Cost-effective Ferrite Chokes and Baluns

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Ferrite Chokes and Baluns

Topics:

1. Why might I need one?
2. What makes a good choke?
3. Three recommended designs

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Chokes and baluns: Why might I need one?

Q1: What are RF chokes for?

A: To stop RF currents from flowing where they aren't wanted

…and so, to help solve EMC problems.

Chokes and baluns: Why might I need one?

Q1: What are RF chokes for?

A: To stop RF currents from flowing where they aren't wanted.

Q2: What are baluns for?

A: Er…to make my antenna balanced?

Wrong!

Chokes and baluns: Why might I need one?

Q1: What are RF chokes for?

A: To stop RF currents from flowing where they aren't wanted.

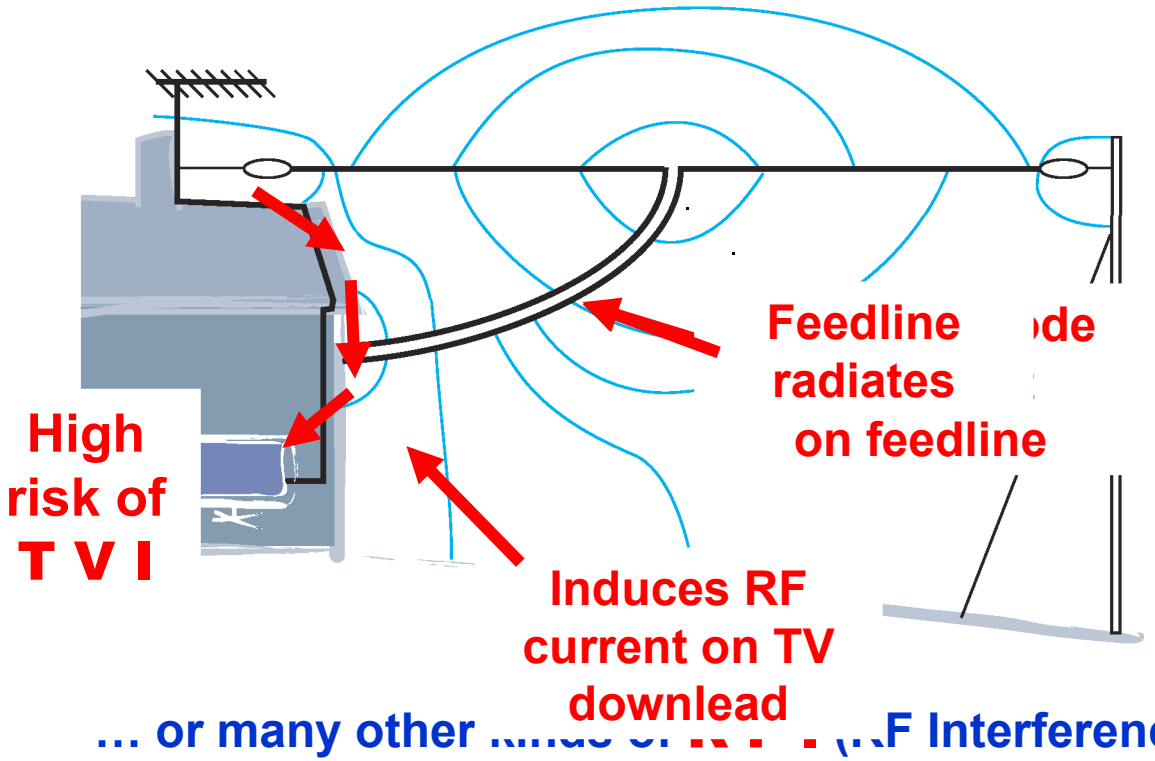
Q2: What are baluns for?

A: Exactly the same as for Q1: to stop RF currents from flowing where they aren't wanted.

Fields around a balanced dipole: the textbook picture

Chokes and baluns: Why might I need one?

