Tips ‘N’ Tricks

And Tales from the Trenches

nautel

Making Digital Broadcasting **Work.**

Agenda

- What you requested (121+/400+ registrations)
- What I'd like to cover
- If time permits
  - Round table…. Fire away!

Agenda

- What you requested (122/400+ registrations)
  - AUI (15 requests)
  - New products/development (10 requests)
  - Tips – maintenance, troubleshooting, install considerations (21 requests)
  - HD Radio (13 requests)
  - Software updates/AUI/SBC issues (9 requests)
  - Remote control – scheduler, SNMP (7 requests)
  - RDS (6 requests)
  - Power – generator sizing, power requirements, MDCL (6 requests)
  - Grounding/lightning protection issues (6 requests)
  - SFN/fill-in boosters – analog/HD (5 requests)

Agenda

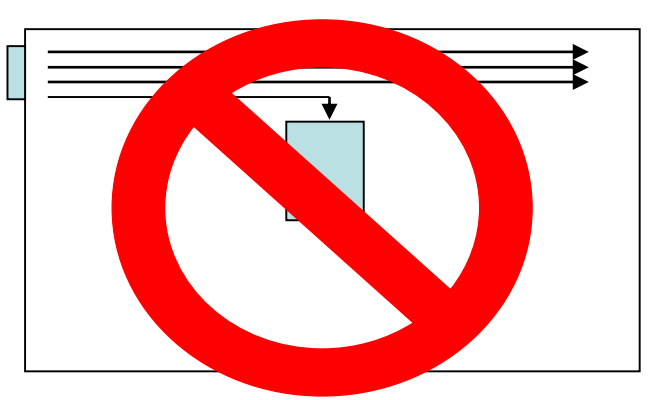
- What I'd like to cover
  - IT security
    - Why it's important
    - Basic requirements
  - Safety!

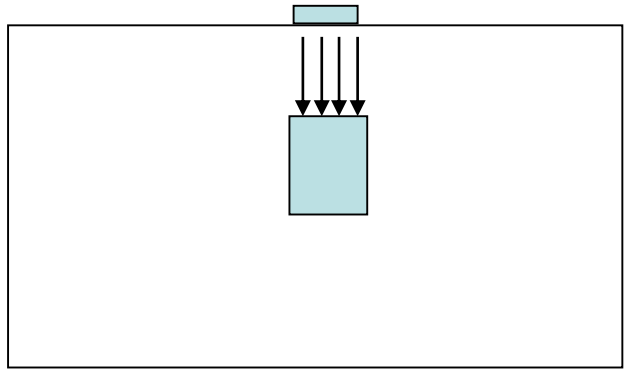
Maintenance Tips

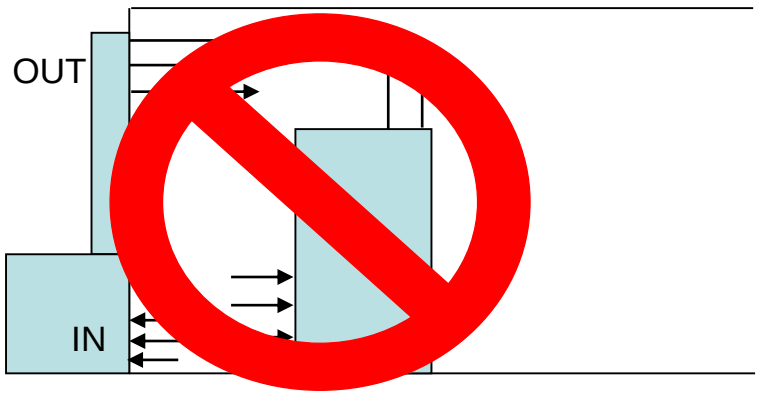
- Keep it cool
- Keep it clean
- Check hardware

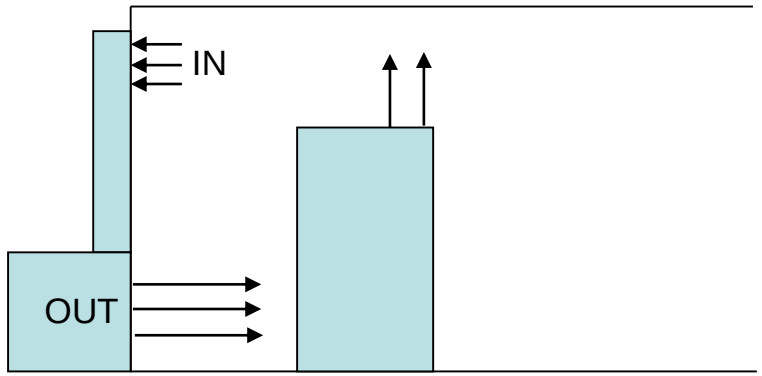
Cooling

AIRFLOW DIRECTION IS CRITICAL!!!









Cooling with Air Conditioning

Calculate transmitter heat load:

TPO/efficiency = power consumed *

Power consumed – TPO = waste heat (in watts)

Waste heat * 3.413 = BTU/hr

BTU/hr/12,000 = tons of AC required

Eg: (10kW/.72 – 10kW) = 3888.9 watts of heat
3888.9 * 3.413 = 13,273 BTU/hr
13,273/12,000 = 1.11 tons of air conditioning

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

Cooling with forced air

- 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.

AC Service Considerations

- Power consumed/voltage = current draw (P/E=I)
  - For three phase, divide this by √3
- Size breakers to allow 25% extra
- Wiring must be appropriate for breaker
  - Must comply to local electrical codes
- For FM+HD, use total (peak) power, not analog TPO
  - Analog TPO + (4*digital TPO)… eg – 10kW @ -10dBc:
    - 10kW + 4*1kW = 14kW

