K9YA Telegraph

Robert F. Heytow Memorial Radio Club

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Cyclone 40

QRP Transceiver Kit by NMØS and 4SQRP

Philip Cala-Lazar, K9PL

When the 4SQRP Group announced the Cyclone 40 40-meter QRP transceiver kit last summer we featured it in our July 2013 issue. Here is my review of that kit.

Eager QRP'ers quickly snapped up the first run of 100 kits. The second run differed from the first with the provision of the Revision A printed circuit board. The first run of Cyclone 40 boards required several operator/builder performed modifications to the circuit. Starting with serial number 100 the supplied boards were revised and require only one simple to install jumper modification. When building your kit, be sure to use the latest assembly manual—it is a "living document" updated as needed. Mine was built according to Assembly Manual, Revision A.0.

"SAVE THE LEADS!"

The Build

My kit, serial number 108, arrived shortly after mail ordering it with its full complement of components–nothing missing. Kudos to the 4SQRP Group kitting and order fulfillment teams. As I inventoried the kit's parts I arranged the components into groups and singletons and labeled them with Post-it® notes. That well-invested 60 minutes saved me time overall by minimizing PCB populating errors.

Included with the kit is a compact (4.4' x 3.6' x 1.9') DIY enclosure comprised of precut, predrilled and silk-screened PCB stock. The builder spot solders the four sides; the top and bottom are screwed on, resulting in an attractive and trendy piano black and white custom case. I chose to darken the PCB's raw abutting edges with a black Sharpie® permanent marker.

Kit assembly over three laid-back evenings progressed without any hitches or head scratching over unclear assembly instructions. To improve access and keep the board clear of the working surface I added temporary stand-offs to the PCB's four corners.

Resistor R9, 470Ω, is color-coded in the manual's list of resistors as Yellow-Red-Brown, but should be Yellow-Violet-Brown.

The kit requires winding three toroids and a coil on form for the permeability-tuned oscillator (PTO). In addition to the threaded nylon coil on form, the PTO comprises a brass screw and two wire supports. The two supports are formed from wire salvaged from dipped silver mica capacitor C15's trimmed leads. As the manual cautions, "SAVE THE LEADS!" you will need them when constructing the PTO as detailed on page 13. There are no smoke tests–testing and alignment are performed when the board is completed.

Alignment is mostly straightforward, a matter of peaking two transmit-mixer transformers and adjusting the balance and offset potentiometers. A bit more fiddly is the PTO adjustment–compress-

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How Does a Callsign from IL Become /MM

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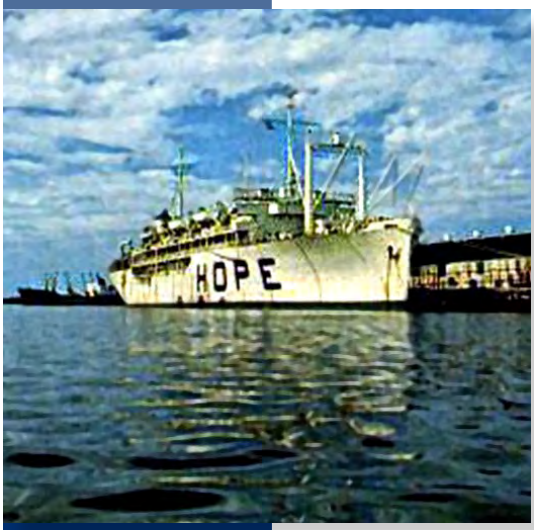

SS *Hope*

Some of us arrived in amateur radio in our teen or pre-teen years for the thrill of making new friends in distant places, of building things that ran on voltages that should have frightened our mothers, and to bring us closer to some of the places we had seen in *National Geographic* and we might never visit otherwise. Some of us had been launched on a path pretty well charted toward getting the best possible education and progressing toward responsible adulthood with little or no thought of what might arise to upset the apple cart (like the Vietnam War) or that might lead us off on some adventure that suddenly appeared on the murky horizon.

But, my pal, Roger Whitaker, K9LJB, who grew up in landlocked Central Illinois, surrounded by corn and soybean fields, ended up with the opportunity to experience real seasickness for the first time while dramatically interrupting his well-conceived education plan. And he volunteered for it!

