

# Alliance Amateur Radio Club

Affiliated with the "American Radio Relay League"



## ZERO BEAT

May 1991

### SPECIAL ELECTION

Due to personal conflicts, Gary KB8GAB has resigned as president of AARC. In accordance with the By Laws the vacated office must be filled at the next meeting of the AARC. Please plan on attending and supporting your club. Gary will still remain a member of the AARC and participate in the club activities when possible.

### Grounding Techniques for Radio Installations

*by Gary Coffman KE4ZV*

There are three main reasons to ground radio equipment.

1. Safety grounding to protect operators from accidental electrical shock.
2. RF grounding to prevent spurious and

harmonic radiatio and to enhance antenna efficiency. 3. Lightning protection.

Each of these require different grounding technique. A careful analysis of the ground methods used is required to determine if all three objectives are met.

Safety grounding is in many ways the easiest criteria to meet. Simply bonding all equipment cabinets to the power company ground with conductors of low resistance and adequate current carrying capacity to blow the circuit breakers will meet safety requirements.

Effective RF grounding is often much harder to achieve. The ground path must not offer any significant impedance at the frequencies of interest. Since the frequencies of interest are often octaves apart, this is challenging. The frequencies of interest are the fundamental frequency of the transmitter, the harmonic frequencies of the transmitter, and any spurious frequencies

**The next meeting of the Alliance Amateur Radio Club will be held on Thursday, 6 June 1991. Meetings are held monthly at the Alliance Community Hospital at 7:30 PM in the cafeteria on the first floor. Visitors are always welcome.**

the transmitter may generate. The latter is usually the toughest.

Grounding for lightning protection is difficult due both to the magnitudes of the voltages and currents involved and to the fact that the lightning waveform is a step function and has considerable RF energy.

Probably the WORST problem one faces in designing an effective grounding system is the prevention of GROUND LOOPS. Ground loops will cause unintended currents to flow in circuitry, often with disastrous effects. Either damage or degraded operation will inevitably be the result of a ground loop.

The best method of securing a good ground for a radio installation is to use a GROUND WINDOW. The ground window technique requires that every cable that enters or leaves the radio room pass through one small area where all ground connections are made.

The power company ground must be bonded to the ground window and surge suppressors such as those marketed by Lightning Protection Associates should be installed in series with the hot wires. Note that simple shunt protectors will not be sufficient to protect the equipment in the event of a direct lightning strike. Series protectors are designed to open the circuit under severe overload.

All coaxial cables must have their shields attached to the ground window and have their inner conductors clamped with an arc cartridge designed to fail shorted. In addition the inner conductor should be fused in a manner that will open the line when the arc cartridge fails.

Telephone cables must enter through the ground window and have their leads clamped with MOVs and arc cartridges that

are designed to fail shorted. In addition all leads must be fused in a manner that will open the line when the arc cartridge fails.

Each piece of equipment in the radio room must be attached to the ground window by a wide heavy strap installed so as to be as short and straight as possible. Neatness definitely does not count here. Don't "dress" the ground cable, make it short and direct. Do not "daisy chain" grounds. Make sure that the only path from one piece of equipment to another is via the ground window. This means that interconnecting shielded cables should go from the equipment out to the ground window, have the shield bonded to the ground window, then return to the next piece of equipment. This is the only sure way to prevent circulating ground currents.

Now that every piece of equipment in the radio room is at the same potential as the ground window, the ground window must be brought to true earth ground. This is fairly easy for DC and low frequency AC, just make sure the cable is heavy enough to have the smallest possible voltage drop across it. For RF, inductance and resonance effects must be considered as well as skin effect. A wide flat copper strap that is routed as straight as possible to earth ground is preferred. For maximum lightning protection, the ground strap must never travel upward because the space charge will resist the current flow. Sharp bends will act as single turn inductances and should be avoided. Since a single ground cable will exhibit resonance at certain frequencies due to its length, several ground cables should be used with each a different length. The lengths should be chosen such that a cable that is near a quarter wavelength at a given frequency will be paralleled by a cable that is near a half wavelength. In practice, several cables varying from the shortest possible length to twice the shortest length should be paralleled so that at least one will present a low impedance at any frequency.

