The LongPath

May 2021 — Volume 45 Issue 5 A North Alabama DX Club Publication

Contents:

From the President

By Bob DePierre, K8KI

I had been deluded into thinking we'd never meet again, in person. But May has now arrived and the pandemic is largely subsiding. I've had my two shots and I hope you all have as well. We now have the opportunity for our first real meeting in over a year. I'm excited to announce that we'll be back at Newk's (on University) on Tuesday, May 11. We'll also go back to the old schedule: dinner sometime around 5:30, meeting starting at 6:00, and the program a little before 6:30.

Zoom may have forever changed our meetings, and I'm still learning to adapt. I think many members still want the meetings on Zoom. I'll get my first data point on May 11, but I will try to make Zoom available. We've been on Zoom for so long that I'm afraid some of us have gotten addicted to virtual meetings. When we get back to restaurant meetings, I'll try to continue the Zoom connection. I hope Newk's has a good WiFi connection.

The pandemic hasn't gone away. It's still here among us, so I can't pretend the danger has gone away. When we get to Newk's, we'll have to follow CDC recommendations, which currently call for masks and social distancing for indoor meetings of our size.

I'll also change back to our old business format.

Another good sign is that the Huntsville Hamfest is ON! As well as the DX Banquet! The banquet will be held at the Spring Hill Hotel, right in back of the VBC. Their prices have gone up, but we have held the ticket prices to $38, exactly where they have been for the last 10 years or so. Please buy them online at our website. You can use credit card or PayPal, as you choose. And our speaker will be Adrian Ciuperca/KO8SCA, who will be DXpeditioning next at Swain's Island in the South Pacific, along with our Steve Werner/AG4W. Adrian is a very talented and interesting speaker. Don't miss him.

Will the Long Path need to readapt to our in-person meetings? I'd like to hear from you about it. The longer format newsletter takes an incredible amount of effort from numerous members. Do you want to keep it up? Last month we produced some 27 pag-

Upcoming NADXC meeting:

Tuesday May 11, 2021

5:30 PM dinner

6:00 PM meeting start

Location: Newk's and via Zoom

From the President (continued)

es, with some mighty good articles. I can't help it, but I view the DX Club as a multi-member enterprise. I don't want it to be for one or two members, but for everyone. The means to me that everyone participates. If you don't see it that way, please tell me. I want everyone to participate, which means everyone writes LP articles, or some activity best suited to their skills.

Our May program will be presented by Bruce Smith/AC4G. This time Bruce will talk about his newly designed emergency backup power system. This won't be the common approach using a gas generator and transfer switch, but rather a battery design with all the modern control components. I've never designed one of these. If you'd like to find a good way to run an emergency power system, come listen to Bruce on Tuesday, May 11, at Newk's Eatery on University. He'll speak after the meeting which starts at 6PM. I hope we can get the meeting up on Zoom. If so, the sign-on will be exactly the same as in the past. I'll send members the Zoom invitation a few days before the meeting.

How I Operated From a Top-25 DXCC Entity

By Bruce Smith, AC4G

In July 1999, I landed a job with the Department of Defense working on Kwajalein Island, Marshall Islands. I was an engineer working in the Range Safety Office providing range flight safety analysis for the test range where the range team conducted intercontinental ballistic missiles testing determining system capabilities. Most flight tests required a target missile and an interceptor missile, both launched from two different locations thousands of miles apart. The major focus was the interceptor hitting the target missile. During my spare time, I was licensed and operated as V73CW making 32,000 QSOs during my two-year stint in the Marshall Islands.

Later in 2001, I was offered and took a position as a Theater Missile Defense (TMD) Mission Planning Engineer for the Kwajalein Missile Range where I interfaced with the project offices planning flight test events and providing mission range costs for the range. In 2001, we planned a flight test where the target missile was going to be launched from Wake Island (KH9) and the interceptor launched from west coast U.S. After many months of planning the test was about to happen. Being one of the top range team members in charge, I elected to go to Wake Island to ensure that all planning from the target perspective was in place. I lived with project office personal for two weeks. My other job function was to help the range optics gurus track the target after launch with a high performance CONTRAVES optical platform that could swivel and elevate while filming and tracking the target missile.

My primary underlying function unbeknown by anyone else was to be DX and hand out as many QSOs as I could during my two-week stay on Wake Island knowing that "KH9" was in the top-25 Most Wanted DXCC List. One of my major problems was how I was going to carry my equipment and antennas to Wake Island, since space was precious on the C141 military aircraft. Another issue was getting the proper permission to operate so that the ARRL DXCC officials would accept my operation for DXCC credit. At that time, there was a single "tyrant" who hated ham operators who controlled who went to Wake Island. I requested permission to operate. He and I worked for the same organization. He said there was not a single day that went by that he did not get an email for a request to put on a DXpedition from Wake Island (KH9) and felt he could not allow any ham operations on Wake. I decided to bring my equipment anyway without permission to operate. I would deal with that later.

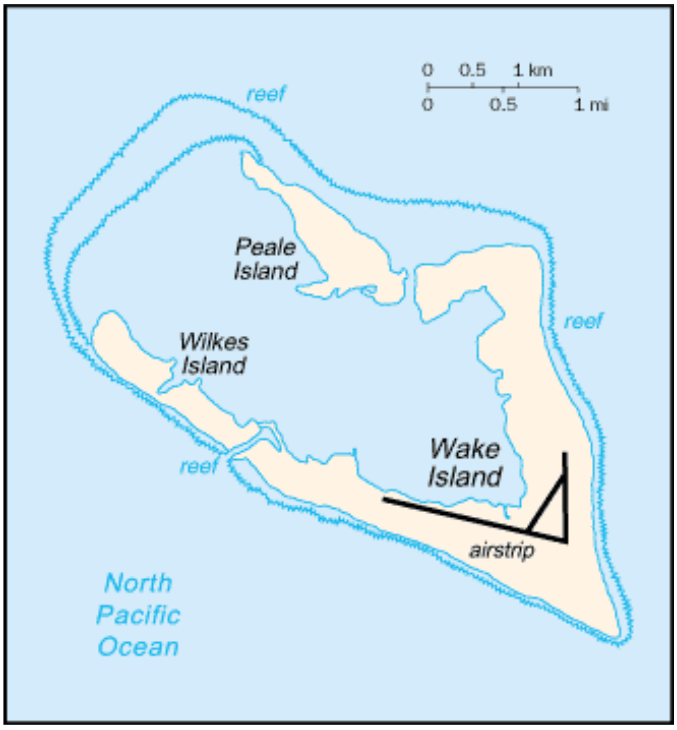
So while on Kwajalein Island, I met with personnel from the range safety ship that would be stationed off Wake Island during the flight test

How I Operated From a Top-25 DXCC Entity (continued)

to "blow" the target if it got off course. I had arranged with these personnel to tote my Cushcraft R7000 vertical antenna, a mast, and a military HF Yagi (40m thru 6m) antenna to take my antennas to Wake Island. I took my all-mode Yaesu FT847 HF rig (1.8Mhz – 50Mhz plus VHF/UHF), Samlex power supply, mobile antenna tuner, dipole antenna, and a roll of coax in my suitcase onboard the military flight to Wake. I did not have too much room for clothes, but for a DX'er, clothes were not important. I informed the team when to meet me on Wake because we had meetings with the range safety ship team prior to the flight test.

AC4G's Yaesu FT-847 All-mode Rig

On the afternoon of our first meeting, I was at the Wake Island marina looking out for my antennas to arrive knowing that the ship personnel were to meet with the on-island team for more test planning meetings. After some time of scanning the ocean, I spotted the range safety ship out in the Pacific Ocean. After 30 minutes, I saw a Zodiac with members of the range safety ship riding the waves into the Wake marina. They slowly entered the narrow passage way leading to the Wake Island Marina as I anxiously awaited my antennas to arrive. Sure enough, the team had delivered my vertical, Yagi antennas, and military bag with a self-supporting 30 foot mast. The vertical was in a four (4) inch PVC pipe with threaded ends, while the Yagi was in a military bag. They said I was crazy, but wished me much success with my operating. I also reminded them that after the flight test, I needed for them to take these antennas back to Kwajalein Island where I would pick them up later on the docked ship.



Now that I had my antennas, my next feat was deciding where to operate on Wake Island as AC4G/KH9. After our work meeting ended discussing details about the flight test, I took off on an adventure to erect some antennas. Since I was on my own, and after figuring out the best spot, I decided to setup near our dorm rooms. The first location I setup at was near the inlet to Wake Island on the east side of the island between Peale Island and Wake Island. Reference the map of Wake Island. It took me some time to setup a dipole antenna. The next issue to overcome was getting permission to operate.

