NVARC
Nashoba Valley
Amateur Radio Club

SIGNAL

A club since 1992
Since 1993
Since 1996

de N1NC March 2021 Volume 30 Number 3

In this Issue

NVARC Monthly Meetings

NVARC general meetings are scheduled for the third Thursday of the month at 2430 UTC (7:30pm, Eastern Time).

Non-members who are interested in attending may send an email to meetings@n1nc.org requesting the teleconference details.

NVARC thanks **Medtronic, Inc** for providing the teleconferencing services under their employee volunteer support program for non-profit organizations.

Last Month's Meeting

The February meeting featured Brint, W3NOZ, speaking on radar and stealth technologies.

This Month's Meeting

Greg, WA1JXR, will speak on the Nano VNA.

Next Month's Meeting

Frank, W3LPL, will speak on the Centennial of the 1921 Transatlantic Tests.

The Day of the YL

***de* Jean, K1AVM**

I am not a contester and listen more than I talk and that's fun too.

But, The DAY OF THE YL event changed the way I now use Ham radio.

It started May 24th and ended May 25th, 2020 and let me tell you what happened. The weekend event was in dear memory of Carine Dubois, F5ISY.

There was a YL certificate offered for the event and if I achieved 33 points while on the air, I could get it. I wanted to get the certificate, but I needed the 33 points to get it.

I was determined, and so, got on the air and tuned 40 meters, then 80 meters, and finally 20 meters looking for YL or OM calling **Day of the YL**.

I scanned and listened on the frequencies for 2 hours with only a few QSOs. It didn't appear I was going to get my minimum 33 points for my certificate.

At the end of the second hour I was so discouraged, and wanted to close up shop. But scanning 20 meters, I heard a little girl's voice calling CQ **Day Of The YL** with her dad's call using K4QDP. Her name was Ella and was 11 years old using her father's station and enjoying the pile up.

I said to myself, "Hey if Ella can do it, so can I!"

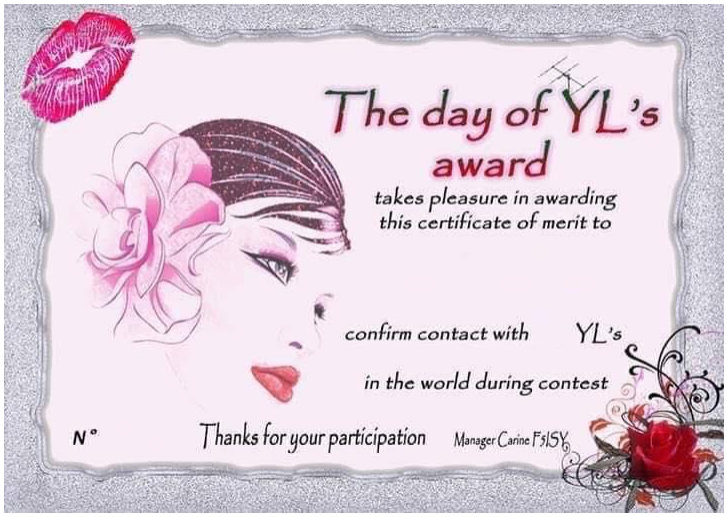
I have never really called CQ, being a listener, and I always just listened and answered other CQs of other operators. I wanted to talk to someone, but I was not comfortable calling CQ. I don't know why, but just a little uncomfortable.

However, I REALLY wanted to print that certificate and the 33 points didn't seem all that impossible at this time.

I found a clear frequency that wasn't in use and called "CQ **Day of the YL**." My voice was a bit soft and the modulation indicator hardly moved, but in time my voice grew stronger and a lot of stations came back and ***I WAS THE PILE UP***!

It got busy ESPECIALLY when Niece - KA1ULN "spotted" me on the YL Chat lister and many YLs were answering my CQ. Did I mention I really wanted to download my winning certificate?

I checked my scores and then scanned my paper log sheets and emailed it to DoYL.Carine@gmail.com. My scores went to 3830scores.com and now I am anxiously waiting for my first certificate. Was this fun? You bet it was!!!



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-*de* Jean, K1AVM

Monday 2m NVARC Information Net

The NVARC Information Net, with Charlie, AB1ZN as NCS, is held Monday nights at 7:30pm, Easten time on the 2m Pepperell repeater, N1MNX: 147.345MHz, PL: +100. Recent activity has been steady, with a dozen or so checkins, several of which are NOT NVARC members. Cool!

However, Charlie will be out of town until the end of May, so the Net is in need of a volunteer to take up the NCS reins for the March 22nd net and beyond.

