

50 Tips for 50 Years

Highlights from Tips N Tricks

Agenda

- Tips, tricks and more stuff

That's all.

Tip #1 – Keep it Cool

Calculate transmitter heat load:

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

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

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

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

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 #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



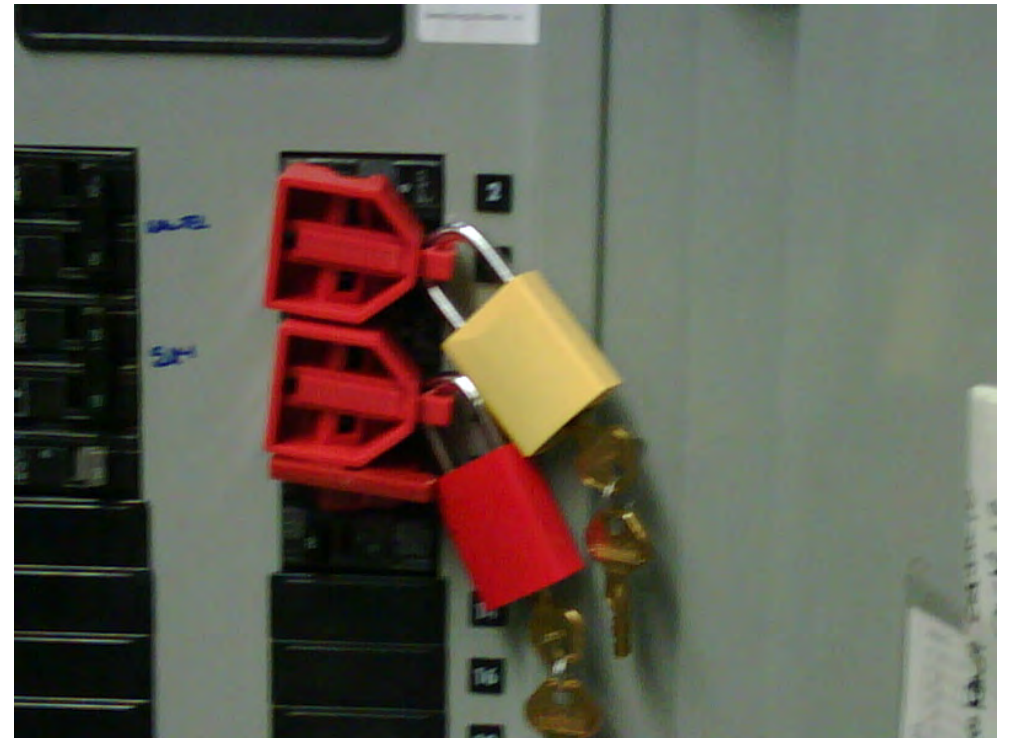
Tip #6 – Use Ferrites

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

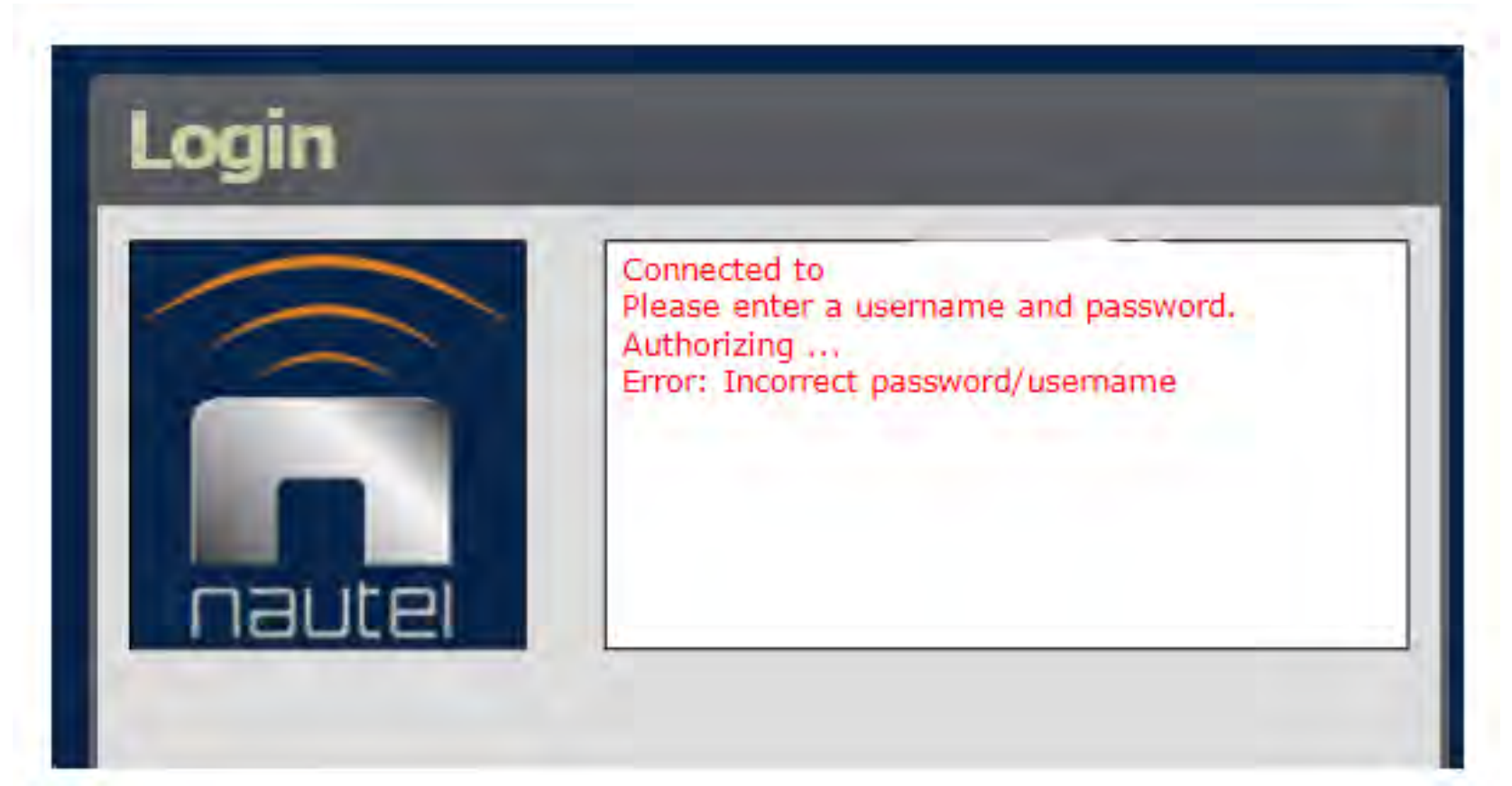