With my face full of gloom, the Wake Island tyrant had not responded to my other request to operate. My face showed depression during the evening meal with my peers. A particular Lieutenant Colonel asked me what was wrong. I told him I had some ham equipment with me and wanted to operate, but did not have permission. He said he knew all about DXing and what it meant to put on a rare island. My face changed from depression to a glowing light. He said his father was a big DXer back in Virginia and went to Hamfests with his dad for years. He said that he would contact the island tyrant and attempt to get operating permission for me. He sent an email later that evening. A few hours later, I had a copy of an email from the Lieutenant Colonel stating "there was nothing to do on

How I Operated From a Top-25 DXCC Entity (continued)

Wake Island and that Bruce Smith had his gear and why could he not operate." The response was "permission granted, just don't tell other hams around the world his contact info." Hot dog! I thanked the Lieutenant Colonel and I sent a copy of this email and a copy of my travel orders to ARRL DXCC desk and ready to make QSOs. I had one stipulation. The Lieutenant Colonel said I had to work his Dad back in Virginia. I said I would try as we chuckled.

Late that evening I made my first QSO into Europe. I had a good pileup on CW into Europe. I was so tired at midnight that I had to quit, shower, and get some sleep. I could not wait for the next evening to operate. When I got off work and had eaten supper with the gang at the cafe, I ran to my room, grabbed my laptop, rig, and key and headed to an empty adjacent room. I fired everything up and began another evening of pileups into Europe. Then all of a sudden after a couple of hours, someone began complaining about the local television stations Armed Forces Radio Television Network (AFRTS) being wiped out. After a short while, I was busted. I had to cease operating or find another location. Needless to say, I had to end my pileup into Europe. I headed back to the room where I had to think about another location to operate.

The next day was spent working on the flight test and thinking about where I was going to operate. After having to go by truck to the north end of the runway near the marina on another detail, I found the best place to operate, the marina. Reference map. The marina was quiet and at night no one was around. It was also a better place to stick up my Yagi. Later that night and after supper, I grabbed a truck and took my equipment to the marina and setup in the inside of a building that had electricity. I found a place where I could leave my coax and Yagi the rest of my stay on Wake Island operating as AC4G/KH9. The first night at the marina, I made six (6) meter QSOs into JA, BY, XX9, UA, 9V, YB, etc. At night, I could see the blue runway lights, a magnificent site being all alone by myself sending & receiving CW. On HF, I was working into Europe, Africa, the Indian Ocean, VK/ZL, etc.

AC4G/KH9 QSL card

I spent the rest of my evenings at the marina until almost midnight Wake Island time every night having to get up the next morning at 0600 a.m. to be at the cafeteria for breakfast. The pileups were horrendous, but was able to make many QSOs. I was exhausted by the time the flight test ended, forcing myself to work the DX pileups down until was literally about ready to drop. I only wish I had more time to operate after the test, but my military flights were booked. After the flight test, members of the range safety ship gathered my antennas and transported these via Zodiac back to the ship and back to Kwajalein Island where I picked up the antennas when I got back to Kwajalein Island.

During my stay on Wake Island only operating 5 hours each evening and one Sunday afternoon during a contest (approximately 55 hours), I made 3200 QSOs. I was fortunate to have operated in the ARRL CW Contest setting a country record for Wake Island (see certificate below) working US contesters. Looking back, I was glad I operated giving a new country to many hams. To this day, only a few hams have operated from Wake Island. Prior to me there was a major DXpedition in the early 90's with callsign of N4XP/KH9 and N6MR/KH9. After my operation, there was Astronaut Chuck Brady, KA4???/KH9; the K9W team; and a few other single-man operations, able to get operating permission. Currently, there is a single-man operation on the air at this time as I write this article in April 2021.

How I Operated From a Top-25 DXCC Entity (continued)

AC4G ARRL DX Contest Certificate (KH9)

Since my operation, oversight of Wake Island changed from Army to Air Force. It is somewhat easier to obtain operating permission, but the fact remains, obtaining permission to get on Wake Island can be a feat in itself since it is a military base. Hopefully, new ham DXpeditions in the future can be granted operating permission.

My advice is if you get an opportunity to put a DXCC country, do it. You will be glad you did. I am proud to be one of only a few hams who have operated from Wake Island (KH9) especially a top DXCC country. Most hams that requested QSLs cards from me, had never worked KH9 and needed "KH9" for their DXCC and CQ awards. Those on the other side of the world who were working a job during my operating times, hopefully worked the later K9W Dxpedition.

The huge pileups were truly huge and amazing, but I was able to work the pileups as long as I could each night until I literally dropped. I was able to polish my pileup skills quickly to find out how I could increase my rate. My tiring effort was worth every minute and was hoping to do it again, but unfortunately never made it back to Wake Island. Writing this article has brought back many memories of my time on Wake Island, KH9. I am glad I could share it with you!

Ionospherica

By "Kai" Siwiak, KE4PT

Propagation Laws — When is it "Free Space?"

Ionospherica (aɪˌɒnəˈsfɛr-ə-kə) *noun, radiowave propagation by means of ionized atmospheric layers.*

Radio signals do not travel from point to point. Instead, they spread and expand according to the geometry of the environment, and they diffract and scatter, much like scattered light illuminating the sky from a Sun set just below the horizon (Figure 1). The "Radiowave Propagation Laws", follow the laws of physics, and ultimately define the communications distance possible, subject to the physical environment. We'll illustrate some propagation laws with VHF examples, then turn our attention to HF propagation.

I operate a 5 W VHF handheld transceiver. With it I can talk to hams orbiting 400 km above Earth in the International Space Station (ISS). Why can't I talk directly to another handheld radio 10 km (6 miles) across town? Is the path affected by the ionosphere? How does all of this apply to HF?

The VHF Path

Let's look closely at a pair of handheld radios. The transmitting power is 5 W or +37 dBm (decibels relative to a milliwatt), and the receiver sensitivity is 0.16 mV (−123 dBm). The difference between the transmitter level and the receiver sensitivity is 37+123=160 dB. That's how much link margin we can "burn up" in the path, including the antennas. For now we'll assume that the antennas at both ends of the link have -7 dBi gain, so 146 dB is the path link margin including the antennas. How far will 146 dB take you at VHF? It depends on the path-specific propagation law.

Ionospherica (continued)

The Free Space Propagation Law

The path distance to ISS can vary from 400 km (249 miles) straight up, to about 2,293 km (1425 miles) on the horizon. We operate on a line-of-sight path, so the radiated waves expand spherically, meaning the radiated power density diminishes as the square of the distance. The receiving antenna gathers 6 dB less power every time that the distance doubles — this the free-space propagation law. Said mathematically, free space path attenuation P_{FS} is:

$$P_{FS} = 32.4 + 20\log(F_{MHz} D_{km})$$

Plug in F_{MHz}=146, and D_{km}=2,293 and we get a path attenuation of 143 dB, or 3 dB stronger signal than we need! Of course, the antenna polarizations must be aligned, and we've ignored ground reflections, which can affect the signal near the horizon. But you get the basic idea – in the absence of interference, you can reach ISS with a 5 W handheld transceiver! There is also an ionospheric effect – Faraday rotation of the polarization – but we compensate for that by reorienting our antenna.[1] The Free Space Propagation Law holds for most HF paths, but we'll get to that later.

Urban / Suburban Propagation

Why, then, can't I talk across town to another handheld transceiver? The radiated waves still expand spherically in the manner of free space propagation, but there are additional factors when both transceiver antennas are low, below the building roof lines. For one thing, the waves illuminate the local buildings and streets, like the set Sun, and waves travel by multiple paths. When they reach the building roof lines, or building corners, they diffract (this adds diffraction losses), then propagate further by multiple paths. Multiple paths mean that one path will be the shortest, followed by many signal copies that arrive delayed in time. Those time-delayed copies of the signal interfere with one another and with the first-path signal, causing multipath fading, just like ripples of the surface of a swimming pool after a splash. The time-delayed multiple copies also steal energy from the first arriving signal copy.[2] We can show that fading gives rise to an additional attenuation of another 0.5 to 2 exponent in the distance attenuation behavior. It's no longer inverse square law, but inverse 2.5 to 4-th power!

Figure 1 – Sky illumination by the set Sun resembles signal illumination from a distant HF station via the ionosphere. *Source: Copyright 2015 Chris Dean, KD7CNJ, used with permission.*

Ionospherica (continued)

The diffraction losses and losses along the roof tops of the suburban path add around 62 dB of loss at a distance of 2.7 km (1.6 miles) between handheld transceivers for a total of 146 dB![3] That's where repeaters show their stuff.

Propagation to Repeater Systems

In a repeater system one end of the link is always high up on the repeater tower antenna. Everyone talks to the repeater, and everyone listens to the repeater. The propagation law is somewhere between our free-space ISS path, and that brutal street to street level suburban path. More specifically, one end of the path is high on the repeater system tower, way above the suburban buildings, but the other end might still be at street level, and includes scattering and diffraction losses to the nearest roof edge.

