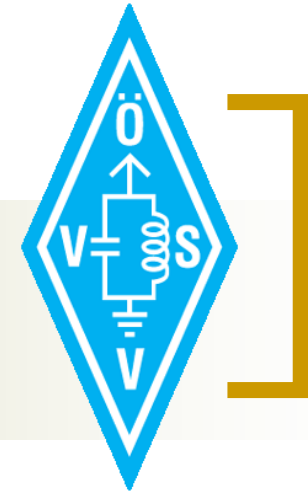


A'funkt kompakt 03-21 Innsbruck:
BALUNs



What they do and how they do it
Was sie machen und wie sie es machen

Enrico Donà

IZ4AFL / OE7AFT

Innsbruck, 19.3.2021

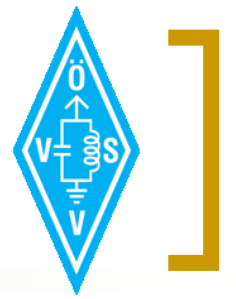
[In Memoriam



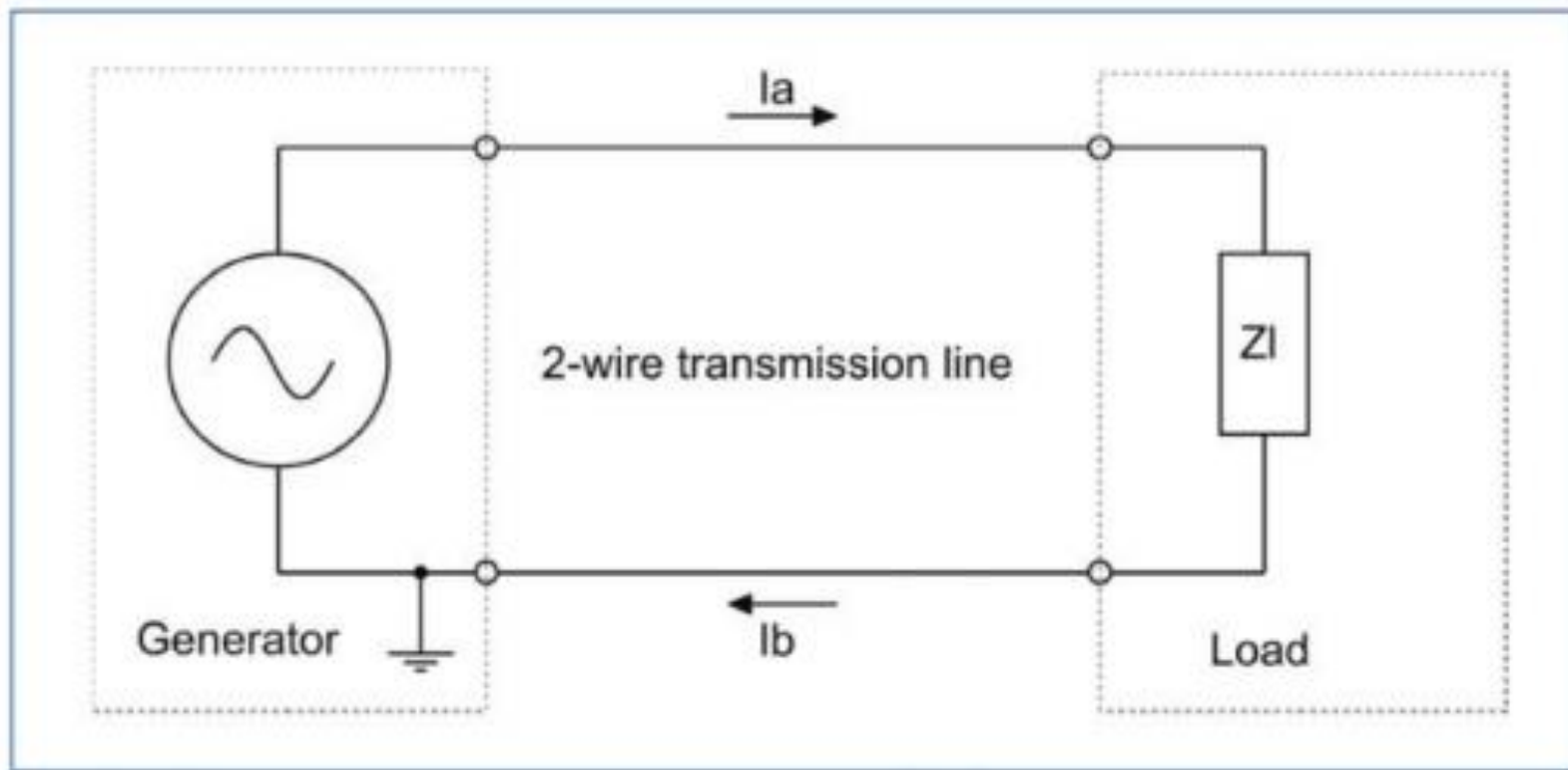
Steve Hunt, G3TXQ

<http://www.karinya.net/g3txq/>

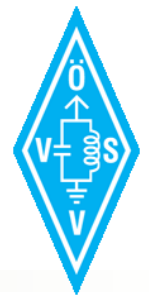
Silent Key 30. December 2018



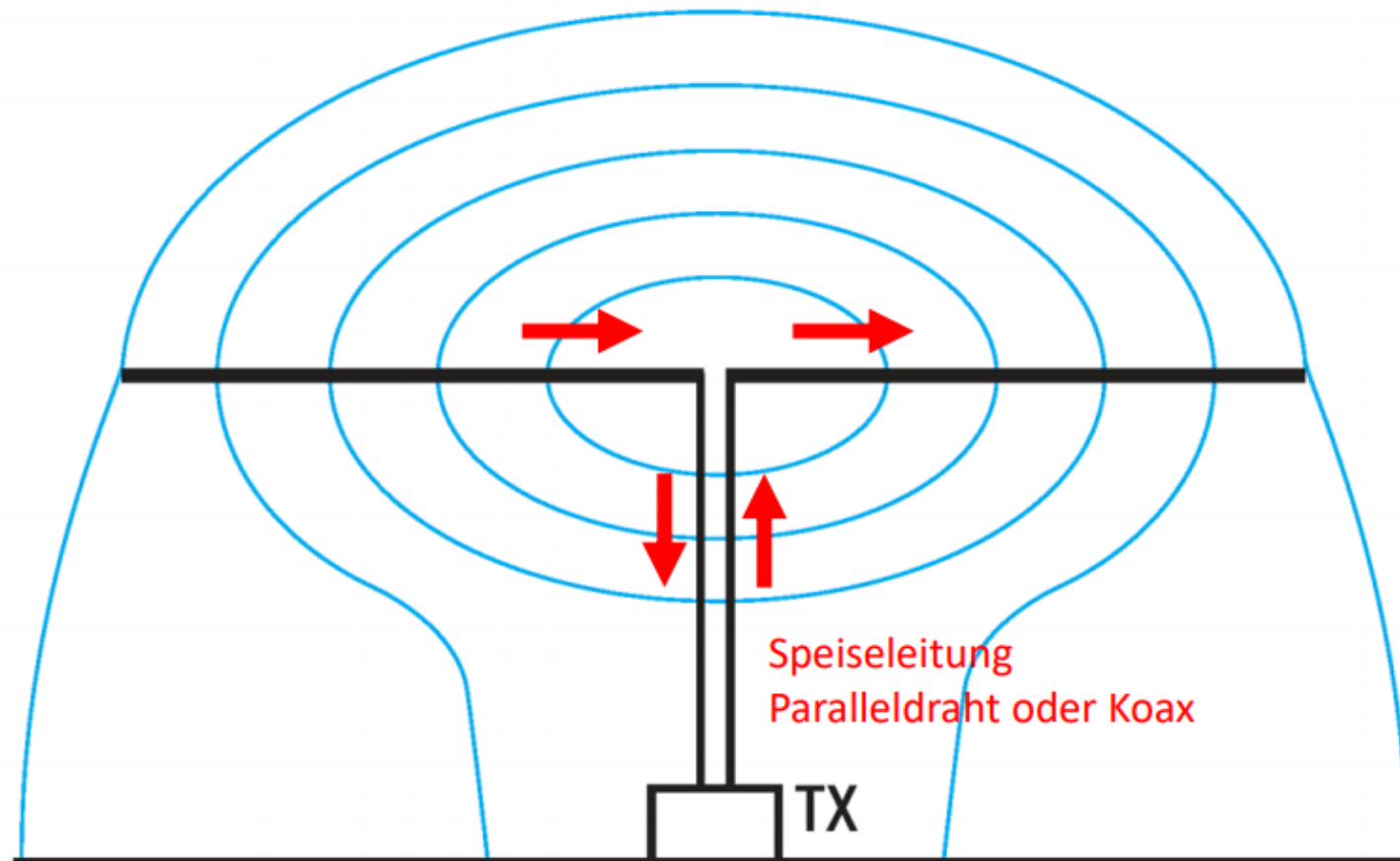
[How does our system look like:



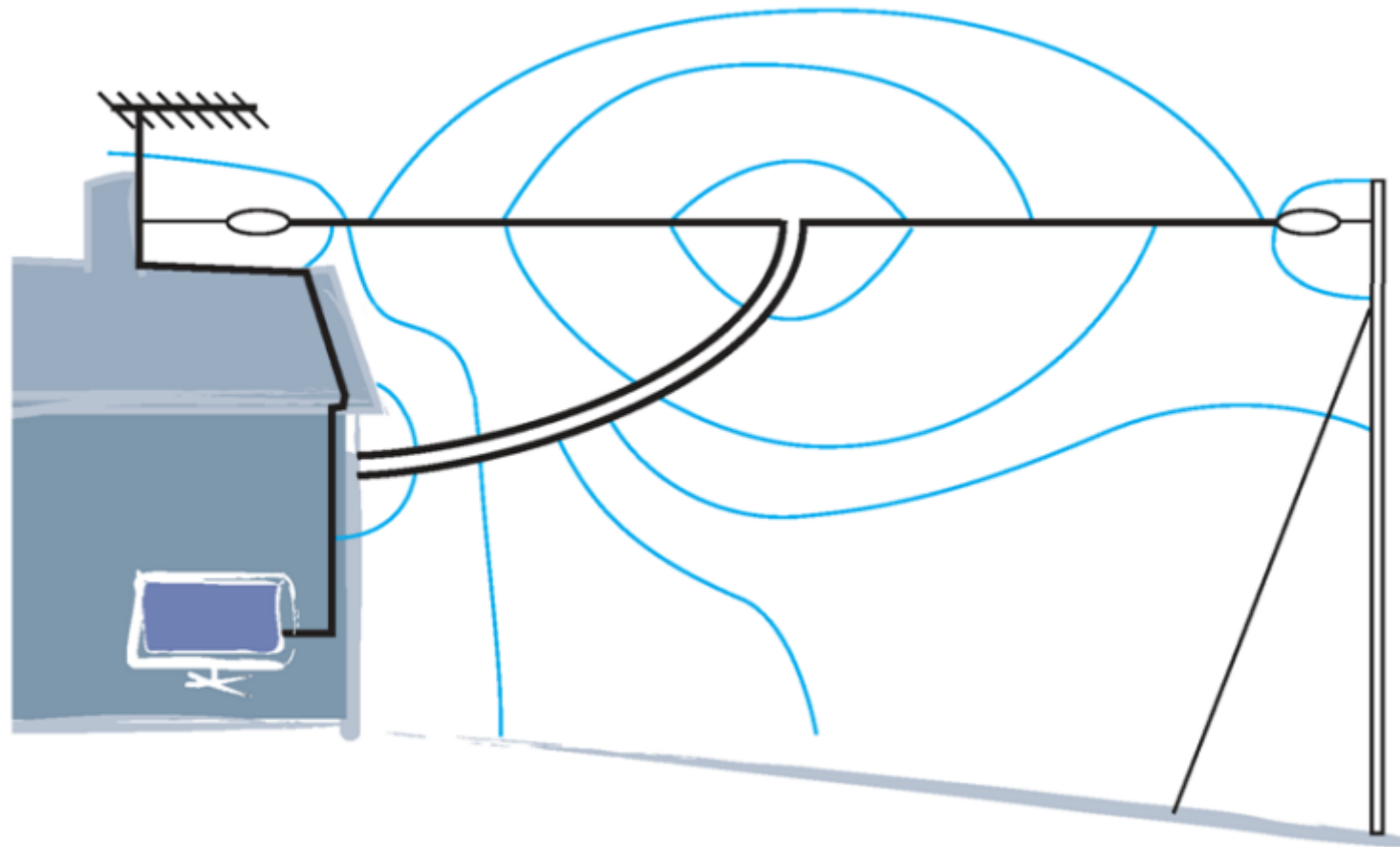
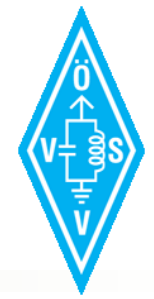
Are you sure?

