

**QSO Today Podcast Transcript**  
**Episode 143 - Roy Lewallen - W7EL**  
Transcription commissioned by: Elwood Downey, WB0OEW

Eric,  
4Z1UG: QSO Today episode 143. Roy Lewallen, W7EL.

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Welcome to the QSO Today Podcast. I'm Eric Guth, 4Z1UG, your host. For my research online, my guest Roy Lewallen, W7EL, approaches ham radio from engineering and even a scientific point of view. Roy is the creator of EZNEC, the popular antenna modeling software, and is the author of many articles on radio and transceiver design, baluns, antennas and inductors.

His contributions to the Amateur Radio hobby and advancing the state of the art put Roy at the head of the class in Amateur Radio. W7EL is my QSO Today.

W7EL, this is Eric, 4Z1UG. Are you there Roy?

Roy, W7EL: I am Eric. Good evening.

Eric,  
4Z1UG: Roy, thanks for joining me on the QSO Today Podcast. Can we start at the beginning of your ham radio story? When and how did it start for you?

Roy, W7EL: Well, the actual beginning of the ham radio story started as a shortwave listener. I had a friend in sixth grade who had an S-38D Hallicrafters Receiver. He was able to hear all kinds of interesting things on it. I would hang out over at his place and listen. I was absolutely fascinated with all the stuff we could hear. This was in 1956 in Anchorage, Alaska. I was 10 years old.

Eric, Wow. What happened after that?

4Z1UG:

Roy, W7EL: Well, after spending a winter at Anchorage, we moved to Douglas, Alaska which is a suburb if you will of Juno. Right when we arrived, we didn't have any furniture I recall. We were in a little apartment. I think the landlord or somebody lent us a Zenith Transoceanic radio which you may be familiar with. Certainly your older listeners will know of that. It was a shortwave radio. Portable. I believe it was a tube type. It must have been back then because this was like 1957, early 1957. Then I listened to that and was fascinated. Not too long after that I got my own S-38D after begging my father and getting some good grades in school as a bribe and did some listening.

I ran into who was me Elmer which I guess is really your next question. 1957, age 11, I passed my novice test and got my first ticket at age 11.

Eric, What was your call sign?

4Z1UG:

Roy, W7EL: WL7CIB. That was Charlie, Ida, baker back then. It would be Charlie, India, bravo in these days.

Eric, Do you remember the name of your Elmer?

4Z1UG:

Roy, W7EL: Absolutely. His name was Fred Cunningham. He was a carpenter by trade. He lived in a quonset hut a couple of blocks up the street from us. I spent many, many, many evenings and late nights up at his place listening to him use the rig and building stuff and just learning about radio and electronics. He was absolutely instrumental in everything I learned and for setting the path that I took later in life. He's a silent key now and he has been for some years.

Eric, Do you remember Fred's call?

4Z1UG:

Roy, W7EL: Oh yes. KL7APZ. KL7 alpha, papa, Zulu.

Eric, It seems kind of amazing when we think of Alaska  
4Z1UG: even in the fifties, it was really out in the sticks. To find other hams or maybe there are more hams in Alaska in those days just because you were out in the sticks.

Roy, W7EL: There were quite a number of them around in this little town of Douglas which was I think population about 2,000 and Juno was about 5,000 at the time. Yeah. There were quite a number of them. Another person who helped me out was Dennis O'Day, KL7 "always quite useless", KL7AQU. There were quite a few other hams around town that I've met, although far and above all the others, Fred was my Elmer.

Eric, Do you remember your first rig?

4Z1UG:

Roy, W7EL: Yeah. My first rig, that was the KL7AQU. He gave that to me. It was a Johnson Viking Adventurer which was a kit. He built it. Put it in a 6146 in place of the original 807. Then he also lent me a receiver which was an NC101X. If you would like me to divert a little bit to a story, I do have a little bit of a story about that receiver.

Eric, Sure. I'd love to hear it.

4Z1UG:

Roy, W7EL: The receiver had no identifying marks on it at all. It had a crinkle black cabinet. It was obviously National. It had a National dial on it, but it had no plate on it anywhere that said what model it was or even who the manufacturer was. I have no idea of what its history was. I have guessed that maybe it was a prototype that got there somehow. It was very much like an HRO, but instead of having the plug in coils, it had a box made out of aluminum that ran on a rack and pinion arrangement underneath that you turn to crank on the front to move the coils in the box into place for each band. I wondered about it for many, many years.

It never came across a reference to an NC101X except I was at Bletchley Park in England where the code breakers broke the Enigma Code and there on the wall was an advertisement for an NC101X. That's the only reference I've ever found to that receiver.

Eric, Of course with your smartphone, you took a picture of it.

4Z1UG:

Roy, W7EL: Absolutely.

Eric, Of the ad, right?  
4Z1UG:

Roy, W7EL: Yes, of the ad. The receiver I gave away many, many, many years ago. Way before smartphones.

Eric, Of course, your operating mode at the time as a  
4Z1UG: novice was CW.

