LETARC Propagation

Special Edition December 2011

Longview East Texas Amateur Radio Club

LETARC.ORG

groups.yahoo.com/group/LETARC/

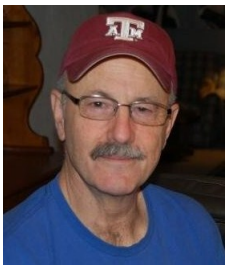
Club Repeater
KI5UA/147.34
(+ 136.5Hz tone)

New Officers for 2012

Following the count of ballots by Jim Quinn and Priscilla Quinn, the new Officers for 2012 are: Gary Lewis, WG5L, President; Tom Wilbeck, N5KGN, Vice President; Terry Johnson, KG5WO, Secretary/Treasurer; Jim Rogers, N5VGQ, Communications Director, and; Todd Hoover, N5TJH, Media Director. Thanks to Jim and Priscilla for handling the elections process!!

Gary, WG5L

Tom, N5KGN



Todd, N5TJH

Jim, N5VGQ

Terry, KG5WO

Amateur Radio Operator of the Year

Outgoing President Jim Quinn, AA5CX, presented the 2011 Amateur Radio Operator of the Year award to Jim Rogers, N5VGQ, for his faithful service to LETARC year after year after year. Jim, who is on the right, has served as Communications Director for LETARC for several years where he has helped to keep our repeaters working well. This year, Jim has arranged for the installation of the new repeater [provided by Richard Brown, K5RRB, at cost], installed the Longview D-Star Hotspot and has been instrumental in the cooperative venture with the East Texas D-Star Association. The Association installed a ICOM D-Star repeater on the DPS Tower in south Tyler. Our area is now well served with repeaters intended to meet most aspects of VHF/UHF repeater operations.

December 17, 2011 Meeting

Thanks to the following people who made 2011 a success!

- ✓ **Gary Lewis** for organizing ARES and GCEC
- ✓ **Jim Rogers** for consistent work on behalf of LETARC
- ✓ **Jim Quinn** and **Priscilla Quinn** for their willingness to help with many projects and event participation
- ✓ **Richard Brown** for coordinating Field Day 2011 – Great improvement!
- ✓ **Jim Quinn, Cloys Tolbert, Jim Rogers Terry Griffith** and **Todd Hoover** for working as Net Control
- ✓ **Terry Johnson** for consistent and extensive volunteer work on several projects
- ✓ Thanks to all who volunteered to work **Field Day 2011** – great job!
- ✓ Thanks to those who helped put on the first **East Texas Regional Tailgate Sale** – outstanding help!

Our Program Presenters this year:
Welden Pittman, KC5GQM
Tom Wilbeck, N5KGN
Gary Lewis, WG5L
John Keith, W5BWC
Gary Newman, N5XPD
Jim Rogers, N5VGQ and
Todd Hoover, N5TJH
Shreveport D-Star Team –
Mike McCrury & Mark Robinson

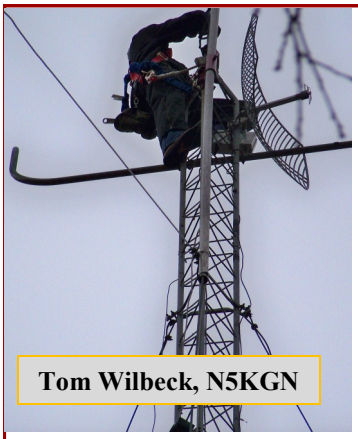
Our ARRL Volunteer Examination Team:
- ➢ Rod Bartlett - N8QVR - Extra Class (VE Team Liaison to ARRL VEC)
  - Terry Johnson - KG5WO - Extra Class
  - Gary Lewis - WG5L - Extra Class
  - Phillip Mullins - AE5KE - Extra Class
  - Jim Quinn- AA5CX Extra Class
  - Jim Quinn - AJ1MQ Extra Class
  - Priscilla Quinn – AA5PQ - Extra Class
  - Cloys Tolbert - K5CGT - Extra Class
  - Tom Wilbeck - N5KGN - Extra Class

Prior to the elections of the new officers, a 30 minute Powerpoint slide program was presented showing the accomplishments by the 2011 members of the Longview East Texas Amateur Radio Club! Among the opening slides is the list of people who participated this year.

You can download your own copy to see all of the events from this past year! It is worth your time see :

LETARC.ORG

New Repeater Installed and Working



Tom Wilbeck, N5KGN

As of this week, the new LETARC 147.34 repeater is now working. Several people were engaged in this process most notably, the leadership of the new **2012 LETARC Board of Directors**. Specifically, those in attendance: **Tom Wilbeck**, Rod Bartlett, **Gary Lewis**, Van Bullock, Dean Patterson, **Jim Rogers**, Paul Piccola, Erik Sandvik, Jim Quinn the Younger, Tim O'Sullivan, Tom Nance… Priscilla Quinn we were told was out in the car… Van's daughter, Jim R.'s granddaughter, Van's dog Sparky…

Thanks to BP America for the funding to purchase the new repeater with assistance from Erik Sandvik and Rod Bartlett.