Do not coil the longer cables, instead fan them at the center point.

The method used to route cables down the tower will effect the degree of lightning protection achieved. If possible use a plumber's delight type of antenna that is dc grounded to the tower. Route the coax down the inside of the tower, and ground the shield of the coax to the tower at  $H_s/_{.x6}$  points. This last will short out the single turn transformer formed by the tower and the shield of the cable. Unless this transformer is shorted, currents flowing in the tower to ground will induce currents in the shield of the coax.

The true ground must be more than a single stake driven into the earth. If the tower is ground mounted, use the base of the tower as the center of the ground field, otherwise drive an eight foot ground rod to form the center point of the ground field. Run radials out from the center of the ground field to a buried loop connecting a series of ground rods separated from each other by no less than eight feet. A minimum of eight rods should be used. If possible, the radials should continue outward for one quarter wavelength at the lowest frequency of operation. If your tower is not ground mounted, bring it's base

## NET SCHEDULE

Eastern Stark County News and Information Net. Net Schedule March 1991.

**6 No Net - Club Meeting Night**

**13**

**20**

**27**

Net control stations are needed. Please attend the May meeting for more info.

ground back to the ground window using multiple lengths of cable as discussed above. Do not run a ground cable directly from the isolated tower to the true ground or a ground loop will surely be created that can allow damaging circulating currents to develop.

This all sounds like a lot of work and expense, but field experience has proven that a system like the one described will withstand direct lightning hits without loss of equipment, air time, or lives.

## CALLS

The latest calls as of May 1st 1991, are as follows:

**EXTRA -- AA8DO**

**ADVANCED -- KF8NE**

**TECH/GENERAL -- N8OHD**

**NOVICE -- KB8MMD**

QST DE W1AW ARRL BULLETIN 21

FROM ARRL HEADQUARTERS NEW-  
INGTON CT MAY 22, 1991

TO ALL RADIO AMATEURS

93 members of the US House of Representatives have become cosponsors of HR 73, the bill sponsored by Tennessee congressman Jim Cooper and titled the Amateur Radio Spectrum Protection Act of 1991. Your help is needed. For more information see March QST, page 41.

QST DE W1AW ARRL BULLETIN 19  
ARLB019 FROM ARRL HEADQUAR-  
TERS NEWINGTON CT MAY 1, 1991 TO  
ALL RADIO AMATEURS

The FCC on April 29 issued its final Report and Order in PR Docket 89-552, adopting rules for the use of 220 through 222 MHz by the Private Land Mobile Service. Amateurs will be required to discontinue all operations in the 220 through 222 MHz band effective 0000 UTC August 28, 1991, which is 8 pm EDT August 27.

QST DE W1AW PROPAGATION FORE-  
CAST BULLETIN 18 ARLP018 FROM  
TADCOOK, KT7H, SEATTLE WA MAY 18,  
1991 TO ALL RADIO AMATEURS

Instead of a peak at 255 on May 15 and 16, the solar flux faded a bit early with a high of 244 on the 12th. Unstable geomagnetic conditions were the rule, with major solar flares on May 13 and 16. At the time this was written on the 16th, a geomagnetic storm and associated absorption and ionospheric disturbances had not begun. This

depends on whether the Earth is in the path of a stream of protons from the flare. If the protons do not miss the Earth, they disturb polar paths for radio waves and recombine with electrons in the ionosphere to make it non-reflective.

Look for low to moderate solar activity this week, with the near term solar flux bottoming out near 130 around the 24th. The flux should then climb to around 250 on June 8 and 9. Although it is difficult to predict, the NOAA Space Environment Service Center shows May 24 through 29 as having the most disturbed geomagnetic conditions of the next few weeks. Anytime that the K index as broadcast by WWV is two or less, conditions on the upper HF bands should be quite good.

