Bal-Un 50:200
SECOND PART

By iw2fnd Lucio

3) Find the impedance Z_0 of the line to be used

The Guanella Bal-Un requires that the transmission line used be:

$$Z_0 = \sqrt{R_p \cdot R_s} = \sqrt{50 \cdot 200} = 100\ Ohms$$

Transmission lines with a characteristic impedance of 100 Ω are typically bifilar lines. They can be constructed, but commercially available conductors for 12V DC (red/black) or audio (blue/black) have a characteristic impedance of around 100 Ω.

4) Select the wire gauge

From an electrical perspective, the Guanella Bal-Un is an up-autotransformer. Therefore, the current passing through the common winding (i_c) is the difference between the primary current (i_p) and the current flowing through the series windings (is, which is equal to that of the secondary). In this case, the current passing through the two transmission lines is half of the primary current.

$$i_s = i_c = \frac{1}{2}\sqrt{\frac{P}{Z_p}} = \frac{1}{2}\sqrt{\frac{500}{50}} = 1{,}58\ A$$

In the market, there are audio cables of various cross-sections.

Since the current density in the cables is chosen around 2 A/mm2. To support a current of 1.58 A, a cable of 1.5 mm2 is sufficient. With such a cable, you can wind 8+8 turns on an FT240-61 ferrite.

