

My Power Meter Lies

John Raydo, KØIZ

My new 100-watt radio is putting out 125 watts according to my SWR meter! Great, even better than I expected.

Oh, not so fast. We have a problem, Houston, high SWR.

The radio is actually putting out 100 watts but the antenna is poorly matched with an SWR of 3.5:1.

When our 100 watts gets there, some power is “reflected” back. This happens because the antenna cannot absorb all the power due to the mismatch. So that reflected power bounces back towards the radio (and our SWR meter).

When it reaches the radio, it bounces back towards the antenna. Contrary to some beliefs, it is *not* absorbed by the radio. Reaching the antenna, a portion is again reflected back. This bouncing back and forth continues, growing less each time.

Our SWR meter shows the *forward power* of the original 100 watts, plus the first-time reflected power, plus the second-time reflected power, etc. Thus our 125 watts. The meter *reflected power* shows 25 watts, the first-time reflected power plus the second time, etc. So our true power out is the *difference*

between the forward power reading and the reflected power reading. In this example it's 125 minus 25 = only 100 watts. Darn!

With no loss in our feedline, all of



our 100 watts eventually gets to the antenna and is radiated. With real coax and high SWR, however, each back

and forth results in significant loss. Our initial 100 watts is about 80 watts when it first gets to the antenna (100ft of RG8X at 14 Mhz). 56 watts is radiated and 30% (of our 80 watts) is reflected back to the radio. About 19 watts reaches the radio after passing through the coax, and about 15 watts when it gets back to the antenna. Of these 15 watts, 70% is radiated and 30% reflected, and so forth. Eventually 34% of our power heats up our coax.

Our RG8X coax loss with 1:1 SWR would have been 20 watts. With the 3.5:1 SWR our loss increases to 34 watts (1.8db).

Our 125 watts of apparent power is actually squirting 66 watts into the ether. Double darn!

MARCH MEETINGS

March 12 – Parks on the Air – Kevin Van Der Does, ADØIM

March 26 – TBA

The Johnson County Radio Amateurs Club normally meets on the 2nd and 4th Fridays of each month at 7:00 PM at the Overland Park Christian Church (north entrance), 7600 West 75th Street (75th and Conser), west of the Fire Station.

Much of the membership travels to the Pizza Shoppe at 8915 Santa Fe Drive for pizza buffet and an informal continuation/criticism/clarification of the topics raised at the meeting ... or anything else.

LEAVE THE CHURCH, TURN RIGHT (WEST) ON 75TH. TURN LEFT (SOUTH) ON ANTIOCH. TURN RIGHT (WEST) ON SANTA FE. THE PIZZA SHOPPE IS JUST PAST THE SONIC ON YOUR LEFT.

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-> FEEDBACK <-

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Johnson County Radio Amateur Club, Inc.*

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PRESIDENT'S CORNER

February brought some of the coldest air the area has



experienced in an exceptionally long time. My home weather station recorded two days with a low of minus 12 degrees

Fahrenheit. I hope the rolling power blackouts I hope did not impact too many of you.

Without heat and air temperatures that low pipes can freeze quickly. The pipe for my water garden froze for the first time. No damage to the pump and the water started to flow again as the ice melted on the pond. It appears that the pipe was not damaged either as I am not seeing water lost.

As you know, T-mobile has done upgrades to the 145.29 repeater site. This included a total rework on the electric power. While the work was in process our 145.29 repeater was off the air. T-mobile called us when we could reconnect the power to the repeater. Bill (WAØCBW) and I met their crew at the site. The repeater has new power from the power distribution panel to the repeater. Bill was impressed by the professional workmanship.

- Bill Gery - KA2FNK

Forty Years Ago

Ted Knapp submitted a forty-year old copy of the Feedback. Here's the news from 1981.

