

# Tips 'N' Tricks

**Tales from the Trenches**

# What we're going to cover

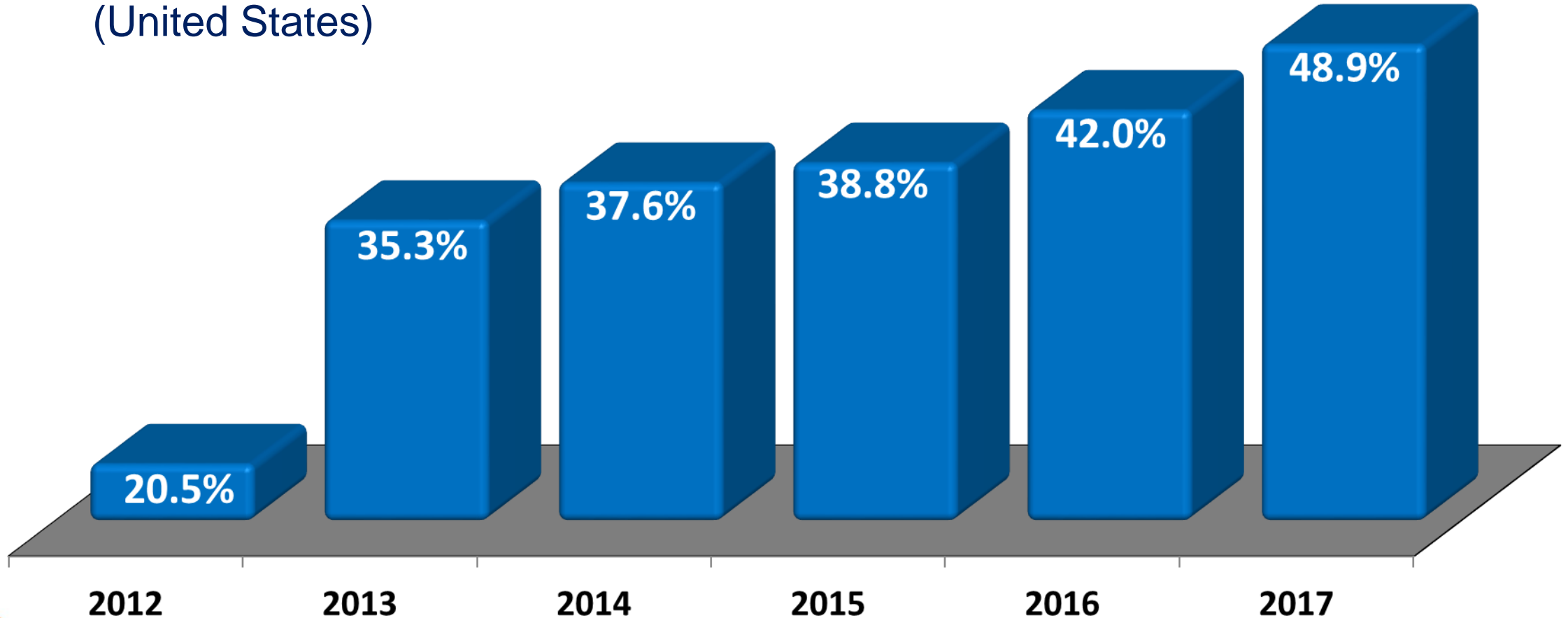
- Requested last year:
  - IT security/Site security
  - SFN
  - Grounding
  - HD Radio
  - Remote control/SNMP
  - MDCL
- Things requested this year:
  - HD Radio/HD data/metadata (26)
  - SNMP (6)
  - RDS (3)
  - HD Time Alignment (1)
  - AUl (use, updating, FLASH) (27)
  - Troubleshooting tips (4)
  - LTE interference (1)
  - maintenance (18)
  - amplifier repair/replacement (3)
  - grounding/lightning prot. (3)
  - cooling (3)

# HD Radio

# HD RADIO



✔ New cars delivered annually with factory-installed HD Radio  
(United States)



2012

2013

2014

2015

2016

2017

Graphic courtesy of Xperi

# Pieces

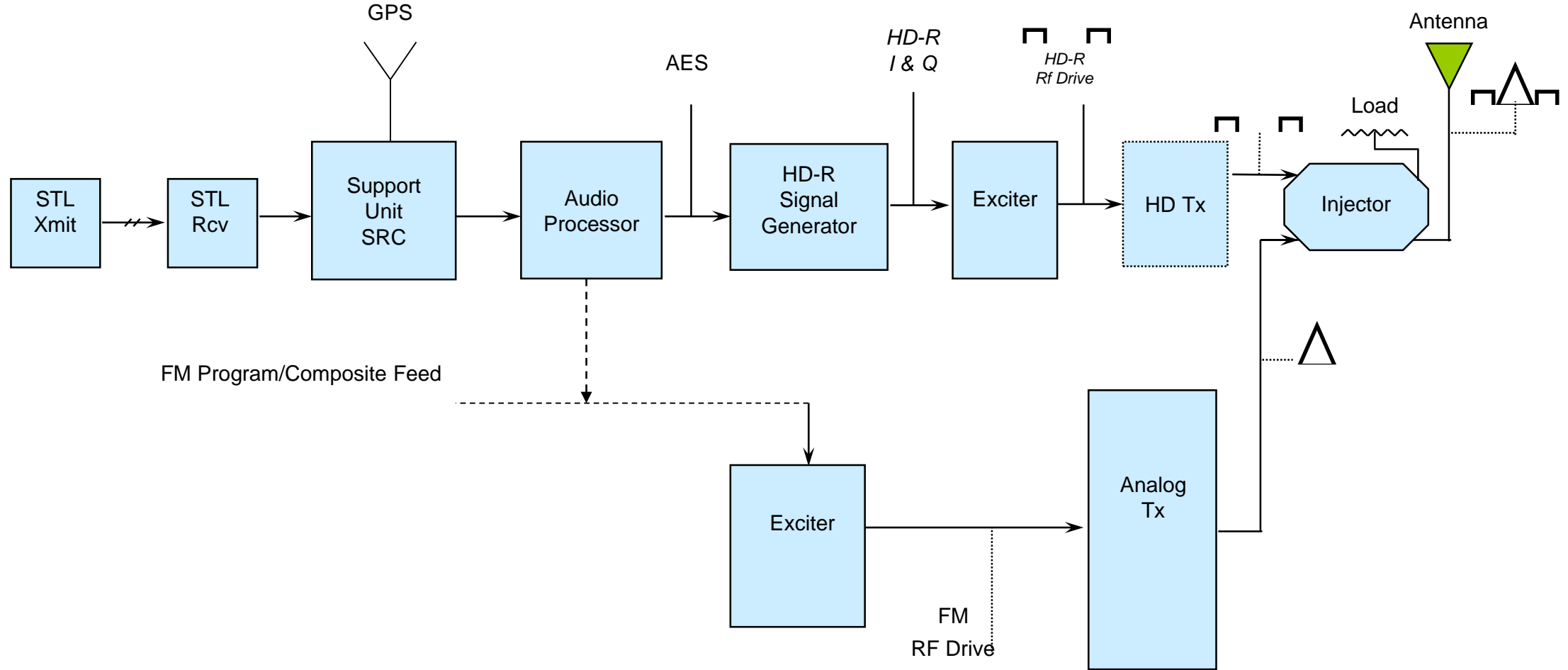
- Exporter – generates HD1 and multiplexes all HD data signals into one stream feeding Engine in exciter.
- Importer – generates HD2/3/4, adds PAD and feeds this signal to the Exporter
- Engine – usually found in Exciter now (or in Exporter in earlier systems), takes the HD data and creates an I/Q signal to drive exciter.

# Transmitters: High level injection

- Less transmitter cost than hybrid
- No additional antenna required
- Higher HD injection level may reduce the analog TPO capability
- Much higher cost of operation, due to losses in injector
- Much bigger footprint
- Overall project cost could exceed other options significantly
- Requires a reject load

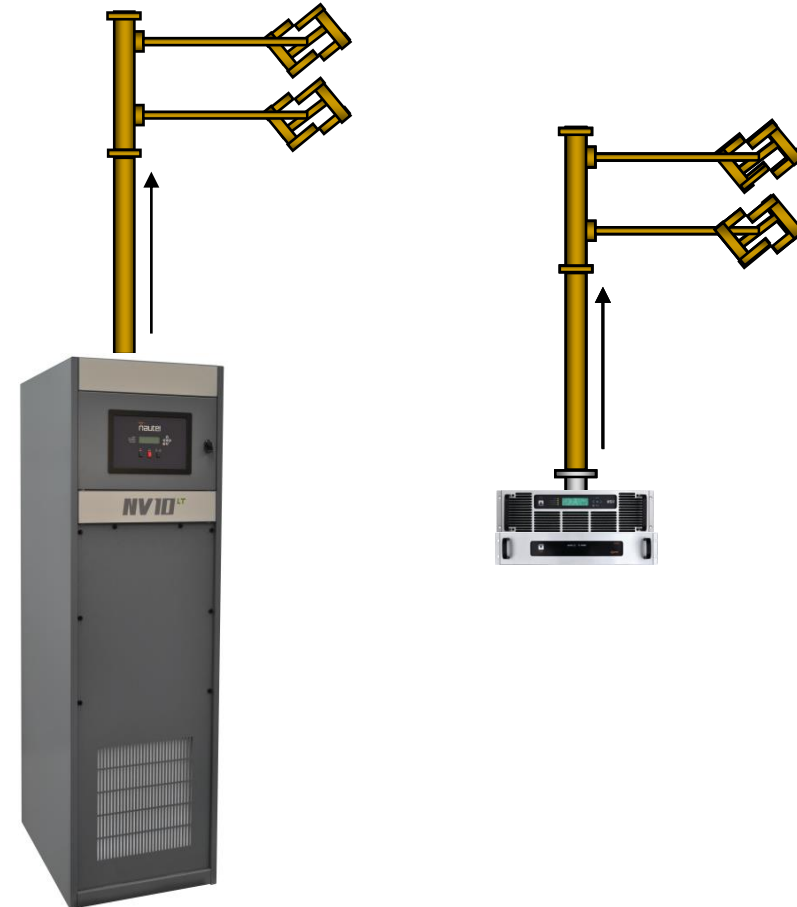


# High Level Combined FM System



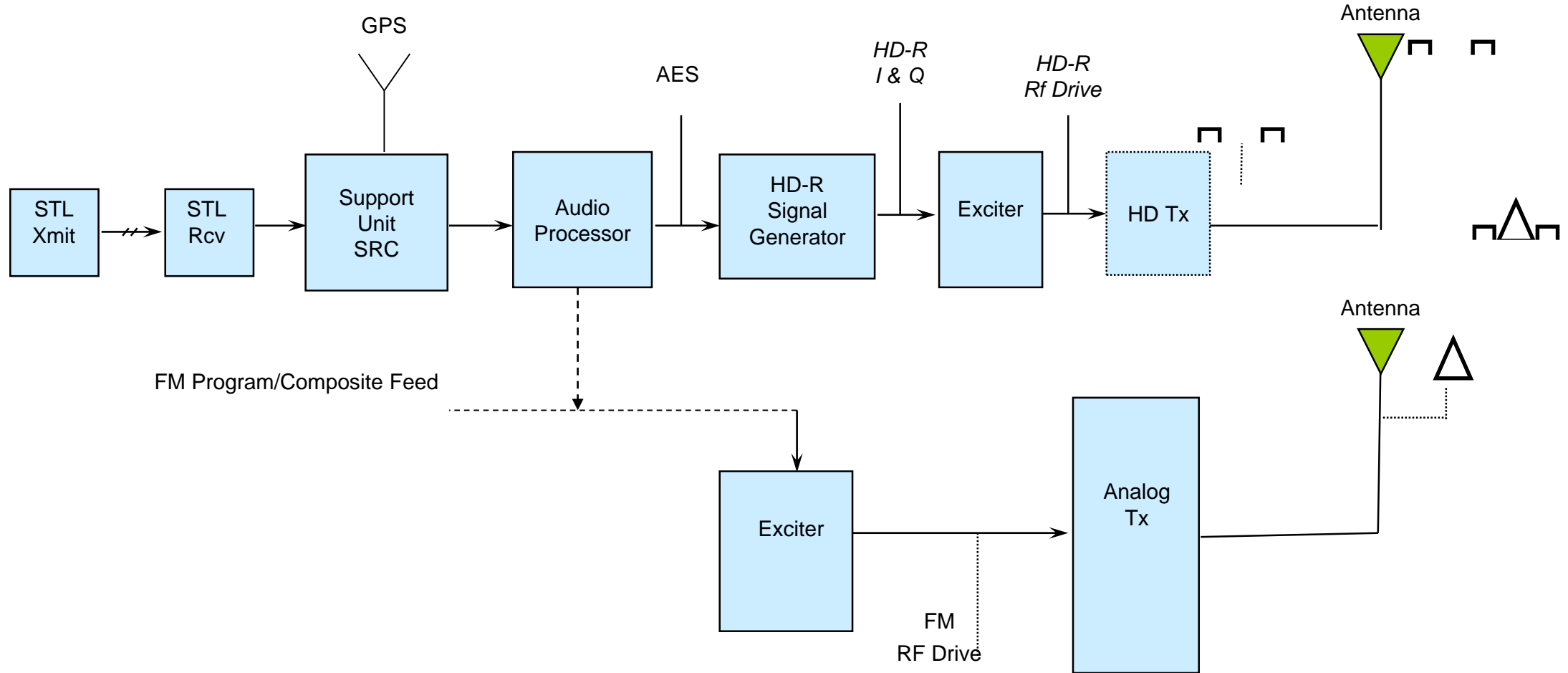
# Transmitters: Space Combined

- More efficient
- Digital transmitter/antenna can be used as backup
- Takes up more space
  - In site
  - On tower
- Pattern replication issues





# Antenna Combined FM System



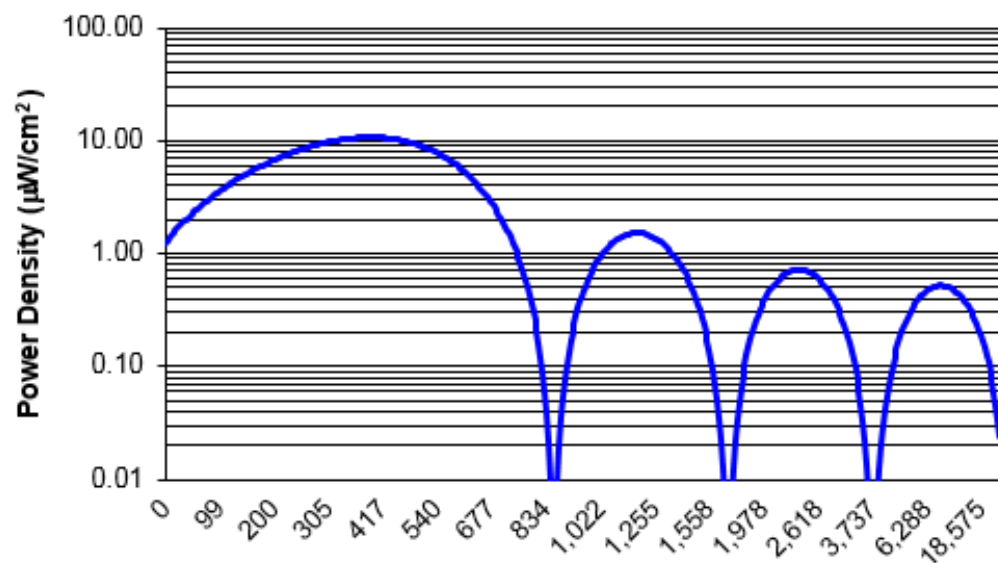
# Antenna Combined FM System

Antenna: ERI SHPX-4AC  
Bay Spacing: 1 wavelength  
Element Field @ -90: 12.6% (avg)  
Far-field Pattern Assumed

R/C Height AGL: 980 feet  
Max. ERP per polarization: 100.000 kW Analog  
3.981 kW Digital (avg)  
Date of Study: 28-Apr-15 /ID# 1

Theoretical Power Density per OET Bulletin 65  
Calculated for 2 meters (6.56 feet) Above Level Terrain

FCC limits: Uncontrolled Access  $\leq 200$ ; Controlled Access  $\leq 1,000$ .