Photo credit – Kevin Trueblood, WGCU Public Media

Tip #7 – Be Safe



Tip #8 – Change Default Passwords!



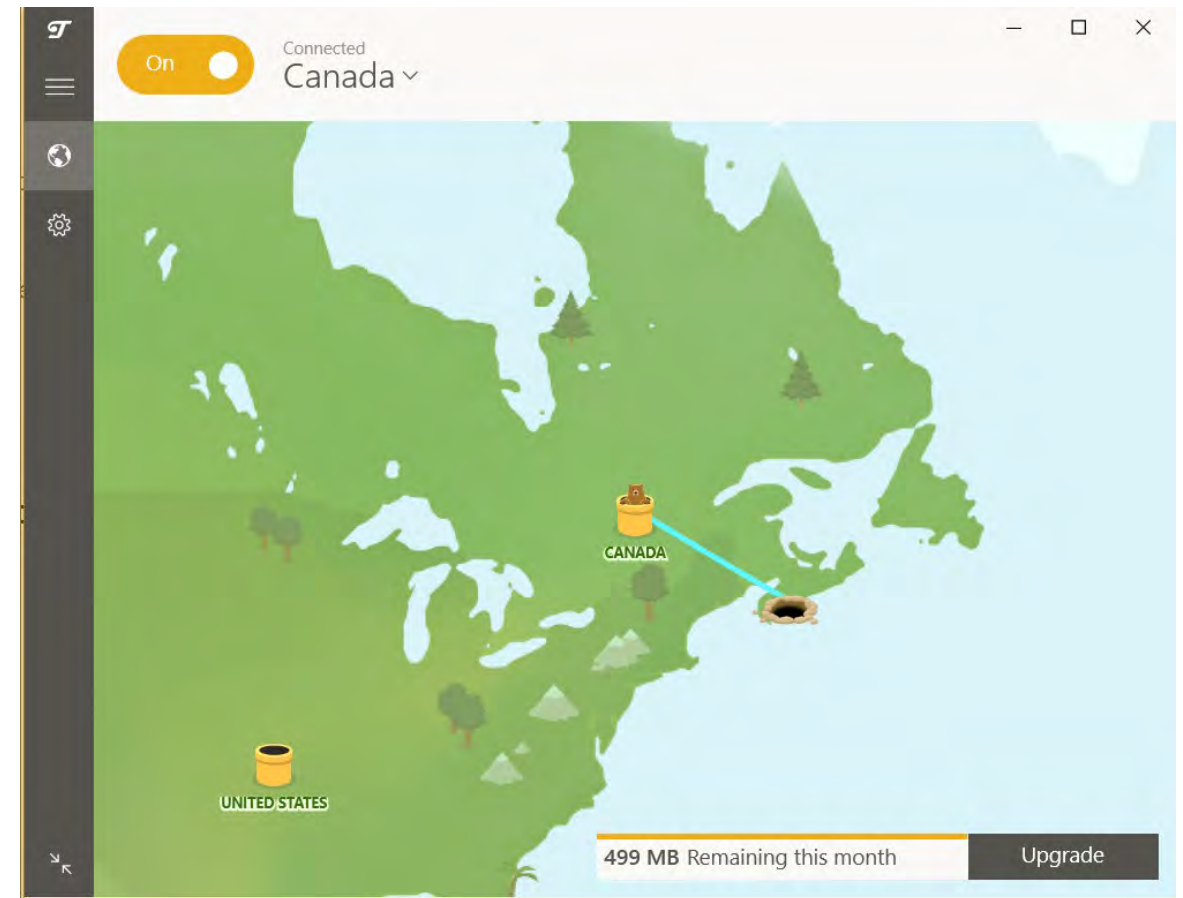
Tip #9 – Use a VPN

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 #10 – Scheduled Inspections



Tip #11 - 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 #12a – 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 #12b – talk “manager”

- Sometimes repair is a better option.
 - look at “pain threshold” (how often repairs are required)
 - look at operating costs, including manpower
 - is a new thing necessary, or just shiny?
 - will it make creating a product more efficient?
 - will it reduce cost of the product, increasing profit?

