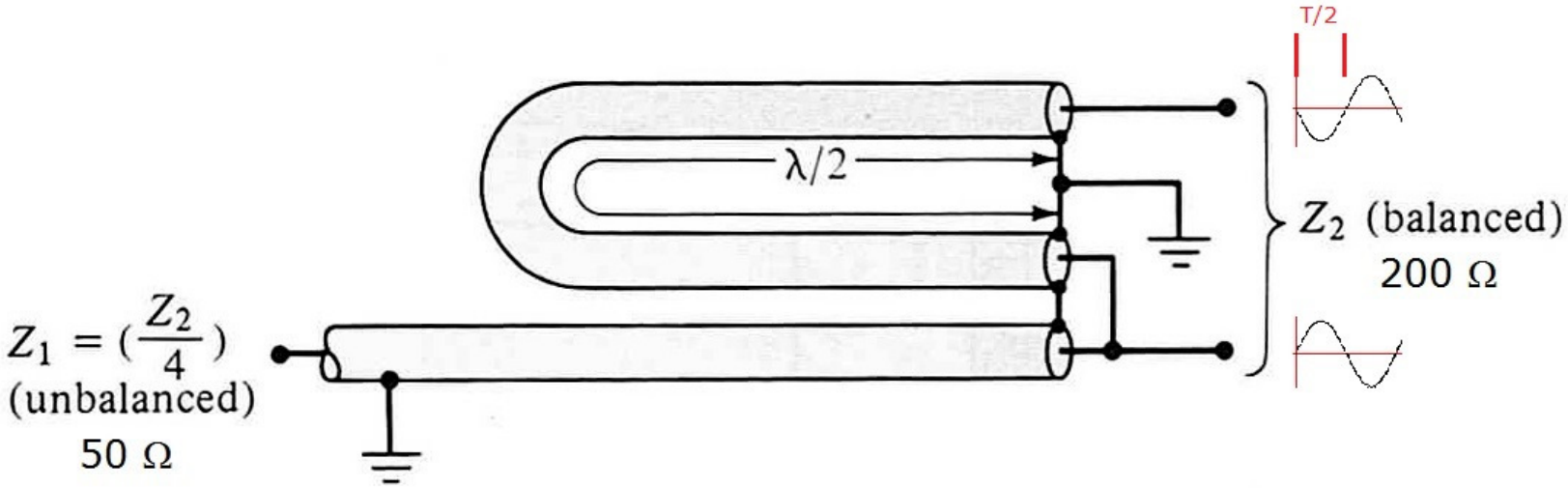
Bal-Un 50:200
FIRST PART

By iw2fnd Lucio

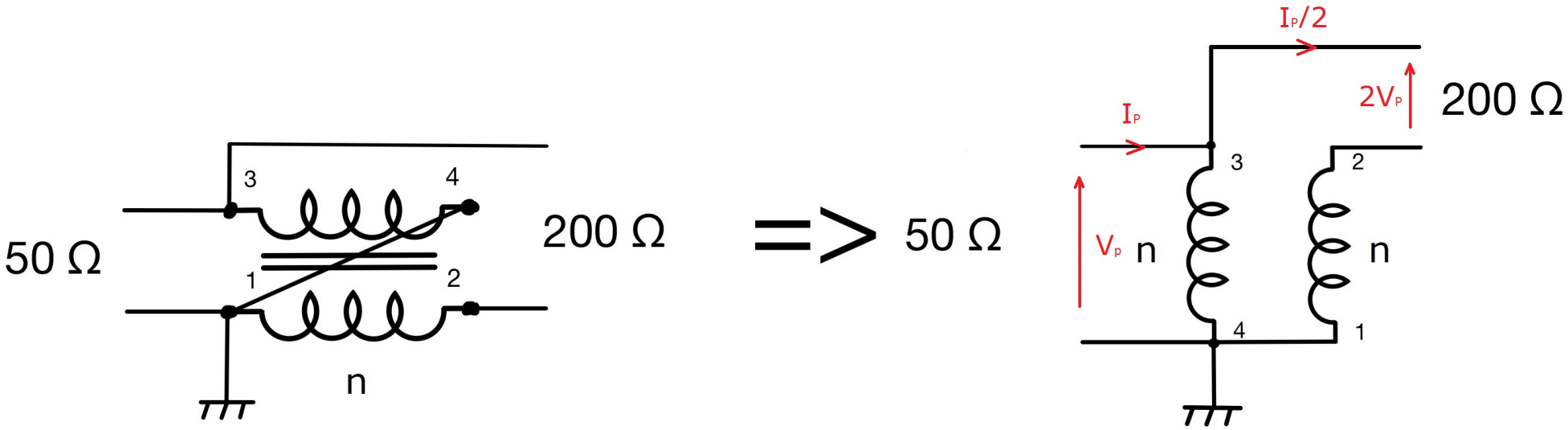