Horizontal Distance from Tower Base (feet)

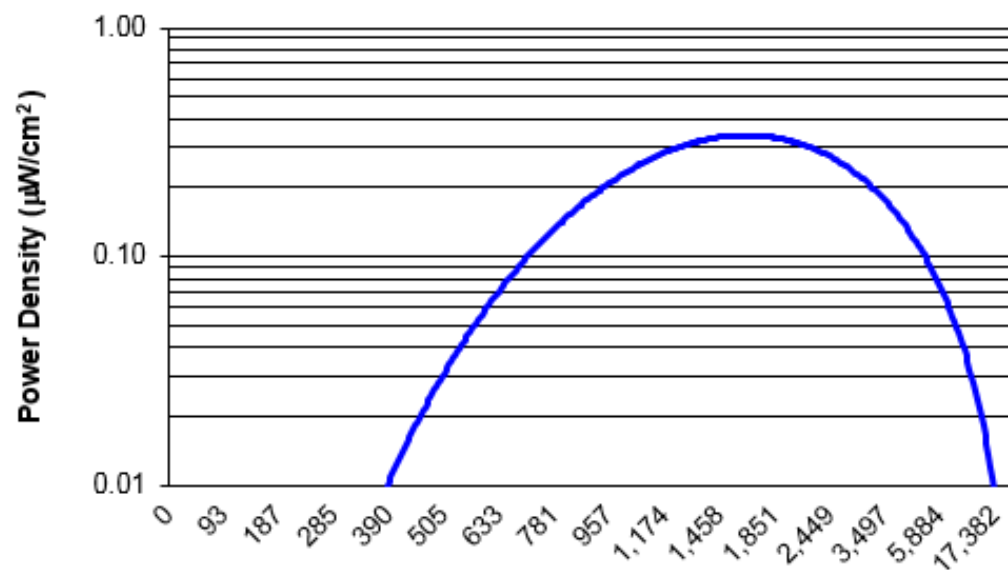
Calculation only for review and acceptance of station engineer or consultant.

Antenna: ERI SMPX-2HW  
Bay Spacing: 0.5 wavelength  
Element Field @ -90: 12.6% (avg)  
Far-field Pattern Assumed

R/C Height AGL: 917.5 feet  
Max. ERP per polarization: 4.000 kW Analog  
0.000 kW Digital (avg)  
Date of Study: 28-Apr-15 /ID# 1

Theoretical Power Density per OET Bulletin 65  
Calculated for 2 meters (6.56 feet) Above Level Terrain

FCC limits: Uncontrolled Access  $\leq 200$ ; Controlled Access  $\leq 1,000$ .



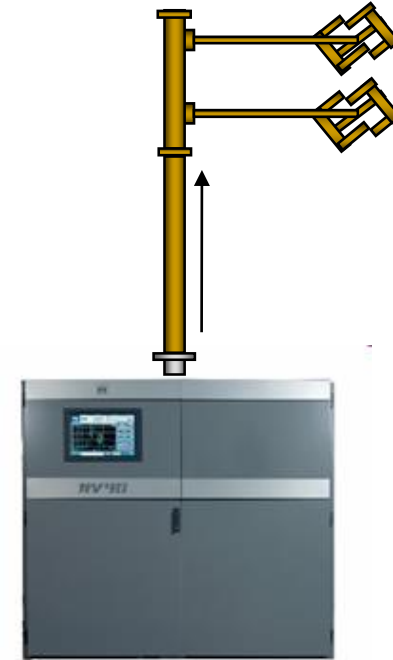
Horizontal Distance from Tower Base (feet)

Calculation only for review and acceptance of station engineer or consultant.

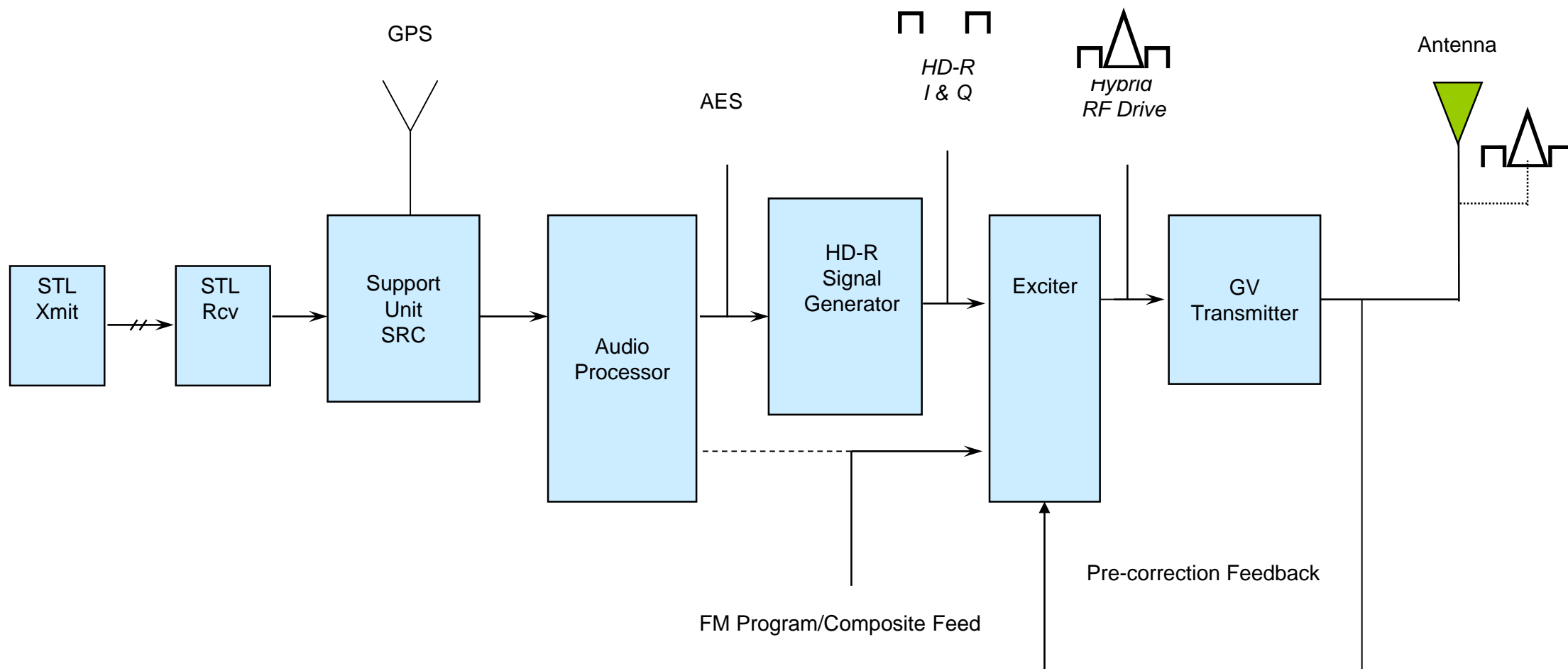
# Transmitters: Higher Power Hybrid

- Simple architecture
- Single box installation
- Higher HD injection level may reduce the analog TPO capability
- May need to replace your transmitter or combine another for higher total power
- Higher injection levels reduce efficiency\*

\* HD PowerBoost increases digital injection and efficiency of an existing transmitter.

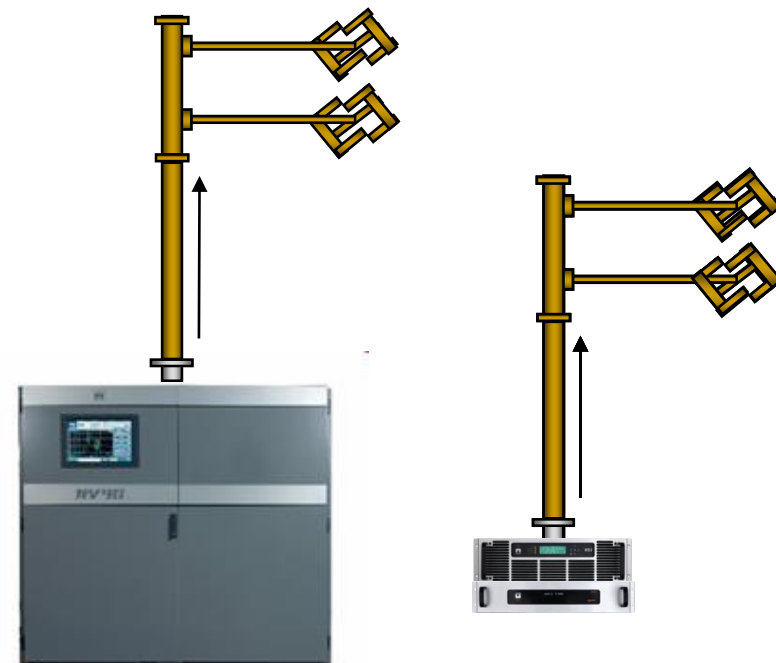


# Low Level Combined FM System



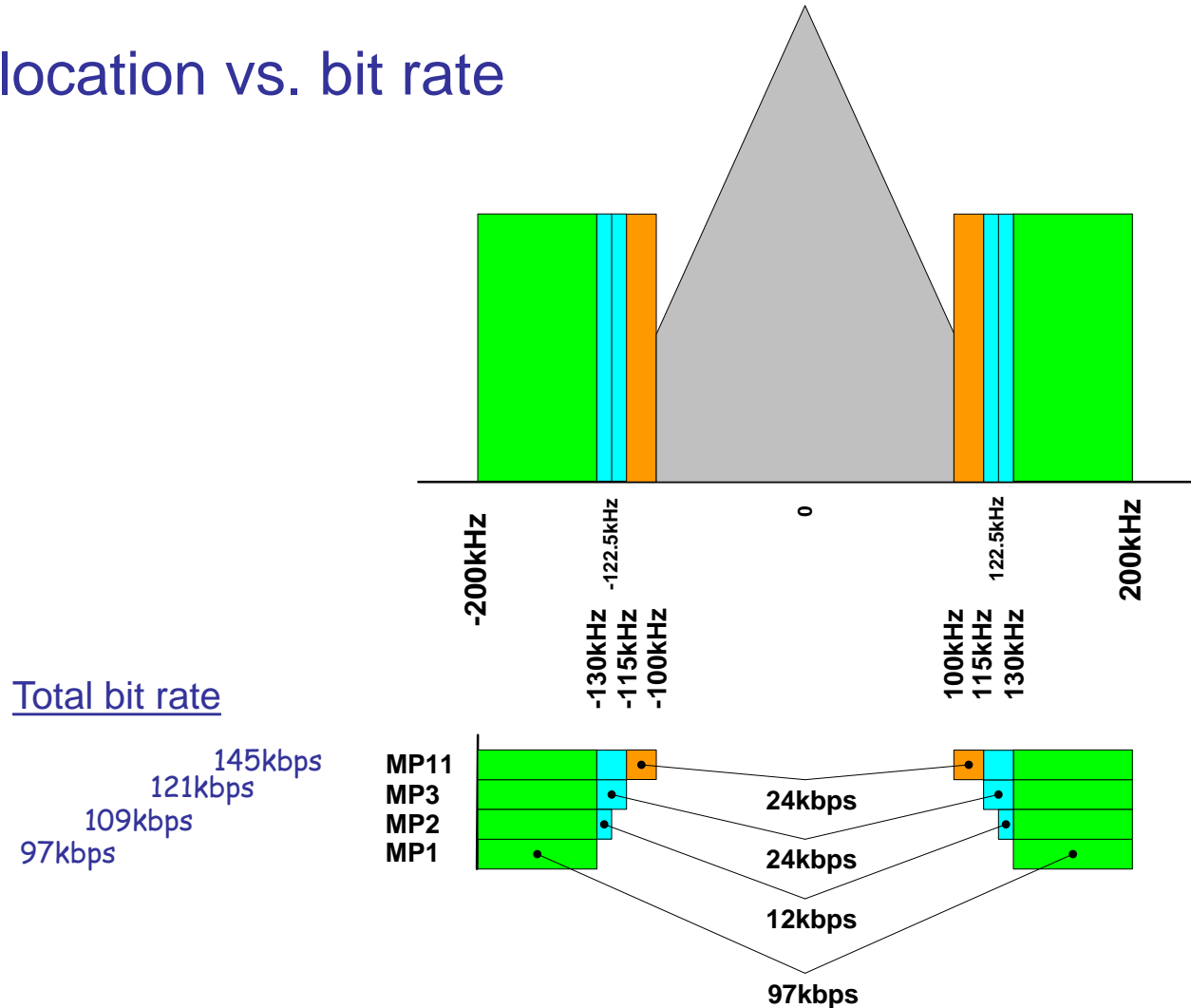
# Transmitters: Backfed Combiner

- Sometimes effective in channel combiner applications, with multiple stations on site.
- Can be significantly restricted by combiner capabilities
- Cost of operation breaks even with hybrid at higher injection levels.