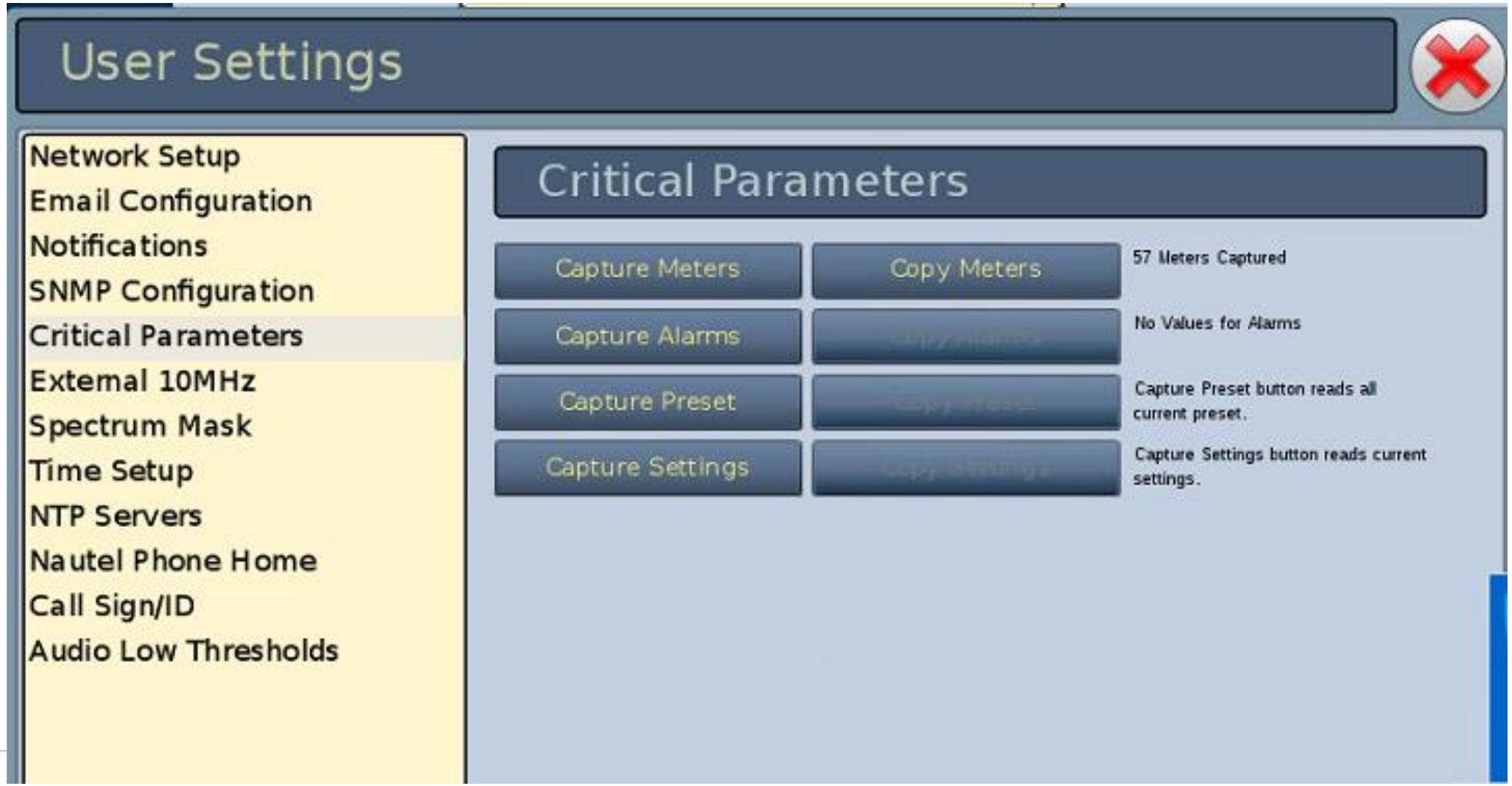
Maintenance Tips

Photo credit: Guy West, Far East Broadcasting Company

Maintenance Tips

Maintenance Tips

Maintenance Tips



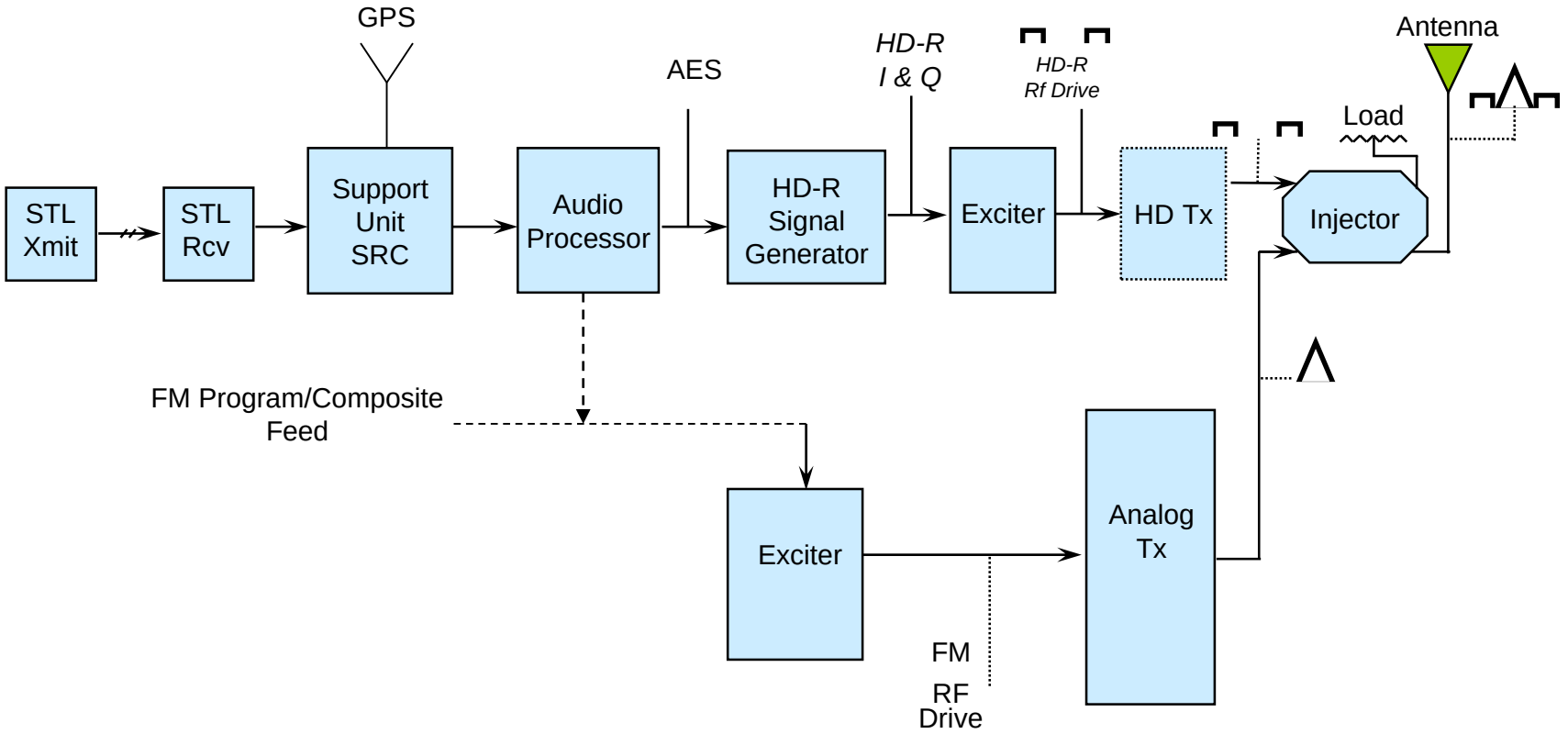
HD Radio™ and DRM

- Points to consider:
  - Cost of implementation
    - Overall cost, including STL, studio changes and licensing
    - Cost of various injection methods, up front and ongoing.
  - Total system requirements
    - Data path to transmitter site and impact on installation
    - Processing for additional audio signals
    - Studio needs for multiple simultaneous audio feeds

Transmitters: High level injection

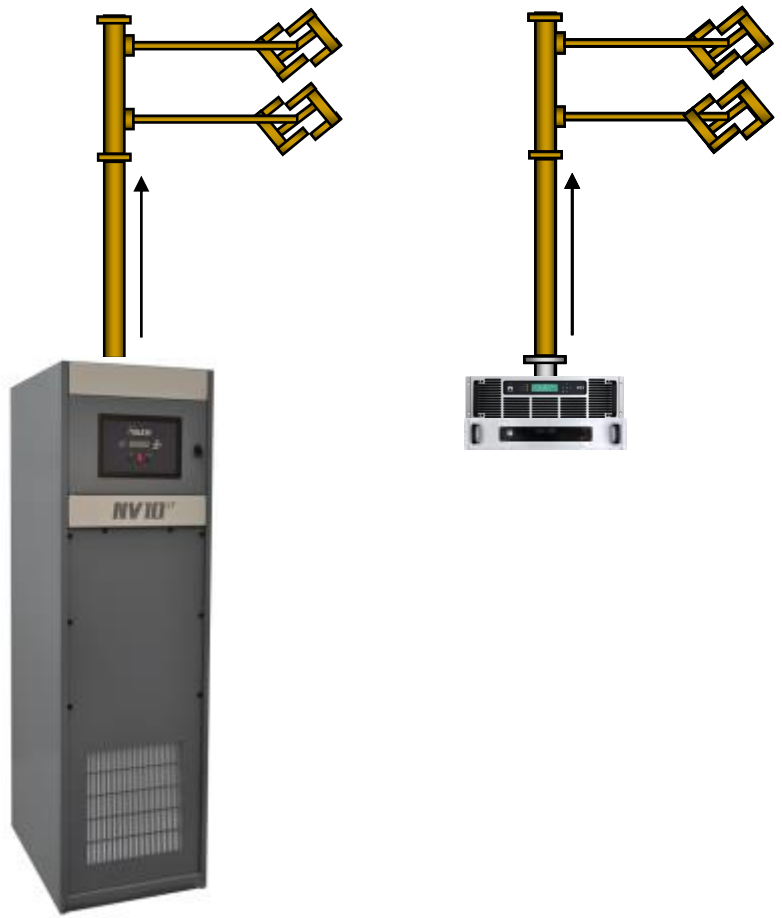
- Less transmitter cost than hybrid
- No additional antenna required
- Higher HD injection level may reduce the analog TPO capability
- Higher cost of operation, due to losses in injector
- Much bigger footprint
- Overall project cost could exceed other options significantly
- Requires a reject load