Thanks to Van Bullock, K5VAB, for the use of his tower!!! And, thanks to Tom Nance and Tim O'Sullivan for their photos! See **LETARC.ORG** for a more detailed description of the work of our Amateur Radio Operators!

From the Desk of …..

Ah…the Tuner!

Tom Wilbeck, N5KGN

Introduction

There are endless myths and superstitions about the use of impedance matching networks with antenna systems. I will discuss the matching network commonly known at the "antenna tuner" or "transmatch". Contrary to what many will say, they are an invaluable tool that will broaden your operating capacity without adding a plethora of different antennas to your landscape.

You may hear such things said as, "a tuner just fools the transmitter", or "all your power will be lost in the tuner". These sayings come from those who haven't looked at authoritative sources that explain how the tuner actually performs its work, and what happens in the "antenna system" after having been matched to the transmitter.

What is a Tuner?

As stated above, a transmatch is an impedance matching device. It accomplishes this by adding capacitance or inductance to the "antenna system" to balance the unwanted part. Remember that the ideal load for a transmitter will appear to be a purely resistive load, with no capacitive or inductive component. As we rarely see the ideal load, we will have both components, and one in excess of what we desire. The load we are discussing here is an "antenna system", both the antenna and the feedline. The transmitter does not see them as separate things, just one system.

When the capacitive component is in excess, it can be cancelled out by adding an additional inductive component, and vice versa. To the transmitter, this appears to lengthen or shorten the antenna. Therefore the transmitter can be matched to the antenna system this way. Without this match, you can never have maximum power transfer from the transmitter to the antenna. With solid-state rigs, the transmitter power amplifier will likely "fold-back" and not deliver the full output, in order to protect the delicate power amplifier transistors or module.

Another trouble is the power loss in the feedline from high Standing Wave Ratio. Back when Amateurs used open-wire feedlines, this wasn't a major problem. The open-wire loss was so low that at HF frequencies, even with high SWR, the loss was minimal. When amateurs began to use coaxial cables, it became more critical. Unfortunately at about the same time, the inexpensive SWR bridge became available. Now hams could see their SWR and begin to worry about it.

What Benefit Can We Get From Tuners?

If you have worked with antennas much, you have at some point had this happen to you. You try to tune an antenna to resonance while it is connected to a feedline that will not be the one that will be used with when placed in its final position. Prune and trim as you might, when the antenna is connected to the other feedline, everything seems to change! That is because your "antenna system" has changed.

Should we worry about making our antennas the exact electrical wavelength of a particular frequency? Not such a big deal if you use a tuner and, do you only operate at one frequency? Cut the feedline to some wavelength multiple? Not hardly! Keep reading!

From the Desk of …..

If you've heard "old-time" hams tell of "loading up a set of bedsprings" or "working Europe on a barbed wire fence", they likely weren't exaggerating. It can be done but the secret is a good matching network between the transmitter and the load…a tuner! Sure bedsprings and fence wire may not be a sufficient elevation to ensure optimum "launch angle" for ultra efficient signal propagation, but it can work. The main thing is that you have to have your transmitter delivering full power output to the load…whatever it may be.

In most reference materials for use by hams, there is a "line loss chart", or at least some formulas, for calculating feedline loss due to SWR. If you examine one of these charts closely, you will find one rather surprising fact. Up to about 3:1 SWR, the loss increase is likely not significant! Here is an example from one of the charts: Take a typical RG8 coax with a published loss figure of 0.6dB per 100 ft. @ 30MHz. Let's say you are running the full 100 ft., from your shack to the top of a tower. With a perfect 1:1 match, you would see 0.6dB loss of signal by the time it radiates from the antenna. This would be an output power of about 85W at the antenna terminal. Now with an SWR of 3:1, the chart says that you would add 0.3dB of loss to the nominal loss of the cable. Your loss would then be 0.9dB, which would result in an output power of between 77W and 79W. Not a big difference. It wouldn't reflect a detectable decrease on a receiving station's S meter. This does not necessarily apply to VHF and above, as feedline losses increase with an increase in frequency.

Unfortunately though, your solid state final amplifier will probably refuse to put out the full 100W at a 3:1 SWR. This is where the statement, "a tuner just fools the transmitter", is partly true. Properly tuned at the output, the transmitter happily generates the full output power it was designed for. It isn't straining to push the power through an impedance mismatch, which is what causes the damage in an unmatched final amplifier stage.

