NVARC
Nashoba Valley Amateur Radio Club

SIGNAL

A club since 1992
Since 1993
Since 1996

de N1NC June 2019 Volume 28 Number 6

This Month's Meeting

This month's meeting presentation will be by Harry Chase, WA1VVH, who will speak on his experiences working at WCJB, The Voice of the Andes in Quito Ecuador. Harry made several trips to the station.

Also, Bruce, K1BG, will be giving a brief tutorial on using N1MM for Field Day.

Last Month's Meeting

Last month's meeting program was a "professionally" produced video documentary of the 2018 World Radio Team Championship held in Wittenberg Germany. Though most of the audio was in German, as you would expect, the closed captioning made it easy to follow.

Thanks to Jim, AB1WQ, for putting this together.

You can view the video at:
https://m.youtube.com/watch?v=mwf-2f0cbjk

The President's Corner
de Stan, KD1LE

Probably more than a year ago, I gave away the control/display part of a Kenwood TM-D700A dual band mobile radio. I have now come into possession of the body of the radio. For a donation of $20 to the club treasurer it can be yours.

I participated in the Westford Kiwanis Apple Blossom Parade a couple of weeks ago to see how other radio clubs run their events and how the needs of events differ.

In some ways this event was similar to our support of the Pepperell Fourth of July Parade, however, most of the organizational emphasis was on getting the parade participants to the correct spots as the parade was being staged. There were a couple of shadow type positions and the rest were at intersections along the route.

Unlike the Groton Road Race, with its numerous intersections, there were only a couple on the seven tenths of a mile parade route.

With so few intersections to cover it was strictly Westford PD, so communications weren't an issue.

I was assigned to be the shadow for who I'll call the Parade Director. The assignment seemed easy enough, as he was to be located where the two staging areas merged into the "parade". Little did I know he would be carrying one end of the banner that leads the parade.

So, I had to walk in the parade following him, and eventually walk back the parade route to my car.

Most of the other radio activity was providing information to the public, like when does it start, where do I line up, when are the fireworks?

In a little twist, Terry, KA8SCP, who organized the support, was the Westford Kiwanis Person of the Year and got to ride in the parade. Terry presented at our May meeting on emergency communications.

See the following link for more information. https://westford.org/kiwanis/?page_id=1290.

After walking in this parade I was Looking forward to next week's Groton Memorial Day Parade where I only have to walk from my van to wherever I need to put down the microphone.

de Stan, KD1LE

Field Day – June 22 – 23
***de* Jim, AB1WQ**
Incident Commander

You do know that your annual wait for Field Day ends at the fourth full weekend in June, right?

Which is June 22-23 this year. NVARC is going back outside for our eatin', operatin', and educatin' extravaganza! C'mon along! Mark your calendar now to join us on June 22-23 for as long or short a time as you have available.

The Field Day site is again the Heald Street Orchard: 110A Heald Street, Pepperell, MA. (See Google Maps.)

We'll begin setting up the equipment at 8:00AM in the orchard. All hands are welcome to join us! This does not entail heavy lifting: It's unrolling a spool of coax or power cord, setting up folding tables and chairs, helping to set up a tent, etc. You can help. Or just supervise the supervisors. Your presence will make a difference! Bob Johnson, AB1CV's, lemonade and cookies will again provide fuel to power the setup action.

We expect to have the setup complete by 11:00AM, allowing for a casual lunch (provided) and break before radio operating (for points) begins at 2:00PM.

You don't have to be a "contester" to contribute to and enjoy operating during Field Day. You can sit at one of the station rigs provided and make a contact with one hand while munching on a cookie with the other!

If you never operate in contests, come out and watch another operator operate for five minutes and you'll see how the simple exchange works.

Then sit in the chair and take control: you'll have a great time.

NEW THIS YEAR:
Restaurant meals from Ranger's BBQ and Tea Café for our Saturday evening dinner!

Delivered on-site by an intrepid messenger, to be named at a later date.