Tip #13 – interface with others



KAPISANAN NG MGA BRODKASTER NG PILIPINAS
(Association of Philippine Broadcasters)



NUG@NAB
Radio Technology Forum



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



making digital broadcasting work

Tip #14 – backup, backup, backup!

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



Tip #15 – Surge protectors

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



Tip #16 - bond grounds

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



Tip #17 – strap beats cable

- Some times...



Tip #18 – Read the Manual!

Figure 1.2.1: NV10LT/NV7.5LT Pre-installation Guide

REQUIRED CLEARANCES

Front: 1.2 m (4 ft)
Rear: 0.9 m (3 ft)
Sides: 0 m (0 ft)
Top: 1.2 m (4 ft)

WEIGHT

Uncrated: 191 kg (421 lbs)
Crated: 257 kg (566 lbs)

COOLING

Maximum Intake Air Temperature
(varies with site altitude as follows):

50°C (122°F) at sea level
47°C (116.6°F) at 500 m (1640 ft)
44°C (111.2°F) at 1000 m (3281 ft)
40.4°C (104.7°F) at 1600 m (1 mile or 5280 ft)
30°C (86°F) at 3048 m (10,000 ft)

Air Conditioning Requirements in Closed Room Cooling
(based on maximum output power and typical efficiency):

FM mode: 1.22 (NV10LT) or 0.96 (NV7.5LT) tonnes

Forced air cooling systems require a minimum of 1000 CFM.
The static pressure at the exhaust duct must be slightly negative.
The static pressure at the intake duct must be neutral or slightly positive.

HEATING

Minimum transmitter room ambient air temperature is 0°C (32°F)

ALL DIMENSIONS
ARE IN INCHES (mm)

AC INPUT WIRE LIMITATIONS & TORQUE REQUIREMENTS

WIRE SIZE RANGE: 2/0 to 6 AWG (70 to 10 mm²)
TB1 TORQUE VALUE: 120 in-lbs (13.6 N-m)

AC INPUT SPECIFICATIONS

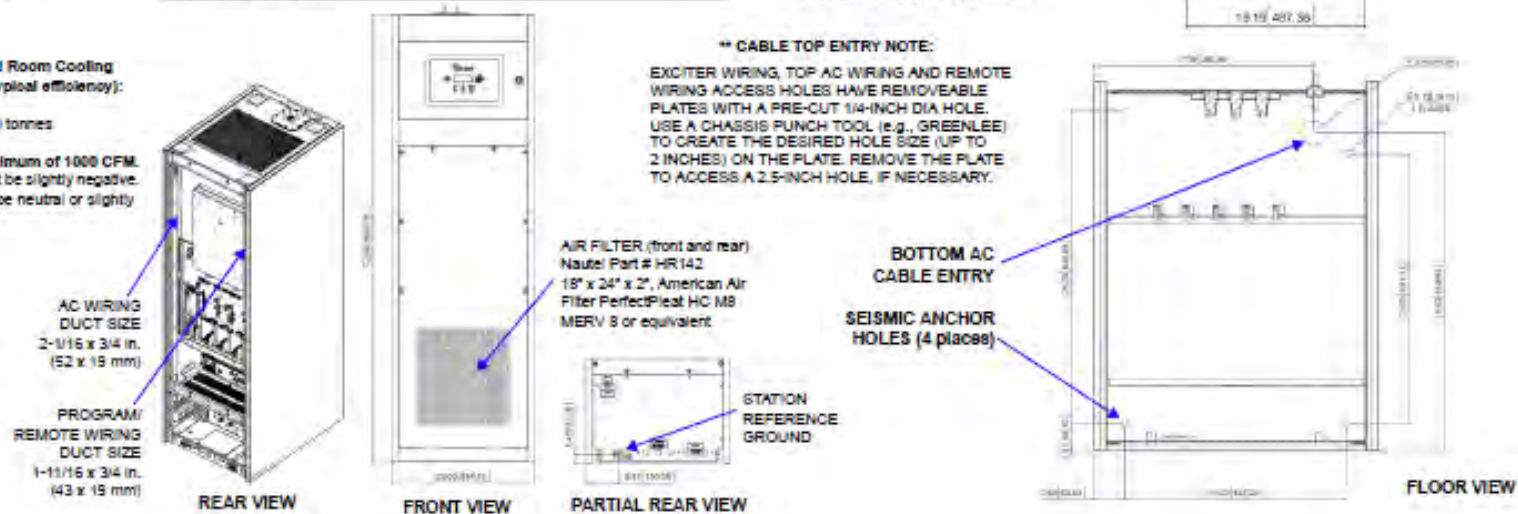
MODE OF OPERATION	INPUT POWER (kW)	AC SUPPLY (V ac)	TYPICAL LINE CURRENT (A)
FM (BANK)	15.6 (NV10LT) 11.4 (NV7.5LT)	3PH, 208 V ac (**115-208) 3PH, 480 V ac (**100-480) 1PH, 240 V ac (**115-208)	41 (NV10LT), 31 (NV7.5LT) 44 (NV10LT), 18 (NV7.5LT) 55 (NV10LT), 58 (NV7.5LT)

** Denotes that the transmitter will operate with an ac input voltage as low as 90 V ac (for 208 and 240 V systems, 180 V ac for 480 V ac systems), but RF output power is limited to approximately 1/2 of rated power at ac voltages less than 115 V ac for 208 and 240 V sources, 30% V ac for 480 V ac sources.

