

# Working Alone

**Not Recommended, but Sometimes Necessary**

Jeff Welton, CBRE

Regional Sales Manager, Central U.S.

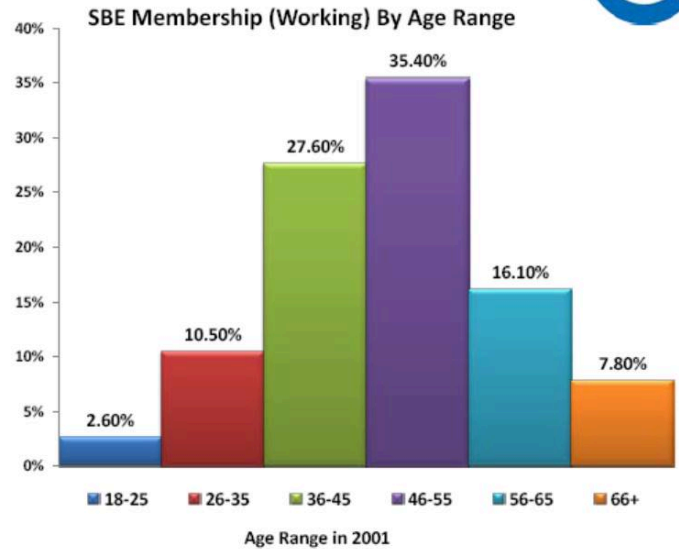
# Overview

- More companies are having to do more with less
- Engineers are getting older
- Safety Implications
- Legal Implications
- Security issues
  - Personal
  - Site
  - IT

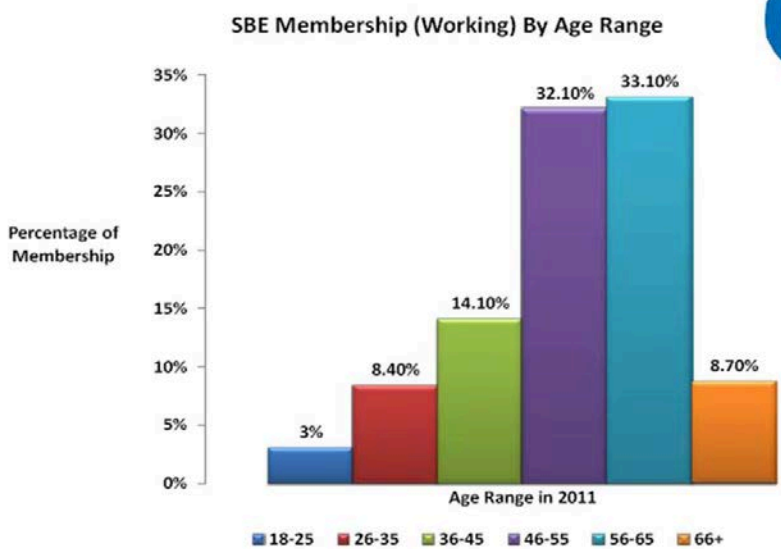
# Graying Talent

- What does it mean?
  - In the 10 year period between 2001 and 2011, the average age of broadcast engineers as a group rose by 4 years.
    - If this continues, very shortly, there will be a shortage of engineering personnel, as older engineers retire.
    - In addition, unless there is a significant upswing in mentoring, essential skills will be lost – the ability to work on equipment with HV sections and tune in an AM array, to name two.