Consider a repeater antenna on a tower of height 61 m (200 ft), and with a +6 dBi antenna (13 dB more than the handheld radio antenna), so that the link margin is 159 dB. The suburban propagation model then predicts a coverage radius of 47 km (29 miles) centered on the repeater tower. Figure 2 (next page) shows a comparison of the VHF propagation laws for the three scenarios: free-space to a space craft on the horizon at 2239 km (1425 miles), portable to a tower high above roof-top level at 47 km (29 miles), and portable to portable radio at street level at a distance of 2.7 km (1.6 miles). Notice that 1425 miles on 5 W is pretty decent QRP DX, especially at VHF!

HF Propagation

Figure 3 (next page) shows the ground illuminated by an omnidirectional transmitting antenna located in Florida. Local coverage extends just tens of kilometers around the transmitter, then a skip zone extends to the first reflection zone at D. I calculated the prediction map using VOACAP software using the graphical interface (HamCAP) written by Alex Shovkoplyas, VE3NEA.

I chose Hawaii as the receiving end-point. The ionosphere is lit up by the transmitter in concentric circles as the spherically expanding wave reflects from the ionosphere back to the ground. The Sun (star symbol), roughly midway between the two endpoints, activates the ionosphere over the day portion of the Earth, but also lingers in the night portion of the globe, as seen here over central and southern Africa.

There are several HF propagation predictors that use the VOACAP software developed by NTIA/ITS for the Voice of America. There is even one available on-line www.voacap.com/prediction.html.[4]

I find HF propagation prediction tools indispensable for my QRP DXing.

References

1. K. Siwiak, "Hams Test Antennas Aboard Space Shuttle Columbia", QST, Oct 1993, pp. 53-55.

2. K. Siwiak, H. Bertoni, and S. Yano, "Relation between multipath and wave propagation attenuation," Electronic Letters, Vol. 39, No. 1, Jan 9, 2003, pp. 142-143.

3. Maciel L. R., H. L. Bertoni, H. H. Xia, "Unified approach to prediction of propagation over buildings for all ranges of base station antenna height," IEEE Transactions on Vehicular Technology, Vol. VT-42, No. 1, pp. 41-45, Feb 1993.

4. VOACAP on-line courtesy of J. Perkiömäki,OH6BG, J. Watson,HZ1JW, and J. Juopperi, OH8GLV.

Kazimierz (Kai) Siwiak, KE4PT, is an avid DXer who packs a DX Go-Bag station on his travels. His technical writings appear in many publications.

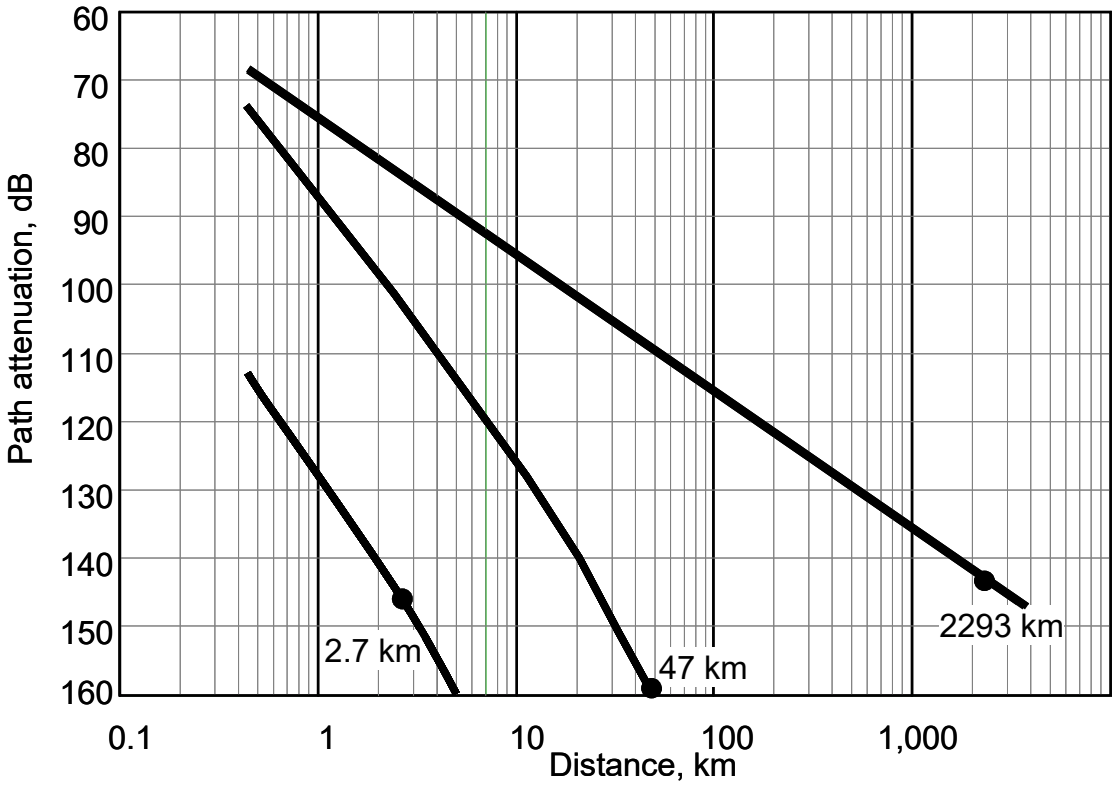


Figure 2 – Propagation laws for a 5 W VHF handheld transceiver (top) free-space law to a spacecraft, and suburban law (middle) to a repeater tower, and (bottom) to another handheld transceiver at street level. The dots indicate maximum range.

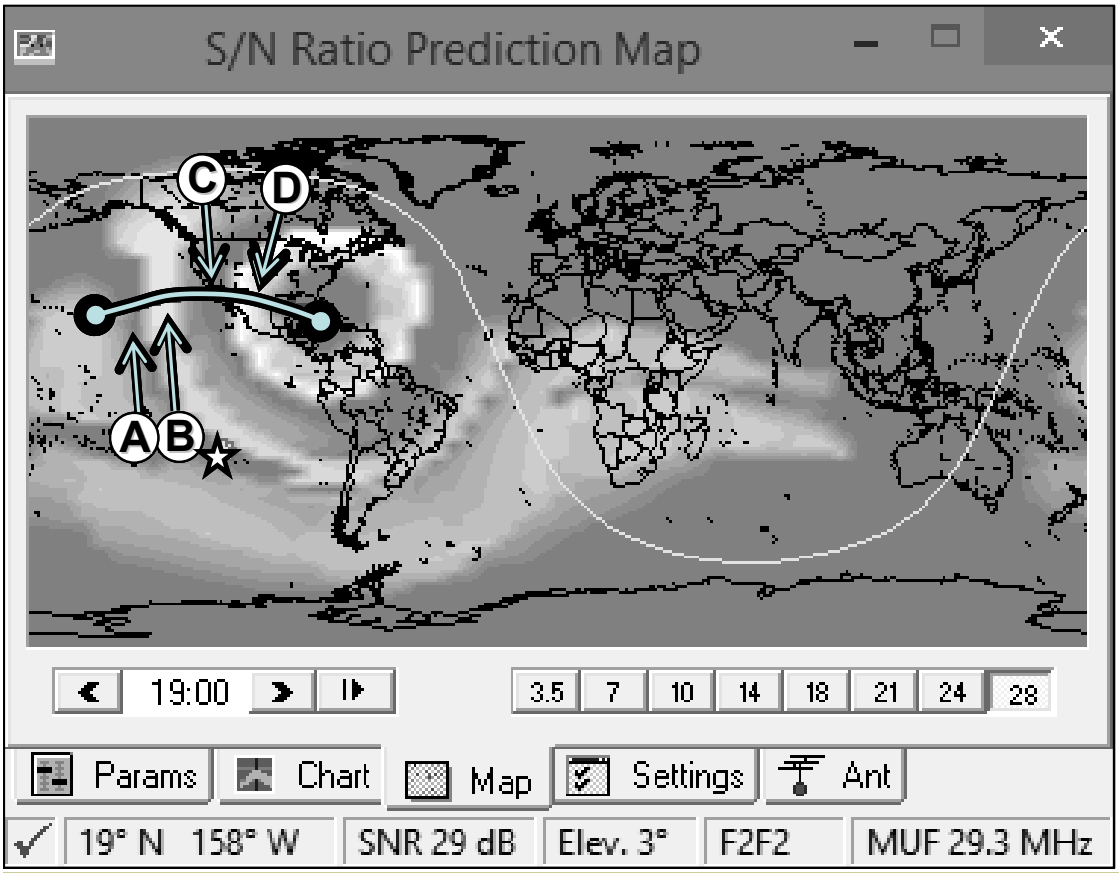


Figure 3 – HF propagation prediction at 28 MHz between a transmitter in Florida and receiver in Hawaii. The signal on the ground peaks at D, B, and Hawaii, but skips over C and A. The Sun (star) is roughly midway between the two end points. *[Source: HamCAP software by VE3NEA].*

The Casual DXer - a Portable QRO Experience

By Kevin Hibbs, KG4TEI

Part of being a casual DXer is finding the time and opportunity for making contacts. With work and family obligations it is often hard to have extended time behind a radio. That's why when I sit down at a radio every minute counts. When we travel, I often take a radio with me. I know at some point the kids will be resting, or off doing their own thing and I can get a few minutes to make some contacts. I've traveled with QRP radios, but putting more than a few stations in the log after an hour of trying can be difficult, especially with compromised small antennas. This is why I have chosen the QRO portable route.

