CVARC Offers a Free Radio to a Lucky Young Ham

CVARC President Rory Eikland announces that the CVARC has authorized an incentive program to young hams (or ham wannabes), 18 years of age and under. Whenever a young person attends a CVARC meeting, they will receive a ticket for a drawing to be held at the end of the year. At the annual CVARC holiday gathering, one lucky youngster will win a brand-new transceiver!

The more meetings attended, the better the chance of winning. The giveaway is also open to non-licensed youngsters, on the condition that they become licensed before being eligible to win the transceiver.

"This is a new way for CVARC to tell young hams we're interested in helping them along and telling them they're not only welcome at our meetings, we want them to know how much we value their energies," Eikland said.

CVARC May Program: Soldering Techniques, and a Practice Session

Our Speaker,Reynold Johnson, is unable to make the meeting tonight so a session on Soldering Techniques, and a practice session for everyone will be given at the Conejo Valley Amateur Radio Club on Thursday, May 8. The meeting will be held at 7:30 pm at the Thousand Oaks Elks Club on Conejo School Road.

CVARC VE Report

By Jeff Reinhardt AA6JR

Results from the CVARC VE session of April 13: The following people earned their Technician license:

Vincent Nolan   Steven Schneider   Hieu Dang   Levon Melik-Avakian.

Eric Oberg KE6MLF received his Extra class.   Robert Waybright KG6QEL earned Element Credits.

FCC License Examinations

By Jeff Reinhardt AA6JR

Next Exam will be on Sunday June 8th.

CVARC hosts FCC License Examinations at 8:30 AM on the second Sunday of even numbered months at the Ventura East County Sheriff Station on Olsen Rd. (near the Reagan Library). CVARC conducts exams for all license classes . Exam candidates must bring a form of government issued photo I.D., the original AND a photocopy of any existing license or Certificate of Exam Element Completion, a Social Security (or government issued Taxpayer I.D.) number, and $12 ARRL VE Exam fee (cash is preferred). No advance reservation is necessary, walk-ins are welcome. Advance notice is needed for special circumstances, such as reading the exam to sight-impaired candidates. If you have any questions, contact CVARC VE Coordinator Jeff Reinhardt at 818-706-3853.

Packet Training Course

Presented By Greg Lane K7SDW

A packet training course is being taught by Greg Lane, K7SDW, in the Community Room at the East County Sheriff's Station on Saturday May 3. The class will be from 8AM to approximately 4PM. A number of packet radio stations will be set up in the Community Room to provide hands on training. This should be a fun day and an excellent opportunity to learn how to operate on packet radio. Those involved in ARES/RACES are encouraged to attend as we have a critical need in ARES/RACES for operators trained in packet communications. Those interested in attending should contact Greg at 805-498-0454 so that Greg will have an idea of how many will be attending. Also, anyone with packet experience that would like to help in the training is encouraged to contact Greg.

Cruisin the Conejo May 10, 2003

By Mike Bass, N7WLC

Cruisin the Conejo is the big event for the Conejo Valley Cyclists. This year is the 19th edition of the bike ride. For bike enthusiasts, this is one of the better bike rides in Southern California. The routes have a good variety of challenges. And the support is very good. From the Boy Scouts manning the rest stops to you the ham radio volunteers helping to coordinate the SAG wagons and keep tabs on the cyclists.

If you would like to be a part of the action, there is a lot you can do to help. We would like to have all of the rest stops (there are 5 stops) staffed with radio support. If you would like to ride along with the SAG wagons, we have about 6 SAG support vehicles on the course. If you like to drive, you can even be a SAG driver. (CVC will reimburse for gas if you drive a SAG wagon.) If you would like to be at a critical place along the route, we can use you to help warn the cyclists as they approach a steep section on Westlake/Decker Canyon or on Potrero Canyon. These places do have accidents and you could get help there much quicker.

So what is in it for you? You get to practice handling real emergency traffic. You get to see some of the great countryside and watch crazy cyclists climb hills no bicycle should go. Most of all CVC treats their volunteers well. They provide a lunch for the volunteers and you get a Cruisin the Conejo t-shirt for helping out.

If you would like to help out, send me an e-mail and tell me what you would like to do and when you can help. The ride hours are from 7:00 AM to 4:00 PM. The first of the SAG wagons will get on the road by 8:00.

Hope to see you at Cruisin!

Mike Bass, N7WLC   n7wlc@vcars.org ;   805-447-1812 (days)   805-493-5714 (evenings)

CQ Field Day, CQ Field Day from Alpha Alpha Six Charlie Victor...