"Do you remember the SS Hope?"

Do you remember the SS *Hope*?

Gee, that rings a bell.

(Well, what some young hams wouldn't do to get their hands on some Collins gear!)

The SS *Hope* began life as a hospital ship toward the end of World War II. Commissioned the USS *Consolation*, having been built in 1944, she served the Navy from 1945-1955. She arrived in the Pacific and was stationed at Japan after VJ Day serving the occupation forces' medical needs. She continued her medical mission with the Navy through the Korean "conflict" (what a misnomer that was!) and was decommissioned at the end of 1955. However, she began a new life in 1960, being chartered to the People to People Health Foundation and renamed SS *Hope*, an acronym for Health Opportunity for People Everywhere. In her new peacetime role, she provided much needed medical services to quite a number of less advanced areas of the world, including South Vietnam, Peru, Ecuador, Guinea, Nicaragua, Colombia, Sri Lanka, Tunisia, Jamaica and Brazil. Her career ended in 1974, when the foundation transitioned its medical service to more land-based efforts.

Consolation began its service the year before Roger was born. At age 11, in rural Central Illinois, Roger had already been infected by the amateur radio bug and, for the usual reasons, the Federal Communications Commission granted him permission to use the call sign KN9LJB on the air. His mother didn't have the slightest idea what those voltages were that were really running around in that DX-40, but she knew her son wasn't out cruising the bars, either. In fact, she was so convinced that her son was on a constructive course that she actually learned the code with him, and got her own Novice license, letting it lapse once he was on his way. That was a shame. I'm sure she had no idea that radio license could have been useful later in tracking her son once he set out on his great adventures.

Roger followed the program, probably getting into the same radio scraps as most of us through high school, working his share of DX and showing off his rig to whomever of the opposite sex might be interested enough to want a peek. After high school, he went east to go to college, Champaign-Urbana, to be exact, about 100 miles from home, where there was and still is one of the world's premier engineering schools. Having been thoroughly permeated with the theory of oscillations, however, Roger decided a stint out west was in order, so he transferred to Rolla, Missouri.

But, over the summer break after his junior year and with only one academic year to go before getting that coveted sheepskin, he got a life changing phone call from an older ham buddy. That call would disrupt the pattern of oscillation and Roger's trajectory was headed much further east.

Roger's pal, not unlike many other hams, believed public service was all part of the game, and it was fun. He ran phone patches. Again, these were the days before cell phones; calling plans that didn't cost

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a half-month's salary, the Internet, text messaging, or e-mail. Amateur radio operators actually had a separate interface (that term wasn't in common usage then, either) that could be connected between the landline telephone system and their receivers and transmitters. Again, notice, please, the reference to receivers and transmitters. This was the era before the proliferation of "transceivers," being a single cabinet about the size of a portable typewriter case (what's that?), where all transmit and receive functions were performed in one convenient box. At that time, only spies and espionage agents, the military, and some very lucky hams had transceivers. Phone patching, however, was a service provided by amateurs through which people in distant places could stay in touch with loved ones and actually hear their voices. If you adjusted your receiver properly, the guy on the other end wouldn't sound like Donald Duck. Phone patches kept overseas military personnel in touch with the folks back home. By the time of the Vietnam War, a ham named Barry Goldwater, K7UGA, a United States senator and presidential candidate, became famous in the amateur radio world keeping the GIs in Southeast Asia in touch with their families and loved ones at home. But, I digress.

Anyway, the phone-patcher told Roger that the organization that ran the SS *Hope* was having trouble locating an amateur radio operator for its upcoming mission to Tunisia. Roger knew what the *Hope* was. And, being the astute DX'er, he knew where Tunisia was.

Now, it is noteworthy to interject that the *Hope* had a very nicely equipped amateur radio operating position in addition to its then up-to-date complement of electronics and communication equipment. It had enough work to keep a maritime radio operator quite busy, and because it was illegal to hire someone to operate amateur radio, Roger booked onboard for other maintenance services, not exactly a cabin boy on a party boat.