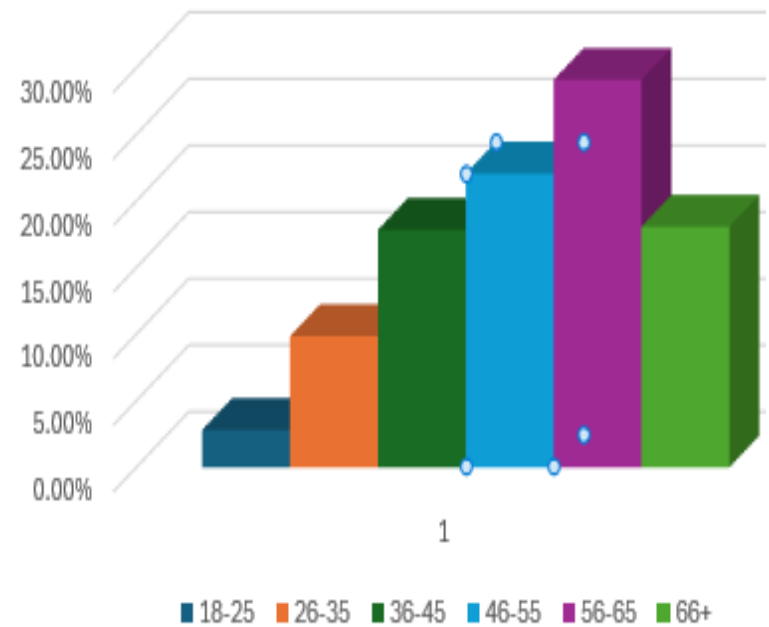
# Aging Demographic



Copyright 2012 Society of Broadcast Engineers, Inc.



Copyright 2012 Society of Broadcast Engineers, Inc.



	18-25	26-35	36-45	46-55	56-65	66+
2001	2.6	10.5	27.6	35.4	16.1	7.8
2011	3	8.4	14.1	32.1	33.1	8.7
2024	2.8	9.9	18.1	22.1	29.1	18.1

# Lower Budgets

- Fifty – or even 25 – years ago, manned transmitter sites were quite common and engineering staff tended to include both RF and audio engineers.



Photo of WCCO transmitter control point, © [www.olderadio.com](http://www.olderadio.com) – originally taken by M. Durenberger

# More Reliable Equipment

- The advent of solid state electronics has permitted redundancy resulting in fewer off-air type situations.
- Modular construction permits repairs to be carried out while on air, during daytime hours.
- Lower operating voltages tend to make equipment safer to work on – in general.

# More IT, less RF

- More and more, equipment is microprocessor based and networked, requiring specialized skills traditionally not part of radio station engineering.
- As a result, in many cases, the bulk of repairs and upgrades can be carried out by personnel with IT skills.
- However, it's still high voltage RF going to the antenna and frequently high voltage AC/DC in the power supplies.

# Nothing Ever Breaks

- With higher levels of redundancy, equipment can frequently stay on air in spite of failures.
  - This frequently gets interpreted as “no failures”, since there were no interruptions to the broadcast.
  - In spite of this, the need for ability to troubleshoot, work a soldering iron and perform complex repairs is still an important part of the job. Perhaps more important as these skills are typically only needed in urgent situations where a simple board swap won't solve the underlying problem.



# Resulting Safety Concerns

I have been getting calls from IT people who are struggling with transmitters that are beyond their level of education or understanding. Those people often do not have the Ohm's Law basic knowledge to help them think through component level troubleshooting problems. Any upcoming radio broadcast engineer needs to recognize this and train accordingly to be equipped mentally to deal with this when it occurs.

Mark Persons, "Where Have All the Engineers Gone?", Radio World, 16 May 2012

- More and more, the person tasked in maintaining the station may have a solid IT background, but have much less training and experience related to dealing with high voltage situations.
  - Power Supplies
  - Tube cavities
  - RF Filters, Phasors, Antenna Tuning Networks

# Why Nothing Ever Breaks

- As a rule, the sites with the fewest actual failures tend to be the ones where the work is put into protection and maintenance, rather than “putting out fires”.
- More and more, in today’s reality, less time is available for maintenance – although there always seems to be time for the “fires”...

# “Other Duties, As Required”

- This frequently leads to a misconception that engineers can be less skilled, since they're frequently doing maintenance tasks – cleaning filters, improving grounding, performing “check-ups” rather than actual repairs.
- In the ideal world, maintenance tasks should take up the vast majority of the engineer's time. If this were the case, the amount of repairs required would decrease dramatically.
- It also lends to parts shortages and disruptions, as shorter component life cycles and fewer points of manufacture mean it doesn't take much to mess things up!

# Resulting Safety Concerns

chief engineer found dead

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

was found dead last Friday in the station's remote mountain transmitter shack.

