REPORT FOR AORC : PUSH PULL POWER AMPLIFIER

01/12/2023

I. Standard circuit

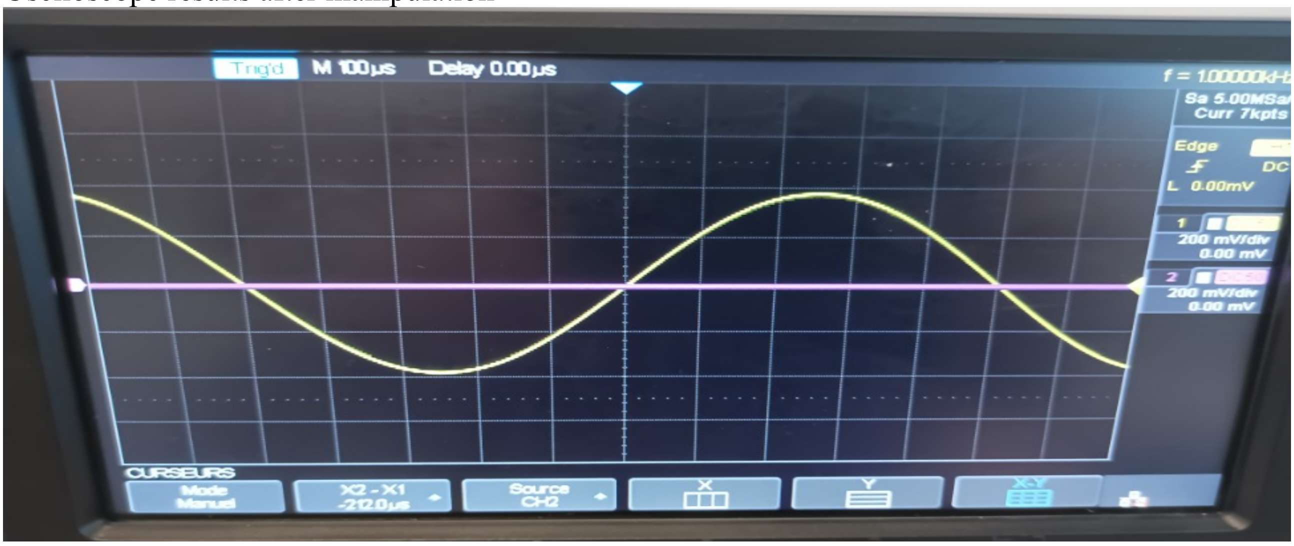
1.1 Preparation

1.1.1. operation of the circuit

As we know from the lecture, in a class B amplifier the transistor is conducting only for one-half of the input period. Here, the two transistors T1 and T2 are both working during half to period T: T1 is conducting for $0 < t < T/2$ while T2 is for $T/2 < t < T$. When one transistor is conducting, the other is OFF. Here, we treat an OFF transistor as an open circuit (zero current).

I.Experiment

For the impedance : 50 Ω
For e(t) = 1V
Osciloscope results after manipulation



We observe that when we plot the input, we saw sinusiodal form. unlike when we plot the both input and output signal . we notice the same for the input but for the out put we saw some distorsion.

For the impedance : HZI Ω

for e(t) = 1V

We notice some distorsion or cross over section that Is due to the delay that transitor 2 to be on , since the voltage must be equal to 0.6 to make the second transistor on so this cross over section because from -0.6V to 0.6V the two transistors are OFF.

And we notice also that the amplitudes is reduced regarding to the impedance of 50Ω.

I.1.4 determination of the DC consumption

For impedance 50Ω :

Pa = 2*VCC*Ic

AN :

I=54.17mA.

Vsmax (SRMS) = 5.83V our cable was not working well the valu should be around 6.62 V.

Vcc= 10 V

Pa= 1.083 mW

Pu= S^2 /Rc

Pu = 0.6797 mW

ŋ= Pu/Pa

ŋ= 17 %

We have these values Because of the cable issue.

For impedance Z= HIZ

ŋ= 60 %

II.Circuit with diode and resistance for pre-biasing

II.1. Preparation

II.1.1 Explantions of the circut :

In this part we add 4 diode for a good polarisation, 2 diodes for the first transistor and 2 for the second to eliminate the cross over section , because the pick-to-pick voltage for the transistor equal to 0.6V+0.6V=1.2V .