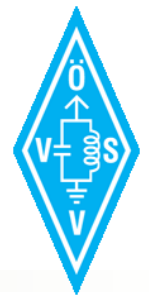


[Ideal case: perfect symmetrical system]

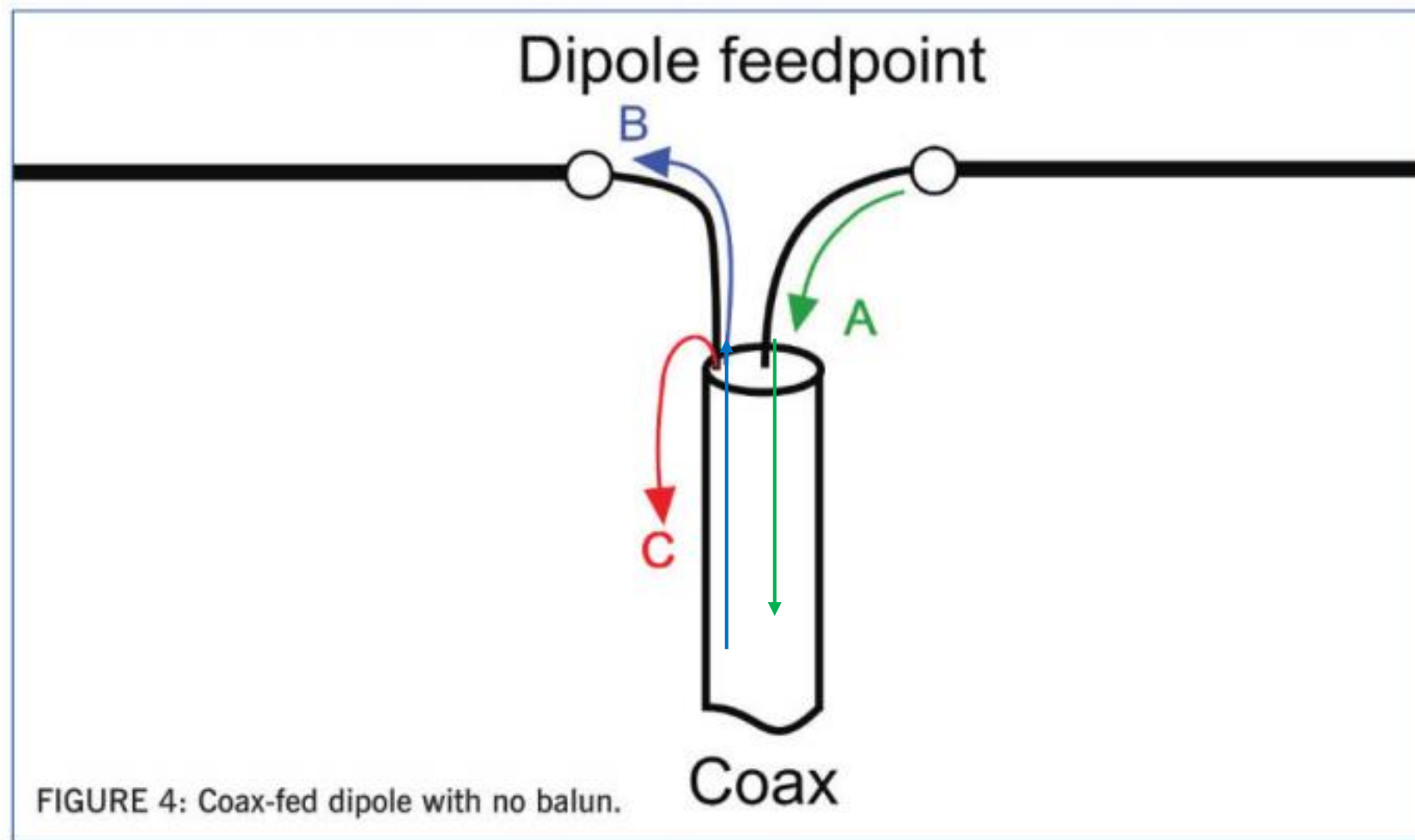


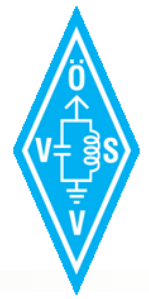
[Real case: asymmetrical system]



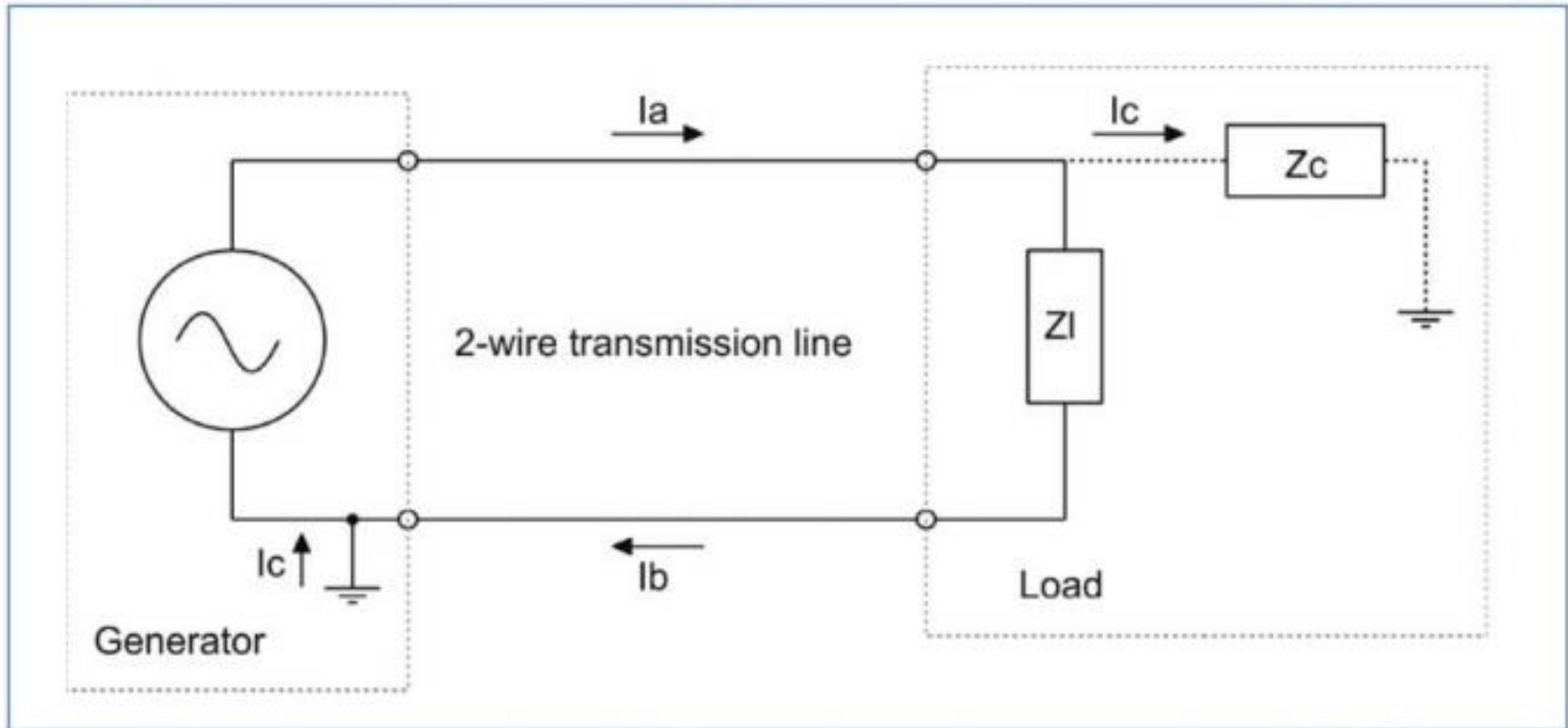


[Real case: asymmetrical system

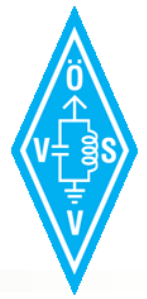




Real case: asymmetrical system



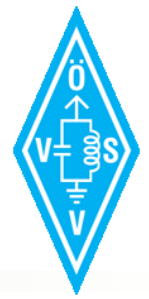
[Consequences of an asymmetrical system]



Distorted radiation pattern

=

RF in the shack!



[...opinions...]

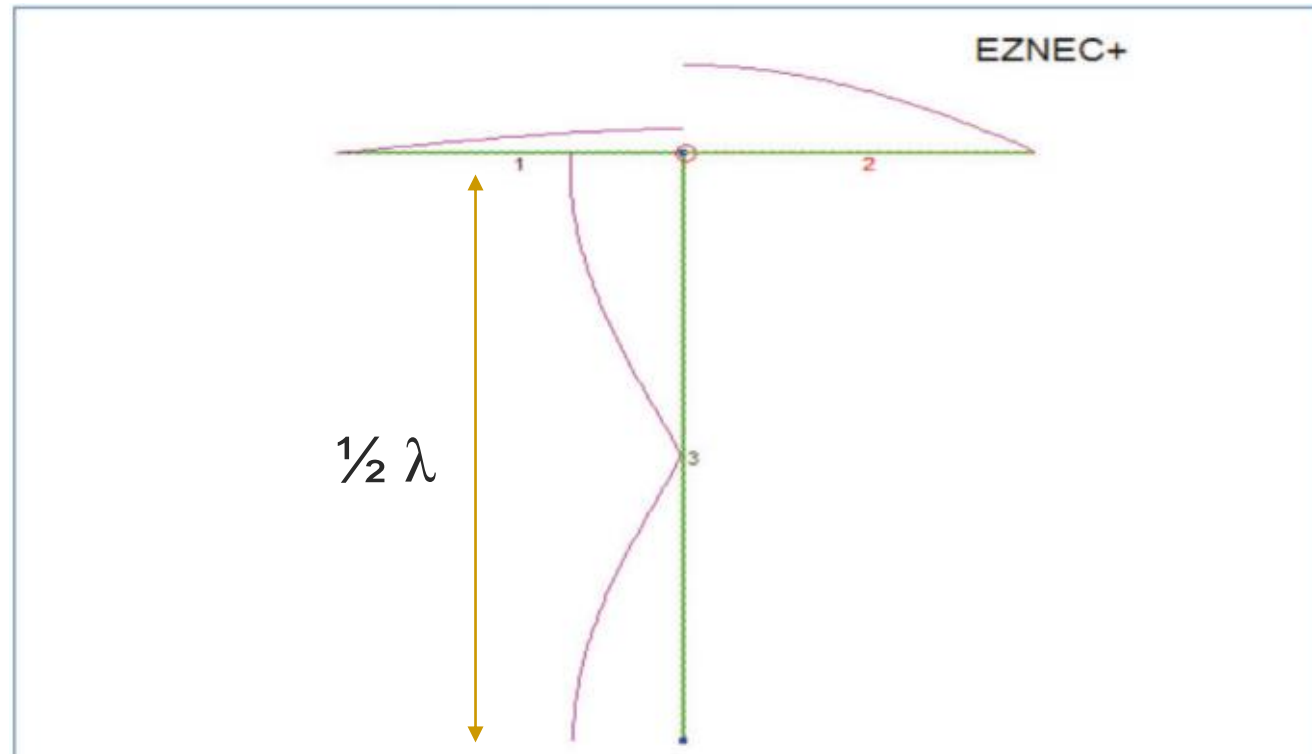
„...I have never used a Balun, my antenna works well even without it...“