Typical line current values are based on maximum RF output power, nominal ac voltage (208 or 240 V ac 3-phase, or 240 V ac 1-phase, as applicable), typical efficiency at 0.50 power factor.

The maximum in-rush current value (per line) is present for half an ac cycle (between 8 and 16 ms) and is based on an ac input voltage of 200 V ac. The maximum in-rush current per line is approximately 150 A for three-phase ac power sources and 300 A for single-phase ac power sources.

Observe local electrical codes when determining wire size and ac input requirements. Consult manufacturer for your local code and breaker ratings for the typical line current for analog mode plus 25% to account for line current inrush and size safety margins.



Tip #19 – upconverters bad!

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



Tip #20 – 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 #21 – 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 #22 – check packing lists

- Make certain that everything was included.
- Also gives weights and dimensions

	DESCRIPTION OF GOODS	QTY. SHIPPED	
CRATE # 1/2	NV3.5LT TRANSMITTER COMPLETE WITH POWER MODULES NAA61C & UG92C'S. C/W (1) 219-5144-02 UPS INTERFACE ASSY 1 - NAE108E CONTROLLER ASSY - UG92C POWER SUPPLY 40" X 28" X 81" -- 421 LBS 102 X 72 X 206CM -- 1.52CUM -- 191KGS	1 1	S/M
CRATE # 2/2	1 - 219-8978-05 ANCILLARY KIT - NVLT-LP 1 - 206-5226 OUTPUT CONNECTOR KIT 1 - JD43 CONN, PLUG 1 - TECHNICAL MANUAL 1 - USB-NVLT - UH145 SURGE ARRESTOR 27" X 17" X 20" -- 63LBS 69 X 44 X 51CM -- 0.16CUM -- 29KGS	 1	