Balance 1:4 with delay line λ/2



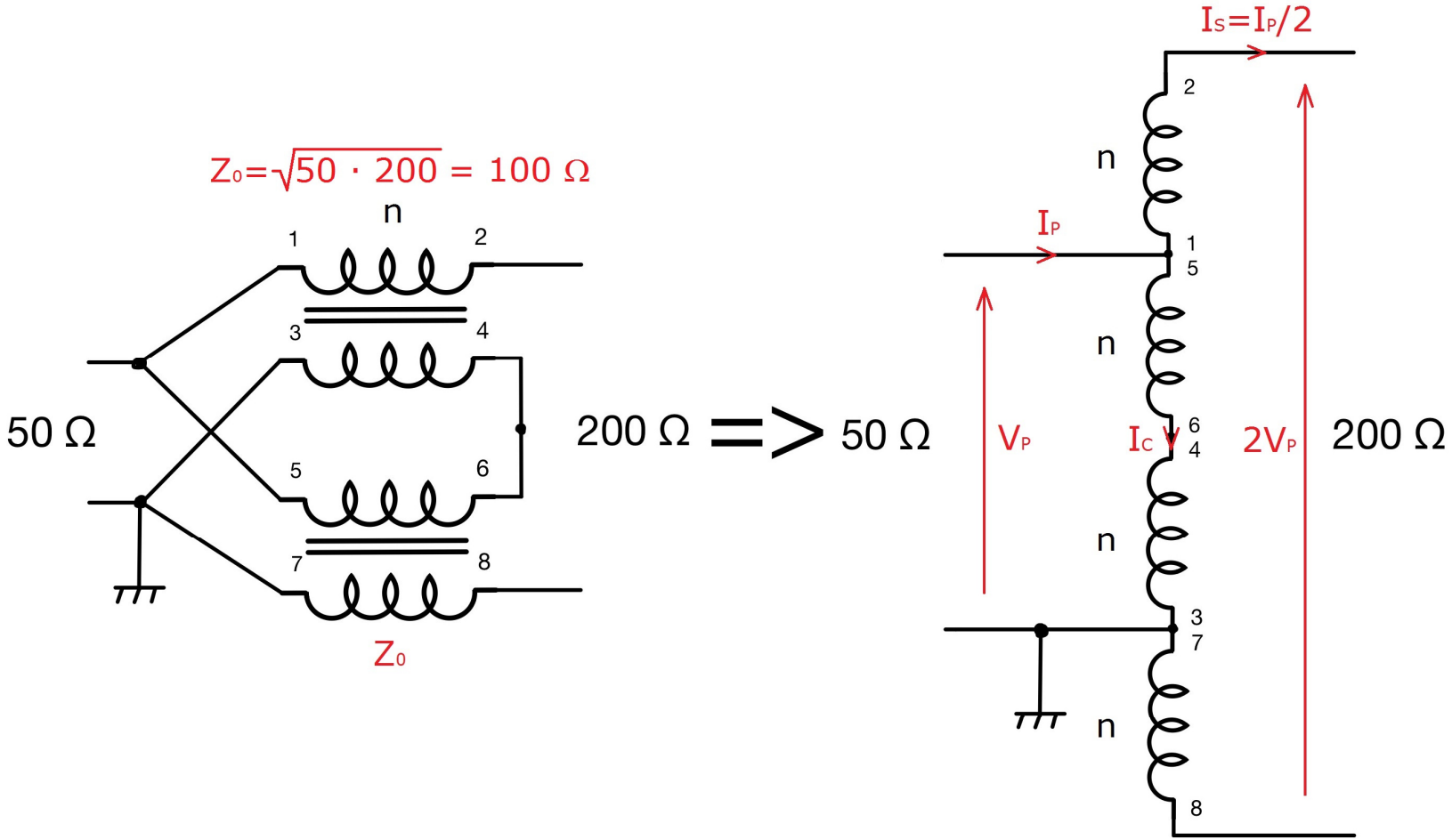
λ/2 coaxial balun (50:200)

