

Tips for the Broadcast Engineer

Maintenance Thoughts

Highlights from Tips N Tricks

Agenda

- Tips, tricks and more stuff

That's all.

Tip #1 – Keep it Cool

Calculate transmitter heat load:

$\text{TPO}/\text{efficiency} = \text{power consumed} *$

$\text{Power consumed} - \text{TPO} = \text{waste heat (in watts)}$

$\text{Waste heat} * 3.413 = \text{BTU/hr}$

$\text{BTU/hr}/12,000 = \text{tons of AC required}$

Eg: $10\text{kW}/0.72 = 13.889 \text{ kW}$ of power consumption
 $13.889 - 10\text{kW}) = 3888.9 \text{ watts}$ wasted as heat
 $3888.9 * 3.413 = 13,273 \text{ BTU/hr}$
 $13,273/12,000 = 1.11 \text{ tons of air conditioning}$

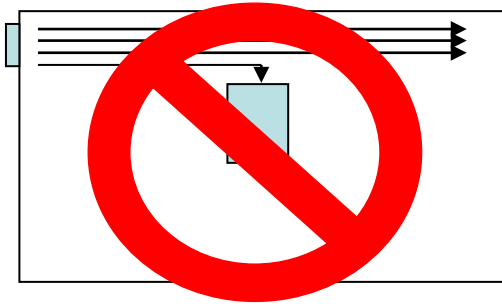
* - allow for modulation in AM transmitters... multiplying by 1.25 will be close

Tip #1 – Keep it Cool

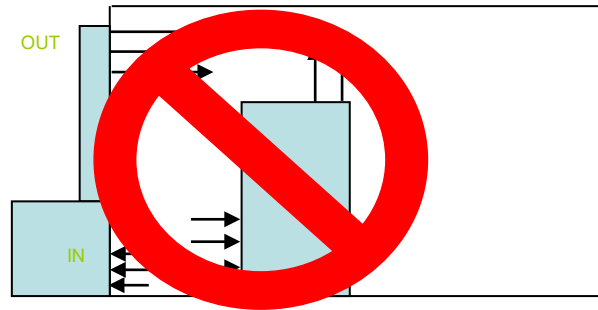
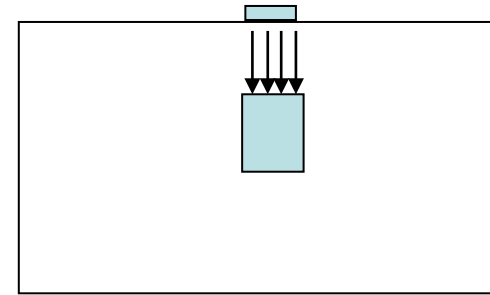
- **POSITIVE PRESSURE!**
 - More air into building than out of it
 - Allow for transmitter airflow
 - For example, transmitter requires 1500 CFM
 - Bring 3000 CFM of filtered air into building
 - Exhaust 2000 CFM
- If you install louvres in ducting, you can cycle exhaust air into room in winter for heating.

Tip #1 – Keep it Cool

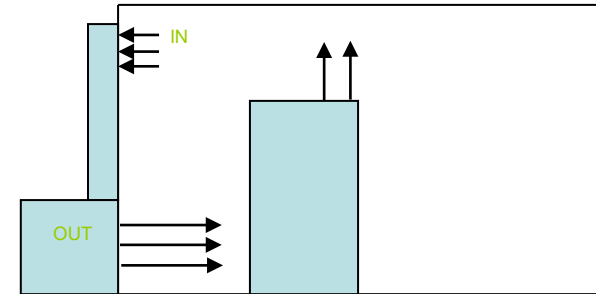
AIRFLOW DIRECTION IS CRITICAL!



TOP
VIEW



SIDE
VIEW



Tip #2 – Keep It Clean

Air Filters should be changed on a schedule, based on site conditions.

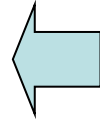
Metal mesh filters can be washed – make sure they are dry before reinstalling!