Roy, W7EL: Yup.

Eric, Did you build up your CW skills?  
4Z1UG:

Roy, W7EL: Oh yeah, but I didn't quite make it to 13 words a minute before my one year was up. I got interested in rockets. Maybe girls then I don't remember and a few other things and got diverted. My novice expired and I was off the air until 1960 when I got interested again. Fred lent me ... Gee, I don't remember the name of the thing. It was a code practice gadget that had a punch paper tape. I used that to build up my code speed and I got my general class in 1960 at age 14.

Eric, You had the same rig at that time or did you  
4Z1UG: upgrade?

Roy, W7EL: I had the same rig at that time, but I started building my own and had a variety of rigs that were home brew. One of them that I ended up using for quite some time was a 6AG7-6L6 and then it was going to have a 813 in it. I had the 813, but I needed the power supply for it. While I was waiting for the power supply, one day I decided to throw a tune link on the 6L6 output and load up the antenna with that. I have no idea what power output it ran. Probably 10 watts or so. It was near the peak of the biggest sunspot cycle that ever was. The biggest sunspot cycle was in 1958 and it was right close to there. I was working the world with my 10 watts to a long wire going out my window to a clothesline pole in the backyard.

I also at one point built up a pair of 807s. Modulated by a pair of 807s AM. Those were a couple of rigs I remembered. I didn't have any commercial rigs after that Johnson Viking Adventurer for a

very long time.

Eric,  
4Z1UG: What's your favorite operating mode now?

Roy, W7EL: CW.

Eric,  
4Z1UG: You did get your code speed up way above 13 words a minute?

Roy, W7EL: Oh yeah. Yeah. I got my extra in 1963. I've operated almost exclusively CW since I got my general.

Eric,  
4Z1UG: You know for a lot of the people that maybe listening, why do you like CW?

Roy, W7EL: Gee, that's hard to say. It's kind of nice being able to sit and talk with somebody and just kind of keep my mouth shut I guess. It's a little like talking another language I guess, although of course the base language is English. I don't know. It's just kind of relaxing. I also got interested in QRP things. Of course, it's way more effective for a given amount of power to use CW than it is sideband. It's also way much easier to build a CW rig than it is a sideband rig.

Eric,  
4Z1UG: QRP is also one of your operating fascinations along with CW?

Roy, W7EL: Oh yeah.

Eric,  
4Z1UG: What's your current rig?

Roy, W7EL: Well, my current appliance as my friend Wes Hayward would call it is an IC-730 which is circa about 1982. I do very little operating now. It suffices for a weekly sched I have with a very old friend of mine. I've got several home brew rigs and I do field day every year. That's my main operating event and I've got all home brew equipment that I use for that.

Eric,  
4Z1UG: What kind of antennas do you have outside?

Roy, W7EL: My dad used to say that the barber's kid always needs a haircut. Being that I developed and sell

antenna modeling software, what I've got in my backyard right now is a 40 meter and an 80 meter dipole for my weekly sched and that's it.

Eric,  
4Z1UG: But modeled first before they were put up?

Roy, W7EL: Why, of course. I do have a very nice antenna for field day. Actually a collection of antennas for field day. One that I'm kind of proud of is my field day special. It's a two element wire beam that I published in QST many years ago and still use on field day.

Eric,  
4Z1UG: Did ham radio play a part in the choices that you made for your education and career?

Roy, W7EL: Oh absolutely. I couldn't get away from electronics. At one point when I dropped out of college the first time, I was questioning that that was the path I wanted to take. By the time I got out of the military and had gone through the tech school and the military and fixed radars for a few years, I also worked as a broadcast engineer and did some other things. It was pretty well finalized that that was what my career was going to be was something dealing with electronics, in particular electronic design.

Eric,  
4Z1UG: Where did you go for school?

Roy, W7EL: Well, my first attempt at school was at Illinois Institute of Technology where I had a four year full tuition scholarship and I lasted less than a year. I dropped out. At that time I was 18 years old. The draft was on for Vietnam. Before there was a lottery. I was fresh bait. After I dropped out of school, I got a job as a radio announcer and then later as a chief engineer of an AM/FM station in Albuquerque. Their handwriting was on the wall. I joined the Air Force and as I said went to tech school and spent four years fixing radar sets. Then I got out. I went back to school where I was a resident and I could afford it, University of Colorado where I got my EE degree.

Eric,  
4Z1UG: In Boulder?

Roy, W7EL: Yes.

Eric,  
4Z1UG: Did you stay in Colorado after that?

Roy, W7EL: No. After I graduated in 1974, I had married while I was going to school. My wife was from Oregon. My parents had retired and moved out to Oregon. I really liked it here. I thought I would check and see if maybe Tektronix would have any interest in hiring me which they did. We moved out here and I bought a house about six months later and that was what, 42 years ago and I'm still in the same house.