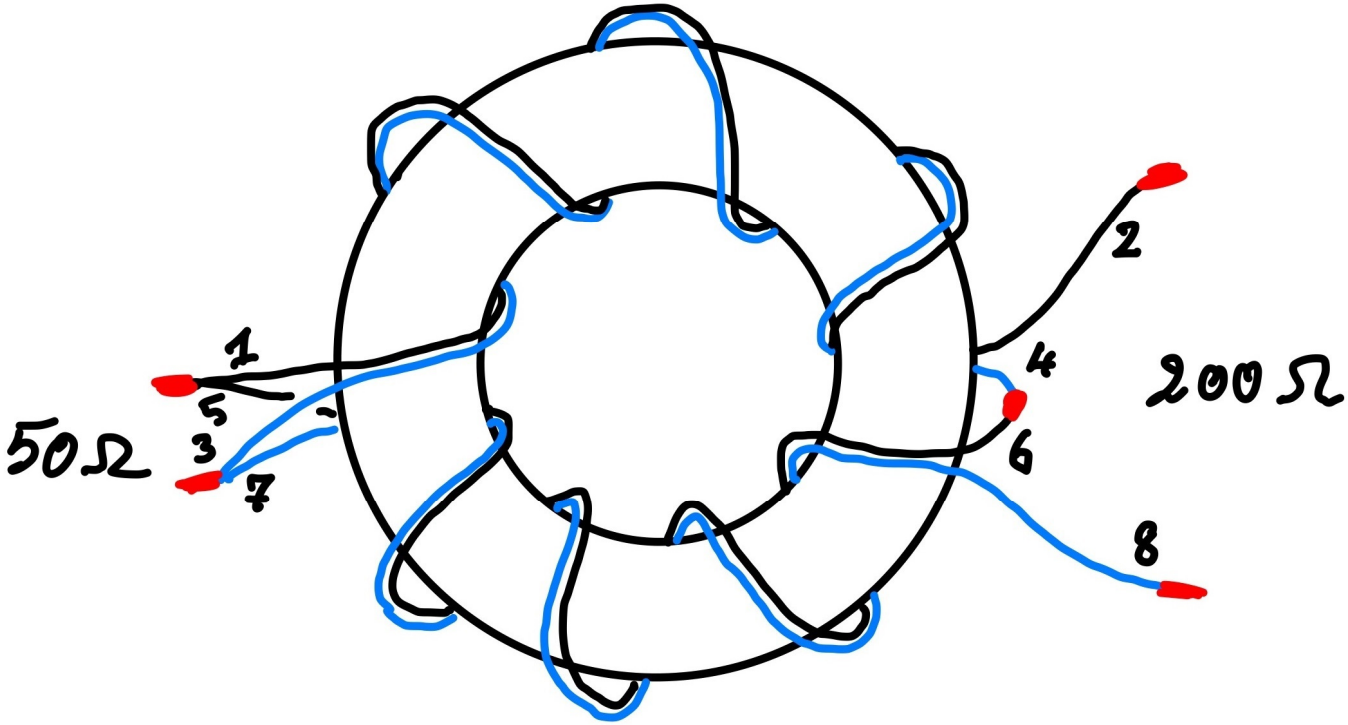
5) Check the ferrite

Ferrite of grade #61 allows a maximum magnetic flux density of 250 mT. The formula for calculating the flux in a toroid is that of transformers. If the frequency f is in [MHz], the area Ae is in [cm^2], the result will be in [mT]:

$$B_{Max} > \frac{10 \cdot V_{eff}}{\sqrt{2}\pi f \cdot n_p \cdot