By Tom Stough, W0UFC

Yes, fellow radio ops-- Field Day on June 28-29 is fast approaching. Band captains are still needed. If you're a follower rather than a leader, fear not--we'll need plenty of operators for each station, as well as antenna "setter-uppers" and "taker-downers". If you like to meet and greet non-ham visitors, we'll put you to work publicizing our club and our hobby. So...call me or email me and sign up! You can also sign up in person at the May meeting.

73, Tom Stough, W0UFC
Operations Chair

Understanding Standing Wave Ratios

By Ken Larson KJ6RZ

We worry a lot about Standing Wave Ratio (SWR) in amateur radio since SWR is one indication of how well our antenna system is working. Most HF transceivers and antenna tuners have built in SWR meters.

SWR is a measure of a transceiver ✗ s output power (P_f) verses the portion of that power reflected by the antenna system (P_r). If the antenna system is working well, most of the forward power will be radiated by the antenna with very little power reflected back to the transceiver. That is, the reflected power will be much less than the forward power ($P_r << P_f$). The difference between the forward power and the reflected power is the actual or true power (P_t) radiated by the antenna ($P_t = P_f \exists\ P_r$), assuming that losses in the transmission line are negligible.

If the output impedance of the transceiver, the characteristic impedance of the transmission line, and the impedance of the antenna itself are all equal (if we have a perfectly matched system), then the SWR will be 1:1. This is the best or ideal case in that all of the transceiver ✗ s output power P_f will be radiated by the antenna ($P_r = 0$). In practice, this case is rarely achieved. Normally the antenna system will reflect some power back to the transceiver. Typically then, the first number in the SWR ratio will be greater than 1. If SWR is represented as S:1, then $S > 1$ in most cases. From a practical point of view, SWR numbers in the range from 1:1 to 1.5:1 ($1 < S < 1.5$) are very good, meaning that the antenna is radiating most of the power sent to it.

The term Standing Wave Ratio, SWR, relates to the variation in the voltage (or current) along the length of the transmission line from the transceiver to the antenna. If the antenna is perfectly matched to the transmission line, there will be no variation in the voltage. The voltage measured at each point along the transmission line will be the same. However, if the antenna impedance is different from that of the transmission line, then some of the forward power will be reflected by the antenna and travel back toward the transceiver. The forward power traveling in one direction along the transmission line and the reflected power traveling in the opposite direction creates an interference pattern along the length of the transmission line. Because of this interference pattern, the voltage measured at various locations along the transmission line will no longer be the same. At some point the measured voltage will be V_m. A short distance from that point the voltage will be less than V_m. A little further on the voltage will be even less. As we continue to move away from that point toward the antenna, the voltage will reach a minimum value and then start increasing again. If we measure the voltage along the entire length of the transmission line, we find that the voltage varies sinusoidally. Furthermore, this sinusoidal voltage waveform is stationary, it does not move, it appears frozen in place along the length of the transmission line. Thus the name standing wave. The ratio of the highest voltage (V_h) to the lowest voltage (V_l) along the transmission line is called the standing wave ratio (SWR). Thus SWR = $V_h : V_l$. If the impedance of the antenna and the transmission line are the same, there is no reflected power, there is no standing wave, and the voltage everywhere along the transmission line is the same. That is $V_h = V_l$, and SWR = $V_h : V_l = V_l : V_l = 1{:}1$, a perfect match. If the impedance of the antenna and the transmission line are not the same, some of the forward power will be reflected by the antenna, a sinusoidal voltage interference pattern will develop along the transmission line, and V_h will not equal V_l . In this situation $V_h = SV_l$, where S is some number greater than 1. Thus in this case the SWR = $V_h : V_l = SV_l : V_l = S : 1$.

The output impedance of commercially available amateur radio transceivers is 50 ohms. The characteristic impedance of the various types of coax cable transmission lines used in amateur radio is also approximately 50 ohms. However, the impedance of the antenna is rarely 50 ohms. The radiation resistance of a quarter wavelength vertical antenna with a very good ground plane is about 35 ohms. The radiation resistance of a half wavelength center fed dipole is about 70 ohms. In each case, this is the approximate impedance of the antenna at its resonant frequency. In both cases the antenna impedance is pure resistive (the antenna appears to be a resistor). Above its resonant frequency, the antenna ✗ s impedance is inductive (the antenna appears to be an inductor in series with a resistor). Below the resonant frequency, the antenna impedance is capacitive (the antenna looks like a capacitor in series with a resistor). The impedance of the antenna is not equal to 50 ohms in any of these situations. As a result, part of the transmitted power will be reflected by the antenna back to the transceiver.