> *"…the finest communications equipment…"*

One wouldn't ordinarily be surprised to hear that one of the most modern amateur radio stations might have one of the new "transceivers." The SS *Hope* had the best, made by Collins Radio. Collins, with its landlocked headquarters in Iowa, was doing a very healthy business manufacturing some of the finest communications equipment for broadcast, military and amateur use. Some of that employed the new "single sideband" technology. The *Hope* also had heavy artillery to use with the Collins, a nice big Henry linear amplifier. And to top it off (pun intended) there was a big Mosley triband beam mounted at a height of about 125 feet above the waterline.

Now, what ham wouldn't jump at that opportunity? Did it bother Roger that he had never been surrounded by water all the way to the horizon in all directions? Did he really understand what it might mean to postpone that engineering degree for a 9-month stint on the *Hope*? Did the fact that there were young nurses on board make any difference? (Of course not, it was that Collins-Henry-Mosley combination that made the prospect of an interruption of an engineering degree path worthwhile. By the way, what is a slide rule?) So, after a short period of soul-searching, off he went on the Tunisian mission of the SS *Hope*.

K9LJB at Sea

After a family drive to the departure point, Roger made it safely on board for what was expected to be a six-day crossing to Tunisia. It had taken almost as long to drive from Central Illinois to the East Coast.

The adventure was proceeding according to plan. But then Roger fell victim to more serendipity. Not long after their arrival in Tunisia, an American sailboat arrived in the port at Tunis. It was a 56-foot long ketch-rigged wooden hulled sailing beauty. The sailors were from New York and were acquainted with one of the physicians on board the *Hope*. They had a problem and wondered whether someone on board the *Hope* might be able to repair the autopilot. Roger, ever the eager engineering student and wizard, stepped forward. Sizing up the problem, his diagnosis was spot on and an impressive repair was accomplished. Roger explained, "The autopilot was relatively simple and included a couple of tubes so it needed a high voltage plate supply of around 250 Volts." He continued, "The 250 Volts was produced by a WWII surplus ARC-5 receiver dynamotor, about the size of a #303 can. The battery voltage on the boat was 32 volts while the dynamotor was the common 24-volt variety so there was a large dropping resistor to adjust the voltage. The problem was that the dynamotor's brushes were completely worn out and were no longer making good contact."

Roger then described the fix: "Since WWII aircraft radio dynamotor brushes were not obviously avail-

CONTINUED - CALLSIGN FROM ILLINOIS ON PAGE 7

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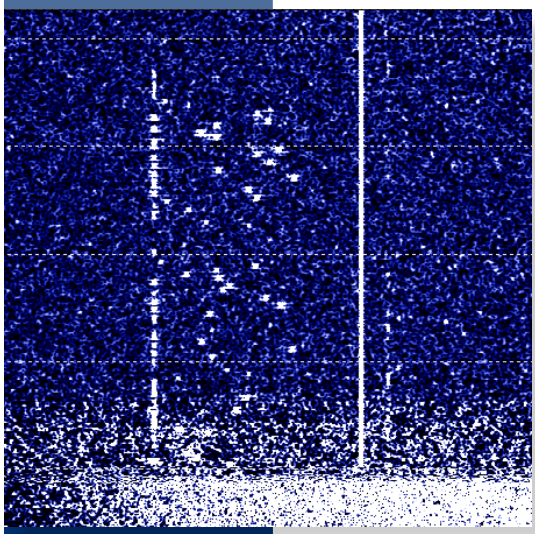
Digital Modes Revisited

"One if by Land, Two if by Sea"

Paul W. Ross, W3FIS



JT65 Signal on Waterfall Display

The effectiveness of digital modes such as JT65 and JT9 hinges upon pre-arranged messages (in most part), sent at specific times, and of a known message structure. Longfellow's poem of the "Midnight Ride of Paul Revere" still has meaning to us even centuries later. The message to be sent to Revere was to be of a certain structure, at a certain time, and unambigious in its meaning. The same applies to JT65 and JT9.

The propagation gods do not appear to have been smiling on us these days. All I hear is grumbling about poor band conditions, lack of QSOs, etc. So, what is a poor amateur radio operator to do?

My situation is no different than most hams these days. We labor under the restrictions of home owner's associations, QRM from all the electronics in our houses, coronal mass ejections and a host of other issues. Well, the answer is to look again more closely at some of the vast variety of digital modes available to us. One that has become quite popular is JT65-HF and, its new little brother, JT9. I'd like to examine them both in detail, and see what is really going on with these modes.