In the past, Leo Hunter, K1LK, has knocked himself out to do this major dinner preparation work virtually singlehandedly. This year we're going to give Leo a break so he can do more operatin' than cookin'.

What that means to you if you intend to join us for the Restaurant Dinner al Fresco, you must purchase a meal ticket and pre-order as directed in the .PDF file attached to the eMail, sent to all members on June 11th, entitled "Msg #2 – Saturday Dinner ".

The .PDF file provides full information on how to pre-order and pre-pay for meals for yourself and any family or friends you want to bring.

More to follow, including our plans for running FT8.

Public Service
***de* Jim, AB1WQ**

Or is it Private Service?

On May 19, 2019 the Boston Brain Tumor Bicycle Ride raised $569,818.24 to put toward finding a cure for this disease.

About a week earlier I was invited to participate as a radio operator, to which I readily agreed. We hams think of the spring as "public service season" when we assist with numerous charitable events

to help justify the reservation of public radio spectrum for our exclusive use.

The ride was in Waltham, MA, which has a well-sited 2m repeater, so using only a handheld 5w dual-band HT in my vehicle with a mag mount antenna on top, I was able to contact net control without any difficulty throughout the ride.

My assignment was to serve as a "sag wagon" patrolling the ride course with a second sag wagon to provide whatever assistance the riders might need-- band aids, extra water, help with a flat tire, etc.

As the ride began, I got behind the last two riders on the short, 10-mile course and idled along behind them. They soon stopped to adjust their headgear and I pulled up alongside them to introduce myself and explain who I was. The father proudly announced that he and his third-grade daughter were "Team Bunny," something that had special meaning for them. I told them, "Great, I'm here to follow the last riders on the course, whoever that is, and provide help if needed." He said, "That's us, and thank you!"

So, I followed them at a safe distance for the next two hours with my blinkers on. Halfway through, it started raining on the riders, but no complaints were heard. I only saw smiles through the windshield of my warm, dry car.

When we got to the finish line, father and daughter were proud of their accomplishment and I had the satisfaction of knowing that I was part of making sure those two had a lifelong good memory to share, untainted by any mishap.

So, do we hams do public service or private service? And is the private party them or us? You decide.

https://events.braintumor.org/boston-brain-tumor-ride/

Some NVARC members supported the Groton Memorial Day Parade under the organization of Bob, AB1CV. Bob is the Parade Adjutant for the Groton American Legion which sponsors the parade. NVARC members provided public address capabilities at various locations on the parade route. The following members participated; Bob, AB1CV; Ralph, KD1SM; Jim, AB1WQ; Stan, KD1LE.

de Stan, KD1LE

Elmering

If you know of a young person who has recently become licensed, or who might be interested in becoming a Ham Radio Operator, and is in need of equipment to set up a station, NVARC has the resources to assist.

Through the generous donation of a fellow ham, NVARC can supply the hardware and setup know-how to get a young-un up and on the air. If you know of such a person, please contact Jim, N8VIM at: N8VIM@arrl.net

NVARC Picnic

Despite his health issues—or maybe as an indication of his indominatabiity (if that's a real word)—Gene, WW4EN, has invited the club to hold its picnic at "the barn" again this year.

The NVARC picnic will be held 2:00-5:00 (that's 1400-1700 local time) on Sunday July 28. Gene has a propane grill on the ground floor and he'll provide the beverages (beer, soda, water), picnic supplies, chips, etc.

Participants just need to bring the usual proteins, sides, salads, desserts, etc. that we're used to bringing to this annual event.

NVARC picnics have been outstanding summer events in the past—especially those at Gene's

QTH. Plan NOW to join us! You can find Gene's QTH via http://qth.novabarn.com.

de Skip, K1NKR

Don't Believe Everything You Read
Or
Why Were My Reports So Bad?
***de* Bob, W1XP**

The watt meter is near the pin, the band is open, the activity is good, but you don't seem to have the commanding signal you expect for that amount of power you are reading. Should you really believe the watt meter? The answer is you may be seeing an inflated power reading.

