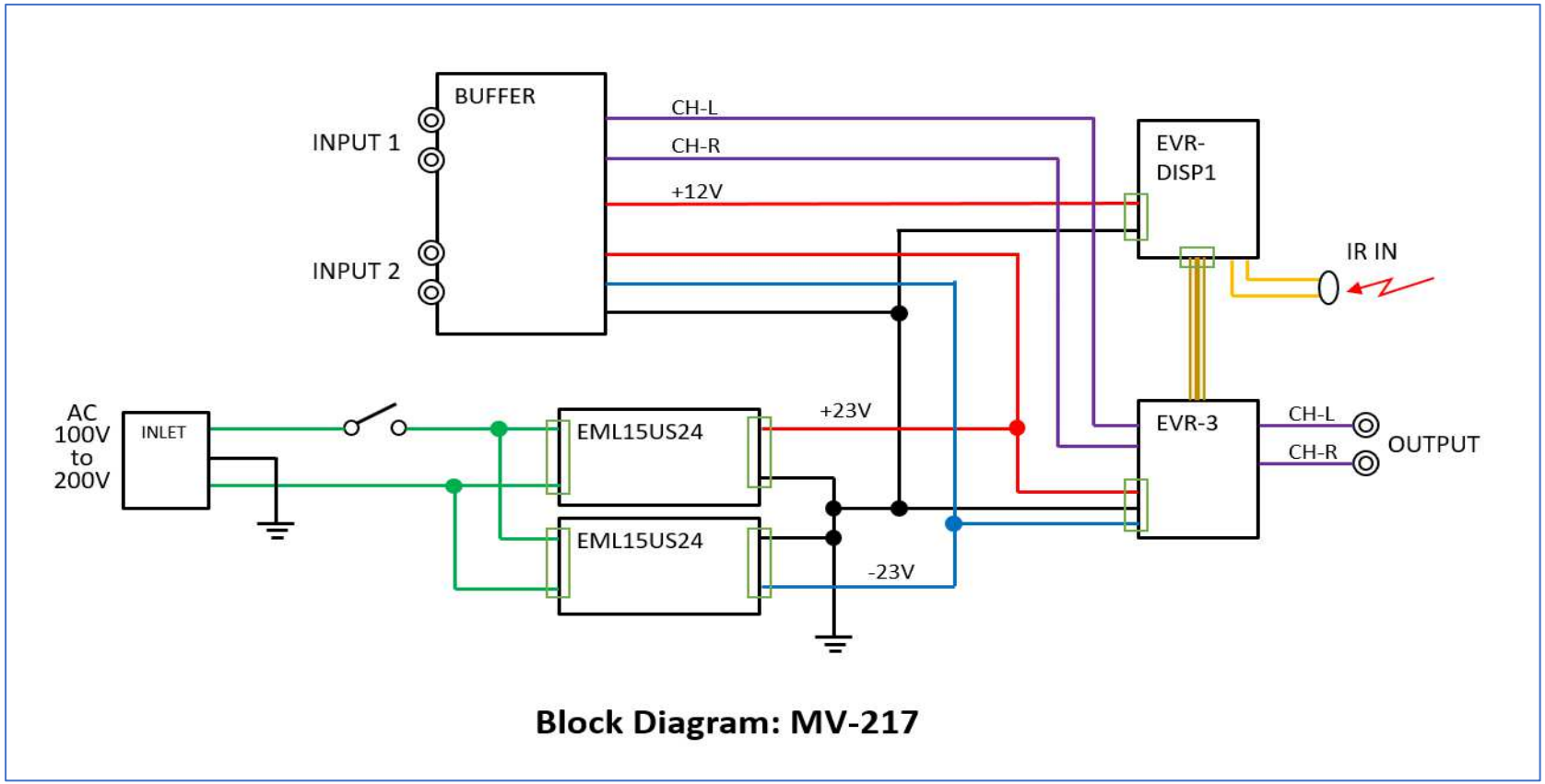
MV-217 X'TAL Design

2020/06/27

Electronical Design

Block Diagram



Block Diagram: MV-217

*** Electronic volume**

The combination of Aedio EVR-3-301 and EVR-DISP1 forms an electronic volume.
It also has infra-red remote control feature.

*** Two inputs mixed**

The buffer board has voltage followers.
The most unique feature of this is mixing the two input signals.
It is an experimental design. I expect it could improve sound quality by omitting mechanical contacts.
Moreover, the user doesn't have to operate the selector switch when he changes the source.
There are two drawbacks: (1) the user has to stop the player that he doesn't select; (2) the noise from the stopped player will be mixed to the signal.

*** Power supply**

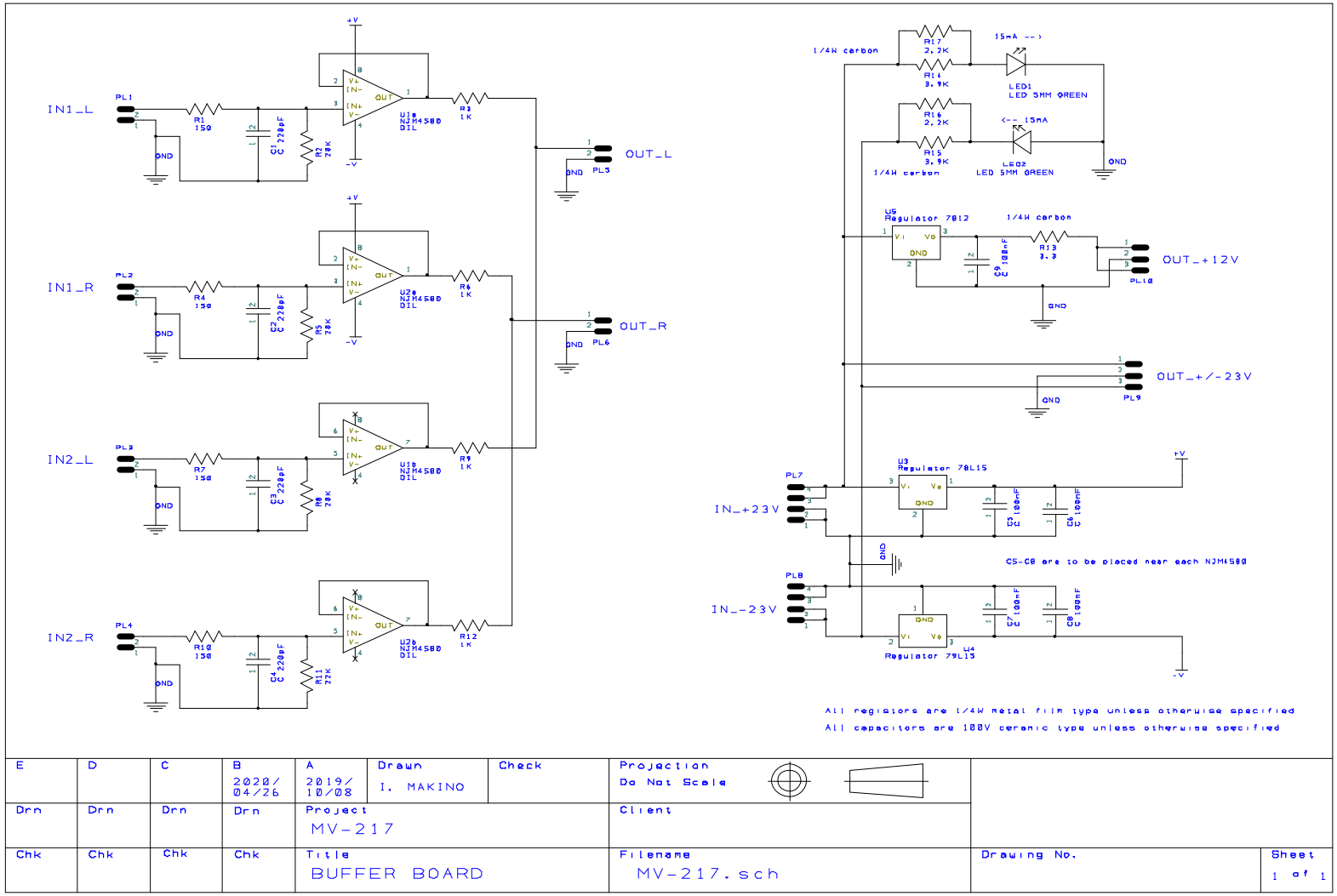
Two units of XP Power EML15US24-T, AC/DC converter for medical use, are used to supply DC+/-23V.
High regulation is expected.
The input voltage range is wide: 85-264V.
This enables MV-217 Move to be plugged to either 100V or 200V outlet.

Schematics of the Buffer Board

Op amp IC JRC NJM4580D is used for voltage follower (buffer).
At the outputs of the voltage followers, the signals from the input 1 and 2 are mixed.

