THE NEWSLETTER OF
THE KINGS COUNTY RADIO CLUB

KCRC

February 2018 *The Semi-Ridiculously Abridged Edition* Volume 5, Issue 2[A]

Minutes of the February 2018 KCRC Meeting,
February 7th, 2018

Our February "Pre-Meeting Question and Answer Session" was a very lively affair this month. Once again, no specific topic took center stage with many topics being discussed.

The monthly meeting was called to order at 8:10 PM, by our Vice President, Howard N2GOT. Also present at tonight's meeting were Treasurer Richard KA2KDQ, General Secretary Roy AC2GS, Dan KC2TRX, Lloyd K2JVX, Alan KD2OMG, Axel KD2OVM, Gene KY2MY, Simon KD2LQE, and a new visitor Rob KD2JMV!

Treasurer Report—Richard KA2KDQ, reported that our Treasury currently has $719.43 in assets in our bank account, with $213.01 in our Club PayPal account, our PayPal subtotal was unavailable tonight. Since last month Daniel KD2OVN, and Jasson KD2PBQ have joined our Club—our Club presently has 67 members in good standing, and 47 members have paid their 2018 year dues!

2 Meter Report—Richard KA2KDQ reported approximately a dozen check-ins to recent Nets. Since the Club presently host three Nets on 2 Meters, it was decided to change the Tuesday Net to "The King County Radio Club's 2 Meter Club Net."

10 Meter Report—Our Net Control operator, Joe AC2AE has had to step down as Net Control Operator for this Net, due to his limited available free time. The Club is searching for a new Net Control Operator for this Net. Anyone with a decent 10 Meter setup with a free hour or two on Sunday morning should consider volunteering. Perfect reception or a very strong signal is not necessarily needed. The participants of the Net are available to relay messages back and forth, as needed. Please consider volunteering for this position. The Club executive committee will try to cover the Net Control Operator post until a more permanent replacement is found.

KCRC TechNet —Our Net Control Operator and Host, Roy AC2GS, reported that the TechNet is doing well. Roy once again asked for suggestions on what topics should receive a similar treatment, he urged Club members to participate with either questions, answers, or comments. Technical Nets are NOT dusty lecture sessions, they are living, breathing reflections of the interests or disinterests of their participants. Please listen to our TechNet and PARTICIPATE!

KC2RC FusionNet—Mitch reported in absentia, that the Wires-X Node for our Repeater will be switched off from midnight until the next morning. This is being done because SOMEONE seems to be "pinging" the node with their private Wires-X node device. Joe AC2AE has this set up in his home and the "pinging" has become an annoyance. If you know who has their Wires-X box doing this pinging, please urge him to STOP IT! Mitch has finally setup a noise-free analog/Fusion audio stream, you can hear it either by using the aliases fusion.kc2rc.com or stream.kc2rc.com, or directly going to its web page: https://www.kingscountyradioclub.com/stream/ . Roy AC2GS will continue to offer another analog audio stream at live.kc2rc.com "just in case".

Field Day 2018 Committee Report—This subject was tabled since many of the people involved in planning our next Field Day were not available for this meeting.

Old Business: Our most recent VE session was January 21st, 2018. There were six examinees—4 Technician licenses were awarded, one General license was awarded and one Extra license was awarded. We were pleased to have one of the examinees decide to join the Club! We decided to hold our VE Sessions in room 6B of the Wesley House, due to it's large space, that it can be separated into two exam rooms, and because food and beverages are allowed, as opposed to our new Carrington Conference Room, inside the Hospital. The Club is always looking for new VE's to join our VE Sessions. For ANY interested individuals, please contact any Executive Member of the Club or the return email address for these emails of our Club Meeting's minutes. People took time out of their busy lives to help get you licensed – pass on the favor!

We decided to permanently establish our monthly meetings from January to November in the Carrington Conference Room. The Carrington Conference Room is between the Hospital Gift Shop and the Cafeteria. Our annual 2018 Holiday Party will be held at Wesley House, in Room 6B.