Tip #3 – Keep it Well Grounded



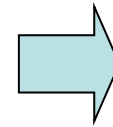
Buss bar for AC grounds

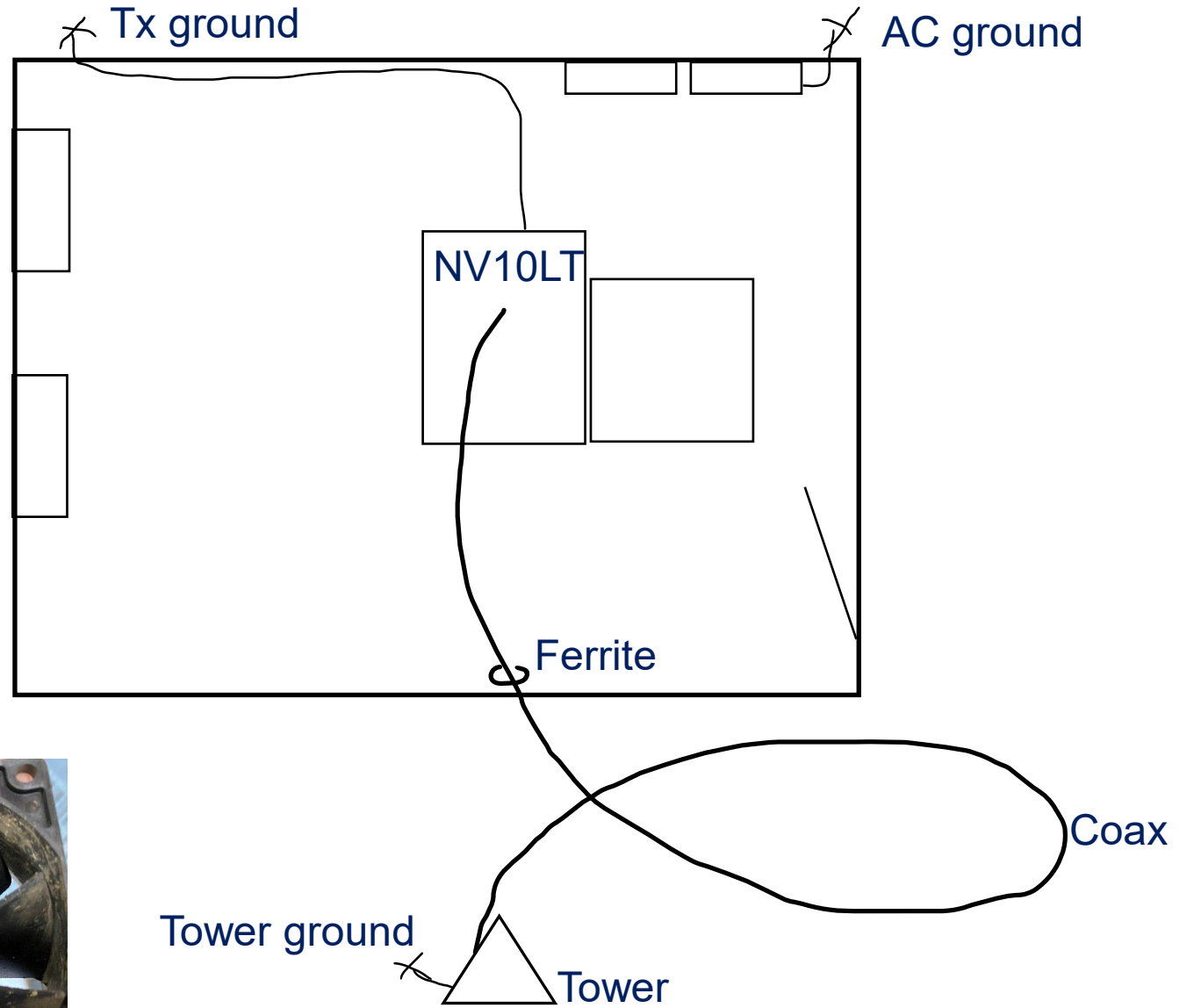


- _Tied to station reference ground
- _All primary equipment connected

Bulkhead ground for coax cables

- _Best done where cables enter building
- _Connected to station reference ground
- _Keep ground leads as short as possible





Tip #4 – Check Connections



Tip #5 – Critter Proof



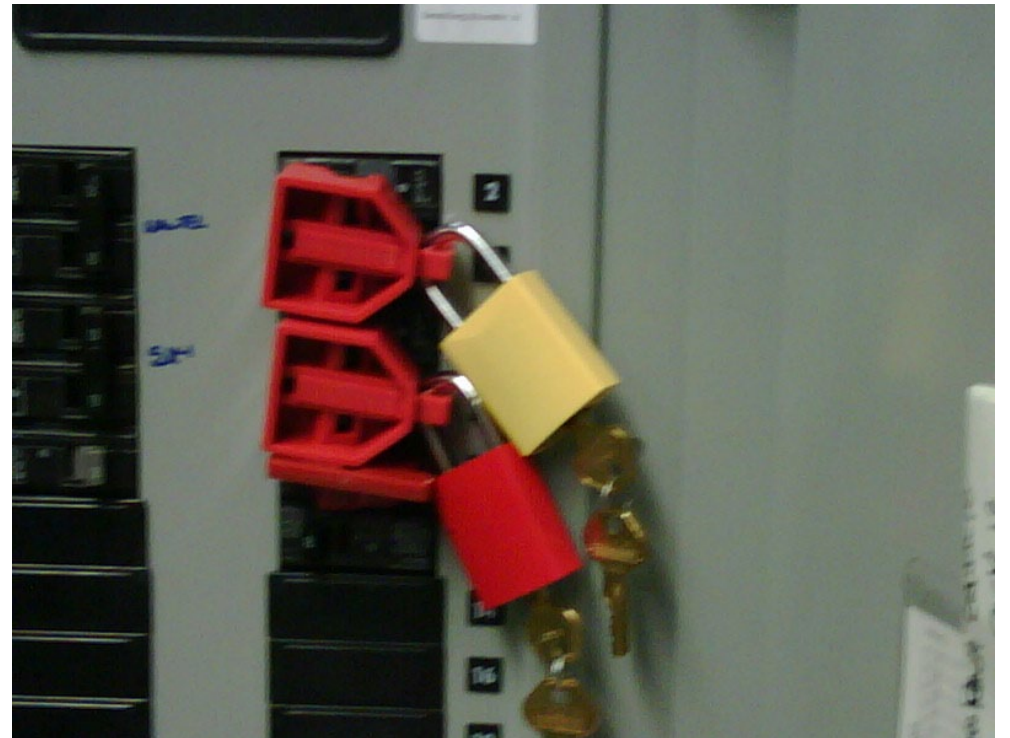
Tip #6 – Use Ferrites

- Not a solution on their own
- In addition to good grounding and surge protection, they can make a difference.