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

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

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It is with sadness that I pass along a report seen on the evening news today out of , Mississippi. Engineer 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.



Photo of WISN phasor © [www.olderadio.com](http://www.olderadio.com)

# 29CFR1910 says:

(3) *Additional requirements for qualified persons.* Qualified persons (i.e., those permitted to work on or near exposed energized parts) shall, at a minimum, be trained in and familiar with the following:

(i) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,

(ii) The skills and techniques necessary to determine the nominal voltage of exposed live parts, and

(iii) The clearance distances specified in §1910.333(c) and the corresponding voltages to which the qualified person will be exposed.

# Costs of Fewer Engineers

- Beyond the legal costs associated with a tragedy, the decline in available engineers comes with several other potential costs:
  - Cost of off-air time due to failures
    - Can tend to be higher as a result of lack of maintenance
  - Cost of repairs
    - Time and materials for in-house repair
    - Higher costs for factory repair/exchange... if available.
  - Increased time to repair failures by inexperienced personnel, with attendant risk of additional failures due to fatigue or misdiagnosis.

# Proper Protection is Important

- 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.



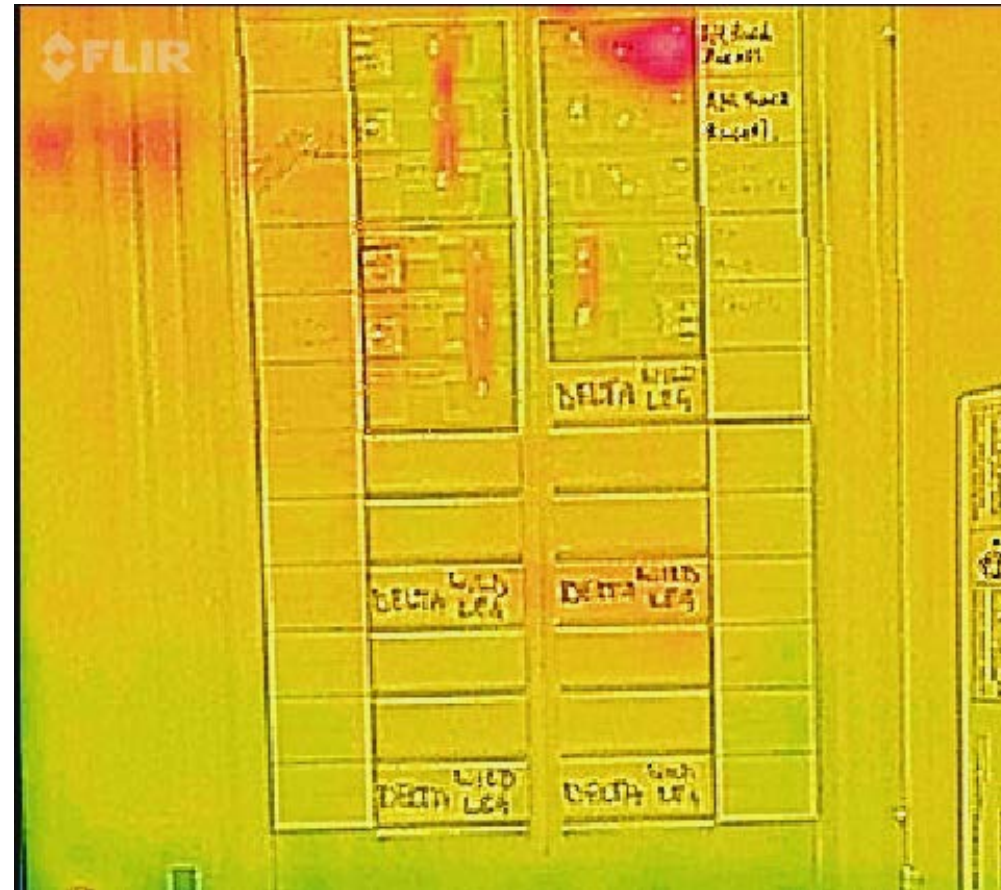


# Ensure everything is discharged

- A ground stick can scare the pants off you if it hits a live circuit... but not nearly as badly as if YOU had hit that circuit.