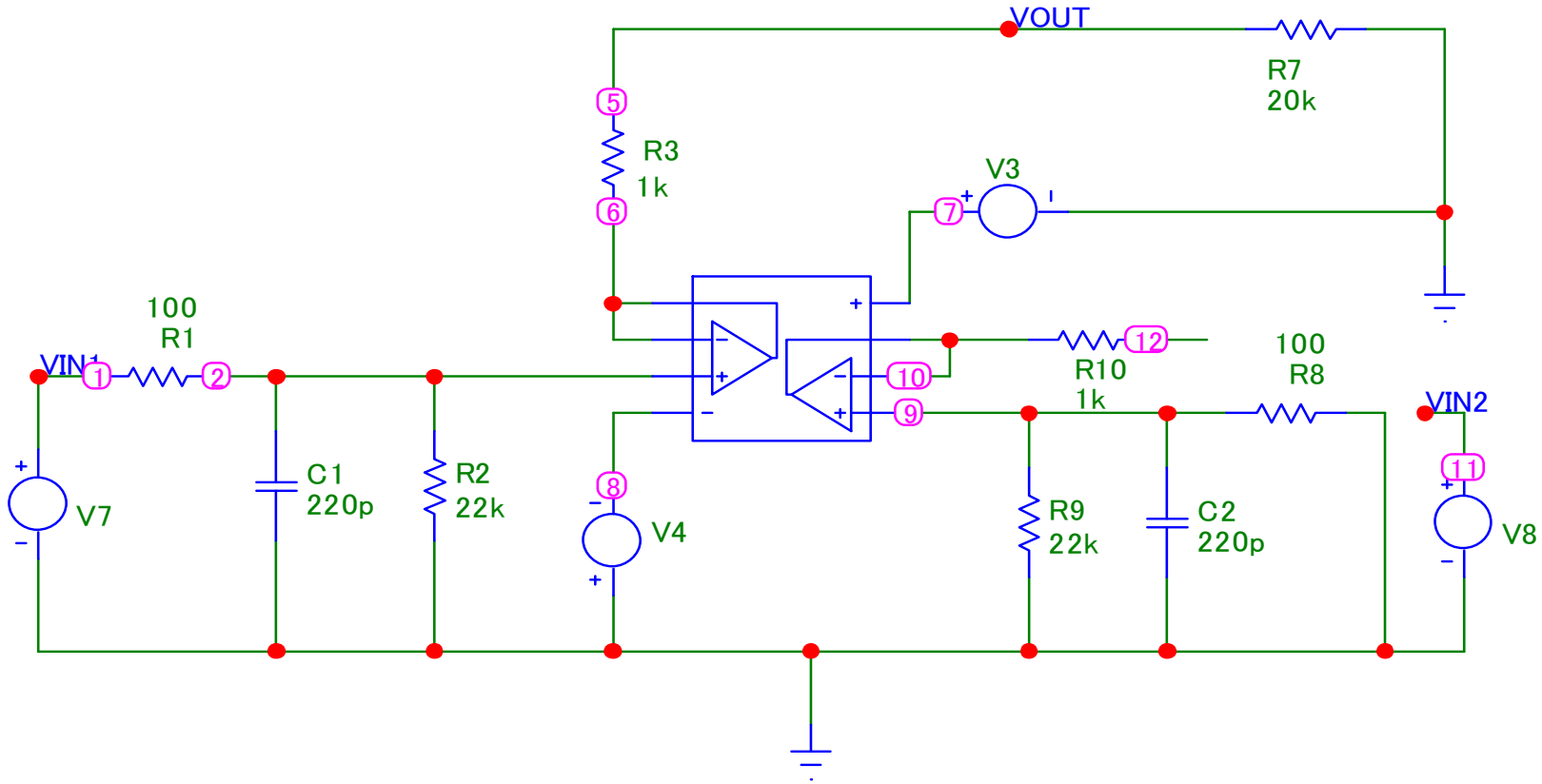
The regulator 7812 supplies DC+12V to EVR-DISP1.

The LED on the board lights the inside of the enclosure, and the light leaks through the clear plastic screws.


IN1_L
IN1_R
IN2_L
IN2_R
OUT_L
OUT_R
OUT_+12V
OUT_+/-23V
IN_+23V
IN_-23V
1/4W carbon
LED1
LED 5MM GREEN
LED2
LED 5MM GREEN
Regulator 7812
Regulator 78L15
Regulator 79L15
C5-C8 are to be placed near each NJM4580
All registors are 1/4W metal film type unless otherwise specified
All capacitors are 100V ceramic type unless otherwise specified
E
D
C
B 2020/04/26
A 2019/10/08
Drawn I. MAKINO
Check
Projection Do Not Scale
Project MV-217
Client
Title BUFFER BOARD
Filename MV-217.sch
Drawing No.
Sheet 1 of 1

Simulation of Buffer Board

*** Schematics for simulation**



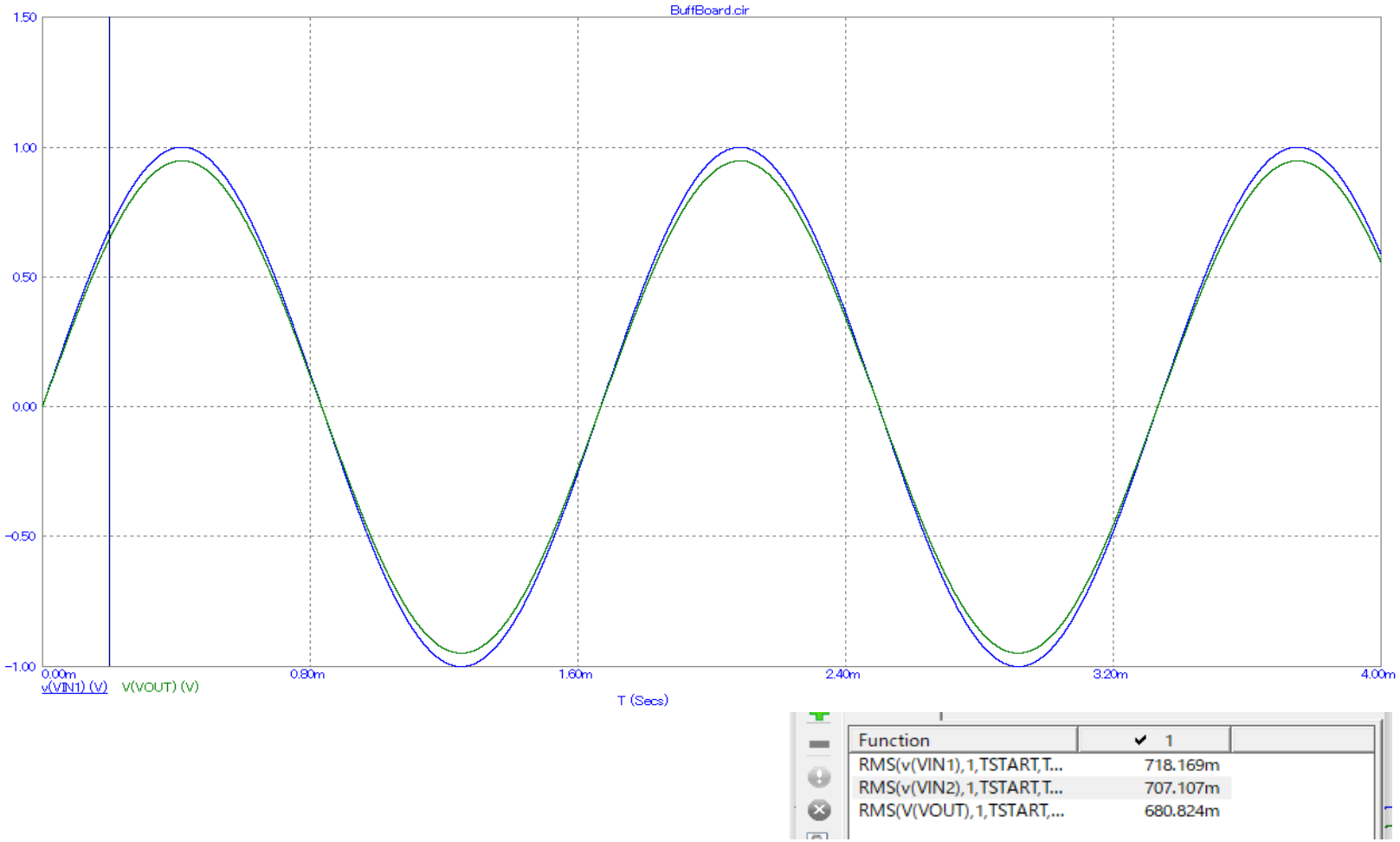
The Pspice model of NJM4580 is imported to the dual op amp IC.

The passive components are generic ones.

*** Waveform - non-mixed**

Node 12 is NOT connected to VOUT

VIN1: 600Hz, 1Vpk

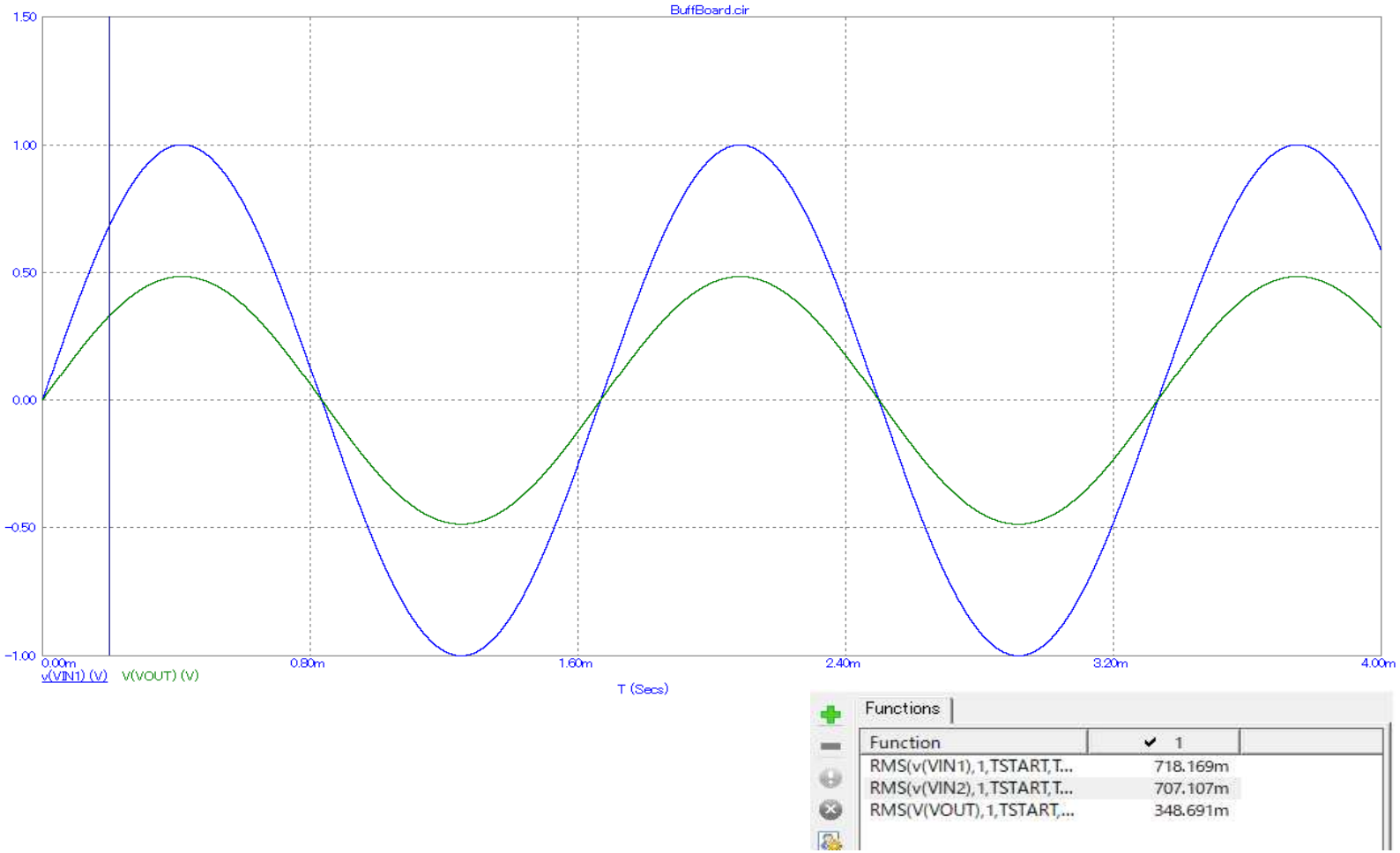


Gain = 20 * log(681/718) = -0.46 [dB]

