

Troubleshooting for the Non-Techie Ham – Key Points

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Troubleshooting and resolving equipment failures is a key area of knowledge for Amateur Radio operators. It sets them apart from other radio service users. You don't need an engineering degree, just a logical approach, some basic knowledge, some simple tools and equipment, patience and determination.

Troubleshooting consists of:

- Recognizing that something isn't working correctly
- Identifying possible causes of the problem
- Isolating and testing each possible cause
- Remediating the root cause if possible
- Find a workaround if repair is not possible
- Checking for resumption of normal operations

How do you recognize that a problem exists?

- You SEE it (no lights, no meter movement)
- You HEAR it (no signals or no replies; arc or buzz)
- You SMELL it (smoke or burning-plastic odor)
- Someone TELLS you (hum, distortion, weak signal)
- Comparisons yielding unexpected results

Some basic troubleshooting concepts:

- Following the flow of power or signal
- Measurement to confirm expected values
- Narrowing down the location of the problem
- Substitution of suspect system components
- Finding a workaround if repair is not possible
- Checking for resumption of normal operations

Sample problem 1: It won't turn on

Possible causes (other than defective radio):

- not plugged in (applies to device and power supply)
- p/s off, bad switch, blown fuse, wrong input voltage
- power cable damaged or connector miswired
- reversed polarity or AC vs. DC required
- oxidized or broken contacts on connector
- wire broken loose inside connector, p/s or device
- insufficient current or voltage available to device

Troubleshooting steps:

- trace wiring to and from device and p/s
- measure voltage at the radio and work toward p/s
- check P/S polarity, output & input voltage settings
- wiggle all power connectors; look for intermittent
- clean or replace contacts on suspect connectors
- open lid of radio or p/s and look for dangling wires
- substitute p/s, cable and radio one at a time

Sample problem 2: No signals heard

Possible causes (other than defective receiver):

- audio chain (can you at least hear noise?)
- squelch engaged or set incorrectly
- no antenna or wrong antenna connected
- short or open in transmission line or connector
- wrong frequency
- dead band
- not keying up repeater (wrong PL, etc.)

Troubleshooting steps:

- turn RF gain full, squelch off, volume up ½ way
- plug in headphones, then try an external speaker
- put end of wire length in antenna jack
- substitute another length of coax to antenna
- tune to a known active band or frequency
- take switches & other accessories out of the line
- listen with 2nd receiver on same antenna

Sample problem 3: Distorted transmit signal

Possible causes (other than defective transmitter):

- operator overdriving or mishandling microphone
- inadequate current or voltage from power supply
- loose connection in microphone
- misadjusted TX audio / processing / deviation (FM)
- RF feedback due to stray feedline currents
- Off frequency (for FM, especially)
- ground loop or bad ground
- noisy other device on same AC line or nearby
- Receiving station's front end is overloaded or other op has noise blanker on

Troubleshooting steps:

- talk across – not into - microphone
- gently shake or tap microphone and listen
- turn off processor, reduce mic gain
- measure p/s voltage under load; change to battery and re-test
- transmit into dummy load and listen on 2nd receiver (no stray RF can escape)
- disconnect or turn off other radios, computers and accessories
- have someone listen up / down a few KHz (FM) to see if signal gets clearer
- unplug nearby computers, motors, etc.
- for RX overload, turn off preamp, turn off noise blanker, add attenuation

RF goes wherever you let it. Every system component is vulnerable to stray RF, whether radiated or conducted (this is why BPL is such a bad idea):

- power supplies, via input and output cables
- other radios, via antenna, power and other ports
- computers, via power, data and audio leads
- computers, routers, etc. also generate RF

Non-Amateur gear is also vulnerable to stray RF:

- computers, via power, data and audio leads
- any AC appliance, via line cords
- TV & stereo, via antenna, speaker & power leads
- garage door openers, via control and power leads
- telephones and intercoms
- automotive electronics

To find out how RF is getting into something, try these steps:

- Try an alternate power source, such as a battery (bypasses power supply wiring)
- Route RF cables separately from others (to minimize magnetic coupling)
- Try good AC line filters (e.g., TrippLite IsoBar)
- Disconnect leads one by one; if problem stops, use ferrites on offending cable
- Replace antenna with dummy load and re-test
- Use good filters: low-pass, high-pass, bandpass, notch
- Try different bands to test for possible resonant-length cables
- Change antenna direction or location

For basic test equipment, don't overlook what you already have:

- metering built into existing equipment
- second radio (even a handheld for the band / mode)
- Known-good spare coax cables and power cords
- vehicle battery and jumper cables
- portable A.M receiver (for noise tracking)

Add these basics:

- clip leads, lengths of wire, coax jumpers & adapters
- volt-ohm-milliammeter (VOM)
- dummy load (it's not just for tuning up!)
- simple hand tools (screwdrivers, pliers, nutdrivers)
- RF wattmeter or SWR bridge
- ferrite cores, spare fuses, small soldering kit

Additional points to remember:

- Get to know your equipment (What is "normal"?)
- Any problem may have more than one cause
Don't jump to conclusions; be systematic
- Substitution is usually the fastest way to locate a problem component in your system . . . but ONLY after you have checked voltages!
- Using labels and diagrams can help you trace problems