Tip #23 – site access



Photo credit – Alex Hartman, Optimized Media Group

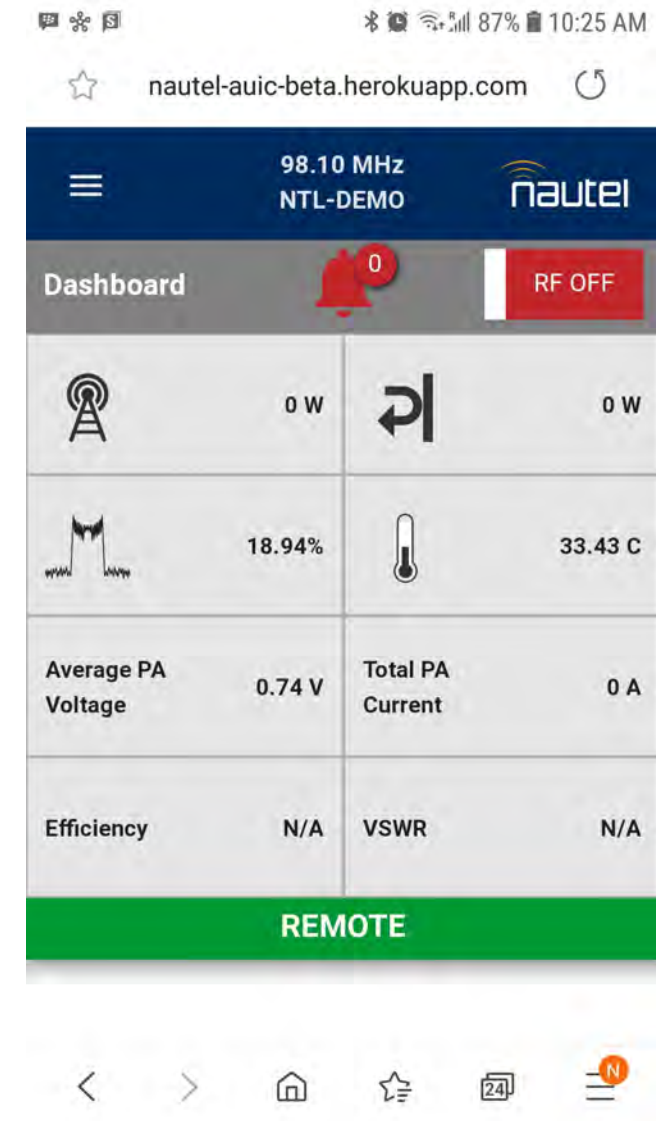
Tip #24 – remote access

- 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

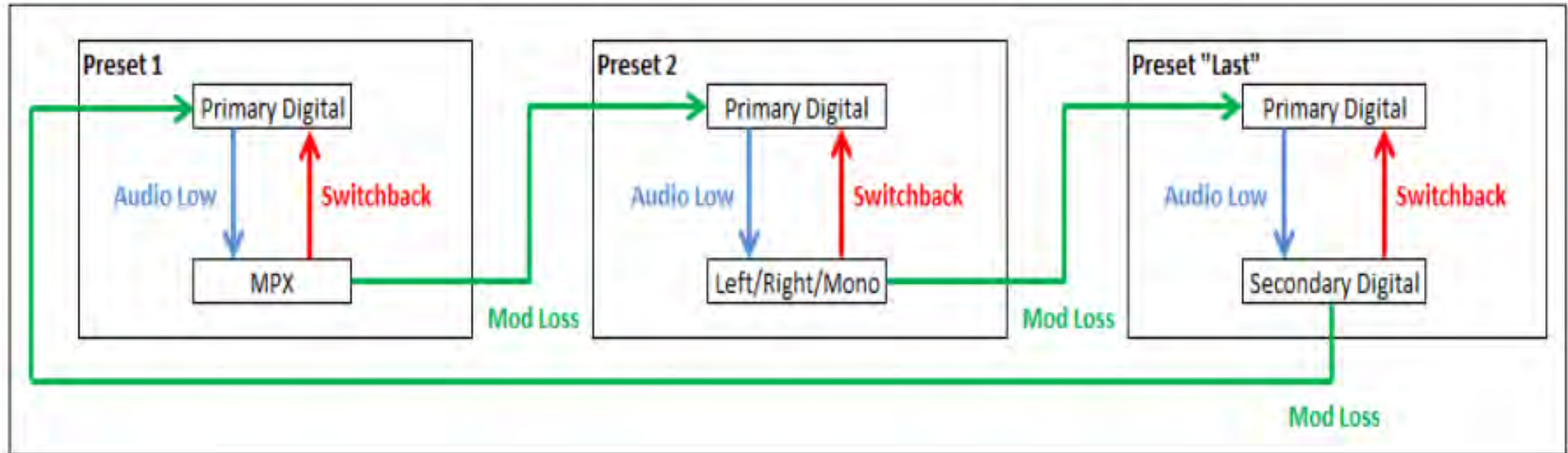


Tip #25 – AUI companion

- Non-Flash
- Mobile accessible
- Starting deployment



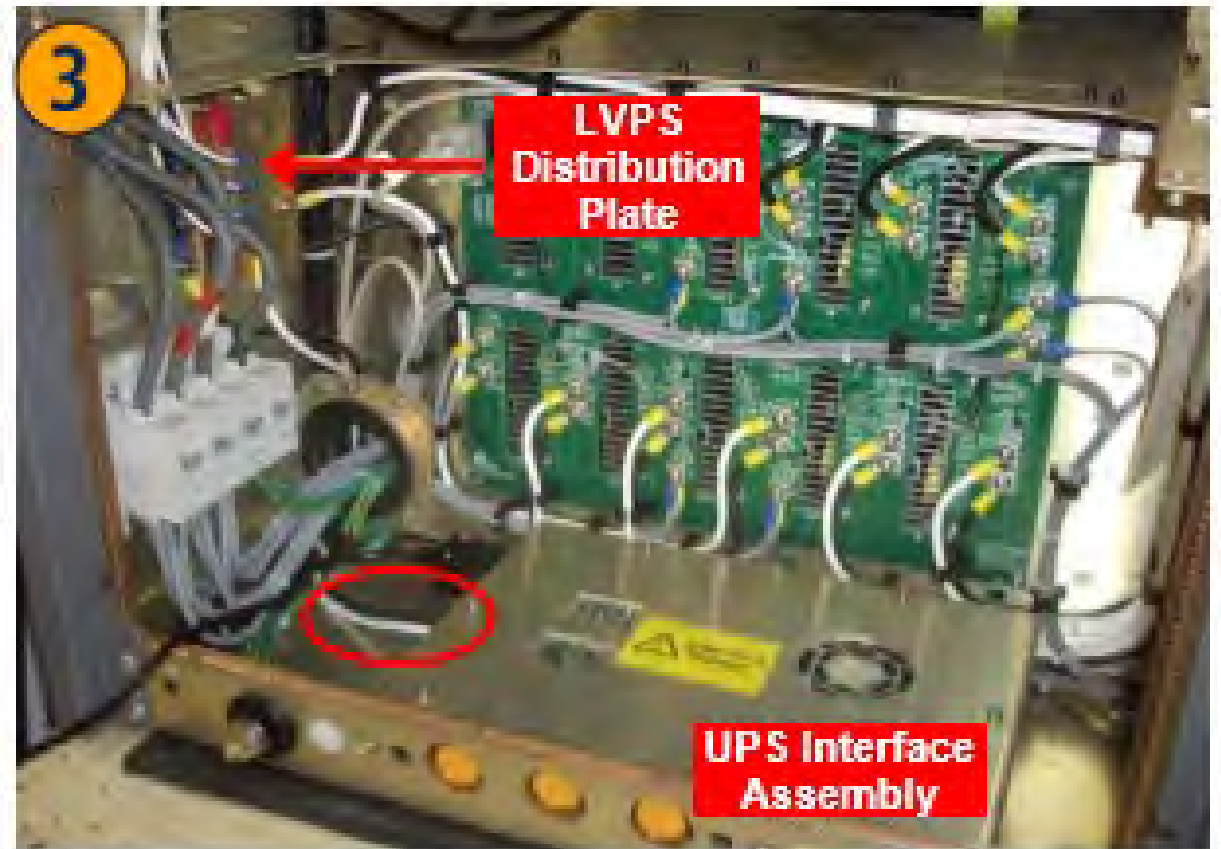
Tip #26 – audio backup



- A way to chain multiple audio signals with auto return to main

Tip #27 – UPS Interface

- Reduces time to restart after AC interruption from 6 seconds to less than ½ second.
- Provides additional LVPS in event of UPS failure.



Tip #28 – where to find stuff?