In terms of SWR ratios, the reflected power $P_r = [(S-1)/(S+1)]^2 P_f$ and the power radiated by the antenna (P_t) is given by $P_t = [1 \exists\ [(S-1)/(S+1)]^2]P_f$. As an example, suppose that the power output of a transceiver is P_f = 100 watts and the antenna system is perfectly matched with an SWR of 1:1 (S = 1), then

$P_t = [1 \exists\ [(S-1)/(S+1)]^2]P_f = [1 \exists\ 0]\, P_f = P_f = 100$ watts.

That is, all of the transceiver ✗ s output power is actually radiated by the antenna. As a second example, suppose that the SWR of the antenna is 3:1 (S = 3). In this case

$P_t = [1 \exists\ [(S-1)/(S+1)]^2]P_f = [1 \exists\ [(3-1)/(3+1)]^2]\ 100 = [1 \exists\ [1/2]^2]\ 100 = 75$ watts.

In this example only 75 watts of the transceiver ✗ s output is actually radiated by the antenna. The remaining 25 watts is reflected by the antenna back to the transceiver. Expressing the true power P_t actually radiated by the antenna relative to the transceiver ✗ s output power P_f as a db power gain (or loss if a negative number) we have

db = $10 \log (P_t / P_f) = 10 \log [1 \exists\ [(S-1)/(S+1)]^2]$.

If the antenna system SWR = 3:1 then the gain = 10 log [0.75] = -1.25 db. Since the gain is negative, the antenna system will actually produce a loss which is what would be expected. What is interesting is that an SWR of 3:1 is considered to be a high undesirable SWR, and yet it results in a loss of only 1.25 db, hardly noticeable to anyone receiving the transmission. Remember that a 3 db gain or lost in power is required at the transmitter before a person receiving the signal will notice any change in received signal strength. However, there is more to the SWR story.

Power reflected by the antenna will travel back through the transmission line and arrive at the output of the transceiver. Modern day semiconductor transceivers do not handle this reflected power well. If the reflected power is sufficiently high, it can severely damage the transceiver ✗ s power output transistors. To avoid damage, manufacturers design protective circuits into the power output stage. The protective circuit reduces the transceiver ✗ s output until the magnitude of the reflected power is below that which would cause damage to the transceiver. In terms of SWR ratios, transceiver ✗ s typically operate at their full nominal output power P_n, for example 100 watts, at SWR values of less than 1.5: 1 ($S < 1.5$). For SWR values greater than 1.5:1, the transceiver ✗ s protective circuitry kicks in, typically limiting the transceiver ✗ s forward output power P_f to approximately $P_f = [1/(S-0.5)^2]\ P_n$, where $S > 1.5$. If the antenna system SWR is 3:1 and the transceiver ✗ s nominal output power $P_n = 100$ watts, the output power of the transceiver will be limited to $P_f = [1/(S-0.5)^2]\ P_n = [1/(3-0.5)^2]100 = 16$ watts! In terms of db change, the protective circuitry drops the transceiver ✗ s power output by

Power reduction = $10 \log [P_f / P_n] = 10 \log [1/(S-0.5)^2]$ for $S > 1.5$.

For an SWR of 3:1, the power reduction = 8 db. This power reduction will clearly be noticeable at the receiving end.

The total loss in power due to a high SWR is the sum of the db power reduction imposed by the transceiver ✗ s protective circuitry and the loss resulting from reflection at the antenna. Thus:

Total SWR loss = $10 \log [1/(S-0.5)^2] + 10 \log [1 \exists\ [(S-1)/(S+1)]^2\ ]$, for $S > 1.5$.

The interesting observation from this equation, and the above discussion, is that the power reduction imposed by the transceiver ✗ s protective circuitry is considerably greater than the loss at the antenna due to mismatch reflection. At an SWR of 3:1, the total SWR loss is 9.25 db, a considerable loss. However, the total SWR loss at an SWR of 2:1 is approximately 4db, which is just barely perceptible at the receiving end. For an SWR less than 1.5:1, power loss is negligible since the transceiver operates at full output power and the mismatch reflection loss at the antenna is less than 0.18 db.

