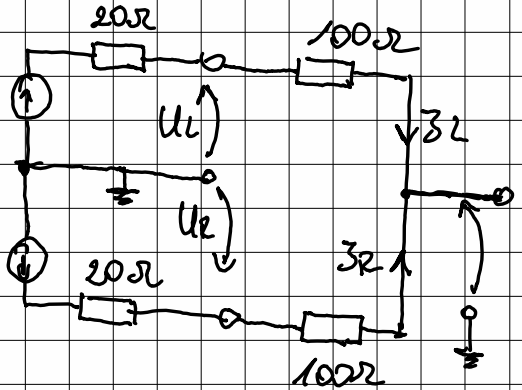
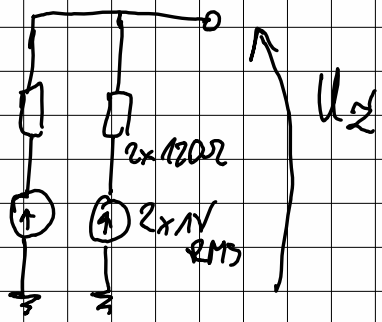
Wyjście audio: $1V_{RMS}$, $Z = 20\Omega$, $I_{RMS} = 50mA$



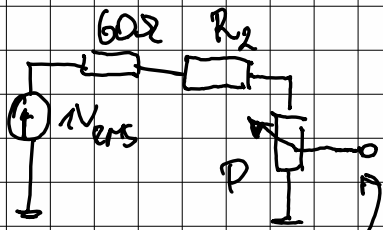


$U_{th} = 1V + I_1 \cdot 120\Omega = 1V$ ($I_1 = 0$), $I_{th} = 2 \cdot \frac{1V}{120\Omega} = 17mA$

