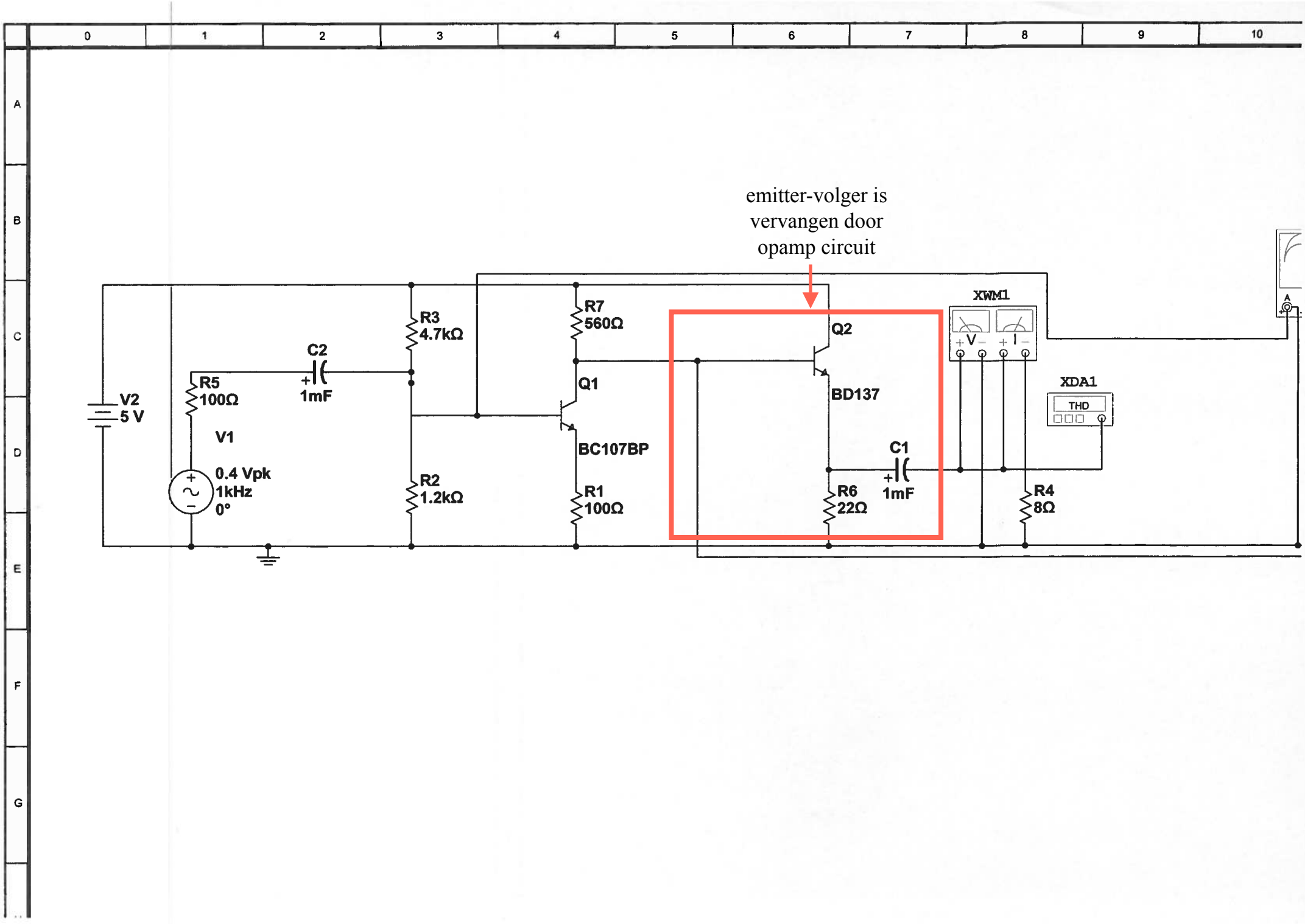
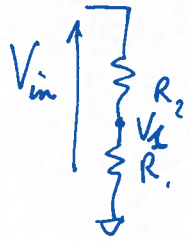

emitter-volger is
vervangen door
opamp circuit
V2
5 V
R5
100Ω
C2
1mF
R3
4.7kΩ
R7
560Ω
Q2
BD137
XWM1
+V−
+I−
XDA1
THD
Q1
BC107BP
V1
0.4 Vpk
1kHz
0°
R2
1.2kΩ
R1
100Ω
C1
1mF
R6
22Ω
R4
8Ω

* Serie schakeling van V-bronnen.

