

Foothills Amateur Radio Society

Relay

March 2006 Volume 36, Number 3

March Club Meeting

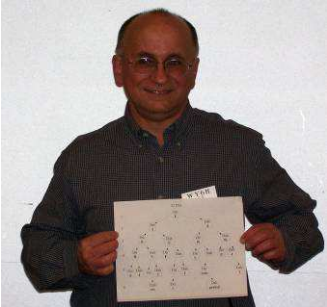
Date: Friday, March 24, 2006.
Time: Socializing at 7 pm, Meeting at 7:30
Place: Covington School, 205 Covington Road, Los Altos
Speaker: Patricia Gibbons, WA6UBE
Topic: "ALE – Not Your Typical Beverage"
Summary: Automatic Link Establishment or ALE is a unique communication protocol whereby radios search frequencies and find each other, and thereby establish connections automatically. Networks can form autonomously out of thin air, with no prior arrangements. ALE was developed for military tactical HF communications, but has become increasingly popular for Amateur Radio communications. WA6UBE will present an overview of the operation and advantages of ALE.

About the Speaker: Patricia Gibbons, WA6UBE, has been a licensed radio amateur since 1964. From 1976 to 2006, she worked in Public Safety land-mobile radio communications and, prior to retirement, was Communications Services Manager with the City of San Jose.

The club offers Anderson Power-pole crimping service, refreshments, and a raffle prize (*Garmin eTrex GPS or Yaesu radio*) at the meeting. Be sure to attend for an enjoyable evening. Don't forget to bring your questions to Dr. Know-it-all.

February Meeting Report

Les Kopari, WY6H, presented a method for learning the Morse Code and addressed problems that we all face as beginners - memorizing the translation table. This table is organized alphabetically for sending code (just look up the letter and send the sound). A receive-oriented organization of the code table was presented that helps with learning the Morse Code. Les presented a lively session as we practiced "Learning Morse Code Verbally."



Les Kopari, WY6H



Brian Egan, KG6YKF

Brian Egan, KG6YKF, won the raffle and took home the Yaesu VX-170 radio. The Wish You Were Here number for Omri Serlin, AA6TA, was chosen. Unfortunately, Omri was not present to claim the prize.

Presidents Corner

Club Meeting. March 24th at 7pm. This month's meeting is "ALE -- Not Your Typical Beverage" with Patricia Gibbons, WA6UBE. This meeting is at our usual location at Covington School, 205 Covington Road in Los Altos.

Am-Tech DAY. The next Amateur Radio Technology Day is scheduled for April 1st at our usual location (Stanford Linear Accelerator Center). Check the FARS web site (www.fars.k6ya.org/) for the latest details and changes. Subscribe to the FARS Announcement list (www.fars.k6ya.org/mail/) to make sure you get an email reminder.

Field Day 2006. It's never too early to start thinking about Field Day. We are in the early stages so here's your chance to help us plan to FARS Field Day this year. I would like to get a few volunteers on board to begin preparing for this year's event. Please contact Phil, KA6MZE, or myself if you can help.

Flea Market. The Electronics Flea Market continues at De Anza College on Saturday April 8th. This one is hosted by the West Valley Amateur Radio Association. Check www.asvaro.org for details and directions.

- de Mikel, KN6QI

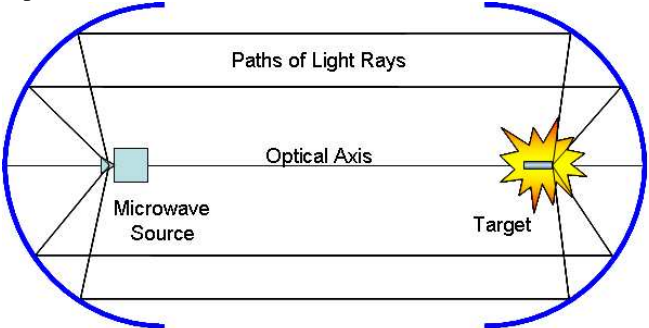
Upcoming Events

- Mar 24 7:00 PM, [Club meeting](#), Covington School
 - Apr 1 8 AM to 9 PM, [AM-Tech day](#), SLAC, 8AM-9PM
 - Apr 6 7:30 PM, Board Mtg at the Los Altos Town Crier
 - Apr 8 [Electronics Flea Market](#), De Anza, 5 am to Noon
 - Apr 28 7:00 PM, [Club meeting](#), Covington School
 - Thursdays 8:00 PM, FARS net, 145.230(-), 100 Hz PL
- See more events, [FARS Calendar](http://www.fars.k6ya.org/events/calendar) <<http://www.fars.k6ya.org/events/calendar>>

Dr. Know-It-All

March 2006

Dear Doctor,
 I am 17 years old and a senior in high school. I am doing a science project for the state science fair, in competition with other schools. The project will use parts from an old microwave oven to show that microwave energy can be beamed through space to heat an object at a distance. Here is a diagram of my setup.