*** Waveform - mixed with zero**

Node 12 is connected to VOUT

VIN1: 600Hz, 1Vpk, VIN2: 0V



Gain = 20 * log(349/718) = -6.27 [dB]

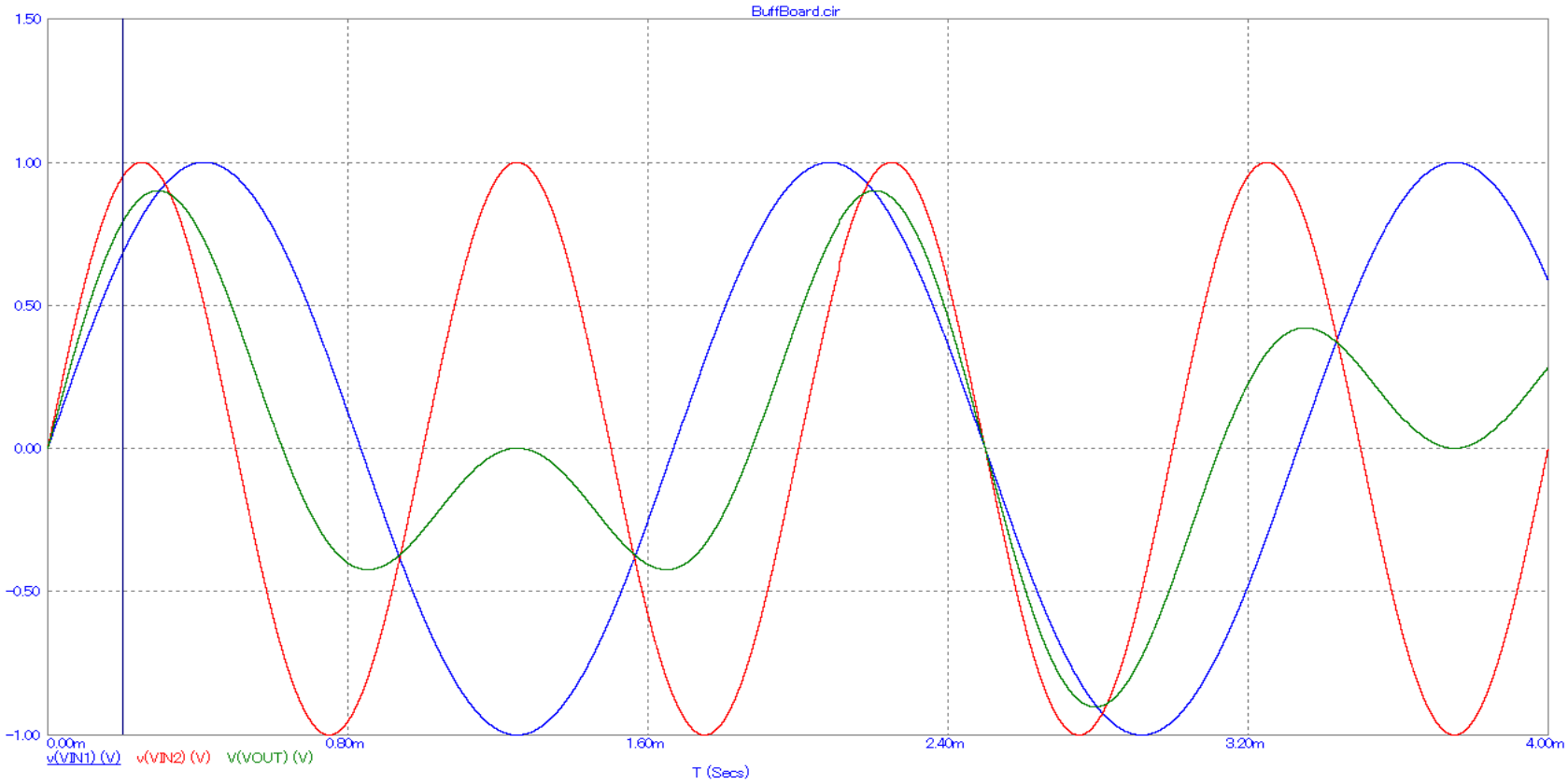
VOUT has been halved in voltage, because it is pulled down to ground by R10.

*** Waveform - mixed with another signal**

Node 12 is connected to VOUT, and R8 is connected to VIN2

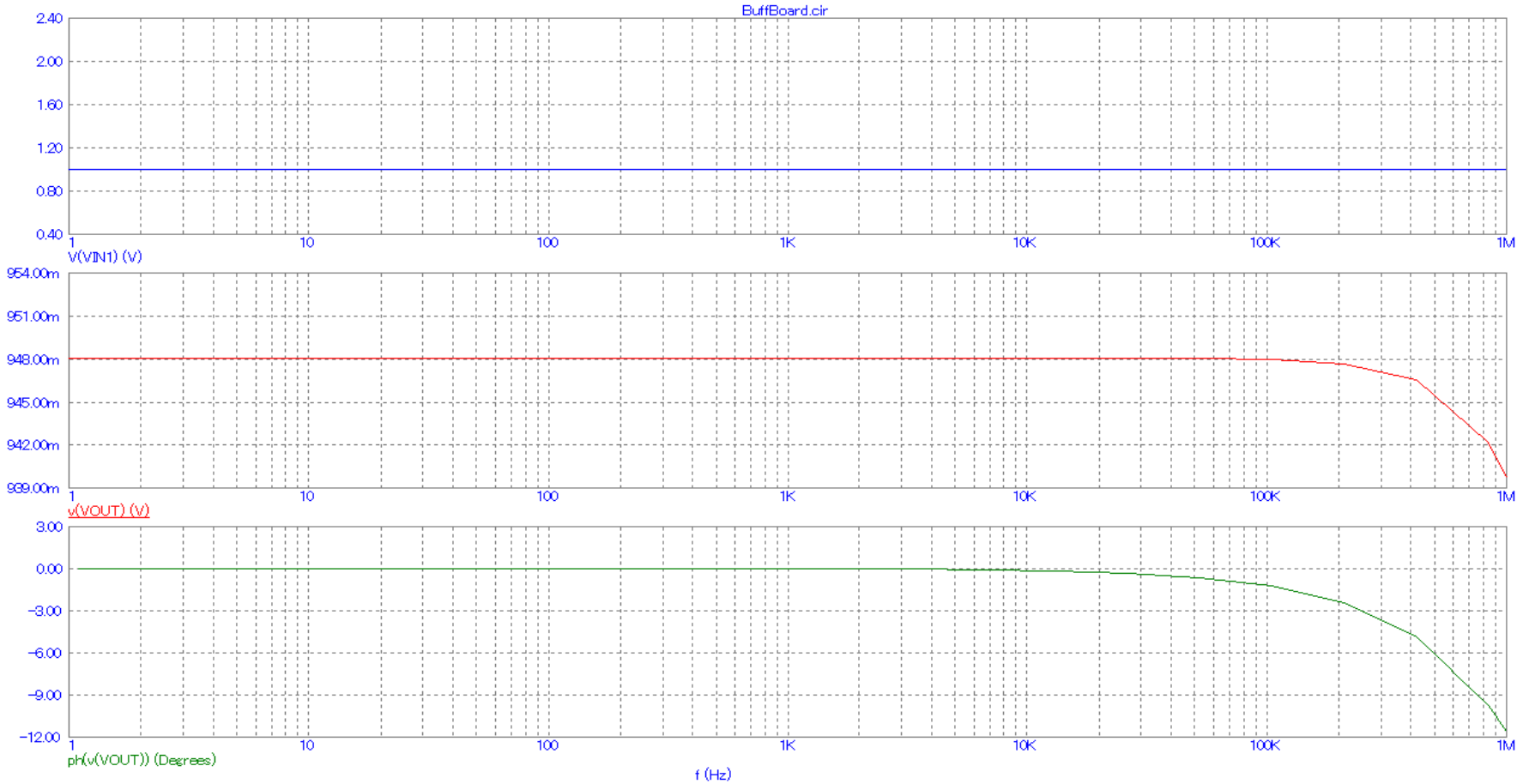
VIN1: 600Hz, 1Vpk, VIN2: 1kHz, 1Vpk

Maybe, this waveform is right.