A_e} = \frac{10 \cdot \sqrt{P \cdot Z_p}}{\sqrt{2}\pi f \cdot n_p \cdot A_e} = \frac{10 \cdot \sqrt{500 \cdot 50}}{4{,}44 \cdot 7 \cdot 16 \cdot 1{,}58} = 2{,}01\ mT$$

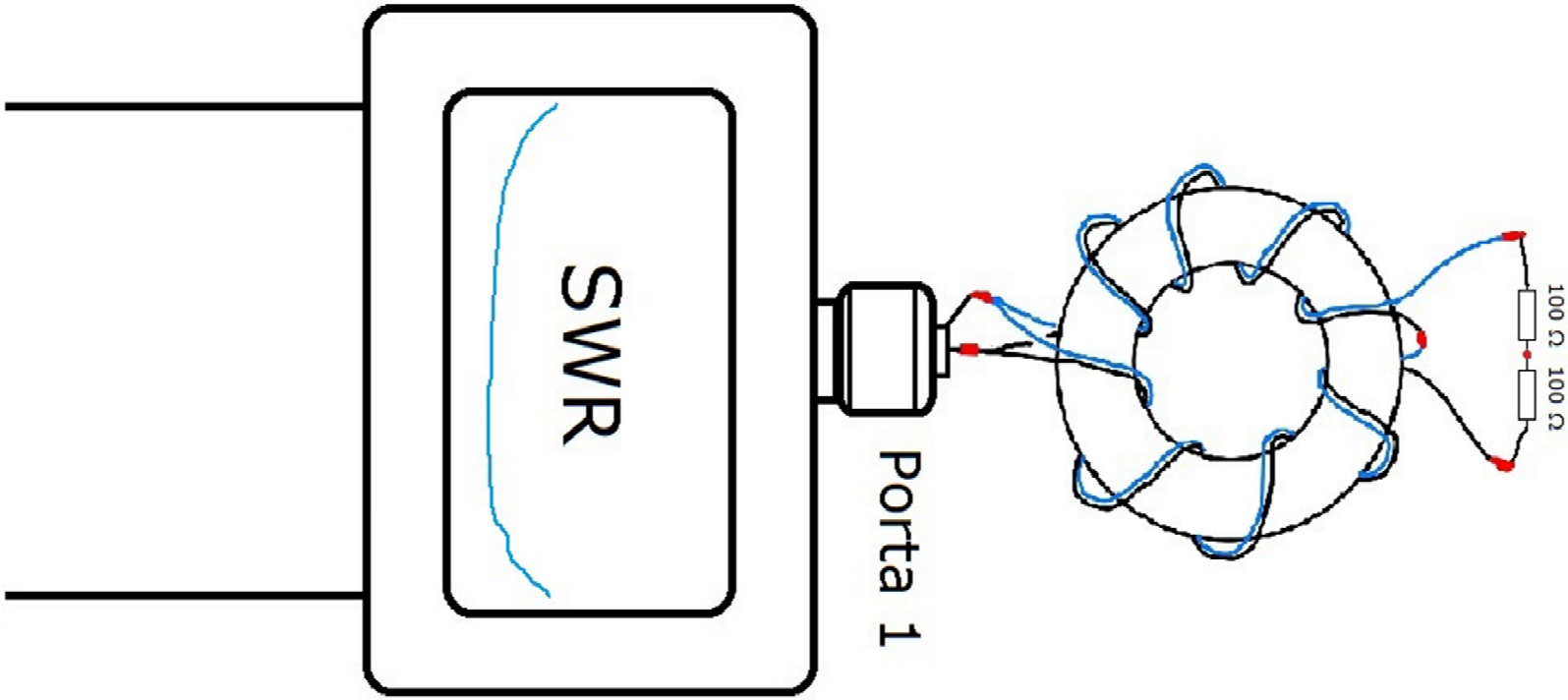
From this, it can be seen that the maximum flux density allowed in the ferrite is much higher than that generated by the transmitted power P of 500W.

