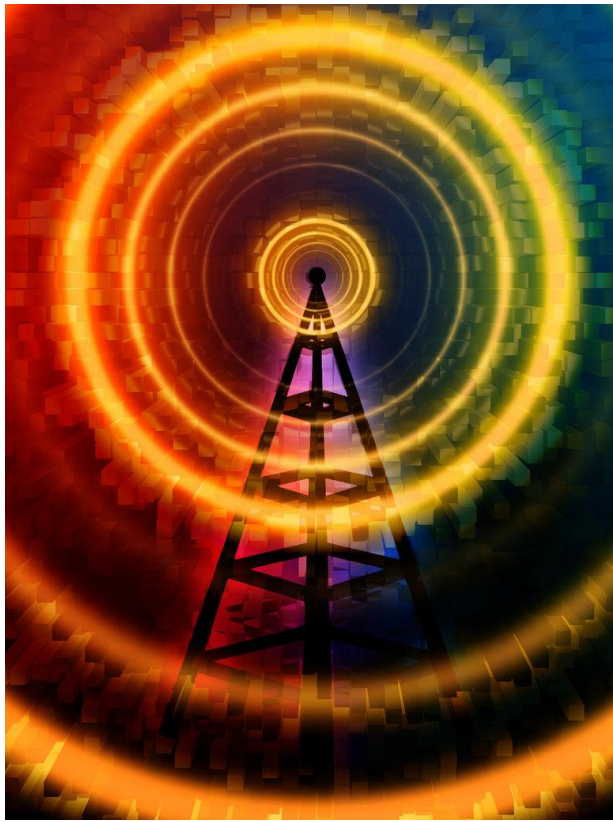


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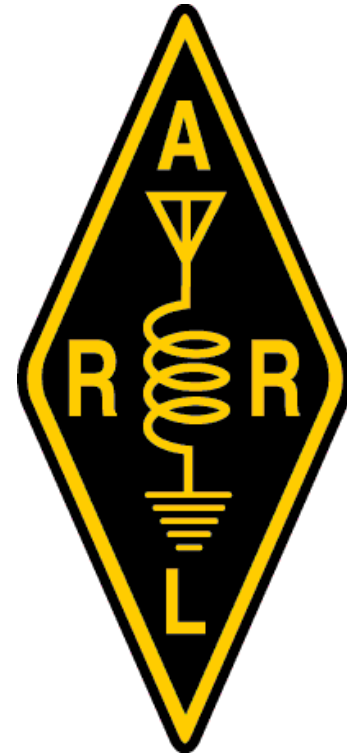


# Dealing with RFI

## Radio Frequency Interference

# Radio Frequency Interference

- ▶ FCC Part 97 Rules
- ▶ FCC Part 15 Rules
- ▶ FCC Part 18 Rules
- ▶ Public Law 97-259
- ▶ Responsibility
- ▶ RFI Paths
- ▶ RFI Types
- ▶ Locating RFI
- ▶ RFI Examples
- ▶ RFI Cures & Fixes



# 47 CFR §97

## Rules of the Amateur Radio Service

- ▶ A–General Provisions
- ▶ B–Station Operation Standards
- ▶ C–Special Operations
- ▶ D–Technical Standards
- ▶ E–Emergency Comm
- ▶ F–Qualifying Examination Systems



\*CFR=Code of Federal Regulations

# 47 CFR §15

## Rules for Unlicensed Transmissions

Regulations regarding unlicensed transmissions for everything from spurious emissions to unlicensed low-power broadcasting.

Nearly every electronics device sold inside the U.S. radiates unintentional emissions, and must be reviewed to comply with Part 15 before it can be sold in the US market.



\*CFR=Code of Federal Regulations



# 47 CFR §18

## Rules for Industrial, Scientific, Medical

Pertains to the Industrial, Scientific and Medical bands. Some lighting devices, such as compact fluorescent lamps and home microwave ovens operate under part 18.



\*CFR=Code of Federal Regulations

# Public Law 97-259

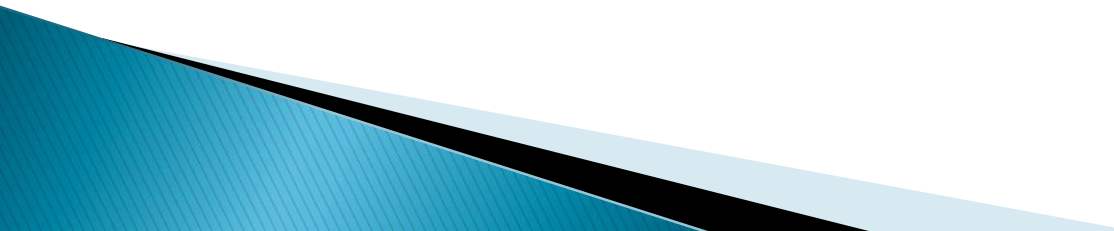
## What if my neighbor calls the police?

