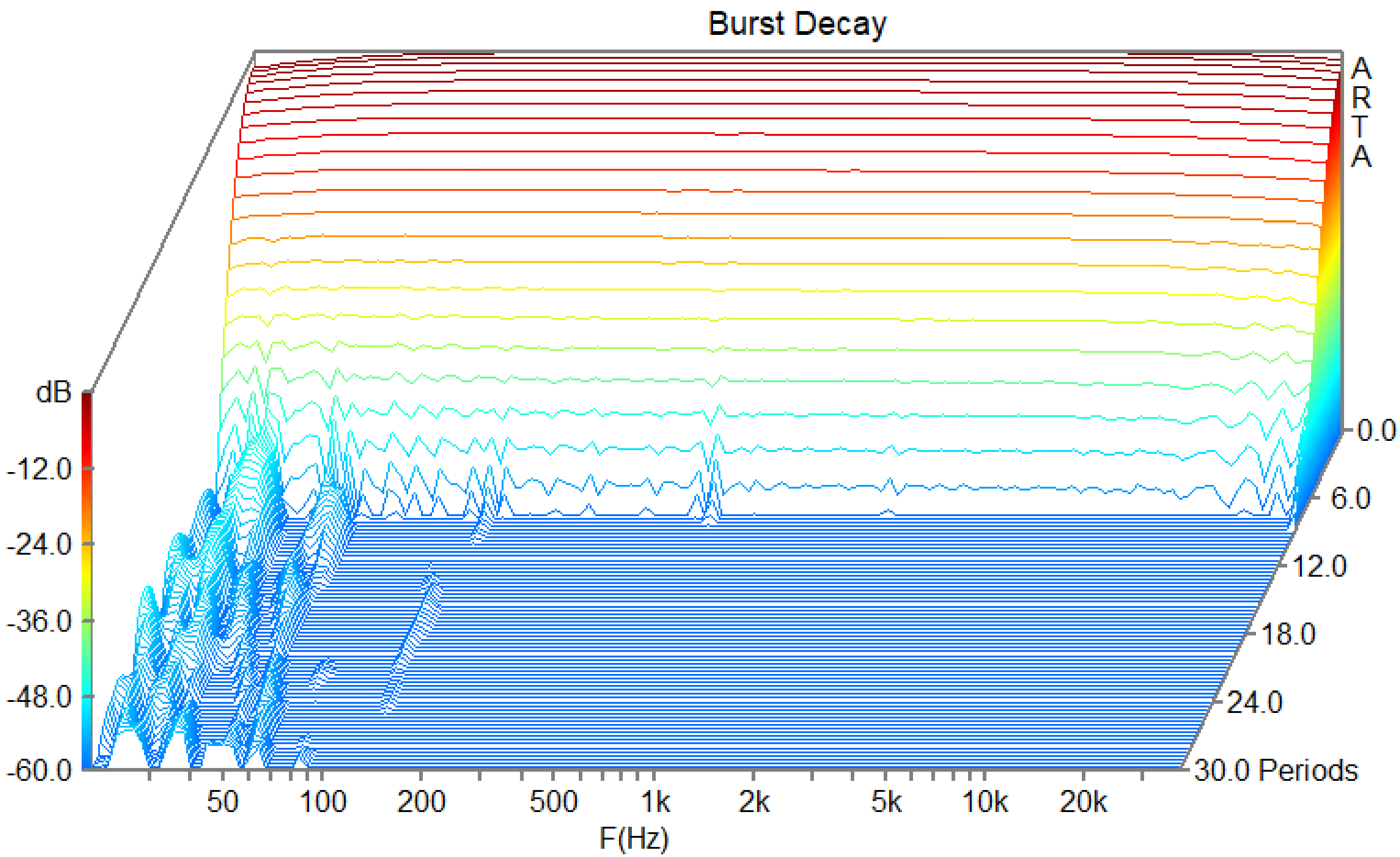

Spectrum magnitude (dBV)
Left Avg:30
ARTA
20.0
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
-140.0
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
F(Hz)
Cursor: 1552.73 Hz, -87.70 dB
RMS = +9.0 dBV THD =0.85% THD+N =0.85%
2024-05-18 Meting AMP Joop-300B-SE - SPA 1W in 8 Ohm Right Channel


Spectrum magnitude (dBV)
Left Avg:30
ARTA
20.0
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
-140.0
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
F(Hz)
Cursor: 20.51 Hz, -104.91 dB
RMS = +6.0 dBV IMD =0.83%
2024-05-18 Meting Joop-300B-SE - FRA IMD 1W in 8Ohm Right Channel

