JOHNSON COUNTY
RADIO AMATEURS CLUB,
INC.
P.O. Box 93 Shawnee
Mission, KS 66201

FEEDBACK

OCTOBER 2014

PRESIDENT'S CORNER

The public service events for 2014 are winding down. The weather for these events in September could not have been better this year. Last year the weather caused several events to be shortened or canceled altogether. I hope you had the opportunity to volunteer for at least one event. It is a good way to keep you equipment in working order.

October means it's time for the Ensor activities and auction. The activities will start Friday evening October 24. These activities include a camp fire, pot luck dinner and movie. As midnight approaches there will be this year's"Spirit of the Ensors" ceremony. Saturday the Auction will start around 11 am, So come out early to look the items.

Search through your ham shack for that forgotten or little-used item that needs a new, caring home. We will be more than happy to assist with your sale and at the same time help support the Club and Ensor Farm. Auction items can be on consignment or donated. Listen to the repeater for date and time of the reverse Santa for picking up items for the auction.

Skywarn Recognition Day is co-sponsored by the National Weather Service and American Radio Relay League. This year the event will start on December 5 at 6 pm CST and end on Saturday December 6 at 6 PM CDT. This event celebrates the important contributions that volunteer SKYWARN radio operators make to the National Weather Service core mission. If you would like to help with this event, please contact me. The Regional Headquarters is located near the airport, Interstate 29, exit 10. We will need volunteer operators starting at 6 pm Friday through 6pm Saturday. I will be checking with Pleasant Hill as to what assistance they will need. – Bill Gery – WA2FNK

OCTOBER MEETINGS

October 10 *– "Three Useful Knots" – Bill Gery - KA2FNK*

October 14 *– Ensor Farm Cookout - 18995 W. 183rd Street Olathe, Kansas 66062*

The Johnson County Radio Amateurs Club normally meets on the 2nd and 4th Fridays of each month at 7:30 PM at the Overland Park Christian Church (north entrance), 7600 West 75th Street (75th and Conser), west of the Fire Station.

IN THIS ISSUE

Editorial Note

Before agreeing to serve as the new editors of the Feedback, we insisted upon and received assurances from several fine writers that they would—and in some cases, would continue—to bring outstanding material to the ham radio community.

In this issue, we are pleased to showcase the talents of two Club members. Tom Wheeler, NØGSG, concludes his acclaimed series "The Art of Troubleshooting" with a bit of literary flair. Jaimie Charlton, ADØAB, brings his light-hearted touch to educate "Hambone" and the newer members of our community.

Thank you, in advance, for your patience as you experience our experiments as we learn about newsletter design, in an attempt to get the membership the high-quality newsletter it enjoyed from our predecessors, Dick Carter, NØTO and Steven Martin, KØSLM. – *Chip (ACØYF) and Deb (KDØRYE) Buckner*

'Twas Brillig -- The Art of Troubleshooting – Part 9 – Tom Wheeler, NØGSG

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe.

From *Through the Looking Glass and What Alice Found There* by Lewis Carroll, 1871

In Carroll's novel, Alice finds a book written in a seemingly undecipherable language. Remembering that she's in the reverse-world within a looking glass, she holds the text up to a mirror and is able to read the poem, although it makes little more sense to her than the odd place she finds herself in.

When you're facing apparatus that's behaving in strange ways, you, too may begin to feel a little like Alice. Your test equipment gives answers just as strange as the malfunctioning of the equipment, and you struggle to understand what it's trying to tell you.

Regardless of the problem, you should take comfort in knowing that all systems we know of depend on the same basic principles of physics in order to operate. Electronics is, after all, just a specialized area of physics that explains how circuits work.

If you have faith and remember a few basic principles, you can solve the "really strange" problems just like the pros do.

Power Supply Cleanliness is Critical

When I was a young engineer, I was asked to investigate the high failure rate in batches of a Z-80 computer training board being manufactured for us by a prominent Kansas City electronics house. More than 75% of the boards were being marked as "defective;" the head engineer at the manufacturing plant was convinced that there was some sort of design issue at hand.

These circuit boards contained a mix of MOS and TTL integrated circuits - about 20 ICs were on each unit. The boards were designed to operate on an external 5 volt power supply.

As a first step in the investigation, I troubleshot each of the defective computer boards from a batch of 25 units. I was dismayed to find out that no two units had the same problem. I was hoping to "zero in" on a common culprit, you see, and things were getting complicated quickly. Each unit had a different integrated circuit at fault; one unit had two bad ICs. Very strange indeed.