High Level Combined FM System

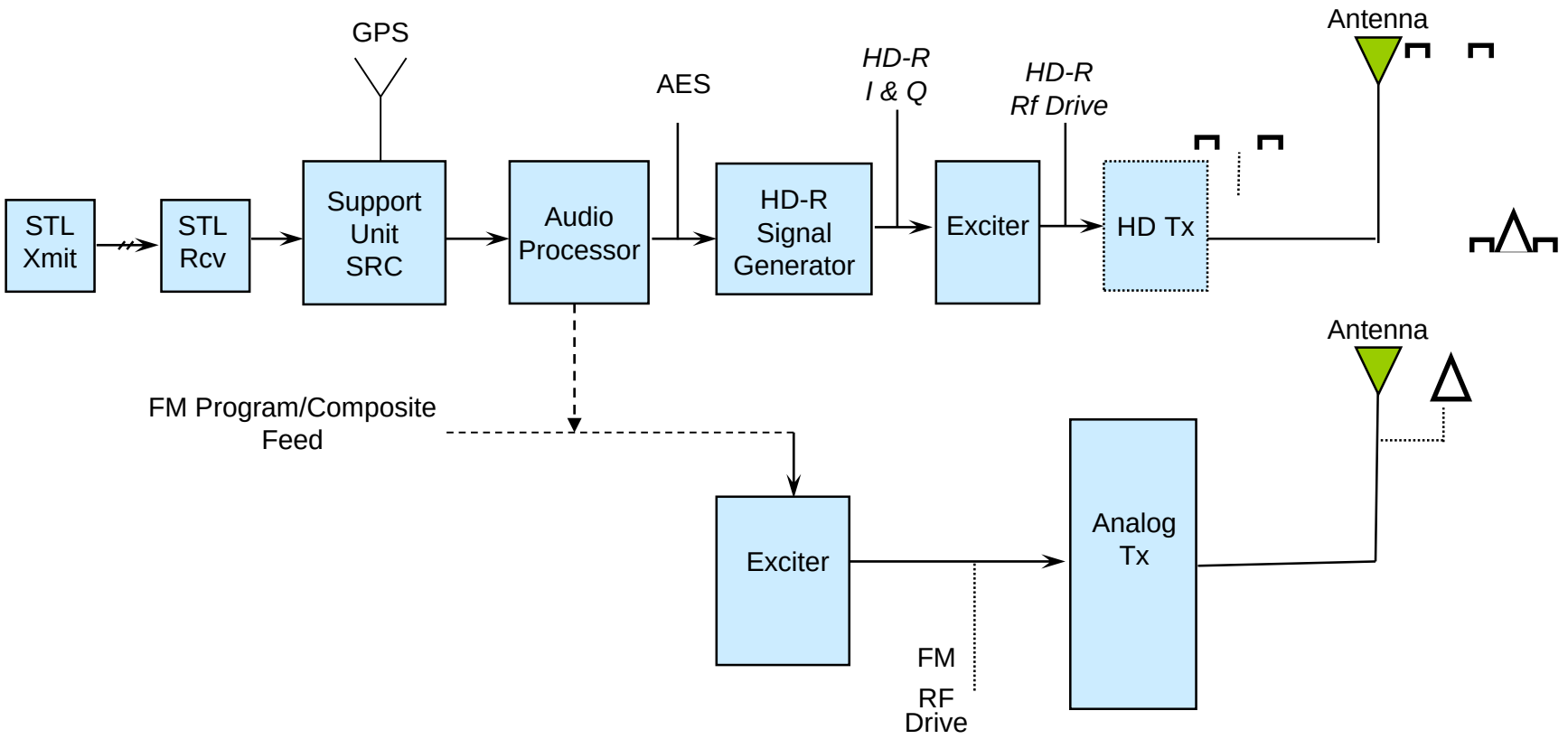


Transmitters: Space Combined

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



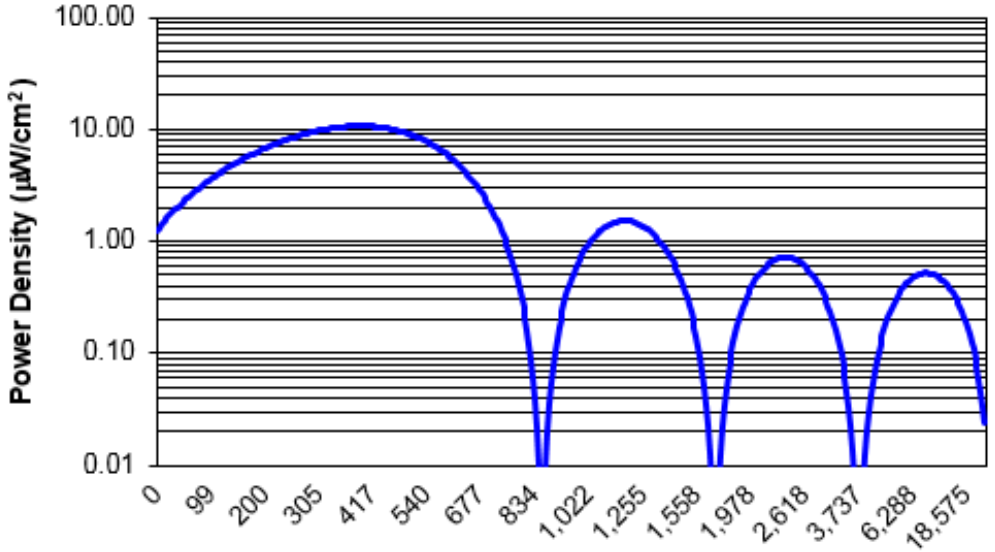
Antenna Combined FM System



Antenna Combined FM System

Antenna:	ERI SHPX-4AC	R/C Height AGL:	980 feet
Bay Spacing:	1 wavelength	Max. ERP per polarization	100.000 kW Analog
Element Field @ -90:	12.6% (avg)		3.981 kW Digital (avg)
Far-field Pattern Assumed		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 =<200; Controlled Access =<1,000.

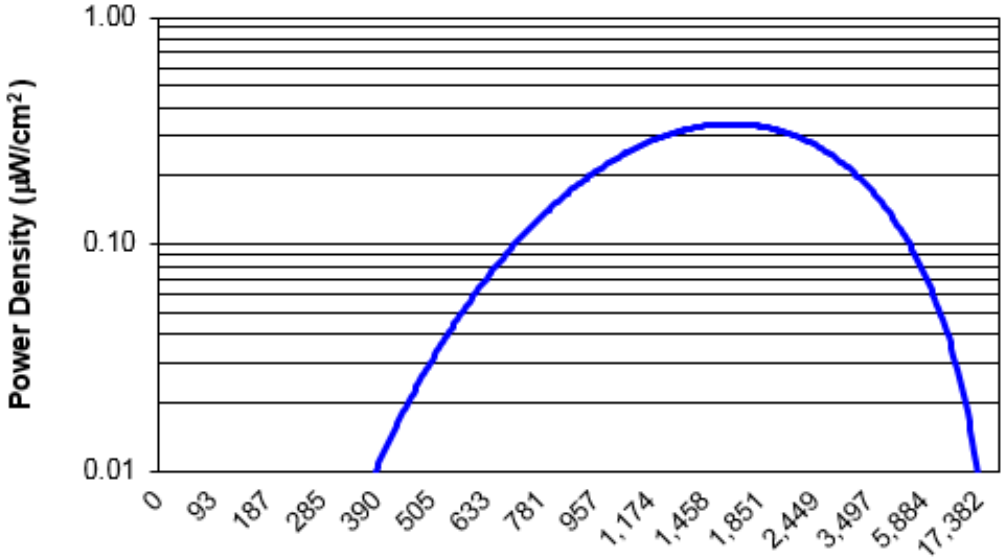


Horizontal Distance from Tower Base (feet)

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

Antenna:	ERI SMPX-2HW	R/C Height AGL:	917.5 feet
Bay Spacing:	0.5 wavelength	Max. ERP per polarization	4.000 kW Analog
Element Field @ -90:	12.6% (avg)		0.000 kW Digital (avg)
Far-field Pattern Assumed		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 =<200; Controlled Access =<1,000.

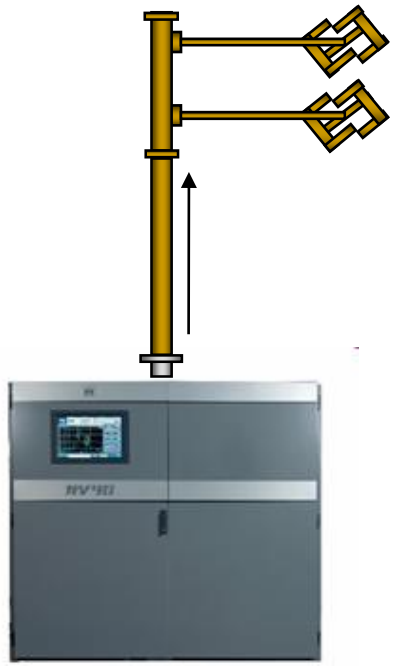


Horizontal Distance from Tower Base (feet)

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

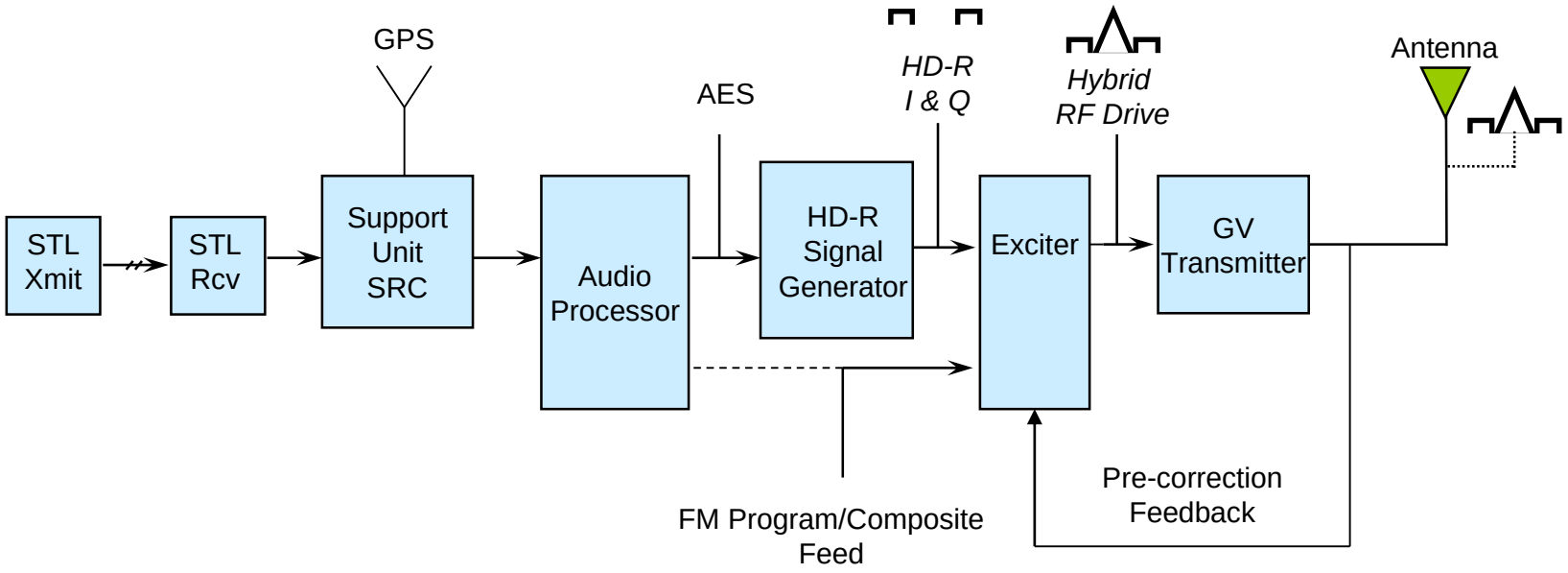
Transmitters: Low Level (Hybrid) Combined

- 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*



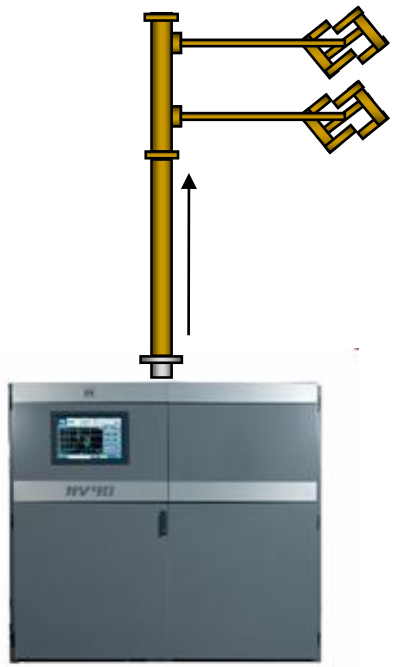
* HD PowerBoost increases digital injection and efficiency of an existing transmitter.

