K9YA Telegraph

Robert F. Heytow Memorial Radio Club

Volume 6, Issue 6, June 2009

Norcal 2N2/20 Kit

A Limited Edition Monobander

Philip Cala-Lazar, K9PL

I first caught wind of this NorCal QRP transceiver kit on one of the many mailing lists I receive. A limited run of the NorCal 2N2/XX series of QRP monobander transceiver kits debuted at Pacificon 2008. The production run included 200 kits for 20-meters, 100 for 30-meters, and 200 for 40-meters—500 total. The rigs are capable of 5-plus watts output, and feature a six-pole filter.

The construction manual offers the caveat that the 2N2 series is a rather complex kit and that "…it **is not** a beginning builders kit." That is a very fair description, but for the ham with a few kits under his or her belt, it's a fun project and offers the experienced kit builder a bit of a challenge. Designed by Jim Kortge, K8IQY, the kit's construction utilizes some unconventional techniques to arrive at a hot performing QRP rig.

"…offers the experienced kit builder a bit of a challenge."

After a VFO drifting problem was revealed in units sold at Pacificon, kits shipments were halted until a solution was worked out. Diligent testing uncovered the source of the VFO drift and NorCal supplied mod kits for units already built and added the revised parts to new kits preparatory to their shipment. Included in the VFO mod kit was: a toroid, NPO capacitors, a trimmer and nylon shoulder washers and nylon screw.

Later a problem was uncovered with the two Fairchild MPSH10 transistors supplied in the kits. The prototype was built with Motorola MPSH10 transistors and the Fairchild units did not meet spec resulting in decreased IF output. To match the prototype's performance NorCal sent two ON branded MPSH10 transistors to all kit owners.

Building the kit occupied a week working evenings and pretty much all of one weekend. Thanks to the comprehensive and well-illustrated PDF instruction manual, populating the high quality printed circuit board with the 300-plus components was uneventful until I incorrectly installed a correctly wound toroid and smoked a 27 ohm resistor while testing that stage.

As each stage is completed there follows a test procedure using a voltmeter for the first few stages, and an RF probe or oscilloscope for the following steps. In that manner, any construction faults are quickly isolated and any troubleshooting needed much simplified.

My homebrew RF probe is based on the ingenious, built into a ballpoint pen casing, N5ESE design: **http://www.io.com/~n5fc/rfprobe2.htm**

Anyone wanting to build the kit is strongly advised to subscribe to the 2N2 list: **http://groups.yahoo.com/group/NorCal_2n2/**. It's a knowledgeable and

Continued - NORCAL 2N2/20 on Page 8

Inside This Issue…

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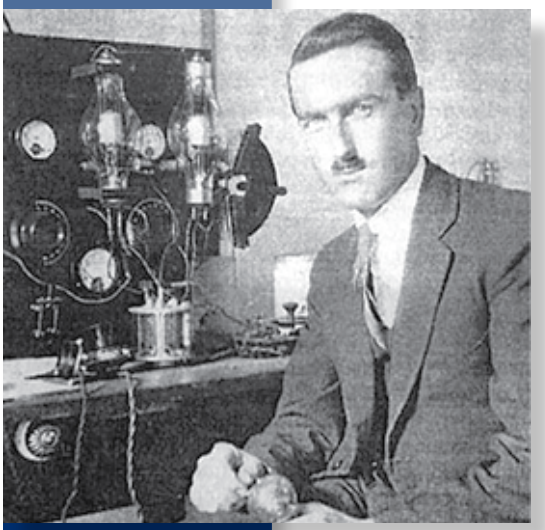
VHF Historical Notes

Part IV

Kevin C. Kaufhold, W9GKA



Ross Hull
VHF Pioneer

Around this time, Ross Hull erected a directional antenna at Seldon Hill in West Hartford, Ct., where many League staffers then lived. He immediately made contact with Boston area hams, some 100 miles distant. Over the next few weeks, it became obvious to Hull and other ARRL staff members that routine contacts on 5 meters were possible far beyond the line of sight. Hull wrote of his experiments in *QST,* and his activities on VHF were widely followed.[1] By showing the effectiveness of directional wire arrays, Hull's VHF propagation articles quickly became classical reading material for both 56 mc work as well as for the entire antenna design field.