Repeater status was reported by Mitch N2RGA—was tabled since those involved in the Repeater maintenance were not available for this meeting.

All Club members that paid their 2018 dues were given their new laminated Club membership cards. Those not present at this February's meeting will have their cards mailed to them by Richard KA2KDQ.

New Business: Richard KA2KDQ reminded us of the upcoming LIMARC Hamfest—February 25, 2018—read all about it: https://www.limarc.org/hamfest-february-25-2018/

At 9:40 PM the meeting was adjourned.

These minutes were respectfully recorded and submitted by Roy AC2GS on this day, February 7th, in the two thousandth and eighteenth year of our Lord of Propagation…

Does Size Really Matter?

Can A Short Length of Transmission Line Really Make a Difference?

Anyone who has spent more than a few hours on the HF bands has, no doubt, come up against an olde timer repeating that empty trope, that all your transmission lines should be at lengths of even multiples of ¼ wavelength ONLY (sometimes they can't keep the folklore straight and advise odd multiples of ¼ wavelength). Any other transmission line lengths and "*caution - there be dragons*"!

My best guess is that this is an erroneous corollary of a simple concept that is almost always a question on Amateur Radio exams:

Any length of a given coaxial cable that is an odd multiple of a signal's ¼ wavelength inverts the impedance connected to the other end. In other words, if the other end of your ¼ wavelength long coaxial cable is not connected to anything and is effectively an "open circuit", at the other end it will look like the other end is shorted together? If you actually shorted the far end of this ¼ wavelength long cable, it would look like an opened wire, not connected to anything else from the opposite end. It is a less than obvious aspect of how coaxial cables "rotate" the phase angle, in degrees and scalar impedance, in ohms, of the complex impedance presented at the far end of that transmission line!

Of course, in a perfect world where your resonant antenna has an impedance of 50 ohms, your transmission line will not change your load's impedance, no matter what length of transmission line it must run through.

But, who said that this is a perfect world?

The lesson to come away with from all this is that there is no such thing as a "forbidden transmission line length", no matter what some of these fellows caution you.

But the length of your transmission line can become important in some situations.

Transmission lines designed for a non-standard 50 ohms impedance can be used as impedance transformers if you get their lengths correct with relation to the wavelength of your transmissions.

But most of us are using good old 50-ohm impedance cables most of the time…

I have an Alpha-Delta DX-CC fan dipole that was a bit off of resonance at 10 Meters. Rather than a Voltage Standing Wave Ratio (VSWR) of 1:1, it tended to show me something in the 5:1 range (oh, well). With the magical powers of an impedance matching network in any decent antenna tuners this is not an insurmountable problem. My solution happened to be an MFJ 998 Intellituner at the time, but other makes and models would suffice. But, when I happened to add an additional one-foot jumper to my transmission line, from my antenna to the antenna tuner, my antenna tuner could no longer find an acceptable inductance/capacitance to correct for my antenna's impedance mismatch?

What that means for this particular antenna tuner is that it ran through its range of available inductance/ capacitance, searching for an SWR of 1:1.7 or less and after it failed to find anything that worked, it just "gave up".

Now, nothing much had changed except for that silly one extra foot of LMR400 coaxial cable…

So, the most likely suspect is a faulty jumper cable, or the barrel connector used to attach it, right?

Well, here in AC2GS-land we actually do have a couple of little "toys" to test this hypothesis. Not only can we use a volt-ohm meter to test for continuity breaks of an open wire or shorts between the center wire and the shield wire, but we also have a nice little RigExpert AA-600 antenna analyzer that can do a quick test of a coaxial cable for any abrupt impedance changes, using its Time Domain Reflectometer (TDR) feature. The coaxial cable was fine, as well as any of the connections used.

But let's make believe that we don't trust such things as Vector Network Analyzers (VNA), or TDRs.