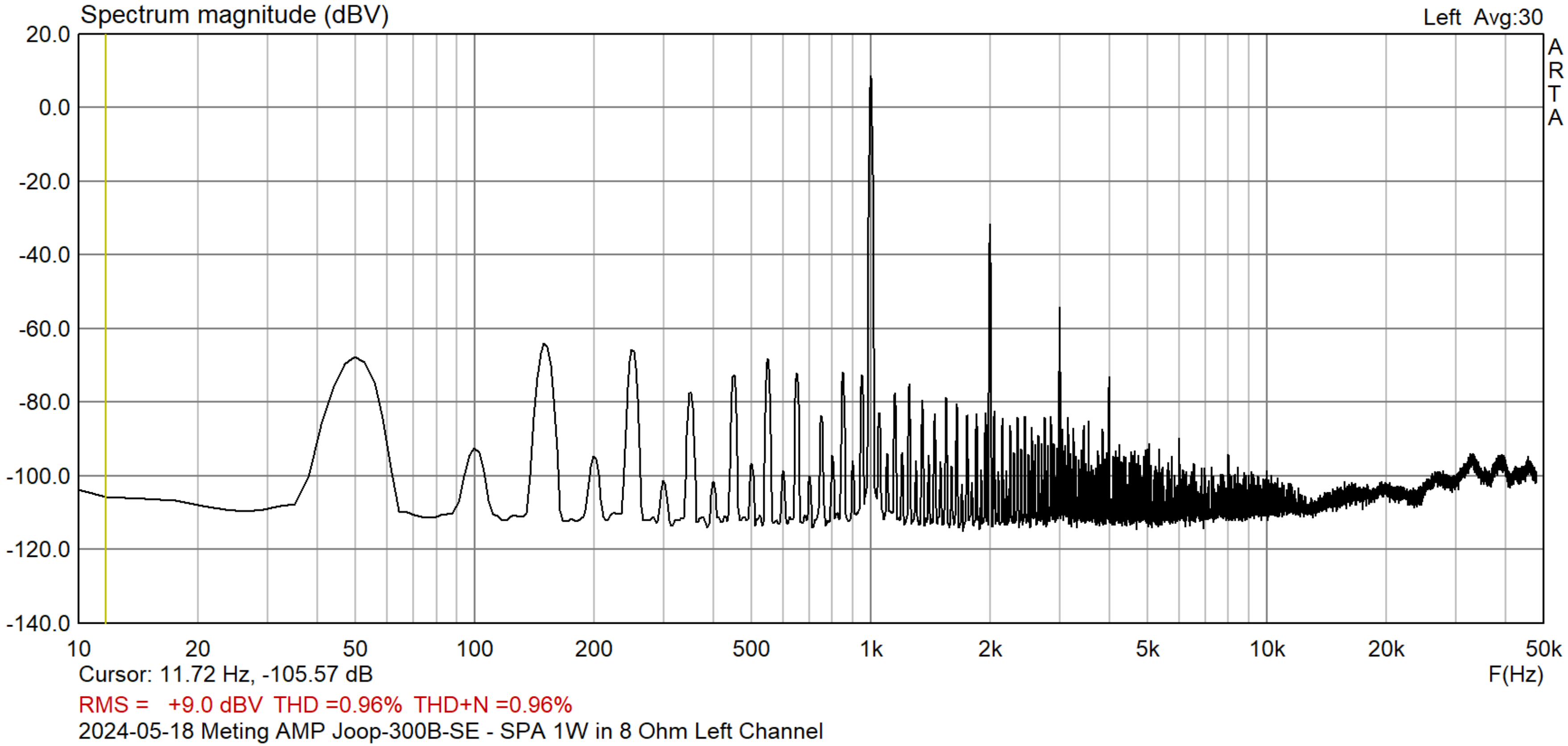


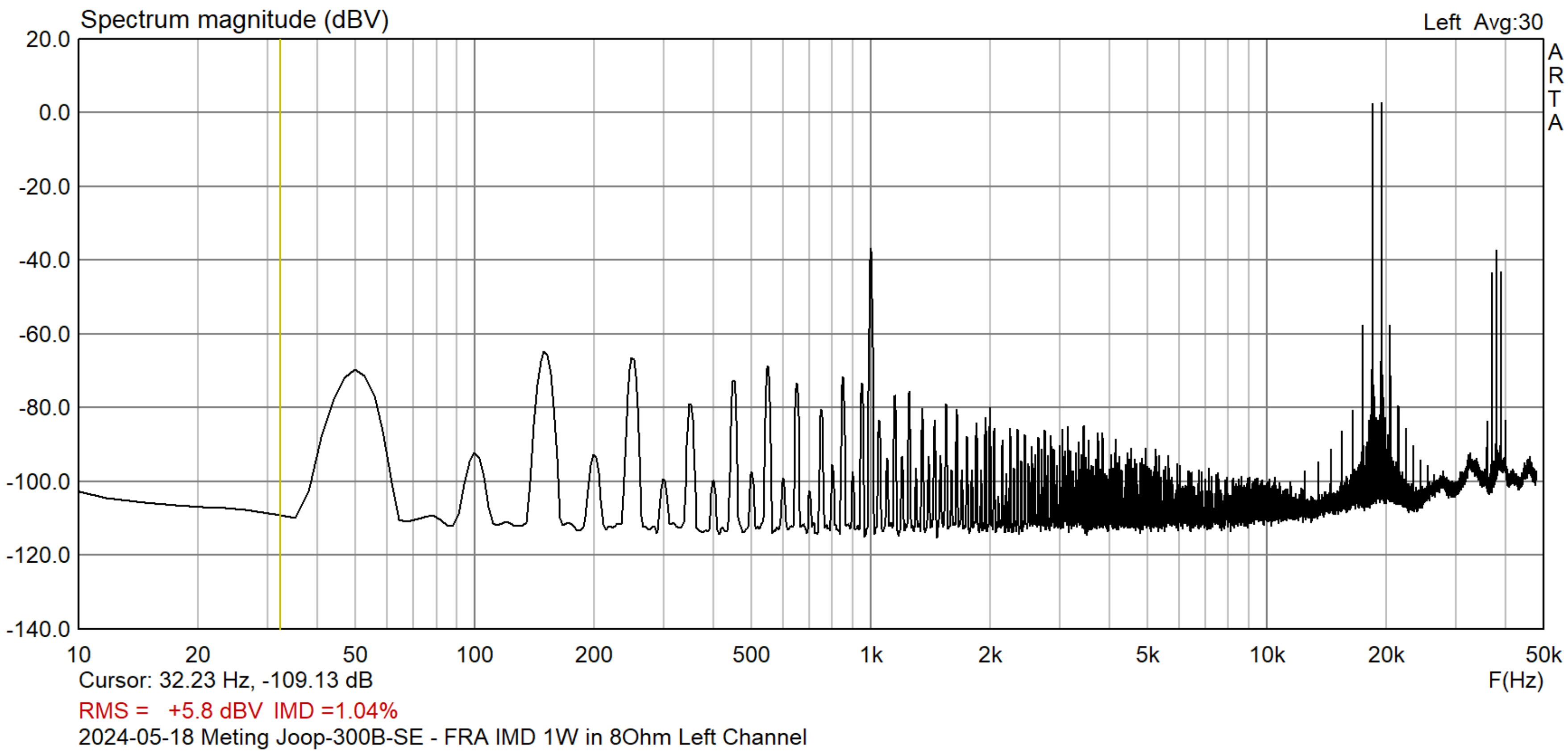
Spectrum magnitude (dBV)
Left Avg:30
ARTA
20.0
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
-140.0
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
F(Hz)
Cursor: 32.23 Hz, -106.22 dB
RMS = +6.2 dBV IMD =58.23%
2024-05-18 Meting Joop-300B-SE - FRA IMD 1W in 8Ohm Right Channel

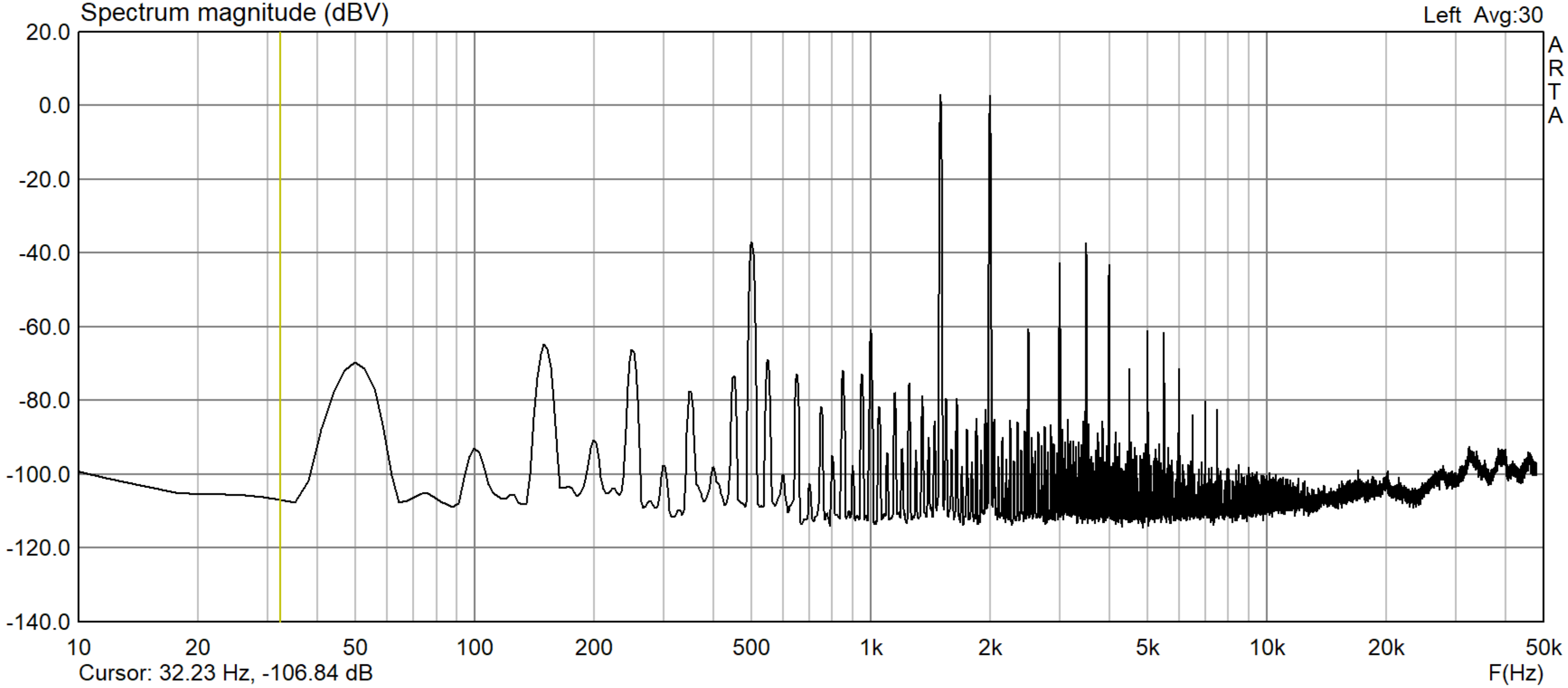

FR Magnitude (dB V/V)
Left/Right Avg:30
ARTA
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
F(Hz)
Cursor:17.58 Hz, 17.97 dB
2024-05-18 Meting AMP Joop-300B-SE - FR2 1W in 8 Ohm Right Channel