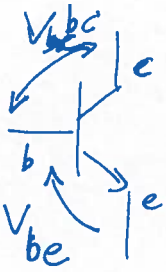
$4 \times 1{,}2\,V = 4{,}8\,V$

* Weerstandsdeler:




* I gemeenschappelijk
* wet van Ω. $R = R_1 + R_2 \rightarrow I = \frac{V}{R_1 + R_2}$
* $V_1$ = V over $R_1 = R_1 I = \frac{R_1}{R_1 + R_2} V_{in}$

* Transistor



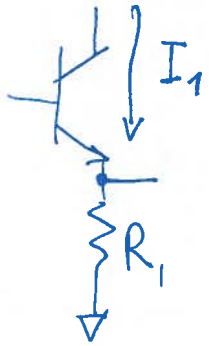

$V_{be} = 0{,}7\,V$

$V_{bc} > 0$

$$\begin{cases} V_b = V_e + 0{,}7\,V \\ V_c \geq V_b \end{cases}$$

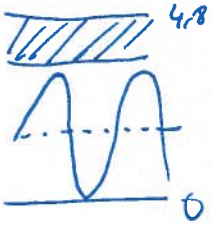
betreft emitter-volger

*




$V_c = 4{,}8\,V \geq V_e + 0{,}7\,V$

$V_e \leq 4{,}1\,V$




midden : 2V

$\Rightarrow$ maximale signaalswing = 0 – 4V $\quad (2\,V \cdot \sin 2\pi f t) + 2\,V$

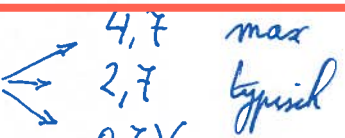
Kies $R_1 \cong 8\,\Omega$

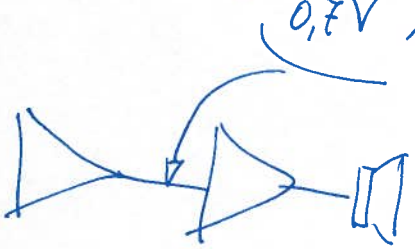
$2\,V = R_1 \cdot I_1 \rightarrow I_1 = 250\,mA$ te groot.

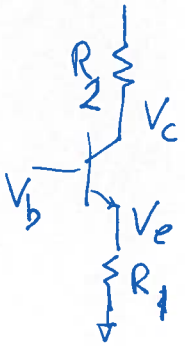
Kies $R_1 = 22\,\Omega \rightarrow I_1 = 91\,mA$ doenbaar.

$I_1$ max => $\frac{4V}{22\Omega} = 180\,mA$

$I_1$ min = 0 = $\frac{0V}{22\Omega}$

$V_b = V_e + 0{,}7V$ 




$V_b = V_e + 0{,}7$

$= R_1 . I + 0{,}7V$

$I = \frac{V_b - 0{,}7}{R_1}$

$V_c = 4{,}8 - R_2 I$

$= 4{,}8 - \frac{R_2}{R_1}(V_b - 0{,}7)$

Versterking van $V_b$ : $V_c = -\frac{R_2}{R_1} V_b$

→ omgekeerd teken

→ versterking $\frac{R_2}{R_1}$

Uitgang 400mV → 2V : Versterking factor 5

$\frac{R_2}{R_1} = 5$

$2{,}7V = 4{,}8V - \frac{R_2}{R_1}(V_b - 0{,}7V) \Rightarrow V_b = 2{,}1 / \frac{R_2}{R_1} - 0{,}7$

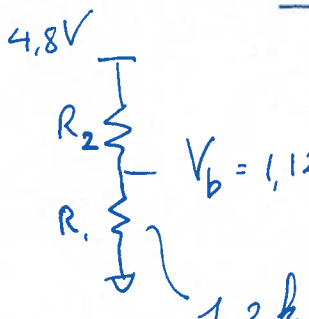
→ $V_b = -0{,}2\,(2{,}7 - 4{,}8 - 3{,}5)\,V = +0{,}2 \cdot 5{,}6 = 1{,}12V$

$-8{,}3$

$G = 5 \quad R_1 = 100\,\Omega \quad R_2 = 500\,\Omega.$

$\Rightarrow$ bien $R_2 = 560\,\Omega$.