# Thermal Scans



# 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



# Safety is Key



Lockout/tagout – it can save your life

# 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

- Even after you've locked out the power source, a fast verification is a good idea (breakers can weld closed)



# Let's Be Careful Out There

- There is always the “potential” for danger.
- AC mains can be up to 600VAC... always measure any AC connection with a known working voltmeter before touching – use an appropriate meter.
- RF connections, especially in AM plants, can carry thousands of volts... use a grounding stick, or fashion one out of a set of jumper cables and a wooden broomstick... **NEVER ASSUME THAT IT ISN'T HOT!!!**
  - A 300 foot insulated tower can pick up hundreds of volts of static on a windy day, even when disconnected from the transmitter.
  - It can also pick up hundreds of volts of RF from another station.
  - Messenger cables on long horizontal coax runs can be great antennas – and carry enough voltage to cause a very painful burn.
  - Be careful of transmitters which may have bypassed interlocks or “modified” protection circuitry.
- Electrical circuits, especially high current DC supplies, have a lot of storage capacity to counteract mains sags. These can be hot for a long while after mains power is removed.

# Safety is Key

- Ensure use of proper safety equipment is mandatory
  - Ladders rated for working with electricity (and make sure ladders are used, don't stand on chairs!)
  - Equipment should be secured when not in use.







Covers NEC® 2017, NFPA 70E® 2018, NESC® 2017, and OSHA 1910 and 1926 electrical standards

# ELECTRICAL SAFETY HANDBOOK

Dennis K. Neitzel | Mary Capelli-Schellpfeffer | Al Winfield



## Electrical Safety Handbook 5th Edition



by Dennis K. Neitzel (Author), Mary Capelli-Schellpfeffer (Author), Al Winfield (Author)

4.8 ★★★★★ 5 ratings

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**Publisher's Note: Products purchased from Third Party sellers are not guaranteed by the publisher for quality, authenticity, or access to any online entitlements included with the product.**

**On-the-job electrical safety essentials—thoroughly revised for the latest procedures and standards**

This fully updated electrical safety guide is a practical, illustrated source of life-saving information designed for specific work environments. The book has been fully revised and expanded to conform to every current major electrical standard, including NEC, NESC, NFPA70E, IEEE 1584, and OSHA. Written by experts in electrical operations, maintenance, engineering, construction, and safety, *Electrical Safety Handbook, Fifth Edition* provides the most up-to-date safety strategies in an easy-to-use format. The book delivers complete details on electrical hazards, safety equipment, management, training, regulatory and legal requirements, accident prevention, and much more. You will find new sections on electrical grounding, heat transfer theory as it relates to the human body, and the medical aspects of

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# Troubleshooting/Maintenance

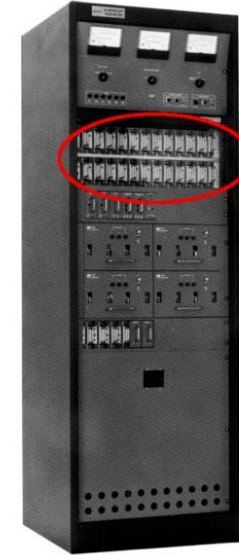
- All legacy equipment (anything over 15 yrs old):
  - Check power supply wiring for cracked insulation
  - Check circuit breakers for mechanical integrity and operating temperature.



# Troubleshooting/Maintenance

– 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!