An Idea is Formed

My wife's family takes a yearly trip to Fall Creek Falls State Park in middle Tennessee. Over the years this place has grown on me. It is a very beautiful location with lots of water falls, trails, and scenic views. For years I have been taking radios up there and making a few contacts when I could. After one particularly dismal radio experience I decided something had to change. I was either going to quit taking radios all together, or I was going to find a way to make myself successful. This is where the idea for "The Project" was formed. I wanted an all-inclusive setup. One box that housed the radio, tuner, power supply, and computer in a neat package. The only thing I wanted to connect when I arrived was the coax and a power cord.

The next question was what components to use? They needed to be small, but still able to deliver power. I already had a small MFJ power supply and manual tuner that could get me started, but the radio was going to be a challenge. At the DX Club picnic at Kelly's, W4VPZ, QTH I found the answer. Rob, NN4NT, had an FT-891, and it fit the bill perfectly for what I wanted to do. QRO power, USB CAT control, and audio in and out for digital modes. Shortly thereafter I bought the radio from our favorite local source, Gigaparts.

The last part was the computer and digital interface. As most of you know I love Raspberry Pi single board computers. There is a large user base for this inexpensive computer, and lots of accessories to make them useful. I settled on the Raspberry PI 3 B+, the Raspberry Pi 7-inch display, and a special case from SmartiPi. The digital interface was made from a generic USB sound card purchased from Wired Communications at the Huntsville Hamfest. I had to add a couple of isolations transformers to isolate the Pi from the radio and to have enough audio from the sound card to drive the radio. A prewired cable with the radio side connector was also purchased from Gigaparts. It made it easy to connect the rig to the audio interface. This was all packaged in a custom 3D printed case from my friend Matthew, KI4AJZ.

The Build

After a bench test to prove out functionality I needed a way to package everything. It had to be self-contained, easily portable, and easy to setup. I looked at a number of cases, and had high hopes of using something really small, but I settled on a medium sized tote bin. I had to remind myself this was QRO portable not SOTA portable. I chose to package the equipment in a stack of shelves cut to fit the dimensions of the bin and tied it all together with all-thread cut to the inside height of the bin so that nothing would flop around while in transit.

Cabling was the next part of the build. Everything was connected in place. I did order some short cables to connect the USB audio interface to the Pi, a short power cable for the rig, and a short coax cable to connect the rig to the tuner.

The First Test

The first outing was less than stellar. I went to Fall Creek Falls with some friends and the project came along for a trial run. Prototypes often have issues and this project was no different. I had a problem with getting the Raspberry Pi to sync to the GPS needed to set its time for FT8. There was also a considerable amount of noise in the radio, and I couldn't hear very many signals on

The Casual DXer - a Portable QRO Experience (continued)

a digital contest weekend. To say I was frustrated was an understatement.

The Solutions

To deal with the time sync issues I purchased a real time clock (RTC) designed to work with the Pi. I have also found a couple other options since then to use as backups should the RTC fail. For the noise, I borrowed a page out of the ARRL grounding book and added a ground plane on the underside of the top shelf, between the Pi, and the RF gear. Once everything was bonded together this reduced the noise by at least 3 S units. To help the hearing problem I changed antennas. I settled on a 9:1 unun kit from fellow club member Chris, KM4KTC, who owns Rocket City 3D. I picked the kit at the 2019 Huntsville Hamfest, but it is also available from Gigaparts. The unun, and a long wire with a counter poise, made a very usable antenna.

The Upgrades

An upgrade I wanted was a single power cord to run everything. In the first iteration, the Pi and the rig had separate power supplies, which meant I often had to bring a power strip. I found an inexpensive DC-to-DC converter to connect to the 13.8 volt output of the MFJ power supply to the 5 volt input of the Pi. I also purchased a small formfactor keyboard with built in USB hub. This way I can save connections to the Pi, and add needed USB ports.

CQ Parks on the Air

So, does this dog hunt? YES, it does. I took the updated project back to Fall Creek Falls in late summer of 2020. I posted to the parks of the air website my intention of operating from Fall Creek Falls. After arriving and setting up, I self-spotted, and jumped on the air. Over the weekend I put 100 contacts in the log; a lot better than the big goose egg I laid a couple years earlier.

What's Next

There are several more changes I expect to do to finalize this project, but it is very usable as is. I would like to attempt a contest with this station to see just how effective the setup could be with those band conditions. Do I expect to make hundreds of contacts? No, but I expect to make at least a few, and hopefully a new one or two.

I'm also planning a bit of a road trip with this radio. I would like to set this up in my van and do a one-day multi-parks on the air activation. Between Huntsville and my in-laws house there are at least 3 parks that can be activated. This means setting up for battery/solar power and not just shore power.

If you have any questions, suggestion to add to the project, words of advice, or antennas to try I would love to hear from you. I am always looking for ways to improve my setup, and make my precious time more productive.

Operating QRP Portable for DXing, SOTA, Field Day, and Just Fun With the IC-705

By Barry Johnson, W4WB

Recently, Steve KI4KWR presented a program discussing the new ICOM IC-705 transceiver. I purchased one from GigaParts last fall when they became available. As Steve showed us, this SDR radio is remarkably capable with a boatload of features crammed into a small package. ICOM offers a nice backpack to carry the radio and the AH-705 antenna tuner plus lots of accessories. After looking at this backpack, I just didn't see that it was worth $170! However, until a few weeks ago I was still trying to figure out a useful way to make a Go Bag for the IC-705 and the concomitant items, and for a reasonable price. While I was looking around the house and shop for items to donate to the Purple Heart Charity, I found a new camera case I got as part of the "bonus package" of items that came "free" with a new camera I purchased several years ago. The case still had the tags on it and I figured the Charity could sell it and generate a few bucks. But then

I opened it up and immediately realized that the IC-705, tuner, and big battery should fit into this well-made and padded case. So, the camera case came off the donation list and I found some more stuff to give them. A free case was more attractive to me than a $170 ICOM backpack.

Figure 1 shows the camera bag and how I configured it to hold all of the stuff I needed to include in my idea of a Go Bag. Although the case has a handle to carry it by, it actually was designed to be worn as a backpack as shown in the upper right of the figure. It goes over your shoulder with a comfortable strap and there is a waist belt to keep it from bouncing around as I walk, hike, and perhaps stumble. With all of the items shown, the total weight of the package is just 10.1 pounds. The kit has two ICOM BP-272 batteries that allow the radio to transmit up to 5 W. The BIOENNO battery allows the IC-705 to transmit at 10 W. With the total available power of 172 Wh, one can use the radio for a day or more. The Nifty Accessories stand is an item I would never use the radio without. It is lightweight and holds the radio at just the correct position as far as I am concerned. To use about any type of antenna with the IC-705, I have a mAT-10 autotuner included. The front pocket of the case holds cables, connectors, my Palm Radio paddles with the Code Cube, charger, etc. In the side pocket, the Nifty IC-705 Mini-Manual is located and I have found this manual to be very handy.

Currently, I sometimes use a bhi, ltd. [1] external speaker with their DSP noise cancellation technology. It works better in my opinion than what is in the IC-705. Years ago, I mounted a bhi DSP board inside of my FT-817 and what a difference it made! It became an install service at W4RT Electronics and was quire popular. Graham, owner of bhi, ltd., recently sent me some photos of the NEDSP1901-KBD installed in the IC-

Figure 1. W4WB's ICOM IC-705 Go Bag.

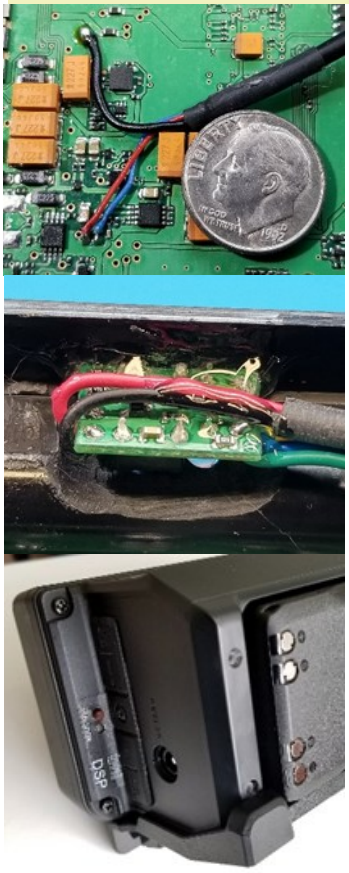


Figure 2. bhi NEDSP1901-KBD installed in an IC-705. Clever positioning of function button.