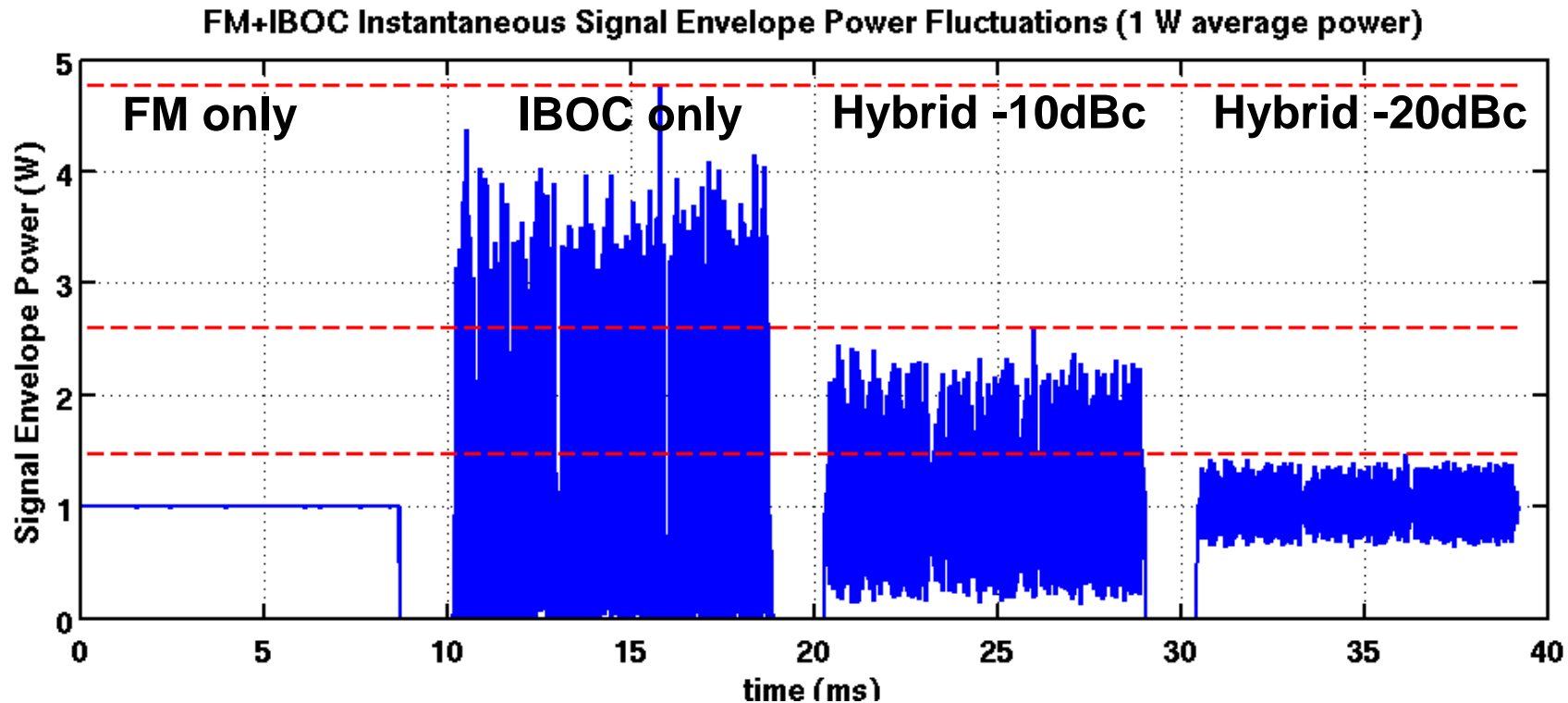


# Hybrid FM modes

Frequency allocation vs. bit rate



# Relative Power Requirements



# Power considerations

- MP Mode: MP1 MP3
- Injection level
- PowerBoost vs no PowerBoost, or Gen 3 vs. Gen 4 (or Gen 5)
- VSWR
- Headroom
- Work with your representative



# Program Associated Data (PAD)

- PAD typically requires additional equipment/software. Arctic Palm CSRDS (more later), or Enco PADapult, for example.
- Ports for PAD are manufacturer specific.
- Requires JMSAC to be implemented on Importer
  - <http://www3.nautel.com/pub/Importer/JMSAC/windows/2.0.5/>
- Album art can be used (requires license and may need 3<sup>rd</sup> party SW), or station logo/art – specs for config can be found in:  
[http://www3.nautel.com/pub/Importer/JMSAC/windows/2.0.5/Artist%20Experience\\_JMSAC.pdf](http://www3.nautel.com/pub/Importer/JMSAC/windows/2.0.5/Artist%20Experience_JMSAC.pdf)

# Other considerations

- Infrastructure (getting either analog plus HD data or three analog channels from studio to site, as well as any RDS/PAD).
- Peak voltages – remember to allow 6dB margin for the digital power
  - E.g.- a 10kW analog TPO, at -10dBc injection, requires components capable of 14kW...  
 $10\text{kW} + (1\text{kW} * 4)$
- Processing required for HD signals. Needs to be optimized for low bitrate audio – streaming processor vs. FM processor.

# Other considerations

- STL... must handle bitrates. Must be stable with respect to dither.
- IP conflicts – use QoS routing when possible. Note IP addresses and port assignments.
- Sample rate conversions... down is okay, up is bad. Avoid as much as possible.

# Other considerations

- Audio levels can be set in board, processor, some STLs, Exporter and Exciter. Especially when using AES/EBU, keep the reference level the same throughout the chain – it helps to make troubleshooting easier.
- Audio delay can be set in the Processor, Exporter or some Exciters... determine if you want your analog running through the Exporter.
- Time alignment is critical.
  - Common location can rely on audio synch/GPS
  - Paths with latency or dither may require correction (e.g.- Inovonics JUSTIN 808)

# RDS

# RDS

- PS Name (Program Service)... PS=xxxx
  - xxxx = descriptor for station typically
- Radio Text... RT=xxxx
  - xxxx = desired text (program name, artist/song title, etc.)
- PI Code... PI=xxxx (hexadecimal code for station call)
  - In North America, this can be looked up
    - [www.w9wi.com/articles/rdsreverse.html](http://www.w9wi.com/articles/rdsreverse.html) (says U.S. only, but works for Canada/Mexico also)

# RDS

- CSRDS – middleware between automation and transmitter
- Automation exports artist/song title as XML, ASCII or IP
- Inputs to CSRDS need to be configured to match automation

CSRDS Properties

Config File: CSRDSradiox.INI

General | Input Sources | **RDS/RBDS** | FTP/File Output | HD/IP Output | Other

**Hard Disk System Connection**

Maximum Speed: 9600 Port: <None>

Connection: Data Bits: 8 Parity: None Stop Bits: 1

Flow Control: ☒ Hardware ☐ Xon/Xoff ☐ RTS ☐ Xon/RTS

**Music Format**

☐ Maestro ☐ WO ☐ CSRAS  
☐ OMT ☐ RCS Billboard ☐ AV ☐ Satellite ☐ SS32 Fmt C - E ☐ Dalet ☐ Radiomation R3 ☐ Simian ☐ GML ☐ MegaSeg ☐ Jelli->Art Size ☐ W0 ☐ Genesys ☐ NexGen ☐ Smarts ☐ David ☐ RDS Fmt ☐ DJB ☐ Arrakis ☐ DiPRO ☐ Storq ☐ ENCO ☐ OPX

**Channels**

☐ B ☒ 1 ☒ 2 ☒ 3 ☐ 4 ☐ WEB

**Input from IP**

: ☐ UDP

**Music From File** W:\METADATA\KVEX\NOWPLAYING.XML

**Artist/Title Separator** Brand ID 97.5 Radio X ☐ Year

☐ Artist First ☐ Reverse Name ☐ Title - Artist - 97.5 Radio X

☒ Do not send promos during songs ☐ Re-Send ☐ Filter Comments

☐ Send Sponsors Prefix With

☐ Send Coming Events

**Split Input Source** ☐ Local ☐ Schedule

**Text Format** ☒ As is ☐ UPPER ☐ Normalize

**Log File**

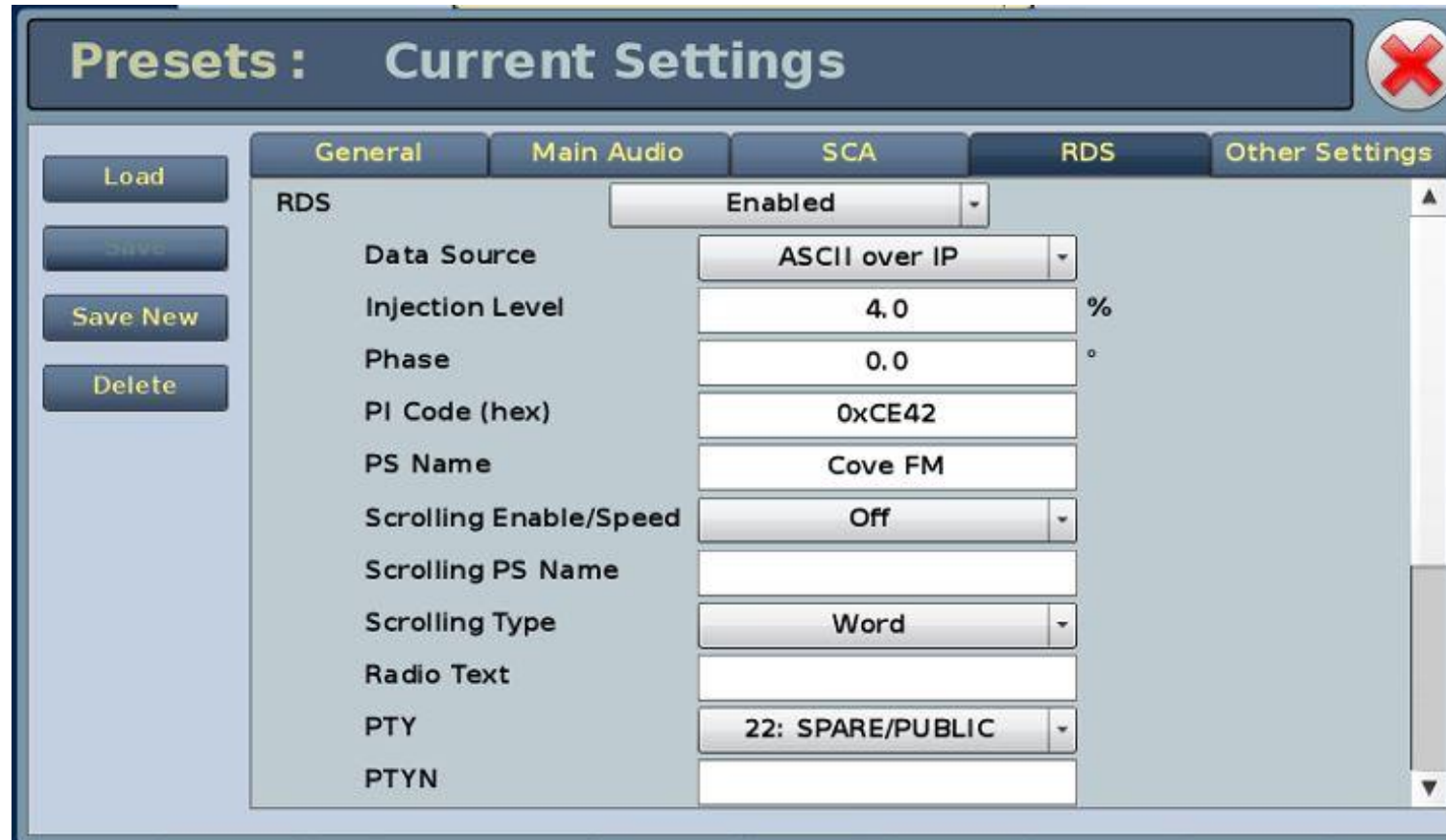
**Format** ☐ CSLogIt File

**KVEX-LP**



# RDS

- In transmitter, set data source
- Look up PI hex code ([www.w9wi.com](http://www.w9wi.com) for North America)
- Set desired injection level (typically 5%)
- Phase important if using internal RDS generator. In quadrature with pilot.



The screenshot shows a software window titled "Presets : Current Settings" with a red 'X' close button in the top right corner. The window has five tabs: "General", "Main Audio", "SCA", "RDS", and "Other Settings". The "RDS" tab is selected. On the left side of the window, there are four buttons: "Load", "Save", "Save New", and "Delete". The main area of the "RDS" tab contains the following settings:

RDS	
RDS	Enabled
Data Source	ASCII over IP
Injection Level	4.0 %
Phase	0.0 °
PI Code (hex)	0xCE42
PS Name	Cove FM
Scrolling Enable/Speed	Off
Scrolling PS Name	
Scrolling Type	Word
Radio Text	
PTY	22: SPARE/PUBLIC
PTYN	



# RDS

- Set CSRDS output
  - Select encoder type
  - Enter transmitter IP address
  - Enter port (for Nautel use 7005)
  - Enter PI code
  - Remaining settings will vary, depending on preference

The screenshot shows the 'CSRDS Properties' dialog box with the 'RDS/RBDS' tab selected. The 'Config File' is 'CSRDSradiox.INI'. The 'Encoder Configuration' section includes 'Encoder Com Port Settings' (Maximum Speed: 9600, Port: <None>, Connection: Data Bits: 8, Parity: None, Stop Bits: 1, Flow Control: Hardware) and 'Encoder Type' (Inovonics 711-730, FMB10(silver), FMB80 NFM, Nautel, T-Fleet, Aztec, Deva SG5, KAVARTA, PIRA32, RDI 20, Tiger Shark, 2WCOM, Omni 9). The 'Encoder' section includes IP= [redacted], PI= 47F3, PS= RadioX, DI= STEREO, RT+= NO, Group=, ID Code=, M/S= MUSIC, RT= ENABLE, LEVEL=, ATT=, PTY=, UDP=, Do not Send Sponsors=, RT\_RATE= 1, PHASE=, G=, H=, AF+=. The 'Radio X' section includes Use Dynamic PS, Artist and Title Only, PAD PS, Radio X, DPSM= NORMAL, DPSS= 3, and Alternate PS. The 'KVEX-LP' button is highlighted.

