The Static

An evolving publication of the Hill Country Amateur Radio Club

…and now a word from the non-prez.

Well, it just will not happen this month so I'll take this chance to go on an editorial rant. We have a really first rate club with a high degree of member involvement, In order to provide the number of services that we do. We have a regular monthly meeting with interesting main topics. The Tech corner before the meeting requires someone to select a topic and present it. People come early and stay late. During the past year, in addition to our regular Monday evening 2 meter net we have added a Skywarn net, and have a number of Skywarn trained observers. We have some members checking into the 2 meter net via Echolink. We have added Technician training classes through Club Ed that has brought new hams to the hobby and the club. We offer quarterly VE sessions and always have Volunteer Examiners on hand to conduct the sessions. We had a successful field day during which 25 members showed up to erect antennas the day before. We operated five stations, all of which were fully staffed and planning for Field Day 2013 is underway. We tried a 10 meter net for new hams that did not work out all that well because of propagation problems so were are starting a 40 meter net which seems more promising. We have a Wednesday morning coffee that is attended by 12 to 18 members and some of the wives gather in an adjacent room. Eight to 12 folks meet for breakfast at 7 a.m. at Acapulco Restaurant every Saturday Morning. We have an active group of Elmers who will come to your QTH to help you get set up, erect antennas, get you connected to the digital modes or other tasks. Chances are that if you want to do something in ham radio, as long as it is legal, you can find someone to help you with it. Does this have the earmarks of a great club?

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Kudos to Bill Tynan, W3XO

The Radio Club of America announced this week that William A. Tynan, W3XO, is the recipient of its 2012 Barry Goldwater Amateur Radio Award. The award recognizes Bill's lifelong service to the public through amateur radio. It will be presented at the club's annual

awards banquet in New York on November 16th. ARRL CEO David Sumner, K1ZZ, like Bill a club Fellow, will be the keynote speaker.

Bill, one of AMSAT's charter members, is a past President and Chairman of the Board. For many years, he conducted QST's monthly column, "The World Above 50 MHz" He is also a past President of the Central States VHF Society. Bill played a key role in the origination of amateur radio from the Space Shuttle and the International Space Station.

The Radio Club of America, founded in 1909, is the world's oldest radio communications association. For more information, see www.radioclubofamerica.org.

Congratulations, Bill!

73 Ray W2RS
(Fellow, RCA)

Weather, it's something we all talk about, comment on, complain about and use for a conversation ice-breaker. If you have even a passing interest in this topic you can take a nine lesson non-credit, no cost course on weather from the National Weather Service. Here is the website:
http://www.srh.noaa.gov/jetstream/synoptic/synoptic_intro.htm

High-Temperature Superconductivity Induced in a Semiconductor With Scotch Tape

ScienceDaily (Sep. 11, 2012) — An international team led by University of Toronto physicists has developed a simple new technique using Scotch poster tape that has enabled them to induce high-temperature superconductivity in a semiconductor for the first time. The method paves the way for novel new devices that could be used in quantum computing and to improve energy efficiency.

"Who would have thought simply sticking things together can generate entirely new effects?" said team leader and U of T physicist Ken Burch. High-temperature superconductors are materials that conduct electricity without heating up and losing energy at liquid nitrogen temperatures. They are currently in use for transmitting electricity with low loss and as the building blocks of the next generation of devices (quantum computers). However, only certain compounds of iron, copper and oxygen -- or cuprates -- reveal high-temperature superconducting properties. Cuprates were believed to be impossible to incorporate with semi-conductors, and so their real-world use has been severely limited as has the exploration of new effects they may generate. For example, observing the phenomenon of the proximity effect -- wherein the superconductivity in one material generates superconductivity in an otherwise normal semi-conductor -- has been difficult because the fundamental quantum mechanics require the materials to be in nearly perfect contact.