In a previous article I talked about the poor performance I was having with a modification to an HF transceiver for operation on 630 meters. I had found an article online that described how a few simple changes to an old HF transceiver would allow the radio to operate on the new MF ham band at 472 to 479 kHz. (630 meters). Having several of these somewhat long in the tooth radios this seemed like a worthwhile project. The radio in question is the iCom 735. This was not a bad radio in its day. I knew already that you could get enough signal out of the radio to drive a comparator circuit to convert the sine wave signal to a square wave signal needed for the class E 100 Watt amplifier I use.

The radio had been modified previously to allow coverage outside the ham bands by removing two diodes. But the article suggested that as much as 90 watts of output power was possible with the modification. This modification mainly consisted of increasing the value of some coupling capacitors in the transmit section of the radio. Being able to get performance like that suggested by the article would be very useful. That would make a nice one-box 630 meter setup. Just what I needed for a portable location set up in NC.

I will admit I was a bit suspicious of the claims. Having had some experience with trying to get wide band performance out of a transistor power amp was not new to me. But it was worth a try.

The power meter on the radio read only 50 to 60 watts on 630 meters after the modification. One thought was that the SWR protection circuit in the IC 735 was rolling back the power of the radio because of the harmonic components of the 475 kHz signal, since there was now no low pass filter between the PA and the SWR detector. There was of course the low pass filter for 160 meters. That is the band that is used for the 630 meter operation. But the 160 meter low pass filter will allow the fourth harmonic (actually the fifth as later measurements would reveal.) This power fold back had been a consideration even before the modification was made. In fact, the author of the modification article had mentioned this. So, I had designed a filter to suppress the harmonics and provide a 50 ohm load to the transceiver at the harmonic frequencies. This filter design may be the subject of a possible article to follow later.

The filter was built and connected to the transceiver. When I put it on the air it was obvious that I didn't have a big signal. But the indicated power out on the transceiver had not changed. This wasn't a surprise as the earlier tests of the transceiver were with a dummy load which would not have reflected the harmonics back to the radio SWR detector. So, I measured the power output of the filter with an oscilloscope.

This measurement of the 475 kHz signal showed only about five to ten watts. Where was all the power going?

The simple answer is "It never existed".

Although the watt meter on the transceiver was reading 50 watts or more, that amount of power does not exist: the simple watt meter on the radio is being fooled by the high harmonic content of the radio output.

I have since measured the spectrum of the transceiver output. The output power of the 475 kHz signal and harmonics are then referenced back to the output of the transceiver. The 630 meter low pass filter is not in line for these tests.

The output power at 475 kHz during these tests is only 3.16 watts. The second harmonic is 12.6 watts and the third harmonic is 0.794 watts. The fourth harmonic is 0.079 watts. And a big surprise is that the fifth harmonic is 0.398 watts.

The push pull amplifier stages will accentuate the odd order harmonics which explains the high amplitude of the third and fifth harmonics. The 12 watts of the second harmonic is a surprise. But I

suspect the second harmonic signal is generated in a low level single ended stage in the driver chain. I think the amp is working better at the second harmonic.

Summing up the powers, the total is only ~17 watts. This is about one third of the indicated 50 watts output.

The real cause of confusion here is the way in which the output power is measured by the wattmeter.

In a typical wattmeter, the output voltage is measured in a diode peak detector circuit. Then the power is displayed on a meter on which the meter calibration is in watts. A more modern radio may actually do some math after converting the voltage measurement to digits via an analog to digital converter. But the idea is that if the load on the radio is 50 ohms the output power is equal to $E^2/50$. E is volts RMS and 50 is the 50 ohm load on the output. This is from the well-known expression for Power, $P = E^2/R$. In this expression E is RMS (root mean squared).

For a sine wave the RMS value is 0.707 times the voltage peak. A simple diode detector senses the voltage peak. But converting the peak to RMS is simply multiplying by 0.707. So, the expression for power is now $P = (0.707\ Epk)^{2)}/ 50$, where Epk is the detected voltage peak. This method typically works very well, but only as long as there is only one frequency present. Any significant harmonic or spurious output present will lead to incorrect readings!