I knew that ICs could be damaged by handling prior to insertion in the boards. Static electricity would be a prime suspect. They could also be damaged during the assembly process by excessive mechanical stress and heat. The logical next step was to visit the manufacturing line and observe it in action.

I visited the electronics house the next day and watched as the units were built. The manufacturing company was employing manual assembly methods for our small run of boards. The ICs were being kept in their anti-static tubes prior to assembly. At each workstation, a bench-top anti-static mat was in use and the workers (mostly women) all wore anti-static wrist bands as they inserted components onto the board and soldered them into place. Finished boards were placed into anti-static bags as they made their way to the final test station.

At the final test station, an engineer connected a video monitor and 5-volt power supply to each unit. I watched as a batch of five were submitted to the final test, which consisted of connecting the computer to the power supply and monitor, turning on the power supply, and awaiting the appearance of the machine's boot-up screen. Four of the five units failed to boot, and were marked as defective.

The power supply at the final test station appeared to be a homemade unit. It was in a metal box about the size of a loaf of bread and had an analog voltmeter and ammeter on the front panel. I looked closer as the engineer turned the supply on. *The voltmeter, which had a scale reading from zero to 25 volts, swung up to an indicated 12 volts for a fraction of a second as the power supply was turned on, then settled immediately to the rated output of 5 volts*. This did not look good!

I asked the engineer about this, and he insisted that the swing of the needle was due to the "ballistics of the meter movement" and was not an indication of power supply trouble. He volunteered that he himself had built the supply, and that it was a new, efficient design called a "switching" power supply. I asked him to connect an oscilloscope to the 5-volt bus to verify the power-up characteristics. A scope can read out much faster than an analog meter.

With the scope in the circuit, we turned on the supply. The voltage on the 5-volt input to the computer was actually rising to +50 volts for several milliseconds (one millisecond is one one-thousandth of a second), then swinging down to negative 12 volts for another millisecond, then settling to +5 volts after 10 ms.

The IC chips in the computer were never designed to survive these voltages. Most TTL ICs work only over a narrow range of voltages, 4.75 to 5.25 v, and draw heavy current over 6 volts. *The manufacturer was*

See 'Twas Brillig on page 3

'Twas Brillig from page 2

unwittingly playing Russian Roulette with our computer boards by subjecting them to high-voltage pulses from the engineer's homebrew supply. Replacing the supply with a standard 5-volt unit caused the failure rate to approach zero, and I was hero for a day.

Moral of the story: Never assume the power supply is good, even if you've measured it with a digital meter. If you're in doubt, use an oscilloscope to check it—and make sure to watch the behavior during power on and off cycles. Switching power supplies, in particular, are complicated and can fail in some very strange ways. *An oscilloscope is the gold standard for measuring the cleanliness of any power source*.

Computers (and HR Departments) Only Tell You What They Think You Ought to Know

Most modern apparatus has at least one microprocessor in it that runs the show. Some systems even have self-diagnostic capabilities built in, though this is hardly standardized and varies widely among manufacturers.

Some computers display trouble codes when something is wrong—or better said, when the computer "thinks" something is wrong. Be careful; the computer's ability to "diagnose" problems is dependent upon the way the computer is interfaced with the system (does it actually see the right test point signals?), and even more importantly, the quality of its operating system software.

The results from all computer diagnostics should be verified with test equipment whenever possible. Don't forget that in the midst of all the high-tech investigating, power supplies are always the most likely culprit, and circuit troubles tend to be rather low-tech (once you find them).

As an example, a Kenwood TS-950 transceiver was brought to the shop with a classic Kenwood complaint: The digital frequency display showed all decimal points ("dots"), rather than the usual readout of frequency. This is a semi-documented feature of Kenwood's firmware indicating that the computer "believes" that one or more of the frequency-determining Phase Locked Loops (PLLs) in the radio are "out of lock," meaning not producing the frequency they've been programmed to produce.

This indication is similar to the "low tire pressure" (TPMS) warning incorporated into the dashboard of many recent cars. Each tire has a tiny pressure sensor and radio transmitter built into it, and signals to the body computer in the car when the pressure falls below a set limit. (One of your tires is low, but you get to guess which one!)

The Kenwood TS-950 contains 11 distinct PLL circuits, each of which is under the control of the central computer chip. In this case the computer was sure that one of them was "broken." Determining which one, and what was really wrong, was left up to me!