Low Level Combined FM System



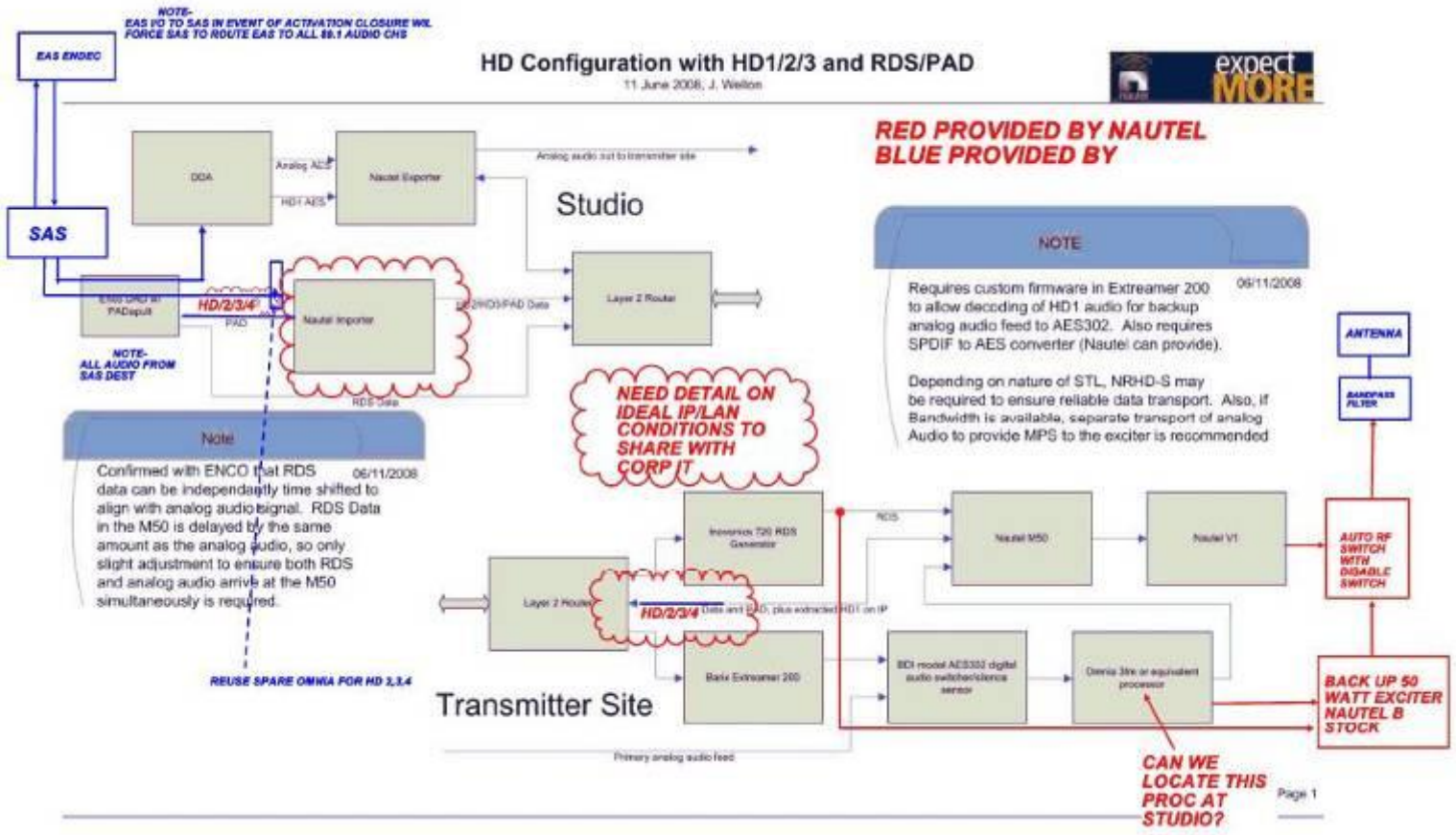
Transmitters: Backfed Combiner

- Only 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.



HD Radio™ and DRM

- Draw a signal flow diagram
  - Show analog and HD audio, as well as RF chain
  - Don't forget data vs. audio and include telemetry



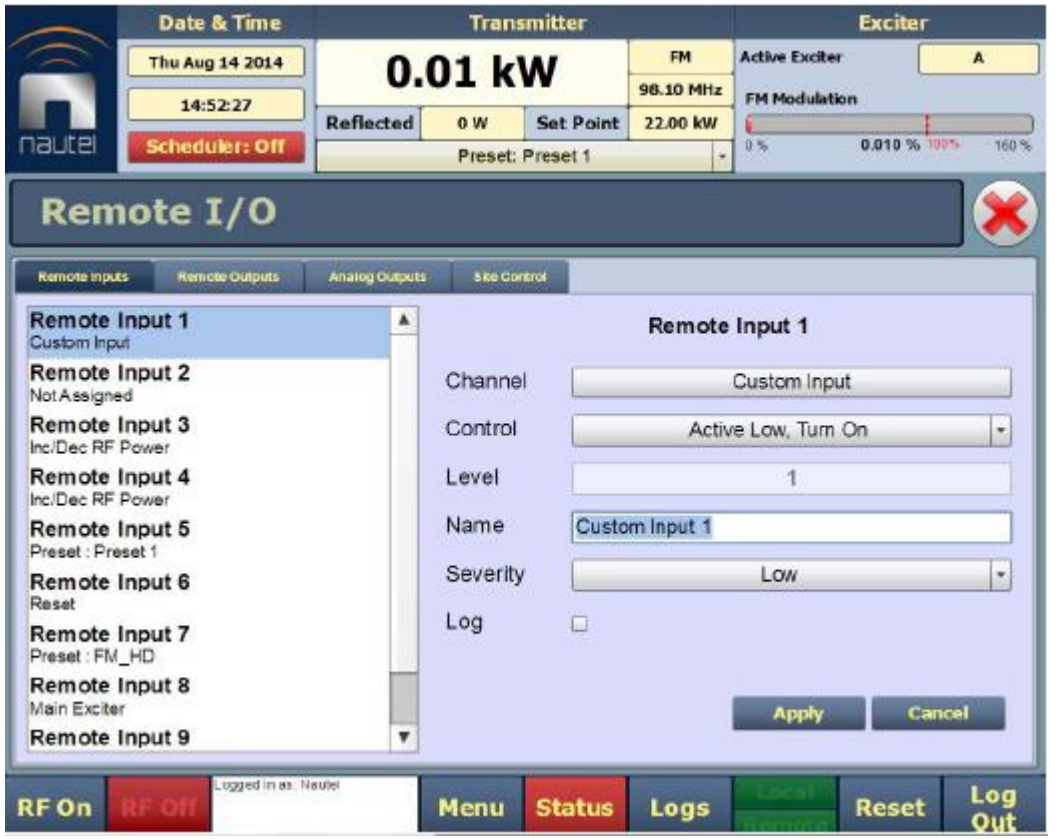
Software Updates and Issues

Index of /pub/GV_Series/GV_SW_4.4.1

Name	Last modified	Size	Description
Parent Directory		-	
GV SW 4.4.1 Release Notes.pdf	11-May-2016 09:11	440K	
GV_4.4.1_CF-img.zip	11-May-2016 09:18	739M	
Handbook/	11-May-2016 12:40	-	
IS14005_VS2.5-NVLT-GV-Series_PA Bias Procedure_iss1_0.pdf	11-May-2016 09:18	89K	
IS15006 - GV Series - Burning Compact Flash Card.pdf	16-Jun-2016 11:24	354K	
Local-remote Functionality.pdf	11-May-2016 09:18	59K	
gv.4.4.1.8.tgz	11-May-2016 09:11	21M	