"Put on your headphones"

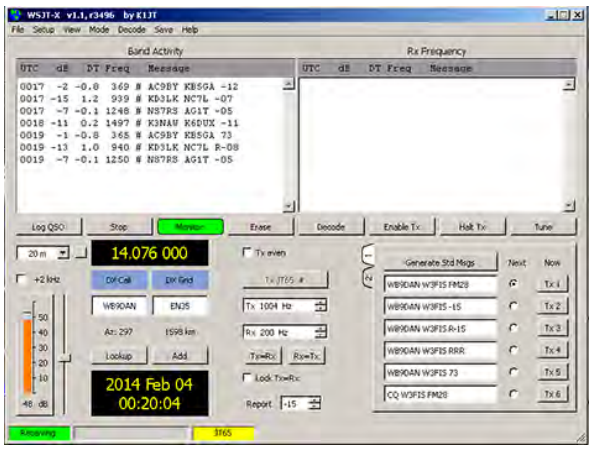
The original software was developed for EME–Earth-Moon-Earth communications by Joe Taylor, K1JT. Unless you have a real "antenna farm," and can deal with the path losses involved–read this as hundreds of decibels, and the need for "full gallon" transmitters, running EME as originally contrived is not for the faint of heart. The software technology has been of sufficient interest to cause it to be re-purposed for HF communications, which is what will be discussed here.

Well, how do JT65 and JT9 work, and why are they such interesting modes? Like almost all digital modes, you can usually communicate with them during less-than-optimal band conditions. Further, since these modes use keyboard-to-keyboard operation, this results in a much more tranquil domestic environment, and a substantially happier XYL. Who among us had not heard the cry of "Close the door," or "Put on your headphones," when you run your radios!

First, some basic considerations for the hardware, then on to the ideas implemented in JT65 and JT9 software. Any digital mode requires:

1. A SSB transceiver. A very modest power of 5 to 10 watts is more than sufficient. It may or may not have a digital mode connection. If you don't, just use the microphone jack, PTT line and audio output from the headphone or speaker jack.
2. A computer–ususally a "Windows" machine, though a great deal of digital mode software is available for Linux based systems. I have even run FLDIGI successfully on a Raspberry Pi system, which is about as simple as you can get.
3. An interface between your computer and radio, which performs these tasks:

   - Sends the digital signal from the computer to the microphone or data input on the radio via a sound card.
   - Receives the audio signal and converts it via a sound card to the digital signal needed by your computer.



JT9 Screen using WSJT Software

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- Implements a "Push to Talk" control to key up your transmitter. Sometimes, the VOX capability of your radio can be used, but the commercial or home-built interfaces are a "path of least resistance."

There are a number of excellent commercial interfaces on the market, or if you have the bits and pieces, one can be easily built using your computer's sound card instead of using the one in the commercial interface.

In addition, for JT65 and JT9, it is necessary to closely synchonize your computer's clock to the nearest second-remember, we said that we agreed to look for a signal only at pre-arranged times. This means you have to syncronize your computer's clock with WWV or some other reliable time source. Dimension 4 software, or comparable packages, will work. If you are working in the field and do not have an Internet connection, then you may have to deal with clock drift on your computer, unless you can coax a GPS into giving you accurate time information.

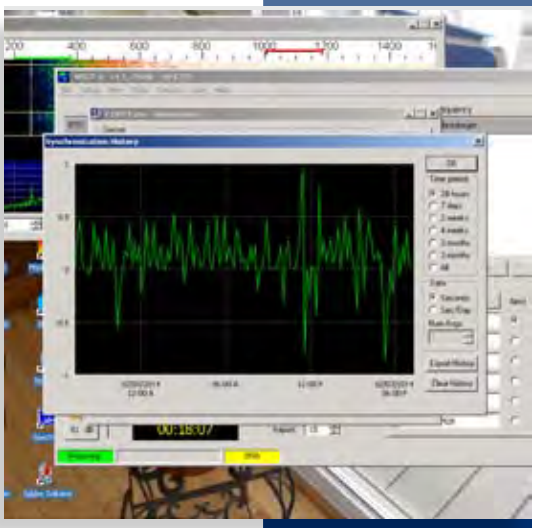
We mentioned that JT65 and JT9 use structured messages. Basically, they support the call signs of the two stations in contact, and ancillary information such as "CQ," "73," "RRR" and a signal report. There is also a limited capability for 13-character messages. In addition to the message itself, a substantial amount of forward error correcting information is included as a Reed-Solomon coding scheme. This is an amazingly robust coding technique. You may be aware, but the Reed-Solomon coding technique is used in the ubiquitious "Q" codes, and your music CDs.