Eric,  
4Z1UG: You're an engineer at Tektronix. Now I uncovered a story that you tell about your son thinking that as an engineer you were a driver of trains. You used it in the context of an online debate about antenna currents. Do you want to tell that story?

Roy, W7EL: Yes. Well, my young son somewhere along the line became aware that I was an engineer. That what was I did for a living and so, "Oh boy, you drive trains." It took me quite a long time at his young age to convince him that well, yes, engineer is what I am called, but it has nothing to do with driving trains. That there are other kinds of engineers besides those who drive trains. I finally thought I had convinced him and he kind of quit asking about trains. This was settled for quite some time. Then I took him out to work one day. At that time I had quit Tektronix for a few years. One of the companies I worked for was Leopold & Stevens, the makers of the rifle scopes, which is close to here. They also had a line of electronic traffic logging equipment and the like.

I was working there at the time. I took him out there and he disappeared for a while. I went and chased him down and found him and said, "Gee, where are you going?" He said, "Well, I'm looking for the train. Where's the train?" He somehow thought that well, there must be a train here somewhere. That engineer must have something to do with trains. He was a bit disappointed when I explained to him that no, there are no trains here either. I think he finally caught on.

Eric,  
4Z1UG: I found a number of QST articles authored by you that go back at least 40 years on your home brew projects. When did you first start to build your own gear and how did it evolve from there to now?

Roy, W7EL: I started to build my own electronic stuff back in 1956 or 57 when I was 10 or 11 years old. I built crystal sets. Then I built a transistor amplifier to go on the crystal set and then I took and I tapped into my good old S-38D which was an AC/DC rig and that would generate a couple other good stories too, but I won't take up too much time with things like that. Tapped into the audio amplifier there. With Fred's help built an audio amplifier and kept making these things more elaborate. I built a home brew keyer, electronic keyer, in I don't know, before I left Juno, so that would have been before 1961. I just kind of built a lot of little stuff, CW monitor, off the air monitor, a little thing that would detect the RF and fire up and drive an oscillator.

That actually provided power for a little audio oscillator so I could hear my CW being sent. I've been fiddling with it just from the very beginning.

Eric,  
4Z1UG: In 1980, you created for QST magazine an optimized QRP transceiver for seven megahertz and I'll have links for this in the show notes page. That transceiver still seems to be the gold standard for high performance home brew transceivers. What about this design had a lasting impact?

Roy, W7EL: Well, you know it's hard to say. Actually it's still being built. I go to Dayton every year. Sell my software. If any of your listeners come out to Dayton, please be sure and look me up. I have a booth to sell EZNEC. I hang out with QRP people at the QRP ARCI hotel. I still have people coming up and saying, "I'm building your rig or I built your rig." It's still actually being built. I think one of the things that has made it attractive to people is its small physical size. I think that's kind of a shame because I don't feel personally that that's at all the most important part of it. The real essence of the rig is the fact that every circuit was carefully analyzed and optimized so that it



works exceptionally well.

It would work very well if it were very small or if it were very big. You can build really crappy small rigs and you can build very good big rigs and that happens to be what I think is a pretty good small rig. I remember Rick Campbell whom I have great respect for. He built a very good facing sideband receivers. I remember in his article he said that he went down the same path I did in evaluating mixers and tried this mixer and that mixer. Finally he ended up giving up and throwing up his hands and discovering that the old diode ring mixer is really the best for that kind of an application which is exactly the conclusion I came to.

There are quite a few parts of that rig that are like that. I have to credit Wes Hayward, W7ZOI, for a lot of the inspiration for that little optimized rig. A lot of it I feel is just small improvements over work that he'd done.

Eric,  
4Z1UG:

We will return to Roy after this word by QRP Labs. I received a QRP Labs newsletter this week. In it Hans, G0UPL, writes about how he now has the ultimate 3S transmitter kit ready for the new US band allocations in the 630 meter and 2,200 meter bands. As always, Hans design and execution of this kit is spectacular and the price for this kit is reasonable. It is a great way to establish a foot hold in these new bands. In addition, Hans writes about Peter, G4HSO's transatlantic crossing in his 45 foot sailboat. Peter uses his ultimate 3S QRP Labs kit on 20 meters as a WSPRnet beacon continually reporting his maiden head locator sub squares location as he makes the crossing.

You may recall from QSO Today episode 125, Hans and I spoke about using WSPRnet and its worldwide listening stations to track high altitude balloons equipped with QRP Labs integrated GPS and QRP transmitters to do the location reporting. G4HSO's Atlantic crossing is an excellent example of an unusual, but very practical application of the ultimate 3S. If you have a project where you'd like to experiment with WSPR integrated with a GPS for tracking, then go to QRP Labs online using the link

from the QSO Today website. Using my link will tell Hans that you heard about it here on QSO Today.

Now back to Roy, W7EL.

Roy, you're best known for your creation of the EZNEC antenna modeling software. How did you come to create it?