Apache Server at www3.nautel.com Port 80

Remote Control



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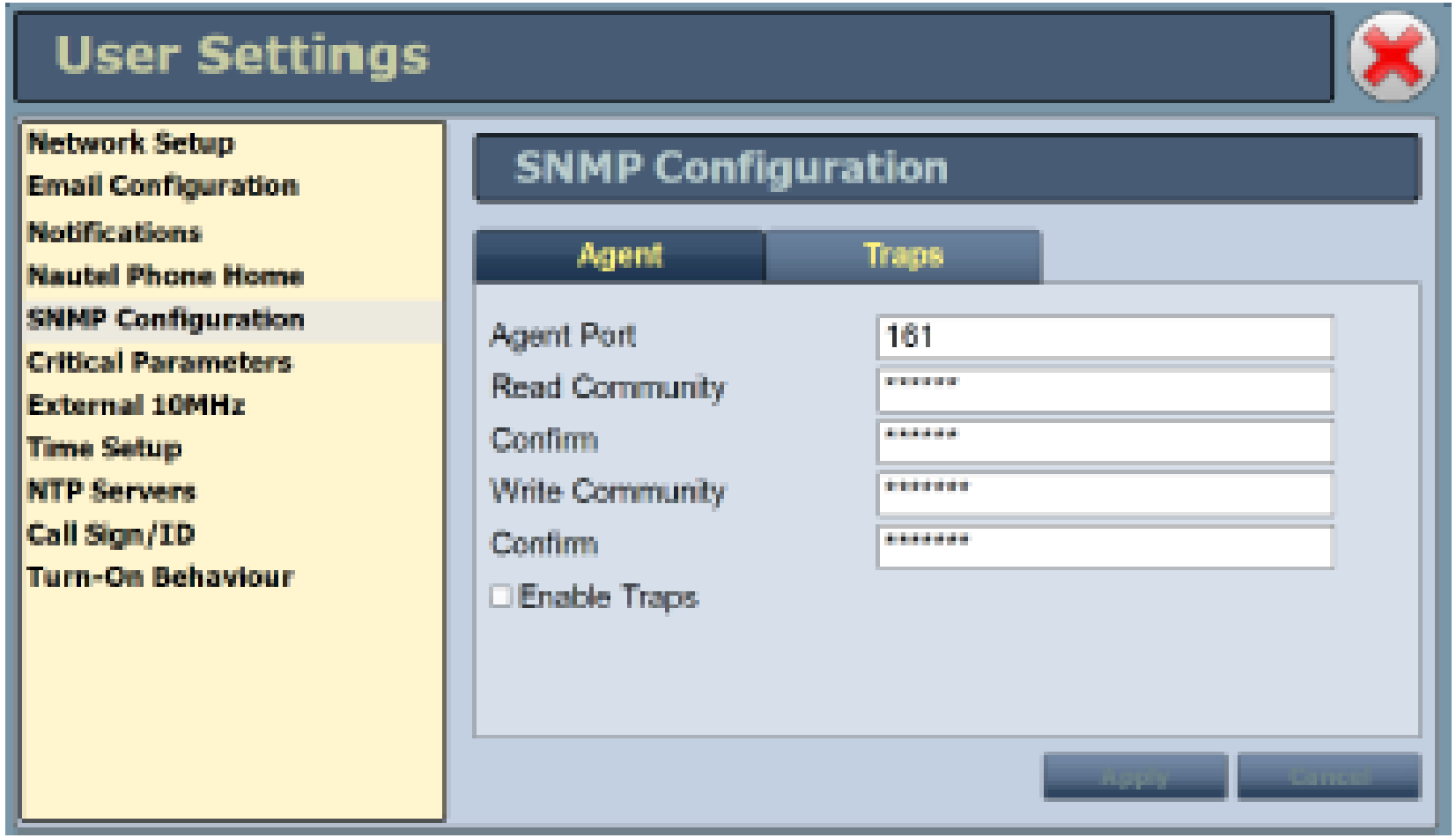
Making Digital Broadcasting **Work.**

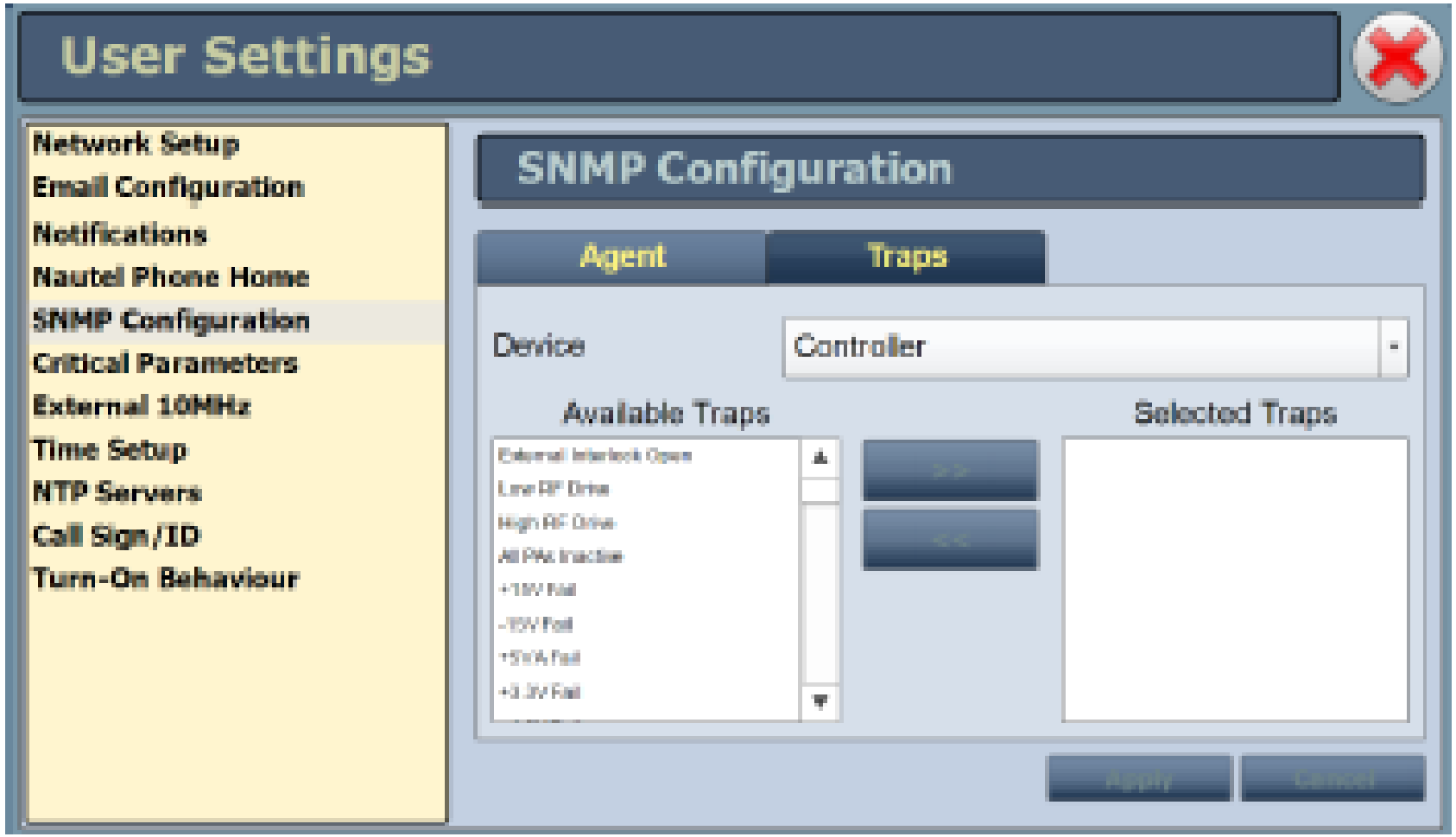
SNMP

- Firewall
- Client PW
  - May be different for read/write
- Enable Traps to send notifications
  - Need IP and port of rx



SNMP

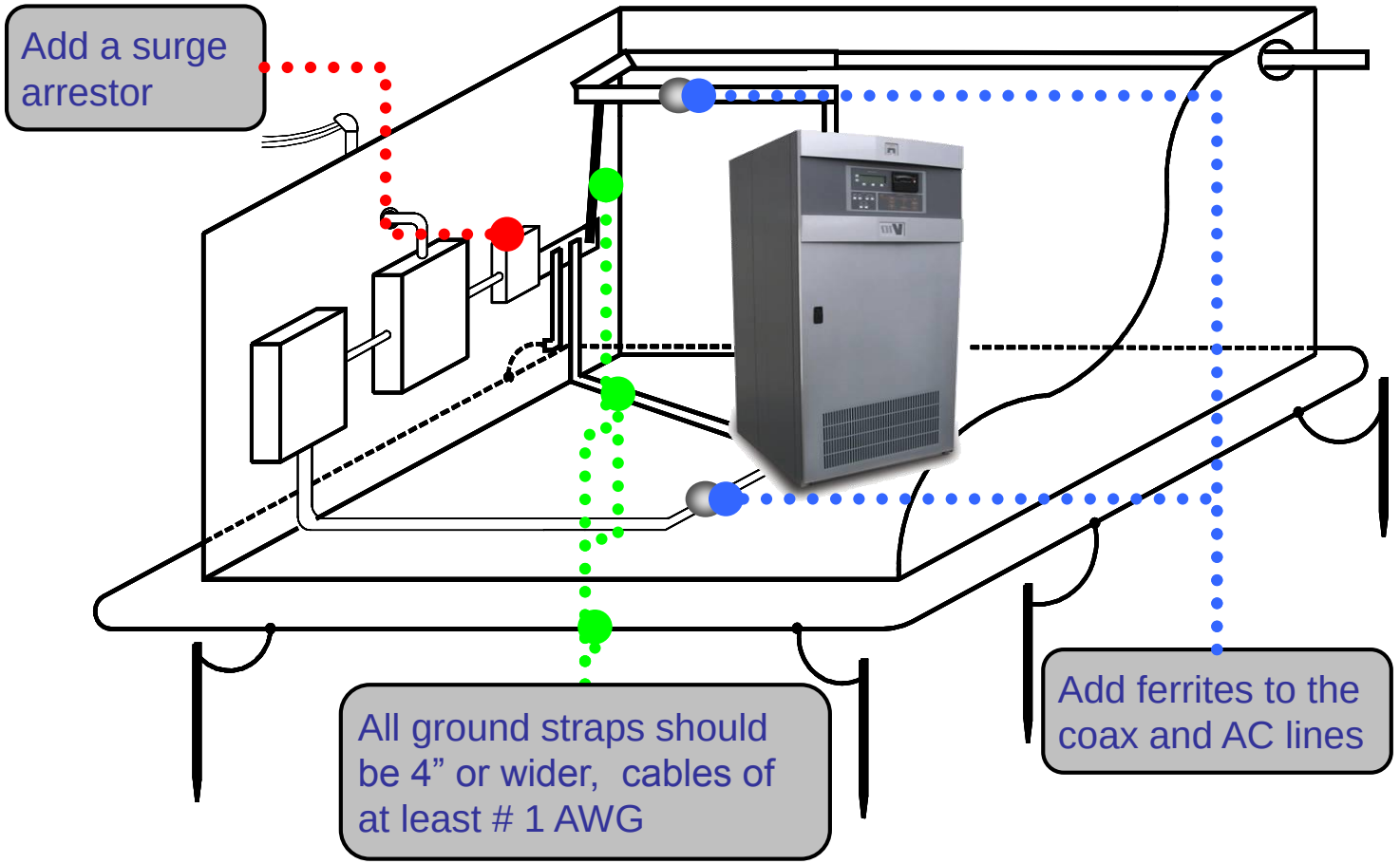
- Select Traps
  - Controller
  - Exciter
  - Etc.
- Apply



RDS

- Points to consider:
  - When feeding data from automation system over IP, must set port number (7005).
    - May need to open port in router.
    - Most automation can send RT (TEXT=“ “), this does not equal PS. Some cars can receive one, but not the other.
  - Some systems send data too often for VS transmitters.

