NCJ NATIONAL CONTEST JOURNAL

$4

March/April 2006

www.ncjweb.com Volume 34 Number 2

Special Low-Band Issue!

- CQWW with VY2ZM on 160 Meters
- 80- and 40-Meter Performance on a Small Lot
- Parameters Affecting Resonance of an 80-Meter Vertical
- 160 Meters from VP9
- August 2005 NAQP CW and SSB Results

In this issue: **VY1ZM** (top) offered stiff competition on 160 meters during CQWW with his mega-station. At the other end of the scale, **NØAH** (right) proves that it's possible to enjoy low-band operating under adverse conditions.

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By Carl Luetzelschwab, K9LA

K9PG's *NCJ Profiles* Column

Paul K9PG took over the *NCJ Profiles* column with the March/April 2002 issue, and throughout his stint has written many great profiles of our fellow contesters. But Paul recently decided to retire from this task. Thank you, Paul, for all your efforts over these four years.

RM-11305 and RM-11306

I hope everyone commented on the two recent RMs that could impact contesting. In a nutshell, RM-11305 (by a group called the Communications Think Tank) proposed any mode anywhere in any band, with gentleman's agreements providing order. And RM-11306 (by the ARRL) proposed that the bands be segmented by emission bandwidth, which for the most part would be a three-tier system (segments within a band for 200 Hz, 500 Hz, and 3800 Hz emission bandwidths). Time will tell where we're headed with respect to these two proposals.

Exerting Peer Pressure

Several months after receiving my Novice license (late 1961) I upgraded my transmitter from a Heathkit DX-20 to an EICO 720. The EICO 720 used a 6146 tube in the output stage, and it was capable of 90 W input power. At the time the Novice limit was 75 W, so the combination plate and grid meter on the '720 indicated the plate current for the 75 W Novice limit. Although I thought the FCC could tell if I was running 90 W instead of 75 W, the real reason I only loaded up to 75 W was because it was the rule.

Power-limit rules are the most tempting to violate during a contest, but why would someone do this? I think some individuals are compelled to cheat because they are driven by the all-too-human need for peer recognition. This desire, and its negative consequences, doesn't just apply to contesting. We see it in DXing and other facets of Amateur Radio where some form of competition is involved.

Unfortunately, as technology has improved, the opportunities to cheat have grown considerably. On the other hand, these same advances in technology also offer a way to expose those who don't follow the rules. One effective method of exposing a particular type of cheater has been devised by David, K1TTT.

After many major contests, K1TTT has posted his analysis of PacketCluster spots to the cq-contest reflector. It is quite obvious to me after reading his analysis that many contesters spot themselves in clever ways, even though the contest rules forbid this.

How are we, the contest community, going to put a stop to cheating? The first step is to try to make the contest rules as clear as possible. Once that is done, I think the second step is to publicly expose the cheaters. It's amazing what a little peer pressure can do!

GACW Results

I received a nice booklet from GACW (Grupo Argentino de CW) with the results of the 2005 World Wide South America CW DX Contest. This is another great example of contest results taking on a personal touch by being mailed to the participants. I also mention this contest because the 2006 event is the weekend of June 10 and 11, which would be a good warm-up for WRTC2006.

N4GG's Article

Due to a recent thread on cq-contest, N4GG was inspired to write a "lighter side" article about the topic discussed. I think he captured the essence of the thread very well. I hope you enjoy his contribution.

W1WEF Addendum

Jack, W1WEF, adds the following about his SO2R article in the January/February issue. "*I forgot to mention a key reason my simple approach to SO2R worked. In SS from New England I primarily beam west. To avoid directing my TH6s on the main radio directly at the vertical on the second radio, I located the vertical to the North of the tower. Also, since the vertical is only 32 ft high, and it was about 100 ft from the tower, it was in the 'shadow' of the beams on the main radio.*" NCJ

A Multi-Band Array For The Burbs

By Paul Veal, NØAH

In the winter of 2002, I relocated my family from our small ranch in the southeast corner of Wyoming to the south Denver suburbs. For my hobby, it was a difficult relocation as I had to give up my antenna farm made of numerous towers, antennas and, in particular, my 4 square arrays for 40 and 80 meters. These arrays were used primarily for my own science studies regarding short and long path DX propagation during the winter months.

By relocating, I was going from 160 acres to a home development lot that offered a backyard that was only 40 feet wide by 86 feet long. My front yard was 20 feet higher in elevation than my backyard, somewhat putting my backyard antenna location in a hole. I knew that my low-band days using arrays were over. But at least I had zero covenant restrictions against antennas. Thus, my mulling began as soon as we unpacked, mainly trying to figure out a way to install an 80-meter bidirectional array.

For the first two years I tried to work the long path propagation with a single vertical with no luck. I had some success trying various antennas for DX QSOs on the short path, but I could not hear weak signal DX being reported either way. Suffering from S9+ ambient RF interference made it nearly impossible to work anything worth mentioning.

So, I decided to do some things in the shack. It started with replacing my existing rig with an ICOM IC-756 Pro III with its new noise reduction technology. My ambient noise levels were cut on average by 2 S-units and the noise reduction was very helpful in pulling out DX.

Then, I was intrigued by the new antenna that Cushcraft was introducing. It was called the MA8040V. It was designed to be small, quiet, self-supporting, effective and able to take at least 1.5 kW on either SSB or CW. It offered two bands: 80 and 40 meters. That was all I needed to hear. Soon after, I ran to Ham Radio Outlet here in Denver and checked things out.

The Cushcraft MA8040V is a very well thought-out product. Per Cushcraft, it is a compact dual-band monopole vertical antenna that features automatic band-switching for the 40 and 80 meter bands. Independent top-mounted resonators are configured in parallel for negligible cross band interaction. Each resonator uses a combination of capacitive and inductive loading that has been proportioned to optimize efficiency and provide a favorable feed-point SWR.

Tuning the antenna is fairly simple. The adjustable top-section "stinger" is used for 80 meters. Some fine tuning on 80 meters also can be done by adjusting the length of the eight capacitance rods directly below the 80 meter coil.

Forty meters is tuned only by adjusting the lengths of the four capacitance hat rods directly below the 40 meter coil. I did not notice any effect on either band's SWR by tuning the other.

The MA8040Vs are small in size, self supporting anywhere from 23-27 feet, with large $2^1/_2$-inch loading coils that use #12 copper wire for high efficiency and power handling capability. Each coil is wisely encapsulated with a tough UV resistant Anchor Seal™ epoxy that introduces negligible RF loss and provides critical weather protection.

The antenna is built to survive. The 21 foot main radiator elements are made of T6061-T6 0.058-inch wall aluminum tubing. RF-current distribution along this portion of the array would be relatively uniform with no intervening structures to introduce loss. Even all the hat rods were well thought out. For both bands, the hat rods are made of resilient 0.1-inch tempered stainless steel that will resist damage from environmental hazards.

For DX, the design of the antenna provides a low take-off angle to favor working long distances. The antenna has a high angle pattern null to reduce interference from local atmospheric noise and QRM. The antenna comes with a 400 foot roll of radial wire to help in setting things up. I thought this was a nice touch by Cushcraft. At my home, the antenna was at least one half to a full S-unit quieter in reception of ambient noise than my previous multiband vertical.

The Array Journey Begins, But Challenges Ahead

Now with materials in hand, I had to install the initial antenna at least 7 feet back from my fence line to meet our municipal code requirements. That was the only red tape I had locally. With an odd shaped lot, I was able to get as far away from my house as possible—right next to where all my neighbors parked along the street. It was over 20 feet from the home's foundation, but unfortunately further down into the hole of my backyard.

Getting the idea that I might actually be able to phase these antennas together for 80 meters, I measured out the distance to put up a second MA8040V. By just a few feet, I had enough room to put this antenna in place. But due to space limita-

The 80/40-meter array in NØAH's backyard. That's a Cushcraft MB1020 beam on the roof of the house.

Paul, NØAH, owner of the 80/40-meter array, at the rig.

tions, it would have to be 6 feet from my house and next to my electrical box outlet. It also was near a clump of trees.

My reason for this spacing and orientation were simple. I had to space the antennas exactly east and west from one another since setting these up with an ideal NE/SW was not possible due to constraints of the yard.

Since my array was going to be designed for 80 meters, I spaced the antennas a quarter wavelength apart at around 63 feet. This was a tight squeeze. Now with the antennas installed, what was the next step if I wanted to phase a multi-band vertical system together using both 40 and 80 meters? I just didn't think it was going to be possible.

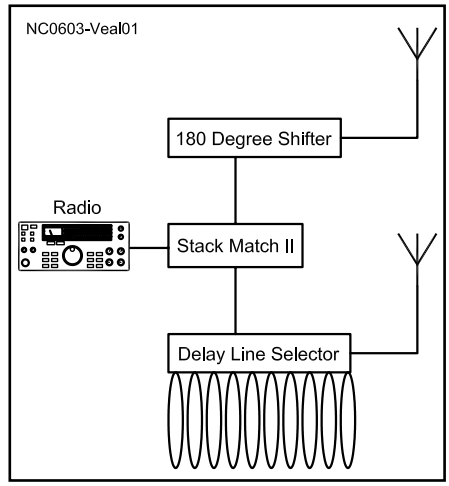
But I contacted Jay, WXØB, at Array Solutions (**www.ArraySolutions.com**), and hoped he had some ideas. Jay told me he had the product already in inventory. It only had to be customized for my bands. And when it arrived, I was surprised by the look of the equipment.

The package contained a WXØB Stack Match II, a 180 degree phase shifter and a coaxial phase shifter unit with a total of 14 SO-239 reciprocals awaiting 14 PL-259 plugs, sufficing room for the six enclosed phase lines and feed-lines. I felt like the Coyote opening up an ACME wood crate out in Moab.

The W9AD Multi-Band Array Answer

This system is known as the Array Solutions W9AD Vertical Multi Band Phase System and it consists of three main components. For more details, check out **www.arraysolutions.com/images/W9AD2elsystem.pdf**.

The first component is the WXØB Stack Match II that power splits the RF power from the rig. You can select antenna A or B for omni-directional use, or both antennas for use in the array.



A simplified block diagram of the 80/40-meter array.

The second component is the 180 degree Phase Shifter to feed antenna A. In the array system, this device plays a large part in determining the directional patterns of the lobes.

The third component is the Coaxial Phase Shifter to feed antenna B. This device controls pattern characteristics of the array. The coaxial phase shifter contains six relays that control the degree of phasing. Six 50 Ω coaxial lines are attached to the outside of the coaxial phase shifter with lengths determined by modeling the array. With all of these coax lines, the cabinet becomes somewhat heavy, but is supported by strong mounting materials.

Jay provides you *EZNEC* patterns so that upon arrival you get a good idea what the array can do.

Once all three components are attached to one another on a mounting pole, short coaxial cables are used to connect both the phase shifter and coaxial phase shifter to the Stack Match II. Inside the shack, you have two control boxes for operating the coaxial phase shifter and phase shifter to utilize the array system.

The array will produce a broadside pattern and an end-fire pattern, as well as other lobes and nulls in various directions as you change the combinations. Testing things out during the summer, the end-fire pattern on 40 meters was most effective at my location.

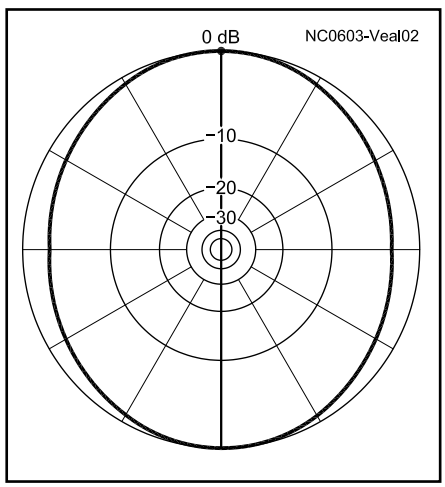
Over the late summer and into fall, the array proved worth its weight in gold for 40 and 80 meter strong signal F/B and F/S dB stateside studies. All selected patterns had notable differences in reception depending upon patterns selected and changes in propagation. The F/B is 15 to 20 dB (plus) and the F/S can peak up to 10-15 dB. Due to heavy QRN, I was unable to really test the system for DX, but it did show excellent promise for short path into Europe and long path possibilities around the globe.

Small Yard, Big Radial Field

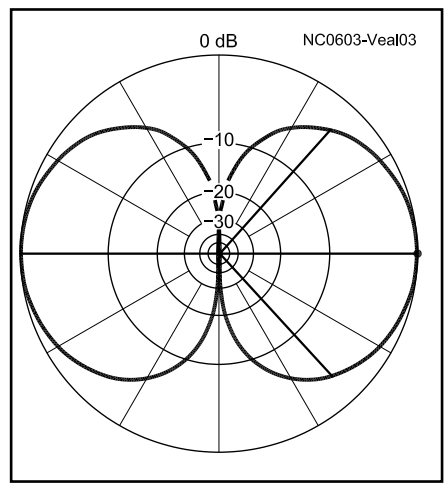
One of the bigger challenges I had in putting the system together was setting up an effective radial field in my small backyard. I only had enough room to fan out my radials in about a 40 degree pattern. But I did two things that made the radials into a decent field.

First, most of my radials were folded back. This way I could take a 60 foot radial and use up thirty feet of space by folding it back towards the antenna. Second, I tied the radials from both antennas together. I had a total of thirty 32 foot radials, and twenty 64 foot radials.

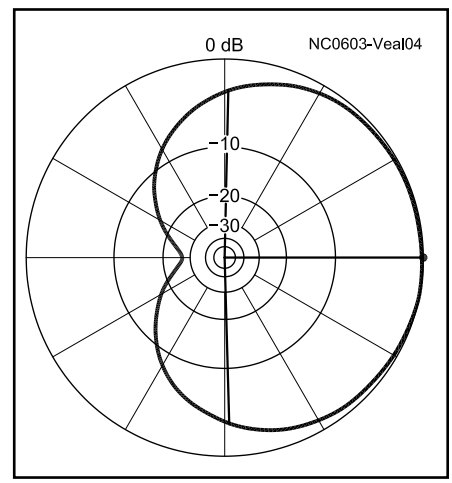
Then, where I could find room under bushes and along my home's foundation, I laid out ten more radials. These ranged in lengths from 4 feet up to 100 feet going under my fence to run along the side



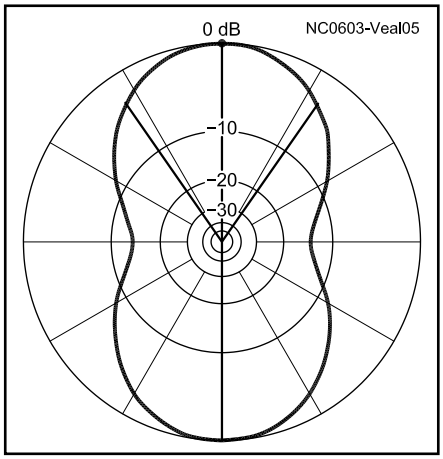
The 80-meter azimuth pattern with the radiators fed in phase.



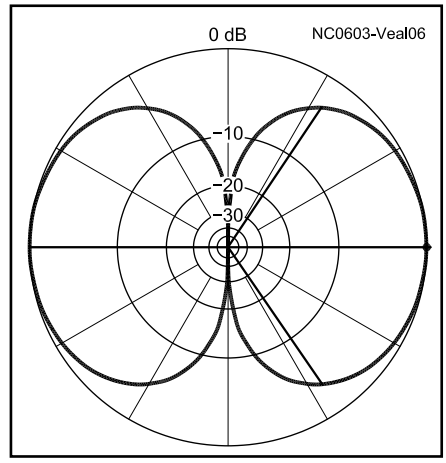
The 80-meter azimuth pattern with the radiators fed out of phase.



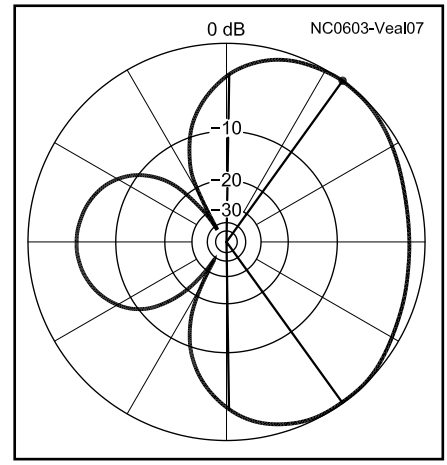
The 80 meter azimuth pattern with one radiator delayed 90 degrees from the other.



The 40-meter azimuth pattern with the radiators fed in phase.



The 40-meter azimuth pattern with the radiators fed out of phase.



The 40-meter azimuth pattern with one radiator delayed 90 degrees from the other.

of my house. The results of these efforts began exposing the natural impedance mismatch of the coax to the antenna. I was satisfied.

"Sure It Can Work This Way" Tuning Syndrome

Out of the box, the antenna's 2.5:1 SWR bandwidth readings on 80 meters performed close to specifications. I was getting around 80 kHz, but I was concerned. My SWR at resonance was 1.7:1, narrowing my bandwidth edges. Forty meters was fine with a minimum SWR reading at resonance of 1.1:1 and a 2:1 bandwidth covering the entire band.

Knowing that I really wanted to enhance the 80 meter bandwidth and resonant SWR reading, I called WXØB to explain my concerns. He suggested that I use a 4-inch-diameter hair pin coil across the feed point made of 6 AWG copper and turns spaced around a half inch apart. This worked great on 80 meters as it brought down my minimum SWR point to a 1:1.1 match. But there was a reverse effect on 40 meters.

Unfortunately, the feed point coil dropped my 40 meter resonant point by over 200 kHz to around 6.900 MHz and gave me a minimum SWR reading of 1.4:1. So what was I to do about 40 meters now? That turned out to be a loaded question, but I found a very simple solution in the manual.

With the antenna being top loaded with capacitance rods and sealed inductors, 40 meters can only be tuned by changing the lengths of the 40 meter capacitance rods. I had to cut my four 40 meter capacitive rods from their original 25 inch length to 22 inches.

After cutting the rods, my 40 meter resonant point jumped to 7.150 MHz. That was the effect I was hoping for, but it was too much. So I exchanged one of the cut capacitance rods with a full-length replacement rod. With just 3 inches added to one rod, my final result was a resonant point at 7.005 MHz. And with the 80 meter SWR being at 1.1:1, I decided to just live with the 40 meter SWR issue.

The higher SWR reading on 40 meters was a small sacrifice for a lower SWR reading and wider bandwidth on 80 meters. I believe that the feed-point coil suggested by WXØB was a good idea to peak the performance of the antenna on 80 meters.

Switching Between 80 Meter DX Windows

Tuning the MA8040V is a lot easier straight out of the box. But why do so many array builders try to get more out of antenna system than what can be expected? Do we ever read manuals that clearly tell us to pick out a portion of the band and tune the antenna for that spot?

My attitude to array tuning can be summarized as follows: "I'm not getting out of this chair to retune my array for 80 meters…during DX or a contest. It could be cold out there and besides, I never wear shoes when my amplifier is on—for good luck. There has to be another way to jump in between DX windows."

The answer to this problem started with a phone call to WXØB. We discussed the placement of an inline custom-made relay-activated tuner that would drop the array from the phone DX window down to the CW DX window. It was suppose to be an easy flip of a relay controlled from inside the shack. After several tests, all it did was drop the 40 meter resonant point down 400 kHz and the 80 meter resonant point by a mere 20 kHz.

The lack of effect on the 80 meter band was due to the high impedance found at the base of the 80 meter coil, with extremely high impedance found at the top of the coil. In other words, my 80 meter section of the antenna was not affected by the tuner.

Chuck Cullian, KØRF, pointed this out to me after studying the antenna schematics. This is why Cushcraft had a stinger above the top of the 80 meter coil for tuning in conjunction with the capacitance rods.

One alternative that did work was to simply start removing individual 80 meter capacitance rods one at a time to raise the antenna's resonant point. By the time I had removed three rods, I was right in the phone window, moving up from the CW window. This obvious solution was already explained in the manual. Yes, the manual is there for more than a makeshift log book under a coffee mug.

But I thought, forget removing the rods. I decided to just spend 10 minutes re-tuning the stinger lengths by adjusting them about 40 inches or so when going from either window. In my case, one inch of adjustment on the stinger length changed my resonant point on an average of 7 kHz. I ended up making something very simple into something very difficult.

Warning! Using an antenna tuner for 80 meters with an amplifier can create voltages that could cause harm to the WXØB system. Using an antenna tuner can also cause added loss in the feedline. Tune the antennas in the array by manual adjustment of various components per the manual.

Results: Winter Low Band Long Path Performance

I know that we all have that special QSO, or QSOs, that makes the struggles of the low-band season worth the effort. For me thus far, the special QSO occurred when I worked YO9HP on 22 December 2005 on 40 meters long path along each one of our gray lines. He was at or below my noise level the entire time, but this is what it's all about with long path DX.

His sunset and my sunrise are around 20 minutes apart and we're both near twilight. With his station so far to the south and to the east of where I normally work

Scandinavian stations, this was a scientific marvel to me.

Here is what he had to say about our QSO in an e-mail exchanged shortly afterwards:

"*Hi Paul,*

Thank you for the details regarding our 40 m QSO, via long path. Well, when I replied to you, I thought we could not make contact because your signal was very weak. This is why I only guessed …who was calling me. But the conditions improved while talking to you. So at the end I copied very well the call-sign. The report should have been 339 and 559 at the end. I was running "close to legal power" and a 3 element Yagi at 25 m height using a 17 element Optibeam OB7-4. Rig is an IC-756 Pro II with ACOM amp. I would say the propagation was poor today, but I am very glad we made it. 73, Alex YO9HP"

The next morning another interesting 40 meter QSO occurred. It was with UA9SC at 1344Z. Zone 17 for long path is very difficult to work from Zone 4 here in Colorado.

Long path this December on 80-meter phone also has had its rewards. At my sunrise times in mid month, I worked or at least was heard with good reports from stations including those in Scandinavia. I even worked a VK6, which is a long distance up the hill from my location. But it has not been a cakewalk due to the noise on my side.

On a good morning, I can pull 80 meter long path phone signals from EU out of the noise. But even when I am heard there, reception remains difficult. For the rest of this season, I plan to operate mostly in the less crowded 80 meter CW window and to continue with good luck on long path on 40 meters.

Conclusion

Regardless of the path, we are not talking about multiple S-units in my application when comparing weak or poor signal copy on 40 or 80 meters, thanks to the 57-59 RF noise levels at my location. For all I know, in a quieter environment these signals could be ten dB over nine, just 2 S units over my typical noise. It really comes down to one simple fact: when using the W9AD Multi-Band Array by Array Solutions, I hear and work stations that I cannot hear on a single vertical. This includes both short and long path propagation around the globe.

The process for me has been worth the effort. I hope this article will help those who may be thinking about trying experiments from a difficult location using a low profile, effective, multi-band array. Be it for DX, contesting, or any other reason, innovative technology is making effective low-band operating a reality for almost anyone.

Typically, antennas within an array have to mirror each other exactly. But in the suburbs, you'll have to grapple with a number of variables that may cause you to fall somewhat short of the ideal. Don't be discouraged. Instead, maximize the positives at your control. That's the key to building your backyard array. You may be faced with many obstacles too numerous to mention, but look at what you can do to minimize these problems by maximizing your tools at hand, including your experience and drive to succeed.

I would like to thank those who provided me with more than I could have expected in terms of time and effort. Everyone's situation differs, but with hard work, and the help of experts in the hobby, you can continue the fine ham tradition of doing what they say can't be done! NCJ

Please Follow the Rules!

Hal Kennedy, N4GG

It's the last half-hour of CQWW-SSB and I still need Zones 3 and 4. I've been reading the CQ-Contest reflector, however, so I know it's just plain wrong to call anyone and make a zero-point QSO. Inspiration strikes! I'll move up to 3950 kHz and call a few CQs. Surely somebody local will answer….

N4GG: CQ Contest, CQ Contest, Anybody Anywhere, Anybody Anywhere, this is N4GG.

KI4JKY: N4GG, please copy KI4JYK.

N4GG: KI4JYK, Five Nine, Five.

KI4JKY: N4GG this is KI4JYK. Please copy 147, 1 watt, Tuna Tin Special, and I need your info.

N4GG: Your report is Five Nine, Five. I need your zone, not a serial number.

KI4JKY: This is KI4JYK. Zone?

N4GG: Zone, Zone, I NEED YOUR ZONE!

KI4JKY: This is KI4JYK. I don't have a zone.

N4GG: Okay, I need your QTH.

KI4JKY: This is KI4JYK. Why? It's not part of the exchange.

N4GG: I can tell your zone from your QTH; where are you?

KI4JKY: N4GG this is KI4JYK. Please copy Springfield, and I need your info.

N4GG: WHAT STATE? And what info do you need? Wait, wait, what contest are you in?

KI4JKY: This is KI4JYK. I'm in the GEARVAKf contest. What contest are you in?

N4GG: CQ Worldwide. Never heard of GEAR-whatever. What info do you need?

KI4JKY: It's GEARVAKf – the Greater Enon Amateur Radio-Vention and Kite Fly Contest. I need your string length, power and rig.

N4GG: You need to help me with string length. Rig is a 30L-1 driving a Henry 8K with modified meter shunts, 1.5 kW, and WHAT STATE ARE YOU IN?

KI4JKY: N4GG this is KI4JYK. Please copy Oregon. Your kite string length?

N4GG: Um, Um… inch and seven eights, oops, sorry, that's the diameter. 250 feet.

KI4JKY: This is KI4JYK. The GEARVAKf rules don't say it can't be over 200 feet, but I don't like logging such a big number. If you fly a kite above 200 feet you can get in trouble with the FAA you know.

N4GG: Okay, well, it's 100 feet on the ground and 150 feet vertical. Oregon is in Zone 3.