# RDS

- Additional Info:

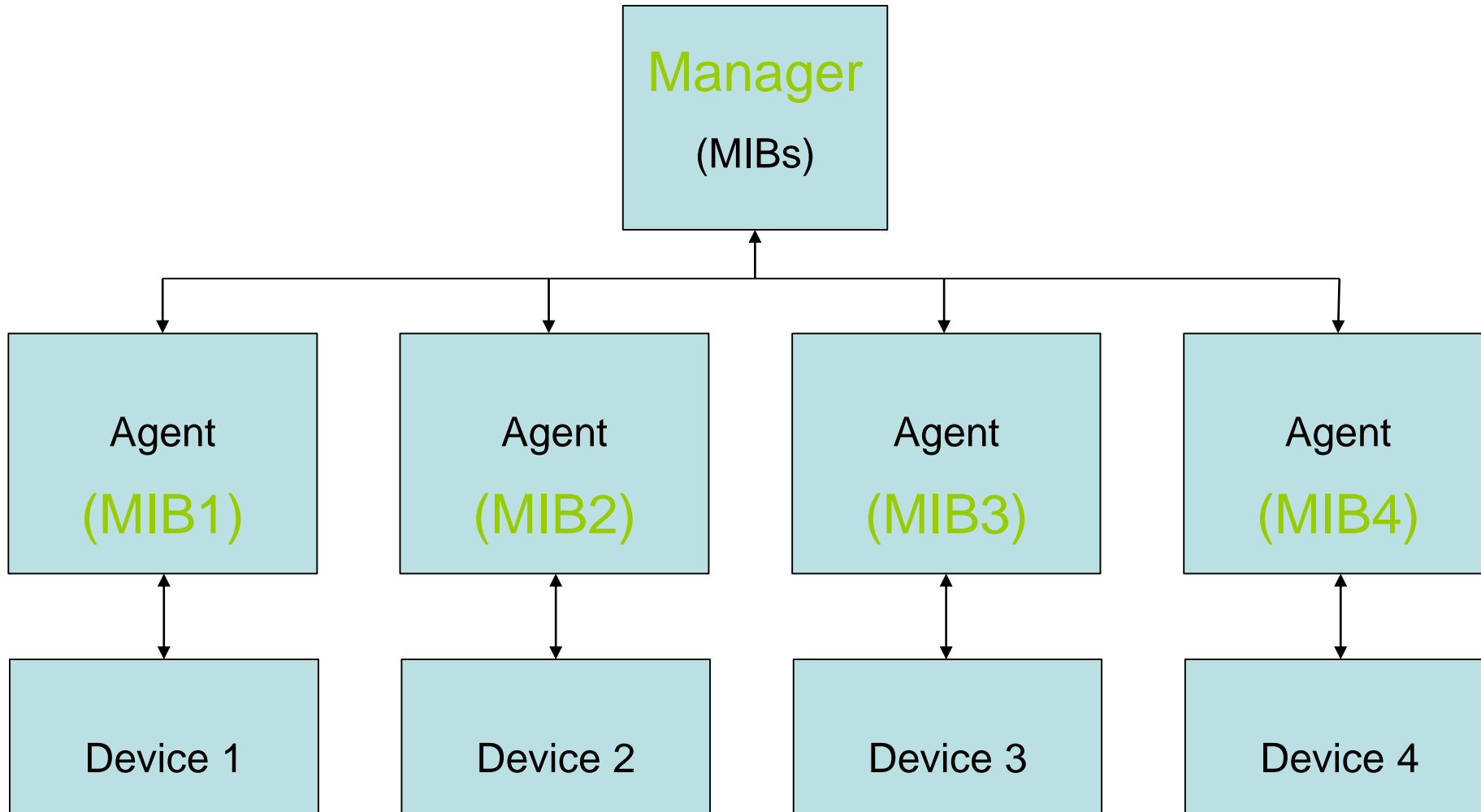
- <https://www.radioworld.com/resource-center/rds-basics-best-practices> eBook with lots of detail on RDS best practices, including setting up CSRDS.
- [https://www.2wcom.com/fileadmin/redaktion/dokumente/Company/RDS\\_Basics.pdf](https://www.2wcom.com/fileadmin/redaktion/dokumente/Company/RDS_Basics.pdf) Excellent resource on the structure and format of the RDS/RBDS systems. Older file, but still quite relevant.
- <http://www.nrscstandards.org/sg/NRSC-G300-B.pdf> NRSC RDS specification provides good technical description

# SNMP

# What is it?

- SNMP was developed in 1988
  - Purpose is to collect and organize data from devices on a network
  - Can also send information to manage devices and change behaviour
  - Provides an easy way to monitor and control anything that is connected

# What is the structure?

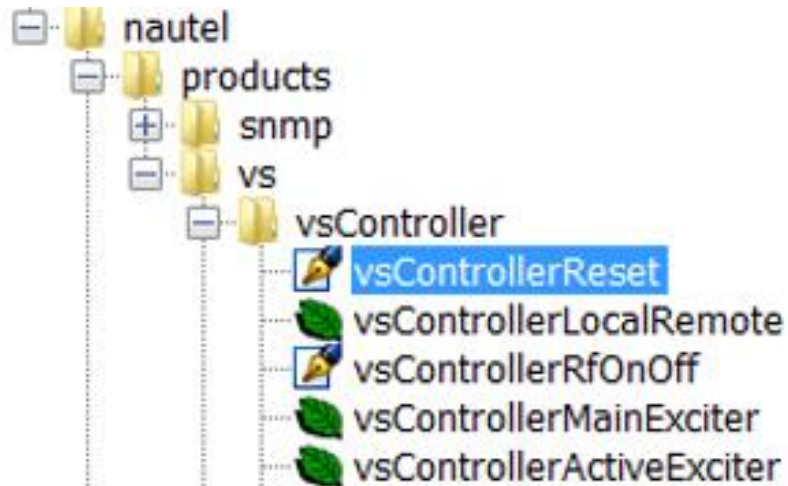


# What is the structure?

- Managers – poll the agents to retrieve status, or push (SET) commands
- Agents/Clients – retrieve information from the devices to send to managers, or take commands from managers and send to devices
- Browsers – a visual tool to view the overall activity, to monitor status for each device, or to provide a simple way to send commands to the devices.

# What is the structure?

- MIB files
  - Management Information Base
    - Predefined structure that stores information that can be queried or set
    - Work from a very structured address set (OID – or Object Identifier)



Name	vsControllerReset
OID	.1.3.6.1.4.1.28142.1.300.256.7
MIB	NAUTEL-VS300-MIB
Syntax	INTEGER (0..1)
Access	read-write
Status	current
DefVal	
Indexes	
Descr	Reset alarms (any value will cause reset - use 1)

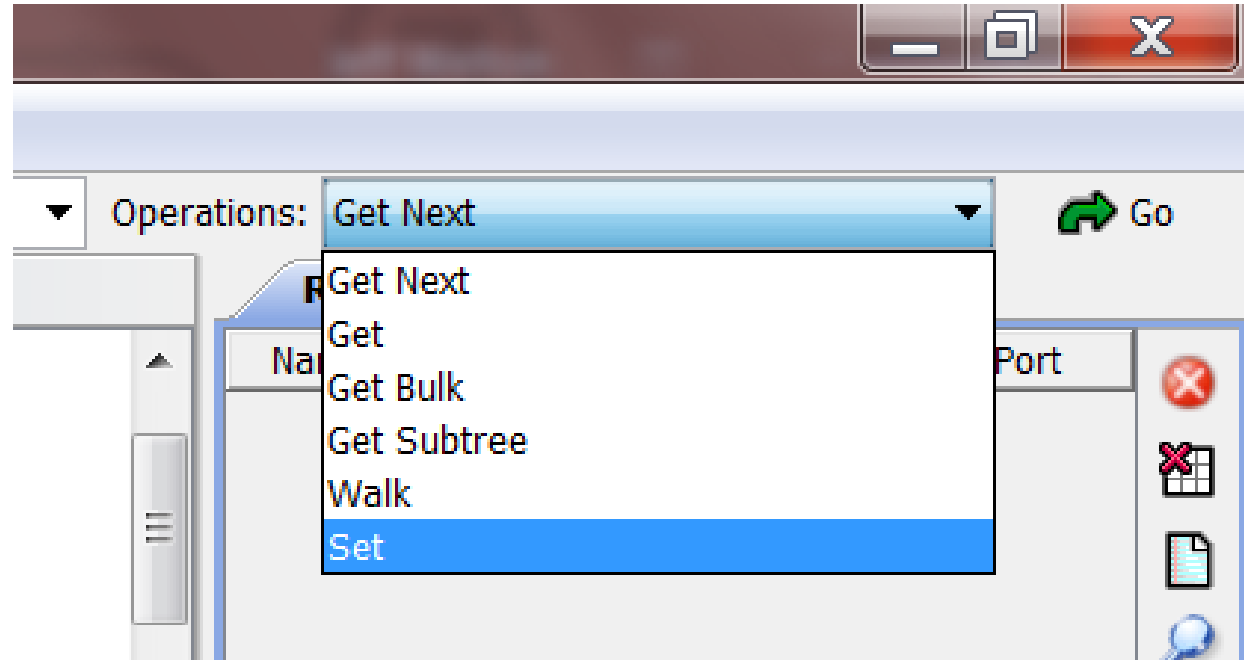
# What is the structure?

- OID: .1.3.6.1.4.1.28142.1.300.256.329.0
  - 1.3.6.1 = iso.org.dod.internet (this will be the same for all devices)
  - 4 = private (1 – directory, 2 – management, 3 – experimental, 5 – security, 6 – SNMPv2, 7 – mail, 8 - features)
  - 1 = enterprise
  - 28142 = manufacturer code (Nautel is 28142)
  - Rest of OID identifies assemblies, down to specific command or monitor point and parameters.



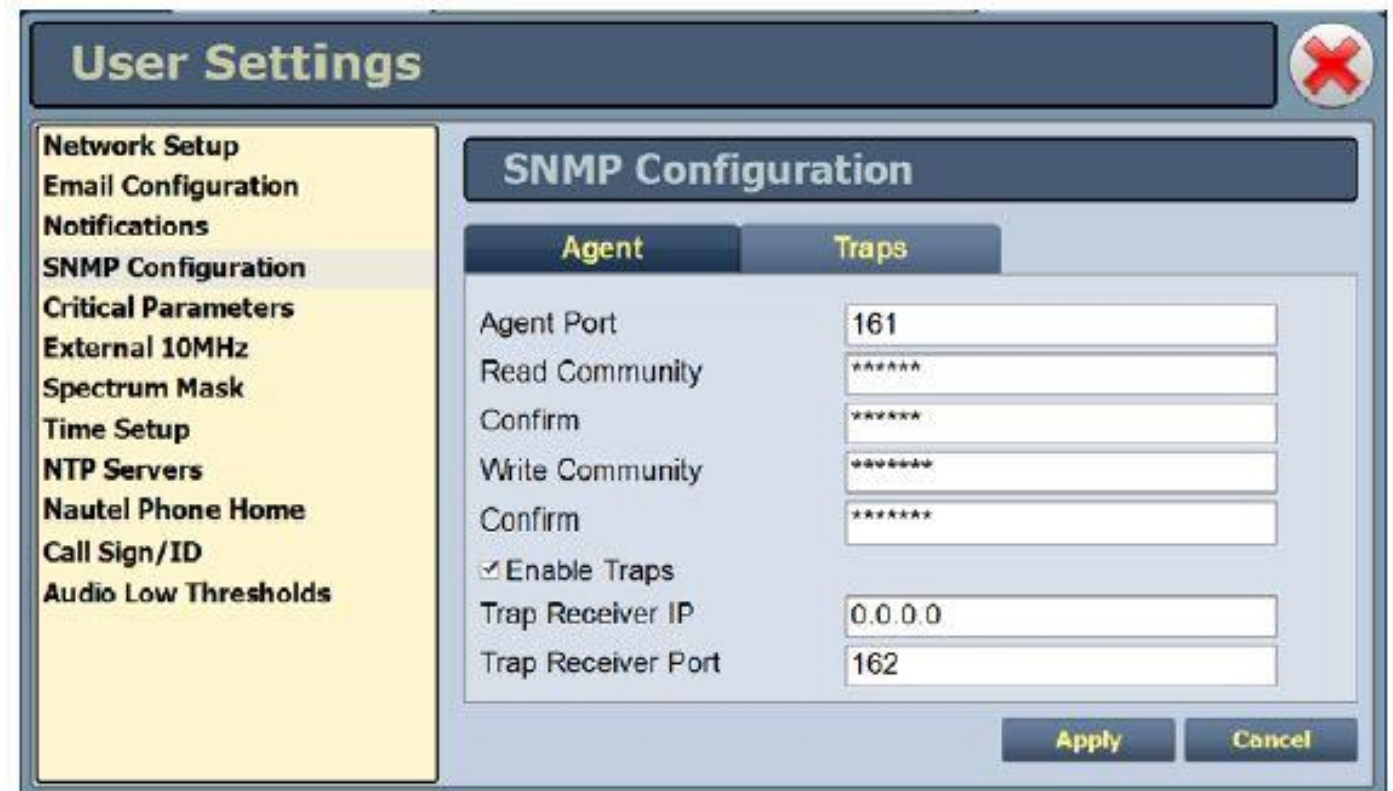
# What are the commands?