Amateurs were astounded in 1935 when W2DEE was heard in Michigan on 56 mc. On June 22, 1935, W1CBJ worked W8CYE on 56 mc in a two-way contact over 900 miles. Over the next year, sufficient long distance contacts occurred to formulate a belief that sporadic communication could be supported beyond those normally reflected beyond the ionosphere.[2]

"…reflected beyond the ionosphere."

This enthusiasm for the ultra-highs carried over into contests conducted on the lower frequencies. While focusing on short-wave lengths, early Field Day exercises allowed UHF activity. Every FD from the second annual event in 1934 through the last pre-war exercise in 1941, contained references in the contest write-ups or soapboxes to the use of 56 mc. Indeed, much of the pioneering work on UHF in the 1930s grew out of these early Field Days. Ed Tilton, W1HDQ, achieved early fame and recognition by being the high-scorer on the 56 mc band during the 1934, 1934 and 1936 Field Days.

In 1936, G5BY was the first European to span the Atlantic on 56 MHz when his signals were heard by W2HXD. By the next year, the 5-meter band had been reduced to a 4 mc bandwidth between 56 and 60 mc. Very unstable oscillator rigs also had overpopulated the band. At the request of the ARRL, the FCC in 1938 imposed stabilization and power supply filtering requirements on 5 meters similar to that required on the low bands. This initially reduced activity on 5 meters but also indirectly led to experimentation on even higher frequencies, as hams simply moved their unstable equipment from 5 meters to 2 ½ meters. The FCC had recently reserved 112 to 118 mc and 224 mc as future amateur bands. By 1938, amateurs were expressly granted amateur privileges on 112 and 224 mc. Many hams moved to these higher frequencies to avoid the new regulations. Ironically, this would prove to be a boon in activity on these newer frequencies.

With better signal stability, 5-meter ops after 1938 did not have to contend with excessive QRM, and thus could concentrate on improving equipment, antennas and equipment. Eventually, crystal-controlled transmissions and superheterodyne receivers with relatively narrow IFs were developed for 5 meters, and that led to regular communications occurring over distances of 250 miles or more, especially on cw. With the longer distances that were now possible, more instances of E-skip on 5 meters were noted.

Field Days in the late 1930s continued with efforts on 56 mc. In the 1937 FD, W2DKJ used 56 mc exclusively, making 74 contacts. This was quite extraordinary for the time, as all equipment was transported to the tower at 40 Wall Street, NYC! The Tri-State Radio Club, W3GKI, located at High Point Park in New Jersey, and solely on 56 mc, made 62 contacts using only 15 to 18 watts of power. In a very early reference to another great VHF location, Mt. Greylock, with W1EFN making 33 QSOs that Field Day. Five other stations were also noted as working only on 56 mc that year.[3] In the 1938 Field Day, W2AJW made 73 of their 165 contacts on

1 *QST,* Oct. 1934, pp. 10-13+; *QST,* Nov. 1934, p. 9; "The Editor's Mill", *QST*, Oct. 1934, p. 9.
2 Orr, *VHF Handbook*.
3 *QST*, 11-37, pp. 12-13.

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56 mc. A 60-foot fire tower in New Jersey at the top of a hill 250 feet above sea level was used in the effort.[4] The leading Field Day crew in the 1939 FD, the Egyptian Radio Club of Alton, Illinois (W9AIU) made contacts on both 56 and 28 mc, as well as 14, 7 and 1.75 mc.[5] In the 1940 FD, a 112 mc distance record was set at 206 miles, only eight months after the frequency was first used in a UHF contest.

In 1938, the Varian brothers developed the Klystron tube capable of microwave output of significant amounts. In England, a resonant cavity was also developed. That same year, the distance record for 56 MHz was shattered when W1EYM made contact with W6DNS over a 2,500-mile contact on July 22, 1938. W1EYM used a rhombic antenna for receiving, with 240 feet on a leg.