705 by one of his adventurous customers. As Graham commented "Installation in the IC-705 is not for the faint of heart! The radio is tightly packed with boards and cables, and the SMD coupling capacitor that needs to be removed from the low-level audio path is extremely tiny, as are the BHI NR connections!" See Figure 2 to appreciate his comment. Nevertheless, I am staying with the external speaker for now.

Not shown in Figure 1 is the Wonder Wand antenna and its counterpoise attachment. The Wonder Wand can fit into the case while the counterpoise fits in the front pocket. Figure 3 shows the IC-705 on the Nifty stand with the Wonder Wand antenna attached and the Wonder Wand counterpoise plugged into the antenna unit. The counterpoise wire should be run out away from the antenna and kept off of the ground at least a meter. There is a general "rule" that a counterpoise wire should be kept at least λ/40 above the ground. The whip length is about 54". This is certainly not a great antenna, but it does work (better than light bulb).[2] Back in the peak of the last solar cycle, I used this antenna with my FT-817 (5 W) to make a number of DX contacts including a station in Brazil on 15 m SSB.

Over the years I have tried numerous portable antennas for QRP activities. Perhaps my favorite is a 135' long-wire antenna deployed into trees using the EZ-HANG Antenna Launcher[3]. Of course, an antenna tuner and a counterpoise are appropriate to use in this case. As I mentioned already, the counterpoise wire should be about a meter above the ground. Best matching and radiated power can be realized by using an MFJ-931 Artificial Ground[4] or equivalent. I have found that matching to the antenna typically required the process of tuning the ATU, then adjusting the MFJ-931, and then doing this again a time or two more. You can observe the field strength increase as you perform the matching process. Back when I still traveled significantly for business, I often took my FT-817, MFJ-931, and the B&W AP-10 Portable Antenna[5] shown in Figure 4. I had learned which hotels had windows at least on the fourth or fifth floor that would open adequately for me to mount the AP-10 and to deploy a counterpoise wire outside of the building by just dropping it with a small weight on its end. I made lots of CW and SSB contacts mostly on 20 m and 40 m.

Figure 3. Wonder Wand antenna with counterpoise.

Figure 4. B&W AP-10 Portable Antenna.

Another good portable antenna is a vertical made using a wire held up by a SOTABEAM mast. Mine is 33-feet tall and is held erect using guy lines. An inverted-Vee antenna can also be erected, but it is wise to attach another line to the mast top to counteract the bending caused by the force exerted by the antenna. In both cases, the MFJ-931 is useful to provide an artificial ground.

All of the antennas mention so far can be carried by a single person who also carries the Go Bag. Nevertheless, it is always a prudent idea to go on an outing with at least one other person who can perhaps carry food and drinks. With another person or so available, more effective antennas can be deployed such as the Buddipole[6] and Hex-Beam. Budd W3FF developed the Buddipole about 20 years ago and it has become sort of the standard in rapidly deployable dipoles. My Buddipole package is shown in Figure 5. The bag is about 42" in length and weighs about 13 pounds. The mast mounted in the tripod positions the dipole at about 18 feet and can operate from 7 to 54 MHz by changing the taps on the coils and lengths of the adjustable radiator elements.

Recently, Budd and his son Chris have developed a tripod and mast system that is sold under the name of Mastwerks™. With this mast system, one can have 4 m, 7 m, and 10 m elevation. The mast can be rotated manually by a hand crank or by a remotely-controlled motor. The Buddipole dipole interfaces beautifully with this mast system. If you would like to see this system in action at a west coast Field Day activity, the see the movie at https://youtu.be/i-G49ZLwA4k.

Figure 5. Buddipole Antenna System for 6-40 m and provides tripod with mast and guys.

Figure 6. Hex-Pac for rapid assembly of a monoband Hex-Beam from 20 m to 6 m.

Figure 7. The Hex-Pac opened up.

Having a rotatable dipole is nice, but having a beam is even better. Mike Traffie, inventor of the Hex-Beam, produce a very few Hex-Pacs (shown in Figure 6) which is a shoulder-carried kit that weights 13 pounds. I am blessed to have one and sincerely love it! With the Hex-Pac, one can in 10-15 minutes assemble a monoband Hex-Beam from 20 m to 6 m. Figure 7 shows the center support, various arm sections used to construct the proper length arms, and the radials for each band plus Mike made me extra radials for the CW and phone bands on 20 m and 10 m.

Operating QRP Portable for DXing, SOTA, Field Day, and Just Fun With the IC-705 (continued)

Figure 8. Hex-Beam for 15 m assembled from the Hex-Pac mounted on a Blue Sky Lite mast.

Raising this beam is perhaps a challenge. It can be "floated" in the air using ropes to raise it and a pair of lines to rotate it assuming there are cooperating trees handy. Figure 8 shows a Hex-Beam for 15 m mounted on a Blue Sky Lite mast attached to the trailer hitch on my Blazer. The Hex-Pac and the Blue Sky Lite kits were in the back of the Blazer and while at a friend's home, Ralph N5DOI and I did a deployment demonstration by assembling the Hex-Beam and mast in under 30 minutes. In this case, the beam was at about 25 feet. I have also interfaced this monoband Hex-Beam with the old Buddipole mast and the beam was about 20 feet height and worked rather well. My plan is to acquire a 10 m Mastwerks™ system and construct an interface between it and the Hex-Beam center post. The Mastwerks™ is a much stronger and capable mast system than the old system. As I mentioned before, it is wise to have one or two friends go on an outing for not only safety and hauling stuff, but for everyone to experience the enjoyment of operating in the field.

References

1. https://www.bhi-ltd.com/
2. Thomas H. Schiller (N6BT), "Everything Works," https://www.okdxf.eu/files/everything_works.pdf.
3. https://www.ezhang.com/
4. https://mfjenterprises.com/products/mfj-931
5. https://www.bwantennas.com/instructions.html (click on AP-10A Window Antenna).
6. https://www.buddipole.com/

Put the NanoVNA to Work

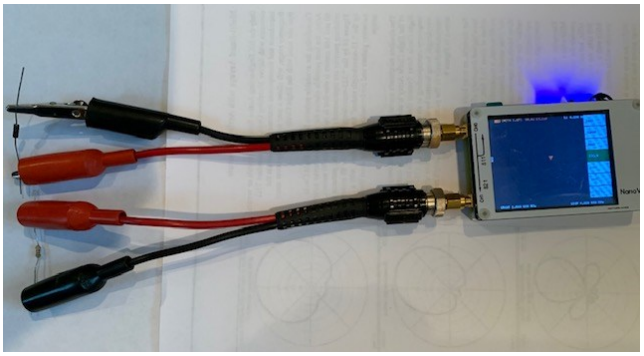
By Steve Werner, AG4W

The NanoVNA is a very tiny handheld vector network analyzer that can be purchased for about $60. It is amazing. It can calculate reflection coefficients S11 and transmission coefficients S21. From those you can see reflection loss, complex impedance and SWR. It can directly work from 50kHz to 300 MHz. I recently used it to measure amplifier gain on 80 and 160 meters on my DX Engineering low frequency receive antenna. This antenna uses 8 receive vertical antennas. The antennas are only 8.5 foot whips so the receive matching unit at the antenna is an impedance matching system and does not have gain. In the past I just used DC current input at 12 VDC to determine if the receive matching units were working and assumed if the currents were close

Put the NanoVNA to Work (continued)

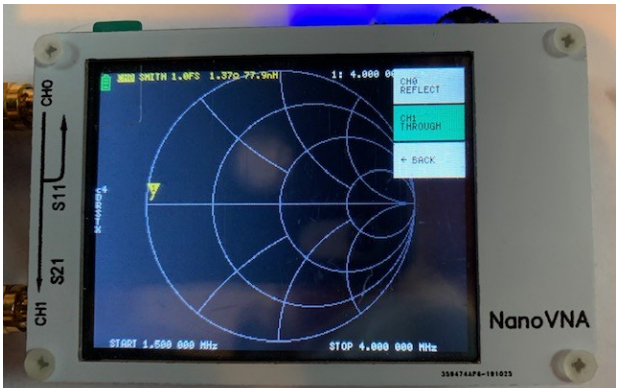
so would be the gain. Ideally you would like the gain to be very similar since 4 of the 8 antennas are used when one of 8 directions is selected.