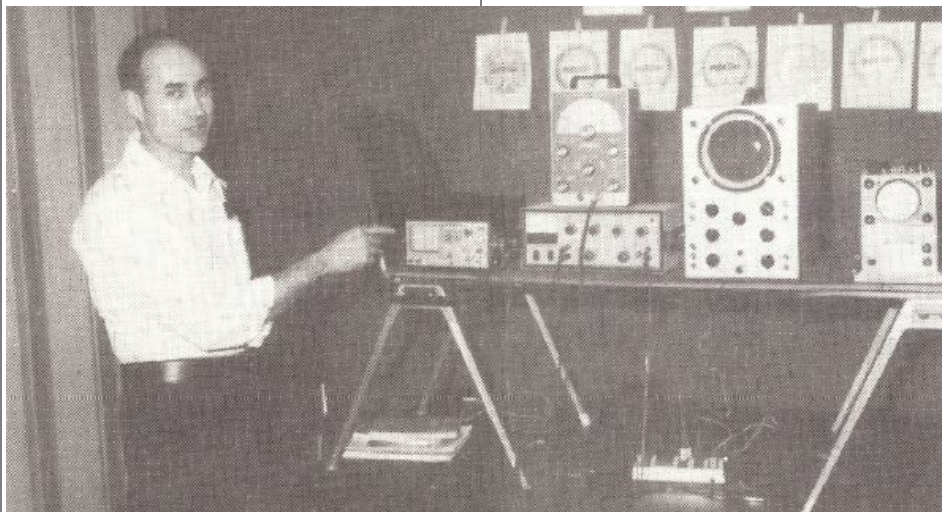
March 13 - "Those Little Black Boxes" - Gene Shapiro, WØDLQ. "You SW buffs will get a chance to examine a fine homebrew memory and regenerator built and refined by Gene."

March 27 - "All About X-rays" - Jules Hollingshead, WDØAIF. "This is an interesting program about X-rays that Jules has been working up for some time. Come—enjoy it and learn the facts."

In his "President's Corner", Club President Jules Hollingshead (pictured, below, making a presentation at the February 13 meeting) noted that Kansas City had a number of good 2 meter repeaters that would be good for communications during storms.

George Showalter, KBØQE, explained "directed nets", noting that "speak when spoken to" was "quite a different way of operating than most amateurs are used to".

Club staff included "Coffee and Donuts", Don Warkentien, WBØNVO.



Johnson County Radio Amateurs Club - February 12, 2021

Meeting Date: Friday February 12, 2021. The meeting Started at 7:00 PM.

Attendance: Due to COVID-19 restrictions, this Meeting took place online using Zoom Video Conferencing. 51 were present.

The Minutes from the January 22, 2021 Meeting were posted on the Club's website for everyone to read.

The Treasurer's report was read and accepted unanimously.

Old Business:

- We welcomed all 1st time visitors to the meeting.
- Repeater Update – Bill Brinker, WA0CBW, reported that 4 of the Repeaters are working well. The 145.29 MHz Repeater is currently experiencing a power supply issue. We will work with T-Mobile to resolve it.

New Business:

- None.

Reports:

- 6 m – NR.
- 10 m SSB Roundtable – 6 participated on February 11.
- 40m SSB Roundtable – NR.
- Fusion Digital 440 net – 14 Check-ins on February 10 and NR for Check-ins on February 3.
- 2m Wheat Shocker net – 12 Check-ins on February 11 and 18 Check-ins on February 4.
- HF Activity – ISS Space Walk Conversation on 222 MHz.

Announcements:

- Pluto Anniversary Countdown Special Event – February 13-21, 2021.
- See Larry's List for upcoming Events.

Business meeting adjourned at 7:15 PM.

Program:

The Program was a presentation by Dr. Bob Heil, K9EID on "Sharing the Science of this Great Hobby".

Submitted by Ted Knapp, N0TEK, Secretary.

Johnson County Radio Amateurs Club – February 26, 2021

Meeting Date: Friday February 26, 2021. The meeting Started at 7:00 PM.

Attendance: Due to COVID-19 restrictions, this Meeting took place online using Zoom Video Conferencing. 46 were present.

The Minutes from the February 12, 2021 meeting were read and accepted unanimously.

The Treasurer's report was read and accepted unanimously.

Old Business:

- We welcomed all 1st time visitors to the meeting.
- Repeater Update – Bill Brinker, WAØCBW, reported that all 5 Repeaters are working well. Power to the 145.29 MHz Repeater was successfully restored.
- Field Day 2021 – We have permission from Shawnee Mission Park to use the old Hutton Farm again this for Field Day. Field Day is June 26 – 27.

New Business:

- John Raydo K0IZ picture was in the March 2021 of QST, page 20. John was showing off his Neo-Vintage high-performance 20-meter SSB Radio he built.
- The new Salvation Army Communication is currently being upfitted at Vandoit in Blue Springs and will be finished around April 1st. Additional Funding and in-kind donations will be needed to completely finish the van and get it ready for the Public Service Event season.

Reports:

- 6 m – NR.
- 10 m SSB Roundtable – 3 participated on February 25.
- 40m SSB Roundtable – 0 participated on February 24 (which means someone was listening).
- Fusion Digital 440 net – 13 Check-ins on February 24 and 19 for Check-ins on February 17.
- 2m Wheat Shocker net – 17 Check-ins on February 25 and 17 Check-ins on February 18.
- HF Activity – Mali, South Africa, Luxemburg, Pluto Special Event Station.