So far the discussion has assumed that the transmission line loss is negligible. But suppose this is not the case. Suppose that there is 3 or 4 db of loss in the transmission line, as might be experienced at UHF frequencies. How will this loss affect SWR readings? A transmission line with loss will cause the SWR measured at the transceiver to be better than the actual SWR at the antenna. It is easy to see why this is the case. The transceiver determines the SWR it sees by comparing the amount of power that it transmits to the antenna verses the reflected power that it receives back from the antenna. However, some of the power that it transmits is consumed by the lossy transmission line, so the power actually reaching the antenna is less than that output by the transceiver. Part of the power arriving at the antenna is then reflected by the antenna. However, since the power arriving at the antenna is lower, because of the lossy line, the amount reflected is also lower. The reflected power is then attenuated by the lossy transmission line as it travels back to the transceiver. The result is the amount of reflected power actually arriving back at the transceiver may be quite small, indicating to the transceiver that the SWR is better than it really is.

Working through the numbers illustrates this point. Suppose that the forward output power of the transceiver P_f = 100 watts, the actual SWR at the antenna is 3:1 (S = 3), and the loss of the transmission line L = 4 db. What is the SWR of the antenna system seen by the transceiver? The actual power arriving at the antenna $P_A = \log^{-1}[-L/10]\, P_f$ = 40 watts. The amount of power reflected by the antenna is $P_{rA} = [(S-1)/(S+1)]^2\, P_A$ = 14.4 watts. This reflected power travels back to the transceiver being attenuated by the lossy transmission line as it goes. The amount of reflected power that arrives back at the transceiver is $P_{rT} = \log^{-1}[-L/10]\, P_{rA}$ = 5.7 watts. The SWR equation seen by the transceiver is $P_{rT} = [(S-1)/(S+1)]^2\, P_f$. Rearranging this equation and solving for S yields a value of S = 1.6. So while the actual SWR at the antenna is 3 : 1, the SWR seen by the transceiver is only 1.6 : 1. The antenna system looks a lot better to the transceiver than it actually is. In the chapter on transmission lines (Chapter 24) of the 15th Edition of The ARRL Antenna Book (1988), there is a nice chart (Fig. 18) that allow you to figure out all of this graphically. I assume that this chart has been retained in more recent versions of the antenna book..

This example raises an interesting situation. When perfect no loss transmission line was used, the transceiver saw the real antenna SWR of 3 : 1. As a result of this high SWR, the transceiver’s protective circuitry kicked in limiting the transceiver’s output to 16 watts. Since the transmission line was lossless, 16 watts was delivered to the antenna. In the above example, the antenna SWR is still 3 : 1, but the transceiver sees the SWR as only 1.6 : 1. The transceiver thinks the antenna system is great, its protection circuitry does not kick in, and it pumps a full 100 watts into the transmission line. Of that 100 watts, 40 watts actually reaches the antenna. With the lossy line over twice as much power is delivered to the antenna. The lossy line actually produces a 4 db system gain! Building a poor antenna and then trying to compensate for it by using lossy coax is no way to design an antenna system. However, it does point out the fact that when designing a system, you have to consider all the parameters. There are broadband applications in which a 3 : 1 antenna SWR may not be avoidable. In such a situation, the system designer may have to look more closely at the loss characteristics of the transmission line.

The conclusion that can be drawn from this is that the threshold SWR, as seen by the transceiver, is about 2:1. An SWR above 2:1 will result in a power loss that will be noticeable at the receiving end. An SWR of less than 2:1 will not create a noticeable drop in power. In terms of perfection, tuning your antenna system for an SWR of less than 1.5:1 will result in full output power from your transceiver and negligible reflection losses at the antenna. Spending a lot of time trying to reduce your SWR from 1.5:1 to a perfect match of 1:1 is generally not time well spent. From a practical stand point, an SWR of 1.5:1 is indistinguishable from a perfect match of 1:1.

Cert Training

A CERT (Civil Emergency Response Team) training course is starting on Wednesday May 21. This is an excellent free training course presented to the general public twice a year by the Ventura County Fire Department. This course teaches many of the safety, fire, first aid, and disaster recovery subjects that we should have learned for the safety and protection of our families, but never had the opportunity to learn. The class is 6 weeks long and is taught here in Thousand Oaks on Wednesday nights beginning May 21. If you have any questions about this course, contact Ken Larson at 805-495-9435.

