



# The VHF Transmitter

Keystone VHF Club, Inc.

W3HZU

Founded 1955 – York, PA



VOL 62 No 3

CIRCULATION 186

March, 2017

## New Amplifiers for 2 meters & 70 cm

During contests and normal QSO's, the club is going to be heard a lot better on 2 meters & 70 cm. **Delivered!**

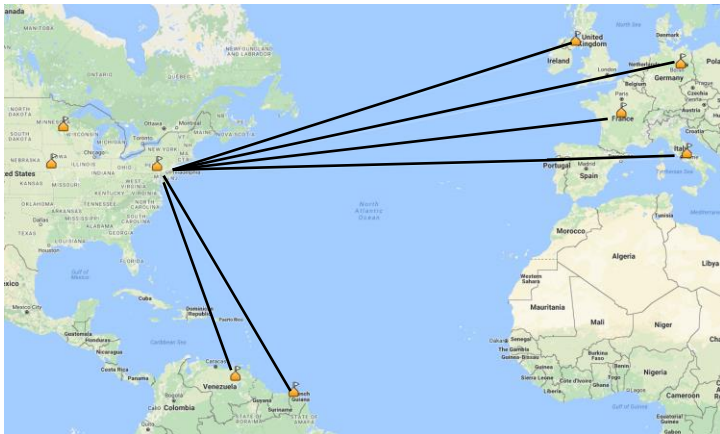


These new amplifiers are sweet! The top, TE Systems model 1452RA will give us 350 watts out on 2 meters with 10-25 watts in. The lower unit is the TE Systems model 4452G. This will give us 180 watts out on 70 cm with 10-25 watts in. Both amplifiers include a switchable low noise GaAs FET receive preamp.



The club has taken possession of both these amplifiers. Both units operate on 12 VDC (drawing lots of amps!) The model 1452 is used as the main power amp at quite a few stations that run EME (Earth-Moon-Earth or Moonbounce). Using this amplifier and 2 - 12 element beams, I have made 15 DX contacts on 2 meters via EME. TE system amplifiers are robust and can take a good deal of abuse and manage to live to tell about it. They are a great way to get reasonably high power at a low cost. Stop up at the club to check them out. You need one of these ... talk to the XYL!

## Tony's, KC3EED experience with his Black Widow Vertical



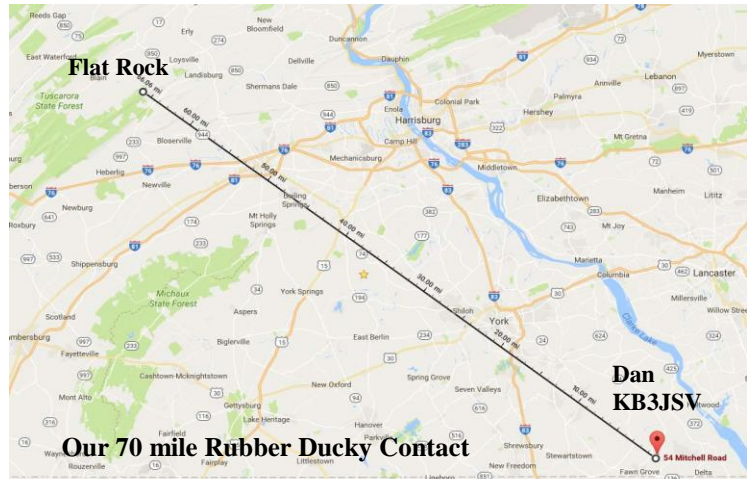
Tony, KC3EED is one of our club members who built a Black Widow Vertical. Over the course of the last couple of weeks he had the Black Widow set up next to his house and made comparisons in performance between this antenna and his full length Off Center Fed (OCF) dipole. All contacts shown on the map above were made using the Black Widow. These included contacts with France, Italy, Germany, the UK, Venezuela, French Gulana, and the states of Iowa and Wisconsin.

There were times when the Vertical worked better than the dipole and vice versa. One really cool thing that Tony found out was that the Black Widow made an excellent "Diversity Reception" receive antenna. At times, signals would fade out on the dipole and switching to the vertical brought the signal up to easy readability, sometimes the dipole was better. Tony was not running QRP to make these contacts, he was running about 100 watts. Yes, the Black Widow's good for QRO as well as a QRP. They say "Life's too short for QRP."

*Continued on Page 5*

## Flat Rock Hike on Sunday, February 19

By Joe Imgrund, KB3TCM



It was a great spring day for an exhilarating climb to the top of the world. Well, it was actually February 19th but the weather made it feel like a spring day. And it wasn't the top of the world, it was to Flat Rock in Colonel Denning State Park -- elevation about 1900 feet. But it was in fact a great day and hike.

Led by internationally recognized hiker Dick Goodman (wa3ug), a small band of intrepid and perhaps foolhardy adventurers set off to conquer the mountain and see how far they could reach with only HTs (and 1900 feet of elevation). Tony (kc3eed), his XYL Chris, Joe (kb3tcm), and Bob (a non-Ham friend of Dick's) started their ascent around 1:30 PM. It took a little less than two hours to make the approximate two mile ascent. That may sound like a fairly slow pace but it is a very steep climb and at least we were not passed by youngsters dressed in their Sunday



Bob (no call) Joe, KB3TCM Tony, KC3EED Chris, KC3EUV, Dick, WA3USG

finery. There were many other hikers on the trail--many of them accompanied by their four legged companions. Once we reached the look-out spot that is Flat Rock, no one was disappointed. The view is absolutely magnificent and even though there was some haze on the horizon due to the unseasonable temperatures, we could see as far east as mountain tops in Lebanon county. It was certainly worth the climb.