Announcements:

- QSO Today Virtual Ham Expo – March 13-14
- See Larry's List for upcoming Events.

Business meeting adjourned at 7:30 PM.

Program:

The Program was a presentation by Bill Gery, KA2FNK on "NOAA WX Satellite Images with Raspberry Pi".

Submitted by Ted Knapp, N0TEK, Secretary.

Dude Saves the Day

Hambone's Monday begins as it always has this year at 8:00AM with his butt in a chair in the lecture hall of the school where he is trying to earn a degree in electrical engineering. Both he and his frat brother, Tim, have chosen seats in the back in the hopes of going unnoticed.



They had determined long ago that, due to the lecture hall's stage lighting and the glare from the projector Professor Erlenmeyer Flask uses to inflict slides on his students, the old prof could not easily see beyond the second row of seats. Thus, they could safely catch some more ZZZs.

The clock clicked over the eight o'clock mark and to the boys' surprise, Professor Flask did not make his usual hurried appearance, dropping whiteboard markers and papers along the way. Instead, a stranger appeared.

"Good morning," the stranger said, "I'm Professor Gavot Bransle. Professor Flask asked me to sub for him this week because he had some urgent personal business."

"I bet his 'urgent personal business' is on the beach at his brother's place in Florida," whispered Hambone to Tim.

"Yeah, if I recall, he went missing about this time last winter, too," Tim whispered back.

"Professor Flask and I substitute for each other as the need arises."

"He seems nice enough," said Tim in his best sotto voce.

"He's cool, he's got an earring and hair. I hope he knows the rule that

says subs don't give quizzes or homework," replied Hambone."

"I teach electromagnetics and circuits at the western campus.

But the subject for today's lecture is negative resistance," continued Professor Bransle.

"I wonder if his earring gets hot when he's working around big magnets?" whispered Hambone at the exact instant the professor looked his way.

"Hey, you in the back, there," said the professor in a surprisingly loud voice. "I appreciate your help explaining negative resistance to your friend, but maybe you could share your insights with the rest of us."

"Who, me?" questioned Hambone.

"Yes, you! Please stand up and tell us your name and what the characteristics of negative resistance are."

Slowly rising to his feet, Hambone felt the room get a lot warmer.

"Hambone. My name is Hambone and I guess if a regular resistance absorbs power, maybe a negative resistance gives out power?"

Hambone moved back toward his seat but was stopped by the professor. "Oh, don't sit down yet. We need some clarification. Where do you suppose that power comes from?"

"I, I don't know," replied Hambone as his forehead started to glisten and dark patches formed under his arms.

"Well, maybe you should sit down and be still while I clear things up for you."

Professor Bransle continued, "We get used to Ohm's law telling us that resistance is just voltage divided by current,

$$R = E/I$$

Where: E=volts; I=Amps and R=ohms.

But we forget that it can be a dynamic characteristic.

Sure, an ordinary resistor is linear in that its resistance is constant as long as the applied current or voltage don't exceed its ratings. We use an ohmmeter to measure its resistance and assume that's its resistance. But that is only its resistance with one particular voltage applied to it. What happens if we apply other voltages?"

"Professor!" shouted Tim waving his hand.

"Yes, boy in the back row, you have a question your friend can't answer?"

Ignoring the slur, Tim continued, "Won't you burn out your ohmmeter if you try to measure the resistor's resistance with voltage applied to it?"

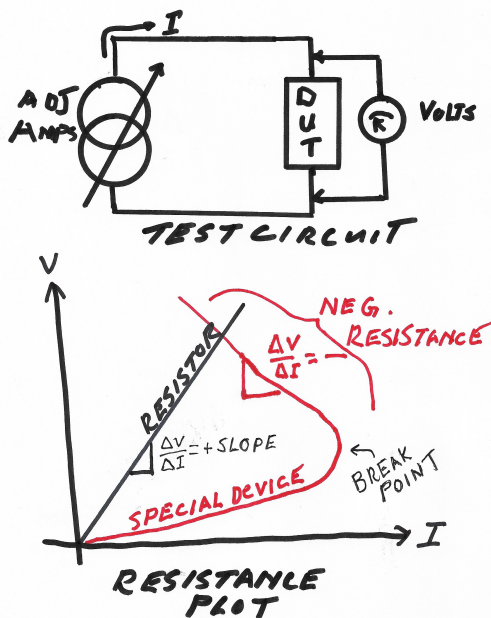
see HAMBONE on page 6

from **HAMBONE** on page 5

“Good question,” Bransle replied. “Of course, you never connect an ohmmeter to an active circuit. But you can measure both the applied current and the resultant voltage across a device and calculate its resistance using the above formula. In fact, applying various currents to a device and measuring the resultant voltages and graphing the results is a good way to determine its resistance.”