KI4JKY: This is KI4JYK. Okay, I'll log that as 150 feet, but it makes me nervous to have to interpret this, and can you turn your power down to QRP?

N4GG: WHAT?

KI4JKY: This is KI4JYK. GEARVAKf is a QRP contest.

N4GG: I'm not in GEAR-whatever it is.

KI4JKY: This is KI4JYK. Doesn't matter. The rules say it's a QRP contest. Can you flip off the amps and get the rig down to 5 or 4 or 1 watt? I'm a little unclear, actually, what the rules mean when they say QRP—maybe you have an opinion on what QRP means?

N4GG: This is the silliest thing I've heard all year. Also, no-can-do. I'm a guest op here and have to raise my hand to get the station owner's permission to touch the amps, and he's out back replacing a balun.

KI4JKY: This is KI4JYK. Okay, but this QSO might not count.

N4GG: I'll chance it. Good luck in your contest KI4JYK. QRZ Contest, N4GG.

KI4JKY: This is KI4JYK. Did you say JYK?

N4GG: KI4JYK, right?

KI4JKY: This is KI4JYK. Nope, I'm pretty sure it's KI4JKY. I just got this call last week and it's really messing me up. QRX one. Okay, yep, it's KI4JKY.

N4GG: Okay, got it, 73. Nuts, now you're a dupe!

KI4JKY: This is KI4JKY. It's okay, when I worked you before I wasn't in the contest.

N4GG: I know I'll regret asking this. Which contest?

KI4JKY: This is KI4JKY. Both, I guess.

N4GG: Okay, in the log for both Qs, 73.

KI4JKY: This is KI4JKY. Why the rush?

N4GG: Contest ends in 12 minutes.

KI4JKY: This is KI4JKY. Oh, GEARVAKf runs until December 31, I think. There's been discussion on the GEARVAKf reflector lately about errors in the Julian calendar however, so it's open to interpretation.

N4GG: Good luck with that, 73.

KI4JKY: This is KI4JKY. I'll spot you on the cluster if it will help. In fact, I'll spot you once a minute for the rest of your contest. Sorry to have held you up.

N4GG: NO! NO! NO! DON'T DO THAT!

KI4JKY: This is KI4JKY. Why, is it against the rules for your contest? I'm not in your contest you know.

N4GG: It's not against the rules, but some people think it's wrong. It's a long story. Also, I'll be reported for cheerleading.

KI4JKY: This is KI4JKY. Is cheerleading against the rules?

N4GG: No

KI4JKY: This is KI4JKY. I'm really confused, but okay, no spotting, I promise. I found you because you were spotted, you know. Did that give you an unfair advantage for the last five minutes?

N4GG: Yes… maybe… well no, not in this case.

KI4JKY: This is KI4JKY. Okay, 73. Does not really being in Oregon matter?

N4GG: WHAT?

KI4JKY: This is KI4JYK, er, darn, this is KI4JKY. Just trying to help. You get points for distance, don't you? If you don't, then N4GG please copy Georgia.

N4GG: Actually, this contact is zero points and very important to my score, and please don't ask why. What state have you been telling people when they ask?

KI4JKY: This is KI4JKY. As far away from them as possible—to give out more points.

N4GG: Are you going to submit a log? In Cabrillo format, of course.

KI4JKY: This is KI4JYK. Probably can't. I don't know Spanish.

N4GG: Okay, Zone 5 it is. 73. This could set a new record. This Q could be a dupe, and a U and a B and an N. Probably 100 penalty points, too.

KI4JKY: This is KI4JKY. What are U, B and N? And don't worry too much, GEARVAKf doesn't have penalty points.

N4GG: No time to explain, 73. CQ Contest, CQ Contest, Anybody Anywhere who is in MY contest and following MY interpretation of the rules. Anybody anywhere, following MY rules….

NCJ

Single Tower SO2R: Design Challenges and Solutions

Pete Smith, N4ZR

My station is a second-tier single-op, single-tower contest station. I have a 40-meter Yagi at 104 feet, tribanders stacked at 69 and 97 feet, low 40 and 80-meter dipoles near the tower for Sweepstakes, a 4-element wire parasitic array (K3LR/W9LT type) for 80 meters and a shunt feed on the tower for 160.

For several years, I used my old Kenwood TS-930 transceiver with a PIEXX µP board for SO2R with a Butternut HF9V antenna on the galvanized steel roof of my garage, about 250 feet from the tower. Running medium high power (a Yaesu FT-1000 Mark V transceiver and an SB-220 amplifier) to the antennas on the tower, I was able to listen moderately well on the TS-930 on most frequencies, but comparisons convinced me that the vertical was a few S units down from the main antennas, and interaction could be quite severe anywhere near harmonic frequencies.

Last spring I decided I wanted to try building a switching system that would enable me to switch all of the antennas on and around my tower to either radio, and get rid of the HF9V (my wife was all in favor of the latter). I'm not a hot SO2R operator, so the whole project had a lot of the "just for fun, let's see if I can make this work" flavor. I am not an engineer, or even particularly technically competent, so I had to anticipate some mistakes along the way.

Early on, I decided that the best way to handle the switching was by the standard TopTen architecture (Figure 1).

Two TopTen 6-way relay boxes, followed by six TopTen clone A/B switchboxes, one for each antenna, provide three sets of open relay contacts between the two radios, regardless of the bands selected, and the A/B switches provide a foolproof hardware lockout to prevent two radios ever being connected to the same antenna. With me, foolproof is important! My research indicated that it would be reasonable to expect 80-90 dB isolation between radios from this setup (antenna-to-antenna coupling aside).

For the high bands, the simplest solution appeared to be to split off the upper and lower tribanders in my stack. I did that

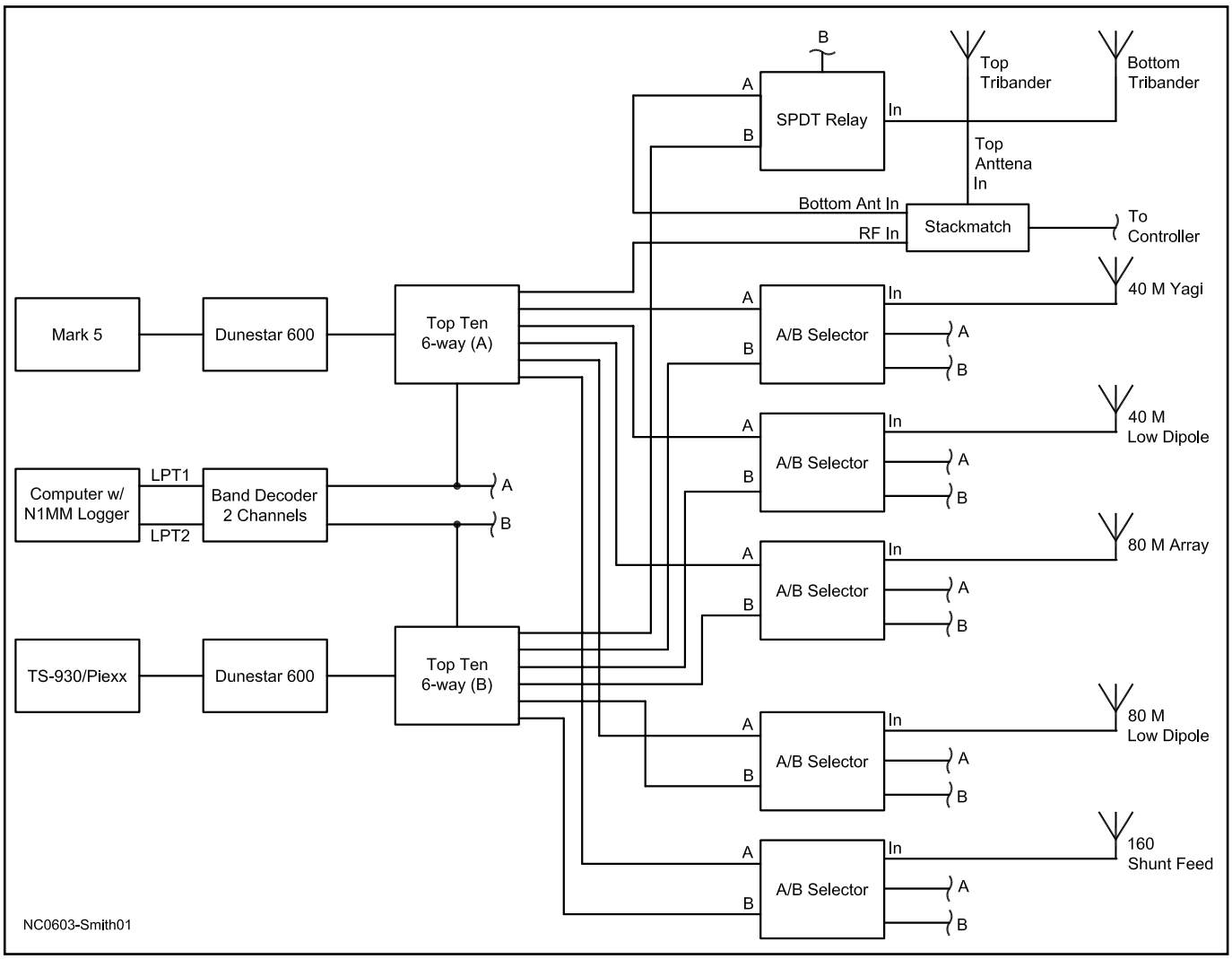


Figure 1—Block diagram of the N4ZR SO2R system.

with a homebrew stack splitter, utilizing the same sort of two-relays-in-series configuration. I have to remember to switch my Stackmatch to "top-only" whenever the second radio is connected to the bottom, to preserve decent matching, but that's the only real compromise with frequency agility that this setup imposes.

Since I only wanted two runs of hardline between shack and tower, all this switching had to be mounted at the base of the tower, rather than inside. Standard weatherproof boxes are absurdly expensive, so I decided to use an approach I've been happy with before. I mounted all the relay boxes on a sheet of aluminum, and mounted it inside a translucent Rubbermaid storage box (see Figure 2), hung on a tower cross-brace with U-bolts that I modified for the purpose (they are now big, beefy, one-legged hooks, attached to the aluminum base plate and passing through the box to hang on the tower). All the coax and control cables are routed in through the bottom edge of the box, as you can see. If I had it to do over again, I would mount the A/B switches so that their coax jacks faced the two 6-way switchboxes—it would have made the coax connections a good deal neater.

A friend, who shall remain anonymous, made all this possible by producing the A/B switch clones; if he hadn't done so, the cost would have been pretty steep. In that case I think I would have seriously considered the 2x6 switchbox made by MicroHAM; the price would have been more than competitive, and it appears to incorporate virtually the same circuitry as the separate-boxes approach. Moreover, eliminating all the inter-box coax would cut out a good deal of cost and potential reliability problems.

To get the control signals from the shack to the switch assembly, I wanted to use some inexpensive CAT 3 networking cable, but I was unsure whether the 24-gauge wire would be low enough resistance. Some rough calculations suggested that if I ran ~14 V at the input to the controller, the voltage at the tower would be about 11 V in a worst-case situation. This has proved out in practice, and all the relay boxes have operated reliably so far, despite cold weather. The cable was so cheap that I ran redundant cables to each side of the switchbox, just in case.

Band Decoding and Antenna Switching Control

Automatic antenna bandswitching (as well as switching bandpass filters) was a must for me. I also wanted to be able to use *N1MM Logger*'s facility for controlling up to 16 antennas on each BCD output. This led me ultimately to W9XT's BCD-10 band decoder PC boards, which are inexpensive and very effective. Two of them, in an old printer switchbox, make a compact nerve center for the whole station (Figure 3). Because of limitations in the decoding and driving ICs, there is no commercial decoder I know of that will select more than 10 antennas, and I only have 6 anyway, so I'm satisfied. By the way, before it triggers a lot of correspondence, I'm left-handed, and have Radio B on my left, which is why the control box is "backward."

One aspect of automatic bandswitching is a little tricky. With tribanders, you want to be able to use one relay position for all three bands, while the bandpass filters (or switched stubs, if you choose that route) need the ability to select each band individually. I wound up building the diode matrices to do this job into the box with the decoder boards. One advantage of this is that I was able to put toggle switches on the front of the control box to bypass the bandpass filters, for example to use the station on 30, 17 or 12 meters, or on 160 with the Mark 5 turned up all the way. The layout of the diode matrix is in Figure 4, so that you can reverse-engineer it if you want.

Bandpass Filters vs Stubs

The most expensive components in the whole system are the two Dunestar 600 bandswitching bandpass filters; I flinched for a long time before deciding that I simply wasn't sure enough of my ability to properly cut and tune stubs. I chose the Dunestars over ICE's similar units, despite their higher price, because their specs seemed slightly better, and because of good reports about Dunestar's customer service. This has subsequently been borne out in my experience dealing with Ron at Dunestar. His filters also are very well built, and are readily adaptable to positive or negative switching.

Goof-Proofing

I have done enough stupid ham tricks over the years that I was worried about doing expensive damage to my radios in the course of setting up and testing, so I decided that effective receiver protection was a must. The protectors have already

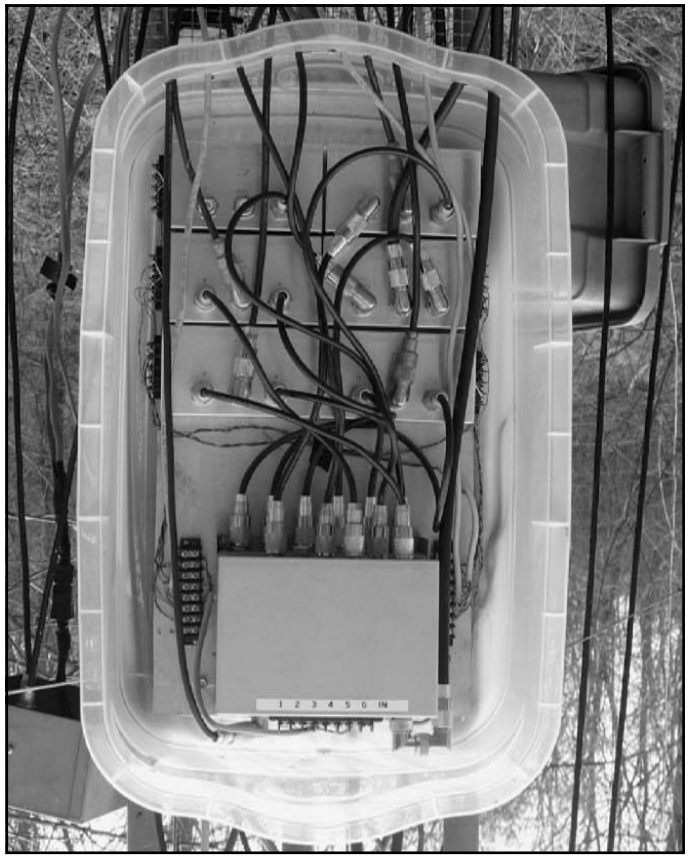


Figure 2—A Rubbermaid weatherproof storage box for switching.

Figure 3—The nerve center of the N4ZR SO2R station.

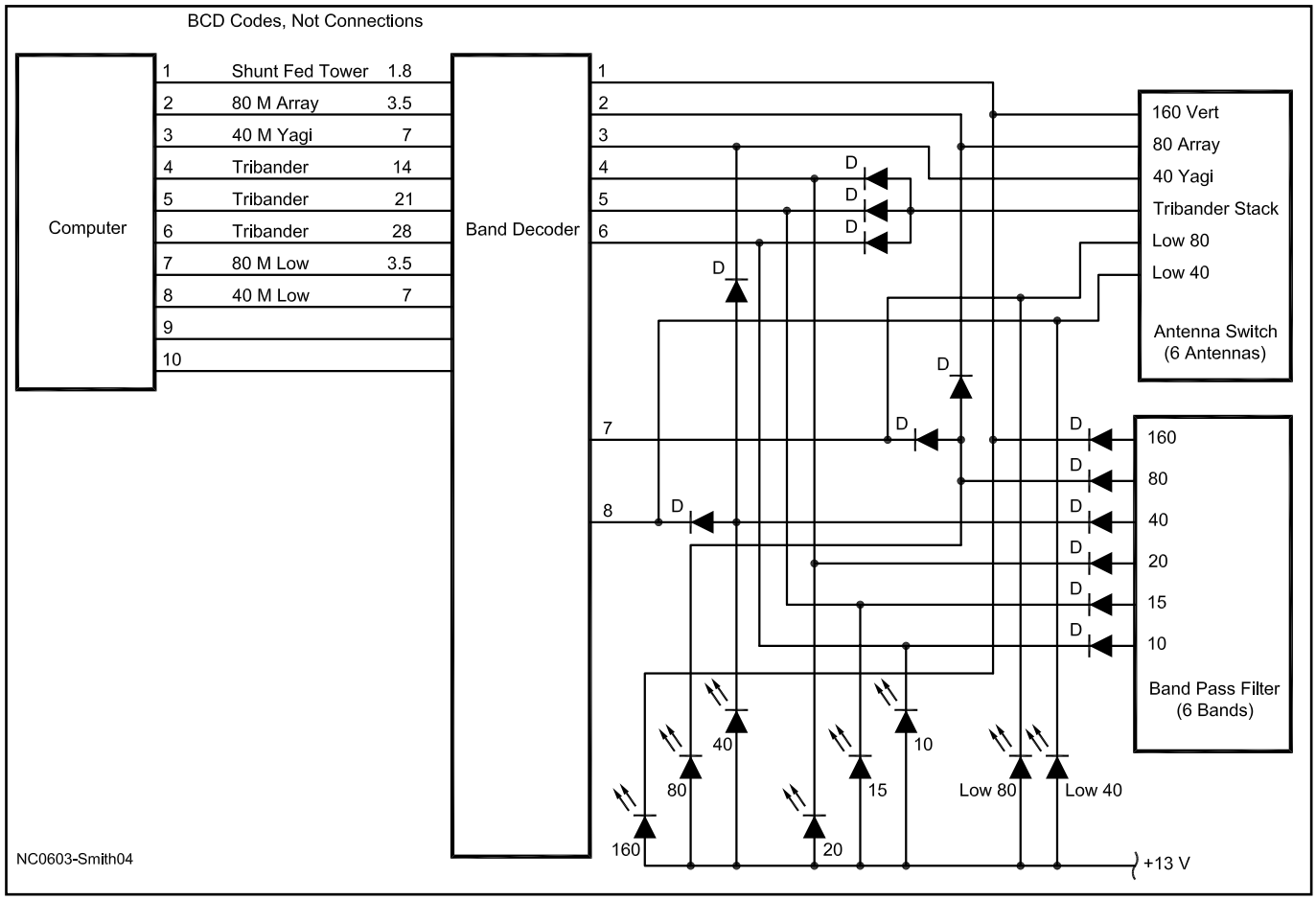


Figure 4—N4ZR's diode matrix configuration—one of two identical sides.

been described in *NCJ* (November/December 2005 issue) so I don't want to go into detail again here. Suffice it to say that the first time you see the bulb on the protector light, indicating potentially dangerous power reaching the protector, you'll be glad you took the extra trouble.

Testing and Test Results

For the moment, I am running low power. My assumption is that once I assess the system performance at the 100-W level, I'll have a pretty good idea of whether I can add amplifiers to one or both radios without severe problems—after all, 10-13 dB more signal is just that. For my tests, I ran 100 W to the TS-930 and recorded results on my Mark 5. I did this at least in part because the TS- 930 has an iffy reputation for broad-band phase noise, and I wanted to take a worst case.

To my surprise, isolation between the two radios is very good, actually better than when I was using the vertical for the second radio. My Mark 5 has the Inrad roofing filter, which may account in part for the good performance. Away from harmonics of the transmitting frequency, all I can hear is a slight increase in the noise floor. The harmonics vary in strength from S9 to S9 +35, and at worst (transmitting on 40, receiving on 20) are audible 4 kHz either side. This is the only case that could be a problem, if I were an active RTTY contester and wanted to operate 40 and 20 simultaneously. In that case, I think I would add a stub to attenuate the second harmonic from the 40-meter radio, but for the sort of contesting I do, that probably won't be necessary because the bandpass filters are doing the job.

The bottom line is this: It wasn't cheap, and it isn't simple, but it seems to work pretty well. It was fun to design and build, and fun to use. I hope my approach, and some of the ideas presented here, stimulate you to try it yourself.

NCJ

2005 CQWW CW DX Contest on Topband from VY2ZM

Jeff Briggs, K1ZM/VY2ZM
k1zm@aol.com

Every now and then the propagation gods smile on us and bless us with fabulous lowband conditions to enjoy during a major DX contest weekend. This past November 2005 was just such a moment on 1.8 MHz and, since I was asked to write about this past weekend in an article for the *NCJ*, I accepted and was grateful for the chance to share this special time with my fellow contesters.

By now, I think most folks are aware of the fact that in September 2000 I first journeyed to Prince Edward Island (PEI) in Maritime Canada to look for a parcel of land. During the summer of 2001, my family and I built a retirement home there and also began the simultaneous construction of a major contest station—with *special* emphasis on 160 meters (or Topband, as it is often called). For more details about the evolution of this contest station, check out the March/April 2003 and July/August 2005 issues of *NCJ*.

Today the station is replete with 10 towers in all, stacked Yagis for 40-10 meters, a 4-Square for 80 meters and a complete suite of 300-meter beverages for the 60/80/170/210 and 300 degree headings. All of this is located directly on saltwater on the northeastern shore of PEI with a clear shot over the water from 320 to about 85 degrees. All of the aforementioned antennas are first-class systems but, without question, the *coup de grace* is the Topband array designed by Peter Hutter, WW2Y and Rob Flory, K2WI, *on a napkin* one day down in Princeton, New Jersey in 1997 (I think).

Some think of it as a 4-Square array (because that is what it looks like in the photos), but clearly it is not, as it is a far better antenna than a classic 4-Square system which offers only 5.68db gain in four principal directions. The WW2Y/K2WI design is a two-by-two driven array that develops gain approaching 8 dB in the most favored directions. It also can be operated with the main lobe split, which can produce simultaneous gain at 6.0 dB in multiple directions at the same time to optimize performance in a major contest. Try doing that with a 4-Square—you can't, or at least not very easily because the spacing between the elements will not allow it.

In addition to the advantages of a directional antenna with meaningful gain right at the salt water's edge, there is also a highly-specialized receive antenna at VY2ZM (also designed by WW2Y and K2WI) that is a miniaturized version of the transmit array—but with 6 active elements. It is known around the 'ZM shack as the "Rx six-pack"—not to be confused with the more commonly known WXØB Sixpack SO2R antenna switch!

This six-pack Rx antenna sits about a half mile from the transmitting array on 8 acres of land specifically cleared for this purpose. This configuration is wholly within existing contest rules as it sits on land I own, which is now around 115 acres or so. It is positioned off to the side of the transmitting array when it is beaming towards Europe, which presents some interesting opportunities for nulling. When nulled, it is actually possible to transmit on the transmitting array and then tune the band for other stations and multipliers during a major contest, all without too much *splash* from the transmit signal being picked up on the sixpack. But these techniques were not employed during this specific contest. They have been used, from time to time, at the station during previous multioperator 160-meter contest entries, however.

Inside the station, an FT1000D and an Acom amplifier are typically used on Topband in most contests, with some manually tuned amps sitting on "hot standby" in backup mode, if needed.

Normally on Topband, as Jack Leahy, VE1ZZ, will tell you, it is possible to hear Europe quite early from the Canadian Maritimes, but this does not necessarily mean you will do well in a 160-meter contest. Case in point: I recall entering CQWW CW single-band 160-meters in November 2001 and getting my doors blown off by most of the better-equipped European stations. So, you do not always do well even when operating from a place as favored as VY2. Nevertheless, I have always felt that the place had major contest potential if the right conditions occurred in a contest.

The Contest is Underway!

I should first note that Scott Robbins, W4PA, from Ten-Tec came up to operate SOAB during CQWW Phone and, at the time of this writing, it is beginning to look like he will finish at #3 in the world, which is simply amazing from North America. While Scott was here, he managed a 200-hour effort on Topband—on phone no less—which we actually managed to record on tape. It is an astonishing hour with all kinds of overseas DX interspersed with well-known US call signs. Scott will never forget that experience as long as he lives. I listened to him do it and even I was impressed with what was going on. With that in mind, Scott and I both secretly hoped the CW weekend conditions would offer similar opportunities on 160 meters for me—and they did!

Jeff, K1ZM, at the VY2ZM station for CQWW CW 2005.

Looking towards EA8 from the 120-foot level of the SE 160-meter radiator at VY2ZM.

View of the 160-meter array phasing control system.

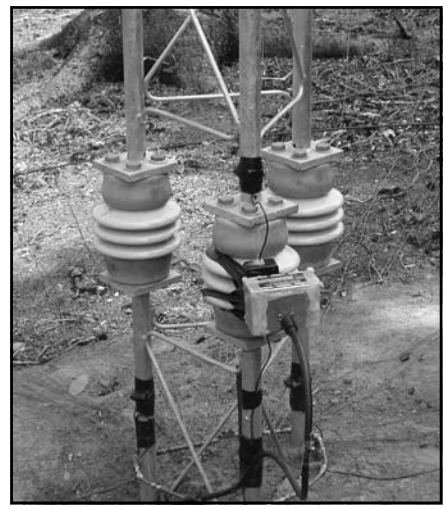
At the start of the contest, Europe was boiling in already with most signals well over S9. The only problem was the QRM level I was beaming into in Europe. It is often so bad that those folks simply cannot hear North America until their sunrise approaches. Fortunately, I found a hole and got a good run going, with stations like OH0Z, 3V5A and LZ9W being logged in the first hour.