After marveling at the splendor beneath us, it was time to break out the HTs (but we left the slim jim antenna in the car). Dick was full quieting into the 97 repeater so he then went simplex and made contacts with the two Dans--N3EEI and KB3JSV. Both contacts were made on 144.34 and although it was a rough copy to Dan near Airville, the approximately 70 mile contact using an HT with a rubber ducky antenna was successful. Radio fun completed, it was time to head back down the mountain. Although it was much faster getting back down, it was tough on the knees and a little more treacherous. If you have the ability to make a climb like this, I highly recommend it. And take someone along with you -- even a non-Ham will thrill at the view.

## NEXT MEETINGS

Thursday March 2nd and April 6th  
at the York County EOC

## Schedule of Keystone VHF Club Sponsored VE Testing for 2017

Laurel VE Group Testing sponsored by the Keystone VHF Club are held the second Saturday of the odd months. All tests are at 10 AM, pre-registration is appreciated except at the Hamfest. Contact, Ralph Brandt at ralph.brandt@comcast.net or phone 717-792-1017.

Location is the York EMA Office at 120 Davies Road, York,

**Testing dates: Mar 11 May 13 Jul 8 Sep 9 Nov 11**

Keystone VHF Club sponsored testing by the Laurel V.E. Group. These sessions are held in the Training Room at the York County EOC, 120 Davies Rd., York, PA. Testing starts at 10:00 AM. Preregistration is appreciated. *Contact Ralph Brandt at: Ralph.brandt@comcast.net or phone 717-792-1017 to register.*

VE exams will be sponsored by Southern Pennsylvania Communications Group (SPCG). These sessions are held at the Shrewsbury Borough Building, 35 Railroad Ave., Shrewsbury, PA. Testing starts at 9:30 AM. *The point of contact for these sessions is Nate, WN3I at wn3i@comcast.net.*

**Apr 8 Jun 10 Aug 12 Oct 14 Dec 9**

### Local area nets:

Capitol Area Traffic Net starts **Monday at 8 PM** on the South Mountain Radio Amateurs (SMRA) repeater on 146.46 (67.0 tone), 1 MHz offset.

The Combined Club ARES/RACES Net meets **Monday at 8:30 PM** on the Keystone 146.97 Repeater (Tone: 123 Hz).

South Mountain Radio Amateurs (SMRA) Net on **Monday at 9 PM** on the 145.43 (Tone: 67 Hz) repeater located in Mt. Holly Springs.

The Keystone VHF Club Digital Net on **Tuesday at 8 PM** on the York 146.97 Repeater ... *to restart on September 6.*

The Keystone VJF Club ELMER Net on **Tuesday at 9 PM** on the York 146.97 Repeater right after the Digital net

A local FM Simplex Net runs **Thursday at 8:30 PM** on 146.55 MHz.

South Central PA 10 Meter Net **Friday at 8 PM** 28.495 MHz USB

Ham Shack Talk Net - Monday at 9 PM: 28.335 MHz.

Delaware Lehigh Valley ARC Net - Sunday 4:00 PM: 28.430 MHz

Do Drop In net - Sunday 8:30 PM: 28.450 MHz

Penn- Mar Club net - Friday. 8:30 PM: 28.495 MHz.

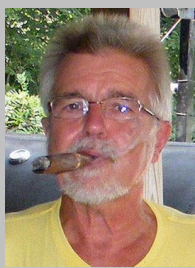
10 Meter Ragchew Net - Every evening starting 7:30PM: 28.600 Mhz

6 Meter Magicians Net from Pottstown Wednesdays at 8:30 PM on 50.130 USB. At 9 PM, they switch to 50.400 and run A.M. modulation and call themselves the Mini Boat Anchor Net.

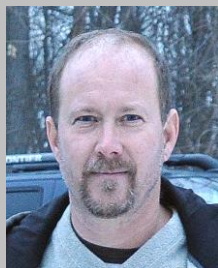
### Trustee's Report



**Tim, W3TWB**



**Dick, WA3USG**



**Jeff, KB3RCT**

Spring clean up! Yep ... it's beginning to look a lot like Spring. We are planning an April 8th Spring clean up work party with a April 15th rain date. We are also thinking about "rebuilding the outhouse." We would remove the tank where all the icky stuff goes and build an insulated Outhouse. This will have to be seen to be believed!!

## Scheduled Club P.S. Events for 2017

- \* **April 9, 2017 - Buckridge Burn Hike Pine Grove \*\*\*SJ**  
POC: Dick Goodman, WA3USG [wa3usg@verizon.net](mailto:wa3usg@verizon.net)
- \* **Date April 11, 2017 - TMI Nuclear Power Drill**  
POC: Sandy Goodman, N3ECF [slgoodman1@verizon.net](mailto:slgoodman1@verizon.net)
- \* **April 23, 2017 - York MS Walk**  
POC: Sandy Goodman, N3ECF [slgoodman1@verizon.net](mailto:slgoodman1@verizon.net)
- \* **April 30 2017 - Ironmasters Challenge Hike \*\*\* SJ**  
POC: Dick Goodman, WA3USG [wa3usg@verizon.net](mailto:wa3usg@verizon.net)
- \* **May 14, 2017 - The York Marathon \*\*\* SJ**  
POC: Jack Dellinger, KC3JD [jdelli@aol.com](mailto:jdelli@aol.com)
- \* **May 7, 2017 - March of Dimes March for Babies**  
POC: Jack Dellinger, KC3JD [jkdelli@aol.com](mailto:jkdelli@aol.com)
- \* **June 11 2017 - 5K/Walk Run (Rudy park)**  
POC: (Brian, KC3CFW [bkimes@klimesgroup.com](mailto:bkimes@klimesgroup.com))
- \* **June 17, 2017 - Double Creek Half Marathon**  
POC: Sandy, N3ECF [slgoodman1@verizon.net](mailto:slgoodman1@verizon.net)
- \* **July 29 - 30, 2017 - Camp Muckelratz Horse Performance Ride**  
POC: Sandy, N3ECF [slgoodman1@verizon.net](mailto:slgoodman1@verizon.net)
- \* **Date August 12, 2017 - Red Lion Street Fair**  
POC: Jack Dellinger, KC3JD [jdelli@aol.com](mailto:jdelli@aol.com)
- \* **Sept 9, 2017 - KTA Superhike \*\*\* SJ**  
POC: Ken Wiggins, N2DYK [n2dyk1940@yahoo.com](mailto:n2dyk1940@yahoo.com)
- \* **Date TBD, 2017 - Kings Gap Time Trials**  
POC: (Micah Neff, KB3TGY [tortmentor@aol.com](mailto:tortmentor@aol.com))
- \* **Oct 14 - 15, 2017 - MS Bike Tour Gettysburg \*\*\* SJ**  
POC: Sandy Goodman, N3ECF [slgoodman1@verizon.net](mailto:slgoodman1@verizon.net)
- \* **Oct 29, 2017 - Michaux Team Challenge \*\*\* SJ**  
POC: Dan McGlothlin [kb3mun@mcglothlin.us](mailto:kb3mun@mcglothlin.us)
- \* **Dec 24-25, 2017 - Glen Rock Carolers** \*\* SJ - Your Slim  
Jim is advisable here  
POC: Stan Walters, AB3EM [abacuspc@comcast.net](mailto:abacuspc@comcast.net)