*** Frequency response - non-mixed**

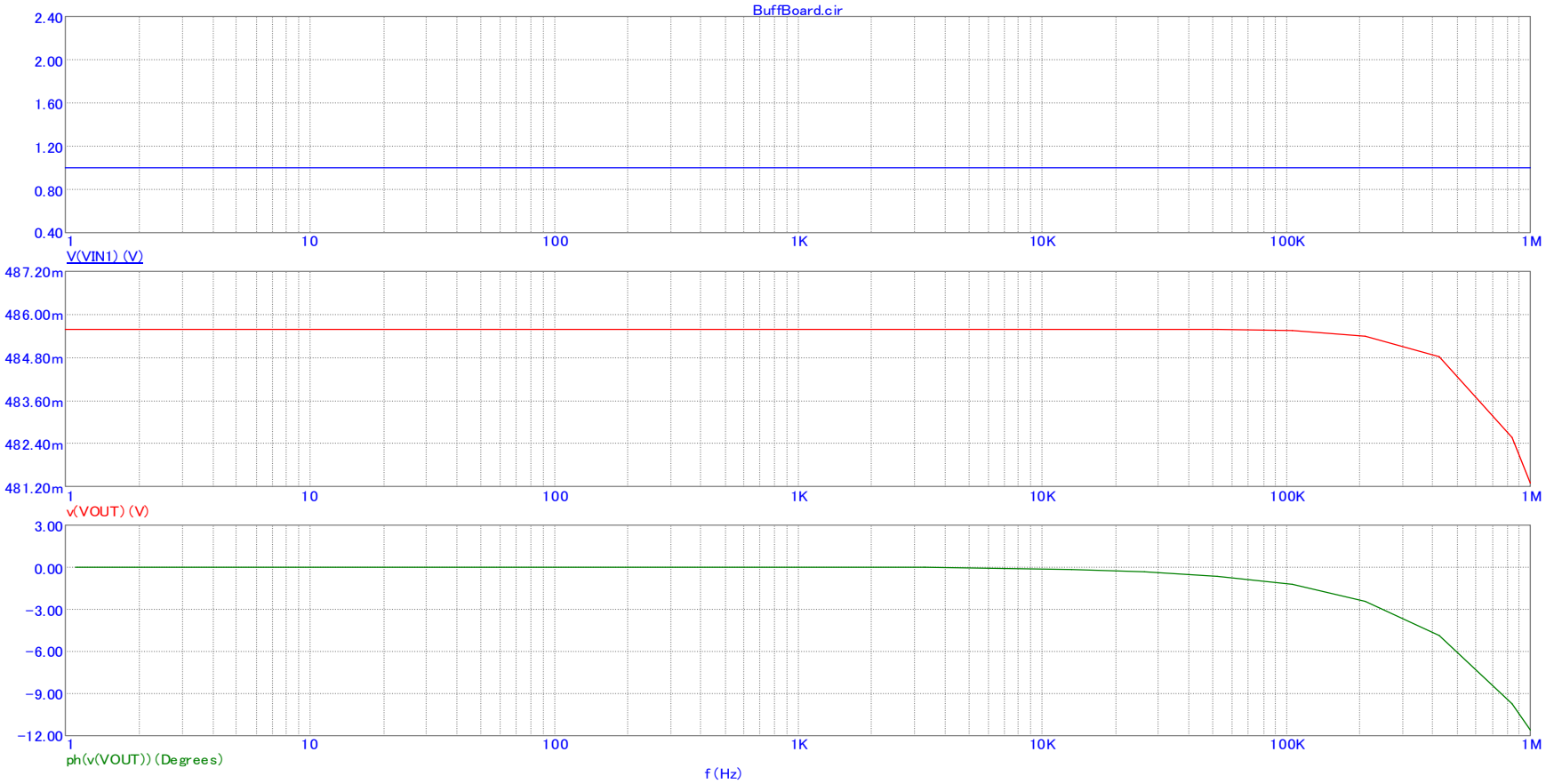
Node 12 is NOT connected to VOUT



*** Frequency response - mixed with zero**

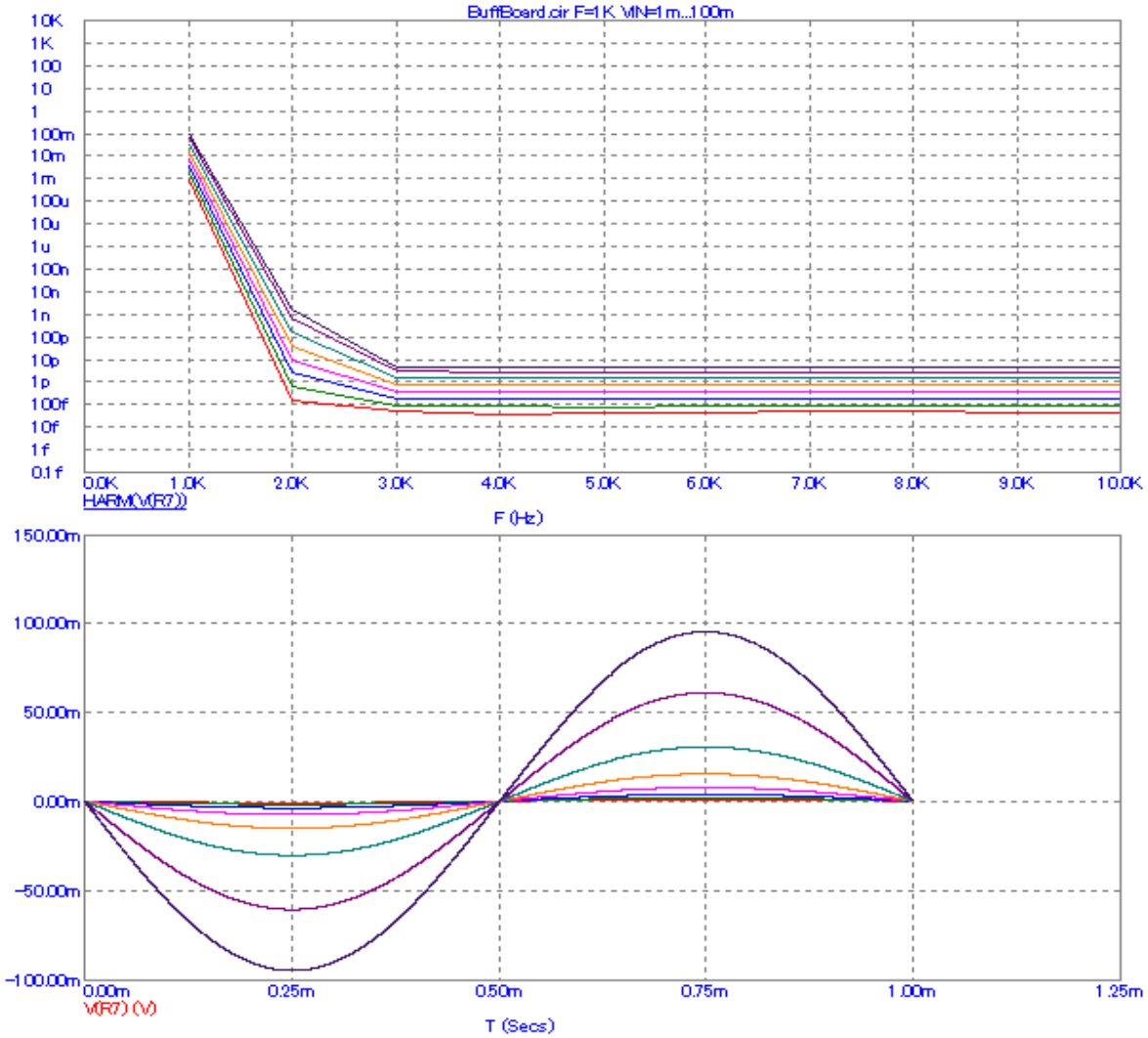
Node 12 is connected to VOUT

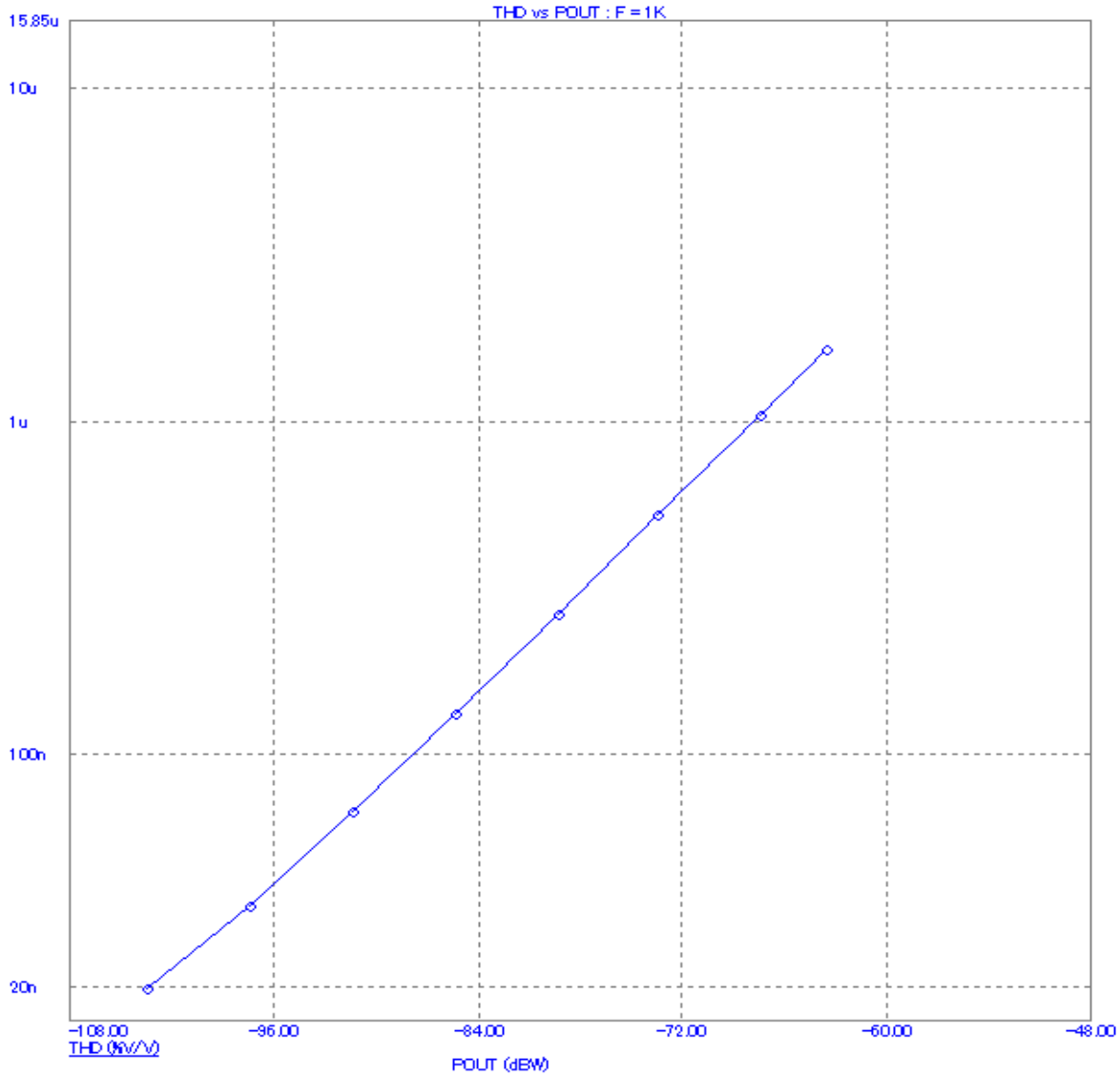