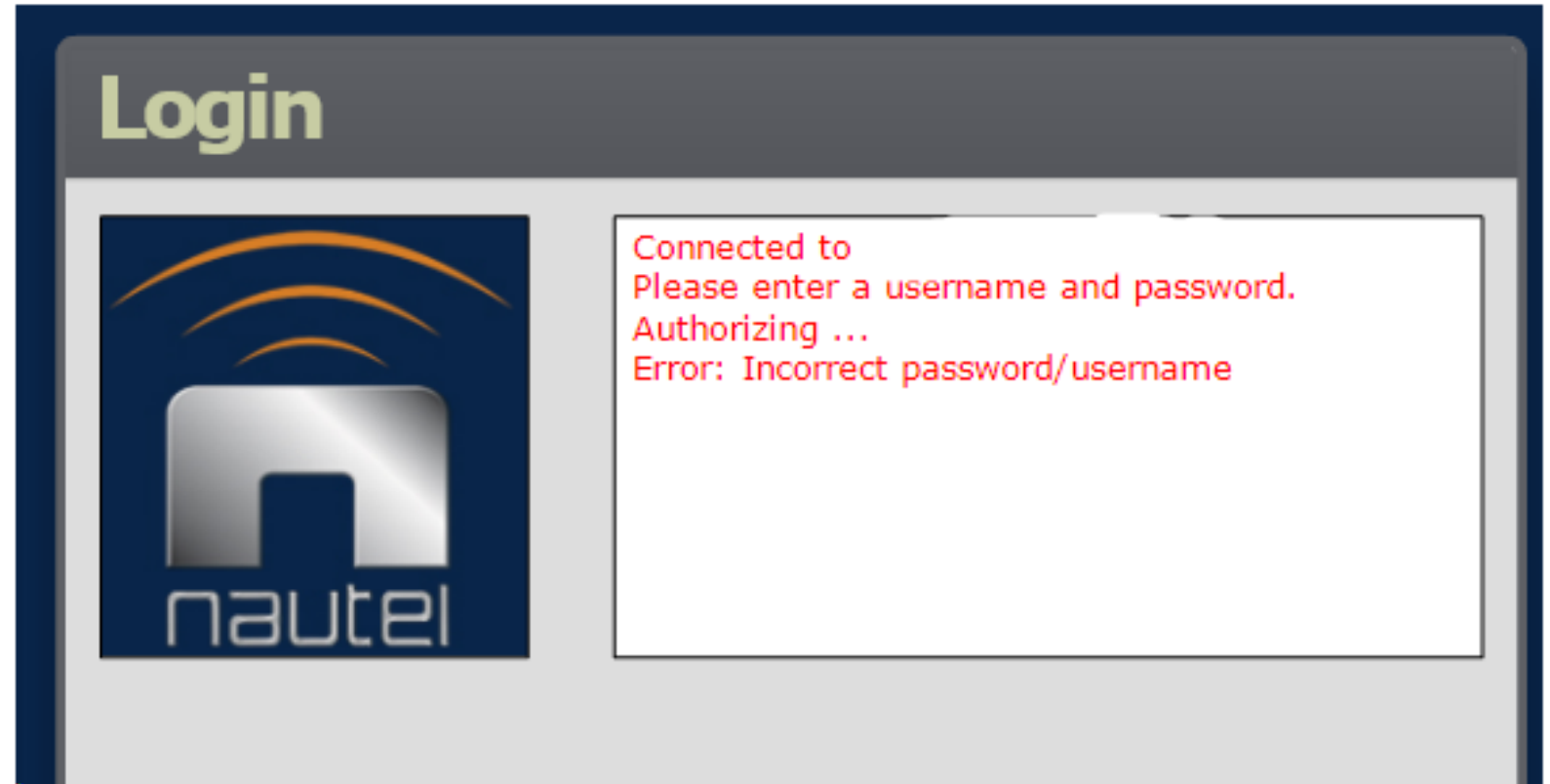


Photo credit – Kevin Trueblood, WGCU Public Media

Tip #7 – Be Safe



Tip #8 – Change Default Passwords!