2024-05-18 Meting AMP Joop-300B-SE - BD 1W in 8 Ohm Right Channel


Spectrum magnitude (dBV)
Left Avg:30
ARTA
20.0
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
-140.0
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
F(Hz)
Cursor: 11.72 Hz, -105.57 dB
RMS = +9.0 dBV THD =0.96% THD+N =0.96%
2024-05-18 Meting AMP Joop-300B-SE - SPA 1W in 8 Ohm Left Channel

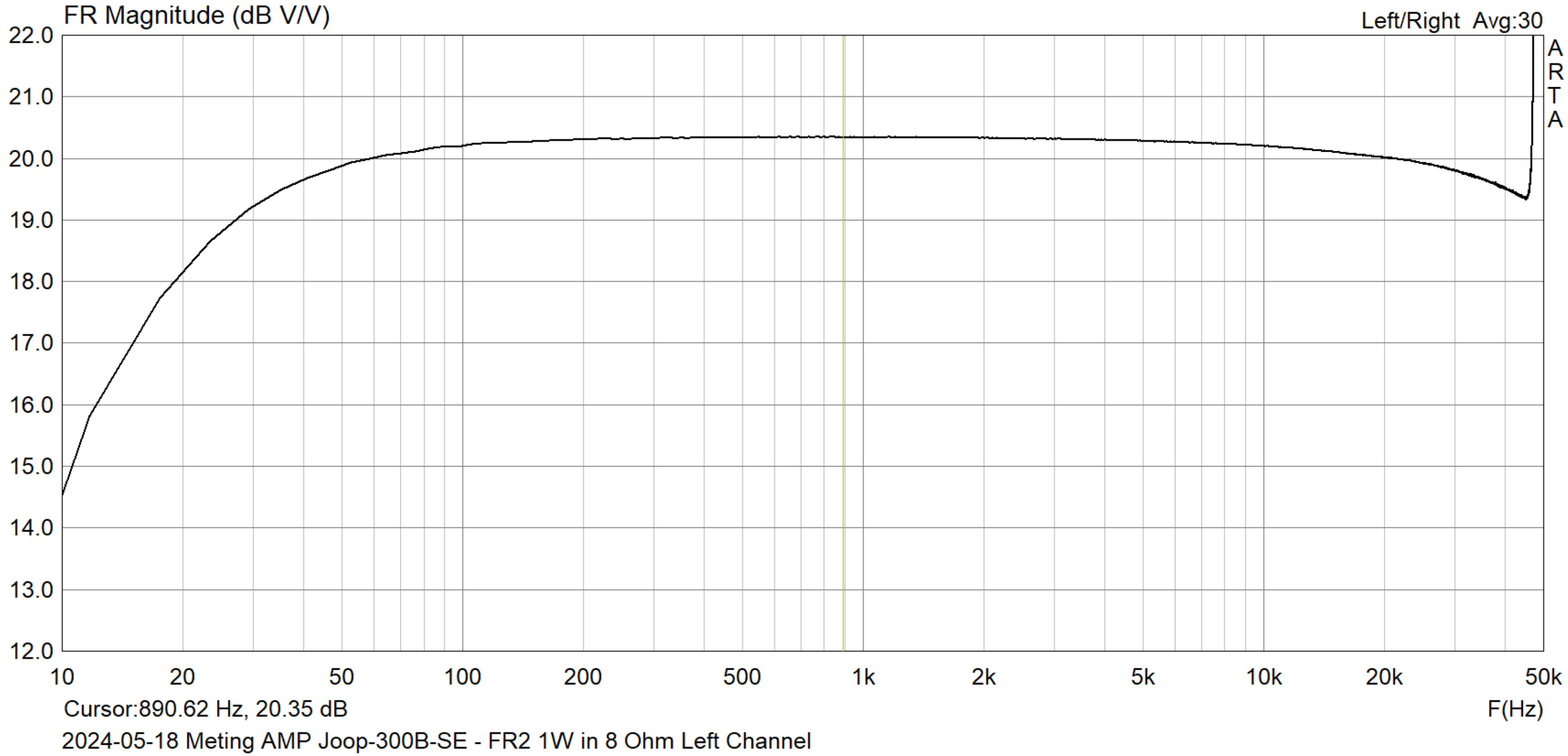

Spectrum magnitude (dBV)
Left Avg:30
ARTA
20.0
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
-140.0
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
F(Hz)
Cursor: 32.23 Hz, -109.13 dB
RMS = +5.8 dBV IMD =1.04%
2024-05-18 Meting Joop-300B-SE - FRA IMD 1W in 8Ohm Left Channel