Ham Quips

DICK SYLVAN, W9CBT

"DUMMY LOAD"

What about "65" and "9"? Well, these simply refer to the number of tones used in the transmission. JT65 uses a wider bandwidth than JT9. The JT9 software interface is somewhat easier to use, but fairly comparable results can be obtained with either technique, in my exprience. Files that offer extensive documentation about both modes are provided with each package—great bedtime reading!



Dimension 4, Time Screen

To get started, assuming you have all of the necessary hardware, download JT65/JT9 from a site such as Sourceforge, or do a "Google" search. Don't forget to get a clock syncronization program as well. Install the program, and run the setup. The basic things you have to do during setup are:

- Identify yourself—your call sign.
- Your location—the Maidenhead Grid Square. I am at FM28KL.
- Set the sound card options—you will have to read the documentation that comes with your interface, if you are using a commercial interface. The details are also operating system dependent.

You can use your software to control you transmitting frequency, but the common "watering holes" are as follows—all *USB.*

- **1838**
- **3576**
- **7076**
- **10139**
- **14076**
- **21076**
- **28076**

What Constitutes a QSO in these modes?

- Your callsign.
- Their callsign
- Location (Maidenhead Grid Square).
- Signal reports (in decibels).

For those with lots of time and little to say… Paul Revere would feel right at home with JT65 and JT9! ■

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The SuperRX

80-Meter Receiver Kit

Duke Wahl, Jr., WA9WJB

I purchased the SuperRX as a kit in the mid-90s and intended to build a transceiver around this receiver, but I never got around to it. Eventually I found it in a box in my crawl space and decided, finally, to build it.

It is a monobander with the appropriate parts determined at kit building time. The first stage (U1-NE602) converts down from 3.5MHz to 455KHz. What follows is the 455KHz filter (FL1). The signal is then fed into a variable IF amplifier (U2-MC3340) to control the gain. Next up is the 455KHz detector stage, which beats against a 455KHz oscillator. The last stage is the (U4-LM380) audio amp.

The unit draws about 30mA on receive. The first three stages probably draw only 10mA, but the LM380 audio amp probably draws the most current at 20mA.

The 455 detector stage can be skewed to receive USB or LSB (or DSB like a DC receiver.

The 40-meter TenTec QRP rig I built this summer taught me a few tricks. If I were to redesign this receiver, I would UP-convert to 11MHz (like the TenTec QRP receiver). The reason is simple; you can get a tighter bandwidth by converting UP, and making your own narrow crystal filter from stock 11 MHz clock crystals (like TenTec did).

TenTec uses discrete parts where this receiver uses IC amps (NE602 & MC3340 chips). The NE602 chips are obsolete, but you can substitute with the improved version, SE612 chip. You can design a decent receiver using a whole lot less parts using chips instead of discrete components.

I use 30-ohm headphones with a stereo jack. I wanted to include batteries in the chassis, but the chassis was too small, so I ordered the extended case and it should be here soon. The batteries are eight AA cells in a pack. They could be replaced with rechargeable Lithium Ion batteries–probably a better choice.

The chassis is anodized black extruded aluminum that offers maximum mechanical stability for tuning. Nothing wobbles, so the frequency stays very stable even with handling and bumping around. If the dial doesn't move, neither will the frequency.

As is, the receiver is a decent little unit. I copied 80-meter traffic with 15 feet of wire in my hotel room. I was using a wall wart to power the unit, but switched to batteries after I discovered a much lower noise level with batteries. The noise was being conducted into the receiver through the wall wart. The batteries offered great isolation from the electrical noises in the hotel.