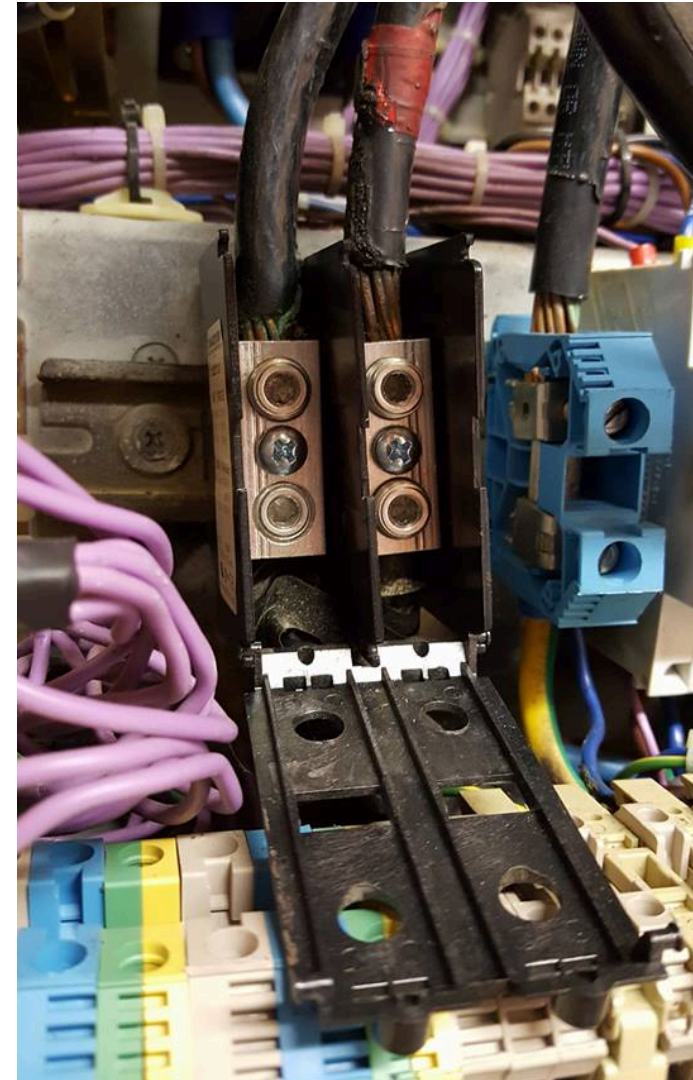
NV20/NV15 INSTALLATION MANUAL

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.

# Hardware

- Compression connections must be checked periodically



# Security – it protects you and stuff



# Security – it protects you and stuff

Floodlights are relatively cheap

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



# Security – it protects you and stuff

There are two ways to prevent copper theft...

Bury it.

Make it less valuable or make it appear so.



# Security – it protects you and stuff

A well secured entrance creates peace of mind.

If vandals or thieves can't get to your front door, it makes their task harder.





# Security – it protects you and stuff

Use good quality locks  
and entrance hardware

Keyed alike is helpful

Security locks for which  
keys are registered (and  
can't easily be copied).



# Security – it protects you and stuff

A high quality peephole lets you see who's at the door.

It's also harder to shoot through!



# Security – it protects you and stuff



Obviously, a well fenced area is harder to get into!

