



Repeater Diagnostics

Lesson Five

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What You Get

- What can go wrong in a repeater operation.
- Diagnostic actions with simple equipment.
- Diagnostic actions with a service monitor.
- Session: 30 min and 15 minutes Q&A.

Welcome

- The lesson videos are posted at YouTube channel ‘K6KN Bill’.
- Slides PDF and video links posted at barkradio.org
- Introduce Bill K6KN, president of Berryessa Amateur Radio Klub BARK.

Sessions Summary

- One: Managing A Ham Repeater
- Two: Repeater Components and Functions
- Three: Repeater Test Equipment and Tests.
- Four: Advanced Repeater Measurements & Settings.
- Five: Repeater Diagnostics
- Optional: Hands on training.

Open With Questions

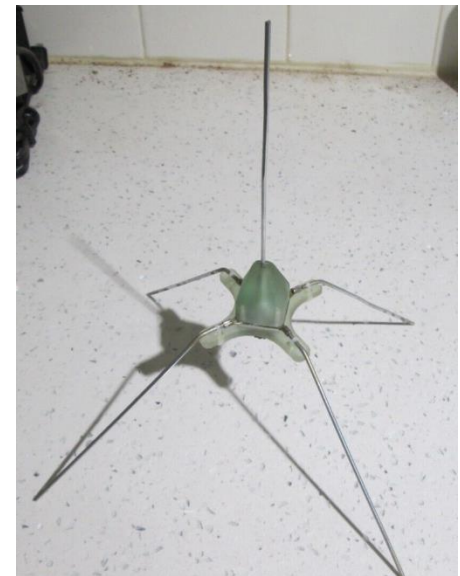
- From your homework, have you thought of with some possible repeater complaints?
- Now is ‘open mic’ for your input on problems.
- I’ll try to address them.

Common Problems

- No repeater response.
- Distant users lose access. Rx sensitivity.
- Some users can't hear repeater. Tx power.
- Repeated "Kerchunking".
- Wind/weather related problem.
- Audio Distorted.
- Post-lightning storm.

Precautions Assisting Troubleshooting

- Have a station log detailing performance over time.
- From your home site: Log sensitivity and power out compared to similar repeaters.
- Using an HT and decade attenuator.

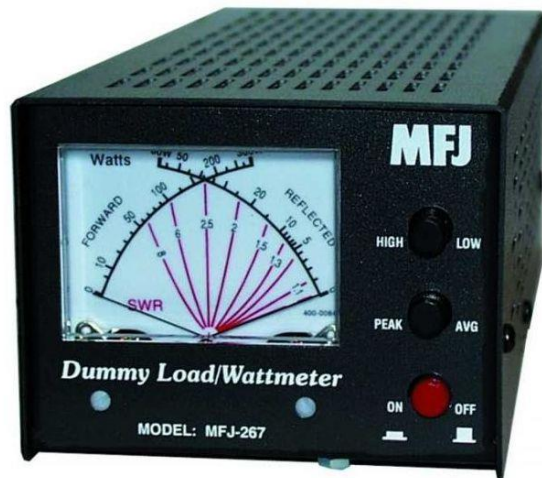


Master Process

- Start at one end and work toward the other.
- Divide and conquer; for a large, complex system.
 - Start in the middle.
 - Evaluate is the problem to the left or right?
 - Go to the middle of that path and repeat.
- The method of random scratching and clawing.
Jump at a point you understand.