„...since SWR increased after I installed the Balun, I removed it...“

„...I haven't any Balun, just a RF choke...“

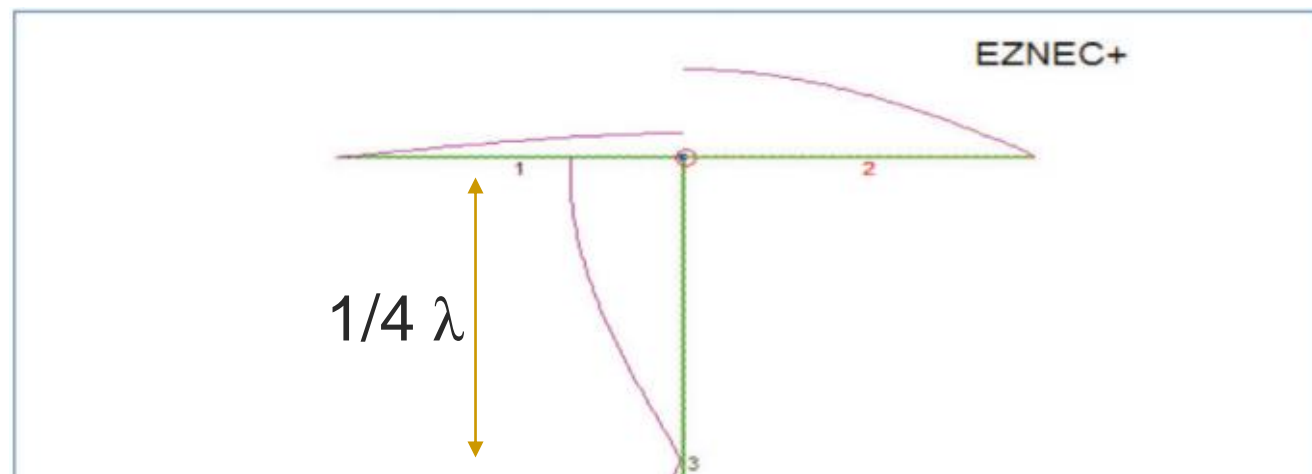


„...I have never used a Balun, my antenna works well even without it...“

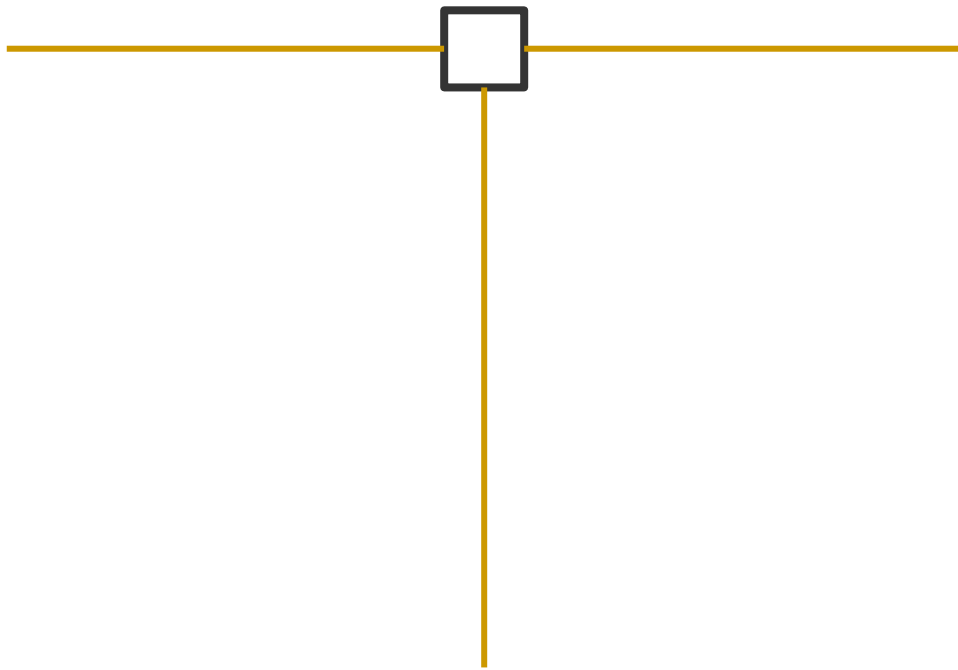
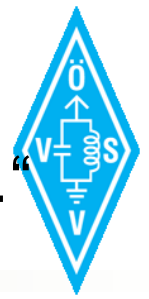




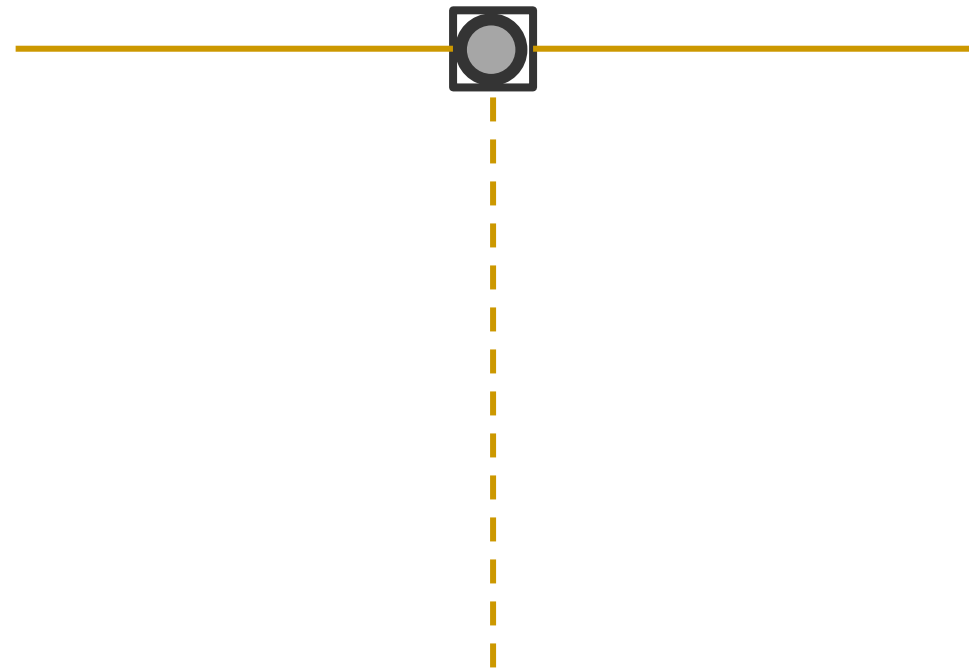
„...I have never used a Balun, my antenna works well even without it...“



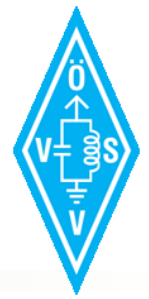
„...since SWR increased after I installed the Balun, I removed it...”



Tri-pole



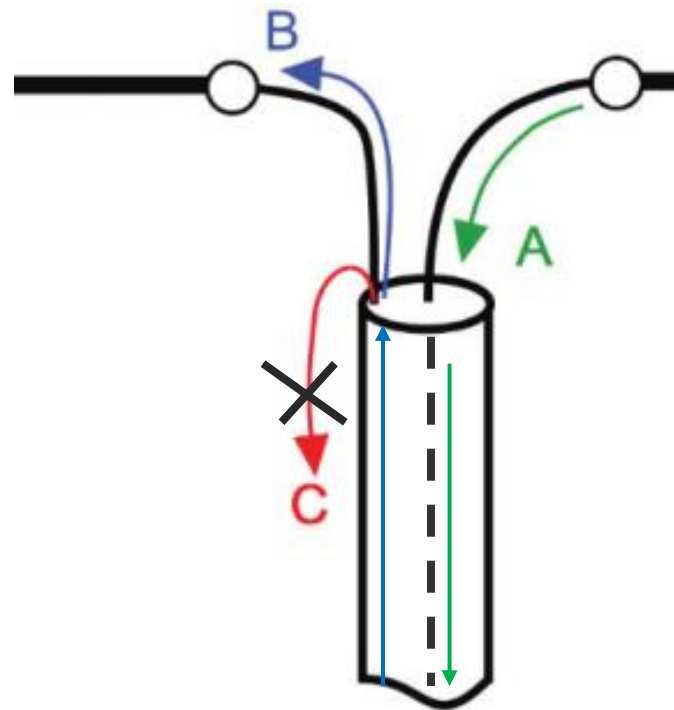
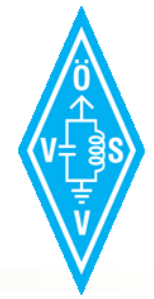
Di-pole



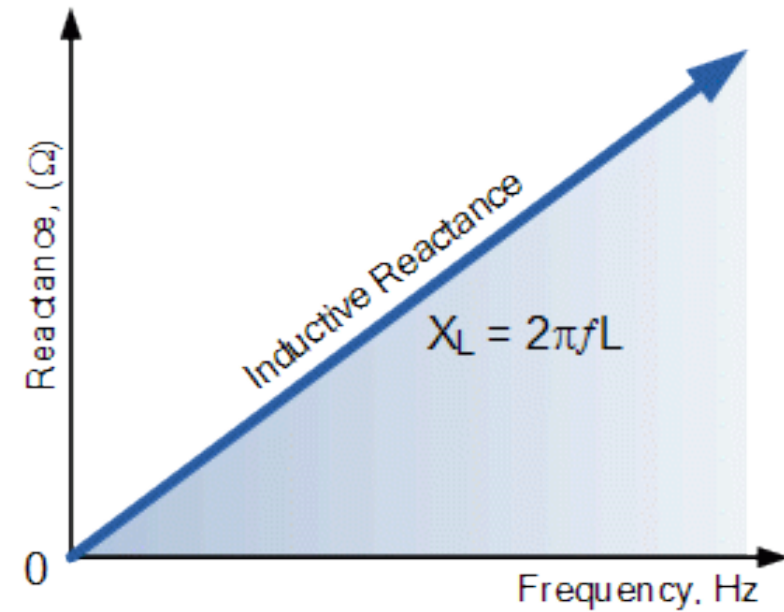
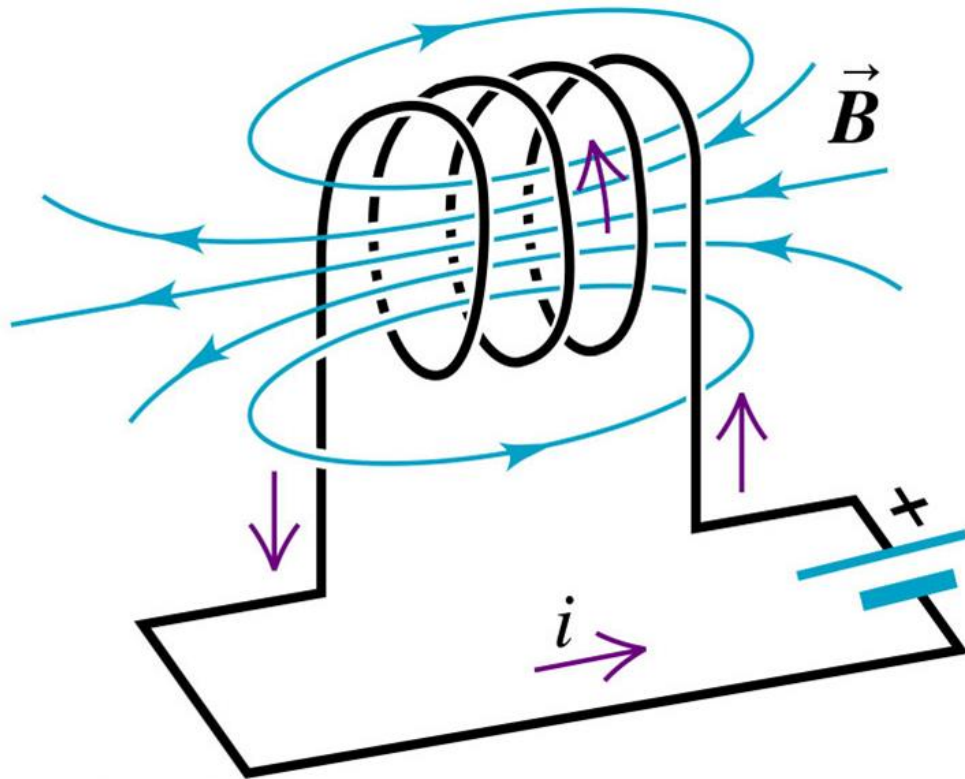
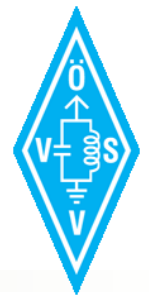
„...I haven't any Balun, just a RF choke...“