# Security – it protects you and stuff

Anti-climb fencing can also be useful

It also takes a lot longer to cut through



# Security – it protects you and stuff

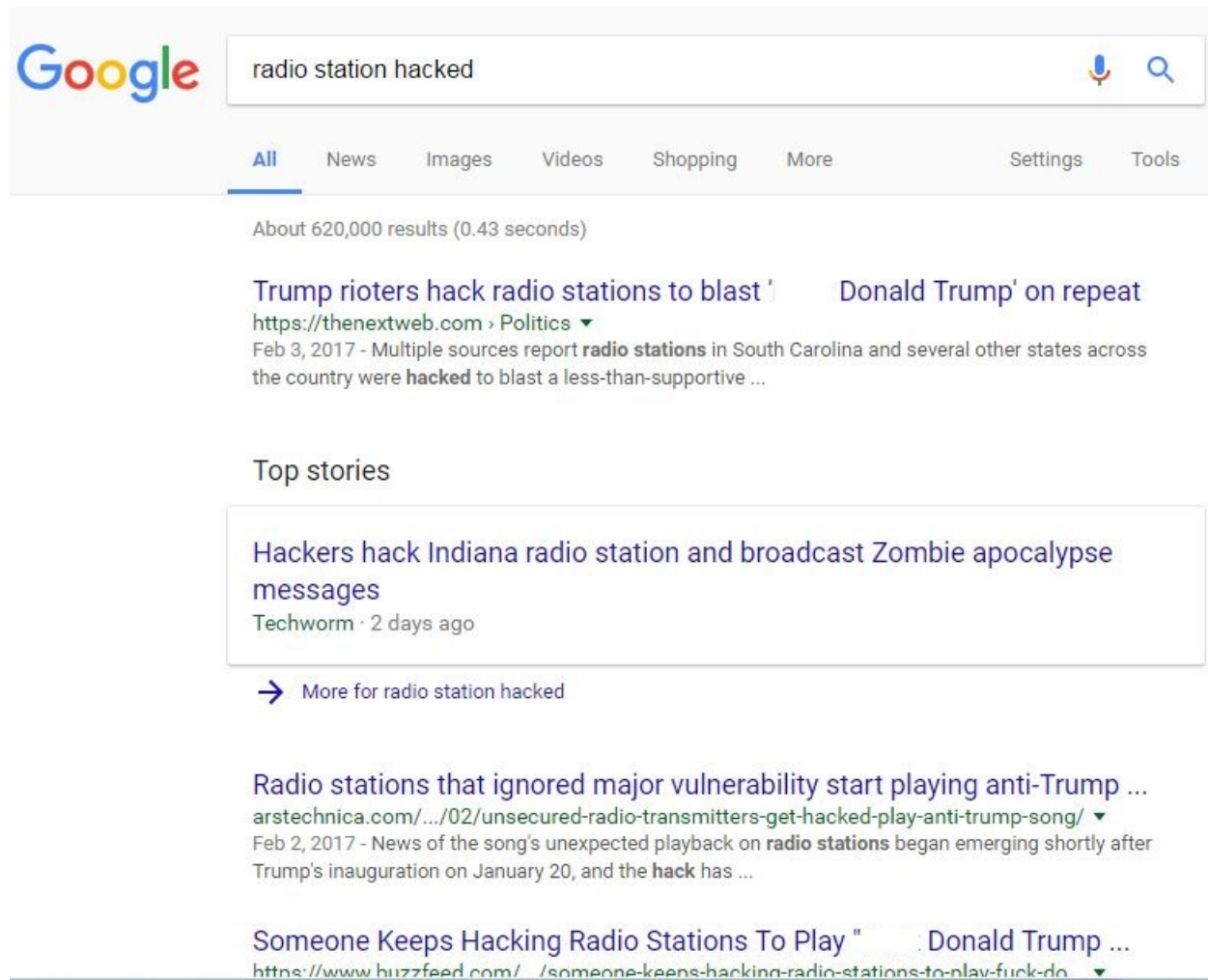
Web accessible cameras are cheap.

They won't prevent break-ins or theft, but they can provide a record.

In connection with motion sensors tied into the remote control, they can provide a way to see what's going on and provide faster police response. This can help limit damage and loss.



# IT Security



Google search results for "radio station hacked".

Search query: radio station hacked

Results: About 620,000 results (0.43 seconds)

Top result: 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/](http://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

Shodan Developers Book

SHODAN

Exploits Maps

TOTAL RESULTS

2,125

TOP COUNTRIES



Shodan Developers Book

SHODAN

Exploits Maps

TOTAL RESULTS

1,553

Shodan Developers Book

SHODAN



Exploits Maps


TOTAL RESULTS

2,238

# IT Security

**Login**

User:  

Password:

Screen Name:

Remember me:

**Enter user & password**

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

← → ↻ 🏠 ⓘ [Redacted] ☆ ABP G

Apps salesforce.com - Cus Tech Stuff Sales Imported Winter Time - Govern SNMP stuff Financing Quoter - N » | Other

HOME LOCATION CONFIGURATION DEFAULTS UPDATE REBOOT Exstreamer 1000 MAC: 00:08:E1:02:C3:C6 FW VB1.06

## Studio Transmitter Link

BARIX

**Transmitter Decoder**

- Basic Settings
- Network
- Streaming
- Audio
- I/O and Control
- Serial
- Security

Apply

Cancel

### BASIC SETTINGS

### INCOMING STREAM

**Stream Method**

**URL**

**Port**

#### Help

**Basic Settings**  
This section helps to setup a fast-startup configuration. It allows the configuration of the first *Outgoing Stream* destination and of the *Incoming Stream* socket. See *Streaming* section help for further information.

