The PROPAGATOR

August, 2002

The Monthly Newsletter of South Orange Amateur Radio Association

RF Safety Topic of Talk

All life on Earth has adapted to survive in an environment of weak, natural low-frequency electromagnetic fields (in addition to the Earth's static geomagnetic field). Natural low-frequency EM fields come from two main sources: the sun, and thunderstorm activity. But in the last 100 years, man-made fields at much higher intensities and with a very different spectral distribution have altered this natural EM background in ways that are not yet fully understood. Much more research is needed to assess the biological effects of electromagnetic radiation (EMR).

Although Amateur Radio is basically a safe activity, in recent years there has been considerable discussion and concern about the possible hazards of EMR, including both RF energy and power frequency (60 Hz) electromagnetic fields. The presentation will consist of a 20 minute videotape entitled, ***Electromagnetic Environment Awareness For Antenna Site Safety***, followed by a presentation on RF safety considerations that Hams need to be aware of.

Art Sutorus, KQ6HF, will present a review of RF safety for Amateur Radio Operators at Monday's meeting. Art is acting ARRL Orange Section Manager and the current ARRL Orange Section Technical Coordinator. In addition to his amateur radio activities, his interests include: Hiking, Camping, Fishing, Traveling, Computers, Astronomy, Church and Community Service Volunteer

New Members

A hearty welcome to SOARA's newest members:

Joe Lopez	W6BGR
Robin Whaling	KG6MCA
Lucia Aguilar	KG6LNY

Picnic Report

Another SOARA picnic has come and gone. Saturday, August 3, 2002 at Baby Beach in Dana Point Harbor club members met and had fun in the sun. It was a beautiful summer day and the breeze from the ocean made the temperature quite pleasent.

Thanks to Ray, AE6H, who arrived early in the morning to ensure that we had our usual site. Ray also brought an HF radio and battery. The station operated through the day using the call K6SOA, and made several contacts.

Steve, KR6CE, ensured that there were plenty of hot dogs and hamburgers for all. He even cooked them to order. Club members brought salads and deserts, and the club provided soft drinks. It was everything a picnic should be. — except — I didn't see any ants! Where did we go wrong.

A big thank you is extended to all who helped make this year's picnic a success. We look forward to seeing you all at the event next year. □

Class Notes

An Entry level (Tech - no code) Amateur Radio License class will be offered by SOARA starting in September. The class will run for ten weeks including a test session at the final meeting. Casses will meet at 7:00 p.m. on Thursdays at the Mission Viejo Community Center, 26932 Veterans Way.

Anyone interested in volunteering to aid in the teaching of this class should contact Mike, KF6HVO, via e-mail [*kf6hva@soara.org*]. Please pass along the class information to any perspective hams who might benefit. □

Show & Tell Night

John Spencer, K7KF, who was scheduled to speak on a contest station he assembled in the 80's had to cancel due to work. SOARQ's resourceful leadership quickly sent out an e-mail call for members who would share some aspect of the hobby at the meeting.

Several members volunteered to make brief presentations. Attendance was high and the brief speakers were well received.

Jim Richards, K6VDH, spoke on the telegraph keys he fabricates and sells. He had samples to show.

Paul Robert, ND6Q, demonstrated some of the features of the new Yeasu VX7-R.

Mitchel Knight, KB6IIG, demonstrated the features of the Kenwood TH-F6A tri-band HT.

Jim Yetter, K6LIO, showed an inexpensive portable antenna support based on a fishing pole.

Brian Roode, KA6CCF, showed a QRP kit, the Elecraft K1 which he has just finished assembling.

Ray Hutchinson, AE6H, explained the features of a portable clock synchronized to WWV.

Dale Griffith, W8RRV, demonstrated the puzzle feature from last month's newsletter.

Steve Perluss, KR6CE, explained how the "Air-mail" program is used to send and receive e-mail in remote locations. □

The Way I See It:

Understanding Radio Theory Without Math.

In this column, last month we looked at the behavior of a non-resonant antenna. The antenna was connected to a transmitter through a tuner and a transmission line. Since the (non-resonant) antenna doesn't match the transmission line, some of the power delivered by the transmission line will be reflected. The antenna tuner was set to reflect back all of the power returned from the antenna. There is nothing wrong with that analysis, but it can be misleading to think simply in terms of power being reflected.

The simple point of view is (1) that power is reflected at any point where the impedance changes, and (2) that the reflection is a function of the termination of the line. At times this approach is adequate, but that is not always the case. Before going into a better view of what goes on, let's review what we know about transmission lines.

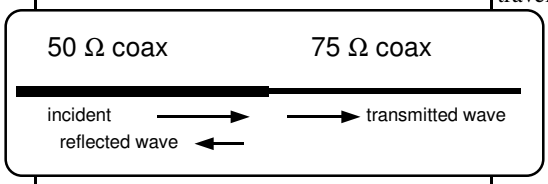
A transmission line has a characteristic impedance. The characteristic impedance tells us the ratio of voltage to current for a wave propagating along the line. A transmission line has a characteristic called the velocity factor which tells us how fast a wave propagate along the line.