The first "true" ultra-high contest that was actually completed was an international one. In 1938, the Radio Society of Great Britain sponsored a 56 mc International Contest. This was also a yearlong event, with distance points awarded and monthly reports sent to the RSGB. Any station in the world could enter. It was strictly a cw event – all types of modulated carriers and telephony were prohibited. This was possibly due to some countries only having cw authorization on 56 mc. The same station could only be worked once every seven days, and all stations had to be from a fixed location (unlike many domestic UHF events, including the UHF Relays, Marathons and especially FD). There was also a companion 56 mc reception-reporting contest, for those areas of the world not yet authorized for transmissions on 5 Meters.[6] A number of U.S. amateurs participated, and W9NY of Milwaukee, Wisconsin led the contest with over 100 contacts. He was on the air 338 days during 1938, running 300 watts input to a two-element, co-linear, in-phase antenna. Only 42 contacts made by W9NY were over 200 miles in distance, and 73 contacts were less than 200 miles.[7] Many years later in 1967, the League commented that "this very first v.h.f. contest was way ahead of its time."[8]

"The World Above 50 MHz"

UHF activity in general was becoming so recognized by the late 1930s that in December 1939, the League started a column in *QST* exclusively devoted to the higher bands. Ed Tilton, W1HDQ, was the column's first editor, or "conductor." Originally entitled "On the Ultra Highs," this column contributed greatly to knowledge of VHF activities in the early days of amateur radio. For a few months in 1942, the column's title was "Off the Ultra Highs," in a not so subtle reference to delays in developing a civilian wartime amateur radio service. The column's title was updated to "On the Very Highs" in May 1943, and was again changed to "The World Above 50 mc" in December 1945. Metric notation was adopted in January 1976, and the column became known as "The World Above 50 MHz." Other than a brief interlude between August 1944 through September 1945 (Tilton was then assigned to the Pacific with the U.S. Navy), the column has run continuously to the present day, and has been a focal point for the entire VHF community.

Radio Astronomy Got its Start with this Dish, Designed by Grote Reber.

Early ham-related ultra high transmissions showed evidence of tropospheric propagation, along with many instances of sporadic E and aurora propagation. For example, Vice Dawson, W9ZJB, of Kansas City, Mo. in 1939, made the first 56 mc "grand slam," having worked all nine U.S. call areas, with several contacts being made by sporadic-E. This accomplishment was considered so monumental at the time that it was noted in Tilton's very first *QST* column in December 1939. Amateurs were making these types of contacts at a time when some professional engineers still doubted atmospheric conditions could be used for radio communications.

A radio engineer, amateur radio operator, and avid DX and VHF enthusiast, Grote Reber, read about Karl Jansky's radio astronomy experiments. Starting in 1936 from his home in Wheaton, Illinois, Reber built a 32-foot diameter dish antenna in his backyard to listen to radio emissions from the skies. He also built most of his radio equipment, and some of his VHF/UHF receivers were on the cutting edge of technological design for the time. Reber conducted many of his experiments at VHF/UHF frequencies, having

Continued - VHF on Page 7

4 *QST*, 12-38, p. 28.
5 *QST*, 12-39, p. 35.
6 *QST*, 12-37, p. 53; 1-38, p. 62.
7 *QST*, 9-39, p. 58.
8 *QST*, 6-67, p. 66.

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Aurora Air Traffic Control Center

A Personal Tour

Duke Wahl, Jr., WA9WJB

Aurora ATC

I asked for and got a personal tour of the Aurora Air Traffic Control Center on West Indian Trail in Aurora, Illinois. In particular (because I am a ham), I asked for someone who was knowledgeable about the huge log periodic array antenna system and radio system(s) associated with it. There have long been rumors about the antenna history and I will now give you the real history and the radio systems present disposition.

I will identify the maintenance person only as "Earl." He seemed to be a very knowledgeable person, both in technology and history, the very person who could answer any and all questions. He was a bit quirky; he fit the ham operator mold perfectly.