Get  
Response  
Get Next  
Walk  
Set  
Trap  
Inform



# How do we make it work?

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

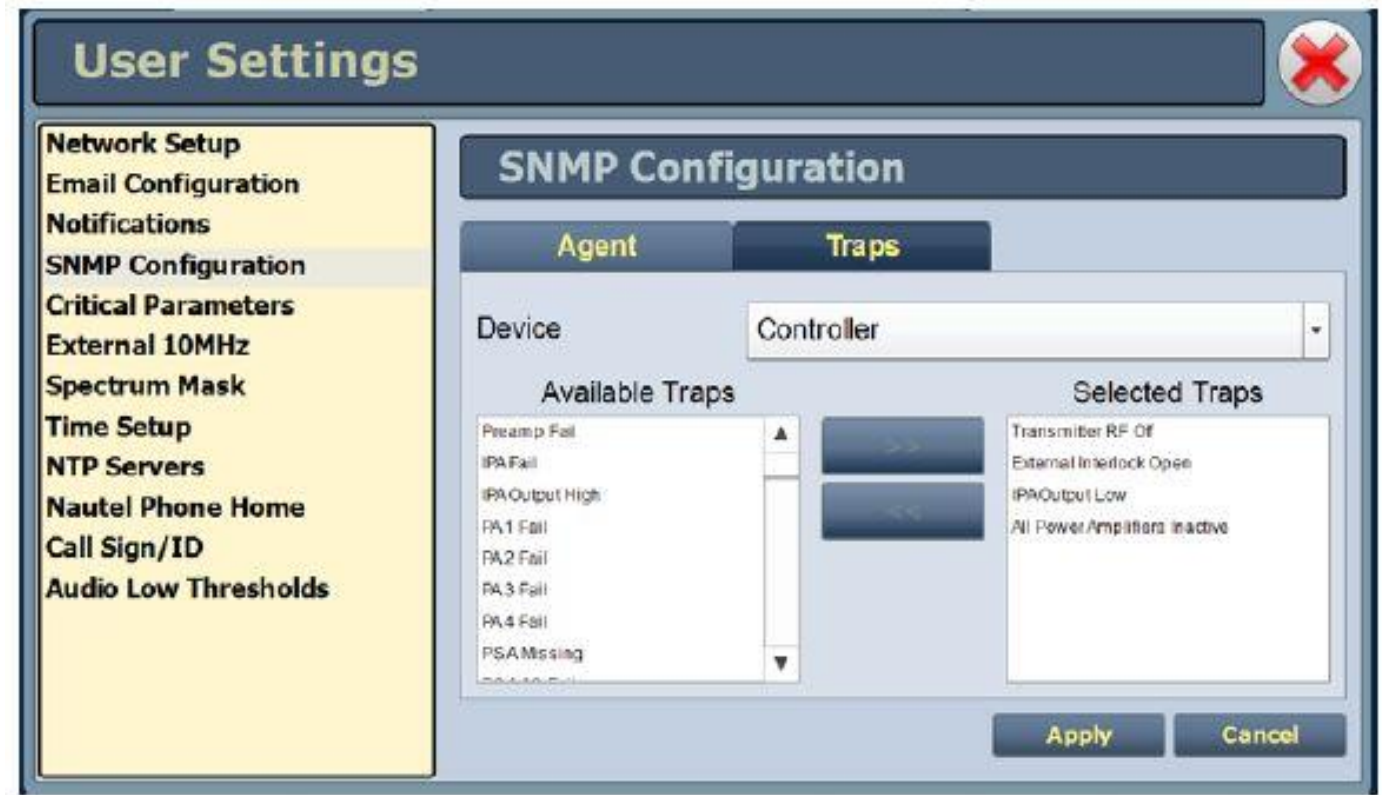


The image shows a 'User Settings' dialog box with a sidebar on the left and a main configuration area on the right. The sidebar lists various settings: Network Setup, Email Configuration, Notifications, SNMP Configuration (highlighted), Critical Parameters, External 10MHz, Spectrum Mask, Time Setup, NTP Servers, Nautel Phone Home, Call Sign/ID, and Audio Low Thresholds. The main area is titled 'SNMP Configuration' and has two tabs: 'Agent' and 'Traps'. The 'Traps' tab is active, showing fields for 'Trap Receiver IP' (0.0.0.0) and 'Trap Receiver Port' (162). There are also fields for 'Read Community' and 'Write Community', both masked with asterisks, and a checkbox for 'Enable Traps' which is checked. At the bottom right are 'Apply' and 'Cancel' buttons.

SNMP Configuration	
Agent	Traps
Agent Port	161
Read Community	*****
Confirm	*****
Write Community	*****
Confirm	*****
<input checked="" type="checkbox"/> Enable Traps	
Trap Receiver IP	0.0.0.0
Trap Receiver Port	162

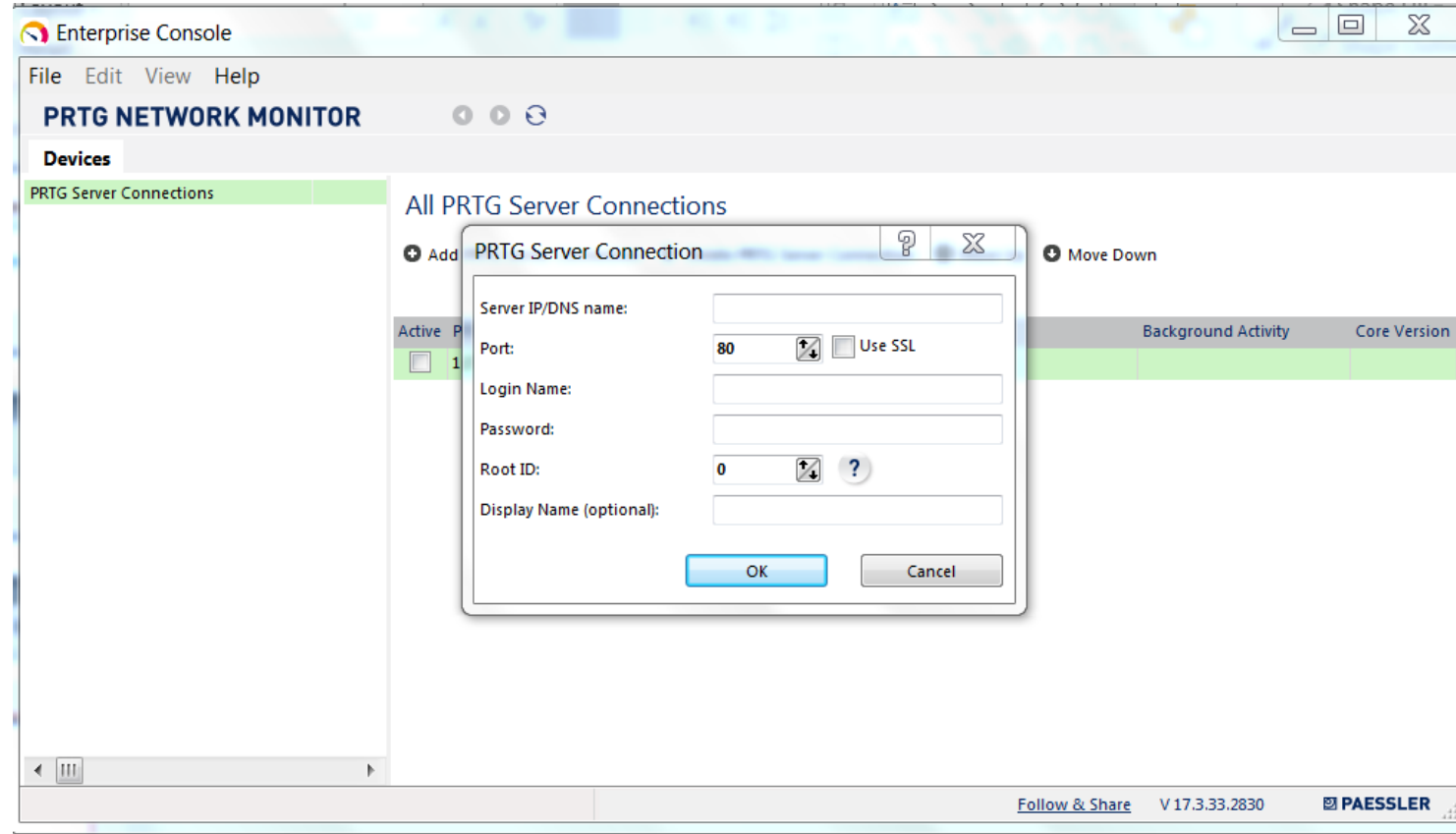
# How do we make it work?

- Configure devices
  - For Traps, select what alarms or functions will send notifications to Manager.



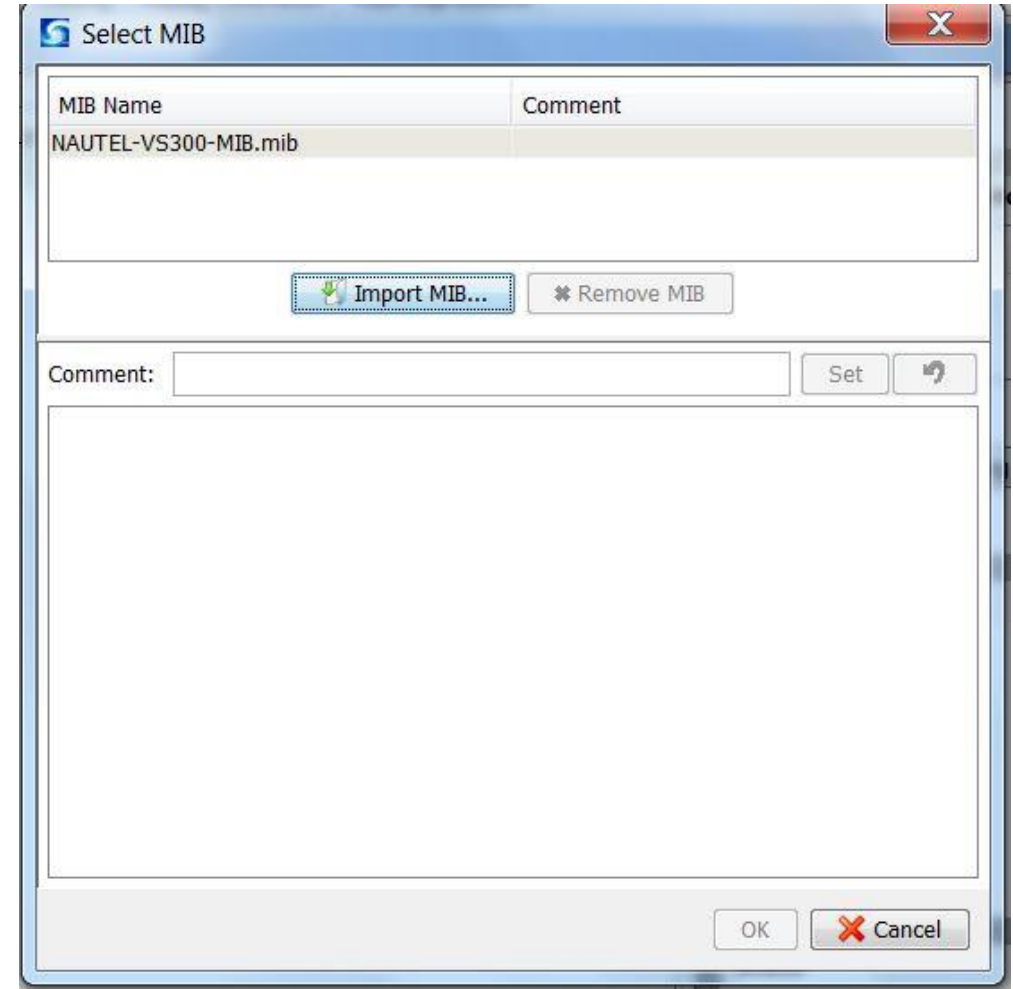
# How do we make it work?

- Configure Manager
  - Set Server (Agent) IP address and login info.
  - Note that some managers will require a password (leaving blank may not be an option!)



# How do we make it work?

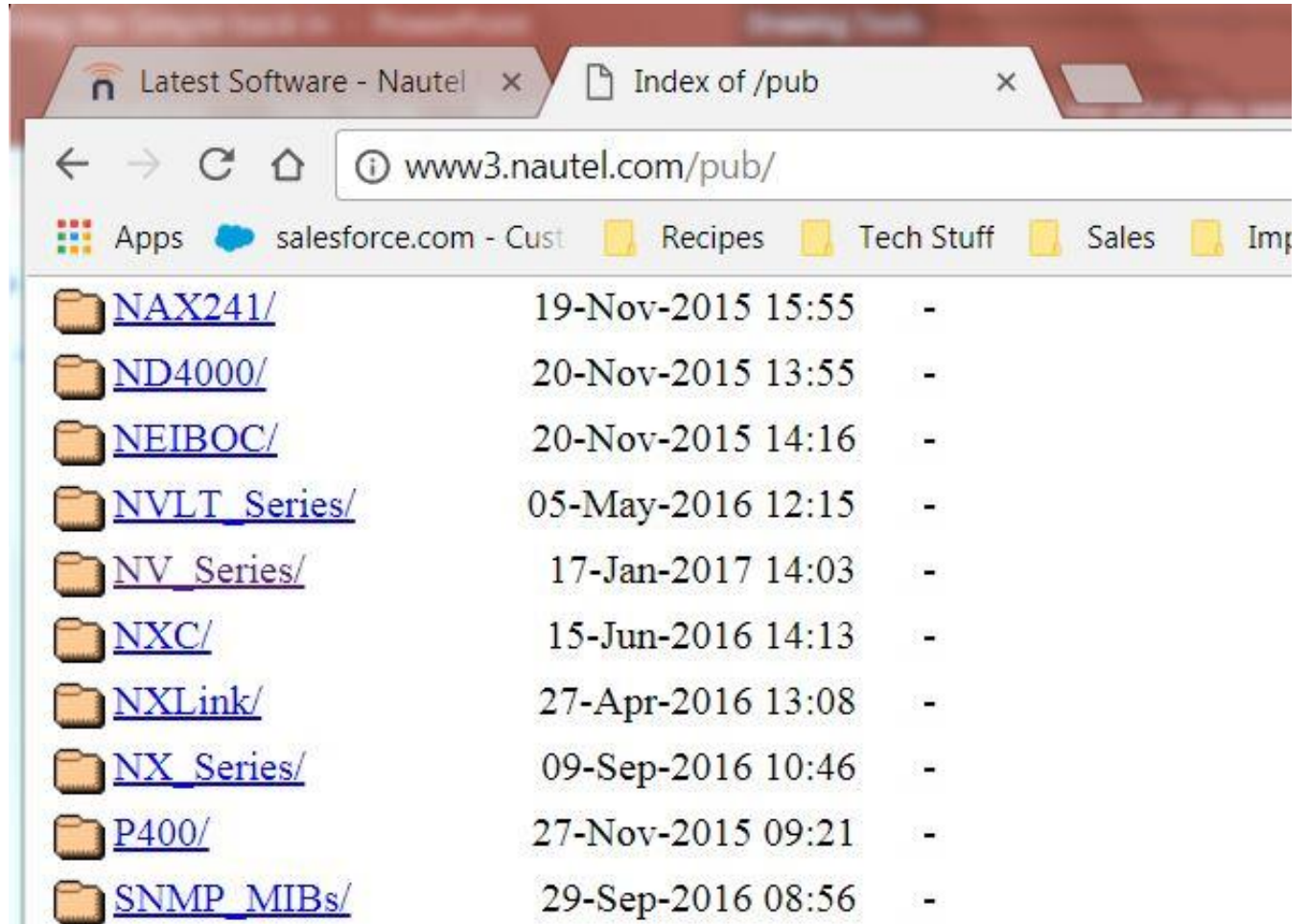
- Configure Manager
  - Import (load) MIBs for all client devices



# How do we make it work?

- Configure Manager
  - Nautel provides MIBs in FTP site

[http://www3.nautel.com/pub/SNMP\\_MIBs/](http://www3.nautel.com/pub/SNMP_MIBs/)



The screenshot shows a web browser window with two tabs: 'Latest Software - Nautel' and 'Index of /pub'. The address bar displays 'www3.nautel.com/pub/'. Below the address bar, there are navigation links for 'Apps', 'salesforce.com - Cust', 'Recipes', 'Tech Stuff', 'Sales', and 'Imp'. The main content area shows a directory listing of folders with their names, last modified dates, and sizes.