Grounding


Add a surge arrestor
All ground straps should be 4” or wider, cables of at least # 1 AWG
Add ferrites to the coax and AC lines

Grounding

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

Ferrites

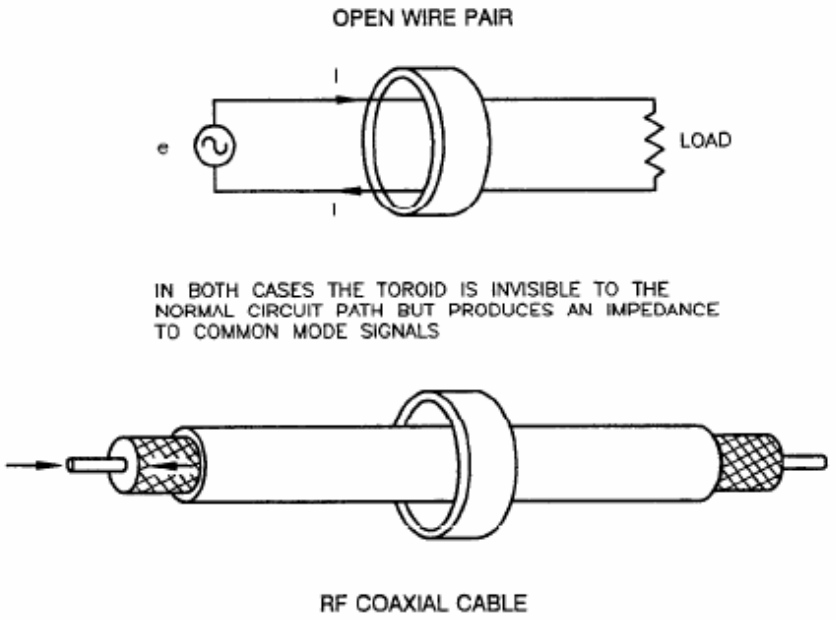


Figure F-4 Use of Toroids to Impede Common Mode Signals

Ferrites are good for reducing common mode signals

-Lightning surges

-Induced RF (especially at co-located AM and FM sites)

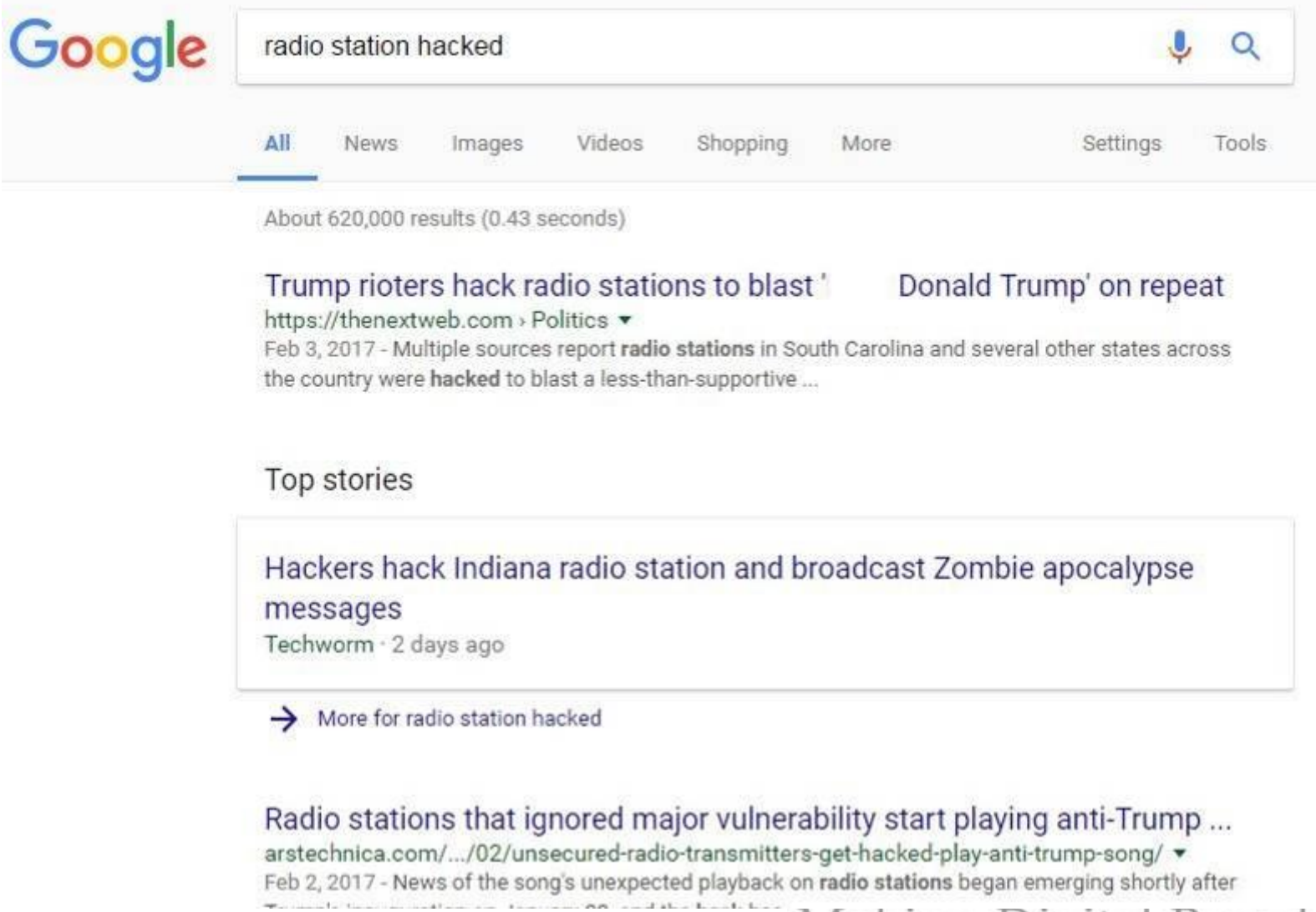
-Power line and power supply noise

Grounding

Ferrites can also be a troubleshooting tool

Ferrites on coax help reduce lightning susceptibility

IT Security


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/
Feb 2, 2017 - News of the song's unexpected playback on radio stations began emerging shortly after

IT Security

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Exploits | Maps

TOP COUNTRIES

United States	915
Israel	56
Argentina	46
Russian Federation	43
Canada	37

TOP SERVICES

SNMP	1,424
8081	58
HTTP	25
NAS Web Interfaces	4
GlassFish Server	4

Total results: 1,543

[redacted]
University of California, Los Angeles
Added on 2017-03-03 16:48:41 GMT
United States, Los Angeles
Details

Barix Instreamer Snr: 02.0b6 (060731)

[redacted]
Cogent Communications
Added on 2017-03-03 16:43:34 GMT
United States, Hackensack
Details

Barix Instreamer Snr: 04.0b4 (151028)

[redacted]
Hughes Network Systems
Added on 2017-03-03 16:38:59 GMT
United States
Details

Barix Streaming Client Snr: 03.1b3 (140408)

[redacted]

Barix Instreamer Snr: B4.0b2 (120718)