If you are interested in helping out, please contact Charlie at vintagem5@hotmail.com.

NVARC 2021 Elections

***de* Bruce, K1BG**

At the March Board of Directors Meeting, Skip Youngberg, K1NKR, and Bruce Blain, K1BG, were appointed to this year's club Nominations Committee as spelled out in the club's by-laws.

The role of the committee is to "develop a proposed slate of officers for the April Election." This slate is not intended to be one person for each position. Ideally, multiple candidates will step forward for each position and make the election a real demonstration of democracy at work!

NVARC, like many civic and social organizations, is always in need of new people to step forward. Having an active organization, led by fresh leadership with new ideas, are key indicators of a healthy and vibrant club.

NVARC needs **YOU**.

We've heard all the lame excuses for not stepping forward – too busy, too old, too young, *etc*, *etc*.

Each of us on the Nominations Committee has been an officer at one time or another and we can attest that the personal rewards one gets from volunteering far exceed the limited time and effort required to make a real difference.

For the amount of time it takes to watch a single television show, or a fraction of the time you spend surfing the internet, YOU could make a real contribution to the club, your community, and your friends.

The nomination committee is seeking volunteers for the following offices. All are for a term of one year, except for the director (a three-year term). Please READ the duties of each open position below and VOLUNTEER by contacting one of us.

President: The President shall preside at all meetings of the club and conduct them according to the rules adopted. The President shall enforce observance of the Constitution and the By-Laws, decide all questions of order, sign all official documents that are adopted by the club and none other, and perform all customary duties pertaining to the Office of President.

Vice-President: The Vice President shall assume all duties of the President in the absence of the latter. The Vice-President or appointee shall act in the capacity of Activities Manager. The Vice President shall maintain close liaison with the ARRL Emergency Coor-

dinator or SEC to promote the fullest possible club participation in the Amateur Radio Emergency Service.

Secretary: The Secretary shall keep a record of the proceedings of all meetings and publish minutes of each in a timely fashion. The Secretary shall carry on all correspondence, read communications at meetings as directed by the Board. The Secretary shall mail written notices to each member as required in the By-Laws.

Treasurer: The Treasurer shall receive and receipt (as required) for all moneys paid to the club, keep an accurate account of all monies received and expended, and make disbursements as directed by the club or its officers. The Treasurer shall publish regular summaries of club accounts for the general membership. At the end of each quarter the Treasurer shall submit an itemized statement of disbursements and receipts to the club directors. The Treasurer shall receive applications for membership and keep the official roll of current NVARC members and have such roll in hand at each general and special meeting.

Director: The Director will be elected for a term of three years. Directors are charged with the responsibility of guiding the club in all its endeavors. They shall decide questions of interpretation of the NVARC Constitution when required. They may elect Honorary members. They shall audit the financial accounts of the club, review and approve agreements prior to submittal to the general membership for approval, and shall monitor agreements accepted by the club for compliance.

You can read the club's by-laws at:
www.n1nc.org/Members/Constitution and Bylaws

where you will find the duties of each position.

Skip Youngberg, K1NKR, k1nkr@aol.com
Bruce Blain, K1BG, bruce.blain@charter.net

K1YOW is active in testing the new WSJT-X

Joe, K1YOW, reports that he is working with the designers of WSJT-X 2.4.0-rc2 on a bug he found when reconfiguring WSJT-X while using the new Q65 mode.

Joe describes the problem as follows: after calling CQ on 6m using his TS-590SG and then switching the hardware configuration to his ICOM IC-9700, after two CQs, WSJT-X turns-off its "transmit enable".

It only happens after a configuration change and only if transmit enable was set in the first configuration.

The ICOM IC-9700 works fine if started in that configuration, indicating a possible code cache problem.

The WSJT-X developers implemented a fix in the ICOM coding, Joe retested it, and it resolved his problem.

Before RC3 is released, Joe will verify that the fix still works.

The Kits Task Force Project

***de* Jim, N8VIM**

The kits task force was started as means to encourage kit building within NVARC, and has potential to be expanded to include producing kits for fundraising.

The product is an inexpensive, but very good quality, twin paddle, CW key.

Jessica, WU3C, and I remixed the original EA7HVO design[1] to make it easier to assemble, stronger, and designed for manufacturability, in that in it's 3D printing it does not require support material, which gets wasted.

Now that the design has been tweaked, and has been declared a very good set of paddles by several experienced CW ops, it is time to enquire if anyone(s) in the NVARC community wants to get involved with kitting out these keys, for sale to the public.