Additional Benefits

Tuners also perform a couple of other miracles. First, they act to "re-reflect" reflected waves in the feedline and put them in phase with the forward power. This adds them together. One unfortunate myth in this area is that reflected power always subtracts from the forward power. For instance, you have a forward and reflected reading wattmeter in your HF radio system. When you transmit, you see 100W forward and 30W reflected. Some would tell you that this means that you are only delivering 70W to the antenna. Not true with a transmatch properly matching your transmitter to your antenna system. The matching network will, within four cycles, synchronize the phase of the reflected energy and the forward energy. Then one reinforces the other. Then, there will only be the loss in the tuning circuitry of the tuner and the loss in the feedline. This will be much lower than the 30W originally believed to be lost. The amount of loss will depend upon the "Q", or quality factor of the components in the tuner, and the nominal feedline loss.

Consider the following remarkable statement. "Although the primary purpose of a Transmatch (matching network between a transmitter and the feed line) is to provide the transmitter with a proper load impedance, some Transmatches attenuate harmonic energy by as much as 30dB or more.", *Radio Frequency Interference* - Fourth Edition, American Radio Relay League, Inc., 1987. Wow! Our tuner serves as a bandpass filter to boot! It is a tuned circuit, tuned to pass our desired frequency, and will exclude unwanted frequencies.

Types and characteristics

You may be saying, "Aw heck, I already have a tuner built in to my rig." Well, that's good, but the tuning range of the average "built-in" tuner isn't nearly as wide as most separate tuners. Take, for instance, the Kenwood TS-570 solid-state HF rig. The tuning range of the "built-in" tuner is 6 - 150 ohms. My old Yaesu rig boasts an auto tuning range of 20 - 150 ohms. Let's see what adding a transmatch gives you. An LDG KT-100 automatic tuner will match 4 - 800 ohms, a considerably wider range. An MFJ-993 automatic antenna tuner gives a matching range of 6 - 1600 ohms. While there are no published specs on an MFJ-969 roller-inductor tuner, I estimate it is somewhere around 5 - 3000 ohms. A Palstar AT4K tuner gives a tuning range of 8 - 2000 ohms.

From the Desk of …..

Caveats

There are some odd combinations of antenna, feedline and transmitter impedance that a given tuner cannot match. In my experience of ten years using tuners, I have only found two. One was with a 75 Meter dipole and about 125 ft of RG-213 coax used at 40 Meters. I lengthened the dipole one foot on each end and then the tuner would happily match the antenna system to entire 40 Meter band. In some high SWR conditions, internal arcing can occur in the tuner. Usually it happens across the tuning capacitors. Once the caps have arced, they may be damaged enough to need repair or replacement. Careful adjustment and an alert ear can avoid serious damage.

Basic Catagories of Antenna Tuners

First, there are the manual tuners. They are mechanically and electrically simple. Usually a "T" network of inductors and capacitors. They come in many different power ratings, so anyone can find one that does not sacrifice space for needs, from QRP to QRO. Some include accessories, like built-in baluns, meters, and dummy loads.

Then there are the automatic tuners. Most have a matrix of inductors and capacitors and use relays to switch in the combination needed for a match. Other auto tuners use variable inductors and capacitors, driven by electric motors. They have circuitry to detect reflected power and calculate what configuration is necessary to neutralize the mismatch. Most of these tuners do not incorporate the accessories mentioned above.

Last are the remote tuners. They can be either manual or automatic, but mount at a remote location. Some can be mounted at the antenna feedpoint and operated from the operating desk or table. The tuning mechanisms are just like the tuners mentioned in the preceding two paragraphs.

Conclusion

There is no reason to fear the tuner. While a manual tuner requires learning the skills to operate it, there are several automatic antenna tuners that do a fair job of impedance matching over a wide range of impedances. Therefore, consider what a tuner can do for your station. It can offer an impedance match that will allow the maximum power transfer at the frequency of choice with a given antenna. It will allow you to work more bands, or a wider portion of a given band without changing antennas, or the configuration of an antenna. It will serve as a band-pass filter to strip off some harmonic energy from your signal.

Even at high SWR levels, as long as the transmitter sees an impedance that it likes, the SWR induced loss in the coaxial cable is insignificant.

References and awfully good reading!

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"The Imperfect Antenna System and How It Works", QST July 1979, Gibilisco W1GV
"Match or Not To Match?", QST Sept 1958, Beers W2AWH
"Antennas and Transmatches", QST Oct 1964, McCoy W1ICP
"What Does Your SWR Cost You?", QST Jan 1979, Gibilisco W1GV
"My Feedline Tunes My Antenna!", QST March 1956, Goodman W1DX
The ARRL Antenna Book, Various Editions, American Radio Relay League
Reflections II, 2001, M. Walter Maxwell W2DU
The Easy Way, HF Antenna Systems, 1984, J. M, Haerle WB5IIR

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