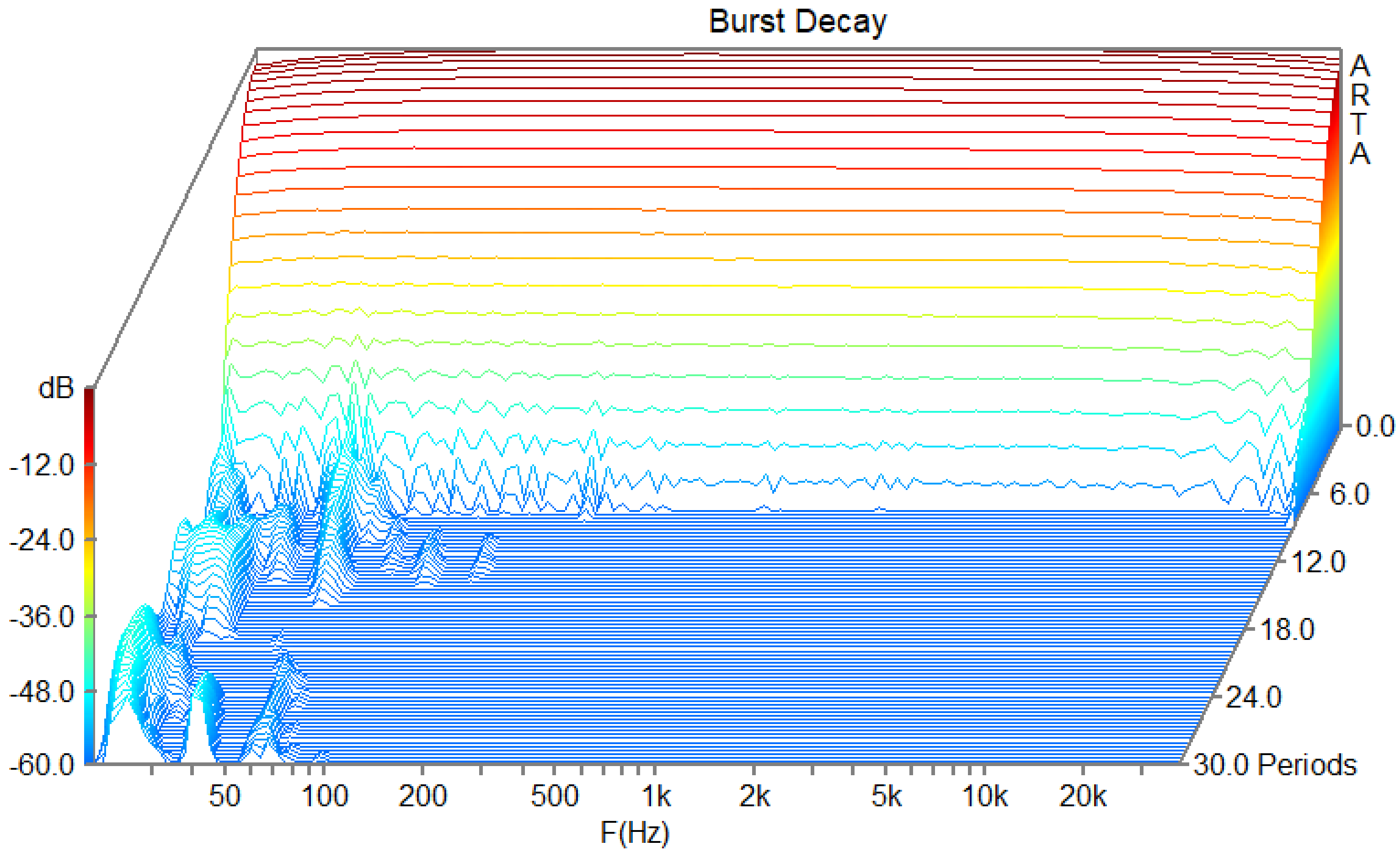


Cursor: 32.23 Hz, -106.84 dB

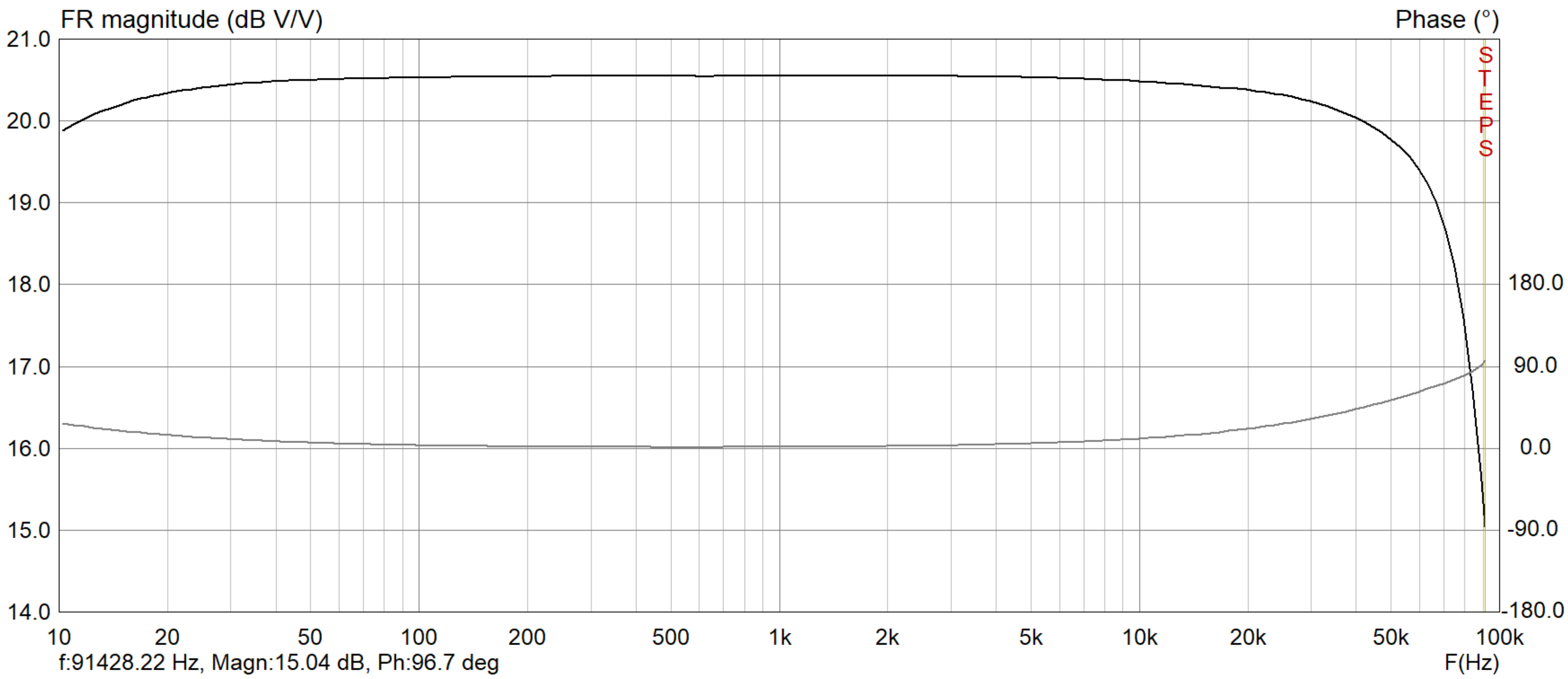
RMS = +6.1 dBV IMD =58.25%

2024-05-18 Meting Joop-300B-SE - FRA IMD 1W in 8Ohm Left Channel

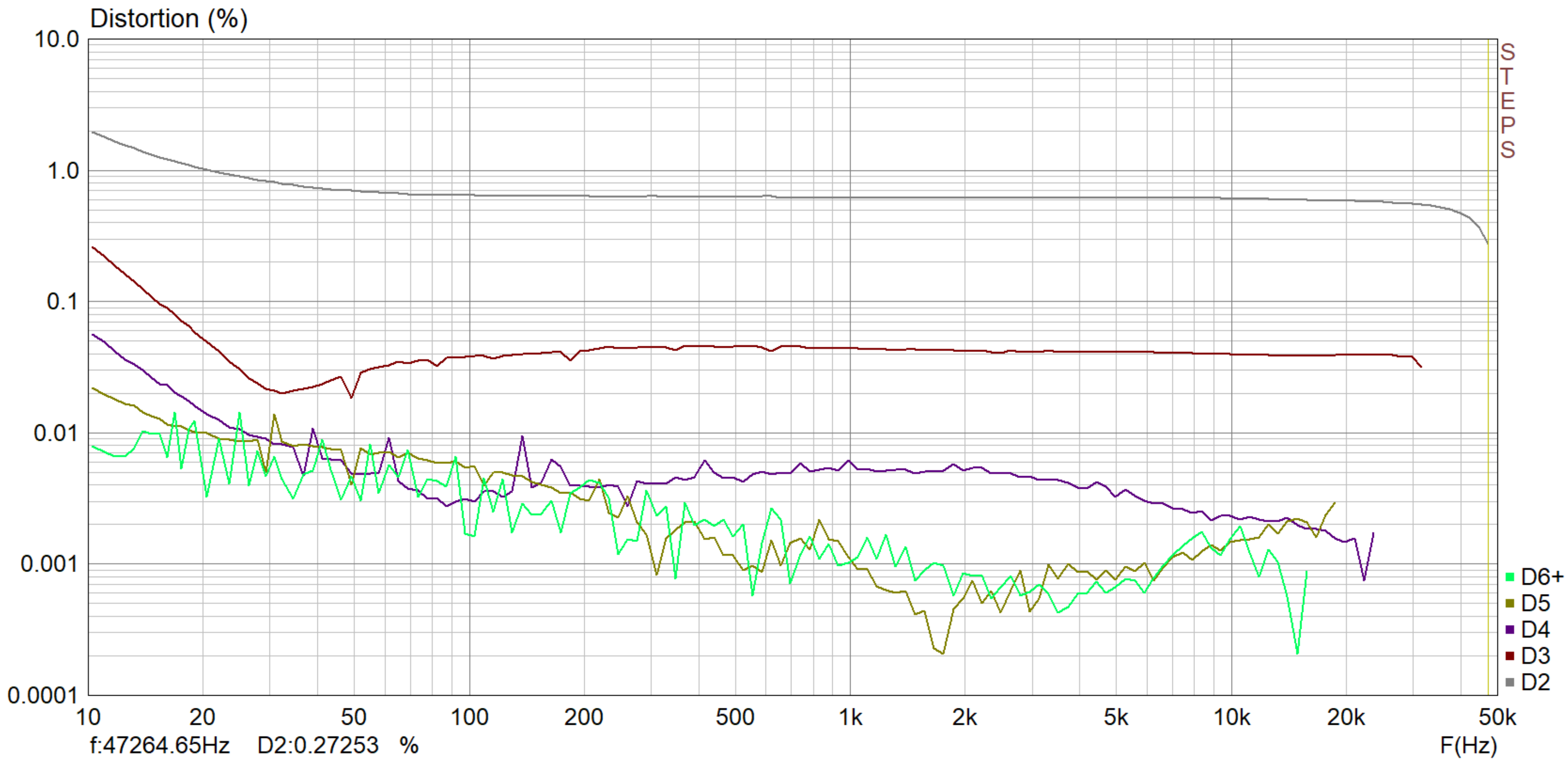

FR Magnitude (dB V/V)
Left/Right Avg:30
ARTA
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
Cursor:890.62 Hz, 20.35 dB
F(Hz)
2024-05-18 Meting AMP Joop-300B-SE - FR2 1W in 8 Ohm Left Channel