That's where the poster tape comes in. "Typically, junctions between semi-conductors and superconductors were made by complex material growth procedures and fabricating devices with features smaller than a human hair," explains Burch. "However the cuprates have a completely different structure and complex chemical make-up that simply can't be incorporated with a normal semiconductor."
So instead, the team used Scotch poster tape and glass slides to place high-temperature superconductors in proximity with a special type of semi-conductor known as a topological insulator. Topological insulators have captured world-wide attention from scientists because they behave like semi-conductors in the bulk, but are very metallic at the surface. The result was induced superconductivity in these novel semi-conductors: a physics first.
The U of T team members include Kenneth S. Burch, Alex Hayat, Parisa Zareapour, Shu Yang F. Zhao, Michael Kreshchuk, Achint Jain. All are members of the Department of Physics and Institute for Optical Sciences and Alex Hayat who holds an additional appointment with U of T's Centre for Quantum Information and Quantum Control. Other scientists collaborating on the project are: Sang-Wook Cheong, Daniel C. Kwok and Nara Lee of Rutgers University, G.D. Gu, Ahijun Xu and Zhijun Xu of Brookhaven National Laboratory and Robert Cava of Princeton.
The work, published in Nature Communications, was supported by the Natural Sciences and Engineering Research Council of Canada, the Canadian Foundation for Innovation, the Ontario Ministry for Innovation and the National Science Foundation.

September was National Preparedness Month so this might be a good time to review your family emergency plans. Below are some links to assist you in this process.

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http://www.ready.gov/sites/default/files/documents/files/familyemergencyplan.pdf

http://www.ready.gov/sites/default/files/documents/files/checklist3.pdf

http://www.ready.gov/sites/default/files/documents/files/R3_3panel_ReadyBrochure.pdf

http://www.ready.gov/be-informed

The LDS Church has a large body of literature on emergency preparedness and here is a good place to start:

http://www.scribd.com/doc/2675141/LDS-Emergencydisaster-Preparedness

What Every Ham Should Know Part 2

This month we're going to take a look at transmission lines. You have many choices of what to use and some of these choices influence the location of

your station and the location of your antenna, common choices plus numerous unusual options. There are three. We'll review the advantages and disadvantages of each. But first we need to understand how a transmission line works.

The radio frequency power is carried in the electromagnetic fields. The fields, magnetic and electric, exist between and around the transmission line conductors. If we use a lossy dielectric where the electric field exists, we will lose power in the dielectric. If we have electrical conductors in the fields, power will couple into these conductors and will be lost to the transmission line. If we have a physical discontinuity in the transmission line, the fields will change in the vicinity of the discontinuity and the losses will increase. A sharp bend or a splice are two examples of discontinuities. Of course, if the transmission line conductors have high resistance, there will be losses due to the resistance.

The reason that discontinuities are a problem with transmission lines is because of the electromagnetic fields which are present in the transmission line. As I said earlier, the RF power is carried by the fields. The electromagnetic fields in a transmission line are described by a mode number. The lowest loss mode is the lowest order mode that the line will support. For multiple conductor lines such as coax and parallel conductor line the lowest order mode is called TEM for transverse electric magnetic. In the TEM mode, the fields are transverse to the direction of propagation and there are no fields along the direction of propagation. The other modes are TE_{jk} TM_{lm} where j,k,l, and m are integers. For these modes there are either magnetic or electric fields in the direction of propagation. When the TEM wave meets a discontinuity, higher order TE and TM modes are created. Some of these modes may radiate and all will produce excess losses. That is the problem with discontinuities,

The first type of transmission line is coaxial cable. Coaxial cable is actually the newest type. It came into its own in WW II. If you look at ARRL handbooks from the 30's, you won't see coax, all you will see is open wire line. Hams didn't start using coax until it became affordable in the 50's. For coaxial cable, the impedance of the cable is determined by the ratio of the inside diameter of the outer conductor to the outside diameter of the inner conductor and the dielectric constant of the insulator between the two conductors. The outer conductor is a cylindrical tube and the inner conductor is usually a wire but could also be a smaller tube. Typical coaxial cable impedances are 50 and 75 Ohms although other values are possible between 50 and 100Ohms.The electromagnetic fields are confined to the region between the outer and inner conductors.