In the original setup I had 75 feet of LMR coax connected to my fan dipole. Onto that was a two-foot LMR400 jumper, which in turn was connected to my antenna tuner.

I removed the 2-foot-long original jumper and used the one-foot jumper that caused all the problems, with

another one-foot jumper after that – the total transmission line length was the same as it was originally, but the *questionable* coaxial cable was being used instead of the original coaxial cable that worked at the beginning.

And don't you know it, that darn thing tuned without a problem!

One silly extra foot of transmission line in a 77-foot coaxial cable made that much of a difference?????

Yup!

For a lucid explanation of why this is so, I will have to review the concept of complex impedance, which you all needed to know for your licensing exams.

The reason we call impedance a *complex* number is not because it is a difficult idea to deal with. No, it is a term from Mathematics – a *complex* number is a number that can be expressed in the form **a** + **b*i***, where **a** and **b** are real numbers (2, -3, 4.777777, 1/32) and ***I*** is an imaginary number whose square is equal to -1.

When Physicist borrowed this concept from Mathematicians, there were already TOO many places where ***I*** was used, so they changed its name to ***j*** instead, but it's the same *imaginary* number that when *squared* gives you the nonintuitive -1 answer.

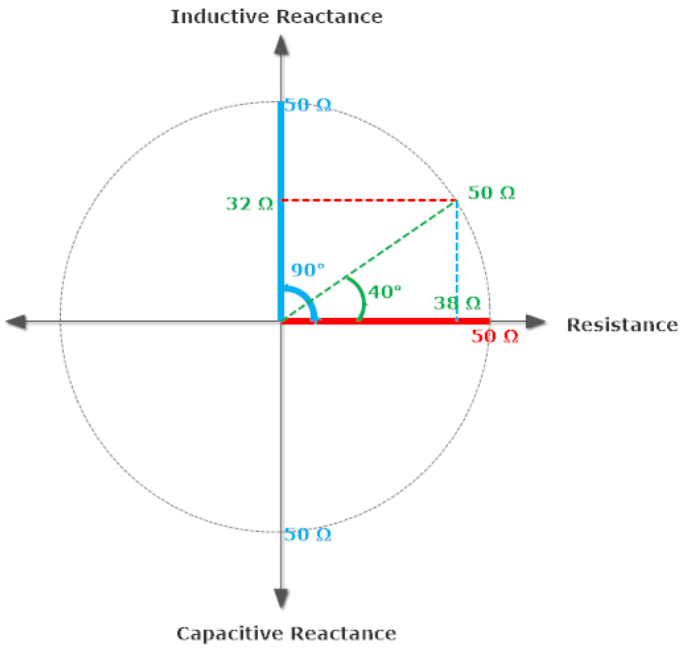
In impedance the real number is the pure resistive component of the complex impedance – **a** value that remains constant as the frequency of the current is varied, and **b** is the *reactance* in the complex impedance – a negative value for capacitance reactance (which decreases with increasing current frequency) and a positive value for inductive reactance (which increases with increasing current frequency). Physicists and Electrical engineers describe complex impedances with the notation:

$$Z\{\text{impedance}\} = R\{\text{resistance}\} + j(\square X_L - X_C\square\{\text{absolute value of the sum of inductive reactance and capacitive reactance}\})$$

If you want to *burst* a Mathematician's bubble, you can explain that there really isn't anything *imaginary* about ***j*** - that ***j*** just represents a 90-degree phase shift between an inductor's voltage and current (current *lags* voltage) and ***-j*** represents a -90-degree phase shift between a capacitor's voltage and current (current *leads* voltage). Since these phase shifts are symmetrical, the largest phase difference that gives unique values is 180 degrees of phase shift, everything further is just mirror images of the first 180 degrees of phase shift or is identical to the first 180-degree phase shift!