---



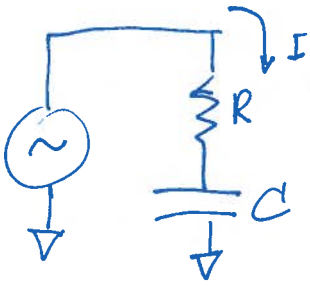

$$V_b = \frac{R_1}{R_1 + R_2} \cdot 4{,}8V = 1{,}12V$$

$R_1 = 1{,}2k \rightarrow$ oplossen.

$$4{,}8V \cdot 1{,}2k = 1{,}12V \cdot 1{,}2k\Omega + 1{,}12V \cdot R_2$$

$$\Leftrightarrow \quad \frac{(4{,}8 - 1{,}12) \cdot 1{,}2k}{1{,}12} = R_2 \simeq 4{,}7k$$

---




$$\begin{cases} V_R = R\,I \\ C\,\dfrac{dV_C}{dt} = I \\ A \sin 2\pi f t = V_{in} = V_R + V_C \end{cases}$$

$V_C = V_{in} + RI$

$$A \sin 2\pi f t = V_C + RC\,\frac{dV_C}{dt}$$

---

$A = 0 \rightarrow \quad V_C = -RC\,\dfrac{dV_C}{dt} \qquad V_C = V_0 \cdot e^{-\frac{t}{RC}}$

$\Rightarrow$ Plop.

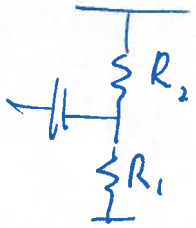
$$A \sin 2\pi f t = RC\,\frac{dV_C}{dt} \Rightarrow V_C = -\frac{A}{RC\,2\pi f}\cos 2\pi f t$$

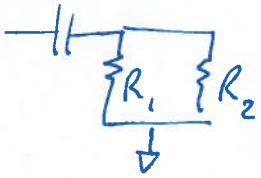

half vermogen → $RC' = \left(2\pi f_{3dB.}\right)^{-1}$

50 Hz  8 Ω (eindtrap)

$C' = \frac{1}{2\pi \cdot 50 \cdot 8} \cong 400\,\mu F$  $\left(\frac{1}{800\pi}\right)$

Ingang:




$R_1 // R_2 \simeq 1{,}2\,k\Omega$

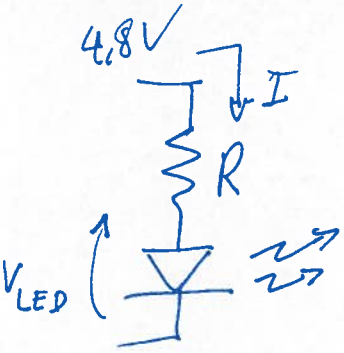
$C = \frac{1}{2\pi \cdot 50 \cdot 1200} \cong 2\,\mu F$

---

Vermogen: met batterij: $IV \cong 100\,mA \cdot 4.8\,V = 500\,mW$

wisselspanning $\frac{1}{2} IV = \frac{1}{2} \frac{V^2}{R} =$

$V_b = \frac{(2V)^2}{2 \cdot 8\,\Omega} = \frac{4V^2}{16} = 0{,}25\,W$




$V_{LED}$ (klem afh.)

voorbeeld $V_{LED} = 1{,}8\ V$

$V_{LED} + RI = 4{,}8\ V$

$I_{LED} = 2\ mA$ (gegeven in datasheet)

$RI_{LED} = 4{,}8 - 1{,}8\ V \Rightarrow R = \frac{3\ V}{2\ mA} = 1{,}5\ k\Omega.$

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Levensduur batterij : $I = 100\ mA$

Capaciteit battery: vb: $800\ mAh = I \cdot$ tijd

$\longrightarrow$ tijd = 8h.

Vermogen in LED $V_{LED} \cdot I_{LED} = 1{,}8\ V \cdot 2\ mA = 3{,}6\ mW$

efficientie (omzetting electrische $\rightarrow$ optische energie)

vb: 80% $\rightarrow$ $P_{licht} = 0{,}8 \cdot 3{,}6\ mW$

$= 2{,}88\ mW$