We have not tried to go into why a transmission line has a characteristic impedance (See chapter 24 of *The ARRL Antenna Book*). Remember that what that characteristic impedance tells you is the ratio of voltage to current.

Now lets get down to some interesting cases. If we join two runs of coax which have different characteristic impedances, what will happen at the junction between the two pieces of coax?

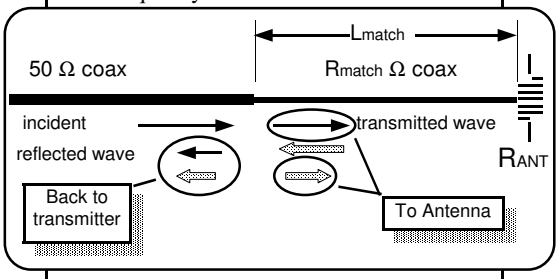
Consider a run of 50 Ω coax (to the left) joined to a run of 75 Ω coax (to the right) and a wave traveling from left to right. I think some numbers will make this easier to follow. I like to pick easy numbers so I don't wear out my calculator — we will have the voltage of the incident wave be 75 volts. The current comes out to be 1½ amps. When the wave reaches the junction between the two coax runs, we have to satisfy several conditions. In the 50 Ω coax, the voltage to current ratio has to be 50 volts/amp, and in 75 Ω coax, the ratio must be 75 volts/amp. At the junction the voltages must be equal (obvious) and the currents have to be equal! To satisfy this last requirement we have to dispose of the excess current in the 50 Ω coax. We must have ½ amp of current return (i.e. reflected) back along the 50 Ω coax. This cancels that much current at the junction point.

Just looking at the simple requirements stated above we see that no matter what is connected to the second run of coax there is a reflection of current and/or voltage at the point of mismatch.



Let us move on to a case that is not so simple but much more interesting. You are probably aware that it is possible to achieve a match to an otherwise unmatched antenna using a run of coax of the proper length and impedance. If you had a piece of transmission line whose characteristic impedance and length you could conveniently change, you could use it in place of your antenna tuner. Well you will have to be content using that technique for single band antenna matching.

Suppose that we have an antenna used for a fixed frequency transmitter and it does not match our 50 Ω transmitter and coax. We can achieve a perfect match by inserting the proper length of a coax (not 50 Ω) between the feedline and the antenna. Remember that a perfect match means that no power is returned to the transmitter, it is all radiated by the antenna. (Still assuming loss free components!)



In the case of using a length of transmission line to match an antenna, the situation gets a bit more complex. We have already looked at the sort of behavior that takes place at the junction of the two coax lines for the wave from the transmitter. (Remember we are looking at the voltage and current waves).

At the antenna, we will have a reflected wave and a wave that propagates into the antenna. Now we consider the wave reflected from the antenna. It is represented by the gray arrows in the diagram. When this wave arrives at the junction of the two coax runs, it also results in a reflected and a transmitted wave. What we really care about are the two waves traveling toward the transmitter. We select the impedance of the matching section to give us equal voltage (current) in these two waves. We select the length to give us opposite phases in these two waves. Thus the two voltage (current) waves cancel and no wave (and no power) travels back toward the transmitter. All of the power must go to the antenna where it is radiated. This is the mechanism behind matching the coax lines to an antenna. It is easier to see in the case of a coax line than for your antenna tuner, but the principle is the same.

Here is a good place to stop and review what we have covered. We have seen that at any and every discontinuity of impedance there is a reflection of the voltage wave and/or the current wave. If it is a simple case of only one reflection (and transmission), then we can immediately (and simply) calculate the power flow, and we are done. If the case is more complex (multiple reflection points), then we have to find the resultant voltages and currents to find the power flow. Granted, the math may get a bit difficult. We have to take into account the phase of the various voltages and currents, but we will get the right answer.

We saw how in a special (and desirable) case the currents canceled in one direction resulting in no power flowing in that direction. Thinking in terms of power reflection would have never brought us to the proper understanding of the situation.

My purpose in going through all of this was not to dazzle you with all of the math (I know, I promised . . .), but to give some insight into how to think about the propagation in a transmission line. □

Year 2002	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
General Meeting 7:00 PM	**28**	**25**	**18**	**15**	**20**	**17**	**15**	**19**	**23**	**21**	**18 Auction**	**No meeting**
Program				DX W6XD	T-hunt W6SQQ	pre Field Day	Show & Tell	RF Safety	LINUX	Contest Station	Auction	
VEC Testing 5:30 PM	**28**	—	**18**	—	**20**	**22**	—	—	**23** Walk-ins	—	**18** Walk-ins	—
Propagator Deadline												
Board Meeting	**2/4**	**3/4**	**25**	**22**	**27**	**24**	**22**	**26**	**30**	**28**	**25**	
ARRL Field Day						**22 - 23**						
SOARA picnic								**3**				
Fall Auction											**18**	
SOARA Holiday Party												**1**

FCC testing available before club meeting in September and November. Call NZ1M.