In 1982 Congress passed Public Law 97-259 which specifies and reserves exclusive jurisdiction over RFI matters to the FCC



Note: It may be helpful to show that you have no RFI problems with similar equipment in your own home.

# Responsibility

- ▶ Proper Station Operation
  - ▶ Interference **to** Neighbor's Equipment
  - ▶ Interference **from** Neighbor's Equipment
  - ▶ Use Diplomacy
  - ▶ **DON'T TOUCH NEIGHBOR'S EQUIPMENT!**
  - ▶ Know your facts / Save your opinions
- 

# RFI Paths

- ▶ Radiation

  - Radiates through space

- ▶ Conduction

  - Travels via physical path (wires, & enclosures)

- ▶ Inductive Coupling

  - Two circuits are magnetically coupled

- ▶ Capacitive Coupling

  - Two circuits coupled through Capacitance

Note: Typical RFI includes multiple paths, such as conduction & radiation.



# RFI Types

- ▶ **Fundamental Overload**

Super strong signals overwhelm a receiver's ability to reject them.

- ▶ **Spurious Emissions**

Extra Emissions sent along with the intended signal

- ▶ **External Noise Sources**

RF energy transmitted incidentally or unintentionally by a non-licensed device

- ▶ **Intermodulation (IMD)**

Two signals combine to create unwanted signals

# Locating RFI

## Noise Source Inside Your Home

- ❖ Most problems are in a complainant's home.
- ❖ Begin by turning off the power to your entire home
- ❖ Listen to a battery powered radio.
- ❖ If the noise goes away, turn breakers on one at a time to identify the source circuit of the RFI.



# Locating RFI

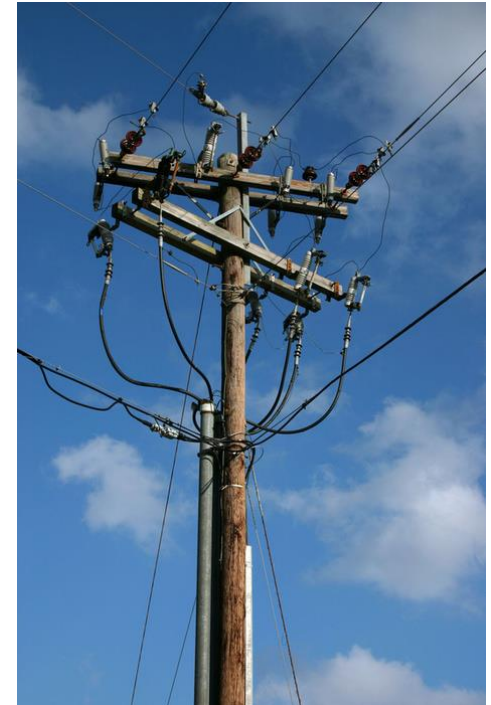
## Noise Source Outside Your Home

- ❖ Verify noise is active
- ❖ Use a beam antenna to take bearings before leaving your home to explore the neighborhood
- ❖ Choose a “radiator” to test at each location (power meter)
- ❖ Compare signal strengths of radiators at each location
- ❖ If the signal decreases, you are moving away from the RFI
- ❖ The location with the strongest RFI signal is the source of the RFI
- ❖ Once located, use diplomacy and PDF Handout\*

# Locating Power-Line RFI

## ▶ Common Causes of Power-line Noise

- ❖ Loose Staples on ground conductor
- ❖ Loose Pole-top pin
- ❖ Ground conductor touching nearby hardware
- ❖ Corroded slack span insulators
- ❖ Guy wire touching neutral
- ❖ Loose hardware
- ❖ Bare tie wire used with insulated conductor
- ❖ Insulated tie wire on bare conductor
- ❖ Loose cross-arm braces
- ❖ Lightning arrestors



# RFI Examples – 1



Package

Click icon to run Video

# RFI Examples - 2



Package

Click icon to run Video



# RFI Examples – 3



Package

Click icon to run Video

# RFI Cures & Fixes

## ▶ Keep it simple

- ❖ Is it really RFI?
- ❖ Is it your station?
- ❖ Take One Away (repair broken equipment)
- ❖ Look around (loose connections, corroded contacts)
- ❖ At your station (be sure it's not in your home)
- ❖ Simplify the problem
  - Disconnect complex systems (phone systems)
  - Start at the beginning and add one at a time
  - Hopefully, you can resolve issues in one pass
- ❖ Multiple Causes
  - Keep Temporary cures in place until problem solved
  - Remove temp. cures one at a time

# RFI Cures & Fixes

- ▶ Common-mode choke
  - ❖ Choose the correct core & ferrite material
  - ❖ Type #31 for HF & low VHF
  - ❖ Type #43 for 5 MHz through VHF
  - ❖ Type #61 for UHF
  - ❖ Wrap 6–8 turns for 10–30MHz
  - ❖ Wrap 10–15 turns for 1.8–7MHz
  - ❖ Remove cables one at a time & add chokes as needed
  - ❖ Once all cables have been check & noise is eliminated, begin removing chokes one at a time to confirm which ones must remain and which can be removed



FIN!



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