### Eastern Pennsylvania ARRL Section Convention...

We are pleased to announce that this year's EPA Section Convention will be held at the Warminster Amateur Radio Club Hamfest on Sunday May 7, 2017. The Hamfest will be held at a new location this year at the Bucks County Community College - lower Bucks campus, 1304 Veteran Highway, Bristol, PA. and has inside vendor spaces with electricity available at all tables in addition to paved parking and tailgate area. This is a new location for the Hamfest this year with convenient access to major highways. We are hoping to have a staff member from Newington headquarters attend as a guest speaker.

We will have more information as the club finalizes it's plans and publishes it's new flyer for 2017. Their website is at [www.k3dn.org](http://www.k3dn.org) and can be reached via email at [k3dn@arrl.net](mailto:k3dn@arrl.net)

## The VHF Transmitter

published monthly by the  
**Keystone VHF Club, INC**  
Editor: Dick Goodman, WA3USG

ADDRESS LETTERS TO THE EDITOR and ARTICLES  
TO

**DICK GOODMAN, WA3USG** Voice: (717) 697-2353  
199 MAPLE LANE  
MECHANICSBURG, PA 17055  
[rickwa3usg@gmail.com](mailto:rickwa3usg@gmail.com)

Website: <http://www.w3hzu.com>

Distribution only via the Internet by WA3USG

To change your address for the Newsletter, contact: Dick Goodman, WA3USG  
199 Maple Lane  
Mechanicsburg, Pa.

# The BitX40 Project

Hooray! My BitX40 arrived from India yesterday. It is quite remarkable what you can still get for \$59.00 these days!



The BitX40 circuit board is 5" X 4.5". The small assembly directly above the board is the Arduino based VFO. Right above that is the bag of controls & connector that must be mounted on whatever chassis you are going to use to contain this rig. I was initially thinking about mounting everything in an enclosed metal minibox. Unfortunately, the heat sink on the PA transistor (bottom) is at VCC potential and care must be taken to not short it to ground. I would also like the heat sink to get better ventilation than it would if it was enclosed in a metal box. Another issue is that you may increase the voltage on the PA up to 20 VDC for greater output (14 watts vice 7). If this is done, the heat sink size must be increased accordingly thereby increasing the potential for shorting it out in a metal enclosure (and the requirement for even better ventilation).

**Electronic Plastic Shell Cartridge Handle Project Case Desk Instrument**  
200x175x70mm

★★★★★ 4.9 (123 Reviews) | [Ask a question](#) | Product ID: 1035473 | Sold 1694

In stock, usually dispatched in 1 business day

Price: **US\$ 9.99** ~~US\$15.27~~

Ship From: **CN Warehouse**

Shipping: **Free shipping** To United States via Priority Direct Mail ☑  
7-12 business days

Quantity:  [Wholesale Inquiry](#)

Order this & earn 9 Banggood points

[Buy it now](#) [Add cart](#)

[Add to Wishlist](#) (1576 Adds)

Dan Melato, KB3JSV sent me a link to the enclosure that he is going to use. It is plastic to reduce the shorting potential. It also looks large enough to install all of the controls, connectors, and the VFO assembly. If necessary, ventilation holes may be drilled below & above the heat sink. A rechargeable battery pack could also possibly fit inside. The URL to this enclosure is shown below:

<http://www.banggood.com/Electronic-Plastic-Shell-Cartridge-Handle-Project-Case-Desk-Instrument-200x175x70mm-p-1035473.html>



There are lots of options to power the BitX40. I highly recommend NIMH batteries over Lithium Ion for this application. Lithium Ion batteries must be only partially charged if you are not going to use them for a while. NIMH batteries do not quite have the energy density of Lithium Ion but they are not as fussy to charge, are cheaper, and seem to have a long life regardless of the state of charge when you store them. This set of two (2) 12V 2.2 AH rechargeable battery packs is available on eBay for \$38.24 at the link below. There are many other battery packs available from other vendors that will work fine as well.

<http://www.ebay.com/itm/2-x-10-AA-Cell-Battery-2200mAh-12V-NI-MH-Rechargeable-Battery-Pack-UltraCell-/401237783423?hash=item5d6ba2b37f:g:5lgAAOSwk15XdKLJ>

The nice thing about having two battery packs is that they could be wired in parallel for extra battery life or in series, with 12 volts from one pack running the radio (except for the PA), and the series output of both packs connected to the PA for 14 watts output (with a larger heat sink on the PA of course). These battery packs could fit inside the enclosure with the charging receptacle on the rear panel.