American sunspot numbers for May 9 through 15 were 146, 136, 108, 117, 106, 124, and 95 respectively, with a mean figure of 118.9. Solar flux numbers as reported by WWV for the same time period were 228, 234, 231, 244, 212, 207, and 191.

## DUPING

So You heard all this talk about field day, at the last club meeting, but maybe aren't quite sure what it's all about? Maybe you've been scared to get your feet wet, because you don't understand this duping stuff everyone is talking about? Never fear, here's a brief rundown on what duping is and what you can expect.

A "DUPE" is a duplicate contact. You are allowed to work a station only once per band and mode for point credit. If a station is worked more than once, then it is considered a dupe. Not only is this not a valid contact, but it must be erased from the log. In fact, most contests state in their rules that excessive dupes are grounds for disqualification. To keep dupes out of the log, 3 types of duping systems are currently in use. They are: No duping, Dupe sheets, & Computer duping. Here's the lowdown on all three.

### NO DUPING

This is probably the worst way to operate a contest. Operators who use this method, rely on their memory (which is not 100% effective, especially when running multi-ops), the other stations duping system (if the other op is also using no duping, you've just wasted his time & yours), & your own dumb luck, to avoid working the same station twice. Remember that during field day, you are allowed to contact a station once on each band & mode. If you can keep all this straight in your head, without a duping system, then we want you sitting next to us at field day, and we can leave the computers at home.

### DUPE SHEETS

This is the old tried & proven system of organizing your QSO's. It is a sheet of paper, divided up into boxes by call area, and letters of the alphabet. When you work a station, you enter that station's call under the box corresponding to that station's call area & the 1'st letter of the suffix of the call. For example, you've worked K7LGD. You enter his call under the box which is labeled 7L. If you've been careful to update your dupe sheet after every QSO, then, it's a simple matter to check the dupe sheets to see if you've worked that station already. Steer clear, though, of the old style dupe sheets, which are catalogued by call area & Prefix. With all the new prefixes out there, that style is simply obsolete.

### COMPUTER

This is the duping choice of more & more hams every year. It is faster & easier, than all the other systems combined. There's a lot of different computer duping systems in use right now, so, if you aren't familiar with a system you may encounter at field day, then ask the operator. Chances are, they'll be happy to show you how to operate it, and give you a couple hours practice time to boot (HI HI). Most systems aren't too difficult to run, but a little bit of instruction now, can avoid a costly error later.

That is the 3 duping systems in use today. When at field day, don't be afraid to ask if one of the operators needs a logger/duper. Chances he/she would welcome the break from the logging/duping chores to enable them to concentrate on working the radio. Also, you may just have some fun to boot. 73 DE WX8G

Zero Beat is published monthly by the Alliance Amateur Radio Club. All correspondence related to the Zero Beat should be addressed to:

Alliance Amateur Radio Club Inc.

Att: Editor Zero Beat

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Articles for publication can be submitted to the editor by mail, in person, or electronic transfer. Electronic transfer can be made by telephone modem, radio teletype or an IBM PC formatted disk. Disks should be 5 1/4" 360Kb or 3 1/2" 720Kb. Disks will be returned. Files should be in ASCII format or if in an IBM PC wordprocessor format, the wordprocessor used must be specified to permit conversion. For radio or teletype transfer contact the editor to make arrangements.

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The activities of the Alliance Amateur Radio Club are coordinated by an elected board of officers. The current officers and the respective positions are:

**President - Gary Grimes KB8GAB**

**Vice President - Allen Dicks W18T**

**Secretary - Kitty Buckwalter N8LIP**

**Treasurer - Patti Hillier - KE8KH**

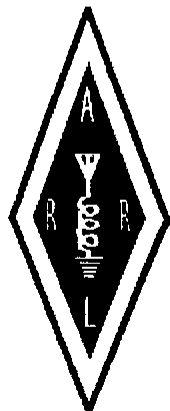
**Trustee - Jim Ferguson - N8DZA**

**Trustee - Dave Buckwalter - KC3CL**

**Trustee - Larry Ashburn - KE8VE**

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