Folder Name	Last Modified	Size
<a href="#">NAX241/</a>	19-Nov-2015 15:55	-
<a href="#">ND4000/</a>	20-Nov-2015 13:55	-
<a href="#">NEIBOC/</a>	20-Nov-2015 14:16	-
<a href="#">NVLTV Series/</a>	05-May-2016 12:15	-
<a href="#">NV_Series/</a>	17-Jan-2017 14:03	-
<a href="#">NXC/</a>	15-Jun-2016 14:13	-
<a href="#">NXLink/</a>	27-Apr-2016 13:08	-
<a href="#">NX_Series/</a>	09-Sep-2016 10:46	-
<a href="#">P400/</a>	27-Nov-2015 09:21	-
<a href="#">SNMP_MIBs/</a>	29-Sep-2016 08:56	-



# The 'Gotchas'

- There are always gotchas.
  - SNMP requires ports 161 and 162 be open (161 for messages from the manager to the agent, 162 for messages going the other way).
  - Different managers will require different amounts of configuration
    - A simple MIB browser needs very little config – but offers little organization
    - A more complex manager can be configured all the way to creating analog metering

# Additional Information

<https://www.digitalocean.com/community/tutorials/an-introduction-to-snmp-simple-network-management-protocol>

A good introduction to commands and structures

<http://www.dpstele.com/snmp/mib/index.php?l=208100001>

Tutorial on MIB structure – note that this does require joining a mailing list.



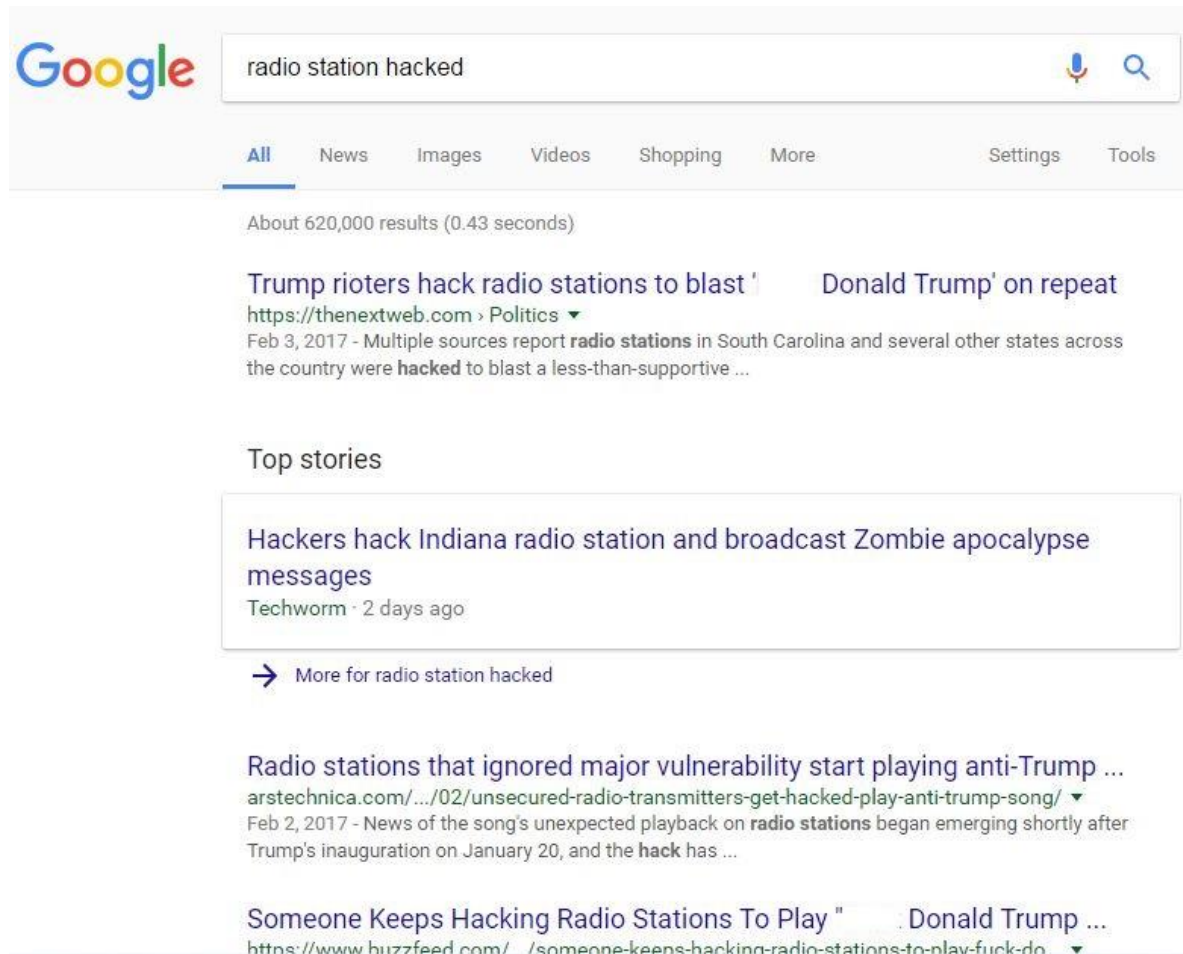


**10 Minute  
BREAK!**



# Security

# IT Security



A screenshot of a Google search results page for the query "radio station hacked". The Google logo is on the left, and the search bar contains the text "radio station hacked". Below the search bar are tabs for "All", "News", "Images", "Videos", "Shopping", "More", "Settings", and "Tools". The "All" tab is selected. Below the tabs, it says "About 620,000 results (0.43 seconds)". The first search result is titled "Trump rioters hack radio stations to blast 'Donald Trump' on repeat" with a link to "https://thenextweb.com > Politics". The snippet below the link reads: "Feb 3, 2017 - Multiple sources report **radio stations** in South Carolina and several other states across the country were **hacked** to blast a less-than-supportive ...". Below this is a "Top stories" section. The first story in this section is titled "Hackers hack Indiana radio station and broadcast Zombie apocalypse messages" by "Techworm · 2 days ago". Below this is a link "→ More for radio station hacked". The second search result is titled "Radio stations that ignored major vulnerability start playing anti-Trump ..." with a link to "arstechnica.com/.../02/unsecured-radio-transmitters-get-hacked-play-anti-trump-song/". The snippet below the link reads: "Feb 2, 2017 - News of the song's unexpected playback on **radio stations** began emerging shortly after Trump's inauguration on January 20, and the **hack** has ...". The third search result is titled "Someone Keeps Hacking Radio Stations To Play 'Donald Trump ..." with a link to "https://www.buzzfeed.com/.../someone-keeps-hacking-radio-stations-to-play-fuck-do-".

Google

radio station hacked

All News Images Videos Shopping More Settings Tools

About 620,000 results (0.43 seconds)

Trump rioters hack radio stations to blast 'Donald Trump' on repeat  
<https://thenextweb.com> > Politics ▼  
Feb 3, 2017 - Multiple sources report **radio stations** in South Carolina and several other states across the country were **hacked** to blast a less-than-supportive ...

Top stories

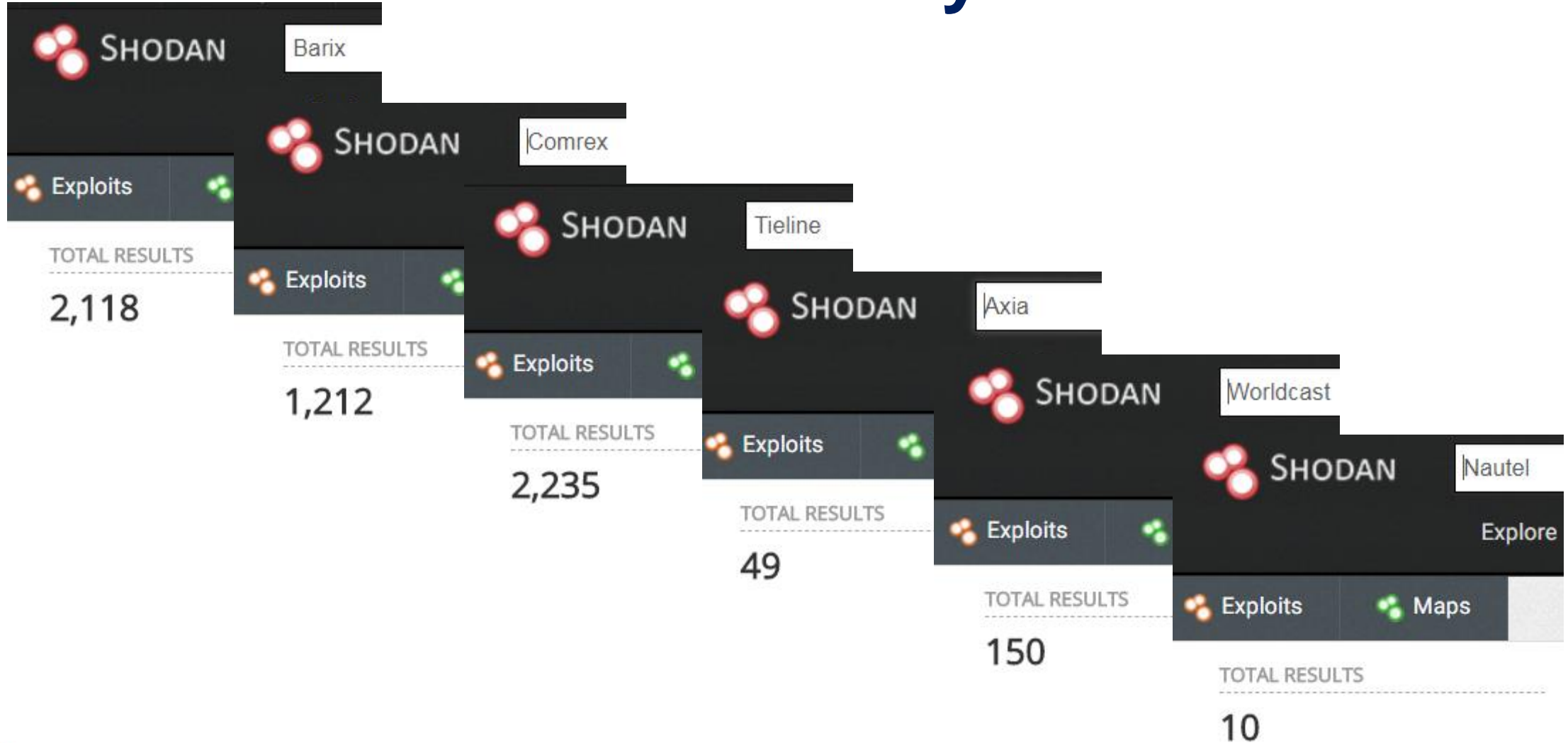
Hackers hack Indiana radio station and broadcast Zombie apocalypse messages  
Techworm · 2 days ago

→ More for radio station hacked

Radio stations that ignored major vulnerability start playing anti-Trump ...  
[arstechnica.com/.../02/unsecured-radio-transmitters-get-hacked-play-anti-trump-song/](https://arstechnica.com/.../02/unsecured-radio-transmitters-get-hacked-play-anti-trump-song/) ▼  
Feb 2, 2017 - News of the song's unexpected playback on **radio stations** began emerging shortly after Trump's inauguration on January 20, and the **hack** has ...

Someone Keeps Hacking Radio Stations To Play "Donald Trump ...  
<https://www.buzzfeed.com/.../someone-keeps-hacking-radio-stations-to-play-fuck-do-> ▼

# IT Security




# IT Security



Comcast Cable

Added on 2017-03-01 08:27:10 GMT

 United States, Jacksonville

[Details](#)

```
220-FileZilla Server 0.9.55 beta
```

```
220-Grass Valley Automation FTP Server
```


```
220 You have full permissions, so please be careful!
```

```
530 Login or password incorrect!
```

```
214-The following commands are recognized:
```

```
ABOR  ADAT  ALLO  APPE  AUTH  CDUP  CLNT  CWD  
DELE  EPRT  EPSV  FEAT  HASH  ...
```

# IT Security



**New Site**

[Home](#)

**Equipment**

[DYRF AM Transmitter](#)

**Administration**

[Site Configuration](#)

[User Administration](#)

You are logged in as root

[Logout](#)

## Device: DYRF AM Transmitter

Data retrieved 2017-03-07T19:47:43

[Status/Control](#) [Presets](#) [Preset Schedule](#) [Meters](#) [Alarms](#) [About this equipment](#) [Save](#) [Event Log](#)

RF Power	On	<input type="button" value="Off"/>	<input type="button" value="On"/>
Forward Power	6.10 kW	<input type="button" value="Increase"/>	<input type="button" value="Decrease"/>
Reflected Power	10 W		
System Control	Remote		
<b>Automation Control</b>			
Automatic Preset Scheduler	Disabled	<input type="button" value="Disabled"/>	<input type="button" value="Enabled"/>
Automatic Exciter Changeovers	Enabled	<input type="button" value="Disabled"/>	<input type="button" value="Enabled"/>
Automatic PM Changeovers	Disabled	<input type="button" value="Disabled"/>	<input type="button" value="Enabled"/>
Active Preset	Manual Adjustment	<input type="button" value="1 ▼"/>	<input type="button" value="Submit"/>
Active Exciter	A		
Active PM	A/B		
VSWR	1.08		
<b>Active Faults</b>		<input type="button" value="Reset"/>	

# IT Security

- Use a firewall, block any ports that aren't essential to operation.
- CHANGE DEFAULT USERNAME / PASSWORD!!!
- For critical devices (most of them) consider a VPN – or put them all on a non-internet connected local network, then use a VPN to access it.
  - <https://www.techradar.com/vpn/the-best-free-vpn-services-of-2018>
- Alternately, use a product such as TeamViewer to access.