II.1.2 Maximum out put voltage

Vs=RcIc=RcβIb=Rcβ(Vcc-Vbe) /R+(Re+Rc) β

Vs=5.11V

II.1.3 Maximum out put power

$$Ps=\frac{Vsmax^2}{2Rc}$$

Ps =261mW

II.1.4 DC consumption power and the efficiency

Pa= 2Vcc*Icmax=650mW

pa=650mW

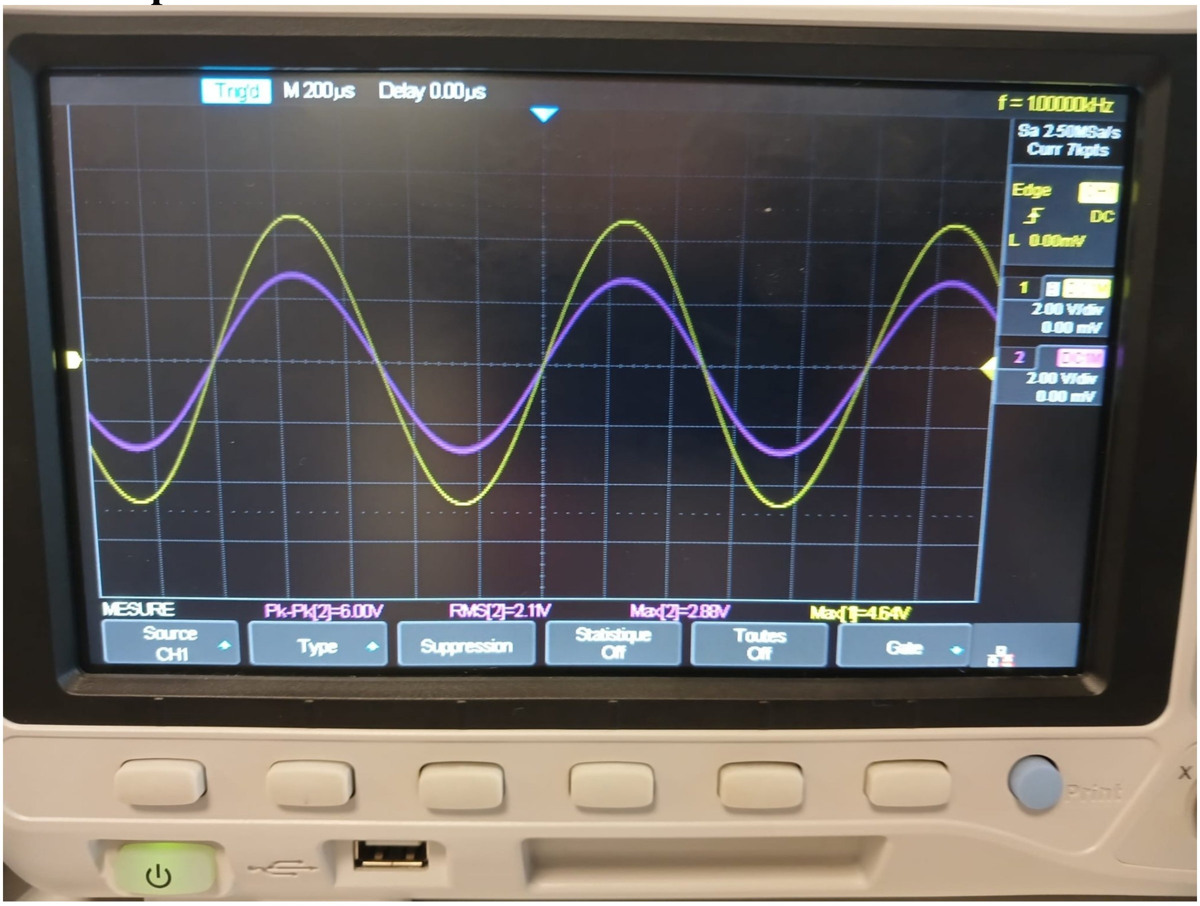
$$Icmax=\frac{Vsmax}{\pi Rc}$$

Icmax=32.5mA

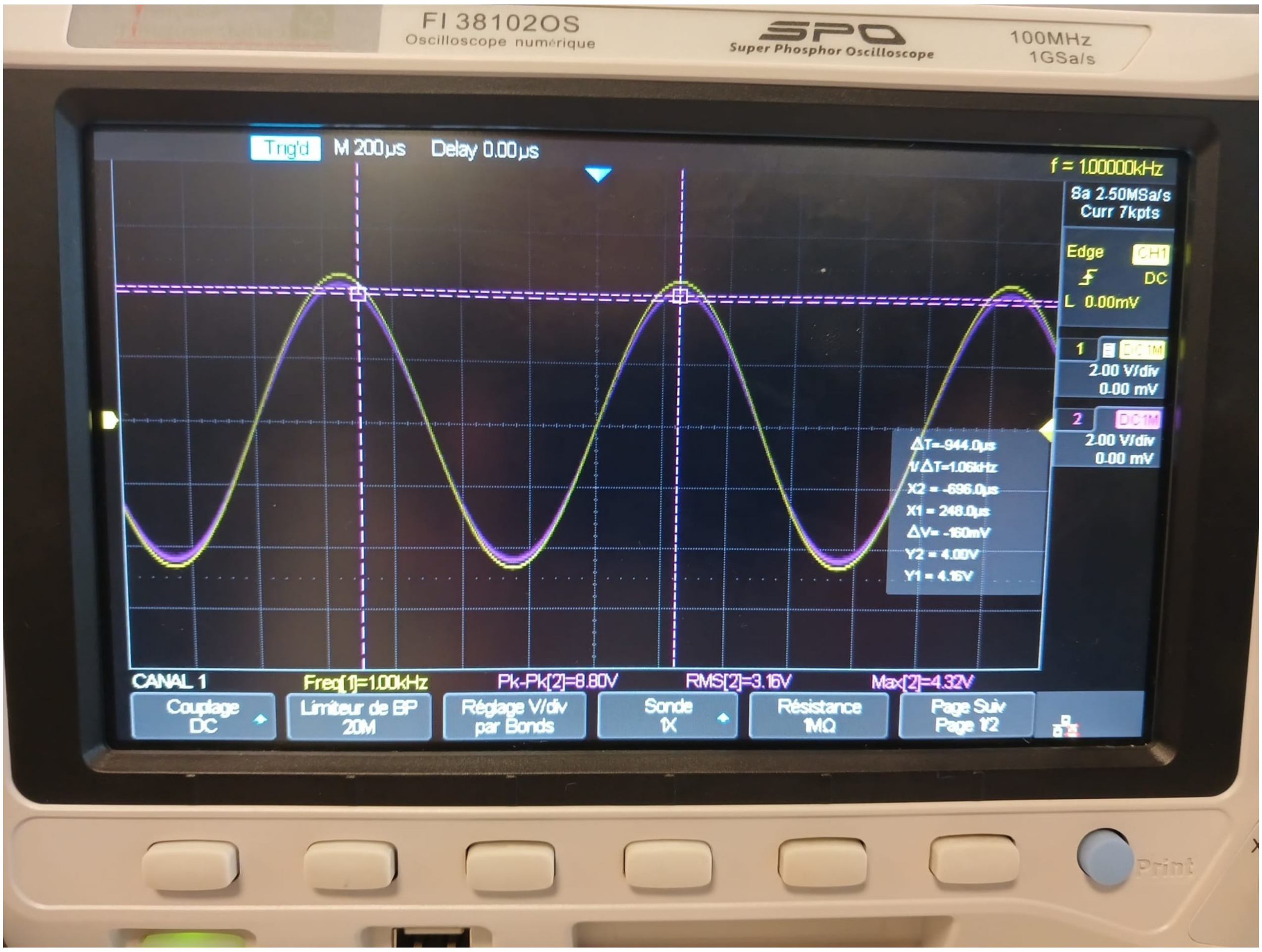
$$ŋ=\frac{Pu}{Pa}$$

ŋ =40%

II. 2. Experiments



Similarly to the previous circuit, T1 and T2 are ON during one-half of the input period each. The two diodes D1 and D2 compensate for the voltage drops at the base-emitter junction T1 and T2, reducing the distortion, as we see in the picture.



Here we get Vsmax=4.32V and its close to the theoretical value (5.11V)

Resistance=2400Ω

III.Circuit with diode and current sources for pre-biasing

III.1. Preparation

Transistor is current source, therefore we add diodes for biasing T1 and T2 for obtain good polarisation and eliminate cross section