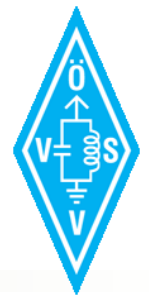
„...ich möchte keine Nudeln sondern Spaghetti...“

[How to block the Common Mode current?]

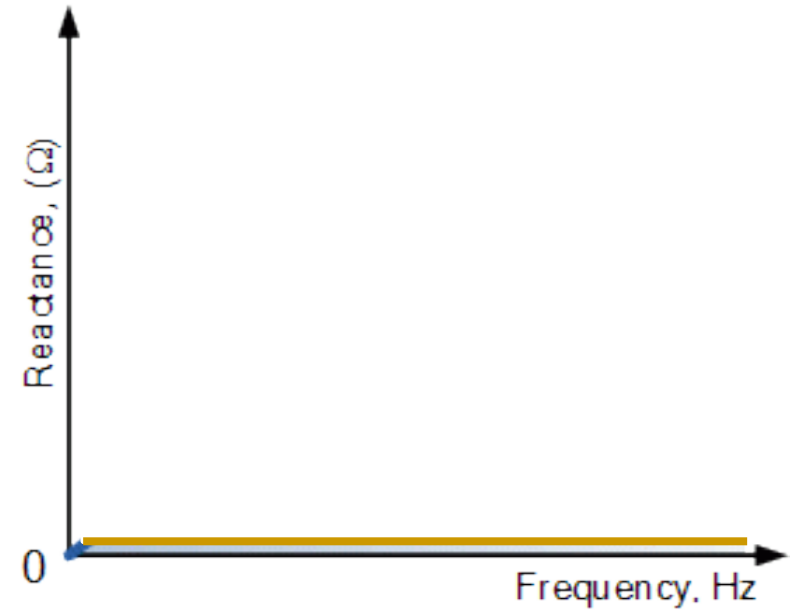
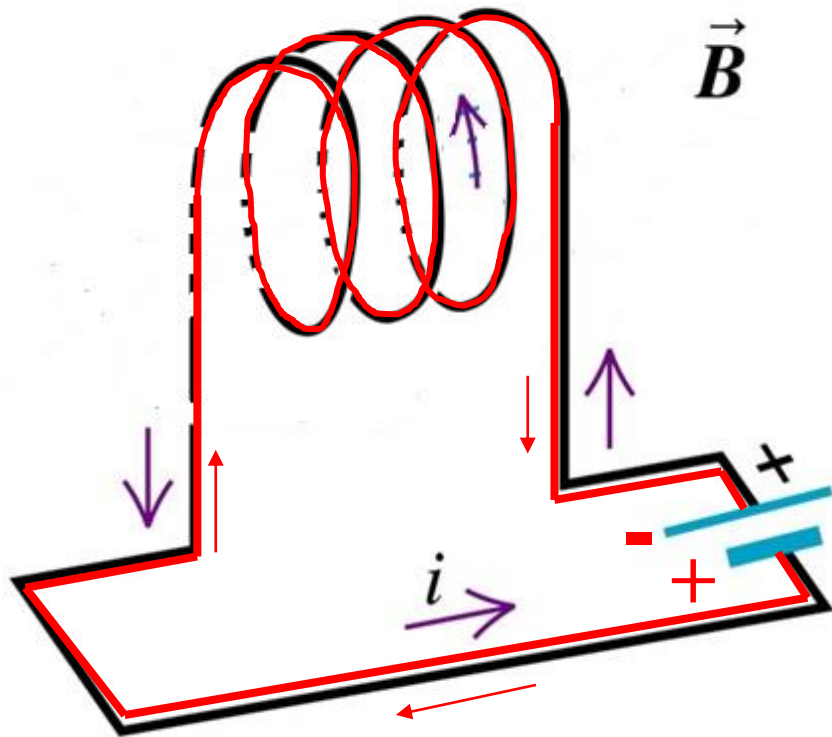


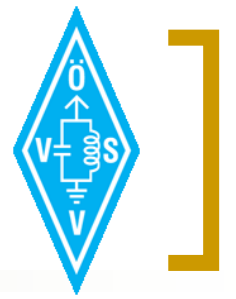
How to block the Common Mode current?





How to block the Common Mode current?





[LTspice simulation

Ex. 1,2 LTspice® simulation files – see Download

<https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html>

Practical Baluns



1:1 BalUn DIY kit 150 Watt - ...
hfkits.com · Disponibile



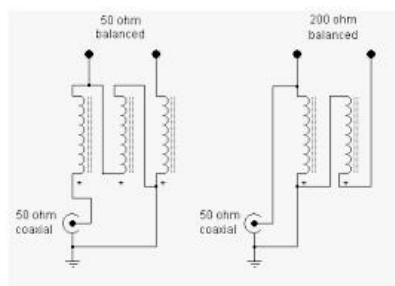
50:200 ohm (4:1) HF Balun or Unun Co...
palomar-engineers.com · Disponibile



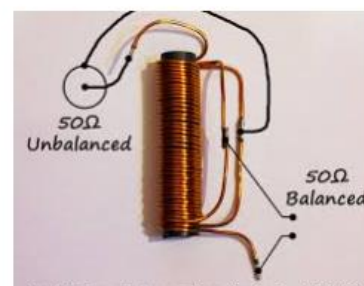
1:1 Voltage Balun for HF wire dipoles ...
m0ukd.com



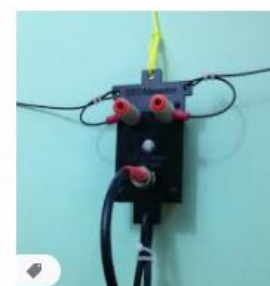
New 1:1 500W Waterproof HF Balun rod balun fo...
aliexpress.com · Disponibile



EA4EOZ, an amateur radio electronic enthusi...
ea4eoz.blogspot.com



1:1 Voltage Balun for HF wire dipoles - ...
m0ukd.com

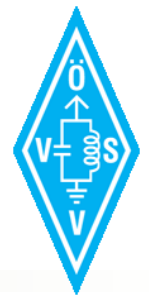


Buy Antenna Centre + 1:1 Balu...
sotabeams.co.uk · Disponibile



1:1 Waterproof HF Balun for 160m ...
aliexpress.com · Non disponibile





Ideal Balun

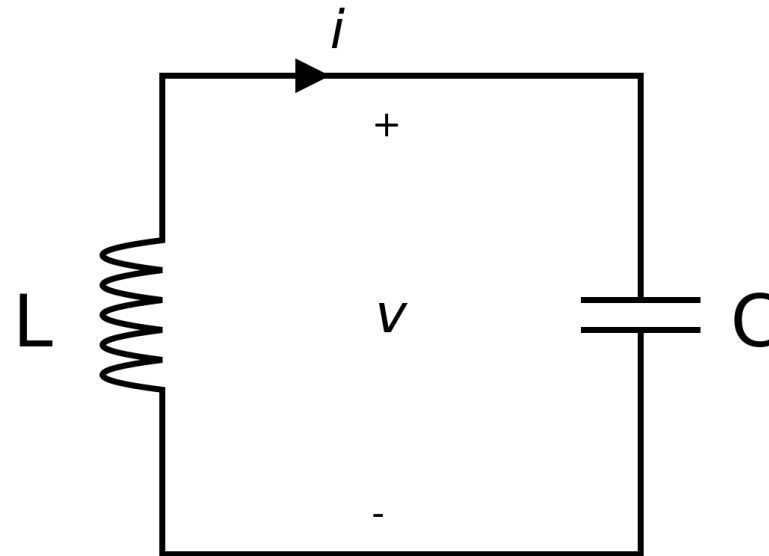
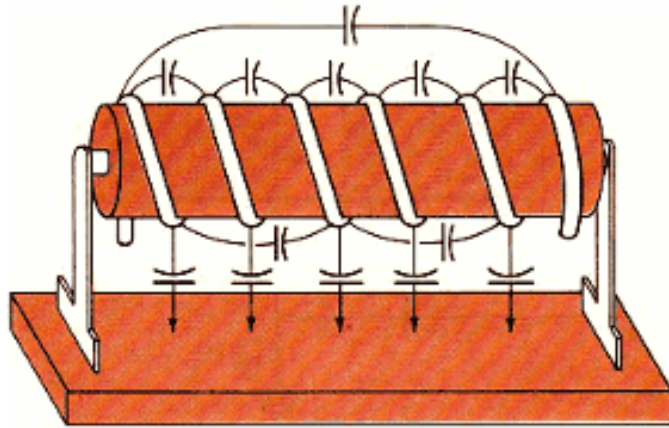
High Impedance for Common Mode Current