# IT Security

**X-332**


<b>Nautel-TPO:</b> 11.00 KW	<b>Sensor 1:</b> 89.7 F
<b>Nautel-Ref1:</b> 0.06 KW	<b>Sensor 2:</b> 89.7 F

<b>Mid Beacon Nor:</b> Normal	<b>NV10-Start:</b> PULSE
<b>Mid Beacon Sou:</b> Normal	<b>NV10-Stop:</b> PULSE
<b>Upper Sides:</b> Normal	<b>PS-1:</b> 11KW
<b>TopBeacon:</b> Normal	<b>PS-2:</b> 2KW
	<b>PS-3:</b> 1KW

Wed, 13 Jun 2018 06:10:05

# IT Security



**Device: DYRF AM Transmitter**  
Data retrieved 2017-03-07T19:47:43

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

**New Site**  
[Home](#)

**Equipment**  
[DYRF AM Transmitter](#)

**Administration**  
[Site Configuration](#)  
[User Administration](#)

You are logged in as root  
[Logout](#)

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

The screenshot shows the 'VIRTUAL SERVER' configuration page for a D-Link DIR-810L router. The page is accessed via a browser at 192.168.0.1/adv\_virtual.asp. The interface includes a navigation menu on the left with options like 'VIRTUAL SERVER', 'PORT FORWARDING', and 'APPLICATION RULES'. The main content area is titled 'VIRTUAL SERVER' and contains a description: '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.' Below the description are 'Save Settings' and 'Don't Save Settings' buttons.

Below the description is a table titled '24--- VIRTUAL SERVERS LIST' with the following columns: Name, Application Name, Port, Protocol, Schedule, and Inbound Filter. The table contains six entries:

Name	Application Name	Port	Protocol	Schedule	Inbound Filter
SSH Access	Application Name	22	TCP	Never	
192.168.0.100	NAUTEL-C77ZTM	22	6		Deny All
http	Application Name	80	TCP	Always	
192.168.0.100	NAUTEL-C77ZTM	80	6		Allow All
email	Application Name	843	TCP	Always	
192.168.0.100	NAUTEL-C77ZTM	843	6		Allow All
AUI	Application Name	3501	TCP	Always	
192.168.0.100	NAUTEL-C77ZTM	3501	6		Allow All

The right sidebar contains 'Helpful Hints ...' with instructions on how to use the 'Application Name' drop-down menu and how to select a computer from the DHCP list or manually enter an IP address. It also provides instructions on selecting a schedule and a filter for the virtual server.

# IT Security

In Summary:

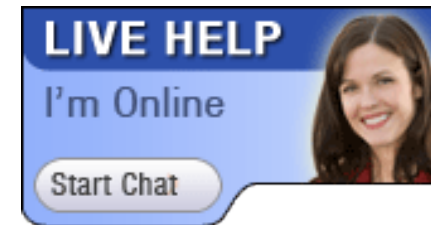
- Use a firewall, block any ports that aren't essential to operation.
- CHANGE DEFAULT USERNAME / PASSWORD!!!
- For critical devices (most of them) consider a VPN – or put them all on a non-internet connected local network, then use a VPN to access it.
- Alternately, use a product such as TeamViewer to access.

# To review:

- We are all doing more with less
  - Fewer resources
  - Lower budgets
  - Shrinking talent pool
- We need to carefully manage to ensure we're not overlooking critical points
  - Safety
  - Maintenance vs. “firefighting”
  - Potential legal implications
    - Protection of license
    - Avoiding liability

# Learn More / Stay in touch

- Nautel Waves Newsletter  
<https://www.nautel.com/newsletters/>
- Webinars  
<https://www.nautel.com/resources/webinars/>
- YouTube  
<https://www.youtube.com/user/NautelLtd>



# Thank You