1.1.Maximum output voltage Voutmax

theoritical value

Vsmax=Vcc-Vbe

Vsmax=10-0,6=9,4Vpp

Vsmax=9,4Vpp*2=18,8 V

1.2. Maximum output pwer2

$$Psmax=\frac{\left(\frac{Vcc.Vse}{\sqrt{2}}\right)^2}{Rc}$$

Psmax=353.44 mW

1.3.DC consumption power and the efficiency ŋ

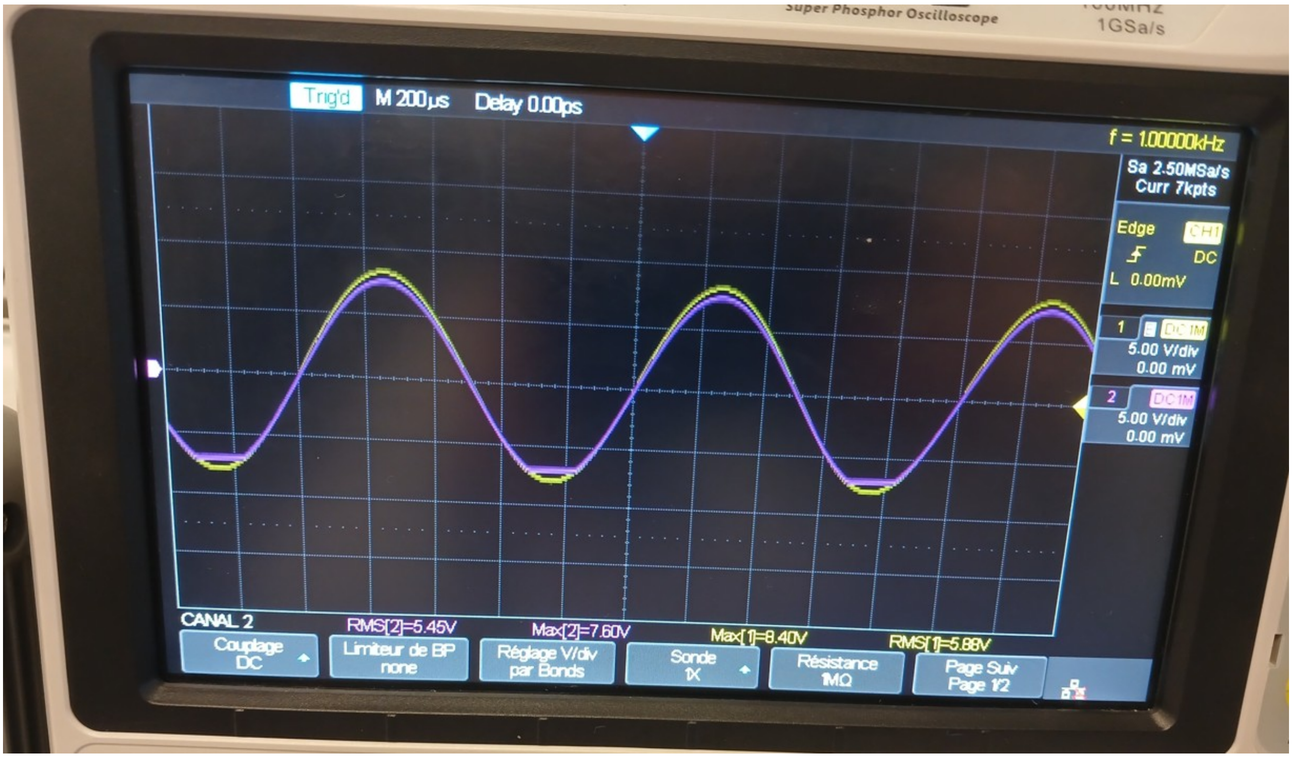
Psuf=2* Vcc *Imax
Psuf=1096.8 mW

Efficiency
ŋ= 60%

III.2. Experiments

III.2.1.Maximum output voltage Voutmax

At 17,200 Vpp we don't have saturation , so Vsmax= 17,200 V
The difference betwwen the both practical and teoritical value is related to RE<<RC and then we can neglect RE.



We observe some staturation,before we reach maximum value of current, that is due to the fact that the two output transistors configuration are not perfectly matched, one may turn on faster than the other, causing the other to saturate, so its Mismatched Transistors.

III.2.2. Measure $\frac{E_{RMS}}{S_{RMS}}$,Pe,Re and deducing Ps, Ap and ŋ

Vsmax=$\frac{1}{8.2}$

S_{RMS} =6.14V

E_{RMS} =8.8V

Ic=54,84mA

For this part we have added to the circuit 2 more transistors, for have a good polarisation, so the output voltage increase regarding to the last schematic . And the resistor is used to protect transistor, and the difference between S_{RMS} and E_{RMS} is equal to 2.
Therefore we conclude that the transistor is treat as a source current.

Table comparing the different circuits we have study

	Basic push-pull	Push-pull with diodes	Push-pull with 4 Transistors
Vsmax	5.38 V	5.11 V	18.2 V
Icmax	54.17 mA	32.5 mA	54.84 mA
Pa	1.038 mW	650 mW	353.44 mW
Pu	0.6797 mW	261 mW	1096.8 mW
ŋ	17 %	40%	60%

Conclusion

In conclusin, at the first our circuit isn't adapted to impedance of 50 Ω, and the theoritical values seems close to practical values, more we add transistors more we have more current consequently more efficiency, therefore the last architecture is the best one for real applications.

The Class B push-pull amplifier, with diode biasing through D1 and D2, effectively remove distortion by compensating for voltage in transistors T1 and T2. This design minimizes crossover distortion,

So its requires a careful balance of factors like thermal stability, transistor matching, for optimal performance in real-world applications.