VIN1: 600Hz, 1Vpk, VIN2: 0V



*** THD - non-mixed**

Node 12 is NOT connected to VOUT

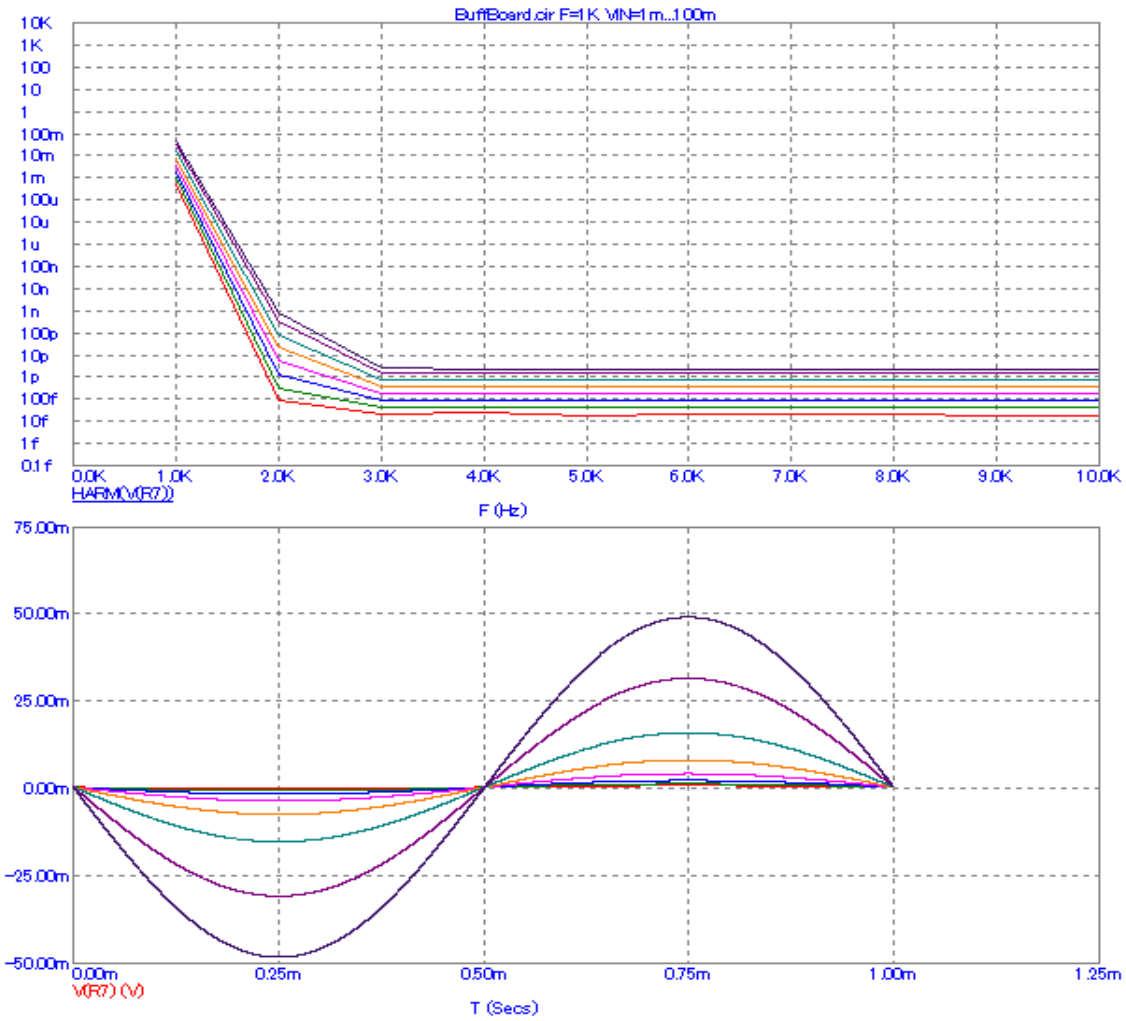


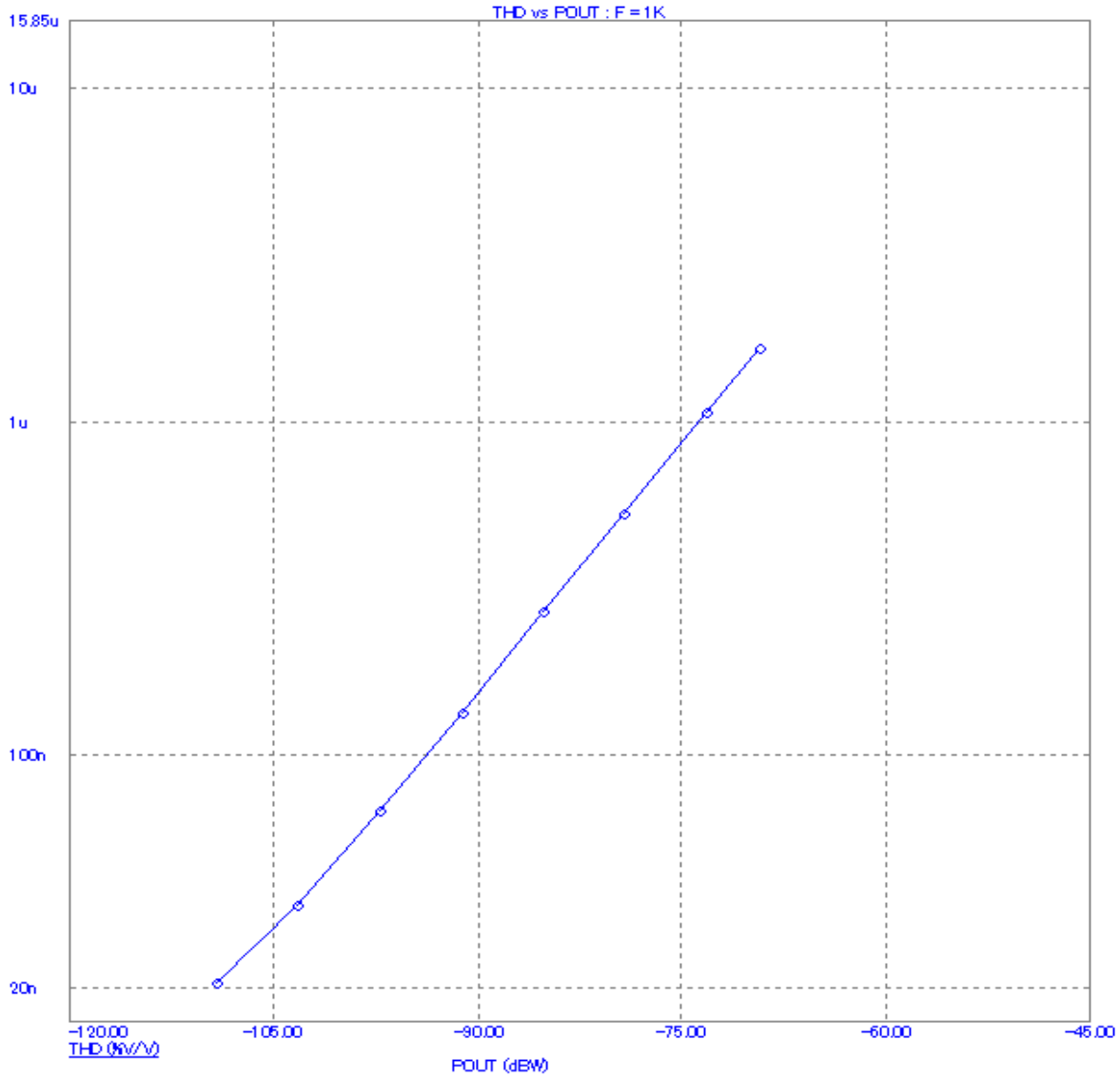

THD vs POUT : F = 1K
15.85u
10u
1u
100n
20n
-108.00
-96.00
-84.00
-72.00
-60.00
-48.00
THD (%V/V)
POUT (dBW)