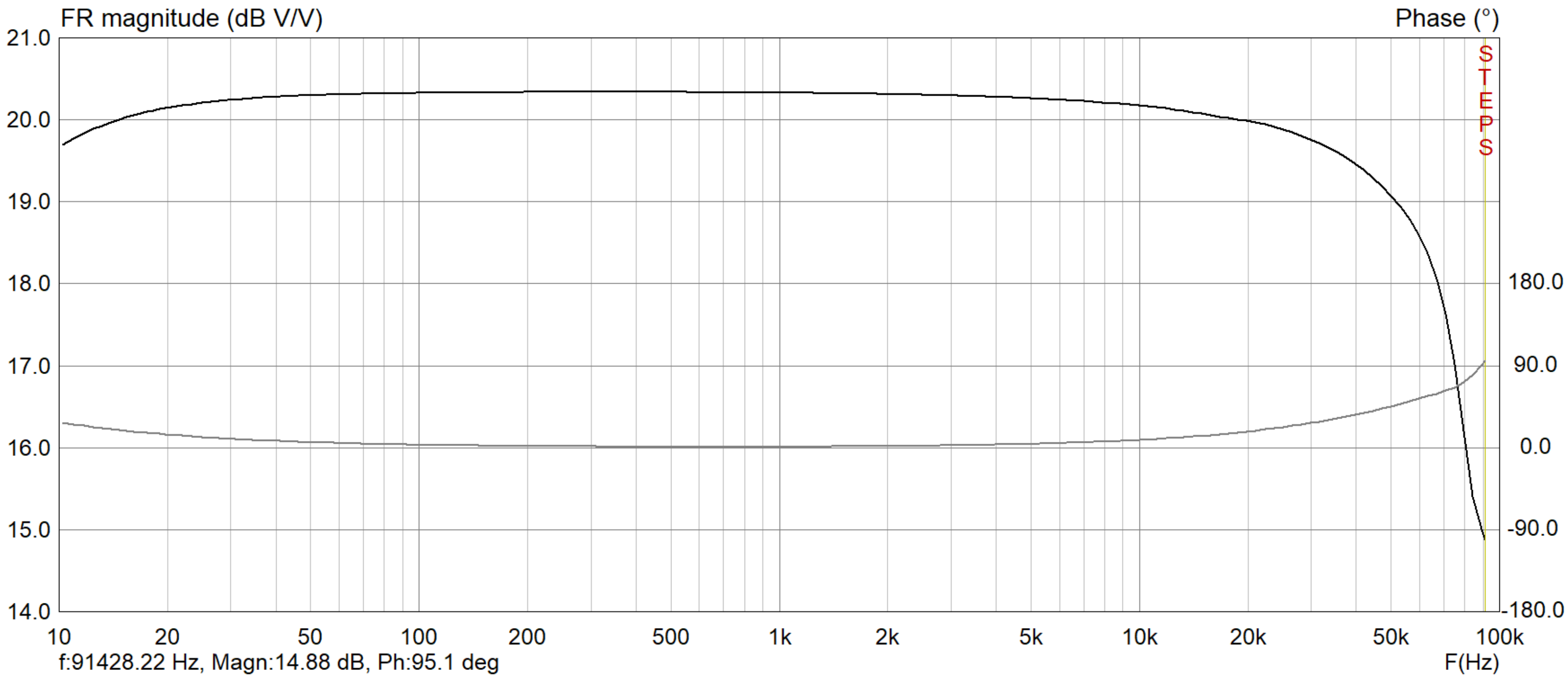
2024-05-18 Meting AMP Joop-300B-SE - BD 1W in 8 Ohm Left Channel



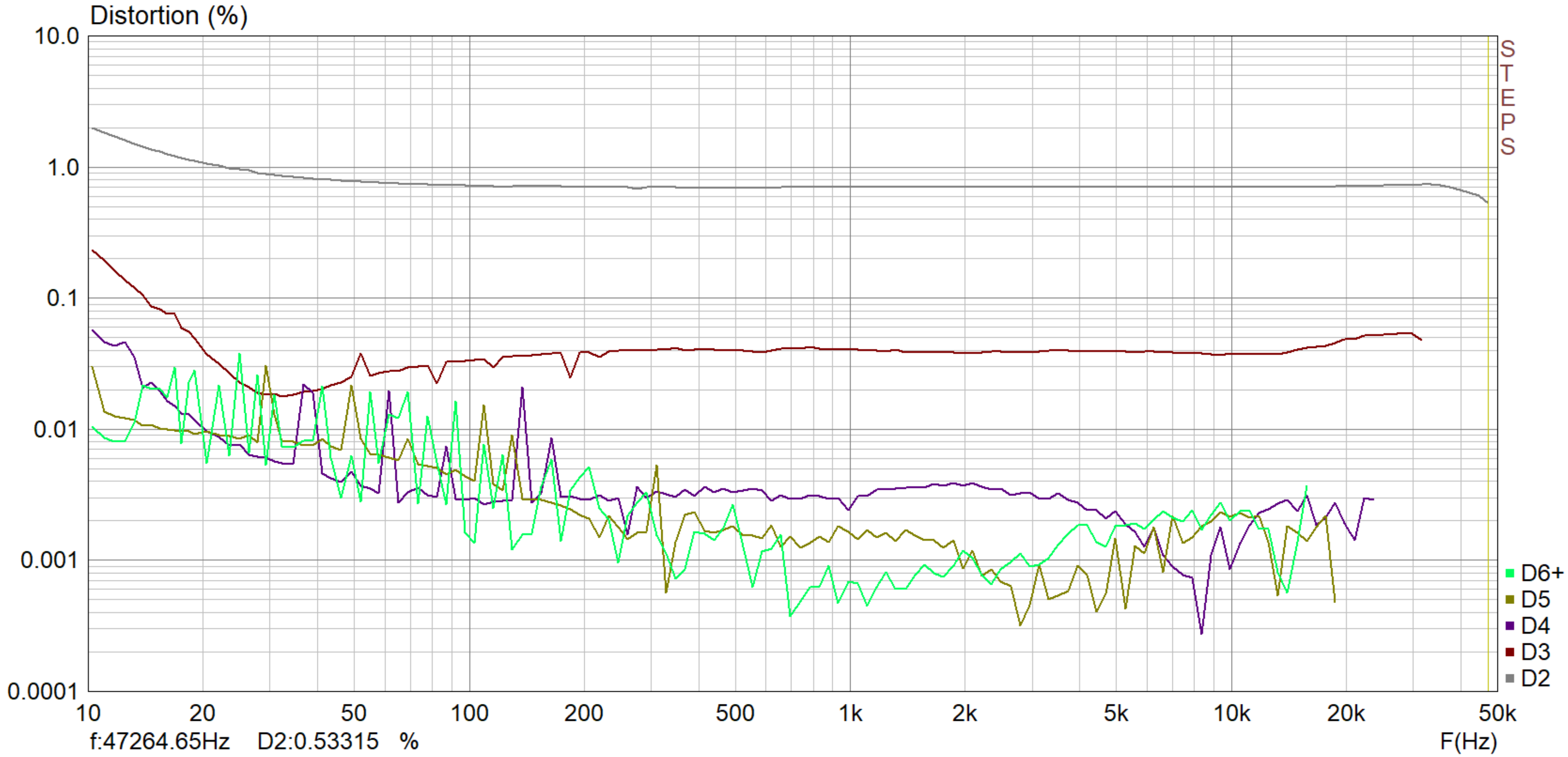
2024-05-18 Meting Joop-300B-SE - STEPS FR 1W in 8 Ohm Right Channel