The second hour on Friday night included TZ5A, R1MVC, IH9P and RW2F. Hour three was also a good one with C4M, 4X4DK, 9H3MR, OY9JD, OJØJ, RX9FM and TE1W making it into the log. Hour four included TF4M, ES5QX and lots of other European and W/K stations.

Here is a quick look at the first night's breakdown shows these hourly rates and new mults on Topband:

00Z	151/38
01Z	96/14
02Z	77/11
03Z	134/06
04Z	140/03
05Z	134/04
06Z	56/09
07Z	46/06
08Z	28/01
09Z	31/00
10Z	17/01
11Z	25/00

Interestingly enough, Europe stayed in until 1011Z on Friday night when I worked my last G (GØHSU) and even managed to work Clive, GM3POI, as late as 1201Z, which is not the first time we have managed contacts at his local noon time. I believe this is possible because of the lowness of the sun in the sky in November, the lack of sunspots at the moment and the fact that each of us is sitting at the edge of the ocean with first-rate 160-meter transmitting antennas.



Typical 160-meter radiator base insulator and feed/matching system.

At the end of the first 24 hours, I recall having 1118 Qs with about 20 zones and 87 countries in the log. I was delighted because I was already ahead of the existing North American record score set in 1998 by Yuri at VE1ZZ (under the call sign VA1A). I figured at the time that if the conditions held up, I could make a big score, so I pressed ahead and ran Europe whenever I could.

Quirky Paths to Europe

I should note in passing that while I had worked GM3POI at 1201Z (just before the band closed), I was able hear Europe again around 1500Z. In fact, as I am typing these lines at 1630Z on December 01, 2005, I am hearing a European pileup on 1834.9 kHz calling a Southeast Asian station I cannot hear. That's the way it works around here in the winter. I cannot always

VY2ZM CQWW CW 2005 Single Op 160-Meters

Countries Worked By DXCC Entity (Call of First Station Worked)

3DAØNW	DJ6YX	HC8N	OHØZ	TZ5A
3V5A	EA5HT	HI3/SP9XCN	OJØJ	RK3DK
4K7Z	EA6IB	5J1W	OL1C	RW2F
4X4DK	EA8ZS	IU2R	OM7M	RX9FM
C4M	EI3GQ	IH9P	ON4WW	UU7J
5R8FU	ER5AG	ISØU	OY9JD	V26K
6W1RW	ES5QX	IT9INO	OZØXX	V31TM
6Y7A	EW1CQ	JA4DND	P4ØW	VO1UL
7XØRY	F5BAR	W4ZV	PAØMIR	VK3ZL
8P5A	FG5BG	KH6ZM	PJ2T	VP2E
8Q7DV	FP/K8DD	KL7HBK	PV8DX	VP5W
9A3RE	G3RTY	KV4FZ	PZ5C	VP9I
9H3MR	GD6IA	WP4G	R1MVC	XE2TG
9Y4AA	GI4VIV	LN8W	S58Q	YL2VW
C6AQQ	GJ2A	LR2F	SM5DQC	YR7M
XQ6ET	GM3OXX	LX7I	SN2N	YZ5C
CO8LY	GWØGEI	LY2MM	SZ1A	YW4D
CT1FJK	HA8ØIARU	LZ9W	T91ALM	Z37M
CT3EN	HB9MM	OE4A	TF4M	ZF1A
CU2A	HBØ/DL6CX	OH3BU	TE1W	ZL3IX
				ZS4TX

be heard in Europe at this hour, yesterday I did work SM6DOI at 1828Z and I have worked other similarly equipped stations even earlier than that under good conditions.

On Sunday morning in the contest, while eating breakfast, I wrote down a few calls I copied very early at 589 or better: LY2IJ at 1537Z, RA6AX at 1538Z and SM5CEU at 1543Z, for example. But these folks do not usually hear me in a contest environment until around 1900Z or so.

The Second Night

As the second night began, conditions remained superb and I worked some additional goodies like 4K7Z, LX7I, Z37M before 2400Z (which is normal). As the second night progressed, some nice multipliers appeared and were logged including KL7HBK at 0155Z, 3DAØNW (K9NW operator), ZS4TX, LR2F, 7XØRY, an HBØ two hours after his sunrise time, XQ6ET and ZL3IX. Europe was again still in until 1011Z (G4ERZ was the last) and then back in again by 1445Z on Sunday morning. The QSO count at 1200Z on Sunday seems to have been 1576 Qs, 26 zones and 96 countries.

As sunset approached again on Sunday afternoon, I could tell conditions were still excellent, and in the final three hours of the contest I managed to log 8Q7DV and JA4DND (on the long path SE) for double-doubles and three additional multipliers, as well to wind up with 1710Qs/28Z/101C for a final claimed score of 564,891 points. An additional 130 QSOs were logged between 1900Z and 2400Z on Sunday afternoon when the contest ended.

VY2ZM Epilogue

This running of the CQWW CW contest will always be special to me because it was the successful culmination of more than four years of very hard work. When something like this comes along, one cannot help but feel how worthwhile all the hard work was, including the investment of time by WW2Y and K2WI, without whose help the antennas in use probably would never have come into being. I am also grateful for being in the right place at the right time to set a new World Record score for a single-band entry on 160 meters, and especially to have been able to achieve it from North America where all my USA QSOs are valued at only 2 points. I guess fortune does indeed smile on us all at some point. Many thanks to all my friends from around the world who helped me set this record score. I hope to see you all again soon on Topband. NCJ

Antenna Parameter Variations and Their Impact on Resonant Frequency

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Have you ever built an antenna that you saw described in a magazine article, only to find that the actual resonant frequency was markedly different from what you expected? Or, have you sometimes found it necessary to make "substitutions" when constructing a certain antenna design, because you didn't have the exact parts that were specified, and wondered how the modifications would change the results? If so, read on...

This article examines several of the common parameters which exist in real-world ham-radio vertical antenna installations, and reviews the effects upon resonant frequency when they are varied. The items to be considered include metal composition, element diameter, element tapering, soil characteristics, and number of radials. All of the antennas were simulated using *EZNEC Pro*[1] with a double-precision *NEC-4* calculating engine.

Element Diameter and Tapering

The first antenna to be modeled is a full-size vertical monopole designed for operation at 3650 kHz (length = 0.25 wavelength [WL] = 67.3679 feet). The antenna is placed over perfectly conducting earth to eliminate the effects of losses in the ground system. The vertical element is initially assumed to be made of aluminum, but copper and zinc are also used (galvanized steel tower sections are made from steel that has been dipped in zinc to resist rust). The diameter of the monopole ranges from 0.0808 inches (#12 AWG wire) all the way up to 20 inches, in order to include vertical antennas made from wire, tubing, or tower sections. Constant-diameter monopoles are utilized, along with a tapered element whose diameter begins at 2.5 inches (at the base) and decreases in steps of 0.25 inch, ending with a tip diameter of 0.5 inches.

The outcome is summarized in Table 1. As expected, the resonant frequency of the antenna continually falls as the conductor is made "fatter." The wire element is resonant at 3554 kHz, while the 20-inch monopole resonates 160 kHz lower. Look what happens when a tapered element is used—now the resonant frequency is well above that of the antenna constructed from #12 wire (by almost 180 kHz), even though it is much larger in size. We can see that the diameter of the monopole has a significant effect upon the resonant frequency, especially when a tapered element is used.

The gain at resonance is nearly constant (at 5.14 dBi) for all versions of the antenna, decreasing by slightly more than 0.1 dB when #12 AWG wire is used instead of tubing or tower sections.

The composition of the vertical monopole was then changed from aluminum to copper, and finally from copper to zinc, with all the models being run twice more. The results for both copper and zinc were essentially identical (resonant frequency within +/- 1 kHz and gain within +/- 0.01 dBi) to those found earlier with aluminum, for all of the elements except the #12 AWG wire. The outcome changed slightly when this wire was used, and that information is included at the bottom of the

Table 1

Input impedance and resonant frequency for quarter-wave vertical elements of various diameters. The monopoles are all made of aluminum (except for the last two entries in the table), and are installed over earth that is perfectly conducting. In each case, the physical length of the element is 67.3679 feet, which is 0.25 WL at 3650 kHz.

Vertical Element Diameter	*Input Impedance at 3650 kHz (Ohms)*	*Resonant Frequency (kHz)*
#12 AWG	40.29 + *j* 23.59	3554
0.5 in.	39.84 + *j* 22.97	3534
1.0 in.	40.12 + *j* 23.14	3521
1.5 in.	40.38 + *j* 23.31	3512
2.0 in.	40.60 + *j* 23.46	3505
2.5 in.	40.80 + *j* 23.61	3498
5.0 in.	41.63 + *j* 24.20	3474
7.5 in.	42.30 + *j* 24.66	3456
10.0 in.	42.90 + *j* 25.04	3441
15.0 in.	43.97 + *j* 25.60	3415
20.0 in.	44.94 + *j* 25.95	3394
tapered from 2.5 to 0.5 inches	34.00 - *j* 13.37	3733
#12 AWG copper	39.82 + *j* 23.18	3556
#12 AWG zinc	40.61 + *j* 23.87	3552

Table 2

Input impedance and resonant frequency for vertical antennas using various numbers of buried quarter-wave radials. The monopole and radials are made from #12 AWG aluminum wire. "Average" soil, with a conductivity of 0.005 Siemens per meter and a dielectric constant of 13, is utilized. In each case, the physical length of the element is 67.3679 feet, which is 0.25 WL at 3650 kHz.

Number of Radials	*Input Impedance at 3650 kHz (Ohms)*	*Resonant Frequency (kHz)*
15	49.41 + *j* 28.55	3528
30	43.89 + *j* 26.04	3539
60	40.28 + *j* 23.72	3549
120	38.36 + *j* 22.01	3557

Table 3

Input impedance and resonant frequency for vertical antennas using various numbers of buried quarter-wave radials. The monopole and radials are made of #12 AWG aluminum wire. "Very good" soil with a conductivity of 0.0303 Siemens per meter and dielectric constant of 20 is utilized. In each case, the physical length of the element is 67.3679 feet, which is 0.25 WL at 3650 kHz.

Number of Radials	*Input Impedance at 3650 kHz (Ohms)*	*Resonant Frequency (kHz)*
15	45.48 + *j* 27.31	3534
30	43.17 + *j* 25.85	3540
60	41.29 + *j* 24.62	3545
120	39.91 + *j* 23.61	3550

Table 4

Input impedance and resonant frequency for vertical antennas using various numbers of buried quarter-wave radials. The monopole and radials are made of #12 AWG aluminum wire. "Very poor" soil with a conductivity of 0.001 Siemens per meter and a dielectric constant of 5 is utilized. In each case, the physical length of the element is 67.3679 feet, which is 0.25 WL at 3650 kHz.

Number of Radials	*Input Impedance at 3650 kHz (Ohms)*	*Resonant Frequency (kHz)*
15	48.61 + *j* 31.00	3521
30	39.89 + *j* 24.67	3547
60	36.12 + *j* 20.76	3563
120	34.50 + *j* 18.84	3571

Table 5

Resonant frequency for vertical antennas using various numbers of buried quarter-wave radials, for three different types of soil. The monopole and radials are made from #12 AWG aluminum wire. In each case the physical length of the element is 67.3679 feet, which is 0.25 WL at 3650 kHz.

	Resonant Frequency (kHz)			
Number of Radials	*Average Soil*	*Very Good Soil*	*Very Poor Soil*	*Change in Resonance (kHz)*
15	3528	3534	3521	13
30	3539	3540	3547	8
60	3549	3545	3563	18
120	3557	3550	3571	21

table. It is evident that the metal selected for constructing the antenna (aluminum, copper, or zinc-clad steel) is relatively unimportant.

Soil Characteristics and Number of Radials

Next, the same quarter-wave monopole was placed over "real earth" containing a ground system composed of buried quarter-wave radials whose number ranged from 15 to 120. Three different types of soil were examined: "average" soil with a conductivity of 0.005 Siemens per meter and a dielectric constant of 13; "very good" soil with a conductivity of 0.0303 Siemens per meter and a dielectric constant of 20; and "very poor" soil with a conductivity of 0.001 Siemens per meter and a dielectric constant of 5.

Table 2 displays the findings for average soil. The resonant frequency of the antenna rises continually as more radials are added, changing by nearly 30 kHz as the number of radials grows from 15 to 120. Not surprisingly, adding more radials also increases the gain, which changes from -0.31 dBi for 15 radials to 0.63 dBi for 120 radials. For very good soil, Table 3 shows that the shift in resonant frequency is not as great as before, rising by only 16 kHz when the number of radials increases from 15 to 120. The gain moves up from 1.97 dBi to 2.50 dBi at the same time. On the other hand, the increase in resonant frequency is fully 50 kHz when the antenna is installed over very poor soil (and the gain rises from -2.03 to -0.94 dBi) when the number of radials is increased from 15 to 120, as recorded in Table 4. We can see that changing the number of radials in the ground system has some impact upon the resonant frequency of the antenna, and the amount of influence becomes larger as the soil conductivity decreases.

Table 5 summarizes the variation in resonant frequency as a function of soil type, versus the number of radials. The addition of more radials always leads to a corresponding increase in the resonant frequency, for any kind of soil. When only 15 radials are utilized, changing the soil type causes the resonant frequency to vary by as much as 13 kHz, but the range decreases to 8 kHz with 30 radials. If the ground system uses 60 radials, then changing the soil type leads to a variation in resonance of up to 18 kHz, increasing still further to a maximum of 21 kHz for a system of 120 buried radials. When the number of radials is fixed, a change in the electrical character of the soil leads to a measurable shift in the resonant frequency of the antenna. However, the magnitude of this alteration is dependent upon the total number of radials.

Limitations

Several items should be mentioned with regard to the accuracy of computer simulations. These models are imperfect representations of the real world, and cannot possibly include all of the features which are actually present, such as buildings, vegetation, other conductive objects, irregularities in the terrain, non-uniformity of the ground constants, etc.

Conclusions

This article has investigated several factors which influence the resonant frequency of an antenna when it is operated in a natural environment. Parameters such as element diameter and tapering, soil characteristics, metallic composition, and number of radials have been reviewed, and the results presented in tabular form. It is hoped that this information will help us to understand why a backyard antenna may not always work "just like it does in the book."

Notes

[1] *EZNEC Pro* is available from Roy Lewallen, W7EL, PO Box 6658, Beaverton, OR 97007.

NCJ

160 Meters from Bermuda in 2005 WPX CW

Jon Jones, NØJK

Putting out a decent signal on Top Band when on a budget contest DXpedition is a challenge. At home you can shunt feed your 100 foot tower, or put up a 4 square array of verticals. But there is no way to pack these in your carry-on luggage. A multiband vertical or a small triband Yagi on a short tower usually covers 10, 15 and 20 meters well. A dipole or loaded vertical in the clear does okay on 40 and 80. But simple antennas like these often disappoint on 160 meters. Typically the contest op can hear lots of stations, but few if any answer when called. CQing ends in frustration. This happened to me when I operated from Guadeloupe in the 2000 CQ WW contest on 160 meters with a low dipole. I wondered if there was a solution.

I faced this dilemma again when I planned to operate single-band 160-meters in the 2005 WPX CW contest from Bermuda. One-sixty is a tough band in this contest, due to high static levels in the northern hemisphere at the end of May, so I needed an effective transmit antenna to be heard. I planned to operate from the rental apartment of Ed, VP9GE. There are no tall towers to shunt feed or hang wires off of. Ed's place sits about a half mile from the ocean, so I could not put a vertical in the beach sand. But Ed does have some tall pine trees. With that in mind, we decided to put up an Inverted L antenna (Figure 1).

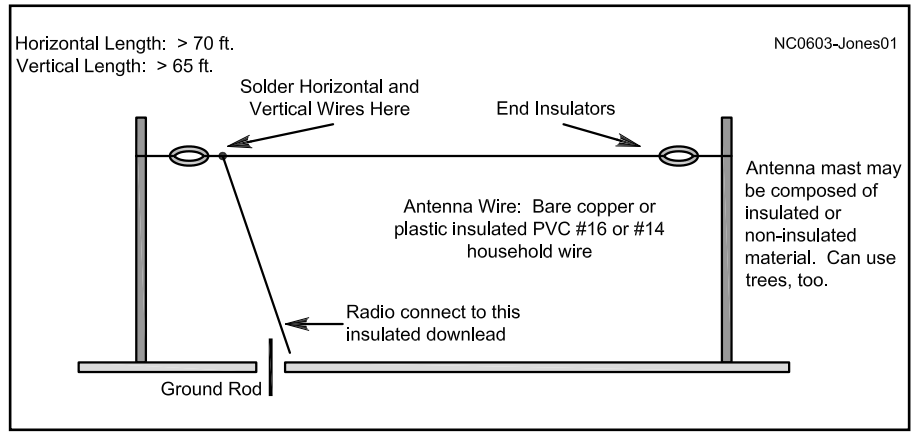

Figure 1—Diagram of the Inverted L used by VP9/NØJK at the QTH of VP9GE.

The Inverted L (also known as a Marconi) is a proven antenna for Top Band. Ours consisted of a little over 130 feet of wire put up in one of the tallest pines. The horizontal portion of the L runs back towards Ed's house. A ground rod was installed and a number of radials stretched out. The taller the vertical part of the L, the better it will work. A ground system is essential, with more radials the better. The antenna was trimmed until the SWR was near 1:1 at 1.830 MHz. With a typical ground system, the antenna impedance is near 50 Ω. Figure 1, adapted from CO2KK, illustrates the basics.

I only operated Saturday night of the contest. As the sun began to set in the west, the antenna seemed to hear well. I could copy some of the bigger European stations before sundown! But can they hear me with 100 W?

W4KZ went into the log at 0045 UTC for contact number 1, followed by VE1ZJ at 0049. The L was getting out. But I could not get any of the European contester's attentions. High static levels in Europe and my low power were hurting. Finally at 0233 UTC, HA8BE went into the log. Then it was like a switch had been thrown! I had a small pileup calling me. About 50 Europeans were logged, including LX7I. The signal levels were strong and the band was in good shape despite the high seasonal static. G3JMJ was the last from Europe to be worked at 0318 UTC - then they were gone. The sun rises early in Europe in May.

Over the next couple of hours I worked stations up and down the eastern seaboard. V25O was heard CQing around 0420 UTC, but did not copy me. KC2NMZ reported I had a big signal, as evidenced by the following spot:

KC2NMZ
1827.5
VP9/N0JK
big signal
0440 29 May 2005

The furthest west worked was NØIM in MN.

N0IM
1827.6
VP9/N0JK
0346 29
May 2005

By 0700 UTC the effects of sleep deprivation began to catch up and I fell asleep at the radio. I woke up at 0800, but there was no one on the band and I didn't get any replies to CQs. I was hoping to work some of the VKs before my local sunrise, but I dozed off again. Here's what I missed:

VK6VZ
1800.0
VP9/N0JK
looking for u Jon!
0913 29 May 2005

Finally the sun peaked in the window. That was the end of the WPX contest for me. The other reason for my trip—to operate 6 meters—came into play later that morning. I had a great 50 MHz E_s opening to Europe and worked all the way to Greece. SV1DH and I completed the first VP9 – SV QSO on 50 MHz at 1546 UTC.

SV1DH
50081.0
VP9/N0JK
519 qsb
1546 29 May 2005

Overall I felt the Inverted L gave a good account of itself on Top Band. I ended up with around 75 contacts, which for 100 W on 160 meters at the end of May is pretty good. Areas for improvement would be put down more radials. A separate receive antenna may help. Ed does not have room for a Beverage, but a pennant or loop receive antenna could be set up. Kyle, WA4PGM, plans to operate the CQ 160 meter CW contest from Bermuda at Ed's station. It will be interesting to see what the L can do on a quiet band in January as opposed to May's static.

NCJ

Retirement: Contester's Voices from the Past

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Many of us contesters will be retiring soon. Have you ever wondered what our thoughts about ham radio and contesting might be when we're retired? Henry N4UH wondered, too, and came up with this.

In the November/December 2003 issue of the *NCJ*, I mentioned a study I had conducted in 1971 about the top contesters of the period 1936-1938. I selected those years because the participants would have reached retirement age in 1971. I hoped to learn from their experiences and gain some idea of what to expect when I retired (I was 52 years old at the time).

I had asked whether the joys of retirement were illusion or a reality. I wanted to know if they were still interested in contesting and DXing and, in general, what they were doing with their time (what changes in their activities had they experienced?).

I came across my survey file while cleaning out junk in 2004. After reading it I wondered if the information was still pertinent today. And do current radio amateurs even remember those great ones?

Reading the comments, I was surprised to realize that their thoughts are just as relevant today as they were 35 years ago. I am now in my 27th year of retirement and can relate to what they said. Some of you may have had these amateurs as your mentors in your younger years, and would enjoy these voices from the past. So, with that in mind, what follows is what I wrote in 1971…

Retired Contester Survey—1971

Scanning the results of the Sweepstakes and the ARRL DX contests allowed the selection of whom to survey. There were not many contests in the late 1930s, but the top winners of each ARRL Section were selected. Due to the redistricting "back there sometime, the only W6s that could be selected were in California as now. There was no Zero district, many W3s became W2s and something happened to spread the Eighth district. The unfortunate W7s got scrambled, but 125 questionnaires were sent to all, which netted 64 replies. That was a good return, although I wondered what happened to the 61 SASEs that never showed up in my mailbox. The 1971 *Callbook* was used for many of the addresses. In some cases it was necessary to check *QST's* "Who the Devil's Who" listing that showing old and new two letter calls.

Several of the comments referred to the XYL. As W2GUM put it, "I have found over the years that while ham radio is a very enjoyable pastime for the operator, it is not interesting to others in the household unless they are hams." How true! It highlights the fact that a happy, retired and active ham tends to be that way because of the tolerance and encouragement of his wife. Certainly, if she nagged him throughout their married life about ham radio, radio and retirement would be no pleasure.

You may be surprised to learn that of the 64 replies, 80% of them stated they were first licensed at the age of 22 or younger. A bell curve of all ages peaked at age 15. That's the way it was in the late '30s. Those were the kids that went on to become the top contesters and DXers.

Not all replies were from retirees, but those that did retire started at age 53, with a few retiring at age 67. Of course there were some like Gus Browning, W4BPD, who said he would retire "after I'm dead!"

I hope you enjoy reading the thoughts of some of the great contesters and DXers of the past as I have. I will warn you that not all were happy about ham radio in their retirement years, but most were. The number adjacent to the call sign is the age of the respondent in 1971.

W2AZL (56)—To me, the typical DX contest is a waste of time. If we all spent a little more time getting better acquainted, the world would be a better place to live in.

W6AM (73)—By looking around it appears the happiest retired men: 1. Had ham radio; 2. Played golf, exercise for exercise sake is not a bit interesting when retired, but exercise is necessary; 3. Played gin rummy with their old cronies (mental exercise).

W2AYJ (62)—I find that my one and only love is still ham radio, and I get on the air whenever the chance arises. I try to take part in most activities, but I find you do slow down. I can no longer spend the long hours in DX contests, although at times I still try.

W8JIN (54)—Diminished competitive drive. Why? Other activities, new QTH not as good as old QTH, poor operating practices of many, especially on SSB. I've several more years before retirement and picture many changes with more leisure time on my hands.

W5LW (65)—If I live to be 100, I am sure ham radio will still be my first hobby.

W4BBD (60)—Ham radio is still very high on my list of activities. It is my primary social contact area, after my family and church. It is the escape I need to get away from the problems of "the other world", the world of jobs and earning a living.

W4KFC (55-60)—Amateur Radio offers the oldster the opportunity to stay in touch with the world, to make new friends and keep in contact with old ones, to render service to others, to assist desirable new recruits into the game—all without great expense or physical exertion. What other hobby can make that claim?

W2BHZ (58)—I expect to do much more operating, experimenting and building, and operation from a home built truck camper with an SB34, which I recently acquired.

W1IF (65)—In the twilight hours, man can relax and enjoy the fruit of his labor, but unfortunately DX contests, etc, have no allure.

W9AFN (60)—After retirement, the sooner the better, I hope to get back with real zeal again in Amateur Radio, in fact look forward to it.

W8HUD, W8BJS (55)—Still love ham radio.

W9LOJ (56)—I am still very much interested in ham radio, and still belong to the ARRL.

W9IOP/W2IOP (50)—Am moving from South Bend, Indiana to Akron, Ohio as new Exec of Teledyne—President of Olson Electronics. Right now ham radio suffering. But frankly, under normal circumstances, it keeps my sanity and I look to it as my great interest on retirement.

W5BZR (61)—As you grow older, being a ham operator seems to mean more to the operator than it ever did.

W4BYY (73)—Have enjoyed ham radio over about a 40 year period, and hope to continue for the rest of my life.

W3CHH (60)—Don't expect to make many changes, except hope to have an antenna farm. After retiring will have to start over again with all the awards like WAS, WAC, DXCC, WAZ, etc.

W8BYM (72)—If you have no other interest, and you like Amateur Radio, you can keep it up until the end.

K4MV (62)—I enjoy ham radio now mostly to maintain contact with my friends who are also hams, as well as an interest in DX antenna performance, etc.

W4NO (68)—I think about ham radio a good deal of the time, but once I get down at the rig, it isn't long before I have to get up and move around. Nostalgia is a big factor.

W4GF/W7GF (59)—I have been retired only 8 ½ months. I have not become fully adjusted to retirement yet. The one thing I miss is the feeling of helping others, which I had at the job. Perhaps more such activity in (or connected with) Amateur Radio will be the answer.

W4BPD (63)—I have learned that to enjoy life. Do what you want to do. You are only here once, and you will be gone

a long time. You cannot take anything with you. Better enjoy yourself while you are here—do what you like doing is my feeling toward anything as long as it's legal and not against the teachings of the Holy Bible. At any rate, I must have retired the day I was born, because I have always done just exactly what I wanted to do.