# Troubleshooting



# Troubleshooting

Check status – shows any current alarms

Use logs – lots of information regarding fault/possible cause

D	Controller	High Reflected Power			Fri Mar 23 2018 13:13:36 510ms
	Controller	High Reflected Power			Fri Mar 23 2018 13:06:12 290ms
	Controller	SWR Foldback			Fri Mar 23 2018 13:00:09 620ms
	Controller	Forward Power Low			Fri Mar 23 2018 12:40:44 140ms
	Controller	PA 2 Fail			Fri Mar 23 2018 10:40:14 120ms
	Controller	PA 3 Fail			Fri Mar 23 2018 10:40:14 080ms
	Exciter	Analog Right Audio Low			Fri Mar 23 2018 02:30:03 880ms
	Exciter	Analog Left Audio Low			Fri Mar 23 2018 02:30:01 880ms
	Exciter	Analog Left Audio Low			Fri Mar 23 2018 02:29:58 580ms
	Exciter	Analog Right Audio Low			Fri Mar 23 2018 02:29:58 180ms
	Controller	Host Network Down			Fri Mar 23 2018 01:37:26 590ms

# Troubleshooting

Don't overlook the obvious!





# PA Replacement

- To remove
  - \* Unsolder wires on edges of board and lift
  - Two FET screws
  - 7 PWB screws
- Reinstall in reverse
  - Torque FET screws to 6 in-lbs
  - Torque PWB screws to 9 in-lbs

\*needs 75W iron



# Troubleshooting

- Resources
  - Support webinars
    - <http://www.nautel.com/support/technical-resources/support-webinars/>  
Modifying presets, configuring scheduler, setting up audio failover and more
  - NUG section of website (requires login)
    - <http://www.nautel.com/nug/>  
Manuals, field upgrades, information sheets, NUG presentations

# Maintenance

# Key to Lightning Protection

- Conduct strike pulse current to ground through a low impedance path
- Prevent this destructive current from flowing through your electronic equipment



# Get Well Grounded



Buss bar for AC grounds

- Tied to station reference ground
- All primary equipment connected

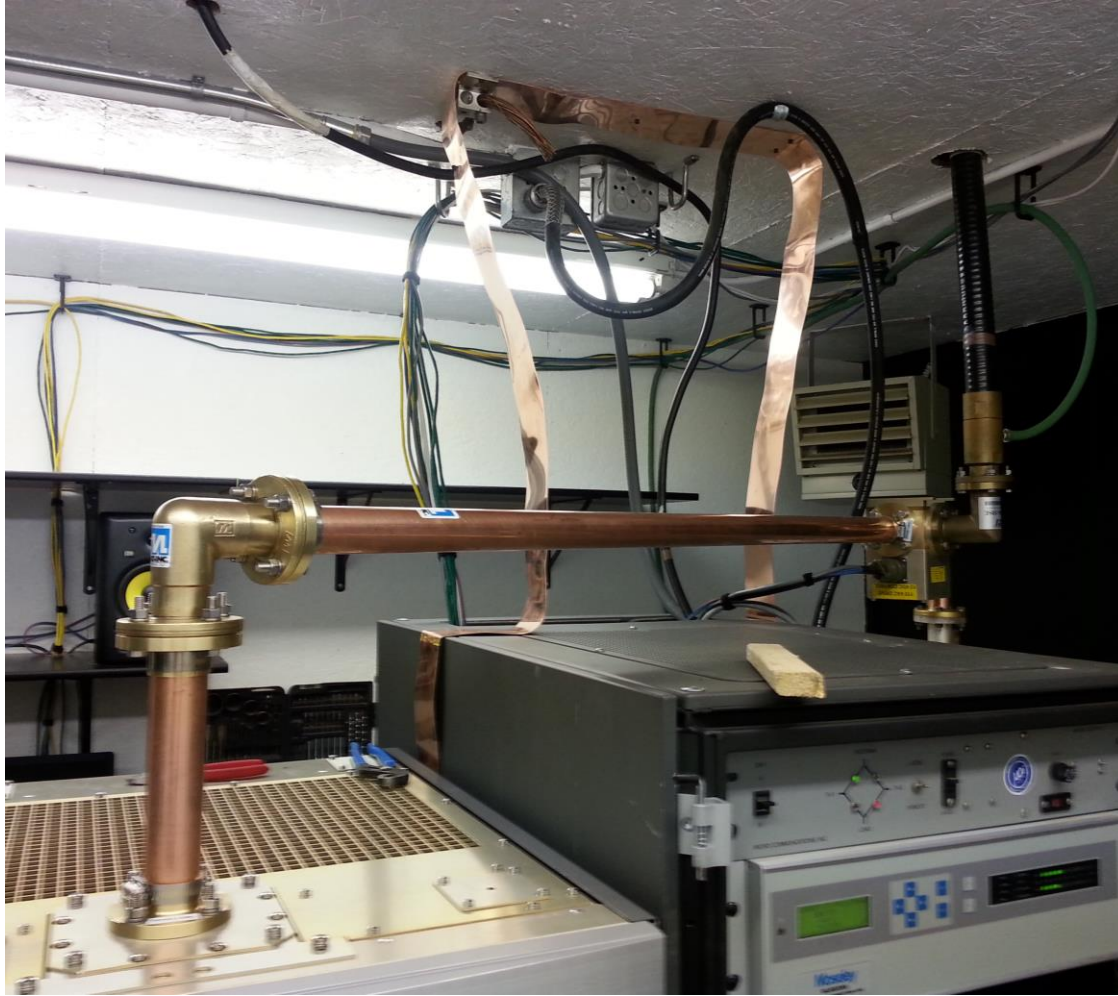
Bulkhead ground for coax cables

- Best done where cables enter building
- Connected to station reference ground
- Keep ground leads as short as possible



Making Digital Broadcasting **Work.**

# Grounding



- What's wrong with this picture?
  - How can it be fixed?
  - What's missing?



# Get Well Grounded...



The best building grounding in the world doesn't help much if it doesn't go anywhere when it reaches the outside world!



# Grounding

- Grounding is important
  - Not just the installation, but the actual type of connection.



# Protection is Important



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

# Keep your Shields UP!

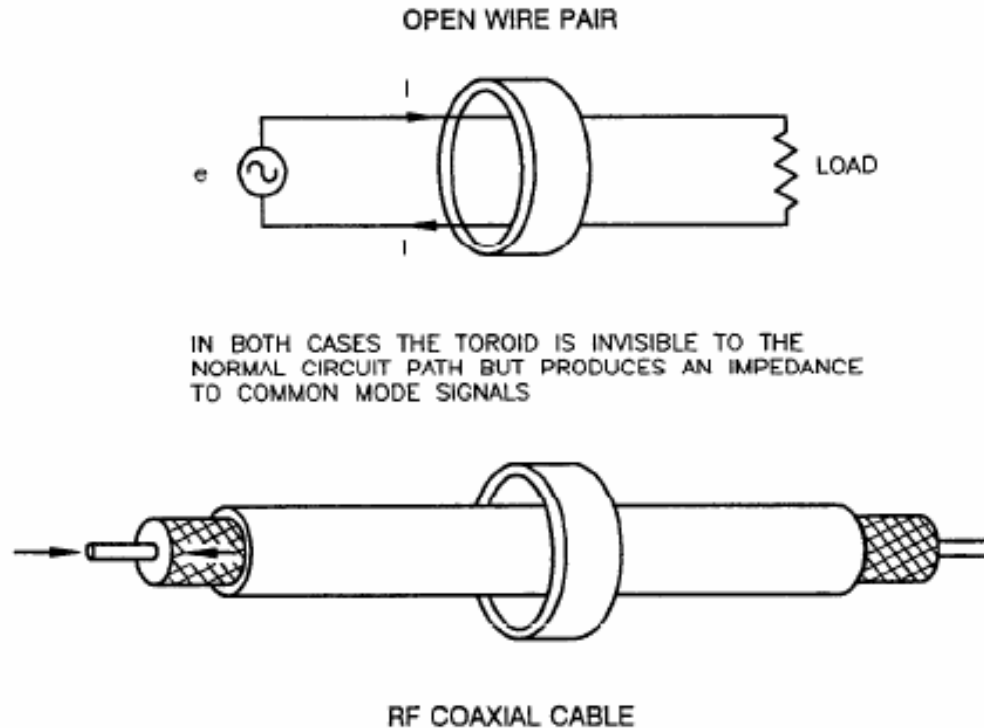


Figure F-4 Use of Toroids to Impede Common Mode Signals

Ferrites are good for reducing common mode signals

- Lightning surges
- Induced RF (especially at co-located AM and FM sites)
- Power line and power supply noise



# Keep your Shields UP!



Ferrites on coax help reduce lightning susceptibility

- Should always be installed between the coax ground at entry and equipment being protected

Ferrites can also 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!



# Routine Inspections

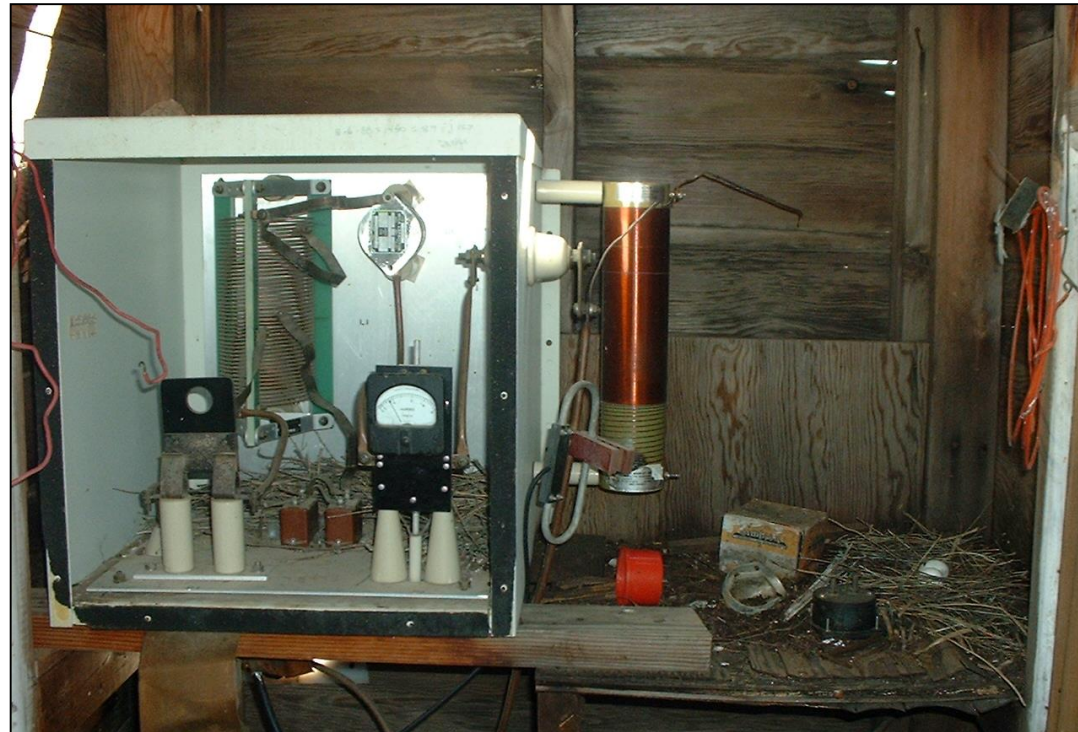
A regular visual inspection of the ATU and lightning protection components helps to prevent damage caused by failures like this.



# Routine Inspections

Keep rodents and animals out, as well as providing protection from the elements.

Inspect seals and lock assemblies annually.





# If It's Arced, Replace It

Once a guy wire insulator has arced, it's no longer an insulator – it's a conductor waiting to happen!

Arcing insulators rapidly change the load the transmitter sees, and stress the system.





# Airflow Considerations

- Airflow is also important
  - As much air as possible should flow through equipment
  - Don't defeat the purpose by reversing direction



# Clean equipment is happy equipment



Air filters – on incoming air and equipment – are there to keep things clean

- They must be cleaned or replaced regularly
- Equipment should NOT be operated with air filters removed, unless a provisions are in place for additional filtering of incoming air. This is rarely advisable
- Do NOT replace air filters with a different type without consulting the equipment manufacturer
- Some air filters require spraying with a sticky substance (FilterKote™) for proper operation

# Safety Considerations

- Locking out a breaker while working on equipment ensures nobody else will be turning it on... while you're still in the rig.
- Transmitter interlocks are a safety feature, not an inconvenience to be bypassed and left bypassed.
- Measure before touching! Some systems have multiple AC mains connections (such as separate feeds for exciters).
- De-energize everything – breakers off, then ground stick.
- Airflow interlocks protect equipment

# Safety is Key

## – Arc Flash

- Can happen on any circuit handling over 125kVA
  - 50kW AM on 240VAC
  - Any AM transmitter 100kW or higher
  - 40kW FM on 240VAC





# Troubleshooting/Maintenance

- All legacy equipment (anything over 15 yrs old):
  - Check power supply wiring for cracked insulation
  - Check circuit breakers for mechanical integrity and operating temperature.



# Troubleshooting/Maintenance

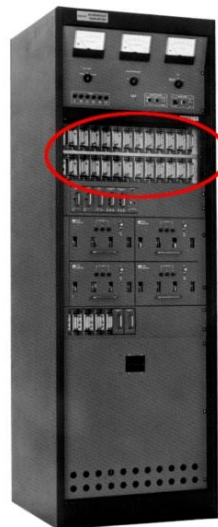
- Fan life is spec'd at zero backpressure and 40 deg. C
  - Life doubles for every 10 deg. C that ambient is decreased
  - Lifespan decreases if fan is stressed (negative pressure)



# Troubleshooting/Maintenance

- If a transmitter has a cover panel, LEAVE IT IN PLACE!

- Safety
- Airflow
- Circulating currents



Unless there is a note specifying it's to be removed!

## NV20/NV15 INSTALLATION MANUAL

## UNPACKING AND POSITIONING

8. Remove the grey, plastic power supply shipping panel in the lower, front compartment of the transmitter cabinet (covers the module power supplies). The panel is secured using M4 hardware.