Broad band

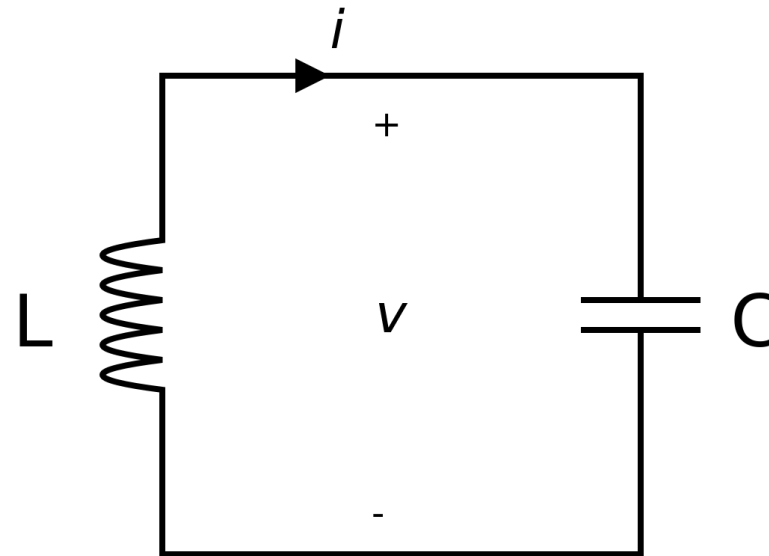
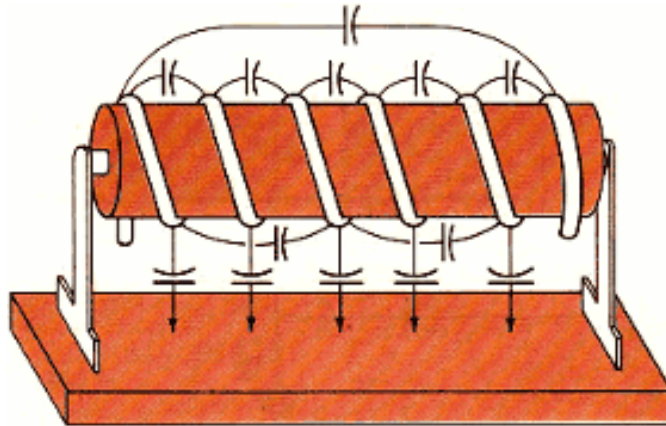
Low insertion loss

Power dissipation

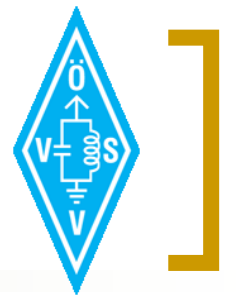
[Parasitic capacitance]



[Parasitic capacitance]



Housing: Plastic better than Metal

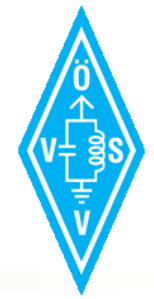


[LTspice simulation

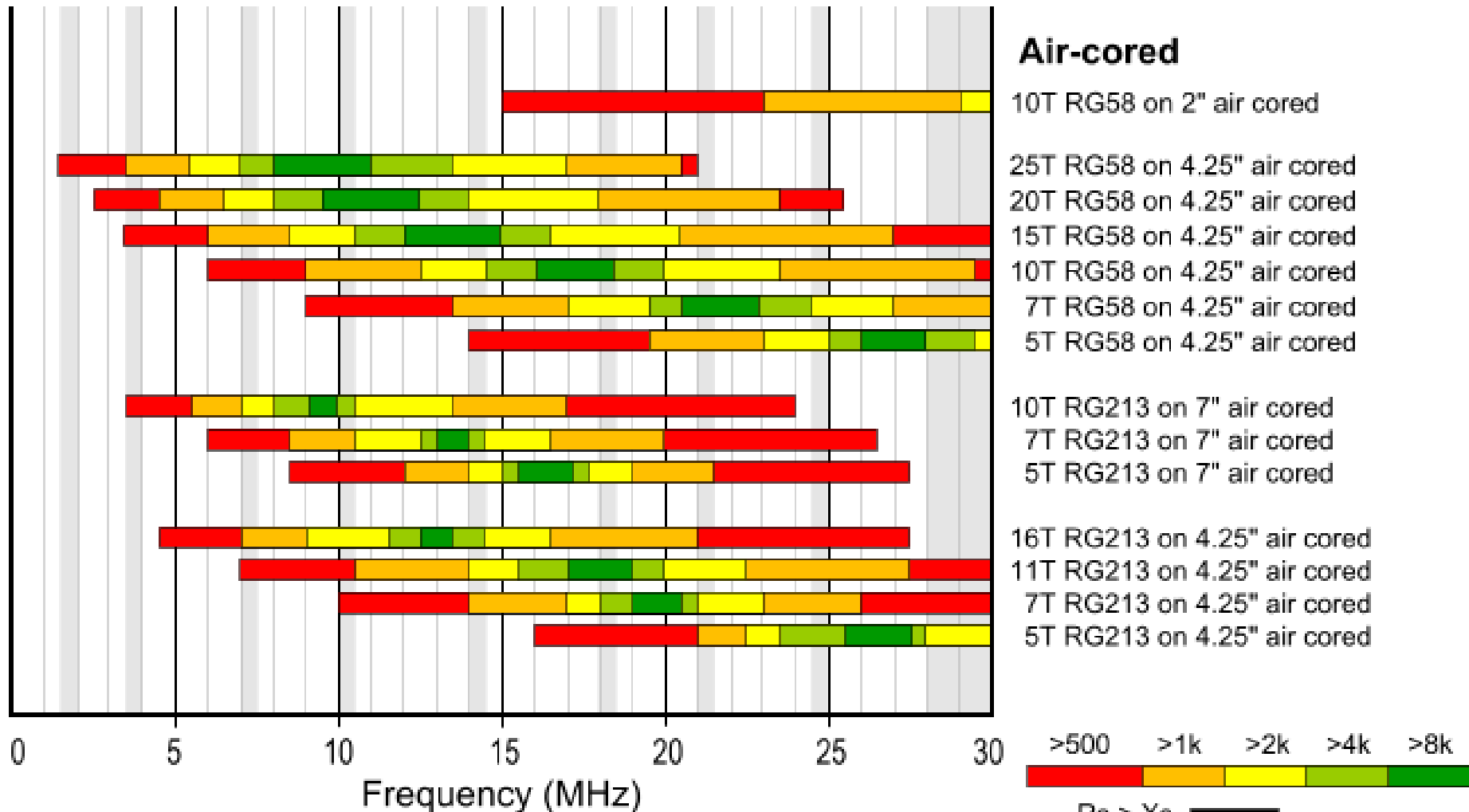
Ex. 3 LTspice[®] simulation files – see Download

<https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html>

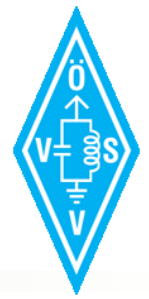
[Coax Cable Balun]



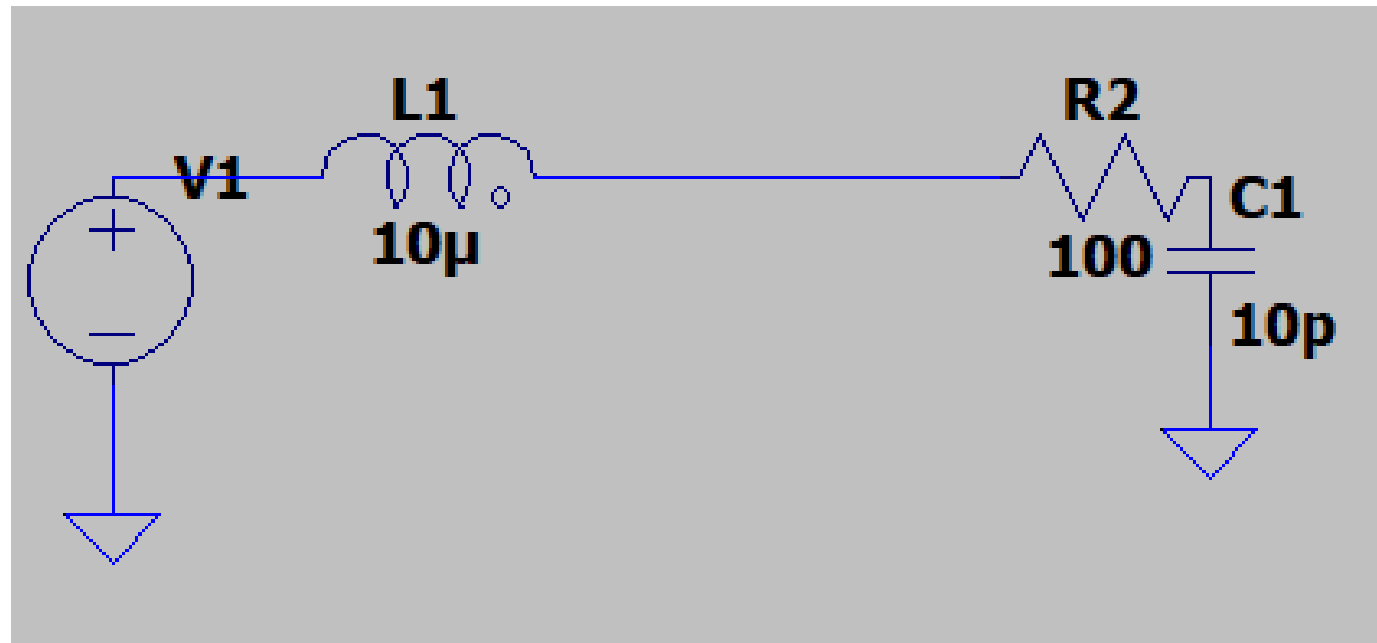
Guideline for Coax Cable Balun



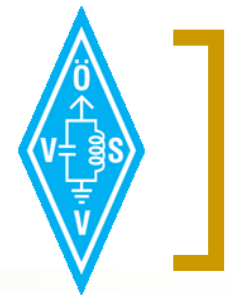
<http://www.karina.net/g3txq/chokes/>



Another problem with air coil Baluns complex impedance:



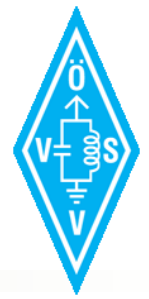
[LTspice simulation



Ex. 4,5 LTspice® simulation files – see Download

<https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html>

[Toroidal Cores]





Toroidal Cores

Toroid Coil Winding Calculator



Use this online tool to calculate the number of winding turns required to achieve the desired inductance with ferrite and iron powder toroidal cores.

Material Type:

Iron Powder Ferrite

Inductance

mH

Core Size

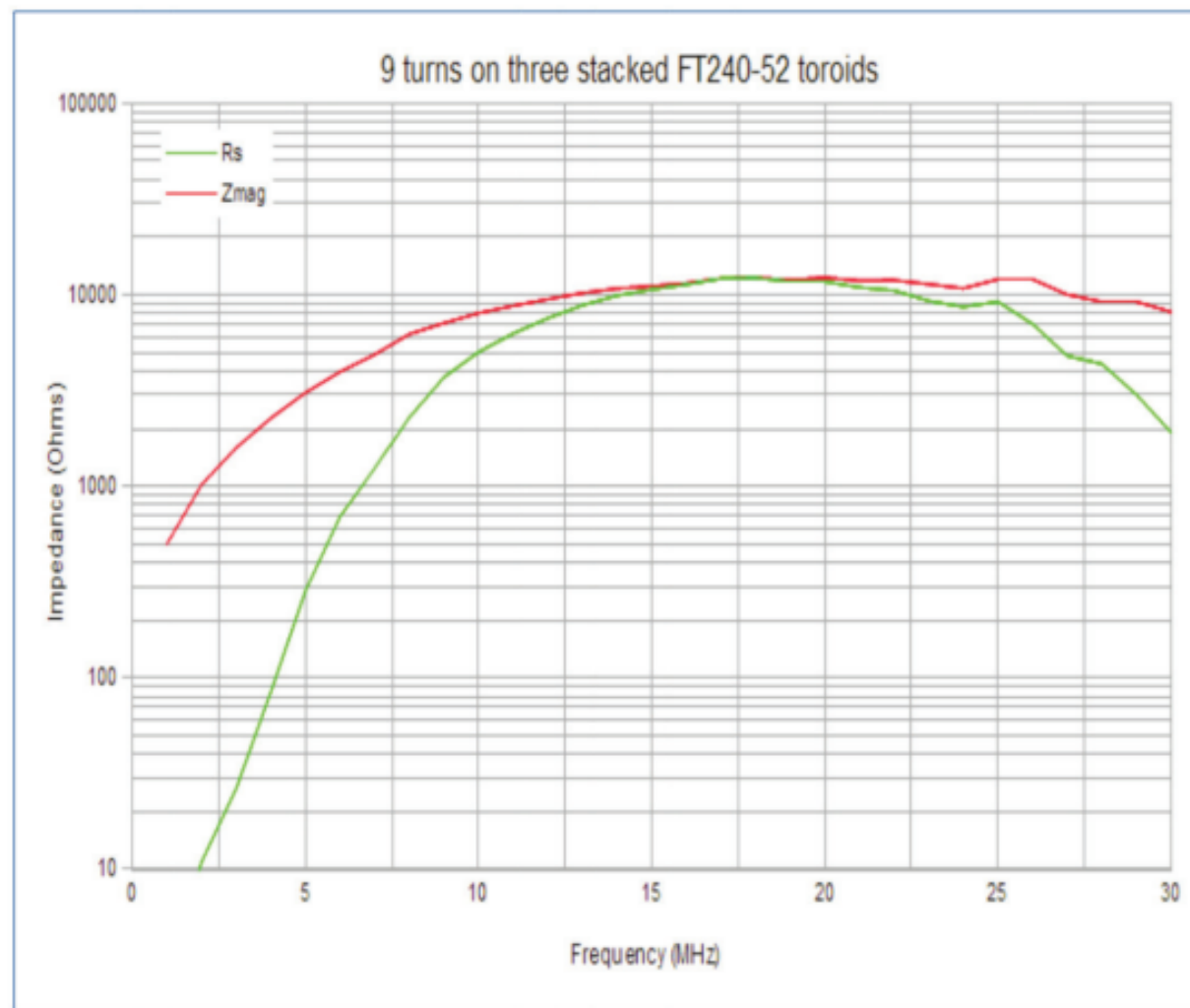
Material Number

Calculate

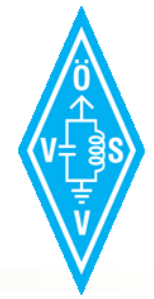


<https://www.66pacific.com/calculators/toroid-coil-winding-calculator.aspx>

[Ferrite Cores]



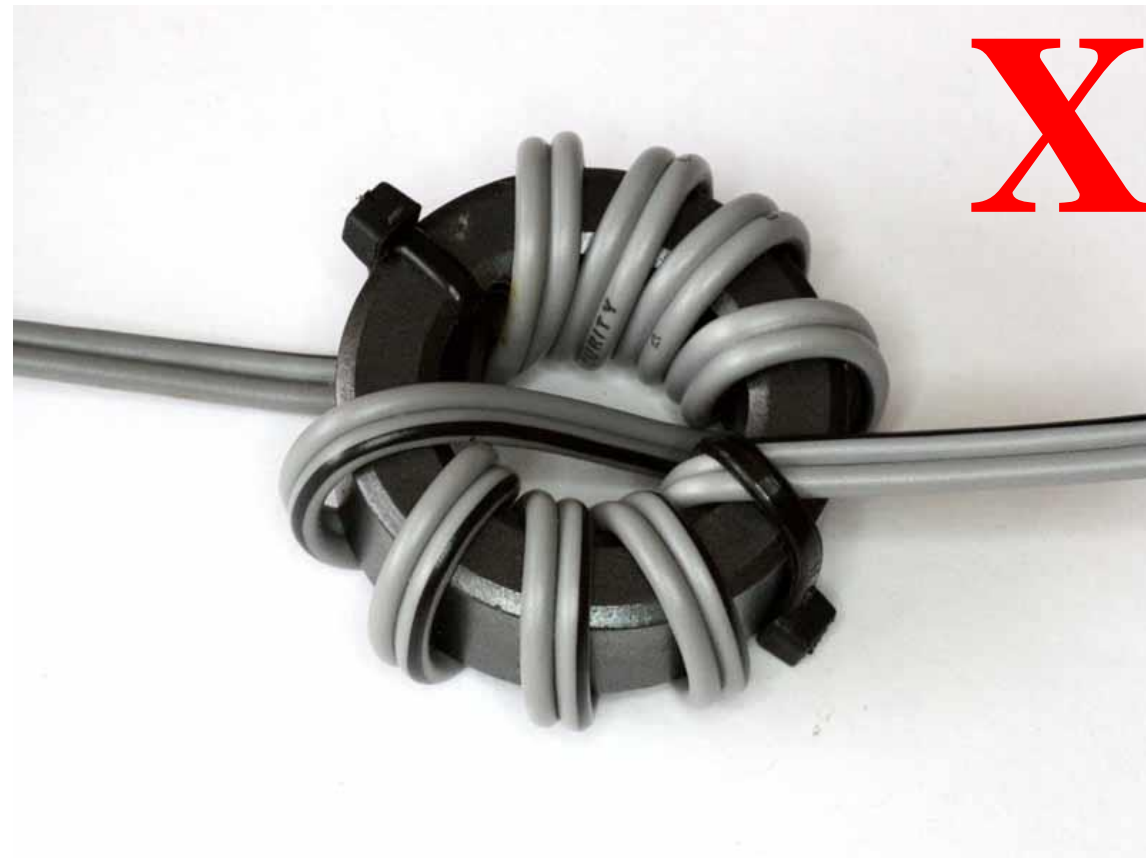
[Ferrite Cores]



[Ferrite Cores]

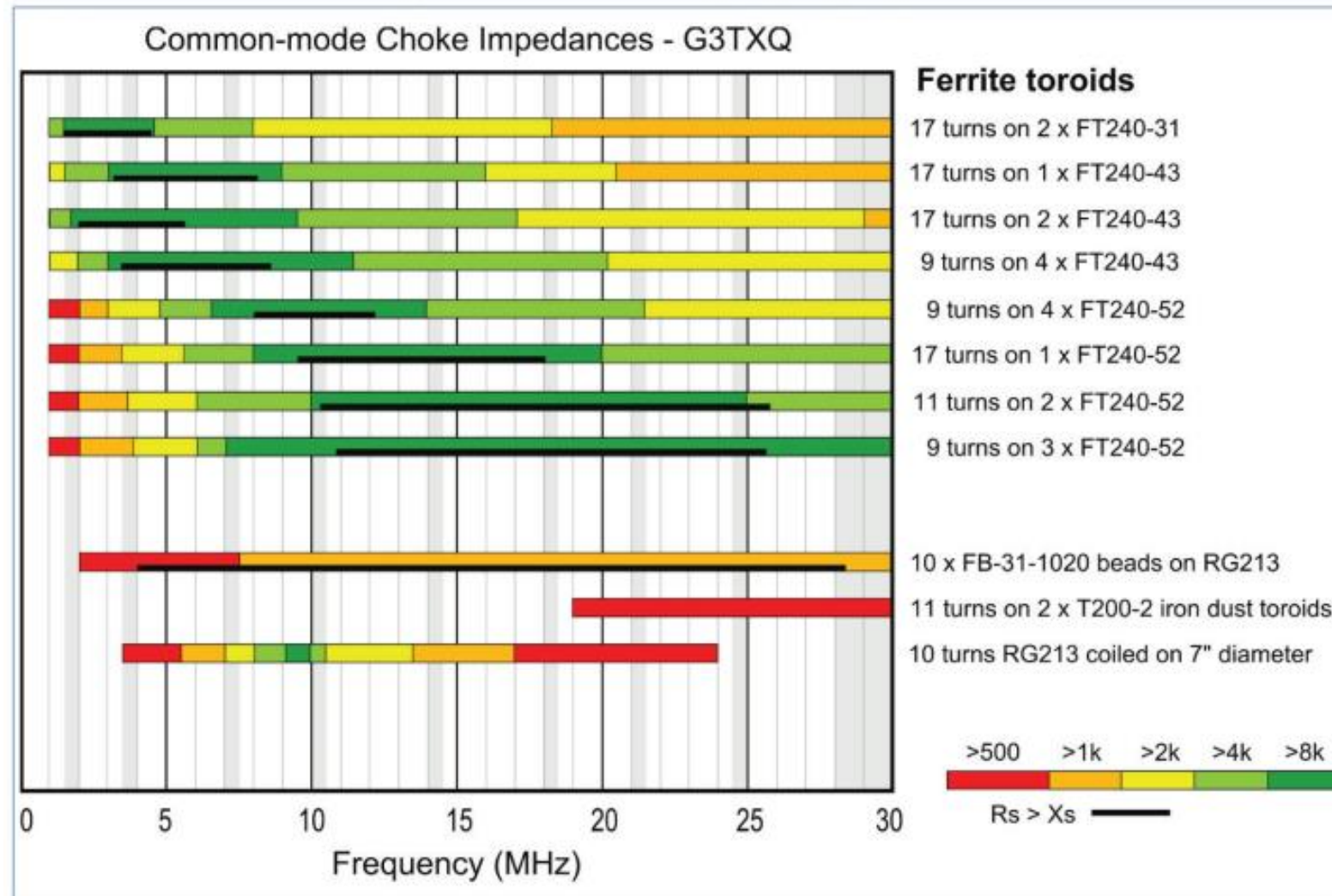


Impedance: 50 ohm



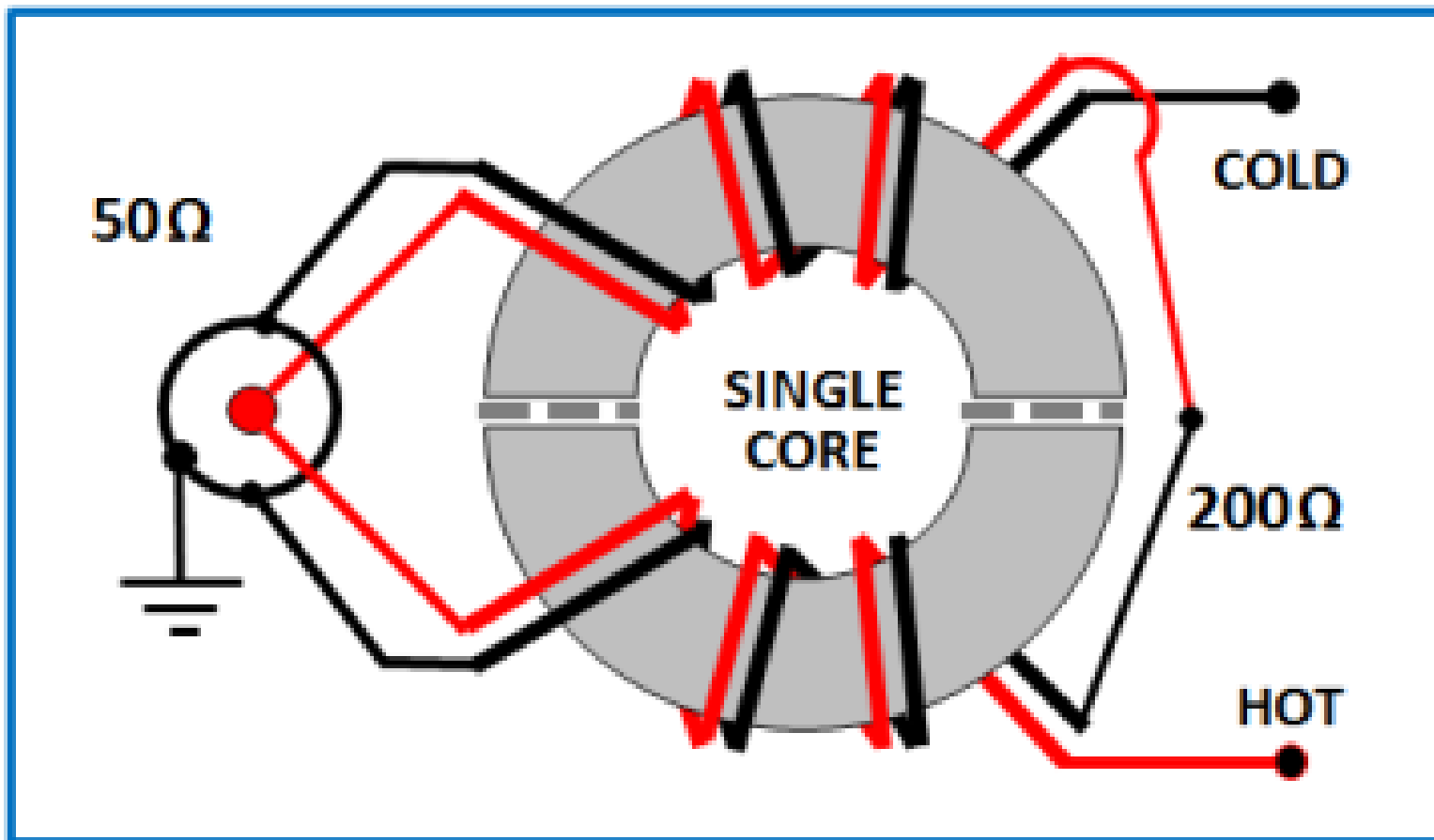
Impedance: ????