Roy, W7EL: First of all, I've had an interest in antennas ever since my early days of ham radio. It's just something that's fascinated me. Once I got an engineering education, I was able to better understand what was going on, although it's still very difficult to get a really deep understanding. I spent many, many hours researching in the wonderful Tektronix library. Lot of papers from the IRE and the IEEE about antennas and trying to learn about them and educate myself about them. I wrote little computer programs for my HP-11 calculator. I resisted getting a computer for a long time. Not really having any justifiable use for one.

Eventually a neighbor ham, a fellow by the name of Jim Larson, I'm afraid I don't recall his call, gave me a floppy disk and it had many NEC3 on it which was a public domain program written by Rockwell and I'm embarrassed here, Logan. Logan and Rockwell. It sat there for quite a long time, but finally I got a computer. My first computer was a XT machine. I loaded this thing in there and I started fiddling with it and holy mackerel, the power of this program as simple as it was absolutely amazing. Up until I used that program, all of these ... In order to even estimate the impedance of a dipole over a wide range of frequencies with various diameters of wire, there are a good half a dozen approximation methods that have been developed to do that.

I've got a file an inch thick or inch and a half thick in my file cabinet of papers on people who attacked this problem. Then we start taking two antennas that are parallel with each other in the same length. Then you start getting into some pretty complex math. If you tilt one a little bit relative to the other, it's a problem becomes

almost impossible to solve. It's because of the integral equations that are necessary that can't be solved in close form. Anyway, this little program would solve those problems and do it very quickly. That was just amazing. I started hacking on it and it was user hostile. If you wanted to make any change, you would have to start all over again. It wouldn't remember anything.

There was no graphics and so forth. It was written in GW-BASIC which I was acquainted with. I started hacking on it, adding graphical stuff and made it possible to save and recall antenna designs and so forth. It needed current sources so I figured out a way to incorporate current sources and on and on and just kind of kept working on it to make it more usable for myself. I had no thought of selling it. Then somewhere along the line I became aware of Brian Beasley selling his software. What he had done essentially is the same thing. I thought gee, mine will do everything his will and a bit more. I would sure like to get enough money to get a new computer because this thing is kind of sole for doing this kind of work.

I got a compiler and bought a couple of months of advertising in CW and QST. My first program. It was called ELNEC. I sold my first one in 1990, early 1990. 1995 I finally got fed up with living in the double work cartoon and I quit my day job. At that time I had EZNEC which was based on the NEC2 code which is also a public domain. I've been living off of that, plus a bit of consulting ever since and I've never looked back. That's the story in a nutshell of EZNEC.

Eric,  
4Z1UG:

I've used the software and I actually have it running on the computer that I'm talking to you on right now. It requires some kind of a learning curve. What's the best way for the average Amateur Radio operator to master EZNEC?

Roy, W7EL:

Well, you know there was a really nice course that the ARRL offered years ago which I recommended. Unfortunately they decided to discontinue it and not replace it with anything. Then the next thing that became available was a book by Ward Silver

published by the ARRL which I recommend. However I believe that maybe going out of print also. Without those two resources, it's a little tough. I've got some tutorial, very simple tutorial stuff in the EZNEC manual. In general, that's really all I can recommend these days. It is necessary however to know a bit about antennas and how they work and what they do in order to make intelligent use of any modeling software. That's a place to start is to try to educate yourself in the ways of antennas.

The ARRL antenna book is one of the I think most accessible text for that for amateurs.

Eric,  
4Z1UG:

Do you think that antenna modeling software like EZNEC is responsible now for some unusual antenna designs? Now the pre-show I said the Hexbeam for example, but maybe you have some other examples that are more elaborate.

Roy, W7EL:

No, I can't really point to any. There are many. There are many unique ones that have come out and some of them are very good. For example, Jim Breakall has done some really remarkable things with log-periodic and it's done with antenna modeling software. I think he's just actually begun using EZNEC for some of his work. He's used other software. He's got access to really good \$50,000 electromagnetics software. That kind of thing can be done with EZNEC. Let's see. There has been quite a bit of work on broad banding antennas that has been done with EZNEC and similar programs. Gary Breed actually got some patents awhile back as I recall on some broad banding techniques where he take a very close coupled if you want to call it element.

Another wire that's just slightly off resonance and put it right close to your wire and it will broadband your antenna. There are just many, many other ones. I myself have used EZNEC on quite a few occasions to design unique antennas for consulting work. I design some antennas for example that go into a winglet in a drone, a surveillance drone and another one that went into a unit used in general aviation for navigational aid and so forth. They are absolutely unique. They're not something that

you could really design very well without the aid of modeling program.

Eric,  
4Z1UG: Right. I guess when we think of using EZNEC, they might maybe thinking on using them on low frequency antennas. Of course, EZNEC is absolutely spectacular up in the VHF, UHF and microwave areas as well.

Roy, W7EL: Frequency is basically a scaling factor. You can take an antenna at any frequency and just put the scale thing and scale it to any other frequency and that will work exactly the same.