Collimating Mirror #1 (First Dish Antenna) Collimating Mirror #1 (Second Dish Antenna)

My physics teacher is concerned that my project might not be safe to be around. Can you tell me if my project is safe or how to make it safe?

Kirk S., Tombstone High School, Tombstone, Arizona

Answer: The safety question requires doing a maximum permissible exposure (MPE) calculation. We want to calculate the safe distance from a source of microwave energy that has been partially collimated into a beam by a dish reflector. The calculation involves biological and physical aspects. The biological aspect is the determination of a safe power density below which biological tissue damage is believed not to occur. We rely on federal safety standards for this part. The physical aspect is to calculate the distance from the source beyond which the microwave power density is below this safe level. In 1991, the Institute of Electrical and Electronics Engineers (IEEE) set standards for radio frequency (RF) exposure levels after a comprehensive review of the worldwide scientific literature. Subsequently, ANSI and the Federal Communications Commission (FCC) created regulations for maximum permissible exposure (MPE) levels based on the IEEE standard. These federal regulations are currently in effect for all workplace environments and radio, television, cellular and wireless transmitting facilities in the United States.

$$\rho = \frac{P}{4\pi r^2}.$$

Conversely, the distance r at which the power density is ρ is given by

$$r = \sqrt{\frac{P}{4\pi\rho}}.$$

Assuming that an isotropic microwave source radiates $P = 1,000$ watts, then the power density ρ is 16.33 W/m^2 at a distance of

$$r = \sqrt{\frac{P}{4\pi\rho}} = \sqrt{\frac{1,000 \text{ W}}{205.3 \text{ W/m}^2}} = 2.21 \text{ meters}.$$

Similarly, power density $\rho = 81.67 \text{ W/m}^2$ occurs at distance $r = 0.987$ meter. These distances, 0.987 and 2.21 meters, are the safe distances from the microwave source in controlled and uncontrolled environments respectively when the radiation is isotropic or equal in all directions. When the radiation isn't isotropic, the distances must be adjusted upward to account for the gain or directivity of the microwave beam pattern.

For electromagnetic waves of wavelength λ , the directivity D of a dish reflector of diameter d , or area $A = \pi d^2/4$, is given approximately by

$$D = 4\pi \frac{A}{\lambda^2} = \left(\frac{\pi d}{\lambda}\right)^2.$$

At a frequency of 2,450 MHz, the free-space wavelength is found from

$$\lambda = \frac{c}{f} = \frac{299,792,458 \text{ m/s}}{2,450,000,000 \text{ Hz}} = 12.24 \text{ cm},$$

where c is the speed of light. At this wavelength, a dish of diameter $d = 55.88$ cm has a directivity of

$$D = 4\pi \frac{A}{\lambda^2} = \left(\frac{\pi d}{\lambda}\right)^2 = \left(\frac{3.14159 \times 55.88 \text{ cm}}{12.24 \text{ cm}}\right)^2 = 205.8$$

The effect of the dish reflector is to increase the power radiated along the dish's axis by this factor.

Consequently, the safe distances are increased by the square root of 205.8 or 14.35 above those for an isotropic radiator.

The safe distances for controlled and uncontrolled environments respectively are, therefore, 14.2 meters (46.5 feet) and 31.7 meters (104 feet) along the dish axis. To be safe in all directions, these distances should be enforced in all directions: Personnel controlling the radiation source must stay back 47 feet. The general public must be kept back 104 feet.

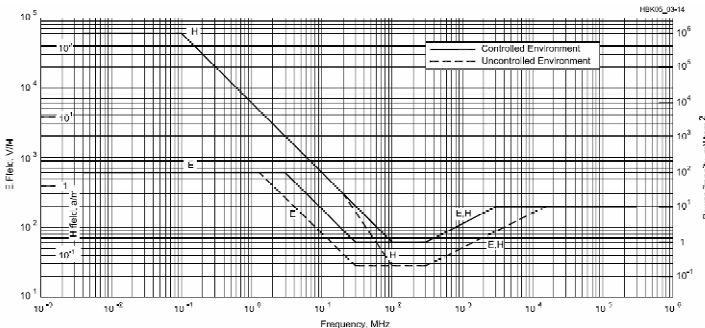
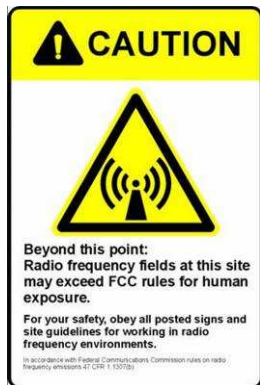
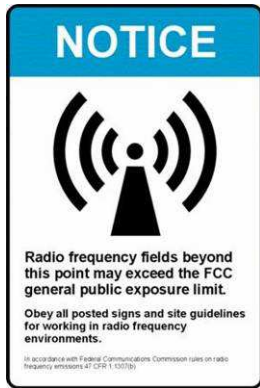


Figure 1. 1991 IEEE C95.1-1999 RF protection guidelines for body exposure of humans.