W1FH (57)—Still thoroughly enjoy my hobby and consider myself lucky to have taken up this hobby in view of all the available time I have.

W1BHR/WB4MZM (70)—Ham radio has been a great hobby for me from many standpoints. It's great to sit down and talk to the many friends that you have made over the years.

W2BXU (55)—My areas of competitive effort have changed. On CW for example I have no great desire to be faster than the other guy, but I would like to send better, zero mistakes. It may be easy to get 59 with 1kW—but how about with 10 Watts?

W2UK (68)—In general am no longer interested in competitive phase of ham radio, but engage in it for the pleasure it gives through maintaining old friendships.

W8ZY/W4CT (72)—You will still enjoy hamming. However, when working wished many times could spend more time especially DXing. After retired and could, it didn't seem as important.

W8AQ (66)—Used to enter every contest with intent to win (hi!). Now I find I haven't the energy needed for long sessions at key.

W5ASG (67)—Ham radio does contribute its part to my satisfaction with retired life, although I try not to become obsessed with any particular interest or hobby.

W3ZQ/KV4AM (62)—The XYL is still jealous of the radio—even at my age. Anyone have an answer of how to keep the XYL happy during a contest? Or on a DXpedition if she goes along?

W9AEH/7 (67)—Amateur Radio is a wonderful thing to keep up an interest with life, and something that can keep us active just about as long as we are able to wiggle.

W2GUM (55)—I have found over the years that while ham radio is a very enjoyable pastime for the operator, it is not too interesting for others in the household. It is only a hobby and must be engaged in with moderation.

W3DGM/K4PJ (59)—Enjoy contest and participate in most CD parties, State QSO parties, SS, and DX, but not go all out. Do not think my retirement will change my pattern of operating much, but will increase the time allocated.

W9BG (63)—The spirit is strong, but the flesh is weak.

W1ER (52)—I am looking forward to retirement as I hope it will give me the opportunity to do a lot of things, including ham radio, that have been curtailed for lack of time. However, I think there are so many variables that it may not be wise to plan too specifically for the future. NCJ

History's Worst Receivers

By John W. Thompson MD, K3MD

Contesters want to own the best equipment possible. They think nothing of going out and buying a new transceiver because a lecturer at the Dayton Hamvention claimed that one rig or another had a better 1 kHz or 5 kHz desensitization point. Top-grade transceivers are going for $3000 to $13,000 a pop. Depending on whom you talk to, a good rig might be an ICOM IC-7800, IC-756ProIII, Yaesu FT-1000MP, FTDX-9000, Elecraft K2-100 Ten-Tec Orion or whatever.

In this article I'll confine my discussion to superheterodyne receivers. However, my first receiver was a Knight-Kit 2 tube regen. Nostalgic articles to the contrary, the radio was impossible to use as a station receiver because even a 7-W transmitter pulled the receive frequency so much that you couldn't spot your transmit signal. This was a terrible receiver. My next receiver was a Knight-Kit R-55, which was a superheterodyne, but had an IF of 1650 kHz. It was as broad as a barn, even though it had bandspread scales.

My uncle, W2MS, took pity on me and donated his Hammarlund HQ-129X, which was light-years ahead of what I had used before. It had a crystal filter that was useful on CW. With no AGC on CW, my solution was to add some back-to-back silicon diodes across the headphone jack for audio limiting. The main drawback of this receiver was the lack of sensitivity on 20 through 10 meters. It was state of the art for 1946, which was, I would imagine, around 40 μV for 10 dB signal plus noise to noise.

I once operated a multi-single with Doug, K3OMP, who had a National NC-303. This was a ham-band-only receiver, which ran circles around my HQ-129X. If you come across one on eBay, it is a collector's item, certainly as worthy of being collected as Drake TR-4s. It was ham-band-only, featured a crystal filter, lacked AGC on CW and used about 14 tubes.

Four Contest Dogs

I have only used four rigs that I considered to be nonusable in contest environments. One was a Heathkit HW-100. This radio was extremely susceptible to overload. The SB series was not as bad. If modern rigs offer 90 to 130 dB dynamic range, the HW-100 was maybe 30 to 40 dB.

Then there was the SX-101 I used at my first Field Day in 1964. Its receiver was unusable because of mixing byproducts. Riding the RF gain did nothing to correct the problem.

The third nonusable rig was an original ICOM IC-706 that I started to operate one Field Day. I gave up after an hour because I couldn't hear anything on 40-meter CW. I switched to my Kenwood TS-50S instead.

Finally, the original Yaesu FT-101s (not the ZDs) were notoriously susceptible to overload. I only used one briefly.

Collins, Drake and ICOM

I have used two Collins 75A4s and a 75A2, which were the IC-7800s of their day. These are nice receivers, with the linear PTO design copied by Heathkit and later by everyone else. It would be interesting to run one of these units through the ARRL Lab's swept-dynamic range testing.

The Drake 2B was a revolutionary receiver of its day. It gave you the linear PTO with an accurate frequency readout. The passband tuning on the 50 kHz IF was adjustable, too. No doubt the "skirts" would not be up to today's standards, but for the money (equivalent to around $1600 today), the receiver was fantastic. I was initially discouraged by some of the Frankford Radio Club members who said the 2B wasn't all that great. When I finally got my hands on a Kenwood TS-520SE 15 years later, however, I found the "rice-box" ran circles around the trusty old Drake.

One rig I really, really, really wanted when it came out (and turned out to be impossible to keep running in the long run) was the ICOM IC-701. This rig was so far ahead of the competition it wasn't funny. The *QST* review of the '701 noted that it had the best immunity to intermod of any rig up to that time. The frequency synthesizer was prone to getting sick in the long run, however.

Yes, I'm aware of the criticisms—no notch, that weird 100-Hz synthesizer step, but it was so much radio in such small package! At the time, it was quite something. This rig came in at an equivalent of $6000 in today's dollars. Few modern-day critics recognize that the IC-701 introduced the era of the double-balanced mixer and dual digital VFO design.

The Modern Era

A hierarchy of contesting rigs developed in the modern era. The great ones included the Kenwood TS-930/40 and the Yaesu FT-1000MP, which were way ahead of the pack. It is amazing that they are still selling the FT-1000MP Field with the same architecture more than 10 years after introducing the original FT-1000MP. Let us not forget the FT-1000D, which divides the men from the boys on the low end of 40 meters. Plus, with the passband adapter, you can listen to two bands at the same time with one rig.

I think I'll sidestep the Omni VI story for now. Ten-Tec fans are in a world of their own. To hear their praises, the Omni VI was a step ahead, with the revolutionary auto-notch, ham-band-only design without initial up-conversion. Once again, performance at the low end of 40 meters was extolled in the Ten-Tec ads. I never used one.

This discussion is hardly complete. Some of you are going to think of rigs I should have included, good or bad (such as the S-Line and KWM-380, Signal One, IC-751, IC-775DSP, TS-950SDX, TS-820S, etc.). The closest I got to an S-Line was 5 feet, but I did handle a KWM-380 once. I was too psyched out to do any evaluation. My radio at the time was a Swan-350, which had the driftiest VFO known to man. This could be partially fixed by rebuilding the entire VFO with new capacitors from Swan.

The opinions expressed are those of the author and do not reflect the opinions of the publishers of the National Contest Journal. *Direct comments and questions to the author at* **jwt105@yahoo.com**.

NCJ

Tim Duffy, K3LR

The DX Engineering DXE-RBS-1P Beverage Antenna System

As the owner and low-band operator of a large multi-multi contest station, I am constantly looking for opportunities to improve our ability to hear very weak stations on 160, 80 and 40 meters (a.k.a. the "low bands"). Much of the good DX available during contest weekends is on the low bands and the signals are not very strong. Many times the signal levels are at or below my local noise level. I have been using the new DX Engineering Reversible Beverage System (DXE-RBS-1P) for over 12 months and it has proven to be very valuable. We are hearing a whole new layer of DX stations that were not even noticeable in the past. It is an outstanding product! I know that Tom, W8JI, has been using this system for over 25 years, as he had it in service when he lived in Ohio.

I have some good directional gain antennas that we use for transmitting. On 160 meters, we use a switchable, 4-direction, 5-element vertical Yagi with 30 dB of front-to-back (F/B). For 80 meters we employ two phased, ground-mounted four squares, spaced at 5/8-wavelength. On 40 meters, we use full size, 4-element OWA stacked Yagis at 190 feet and 118 feet.

Until I installed the DX Engineering RBS antennas, we also used the transmit antennas for receiving. When switching to the Beverages, it is remarkable to hear signals jump out of the noise compared to listening with the big gain directional transmit antennas!

Installation

The installation of the DX Engineering RBS system could not be easier. DX Engineering provides a detailed instruction manual that leads you step-by-step through the process.

I have two DX Engineering RBS-1 systems installed at this time. One is oriented North-East/South-West, and the other runs North-West/South-East. Each Beverage system uses 450-Ω ladder insulated line feeders (#18 gauge solid copper clad steel) 720 feet long.

I used five or six supports about six feet off the ground for the ladder line. I installed two five-foot ground rods spaced five feet apart at each end of each Beverage. I think that one or two additional ground rods might make the performance a little bit better. They are probably overkill, but I will install them soon anyway.

I chose to run two RG6 feedlines from the feedpoint of each RBS system. That way, we can listen to both directions at the same time. This has proven to be very effective for the low-band operating positions because we have immediate access to all four directions without switching. If you don't need to listen to both directions at the same time, use a single feedline and switch directions by sending negative 12 Vdc down the feedline.

The small reflection transformer termination box used at the far end of each beverage only requires connection to the ladder line and a ground connection. It's that simple.

Performance

DX Engineering explains that the performance of any Beverage is limited by the proximity (coupling) to other wires, towers and antennas in the near field. The more isolation from these "noise re-radiators", the better any Beverage will work. My DX Engineering RBS systems are close to several towers; however, the directivity and front-to-back ratio are outstanding.

On low-angle DX signals, the F/B is at least 20 dB and some times 30 dB.

I have measured the VSWR of the DX Engineering RBS system at the shack end of my RG6 lines. This is a 75-Ω system and the HP Network Analyzer showed a very consistent range of 72 to 78 Ω resistance with little reactance across the 1.8 to 7.3 MHz range that I tested.

One of the Beverages is only 50 feet from the K3LR 80 meter vertical array. There have been no indications of overloading the RBS transformer. The RBS systems have withstood five multi-multi contest weekends with no failures whatsoever.

The construction of the DX Engineering RBS-1 boxes and connection hardware is superb. The feed point unit and all hardware are stainless steel and first class.

If you have been frustrated by trying to figure out what is your best solution for a great dual-direction Beverage system, look no further than the DX Engineering RBS-1 Reversible Beverage System. I have tried every one of the commercial and home brew systems that are out there and the performance of the RBS-1 beats them all. Hands down!

DX Engineering RBS-1 Reversible Beverage System—$129.00. See the DX Engineering site on the Web at **www.dxengineering.com,** or phone 800-777-0703 8:30AM to 4:30 PM Eastern.

Figure 1—The feed point of the RBS system.

Figure 2—The RBS reflection transformer.

Array Solutions PowerMaster VSWR RF Power Meter

Over the last three years K9LZJ and I have been perfecting a remote control ham station located in the country, far from the reach of zoning regulations. The station is housed in a pole barn, affectionately called "the barn." We used off-the-shelf technology that anybody can duplicate, but still we needed a good remote power/VSWR monitor to complete our setup. An advertisement for the new PowerMaster from Array Solutions looked promising, and after some research and a couple of calls to Jay, WXØB, at Array Solutions, we purchased the unit and put it into play. After several weeks of both remote control and in-shack use at the barn, the PowerMaster has become an indispensable station accessory. Because most people who read this will be interested in what this device can offer for contesting or DXing, the features are described below.

Setting it Up

The PowerMaster package comes with a large sensor/coupler with a jack for connecting to the display head. This allows the coupler to be positioned right at the amplifier output while the display head rests elsewhere.

The display head is ruggedly build and stays put since there are no bulky coax connections. There are several jacks on the head including an RS232 port that can be connected to a computer COM port or to a USB port (with a suitable adapter).

Another feature on the display head is the ability to disable amplifier keying when necessary. This function is enabled by running one cable between the amplifier keying circuit of the rig to the PTT IN jack on the display head, and another between the display head's PTT OUT jack and the amplifier keying circuit. Simple cables with RCA jacks on each end work fine for this purpose.

With the display head running from our 12 volt power buss with battery backup, we loaded *PowerMaster Lite* software onto the computer from the CD and the fun began.

We selected the proper COM port for our USB-to-serial adapter and set the baud rate to 38,400 for best performance. Once the computer is communicating with the control head, the programming can be performed at the display head or through the computer. The display head has a blue florescent panel that allows easy visualization during initial programming and use. The MODE and MENU buttons allow you to set parameters in a straightforward manner. The programming description (Table 1) details this process.

The *PowerMaster Lite* software display allows text programming, setting power level scales and a number of other changes that can be implemented remotely or via the keyboard.

PowerMaster Lite

The *PowerMaster Lite* software can provide a large two-bar graph display or a half-size single bar graph within its display window. The *PowerMaster Lite* window can be dragged around on the screen and can be set to always stay on top of all other windows. The double graph offers instantaneous forward power on the top graph and reflected power on the lower graph. It also has numeric readouts for peak power, SWR and reverse power. The single bar graph displays forward power in bright blue and reflected power in bright red on the left of the bar graph as a "stacked graph," and has numeric readouts for peak power and SWR. The meter hold times can be set for 0.2, 1.0 or 2.0 seconds on all readings depending on your preference. The power scale can be set to auto adjust, or to several specific full-scale values ranging from 10 W to 3 kW.

There are also "simulated" LEDs in the *PowerMaster Lite* window to indicate computer activity as well as the SWR and power alarm status. The alarms can be conveniently reset by clicking on the display after eliminating the problem. This is particularly helpful in remote operation.

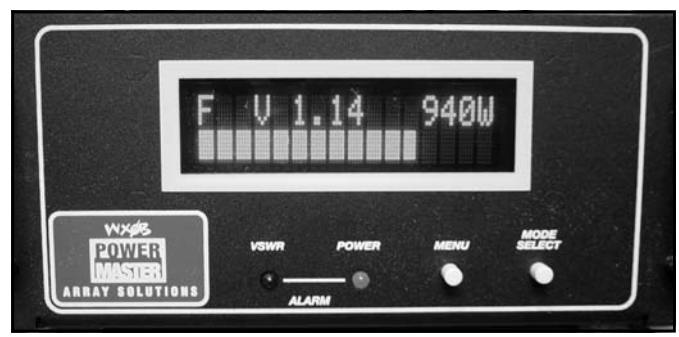
There is a program mode to switch COM ports and baud rates, along with a meter-setting mode to adjust all of the PowerMaster parameters. You can change the meter hold times by clicking the "switches" on the right side of the window. These same switches bring up the VSWR indicator so that you can observe the changes while tuning the antenna. The only thing we didn't like about *PowerMaster Lite* was the inability to adjust the relative size of the window if the remainder of the screen had too many other things on it.

Putting the PowerMaster to Work

The equipment at the barn site consists of an ICOM 756 Pro transceiver driving either an ICOM PW1 amplifier for remote control versatility and easy operation, or a QRO 2500 for brute strength during contests and low band operation. The antenna selections include an inverted-L on 160, a 160/80-meter dual-element dipole, a quarter wave vertical on 80 meters, a 2-element shortened Yagi on 40 meters, a 4-element SteppIR Yagi on 20 through 6 meters and two Force 12 3-CS antennas. These can all be switched remotely by using *Ham Radio Deluxe* or *TRX Manager* software via remote desktop over the Internet (when in the shack we operate manually using an MFJ 8-position switch). We also have two Green Heron RT-20 antenna rotor controllers that can be remote controlled and even linked together if necessary.

I used the PowerMaster during the

Rear panel view of the PowerMaster.



Front screen of the PowerMaster.

CQWW Phone contest in October 2005 with both the PW1 and the QRO 2500 amps. The single bar graph was displayed on top of *Writelog* during the entire contest to show me what was going on. The PowerMaster's low power limit was set to 100 W for both amplifiers to warn if they weren't functioning. At the other end of the scale, the peak power limit for the PW1 was set to 1100 W and the QRO was set at 1600 W. We configured the system to initiate an amplifier shutdown if the limits were exceeded.

The SWR limit was set at 2:1 and was also configured to shut down the amplifiers if the limit was breached. I worked the first part of the contest with the PW1 and had the drive power set low enough that the high power alarm never tripped. There were no SWR problems since the amplifier automatically switched bands with the rig. When I switched to the QRO 2500, the high power alarm went off right away and I had to reset the cutoff relay and reduce the drive level accordingly.

On two occasions I switched bands, set the tune and load controls, but forgot to switch the amp bandswitch. I saw a low power indicator alarm that immediately told me how stupid I was. One time I forgot to hit the SPLIT button on 40 meters and was on the wrong part of the band with a high SWR. This immediately resulted in an amplifier shutdown, saving me some embarrassment. In another instance the SWR alarm went off because the wrong antenna was selected. Good contesters don't do this type of thing, but I sure seem to do it often.

It is certainly reassuring during the contest to see the meter display on the computer monitor and be able to glance at the peak power and SWR readings to make sure everything is okay. I am a casual contester and never work over half of a 48 hour contest, but I can imagine serious contesters would be happy to see the display on the computer screen and have a warning for low power, and an amplifier cutoff for high power and high SWR.

After the contest I experimented with different scenarios and found the PowerMaster to be accurate and consistent in warning about problems. The low-power alarm warns of an amplifier that is on the wrong band, out of tune, or on standby. The SWR alarm warns of feed line/antenna problems or improper antenna selection. The high power alarm/amplifier cutoff is especially helpful to avoid overdriving amplifiers such as the PW1 and blowing out its FET finals, or putting out illegal power levels on a beefy amp like the QRO 2500.

Construction

The sensor/coupler is well built with two large toroids and a cleanly laid out PC

Table 1

Normal Operation Mode: Four settings that include a display hold times of 0.2, 1.0, or 2.0 seconds, and another setting for the VSWR to be displayed on the bar graph instead of power output.

VSWR alarm mode: Settings for Off, 1.5/1, 2.0/1, 2.5/1, 3.0/1 SWR levels.

VSWR Alarm polarity mode: For setting the alarm relay to open or close for high SWR.

Low power alarm mode power: Off, 5W, 50W, 100W, 250W, 500W, 1000W, or 2000W.

High power alarm mode power: Off, 175W, 225W, 700W, 1,100W, 1.6KW, 2.6KW, 3KW.

High alarm trips amp mode: For setting *yes* or *no* to trip the alarm relay for high power.

High alarm relay polarity mode: For setting alarm relay to open or close for high power.

Show Call mode: Allows choice of *yes* and *no* for showing a text message (Call sign).

Intensity mode: Allows setting intensity of the display to one of four brightness levels.

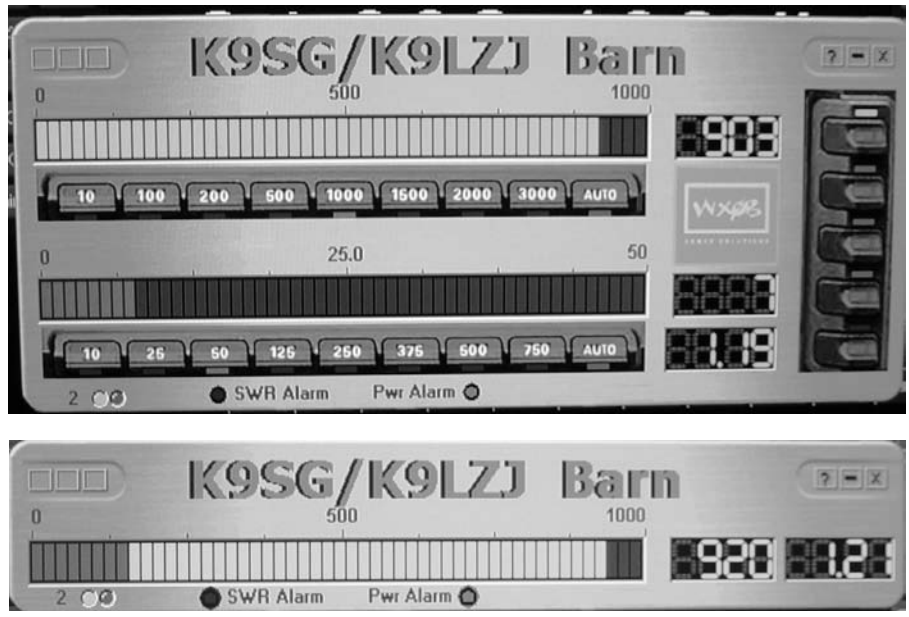
Bar graph Ranges mode: Allows various power ranges to be set for the bar graph indicator.

Forward Power trim mode: Allows fine tuning the control head to a specific sensor.

Reverse Power trim mode: Allows fine tuning the control head to a specific sensor.

Power Display mode: Net Power (Forward - Reflected) or Forward power only.

Baud Rate mode: For setting RS232 signaling rate to 9600, 19200 or 38400 baud.



Two bar display (top) and single bar display (bottom).

PowerMaster display head and sensor/coupler.

board with discreet components. It was handy to have a jack on the coupler and the control head to allow distant remote placement with a shielded cable. The display head is laid out in a very rugged mini-rack-mount metal box that measures 8.25 inches wide, 3.5 inches high, and 4.25 inches deep. The circuit board has discreet components and several ICs. It connects to the separate display board with a ribbon connector. At its lowest brightness level, the display remains readable in average room lighting. The highest level is best for strong ambient light. The display head is heavy enough that it doesn't scoot around on the desk.

Summary

The PowerMaster is a great SWR/power measuring device that is useful during contesting and remote control operation. For the serious HF operator or contester, the PowerMaster is a great station accessory. Jay, WXØB, from Array Solutions told me that sensors will soon be available for 144-220 MHz, 440 MHz, 900 MHz and 1.2 GHz, which will make this a wonderful product for serious VHF and UHF enthusiasts. The PowerMaster will be mentioned in a future *QST* article about remote control operation.

Price and Availability

The PowerMaster is priced at US$400 and is available now. The VHF and UHF sensors will start selling soon with the price to be announced. Contact Array Solutions at **www.arraysolutions.com** or call 972-203-2008.

NCJ

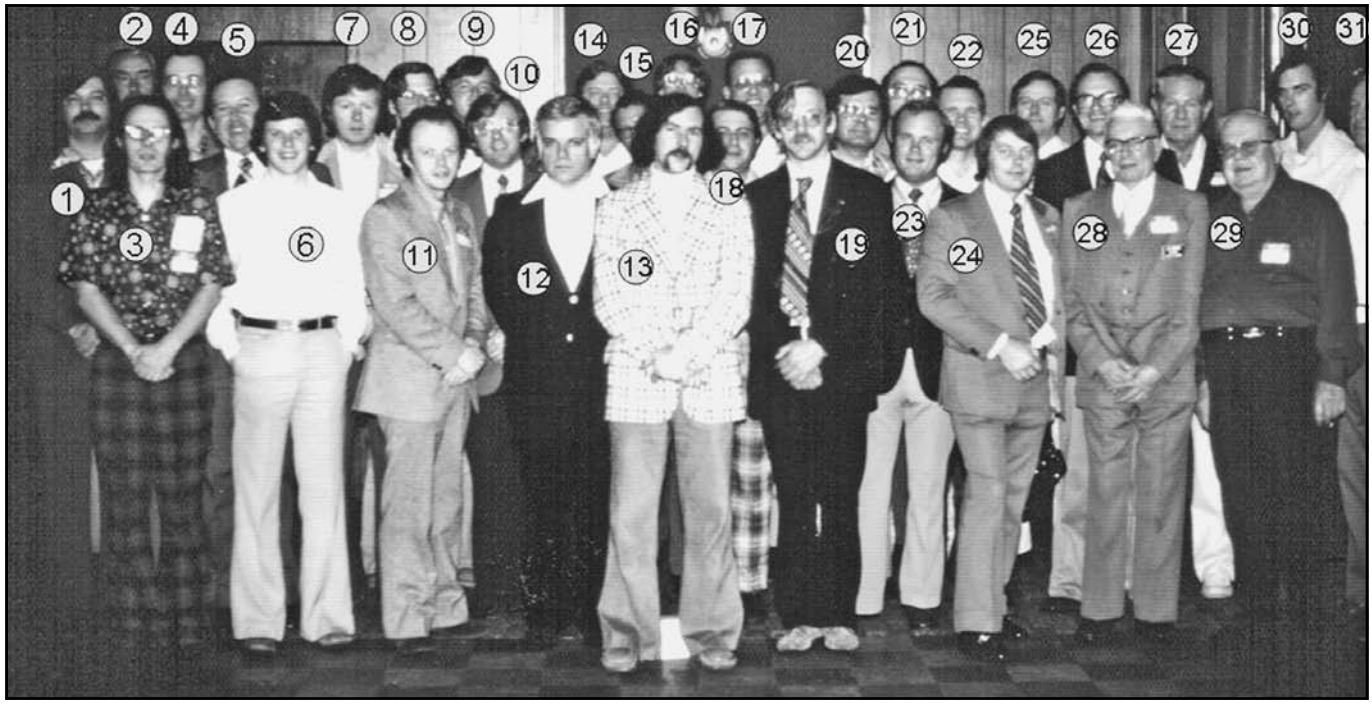
Classic Photo—and a Mystery

Tom Taormina, K5RC

In July 1976, we had the first and only TACO convention in Houston. In 1977 K5MA, K7BV and I formed Houston Ham Conventions and ran conventions in Houston until 1983, when we hosted the ARRL National Convention.

The accompanying photo is from the 1976 TACO convention. I've tried to identify as many of the attendees as I can. Can anyone help with the question marks and blanks? And maybe confirm the others. I can be reached at **tom@k5rc.cc**. Thanks!