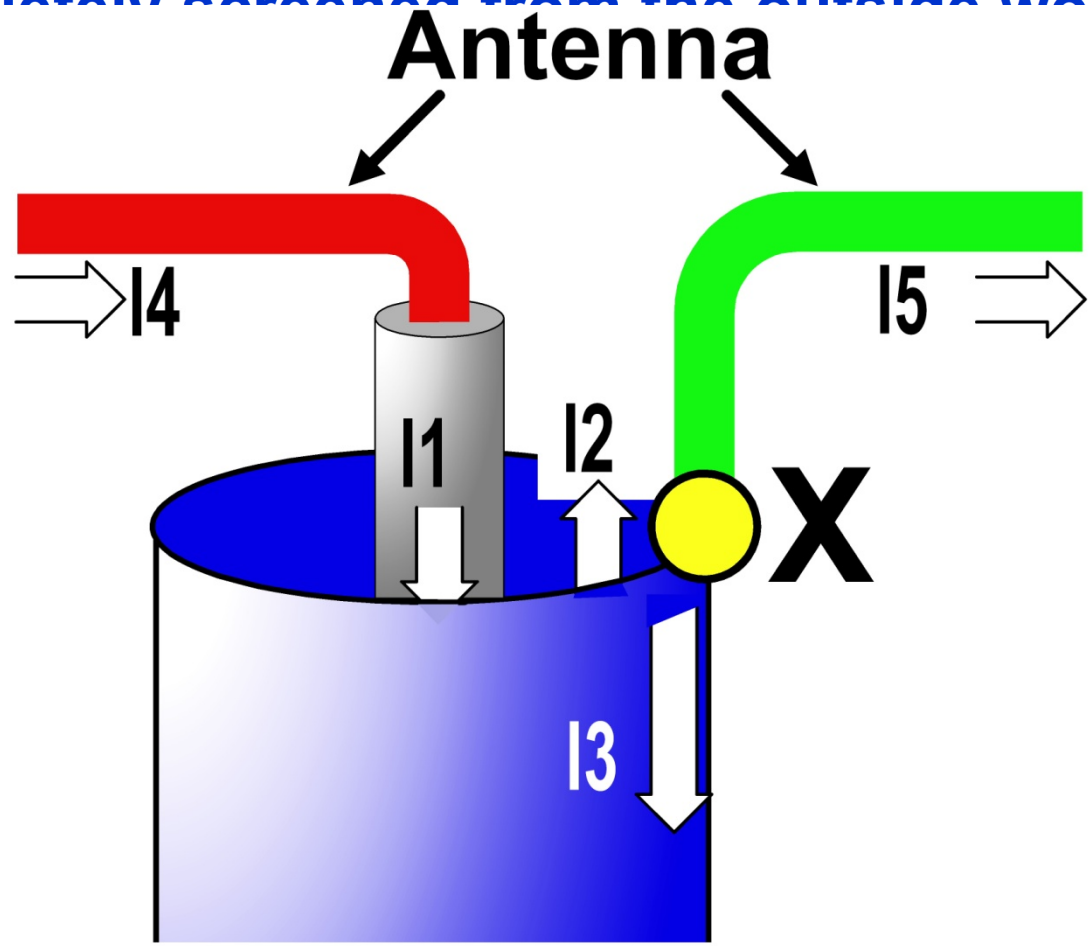
Reality looks like this…



… or many other [illegible] (RF Interference)

Coax basics:

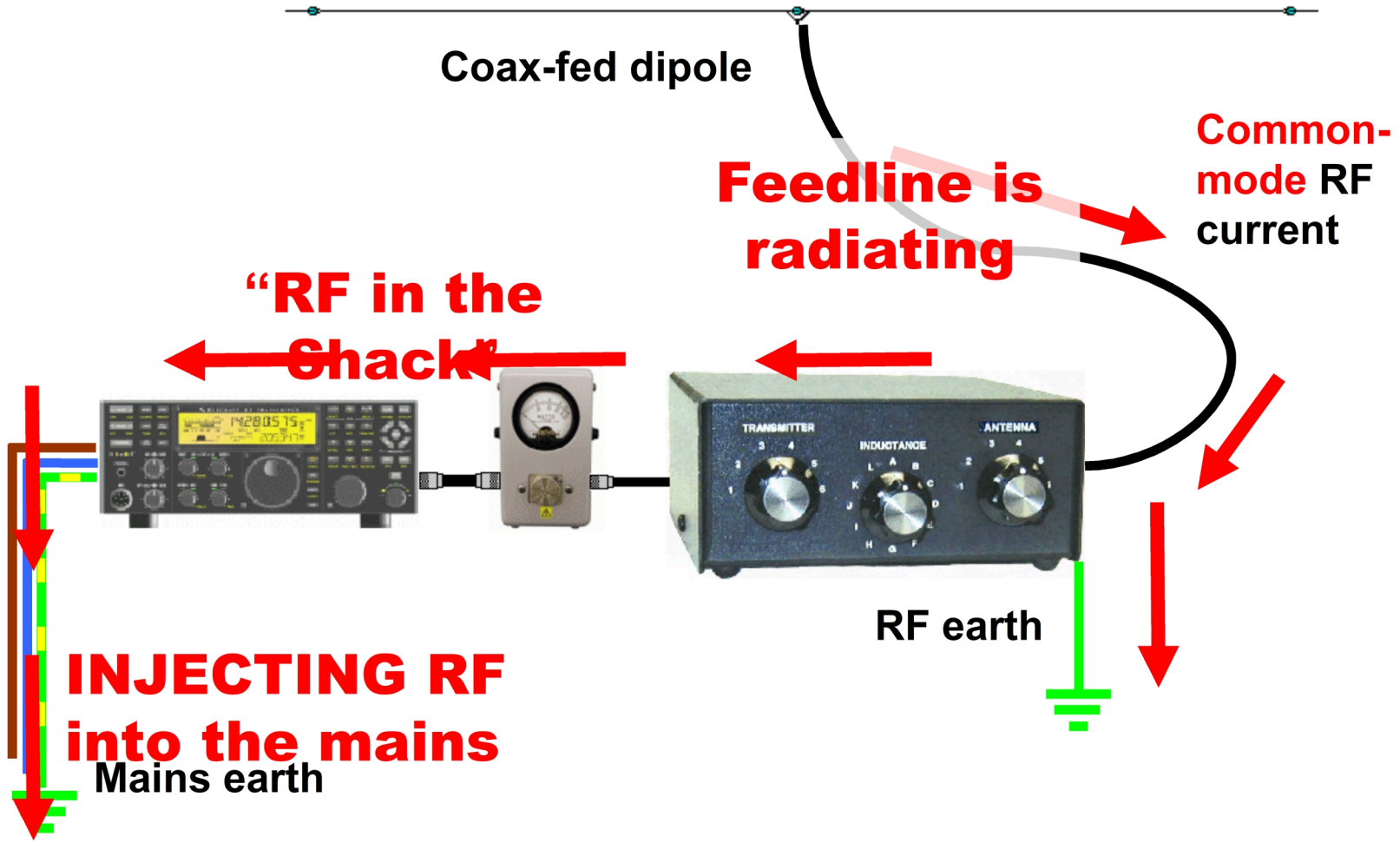
1. The inside of a coaxial cable is private –
   comp[illegible]ld.
2. At R[illegible]
   conc[illegible]
   Ar[illegible]
   fee[illegible]
   insid[illegible]
4. The [illegible]
   the c[illegible]
   com[illegible]