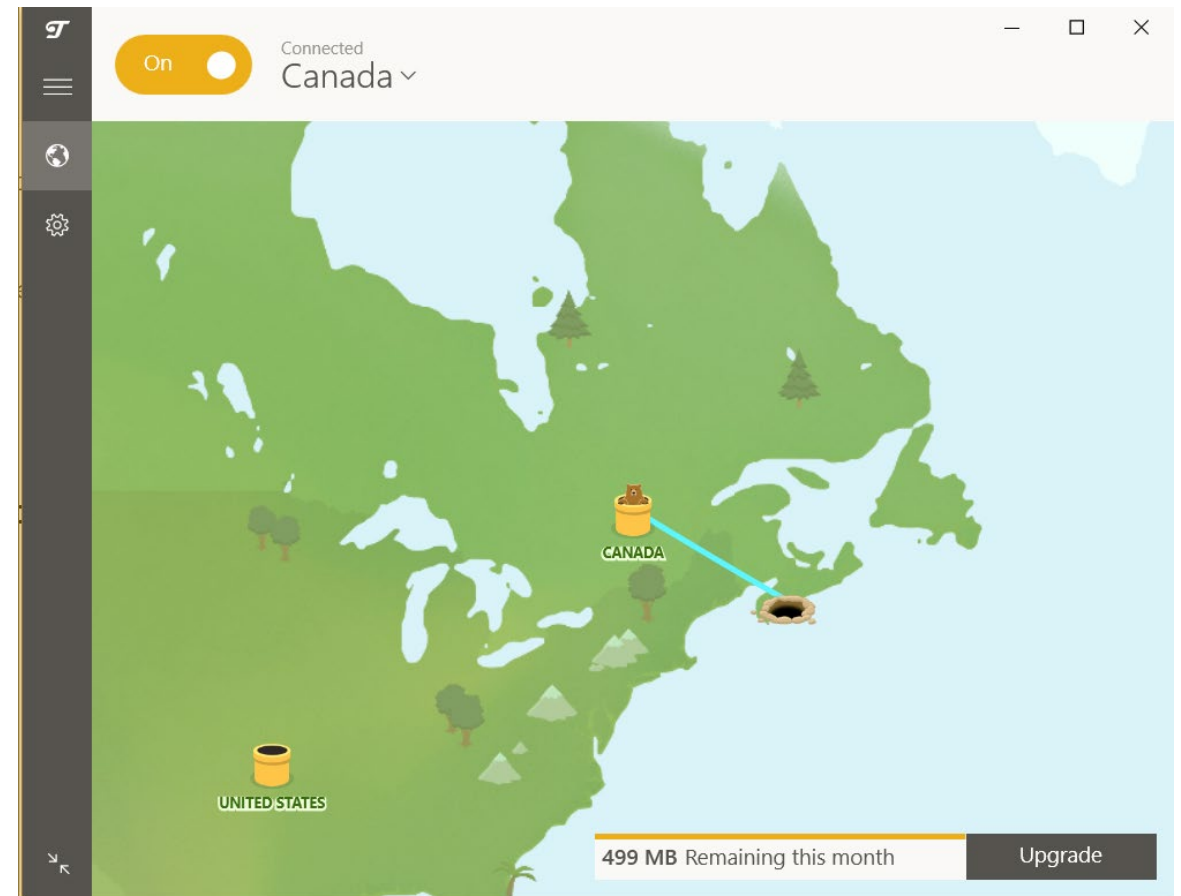
Tip #9 – Use a VPN

Free or paid, will depend on requirement

– <https://www.techradar.com/vpn/best-free-vpn>

Paid versions tend to be fairly cost effective – 10.00/mo or less.

Offer a lot more features – more servers, better service, no data caps.



Tip #10a – Scheduled Inspections



Tip #10b - Checklists



- Make a checklist of things to do
- Like checking the generator
- Changing air filters
 - On both the transmitter
 - And the air handling system
- Or testing the backup STL
- Tick off items as they're done to minimize surprises

Tip #11 – talk “manager”

- Cost of Ownership
 - Purchase Cost + Cost of Operation
- Cost of Operation includes:
 - Parts costs
 - Engineering Time/Costs
 - Power Bill
- Remember “non-cost” factors:
 - Learning curve
 - Pain of use

Tip #12 – interface with others



ADVANCING THE ART AND SCIENCE OF PUBLIC RADIO ENGINEERING THROUGH RESEARCH, EDUCATION, AND PUBLIC SERVICE



Tip #13 – backup, backup, backup!

- Full backup at least monthly
 - Stored offsite
 - Provides restore point
- Incremental backup daily
 - Could be cloud based