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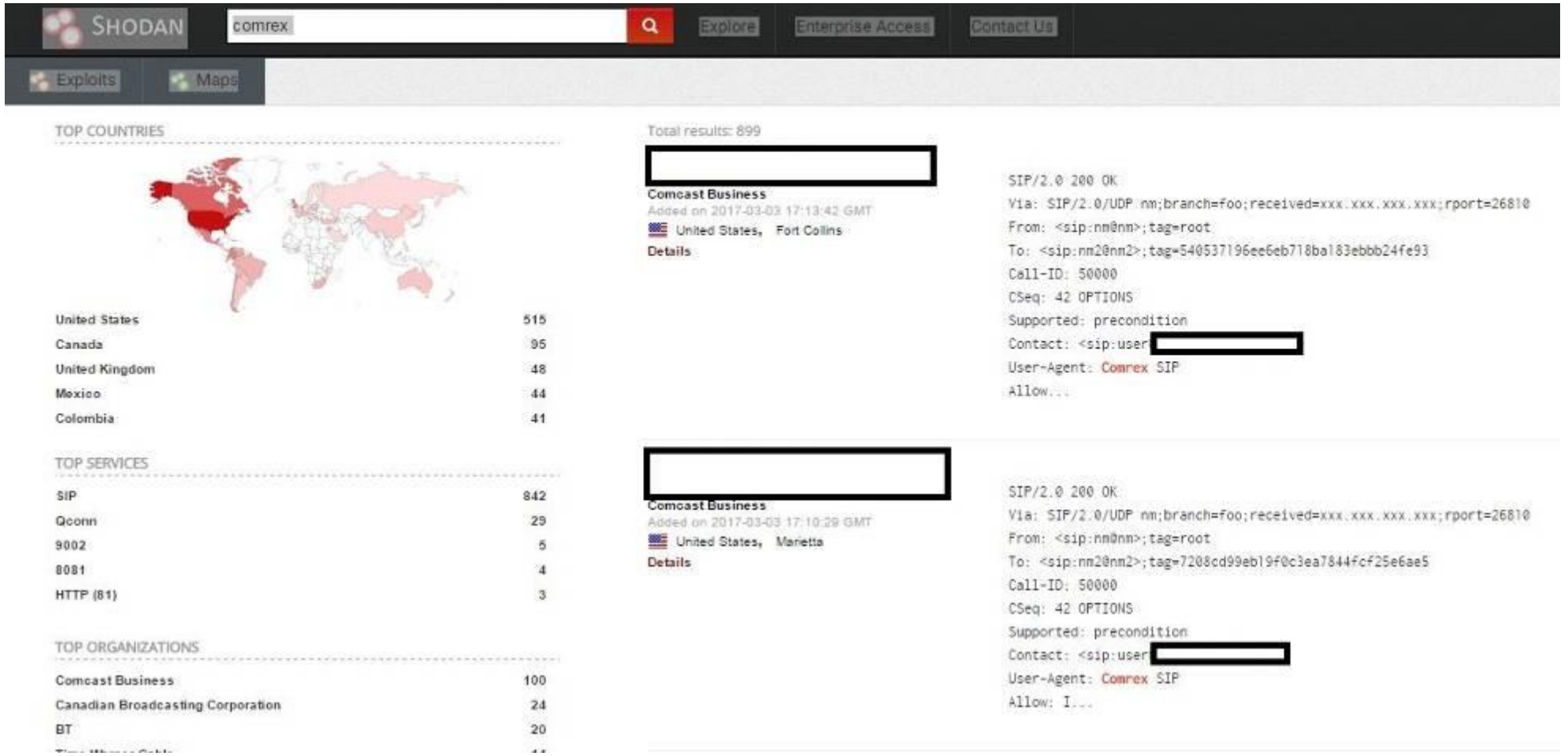
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Enterprise Access
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Exploits
Maps
TOP COUNTRIES
United States 515
Canada 95
United Kingdom 48
Mexico 44
Colombia 41
TOP SERVICES
SIP 842
Qconn 29
9002 5
8081 4
HTTP (81) 3
TOP ORGANIZATIONS
Comcast Business 100
Canadian Broadcasting Corporation 24
BT 20
Total results: 899
Comcast Business
Added on 2017-03-03 17:13:42 GMT
United States, Fort Collins
Details
SIP/2.0 200 OK
Via: SIP/2.0/UDP nm;branch=foo;received=xxx.xxx.xxx.xxx;rport=26810
From: <sip:nm@nm>;tag=root
To: <sip:nm2@nm2>;tag=540537196ee6eb718ba183ebbb24fe93
Call-ID: 50000
CSeq: 42 OPTIONS
Supported: precondition
Contact: <sip:user
User-Agent: Comrex SIP
Allow...
Comcast Business
Added on 2017-03-03 17:10:29 GMT
United States, Marietta
Details
SIP/2.0 200 OK
Via: SIP/2.0/UDP nm;branch=foo;received=xxx.xxx.xxx.xxx;rport=26810
From: <sip:nm@nm>;tag=root
To: <sip:nm2@nm2>;tag=7208cd99eb19f0c3ea7844fcf25e6ae5
Call-ID: 50000
CSeq: 42 OPTIONS
Supported: precondition
Contact: <sip:user
User-Agent: Comrex SIP
Allow: I...

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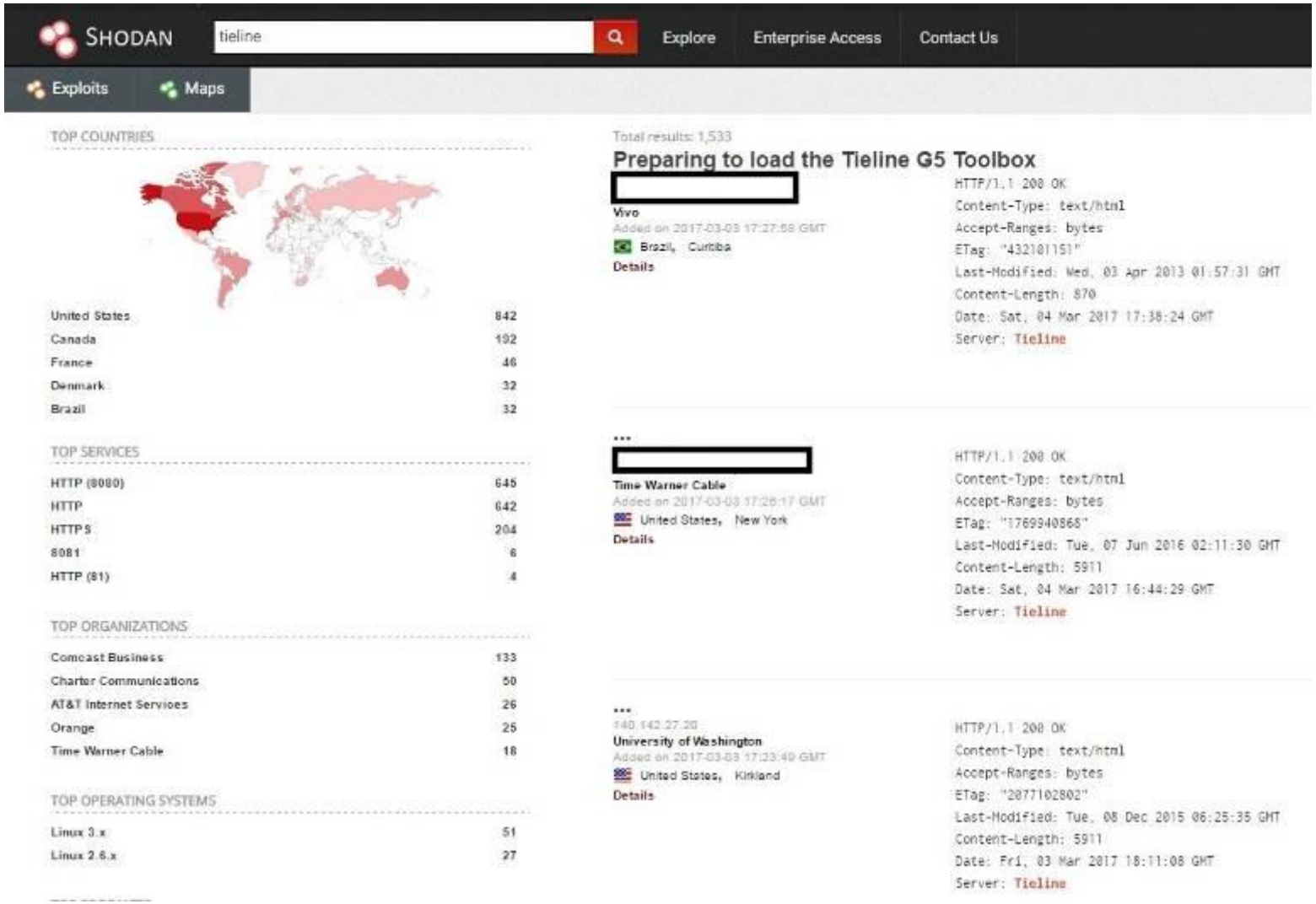
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Explore
Enterprise Access
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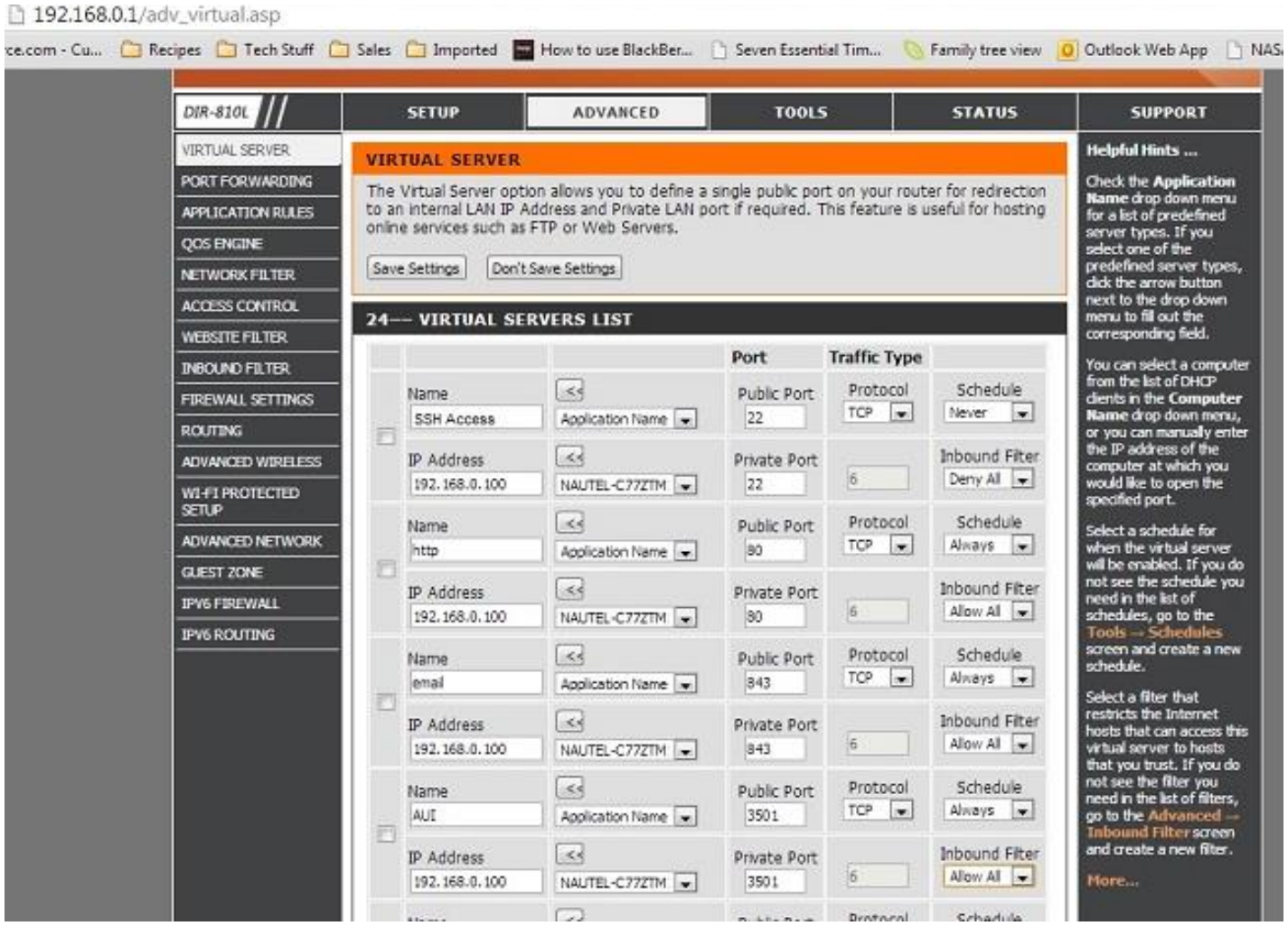
Maps
TOP COUNTRIES
United States 842
Canada 192
France 46
Denmark 32
Brazil 32
TOP SERVICES
HTTP (8080) 645
HTTP 642
HTTPS 204
8081 6
HTTP (81) 4
TOP ORGANIZATIONS
Comcast Business 133
Charter Communications 50
AT&T Internet Services 26
Orange 25
Time Warner Cable 18
TOP OPERATING SYSTEMS
Linux 3.x 51
Linux 2.6.x 27
Total results: 1,533
Preparing to load the Tieline G5 Toolbox
Vivo
Brazil, Curitiba
Details
HTTP/1.1 200 OK
Content-Type: text/html
Accept-Ranges: bytes
ETag: "432101151"
Last-Modified: Wed, 03 Apr 2013 01:57:31 GMT
Content-Length: 870
Date: Sat, 04 Mar 2017 17:38:24 GMT
Server: Tieline
Time Warner Cable
United States, New York
Details
HTTP/1.1 200 OK
Content-Type: text/html
Accept-Ranges: bytes
ETag: "1769940868"
Last-Modified: Tue, 07 Jun 2016 02:11:30 GMT
Content-Length: 5911
Date: Sat, 04 Mar 2017 16:44:29 GMT
Server: Tieline
University of Washington
United States, Kirkland
Details
HTTP/1.1 200 OK
Content-Type: text/html
Accept-Ranges: bytes
ETag: "2077102802"
Last-Modified: Tue, 08 Dec 2015 06:25:35 GMT
Content-Length: 5911
Date: Fri, 03 Mar 2017 18:11:08 GMT
Server: Tieline