"Nothing wobbles…"

The NE602 variable oscillator is not very stable. It drifts with time, temperature and oscillator demand. It is very stable with a crystal plugged into the NE602, or with a frequency synthesizer.

For an antenna, I intend to make a small tuned loop for the bicycle. ■

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Continued - Callsign from Illinois from Page 3

able in Tunis' harbor, I suggested that I could cobble together a power supply from the junk box on the ship so the auto pilot could work when the generator was running. That turned out to be quite satisfactory since the only time the autopilot was used was at mealtime so everyone could eat together. The generator was customarily run then to power the electric stove and recharge the batteries, which ran the lights, loran and stereo system.

"I built the power supply breadboard style such that it could be screwed to the bulkhead inside the cabinet where the autopilot unit was mounted. I returned the next day, installed it, and tested it."

Obviously, Roger had progressed much further than building his old Heathkit DX-40! Had they taught this stuff at the fancy engineering schools?

The fix worked. Seeing how useful it might be to have someone of Roger's talents on board their vessel, the sailors made him an offer to return him to the Western Hemisphere in their 56' ocean-going sailboat. It wasn't quite what he had signed on to do and Roger was conflicted. The brass on the *Hope* was amenable to the proposition and saw the opportunity that the new assignment would give to their young phone-patcher. Besides, the regular radio operator had decided to re-up, having found the nurses on board were enough of a diversion to entice him away from seeking a new assignment after the *Hope* had reached Tunis; there might be enough free time to do a little phone-patching after all.

"It wasn't easy."

So, again throwing caution and prudence to the wind, Roger signed off from the KWM-2—Henry—Moseley combination. He gave two weeks notice and said good-bye to the *Hope*. The amateur radio coordinator for the *Hope* then arranged for shipment of a Galaxy V transceiver and triband vertical antenna to equip Roger's westward crossing of the Atlantic.

After leaving the *Hope*, Roger flew via Algiers to Casablanca and then on to Tangiers. With a stopover there, he was able to tour Tangiers and caught the ferry across the straits. Once in Gibraltar, there was some work to do on the boat before departing on the second great adventure. The owners spent a week visiting friends in Europe and Roger got a personalized tour of "The Rock" from the commander. A couple of side trips to the casino didn't clean out his treasury, however.

Departing Gibraltar, Roger and the crew sailed down the coast of Morocco to Casablanca and anchored at the yacht club just in time for engine trouble to appear. "Mechanics from the local Mercedes dealer spent about four or five days with us getting the engine fixed. While we had everything apart, I noticed that the brushes in the Onan generator were badly worn. There was no Onan dealer in Casablanca, but we were able to find some brushes that were larger so I could file them down to fit." Another brush with destiny!

Roger, K9LJB in his Home Shack

"While in Casablanca, we took in some of the nightlife and then made a side trip down to Marrakech and an oasis at the foot of the Atlas Mountains. When we finally sailed out of Casablanca, we went across to Las Palmas in the Canary Islands and were there for Christmas. We shopped at the local market to stock up on provisions for the crossing and, after about three days, set out for Barbados.

"We saw one ship the first day out of the Canaries and one ship the same day we landed in Barbados. Otherwise we had the ocean to ourselves, except for the dolphins, orcas and the fish. The crossing took 28 days, which was a bit longer than expected because we were set back by winds as high as 80 knots and seas of around 20 feet which we had to run off before, costing us almost 500 hundred miles in mid-ocean." Aha, finally, something to make the trip interesting!

"When we arrived in Barbados, I spent one day there and flew back home the following day, just in time to get back in school for the spring semester."

Imagine that, living on a sailboat for several months, testing the effectiveness of salt water as a ground plane for a vertical, while he prolonged the pursuit of an engineering degree. As we say, somebody had to make the sacrifice. It might as well have been Roger.

I was left with one question: "Roger, just how could you manage to sit in a classroom again after that?" Roger, smiling, said, "It wasn't easy." ■

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Continued - Cyclone 40 from Page 1

ing and spreading turns on the coil you've already wound and securing them with clear nail polish once the sweet spot is found. While performing this test I maintained magnet wire positioning between compressions and expansions with a strip of adhesive tape. My Cyclone 40 tunes from 7.000 to 7.125+ MHz.