The NanoVNA must be calibrated for the cables you intend to use during the test. Calibration of VNAs is important. The cables you use must also support the measurement frequencies you intend to use. I have used the NanoVNA before when I converted my SB-220 to 6 meters. The test cables did not support 6 meters. Then I was looking at the resonant frequency of tuned circuits. When calibrating the NanoVNA you check the test leads with an open circuit, short circuit and with a 50 ohm load. The VNA comes with SMA calibration connections to perform the test at the VNA. That is great for checking SWR on an antenna. When you use test leads you will need a 50 ohm resistor to perform the test. When you do an S21 measurement you also need to perform the isolation and thru test. The isolation test requires two 50 ohm resistors. The thru test connects the input to output. The calibration should be done over the frequencies range you intend to check. The frequency range is set up under stimulus and enter the start and stop frequency. I used 1.5 to 4 MHz. The NanoVNA will save your calibration but will not save settings.

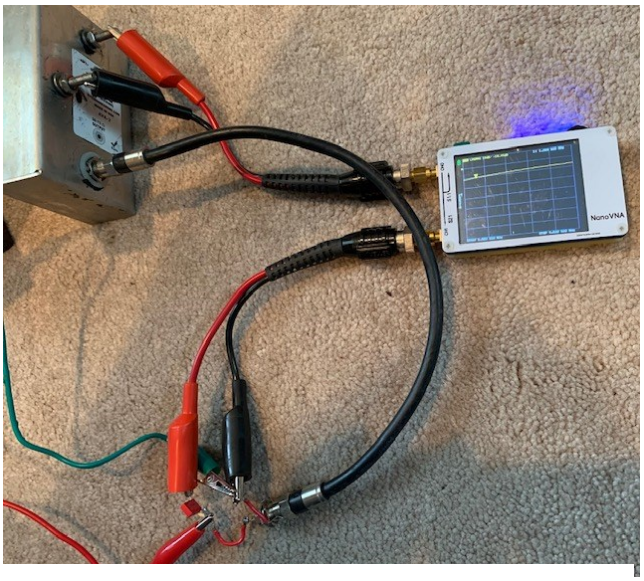


Calibration using two 50 ohm resistor during isolation

This means every time you turn on the NanoVNA you must reenter the stimulus range. You must also select the calibration you want to use. Then you select under the display settings that you want format and then logmag. If you wanted SWR for an antenna or a smith chart this is where you select it. To check an amplifier using S21 you also need under display to choose channel and select channel 1 through. Now you can hook the antenna to the CH0 and output of the unit to CH1. In this test I had to isolate the output with a capacitor since the unit is provided 12VDC on that line. I used a .12uf capacitor.



Setup using CH1 Through in Display/Channel

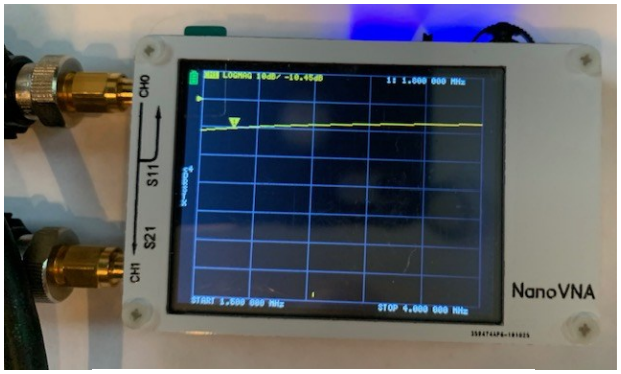


Unit under test setup

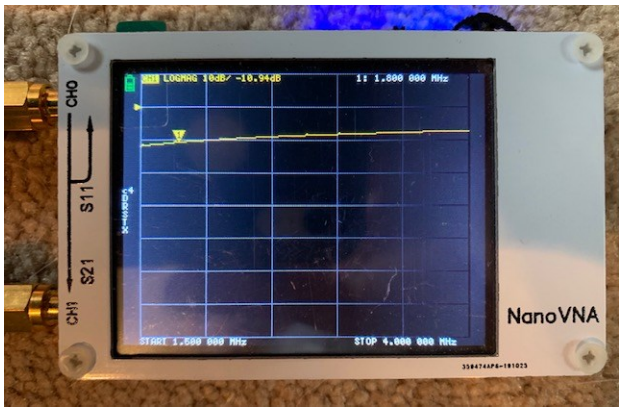
The screen will then give you the test result. When compared to a very expensive HP spectrum analyzer you will find the actual result will still be off some. That was not a problem for me since I was looking for them to all be the same and didn't care about the exact gain or loss value. The working units had power readings from 45 to 121 ma at 12 VDC and gain of -10.3 to -13.8 dB.

Put the NanoVNA to Work (continued)

The HP analyzer measured -3dB. I decided the best useable units had currents from 66 to 92 ma with gain readings from -10.3 to -11.5 dB. After I fix the ones that fall out of the acceptable range I may be able to further narrow which units are best.



Unit 1 test result



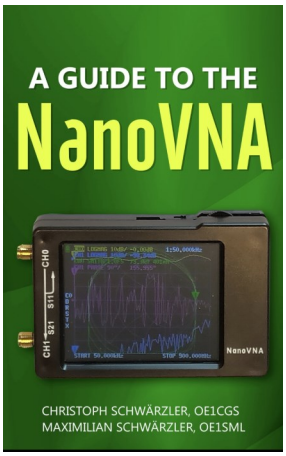
Unit 2 test result

One of the frustrating things about the NanoVNA is that the battery life is short. When you add to that you have to reenter information each time it is a pain. A bigger problem is that the numbers on the display are extremely small and the display is not sunlight readable. It is poor when partly sunny. My redneck solution was reading the display thru a paper towel tube. Crazy but it barely worked. I have seen some people completely cover their head and the display with a tarp.

Redneck sunlight viewer

View down the tube

I encourage you to read the book "A Guide to the NanoVNA" by Christoph Schwarzler OE1CGS and Maximilian Schwarzler OE1SML. This will get you started with using the NanoVNA with much less frustration. It is available as a Kindle book.



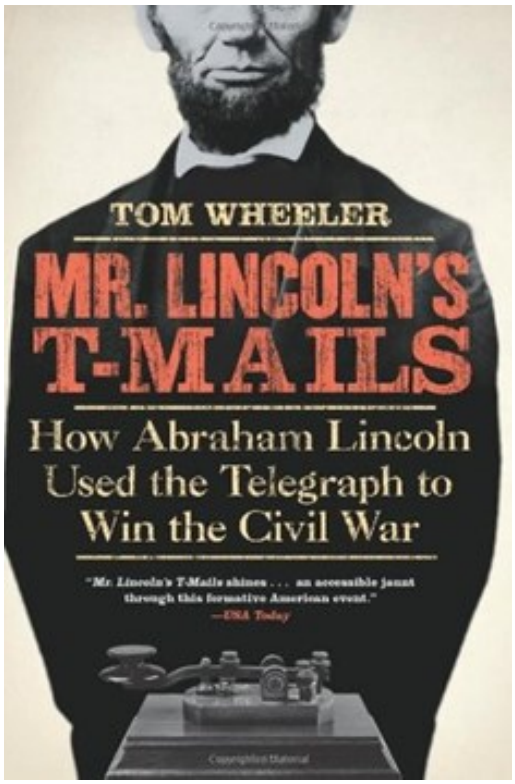
A Look at Radio's History

By Wil Robertson, AI4QT

A wonderful aspect of our service-hobby is that there are many facets that comprise it. Amateur radio bridges home-brew projects--from the simple to the complex, to the search for DX or to something as mundane as uploading to LoTW, or QSL card designing.

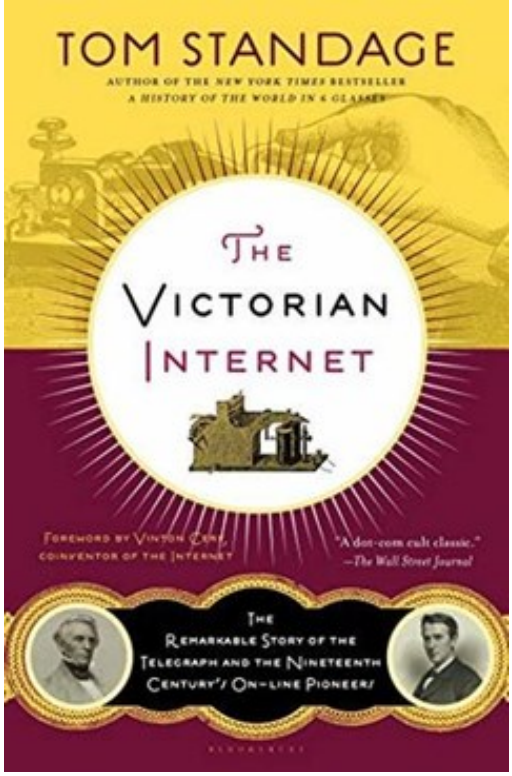
One of the enrichments of radio, to me at least, is reading the history of it all-- telegraphy, radio and to some extent television and appreciating how these inventions impacted society and culture.