- Pre-Install manual
 - Things you need before you start wiring stuff up...
 - Current draw, air handling, remote connections, etc.
- Installation manual
 - How to wire it up
- Maintenance and Operation manual
 - How to use it after it's wired up
- Troubleshooting manual
 - How to fix it when it breaks

Tip #29 – HD Radio coverage



A service of

& Associates, Inc. and powered by FCCInfo.com

Call Sign	FCC Status	IBOC Candidate Station		IBOC Power Limit (dBc)	
		Channel		lower	upper
KVSC ST. CLOUD, MN	LIC	201C2		-10	-14


Status	Call Sign	Sideband of KVSC	Channel	Power (kW)	HAAT (m)	City	State	KVSC's F(50,10) dBu at the protected contour	Allowable Power (dBc)
LIC	WHWC	U	202C1	70.00	320	MENOMONIE	WI	50.0	-11
LIC	KJTS	U	202A	2.40	29	NEW ULM	MN	52.9	-14
LIC	KBPN	U	202C3	5.00	204	BRAINERD	MN	72.7	-14
LIC	KJGT	U	202C3	11.00	86	WACONIA	MN	72.9	-14

<http://support.nautel.com/rf-toolkit/hd-radio-calculator/>

Tip #30 – calculating breaker requirements

- First, RTM! Current draw provided in pre-install manual
 - To verify...
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 #31 – RDS tips

Preset: * Current Settings 

	General	Main Audio	SCA	RDS	Other Settings
Load	PS Name		PS Name		
Save	Scrolling Enable/Speed		Fast		
Save New	Scrolling PS Name		This is Scrolling PS Name Field		
Delete	Scrolling Type		Word		
	Radio Text		This is Radio Text Field		
	PTY		0: NONE/NONE		
	PTYN				
	Music/Speech		Speech		
	Traffic Info		None		
	Alt. Frequencies		None		
	Artificial Head		Off		
	Compression Flag		Off		

Tip #32 – SNMP tips

- Configure devices
 - Set Community PWs
 - Enable Traps
 - Set IP of Manager for receiving Traps



User Settings

SNMP Configuration

Agent **Traps**

Agent Port: 161

Read Community: *****

Confirm: *****

Write Community: *****

Confirm: *****

☒ Enable Traps

Trap Receiver IP: 0.0.0.0

Trap Receiver Port: 162

Apply **Cancel**

Tip #33 - airflow

- **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 #34 - cleaning

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



Tip #35 – 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 #36 - Flash

- Workaround to allow Flash on Chrome:
 - In URL, type “chrome://flags/#enable-ephemeral-flash-permission”
 - First item in list that appears should be “Enable Ephemeral Flash Permissions”
 - In pulldown to right, select DISABLED
 - Relaunch Chrome

(compliments of Aaron Read)

Tip #37 - streaming

Shoutcast/Icecast:

- Sample rate must be 48kHz or lower.
- Bit rates have only been tested to 384 kbps.
- Audio must be 16 bit stereo, MP3
- Server must be public