As I see it, such an effort would require a person or a team to perform tasks in the following areas:

[1] https://www.instructables.com/3D-Printed-Twin-Paddle-Cw-Key/

1. Overall management: Take orders (perhaps setup something online?), make sure orders are completed, order hardware parts as needed for kits

2. Assemble parts and documentation into a kit, pack kit, ship out kits

3. Print the 3D parts and supply them to the kit assembler (This is my role at present)

One person may take on more than one role if they're comfortable with it. My thoughts are to start making this available locally at first, then expand availability after we work out all the kinks.

Proposed pricing is $30 in kit form, $40 assembled.

If you are interested, please contact me at n8vim@arrl.net.

-de Jim N8VIM

Impressions of the tinySA

***de* Phil, W1PJE**

In the beginning of radio, the homebrewer was king, for there was no other option. Breadboards with Fahnestock clips, individually wound RF chokes and transformers, variometers, homemade variable capacitors, Galena crystal chunks with surface imperfections that served as nonlinear junctions - all of these were at the core of making a signal (be it from spark, Hartley or Colpitts oscillator, etc.), sending it out into the world, and listening for a reply.

Even as the decades moved forward to superheterodyne architectures thanks to Major E. H. Armstrong, many amateurs still started their careers using simple homebuilt novice transmitters with tight "rockbound" crystal control (as per regulations) so as not to cause chaos on the bands, paired with equally simple homodyne / tuned RF direct conversion receivers.

Debugging and alignment used to be done with the likes of RCA VoltOhmyst VTVM analog meters driven by diode detectors, and indeed this still can be a perfectly viable art - just look at any of the alignment instructions in a Rider service manual for classic tube based sets, for example.

Recently, however, there has been an explosion of really affordable yet well performing RF test tools available by clicking on your favorite web store.

These bring capabilities to the ham homebrewer that were only dreamed of in earlier days - things that were solely available at "unaffordium" prices by haunting used test gear auctions and paying careful attention to the "two man lift required" sticker on the side.

A reasonably performing example of this trend are vector network analyzers (VNAs) in the form of the nanoVNA which have been documented extensively in many diverse pages, including the Signal, and have led the way in this affordable revolution.

But for test gear, you really also want a sensitive receiver with spectral display, not a "stimulus and response" VNA device. Spectrum analyzers are absolutely invaluable for this task and have always been considered the *sine qua non* of instruments for sniffing out harmonic oscillation problems or subtle RF circuit errors.

Alas (if you could afford them) HP or Tek SAs are precise but also complex, very expensive, and fragile beasts requiring care and feeding to avoid blowing out the $$ front end mixer with DC or excessive power.

Enter the "tinySA" - a $55 (as of this writing) small, battery powered spectrum analyzer along the same general thought patterns that created the nanoVNA line. I obtained one of the earliest tinySA devices available based on a tip from some colleagues at Haystack and Stanford, and have had very good luck with it in real world use. So, consider this a quick overview and short field report.

TL;dr[2] Summary: **GET ONE**; it's amazing.

Customer Support and Documentation: Erik Kaashoek, a European hardware/software engineer, is the developer. He is extremely fast at issuing firmware updates that continually add functionality, and provides quick customer service on the "groups.io" mailing list devoted to the tinySA.

Sign-up for the mailing list is easy (https://groups.io/g/tinysa). Erik maintains a very extensive wiki site with all information available at https://www.tinysa.org/wiki/, and also has an active YouTube channel (see the wiki for the link) with very short, informative videos putting the tinySA through its paces in many applications - more than I could possibly cover here. It's all quite good.

Don't Get An Illegal Clone! The tinySA is much more controlled in its hardware and software variations as opposed to the wild west that is represented by the dozens of nanoVNA clones.

[2] [Ed: "Too long; didn't read". An abbreviation I had never seen before; thank you, Phil. See: https://www.howtogeek.com/435266/what-does-tldr-mean-and-how-do-you-use-it/]

Erik specifically chose this development and release model in order to keep a more tight rein on the copycat producers who cut corners on hardware production.

There is, in fact, only one official hardware design.

Alas, the overseas clone market has now discovered the interest in the tinySA and is in full output mode, so just Googling for the device will likely get you one which is not only disapproved by the developer but worse yet will have substandard RF performance.