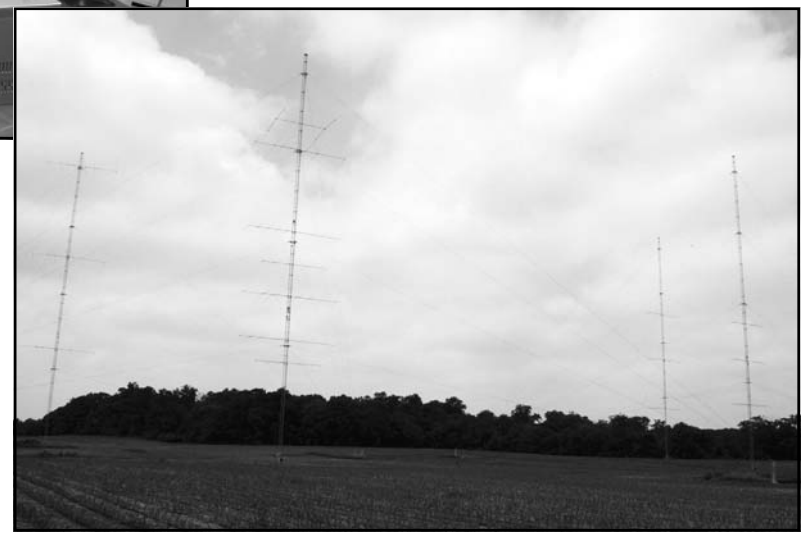
1	K5NW	11		21	
2	K6SE ?	12		22	K5JS ?
3	N5AM	13	K1TN	23	
4		14		24	N5TP
5	K5NA	15	5DEG ?	25	K5CA ?
6		16	N5JJ (SK) ?	26	
7	N5MA	17	K5DJ ?	27	K5DB ?
8	K5TM	18	K5RC	28	
9	K5WA (SK)	19	K3EST	29	W5JC (SK) ?
10	K5KG ?	20		30	KZ5KG
				31	K5DX (SK) ?



2005 IARU Contest Snap Shots

Figure 1—Randy, K5ZD, at the controls of Jeff, K1ZM's, Prince Edward Island station VY2ZM in the 2005 IARU contest (in addition to the VY2ZM feature in this issue, see the March/April 2003 *NCJ* and the July/August 2005 *NCJ* for more on VY2ZM). Randy was a single op CW entry. He wanted to see Jeff's station and the IARU contest offered a great opportunity to do so. Randy reports that the antennas are amazing. Randy's score put him in 1st place in the W/VE SO CW HP category and in 3rd place in the World.

Figure 2—Roy, AD5Q, running 'em at the QTH of Jay, WXØB. Roy was a single op CW (SO2R) entry using the WXØB call sign. His score put him in 8th place in the W/VE SO CW HP category.



Figures 4 and 5—The new station and antennas at John, N3HBX's, contest station in Poolesville, MD. The station has four 190 foot rotating towers with stacks on 40–10 meters. In the shack there are two SO2R operating positions. See N3HBX's two-part series in the November/December 2005 and January/February 2006 issues of *NCJ* for more details on this contest station. Mark KD4D and John entered as a multi-single using KD4D. Mark did CW and John worked phone. John notes that looking at the scores of those who beat them indicates that they spent too much time on phone and too little time on 10 meters. However, he says they had a lot of fun and nothing broke! Their score put them in 4th place in the W/VE M/S category.

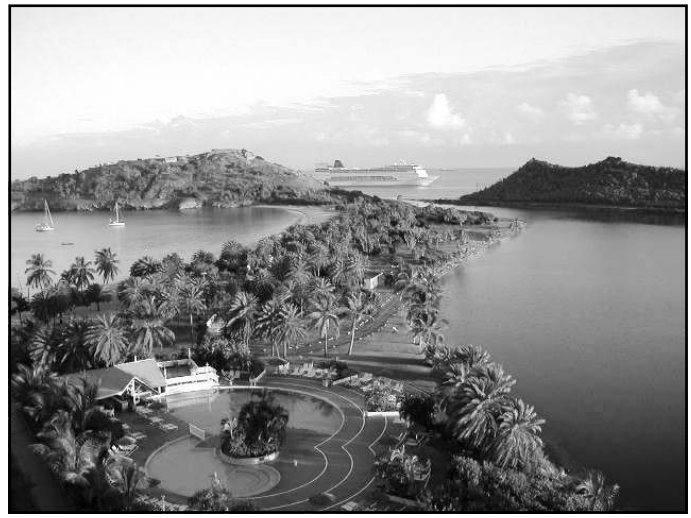
Figure 3—The NU1AW/3 crew at the Western Pennsylvania QTH of Tim K3LR. Their score put them in 1st place in the W/VE HQ category. Even though this station is pretty far west for an "East Coast" station, it is to be reckoned with. For example, K3LR (ops K3UA, K0RF, N2NC, K3EST, W0UA, N5RZ, K8CX, N3SD, KL9A, W2AU, K3LR) took 1st place in the USA (they squeaked by W3LPL) and 2nd place in the World in the Multi-Multi category in CQWW CW 2004.

VHF-UHF Contesting

Jon K. Jones, NØJK
n0jk@hotmail.com

June VHF QSO Party "Write-up" Comments

A great June 2005 VHF QSO Party write-up by Rick, K1DS, appeared in the December 2005 issue of *QST*. He gave a balanced discussion of various contest stations and a review of the propagation highlights. "There was E-skip for many, and an aurora for many more … can you equate the stimulus of an hour of wall-to-wall stations calling on E-skip or aurora to the caffeine in a cup of espresso or a can of Red Bull?" (VHF Contest Tip: My daughter raves about Red Bull and Rooster Booster. I have found both of them to be good "pick me ups" when the bands are slow.) Rick celebrates increased participation and log entries. "It is exciting to see a 10 percent increase in submitted logs over last year for this event: 840 logs received in 2005 versus 763 in 2004." I do not attempt to compete with the *QST* write-ups in this column, but rather to focus more in depth on specific areas like propagation and contest strategies.



The hotel from where Kevin, WB8XX, operated as V25XX in the June 2003 ARRL VHF QSO Party.

One irony to me is the contest "box score" section where my call is listed in the Midwest Region for the "Q" class. I got my call in *QST* for a very limited, casual, budget entry compared to WB8XX. Kevin traveled on his own to Antigua and operated as V25XX in the June 2003 VHF QSO Party, placing first place high power DX in the contest. He used the ICOM 756-Pro, a TE Systems 0550G 300-W solid state amplifier, and an M^2 6M5X Yagi. This was an outstanding effort and it took a lot of work. Kevin gave many stateside and European 6-meter operators a new country. See **www.wb8xx.com/v25xx.htm**. Despite all this, there was no box score listing or mention in the *QST* magazine contest write-up for V25XX.

I traveled to Bermuda twice in 2003 to enter the June and September 2003 VHF QSO Parties as VP9/NØJK. I posted the top single op low power DX score in both contests. No mention, either. In fairness, Kevin's and my scores are listed in the "*Printable Line Scores*" for the June 2003 ARRL VHF QSO Party on the ARRL Web site. I believe DX activity enhances the overall contest experience and adds spice for all participants in the ARRL VHF Contests. A little encouragement goes a long way.

I credit Rick for mentioning the DX activity in the June 2005 VHF QSO Party. He singles out Tom, FP/N6RA and Paul, VP5/N4VHF, in the contest write-up. Bravo! Speaking of DX, Gordon Fogg, N5AU, of HF contesting fame has installed a 6 meter Yagi at VP2E. I worked Gordon August 01, 2005 via double hop E_s on 6 meters and he had a booming signal into Kansas. Maybe Gordon will enter the June 2006 VHF QSO Party from VP2E. Now if the ARRL will add the top DX stations scores in the box listing, offer some plaques and put in a few photos, all will be well.

W3IY SK

Bill Seabreeze, W3IY, became a Silent Key at the end of last summer. Bill put in some remarkable rover efforts with Christophe, ON4IY, in many of the VHF contests. He wrote several of the ARRL VHF contest summaries, and was dedicated to encouraging other VHF operators to be active on all the bands through the microwave spectrum. Bill never missed a VHF contest. I never met Bill in person, but corresponded with him on a number of VHF contest issues. Bill was supportive of increasing DX station participation in the ARRL VHF contests. Gene, W3ZZ, reviewed Bill's many accomplishments and his life in his World Above 50 MHz column in the December 2005 issue of *QST* on page 78. This is well worth taking the time to read. Bill will be missed.

W3IY Rover Recognition Award

As announced in the December 2005 issue of *QST* (page 105), the Mt Airy VHF Radio Club is establishing the "Rover Recognition Award" in memory of W3IY. The 2005 Rover Recognition Award will be given in 2006 to a rover station that has demonstrated particular excellence throughout the year in 2005. The "Packrat" Board of Directors will review the activity of the rover contest stations in all of the competitive VHF events throughout the year. Consideration will be given to the effort, regularity of operation, bands operated, grids covered, contribution to the VHF community as well as unique factors and operating characteristics. Although total scores will be factored in, they will not be *significant* criteria for this award.Queries regarding this award may be sent to Rick Rosen, K1DS, at **rick1ds@hotmail.com.**

Grid Circling and Captive Rovers

There was a long and spirited discussion on the VHF Contest Reflector last summer about the effects of two practices: grid circling and captive rovers. Many emotional arguments were made supporting or condemning these activities, the ethics of both practices, and whether either or both should be eliminated by changing the contest rules. You can follow the threads on these discussions by going to the VHF Contest Reflector archives at **lists.contesting.com/pipermail/vhfcontesting/.**

Most of the posts related to these topics were made in the months of July and August (2005).

VHF Contest Trends in 2005

One trend is the increasing availability of microwave gear, particularly for the higher microwave bands. It is not uncommon for 24 and 47 GHz QSOs to be made in the VHF contests. The 1.2, 2.3, and 10 GHz bands are almost off-the-shelf now. Fifty, 144, and 432 MHz band capability is now in many of the HF+ radios sold by Kenwood, ICOM, and Yaesu. Grid circling, especially pack or caravan roving, is another trend. Digital communications utilizing K1JT's software is becoming more common in the contests. An increase in the signal detecting capability of Joe's digital *JT-65* mode is revolutionizing EME on 50, 144 and 432 MHz. Now modest stations on 6 meters, QRP, and even QRPp stations on 144 and 432 MHz can

make contest EME QSOs. For example, OE3FVU running a single Yagi and 35 W and RW1AY/1 using 50 W and only a 7 element Yagi both worked HB9Q on 432 MHz EME with *JT-65c*.

The WSJT *FSK-441* mode has become the *de facto* standard for VHF meteor scatter communications. Many VHF Contest stations routinely run WSJT scatter skeds during slow periods in the VHF contests. K2DRH bemoaned the loss of his WSJT skeds in the June 2005 VHF QSO Party when he lost commercial power! SSB contest meteor scatter contacts are becoming increasingly rare, but are still fairly common on 6 meters Sunday morning.

I find myself ambivalent about the digital modes on VHF. They certainly encourage activity, and allow modest stations to make meteor scatter and EME contacts. Their effect on the major VHF contests has been minor so far, as they are not "rate" modes. In hotly contested sections with close scores, a few completed WSJT skeds could make the difference in the outcome. At the same time, I wonder if the digital modes take some of the challenge out of VHF operating and may lower the bar to achieving awards such as DXCC, WAS, VUCC, etc. There was an interesting discussion of digital modes on the Topband reflector (of all places) recently. Check out **lists.contesting.com/pipermail/topband/**

VHF Contesting in 2006

No doubt the trends we've been discussing will continue this year. The solar cycle may bottom out in December 2006. This will mean little or no F2 openings on 6 meters, and far fewer geomagnetic storms with associated aurora. However, E_s (a.k.a. E-skip) on 6 and 2 meters occurs throughout the solar cycle. Sometimes the best E_s openings occur during the solar minimum. Tropo openings are weather related. Perhaps long-term climatic changes are related to the solar cycle. Rover and digital mode activity may increase in the VHF contests. I see some of the radio manufacturers are sponsoring the ARRL HF contests. Perhaps ICOM, Kenwood, or Yaesu could sponsor the June VHF QSO Party? The HF contesters are eagerly anticipating WRTC2006 in Brazil. How about a VHF Contest WRTC?

Predicting Long Distance VHF Propagation

In time for the 2006 VHF contest season may be a method to predict band conditions. Bob, ZL3NE, says "All propagation on 6M, 2M and 70cm can be predicted before it happens." Apart from F2 and aurora, he theorizes all the other VHF propagation modes (including sporadic E) are weather related. If you wish to test his prediction method in the next VHF Contest or perhaps use it to get a leg up on your competition, you can download Bob's article here **www.df5ai.net/Material/articles6.html#PaperZL3NEPropPredict**.

ZL3NE requests that you send him feedback and comments about his concept.

A Positive Trend for 2006

There is one VHF contest trend that can have a positive impact on this year. That is "Elmering," or helping out new VHF contest operators. As K1DS notes "The more stations on the air, the busier the operators, the higher the scores and the better the satisfaction of the participants." Just imagine what would happen if each one of us helped out just one new VHF contest operator to get on the air in 2006.

NCJ

Carl Luetzelschwab K9LA

Low Band Antennas and Trees

Putting up a competitive low-band antenna can be tough for those without a suitable man-made support. One solution, taking the lead from K5AF's "Contesting on a Budget" column in the May/June 2005 issue of *NCJ*, is to utilize a tree.

I use a tree to support my 80/160-meter wire antenna system. The vertical wire starts at 7 feet above ground and goes up to about 65 feet. I have an 80-meter trap at the top of the vertical wire, and a wire from the top of the trap runs back toward the house to resonate the system on 160 meters. Thus it's a full size quarter-wave vertical on 80 meters (it has a small inductor at the bottom for resonance and for switching from the phone to CW portions of the band), and an inverted-L on 160 meters. I use six elevated radials—three 60 footers and three 120 footers.

I've always wondered how the tree I use to support my 80/160-meter antenna, and the surrounding trees, affect the performance. Thus, the goal of this column is to discuss the effect of trees on low band antennas. I would expect that, for the most part, the discussion is applicable to the higher HF bands, too.

There appears to be two areas of concern with respect to trees affecting low band antennas: the trunk portion of the tree and the leaves (foliage).

With respect to the trunk portion, the "Technical Correspondence" column in the November 1991 issue of *QST* had some interesting observations by KF4IX (call now unknown) and K4OQK (now W3BZ). They had a single 75-meter quarter-wave monopole hanging in a tall pine with seven radials raised 15 feet off the ground. The distance from the trunk of the tree to the bottom portion of this antenna was about 1 foot. The distance from the trunk of the tree to the top portion of the antenna was about 3 feet. The resistance at resonance (3.74 MHz) was measured to be 50 Ω. A model of this antenna indicated the resistance at resonance should have been about 32 Ω.

To determine where the extra 18 Ω of resistance came from, they first moved the bottom portion of the antenna farther away from the trunk of the tree (from 1 foot to about 15 feet). Nothing changed. Then they moved the top portion of the antenna farther away from the trunk of the tree (from 3 foot to 6 feet). Resonance moved up to 3.77 MHz and the resistance was now about 35 Ω. Their conclusion was that the tree trunk, being a lossy dielectric, introduced significant loss due to the proximity to the high voltage portion (top portion) of the antenna.

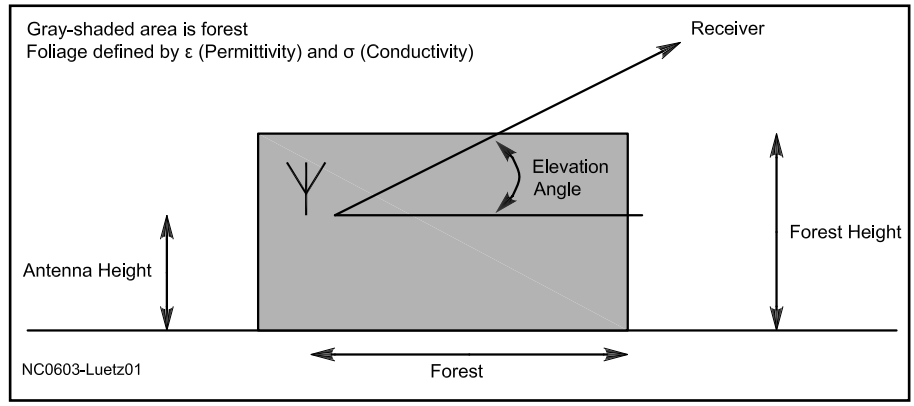


Figure 1—Theodor Tamir's model of an antenna in a forest.

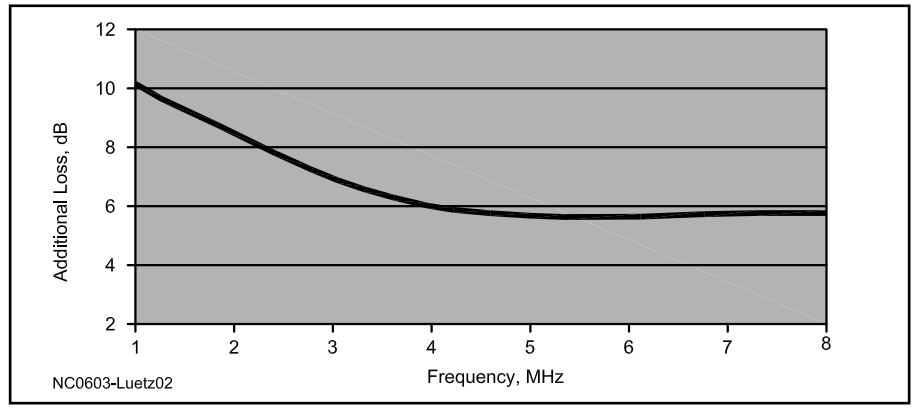


Figure 2—The additional loss versus frequency due to foliage.

With respect to foliage, we'll use the work of Theodor Tamir.[1] Tamir developed equations to calculate the additional loss on HF propagation by foliage in a forest. Figure 1 shows the basic model used by Tamir.

My specific situation has the forest extending north and east of our property for about one quarter mile—thus, I set the "distance in forest" parameter to 402 meters. The trees are about 75 feet high, so I set the forest height to 23 meters. The major portion of the foliage is near the top of the trees, and is about 20 feet thick, so I set the antenna height to 17 meters. Finally, I chose an elevation angle of 20 degrees.

For the relative permittivity and conductivity of the foliage, an earlier work by Tamir[2] gives insight into these values. The relative permittivity of foliage is typically between 1.1 and 1.2, so I used 1.15. The conductivity of foliage is on the order of 1×10^{-4} S/m. As a side note, the value of the conductivity is the major player in the model, varying the relative permittivity resulted in minor change to loss. The additional loss versus frequency due to the foliage is shown in Figure 2.

Tamir's model says the additional loss due to foliage incurred by my 80/160-meter antenna system at an elevation angle of 20 degrees is on the order of 9 dB on 160 meters and 6 dB on 80 meters. It increases by several dB at lower elevation angles and decreases by several dB at higher elevation angles. Is this amount of predicted loss reasonable? I don't know, as I don't spend too much time on 80 and 160 meters during the summer months (even if I did, I have nothing to compare it to in order to validate the model).

This brings up an important issue—my trees are deciduous. When I run the model

with a relative permittivity of 1.0 and a low conductivity (1 x 10^{-5} S/m) to emulate winter conditions with no foliage, the model predicts no additional loss (as expected). My experience during the winter months with my 80/160 meter antenna system tends to confirm this result—I don't think I'm losing much, if any, in the pileups in winter due to the fact that my low band antenna system is in trees.

In summary, if you have to implement your low band antenna in a tree, try to get the top portion away from the trunk by at least 0.023 wavelengths (based on the 1991 "Technical Correspondence"). And it would be nice, if possible, to pick a tree with minimal foliage. If the latter recommendation can't be achieved, at least be happy that we do most of our contesting in the winter months when the foliage has usually disappeared.

Notes

[1]Tamir, Theodor; "Radio Wave Propagation Along Mixed Paths in Forest Environments"; *IEEE Transactions on Antennas and Propagation*; AP-25, No 4, July 1977; pp 471-477.

[2]Tamir, Theodor; "On Radio-Wave Propagation in Forest Environments"; *IEEE Transactions on Antennas and Propagation*; AP-15, No 6, November 1967; pp 806-817.

NCJ

Contest Tips, Tricks and Techniques

By Gary Sutcliffe, W9XT

Noise—Part 1

About 30 years ago I was studying electrical engineering in college and was in my first communications course. The professor asked, "Say you want to design a radio receiver. How much amplification do you need?" My newly minted Amateur Extra class license proved I already knew this stuff, so I raised my hand.

"Start with the weakest signal you will want to receive and then calculate how much amplification you need to get the desired output at your speaker," I answered.

"And how strong will the weakest signals be?" asked the professor. The best ham receivers of the day specified about 0.5 μV, so that was my answer. "That has nothing to do with it! You need to know what your noise level is, and that will set the upper level of your required amplification. After that you will just be amplifying noise! Noise limits what you can receive." I was pretty quiet for the rest of that class.

The professor's question was the start of a lecture that went into a lot of math proving the old ham adage, "You can't work 'em if you can't hear 'em." The main reason you can't hear them is noise. The noise covers up the desired signal and there are a lot of sources of noise. This installment of Contest Tips, Tricks and Techniques looks at some of the noise sources and how our readers were able to deal with them.

Atmospheric Noise

Natural static (QRN) is a major problem on the lower bands. The static caused by a lightning storm in the tropics can propagate to other regions. Even a relatively quiet winter night can result in S7 noise levels, covering up layers of signals. Special receive antennas can be a great help here. Beverage antennas can provide excellent results but require a fair amount of real estate. Loop type antennas such as K9AY arrays, EWEs and Pennants are alternatives for those with less space.

Even if you don't have space for a full size Beverage, short ones can be useful, according to K4RO. Kirk says that short Beverage antennas have provided more QSOs per dollar than any other station investment he has made.

I personally started getting interested in low band DXing and contesting at my last station location. I didn't have much room there, but made some simple Beverages. I laid out 80-90-foot lengths of wire towards Europe and the Caribbean. I used small-gauge wire and laid it directly on the ground in the fall. The feed end had a 4-foot ground rod and didn't use a matching transformer. The ends were unterminated. This was about as far from optimum as you can get, and required a preamp. Yet on many nights I could hear much better with these wires than I could on my transmit vertical and dipoles.

Right now I have 350-foot terminated Beverages towards Europe and Japan. Even this length is way under the recommended lengths for 80 and 160 meters, but they almost always outperform the reception obtained from my vertical on 80 and dipole on 160 meters. They usually outperform my K9AY array in their favored direction. The K9AY array has been a great help in the other directions, though.

Mel, KJ9C, also points out that horizontal antennas are usually quieter than verticals. If your low band antenna is a vertical, you may find that a dipole, even one for another band, may be better at receiving. One other thing about the low bands is that the best receiving antenna on one night may be the worst the next. Don't be afraid to listen on everything you have to see if one of them can pull out that rare multiplier.

Line Noise

One of the worst and most common noise problems for hams is line noise. This is caused by arcing on power line insulators, or sometimes faulty transformers or switches. Bad cases can result in S9+ noise from 160 meters through VHF.

The first step is to identify where the noise is coming from. K5ZD says you will have a better chance of getting the power company to resolve the problem if you can give them the number of the offending pole. If you have directional antennas, you can use them as a first start to get a general idea of where the noise is coming from.

Pete, N4ZR, used to just drive around with the car radio tuned to a clear frequency on the high end of the AM band. Then he started using a portable HF receiver, but now favors a VHF handheld radio tuned to the AM aircraft band and a Moxon beam. With that, Pete says, there is little doubt of the offending pole.

Mel, KJ9C, also drives around with the car radio tuned to a clear AM broadcast channel at the top of the band. He sometimes switches to a mobile rig on 20 or 40-meter AM when he gets close. The noise will usually go down as you go higher in frequency, so you know you are close to the source when you hear it there. Finally he uses his handheld transceiver set for the AM aircraft band with a homemade dipole. He uses the nulls off the ends to triangulate the offending poles.

N4GG searches with a Grundig hand held SW receiver he picked up at RadioShack last year for about $20. It has a telescoping whip antenna that Hal shortens to reduce the signal as he zeros in on the noise source. K5ZD bought one of the MFJ power line noise meters and has used it to track down problems.

You can usually ignore poles unless they have a lightning arrester, transformer or a junction according to N4ZR. The exception, he says, is "slack spans." In these the wires cross the road, but the poles are not back guyed. They use taught wire insulators and hardware, but the conductor is left slack. These caused Pete trouble, but he eventually convinced his local power company to replace them with the proper hardware.

Once you find the source of the line noise you need to report it to your power company. They are required to repair such problems, but some companies are more responsive than others. There are a lot of horror stories out there where hams have been unable to get their power company to take care of the problem. Other companies are very good at fixing these problems.

N4ZR says his power company is in Chapter 11, and is not too inclined to go out to fix vague reports of noise. Pete says if you can convince their engineers that you know what you are talking about, and can tell them the number of the offending pole, you will usually get much further.

We are out of room for this issue, but have more noise sources to cover. Next time we will look at some other noise sources, such as faulty thermostats, electric fences, etc, as well as digital noise from computers and other devices. If you have resolved a noise problem, it is not too late to share it with our readers.

Topic for May-June 2006 (deadline March 15)

What unusual noise sources have you tracked down? How did you find it? How did you fix the problem? What sort of results have you had with noise canceling devices?

Send in your ideas on these subjects or suggestions for future topics. You can use the following routes: Postal mail—3310 Bonnie Lane, Slinger, WI 53086; e-mail—**w9xt@unifiedmicro.com**. NCJ

Contesting on a Budget

Paul Schaffenberger, K5AF

Dealing with Contingencies and Disasters

There is a cost for everything. A cost for getting on the air, a cost for staying on the air, a cost for merely surviving all that nature and Murphy throw at us, and even a cost for rebuilding. I polled the community to find out how those costs can be mostly efficiently distributed. It seemed fitting to do this after the Fall of 2005, which was filled with so many disasters.