# Trim Around the Edges

Especially at AM sites, weeds and brush can create challenges

- Brush and trees can degrade, or even destroy, ground radials
- In some areas, high grass can also hide other hazards (snakes, for example)
- Keeping the area around towers free of weeds can also save other problems
  - In some cases, we've seen kudzu or ivy growing up an AM tower, resulting in VSWR trips every time it rained
- In addition to safety and reliability of signal, there is a security issue, as tall grass and growth can help to mask the presence of intruders



# Trim Around the Edges



# Site Considerations



Figure 1.2.1: GV10/GV7.5 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

Unrated: 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 1800 m (1 mile)

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

FM mode: 1.22 (GV10) or 0.96 (GV7.5)  
tonnes  
FM+HD (-20 dB) mode: 1.22 (GV10) or 0.91  
(GV7.5) tonnes  
FM+HD (-14 dB) mode: 1.93 (GV10) or 1.45  
(GV7.5) tonnes  
FM+HD (-10 dB) mode: 1.73 (GV10) or 1.31  
(GV7.5) tonnes  
HD mode: 1.92 (GV10) or 1.44 (GV7.5)  
tonnes  
DRM+ mode: TBD

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)

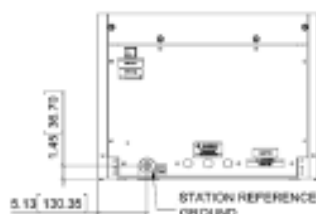
#### AC INPUT SPECIFICATIONS

MODE OF OPERATION	INPUT POWER (kW)	AC SUPPLY (V ac)	TYPICAL LINE CURRENT (A)
FM (analog) Typ. eff. = 72% (GV10) or 71% (GV7.5)	15.6 (GV10) 15.9 (GV7.5)	3-Ph, 208 V ac (**175-345)	43 (GR16), 33 (GV7.5)
		3-Ph, 380 V ac (**303-438)	24 (GR16), 18 (GV7.5)
		1-Ph, 240 V ac (**175-345)	65 (GR16), 50 (GV7.5)
FM+HD (-20 dB) (hybrid)	14.6 (GV10) 15.9 (GV7.5)	3-Ph, 208 V ac (**175-345)	40 (GR16), 30 (GV7.5)
		3-Ph, 380 V ac (**303-438)	22 (GR16), 17 (GV7.5)
		1-Ph, 240 V ac (**175-345)	61 (GR16), 46 (GV7.5)
FM+HD (-14 dB) (hybrid)	15.1 (GV10) 12.1 (GV7.5)	3-Ph, 208 V ac (**175-345)	45 (GR16), 34 (GV7.5)
		3-Ph, 380 V ac (**303-438)	24 (GR16), 18 (GV7.5)
		1-Ph, 240 V ac (**175-345)	67 (GR16), 50 (GV7.5)
FM+HD (-10 dB) (hybrid)	13.0 (GV10) 9.8 (GV7.5)	3-Ph, 208 V ac (**175-345)	36 (GR16), 27 (GV7.5)
		3-Ph, 380 V ac (**303-438)	19 (GR16), 15 (GV7.5)
		1-Ph, 240 V ac (**175-345)	54 (GR16), 41 (GV7.5)
HD (all-digital)	11.5 (GV10) 8.8 (GV7.5)	3-Ph, 208 V ac (**175-345)	32 (GR16), 24 (GV7.5)
		3-Ph, 380 V ac (**303-438)	17 (GR16), 13 (GV7.5)
		1-Ph, 240 V ac (**175-345)	48 (GR16), 36 (GV7.5)
DRM+	180	3-Ph, 208 V ac (**175-345)	180
		3-Ph, 380 V ac (**303-438)	180
		1-Ph, 240 V ac (**175-345)	180

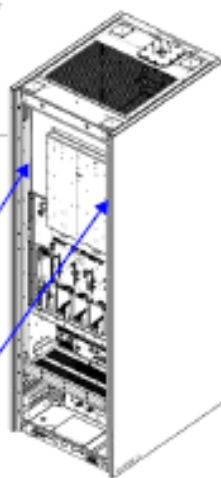
\*\* Denotes that the transmitter will operate with an ac input voltage as low as 175 V ac (for 208 and 240 V ac sources; 180 V ac for 380 V ac sources), but RF output power is limited (to approximately 115% of rated power) at ac voltages less than 175 V ac (for 208 and 240 V ac sources; 303 V ac for 380 V ac sources).

Typical line current values are based on maximum RF output power, nominal ac voltage (208 or 380 V ac 3-phase, or 240 V ac 1-phase, as applicable), typical efficiency and 0.98 power factor. The maximum inrush current value (see 1 sec) is present for half an ac cycle (between 8 and 10 ms) and is based on an ac input voltage of 200 V ac. The maximum inrush current per line is approximately 120 A for three-phase ac power sources and 300 A for single-phase ac power sources.

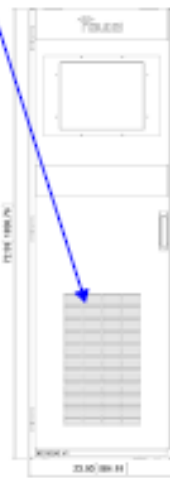
Observe local electrical codes when determining wire size and circuit breakers. Nautel recommends that you take your wire sizes and breaker ratings on the typical line current for analog mode plus 25% to account for line current imbalance and site mains regulation.



PARTIAL REAR VIEW



REAR VIEW



FRONT VIEW

#### AC INPUT WIRE LIMITATIONS & TORQUE REQUIREMENTS

WIRE SIZE RANGE: 2/0 to 8 AWG (70 to 10 mm<sup>2</sup>)  
TB1 TORQUE VALUE: 120 in-lbs (13.6 N-m)

TB1: Ac terminal block  
(below ac entrance hole, in bottom  
section of transmitter cabinet)

#### CONTROL/PROGRAM CABLE ENTRY \*\*

Audio wiring, LAN, remotes (if  
remote interface PWB not used)

#### \*\* CABLE TOP ENTRY NOTE:

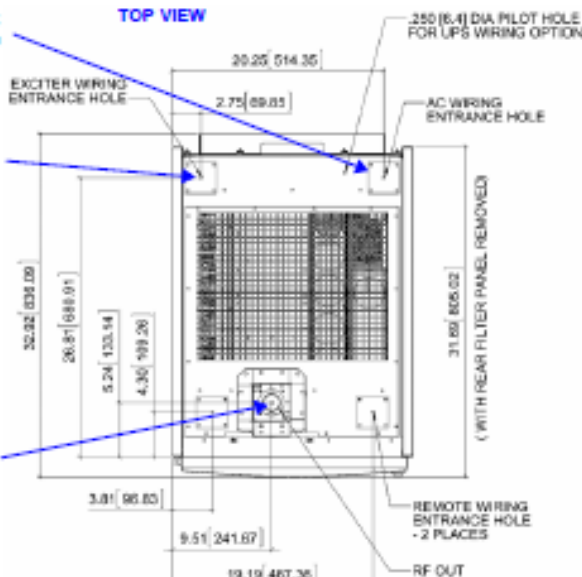
EXCITER WIRING, TOP AC WIRING AND REMOTE  
WIRING ACCESS HOLES HAVE REMOVEABLE  
PLATES WITH A PRE-CUT 1/4-INCH DIA HOLE.  
USE A CHASSIS PUNCH TOOL (e.g., GREENLEE)  
TO CREATE THE DESIRED HOLE SIZE (UP TO  
2 INCHES) ON THE PLATE. REMOVE THE PLATE  
TO ACCESS A 2.5-INCH HOLE, IF NECESSARY.

#### RF OUTPUT

Standard: 1-5/8 inch EIA  
Options: 3-1/8 inch EIA or  
7/8 inch EIA

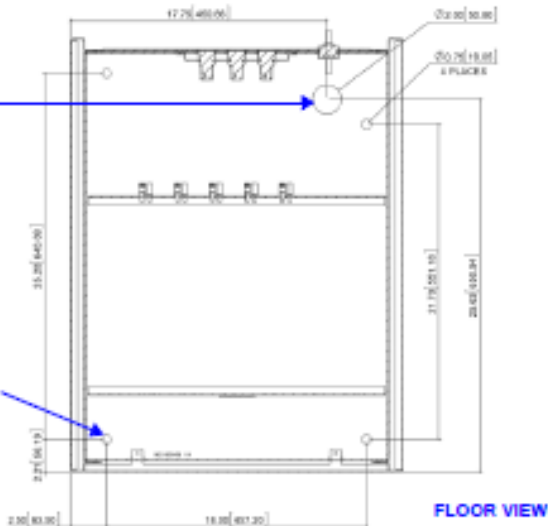
AIR FILTERS  
(front and rear)  
Nautel Part # HR142  
18" x 24" x 2", American  
Air Filter PerfectPleat SC  
M8 MERV 8 or equivalent

#### TOP VIEW



#### BOTTOM AC CABLE ENTRY

#### SEISMIC ANCHOR HOLES (4 places)



FLOOR VIEW

# Accessibility



- Remember details like:
  - Can a truck get in the driveway without sinking?
  - Is a lift gate required and are there steps/railings in the way?
  - Stairs – if using a stair crawler, vertical clearance needs to be considered
  - Transmitter dimensions (crated and uncrated)
  - Doorways
  - Other equipment in the way



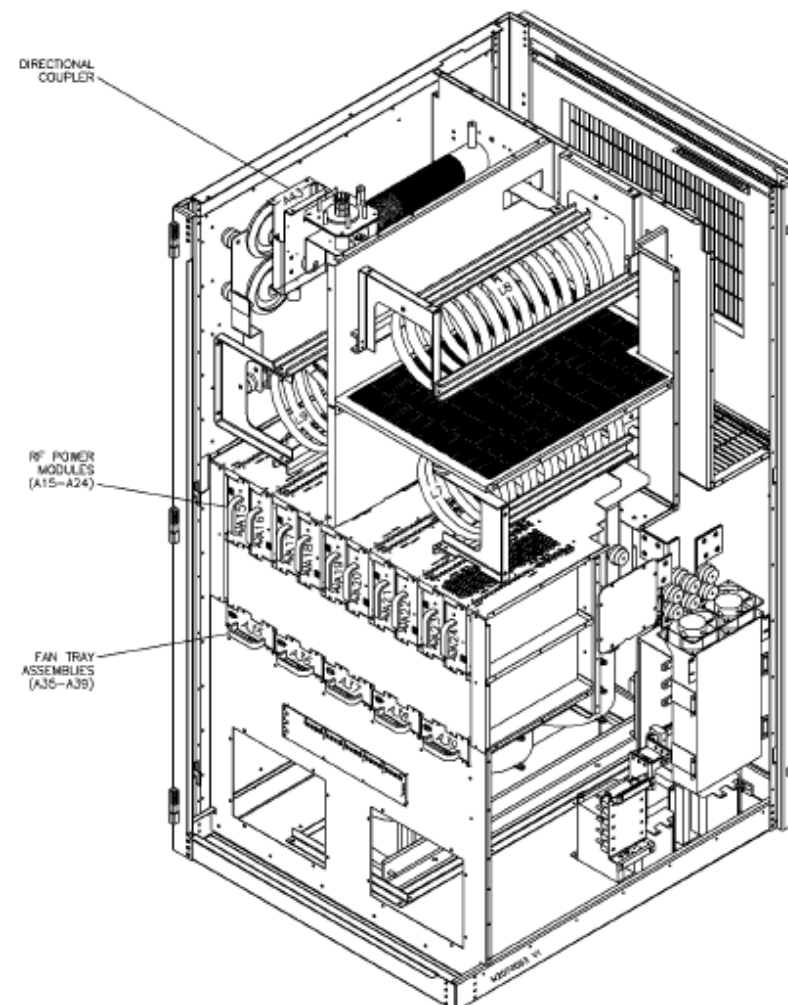
# Moving



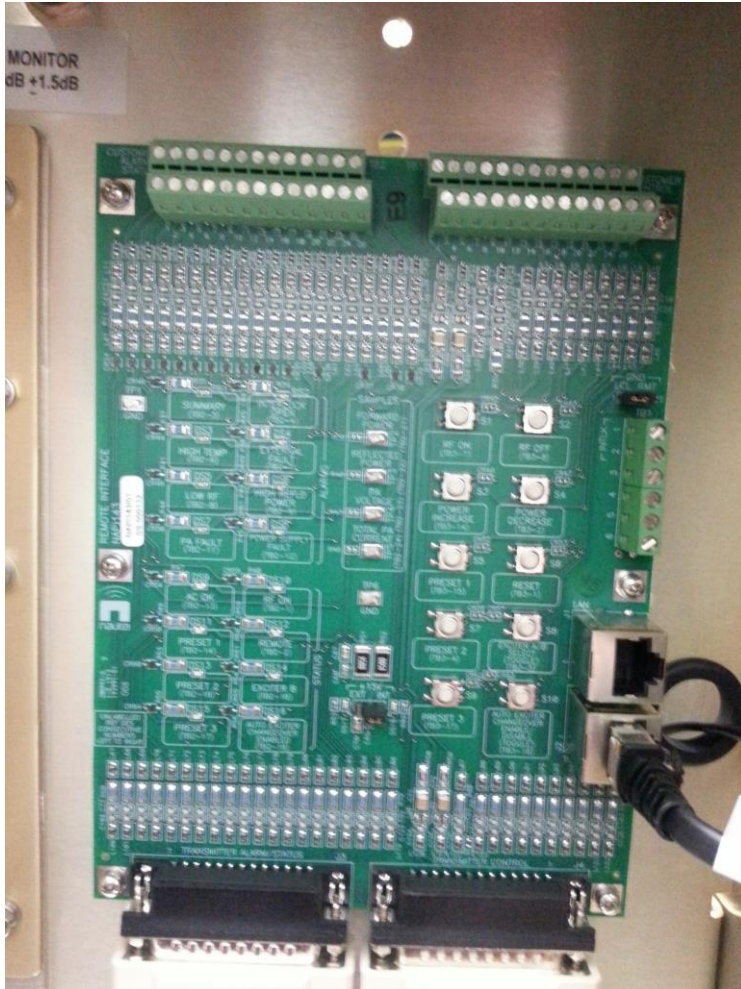
- Will mechanical assistance be required?
  - Due to either accessibility or site conditions
  - Due to limited manpower
- Are clearances sufficient?
  - Would it fit if uncrated?
  - Are there stairs to consider?
  - Remember that crated size is much bigger than published dimensions

# Installation

- Observe manufacturer specified clearances when placing equipment, or call their Support team to verify.



# Cable Entry



- Prior to installation confirm:
  - Location of remote interface
  - AC entry point
  - Routing of audio/monitor/IP cabling



# Gotchas



- Some systems may have power modules secured for shipping.
- Ensure any packing materials are removed.
- If there are cover plates installed for shipping, these need to be removed.

# Wrapping It Up



- More and more, some programming may be required
  - Configure RDS
  - Set up SCAs
  - Program audio loss alarm and actions
  - Set up email alerts
  - **ACTIVATE PHONE HOME!!!**

# In Short...

- Keep them cool, clean and well grounded
- Use the LOGS and alarm history
- SNMP is a useful tool and good backup for AUI
- CHANGE THE DEFAULT USER/PASSWORD!!!
- HD Radio can work and work well
- Play safe and see you next year!

NXSeries **AM/MW**

**3 kW – 2 MW**



# Thank You