Eric,  
4Z1UG: When I'm using the software, it seems to me that these are open field designs. If I want to build a model for an antenna for my house for example and my house is made of cement and steel rebar on the side of a hill, is there a way to account for objects around the antenna model?

Roy, W7EL: Not really. The problem is that you restricted it to only having a few tools if you will, a few items that you can use for your modeling particularly round, straight conductors. You can model most anything that can be built of round, straight conductors or approximated with them, but outside of that, no. For example if you have something with dielectric patch antenna for example, dielectric is one of the really important components of that antenna. It can't be modeled accurately with EZNEC because EZNEC like its core calculating code does not have any way to accommodate the dielectric. If you have a wall that's say concrete, now the concrete wall could in theory be modeled as a wire grid to simulate a plain surface.

Then you could load the wire grid with approximate resistances. You put resisted loads in there to approximate the lossiness of the concrete. However, I don't have any way to tell you to figure out what those resistors should be. Similarly, you could probably model a tree if you had some way of figuring out what the resistance values you should use are. Those are the practical limitations. The short answer to your question is no.

Eric,  
4Z1UG: Are there any primary assumptions about antennas that you had before the creation of these antenna modeling software and especially EZNEC that has changed? Have your assumptions changed after able to model the antennas on software?

Roy, W7EL: Not mine. I think I sorted out a lot of really basic things about antennas before I got involved in modeling them. I still get surprised once in a while by one thing or another, but the basic fundamental principles of antenna operation I had pretty well established before EZNEC. For example, I wrote most of the phased array chapter in the ARRL antenna book probably ... I think it was before ... I know I wrote the content of that before I had any modeling program. I had sorted out a lot of the fundamental things about phased array antennas before that. Now anybody can take a program like EZNEC and very quickly see that what I've written in there is correct. Before that it was kind of hard sell for a long time that some of this stuff was correct because it's not very intuitive.

I would say though that very many, many users of EZNEC have learned an awful lot about the fundamentals of antenna operation from the modeling programs. If I were to talk to all potential EZNEC users or users of all modeling software, that you should always be careful what the program tells you. You got to remember that it is analyzing a model of an antenna. It's not analyzing a real antenna. EZNEC does know the fundamental rules that an antenna must abide by. Therefore if you have a model that exactly imitates a real antenna, then the results will be absolutely jaw-droppingly correct. However, it's often like you say there will be a building with a concrete or some trees or something nearby.

You can have some little hooks or loops that you didn't account for and so forth that will make the real antenna different from the model antenna in some way. It takes some time and skill to realize and to learn what of those things are important and which ones are not. Until you do, then you run the risk of really ... You have to watch out in

assuming that the results you're getting for your model antenna are actually results you would get with a real antenna. I'd say that's a caution that you should take for any modeling of any kind regardless of whether it's for antenna circuit analysis or whatever. That's probably the most important thing I could say about EZNEC. Also please get the demo program and download it and try it out.

It allows you to do everything the standard version will except for it limits the complexity of antenna you can model. You're welcome to use it for as long as you want. There's no restriction or limit on it. You can give it away. I encourage it.

Eric,  
4Z1UG:

Well, I think of the things that we see in a lot of the antenna articles in magazines and online, antenna modeling is done to kind of get you into the ballpark, but then you still have to go out into the field and put the antenna up and see how it works.

Roy, W7EL:

It depends. Yes and no. I do an awful lot of design and have the antennas come out very, very close to how I design. I have many customers who have told me the same thing. Sometimes you can identify a situation where you can't exactly model it. I've got ground that's kind of lumpy and slopes a bit. I've got an antenna that kind of goes up and comes down at a weird angle. If I really want to take my time and carefully model it, I should be able to come out very, very close. If I'm sloppy with it or if there other factors around, trees, rain gutters and so forth that are not in my model, then what you say is true.

For example if you're going to put an antenna up in your attic, you put your antenna up at the attic and there are wires in your house that run all over the place and pipes and other conductors, rain gutters and so forth which it's virtually impossible to include in your model. In that case, you can get a general idea of how the antenna is going to work, but it's not going to be exact because of the effect of all the stuff that's not in the model. Remember again that you are getting

results for a model antenna, not for the real thing.

Eric,  
4Z1UG: I found a paper online that you wrote called "Baluns: What They Do And How They Do It." It seems that baluns and feed lines to many of us are still a mystery. Most of the modern transceivers almost without exception have an unbalanced 50 ohm output. When and how should we use baluns and what's the difference between a current balun and a voltage balun?

Roy, W7EL: Eric, for that I will refer you to that paper. It's available on my website. You can do a web search for it. I believe there's a link for it from my main page. If not, I can certainly furnish it for anyone who's interested.

Eric,  
4Z1UG: I also have the link. I'll put that in there. I did read the paper. I was just wondering if there's a way to 25 words or less answer the question.