“Let’s look at this *Test Circuit* for checking resistances. It’s just a variable current source and a voltmeter connected to our *Device Under Test*. We simply increase the current, starting at zero, and record the resulting voltages by plotting the various readings on a graph. Well call this our *Resistance Plot*.”

The professor grabbed his black whiteboard marker and began to draw.



“You see, the plot for the resistor shows that as we increase the current through it the voltage rises proportionately. This is what we would expect from Ohm’s law. Notice that the graph has a positive, up-hill, slope indicating that the resistance is positive. But look at this curve for the special device.”

Bransle took his red marker and proceeded to draw a more complex curve that actually doubled back on itself.

“At first, this curve has a positive slope, but at a certain point – the break point – something happens and the slope becomes negative or ‘down-hill’. That is, increasing the current through the device results in a decrease of the voltage appearing across the device. This means the device is exhibiting *negative resistance*. It is not, as Mister Hambone suggested, generating power. Nonetheless, there are applications such as oscillators and pulse generators for negative resistance devices to name just two.

Are there any questions, so far?”

“Professor Bransle, Sir.” A girl in the front row raised her hand and asked, “What are some examples of negative resistance devices?”

“I’m glad you asked. That is your homework assignment. For next week, you are to identify at least one negative resistance device and design a simple circuit using it. You are to build that circuit and demonstrate it.

Your grade will be determined by the complexity of your circuit. The more parts it has, the lower your grade. Lab power supplies and batteries do not count as parts, but everything else does.

Class dismissed.”

“Geeze, Hammy, that prof is not one of the cool ones. He broke the subs rule big time. I don’t even know where to start,” moaned Tim.

“I do,” replied Hambone. “Let’s visit my Uncle Elmer and his endless supply of parts.”

* * *

“Hi Unck,” said Hambone as he and Tim barged into his uncle’s basement ham shack unannounced.

“Hi boys, what can I do for you?” responded Elmer, apparently accustomed to such surprise arrivals.

“We have a problem. We have a substitute teacher, Professor Gavot Bransle from France or somewhere and he assigned homework!” Announced Hambone.

“Yeah,” added Tim, “He doesn’t know the rule about subs not giving assignments. And he gave us a hard one!”

“First off, boys, there’s no rule. If you remember, when I subbed, I gave you assignments.”

“Yes, Unck, but yours were easy this one is hard,” moaned Hambone.

“Easy, huh?” mused Elmer. “The next time I’ll have to raise the bar. Anyway, what’s the problem?”

“Gave was...”

“That’s Professor Bransle, to you boys.”

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from **HAMBONE** on page 6

“Okay, Professor Bransle was talking about Ohm’s Law and resistors and how there’s such a thing as negative resistors. He drew some crazy-looking graph and said that’s a negative resistance curve,” explained Tim. “So, and the problem?”

“But then he said as homework we must find a ‘negative resistor’ and actually build it into some kind of circuit and demonstrate it in front of the class!” shouted Hambone. “I don’t even know what a negative resistor looks like, but I figured you do, Unck. We need your help. You have everything.”

“I do have some negative resistance devices. But it seems to me the purpose of that assignment is to get you guys to do some research and discover something a bit unusual. If I do the work for you, do I get the grade?” asked Elmer trying to maintain a straight face.

“Unck,” pleaded Hambone. “We are doing research, we’re asking you.”

At this exact moment, Dude, Hambone’s younger brother, burst into the shack carrying a scramble of wires on a breadboard and interrupting everything.