Takeaway: the sensor responds to the voltage peak, not the total power.

Generally, the harmonic voltages are removed by the low pass filter that follows the amplifier in the transceiver. But in this case the low pass filter is not effective because the fundamental is so much lower than the filter cut off frequency. Note that the fourth harmonic of 475 kHz. Is 1.9 MHz. And this is further complicated by the high amplitude of the harmonics.

If we calculate and sum up the peak voltages of the harmonics and of the fundamental we should be able to come up with the power displayed on the meter.

Using the power expression above, the peak voltage of each harmonic and the fundamental were calculated. The results are as follows:

Frequency	Power (W)	Vpk (V)
Fundamental	3.16	17.8
2nd Harmonic	12.6	35.5
3rd Harmonic	.794	8.9
4th Harmonic	.079	2.8
5th Harmonic	.398	6.3
Total Vpk		**71.3**

Total Power = $(0.707 * 71.3)^2/50 = 50.8$ W,
which is in good agreement with the observed value.

There is also one other lesson here, besides questioning measurement made of power based on diode detectors (which includes many devices including most SWR meters).

The inability to obtain a good SWR may be traced to excessive harmonic or spurious output. Most reliable power meters base their detection on heat and this reduces the sensitivity to low level harmonic energy. It the case of the 630 meter with a second harmonic four times the amplitude of the fundamental this would not have helped. But 17 watts is a better answer than 50 Watts.

It is necessary to always suppress the harmonics and other spurious signals when trying to make measurements, especially with instruments that use wide band diode detectors. This includes instruments such as the Bird thru line Watt meter. Most of the antenna measuring devices use simple diode detectors. As a result the purity of the oscillator signal can be a problem. I believe the designers have done a good job in keeping this problem under control in most of the devices on the market. But external signals can disrupt the measurements in the same way as the harmonics of the transmitter. Received signals from local sources on the antenna that are being evaluated with an antenna analyzer or SWR meter can disrupt the measurements in the same way the output power measurement is.

So, while the power meter on my modified transceiver gave one the impression of lots of signal, the opposite was true.

Just one more example of the importance of doing careful measurements and understanding what is really being measured.

I hope you found this interesting and informative. Till next time, 73. Bob W1XP

"Arduino" Group
de Stan, KD1LE

It is hard to believe, but the "Arduino Group" that I proposed began meeting way back in August of 2017.

What started as a way to learn a little about programming Arduinos has become quite a bit more than just that. Early on, Jack, W8TEE's Arduino based Antenna Analyzer (AA) article in the November 2017 QST gave us a common focus.

While it is true that the majority of our two-hour weekly meetings are spent ragchewing about just about anything radio, and not specifically about "Arduino", the group has contributed publicly to the greater Amateur community by implementing and publishing online several enhancements to the software and hardware that accompanied Jack's QST article. Specifically, group members' contributions include:

- enhancements to the circuit and user interface,
- additional run-time controls for editing operating parameters,
- coverage for the 630 and 2200 meter amateur bands,
- statistical tools to help the user analyze the analyzer's performance,
- updated User's and Hacker's Guides

The antenna analyzer project became our focus so that we would have something "real" to work on between ragchews.

My original goal in suggesting the interest group was to learn enough to complete a project that I had had on the shelf for a while: an Arduino computer interface to drive an AZ-EL antenna system for satellite work.

Now that the AA project is at a steady state, several of us have focused back to AZ-EL technologies and satellite communications.

This re-focusing was given a little shove when we were tossing around the possibility of supporting another school ISS contact.

Last time the coordination for the school/ISS contact entailed a two-month crash program starting from scratch. Since we now have most of the hardware from that event, continuing with an Arduino based AZ-EL project seemed a good line of inquiry.

So, going forward, one project the group is working on is to put together a higher end satellite tracking station to learn about all that it takes to set up and operate satellites.