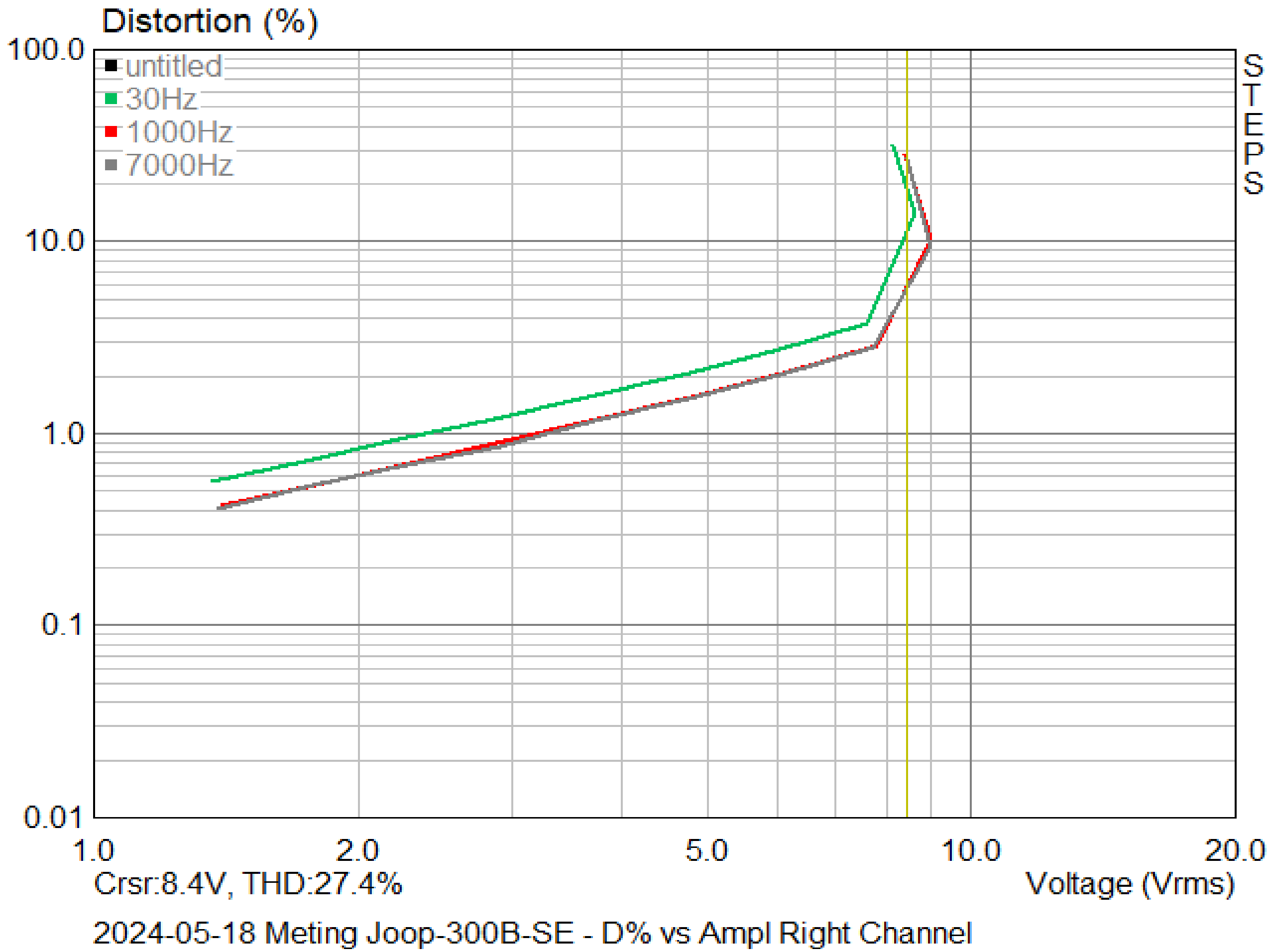
2024-05-18 Meting Joop-300B-SE - STEPS D% 1W in 8 Ohm Right Channel