Roy, W7EL: Here's the deal. I coined the terms current balun and voltage balun in that article. As far as I know, nobody was using those terms until I wrote that. I came up with those terms. My friend Wes Hayward in his first classic book on Solid State Design for Radio Amateurs described what I call a voltage balun and he called that a balun. Then he also showed what I call a current balun and he called it a sort of balun. This was kind of logical because in the environment that he worked a lot, a balun was used to supply out of phase signals to drive a push-pull amplifier for example from a single ended amplifier. The appropriate type of balun used for that is the voltage balun.

The problem is that the voltage balun is not the appropriate thing to use for feeding your antennas. What a balun does in feeding antennas and to be very brief is it prevents your feed line from radiating or from being susceptible to signals coming in when you're receiving. It will receive signals if it's not balanced up when you're receiving and it will radiate them on transmitting. The balun prevents this by making the currents in the two conductors of feed line equal and opposite



so the fields cancel each other out. That's the purpose of a balun. A current balun does that. A current balun forces the two currents in the two conductors to be equal and opposite. The voltage balun forces the voltages and the two sides to be equal and opposite relative to some third reference point. That's it in a nutshell, Eric.

Eric,  
4Z1UG:

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Now back to Roy Lewallen, W7EL.

In doing my research for this QSO, I found in an article where you were exploring the basic science of radio. One that comes to mind is mounting toroidal inductors with common materials which was on the QRP home builder website. In this article you were testing different kinds of cements and the effects that they had on the core of the inductor.

How did you decide to do this kind of experiment?

Roy, W7EL:

I get curious. I wonder gee, what should I use to pot this thing with. I don't want to goof up the

cue. I don't know the answer to that question and so the only way I know how to answer it is to set up an experiment to find out. I do that a lot of with a lot of things. I'm doing that just about all the time. That's the way I collect information. I'm an engineer. I operate with data and known facts. If I don't have the data or the known facts, then I have to get them myself. I frankly don't quite understand how people function without doing this.

Eric,  
4Z1UG: Well, perhaps we rely upon people like you to write articles like you're doing to kind of shortcut the process of learning.

Roy, W7EL: Well, I'm always to find good data that other people have done and the results of careful experiments that they've done. I'm very happy to have them do it for me also. The problem is that so often it's just anecdotal evidence like do I need a balun. Well, no problem. Just always cut your feed line to 32.5 feet and you won't need a balun. I tried it and it worked great. Another guy tried it. It didn't work great, but then well, maybe he didn't do it quite right or something. That kind of stuff is all over the place. It's all over the place in our politics. It's all over the place in our antenna literature. There's an awful lot of bad information out there. Wherever I can I replace that with some facts.

Facts are really nice things because once you know them, then you can rely on them and you can use them to create new things.

Eric,  
4Z1UG: It seems to me that a lot of the brand new rigs now have very unforgiving solid state amplifiers that are 50 ohms output on an unbalanced connector. What do you think about the use of antenna tuners in the shack where people think that having an antenna tuner means that they can hook up any piece of wire to the output of that and load that up and turn that into an antenna?

Roy, W7EL: Well, this gets into some really basic fundamental stuff. What you really are trying to do here is make your transmitter happy. You do this by matching the impedance of whatever it's looking

into to 50 ohms. That doesn't mean the transmitter's output impedance is necessarily 50 ohms, but it is designed to work into a 50 ohm load. If the load that is working into deviates too far from that, the rig will start reducing its power to protect itself. It's necessary to take whatever antenna you've got and match it to 50 ohms in order to get your transmitter to work properly. That's basically what an antenna tuner or a transmatch does.

Now when it does that, it will contain inductors and capacitors which because of the circulating currents in the inductor and the voltage cost capacitors, they will have loss. Mostly the inductor in a practical tuner. Your inductor will dissipate some power and the amount of power that it dissipates depends on how extreme a match it's trying to make. If you're trying to match an antenna that is thousands of ohms down to your 50 ohms, you will probably have a lot of circulating current in your inductor and it will have a lot of loss. I remind people that I've worked all over the world with a watt and a half. If you've got say a 100 watt transmitter and you are losing 99% of that power in your transmatch, that's okay.

You're still radiating a watt. I've worked many countries with a watt. I'm all in favor of using the transmatch where it's appropriate. Sometimes it will eat you up with loss, sometimes not, depends on how extreme the thing you're trying to match. Also how big physically is the inductor in that. If you've got a little transmatch that's a size of a pack of cigarettes, it's going to be a lot more lossy than a great big Johnson matchbox or something with a great big inductor in it. That's just the laws of physics and you can't get around them. Now there are lot of things you can do to your antenna to minimize the losses in the feed line and other things, but that's kind of a lengthy topic to go into here, Eric.

Eric,  
4Z1UG:

If we're looking at purchasing a transmatch or an antenna tuner and there's a number of companies that make them now, those devices have power ratings. Are those power ratings ... Would you

guess are they based on the actual amount of power that could be lost in the device itself or how much power that passes through the device?

Roy, W7EL: Probably neither one. It's probably developed in the marketing department and is designed to sell units and make them sound impressive. I remember stopping at a truck stop one time and seeing Citizens Band Antennas that were just a vertical whip with a loading coil on them that were rated at 16,000 watts.