You will tell because it will fail the internal check (see below). The tinySA mailing list is filled with people who have bought illegal clones as verified by Eric, with subsequent recourse only through a time-consuming seller's refund. So, don't waste your time - I highly suggest that you ONLY go through the developer approved vendors list here: https://tinysa.org/wiki/pmwiki.php?n=Main.Buying

FYI, through the wiki, you can also get to Erik's github site and browse the open-source code that drives the tinySA, if you are especially adventurous.

Physical Operation: The device has only one version with a 2.8" screen - get out those reading glasses or a magnifier, although I find the screen is quite readable.

(Snapping a photo with your phone works well to document a trace.) The tinySA can operate solely in battery mode (recommended) or can be hooked to a computer through a microUSB port. (Of course, that usually produces a number of spurs due to the unshielded cable and common mode RF on the computer, so best to try to measure using the built-in battery and screen in order not to chase ghosts.)

Bootup is essentially instant - try that with a professional SA as you wait for 2-3 minutes while it does its internal calibration sequence. A jog wheel on the top provides menu navigation as well as the by-now standard "guitar pick stylus" for operating menus on the touch screen.

Unlike the nanoVNA, it comes pre-calibrated out of the box, as SA operating methods don't require short/open/load cal sequences. There is a PC based application for computer capture and display, but I'm not a Windows person, so I haven't tried that yet. Run time on the battery is a workable >2 hours.

Accessories: The kit comes with two reasonable quality SMA extension cables as well as a short whip antenna for use in portable RFI sniffing. The former is used for a self-test procedure by hooking the two inputs together (see below), while the latter has proved surprisingly useful for hunting down loud HF devices radiating away in the house.

Self Test Check: Hooking one of the included SMA cables between Low and High connectors allows an internal self-test sequence - very thorough - to be executed. This will show up any system problems including with the input attenuators.

Frequency Coverage and Sensitivity: The device has two SMA inputs: a "Low" high quality MF/HF/VHF input for 0.1MHZ-350MHz, and a "High" lesser quality UHF input for 240MHz-960MHz. So, you won't be scoping out your L band EME receiver stack with this device, but the range is perfectly usable for a vast range of ham activities. Outside of the self-test check, I've only had occasion, to date, to use the main "Low" port.

Display: A standard frequency vs. spectral power in dBm is provided with information side bars, and a waterfall can be turned on as well (which uses up some of the screen).

Signal Generator Mode: The tinySA can also act as a reasonably good signal generator on both the Low (sine output) and High (square output) frequency ranges. A reference generator mode is also available, providing square wave on the high output port, with the fundamental at -25dBm and frequency options of 1MHz, 2MHz, 4MHz, 10MHz, 15MHz or 30MHz.

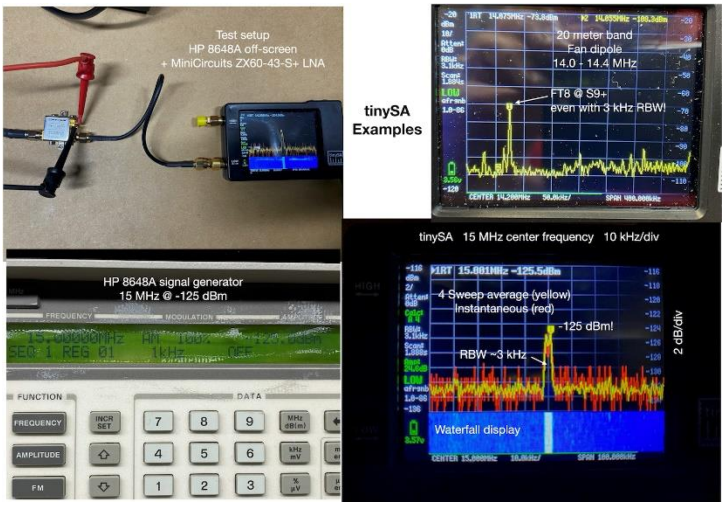
RF Sensitivity: This reveals the true advantage of a SA device: the lowest discernible signal on the tinySA using a resolution bandwidth of 30kHz is -102dBm. Not bad and way better than a nanoVNA.

But we can do better: Erik has an example on the wiki of using an external broadband 20 to 30 dB low noise amplifier with the tinySA's internal battery, although with some power draw caveats (https://tinysa.org/wiki/pmwiki.php?n=Main.LNA). If you do that and drop the resolution bandwidth to its minimum 3 kHz setting, you can get down to -135 dBm! That is a whopping "S minus one" (referencing -73 dBm or 50 uV into 50 ohms = S9 on a properly calibrated receiver). Add the included inefficient electrically short whip antenna and you're in business for sensitive portable RFI sweeps even at HF.