We were led to a RESTRICTED area of the basement (that used to house the radar screen systems), to a storage area with a huge metal box that looked to be a large stand-up refrigerator. Grabbing the large handle that operated a draw bar and three large metal latches, the huge door swung open to reveal and almost empty room. I soon realized the door and walls were four inches thick, with sheet metal on both sides, with an RF seal all the way around the door. The room appeared as an RF shield room, with copper gaskets in all the joints, two layers of heavy sheet metal, both outside and in, with electric feed lines going to an RF-tight box, interior overhead light, and two feed lines, one 3-inch and the other 1.75-inch coax cable.

> *"…the door and walls were four inches thick…"*

I asked about the room and Earl said the company that built it (now out of business) claimed it was nuclear blast proof, although he noted that the other parts of the building and antenna system may not survive such a blast. I didn't question his comments on blast proof, but instead prefer to believe my instincts about it being an RF-shielded room and was probably EMP proof.

In any case, we stepped inside to find only a Motorola VHF radio cabinet, and a table with an old computer sitting on it. Earl said the computer was old and ran a Z80 system (A what?). He said they used to run an old version of DOS to control the radio and antenna system.

"OK, what radio system?" I asked. Earl said they had one Motorola VHF system, and two Harris LF radios. He told me the Harris model number, but I forgot. He said the then state-of-the-art Harris radios were capable of vestigial sideband, regular sideband USB LSB, AM, FM, and pulse (presumably CW also), continuous frequency coverage. (He didn't specify the frequency coverage.) The 1.75-inch coax was for the Motorola system and the 3-inch line was for the Harris low frequency system.

OK, where are the Harris LF radios? Earl said the system had been abandoned for the last 10 years! He did not say where the Harris radios were presently. I then started asking history questions about the system. He debunked every notion I had about what the radio system was for and why it was there. I was astounded.

When I first saw the monster log periodic antenna, it was just after the major fire at the AT&T switching facility in a western suburb of Chicago many years ago. Speculation was the antenna was used for backup emergency communications in case the Aurora ATC wire line services were ever interrupted again. Not true. Also speculation the antenna was used to communicate with overseas flights (HF) over the Atlantic Ocean. Not true.

OK, so what is this system used for anyway? Earl explained it was a radio system whereby Aurora ATC could call the "Post Office." Earl explained that during the 1960s in case of a nuclear attack, regular governmental agencies were instructed to report to the regular post office as a way to report to Washington, D.C. their situation after an attack. There was a radio system that some government agencies used

CONTINUED - AURORA ATC ON PAGE 7

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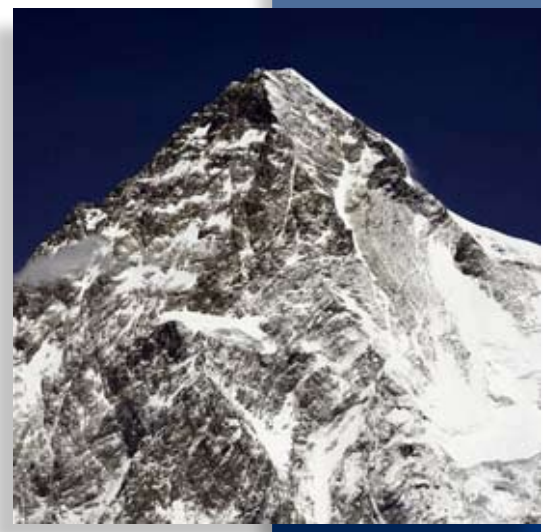
K2—A Fine Peak

Bob Ballantine, W8SU

Would I ever start another of these kit transceivers? No way, but I've got something I am very proud of and will be a conversation piece for years to come. Over the years I've noticed Elecraft has a good foothold in the kit community and knew from experience they've a fine entry with their K2. Specs don't lie. I've looked them over for years and the mere fact of my dwindling skills at age 66 has restrained the pleasure of a last kit build, until… The old days of Heathkit remain implanted in my soul and memory banks. At Elecraft the Benton Harbor spirit coexists with 21st century technology.