The advantages of coax are it is mechanically very rugged, its impedance matches the impedances commonly used and the fields are confined to the cable. Coax can be buried. It can be run in walls and attics. It is generally weatherproof and its impedance doesn't change in the rain. It can be run next to other conductors. It has one major disadvantage; it has more loss than other transmission lines although this loss is not a factor at HF. It also has lower power handling capacity but for hams at HF this is not a serious problem. You should also run coax at a low SWR. Coax cable gives you the most freedom in where you locate your station and antenna and how you run the transmission line between the two.

The second type of transmission line is parallel conductor line which is called open wire line, ladder line, window line, or twin lead depending on how it is constructed. The impedance of the line is determined by the ratio of the separation between the conductors to the diameter of the conductors and the dielectric constant of the insulator between the conductors. Open wire line and ladder line are the same thing. It consists of two parallel wires separated by periodic insulating bars. The bars before the 60's were usually ceramic or wood. Modern open wire line uses plastic insulators. Window line used a solid plastic web with rectangular cutouts to separate the parallel wires. In window line the wires are insulated. Twin lead has a solid plastic web between the two wires. Typical impedances are 400 to 600 Ohms for open wire line, 300 Ohms for window line, and 75 to 300 Ohms for twin lead. Parallel conductor transmission line is inherently balanced unlike coaxial cable which is inherently unbalanced.

Open wire line has two big advantages, first it is very low loss if properly installed and second it is high impedance balanced line if that is what your antenna desires. Its disadvantages are it is very fussy about installation, it doesn't like rain (not that it rains here in the hill country of Texas!) and its impedance doesn't match the unbalanced low output impedance of virtually every modern XCVR.

Let's look at the installation requirements. In open wire line, the electric and magnetic fields aren't confined to the transmission line like they are in coax cable. With open wire line there are fields around each conductor. At large distances from the line these fields cancel each other and there is no appreciable field there. Large distances depend on the wavelength and the spacing between the parallel conductors. For typical lines, this is several times the spacing between the conductors. For HF open wire line with a spacing of 4-6"this distance is about a foot. You have to keep the open wire line about a foot from any conductors or lossy material. You should twist the line every few feet

to preserve its balance. You can't clip it to the side of your house and drape it across your roof like you can with coax. As you can see, for open wire line, you can't just drill a 1"hole in the shack wall and run the open wire line through it and then along the baseboard to your transmitter.

How did the old timers do it? Well, open wire line was all they had to work with and they learned how to work with it. The entry to the shack was often two large ceramic feedthrough insulators spaced the line spacing apart. A short length of open wire line went from the feedthroughs to the antenna matching unit and/or transmitter. Many transmitters were designed for high impedance balanced output. We could still do it that way but it is inconvenient compared to coax. How can you do it now? I believe most people using open wire line successfully have a 4:1 balun outside at some convenient location to convert the high impedance balanced open wire line to low impedance coaxial cable which is what they bring into their radio shack.

When you are thinking about where you will put your station, you should keep in mind that you will have to bring a transmission line from your antenna into your shack. If you want to use parallel conductor line rather than coax be sure you know how you are going to route the transmission line from the antenna and into your shack. If you are using coax, you have a lot more freedom although you probably will want to minimize the length of the coax.

There are several additional transmission lines around although they are seldom used by amateurs and rarely used at HF. Waveguide is one used at the higher microwave frequencies. Typical waveguide has a cross section of approximately a half wavelength by a quarter wavelength. You won't be seeing any 80 meter waveguide! There is a type of transmission line used at UHF called Goubau line or simply G-Line. It consists of a single wire surrounded by an insulator. The electromagnetic fields are primarily in the insulator and the surrounding air. It is a low loss line but it has to be straight. Any curve no matter how large the radius adds loss. There are numerous special coaxial cables.