$$\lambda = \frac{VF \cdot c}{f}$$

Balance 1:4 with Voltage or Ruthroff Bal-Un



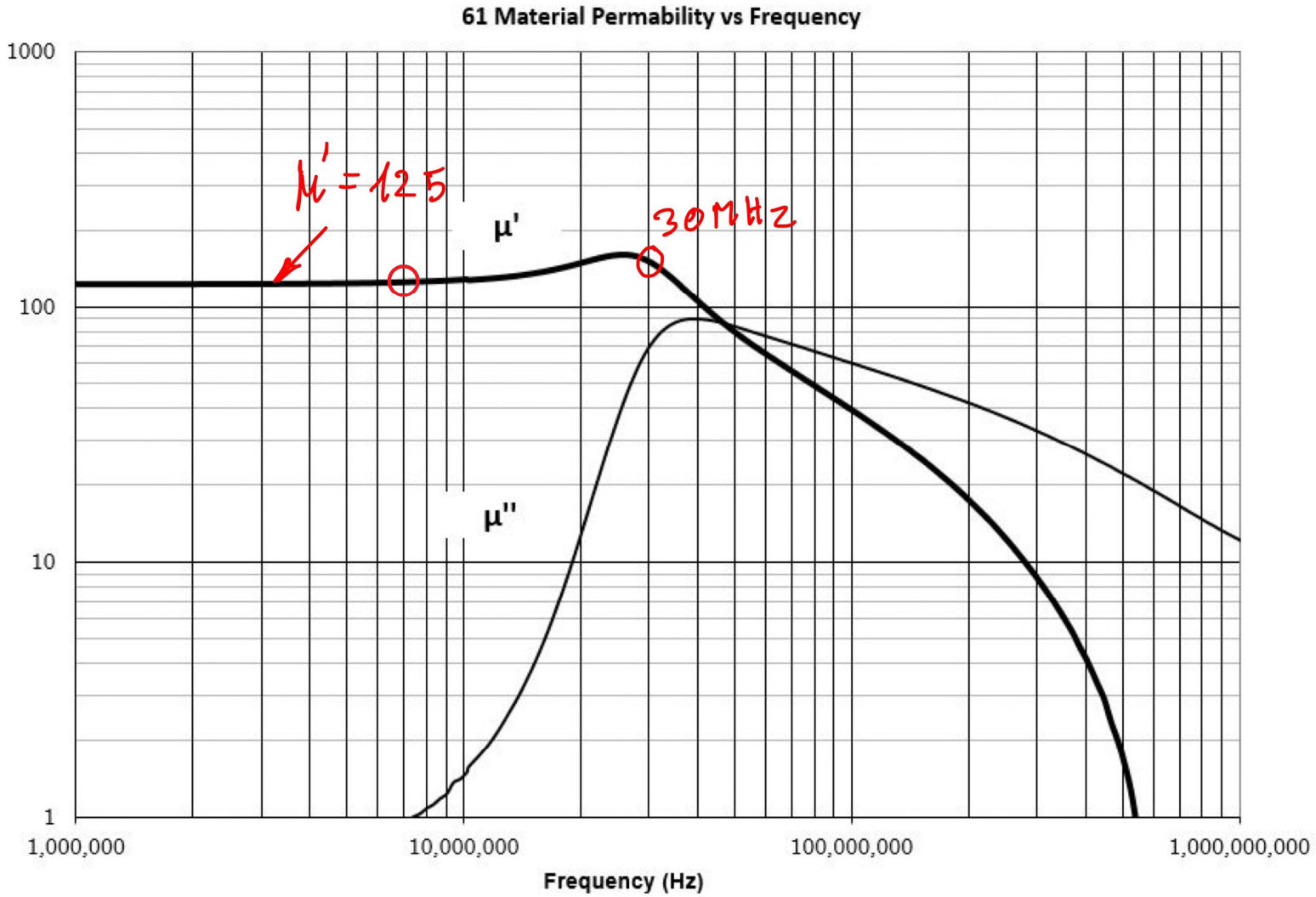
Balancing 1:4 with Current or Guanella Bal-Un