**dynam**  
Dynam Supermate DC6 DC Balance Charger Discharger  
DYC-1004 for 6 Cells Lilo LiPo LiFe 15 Cells NiCd NiMH  
Battery

Be the first to review this item

Price: **\$38.88** & FREE Shipping

Note: Not eligible for Amazon Prime.

In Stock.

Get it as soon as March 24 - April 11 when you choose Standard at checkout.

Ships from and sold by Dynam RC Hobby Co., Ltd.

• Dynam Supermate DC6 DC Balance Charger Discharger DYC-1004 for 6 Cells Lilo LiPo LiFe 15 Cells NiCd NiMH Battery

New (1) from \$38.88 & FREE shipping.

[Report incorrect product information.](#)

A proper battery charger is a necessity for whatever battery pack that you use. The Supermate DC6 available from Amazon will charge any type of battery pack you have. You connect the input of this charger to your 12 volt power supply and the output to your battery pack. This is a microprocessor controlled charger and it will do a good job on anything. I have had two of these units for over 6 years and they will charge anything from a 100 AH deep cycle lead acid battery to any battery pack that you might use. Cost is about \$38. This will make a great all purpose charger for your shack.

I am also considering mounting my BitX40 on the top of a nice, finished piece of wood. It would be stained with a coat of clear varnish. If I do this, a Plexiglas cover would protect the components if taken outside for backpacking or whatever.

So when do we want to start assembly? I think that it would take about 3 tech sessions to put this together. **If you are reading about this for the first time, check out Page 8 of February's newsletter accessible from our website.** It takes about 3 weeks for this item to arrive from India so if you are interested in taking part in this club project, order now!

I would like to start the first session in about the third week in March. There would actually be a total of 6 sessions, split on week days and weekends ... this way hopefully everyone could make at least 3 sessions. An excellent accessory to this radio would be the Black Widow Vertical. Additional tech sessions to build those could also be arranged.

## FOR SALE/WANTED

### For Sale:

Kenwood TS-570sg 160-6 meter, 100 watt AM/FM/SSB/CW transceiver for sale: **\$425 or best offer.** Excellent condition; great starter rig or "hill-top" portable. Worked DXCC and WAS with simple dipole antenna. Non-smoking environment.

Includes: rig, 12VDC power cable, hand-microphone, accessory plugs, built-in auto-antenna tuner, user manual. Serial number: 30100035.

Extra included: Buxcomm Rascal Mark-V rig interface specific to Kenwood-for PSK31, RTTY, etc. to the transceiver. Tweaked to support FSK, not just AFSK; modified schematic is enclosed.

Prefer local drop-off. Photos available on request.

73 Neil W3ZQI  
Timonium, MD  
[neilatv@yahoo.com](mailto:neilatv@yahoo.com)

### Uniden Bearcat BC350A Scanner

Covers----

29 to 54 MHz  
108 to 137 MHz AM  
137 to 174 MHz  
406 to 512 MHz

Comes with----

Original Owner's manual  
110V "Wall Wart" power supply  
12 VDC mobile power cord  
Does not include an antenna.

The antenna connector is a BNC type.

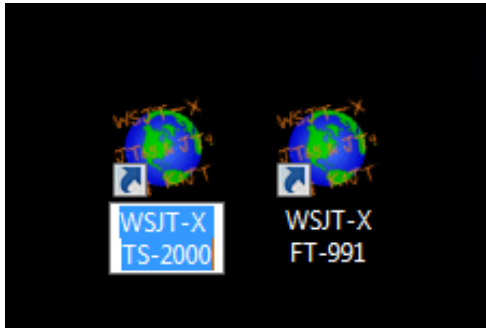
Asking \$20.00

Bob Gundlach N3NBT  
2829 Glen Hollow Dr.  
York, PA 17406-9706

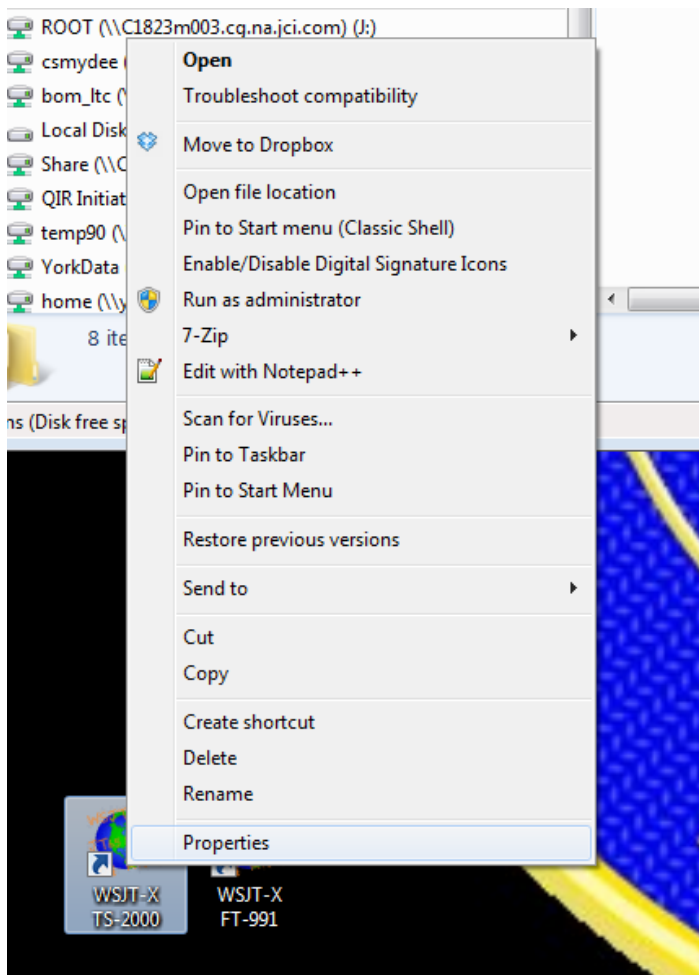
## Configuring two instances of WSJT-X in order to use multiple radios