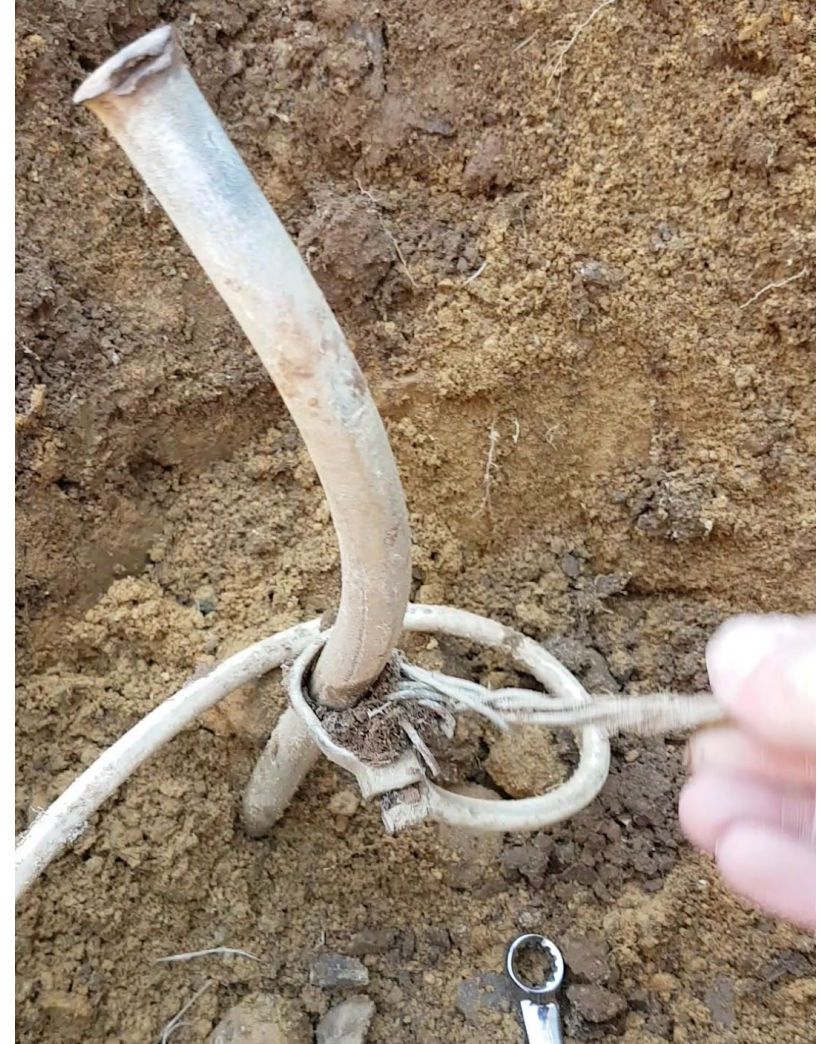
Tip #14 – Surge protectors

AC Power line protectors are a must – and they **MUST** be connected to your station reference ground.



Tip #15 - bond grounds

- Compression connections WILL get loose over time
- Will be worse with stranded cable
- Exothermic bonds are longer lasting



Tip #16 – upconverters bad!

- Repeated sample rate conversions degrade audio
 - Especially upconverters
 - Generate artifacts
 - Degrade audio



Tip #17 – standardize on a level

- Through the entire facility
 - The actual level is not important
 - Standardized levels make troubleshooting easier
 - Makes installing new equipment simpler.



Tip #18 – software updates!

- What we used to do with bags of parts, we now do with software updates.
- Pay attention to Release Notes!

Latest Software

GV Series 4.4.1

[Release Notes](#)

[Software downloads \(FTP\)](#)

NV Series 4.4

[Release Notes](#)

[Software downloads \(FTP\)](#)

NV^{LT} Series 4.6.1

[Release Notes](#)

[Software downloads \(FTP\)](#)

VS Series 5.2

Tip #19 – remote access

- Backup access
 - What happens if primary link fails?
 - STL dies/backhoe fade
 - Is there a redundant method of control?
 - Wired line
 - LTE data link
 - Wi-Fi bridge