Assessing the Environment

There is a saying in politics that "where you stand depends on where you sit." This is also very appropriate in our world, as someone who sits in a shack on the Gulf Coast deals with a completely different set of potential contingencies and disasters than someone who sits on a mountaintop. Each individual has to assess the risks associated with his environment.

I got in-depth responses from a couple of guys who face somewhat different challenges and have a lot of experience dealing with them. Tom Taormina, K5RC, has seen it all, from wading through chest-deep water during the Houston floods of 1979 to a 100 year storm and wild fires in the Sierra Nevada Mountains. Marv, N5AW, has a unique location in South Central Texas. He sits atop a limestone formation with a dramatic 300-foot drop to the north and northwest. His antennas are the tallest things for two miles in any direction, making his location a magnet for the fierce electrical storms we face in this part of Texas. Both these guys shared their unique perspectives on this month's topic. These were combined with the inputs of several others to derive some interesting conclusions.

An Ounce of Prevention

The phrase "an ounce of prevention is worth a pound of cure" can be translated to "a few bucks now can save thousands later." Sometimes installing a thirty cent fuse in the line will protect that expensive transceiver during a power surge. That slightly more robust grade of phillistran will save a megabuck tower and array.

Marv, N5AW, sent me a textbook description of preventive actions taken to deal with his risk of a lightning strike. Marv notes "*I have always been concerned about lightning. Both towers have extensive lightning protection. The ground is extremely rocky at the first tower. I had a rock saw cut trenches from the tower 100 feet back to the ham shack and 50 feet in two directions from the base of the tower. All three have 1 1/2 inch copper straps buried in them. I brought in clay soil to fill the trenches to improve the conductivity. I also have ground rods at the ends of the two 50 foot trenches and midway on the 100 foot trench to the shack. Several PVC pipes are buried in the 100 foot trench with coax and control lines run in them. Where these enter the hamshack I have an approximately 18 inch square by 1/4 inch thick copper plate bulkhead. The bulkhead is connected to the copper strap from the tower. Another 50 feet of copper strap is buried along the foundation of the building and connected to the bulkhead. All coax connections coming into the shack have Polyphaser lightning protectors. All control lines have Polyphaser lightning protectors.*

"The new tower is 450 feet from the shack. This location is not as rocky as the first one - it is partly caliche. I'm still working on the grounding at this tower. The first 60 feet of cable from the tower is run through buried PVC pipe. A piece of scrap aluminum wire from a high voltage power line (this stuff is multistrand and about an inch in diameter) is buried in the trench with the PVC for grounding. A second piece of this wire about 40 feet long will be buried in another trench. A 1 1/2 inch copper strap will be run 50 feet from the tower to a buried car radiator bought at a junkyard. Finally another car radiator will be buried at the base of the tower with two 1 1/2 inch copper straps connecting it to the tower legs. Cable runs from this tower go past the other tower and are buried in the vicinity of it. They enter the shack at the same bulkhead."

Marv has suffered a major lightning strike, but it only caused minor damage to a fiberglass element on his SteppIR antenna. I think his preventive measures speak for themselves!

The Virtue of Overbuilding

Sometimes prevention takes the form of studying the local environment and building with a comfortable safety cushion, especially with the recent weather patterns that seem to defy the laws of nature.

Billy, AA4NU, provided some interesting insight here. He notes that overbuilding to a reasonable degree is necessary, ensuring that towers and rotors aren't overloaded. He further touts the value of regular inspections to ensure everything continues to meet standards.

N5AW's location is always windy, so he uses power company-style guy anchors drilled seven feet into the ground to keep his two 135-foot towers in place. He has two sets of anchors on each leg at 50 and 100 feet from the tower base.

Redundancies

Tom, K5RC, looks for redundancies in his equipment suite as a means to deal with contingencies and disasters, having a third backup available to support his SO2R effort whenever possible. He also likes to have separate antennas available for all bands for the SO2R setup and feels his recent NAQP effort was thwarted somewhat due to only having one 160-meter antenna up.

Backup Power

Perhaps the most unusual response in this area came from Dave, K6LL. "*My backup plan relies on the car in the garage having a fully charged battery and more than half a tank of gasoline. I take the radios into the car (in the garage) and run a long coax to carry the RF into the station, where it connects to the big antennas. I tried to do it another way, with an inverter and long extension ac cord, but the cheap inverter generated too much RFI. I use the inverter to operate momentary ac loads, like the antenna rotator, and then turn the inverter off.*"

Dave is also exploring the possibility of purchasing Chinese-made 2250-W portable generators that are available from a major auto supply chain, Pep Boys. They are available for $199, but Dave notes that with a generator comes the need to periodically run them and perform recurring maintenance.

Marv, N5AW, notes that he is the only electrical customer on almost a mile of power line and recognizes that he'd be pretty low on the priority list during a period of major outages. He has a 5 kW generator available and has put it to use during a couple of brief power outages.

Tom, K5RC, sees momentary power surges as a main threat to the health of his equipment, and is in the process of installing UPS boxes (designed for computers) to his radios and peripherals. He notes that a typical transceiver requires a fairly large UPS.

Backup Antennas and Gear

Steve, KØOU, always keeps a multiband vertical ready to go. It is an integral part of his second radio setup, but it has saved his bacon during last January's Sprint, when he had to use it as his main antenna.

I coined the phrase SO1.5R on the 3830 reflector when I had to use my

backup, a Ten-Tec Argosy, as a second radio when one of my Omni Sixes went deaf on me. It truly is a half-radio, only 50W out and a hot receiver, but lousy AGC and filtering. Even so, it helped keep me going and I was surprised at how many second-radio Qs I could still make.

In addition to having a third position available for his SO2R operations, Tom, K5RC, also keeps his business laptop nearby to handle the logging chores should his computer crash. Both Tom and Billy, AA4NU, note that for really important contests or major contingencies, one can often arrange some "loaner" gear to use as a backup. Billy further recommends that you keep extra wire, cable and coax available at all times

Insurance

While a couple of respondents indicated that they had insurance, Tom, K5RC, who certainly has a lot of experience here, takes a cautious view. "*Many homeowner's policies have a limit of $1000 hazard coverage for electronics. When you figure the deductible, it is useless unless the house burns down. There is also a national database that most insurance companies subscribe to and report claims. Claims have demerit points, just like driving infractions. File a claim or two and not only might your current carrier not renew your policy, but you could wind up being put into a substandard company pool and pay outrageous premiums for minimal coverage.*"

[And don't forget the ARRL "All Risk" Ham Radio Equipment Insurance Plan. More info available at **www.arrl.org/FandES/field/regulations/insurance/equipment.html**.—*Ed*]

Recovery

The good news for all of us is that whenever disaster hits, there is a community there to help us get back on our feet. Mike, K4GMH, lost a 130 foot tower and antennas as a result of Hurricane Isabel. His tower would probably have survived the storm had a neighbor's 80 foot pine not fallen across his guy wires to produce the damage. (How do you prevent that?!)

Mike says "*Let others know what happened and what you need. Use the Internet reflectors, e.g., Tower Talk, CQ-Contest, local club, etc. Paul, K4JA, found out about my post Isabel situation after it was posted on a PVRC regional reflector…he let me know Bill, K4XS, as possibly having used tower sections for sale. Fortunately, Bill did have some sections at the time for sale. New tower sections were next to impossible to obtain since Rohn had recently gone out of the tower business.*"

Paying to Save

The inputs for this issue explored a wide range of options in dealing with disasters and contingencies. Perhaps the lesson is that money spent here is smart money, especially if it keeps on the air and prevents major damage to the station or antennas.

Just as it's great to know we can rely on others to help us out whatever the disaster or contingency, it's also great to be able to count on the following contributors who helped make this month's column possible: K4GMH, AA4NU, N5AW, K5RC, K6LL and KØOU. Thanks, guys!

Next month's column: Those "super radios": the cat's pajamas or a gold plated Lexus? With many good radios available on the new and used markets for under $2000, why spend $14,000 on an IC-7800, or why purchase even the much more reasonably priced Orion II? Do the capabilities justify the cost? Are the myriad features a plus or just too many to master? Can we build true SO2R capability into one box? Do we even want to? What less pricey alternatives are available? Please direct your responses to **PaulKB8N@AOL.com**. NCJ

Workshop Chronicles

Don Daso, K4ZA

The Station Notebook

(with apologies to Henry David Thoreau)

I'm often surprised to discover that fellow hams (or clients) do not have, nor keep, notebooks concerning their stations. A station notebook is something like a naturalist's set of observations, if you will. A hurdle for today's active ham can be the high cost of gear, including test or recording equipment. Yet one of the most useful tools available costs next to nothing—the simple station notebook. This column will suggest how to keep and maintain useful station records.

Why bother? A number of reasons exist, of course, but here are a few: 1. You can and will forget things; 2. You will have data to compare when things go wrong; and 3. You will learn more about your station because note-taking will actually improve your ability to observe.

I've often heard folks say they like to use the backs of their logbook pages for this sort of thing, and I used to do that myself. But it quickly became apparent this sort of record keeping was simply too random—there was no easy way to find or retrieve any information once I'd recorded it. Obviously, what I needed was something a bit more serious.

This will probably come as a shock in today's digital-everything world, but I recommend a hard copy instead of electronic formats. I find it's faster, more convenient, less prone to loss or theft, and more portable than any computer-oriented system. Use index cards, loose-leaf notebooks, a sketchpad, or whatever works for you. Check out artist's, school or office supply stores for some suitable solutions.

I prefer the three-ring loose-leaf notebook approach. I use regular lined paper for notes, along with blank paper for drawings or sketches. The standard 8 ½ x 11 size means I can insert copies of articles (where relevant), too. Use a waterproof ink pen, not pencil, for notes and such. I like Pentel's Rolling Writer.

What Should Your Notebook Include?

In no particular order, consider several tabs for various topics or subjects. I have sections for:

• **Serial numbers.** When I purchase gear, I record relevant data here, including model and serial numbers. Everything is in one place, which makes preparing a list prior to overseas travel simple and fast. And it's also a great insurance tool (although one I hope you never have to use, and I'm speaking from experience here!). I include information from the supplied manual as well, in case it's later lost or misplaced.

The author's station notebook.

• **Antenna system.** The largest file, and perhaps the most important. Besides the usual SWR or impedance readings and descriptions, I include data on the type of coax or feedline, including date installed, information on connectors, and the color code used. As changes occur, these get recorded, as well.

• **Towers.** The second largest file, with installation data, and recordings of guy tensions, hardware used, and relevant data on tower bases and guy anchors and so forth. Every year, when the annual tower inspection rolls around, it's especially handy to be able to see what changes have occurred, or what repairs need to be done. Again, as changes take place, they get recorded here.

• **Rotator system.** Similar to the antenna file, with voltage and resistance readings, color codes, and more.

• **Station signal flow-chart.** A block diagram of every signal (RF, AF, logic and keying or control) or circuit path in your setup. The type of thing you often see in *NCJ* or *QST* articles. It's amazingly helpful when things go wrong to be able to know exactly (especially when you're suddenly frustrated) what's supposed to do what. All the cable IDs or label tag info gets recorded here, too.

• **Worklist.** The one area where I'll allow myself to throw things out, afterward, or otherwise be sloppy. It's one ham's approach to those silly THINGS I GOTTA DO notebooks you see for sale in discount stores. In one place I can map out or write down project ideas, vendor information, contact information, reactions from fellow contesters, ideas gleaned from articles or the Internet, and so on. In short, a catch-all area, a place where I plan for the future. The key factor for this tab is that once it's written down, I have a much greater tendency to recall or remember it!

Such record-keeping and summaries of your station building, along with operational notes, will increase your ability to troubleshoot and repair the system when it breaks. Trust me—this is a good idea. And, I'm willing to wager, you'll feel some further manifestation of pride or accomplishment in making such journal entries or summaries. A little glance backward, toward Thoreau, who said, "I feel as if my life had grown more outward when I can express it." It's a perfect metaphor for radio's ability to express and explore as well. NCJ

RTTY Contesting

Bill Turner, W6WRT

Getting Started in RTTY Contesting—Part 2

Continuing our Q & A from last issue's column…

Q. I'm trying to get *MMTTY* installed but I'm confused about some things.
A. Like what?

Q. Well, for one, the help file talks about AFSK and FSK. Are they two different modes?
A. No, there is only one RTTY mode transmitted over the air. The difference is how you generate the RTTY signal in your shack. AFSK creates audio tones which you feed into your mike connector or data connector (Audio Frequency Shift Keying), while FSK (Frequency Shift Keying) generates an on-off keying signal which you feed into the FSK jack on your transceiver.

Q. Which should I use?
A. Either will do the job, but there are advantages and disadvantages to each one.

Q. Keep in mind I'm a beginner at RTTY. What do you recommend?
A. If your transceiver supports it, FSK is the easiest to configure and use, and the most foolproof. Even highly experienced operators usually prefer FSK.

Q. My transceiver does support it so I'll do FSK to start with. But just out of curiosity, what is different with AFSK?
A. Actually, AFSK was created as a work-around for transmitters that could not do FSK directly but could do SSB. As a side benefit, AFSK proved to have one capability which FSK does not.

Q. And that is....?
A. With AFSK you can have the software automatically control both your transmit and receive frequencies at the same time. For example, when you're tuning across the band and come to a signal, AFSK can automatically set both your transmit and receive to exactly the other guy's frequency. This feature is called "NET." FSK can do the receive setting, but not the transmit.

Q. That sounds great! Why doesn't everybody want to use AFSK and NET?
A. A lot of operators do, but it requires some extra caution that FSK does not.

Q. And that would be...?
A. For one, you must constantly be aware of the drive level of the audio tones fed into your rig. Excessive drive will cause harmonics to be generated in your rig's audio section and they will be broadcast over the air.

Q. What does that do if it happens?
A. Your signal will be heard at two places in the band about 2 kHz apart. For really serious overdrive, maybe even three places.

Q. Not good. How do I avoid overdriving?
A. Two ways: If you have a 100-W transmitter, never try to drive it to the full 100 W, and also watch your transmitter's ALC meter. Keep the drive low enough that it shows no ALC action at all.

Q. Once I have the levels set, I don't have to worry about it anymore, right?
A. Unfortunately, no. With some transceivers, gain changes when changing bands due to the nature of the internal ALC feedback loop. Every time you change bands you should recheck your drive level. Also, your computer might change the level of the audio tones without your being aware of it.

Q. How would my computer change drive levels?
A. Some programs such as CD player software have the capability to change the *Windows* Volume Control settings. If they don't return it to their previous setting when closing, you may have a problem.

Q. I see. Doesn't FSK have that kind of problem?
A. No, and that is why it is considered foolproof. All that goes into your transceiver is an on-off keying signal. There is no drive level at all, just either on or off. Your transceiver does the rest internally.

Q. Any other drawbacks to AFSK?
A. One more, which is more an annoyance than anything. With FSK, your transceiver's dial will display the actual frequency of your MARK signal. With AFSK, it won't.

Q. Really? So how do I know what frequency my AFSK signal is being transmitted on?
A. Two ways. You can do the math in your head, either adding or subtracting the MARK audio tone from what is shown on your transceiver's display, or, if your transceiver supports it, by entering a pre-set frequency offset into one of its memories.

Q. I'm beginning to think AFSK is more trouble than it's worth.
A. Most operators do. Remember AFSK was created as a work-around, not as a desirable method of its own.

Q. Okay, FSK it is. Now what?
A. Follow the instructions for making cables in the *MMTTY* help files. You will need to decide whether to use hardware or software PTT.

Q. What's the difference?
A. Hardware PTT uses a COM port to send an on-off keying signal to your transceiver's PTT jack. *MMTTY* has complete instructions for building the necessary cable. As mentioned before, you can buy one ready made. Software PTT, if your transceiver supports it, sends a command to your transceiver over the same cable used for VFO control. It's easier if your rig supports it since no extra cable is needed. I use it at my station and it works fine.

Q. Done. Cables are made and plugged in. I've read the *MMTTY* help files from one end to the other. What next?
A. Start *MMTTY* and turn on your transceiver. Set it to FSK mode. Use a dummy load for now. Turn on your transceiver's monitor function so you can hear what's being sent. Click the "TX" button on the *MMTTY* main screen. If everything is okay, your rig will go into transmit mode and you will hear the characteristic "diddle" sound of RTTY. That's one of the most beautiful sounds in ham radio, in my opinion!

Q. Wow! It works. Now what?
A. The hard part is done. For now, try making some RTTY QSOs using *MMTTY* alone to get a feel for how RTTY works. Do some ragchewing or chase some DX. Try it with AFC on and off. When you're comfortable, you can connect *MMTTY* to a true contest program. Be sure *MMTTY* is working in all respects first, though. If something's not right when contesting, you don't want to have to troubleshoot two programs at the some time.

A Week Later

Q. Okay, *MMTTY* is working fine and I'm ready for a contest. What next?
A. As mentioned before, you have some choices as to contesting software. For now I'd suggest starting with *N1MM Logger* because it's free. There are other fine programs such as *WriteLog* available , but they are not free. You can explore them later when you have some experience and know what features and functions to look for.

Q. Got it and installed it. Now what?

A. First, read the help file (or manual) from start to finish. Yes, it takes some time but it will save you time in the long run. *Logger* supports SSB and CW contests, too, so you can use it for all three modes. Basically, you have to tell *Logger* that you are using *MMTTY* (as opposed to a hardware TNC) and where to find the mmtty.exe file so *Logger* can load it automatically. You have already configured *MMTTY* standalone, so all of those settings are picked up by *Logger*. You will also have to tell *Logger* which COM ports you are using for which functions.

Q. Done. Now what?

A. Using a dummy load, practice. Even with a dummy load, turn your RF power all the way down. I've worked stations while using a dummy load, so they *do* radiate a little.

Q. Practice how?

A. Pretend like you're operating a real contest. Set up your macros (or use the default ones supplied). Call CQ, answer an imaginary station, send exchanges, enter his exchange, log the QSO, etc. To get another station's call on the screen so you can click it, just go to talk mode and send a call sign. Check the scoring to be sure it conforms to the contest rules (programming errors have been made in this area, not just in *Logger* but other programs, too). Here's a link to a Web page showing how my screen looks for *Logger* during the recent UK DX RTTY contest: **members.ispwest.com/dezrat1242/fs.jpg**. Note that I am in run mode and AFC is on. When I go to S&P mode I will turn AFC off and click the "HAM" button to reset the audio tones being received. This is very important! Also, I am set up for SO1R and no packet or bandmap. You can add those items later when you gain experience. *Logger* and *MMTTY* are highly configurable and half the fun is trying different configurations.

Q. Whew! I guess I'm ready. Anything else?

A. One last thing. I'll repeat again because it's so important: Join the discussion groups for whatever software you are using. *MMTTY* and *Logger* are at **www.groups.yahoo.com**. The *WriteLog* and RTTY reflectors are at **www.contesting.com**.

Welcome to RTTY contesting. See you in the pileups! NCJ

CONTEST CALENDAR

Compiled by Bruce Horn, WA7BNM

Here's the list of major contests of possible interest to North American contesters to help you plan through June 2006. The web version of this calendar is updated more frequently and lists contests for a 12-month period. It can be found at: **www.hornucopia.com/contestcal/**

As usual, please notify me of any corrections or additions to this calendar. I can be contacted via e-mail at: **bhorn@hornucopia.com**. Good luck and have fun!

March 2006

ARRL International DX Contest, SSB	0000Z, Mar 4 to 2400Z, Mar 5
Open Ukraine RTTY Championship	2200Z-2359Z, Mar 4 (Low Band) and 0000Z-0159Z, Mar 5 (Low Band) and 0800Z-1159Z, Mar 5 (High Band)
DARC 10-Meter Digital Contest	1100Z-1700Z, Mar 5
ARS Spartan Sprint	0200Z-0400Z, Mar 7
AGCW YL-CW Party	1900Z-2100Z, Mar 7
Pesky Texan Armadillo Chase	0230Z-0400Z, Mar 9
Idaho QSO Party	0000Z, Mar 11 to 2400Z, Mar 12
RSGB Commonwealth Contest	1000Z, Mar 11 to 1000Z, Mar 12
AGCW QRP Contest	1400Z-2000Z, Mar 11
Oklahoma QSO Party	1400Z, Mar 11 to 0200Z, Mar 12 and 1400Z-2000Z, Mar 12
EA PSK31 Contest	1600Z, Mar 11 to 1600Z, Mar 12
North American Sprint, RTTY	0000Z-0400Z, Mar 12
UBA Spring Contest, CW	0700Z-1100Z, Mar 12
NSARA Contest	1200Z-1600Z, Mar 12 and 1800Z-2200Z, Mar 12
Wisconsin QSO Party	1800Z, Mar 12 to 0100Z, Mar 13
10-10 International Mobile Contest	0001Z-2359Z, Mar 18
BARTG Sprint RTTY Contest	0200Z, Mar 18 to 0200Z, Mar 20
Russian DX Contest	1200Z, Mar 18 to 1200Z, Mar 19
CLARA and Family HF Contest	1700Z, Mar 18 to 1700Z, Mar 19
Virginia QSO Party	1800Z, Mar 18 to 0200Z, Mar 20
9K 15-Meter Contest	1200Z-1600Z, Mar 19
Run for the Bacon QRP Contest	0200Z-0400Z, Mar 20
CQ WW WPX Contest, SSB	0000Z, Mar 25 to 2359Z, Mar 26
Spring QRP Homebrew Sprint	0000Z-0400Z, Mar 27

April 2006

Kid's Roundup	1400Z, Apr 1 to 2200Z, Apr 2
SP DX Contest	1500Z, Apr 1 to 1500Z, Apr 2
EA RTTY Contest	1600Z, Apr 1 to 1600Z, Apr 2
QCWA Spring QSO Party	1800Z, Apr 1 to 1800Z, Apr 2
Missouri QSO Party	1800Z, Apr 1 to 0500Z, Apr 2 and 1800Z-2400Z, Apr 2
ARS Spartan Sprint	0100Z-0300Z, Apr 4
YLRL DX-YL to NA-YL Contest, CW	1400Z, Apr 4 to 0200Z, Apr 6
144 MHz Spring Sprint	1900-2300 local, Apr 4
JIDX CW Contest	0700Z, Apr 8 to 1300Z, Apr 9
ARCI Spring QSO Party	1200Z, Apr 8 to 2400Z, Apr 9
EU Spring Sprint, CW	1600Z-1959Z, Apr 8
Georgia QSO Party	1800Z, Apr 8 to 0359Z, Apr 9 and 1400Z-2359Z, Apr 9
Yuri Gagarin International DX Contest	2100Z, Apr 8 to 2100Z, Apr 9
Montana QSO Party	2300Z, Apr 8 to 2300Z, Apr 9
UBA Spring Contest, SSB	0600Z-1000Z, Apr 9
YLRL DX-YL to NA-YL Contest, SSB	1400Z, Apr 11 to 0200Z, Apr 13
222 MHz Spring Sprint	1900-2300 local, Apr 12
ARLHS Annual Spring Lites QSO Party	0001Z, Apr 15 to 2359Z, Apr 23
ES Open HF Championship	0500Z-0559Z, Apr 15 and 0600Z-0659Z, Apr 15 and 0700Z-0759Z, Apr 15 and 0800Z-0859Z, Apr 15
EU Spring Sprint, SSB	1600Z-1959Z, Apr 15
Michigan QSO Party	1600Z, Apr 15 to 0400Z, Apr 16
EA-QRP CW Contest	1700Z-2000Z, Apr 15 (20-10m) and 2000Z-2300Z, Apr 15 (80m) and 0700Z-1000Z, Apr 16 (40m) and 1000Z-1300Z, Apr 16 (20-10m)
Ontario QSO Party	1800Z, Apr 15 to 1800Z, Apr 16
YU DX Contest	2100Z, Apr 15 to 0500Z, Apr 16 and 0900Z-1700Z, Apr 16
Run for the Bacon QRP Contest	0100Z-0300Z, Apr 17
Low Power Spring Sprint	1400Z-2000Z, Apr 17
432 MHz Spring Sprint	1900-2300 local, Apr 20
DX Colombia International Contest	0000Z, Apr 22 to 2359Z, Apr 23
SP DX RTTY Contest	1200Z, Apr 22 to 1200Z, Apr 23
Florida QSO Party	1600Z, Apr 22 to 0159Z, Apr 23 and 1200Z-2159Z, Apr 23
Helvetia Contest	1300Z, Apr 29 to 1259Z, Apr 30

May 2006

MARAC County Hunter Contest, CW	0000Z, May 6 to 2400Z, May 7
10-10 Int. Spring Contest, CW	0001Z, May 6 to 2359Z, May 7
Microwave Spring Sprint	0600-1300 local, May 6
7th Call Area QSO Party	1300Z, May 6 to 0700Z, May 7
Indiana QSO Party	1600Z, May 6 to 0400Z, May 7
ARI International DX Contest	2000Z, May 6 to 1959Z, May 7
New England QSO Party	2000Z, May 6 to 0500Z, May 7 and 1300Z-2400Z, May 7
VOLTA WW RTTY Contest	1200Z, May 13 to 1200Z, May 14
CQ-M International DX Contest	1200Z, May 13 to 1200Z, May 14
FISTS Spring Sprint	1700Z-2100Z, May 13
50 MHz Spring Sprint	2300Z, May 13 to 0300Z, May 14
US Counties QSO Party, SSB	0000Z, May 20 to 2400Z, May 21
His Majesty King of Spain Contest, CW	1200Z, May 20 to 1200Z, May 21
EU PSK DX Contest	1200Z, May 20 to 1200Z, May 21
Portuguese Navy Day Contest, CW/SSB	1500Z, May 20 to 1500Z, May 21
Portuguese Navy Day Contest, PSK31	1500Z-2100Z, May 20
Manchester Mineira CW Contest	1500Z, May 20 to 2400Z, May 21
CQ WW WPX Contest, CW	0000Z, May 27 to 2359Z, May 28
ARCI Hootowl Sprint	2000-2400 local, May 28
MI QRP Memorial Day CW Sprint	2300Z, May 28 to 0300Z, May 29