$R_{th} = 60\Omega$

$K_{OPAMP} = 10\ V/V$, $U_{max\,out} = 3V$

$U_{DIV} \in [0V; 0,3V]$

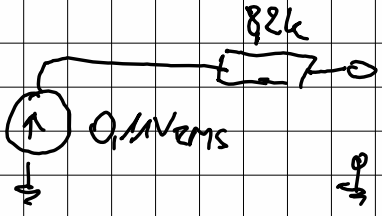


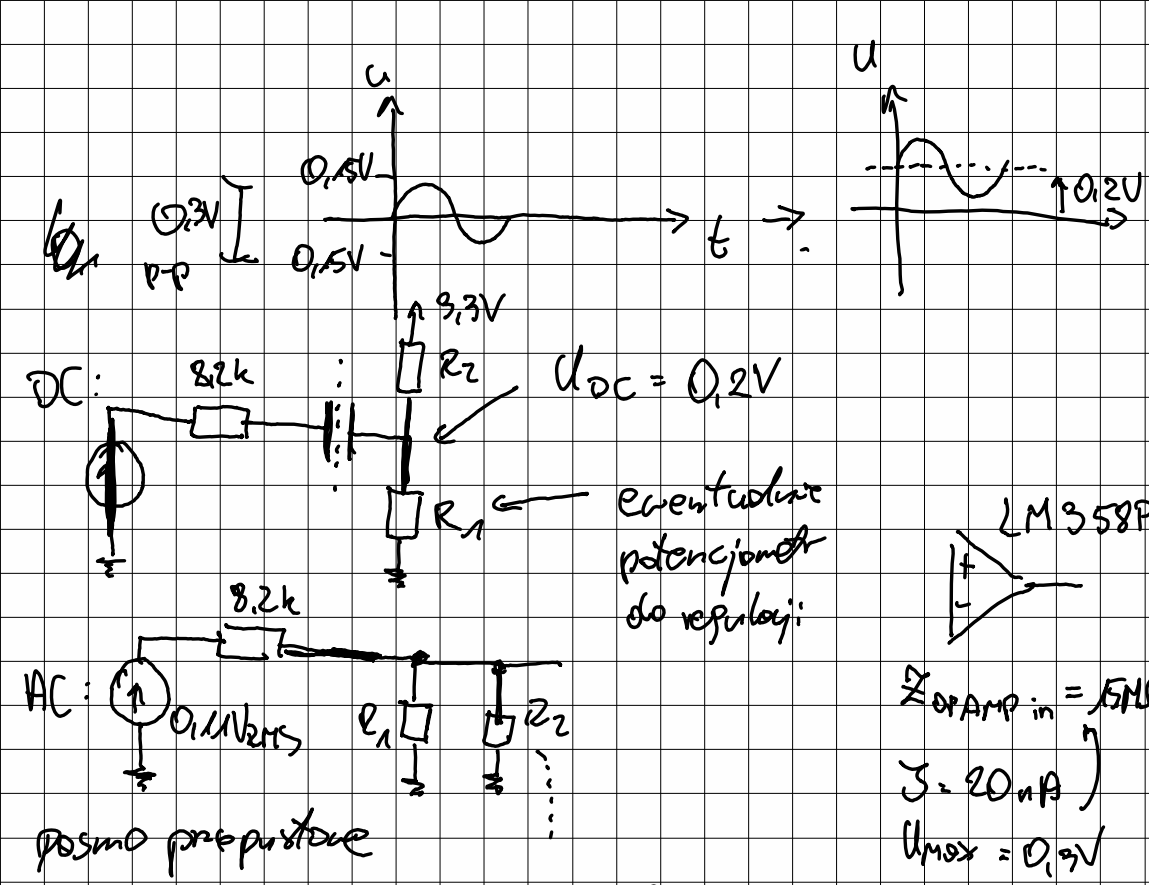
$U_{DIV} = 0,3V \Rightarrow U_{DIV_{RMS}} = 0,11V_{RMS}$ ← peak to peak

$1V \cdot \frac{P}{R_2+P} = \underbrace{0,3V \cdot \frac{1}{\sqrt{2}} \cdot \frac{1}{2}}_{0,11V_{RMS}}$ $P \approx 1k$

$\frac{P}{0,11} - P = R_2 \Rightarrow R_2 = 8,1k \approx 8,2k$

$I_{DIV_{th}} = \frac{1V}{8,2k} = 120\mu A = 0,12mA$





$U_{DC} = 0{,}2V$

ewentualnie potencjometr do regulacji

LM358P

$Z_{OPAMP\,in} = 5M\Omega$

$I = 20nA$

$U_{max} = 0{,}3V$

pasmo przepustowe

$8{,}2k \dots R \dots 5M\Omega$

$R_1 = 100k \Rightarrow 3{,}3V \cdot \frac{R_1}{R_1+R_2} = 0{,}2V$

$R_2 = \frac{3{,}3 \cdot R_1}{0{,}2} - R_1 = 1550k = 1{,}55M$

$\approx 1{,}6M$

$R_{12} = R_1 \parallel R_2 \cong 94k$

$U_{RMS} = 0{,}11 \cdot \frac{94}{94+8{,}2} \cong 0{,}102\,V_{RMS}$

$f_0 = \frac{1}{2\pi R_{12} C}$

$f_0 \cong 15Hz$ mniej $60 \dots 20Hz$; tak nie ciężko na wzmacniaczu. $C = 6nF \rightarrow 10nF$

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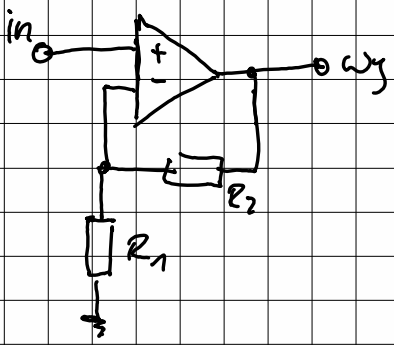