6) Construct the Bal-Un



8+8 turns of bifilar transmission line Z0 = 100 Ω,
on FT240-61 ferrite.

7) Test the Bal-Un with a VNA



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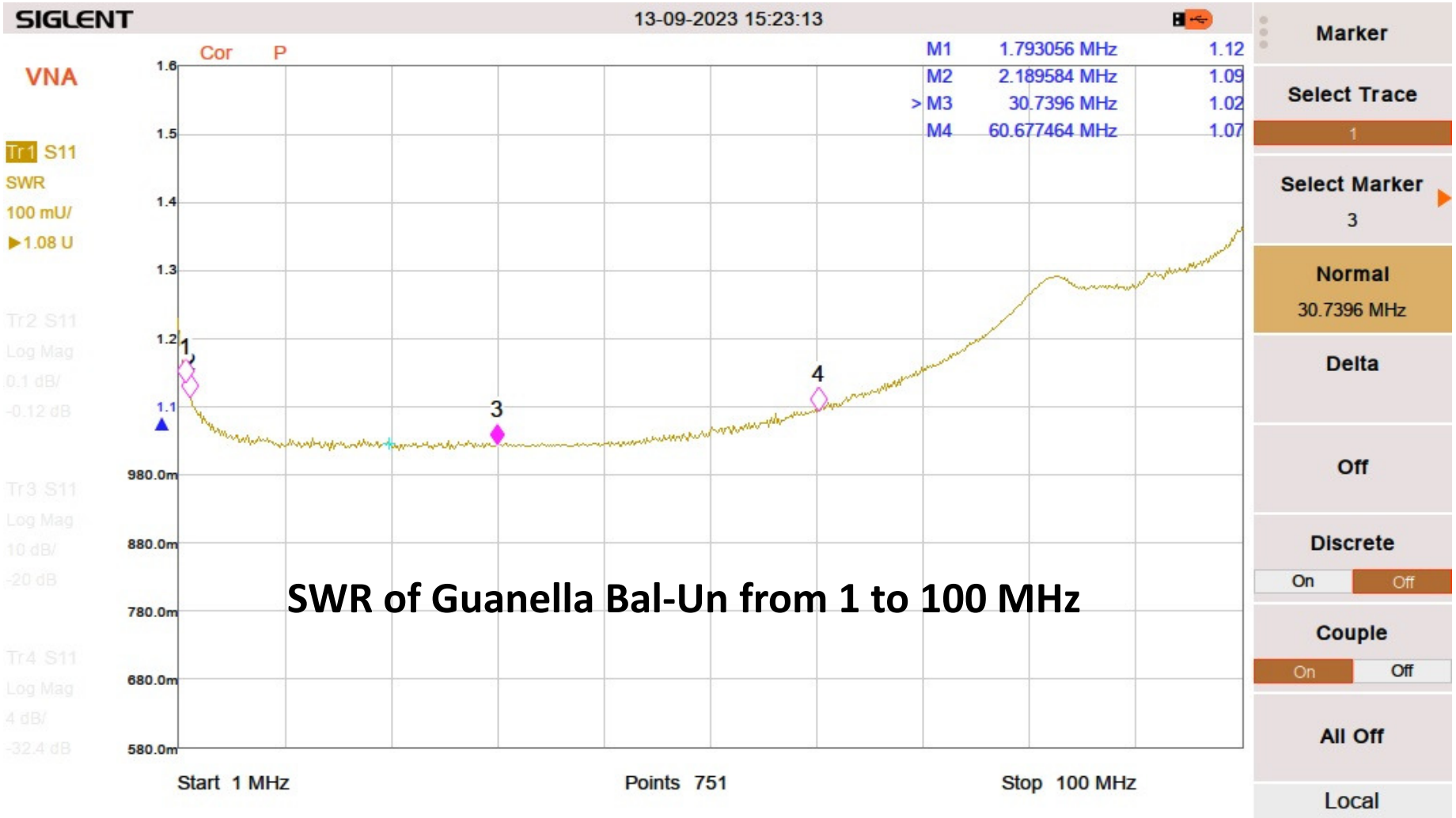
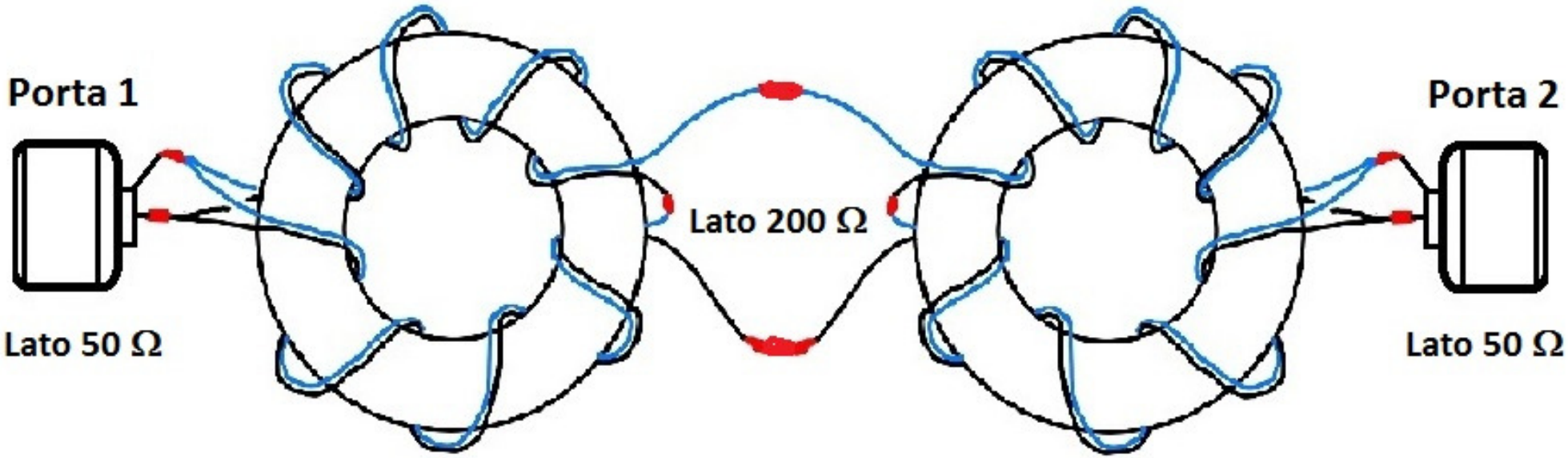


7) Test the Bal-Un with a VNA

Set-up per la misura della perdita d'inserzione S21



7) Test the Bal-Un with a VNA