*** THD - mixed with zero**

Node 12 is connected to VOUT

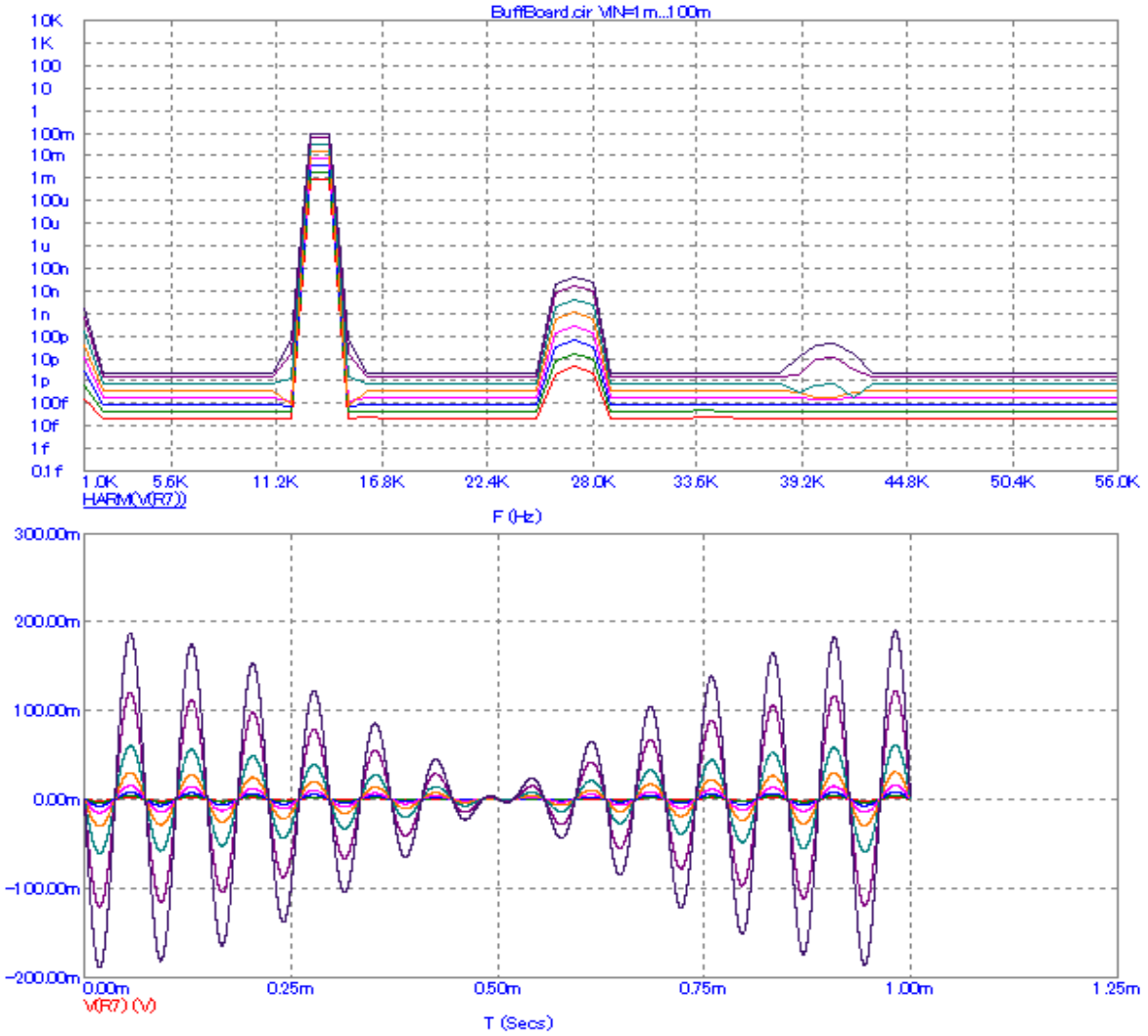
VIN1: 600Hz, 1Vpk, VIN2: 0V

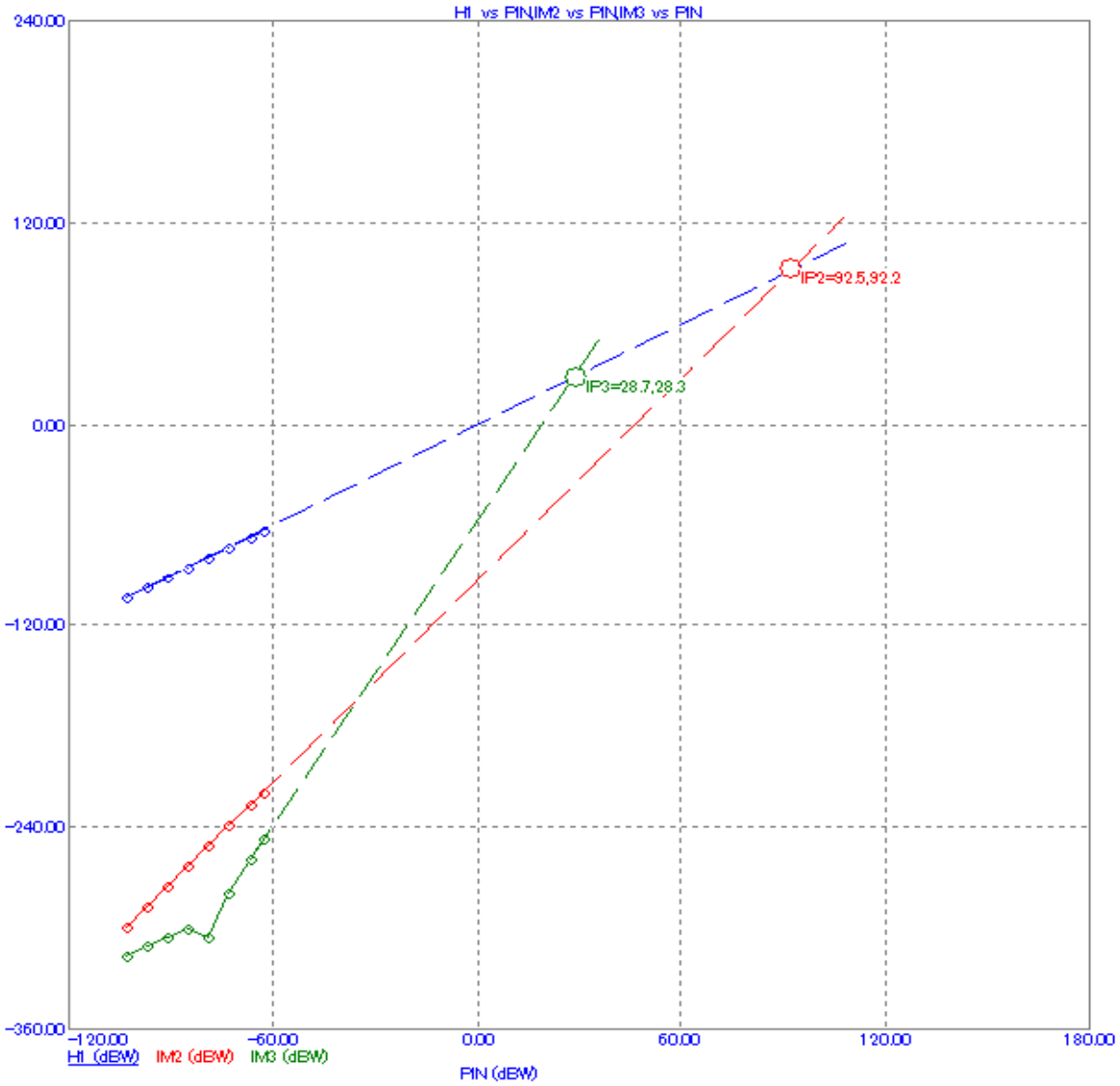



THD vs POUT : F = 1K
15.85u
10u
1u
100n
20n
-120.00
-105.00
-90.00
-75.00
-60.00
-45.00
THD (%V/V)
POUT (dBW)