Ferrite Cores



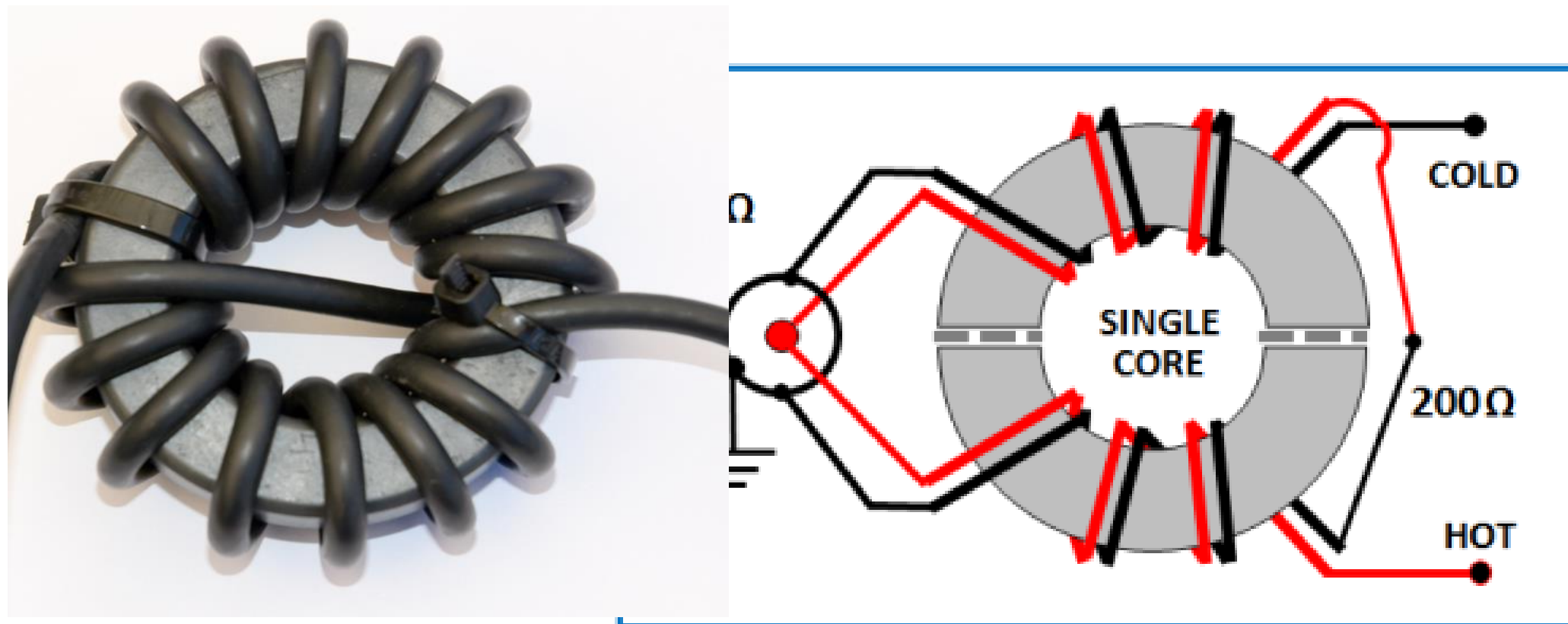


[Balun vs transformer]



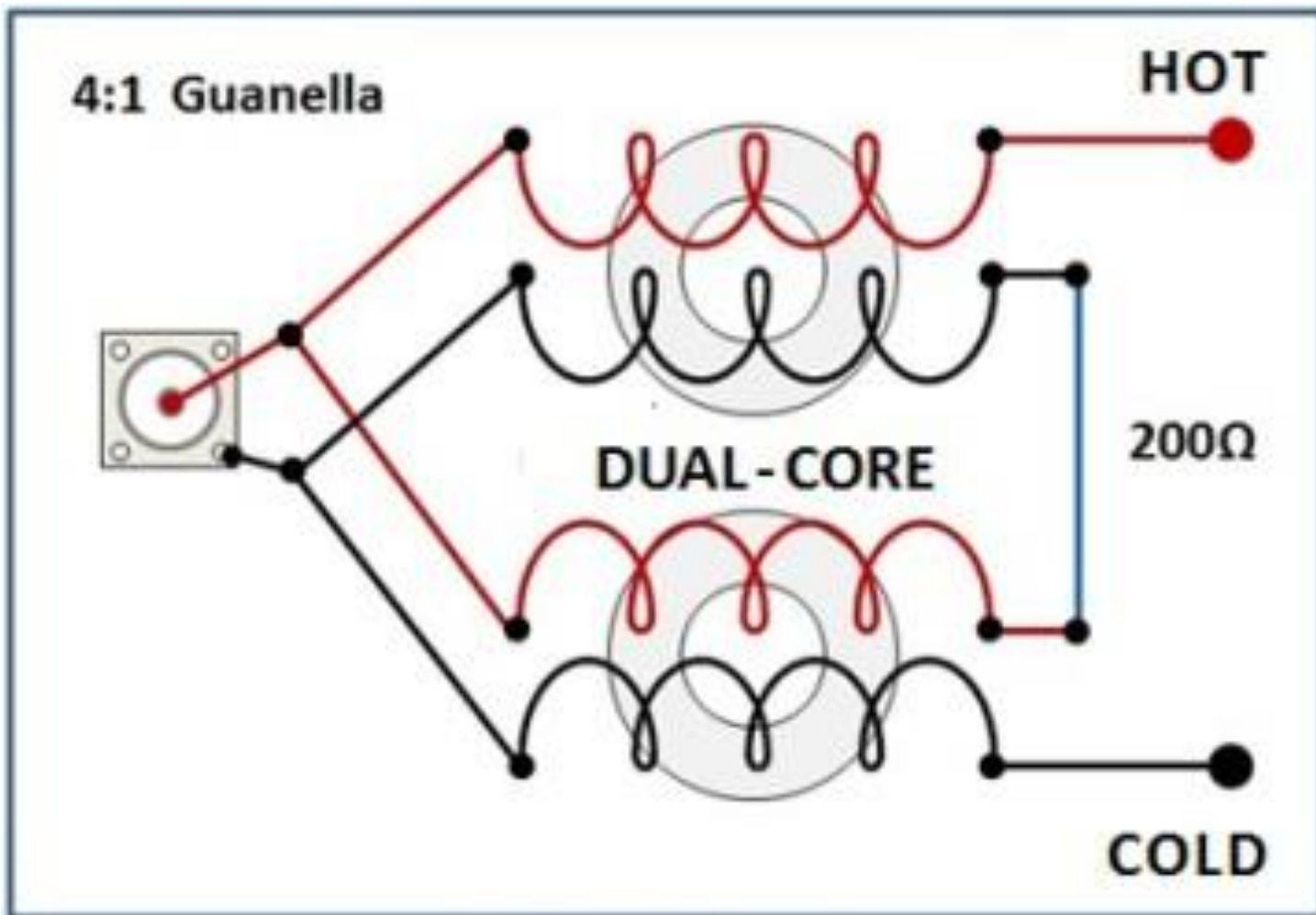
4:1 impedance Transformer
IS NOT A BALUN

[Balun + transformer]



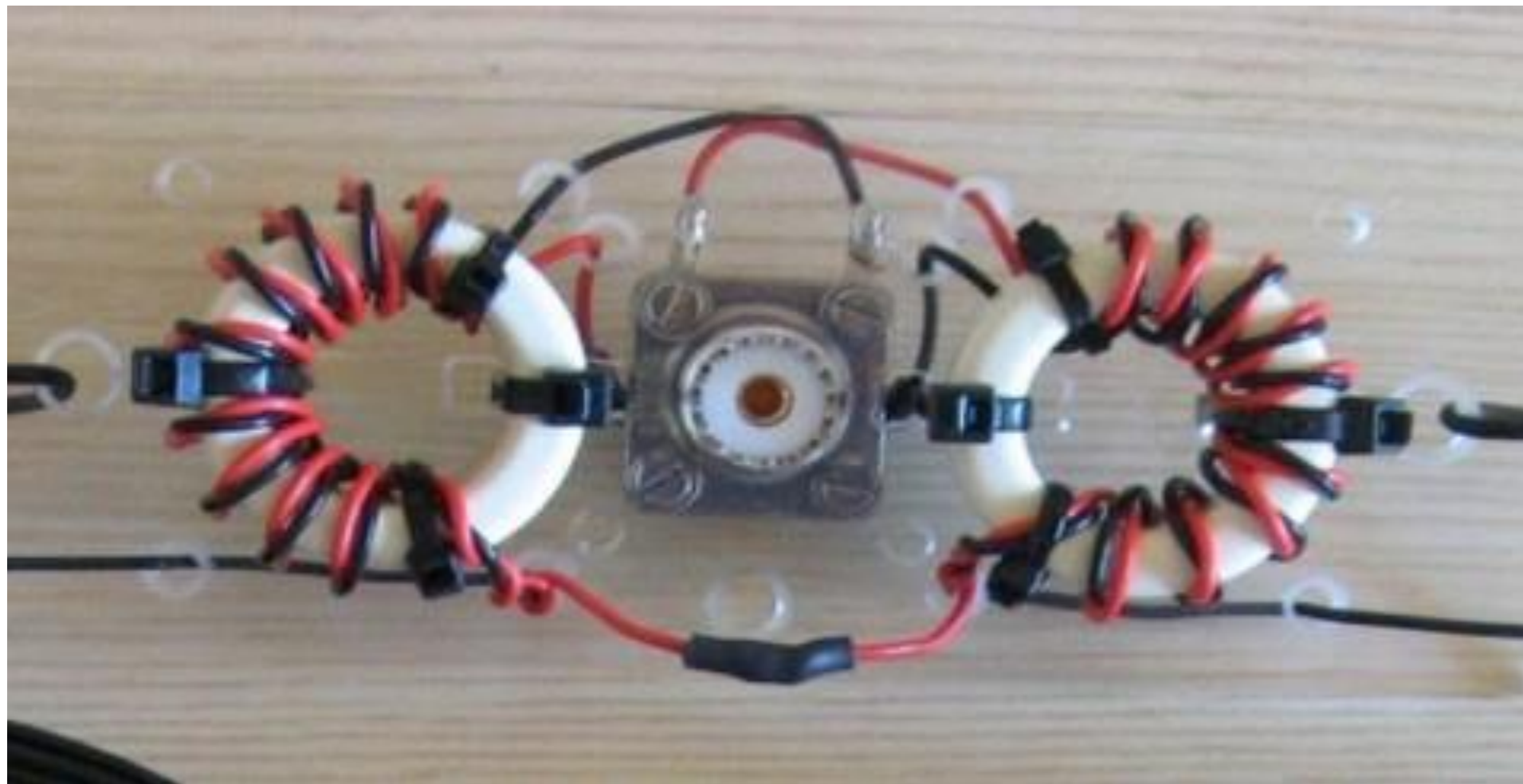


[4:1 Guanella Balun]



4:1 impedance Transformer
+
BALUN

[4:1 Guanella Balun]



[Good offer??]