A side benefit will be a big head start should another school/ISS contact come along.

Everyone is invited to join in these sessions! We meet Monday mornings at 10:15 in the Pepperell Community Center.

NVARC Swap Shoppe

The following items are available for a donation to the NVARC Treasurer:

- Kenwood TM-D700A dual band radio body: $25
- Almost complete Kenwood TM-D700A with remote adapter panel but no serial cable or microphone: $45
- MFJ 944 Versa Tuner II: $20
- Henry Electronics two meter amplifier 1 to 5 watts in, 80 watts out max: $25
- KLM 10-70B two meter amp 10 watts in, 70 watts out: $25
- Ranger Communications RCI-600 VHF/FM Marine Radio with microphone. Looks brand new/unused: $45
- Pair of tower wall brackets. Looks like they are sized for Rohn 45 but are adjustable: $40

- One U shaped tower cross arm to support two vertical antennas. Adjustable for Rohn 25 or 45. It is six feet wide with two foot high vertical sections on the ends for mounting antennas. It also has loops for pulleys at the ends: $25.

de Stan, KD1LE

Board Meeting Notes

Attending were: Stan, KD1LE; Bruce, K1BG; Jim, N8VIM; John, KK1X; Ed, N1YFK; Ralph, KD1SM; Jim, AB1WQ and George, KB1HFT.

We understand that Harry Chase, WA1VVH, is on for June presentation. Jim AB1WQ having lunch with Harry to check. (Editor: Harry has accepted.)

Field Day – current plan is to run 2A plus VHF.

Need September & October meeting subjects. Skip might be working on a lead (Pete Hoover).

Card sort in November this year due to timing at the bureau.

Home Brew in December

Short Subjects in January

de John, KK1X

Treasurer's Report

Income for May was $50 from membership renewals and $20 from Field Day meal ticket sales. We had no expenses for the month, leaving a net income for the month of $70. The auction of the estate of Herm Raymond, WW1HR brought $150. Per our custom this is added to the Community fund for future use to contribute back to our local communities.

Current balances:

General fund	$3,038.11
Community fund	$5,461.52

Overdue welcomes to new members Dan, KB1OPO (February); Owen Salter, KC1KZT (March); Brint W3NOZ (April); and Jessica, WU3C (April).

As of 2 April we have 45 members who are current with their dues and 22 renewals outstanding. Thank you to those of you who mail or hand in your dues before Ralph comes to you. Please check your renewal status on the roster circulated at the monthly meeting or ask Ralph.

If you are joining ARRL or renewing your membership please consider letting Ralph send in the paperwork for you. The Club will buy the stamp and will get a commission from ARRL. ARRL membership checks should be made payable to NVARC; Ralph deducts the Club commission before forwarding your paperwork to Newington. As a Special Service Club, the ARRL expects a majority of Club members to also be ARRL members.

de Ralph, KD1SM

Repeater Maintenance

If we are going to keep the repeaters operating, we have to get back in the routine of regular maintenance.

This past week I spent one and a half hours mowing the two-and-a-half-foot high grass on the site. That's my contribution for the month.

There are at least three other projects that need to be done. A two-person project (for safety reasons) is to test and water the backup batteries, measure voltages, general inspection. Another project for three or four people is to paint the building. The last project I can think of is to cut back the brush on the south edge of the site to clear the west and south guy areas. The thorns and brush are continuously trying to fill the void.

de Stan, KD1LE

UK's National Grid reported several milestones were reached during the week of 1 to 8 May. They had the first week since the 1880's that zero electricity was generated by coal-fired power stations.

Also, on one afternoon, for the first time, there was less electric demand by homes and businesses in the afternoon than there was at night due to solar energy.