Kenwood gives no explanation of how to locate troubles in their PLL subsystems, but does include an alignment procedure, which involves little more than reading the DC control voltages at 11 test points spread throughout the radio that correspond to each of the 11 loops. In this case, it turned out that PLL #1 was the culprit; it was running freely at around 75 MHz, instead of the design value of 64.2 MHz, due to a defective capacitor in its voltage controlled oscillator (VCO).

Moral of the Story: When you see diagnostic information from a computer, remember that computers cannot think; they can deliver information only as good as their sensor wiring and operating system coding can provide. Remember the rule for computers is GIGO—Garbage In, Garbage Out. Always verify computer results with test equipment readings whenever possible.

My Pinto Can Shut Down Your 1981 Corvette

The Ford Pinto was the little economy car of the early 70s that everyone loved to hate. It was downright ugly, of dubious safety and build quality, and tended to rust away shortly after the warranty expired. But we found one example of this car that could smoke some of the Corvettes from the early 1980s.

The secret? The Pinto owner had installed an illegal 300 watt linear amplifier (which probably used up about half of the Pinto's useful horsepower capacity!) on his CB radio. GM was experimenting with first-generation computer engine controls in the early 1980s, and 1981 was the first year that these were installed in non-California Corvette models. These first computerized Corvettes were especially vulnerable to stray RF due to their fiberglass body structure, which was transparent to RF energy.

Parked next to the Corvette, the energy from the Pinto's 300 watt CB transmitter swamped the sensor wiring of the Corvette's onboard engine control unit (ECU). The ECU, unsure of even basic information such as crank position, stopped delivering fuel and spark to the engine. The Vette was dead in the water. At least it didn't catch fire, as many Pintos were likely to do! (This problem was not limited to the Corvette; early VW fuel injection systems could also be killed by errant CB signals.)

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A Hambone and Elmer Story

Any Wire Is An Antenna – Jaimie Charlton, ADØAB

"Hambone, why so glum? Doesn't that new all band antenna you just put up work?"

"No Elmer, it's fine. I'm just mad about what that guy, Jim, was saying on 40 meter sideband yesterday. Here, I just paid over $150 for this great multi-band antenna that you helped me put up. Its advertising says it puts out a great signal. The testimonials on eHam say it's great. Why, one guy said after he put his up he got China with only five watts. That's amazing!"

"So, Hambone, what's the problem? Hasn't your hundred watts reached China?"

"Well, no, but that's not what I mean. I was listening to guys talking about antennas on 40 meters sideband yesterday and this guy, Jim, said that any piece of wire will radiate and can be an antenna.

How can he say that? Antennas are special so they can throw off radio waves, aren't they?"

"I hate to burst your bubble, Hambone, but that Jim is right, any piece of wire can be an antenna and will radiate radio waves."

"But Elmer, why was my wire antenna so expensive if it doesn't have some special qualities?"

"You paid for good quality parts and solid construction, not some electromagnetic magic."

"Okay, you're the elmer, Elmer. But I still don't see why a piece of wire can be an antenna."

"Hambone, in my opinion, antennas are one of the most complex pieces of ham radio equipment. We all have them, but few of us have even a basic understanding of how they work. The situation is made worse because they look so simple.

Take amplifiers or receivers for example. You can always find their schematic diagrams and, with some difficulty, figure out how the work. Not so with antennas. Sure, you can easily draw the schematic, but it gives no clue as to how the antenna works."

"You're right! Why is that?"

"It's because very little of interest takes place 'in" the antenna itself. All the excitement occurs around the antenna in a complex set of electric, magnetic and electromagnetic fields. While these are all important, right now we are only interested in the electromagnetic field."

"Slow down, Elmer, you're starting to lose me."

"Not to worry, Hambone, we'll take it slowly. Let's start with the transmission line – the wire connecting your rig to an imaginary antenna. Some people use coax and some use twin lead, let's start with coax. Why do you suppose that all your transmitter power doesn't just shoot off the coax?"

"I suppose the shield keeps it inside until it gets to the antenna."

"I thought you'd say that. So, what if you use twin lead for a transmission line, it doesn't have a shield?"

"Hmm, I never thought about that, what does keep the power from leaving twin lead?"

"It's a bit more complex than I'm explaining here, Hambone, but basically, the electromagnetic field created by the RF current going up one side of the twin lead is essentially cancelled out by a second, but opposite, electromagnetic field generated by the current coming down on the other side of the twin lead. The two currents generate opposite fields because they are going in opposite directions. You could say that they are out of phase. The two currents are equal because current, even RF current, always flows in a loop. Every single RF ampere that leaves your transmitter comes back to it."