Eric, On the side mirrors next to the driver?

4Z1UG:

Roy, W7EL: Yeah.

Eric, Since World War II and the advent of coax that was used in World War II, 50 ohm coax, and the availability of that coax after World War II to Amateur Radio operators, it seems that every antenna solution and every feed line solution is with 50 ohm coax. Are you an advocate of using 50 ohm coax for feeding HF antennas or are you an open line kind of guy?

Roy, W7EL: I'm very much a coax kind of guy. What I like to do is I like to design my antennas and/or match them at the feed point to provide close to 50 ohms at that point and then I feed them with coax. That's my choice. There's no reason that you can't take an antenna and use some very little loss open wire line and do your matching down at the rig and run a very high SWR on the line. There's some disadvantages to doing that. Well, there are several disadvantages to doing that, but it's practical for some people. For example if you want one antenna to work on multiple bands, that's one way to do it. One of the problems with running the very, very SWR on an open wire line is the effect of water.

Now I haven't really tried ladder line, but many, many years ago I took some TV twin lead and I did some test to see how lossy that would be. I think I did publish that somewhere. What I discovered was that once you got a little bit of dust and dirt on it, if it didn't rain for a couple of weeks and

then you got a little bit of rain and you got kind of some mud, you ended up with basically mud on the antenna or dirty water, the water is very, very lossy stuff especially dirty water. The loss in the twin lead got up higher than even small diameter coax. Sometimes you're fooling yourself thinking that you're going to have a really low loss system.

True open wire line like ceramic insulators in between probably wouldn't have this problem to any big extent and possibly your punch ladder line isn't too bad, but I'm sure it's susceptible to that also. Also when you have a really high SWR on a line like that, you're going to find that everything is very neuro banded so that if you change frequencies even a small amount, you'll probably have to retune. Everything's going to change as the impedance is transformed dramatically through this line with a high SWR. I'm pretty much a coax guy, but I always keep the SWR in my coax down to some reasonable value because once it starts getting up really high, you start incurring extra loss on the coax.

It's okay two and a half, three to one or something like that isn't really a problem as a general rule, but when you try to do 10 to one or something like that, you're going to start eating up an awful lot of loss.

Eric,  
4Z1UG: Do you have any feelings about an open wire fed antenna where there is an antenna tuner at the bottom of the antenna mast feeding the open wire line up to maybe a random length dipole for multi-band operation?

Roy, W7EL: You're talking about the tuner at the shack?

Eric,  
4Z1UG: No, the tuner at the bottom. Maybe the tuner is remote controlled out at the bottom of the antenna support.

Roy, W7EL: Yeah. The closer you can get your tuner to the antenna, the less most of these effects are. You will still have the potential amount of loss in the inductor if you're doing an extreme impedance match. If you're not doing an extreme impedance

match, you do not have the loss on the long open wire line then and you don't have the rapid change with frequency. The closer you get your matching to the antenna in general, the better off you are.

Eric,  
4Z1UG:           What kind of impact has Amateur Radio had on your family life?

Roy, W7EL:       It's been positive. I don't mind you're asking that question at all. I've been happily married for 48 years to the same woman. She's really great. We get along terrifically. I was a ham when she married me of course and I'm still a ham. Ham radio has been a big part of my life one way or the other all of that time. We each have our hobbies. We respect each other's hobbies. She is happy that I've got something to entertain myself and vice versa. I'm happy that she has stuff. Ham radio has always been a positive factor. Also I noticed some years ago that virtually all of my close friends are hams. I've had very few friends, really close friends, outside the Amateur Radio community. That's also been a really big factor.

My wife mentioned not too long after we got married she said, "Gee, all of your friends are so nice." My response was, "Why, of course. That's a requirement."

Eric,  
4Z1UG:           Of Amateur Radio.

Roy, W7EL:       Yeah. That is a requirement that my friends be nice. I don't have any friends that aren't nice. Hams tend to be that way. Hams are just a really great bunch of people.

Eric,  
4Z1UG:           Do you find that younger people are doing hobbies less now? It seems to me that your generation, my generation, I'm a few years behind you, was a generation of hobbyists. It seems that the younger generation may not be hobbyists. Do you see that there?

Roy, W7EL:       They're certainly not hobbyists in the classical context that we're used to. For example there are no longer any stamp collectors. There aren't model railroad enthusiasts to any extent. The kind of ham

radio that I grew up with is pretty much no longer in existence except among the geezers like me and so forth. The answer is absolutely yes. You might describe some of the things that the youth are doing as hobbies and just maybe not recognizable to us as not looking like ham radio or stamp collecting or something. I haven't followed well enough to really comment on that. I think you really need a sociologist or something to talk about that.

Eric,  
4Z1UG:           What excites you the most about what's happening in ham radio now?

