youtube link https://youtu.be/RWCddTGrv5U

mehmet batuhan orak 21828734

Amplifier is an electronic device. The device which increases the value of a signal is called amplifier. In input a weak signal is applied, in output a strong, same shape signal is gained. Amplify means to increase the value of something.

Buffer amplifier is a circuit which transforms electrical impedance from one circuit to another. The main purpose of a buffer is to prevent the loading of a preceding circuit by the succeeding one.

The equalizer stage of an amplifier allows control of the frequency working interval.

The gain stage of an amplifier raises the sound, making it better to be heard.

A single stage amplifier amplifies a weak signal but uses only a single transistor to achieve this.

Multistage Amplifiers :In practice, we need amplifier which can amplify a signal from a very weak source such as a microphone, to a level which is suitable for the operation of another transducer such as loudspeaker . This is achieved by cascading number of amplifier stages, known as multistage amplifier

The role of capacitor in amplifier

Coupling Capacitors: A coupling capacitor is a capacitor which is used to couple or link together only the AC signal from one circuit element to another. The capacitor blocks the DC signal from entering the second element and, thus, only passes the AC signal.

Bypass Capacitor: A bypass capacitor is a capacitor that shorts AC signals to ground, so that any AC noise that may be present on a DC signal is removed, producing a much cleaner and pure DC signal.

A bypass capacitor essentially bypasses AC noise that may be on a DC signal, filtering out the AC, so that a clean, pure DC signal goes through without any AC ripple.

Differences between MOSFET, JFET and BJT

•BJT is current control device. While FET and MOSFET's are voltage control device

• BJT is bipolar junction device while FET and MOSFET's are junction transistor devices.

• BJT has lower input impedance while FET and MOSFET's are high input impedance device.

• BJT is not thermally stable but FET and MOSFET's are thermally stable due to increase in collector current and Icbo.

• BJT is more power consumption and in FET, FET has more power consumption but MOSFET's are lower power consumption device therefore MOSFET'S are preferred over than FET.

•**Application**___ BJT: for Lower current application FET : lower voltage application

MOSFET: Since power consumption is lessl therefore used in CMOS circuits.

• In the case of BJT, there are Active, saturation and cutt -off mode.

• in the case of FET, ohmic and pinch off region

• in case of MOSFET, linear and saturation region.

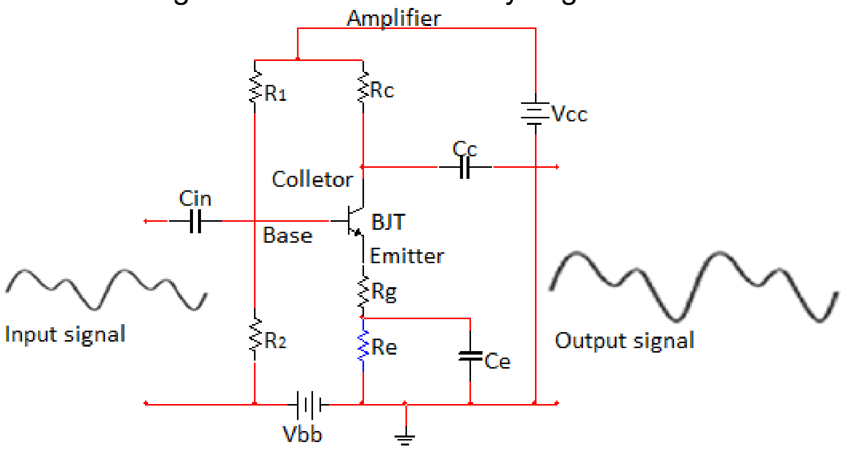
• FET is easily damage but BJT is robust.

• FET is faster than BJT • FET has low voltage gain while BJT has high voltage gain

2. **Give brief information about the transistor**

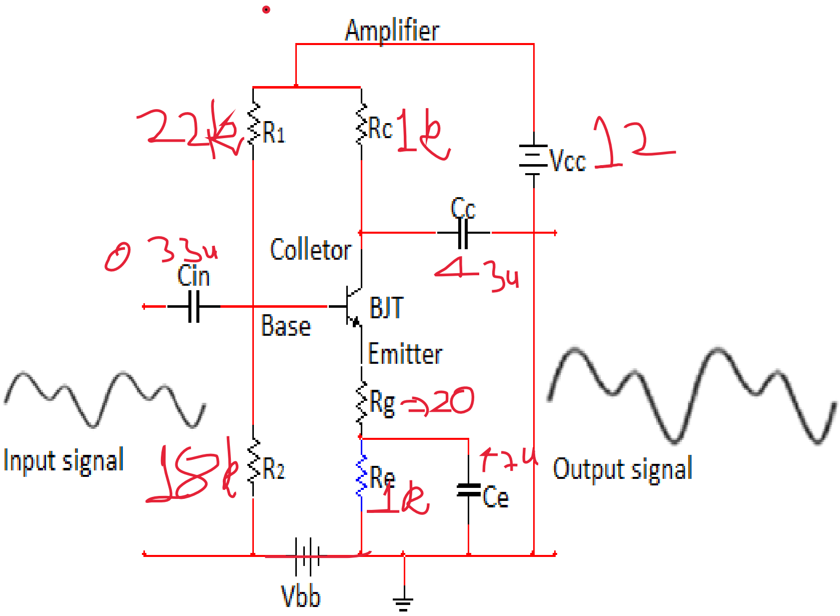
I choose BJT as 2n222a and JFET as a bf245a .Because cheap and enable our application. Also I investigate and I saw the same application on the internet.also I put the datasheet .

3. Design a single stage audio amplifier with parameters given by your laboratory assistants (frequency, gain). Discuss about the design (is it possible or not? If not, why?).
Yes we can design .But the noise will very high.



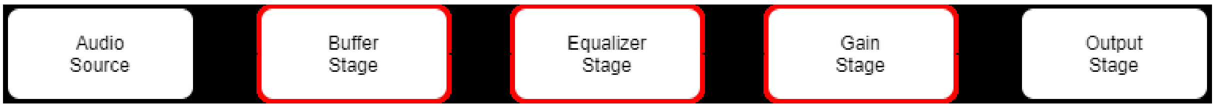
Common Emitter Transistor Amplifier Circuit