The safety guideline depends on the frequency of the RF energy as shown in Figure 1. The upper solid line is for “controlled” environments, and the lower dashed line is for “uncontrolled” environments, where a greater safety margin is mandated. At a magnetron frequency of 2,450 MHz, the levels considered safe are respectively 8.167 milliwatts per square centimeter (81.67 W/m^2) in controlled environments and 1.633 milliwatts per square centimeter (16.33 W/m^2) in uncontrolled environments. We will base our distance calculation on these power densities. A radiator of power P is called “isotropic” if it radiates equally in all directions. The surface area of a sphere of radius r is $4\pi r^2$. The power density ρ at distance r is therefore

Notice, Caution, and Warning signs should be posted at these distances: Post blue *Notice* signs at the 104-foot perimeter to mark the uncontrolled exposure area. Post yellow *Caution* signs at the 47-foot perimeter to mark the controlled exposure area. Finally, post orange *Warning* signs inside the 47-foot perimeter to mark the danger zone.



That's it for this month. You can send your comments or questions about any aspect of Amateur Radio to Dr. Know-It-All. Written comments and questions are accepted at the monthly meetings of the Foothills Amateur Radio Society, by email to FARS officers and board members, or through the FARS web site at <http://www.fars.k6ya.org>.

CLUB INFORMATION

President: Mikel Lechner, KN6QI
 Vice President: Steve Stearns, K6OIK
 Treasurer: David Cooper KE6PFF
 Secretary:
 Radio Officer: Phil Hawkins, KA6MZE
 Training Officer: Steve Leander KV6O
 Relay Editor: Mark Hardy, KG6GRR

FARS Board: Dick Baldwinson N6ATD, Robert Flemate KE6TFU, Rob Goodson N2RAG, Ron Green KG6RLG, Kristen McIntyre K6WX, Barbara Neuhauser AE6RM.

Station Trustee: Stan Kuhl, K6MA
 FARS Web Page: <http://www.fars.k6ya.org>
 Download Relay: <http://www.fars.k6ya.org/relay>

Club members and non-members are encouraged to subscribe to the FARS Announcement list by browsing www.fars.k6ya.org/mail, clicking on Subscribe/Unsubscribe and following the instructions under "Subscribing to fars-announce."

You may submit announcements to the FARS Announcement at fars-announce@sypal.org. The list is moderated and messages will be posted as approved by the list moderator.

The FARS board of directors may be reached at fars-board@sypal.org

Club meetings are held at 7 PM on the fourth Friday of each month except January (Winter Banquet); and sometimes there are changes for June (for field day) and Nov. & Dec (for holidays).

Annual club membership is \$20. Club badges are \$6. Visitors are always welcome! Directions in this newsletter. Talk-in: N6NFI (145.23-, 100 Hz) or W6ASH repeater (145.27-, 100 Hz).

FARS *Relay* is the official monthly newsletter of the Foothills Amateur Radio Society. Contributions to the newsletter from members, family, and guests are earnestly solicited! Contributions subject to editing and/or compression. ASCII files via Internet preferred; but all readable forms welcome.

Here is how to reach the editor:
 Mark Hardy, KG6GRR
 Mail: 2998 Jerald Avenue
 Santa Clara, CA 95051
 Voice: 408-243-0701 (Before 9 PM, preferred)
 Email: kg6grr@arrl.net, At FARS meetings.

FARS Membership Form

PLEASE fill out the form for all new/renewal memberships.

FARS 2006 MEMBERSHIP RENEWAL FORM Date: _____

Name(s) & Callsign(s) & Class (E-A-G-T-N-None): _____

Mailing Address: _____

Home phone: _____ Work phone: _____

Fax (H or W?) _____ Packet BBS Address: _____

E-mail: _____ ARRL Exp Date(s): _____

Preferred modes: (e.g. HF-SSB/VHF/QRP/Other): _____

I'm willing to Elmer new hams with: _____

Special topics of interest / suggestions for club meeting speakers:

Dues: \$20 per year, new members add \$6 for badge fee.

Please note: Membership runs from January 1 to December 31.

Send your check payable to FARS, to:

David A. Cooper, KE6PFF
270 Redwood Shores Parkway
PMB 41
Redwood City, CA 94065-1173



How to get to FARS Club meetings (Visitors always welcome)

Meetings are held at the Covington Elementary School (directions below) on the fourth Friday. Socializing at 7 PM with the regular meeting at 7:30 PM. There may be changes in the meeting dates for January, June, November, and December.

DIRECTIONS:

From Interstate 280. take the El Monte exit Northeast. Cross Foothill Expressway. (A) At the first traffic light turn right on Covington. (B) Immediately at the fork take the left street (Covington). Go about 1/10th of a mile. Turn left into the parking lot. The gym is the tall building to your right with red and white stripes.

From Foothill Expwy., take the El Monte exit and go Northeast; then follow directions as above at point (A).

From US101 or El Camino: take San Antonio Road west (to Foothill Expressway). Then follow directions above at point (A).

TALK-IN via the [N6NFI](#) (145.230-; 100Hz PL) repeater or the [W6ASH](#) 145.27- (100Hz PL) repeater.