Compiled by Eric Smyder, KB3CNH

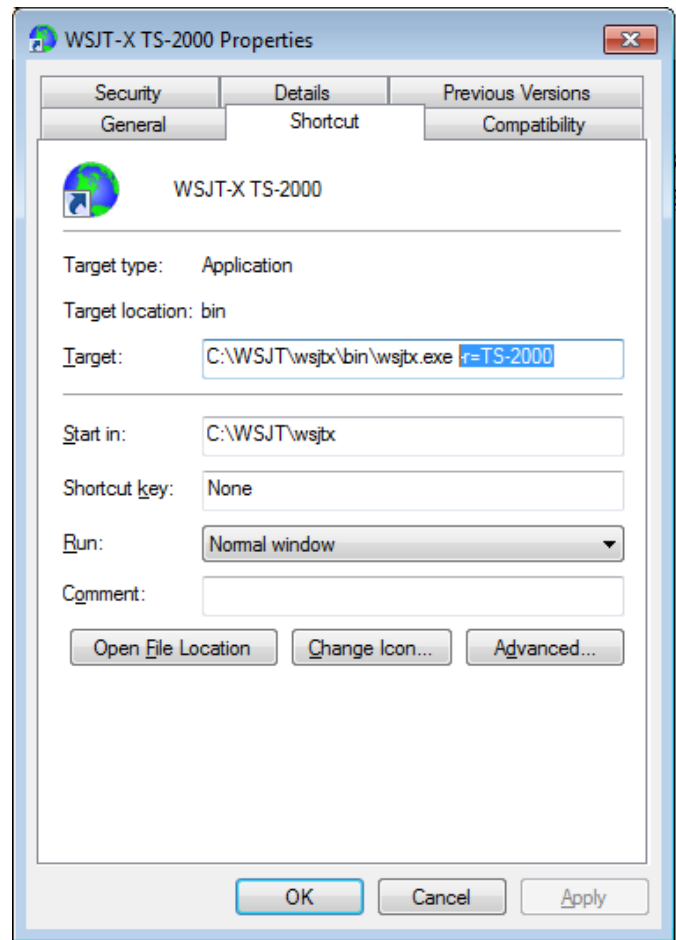
Here's a set of screenshot instructions on how to set up two different radios in WSJT-X. Create two shortcuts (on your desktop or wherever you want them). Then press F2 to change the name. I changed them to name each radio



After they are re-named click away and then RIGHT-click on the icon to select its properties.



Once you are in the properties tab, you can fill in the `-r=myradiomodel` after the target



So for a TS-2000 I just entered `-r=TS-2000`

The same goes for your FT-991 or IC-746 or whatever radio you have. It doesn't matter.

Do the same for the other shortcut icon and label it `-r=FT-991`

Then when you open the instances of WSJT-X it will be custom for that radio. Of course it's not magic based on model number, you'll have to enter the setup data in the preferences tab for the particular radio.

The point is that the software will store the configurations separately and then you can run both without having to manually reconfigure, or you can run both radios at the same time and log QSO's with the same timestamp!

Good DX !

KB3CNH

Eric

## Two "Atta Boy" Awards

This month's awards go out to two club members who stepped out beyond the call of duty. **Eric Smyder, KB3CNH** repaired the Counties Kenwood TS-2000. This radio is normally stored in the York County EOC in the RACES room. We had signed it out from county to use it in the January ARRL VHF contest. We tried using it but there was no output on 2 meters or 70cm. Eric did some troubleshooting and found a bad pre-driver transistor, two dead final output transistors, and a soldered in fuse that was blown. Now the county doesn't have to pay to have it fixed.

The club had obtained a Honda EU1000i generator from county. The generator had a carburetor problem and would not start. **Rich Diem, W3OKU** took the generator home and rebuilt the carburetor. The county would have paid for the repair but it's great that we can be self-sufficient and do the work ourselves. It because we have members like Eric & Rich that we come out looking so good! A major kudos to both of you guys!

### *The Black Widow ... continued from Page 1*

Over the last 4 months, about 9 club members have built these antennas. While originally designed for QRP operation on 40, 20, and 30 meters, they will handle 100 watts. I found that using 50 watts with a Yaesu FT897, I could talk to anyone that I could hear ... and received good signal reports.

While I enjoy QRP operation, it's really nice to have an easy to set up portable antenna for operations out in the field that rivals a full length wire antenna. Operating QRO (higher power than QRP) means making many more contacts. If the poor guy on the other end doesn't have to strain to hear what you're saying, it's much more conducive to ragchewing.

So far, we've had 3 Tech Sessions at the club to build these antennas for interested members. **It will cost you about \$40 if you buy all the parts new.** Check page 1 and 3 of February's newsletter (on our web site) for more information about this remarkable antenna. If you are interested drop me an e-mail at [rickwa3usg@gmail.com](mailto:rickwa3usg@gmail.com) and we will schedule additional tech sessions.



### **A Cautionary Tale by our Own Ralph, K3HQI**

*Don't let this happen to you!*

Can the FCC mail you a letter based on your address on the Universal Licensing System **AND** the FRN data base? They are two separate data bases and your address must be changed on both. They do not cross post.

If the FCC sends you a letter and it is returned as not deliverable, **your license will be suspended.** If your info is not up to date on both and you need help doing it, any of the VE groups can help you. It can be done on-line too.

As an OO I encountered one recently. I mailed a card to a ham in Texas, it was returned as an incomplete address. I first thought that I copied the address wrong. I checked and it is the same in QRZ and ULS. A web search of the address shows it is a condo - his address is the condo address but he does not show a unit number or box number which is usually necessary. Had that card come from the FCC he would be suspended.

I am trying to contact the condo to see if I can get a message to him to correct this.