[illegible]-mode
[illegible]ows on
[illegible]urface

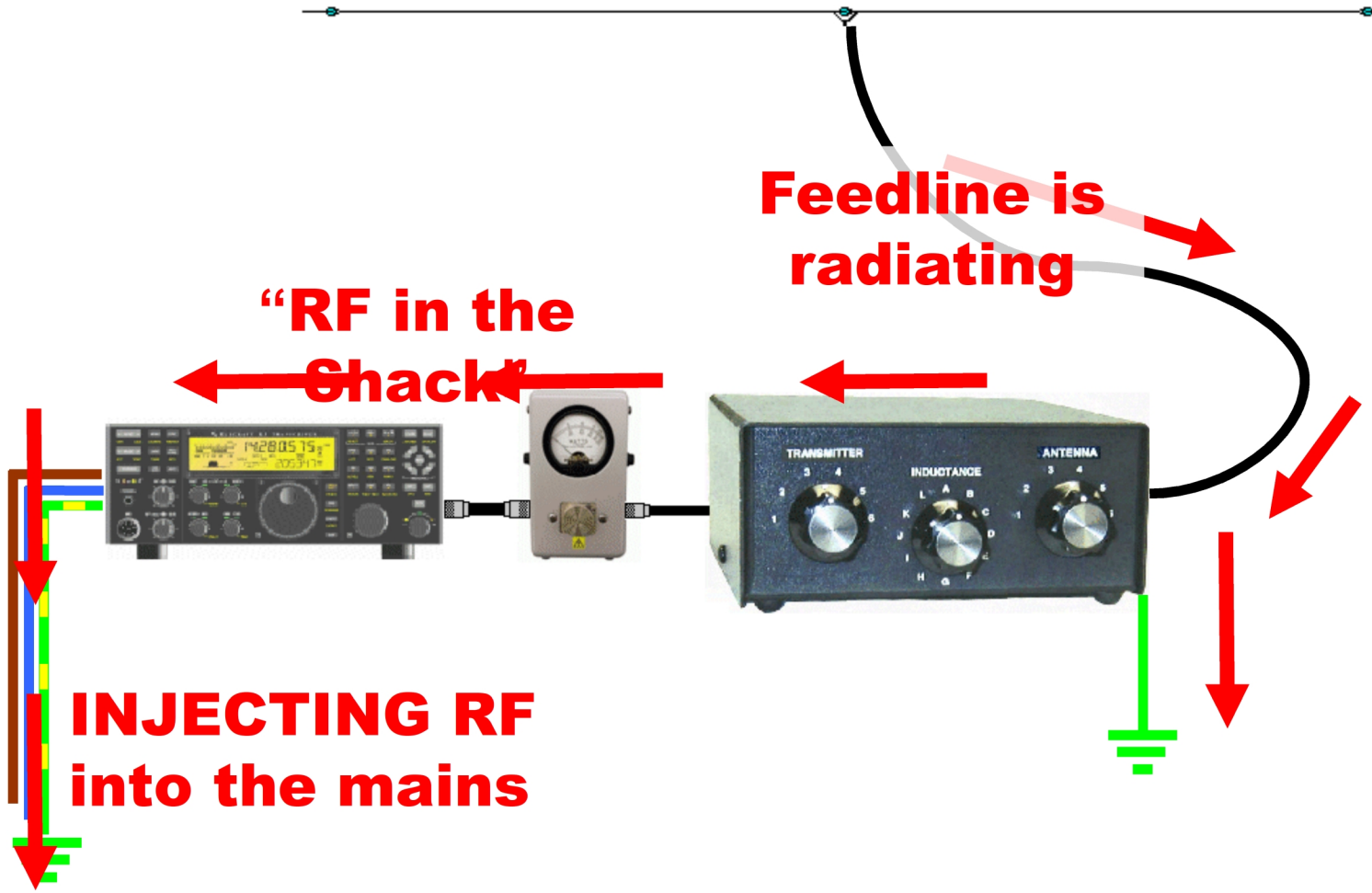
Chokes and baluns: Why might I need one?