Balancing 1:4 with Current or Guanella Bal-Un

1. Choose the best ferrite;
2. Determine the number of turns;
3. Find the impedance Z_0 of the line to be used;
4. Select the wire gauge;
5. Check the ferrite;
6. Construct the Bal-Un;
7. Test the Bal-Un with a VNA.

1) Choose the best ferrite



1) Choose the best ferrite

FAIR-RITE

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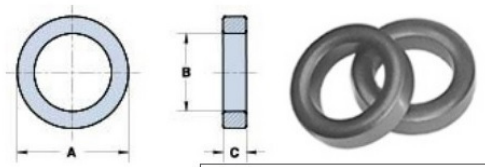

Dimensions: Top numbers are in millimeters, bottom numbers are in nor

Low Permeability, 61 (ui=125) material

Part Number	Frequency Range	A	B	C	Wt. (g)	A_L (nH)	Ae(cm^2)	l_e (cm)	V_e (cm^3)
5961000221	61 Material	010.20 Max (0.401" Max)	04.10 Min (0.162" Min)	03.80 Max (0.149" Max)	0.880	55+-25%	0.072	2.07	0.15
5961003821	61 Material	62.80 Max (2.472" Max)	34.20 Min (1.347" Min)	13.70 Max (0.539" Max)	106	170 ±25%	1.58	14.5	22.8
5961003801	61 Material	61.00 ±1.30 (2.400")	35.55 ±0.85 (1.400")	12.70 ±0.50 (0.500")	106	170 ±25%	1.58	14.5	22.8
5961002721	61 Material	36.80 Max (1.448" Max)	21.95 Min (0.865" Min)	13.70 Max (0.539" Max)	33	140 ±25%	0.78	8.9	7
5961002701	61 Material	35.55 ±0.75 (1.400")	23.00 ±0.55 (0.900")	12.70 ±0.50 (0.906")	33	140 ±25%	0.78	8.9	7
5961001721	61 Material	33.00 Max (1.299" Max)	18.05 Min (0.711" Min)	10.30 Max (0.405" Max)	23	120 ±25%	0.59	7.6	4.5

https://fair-rite.com/product-category/inductive-components/toroids/low-permeability-61-ui125-material-antennarfid-rods-toroids/

2) Determine the number of turns

The magnetizing impedance X_{LM} of the primary winding must be greater than or equal to 5 times Z_0 at the minimum operating frequency, in our case, 250 Ω at 7 MHz.

$$L_M \geq \frac{X_{LM}}{2\pi f_{min}} = \frac{250 \cdot 10^3}{6{,}28 \cdot 7} = 5686\, nH$$

$$A_L = 4\pi\, \mu' \left[\frac{A_e}{l_e}\right] = 12{,}57 \cdot 125 \cdot \left[\frac{1{,}58}{14{,}5}\right] = 171{,}2\, nH/sp^2$$

$$n_p \geq \sqrt{\frac{L_M}{A_L}} = \sqrt{\frac{5686}{171{,}2}} = 5{,}76\, minimal\ primary\ turns$$

END OF THE FIRST PART