I have verified this low noise floor using a calibrated HP 8648A signal generator and a MiniCircuits ZX60-43-S+ 24 dB gain low noise amp, driven in this case by a bench supply. As you can see in the photo, a -125 dBm signal - nearly S0 - is clearly visible on both the average (yellow) and instantaneous (red) trace (2 dB/div) as well as the waterfall.

I used the tinySA "External Amp" menu entry to compensate for the amplifier gain before this measurement so it reads directly in calibrated pre-amplifier dBm. It really does perform as advertised. This is pretty extraordinary for a $55 device (not counting the preamp cost)!

As a bonus, the upper right panel in the figure shows the tinySA directly hooked up to my fan dipole - nothing in between - and showing the entire 20 meter band. Resolution bandwidth of 3 kHz or so is limiting, but FT8 transmissions clearly show up. (No demodulation though available; too much horsepower required.)



John, AE5X, has demonstrated another skill example using the tinySA as an approximately calibrated signal generator with a handful of external attenuators to do a MDS measurement on a receiver. The result comes within 1 dB of published specs – see:
https://ae5x.blogspot.com/2021/03/measuring-mds-with-tinysa-rms.html

Precision/Accuracy: Power detector resolution is 0.5dB with linearity versus frequency of +/-1dB, and the quoted absolute power level accuracy after power level calibration is +/- 1dB. I have verified all of these with the HP 8648A. Plenty good for hobby level anything, and some semi-pro applications too.

Input Warning - Don't Blow It Up! There is limited ESD protection on each input. The SMA connectors are soldered directly to the internal PCB so they are prone to flexure problems, and are rated only for 500 mate/de-mate connections (as most SMAs are).

I purchased a "connector saver" SMA male to female adapter (Amphenol RF 132171RP) for both Low and High, and keep it on the unit at all times - if that wears out, I simply replace it. Be careful with connections though.

As with any SA, do NOT ever feed this DC or power levels greater than +10 dBm absolute maximum. I recommend a DC block[3], as well as a few fixed 10 and 20 dB SMA attenuators.

Start with a lot of external attenuation and gradually remove it. To be honest though, I'd rather blow this up by mistake when debugging a receiver as opposed to a $10K benchtop SA.

But with care, you can do amazing things. My friend Greg Charvat has, for example, investigated the bandpass shape of a tuned RF architecture RCA Radiola 18 set (one of the first all-electric MF broadcast receivers, circa 1928) by clipping a scope probe to the grid of one of the stages and observing the response to a swept test signal from a nanoVNA fed into the rheostat at the antenna terminal.

Although he was using the nanoVNA as the receiver, the tinySA also would do a fine job of showing the response envelope.

It worked and because of his care, and fortunately, it did not die through accidentally "eating plate voltage".

Limitations Compared to Professional Devices: There are of course limitations:

- Most restrictive: minimum resolution bandwidth is 2.4 kHz. So, this is not going to resolve any SSB modulation envelopes or CW tones. You have to upgrade to a more professional SA for that. The wiki does have some examples of trying to determine some AM modulation envelopes - but you MUST disable the internal AGC or you'll get strange results. More at:
  https://tinysa.org/wiki/pmwiki.php?n=Main.AMModulation
- Screen size could be an issue.
- I find it is best to keep the input signal below -20 to -30 dBm for best linearity. This is covered in the wiki as well.
- As with any SA, do not hook directly to even a QRP transmitter, unless you enjoy buying another tinySA. Learn about directional couplers and use them.
- Internal phase noise of -90dB/Hz at 100kHz offset and -115dB/Hz at 1MHz offset is a clear limitation for some applications, say for purity of an oscillator you are evaluating. But let's be reasonable!

[3] Search for "NooElec SMA DC Block" on Amazon.

- High input has no bandpass or tracking filter, so strong out of band signals on that input can compress front ends and cause ghosts / mixing artifacts.
- Spur-free dynamic range is 70 dB so there are limits on what you can see for weak things in the presence of strong things.
- There are 48 MHz spurs from the internal oscillators, but recent firmware versions have greatly reduced these.
- If you have worked with a SA before, the averaging feature on this is different from the usual Video Bandwidth settings to reduce noise, and takes a bit getting used to. But it does the job once you're over that hurdle.

A full list of limitations and some mitigations is on the wiki at:

https://tinysa.org/wiki/pmwiki.php?n=Main.Limitations.

Conclusions: Similar to "TL;dr" above: just GET ONE. You'll be happy.