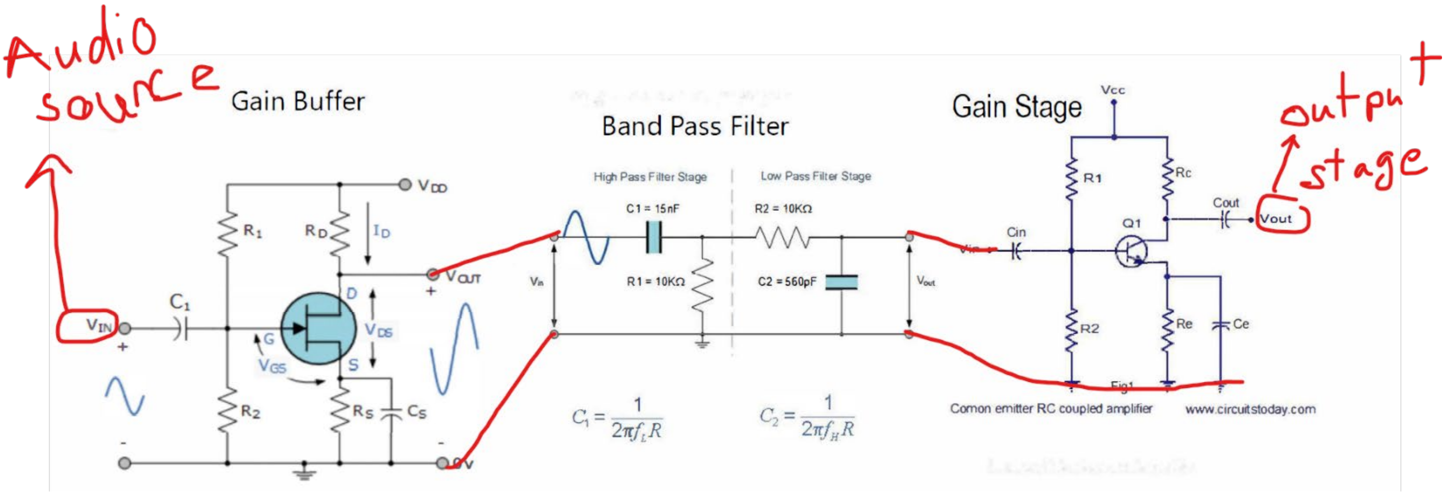
I put one design



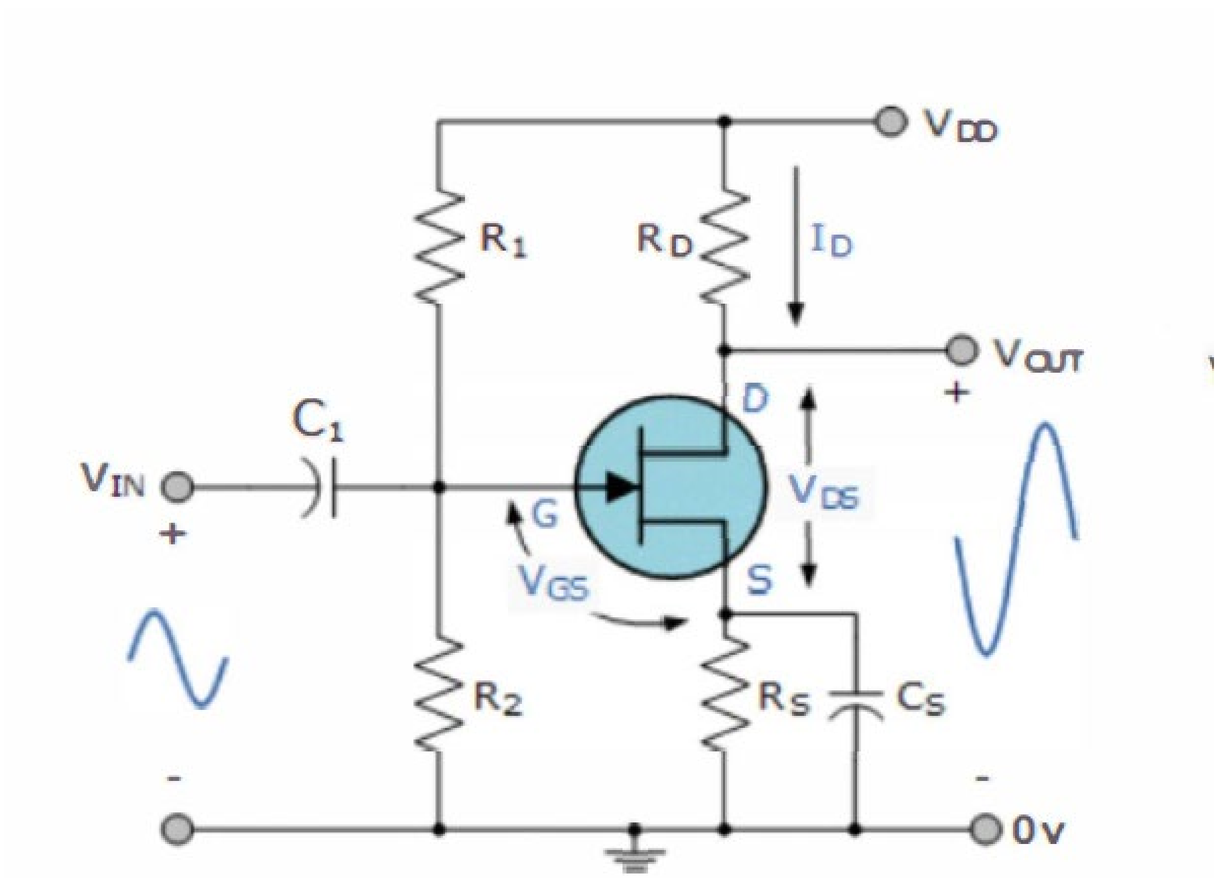
we can design this circuit ı give the pdf

4-

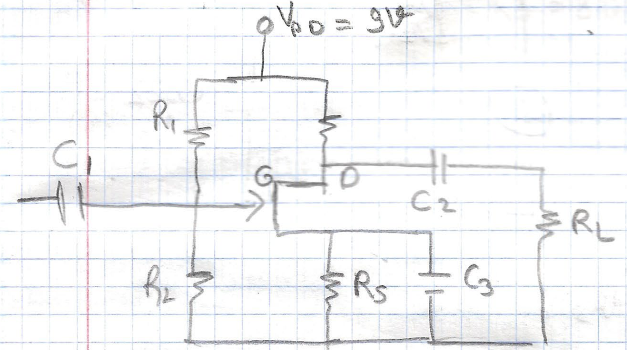




DESİGN PART Buffer Stage: BF245A =>>>>>YOU CAN LOOK DATASHEET



Buffer stage

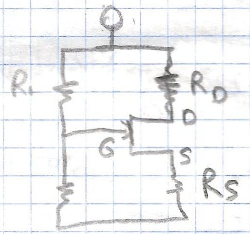


$I_{DSS} = 5mA$

$V_P = -2V$

$R_L \Rightarrow 1k$

I chose

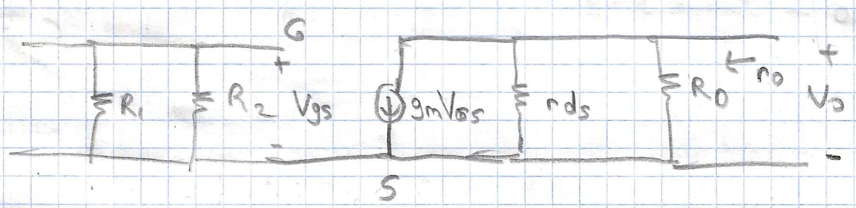


$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

$$= 5\times10^{-3}\left(1 + \frac{V_{GS}}{2}\right)^2$$

$$I_D = 5\times10^{-3}\left(\frac{V_{GS}^2}{4} + V_{GS} + 1\right)$$

SSAC equivalent model



$$A_v = -g_m(R_D \parallel r_{ds} \parallel R_L)$$

if $r_{ds} \geq 10R_D$ $\quad A_v \Rightarrow -g_m(R_D \parallel R_L)$

Here I choose V_S as 0.9 for Q point stabilization and $R_S = 300$ so $I_D = \frac{0.9}{300}$

$I_D = 3mA$

$V_G = \frac{R_2}{R_1 + R_2} \cdot V_{DD}$ $\quad I_D = 3mA = 5 \times 10^{-3} \left(\frac{V_{gs}^2}{4} + V_{gs} + 1 \right)$

and $V_{GS} \geq -2V$

By doing calculation $V_{GS} = -0.45V$

$V_G = V_{GS} + V_S$ where $V_S = 0.9V$

so $V_g = 0.9 - 0.45 \Rightarrow 0.45V$

$\frac{R_2}{R_1 + R_2} = \frac{V_G}{V_{DD}} = \frac{0.45}{9} = \frac{1}{20}$ so I choose $R_2 \Rightarrow 1k$ and $R_1 = 19k$

$g_m = \frac{2 I_{DSS}}{|V_P|} \sqrt{\frac{I_{DQ}}{I_{DSS}}} \Rightarrow \frac{2 \times 5 \times 10^{-3}}{2} \sqrt{\frac{3}{5}}$