*** IMD - non-mixed**

Node 12 is NOT connected to VOUT

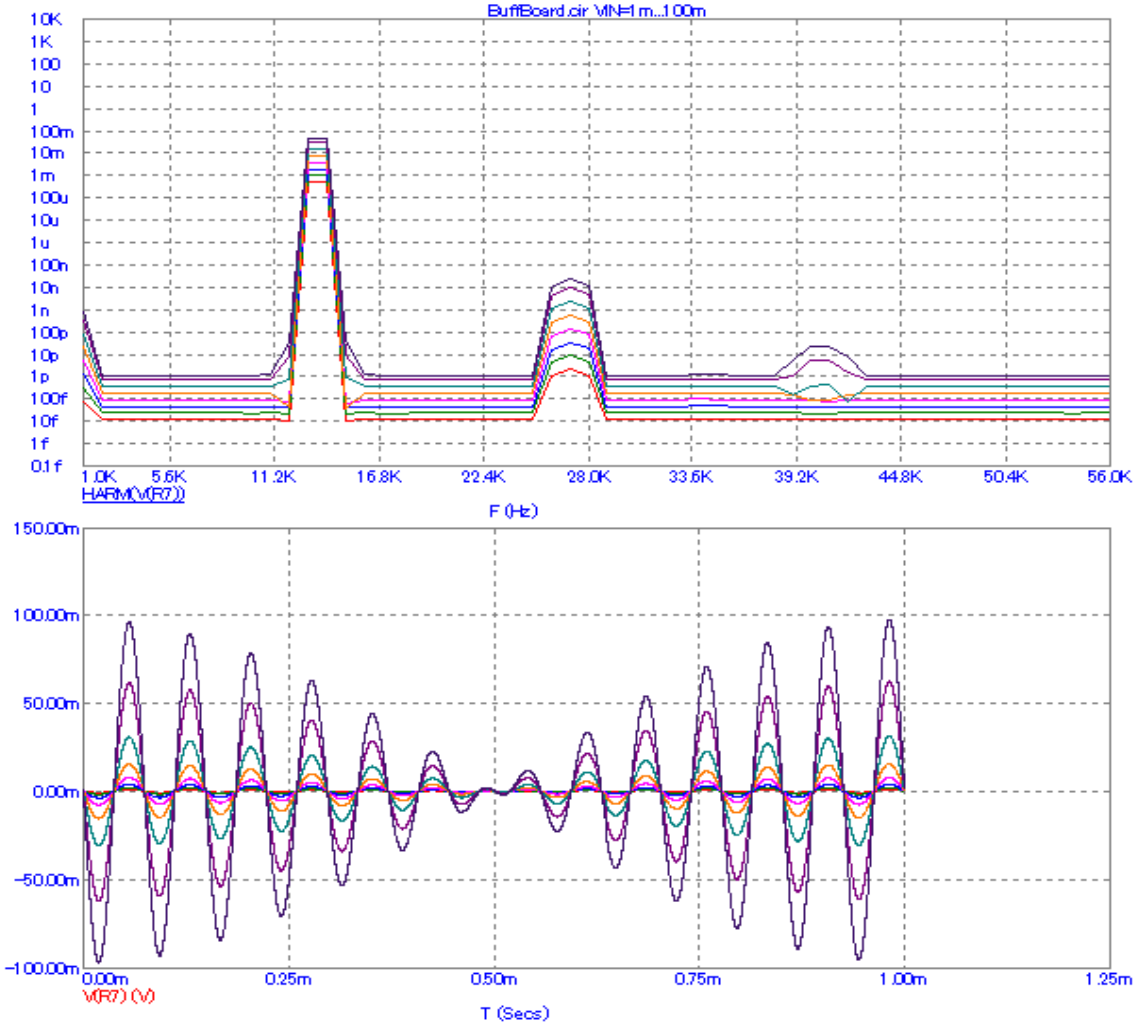


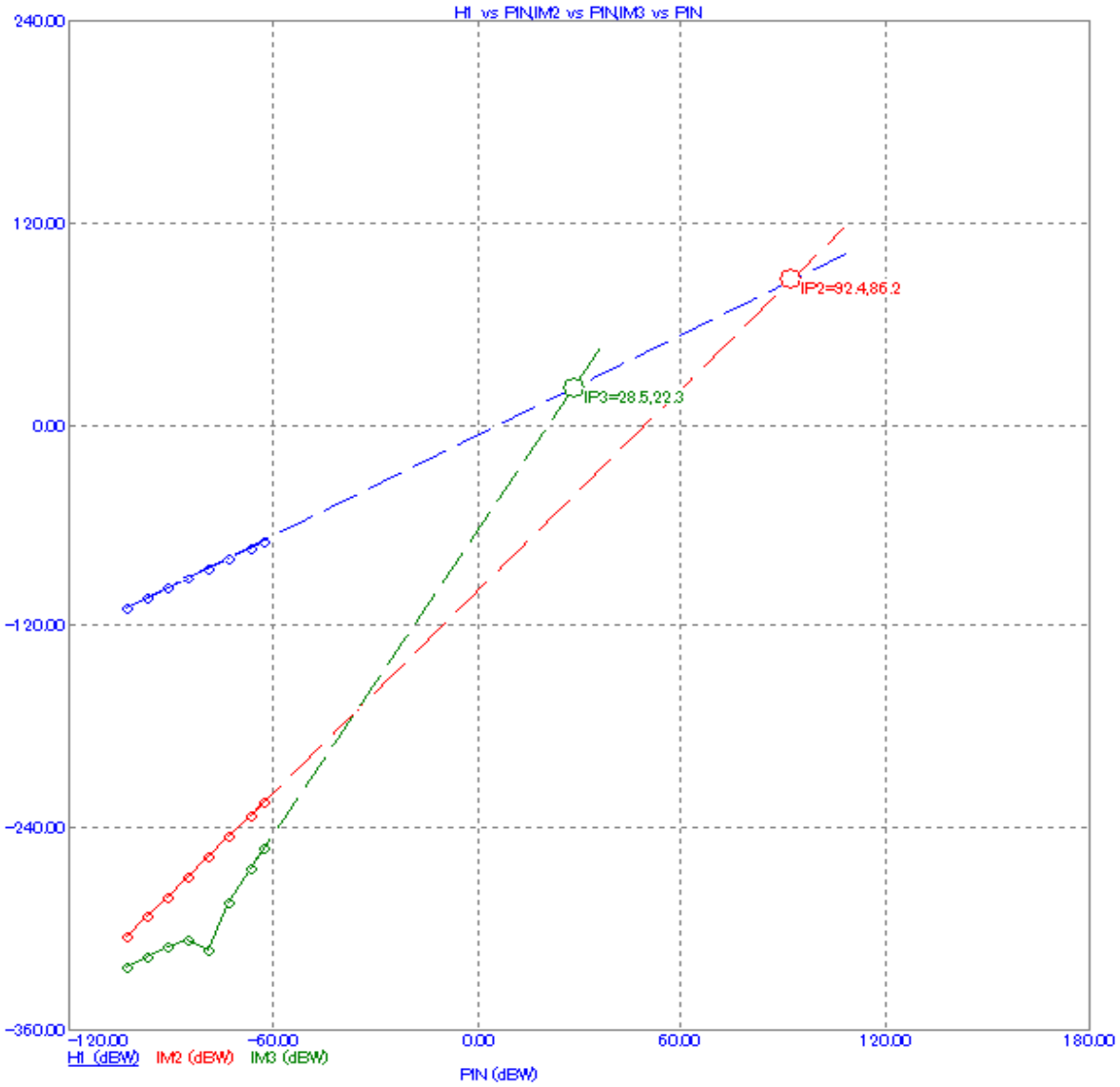

H1 vs PIN,IM2 vs PIN,IM3 vs PIN
240.00
120.00
0.00
-120.00
-240.00
-360.00
IP2=92.5,92.2
IP3=28.7,28.3
-120.00
-60.00
0.00
60.00
120.00
180.00
H1 (dBW)
IM2 (dBW)
IM3 (dBW)
PIN (dBW)

*** THD - mixed with zero**

Node 12 is connected to VOUT

VIN1: 600Hz, 1Vpk, VIN2: 0V




Hf vs PIN,IM2 vs PIN,IM3 vs PIN
240.00
120.00
0.00
-120.00
-240.00
-360.00
IP2=92.4,86.2
IP3=28.5,22.3
-120.00
-60.00
0.00
60.00
120.00
180.00
Hf (dBW)
IM2 (dBW)
IM3 (dBW)
PIN (dBW)

*** Simulation results**

These factors have been made sure:

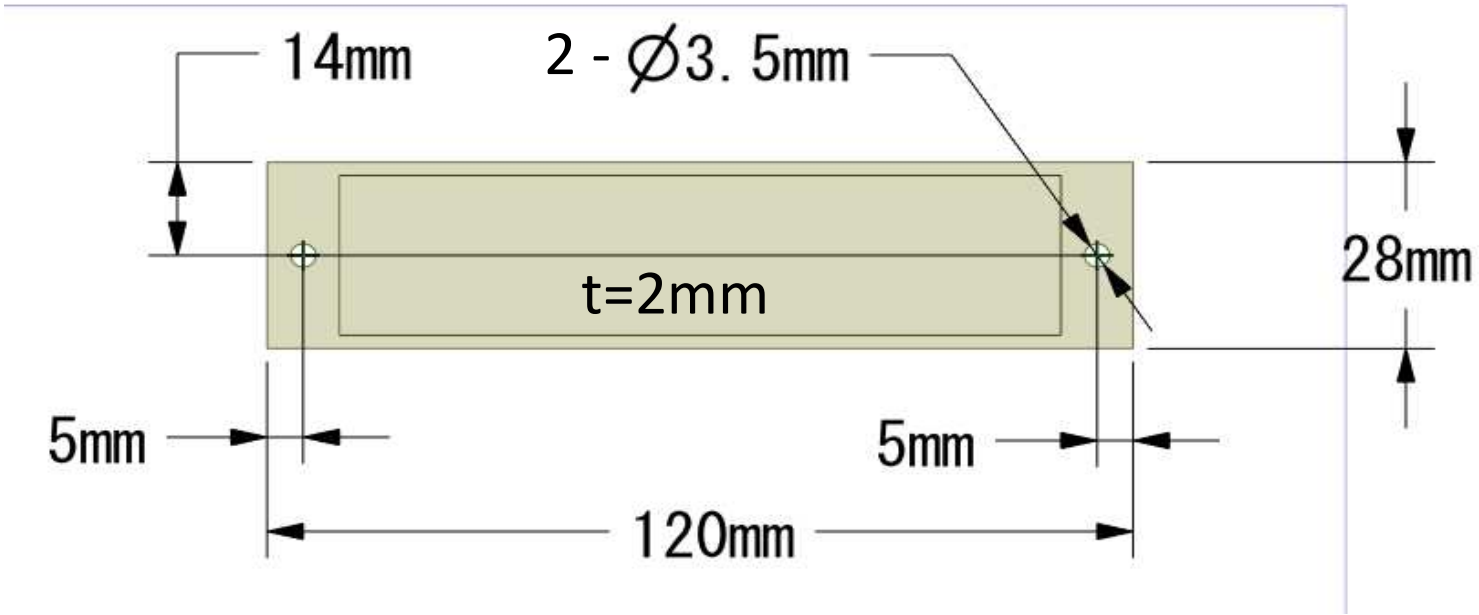
(1) The gain is halved (-6dB).

(2) There is no big difference in distortion ratios.

It is obvious that the noise from the other input will be mixed.