-de Phil, W1PJE

Restoration of a Central Electronics 20A

***de* Bill, AB1XB**

When I was 16, I bought a used Central Electronics Model 20A Multiphase SSB Exciter built in 1954.

This is a wonderful, well designed 20-Watt vacuum tube single sideband exciter with full HF band coverage for that era, upper and lower sideband modulation, AM, PM, CW, and voice operated relay (VOX)

I happily used it for a year, with a 200-Watt linear amplifier, then went off to college; the 20A has been sitting on the shelf ever since.

In November 2020, George, KB1HFT, and Peter, N1ZRG, each put together a "Phaser" transceiver kit, and Bob, W1XP, described how it works. As a result, I got interested in restoring my 20A phasing rig that I have wanted to get back on the air for over fifty years.

In this article I will give a bit of background and history of SSB, and in a later article I plan to describe the challenges and joys of bringing this rig back to life.

History

More efficient in power and bandwidth than Amplitude Modulation, SSB had been an idea since 1915, when Jon R. Carson at AT&T filed a patent describing a mathematical model for eliminating the AM carrier and suppressing the unwanted sideband[4].

In 1925, Ralph Hartley filed a patent for a phasing method to generate a single sideband suppressed carr

ier (SSSC) signal.[5] This is the technology used in the Central Electronics exciters.

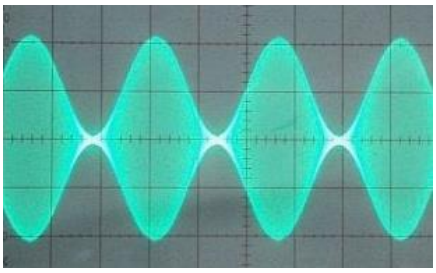
AT&T used Carson's invention to increase the number of calls that could be placed on long distance telephone lines, and in 1927 regular transatlantic radiotelephone calling using SSB was put into service with $75 for a three-minute call. In 1957 the Strategic Air Command converted communications from AM to SSB for its new B-52 bombers.

In 1947-48 QST ran a series of articles on the new SSB technology and adoption by hams started to take off. In the early 1950's, Central Electronics (CE), Eldico, Collins and other companies pioneered the development of single sideband (SSB) for amateur radio.

AM Signals

As a young, uninformed ham I pondered how you could propagate a signal with no carrier. Isn't this like driving a cart of apples to market and taking away the cart? How do those apples float along by themselves? As it turns out, the term "carrier" is a misnomer.

Early AM developers thought of AM as a modulation of the RF signal's amplitude. On an oscilloscope the modulation envelope of a single-tone AM signal looks like this:



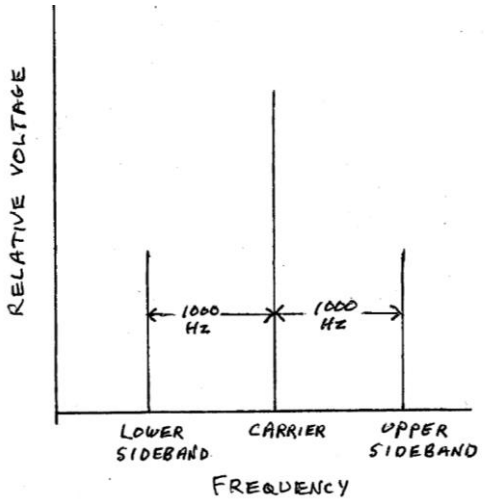
100% AM envelope pattern, in the time domain.

[4] [Ed: The patent at the US Patent Office makes for interesting reading, but it's URL is way long, so I've abbreviated it here:]

[5] [Ed: Also interesting: here.]

However, an AM signal is actually composed of three RF signals, a carrier and two sidebands, one above and one below the carrier, separated by a frequency equal to the audio frequency. Of course, with voice the audio frequency and amplitude are varying. When added together the three signals make the familiar envelope oscilloscope pattern.

When you view a single-tone AM signal on a spectrum analyzer, you can see that it is composed of three signals at specific frequencies.



modulation of a carrier by a single 1000 Hz tone, in the frequency domain.

The two sidebands are a result of how the AF and RF sine waves are mixed in the transmitter - they are multiplied. When two sinusoidal waves are multiplied and the DC offset is positive, trigonometry tell us that:

$$\text{AM signal} = \sin(2\pi f_c t) + 0.5m \cos(2\pi[f_c - f_m]t) - 0.5m \cos(2\pi[f_c + f_m]t)$$

[ARRL Handbook, Section 10.2, Mixer Math: Amplitude Modulation, equation (9).]

where m is the modulating signal's amplitude, f_c is the carrier frequency, f_m is the modulation frequency and t is time. In this equation the first term is the carrier, second term is the lower sideband, and third term is the upper sideband.