Another example…



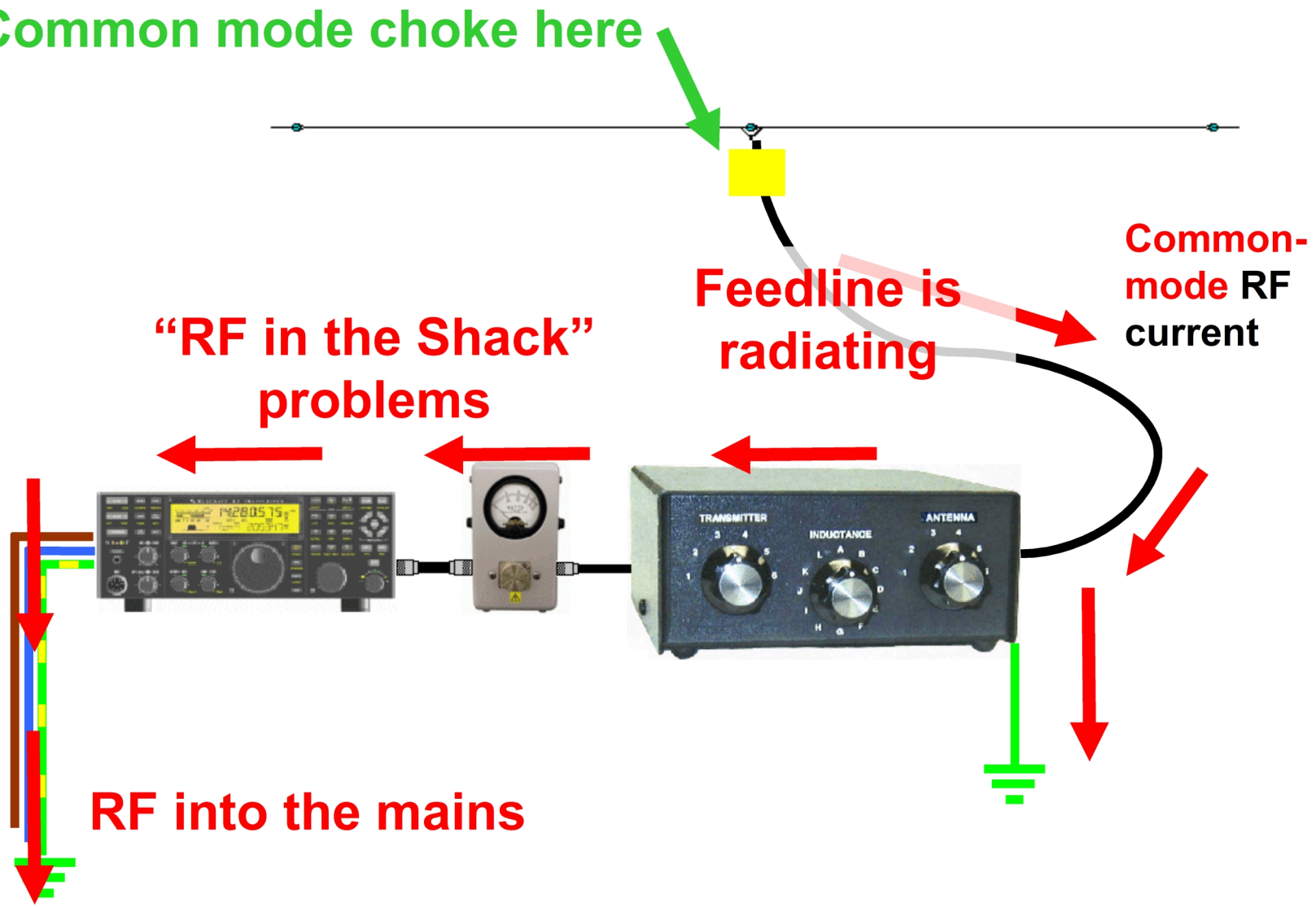
Chokes and baluns: ***Why might I need one?***