Impedance isn't actually a simple one-dimensional *scalar* value, like resistance, it is a *vector* value with an amplitude ***AND*** directionality – in this case it is the phase angle between current and the voltage. The phase angle can be zero and the complex impedance can be purely a resistive one, or 90 or -90 degrees and be a purely reactive complex impedance. The total *scalar* part of the impedances for all of these cases can be identical, ***BUT*** their phase angles are quite different and how they interact in their circuits are incredibly different!

It is possible to describe the same exact *scalar* portion of a given complex impedance in ohms as the radius of a circle, whose resistive and reactive components portions are forever changing as a function of phase angle!



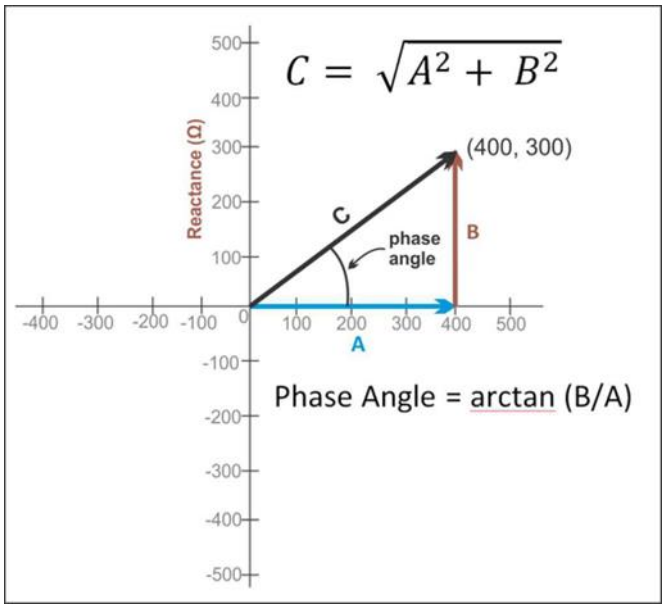
(Notice that these are all just a bunch of right triangles, and surely you remember your Pythagorean Theorem, or maybe even a bit of Geometry?)

The red colored complex impedance is exactly what you would like your antenna system to show: a PURE resistive 50 Ω impedance (with a phase angle of 0 degrees – the current and the voltage are exactly in phase with each other)!

The blue line shows the *same* 50 ohms of impedance, but rather than a pure resistive impedance, it is a pure inductive reactance, and the phase angle between its current and voltage is 90 degrees out of phase.

Impedances are not always *pure*ly inductive, capacitive, or resistive. Very often it is some combination of Reactance and Resistance, and there are A LOT of combinations of these values that will give you 50 ohms of complex Impedance – the phase angle will give you an idea how and why all these *seemingly identical* impedances are quite different!

When you are dealing with a perfect antenna system of a pure 50 ohm resistive impedance, the length of your transmission line is inconsequential, but when there is a mismatch between the impedance of your antenna and the impedance of your transmission line, that's where *the magic* happens. Under these circumstances the absolute impedance, in ohms changes, but often more importantly the impedance's phase angle rotates, as the



transmission line length increases. This can be a bigger problem than how many ohms the Impedance gains or loses.

Antenna tuners are *a bit magical* as well. They are impedance matching circuits with limits to how much impedance can be transformed into something like 50 ohms resistive impedance, and the Impedance's phase angle is a very important factor.

Although my autotuner could handle my less than resonant antenna for a given phase angle, when I extended my transmission line a mere extra foot, it was too much for my autotuner to handle, and failed miserably.

What difference does a foot of coaxial cable make? Sometimes all the difference in the world!

Sometimes you ***really*** need to be concerned about the transmission line length to get your signal out. But most times this is not necessary at all.

So, when some guy on the HF band tells you why you **MUST** measure out all your transmission lines to multiples of ½ wavelength, either wish him a good day or be prepared for a long QSO while you attempt to explain why this is not quite true, except for special conditions…

Or send them a link to this article <grin>!

73,

Roy AC2GS