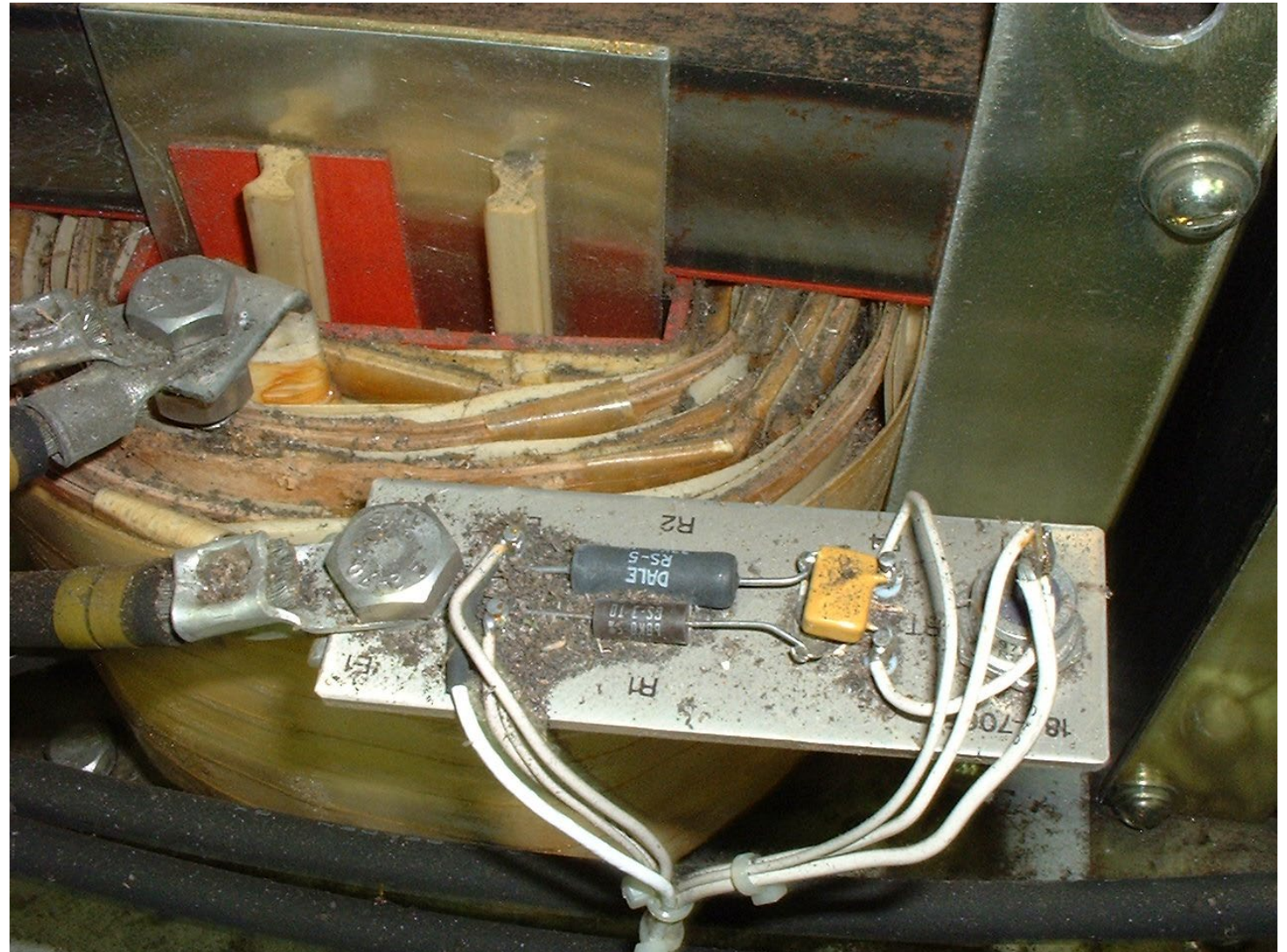


Tip #20 – calculating breaker requirements

- First, RTM! Current draw provided in a lot of manuals
 - TPO/efficiency in decimal (* mod index for AM) = power consumption
 - Power Consumption/phase to phase voltage = single phase current draw... divide this by the square root of 3 for three phase
 - Add 25% safety margin
 - For 10kW @ 70% efficiency, with 240V 1-ph... $10,000/.7=14,285$
 - $14,285/240 = 59.5A$, or 75A with safety margin

Tip #21 - cleaning

- Vacuum is preferable to compressed air
- Remove the dirt, don't relocate!



Tip #22 – LTE interference

Shannon-Hartley theorem

- Builds on the Nyquist theorem (minimum sample rate for any signal is twice the maximum frequency).
- Effectively Nyquist for digital

$$C = B \log_2 \left(1 + \frac{S}{N} \right)$$

- C= Channel capacity
- B= Channel BW
- S= signal power (average over BW)
- N= noise (average over BW)

Tip #23 – IP security

Limit user access

- control who can write what to where

Break up domains

- fewer users with high level access in each

Keep an eye on Active Directory in Windows networks

- not everybody needs domain admin access

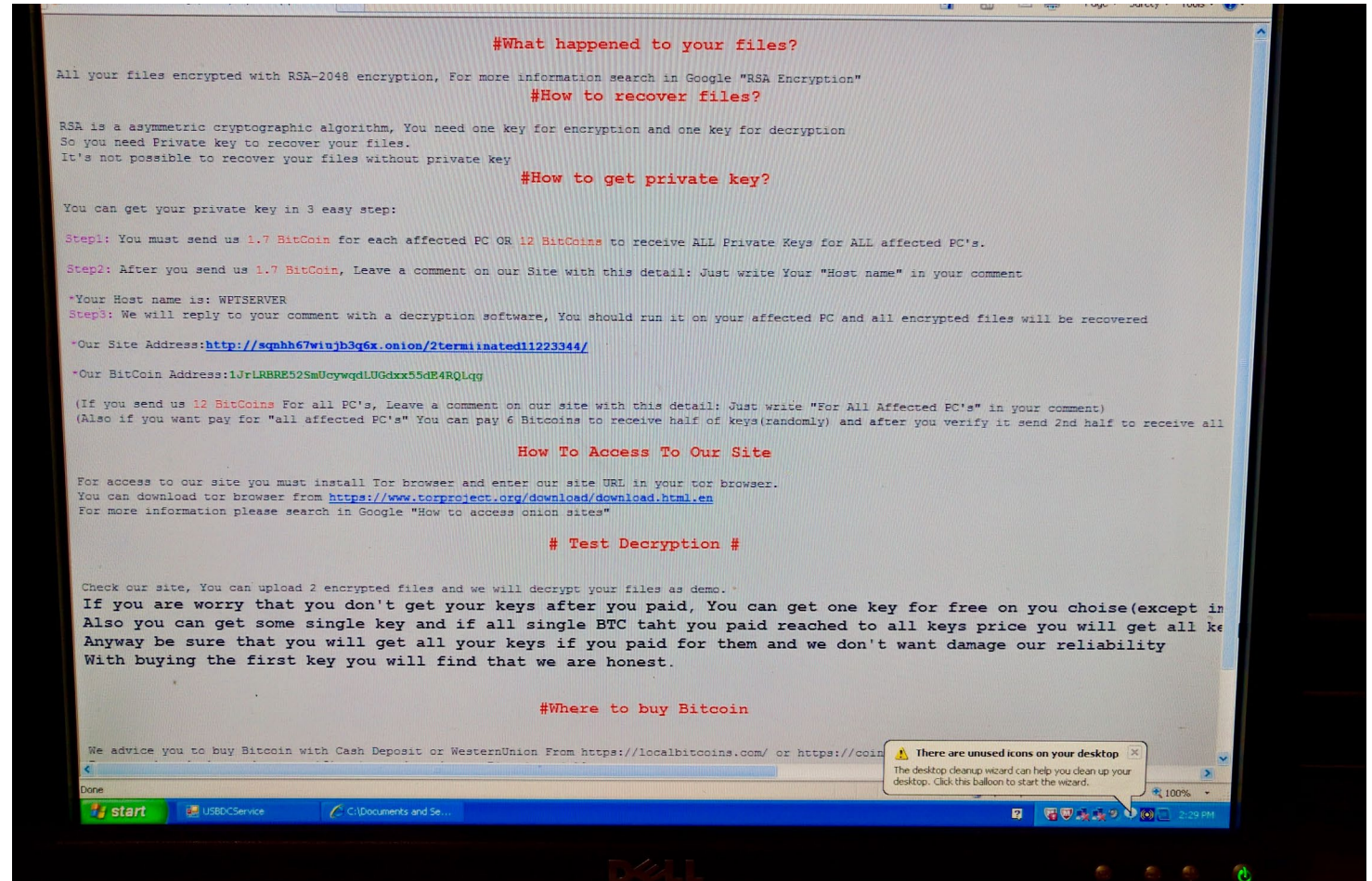


Photo credit, KQED: <https://www.kqed.org/futureofyou/how-to-make-it-harder-for-malware-to-shut-you-down>