Für größere Ansicht Maus über das Bild ziehen

Acreative 10-160 Meter Amateur-Schinken HF Band Radio Draht Loop Antenne Balun Unun DIY Kit T200-2 Typ 2 Eisen Pulver Ferrit Toroid Core 16 AWG 1,3 mm emailliert Magnet Wickeldraht

Marke: Acreative

★★★★☆ 22 Sternebewertungen

| 3 beantwortete Fragen

Preis: 48,99 \$

- Alle Hardware, um Ihre eigenen Balun/Unun bis zu 1,5 kW zu bauen, für 1:1, 4:1 oder 9:1 Balun/UNUN wie gewünscht, viele schöne Bauplan online verfügbar (wir bieten keinen Bauplan).
- Präzise vorgebohrte wasserdichte Balunbox High Q Low Loss T200-2 Typ 2 Eisen Pulver Toroid Kern (Optimaler Resonant Freq Bereich 0-40Mhz)
- Emaillierter Magnet-Aufwicklungsdraht, 1,30 mm (Temperaturklasse 155 °C), vernickelte Messing-Verbindungsstücke
- Maße der Balun-Box: 8 x 8 x 6 cm.
- (zerlegtes Set) Lieferumfang: 1 x SO-259 Antennensteckdose, 2 x Antennendeckel, für bis zu 8 AWG Draht, Muttern, Schrauben, Unterlegscheiben, Drahtklemmen im Lieferumfang enthalten.



Für größere Ansicht Maus über das Bild ziehen

AEcreative 10-160 Meter Amateur-Schinken HF Band Radio Draht Loop Antenne Balun Unun DIY Kit T200-2 Typ 2 Eisen Pulver Ferrit Toroid Core 16 AWG 1,3 mm emailliert Magnet Wickeldraht

Marke: AEcreative

★★★★☆ 22 Sternebewertungen

| 3 beantwortete Fragen

Preis: 48,99 \$

- Alle Hardware, um Ihre eigenen Balun/Unun bis zu 1,5 kW zu bauen, für 1:1, 4:1 oder 9:1 Balun/UNUN wie gewünscht, viele schöne Bauplan online verfügbar (wir bieten keinen Bauplan).
- Präzise vorgebohrte wasserdichte Balunbox High Q Low Loss T200-2 Typ 2 Eisen Pulver Toroid Kern (Optimaler Resonant Freq Bereich 0-40Mhz)
- Emaillierter Magnet-Aufwicklungsdraht, 1,30 mm (Temperaturklasse 155 °C), vernickelte Messing-Verbindungsstücke
- Maße der Balun-Box: 8 x 8 x 6 cm.
- (zerlegtes Set) Lieferumfang: 1 x SO-259 Antennensteckdose, 2 x Antennendeckel, für bis zu 8 AWG Draht, Muttern, Schrauben, Unterlegscheiben, Drahtklemmen im Lieferumfang enthalten.



Iron powder has far too low permeability!



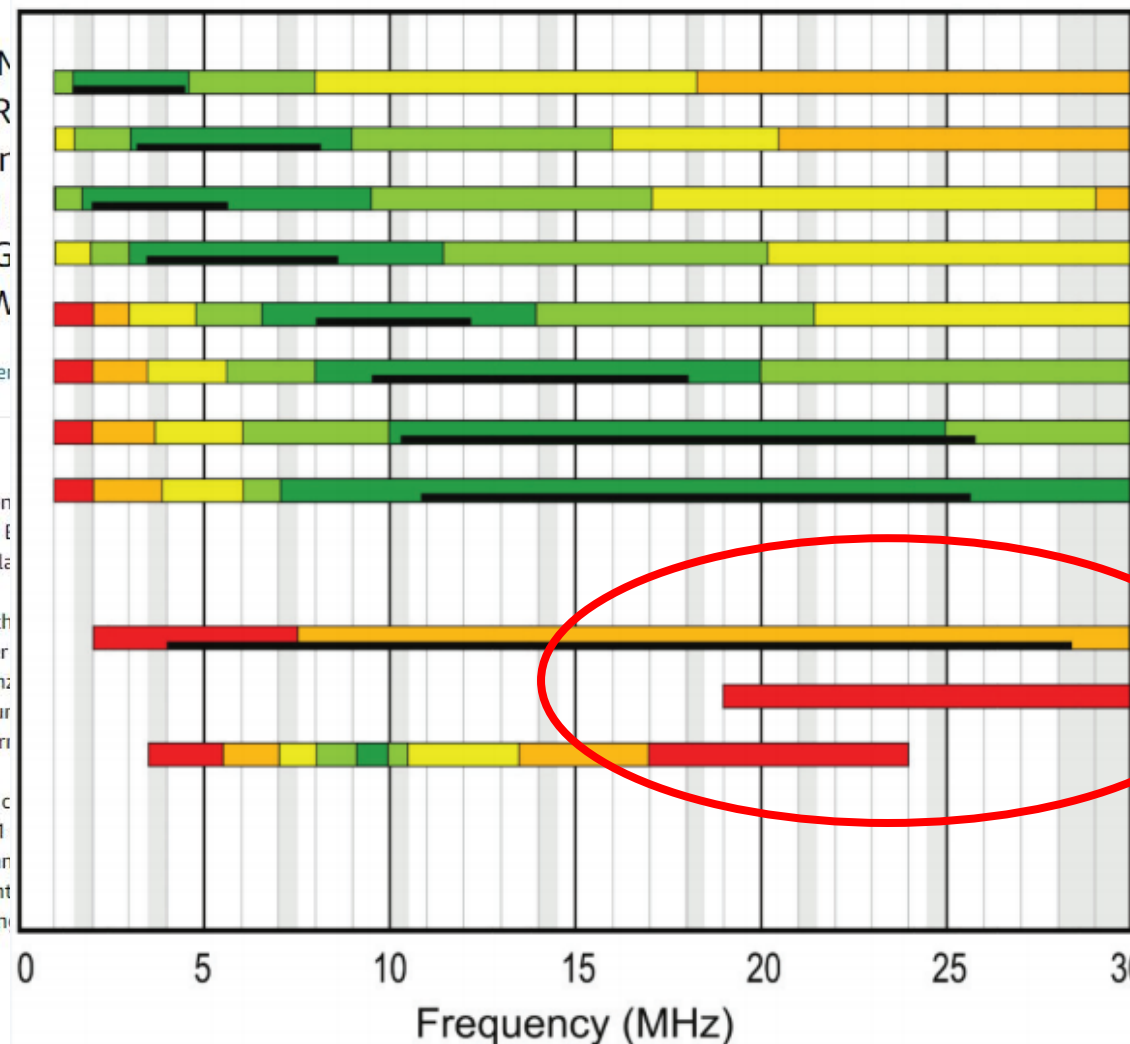
Für größere Ansicht Maus über das Bild ziehen

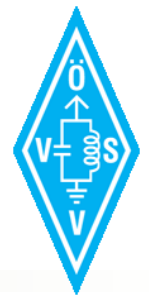
AEcreative 10-160 MHz
Schinken HF Band R
Loop Antenne Balun
T200-2 Typ 2 Eisen
Toroid Core 16 AWG
emalliert Magnet W

Marke: AEcreative
★★★★☆ 22 Sternebewer
| 3 beantwortete Fragen

Preis: 48,99 \$

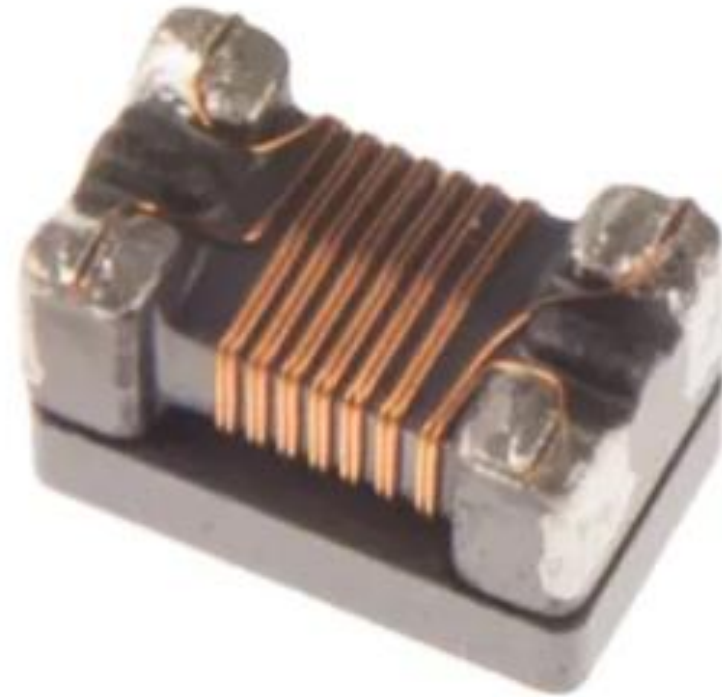
- Alle Hardware, um Ihre eigenen zu bauen, für 1:1, 4:1 oder 9:1 (gewünscht, viele schöne Baupläne bieten keinen Bauplan).
- Präzise vorgebohrte wasserdichte Loss T200-2 Typ 2 Eisen Pulver Resonant Freq Bereich 0-40MHz
- Emallierter Magnet-Aufwicklung (Temperaturklasse 155 °C), verschiedene Verbindungsstücke
- Maße der Balun-Box: 8 x 8 x 6 cm
- (zerlegtes Set) Lieferumfang: 1 Antennensteckdose, 2 x Antennendräht, Muttern, Schrauben, Unterdrahtklemmen im Lieferumfang



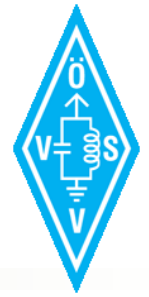


[Not only for HAMs]

Chip Baluns



Wrap-up

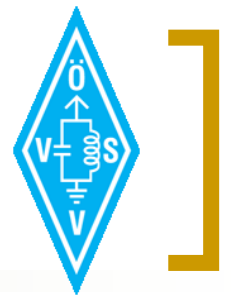


Our antenna are almost ALWAYS unbalanced
→ balun blocks CM Currents

Air vs ferrite core balun

Balun vs impedance transformer

Ferrite vs iron powder



Useful links

<https://gm3sek.files.wordpress.com/2019/01/G3TXQ-RC.pdf>

← Best article on RF chokes

<https://www.eznec.com/Amateur/Articles/Baluns.pdf>

← Other great article on baluns

https://www.dl4zao.de/_downloads/Balun_dl4zao.pdf

← auf Deutsch

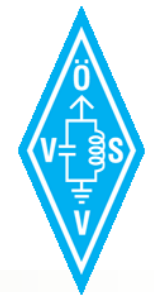
<https://www.dj0ip.de/balun-stuff/>

← Balun stuff from the „Guru“ Rick DJ0IP

<https://www.dj0ip.de/ef-cmc-chokes/>

<https://www.66pacific.com/calculators/toroid-coil-winding-calculator.aspx> ← Ferrite cores calculator

[Questions?]



Fragestunde

[Vortrag: BALUNs]



Vielen Dank für euer Interesse!

Innsbruck, 19.3.2021

**WIR SAGEN
DANK**