Andrews make a series of large coax with corrugated copper tube inner and outer conductors and dielectric disks to keep the inner conductor in the center of the outer conductor. These cables have been assigned RG numbers (as has the various waveguides). Coax cable is also made for VHF and UHF with an aluminum outer conductor and an aluminum or copper wire inner conductor. The dielectric is generally the same kinds of plastic and foam dielectrics used with normal coax. Cable TV is especially fond of these solid aluminum coax cables. As you might imagine, these cables are semi-flexible at best. I

believe the ‘semi’ refers to the fact that you need a big truck to bend the cable.

There are also unusual varieties of parallel conductor line. One is a twisted pair inside a braid shield. This cable as a characteristic impedance of 150 Ohm and is primarily used at MF and HF. Both the SP-600 Super Pro and the R390/R390A have a 150 Ohm balanced input as their primary antenna input. Naturally, there are standard military connectors for this cable which look like a PL-259 except they have two inner conductor pins. There are also parallel conductor lines which have more than 2 conductors. 4 conductors are frequently seen and 6 and 8 conductor lines aren’t unknown. Their main feature is power handling capability. If you have a couple hundred kilowatts, they are what you need!

Now a word on power ratings. The limitation on power for solid dielectric cables is primarily the power level at which the line losses are high enough that the dielectric between the outer conductor and inner conductor starts to soften. There is actually a temperature rating for coax. Hams almost always have low temperature cable. It is limited to about 100° C. Foam dielectric cable actually is more sensitive to heat than solid dielectric cable. High temperature cable uses special plastic for its dielectric. Teflon is often used. High temperature cable is quite expensive, several dollars/foot, but its maximum temperature of 200-250° permits a power rating several times higher. With 100 W at HF it doesn’t matter. At VHF and UHF it becomes important. I melted some RG-59/U with about 300 W at 2 meters when I was still in high school. RG-11/U, the half inch diameter equivalent solved the problem.

Parallel conductor lines are mainly limited by the voltage breakdown between the lines. As long as its not raining or you haven’t let a conductor get too close to the conductors, you can probably run illegal amounts of power through parallel conductor line!

That brings transmission lines to an end. My recommendation is coax because of the freedom it gives you in installation and its mechanical ruggedness. And of the many varieties of coax around, my choice is RG-213/U which is a solid dielectric, double shielded, half inch cable that uses standard UHF and N-series connectors. It is hard to beat for MF ad HF applications.

Next month we will take a look at antennas, types and where to install. Until then, 73,

Kerry

In the meantime, if you are looking for an antenna to build, try checking out the following site. It is pretty straight forward and not very technical.

http://www.hamuniverse.com/provenantennasbook.html

The following is from **QST** Magazine, November 1966. Thanks to Fred Gilmore for sending it .

A little black box of jewels and rocks with lanterns that flicker and glow.

Make lighter the gloom in my little back room, where often I haste to go.

An anthem it peals of whistles and squeals And voices so ghostly and queer,

That you'd never decry, should you chance to pass by, what a brotherhood foregathers here.

Each separate tone has a soul of its own; each voice is the voice of a friend,

United through space in this gathering place, at the radiant rainbow's end.

Reverberant sounds ride the wave that rebounds, like the waves of the sea from afar,

Reporting the doings, the comings and goings of brothers, wherever they are.,

A curious band, spread over the land yet joined from equator to poles,

Disperses the gloom in each little back room by this magic communion of souls.

I could part with the lot of the things that I've got, but I'll carry my love to the tomb,

Of that little black box and the joys it unlocks

When I enter that little back room..

Next month's Static is already started. Be sure to see Kerry Sandstrom's article on antennas. Until then 73

Bob, K5YB