Both Carson and Hartley realized that the carrier in fact conveyed no modulation information (the first term above having no modulation component), and therefore could be removed. They also realized that one sideband was an exact duplicate of the other but inverted in frequency. So, one sideband could also be removed without losing information. These changes reduce signal bandwidth by more than one-half.

Eliminating the carrier and one sideband means that an amplifier built to handle a certain power level with AM can deliver much more modulation power with SSB. The power saved can be put to use by increasing the power of the desired sideband. And the bandwidth saved allows more signals to fit in a given band.

Designers further narrowed SSB bandwidth by realizing the human voice only needs approximately 300 to 2400 Hz of audio range to convey information. So they added filtering, somewhat reducing fidelity in eliminating overtones, but maintaining intelligibility. This resulted in the Collins standard 2.1 kHz mechanical filter.

How does the receiver handle the single sideband signal?

The receiver local oscillator (BFO) "adds the carrier back", to heterodyne the sideband back down to baseband audio frequency. The BFO has to be fine-tuned very close to the frequency of the missing carrier for a voice to sound natural (and not like Donald Duck or Darth Vader).

How are the carrier and unwanted sideband suppressed?

There are historically two ways to achieve single sideband suppressed carrier, which are *filtering* and *phasing*.

The **phasing method** uses a phase-shift RC network to cancel one sideband and enhance the other. Two copies of the audio signal are generated and phase-shifted by 90° from each other. Each signal then modulates two RF carrier frequencies that are also phase-shifted by 90°. Now one pair of audio signals are 180° out of phase and cancel each other, and the other pair are in-phase and add together. In a similar way the carrier is cancelled.

The phase shifting has to be very precise and linear to suppress the unwanted sideband. This is part of the challenge of designing and aligning a phasing exciter, and critical to restoring it. The 20A is a phasing exciter.

When properly aligned it achieves phase shifts within 1.3° of 90° and sideband suppression of -40 dB from 225 to 2750 Hz, considered excellent by 1950's standards. Current phasing designs do much better.

The **filtering method** of generating SSB uses very narrow filters to suppress the carrier and reject the unwanted sideband. The complexity of design and cost of crystals in the early days made this a more costly method than phasing. Collins held patents on the mechanical filters used in their filtering SSB radios.

By switching, the operator can choose which sideband to suppress, selecting LSB or USB mode, or allow both sidebands to pass and add back the carrier to select AM.

In the 20A the RF carrier frequency is generated by a 9.0 MHz crystal oscillator. The 9.0 MHz modulated signal is mixed with an externally sourced VFO signal and then passed to the power amplifier stage where it is tuned and filtered for final RF output.

What Next

Of course, one of the beauties of SSB is that it can be adapted to non-voice purposes and used for tone modulated digital modes such as FT8. This is what I plan to do after restoring the 20A.

In next month's Signal I will describe the restoration I have done on the 20A, the surprises along the way and the help I have received from other hams. It is an ongoing project.

Thanks to Bob Reif, W1XP, for his review and contributions to this article.

-*de* Bill, AB1XB

Acknowledgements and Further Reading

1. Amateur Radio and the Rise of SSB, by Gil McElroy, VE3PKD

2. Single Sideband for the Radio Amateur, Copyright 1954 by the American Radio Relay League

3. A New Approach to Single Sideband, by Donald E. Norgaard, W2KUJ, June 1948 QST, Copyright ARRL

4. Condensed Operating Instructions for Multiphase Exciter Model 20A, by Central Electronics

5. Ham News, Nov – Dec 1950, Copyright 1950 by General Electric Company

6. SSB and the Phasing Exciter, presentation by Nick Tusa, K5EF

7. History of SSB, by George Maier, W1LSB. Video on Episode 81 of Ham Nation, https://twit.tv/shows/ham-nation/episodes/81 starting at 23:08.