June 2006

IARU Region 1 Field Day, CW	1500Z, Jun 3 to 1459Z, Jun 4
RSGB National Field Day	1500Z, Jun 3 to 1500Z, Jun 4
ANARTS WW RTTY Contest	0000Z, Jun 10 to 2400Z, Jun 11
Asia-Pacific Sprint, SSB	1100Z-1300Z, Jun 10
GACW WWSA CW DX Contest	1500Z, Jun 10 to 1500Z, Jun 11
ARRL June VHF QSO Party	1800Z, Jun 10 to 0300Z, Jun 12
All Asian DX Contest, CW	0000Z, Jun 17 to 2400Z, Jun 18
SMIRK Contest	0000Z, Jun 17 to 2400Z, Jun 18
West Virginia QSO Party	1600Z, Jun 17 to 0200Z, Jun 18
Quebec QSO Party	1700Z, Jun 17 to 0300Z, Jun 18
Kid's Day Contest	1800Z-2400Z, Jun 17
His Majesty King of Spain Contest, SSB	1200Z, Jun 24 to 1200Z, Jun 25
Marconi Memorial HF Contest	1400Z, Jun 24 to 1400Z, Jun 25
ARRL Field Day	1800Z, Jun 24 to 2100Z, Jun 25
ARCI Milliwatt Field Day	1800Z, Jun 24 to 2100Z, Jun 25

NCJ

DX Contest Activity Announcements

Bill Feidt, NG3K

ARRL DX SSB Contest (March 4-5, 2006)

Call	*Entity*	*Class*	*Operators*
3D2RX	Rotuma	M/S	N7OU, W7YAQ
8R1EA	Guyana	?	AH8DX
8R1ZUM	Guyana	?	K7ZUM
HI3CCP	Dominican Rep	SO LP	HI3CCP
HI3TEJ	Dominican Rep	SOAB QRP	HI3TEJ
NP2KW	Virgin Is	SOAB LP	NP2KW
OE4A	Austria	M/2	OE1EMS + others
P40CW	Aruba	SOAB	F5CWU
P40W	Aruba	SOAB	W2GD
PJ2T	Neth Antilles	M/2	W9JUV, NW0L, W0CG, K8ND, WB9Z, KB0US, KB0UT, KB0VVT
PJ7	Sint Maarten	?	DL4WK, DL7UFR, DL7VOA, DL7DF, SP3DOI
TA0U	Turkey	SOSB 20M	TA0U
TI8M	Costa Rica	M/2	TI2KAC, K4UN, K4WPM, W4BW, W4KTR
TO5A	Martinique	SOAB HP	F5VHJ
V31	Belize	M/?	OH2BH (V31BH), OH2PM (V31PP)
VP9/W6PH	Bermuda	SOAB LP	W6PH
WP3C	Puerto Rico	SOSB 40M	WP3C
ZP0R	Paraguay	?	ZP5AZL

Thanks to: AH8DX, DL7DF, F5CWU, F5VHJ, HI3CCP, HI3TEJ, K7ZUM, N7OU, NP2KW, OE1EMS, OH2BN, TA0U, W0CG, W2GD, W4BW, W6PH, WP3C, ZP5AZL
See **www.ng3k.com/Misc/adxs2006.html** for further details

NCJ

Top Ten Combined Single Operator Scores for August 2005 NAQPs

Mike, W9RE, won the combined CW/SSB NAQP competition with his first place CW and third place SSB finishes. N6NF and N4PN took second and third places, respectively. Congratulations to all of these great ops!

Operator	*CW Points*	*SSB Points*	*Total Points*
W9RE	500	396	896
N6NF	275	500	775
N4PN	341	394	735
N4ZZ	426	285	711
AA3B	401	234	635
W5WMU	279	324	603
N5DO	223	288	511
K7RL	0	475	475
K4RO	393	37	430
VE3EJ	428	0	428

NCJ

Results, August 2005 NAQP SSB Contest

Bruce Horn, WA7BNM
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What a difference two weeks makes! While the August CW contest favored the Midwest and East, West Coast operators took four of the top ten spots in the single op category of the August 2005 edition of the NAQP SSB contest. N6NF in California took first place by 9,000 points over K7RL in Washington. Indianan W9RE edged Georgian N4PN by a thousand points for third. W5WMU operated from Louisiana for fifth, while WX5S was sixth from California. N5DO took seventh from Texas, with N4ZZ, W6YI operated by K6AM, and K5TR operated by WM5R rounded out the top-ten scores from Tennessee, California and Texas, respectively.

KO1H, operating from Rhode Island, easily won the single-op QRP category by a wide margin. N8IE took second from Ohio, with NE1RD third from Massachusetts.

The NX5M Texas crew took first place in the multi-two category by a comfortable margin over KTØR in Minnesota. W4MYA was third from Virginia.

Although the Southern California Contest Club #1 team only had one member in the top-ten single op scores, it was able to capture first in the team competition. The Tennessee Contest Group Strikers team was second, with the Northern California Contest Club #1 team third.

Single Op Top Ten Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160*	*80*	*40*	*20*	*15*	*10*	*Team*
N6NF	185,555	1003	185	19/8	93/32	195/50	554/56	137/38	5/1	
K7RL	176,460	865	204	23/11	64/37	240/54	433/55	95/39	10/8	
W9RE	147,138	822	179	71/29	201/50	287/52	237/38	21/7	5/3	SMC #2
N4PN	146,118	1029	142	20/10	44/24	208/41	730/58	27/9	0/0	Tm USA
W5WMU	120,232	791	152	13/9	93/35	280/49	377/50	27/8	1/1	TCG Skr
WX5S	115,045	665	173	24/8	71/29	160/47	346/59	58/28	6/2	NCCC #1
N5DO	106,896	816	131	10/7	78/29	139/37	589/58	0/0	0/0	
N4ZZ	105,648	744	142	32/14	131/37	357/47	206/38	16/5	2/1	TCG Skr
W6YI (K6AM)	105,280	658	160	24/11	72/29	199/46	324/52	36/20	3/2	SCCC #1
K5TR (WM5R)	105,056	784	134	10/8	62/27	115/39	588/54	9/6	0/0	

Single Op QRP Top Three Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160*	*80*	*40*	*20*	*15*	*10*	*Team*
KO1H	27,807	299	93	5/3	33/17	137/35	116/32	7/5	1/1	CTRI
N8IE	3,298	97	34	0/0	0/0	75/24	22/10	0/0	0/0	
NE1RD	2,205	63	35	0/0	4/4	34/20	25/11	0/0	0/0	

Multi-Two Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160*	*80*	*40*	*20*	*15*	*10*
NX5M	304,388	1553	196	21/14	107/37	345/53	999/61	73/28	8/3
KTØR	267,932	1367	196	63/28	208/49	523/55	557/53	16/11	0/0
W4MYA	241,110	1269	190	59/25	282/45	510/53	379/52	39/15	0/0

Team Scores

1. SCCC #1

W6YI	105,280
W6TK	82,432
AA6PW	79,506
K6LA	54,810
N6HC	50,925
Total	372,953

2. TCG Strikers

W5WMU	120,232
N4ZZ	105,648
AD4EB	51,253
KU8E	7,260
Total	284,393

3. NCCC #1

WX5S	115,045
N6EE	88,768
W7RN	25,168
KE6QR	17,328
AE7DX	14,700
Total	261,009

4. Grand Mesa A-Team (KØUK, WØETT, KO7X, KØRFD, KØRI) 213,078
5. SMC #2 (W9RE, KA9F) 172,716
6. SMC #1 (W9IU, WW9R, W9LAS, N9YM) 169,990
7. Team USA (N4PN, W8ANT) 148,148
8. No Old Men Allowed (N3CA, N4CV, KD5OWO, AE6NY) 142,758
9. SECC #1 (W4BW, WA4TII, AA4LR) 141,925
10. CCO Team 1 (VE3XD, VE3RZ, VE3SY) 131,314
11. Team CTRI (N1HRA, AJ1M, KO1H, NW1E) 111,873
12. TCG Seabees (K4LTA, W4NZ, AF4QB, N4VI, WA4VJC) 77,912
13. CCO Team 2 (VE3KP, VA3NR, VE3RCN, VE3DZ) 75,180
14. FCG 1 (K9OM, K9ES) 67,819
15. NCCC #2 (AE6Y, K6III, W6FB, W6ZZZ) 64,740
16. NCCC #3 (K7NV, K6EU, NO6X, W6EB) 59,190
17. TCG In Harm's Way (W0ETC, K4RO, WA4OSD, W9WI) 54,473
18. CCO Team 3 (VA3GGF, VE3MGY, VE3TPZ) 51,249
19. FCG 2 (NF4A, AA4RX) 51,124
20. SCCC #2 (N6QQ, K6EY, K6ZCL, N6AA) 47,754
21. NCCC #4 (KA6BIM, N6AJR, W6FRH, NU6T) 29,572
22. SMC #5 (WE9V, AI9L, AF9H) 28,611
23. North Carolina Contest Group (KB4FWN, KB4QLZ, KG4DXS) 26,965
24. SMC #3 (K9WX, N9FN, K9MI) 24,920
25. SMC #4 (AK9F) 20,088
26. Order of Boiled Owls of New York (KS2G, W2YK) 14,750
27. Team GRVARS (N9CDX, KB9LIE, K9PVZ) 13,803
28. TCG Green Berets (K1GU, NY4N) 11,182
29. TCG Flying Leathernecks (K4BP, WM4Q, WA4JA/M) 7,838
30. TCG Flying Tigers (N1WI) 3,608
31. South Texas DX Goons (N5LYG) 2,625
32. SECC #2 (W4NTI, K4OGG) 2,090

Single Operator Scores

Call	Score	QSOs	Mults	QTH	Team
N1HRA	40,584	456	89	RI	Team CTRI
*KO1H	27,807	299	93	RI	Team CTRI
K1HT	22,072	248	89	MA	
KK1KW	20,740	244	85	NH	
NB1B	18,761	257	73	MA	
KB1H	10,880	160	68	CT	
NW1E					
(K1JN)	9,912	168	59	CT	Team CTRI
KB1LAX	5,676	132	43	VT	
K1SEZ	3,990	95	42	CT	
WB2ART	2,442	74	33	RI	
*NE1RD	2,205	63	35	MA	
N1FR	195	15	13	MA	
W2RU	35,433	381	93	NY	
WA2MCR	25,668	276	93	NY	
K2BF	19,465	229	85	NY	
N2NC	17,425	205	85	NJ	
W3TB	13,068	198	66	NY	
KS2G	11,390	170	67	NY	Order of Boiled Owls of New York
W2LE	4,158	99	42	NJ	
W2YK	3,360	80	42	NY	Order of Boiled Owls of New York
AB2SA	3,240	81	40	NJ	
K2NPN	2,356	62	38	NY	
W8ANT	2,030	70	29	NY	Team USA
AB0OX	18	6	3	NJ	
N3CA					
(at WX3B)	97,236	657	148	MD	No Old Men Allowed
AA3B	86,832	648	134	PA	
W3LL	20,650	350	59	MD	
AJ3M	19,740	235	84	MD	
N3FJP	10,948	161	68	MD	
AJ3U	10,944	152	72	MD	
AD8J	8,127	129	63	PA	
K3GY	7,791	147	53	PA	
K3RWN	4,100	82	50	PA	
K3HR	1,100	50	22	NJ	
K3VED	1,075	43	25	PA	
W0BR	285	19	15	PA	
N3TXH	208	16	13	PA	
N4PN	146,118	1029	142	GA	Team USA
N4ZZ	105,648	744	142	TN	TCG Strikers
W4BW	60,835	529	115	GA	SECC #1
N4KZ	53,192	488	109	KY	
AD4EB	51,253	479	107	TN	TCG Strikers
KA1ARB	50,868	471	108	NC	
K9OM	50,467	463	109	FL	FCG 1
NF4A	44,464	397	112	FL	FCG 2
WA4TII	43,290	390	111	GA	SECC #1
AA4LR	37,800	360	105	GA	SECC #1
K4LTA	35,090	319	110	TN	TCG Seabees
N4CV					
(at K4KDJ)	29,088	303	96	VA	No Old Men Allowed
KR4M	26,928	272	99	SC	
W4NZ	20,416	232	88	TN	TCG Seabees
K9ES	17,352	241	72	FL	FCG 1
KB4FWN	15,762	222	71	NC	North Carolina Contest Group
N2GWK	14,972	197	76	KY	
K4RO	13,680	171	80	TN	TCG In Harm's Way
K5EEE	12,738	193	66	FL	
KA0GGI/M	11,024	212	52	FL	
K4BAI	10,730	145	74	GA	
AF4QB	10,132	149	68	TN	TCG Seabees
KB4QLZ	9,231	181	51	NC	North Carolina Contest Group
KG4NWS	8,195	149	55	SC	
K1GU	8,100	150	54	TN	TCG Green Berets
NT4XT	7,392	112	66	GA	
WA4OSD	7,371	117	63	TN	TCG In Harm's Way
KU8E	7,260	121	60	GA	TCG Strikers
NQ4U	6,981	179	39	TN	
W9WI	6,960	120	58	TN	TCG In Harm's Way
AA4RX	6,660	111	60	FL	FCG 2
N4VI	6,554	113	58	TN	TCG Seabees
K4GM	6,325	115	55	VA	
NJ2F	6,254	106	59	FL	
WA4VJC	5,720	104	55	GA	TCG Seabees
K3CQ	5,014	109	46	TN	
K4BP	4,998	98	51	TN	TCG Flying Leathernecks
K4WW	4,012	118	34	KY	
N1WI	3,608	82	44	TN	TCG Flying Tigers
NY4N	3,082	67	46	TN	TCG Green Berets
N4WO	2,100	60	35	FL	
KG4DXS	1,972	68	29	NC	North Carolina Contest Group
W4NTI	1,870	55	34	AL	SECC #2
WM4Q	1,815	55	33	TN	TCG Flying Leathernecks
KG4EVJ	1,161	43	27	FL	
WA4JA/M					
(WA4JA)	1,025	41	25	AL	TCG Flying Leathernecks
*AF4KL	858	33	26	GA	
*NX9T	816	34	24	NC	
KG4ZXP	682	31	22	KY	
AC4JI	672	28	24	TN	
K4LW	612	34	18	GA	
W4OGG	567	27	21	TN	
N4EKG	510	30	17	GA	
K1SO	476	34	14	VA	
K3MZ	476	28	17	VA	
WB4QNG	432	24	18	KY	
K9GWB	378	21	18	TN	
WB4JM	266	19	14	KY	
KV4CN	264	24	11	NC	
K4OGG	220	20	11	GA	SECC #2
KG4MWO	60	10	6	FL	
W5WMU	120,232	791	152	LA	TCG Strikers
N5DO	106,896	816	131	TX	
K5TR					
(WM5R)	105,056	784	134	TX	
K5AM	94,164	798	118	NM	
K5XR					
(W5ASP)	49,595	545	91	TX	
KE5OG	27,489	357	77	TX	
KI7GV	20,090	245	82	AR	
N5YE	16,810	205	82	LA	
W5PUF	15,300	204	75	OK	
KD5OWO	13,400	200	67	TX	No Old Men Allowed
W3TZ	11,008	172	64	AR	
KD5NFW	9,150	150	61	TX	
KC5R	8,978	134	67	LA	
AD5SR	4,738	103	46	OK	
KC5EES	4,512	96	47	TX	
W5GN					
(K5VXM)	4,186	91	46	TX	
N5ZC	4,080	80	51	TX	
K5WWT	3,735	83	45	TX	
KC5TA	3,652	83	44	TX	
AD5RK	3,276	84	39	TX	
W5PQ	3,034	74	41	LA	
N5LYG	2,625	75	35	TX	South Texas DX Goons
K5WW	1,770	59	30	TX	
N5DTT	1,740	58	30	TX	
W5MEJ	1,700	50	34	TX	
N0IRW	630	35	18	OK	
W4DLZ	475	25	19	LA	
N1END	252	18	14	TX	
N6NF	185,555	1003	185	CA	
WX5S					
(at N6RO)	115,045	665	173	CA	NCCC #1
W6YI					
(K6AM)	105,280	658	160	CA	SCCC #1
N6EE	88,768	584	152	CA	NCCC #1
W6TK	82,432	644	128	CA	SCCC #1
AA6PW	79,506	631	126	CA	SCCC #1
N6KI	72,141	519	139	CA	
W6AFA	55,328	532	104	CA	
K6LA	54,810	435	126	CA	SCCC #1
N6HC	50,925	485	105	CA	SCCC #1
WN6K	43,623	393	111	CA	
AE6Y	42,598	361	118	CA	NCCC #2
N6QQ	41,830	445	94	CA	SCCC #2
K6EU	17,920	224	80	CA	NCCC #3
KE6QR	17,328	228	76	CA	NCCC #1
NH7DX					
(I2UIY)	16,644	228	73	CA	
KA6BIM	14,852	188	79	CA	NCCC #4
K6III	13,200	176	75	CA	NCCC #2
W6FB	8,642	149	58	CA	NCCC #2
NO6X	7,316	118	62	CA	NCCC #3
N6AJR	6,612	116	57	CA	NCCC #4
KD6PQF	5,610	102	55	CA	
W6FRH	4,410	98	45	CA	NCCC #4
W6EB	3,864	84	46	CA	NCCC #3
NU6T	3,698	86	43	CA	NCCC #4
K6EY	3,080	88	35	CA	SCCC #2
AE6NY	3,034	74	41	CA	No Old Men Allowed
K6ZCL	2,412	67	36	CA	SCCC #2
W6RCL	2,331	63	37	CA	
N6IJ					
(K3KOA)	1,947	59	33	CA	
W6ISO	1,938	57	34	CA	
WB6KDH	1,848	56	33	CA	
W6BBL	1,798	58	31	CA	
K6CSL	925	37	25	CA	

Call	Score	QSOs	Mults	QTH	Team
K6BIR	442	26	17	CA	
N6AA	432	24	18	CA	SCCC #2
WB2TVB	405	27	15	CA	
W6ZZZ	300	30	10	CA	NCCC #2
N3LQ	9	3	3	CA	
K7RL	176,460	865	204	WA	
K7ZSD	99,314	782	127	OR	
N7VM	97,988	748	131	UT	
W7ZR	71,492	586	122	AZ	
KO7X	45,136	434	104	WY	Grand Mesa A-Team
NI7T	34,528	332	104	UT	
NN7ZZ (N5LZ)	33,475	325	103	UT	
K7NV	30,090	295	102	NV	NCCC #3
W7RN (K5RC)	25,168	286	88	NV	NCCC #1
WG7Y	23,940	285	84	WY	
AE7DX	14,700	196	75	NV	NCCC #1
K7BAA	13,002	197	66	OR	
K7UT	12,580	185	68	UT	
AA6RR	2,144	67	32	WA	
W7LDT	1,260	45	28	AZ	
NG7Z	792	33	24	WA	
AD7GG	154	14	11	WA	
*KL7FDQ	24	6	4	MT	
AJ1M	33,570	373	90	WV	Team CTRI
K8BB	14,726	199	74	MI	
W8TM	9,800	175	56	OH	
K8IR	8,880	148	60	MI	
K8MR	5,974	103	58	OH	
WB8JUI	3,478	74	47	OH	
*N8IE	3,298	97	34	OH	
K8JWT	2,176	64	34	WV	
AB8S	2,014	53	38	WV	
NF8M	1,855	53	35	MI	
KC8YLD	1,000	40	25	OH	
KC8FVE	112	16	7	WV	
W9RE	147,138	822	179	IN	SMC #2
K9GX	98,384	688	143	IN	
W9IU	70,176	544	129	IN	SMC #1
KE9S	66,096	486	136	WI	
WW9R	63,928	524	122	WI	SMC #1
K9BGL	29,406	338	87	IL	
KA9F	25,578	294	87	IN	SMC #2
WE9V	23,751	261	91	WI	SMC #5
AK9F	20,088	248	81	IL	SMC #4
W9LAS (K9JS)	19,950	266	75	WI	SMC #1
N9YM	15,936	192	83	IN	SMC #1
K9WX	11,492	169	68	IN	SMC #3
N9CDX	8,517	167	51	IL	Team GRVARS
N9FN	8,190	126	65	IN	SMC #3
K9MI	5,238	97	54	IN	SMC #3
NA9U	4,664	88	53	IN	
KB9LIE	3,570	85	42	WI	Team GRVARS
AI9L	3,375	75	45	IL	SMC #5
KB9YGD	3,030	101	30	IN	
K9PVZ	1,716	52	33	IL	Team GRVARS
AF9H	1,485	45	33	IL	SMC #5
*KG9N	713	31	23	IL	
K9ZEN	368	23	16	IN	
K9FH	1	1	1	IL	
KØRH	98,373	813	121	KS	
KØUK	86,904	639	136	CO	Grand Mesa A-Team
WØETT	51,810	471	110	CO	Grand Mesa A-Team
KØWA	41,800	418	100	KS	
NTØF	39,520	380	104	IA	
WØETC	26,462	262	101	IA	TCG In Harm's Way
KØRFD	26,112	272	96	CO	Grand Mesa A-Team
NØWY	16,250	250	65	NE	
KIØY	12,740	182	70	MO	
KØOU	10,952	148	74	MO	
KCØRQH	10,488	138	76	MN	
KØMPH	7,150	130	55	MN	
KSØT	6,600	120	55	MN	
KEØL	5,940	99	60	MN	
KØDAT	4,488	88	51	MO	
N9CI	3,990	95	42	IA	
KBØARZ	3,198	82	39	NE	
KØRI	3,116	82	38	CO	Grand Mesa A-Team
WAØVPJ	2,511	81	31	MN	
ABØSD	1,736	56	31	IA	
ACØCH	1,248	52	24	CO	
KFØRT	1,150	50	23	CO	
ABØYM	702	39	18	CO	
KB5ENP	589	31	19	MO	
KØLWV	496	31	16	MO	
KCØNFB	486	27	18	MN	
*WØPSS	99	11	9	CO	
VE3XD	65,559	533	123	ON	CCO Team 1
VE3RZ	48,360	465	104	ON	CCO Team 1
VE3AGC (at VE3WG)	38,412	396	97	ON	
VE1SKY	28,830	310	93	NS	
VA3GGF	28,480	320	89	ON	CCO Team 3
VE3KP	25,200	252	100	ON	CCO Team 2
VA3NR	23,644	257	92	ON	CCO Team 2
VE7FO	19,926	243	82	BC	
VE3MGY	19,844	242	82	ON	CCO Team 3
VE3SY	17,395	245	71	ON	CCO Team 1
VE3RCN	16,766	202	83	ON	CCO Team 2
VE2AWR	15,549	213	73	PQ	
VE3DZ	9,570	165	58	ON	CCO Team 2
VE3TW	8,432	136	62	ON	
VA2SG	4,508	98	46	PQ	
VE3TPZ	2,925	75	39	ON	CCO Team 3
VA7MJR	1,053	39	27	BC	
*VA3RKM	70	10	7	ON	
VE4MBQ	56	8	7	MB	
HK3AXY	3,116	82	38	HK	

* Indicates QRP entry

Multi-Two Scores

Call	Score	QSOs	Mults	QTH
NX5M (NX5M, N5XJ, KU5B, N5NMX)	304,388	1553	196	TX
KT0R (KØAD, KØOB, KEØL, WGØM, KTØR)	267,932	1367	196	MN
W4MYA (N3UA, W4MYA, WK4Y, WA4PGM)	241,110	1269	190	VA
N5QQ (N5QQ, K5MR, K5NZ)	238,320	1324	180	TX
W4AN (K9MU, WY4N, NQ4I, K4NV)	215,238	1237	174	GA
W6YX (N7MH, W6LD, K6OWL, N6DE)	199,675	1141	175	CA
NK7U (NK7U, K7MJR, K7ZO)	178,712	1004	178	OR
W4RM (W4RM, W4NF, K5OF, WA4TK)	145,855	941	155	VA
WW4LL (WW4LL, NN4RR, K4AQ, K1DW, K4ZJ, K9MUG)	89,976	652	138	GA
N4TP (N4WEB, W1GUD, K4LVR, WA3DIT)	83,500	835	100	FL
K4HTA (AC4LT, AE4R, AF4PM, K2HYD, K4TCM, KA4YMA, KG4JBJ, KG4OJT, KG6EFT, KG6ZR, KI4HLV, KO1D, N4ZPT)	50,949	459	111	VA
K5ER (K5ER, W5WZ)	49,632	517	96	LA
WT9U (WT9U, KC9FZT)	47,460	420	113	IN
W5YD (KC5OXI, KD5ZJZ, KD5SDQ, N4OGW)	37,673	373	101	MS
W1MX (KF4KJQ, KB1CGZ, WG1Z)	35,776	416	86	MA
KØRAY (KØRAY, NØBDS)	27,755	305	91	MO
KØXI (WØYZZ, AAØML, WØMHS)	23,360	292	80	MO
W8GQN (W8GQN)	21,576	248	87	MI
W4MY (W4MY, KC4HDI)	14,600	200	73	NC
N8UZE (N8UZE)	5,400	100	54	MI
N4CW/1 (KD1EA, N4CW)	5,000	100	50	ME
KM9M (KM9M)	4,232	92	46	IL
WY7N (WY7N)	960	48	20	AZ
WF4DD (WA4FJK, KG4CZU, KI4GHK)	792	36	22	NC
W2PWE (W2PWE)	176	16	11	NJ

Check Logs: KW9L, N5KO, N6DRA, VE3KYG, W1LZ, W8UE, WA4GLH

Results, August 2005 NAQP CW Contest

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Conditions favored operators in the eastern to Midwestern portions of the United States and Canada during the August 2005 edition of the NAQP CW contest. Unlike the January edition, no operators in the West made the top-ten single op list. W9RE took first place by a comfortable margin from his Indiana QTH. VE3EJ was second from Ontario with a less than thousand point lead over Tennessean N4ZZ. AA3B captured fourth from Pennsylvania, while another Tennessean, K4RO, took fifth by nipping K3WW by less than 50 points. KØRF took seventh as the furthest west station (Colorado) in the top ten. KØEJ, N3BB and NØAT captured the remaining places from Tennessee, Texas and Minnesota, respectively.