"Wow, Elmer, I never thought of it that way."

"But wait, there's more! If you could get very close, say, between the twin lead conductors (or inside the coax) you would find very intense fields. As you move outside the twin lead by a few inches, you find the fields are pretty much canceling each other out. But within a few inches, there's a lot going on and that's why you don't want to put twin lead inside a pipe or against anything. These things absorb the fields and that represents power that doesn't make it to your antenna. With coax, the shield confines everything inside the cable so you don't have to worry."

"Nice, Elmer, I sort of get why transmission line doesn't radiate. But, I want to know why that Jim guy says a piece of wire does."

"I'm getting there," Grinned Elmer.

"Take the far end of this imaginary twin lead and separate a few inches of the wires a little bit so they

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form a kind of a 'Y'. Now, the two wires are not quite parallel so their opposing electromagnetic fields don't quite cancel each other. That means that a little bit of the field goes off into the air. Continue separating and flattening more of the twin lead it so it forms the top of a letter 'T'. As you do this you realize that the fields of the two wires no longer cancel each other and are free to go off into space. Which they do."

"I get it, all you have to do is get some RF current flowing in a wire and it will act like an antenna and radiate," Hambone said. "But what if you just have a wire thrown up in a tree?" That's what Jim was talking about."

"It's the same thing, Hambone. Just turn that imaginary dipole so it is vertical with one leg lying on the ground and you have a vertical or just a long wire antenna.

All you need is some RF current flowing in a wire and it will create an electromagnetic field. If there is no parallel wire nearby creating an opposing field to cancel it out, we have a radio wave, and the wire carrying the current is the antenna. It doesn't matter what kind of wire it is, only that it has RF current flowing through it."

"Not so fast, Elmer, how do you get RF current to flow in that wire? There's nothing connected to the far end. You said current always flows in a loop." Hambone asked.

Elmer takes a deep breath and replies, "This is where the magic happens. Since we are talking about an imaginary antenna, take your imaginary multimeter and measure the resistance at the transmitter end of the twin lead. It reads infinite resistance, doesn't it?"

"I guess so," replies a skeptical Hambone. "The wires don't go anywhere so, I guess the resistance is infinite."

"Right you are, my boy," replies Elmer, clearly warming up to the subject. "That's why we use high frequency AC current when we want to generate radio waves. In fact, we call it RF, or radio frequency, current."

"But, why does RF current flow in this piece of wire when DC won't?" Hambone quizzes.

"The RF current flows because when your transmitter first applies a sine-wave voltage to the terminals, that voltage causes a sine-wave current to start down the wire. That beginning current flows because it does not 'know' there is no place for it to go when it reaches the end. Of course, that current is zipping along the wire at close to the speed of light, around 900 million feet per second. Fast, but not even warp 1."

"The traveling current causes a sort of 'back voltage' to be generated on the wire which the transmitter sees, but since the transmitter is generating an RF voltage which is changing really fast, it is always able to stay one step ahead of the back voltages and keep pushing current into the wire."

"For example, at 14 MHz, which is the 20 meter ham band, our sine-wave RF voltage goes through a complete cycle - that is, it goes from zero to fully positive, back to zero, to fully negative and finally back to zero - in one fourteen-millionth of a second, that's quick. During that time, our current has traveled about 66 feet. If the wire is longer than 66 feet, our current doesn't know that there is nothing connected to the end, yet.

"But Elmer, what happens when that first current hits the end of the wire and finds it has no place to go?" Asks a bewildered Hambone.

"What do you think it does?" Asks Elmer. "It reverses itself and comes back! Once it starts coming back, you get a combination of the outgoing and reflected currents and voltages on both your antenna wire and your twin lead transmission line as well. It is the combination of these voltages and currents that are the origins of antenna impedances and standing waves. But that is a topic for another time."

"The important thing here, Hambone, is that by using high frequency AC voltage, which we call RF, we are able to get current to flow back and forth in a wire with no connection at the far end. It is that rapidly changing current that gives rise to the electromagnetic field we call radio waves. So, you see, there is nothing special or magic about the antenna wire or transmission line."

"But Elmer, why is the length so important and why are those coils on my antenna?"