$g_m = 3.873 \times 10^{-3}$

we can ignore r_{ds} due to $r_{ds} \geq 10 R_D$

Gain $\Rightarrow 1 = -g_m \, R_D // R_L \Rightarrow R_L \Rightarrow 1k\Omega$

$R_D // R_L = \frac{1}{g_m} \Rightarrow \frac{1}{3.873 \times 10^{-3}} = 258.2$

$R_D // R_L \Rightarrow 258.2$ by calculating $R_D = 287\Omega$

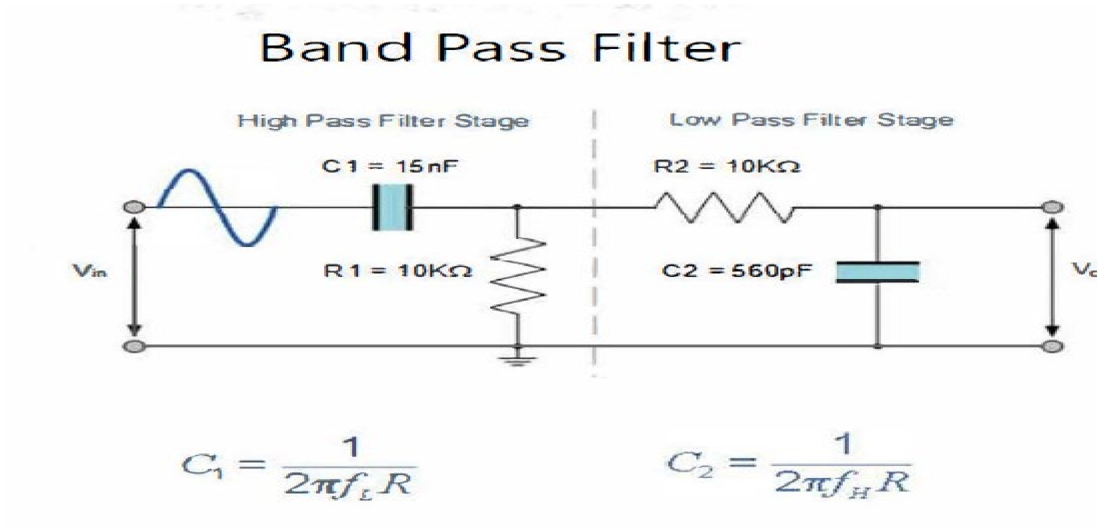
$V_{DS} = V_{DD} - I_{DD}(R_S + R_D)$

$\Rightarrow 9 - 3 \times 10^{-3} (287 + 300)$

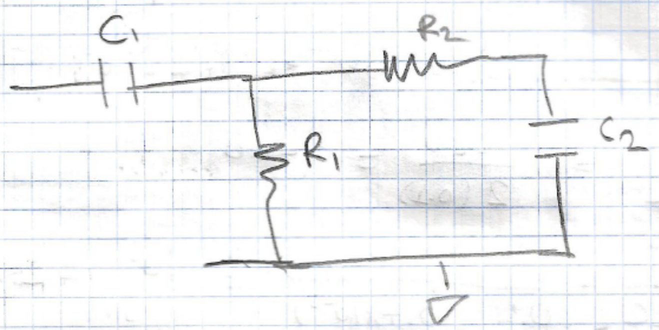
$V_{DS} \Rightarrow 7.24$

we apply the values on the circuit

DESİGN PART BANDPASS FİLTER



bandpass filter



$$C_1 = \frac{1}{2\pi f_L R}$$

$f_L \Rightarrow 340$

$R_1 \Rightarrow 100k$

if we write $C_1 \Rightarrow 4.68n \Rightarrow 4.7n$

$$C_2 = \frac{1}{2\pi f_H R}$$

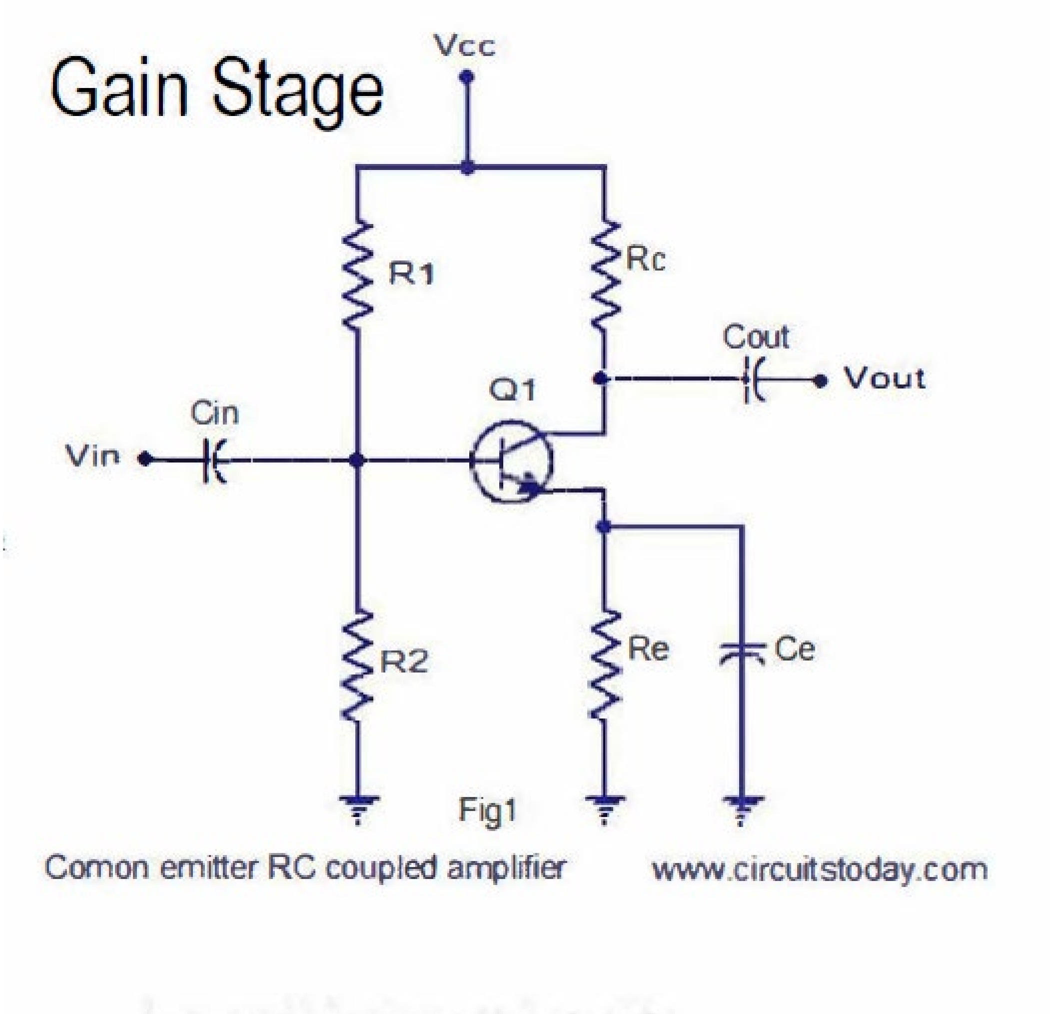
$f_H = 16.6k$

$R_2 \Rightarrow 100k$

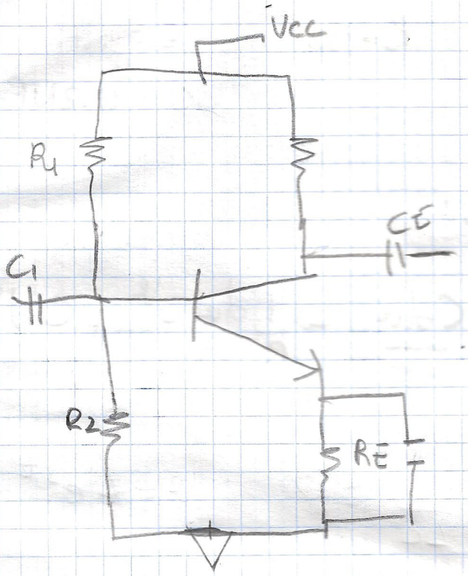
$C_2 \Rightarrow 96p \Rightarrow 100p$

we apply the values on the circuit

DESİGN PART 3-GAİN STAGE



CALCULATİON



$\beta = 200$

$I_B = 0.02\,mA$

$I_C = 4\,mA$

$V_{CE} = 4\,V$

$$r_e = \frac{26\,mV}{4\,mA} = 6.5\,\Omega$$

$$A_v = \frac{R_C}{R_E + r_e} = 4 = \frac{R_C}{R_E + 6.5} = 4R_E + 26 = R_C$$

$$(V_{CC} - V_{CE}) = (R_E + R_C)\,I_C$$

$$(9 - 4) = (R_E + 4R_E + 26)\ 4\,mA$$

$$5 = (5R_E + 26) \cdot 4\,mA$$

$$1250 - 26 = 5R_E \qquad R_E = 244.8\,\Omega$$

$$R_C = 1005.2\,\Omega$$

$$R_{B_2} \le \frac{\beta \cdot R_E}{10} \quad R_{B_2} \le \frac{200 \cdot 245}{10} \qquad R_{B_2} \le 4.9k$$

$$R_{B_2} \Rightarrow 4k$$

$$V_b \Rightarrow V_{be} + I_C R_E$$

$$V_b = 0.7 + 4\,(244.8) \Rightarrow 1.68$$

$$\frac{1.68}{9} = \frac{R_2}{R_1 + R_2} \Rightarrow \quad R_1 \Rightarrow 4.35 R_2$$