$$K = 1 + \frac{R_2}{R_1}$$

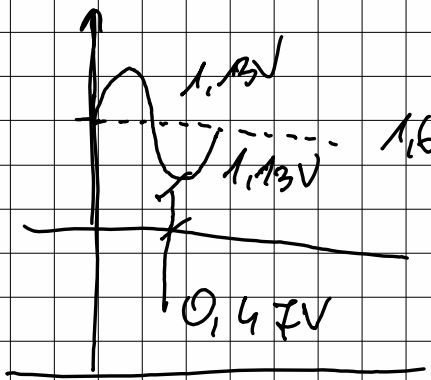
$$K = 8 \left[\frac{V}{V}\right]$$

Wzmocnienie DC: $0{,}2V \rightarrow 1{,}6V$

Wzmocnienie AC: $0{,}1\,V_{PtPAC} \rightarrow 2{,}34\,V_{RMS}$

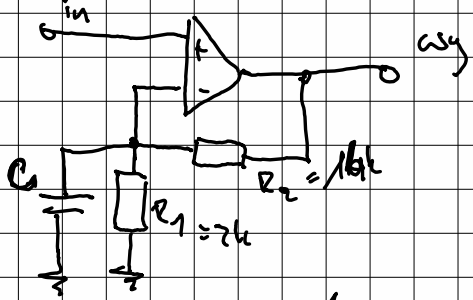
$K_{DC} = 8 \left[\frac{V}{V}\right]$

$K_{AC} = 23 \left[\frac{V}{V}\right]$



$0{,}8\,V_{RMS} \rightarrow 1{,}13V$

$2{,}26V$ peak-to-peak



$K_{DC} = 8 \frac{V}{V}$

$K_{AC} = 23 \frac{V}{V}$

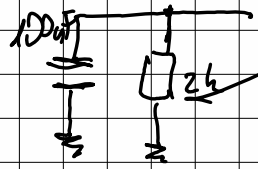
$$23 = 1 + \frac{R_2}{X_{RC}} \Rightarrow X_{RC} = \frac{1{,}4k}{22} = 636\Omega$$

$$X_C = \frac{1}{\omega C}$$

$f \in [20, 20k\,Hz]$

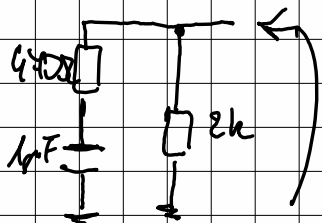
$X_{C_1} = \frac{1}{100\,nF \cdot 20\,Hz} = 500\,k$