"Remember, Hambone, those reflected waves coming back to the transmitter? Well, they can cause problems for the transmitter. In order to control them, the antenna designers set the lengths of the wires and add coils etc. so the antenna works with your transmitter. That's called impedance matching and is measured by your standing wave ratio meter. An SWR of 1:1 means all the power your transmitter sends out, stays out and none gets reflected back. In effect, it makes your transmitter 'think' the transmission line goes on forever. It really has nothing to do with the antenna's ability to radiate."

"But Elmer," asks a weary Hambone, "How can some guys, like that Jim, get away with using any old length of wire? Doesn't it screw up their transmitters?"

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September 12, 2014

The meeting Started at 7:30PM.

Attendance: Self introduction with name and call sign. 31 signed the check in sheet. This was followed by the Pledge of Allegiance.

The Minutes from the August 22, 2014 meeting were read and accepted with 1 opposed vote.

The Treasurer's report, as follows, was read and accepted unanimously.

Cash on Hand	$ 251.94
Checking Account	$ 408.41
Savings Account	$ 8,196.96
Total	$ 8,857.31
Repeater Operating Reserve	$ 597.87
Memorial Fund	$ 150.00
Active Members	142

Old Business:

- Both the 440 Repeater and 2m Repeater are working fine.
- Ensor Auction – October 24 and 25. Dave Schulman WDØERU, last year's auctioneer would like to help us make the Auction bigger and better than it has been in past years. We need to find a place to store radio equipment in the area - Garage, building, somewhere out of the weather and where potential bidders can view the items. The inspection would take place one day that week prior to the auction. We also need some help moving equipment from Dave's location up north to the preview location for inspection then on to Ensor that Friday. Please contact Jay or Dave if you can help.
- The World War I Special Event Station WW1USA was a great success! Thanks to all that participated.
- Feedback Newsletter Editor - Chip and Deb Buckner ACØYF/KDØRYE have agreed to be the Feedback Editors. Thank you Chip and Deb.

New Business:

- Bill Gery KA2FNK would like to explore options for a Club Shirt. The idea would be to have the club pick a company, pay for the logo set up fee and the color. Members would then be able to order any style shirt with the club's logo on it. The option to have name and call sign on the shirt will also be explored. After discussion and questions, club members gave Bill the go ahead to explore options and bring back a recommendation.
- Doug Tombaugh N3PDT became a member of ARRL A-1 Operator Club. Membership comes after nomination by two A-1 Operator Club members, who find the nominee qualified to be a member of this elite group. The A-1 Ops Club membership is based on ON-AIR operating proficiency.

Reports:

- 6 m – Nothing.
- 10 m SSB Roundtable – 2 participated on September 11 and 5 participated on September 4.
- 440 Wheat Shocker net – 18 check-ins on September 10 and 20 check-ins on September 3.
- 2m Wheat Shocker net – 23 check-ins on September 11 and 24 check-ins on September 4.
- HF Activity – New Caledonia, New Zealand, and Russia.

Announcements:

- Skywarn Reconigition Day December 5-6, 2014
- MS Ride – September 13 – 14. See Herb Fiddick NZ0F.
- Santa Fe Trail Amateur Radio Club's Hamfest September 13 in Gardner.

Business meeting adjourned at 8:15 PM

Program:

- The Program for this evening was a presentation on DMR Radios by Mac MacLemore KK4MHI.

September 26, 2014

The meeting Started at 7:30PM.

Attendance: Self introduction with name and call sign. 34 signed the check in sheet. This was followed by the Pledge of Allegiance.

The Minutes from the September 12, 2014 meeting were read and accepted with 1 opposed vote.

The Treasurer's report, as follows, was read and accepted unanimously.

Cash on Hand	$ 212.74
Checking Account	$ 407.44
Savings Account	$ 8,199.12
Total	$ 8,819.30
Repeater Operating Reserve	$ 615.87
Memorial Fund	$ 150.00
Active Members 142	

Old Business:

- Both the 440 Repeater and 2m Repeater are working fine.
- Ensor Auction – October 24 and 25. Plans are progressing. We need some help moving equipment from Dave's location up north to Ensor. The planning team is working on a location for the preview. An effort is underway to make contact with Larry Woodworth, WØHXS at Ensor to see if it is possible to have the preview there on Friday Afternoon. We are still looking for Auction items. The planning team would like to be able to take Credit Cards as a form of payment on the day of the auction. It's their feeling that this will increase revenue. Cal Lewandowski, KCØCL Treasurer has explored this possibility and it is feasible. A motion was made to use Credit Cards at the Auction, a discussion took place and a vote was taken. The motion was accepted with 1 opposed vote. The opposed voter felt it was a lot of work for just 2 or 3 people that might pay by Credit Card. It was also mentioned that in order for Credit Card transaction to take place properly we will need to have an excellent internet connection. Cal will test out the connection prior to the Auction.
- Club Shirt Update - Bill Gery, KA2FNK is still working on collection information.