I will be watching for this when I do test sessions. I am not sure how to spot it but I am going to mention this situation. Hopefully if someone has it they will recognize it. Any deeper thoughts on it are welcomed.

### **A great, simple general discussion of some of the theory behind modulation schemes and weak signal modes including QRA64.**

*Written Andy Talbot, G4JNT*

*Submitted by Steve Cruse, K3WHC*

*With comments by Dick Goodman, WA3USG*

I would argue that COFDM is not a way to improve weak signal performance. COFDM and all the related modulations have as a prime aim to optimize bandwidth usage in defined channels and make the best use of allocated spectrum. In data communications terms, they are generally referred to as "**bandwidth-limited**" modulation, making use of high order constellations like QAM and parallel stacked carriers themselves carrying QAM carrying. They are NOT weak signal modes in their own right. The need to conserve bandwidth automatically stops them from having the best weak signal performance.

The reason for the overwhelming popularity of multicarrier COFDM modes is their resilience to multipath as the resulting symbol rate of the multiple parallel tones is far lower than the

combined data rate of the complete information stream.

*In contrast, where bandwidth is not an issue but power or S/N is, we enter the realm of "power limited" modulation.* And this is where most of amateur radio sits. But first of all you have to realize this does not just mean a wide signal bandwidth. "Bandwidth expansion" means a lot more than this in signal processing terms.

Take as an example, repeating a messages (in SSB or Morse) five times to get it though. It has taken 5 times as long to transmit the same amount of source information. In a way you could say it has been expanded 5 times. In data there are other ways of doing it. You could expand the input data by adding error correction bits that increase it the same five-fold. That would result in a far-stronger error correction (getting the message through) than the 5 times repeat can offer.

Back to modulation. We rarely need more than a few tens of bits per second for normal QSO traffic. Add very strong error correction which expands it say 5 times (and that is very strong indeed!) and you will get 100% copy at normalized S/N ratios ( $E_b/N_0$ ) of around 2 to 5dB depending on the actual modulation type - PSK, FSK.

But we are still only talking about a modulation that has to carry about 1000 symbols per second and that will easily fit into a 3 kHz spectrum. There's nothing to be gained in a pure additive noise environment by expanding further. In fact there are many purely practical advantages now of keeping modulation simple and using something like basic FSK to overcome the practicalities of transmitters - like linearity.

Even if the result is wider than it need be. In spite of our reducing allocations, we still have a huge amount of spectrum to transmit a few hundred bits per second in. 3 kHz arbitrary channelization is still very wide in an AWGN environment.

Difficulties come when we consider extreme microwave paths including rain scatter and EME scintillation and that requires a complete rethink. If we assume our signal is spread out to a few hundred Hz, that automatically limits our symbol rate permitted to a fraction of that, say a few tens of symbols per second.

We cannot possibly send anything with symbols moving faster or even approaching the random shifts of the spreading. There's no hope of doing anything coherent

So we need to choose a modulation that can send that on a scattered path. It's rather ironic, that the simplest modulation of its type, basic ON-OFF keying, is actually quite useful now. We look for the power change over the entire tone-band of the spread signal and integrate down to the symbol speed. That way we look over a signal spreading bandwidth of say 200Hz but compress the result to say 10Hz.

Pure ON/OFF is wasteful of transmitter energy. So we alternate between two tones, well separated in frequency to completely differentiate when the RS or scintillation or whatever, spreading occurs. By comparing one tone's averaged power per symbol against the other, 3dB advantage is gained over simple ON/OFF keying when transmitted peak power is compared.

By sending as one of, say, 64 tones instead of one of two, six information bits can be encoded at a time so for paths that give only a few Hz of shift (VHF and down) multi FSK is used

To allow the symbol timing to be regenerated at the receiver, synchronization signals have to be added to the symbols which reduces efficiency. For really good weak signal performance and recovery this could be as much as another 100% overhead.

But we're still only at 2k symbols per second for standard QSO speed. For contest and routine DX exchanges with limited info content we can go a lot slower - which means less source information in the same bandwidth. Or reduce the signal bandwidth further by still heavier signal processing.

The weak signal WSJT modes take all this into account and I think really do represent the best we are going to get on the amateur bands for weak signal DX type working. They don't support real time waffle type QSOs, where RTTY and PSK31 would be used, but for contest and EME exchanges and pre-formatted messages, can't be beaten

All the weak signal tones use multi FSK of 4, 9 or 65 tones with tone spacing options that can be chosen for the path. They all have a large overhead for synchronization allowing for reliable lockup based

*Continued on Page 6*

**Modulation schemes continued from Page 5**

only on a search in time and frequency over a limited range.

Up to recently that have all used similar error correction coding, JT4, JT9 and WSPR all use convolutional coding with about three times expansion of the number of bits. JT65 does it differently with Reed Solomon and its resulting six-symbol MFSK. But they all have a similar performance in terms of normalized S/N (Eb/No) needing about 4dB in their respective symbol bandwidths ranging from 1.5Hz for WSPR to 4.4Hz for JT4. That puts it within about 4 dB (very roughly) of Shannon's theoretical limit for this modulation type.

The latest change is a completely new error correction coding in the latest version of WSJT, called QRA64. The encoding is simpler than JT65, it is sent using the same modulation - one of 64 tones with a reduced synchronization overhead. The clever bit comes in the decoding. It is now believed to be within 0.6dB of the theoretical limit of Shannon limit for incoherent (FSK type) modulation.