Answer: To block unwanted common-mode currents



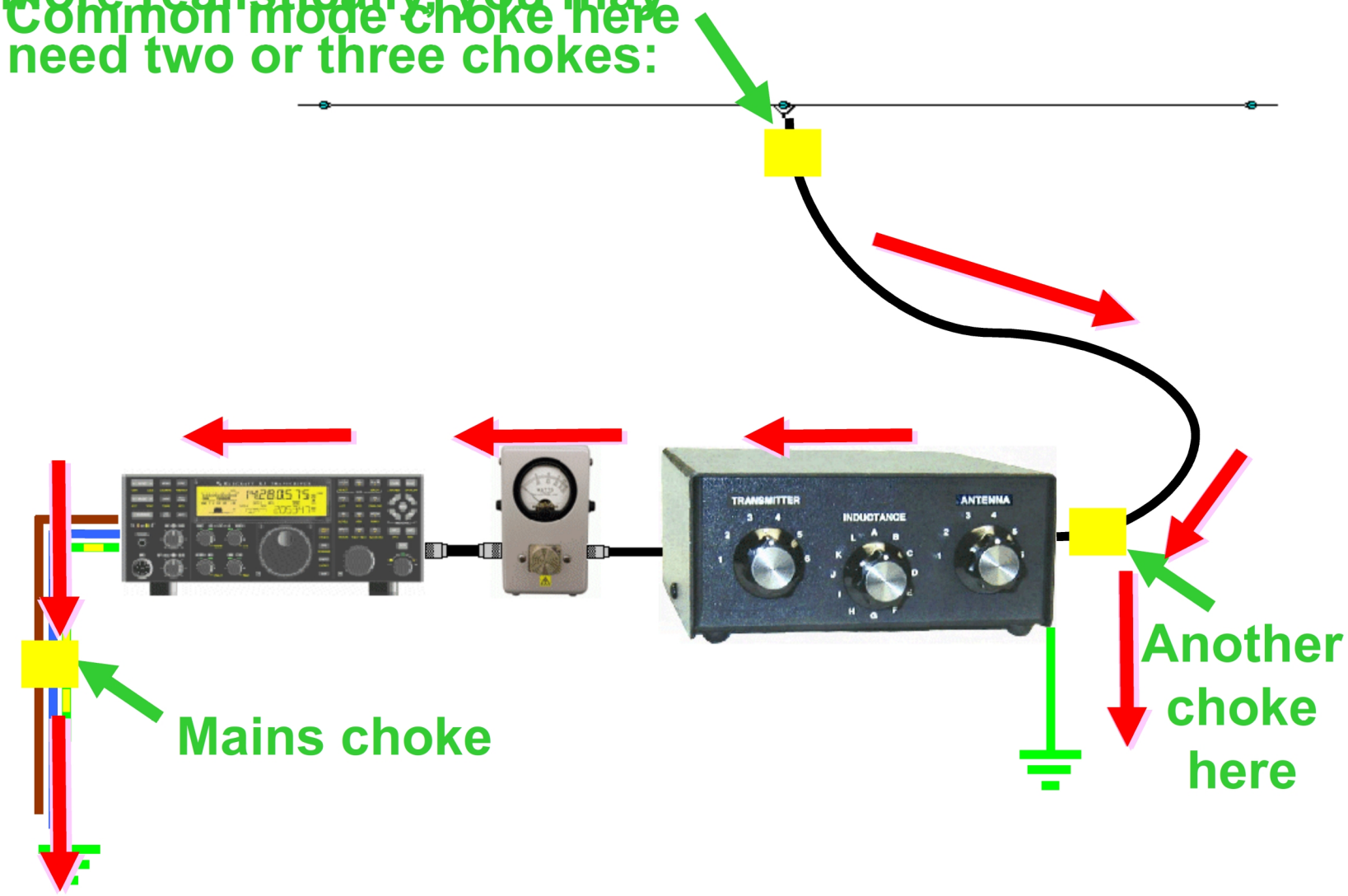
Chokes and baluns: Why might I need one?

Chokes and baluns: Why might I need one?