$X_{C2} = \frac{1}{100\,nF \cdot 20\,kHz} = 500\,\Omega$



$\Rightarrow X_C \in [500, 1992]\,\Omega$

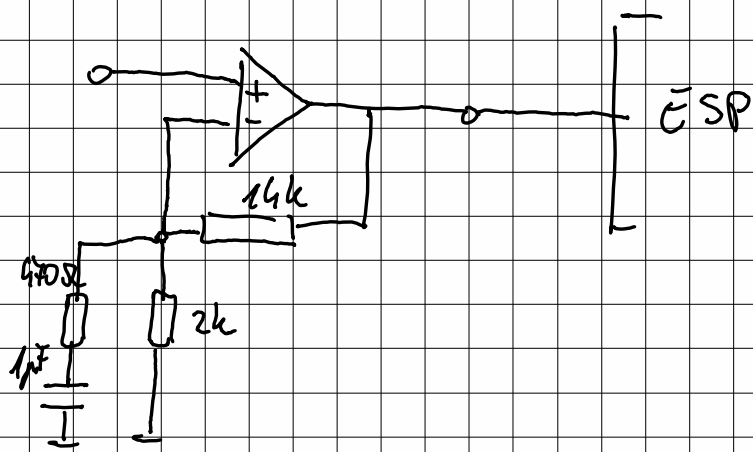
K_{AC}: 35 8

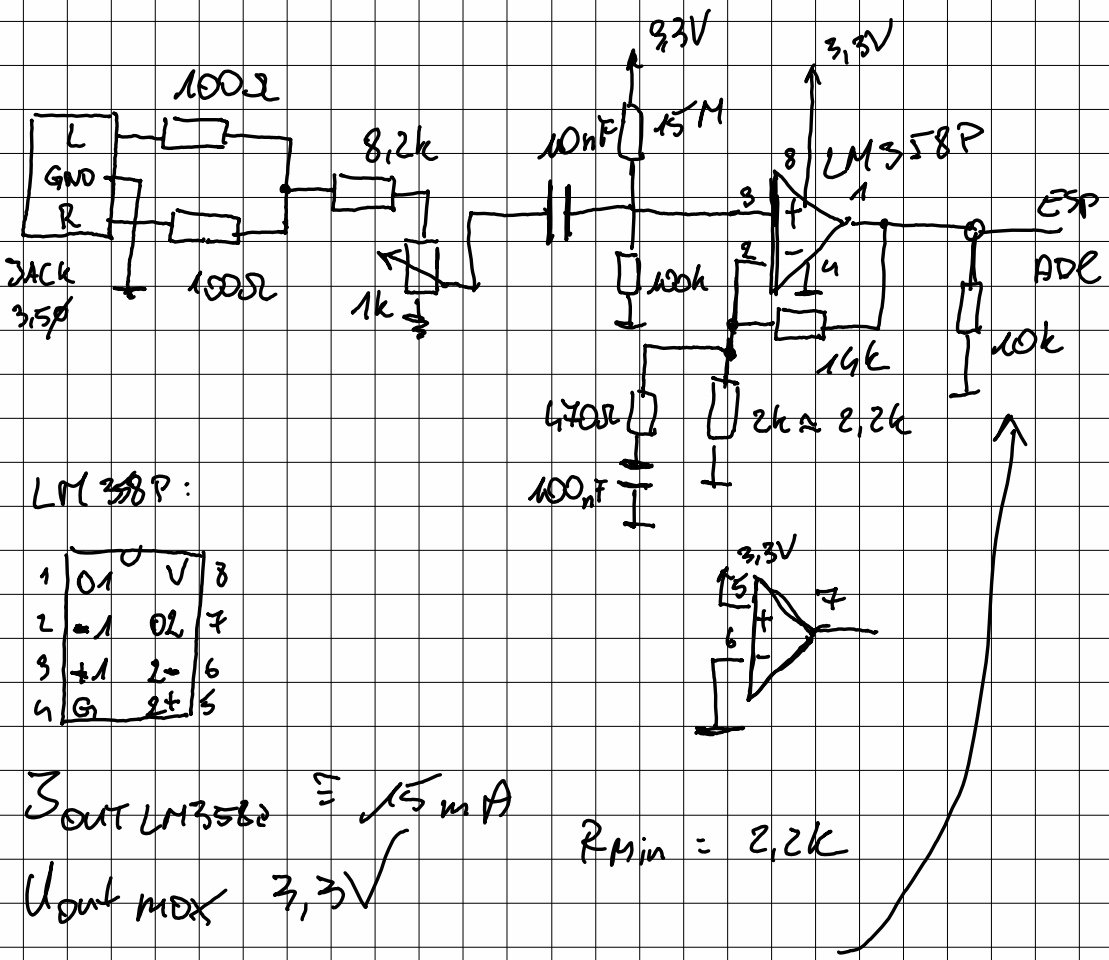


636 Ω na środkowe pomiędzy 20 Hz ÷ 20 kHz

20 Hz: 842 Ω || 2000 Ω ⇒ 1616 Ω ⇒ K = 9,7 %

$X_C \in$ 20 kHz: 477 Ω || 2000 Ω ⇒ 385 Ω K = 3,7 %





LM358P:

1	O1	V	8
2	-1	O2	7
3	+1	2-	6
4	G	2+	5

$I_{OUT\ LM358} \approx 15\ mA$

$U_{out\ MAX}$ 3,3V ✓

$R_{min} = 2,2k$

Dla 10k, $I = 0,33\ mA$