Tip #24 – site maintenance

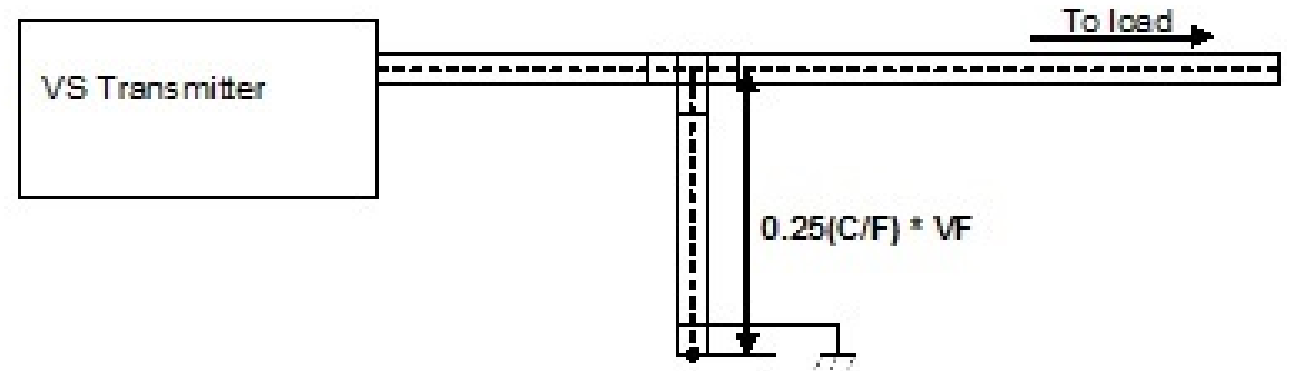
- Fluid levels and changes
- Belts and filters
- Check for leaks
- Fuel conditioning/treatment
- Battery check



Photo credit: www.cat.com

Tip #25 – shorting stubs

- Can help reduce stress during transients
- Not difficult to build
- Account for velocity factor



Tip #26 - DeOxit



Tip #27 - PPE

- ESR (EH in the U.S.) rated footwear can keep you alive if you come in contact with a live circuit.



Electric Shock Resistant Boot / Electric Shock Resistant Footwear (ESR)

Boots labeled "ESR" are manufactured to protect you from electric shock when working near electrical hazards. Testing concluded the leakage current did not exceed 1 mill ampere when applying an 18,000 volt / 60HZ electrical discharge to ground for one continuous minute.



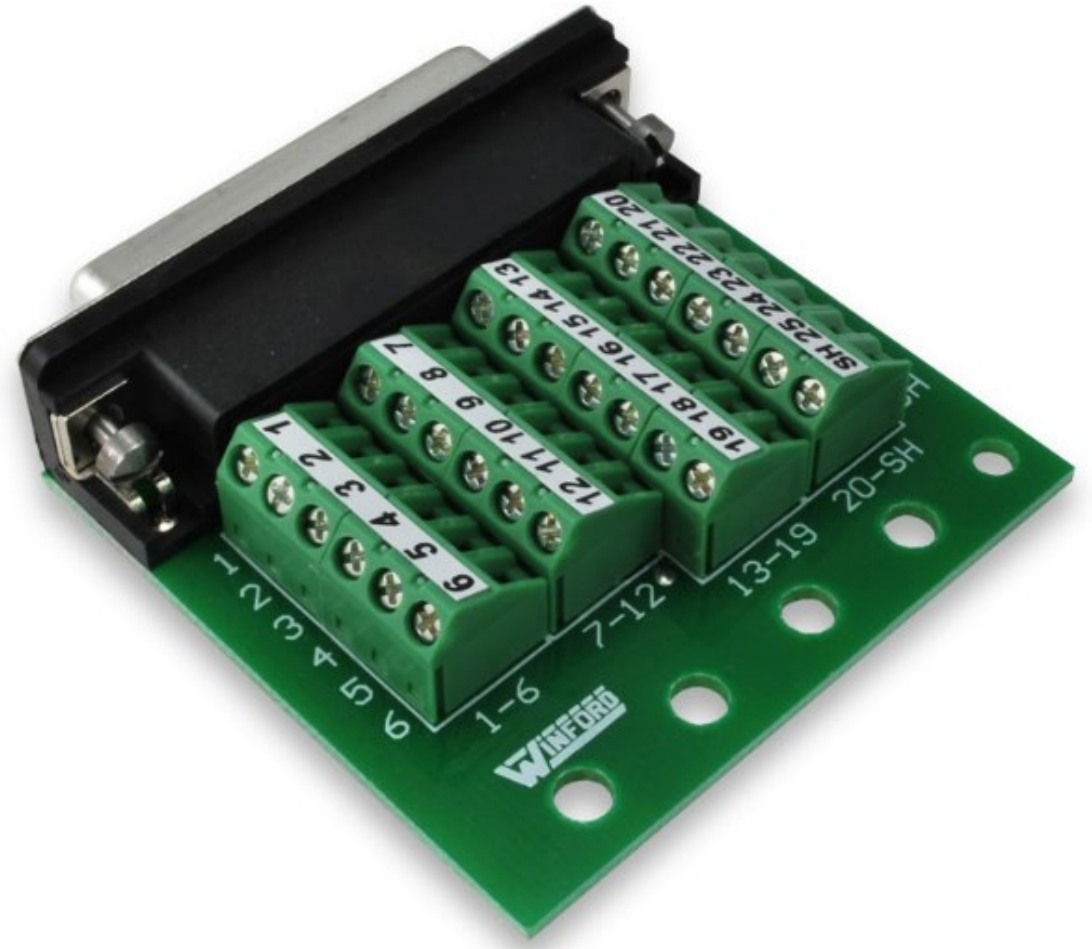
Tip #28 – Too much humidity bad!