My secret desire was to build one of these and get it on the air. Friend, Dennis, WB8WTU, loaned me his pride and joy, an Elecraft K2, for nearly three months and I was hooked. The quality of the receiver was as good or exceeded my Kenwood rigs. How can a small single conversion receiver do it? They've got some good explanations on their Web site.

My own K2 premiered on 18 July at two fifteen Eastern Time on 14.062 MHz. Old friend Bud, W8EC, was hanging on and got the first QSO. A clean signal and a good report are all one could ask for at ten watts output. Low power, are you kidding? It cranks 15 watts plus out and that is more than enough to work the world.



It seemed, from the start, I couldn't go wrong with the unit because it was serial number 6146—that had to be a good omen.

Yet, I did have my problems with too many all night runs to get the unit completed. Two inductors had to be removed and one part, a 2.7 pf capacitor, got in there when it should have been a 47 PF NPO. The board is really built, despite parts removal, it held up just fine. Oh, forgot, corrected one solder splash fouling a regulator circuit, and I was in business. Gary Surrency, Elecraft factory rep, was a gem on the Internet for instant help; he hung in there until the very end.

Hurrah! 6146 is history and ready in all respects. Filtering is steep-skirted just like K2, the second highest mountain in the world. What a babe! ■

K9YA Spring Pizza Bash

(L to R) George, K9GDT; Ron, K9KLT; Duke, WA9WJB

(L to R) Duke, WA9WJB; Steve, N9WAT; Philip, K9PL; Mike, N9BOR; Pete, W9RMB; Don, KB9WBM; Arny, W9FO; Dave, NE9H

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The Regenerative Repeater

An Adventure on 1120 kHz

Rod Newkirk, VA3ZBB/W9BRD

Harry Caray

In the late 1940s the Chicago Cubs, as usual were not burning up the league. They were on a road trip. It would be nice if they could lick the Cardinals just once in their own ball park. My dad and I were following them on KMOX. The signal from St. Louis on our five-tube parlor superhet was fair, just above the noise level.

It was a close game. Our hapless heroes got the bases loaded with one out. Harry Caray and Gabby Street announced a great game with plenty of erudite baseball pointers. Then KMOX took a nosedive below noise level. We had to get that next play, so I ran into my ham shack and turned on my two-tube regenerative blooper. Its 160-meter coil covered the upper half of the broadcast band. I located KMOX on the uncalibrated dial and cranked up the regeneration. "It's coming in okay now," shouted dad from the living room. The St. Louis signal was now loud and clear, just in time to have the next batter hit into a double play. I snapped off the blooper.

Dad reported the signal abruptly back down into the noise level. I went back and turned on the two-tuber. KMOX's signal was loud and clear again. I turned off the blooper and the signal was back in the noise. I repeated the process again and again. With the regenerative set working, the station was more than readable in the parlor. Without the blooper turned on. Harry Caray was unintelligible in the noise.

Very interesting, indeed. The blooper's antenna was a piece of hookup wire running around the shack. How was the enhanced regenerative signal getting into the superhet two rooms away? Maybe via the AC line. I dragged up my brother-in-law's battery BC portable and established that the beefed-up signal was in the air throughout the premises and beyond. The arrangement worked equally well on other signals besides KMOX, so long as regeneration was set just below oscillation.

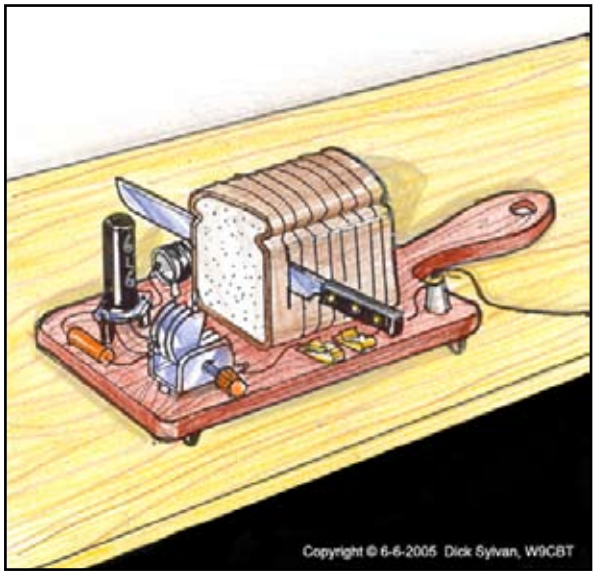
We're talking extreme QRP here. The blooper's regen circuit had about 40 volts with miniscule current, yet it added 10 or 15 dB to the KMOX signal in the parlor. The set-up was a single-frequency repeater system. I visualized a 50-watt regenerator on a hilltop location covering Chicago's north side. But Chicago had no hilltops.