8. Central Electronics History, http://www.ce-multiphase.com/history.html hosted by Nick Tusa, K5EF

9. The ARRL Handbook for Radio Communications, 2015.

Board Meeting 4MAR2021

Attendees:

John KK1X, Bruce K1BG, George KB1HFT, Skip K1NKR, Jim N8VIM, Jim AB1WQ, Ralph, KD1SM

- Jim reported that Jessica has asked him to chair meetings for the remainder of her term.
- We really need to find a candidate slate - toward that end Jim appointed Bruce and Skip as the Nominating Committee.
- Key project seems to be going nowhere. Jim N8VIM to offer kits to club members.
- George will run a help-wanted ad for key Project Manager.
- George distributed Signal to Electronics Plus in Littleton.
- No conversation with Owen, and Bruce has not been active in Youth recruiting.
- Skip noted that the ARRL Board considered a motion to subsidize the license fee for youths. The proposal applies only to youth who belong to an affiliated club with 501(c)(3) status. That led to a brief discussion about other possible benefits of 501(c)(3) status. No decision was made.
- Bruce is planning another Tech class in the "not too distant" future, 6-8 weeks out. Should have a better idea by the April board meeting.
- Net volunteers - recent checkins will be polled for NCS during Charlie's absence.
- Bruce asked about the ARRL Club liability insurance program. Ralph provided some brief details and offered to forward NVARC's policy for Bruce to read.
- What is a reasonable approach for restarting in-person meetings?
  - vaccine policy

- Pepperell policy
- safety measures at meetings
- can we reasonably exclude non-vaccinated?

- March speaker - Greg WA1JXR
  April speaker - Frank W3LPL

-*de* John, KK1X

Have YOU paid your NVARC Dues?
See http://n1nc.org/Members/Roster
for your renewal month.

Treasurer's Report

Income for February was $60 in membership renewals. Expenses were $0.74 for PayPal fees, leaving a net income of $59.26.

Current balances:

General fund	$2,650.43
Community fund	$5,948.25

As of 4 March we have 43 members who are current with their dues and 25 renewals outstanding. Thank you to those of you who mail your renewals or use PayPal. Renewal months are in the member list on www.n1nc.org in the Member's area.

To pay membership dues via PayPal see the instructions in the same Members area.

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. As an Special Service Club, the ARRL expects a majority of Club members to also be ARRL members.

Contact Ralph for further information if you need it.

de Ralph KD1SM

W1AW

W1AW Schedule

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1400		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	1500-1700 1800-2045	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	2100	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	2200	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	2300	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	0000	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	0100	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	0200	DIGITAL BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	0245	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	0300	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0400	CODE BULLETIN				

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US time + 4 hours. For the rest of the year, UTC = Eastern US time + 5 hours.

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675, 50.350, and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13, and 15 WPM.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13, and 10 WPM.

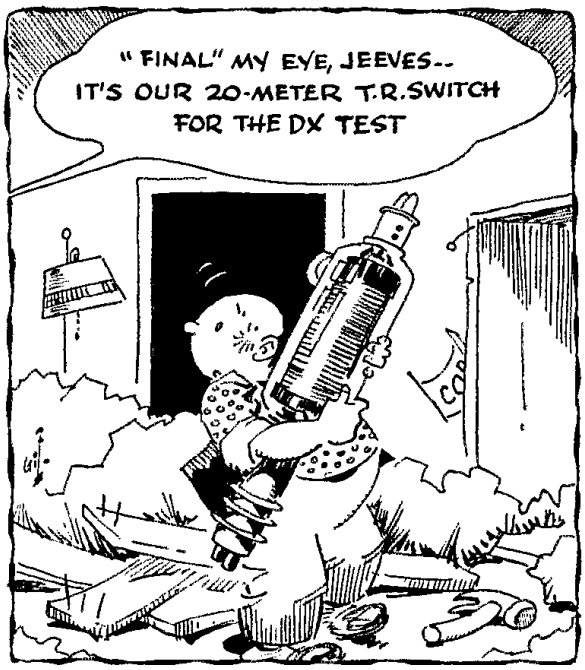
Code bulletins are sent at 18 WPM.

NVARC Calendar

March
18 Greg, WA1JXR, on the Nano VNA

April
15 Frank, W3LPL, on the Centennial of the 1921 Transatlantic Tests.

STRAYS



QST, January,1960

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Board Members:
Bruce Blain, K1BG, 2018-2021
Jim Wilber, AB1WQ, 2019-2022
Skip Youngberg, K1NKR, 2020-2023

Property Master: John Griswold, KK1X
Librarian: Peter Nordberg, N1ZRG
Emergency Coordinator: [open]
N1NC Trustee: Bruce Blain, K1BG

Join NVARC! Annual membership dues are $15; $20 for a family.

NVARC general meetings are scheduled for the third Thursday of the month at 2330 UTC (7:30pm, Eastern Time).
Non-members interested in attending may send an email to meetings@n1nc.org requesting the teleconference details. NVARC thanks Medtronic, Inc for providing the teleconferencing services under their employee volunteer support program for non-profit organizations.

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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