KG5U easily won the single-op QRP category from Texas by almost 10,000 points over second place VA3DF in Ontario. NA4BW took third from Georgia, while N6WG (California) and W8TM (Ohio) captured fourth and fifth.

In multi-two K5KA took first place from Oklahoma with W5NN close behind for second from Texas. W6YX was third from California.

The Tennessee Contest Group #1 team used top-ten single-op finishes by three of its members to take first place in the team competition by almost 100,000 points over the second-place Austin Powers Jalapenos team. The Contest Club Ontario Team 1 was close behind in third. It's unusual when no West Coast team is among the top-three teams.

Single Op Top Ten Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160*	*80*	*40*	*20*	*15*	*10*	*Team*
W9RE	223,317	919	243	130/45	192/49	217/54	271/49	92/33	17/13	SMC #1
VE3EJ	191,268	828	231	91/39	145/43	217/51	210/47	123/35	42/16	CCO #1
N4ZZ	190,422	894	213	82/30	171/41	208/48	292/49	105/29	36/16	TCG #1
AA3B	179,095	833	215	61/29	129/40	265/52	246/48	102/32	30/14	FRC #2
K4RO	175,560	840	209	78/27	163/42	231/46	241/47	80/29	47/18	TCG #1
K3WW	175,518	882	199	66/27	126/39	290/49	278/45	89/26	33/13	
KØRF	166,492	778	214	62/27	125/41	209/46	196/44	149/36	37/20	
KØEJ	162,583	817	199	55/21	107/34	270/47	262/50	98/32	25/15	TCG #1
N3BB	161,787	813	199	47/22	69/30	248/51	303/54	128/32	18/10	AP Jala
NØAT	161,182	794	203	79/34	182/42	228/48	206/45	71/22	28/12	MWA #1

Single Op QRP Top Five Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160*	*80*	*40*	*20*	*15*	*10*	*Team*
KG5U	49,400	380	130	0/0	51/23	65/26	146/45	109/30	9/6	AP Ench
VA3DF	39,975	325	123	2/2	56/25	113/39	110/38	35/14	9/5	CCO #2
NA4BW	29,160	270	108	5/3	51/21	88/32	83/28	37/19	6/5	SECC #2
N6WG	27,169	269	101	13/4	30/7	83/39	121/41	19/9	3/1	NCCC #3
W8TM	21,280	266	80	0/0	0/0	173/47	91/31	2/2	0/0	

Multi-Two Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160*	*80*	*40*	*20*	*15*	*10*
K5KA	340,218	1383	246	145/42	318/51	370/53	373/51	150/34	27/15
W5NN	318,664	1306	244	106/34	215/50	378/54	395/52	180/40	32/14
W6YX	224,270	1094	205	67/20	176/39	298/55	413/54	117/30	23/7

Team Scores

1. TCG #1		***2. Austin Powers Jalapenos***		***3. CCO Team 1***	
N4ZZ	190,422	N3BB	161,787	VE3EJ	191,268
K4RO	175,560	K5OT	152,200	VE3DZ	147,264
K0EJ	162,583	W5KFT	144,279	VE3XB	135,360
W4NZ	136,500	K5WA	121,930	VE3KZ	101,135
K4LTA	110,264	K5TR	95,850	VE3KP	93,879
Total	775,329	Total	676,046	Total	668,906

4. SECC #1(N4PN, K4FXN, K4BAI, W4OC, KU8E) 654,820
5. TCG #2(W9WI, WO4O, AD4EB, NA4K, W4HZD) 580,227
6. SMC #2(NØAV, KØOU, K9MMS, W9IU, K9WX) 549,009
7. NCCC Team #1(N6RO, AE6Y, K7NV, K2KW, K6MR) .. 533,849
8. MWA Team #1(NØAT, KØAD, NAØN, KTØR)) 504,033
9. SMC #1(W9RE, KJ9C, WT9U, WW9R, KA9F) 489,909
10. PVRC (K7SV, K3AU, N8II, VY2/KD4D, K3STX) 478,137
11. Parker County Posse Team No 3(K5BG, WØUO, N5PO, N5OE, W5GN) 440,701
12. FRC Team #2(AA3B, N3AD, K3CT) 370,125
13. Austin Powers Enchiladas (KZ5D, N5DO, W5JAW, KG5U, AC5AA) 356,247
14. NCCC Team #2(K6XX, K6LRN, ND2T, NO6X) 275,727
15. SCCC #2(K6NR, W6TK, WN6K, W6KY) 252,619
16. SCCC #1(W6RFU, N6HC, XE2MX) 244,128
17. CCO Team 3(VE3JM, VA3NR, W1AJT/VE3, VE3RCN) 221,542
18. SHARCS (W0UY, KKØHF, KØPY, N3PXF, NØXM) 196,725
19. MWA Team #2(KMØO, KØTK, NØBUI, KEØL) 192,458
20. CCO Team 2(VE3RZ, VA3DF, VE3XD, VA3EC, VE3HG) .. 187,142
21. TCG #3(K1GU, K4AMC, NY4N, N4DW, WØETC) 185,114
22. Maritime Contest Club (NY1S, VE1OP, VE1RGB, VA1CHP) . 181,753
23. Azenmokers (N6ZZ, W7YS, NØQT, KC7V, K7UP) 178,292
24. SECC #2(K4IQJ, NA4BW, N4GI, AA4GA, WØAG) 174,822
25. GMCC (WØETT, NØSXX, KØRI, WA7LNW) 174,403
26. FRC Team #1(K3MD, N2NC) 166,667
27. Austin Powers Burritos (N9NE, N5AW) 161,078
28. NCCC Team #5(N6XI, K6III, W6OAT, N6ZFO) 138,238
29. NCCC Team #3(W6RK, N6WG, AE7DX, KO6LU) 89,042
30. SECC #3(AA4LR, W4NTI) 86,429
31. SECC #4(K9MUG, K4OGG) 81,239
32. NCCC Team #6(N6EE) 57,652
33. SMC #3(AK9F, W9WUU) 55,940
34. Team GRVARS (K9WA, FP/K9OT, NN9K, N9BIL, NE0P) ... 51,212
35. SCCC #3(W6SJ, K6ZCL, KU6A) 48,277
36. NCCC Team #4(KE6QR, N6IJ, W6ZZZ) 39,640
37. Chautauqua Contest Group (AA2AD) 31,164
38. SCCC #4(K6XT, K6EY) 27,057
39. TCG #4(WA4OSD, W2OO, N2WN) 25,882
40. Mad River Radio Club (K8BB, K9NW) 15,164

Single Operator Scores

Call	Score	QSOs	Mults	QTH	Team
NY1S	81,315	585	139	ME	Maritime Contest Club
KB1H (K1EBY)	79,650	590	135	CT	
N4CW/1 (N4CW)	59,605	455	131	ME	
N1YC	35,292	346	102	CT	
W1TO	15,824	172	92	MA	
AE1T	15,756	202	78	NH	
W1JQ	12,960	162	80	CT	
*KO1H	10,508	148	71	RI	
W1EQ	5,400	100	54	CT	
W1END	4,059	99	41	NH	
K1KI	3,403	83	41	CT	
WO1N	3,362	82	41	MA	
W1EBI	1,584	66	24	MA	
K4SF	768	32	24	CT	
*K1TW	494	26	19	MA	
K2QMF	46,311	359	129	NY	
W2LE	40,000	320	125	NJ	
N2NC	39,786	349	114	NJ	FRC Team #1
N2CU	36,296	349	104	NY	
K2ZR	25,175	265	95	NY	
KA2D	19,320	210	92	NY	
KD2HE	2,844	79	36	NY	
WA2BMH	1,536	48	32	NJ	
AA3B	179,095	833	215	PA	FRC Team #2
K3WW	175,518	882	199	PA	
N3AD	147,857	743	199	PA	FRC Team #2
K3MD	126,881	701	181	PA	FRC Team #1
K3AU (K2YWE)	98,384	572	172	MD	PVRC
K3STX	47,838	357	134	MD	PVRC
K3CT	43,173	351	123	PA	FRC Team #2
NA3V	43,030	331	130	PA	
W3KB	36,208	292	124	PA	
W3BBO	31,200	300	104	PA	
AA2AD	31,164	294	106	PA	Chautauqua Contest Group
WA3AAN	26,100	261	100	PA	
NF3R	20,235	213	95	MD	
AA0CY	11,520	144	80	PA	
*K3WWP	9,945	153	65	PA	
K3KU	5,781	123	47	MD	
W0BR/3	900	36	25	PA	
N4ZZ	190,422	894	213	TN	TCG #1
K4RO	175,560	840	209	TN	TCG #1
K0EJ	162,583	817	199	TN	TCG #1
W9WI	160,576	772	208	TN	TCG #2
K7SV	160,500	750	214	VA	PVRC
N4PN	152,358	758	201	GA	SECC #1
WO4O	137,340	763	180	TN	TCG #2
W4NZ	136,500	750	182	TN	TCG #1
K4FXN	134,748	684	197	KY	SECC #1
K4BAI	125,670	710	177	GA	SECC #1
W4OC	125,600	628	200	SC	SECC #1
AD4EB	118,660	698	170	TN	TCG #2
NA4K	116,501	623	187	TN	TCG #2
KU8E	116,444	677	172	GA	SECC #1
K4QPL	111,884	674	166	NC	
K4LTA	110,264	616	179	TN	TCG #1
K4IQJ	91,932	564	163	AL	SECC #2
K9MUG	80,480	503	160	AL	SECC #4
K1GU	76,050	507	150	TN	TCG #3
AF4OX	75,525	475	159	SC	
K9OM	75,429	493	153	FL	
NF4A	69,639	501	139	FL	
AA4LR	61,904	424	146	GA	SECC #3
W4HZD	47,150	410	115	TN	TCG #2
KM4M (W3BP)	42,601	377	113	VA	
N4GG	40,848	368	111	GA	
K4AMC	32,745	295	111	TN	TCG #3
NY4N	30,800	280	110	TN	TCG #3
*NA4BW	29,160	270	108	GA	SECC #2
AA4FU	29,040	264	110	NC	
N5VI	26,200	262	100	GA	
W4NTI	24,525	225	109	AL	SECC #3
N4DW	23,664	232	102	TN	TCG #3
KJ4QF	21,090	222	95	VA	
N4GI	20,812	242	86	FL	SECC #2
KN4Y	19,805	233	85	FL	
AA4GA	19,158	206	93	GA	SECC #2
K4BX	18,912	197	96	TN	
WF4W	16,999	191	89	GA	
W4KAZ	15,555	183	85	NC	
AD4IE	14,616	174	84	NC	
WD4AHZ	14,000	200	70	FL	
W0AG	13,760	172	80	GA	SECC #2
AI4IE	13,690	185	74	FL	
WA4OSD	11,259	139	81	TN	TCG #4
K4LW	11,152	164	68	GA	
KE1F	10,720	160	67	FL	
KT4PD	10,164	154	66	FL	
W2OO	8,591	121	71	TN	TCG #4
N4TB	7,020	130	54	FL	
N2WN	6,032	116	52	TN	TCG #4
K3MZ	5,900	100	59	VA	
N2YO	4,025	115	35	VA	
W4ARM	3,600	100	36	FL	
W4BW	2,574	66	39	GA	
K5ESE	2,190	73	30	SC	
W4BCG	1,989	51	39	TN	
W4IHI	1,980	60	33	FL	
*K4KO	1,798	58	31	TN	
K0COP	1,364	44	31	SC	
KI4EGT	1,352	52	26	GA	
K4WW	1,248	48	26	KY	
N4HXI	943	41	23	NC	
K4OGG	759	33	23	GA	SECC #4
WA4GLH	567	27	21	TN	
N3BB	161,787	813	199	TX	Austin Powers Jalapenos
N6ZZ	158,826	771	206	NM	Azenmokers
K5OT (N5TW)	152,200	761	200	TX	Austin Powers Jalapenos
W5KFT (K5PI)	144,279	697	207	TX	Austin Powers Jalapenos
AD5Q	138,768	708	196	TX	
K5BG	136,576	704	194	TX	Parker County Posse Team No 3
W0UO	135,222	727	186	TX	Parker County Posse Team No 3
W5WMU	124,763	697	179	LA	
K5WA	121,930	685	178	TX	Austin Powers Jalapenos
KZ5D	110,004	618	178	LA	Austin Powers Enchiladas
N5DO	99,538	634	157	TX	Austin Powers Enchiladas
K5TR (KE5C)	95,850	639	150	TX	Austin Powers Jalapenos
N5QQ	85,722	546	157	TX	
N5PO	77,380	530	146	TX	Parker County Posse Team No 3
K5CM	76,946	487	158	OK	
N5AW	69,108	443	156	TX	Austin Powers Burritos
N5OE	68,728	484	142	TX	Parker County Posse Team No 3
W5JAW	56,025	415	135	TX	Austin Powers Enchiladas
WQ5L	52,793	403	131	MS	
*KG5U	49,400	380	130	TX	Austin Powers Enchiladas
W5KDJ	43,740	405	108	TX	
N5CHA	42,822	351	122	TX	
WA5TWL	41,912	338	124	TX	
AC5AA	41,280	320	129	TX	Austin Powers Enchiladas
W5MK	34,720	310	112	AR	
K0GEO	34,384	307	112	TX	
N5II	25,935	247	105	LA	
W5GN	22,795	235	97	TX	Parker County Posse Team No 3
K7IA	22,113	243	91	NM	
*K5UV	19,295	227	85	OK	
KD5MDO	17,835	205	87	LA	
K5AM	14,535	171	85	NM	
N5YE	11,122	166	67	LA	
*KU5S	8,896	139	64	TX	
W4DLZ	5,640	94	60	LA	
*N0QT	4,998	98	51	NM	Azenmokers
W5PQ	4,512	94	48	LA	
*K7UP	2,432	64	38	NM	Azenmokers
K5YQF	1,683	51	33	TX	
NE0P	912	38	24	OK	Team GRVARS
*AA0NI	816	34	24	OK	
N6RO	150,540	772	195	CA	NCCC Team #1
N6NF	123,018	707	174	CA	
K6XX	116,280	680	171	CA	NCCC Team #2
AE6Y	110,980	620	179	CA	NCCC Team #1
K2KW	99,434	599	166	CA	NCCC Team #1
W6RFU (AC6T)	91,266	574	159	CA	SCCC #1
N6HC	80,115	545	147	CA	SCCC #1
K6NR	79,674	542	147	CA	SCCC #2
W6TK	79,050	527	150	CA	SCCC #2
N7CW	67,431	507	133	CA	
K6MR	66,456	468	142	CA	NCCC Team #1
K6LRN	63,756	462	138	CA	NCCC Team #2
N6EE	57,652	406	142	CA	NCCC Team #6
WN6K	55,375	443	125	CA	SCCC #2
N6XI	54,103	413	131	CA	NCCC Team #5
ND2T	53,235	455	117	CA	NCCC Team #2
K6III	45,108	358	126	CA	NCCC Team #5
NO6X	42,456	366	116	CA	NCCC Team #2
W6KY	38,520	360	107	CA	SCCC #2
W6SJ	38,250	375	102	CA	SCCC #3
W6RGG	37,168	368	101	CA	
W6RK	28,809	297	97	CA	NCCC Team #3
W6OAT	27,807	299	93	CA	NCCC Team #5
*N6WG	27,169	269	101	CA	NCCC Team #3
KE6QR	21,805	245	89	CA	NCCC Team #4
K6RIM	21,068	229	92	CA	
N6IJ (K3KOA)	13,035	165	79	CA	NCCC Team #4

Call	Score	QSOs	Mults	QTH	Team
KO6LU	11,644	164	71	CA	NCCC Team #3
WW6D	11,232	144	78	CA	
N6ZFO	11,220	165	68	CA	NCCC Team #5
W6ISO	8,384	131	64	CA	
W6FRH	7,750	125	62	CA	
N7LU (N6NC)	7,526	142	53	CA	
K6ZCL	5,353	101	53	CA	SCCC #3
K1USC	5,130	95	54	CA	
W6ZZZ	4,800	100	48	CA	NCCC Team #4
KU6A	4,674	123	38	CA	SCCC #3
N6NG	3,960	88	45	CA	
K6CSL	3,388	77	44	CA	
K6EY	3,120	78	40	CA	SCCC #4
N6VH	1,876	67	28	CA	
W6RKC	1,782	54	33	CA	
K2RD	1,550	50	31	CA	
N6RY	60	10	6	CA	
*N2YM	21	7	3	CA	
N6TR	142,450	770	185	OR	
K7NV	106,439	653	163	NV	NCCC Team #1
W7ZR	91,200	608	150	AZ	
W7CT	55,380	426	130	UT	
W3CP	25,298	278	91	OR	
N7LOX	22,632	246	92	WA	
AE7DX	21,420	252	85	NV	NCCC Team #3
*N7IR	20,315	239	85	AZ	
N7VM	15,498	246	63	UT	
W6RLL	14,850	198	75	AZ	
W7WHY	12,580	170	74	OR	
KL7WV (W3YQ)	12,012	182	66	KL7	
WA7LNW	8,904	168	53	UT	GMCC
W7HS	8,241	123	67	UT	
W7YS	7,434	126	59	AZ	Azenmokers
AA6RR	7,380	123	60	WA	
NG7Z	7,040	128	55	WA	
KC7NUP	5,733	147	39	NV	
KC7V	4,602	118	39	AZ	Azenmokers
AL2P	1,484	53	28	KL7	
*N7ON	1,242	54	23	NV	
*KL7FDQ	238	17	14	MT	
N8BJQ	133,632	696	192	OH	
KV8Q	95,480	616	155	OH	
N8II	90,479	523	173	WV	PVRC
WA8WV	88,404	556	159	WV	
W8KW (W8UE)	60,691	443	137	MI	
K8JQ	46,311	359	129	WV	
KG8GW	30,600	300	102	WV	
N8IE	23,859	241	99	OH	
*W8TM	21,280	266	80	OH	
K8BB	14,328	199	72	MI	Mad River Radio Club
K8NZ	8,687	119	73	OH	
W8UE	4,992	104	48	MI	
NF8M	4,788	84	57	MI	
N8CPA	3,936	82	48	OH	
K8AJS	2,108	62	34	OH	
K5ZG	1,232	44	28	OH	
K9NW	836	44	19	OH	Mad River Radio Club
W9RE	223,317	919	243	IN	SMC #1
KJ9C	113,520	660	172	IN	SMC #1
K9MMS	108,720	604	180	IL	SMC #2
W9IU	105,456	624	169	IN	SMC #2
WT9U	102,942	602	171	IN	SMC #1
N9NE	91,970	541	170	WI	Austin Powers Burritos
K9WX	67,821	481	141	IN	SMC #2
K9WA	31,320	290	108	IL	Team GRVARS
WW9R	31,130	283	110	WI	SMC #1
AK9F	30,765	293	105	IL	SMC #3
W9WUU	25,175	265	95	WI	SMC #3
K9QVB/9	24,992	284	88	WI	
K1TN	21,472	244	88	IN	
KA9F	19,000	190	100	IN	SMC #1
W9YQ	18,634	242	77	WI	
K9OZ	16,770	195	86	IL	
K9UQN	13,321	73	77	IL	
N9ESC	6,360	106	60	WI	
*KB9YSI	5,544	99	56	IL	
NN9K	5,252	101	52	IL	Team GRVARS
KG9LZ	4,464	93	48	IL	
NA9U	2,920	73	40	IN	
N9BIL	1,400	56	25	IL	Team GRVARS
WM9M	1,242	46	27	IN	
*K8ZZV	968	44	22	WI	
WA8MWA	850	34	25	OH	
*WB9HFK	780	39	20	IL	
AA9KH	672	32	21	IL	
*KC9ECI	660	30	22	WI	
*KB9BVN	264	22	12	IN	
KØRF	166,492	778	214	CO	
NØAT	161,182	794	203	MN	MWA Team #1
NØAV	135,801	711	191	IA	SMC #2
KØOU	131,211	717	183	MO	SMC #2
KØAD	123,080	680	181	MN	MWA Team #1
NAØN	110,208	656	168	MN	MWA Team #1
KTØR	109,563	619	177	MN	MWA Team #1
KMØO	91,808	608	151	MN	MWA Team #2
WØETT	76,406	506	151	CO	GMCC
WØUY	74,568	478	156	KS	SHARCS
NØSXX	70,807	451	157	CO	GMCC
KØFX	70,226	481	146	CO	
KKØHF	64,546	547	118	KS	SHARCS
KØWA	60,928	476	128	KS	
KØTK	43,896	372	118	MN	MWA Team #2
WS4Y	39,520	304	130	KS	
WØNTA	37,120	320	116	CO	
KTØK	34,965	333	105	NE	
NØBUI	31,416	308	102	MN	MWA Team #2
KØPY	25,949	337	77	KS	SHARCS
KEØL	25,338	246	103	MN	MWA Team #2
K6XT	23,937	237	101	CO	SCCC #4
WØETC	21,855	235	93	IA	TCG #3
*AKØM	20,962	223	94	NE	
KØRI	18,286	223	82	CO	GMCC
N3PXF	17,712	246	72	KS	SHARCS
NØXM	13,950	186	75	KS	SHARCS
KGØGY	12,800	160	80	NE	
KSØT	9,106	157	58	MN	
*KEØG	7,952	142	56	MN	
NZØR	7,552	128	59	IA	
KCØRET	2,345	67	35	MN	
*NO2D	2,205	63	35	CO	
KØWPK	1,120	40	28	MN	
KJØG	1,012	46	22	CO	
WØQQS	759	33	23	MN	
WØKT	630	35	18	NE	
WAØIAF	609	29	21	IA	
KB5ENP	117	13	9	MO	
*K2HT	36	6	6	MO	
VE3EJ	191,268	828	231	ON	CCO Team 1
VE3DZ	147,264	767	192	ON	CCO Team 1
VE3XB	135,360	720	188	ON	CCO Team 1
VE3JM	106,977	633	169	ON	CCO Team 3
VE3KZ	101,135	565	179	ON	CCO Team 1
VE3KP	93,879	549	171	ON	CCO Team 1
VA3NR	84,001	503	167	ON	CCO Team 3
VY2/KD4D	80,936	536	151	PEI	PVRC
VE3RZ	61,061	427	143	ON	CCO Team 2
VE2AWR	57,528	408	141	PQ	
VE1OP	56,924	428	133	NS	Maritime Contest Club
VA7ST	52,992	414	128	BC	
*VA3DF	39,975	325	123	ON	CCO Team 2
VE3XD	34,917	309	113	ON	CCO Team 2
VA3EC	28,035	267	105	ON	CCO Team 2
VE1RGB	27,800	278	100	NS	Maritime Contest Club
VE3HG	23,154	227	102	ON	CCO Team 2
W1AJT/VE3	21,984	229	96	ON	CCO Team 3
VA1CHP	15,714	194	81	NS	Maritime Contest Club
VE3RCN	8,580	132	65	ON	CCO Team 3
VE3FH	8,220	137	60	ON	
VE7NI	5,439	111	49	BC	
VA3ATT	1,118	43	26	ON	
VA2SG	400	25	16	PQ	
*VA3RKM	4	2	2	ON	
XE2MX	72,747	531	137	XE	SCCC #1
XE1/N5KO	30,360	276	110	XE	
FP/K9OT	12,328	184	67	FP	Team GRVARS
CU2JT	5,040	105	48	CT	
*I0QM	70	10	7	I	
HA2MN/5	24	6	4	HA	

* Indicates QRP entry

Multi-Two Scores

Call	Score	QSOs	Mults	QTH
K5KA (K5KA, K5YAA, N5OT, N5RZ, WØUA)	340,218	1383	246	OK
W5NN (N1LN, K5GA, K5NZ)	318,664	1306	244	TX
W6YX (K6UFO, N7MH, W6LD, W6KNS)	224,270	1094	205	CA
WW4LL (K4AQ, NT4XT)	138,240	720	192	GA
KØRAY (KØRAY, NØBDS, KWØA)	110,985	735	151	MO
AJ6L (AJ6L, K1VA)	98,910	630	157	AZ
KØXI (WØMHS, WØYZZ)	27,072	288	94	MO
KM9M (KM9M)	5,734	122	47	IL
K4HTA (K4HTA)	3,888	81	48	VA
WY7N (WY7N)	2,482	73	34	AZ
NU6T (NU6T)	9	3	3	CA

Check Logs: K2TA, KF6T, KL7/WF9A, N1NN, N4WO, N5UM, W4MY, WJ9B

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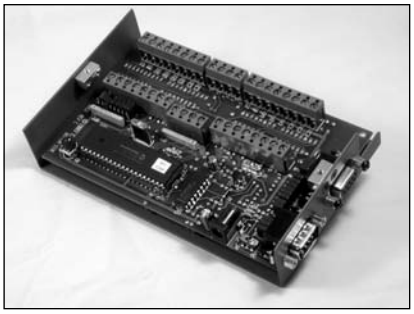

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- Also has BCD HF band and transverter band outputs
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