My subsequent research into the subject of regenerative RF relay bore little fruit. A yellowing library copy of Mary Loomis's radio schools handbook indicates that such a repeater system was used briefly in the 1920s to enhance transoceanic signals for a select New Jersey clientele but details are sketchy. My wizened brain turned another way. If such regeneration strengthens a signal what would degeneration do? Suck in the signal and cause a little black hole to appear in the broadcast band? Reversing the power leads to the blooper won't do it. I haven't devised a circuit yet that will suitably degenerate. Any suggestions? Oh, as a footnote to wireless history, the Cubs lost 4 to 3. ■

KMOX 1120 the voice of St. Louis

Click HERE for Supplemental Drawing

Ham Lingo DICK SYLVAN, W9CBT



BREADBOARD PROTOTYPE

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Continued - VHF from Page 3

attempted radio observations first on 3,300 mc and then on 900 mc. In 1939, Reber confirmed Jansky's earlier discovery by listening for radio signals at 160 mc, slightly above our present day 2-meter band. By methodically mapping all the radio sources he could detect, Reber by 1941, had completed the world's first radio sky survey. For almost a ten-year period before and during WWII, he was the only radio astronomer in the world. It was only many years later that both Jansky's and Reber's early and groundbreaking work became widely recognized and honored. Reber's results were eventually published in many scientific journals, and his Sky Surveys became the standard reference manual for all radio astronomers for many years. Today, his contributions to radio astronomy are considered so important that his original parabolic antenna (as well as a replica of Jansky's original antenna) is on permanent display at the National Radio Astronomy Observatory (NRAO) site at Green bank, West Virginia. Reber's amateur radio callsign, W9GFZ, is now in use by the NRAO amateur radio club.[9]

The original radio astronomy parabolic dish antenna of Grote Reber drew so much interest in his hometown that it became a minor tourist attraction. The dish antenna was custom designed by Reber at a time in which television antennas only existed in a few experimental research laboratories around the country. The photo was taken in Reber's backyard in Wheaton sometime after 1936. The wooden platform in front of the antenna was used for servicing the focal point apparatus.[10] ■

9 NRAO Website, Ham Radio Connection sub-page: http://www.nrao.edu/.

10 Photo from *QST*, _____.

Your Most Interesting QSO

What was your most interesting QSO? What made it so special? Was it the other op, the time, the place or something else that made it so memorable?

Perhaps your QSO was with a legendary ham or with an operator whose fame was celebrated outside the amateur community: a performer, military figure, scientist, politician or head of state.

Maybe it was your first or 10,000th QSO, but it stands out from all the others.

Share your special QSO with other *K9YA Telegraph* readers by sending your story to:

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Continued - AURORA ATC from Page 4

to report back to Washington, D.C. after an attack, to report their situation and status. Aurora ATC was mandated to use such a radio system, SIMPLY to call Washington and tell them, as Earl put it, "We're still here." Nothing more.

They used the radio system once a month to "check in" to the Washington, D.C. net, but after check in, they (the technicians) used it for their own private SWL station. (Sweet, really sweet.) Earl recalled they would play with the radio system during their spare time and listen to underground European radio stations. He said a German underground radio station had played some really strange music. That SWL activity continued until they were instructed to remove the radios because the emergency radio system was no longer used.

OK, now the antenna part. Earl said an "outside" maintenance company serviced the periodic antenna periodically (Cute, huh? Periodic right?) Anyway, Earl would accompany the maintenance crew and described the high wire act they performed to get on top of the antenna and walk the boom–yes–walk the boom. They did not use a crane.