$$R_1 \Rightarrow 4.35 \times 4k$$

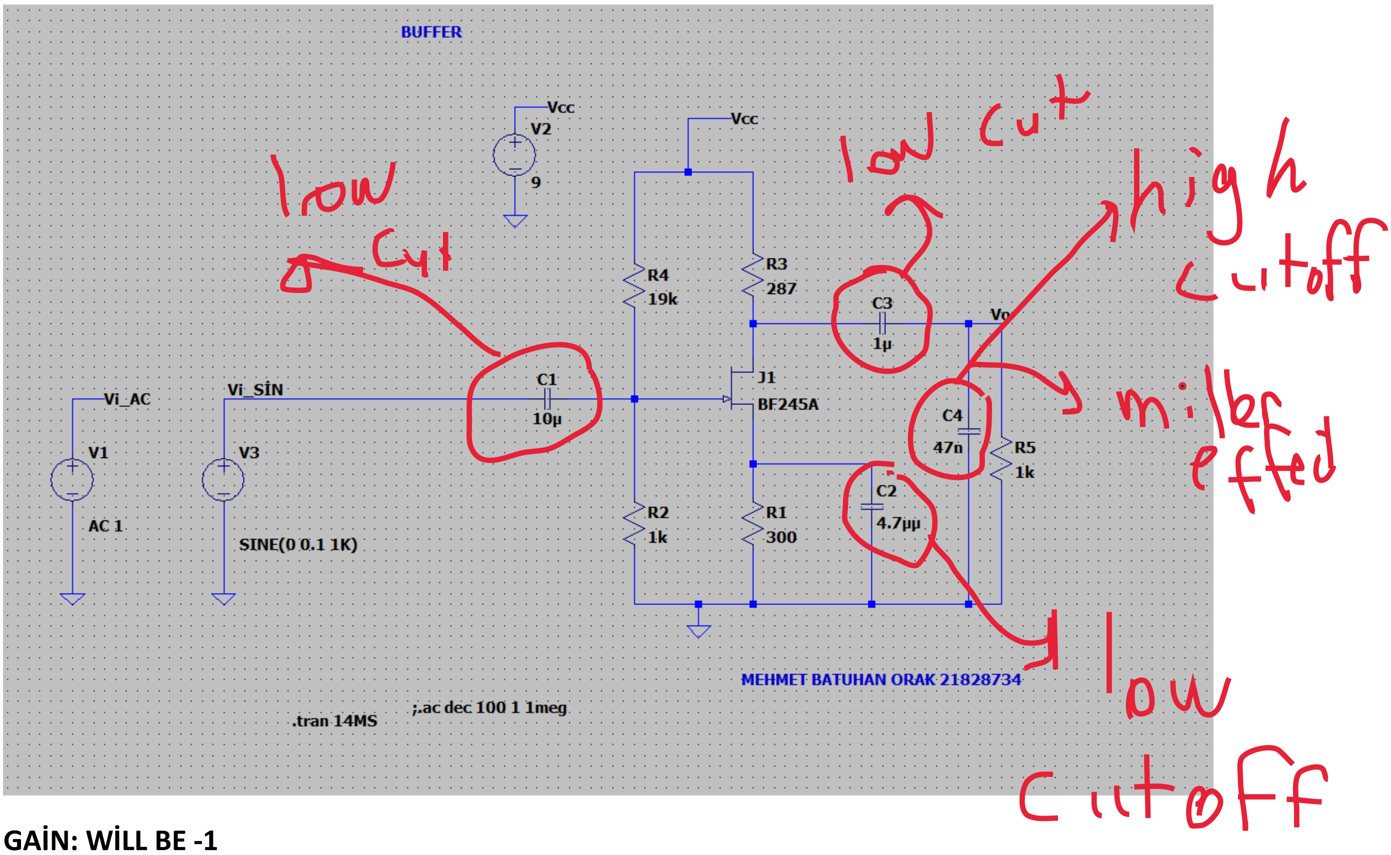
$$R_1 \Rightarrow 17.42k$$

we apply the values on the circuit

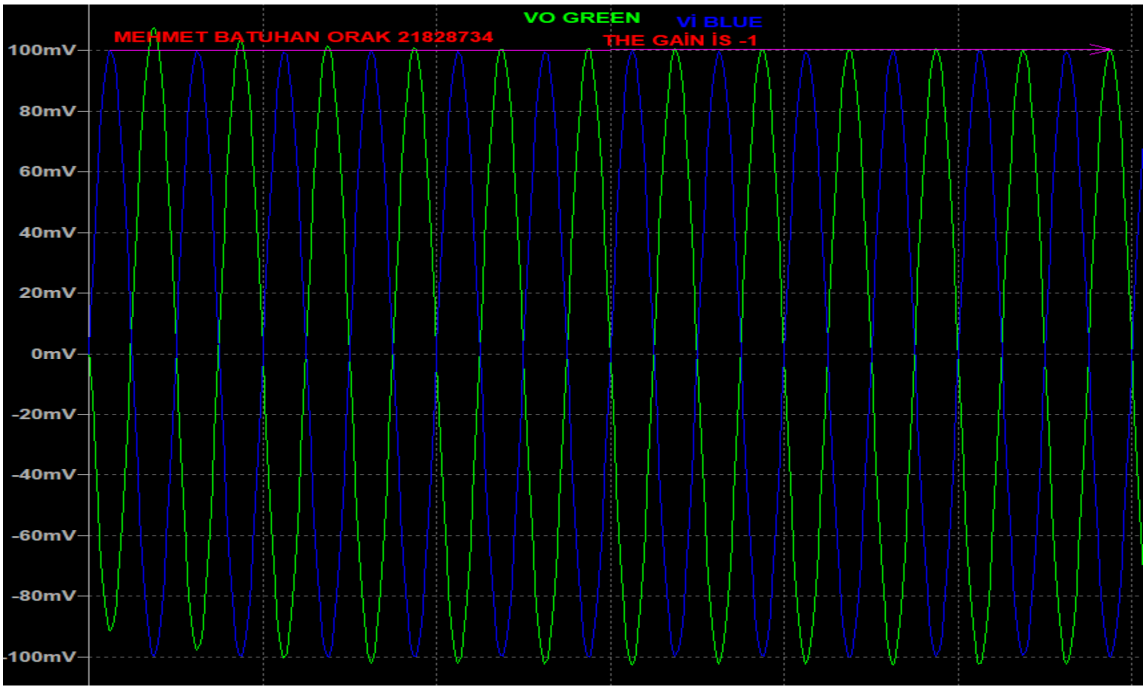
PART 2: SIMULATION

Buffer Stage:

I CHOOSE THE CAPACİTORS WİTH TRYİNG MY WORKİNG AREA

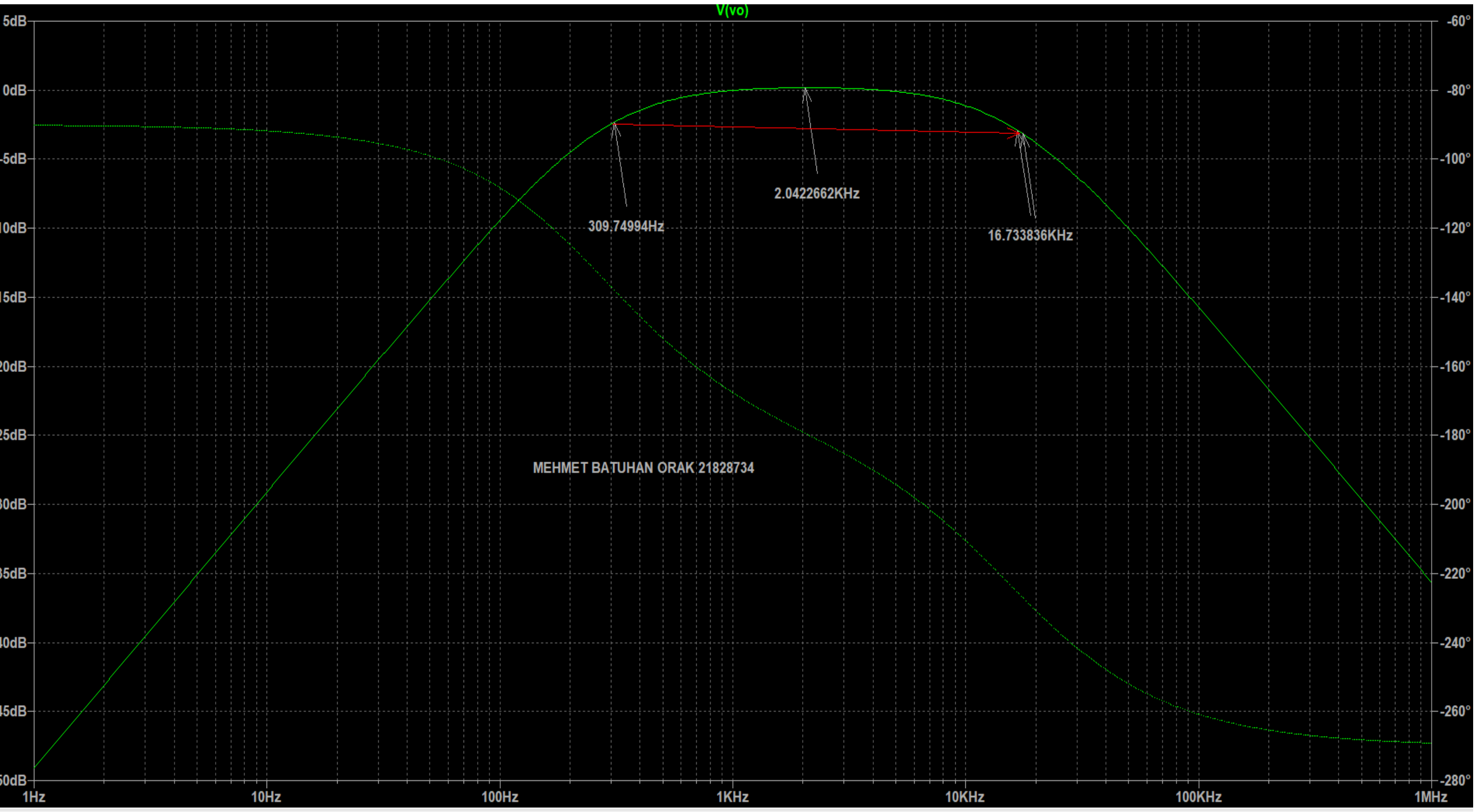


GAİN: WİLL BE -1



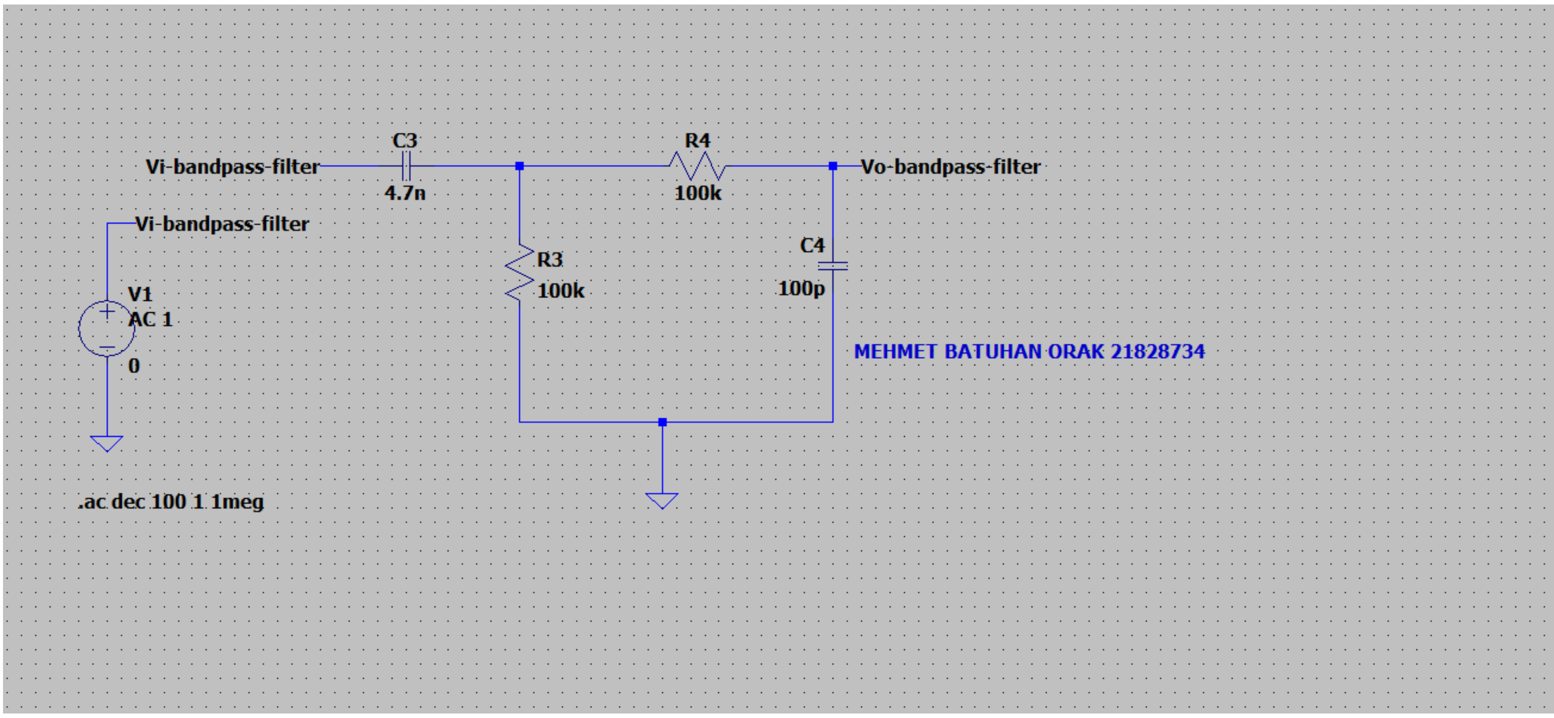
WE CAN SEE AMPLİTUDE İS THE SAME AND GAİN -1

FREQUENCY WORKİNG AREA

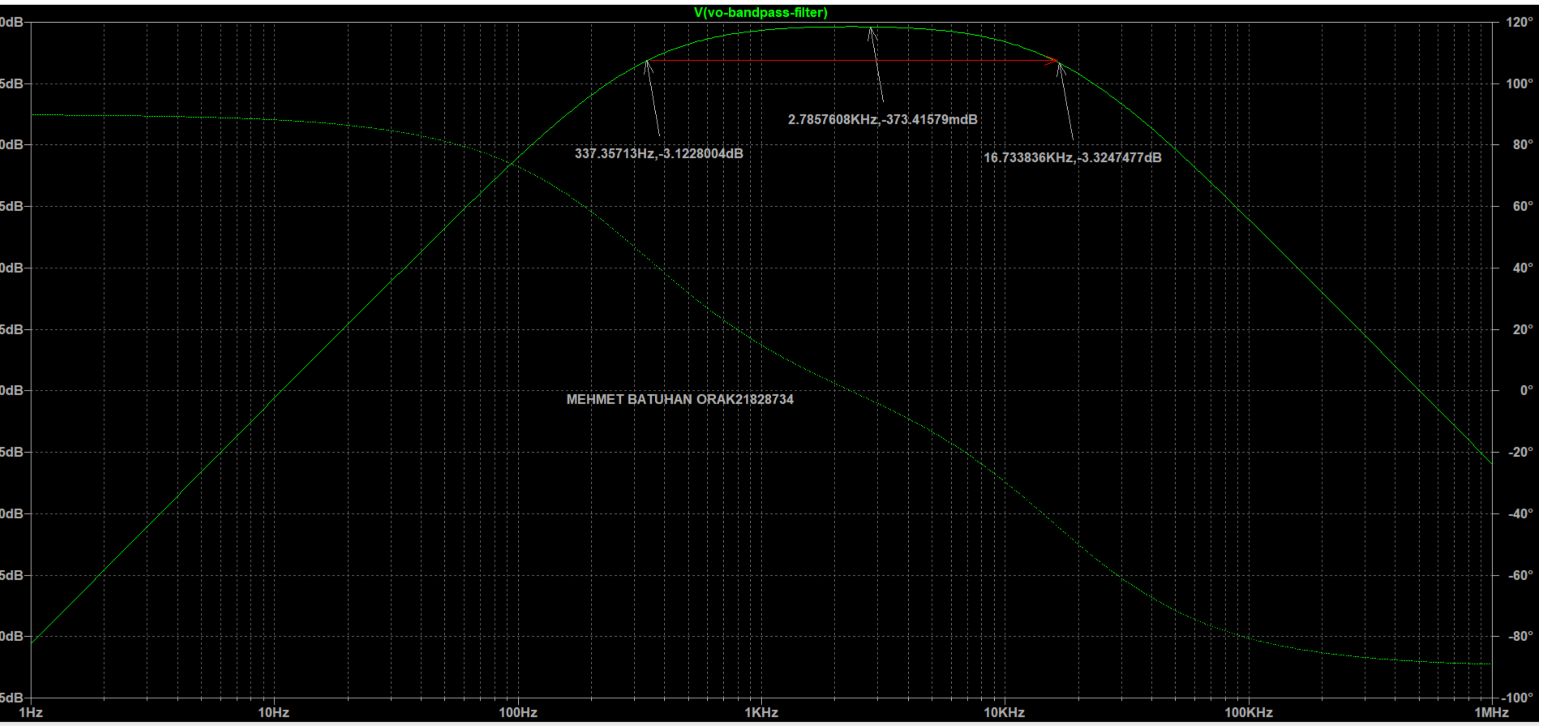


MY FREQUENCY AREA =>>>340-16.600

2-BANDPASS FİLTER:



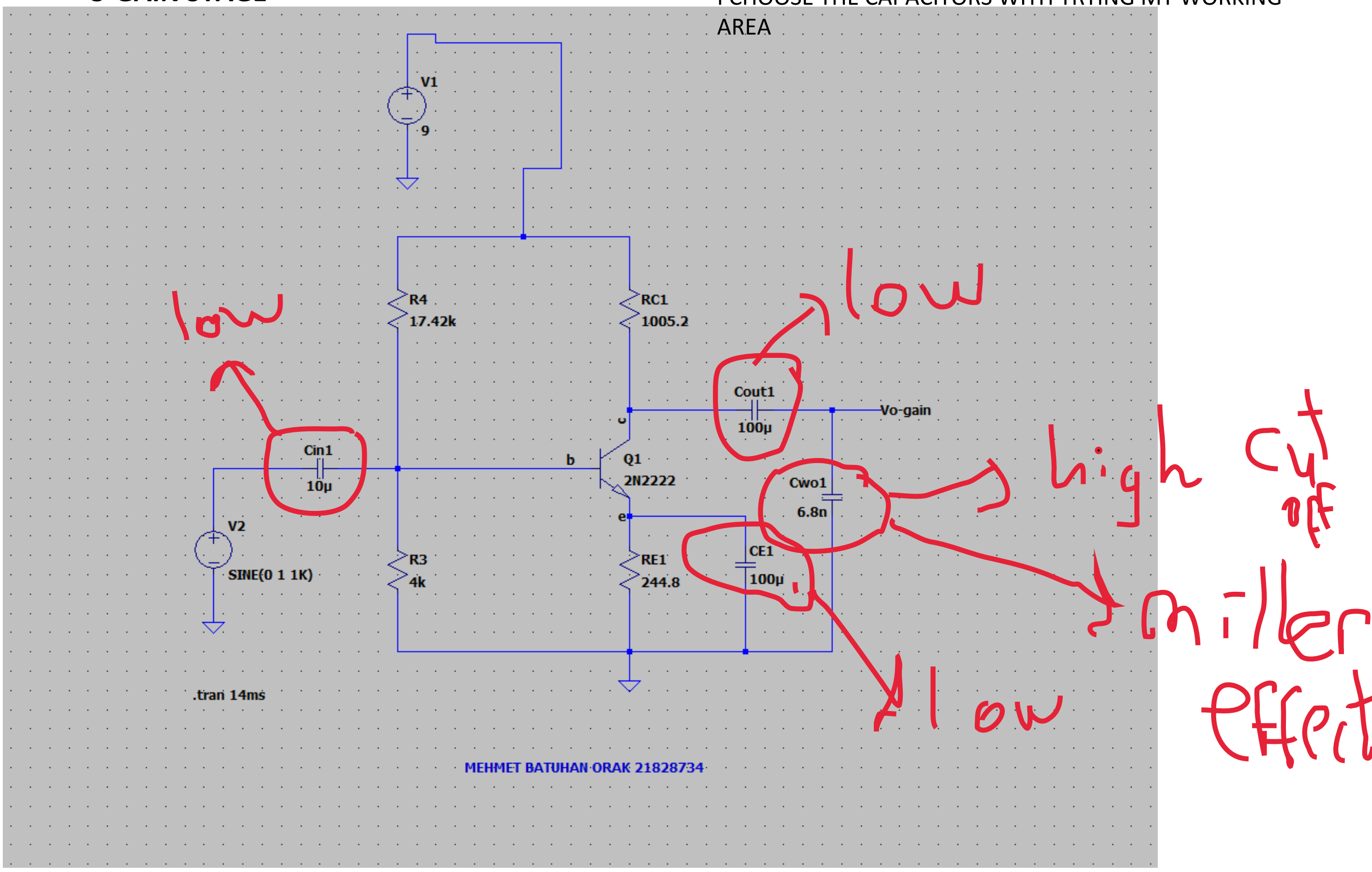
FREQUENCY WORKİNG AREA



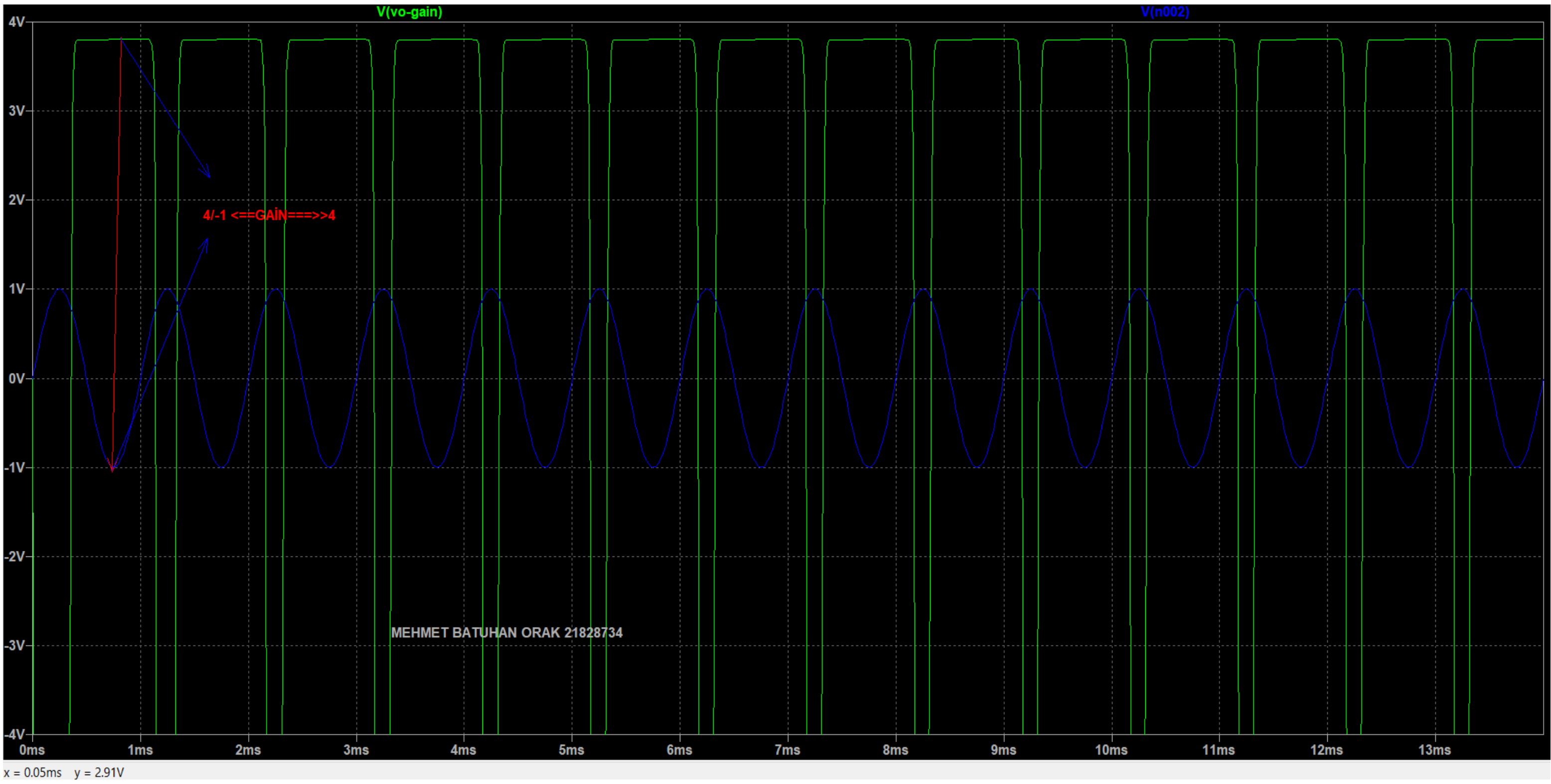
MY FREQUENCY AREA =>>>340-16.600

3-GAİN STAGE

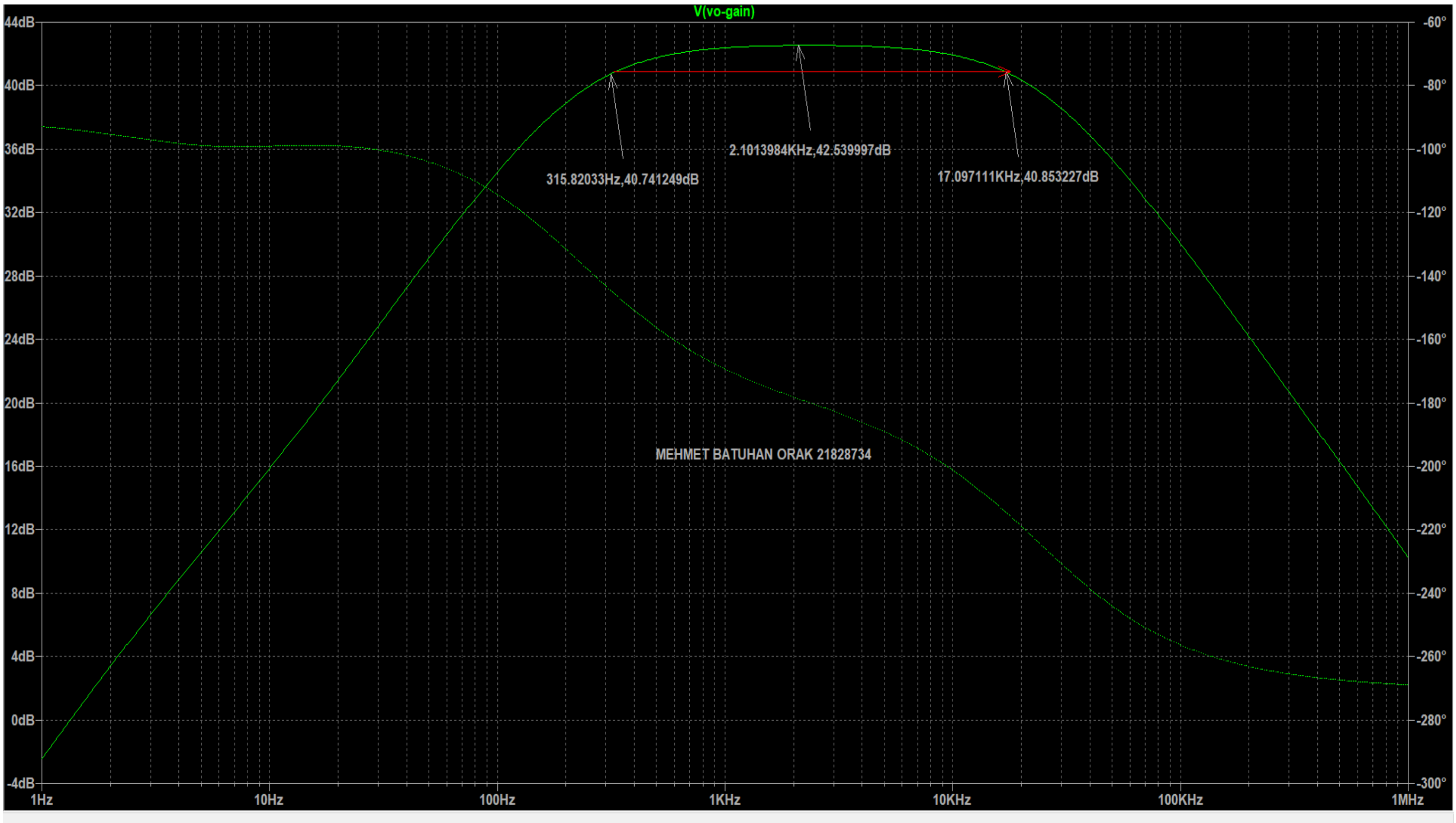
I CHOOSE THE CAPACİTORS WİTH TRYİNG MY WORKİNG AREA



MY GAİN WAS =4   AND THİS THE GRAPH

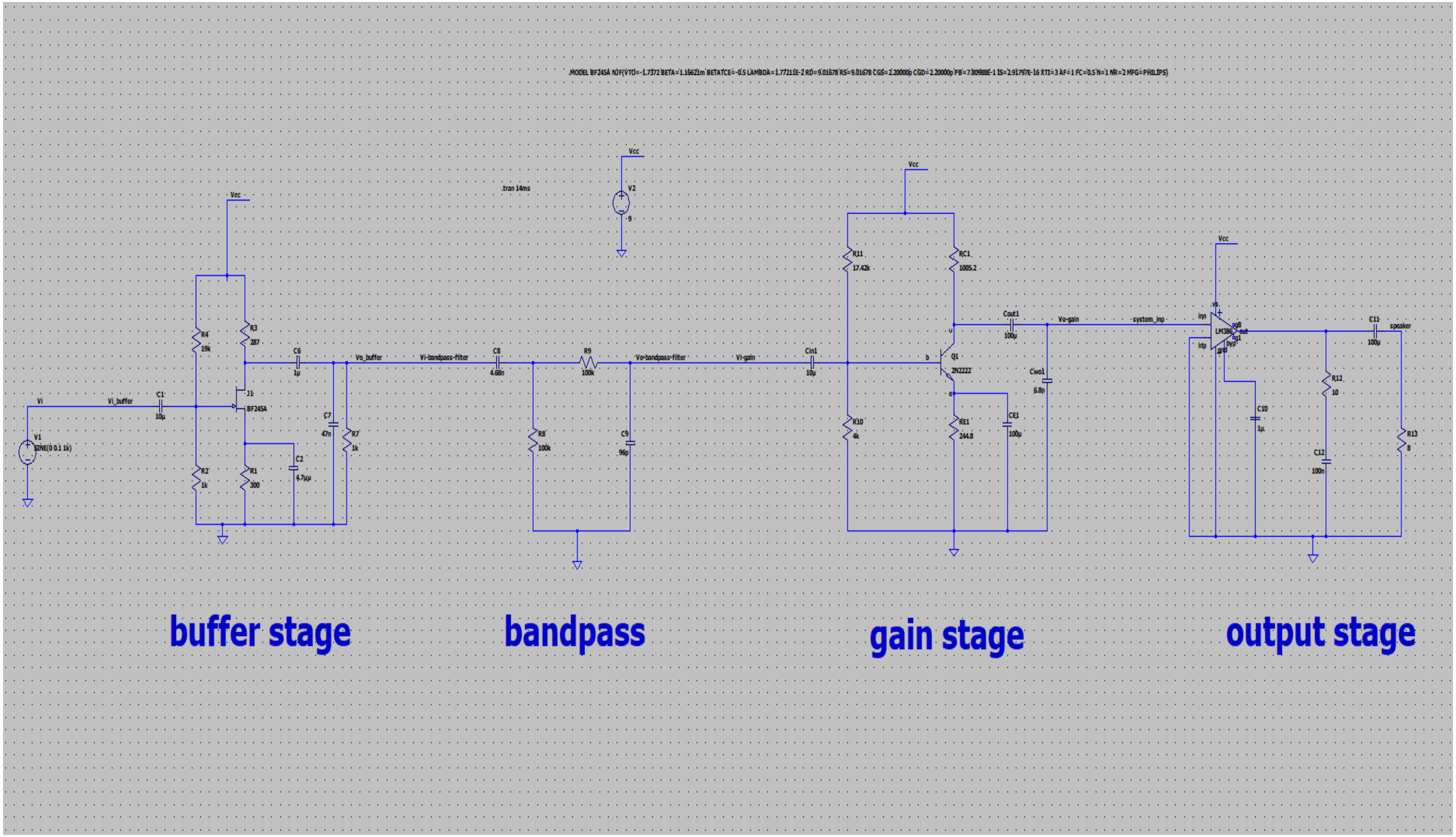


FREQUENCY WORKİNG AREA

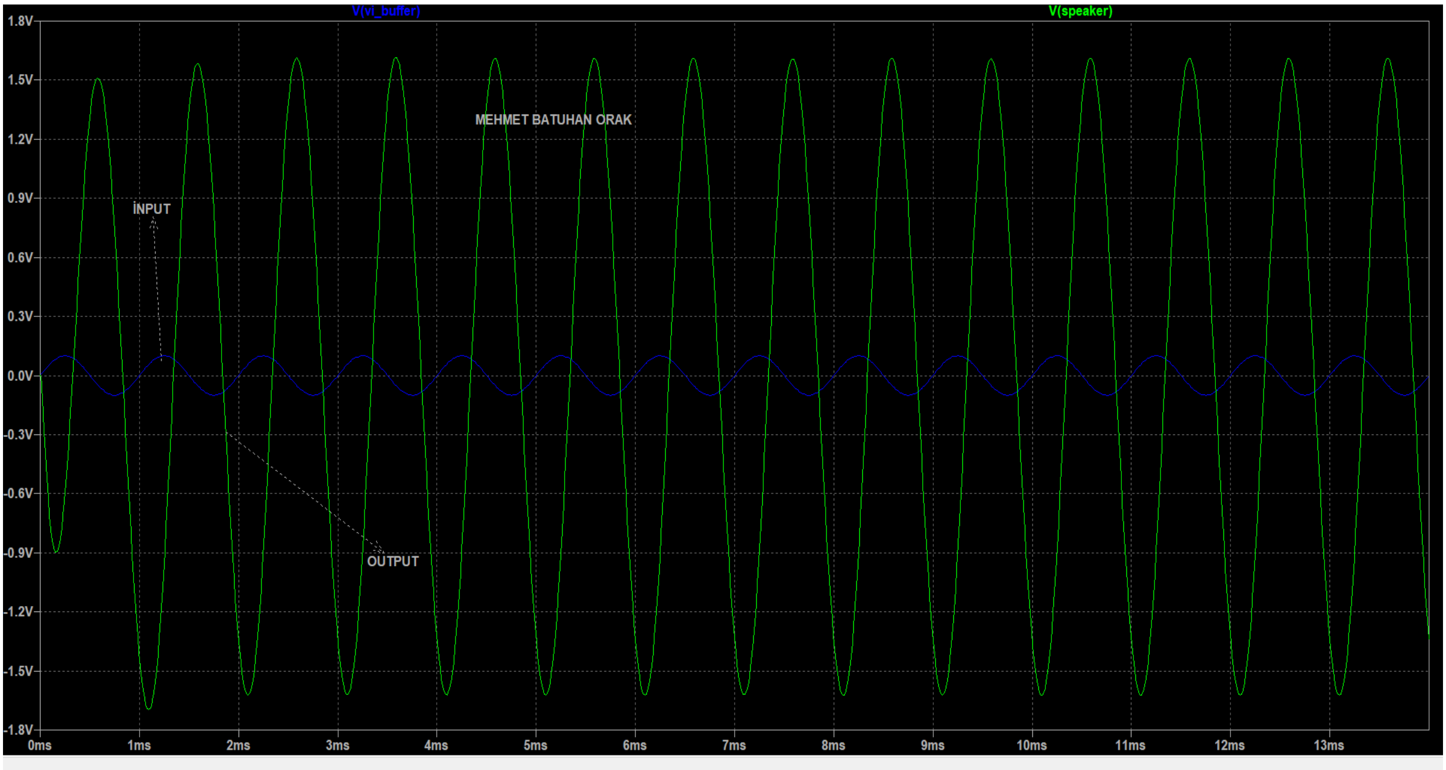