Tip #38 – 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

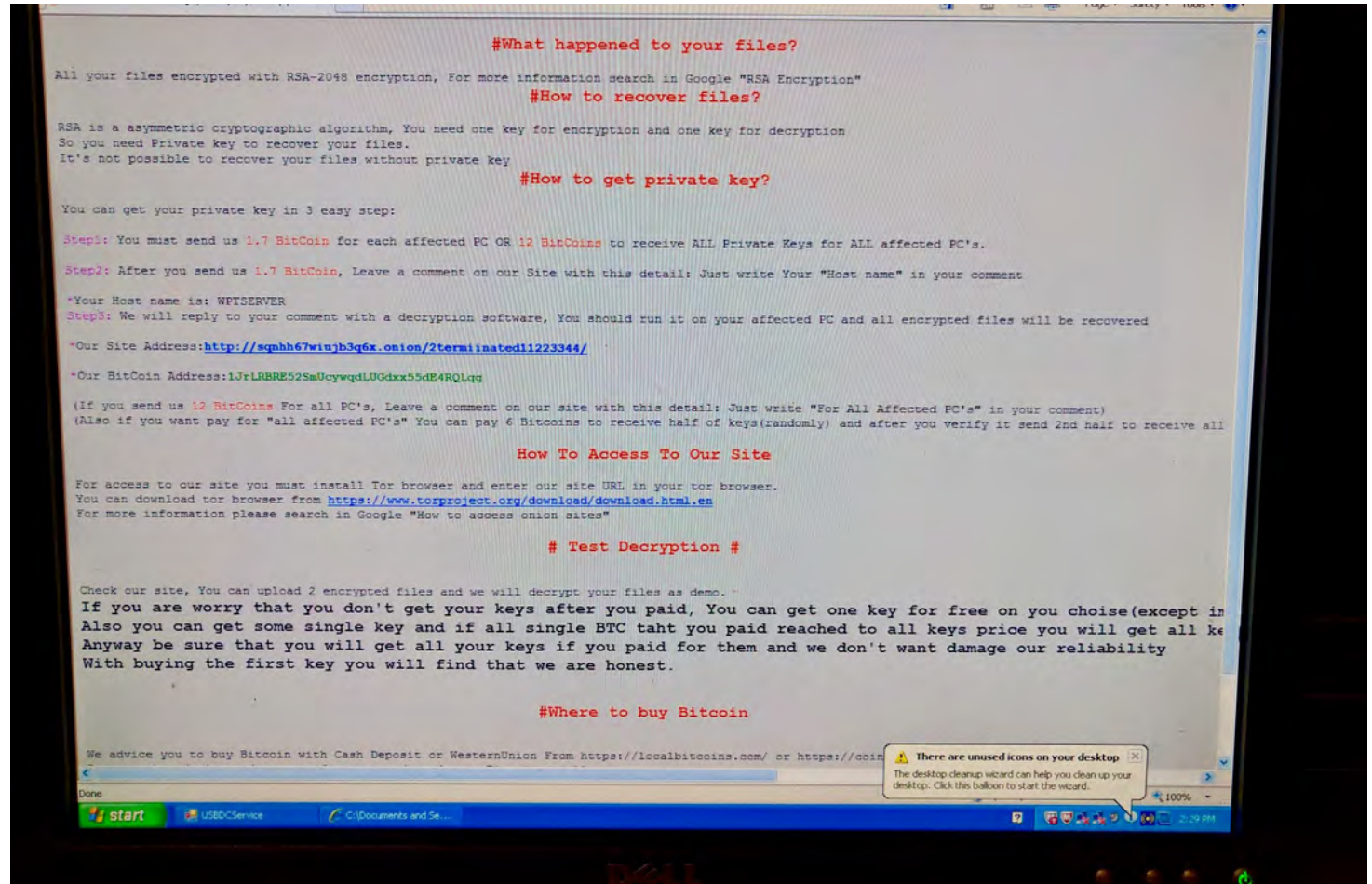


Photo credit, KQED: <https://www.kqed.org/futureofyou/how-to-make-it-harder-for-malware-to-shut-you-down>

Tip #39 – NUG section of website

- All current and many legacy manuals can be found here
- There is also access to the RF Toolbox

Technical Documentation

Family *

AMPFET ND Series ▼

Model *

ND10 ▼

Release or Hardware # (if available)

- select one - ▼

Category

☐ Module Booklet
☐ Technical Manual

SEARCH

Tip #40 – site maintenance

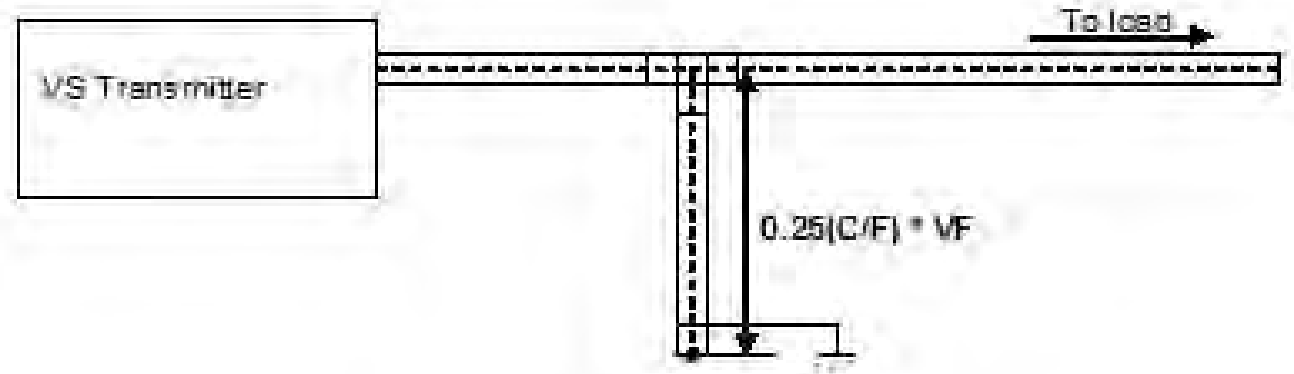
- Fluid levels and changes
- Belts and filters
- Check for leaks
- Fuel conditioning/treatment
- Battery check



Photo credit: www.cat.com

Tip #41 – shorting stubs

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



Tip #42 - DeOxit



Tip #43 - 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 #44 – Too much humidity bad!