PCB Design

*** Dimension**

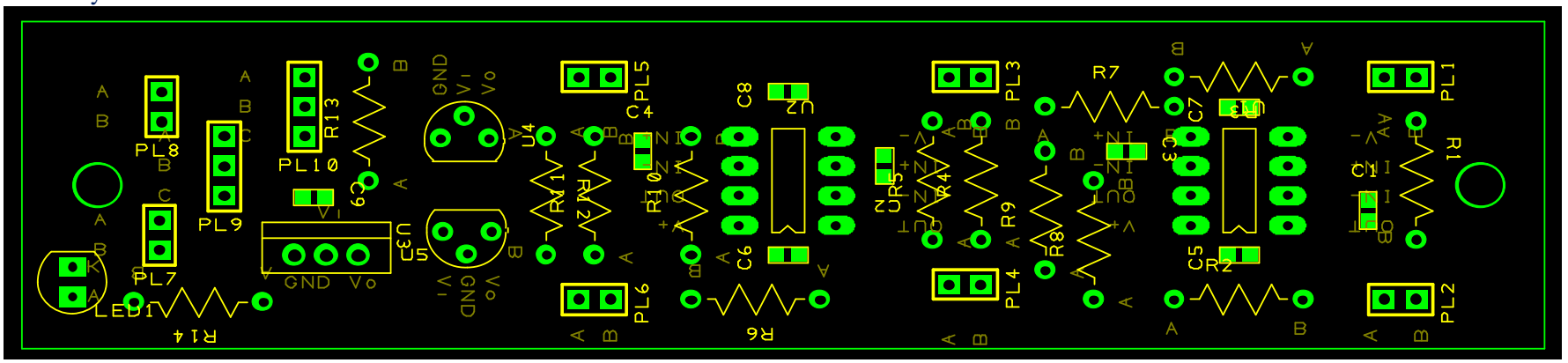


*** Layout and Routing**

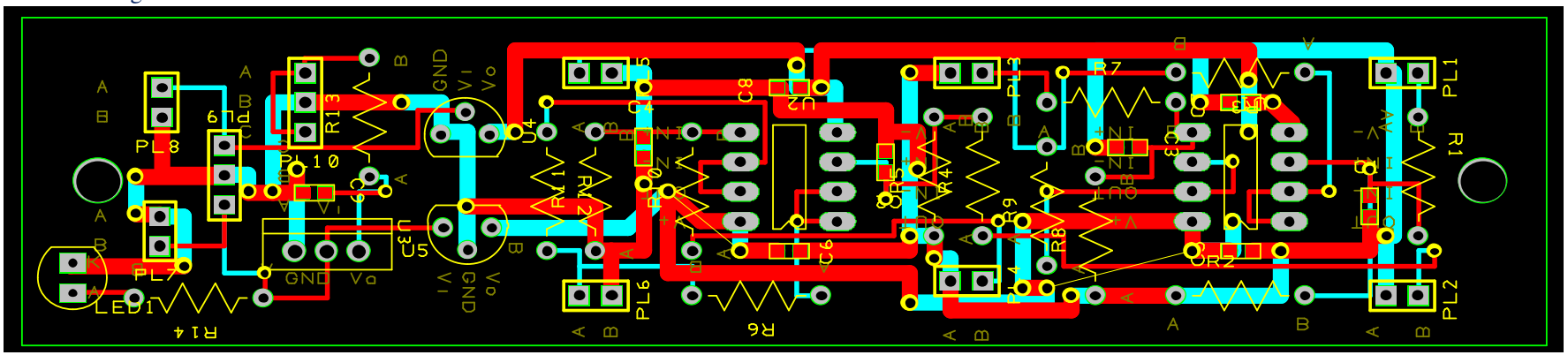
I designed the PCB of Buffer Board by using the PCB CAD, DesignSpark PCB 8.1.

The layout was manual, and routing was automatic.

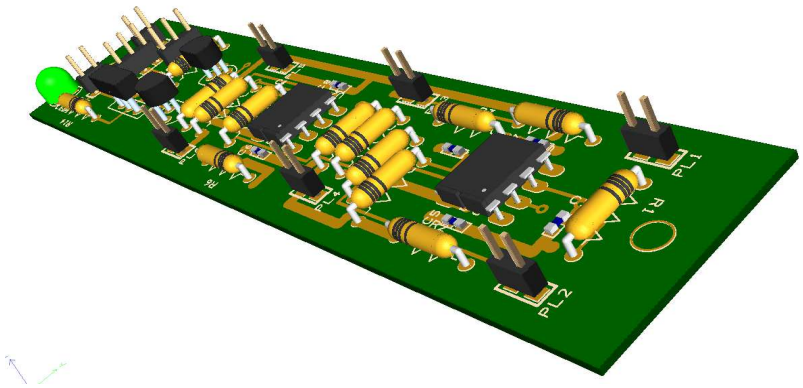
Layout



Routing



3D image created by CAD

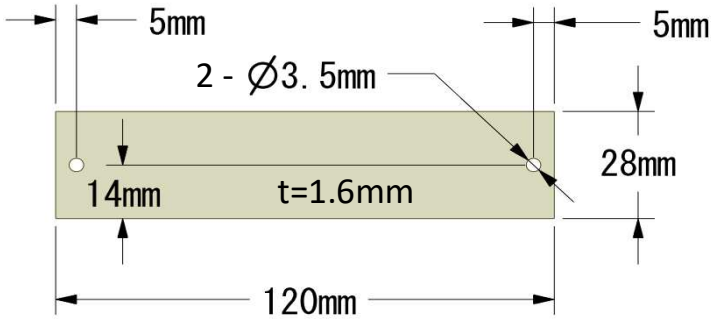


P2P Board Design

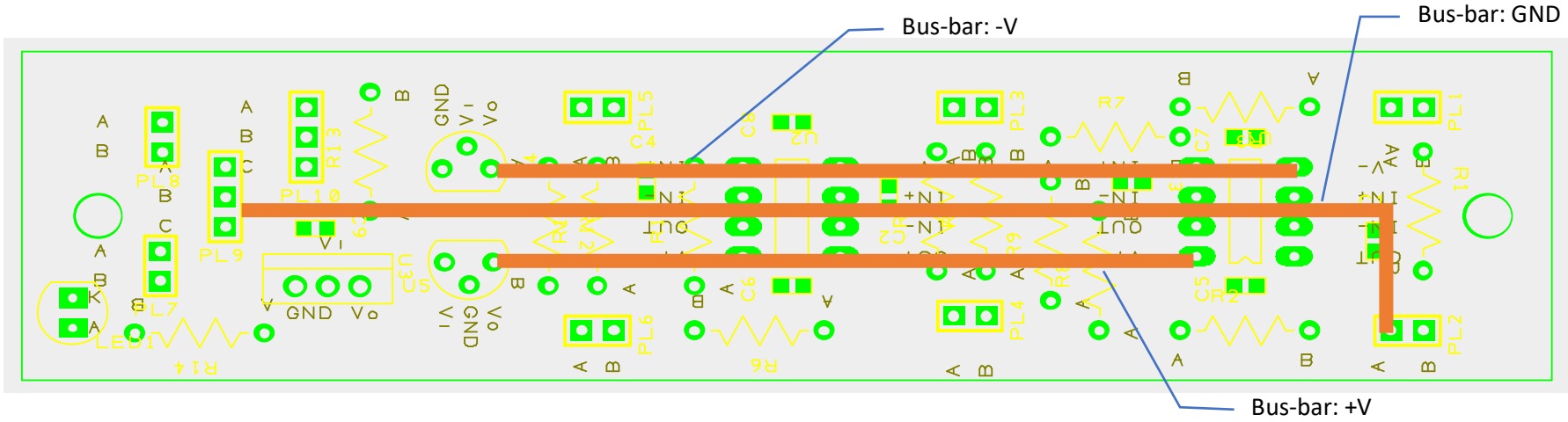
I've decided to employ a universal board for Buffer Board.

*** Dimension**

Same as the PCB design.



All the capacitors are chip type (SMD) in the PCB design, but lead type will be used on the actual Buffer Board.
The bypass capacitors, C5-C9, will be mounted on the bottom side (printed side).
The capacitors, C1-C4, will be mounted on the leads of other components.
Three (3) bus-bars are mounted on the bottom side for the power and ground lines.
The connectors, PL7-PL10 (DC power), are not mounted. The cables are soldered.



Wiring

Ref des	Type	Wire	Color	Length	Connector1	Connector2	Note
W1	Ground	AWG20	Green	100mm	(soldering)	M3 soldering tab	CN1--FG
W2	Ground	AWG20	Green	90mm	(soldering)	M3 soldering tab	BD1--FG
W3	AC high voltage	OFC AWG22	Black, white	160mm	(soldering)	Housing: JST XHP-3, Contact: SXH-001T-P0.6	CN1--PS1
W4	AC high voltage	OFC AWG22	Black, white	160mm	(soldering)	Housing: JST XHP-3, Contact: SXH-001T-P0.6	CN1--PS2
W5	DC power supply	OFC AWG22	Red, black	220mm	Housing: JST XHP-4, Contact: SXH-001T-P0.6	(soldering)	PS1--BD1
W6	DC power supply	OFC AWG22	Blue, black	220mm	Housing: JST XHP-4, Contact: SXH-001T-P0.6	(soldering)	PS2--BD1
W7	DC power supply	OFC AWG20	Red, blue, black	140mm	(soldering)	Housing: ? (3P), Contact: ? (*1)	BD1--VR1
W8	DC power supply	OFC AWG20	Red, red, black	180mm	(soldering)	Housing: ? (3P), Contact: ? (*2)	BD1--VR2
W9	Control signal	Flat ribbon AWG26, 8 cond	Brown, red, orange, yellow, green, blue, purple, gray	140mm	(soldering)	Housing: ? (8P), Contact: ? (*2)	VR1--VR2
W10	Audio signal	PC-OCC AWG22	White, black	100mm	(soldering)	Housing: JST XHP-2, Contact: SXH-001T-P0.6	CN2--BD1
W11	Audio signal	PC-OCC AWG22	White, black	100mm	(soldering)	Housing: JST XHP-2, Contact: SXH-001T-P0.6	CN3--BD1
W12	Audio signal	PC-OCC AWG22	White, black	100mm	(soldering)	Housing: JST XHP-2, Contact: SXH-001T-P0.6	CN4--BD1
W13	Audio signal	PC-OCC AWG22	White, black	100mm	(soldering)	Housing: JST XHP-2, Contact: SXH-001T-P0.6	CN5--BD1
W14	Audio signal	OFC shielded	White	210mm	IC socket, SIP, 1pos	(soldering)	BD1--VR1
W15	Audio signal	OFC shielded	White	210mm	IC socket, SIP, 1pos	(soldering)	BD1--VR1
W16	Audio signal	OFC shielded	White	270mm	(soldering)	(soldering)	VR1--CN6
W17	Audio signal	OFC shielded	White	270mm	(soldering)	(soldering)	VR1--CN7
W18	AC power cord	AWG18	Black	2000mm	NEMA 5-15P	IEC C13	AC--CN1
W19	AC jump wire	0.5 sq	Black, white	60mm	(soldering)	(soldering)	CN1--CN1

(*1) Included in VR1

(*2) Included in VR2

[END OF DOCUMENT]