MY FREQUENCY AREA =>>>340-16.600

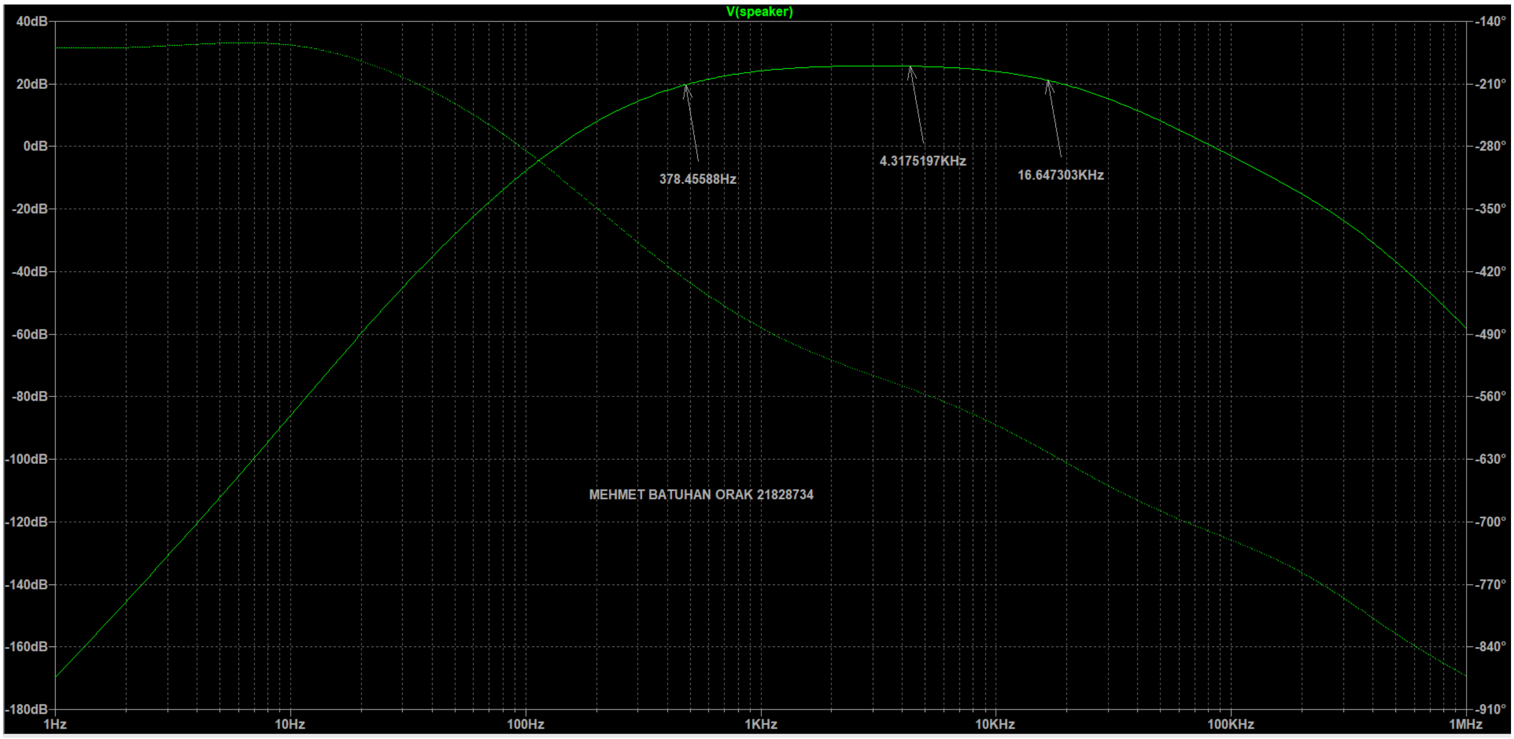
4- PROJE


.MODEL BF245A NJF(VTO=-1.7372 BETA=1.16621m BETATCE=-0.5 LAMBDA=1.77211E-2 RD=9.01678 RS=9.01678 CGS=2.20000p CGD=2.20000p PB=7.80988E-1 IS=2.91797E-16 XTI=3 AF=1 FC=0.5 N=1 NR=2 MFG=PHILIPS)
.tran 14ms
Vcc
V2
9
Vi
Vi_buffer
C1
10µ
V1
SINE(0 0.1 1k)
R4
19k
R3
287
J1
BF245A
R2
1k
R1
300
C2
4.7µµ
C6
1µ
C7
47n
R7
1k
Vo_buffer
Vi-bandpass-filter
C8
4.68n
R8
100k
R9
100k
C9
96p
Vo-bandpass-filter
Vi-gain
Cin1
10µ
R11
17.42k
R10
4k
RC1
1005.2
Q1
2N2222
RE1
244.8
CE1
100µ
Cout1
100µ
Cwo1
6.8p
Vo-gain
system_inp
LM386
C10
1µ
C11
100µ
speaker
R12
10
C12
100n
R13
8
buffer stage
bandpass
gain stage
output stage

4-PROJE SİGNALS



FREQUENCY WORKİNG AREA



MY FREQUENCY AREA =>>>340-16.600