Event Calendar

Date	Event	Comments
Jan. 9	CVARC Meeting	Care and feeding of batteries
Feb. 4	CVARC Radio Class	CVARC amatuer radio class begins
Feb. 8	On foot fox hunt	On foot transmitter hunt in Santa Barbara
Feb. 9	CVARC VE Session	License exams given at sheriff station
Feb. 13	Student Radio Class	Technician class for students
Feb. 13	CVARC Meeting	Old Time Ham Radio
Feb. 20-23	Coyote 4 Play	Communications Support
Feb. 24	ARES/RACES Training	ARES/RACES Training class at sherrif's station
Mar. 9	CLU MS Walk	CROP Walk
Mar. 12-14	IWCE	North America's largest wireless technology show
Mar. 13	CVARC Meeting	Radio Direction Finding
Mar. 22	Arbor Earth Day	Civic Arts Plaza from 11 AM to 4 PM
April 6	Westlake Street Fair	Fair is open from 10 AM to 5 PM
April 6	Simi Valley MS Walk	Volunteers Welcome
April 10	CVARC Meeting	General Meeting
April 12-13	Baker to Vegas Run	Supporting Ventura County Sheriff Dept.
April 13	CVARC VE Session	License exams given at sheriff station
May 3	**ARES/RACES Packet**	Packet workshop at East County Sheriff Station
May 8	**CVARC Meeting**	Evolution of Radio and Electronics
May 10	**Cruisin Conejo Bike Ride**	A major CVARC event supporting Conejo Valley Cyclist

May 17	**Sea To Summit Bike Ride**	Major Ventura County ARES/RACES event
June 8	CVARC VE Session	License exams given at sheriff station
June 28-29	Field Day	CVARC annual field day event, you don't want to miss it!
July 3	Moorpark Fireworks	Comm. support for Moorpark's 4th of July Fireworks
Aug 10	CVARC VE Session	License exams given at sheriff station
Sept	Country Days	Fun event supporting Moorpark Country Days Parade
Oct	SET	Simulated Emergency Test
Oct 12	CVARC VE Session	License exams given at sheriff station
Nov	State Hospital Drill	A very important annual emergency communications drill
Dec 13	Camarillo Parade	Big annual event for Ventura County ARES
Dec 14	CVARC VE Session	License exams given at sheriff station

Radio Amateur Civil Emergency Service

Ventura County Area 2 R.A.C.E.S. members are encouraged to check in every Tuesday night at 7:00 pm on the Area 2 Check-in Net. Specific ARES/RACES times and frequencies are as follows:

ARES/RACES Times And Frequencies

Area	**Time**	**Mode**	**Frequency**	**Pl**	**Repeater**
County	7:30-8 pm	Voice	146.880 -	127.3	WA6ZTT
County	7:30-8 pm	Voice	224.020 -	127.3	WB6ZTR
County	Before 6:30 pm	Packet	145.710	No pl	Hospital Net
County	RACES Simplex	Voice	147.570	No pl	____
Area 1	7:00-7:30 pm	Voice	147.930 -	127.3	WB6WEY

Area 2	**7:00-7:30 pm**	**Voice**	**147.885 -**	**127.3**	**N6JMI**
Area 2	**Simplex**	**Voice**	**147.555**	**No pl**	**___**
Area 2	**Backup Repeater**	**Voice**	**146.850 -**	**94.8**	**K6AER**
Area 2	**Amgen Repeater**	**Voice**	**449.440 -**	**131.8**	**KE6SWS**
Area 3	7:15-7:30 pm	Voice	147.150 +	127.3	WB6ZTQ
Area 4	7:15-7:30 pm	Voice	146.970 -	127.3	WB6YQN
Area 5	7:00-7:30 pm	Voice	145.400 -	No pl	N6FL
Area 6	7:00-7:30 pm	Voice	147.975 -	127.3	N6AHI
Area 7	7:00-7:30 pm	Voice	146.985 -	127.3	WB6ZTX
Area 8	7:00-7:30 pm	Voice	145.280 -	100	WB2WIK
6 Meter	6:45-7:00 pm	Voice	052.980 -	082.5	K6SMR

The Net Controller's script for the Area 2 weekly RACES check-in net is on the CVARC website, in printable form. Every member is encouraged to periodically serve as net controller. RACES members should remember that their RACES card is issued for only two years. When your card is due to expire call Jackie at the Office of Emergency Services in Ventura for an appointment to renew your card. Call (805) 654-2551 or toll free from the east half of the county at (800) 660-5474. For packet, call coordinator Dan Dicke KE6NYT (805) 983-1401. To register for Red Cross Disaster Services Classes, call (805) 339-2234 ext 0 Ventura County ARES/RACES web site: http://home1.gte.net/res19999/

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The Conejo Valley Amateur Radio Club is an ARRL affiliated Special Service Club. Meetings are held on the second Thursday of each month, unless otherwise noted. Meeting location is at the Elks Lodge, 158 Conejo School Rd., Thousand Oaks, CA. Meetings start at 7:30 pm. with a pre-meeting social and technical assistance session, for those who are interested at 7:15 pm. Meetings are open to the public, and members are encouraged to bring their friends.

Return to CVARC

Editors: Ken and Paula Larson