*This was not an easy read! There were many parts that I didn't exactly know what the author was saying. The gist of this article seemed to illustrate the advantages & disadvantages of Forward Error Correction (FEC) as applied to data exchange in Amateur Radio. FEC is really sending the data redundantly in time, frequency, or both. It greatly increases the amount of data that has to be sent. Since a typical QSO takes place at a fairly low data rate, sending this extra information doesn't normally affect the QSO. It does however, help ensure that the data gets through with no errors.*

*Modes such as JT65 & JT9 have such robust (and voluminous) FEC that the mode is no longer in "Real Time". The results of this are that while "chat-like" QSO's are not possible, the transmission may be received further down in the noise better than any mode that does not use FEC .... Even CW which has always been the standard candle in comparing the modes that we use, is takin a beating. Take a look at Table 2 below:*

**Table 2  
Average Receiver Sensitivities**

Mode	Receiver Sensitivity (microvolts)	Receiver Sensitivity (dBm)	Compared to CW (dB)
AM	0.72	-109.9	-25.1
SSB	0.22	-120.3	-14.7
FM	0.29	-117.7	-17.3
RTTY	0.096	-127.3	-7.7
CW	0.040	-135.0	ref: 0
PSK31	0.023	-139.8	+7.1
JT65	0.0035	-156.2	+21.2

This was published in QST about 3 years ago. It details the efficiency of many of our transmission modes with the top being the worst and the bottom the best. Next to the mode designator is the "Receiver sensitivity (microvolts)", this is the signal level (in microvolts) that will result in adequate signal copy for that mode. Next to that is "Receiver Sensitivity dBm). This is the signal level in dBm required to copy the transmission. Finally the "Compared to CW" column details how this mode compares to CW.

Looking at AM. We can see that it requires a whopping 0.72 microvolts to get a copyable signal. This is because with AM, your receiver bandwidth has to be wide enough to encompass both sidebands and the carrier (the wider the bandwidth the more noise you receive along with the desired signal). The carrier must also mix with both sidebands in order for you hear the information being transmitted. With AM, you are receiving this carrier perhaps from many thousands of miles away. It is fading in and out and due to *selective fading* the carrier may be fading at a different time than the either sideband. If the carrier or either sideband fades, than you lose the entire signal. Looking at the "Compared to CW" column, one can see that an AM signal must be 25dB stronger than a CW signal to get the same level of copy (3 dB is doubling signal strength).

The SSB mode really helped things. With SSB, you only have to receive one sideband (lower or upper). You do not have to receive a carrier as none is transmitted. This cuts your bandwidth in half (along with the noise). Now you still need a carrier to mix with that sideband in order to hear anything but that carrier is now generated inside your receiver. There is an oscillator inside a SSB

receiver sometimes called a "Beat Frequency Oscillator" or BFO. This generates the carrier locally and it is always strong. With SSB, you've cut your bandwidth (and noise) in half. The carrier wave is always strong. Finally, selective fading can now only affect the single sideband that is being transmitted ... with AM, it could affect either the lower or upper sideband and the carrier. That's a lot of improvements and a SSB signal only has to be about 15dB stronger than a CW signal to get the same level of copy.

What about FM? For some reason, this is out of order in the chart. Actually FM is a lot better than most folks think in relation to receiving a weak signal. FM only requires a 0.29 microvolt signal to get an adequate copy. It is actually very close to SSB in weak signal performance. There is less than a 3 dB advantage of SSB over FM and most people don't realize this. With FM, the transmitting station transmits full power when they key the mic. This tends to "quiet" the noise being received at the other end. Since FM is Frequency Modulation, and noise is actually Amplitude Modulation (AM), the FM detector is much better at discriminating the desired signal from this noise. An FM signal needs to about 17 dB stronger than a CW signal for the same level of copy (very close to SSB). Who says that FM can't be a DX mode!

Moving down to RTTY. RTTY is sent using two tones, a mark tone at 2125 Hz and a Space tone at 2295 Hz. The spacing between these two tones is 170 Hz and that is the required bandwidth for a RTTY transmission. SSB requires a bandwidth of about 2700 Hz, so you can see what reducing the bandwidth down to 170 Hz will do for reducing received noise. Additionally, your RTTY detector (a computer), only has to tell if a 2125 Hz tone or a 2295 Hz tone is being received. It doesn't have to receive syllables through a lot of noise ... it simply has to differentiate between a Mark & a Space tone. A RTTY signal has to be about 7 dB stronger than a CW signal for the same level of copy.

Through all of this so far, you can tell that CW is king. A 1 watt CW signal can be as "good" as a 256 watt AM signal. It can also be as "good" as a 32 watt SSB signal.

PSK31 started to change things. PSK31 requires a bandwidth of only about 40 Hz. That is really narrow and gets rid of a lot of noise. You can fit about 40 PSK31 QSO's in the space taken by a single SSB transmission. The modulation impressed on the carrier by PSK31 is done by changing the phase of the carrier. This is ultimately detected & decoded by the computer ... which is really efficient at doing this. PSK31 will go into the noise about 7 dB better than CW! PSK31 was the first mode where a computer made a substantial improvement in reception.

Finally we get to JT65. There is almost as much of an improvement in JT65 over CW as CW was better than AM. JT65 will go down into the noise over 21 dB better than CW! This is absolutely incredible. Running JT65 with a radio with a power level of 5 watts, and an antenna that consisted of a 4 foot whip on the back of the radio, from inside a hotel room, I was able to have a QSO with someone in the UK and Australia. With JT65, you don't need a large antenna, or much power. The disadvantage ... JT65 is not a "Real Time" QSO mode. It takes about 3 to 4 minutes to send your call, location, and give a signal report. You certainly can't chat!