Roy, W7EL:       I'm not very excited about what's happening in ham radio now. This is something that I can spend a little bit of time talking about, but it's just my personal opinions. The ham radio that I knew no longer exist. When I was young, ham radio was just magic. I could listen to this radio and I could hear all kinds of interesting stuff from far away. Later on I could build rigs to talk to these people far away which really I could not do in any other way. I could not meet people from other countries and on and on. Nowadays of course anybody can pick up a cellphone and dial an international number right there standing in wherever. He is talking to someone around the world and thinking nothing of it.

The magic of ham radio ... I used to go down to the city dump that was back in the days when they would take all the trash and dump it in a big pile out over along the shore of the Gastineau Channel. In the daytime I would go out there and collect components out of discarded TV sets to use in my home brew rigs. Then at night I would tape a flashlight to my rifle and go out and shoot rats. Neither one of those things is really possible anymore. I guess to some extent that's good. People who were entering ham radio are doing it for entirely different reasons. I'm not too sure what all of those reasons are. They're different to the ones that attracted me to ham radio though because like I said the reasons that attracted me to ham radio no longer exist.

I'm a pilot. I encountered on a number of the pilot forums people who mentioned getting a ham radio license simply so they could use the APRS, the position reporting service, to put in their airplanes. That's the sole reason that they got an amateur license. I think we probably have some people that are interested in doing public service or people who are just interested in chatting with people on two meters or whatever. I think those are the reasons that a lot of the people are entering ham radio today. It's becoming a very, very different hobby than what attracted me. I won't say it's a bad thing, but it certainly is different and changing. One thing I have found very encouraging, very interesting is that every year I go to the events at Dayton sponsored by the QRP ARCI.

They have a day of seminars and other events preceding Dayton and during the Dayton Convention. They call it the Four Days In May, FDIM. One of the things they usually have is a show and tell or a home brew contest where people bring their home brew projects and show them off. I've really been impressed with the number and quality of the things that people have been designing and building. It's really great. Some are just absolutely marvelous craftsmanship. Some of them are extremely clever design. As a professional design engineer, I can appreciate that. The number of people attending FDIM seems to be growing every year. Unfortunately I think it's still very heavily dominated by older people.

I don't see nearly as many young people as I would like to, but I think there are some young people that are coming up and getting interested in that. It seems like QRP is one of the last holdouts of the home brew portions of Amateur Radio that I really love. The other fairly encouraging thing is boy, there sure a lot of people filling with their antennas. Antenna seems to be one of the other last things that people are playing with and doing some experimenting and building of. My EZNEC sales just keep going up as more people get computers and decide to try it. That's really encouraging from the standpoint of the future of ham radio.



Eric,  
4Z1UG: Well, I think that's very interesting. I'll be at  
FDIM this year. This is my first Dayton Hamvention  
coming up and I'm signed up for FDIM. I'll get to  
spend the entire Thursday before the Dayton  
Hamvention in the FDIM seminars and hope to see you  
then.

Roy, W7EL: Oh yeah. I'll be there. I come in on Wednesday  
night and don't leave until Monday morning.

Eric,  
4Z1UG: What advice would you give to new or returning  
hams?

Roy, W7EL: Well, as I said, the hobby is quite a bit different  
than what it was when I started out, but I do have  
just a couple of words of advice. The first one is  
to join the ARRL. If you're in another country,  
join the equivalent organization in your country.  
The reason is if no other reason, they are our  
lobbying group. They're really the only thing that  
stand between us and a whole bunch of restrictions  
and other things that would really harm our hobby.  
I think we should support the ARRL if for no other  
reason for that one. It is also a great resource  
for a large number of things of interest to all  
amateurs. They sponsor contests and they sponsor a  
lot of other events that interest a lot of hams. I  
highly recommend that.

The second thing is to find a group of people that  
have the same interest as you do. Ham radio is a  
very diverse hobby. There are people like me.  
There's a geezer crowd CW die hards. There are  
people who do QRP home brewing. There are people  
who like to play with microwave stuff or digital  
modes. People who just like to chat on two meters.  
There are people who like to contest. Work DX.  
There's just a lot of stuff. Find a group that  
specializes in that where a lot of the members  
share that same interest and then connect with  
them. I think you will find that that greatly  
increases the fun you'll have out of ham radio. If  
you go to Dayton or a similar kind of a great big  
convention, you'll find that each one of the groups  
has its own hotel.

Find which group has the interest that are those of

you and join them and stay with them and meet some people that share your interest. Those are my just two pieces of advice.

Eric,  
4Z1UG: Well, that's great advice. Roy, I want to thank you so much for joining me on the QSO Today Podcast. I appreciate it. 73.

Roy, W7EL: The pleasure was mine, Eric. 73.

Eric,  
4Z1UG: That concludes this episode of QSO Today. I hope that you enjoyed this QSO with Roy. Please be sure to check out the show notes that include links and information about the topics that we discussed. Go to [www.QSOToday.com](http://www.QSOToday.com) and put in W7EL in the search box at the top of the page.

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Until next time, this is Eric, 4Z1UG. 73.

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