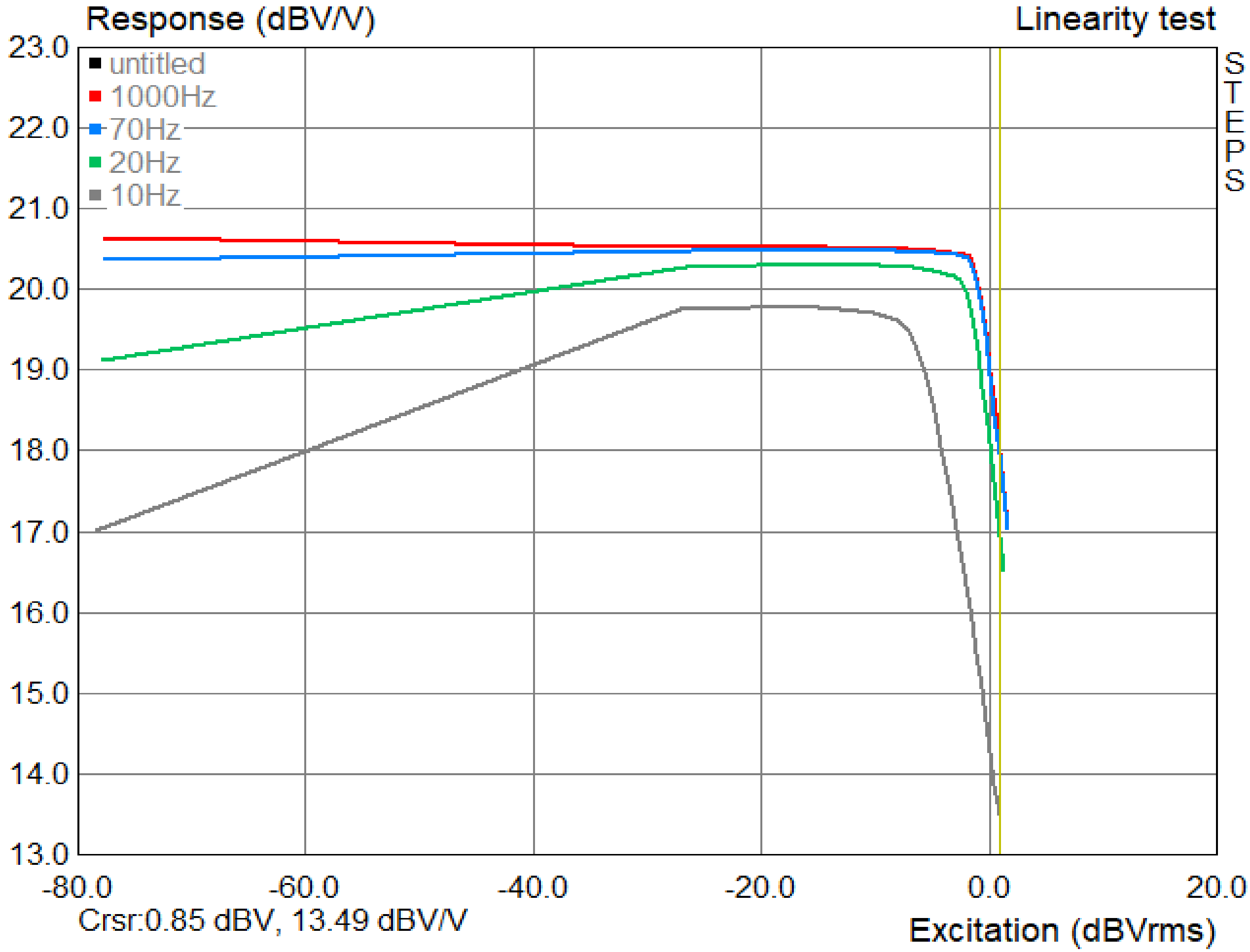


2024-05-18 Meting Joop-300B-SE - STEPS FR 1W in 8 Ohm Left Channel

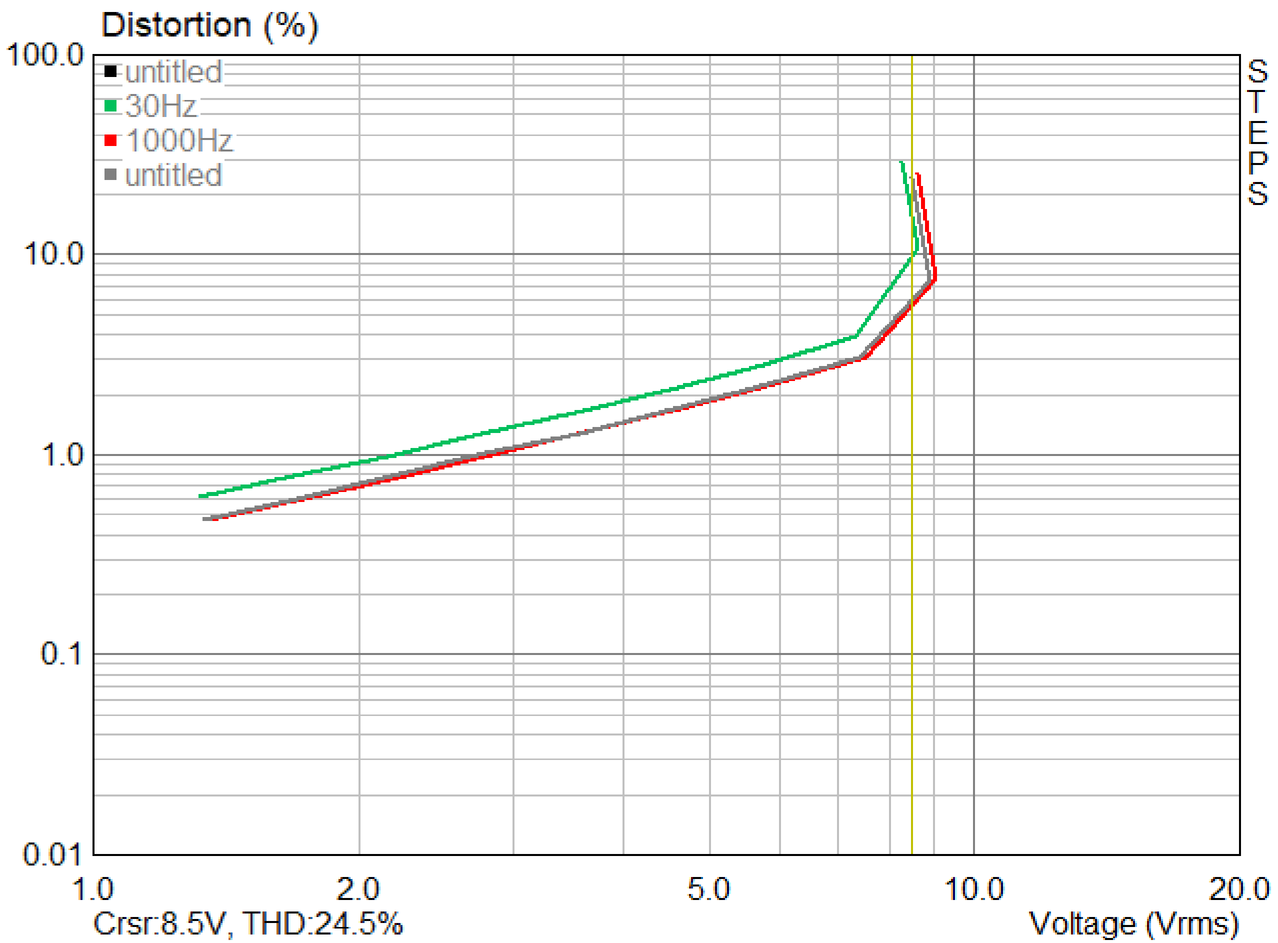


2024-05-18 Meting Joop-300B-SE - STEPS D% 1W in 8 Ohm Left Channel

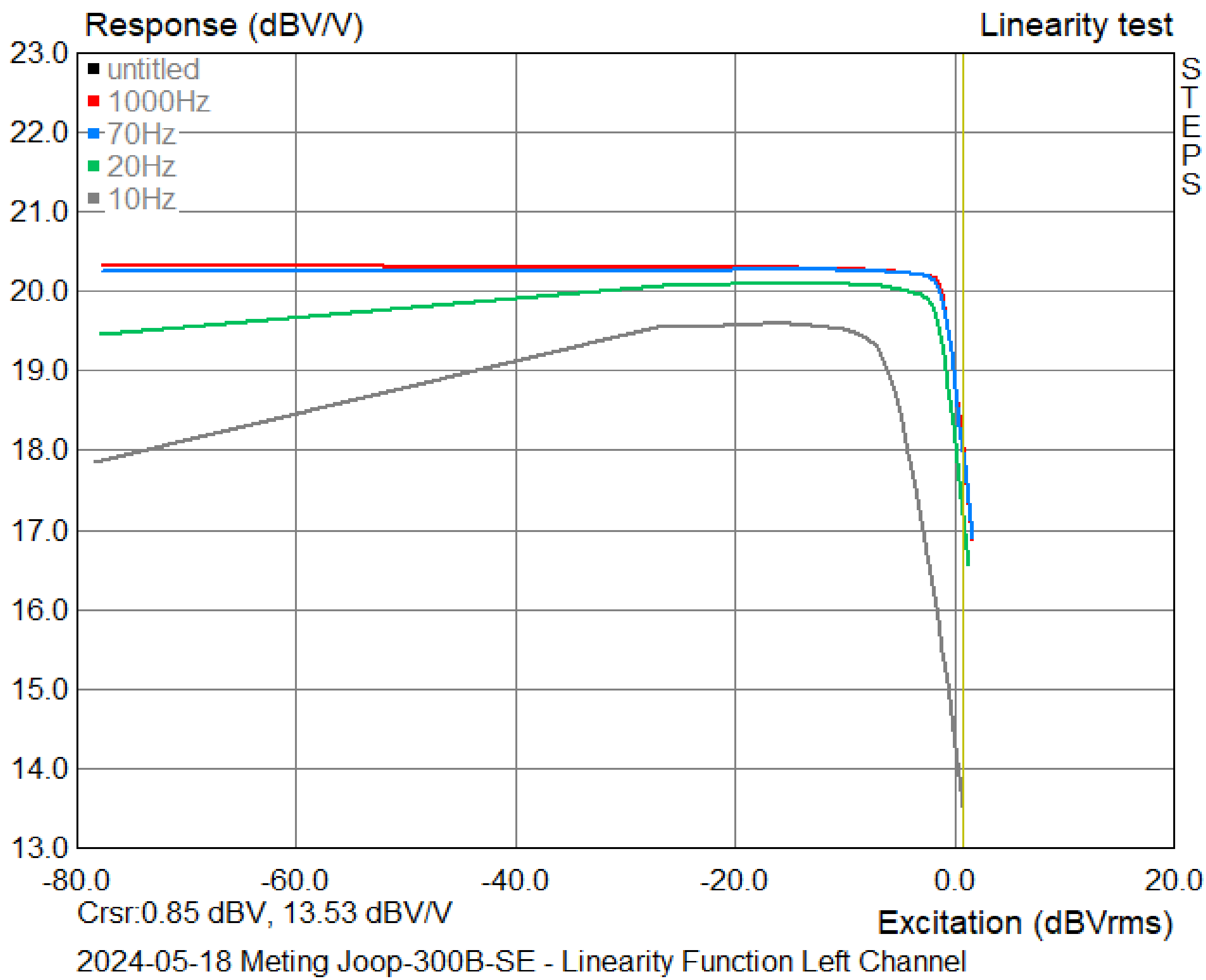

Distortion (%)
100.0
10.0
1.0
0.1
0.01
untitled
30Hz
1000Hz
7000Hz
STEPS
1.0
2.0
5.0
10.0
20.0
Crsr:8.4V, THD:27.4%
Voltage (Vrms)
2024-05-18 Meting Joop-300B-SE - D% vs Ampl Right Channel