Here are three interesting books that cover the impact of telegraphy and radio in its beginning.



Mr. Lincoln's T-Mails by Tom Wheeler

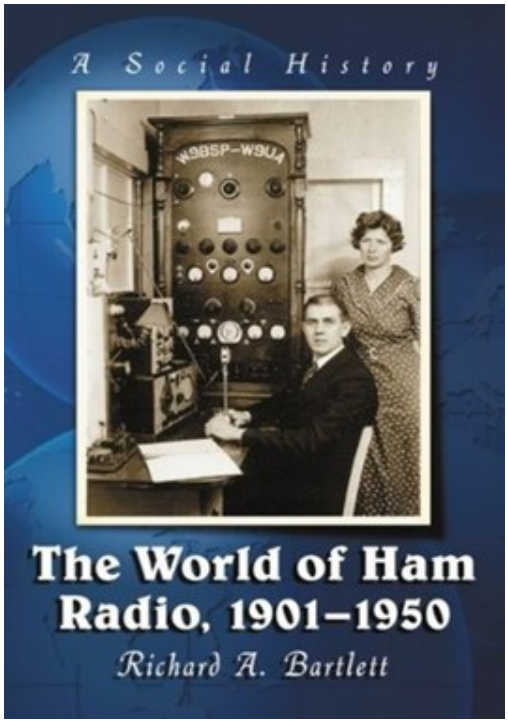
A fascinating read how the telegraph impacted the American Civil War and how President Lincoln managed his generals by using the telegraph to give orders-- often times sending orders to the general on the battlefield itself. I'm not sure if anyone today (except for us ham operators) really appreciate how instantaneous messaging was available 150 years ago. It is obvious reading this book that Mr. Lincoln embraced the new technology of instant communications or as the author referenced it by the sending of "T-mail."



The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's On-line Pioneers by Tom Standage

I would gather few people know how much the invention of the telegraph changed the way the world interacted with itself when this technological marvel appeared during the mid-19th century. This book really brings into perspective all the manifestations of how Victorian society interacted with this new invention. It was enlightening to learn the parallels between the early days of telegraphy and the early days of the Internet from business dealings, news dissemination, one-on-one friendships, hacking, and even scamming others by unscrupulous telegraphers.

A Look at Radio's History (continued)



The World of Ham Radio, 1901-1950: A Social History by Richard Bartlett

This is a thoroughly researched book on the beginnings of the civilian use of wireless communication technology. The book covers the first 49 years of radio's arts and sciences. It is a treasure trove starting at the beginnings of radio before AM broadcasting and how individuals for a knack of tinkering, would later become amateur radio operators. These operator-hobbyists would lay the groundwork in developing the technologies for many scientific advancements in communications. Although the book covers amateur radio history for the first 49 years (the writer explains why it only covers these years), it is a long read but worth it if you are fascinated by early technologies used in radio's development.

Each of the aforementioned books are available from Amazon in Kindle editions. It goes without saying that like many who enjoy reading e-books, time is never wanting as to when one has the opportunity to read. In many ways reading is much easier today since you can read using your phone on the go —at the gym, standing in line, waiting for appointments or waiting to be served in a restaurant. Today, one is always within reach of a good book or e-magazine as it pertains to our wonderful radio avocation.

DXpeditions in May 2021

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May-21						
2021 May07	2021 May25	**Christmas Island**	**VK9XX**	EB8DX	DXW.Net 20210415	By VK6SJ fm IOTA OC-002; focus on 80 40 30m; mainly FT8; wires, perhaps a vertical; QRV local mornings and evenings
2021 May10	2021 Jun15	**Niger**	5UAIHM	F4IHM	TDDX 20210416	By F4IHM fm Niamey; CW; 40 20m; wire antenna
2021 May23	2021 Jun05	**Martinique**	**FM**	ON4RU Direct	ON4RU 20210314	By ON4RU as FM/OQ3R fm IOTA NA-107; 160-10m; only CW; holiday style operation; QRV for WPX CW as TO3F
CQ WW WPX Contest, CW (May 29-30, 2021) Check here for pericontest activity too.						
2021 May30	2021 Jun30	**Tonga**	A35JP	LoTW	JA0RQV 20210404	By JA0RQV fm Tongatapu I (IOTA OC-049); 80-6m; CW, SSB, FT8; QSL via Club Log OQRS; See web for details; dates may change due to Covid-19
Jun-21						
2021 Jun10	2021 Jun12	**Ogasawara**	JD1BLY	JI5RPT	JI5RPT 20210422	By JI5RPT fm Chichijima I (IOTA AS-031); 40-6m; FT8 CW SSB; QSL OK B/d; COVID permitting
2021 Jun12	2021 Jul10	**St Kitts & Nevis**	V47JA	LoTW	W5JON 20201222	By W5JON fm Calypso Bay; 160-6m, incl 60m; SSB FT8; yagi, verticals; QSL also OK via W5JON direct
2021 Jun22	2021 Jun28	**St Eustatius**	PJ5	LoTW	W5JON 20201222	By W5JON as PJ5/W5JON; 40-6m SSB FT8; QRV for CQWW DX SSB; QSL also OK via W5JON direct
2021 Jun30	2021 Jul03	**Alaska**	KL7RRC	N7RO	TDDX 20210420	By N7QT W8HC NL8F N3QQ fm Adak I (IOTA NA-039); 40-6m; CW SSB FT8 (f/h)

Wattmeter Special Edition: Member Reviews and Experiences

Introduction

By Fred Kepner, K3FRK

This month the LongPath features articles about wattmeters. We all have them, probably too many of them. Some are proudly displayed at our operating station and others sit on a shelf, delegated to backup use. The following articles are about the meters that some of our members currently have in use. I hope you see something that you'll just have to have.

Alpha 4520A

By Bruce Smith, AC4G

Several years ago in 2014, I was using a Yaesu SWR-Watt meter (the model number escapes me), but when I purchased a modern HF transceiver that also had six (6) meter capability, I also needed to upgrade to an external SWR-Watt meter having capability to cover the 50 MHz band. After a broad internet search on vendor websites such as Array Solutions, DXEngineering, Ham Radio Outlet and others, I found the meter I wanted, an Alpha 4520A. The reputation, ruggedness and dependability of the legendary Alpha amplifiers helped guide me toward this meter.

The 4520A covers amateur HF bands from 160m through 6m and features a USB connector for computer connections. Every meter is individually calibrated over a wide frequency range and temperature range to ensure accurate RF measurements under most all conditions. The typical power measurement accuracy is better than 3.5% across the meter's full frequency range. This meter has a digital readout which displays forward power and an analog meter that can be set to display forward or reflected power or SWR. PEP or tune & carrier modes are supported. The meter has 9 RF power display ranges that can be manually set or auto switched. A universal power supply that operates from 85- 260 VAC, 50/60 Hz is provided.

AC4G's Alpha 4520A SWR-Wattmeter

This SWR-Wattmeter covers power from 1 watt (0 dBW) to 5 kilowatts (+37 dBW). The operator does not have to purchase or change slugs to cover the frequency range specified above. The meter has protection circuitry to protect against typical operating anomalies. The wattmeter automatically determines the direction of power flow, allowing the rear coax connectors to be connected interchangeably between RF sources (transmitter) and load (antenna/dummy

Alpha 4520A (continued)

load). The UHF style coax connectors can be changed in the field if a different style of connector is required such as a BNC or type N connector.

The Alpha 4520A SWR-Watt meter sold for $795.00 back in 2014 when I purchased it new from RF Concepts. This meter price seems to be a bit pricey, but aren't all Alpha products? I have never have had any issues with this meter and glad that I selected this SWR-Watt meter to purchase. So far, this meter has served me well.

Coaxial Dynamics 81000A

By Bob DePierre, K8KI

Steve/AG4W is one of the few of us who regularly transmits a KW on 2m. And you could argue it's QRP since he gets more miles per watt than any terrestrial radio: he uses it for EME work. His amp had burned up his previous wattmeter and a bunch of coax. Steve picked up a new Coaxial Dynamics meter an regularly subjects it to a measly 800 to 1000 watts on 2m.

The Coaxial Dynamics 81000A accepts Bird slugs

Palstar PM2000AM

By Fred Kepner, K3FRK

Palstar sells two versions of its current wattmeter, the PM2000A and the PM2000AM. The specs are identical. The difference is that the "M" model is the "mobile" version. I chose the mobile version because it fits conveniently in my shack. The mobile version consists of a meter in a small housing connected by a 14 foot cable to a coupler. I have the meter located on my desk, near the radio and directly in front of my computer monitor. The meter is approximately 4.75W x 4.5H x 2.75D (inches). The coupler sits behind the desk and connects between the amplifier and tuner. I believe the non-mobile version, the PM2000A, is only slightly deeper at about 4 inches but the coax connections on the back of the unit would not allow it to fit where I have installed my mobile version. The meter has a ground stud and a DC power connection. The DC power supplies the meter's light. The meter is rated for 2KW and covers 1.8 to 60 MHz. There are four buttons on the front of the meter for various functions. The meter can be set for average power or peak power. It also has the ability to hold the peak reading for a short period of time. There are two screws on the front for calibration, if necessary.

