

HF News

Engineering News, Links, and More



Address: P. O. Box 60941, Boulder City, NV 89006
TEL: 800-323-3956/702-570-6108
FAX: 702-570-6013
Mobile: 408-858-4528
URL: www.dsmith.org
Email: doug@dsmith.org



D. C. Smith Consultants
High Frequency Measurement Website
Douglas C. Smith

HF News: Analog RFI, ESD, and More

Issue 4

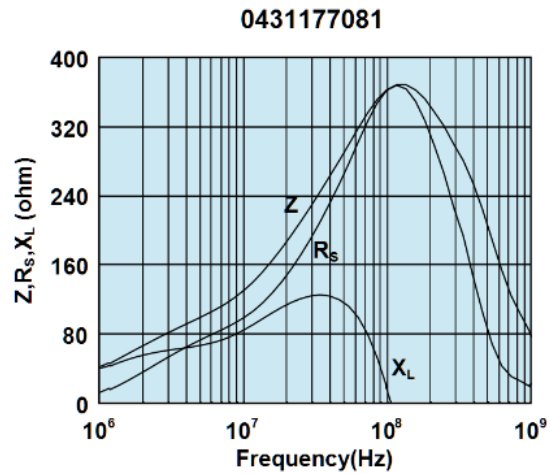
March 13, 2017

Overview: Ferrite used in ESD/EFT/EMC mitigation is the subject of the week. As usual there are lots of engineering links this week, some funny and some informative.

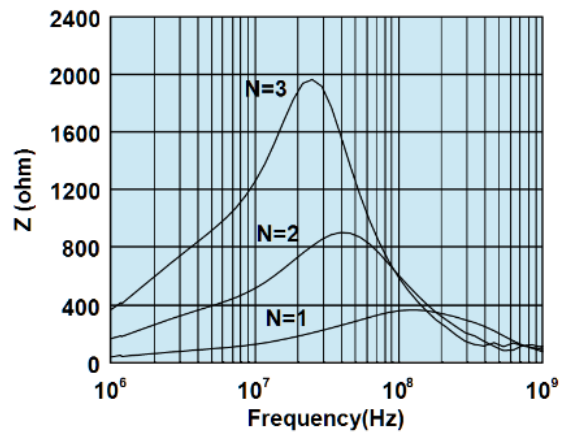
General News: Interference from pulsed sources of noise like ESD and EFT (electrical fast transient) continue to become more of a problem these days and much of my recent work has been to help clients overcome problems resulting from pulsed EMI. Although there are some general rules, each case is different and often requires a custom approach to the problem. Most designs with problems could use multiple changes to the designs to make the designs good, but only one change is usually required. The catch is to find just what is necessary. Often fixing all the design problems are not necessary to get a product to work as expected.

What I Have Been Doing: I have been pretty much consumed by the preparations and presenting at EMC Week in Boulder City, NV. In addition, a few clients have been soaking up time so I was unable to get HF News out the last two weeks. But I am back on track now and this week I want to discuss the use of ferrite cores.

For many years I have known that two turns of a cable through a ferrite core works better below 200 MHz and a single pass of a cable is best for frequencies above 200 MHz. I was browsing the Fair-Rite website recently and they have a great impedance plot that shows this convincingly. Figure 1 below shows the plot:



Impedance, reactance, and resistance vs. frequency.



Impedance vs. frequency with one, two, and three turns.

Figure 1: Ferrite Impedance Plots

<http://www.fair-rite.com/product/round-cable-snap-its-431177081/>

The upper plot shows the impedance inserted into a cable in common mode for one pass of the cable through the ferrite. Notice that the impedance is mostly resistive. This is desirable as adding inductance will just tune the cable resonance to a different frequency whereas a lossy core with a mostly resistive impedance will damp resonances.

The lower plot is the most interesting of the two. Notice that below about 200 MHz adding a second or third turn of the cable increases the series impedance injected by the core on the cable whereas above 200 MHz additional turns actually reduces the added series impedance of the core. As the frequency approaches 1 GHz, the core itself is not performing well and we need a different core material.

Here are a few more links from Fair-Rite on engineering kits, always useful to have around the lab:

<http://www.fair-rite.com/products/engineering-kits/?kit=21669>

Type 43 cable kits

<http://www.fair-rite.com/products/engineering-kits/?kit=21668>

Type 31 cable kits

<http://www.fair-rite.com/products/engineering-kits/>

Listing of engineering kits

If you have links to more ferrite kits or information, let me know and I will publish them in the next issue.

Useful Links: ESD testing is big business today and inductance plays a large role in the response of a system to ESD. Remember that $E = L di/dt$ and for an inductance of only 20 nH, the voltage drop for a change of only 2 Amperes in one nanosecond (a very mild ESD event, likely much less than 1 kV) across the inductance is 40 Volts! Here are two links you may find interesting:

1. A brief overview of equipment ESD test standards from esdguns.com:
<https://www.esdguns.com/content/category/6-esd-compliance-standards>
2. Inductance Calculator:
http://www.cvel.clemson.edu/emc/calculators/Inductance_Calculator/

Engineering News Links:

1. Technology News:
<https://phys.org/technology-news/>
2. Signal Integrity Journal:
<https://www.signalintegrityjournal.com/>

Fun Engineering Links:

1. Here is a great XKCD cartoon:
<https://xkcd.com/1807/>
Worried about audio privacy when visiting friends. This is one way to handle it.
2. Tesla Coil fun! The video in the link below is a lot of fun and reminds me of the Tesla Coil I built in the 9th grade that was powered by 600 Watts of RF energy at 300 kHz from a pair of 811a vacuum tubes. Killed every TV picture on the block and brought the FCC to my house. The sparks were continuous not pulsed like in the video here:
https://www.youtube.com/watch?v=fTC_Ud_k3U

Upcoming Events:

- My Courses at Oxford University in early June. These courses come with a bonus day on Friday of course week of a hands on lab session for no extra cost.

High Frequency Measurements: Probes and equipment used in signal integrity and EMC work. Mon 05 Jun 2017 to Tue 06 Jun 2017

<http://www.conted.ox.ac.uk/courses/H600-5>

EMC and ESD Lab Techniques for Designers: Troubleshooting to proactively avoid field or compliance problems. Wed 07 Jun 2017 to Thu 08 Jun 2017

<https://www.conted.ox.ac.uk/courses/emc-and-esd-lab-techniques-for-designers?code=H600-8>

- PCB West, September 12 – 14th, 2017: <http://www.pcbwest.com/>
- IEEE EMC Symposium: <http://www.emc2017.emcss.org/>
- My design troubleshooting seminars in California and Michigan this spring/summer, details forthcoming

Let me know if you would like to post your event here.

Feel free to contact me anytime!

And now a word from our sponsor, me that is! If you are interested in finding hidden flaws in your design that may become lab or field disasters, or quickly determine the cause of a field problem you already have, I have developed tools that accomplish these tasks quickly and easily that standard engineering analysis cannot. Many of these tools and techniques are not available in the literature. Most design problems I work on are understood, and even fixed, in a few days, even after weeks or months of effort by in-house resources have failed. Call me to discuss.

Douglas C. Smith
PO Box 60941
Boulder City, NV 89006
<http://emcesd.com>
Email: doug@dsmith.org
Tel: 702-570-6108
Cell: 408-858-4528