- An oversized air conditioner may not remove enough humidity from the air
- Can cause condensation in equipment



Tip #29 – D connectors

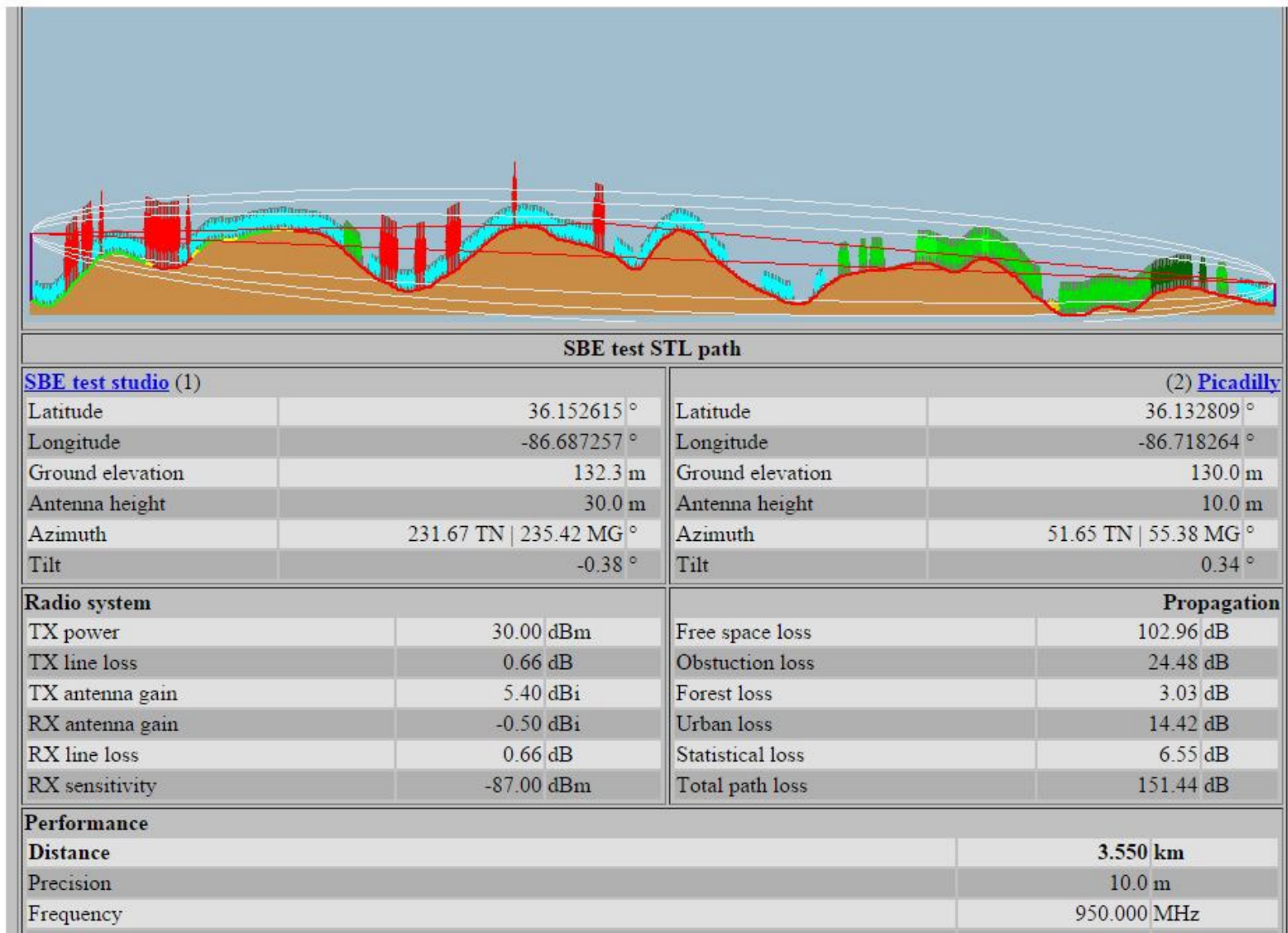
- Slimline breakouts easier than soldering
- In U.S. available from Winford Engineering
- www.winfordeng.com



Tip #30 – RF Toolkit

<http://support.nautel.com/rf-toolkit/radio-coverage-tool/>

Ensure groundcover is turned on when doing a path plot.



Online Information



Webinars

<https://www.nautel.com/resources/webinars/>



Nautel Waves Newsletter

<https://www.nautel.com/newsletters/>



YouTube

<http://www.youtube.com/user/NautelLtd>



<https://www.nautel.com/resources/webinars>

THANK YOU!