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



Tip #45 – add some j

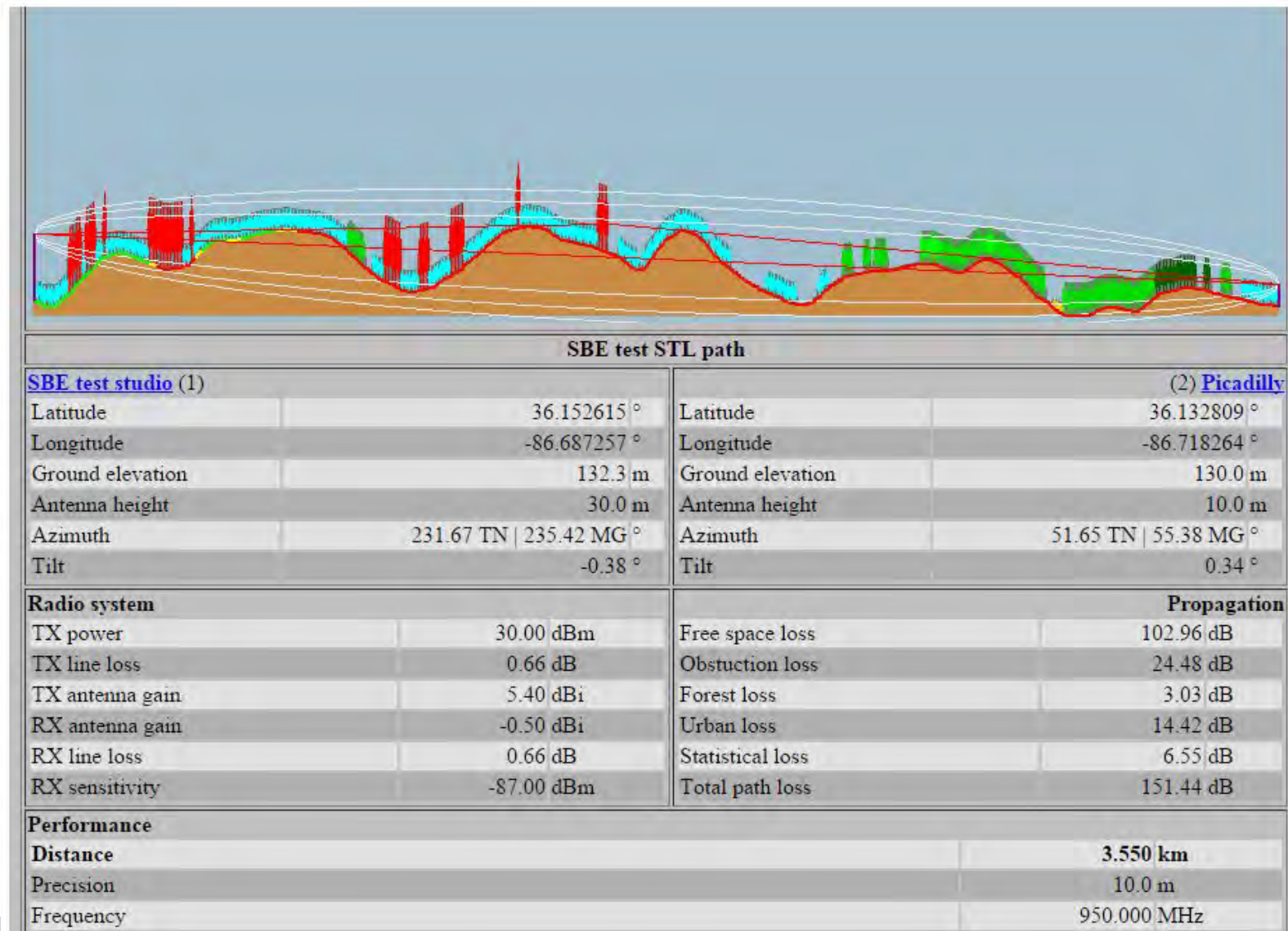
- J1000, XL and XR series transmitters like to see a bit of +j
 - Capacitive load slows down FET discharge, makes them more susceptible to transients
 - Setting impedance at transmitter output to $50\Omega + j5$ will help to minimize this. Also helps to compensate for any meter tolerance issue.

Tip #46 – D connectors

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

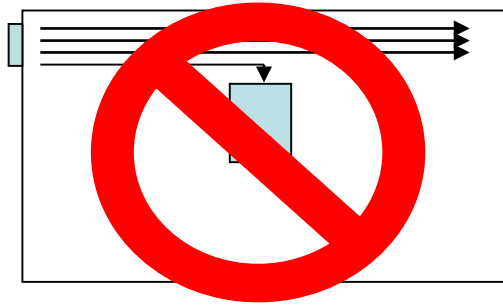


Tip #47 – RF Toolkit

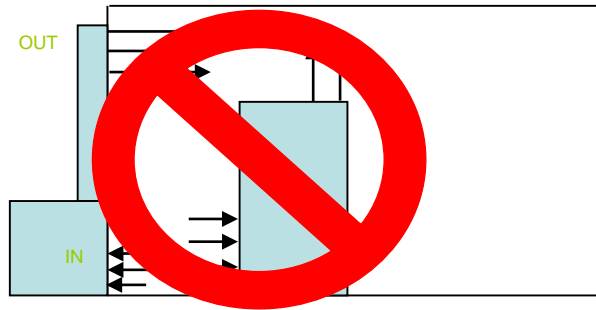
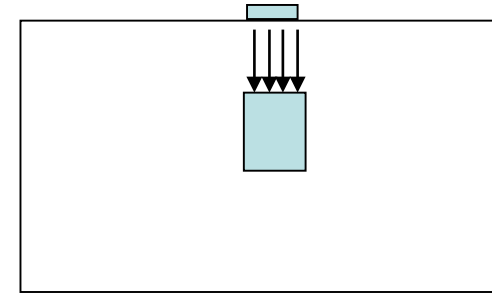


Tip #48 – airflow direction

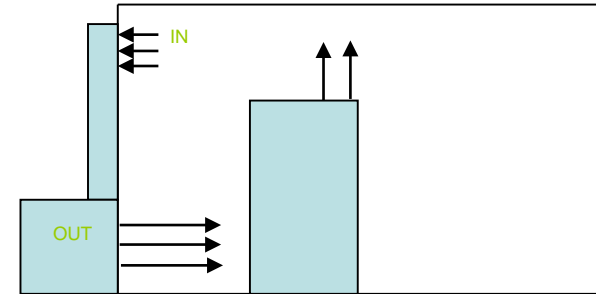
AIRFLOW DIRECTION IS CRITICAL!



TOP
VIEW



SIDE
VIEW



Tip #49 – site security

Floodlights are relatively cheap

A well lit site is less likely to be robbed or vandalized.



Tip #50 – ferrites for troubleshooting

Ferrites can be a troubleshooting tool

- If there is an imbalance between feed and return currents (common at AM transmitter sites), a ferrite on the coax will get warm – or even hot!





Thank you
for **50 years**
from all of us
at **Nautel**



making digital broadcasting work