Available

Jim Dunkley, AB6ZF, has the following items for sale:

~~Butternut Vertical HF11 (180m through 6 meters - all bands ($100).~~ SOLD

~~Cushcraft R3 Vertical ($100)~~

Ameritron Al 811 Amp with extra set of power tubes ($300).

4 element 6 meter Yagi ($50).

7 element 2 meter Yagi ($50).

MFJ249 Frequency/SWR Meter ($50)

Jim can be contacted via e-mail at *ab6zf@soara.org*

or by phone at (949) 951-0371 ☐

A Message from the President

I would like to urge the SOARA membership to take a few minutes to go on record in support of **HR4720**. This is a bill currently working it's way through the U.S. House of Representatives and is titled "The Amateur Radio Emergency Communications Consistency Act". Essentially this bill extends PRB1 type protections to Hams affected by CC&R's and other HOA and deed restrictions. It will make it illegal for a homeowner's association to prohibit all amateur antennas, and require them to make the same "reasonable accommodation" now required of local governments by FCC regulation PRB1.

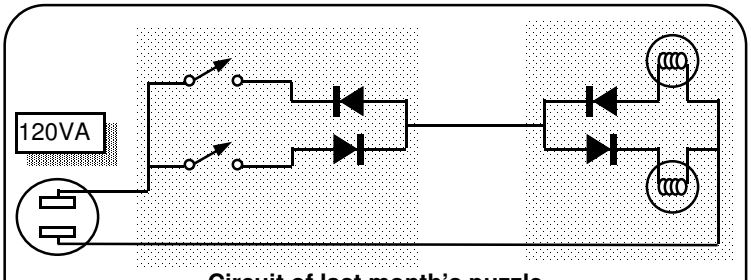
SOARA members can e-mail their comments of support for **HR4720** to Congressman Darrel Issa who represents S. Orange Co. Congressman Issa's office can be easily reached by going to: http://www.house.gov/issa, and then following the links "Write Your Representative" to bring up the e-mail form.

We need to get this important legislation enacted while the recent emergency events and homeland security issues are at the forefront. Please take a few minutes to lend your support to help your fellow hams.

Thanks, and 73 de Ray, AE6H

How do they do that?

Here is is puzzle from the days of vacuum tubes. In a high power amplifier it is important that the filaments are turned on before the plate supply (H.V.). One forgetful chap wired two switches so that when one switch (either one) was turned on power was supplied to the filaments, and when both switches were on power was also supplied to the high voltage plate supply. Thus the power was always applied in the proper sequence no matter which of the two switches he turned on first. How were the switches wired? *Hint: He did not use single pole single throw switches.*



Circuit of last month's puzzle

The two switches in the left box control the individual lamps in the right box. Diodes steer positive and negative half cycles to the proper lamp using only two wires between the boxes.

The PROPAGATOR

South Orange Amateur Radio Association
P.O. Box 2545
Mission Viejo, CA 92690

Address Service Requested

First Class Mail

Meeting: August 19, 2002 at 7:00 PM
Art Sutorus, KQ6HF: RF Safety

☞ **SOARA** meets at the Mission Viejo Community Center, 26932 Veterans Way, Mission Viejo, the third Monday of every month at 7:00 PM. Changes to the meeting time or place are announced in this newsletter and on the two-meter repeater.

☞ **License Exams**: Amateur License Exams are given prior to SOARA meetings every other month. Exams are from 5:30 to 7:30 PM. Walk-ins are welcome. For information call Paul Levey, NZ1M, at 949-249-0121.

☞ **Contacting SOARA:** Questions about SOARA? Send e-mail to: i*nfo@soara.org*, or leave a message at 949-249-1373.

☞ **Web Site:** SOARA maintains a web site with current club information. The URL is: **http://www.soara.org.**

☞ **Repeaters:** The SOARA 2-meter and 70 cm repeaters are open to all licensed hams.

SOARA 2m — 147.645 - (110.9)
SOARA 2m — 145.240 - (110.9)
SOARA 440 — 445.660 - (110.9)

The SOARA 220 and HROC 440 repeaters are shared by members of both clubs. Each machine is subject to the operating rules of its respective club. Call KG6GI for details.

SOARA 220 — 224.100 - (110.9)
SOARA 220 — 224.640 - (123.0)
HROC 440 — 447.180 - (131.8)

☞ **Nets:** SOARA 2 m repeater open net is held Tuesday 8:00 PM
40 meter HF net (7.268 MHz +/- for QRM), Sunday 7:30 AM.
PSK - 31 net (28.120.15, 1000 on waterfall) Friday 7:00 PM.

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