Tools

Power Meter



Dummy Load



Tools

HT Hand Transceiver



RF attenuator

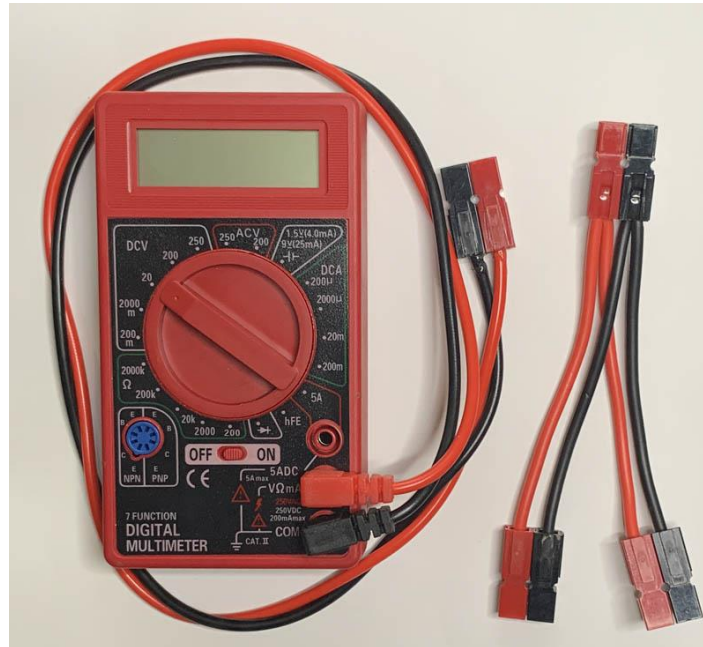


Tools

Antenna Analyzer



Digital Volt Meter DVM



Tools

Service monitor IFR COM-160B



No Response

Repeater doesn't respond.

Start in middle and work left or right.

Possibilities

- DC power bad,
- Repeater internal failure,
- Output chain problem. Tx side.
- Input chain problem, Rx side.
- Cable or connector problem.

No Response

- Quick test with HT to verify the problem continues.
- Verify DC into repeater OK 12 to 13.5V.
- Add power meter inline to cavity.
- Key HT.
- If no response, HT into 1" stub at Rx antenna input to repeater testing for Rx side problem. If a response check the Rx input chain.
- If response check the Tx output chain.

Utility Power

- Measure voltage of utility, battery, solar open circuit.
- Then voltage input to repeater from one source at a time; keyed and unkeyed.

	Isolated	Input Unkeyed	Input Keyed
Utility Power	13.70 V	13.50 V	13.27 V
Battery	13.50 v	13.41 V	13.07 V
Solar	22.60 V	13.41 V	13.10 V

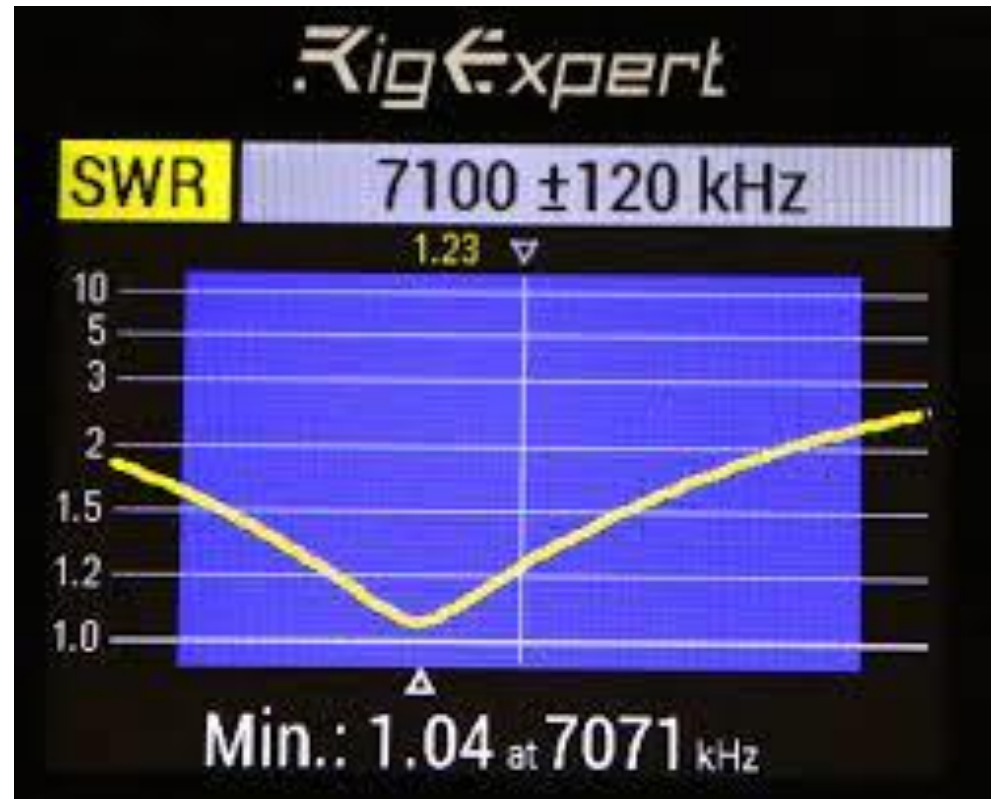
Transmit Side

Using antenna analyzer verify a reasonable SWR (under 2) toward Tx cavity, then toward lightning suppressor, then to the Tx antenna.