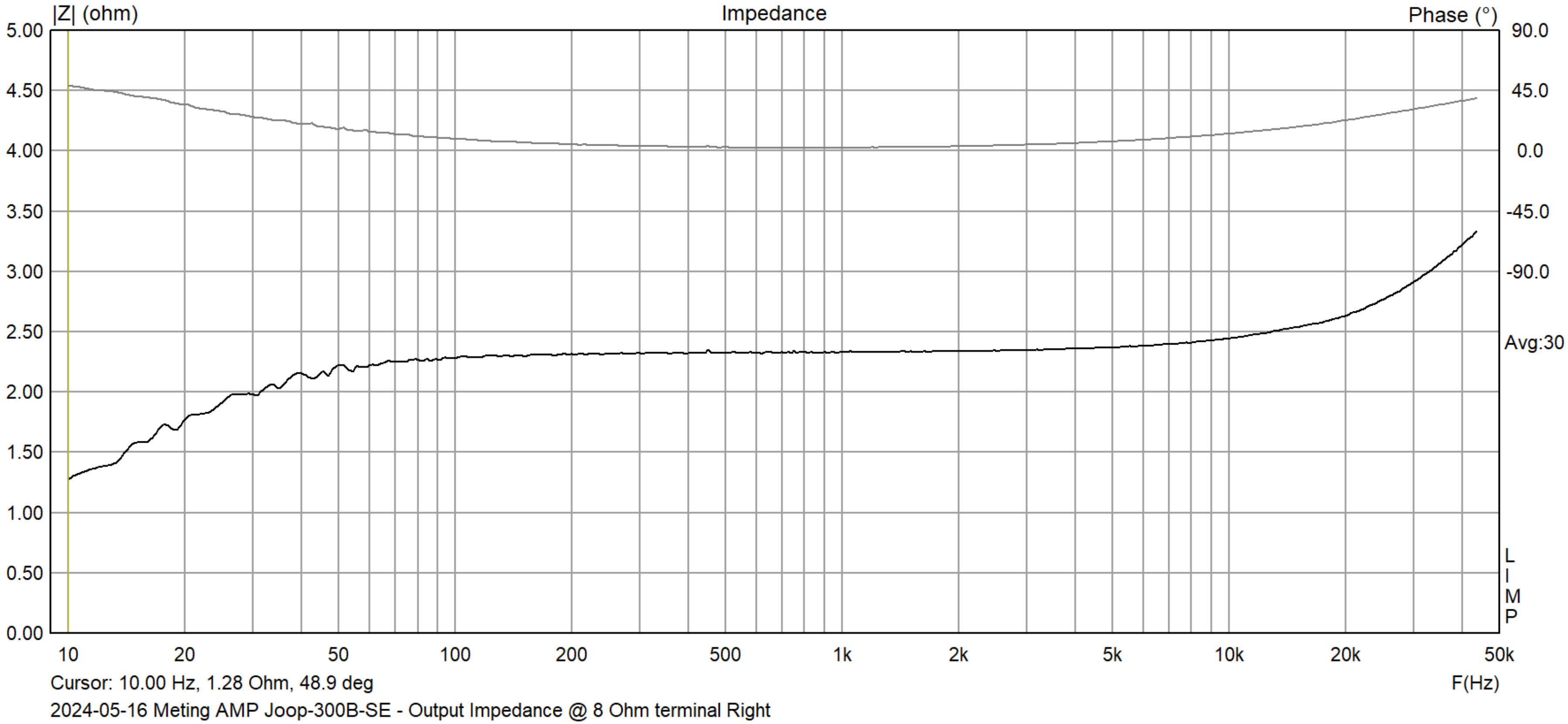


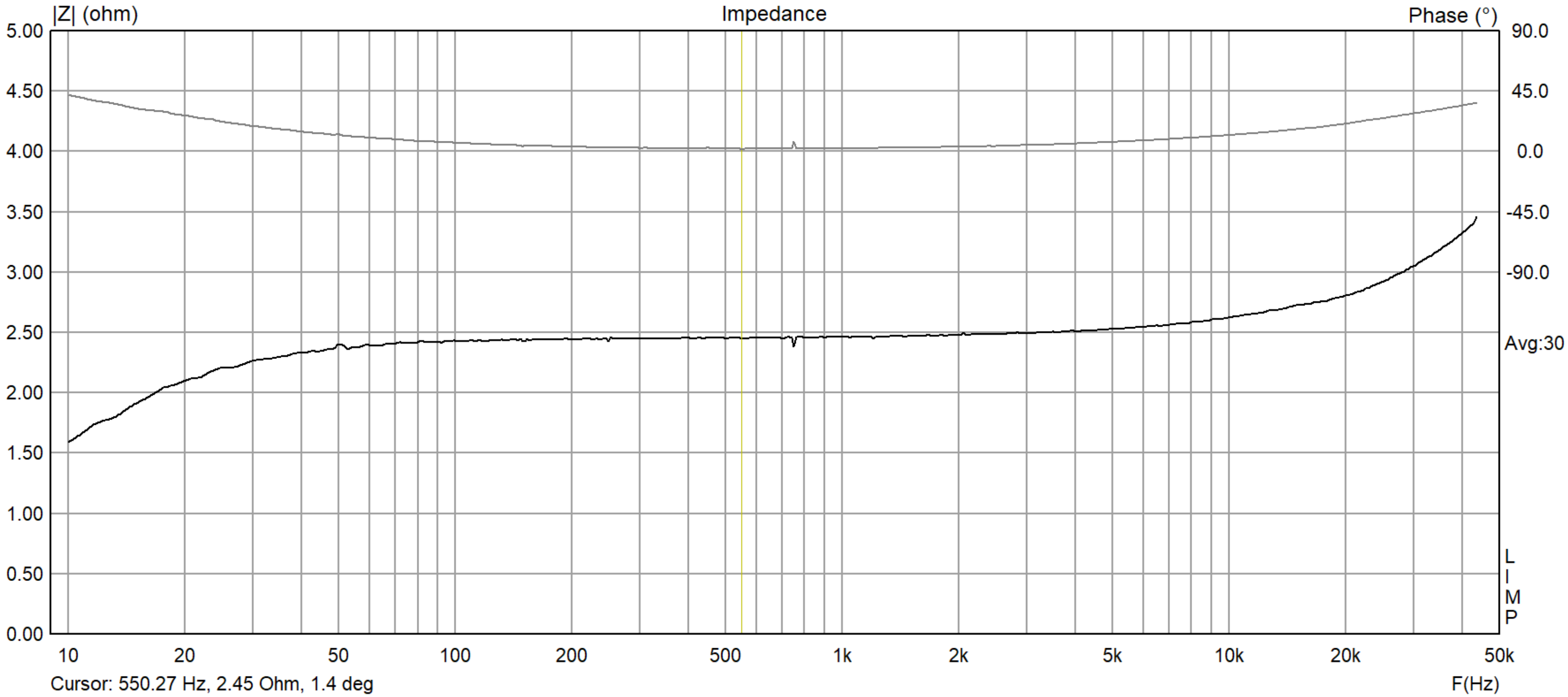
2024-05-18 Meting Joop-300B-SE - Linearity Function Right Channel



2024-05-18 Meting Joop-300B-SE - D% vs Ampl Left Channel


Response (dBV/V)
Linearity test
untitled
1000Hz
70Hz
20Hz
10Hz
STEPS
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
-80.0
-60.0
-40.0
-20.0
0.0
20.0
Crsr:0.85 dBV, 13.53 dBV/V
Excitation (dBVrms)
2024-05-18 Meting Joop-300B-SE - Linearity Function Left Channel


|Z| (ohm)
Impedance
Phase (°)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
90.0
45.0
0.0
-45.0
-90.0
Avg:30
L
I
M
P
10
20
50
100
200
500
1k
2k
5k
10k
20k
50k
Cursor: 10.00 Hz, 1.28 Ohm, 48.9 deg
F(Hz)
2024-05-16 Meting AMP Joop-300B-SE - Output Impedance @ 8 Ohm terminal Right



Cursor: 550.27 Hz, 2.45 Ohm, 1.4 deg
2024-05-16 Meting AMP Joop-300B-SE - Output Impedance @ 8 Ohm terminal Left