New Business:

- As we are all aware, the Projector at the church that we use for presentations is no longer working properly. It's out of focus, words are "doubled" and colors are missing and aren't correct. After inspection by Church personnel, it was determined that the projector is failing (the projector is roughly 10 years old). Therefore the club would like to purchase and donate a new projector to the church as a way of thanking the church for allowing us to use your facilities for many years. A motion was made to purchase 2 Dell Projectors at $335.95 (plus tax and handling) give on to the church and the club would keep the other for times went we can use the Fellowship Hall and for use at other club events. The possibility also exist that eventually we may be hold are meeting in the basement of Associated Radio and we will need a Projector there. After a short discussion it was suggested that we purchase only 1 Projector initially and donate to the church. This way we can see how well it works and performs before we purchase a second one. The motion was amended, a vote taken. The motion passed unanimously.

Reports:

- 6 m – 1 contact in Leavenworth Kansas.
- 10 m SSB Roundtable – 2 participated on September 25.
- 440 Wheat Shocker net – 22 check-ins on September 24 and 22 check-ins on September 17.
- 2m Wheat Shocker net – 21 check-ins on September 25 and 29 check-ins on September 18.
- HF Activity – Brazil, St Thomas USVI on 20m.

Announcements:

- Skywarn Reconigition Day December 5-6, 2014
- October SET Drill on October 4.
- Both Doug Tombaugh, N3PDT and Rich Zaban, KCØVDH recently upgraded their licenses. Congratulations!

Business meeting adjourned at 8:03 PM

Program:

- The Program for this evening was a presentation "Preserving the History and Honoring the Tradition of the Continuous Wave" by Vern Wirka, WØVMP, KSDB-FM Chief Operator and Faculty Adviser at the A.Q. Miller School of Journalism and Mass Communications - Kansas State University.

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Moral of the Story: Don't underestimate the power of stray RF energy to really goof things up. Insufficient RF grounding, operating equipment with shields removed, and just about any other related poor practice is just inviting trouble. Even test equipment (such as digital multimeters) can get downright cranky and unreliable in the presence of strong RF fields. Computers will typically reboot if they get a strong dose of radio energy. If the rebooting computer happens to be the one inside the radio that's controlling everything, then you have a very strange situation (think about Alice's predicament) on your hands.

These can be the most difficult cases to solve, especially if you're working on a supposedly "malfunctioning" piece of equipment that works fine in your shop, but not at a customer site. If you do suspect stray RF to be a problem, then take steps to isolate it; for example, temporarily reduce or remove drive from the RF power amplifier stage to see if the problem goes away.

Conclusion

Jabberwocky ends with a stanza that's identical to its opening:

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe.

Just as Alice was confused by the poem, we too can be easily confused by illogical and unexpected "larger than life" problems that appear in equipment. As we've seen throughout this series, most troubles have a logical explanation. A careful and methodical investigative approach, based on a little theory (and a lot of practice) goes a long way towards solving problems.

When you're confused, always go back to fundamentals. Stick with a common approach (we used the three-step system of Inspection, Power Supply Checks, and Input / Output Checks) so that you can stay on track. If you do this, you'll be on your way to joining the ranks of the professionals.

Series Dedication

This series is dedicated in memory of Dick Carter, NØTO, ex WBØIZY (SK), the past editor of the JCRAC Feedback. Dick supported the concept of the "Troubleshooting" column from the beginning and was a valuable partner in its execution. Thank you, Dick!

HAMBONE from page 5

"Boy, Hambone, you never give up.

"Those guys use 'antenna tuners' on their long wire antennas. An antenna tuner manages the reflected waves coming down the twin lead so the transmitter doesn't see them. It does this by changing the ratio of voltage to current (impedance matching) to something their transmitters can drive. The name is misleading. Antenna tuners don't actually do anything to antennas. Again, they only make the transmitter 'think' it's connected to an endless transmission line.

"That's enough for today. There is a whole lot more to antennas such as how does that current actually creates a radio wave, what exactly is SWR and what does it mean, what is impedance matching, what are near and far fields, how do beams work, and the biggie, how does an antenna receive?

"Those are topics for another day."