The mobile PM2000AM meter and coupler

I do not have the necessary tools to check the meter's accuracy but I have compared it to the reading on my Palstar HF-Auto tuner. The wattmeter typically reads 50-100W less than the tuner. The larger discrepancies are on the highest and

Palstar PM2000AM (continued)

lowest bands with the center bands being much closer to the tuner's readout. I believe the tuner to be more accurate because Palstar calibrated it when it was serviced. I mainly use the wattmeter for the convenience of viewing the needle for quick power and SWR checks without turning away from the computer or radio.

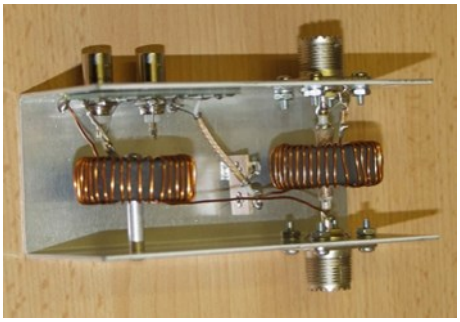
Both the PM2000A and the PM2000AM retail for $199. They do occasionally come up for sale on classifieds and I have observed that some older units are rated up to 30 MHz instead of the current 60 MHz. The rating is on the front of the meter so if buying a used one, check the picture closely.

Telepost LP-100A

By Bob DePierre, K8KI

I've been collecting measuring equipment for decades. I no sooner find out how a piece of equipment works than I find out what are its limits. And so it has long been with SWR meters and RF wattmeters. I was familiar with the concepts of the Monimatch (Bird) and the Breune Match (Collins, Drake, and now many transceivers), but knew their accuracy was somewhat dependent of the load they saw. They did best at 50Ω, but their accuracy fell off as the load went up or down. "Good enough" just wasn't what I wanted. Then I happened to stop by the booth of Larry Phipps/ N8LP at the Hamvention around 2008. He showed me his new LP-100A "Digital Vector RF Wattmeter." Now I'd been to school and knew well that watts were not a vector quantity, so at first I thought I was talking to just one more quack. Turns out the product was really a vector network analyzer that just happened to compute some scalar products such as RF watts. This was what I was looking for. The coupler had two pickup coils (one for directional volts and one for directional amps). It didn't care what the load impedance was (or the SWR either).

You can use the LP-100A merely as a SWR/wattmeter, or you can have it do most anything a VNA will do. You can sweep the SWR of your antenna and read the complex impedances, or you can use software to display your impedances on a Smith Chart. I have since added a second coupler so I can automatically display the SWR and watts on a second antenna. As expected, this unit is a little pricey, but not bad. It is especially accurate. You can find much more info here.



Above: K8KI's LP-100A

Left: The coupler's pickup coils

Telepost LP-500

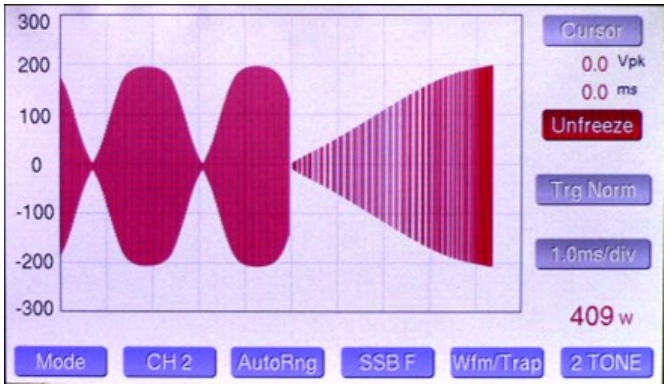
By Bob DePierre, K8KI

I have 4 antennas, and my amp has a 4-port built-in antenna switch. So there is no way for me to insert a single SWR/wattmeter. I need to monitor all 4 cables. My LP-100A will monitor only two of them for me, so I needed something else to monitor those other two cables. After some searching, I found that N8LP was due to enter his new LP-500A into the market. I had seen it several times at the Hamvention, but it was having design/manufacturing delays. I got on the list...for a year. I got two couplers with it so I could monitor those other two antenna cables.

The LP500 is a totally different design from the LP100A. It uses a Breune Match, but includes a digital sampler that can display frequency and

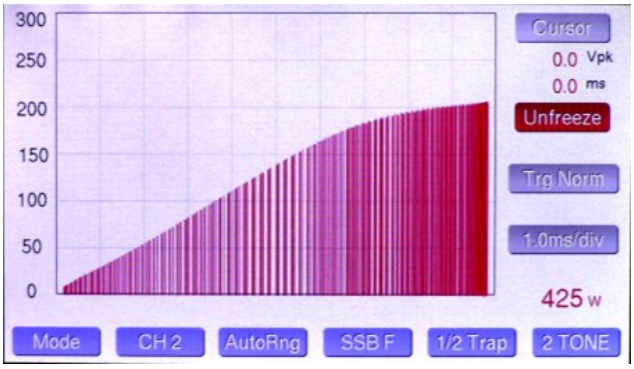
LP-500 (continued)

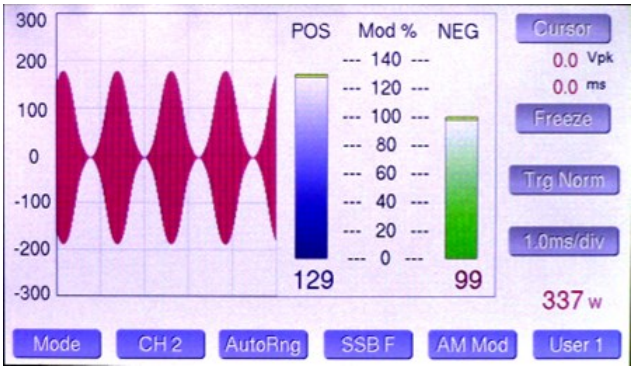
time functions, as well as a trapezoid. I had connected my oscilloscope to do this several times in the past; there are even some OEM tools to develop similar displays. But those didn't have touchscreen, color flat panels with digital sampling. So this was something new on the market that didn't have a competitive alternative. After I had it for a year, I got a third coupler box so I could monitor the input to my amp, and thus produce trapezoid displays.



I've had the LP500 for about 4 years, and mostly use it as merely an SWR/wattmeter. But this meter has huge potential when you need to make some difficult measurements. It has a µSD card so you can record/playback thousands of signals. It comes with a 2-tone generator as well as a white noise generator on the µSD card, so you can see exactly what is the distortion coming from your transmitter. On a split screen you can see the rising and falling edges of your CW signal.

I'm guilty of building a fairly complex sta-





tion. That means it's not long until the next component breaks. After this many years of fixing broken stuff, I'm pretty sensitive about having the tools available to fix what is not working...as I want it to. I have a closet full of lab tools at the ready, but this one is always turned on. If it's always turned on, that should mean it's somewhat more valuable than the rest.

When AG4W bult his 6-meter amp, we used the LP500 in trapezoid mode to display the amplitude distortion and output power. The amp was really very good, but the LP500 clearly pointed to the tune settings to avoid.

The LP500 is, of course, more expensive than the LP100A, especially if you plan to buy all the signal couplers to keep it busy. But if you have a distortion problem, or want to just know how much distortion you're generating, then this is the piece you need.

WaveNode WN-2

By Walter Miller, AJ6T

I use the WaveNode-2 Digital Wattmeter to monitor RF power on four separate feedlines simultaneously. The main unit connects to a Windows PC via USB (the original now-obsolete WN-1 used a parallel port) and the computer displays forward and reverse bar graphs of instantaneous RF power that is sampled by up to four inline directional couplers. The system is very flexible by virtue of the wide range of couplers that cover from 100 kHz to 1.3 GHz in various ranges and power levels. The most common sensor (HF-1) covers 1.8-60 MHz at 2000 watts.

In addition to the RF bar graphs, the WN-2 offers a number of other very useful features. If the SWR on any of the feedlines exceeds 3:1 a HIGH SWR output can be used to inhibit a transmitter. It also includes four digital inputs and outputs that can be used for general purpose monitoring of signals from your shack. The 12 volt power feed to a transceiver can be routed through the WN-2 for display of power supply voltage and current. An optional "RFView" port can be added to the directional coupler to provide a RF sample for monitoring on an oscilloscope or as feedback for amplifier linearization. In essence, the WN-2 can be the centerpiece of a comprehensive station monitoring scheme. The WN-2 displays provide an at-a-glance reassurance that my station is operating properly, especially when I am controlling it remotely.

https://wavenodedevelop.com/controllers/wavenode-wn-2/

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