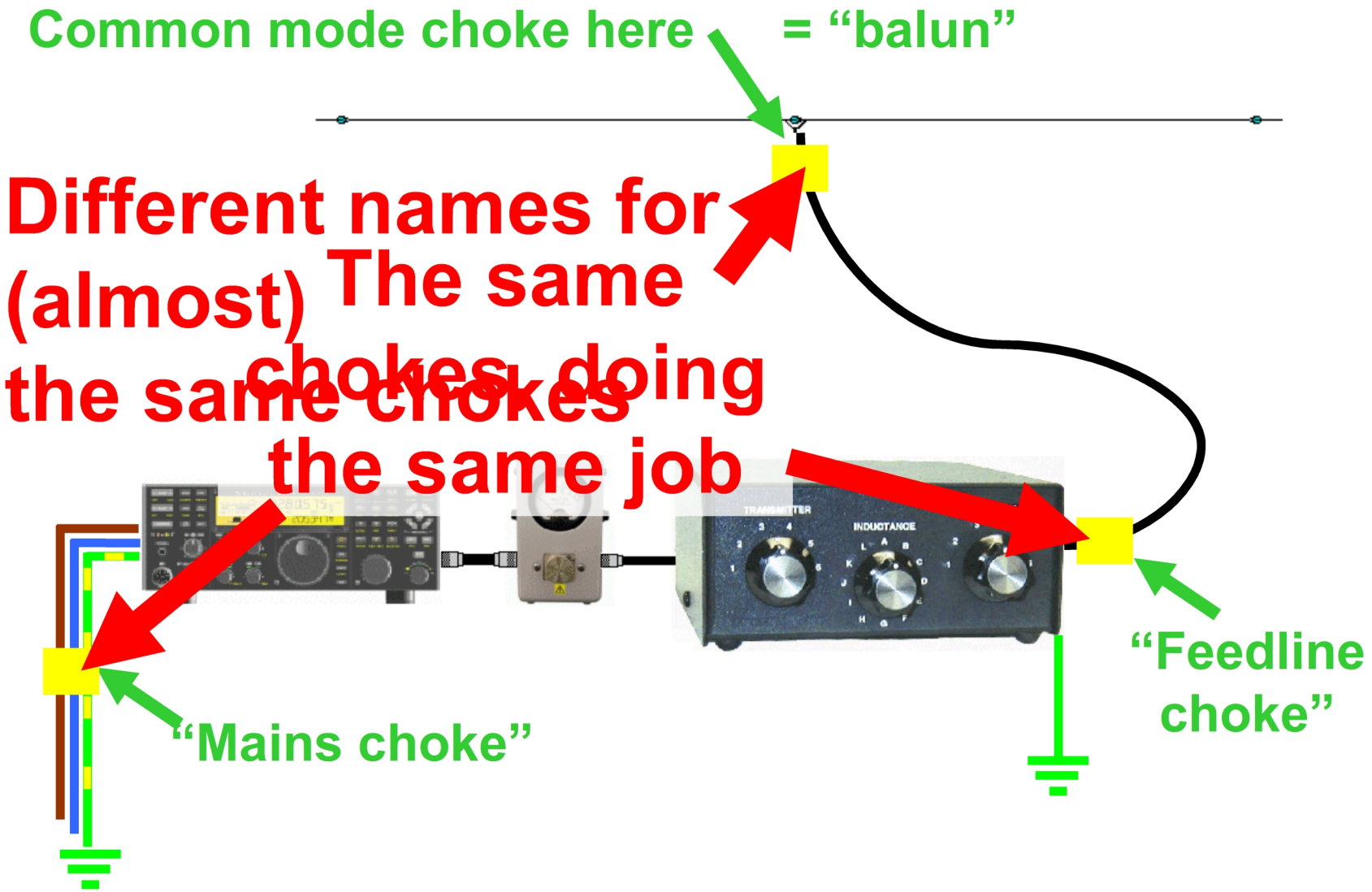


Chokes and baluns: Why might I need one?

More realistically, you may need two or three chokes:



Chokes and baluns: Why might I need one?



Chokes and baluns: Why might I need one?

The same chokes – same ferrite cores, same number of turns, same diameter.

Only the cable is different, depending on the application.

Because they're all doing the same job – blocking unwanted common-mode RF current on that particular cable.

Chokes and baluns: Why might I need one?

Summary:

- **To solve EMC problems**
- **Specifically… to stop RF currents flowing in the wrong places**
- **Chokes may be needed in several different places:**
  - **at the antenna feedpoint ("a balun")**
  - **at other places on coax feedlines**
  - **on other wiring in the shack (eg computer cables)**
  - **on mains wiring.**
- **The same choke designs will work for a range of applications (only the cable and connectors need to change).**

Ferrite Chokes and Baluns

✓ Why might I need one?

Next:

What makes a good choke?

Chokes and baluns: What makes a good choke?

Remember this is an EMC problem.

The Curse of EMC

is that every situation is different.

- **Some EMC problems are 'soft' and easy to solve – for these, almost any choke will give good results**
- **But some problems are much harder – these need chokes with much higher performance**
- **The curse of emc is, you never know which it will be…**

So always aim for overkill

– high-performance chokes are far more likely to do the job.

What does “high performance” mean?

In any RF choke,

high performance = high impedance

For hard EMC problems, that means…

- **Impedance of several thousand ohms**
- **Maintained across a wide bandwidth**
- **Impedance must be mainly resistive**

Why?

See the Radcom article.

Chokes that don't work well

…or may only work for 'soft' EMC problems.

Chokes that don't work well

✘ Air-wound chokes

What's good:

1. Cheap and easy to make (only needs extra cable)
2. Lightweight

What's bad:

3. Very narrow-band
4. Can easily be detuned in real-life situations.

Chokes that don't work well

✘ Strings of ferrite beads

What's good:

1. **Broadband, mainly resistive impedance**

What's bad:

2. **Usually not *enough* impedance (needs a *large* number of *large* beads of the *right type*)**
3. **Very expensive to do properly**
4. **Very long and heavy.**

Ferrite Chokes and Baluns

- ✓ Why might I need one?
- ✓ What makes a good choke?

Next:

- Three recommended designs

Chokes that do work well

✓ **Ferrite cores and multiple turns**

But you MUST:

- **Use a good design**
- **Use the specified type of core.**

Unknown surplus ferrite cores WILL NOT WORK!

For good results, use the right ingredients and follow the recipe.

Thanks for reading!

73 from Ian GM3SEK