After they climbed the top of the tower, there was no ladder to get atop the boom, so the climber would throw a large rope over the top of the boom and climb the rope bare- handed (I found Earl's story a bit hard to believe, but he continued). After which, the climber would walk the boom from end to end, perform his inspections or repairs, then depart the boom the same way he got up there, with the rope.

I asked the final series of questions relating to the use of the antenna. Earl said it's been inactive for the last 10 years. I asked why the antenna has been in different positions from time to time. Earl said the CHAIN DRIVE was broken again, and since the antenna hasn't been in use, it just changes directions in strong winds against the brake system. The brake system is intended to slip in very high winds and let the antenna find its own direction.

Earl jokingly said this stuff might go on government surplus. I wouldn't be surprised.

So there you have it folks. The system wasn't used for much, it probably cost lots of tax dollars to implement, was used very little, and is now obsolete and blowing in the wind. I was so numbed by the enormity of it all, I forgot to ask if the ATC had a ham Club. Oh rats! ■

7

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Volume 6, Issue 6

Continued - NORCAL 2N2/20 from Page 1

welcoming group; if you have a problem, it's more than likely been addressed. I would not attempt to build the kit without first subscribing.

Another invaluable aid to assembling the 2N2 is the detailed construction pictorial generously provided by Chuck Adams, K7QO, at: http://www.k7qo.net/ (Removed as of 18 April 2008.)

Rear Panel View of Norcal 2N2/20

Peaking and fine-tuning the completed kit was a time consuming, but worthwhile task; winding up with a sensitive and selective receiver and 5 watts output at 13.8 volts. At first, the receiver seemed quite deaf no matter how much I fiddled with the trimmers. I queried the 2N2 Yahoo group and that same day K8IQY came back with the answer: tweak the local oscillator a bit higher to match the rig's passband; that did the trick and that morning 20-meters erupted with domestic and DX signals. The 2NT's tuning is blessed with a 10-turn potentiometer easing separation of signals on the now only occasionally busy 20-meter band. On the downside, until warmed up, the receiver is plagued by oscillations, "sweepers" are readily apparent for the first 5 to 10 minutes following a cold start.

Using the NorCal digital power meter simplified the transmitter peaking procedure; a few minutes of back and forth between three trimmers obtained more than 6 watts output (at 13.8 v.), but I kicked it back to 5 watts.

To further enhance stability, a late modification included the replacement of Q20 (2N4124) an RF gain transistor, with a 2N3904 transistor and replacement of resistor R75, 4.7K, with a 2.2K resistor.

As built the rig's sidetone level was way too loud—downright painful—until two 10-megohm resistors in series were inserted at R14. From the 2N2 group I read that R14 may be omitted to even further attenuate the sidetone level.

The rig does not include a built-in keyer or power switch. If I eventually miss having a power switch it will be no problem to add one. It would be helpful to have a built-in keyer, especially when operating portable, but that lapse, too, is easy to remedy with one of the many tiny keyers available.

On The Air

With the rig hooked to a 20-meter dipole P4ØMH was snagged with a single call on the rig's maiden voyage only seconds after adjusting the sidetone level. This was followed by a QRP-to-QRP ragchew with an op in Nova Scotia, then on to a few numbers harvested in the FISTS Sprint.

The rig's QSK is unobtrusive. Transitioning between transmit and receive is smooth and displays no popping or other untoward characteristics. The RF gain is not linear, rather almost all on or all off at about the three-quarters rotation point of the control knob. This characteristic disturbs some operators, but since I run my rig's RF control full on it has not (yet) been much of a concern.

Despite the mods described above my rig still drifts. After the first couple of QSOs I learned to turn the rig on about 15 minutes before operating to minimize drift and banish "sweepers."

As of the writing of this article, March 2009, ordering has been suspended for all kits at the NorCal QRP Club Web site. According to a post on the 2N2 group, sales will resume around June 1, 2009. ■

http://www.norcalqrp.org/nc2n2xx.htm

Fully Populated PCB for Norcal 2N2/20

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