Receive Side

Using antenna analyzer verify a reasonable SWR (under 2) toward Rx cavity, then toward lightning suppressor, then to the Rx antenna.



Some Get Through, Some Don't, Receiver Sensitivity

- RF from HT on lowest power setting through a decade dB attenuator to Rx input.
- Connect directly to the receiver input.

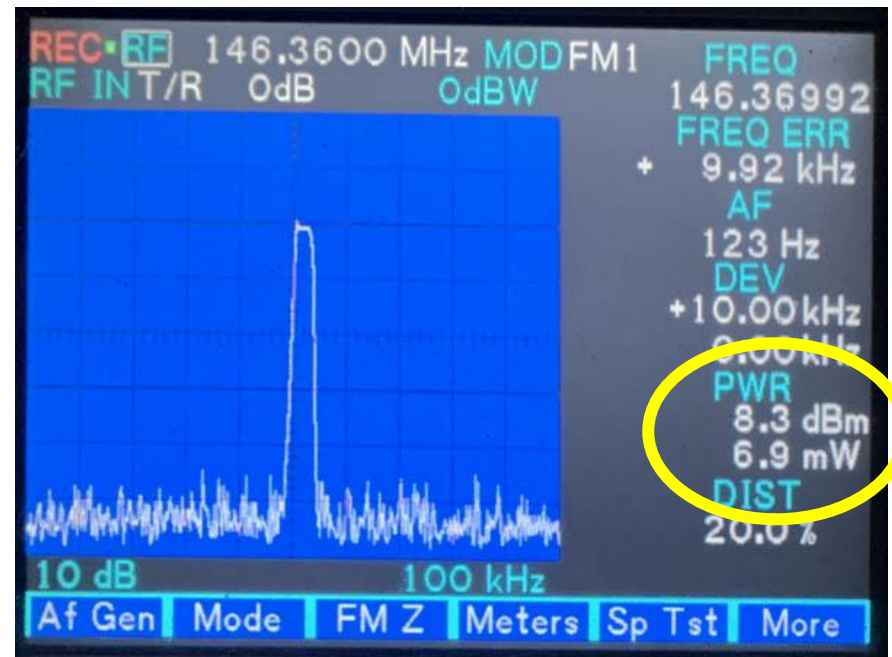


Some Get Through, Some Don't, Receiver Sensitivity

- Find attenuated power setting to break squelch.
- Determine HT output in dBm (5 watts is +37 dBm, 1 watt is +30 dBm, ½ watt is +27 dBm) and subtract attenuator value.
- Compare to your notebook record. Expect -90 dBm to -120 dBm.
- If not determine reason for loss of sensitivity. Antenna breaks, lightning suppressor, and ??

Sensitivity From Home

- HT on low power through a decade attenuator to an antenna.
- Find attenuation to just break squelch on the repeater.
- Calculate and dBm or power.
- Our case:
8.3 dBm or 7 mW.
- Record and compare to other repeaters.



Distant Users Lose Service

- Check RF power out into dummy load
- If OK check then use antenna analyzer to check the output chain, to cavity, lightning suppressor and then antenna.

Repeater Kerchunking

- Expect desens when a weak user breaks squelch and then drops.
- Measure desens with a service monitor. Lesson Four.
- Then evaluate cable shielding and cavity filters to locate Tx signal crossing into the Rx side.

Weather/Wind Related Issue

- Rain can increase background noise.
- If intermittent signal breaks or clicks, likely antenna mount or connector,
- Less likely a feed line.

Distortion

- Loud sound leading to crackling.
- Is it most all users or a very few?
- If a single user, counsel on reducing mic gain (over-eviation).
- If it is most users, use service monitor to set repeater deviation.
- See Lesson Four.



Local Lightning

- Before-hand determine if your lightning suppressors have DC continuity or not.
- With an antenna analyzer, test SWR through each lightning suppressor to its antenna and then directly to the antenna.
- If different, replace the lightning suppressor.

Conclusion

- Keep your notebook up to date for comparison values upon trouble.
- Any club managing a repeater should have or be able to borrow a service monitor.
- To perfect your repeater skills, find a local club and volunteer.

References

- Barkradio.org/training for resource material.
- ke6yuv.slack.com. For PDFs, questions, discussion & YouTube links.
- YouTube.com channel: “K6KN Bill”
- www.repeater-builder.com
- The ARRL Handbook For Radio Communications.
- The ARRL Antenna Book.