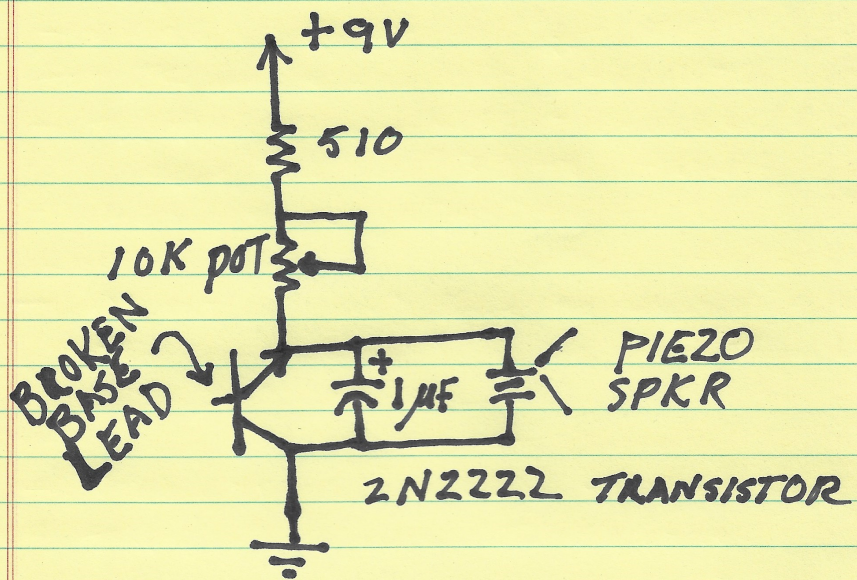
“Unck, look what I discovered! I just built this code practice oscillator, but it didn’t work. I guess I wired it wrong. But while I was trying to troubleshoot it, I accidentally broke the base lead off the transistor and it started to work. It’s magic!”

“Hold on there, Dude, it may not be magic. First off, your battery is connected backwards, that’s an NPN transistor not a PNP. Second, I don’t know the circuit you were

trying to build, but it looks like that capacitor is also wired wrong.”

“But Unck, doesn’t that mean that the backward battery has canceled out my wiring mistake? Sort of two wrongs making a right?” Assuming his professorial demeanor and retrieving his yellow pad from the shelf, Elmer seized this teaching opportunity. “I’m pretty sure that two wrongs aren’t making a right in your circuit. Why don’t you three guys get together, sketch out

Grudgingly, the boys set to work. They first verified that the oscillator did indeed make a tweety sound come from its tiny speaker when they applied power with what seemed to be the wrong polarity. Next they verified that the transistor no longer had three wires – its missing base lead was still stuck in the breadboard. Carefully, they separated the rats-nest of wires and drew the circuit on the yellow pad as Elmer watched and sipped his coffee.



exactly what Dude has wired here and figure out why it works. I think all three of you will benefit from that exercise.

While you do that, I’m gonna get a cup of coffee.”

“Thanks Dude,” snarled Hambone. “You spoiled everything. We were just about to get Unck to do our homework for us and you barged in with this stupid thing.”

“I heard that,” came Elmer’s voice from the kitchen. “I have already done your work. Now do what I said.”

“I think this is it,” said Hambone. “There’s lots of extra wires here, but most don’t go anywhere.”

“Okay. I see what’s left of the transistor seems to be connected backwards. All the circuits I know with NPN transistors have the positive voltage on the collector, not the emitter like Dude has. How can this work?” asked Tim.

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from HAMBONE on page 6

“Like Dude said, it’s magic. Or maybe not,” said Elmer. “If you traced the resistance curve of Dude’s two-legged transistor you would see that at low voltages only a small current flows from the emitter to the collector with the base disconnected. This is because the base-emitter junction is backward biased. That is, it’s acting like a slightly leaky diode. But as you increase the voltage, at some point the ‘diode’ breaks down and a whole lot of current begins to flow

The current increases because the diode’s internal resistance has dropped. Because the resistance has dropped, the voltage across it drops. The greater the current, the lower the resistance and the lower the voltage. The result is a device in which an increasing current causes a decreasing voltage drop.

The semiconductor is said to be experiencing an avalanche breakdown. But you boys might call it ...” Elmer paused for dramatic effect.

“Oh my gosh, negative resistance,” gasped Tim.

“I see it!” shouted Hambone. The voltage on the capacitor rises as it charges up through the resistor and pot. When it hits the transistor’s break point, the transistor avalanches and discharges the capacitor. When the capacitor is discharged, its voltage is below the transistor’s breakdown voltage and the whole thing resets. The little speaker just follows the voltage on the capacitor as it goes up and down.”

“Dude, your oscillator is our homework assignment and it only has five parts! You saved the day!” shouted Hambone as he and Tim grabbed the breadboard and drawing ran out the door.

After hearing the door slam, Elmer commented to Dude, “Too bad they left in such a hurry, we could have used an NE-2 neon glow lamp and built an oscillator with only three parts.”

Wanted to Buy

Looking for a broadcast radio type variable capacitor, single section.
John, KØIZ, 816 914 2367