The Cyclone 40 does not include RIT or a built in keyer. Provision is made on the board for wiring in the keyer of your choice. Frequency readout is by Morse annunciation accessed by a tactile switch on the enclosure's left side.

RF Power Output, selected frequencies, at 12 volts into a 50-ohm dummy load.

7.000 5.2 watts

7.025 5.1 watts

7.050 5.0 watts

7.058 5.0 watts

7.100 4.7 watts

7.121 4.6 watts

As built, from cold, my rig drifted approximately 1.5 kHz over a 15-20 minute warm-up period. Once stabilized the rig drifted about 100 Hz following periods of keying. To minimize drift I worked with the crew at 4SQRP and added 4SQRP-supplied heat sinks at U2 (78M05) and Q6 (2N7000) to supplement the furnished with kit heat sink at Q8 (MPF102). From cold, these additions reduced drift to 1 kHz over a 15-20 minute warm-up period.

Finally, the solution I and some other Cyclone 40 owners settled on was to operate with the rig's top cover removed. So set up, the rig drifts approximately 900 Hz from cold and heating-cooling cycles are moderated during operating sessions.

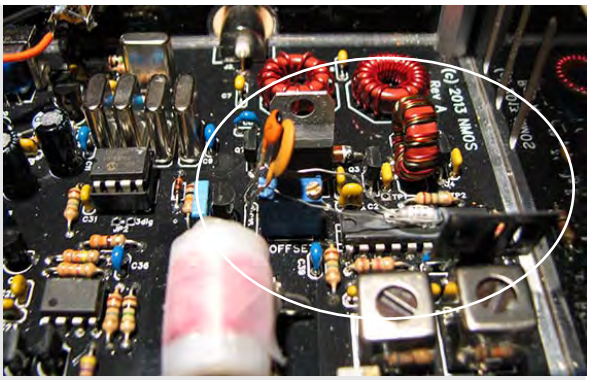
On the Air

My first few QSOs were to Ottumwa, Iowa, RST 449 (251 miles); Ravenswood, WV, RST 578 (the 8 Tone due to the poorly filtered power supply first used) and drift (383 miles); Dickson, Tenn., RST 599 (TN QSO Party—so we're all 599—413 miles); Hastings, Minn., RST 579 (315 miles); Springfield, Ohio, RST 559 (251 miles); and Columbus, Ohio, RST 559 (288 miles). All QSOs were worked on my 10-80 fan dipole at 25 feet.

The rig's receiver is quite sensitive. Within a few minutes of nighttime listening at the lower end of the band during mediocre conditions I copied EA8, F5, SJ2 and a PY to PP QSO—sensitive, yes, but also quite resistant to blasting when tuning across strong signals thanks to its effective AGC design.

Listening through an inexpensive pair of Sony earbuds the Cyclone 40's received audio is pleasant and non-fatiguing over extended operating periods. For me, the rig supplies sufficient audio output to minimize strained eardrums. For ragchewing and casual operating the rig's filtering does a fine job of separating nearby signals. If needed, an add-on filter like 4SQRP's Hi-Per-Mite (*K9YA Telegraph*, February 2013) or the New England QRP Club's NEScaf (*K9YA Telegraph*, July 2011) will do the job and boost audio output if desired. ■

Click **HERE** to subscribe to the Cyclone 40 Yahoo! Group.



Addendum

In mid-March the 4SQRP Group announced the Cyclone 40 PTO Modification and mailed the components to Cyclone 40 owners. According to 4SQRP, "This simple mod will reduce the drift considerably, and in some cases eliminate it for all practical purposes." The drift is attributed to minor heating of component U1, a 74HC240.

It is a very simple two-component mod, consisting of 150pF NP0 and 180pF polystyrene caps. For my particular rig, a 10pF cap was paralleled with the 150pF cap to return the base frequency to 7.000 MHz, and the heat sinks added in the previous mod removed.

The mod works, from cold my rig now drifts up 120 Hz and stabilizes. During operating sessions, receive and transmit, the rig does not noticeably budge, and the enclosure lid stays on.

Thanks to all at the 4SQRP Group for their range of economical, high quality kits and ongoing builders' support.

Mod information and photos at:

http://www.4sqrp.com/kits/cyclone/cyclone_pto_mod.html

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