IT Security


192.168.0.1/adv_virtual.asp
DIR-810L
SETUP
ADVANCED
TOOLS
STATUS
SUPPORT
VIRTUAL SERVER
PORT FORWARDING
APPLICATION RULES
QOS ENGINE
NETWORK FILTER
ACCESS CONTROL
WEBSITE FILTER
INBOUND FILTER
FIREWALL SETTINGS
ROUTING
ADVANCED WIRELESS
WI-FI PROTECTED SETUP
ADVANCED NETWORK
GUEST ZONE
IPV6 FIREWALL
IPV6 ROUTING
VIRTUAL SERVER
The Virtual Server option allows you to define a single public port on your router for redirection to an internal LAN IP Address and Private LAN port if required. This feature is useful for hosting online services such as FTP or Web Servers.
Save Settings
Don't Save Settings
24-- VIRTUAL SERVERS LIST
Port
Traffic Type
Name
SSH Access
Application Name
Public Port
22
Protocol
TCP
Schedule
Never
IP Address
192.168.0.100
NAUTEL-C77ZTM
Private Port
22
Inbound Filter
Deny All
Name
http
Public Port
80
Always
Private Port
80
Allow All
Name
email
Public Port
843
Always
Private Port
843
Allow All
Name
AUI
Public Port
3501
Always
Private Port
3501
Allow All
Helpful Hints ...
Check the Application Name drop down menu for a list of predefined server types. If you select one of the predefined server types, click the arrow button next to the drop down menu to fill out the corresponding field.
You can select a computer from the list of DHCP clients in the Computer Name drop down menu, or you can manually enter the IP address of the computer at which you would like to open the specified port.
Select a schedule for when the virtual server will be enabled. If you do not see the schedule you need in the list of schedules, go to the Tools -- Schedules screen and create a new schedule.
Select a filter that restricts the Internet hosts that can access this virtual server to hosts that you trust. If you do not see the filter you need in the list of filters, go to the Advanced -- Inbound Filter screen and create a new filter.
More...

IT Security

In Summary:

- Use a firewall, block any ports that aren't essential.
- CHANGE DEFAULT USERNAME / PASSWORD!!!
- For critical devices (most of them) consider a VPN.
- Alternately, use a product such as TeamViewer.

Safety

[redacted] chief engineer found dead

[redacted] sends thoughts and prayers to the family and friends of [redacted], who was chief engineer at [redacted] in [redacted]. The station plays "lite" contemporary Christian music and has many translators including [redacted]

[redacted] was found dead last Friday in the stationâ€™s remote mountain transmitter shack.

Technical engineer for [redacted] Radio, [redacted], was found dead at the station's transmitter site

Title: **Engineer Electrocuted Making Repairs At** [redacted]
Post by: [redacted] on **August 20, 2010, 06:06:28 PM**

It is with sadness that I pass along a report seen on the evening news today out of [redacted], Mississippi. Engineer [redacted] died yesterday while working on the station's transmitter

- More frequently, engineers are working alone, often after a full day at another job, bringing fatigue into the equation.

Safety

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

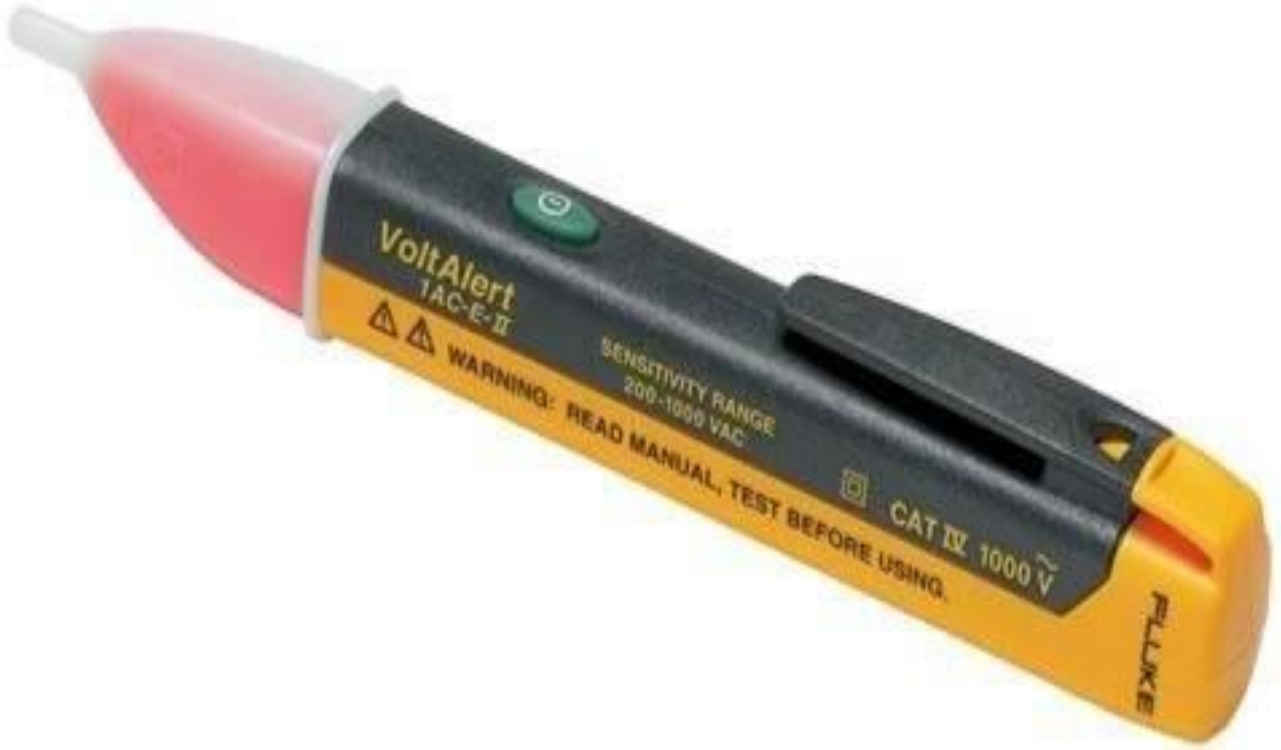
Electric Shock Resistant Boot / Electric Shock Resistant Footwear (ESR)
Boots labeled "ESR" are manufactured to protect you from electric shock when working near electrical hazards. Testing concluded the leakage current did not exceed 1 mill ampere when applying an 18,000 volt / 60HZ electrical discharge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

Safety

Safety

Lockout/tagout – it can save your life

Safety


VoltAlert
1AC-E-II
WARNING: READ MANUAL. TEST BEFORE USING.
SENSITIVITY RANGE
200-1000 VAC
CAT IV 1000 V
FLUKE

Round Table

Questions?

Comments?

Concerns?

Anything I missed…

Thank You

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Making Digital Broadcasting **Work.**