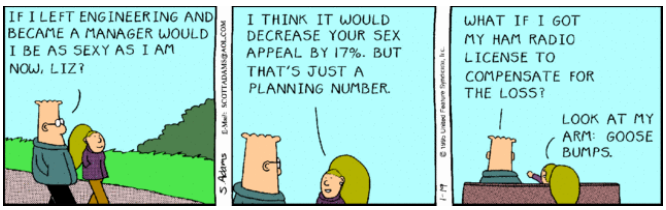
It took forty years for the US to reach the first million solar installations in 2016. It took only three more years to reach two million installations. Some projections see the US hitting three million installations by 2021 and four million by 2023.

de Stan, KD1LE

For over one hundred years the reference "kilogram" has resided under lock and key in Paris France. As of May 20th the definition of a kilogram in the International System of Units has changed and is now based on the Planck constant.

Don't panic, we are not affected, as the US, Myanmar, and Liberia don't use the International System of Units (Metric System). Whew!

de Stan, KD1LE



Editor's Note
***de* George, KB1HFT**

As soon as I had put last month's Signal to bed, I skipped town for our yearly weeklong visit to sunnier climes: St. Augustine, FL., to visit with Cyndy's sisters. This time, I wanted to be able to play radio as Cyndy and her sisters had their eyeball QSOs.

I had just acquired from Dan, KW2T, an RTL-SDR dongle that covers from LF to 2.5GHz, and is able to demodulate AM / FM / NFM / SSB / CW / etc. So, I packed the dongle, my Surface laptop, some wire, and some connectors.

I was afraid that TSA's carry-on X-ray scanner would notice all the wiring, and disallow it all, but they let me thru without batting an eye. <Whew! I had no backup plan.>

Once ensconced in the oceanfront cottage that we rent each year, I noticed interesting additions since the last hurricane blew through: the deck had been rebuilt, with railings that featured an array of taught horizontal stainless cables to keep small-fry from falling off the deck. Eleven horizontal cables on each side of a gate to the beach steps. 22 feet long on one side, ~ 17 feet on the other. Spaced ~3" apart. The wires are oriented almost exactly North/South.

"That begs to be tried as an antenna", I said in a stage whisper. The girls rolled their eyes.

So, I and a sister's significant other hied it over to Home Depot where we got some sandpaper to buff the stainless cables and some bare copper wire to tie them together at the inner ends. The dongle was then fed from the center:

A long USB cable fed the laptop inside the house.

It was my first tryout of the dongle and it's free (!) software, "SDRSharp" (Google it), and I had only briefly RTFM (Read The Fine Manual). I tuned around and was impressed by the control one has on demodulation, passbandwidth, sensitivity et. al.

I was able to monitor the air traffic controllers at Jacksonville airport (120.750MHz), as well as AM & FM broadcast stations, and the HF bands.

I was able to hear CHU, Canada's Dominion Observatory's 3KW time signal at 14.670 MHz; doc-

umented in this linked video: CHU: The Dominion Observatory, Canada.

I also heard a "numbers station" on which a female voice was repeatedly reading groups of 5 numbers. In Spanish. Hmmm. Something Nefarious most Likely.

On the plane ride home, I built some EZNEC models of the wire array, to see what SWR profile it might have with all 22 cables vs. with just the two center cables as a two-wire dipole. (I should have brought the Antenna Analyzer!).

While EZNEC is "EZ", it does have a learning curve, which I thought I had traversed. Not in enough detail, though: my results were inconclusive. "Stay Tuned!"

de George, KB1HFT

Advertisers

NVARC

Nashoba Valley Amateur Radio Club

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http://www.n1nc.org/

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Ed Snapp, N1YFK, 2017-2020
Bruce Blain, K1BG, 2018-2021

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Emergency Coordinator: [open]
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Join NVARC! Annual membership dues are $15; $20 for a family.

Meetings are held on the 3rd Thursday of the month at 7:30 p.m. in the Pepperell Community Center.

Contact us on the N1MNX repeater.
442.900 (+), 100Hz
147.345 (+), 100 Hz
53.890 (–), 100Hz

This newsletter is published monthly. Submissions, corrections and inquiries should be directed to the newsletter editor: editor@n1nc.org.
Articles and graphics in most PC-compatible formats are OK.

Editor: George Kavanagh, KB1HFT

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