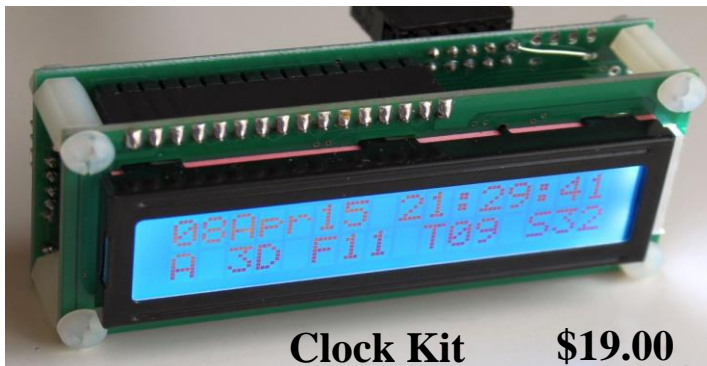
JT65 requires a bandwidth of 200 Hz, a lot wider than PSK31. With this wider bandwidth, more noise is received than with PSK, RTTY, and CW but it still will dig out much weaker signals. Again, computers make the difference. JT65 transmits its intelligence by using 65 different tones, that the computer differentiates quite well. As detailed earlier in this article, JT65 also provides an incredible amount for Forward Error Correction (FEC). In the 50 second JT65 transmit cycle, all of the data is sent five (5) times. This is done in five separate time slots and on five (5) separate frequencies within the 200 Hz bandpass.

There is another mode, JT9 that goes down into the noise 2 dB further than JT65. For some reason, folks don't like to use that and they stick with JT65

Finally, the creator & author of both JT65 & JT9, Joe Taylor, K1JT (a Nobel prize recipient) has rewritten JT65 so that it is even better. Look forward to more remarkable advancements in the years (maybe months) to come. Computers are getting faster and more capable. Software developers are getting ever more creative! Right now using JT65 and 100 watts, I can work people off the moon. If you're a new Ham, you've gotten into this hobby at the right time.

We are truly living in the golden age of Amateur Radio!

## 3 Kits you can build on the cheap

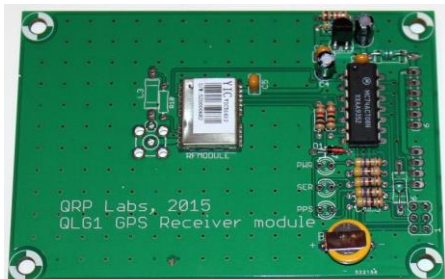


**Clock Kit \$19.00**

This clock kit is based on the same hardware as Ultimate3/3S QRSS/WSPR kit and a special firmware version. A **GPS receiver module such as the QLG1 can optionally be connected for precision time-keeping.** The display format is customisable; as well as time and date, you can also choose to display GPS data (e.g. location, number of received satellites, etc).

**This is a shack clock kit** which can optionally also be connected to a GPS receiver module such as the [QLG1](#) to provide precise time. Alternatively it can be used standalone or with a different 1 pulse per second (pps) signal source.

The clock can be configured to display time, date, and various information decoded from the GPS serial data stream. Two Analogue temperature sensors an optionally be connected to the kit, so that temperature measurements can be displayed (for example, indoor and outdoor temperature). The contents of the display are configurable. The photographs on this page show the default configuration of the clock display.



All 3 kits available from  
**QRP Labs**  
<http://qrp-labs.com>

**\$23.00**

**This GPS receiver module kit** includes an extremely sensitive patch antenna, with factory pre-soldered Mediatek chipset RF module. It has three onboard LEDs for visual status indication, 3.3V regulator and power supply filtering, and 5V logic level conversion. It's easy to build and directly compatible with all QRP Labs kits.



**\$22.00**

The Clock case is basically the same as the [U3/U3S case](#) but has differently drilled/labelled front and rear panels. It is made from black anodised aluminium, dimensions 122 x 45 x 160mm deep. It's a 4-part case: front panel, back panel, top half and bottom half. The 4 parts are held together by 8 screws. The front and rear panels are drilled and silk-screen printed for the [Clock](#) kit, as shown. The case also includes an accessory kit, with switches, buttons, connectors etc.

## Is someone pulling ahead in the Digital War?

Yaesu System Fusion, D-Star, DMR ... is there a winner starting to pull ahead yet? Perhaps. There are now over 20 DMR repeaters in the commonwealth of Pennsylvania. In the local area there is one up on Blue Mountain, one on Reesers Summit, one in Thermont, Maryland, and one in Cornwall. The SPCG in Shrewsbury is installing a DMR repeater within the next month on UHF and the SMRA in Carlisle is installing one on 2 meters.

What advantage does DMR have over the other digital modes? A really big one in my opinion. DMR has two time slots. That means that on the same repeater, at the same time, you can have two completely independent QSO's going on. Why is this a really desirable feature?

Let's use an example of a typically configured DMR repeater. Time slot 1 is configured for traditional repeater use. Anyone can use it to simply chat with someone else. This time slot is open to local RF traffic only. There is no linking to other repeaters or other nodes on the Internet. Unless a local Amateur is using it, it is quiet.

Time Slot 2 is completely independent of Time Slot 1. The Time Slot 2 side of the repeater can be configured to be linked to other repeaters, and other nodes on the Internet. These links can be to anywhere in the world or to other DMR repeaters in a more local area. It could get quite busy at times. If Carlisle, York, Shrewsbury, and Towson Maryland were all linked together, someone could start out in Harrisburg and drive all the way to Baltimore and be talking with the same group of people without going out of range.

Up until recently, there were not many DMR radios to choose from in the price range of most Amateurs. Commercial radios such as Motorola have been using DMR for many years but a Motorola HT is in the \$600 to \$800 range. A Motorola DMR mobile radio is probably over \$1000. There are now several manufacturers such as TYT, Connect Systems, Anytone, and Baofeng that are making DMR HT's at a price from \$80 to \$250. At this time these radios are single band only (2 meters or 70 cm) but within 3 to 6 months there will be both dual band DMR HT's and mobile class radio available in the \$200 to \$300 class range.

Over the next year or so, I think that the DMR market will be dominated by Chinese radios. If DMR does become as popular as I suspect it will, I think some of the more traditional manufacturers will get on board ... even companies like Yaesu, Kenwood, and Icom. Right now each of these companies is pushing their own digital mode but if DMR becomes dominant, they may go where the money is.

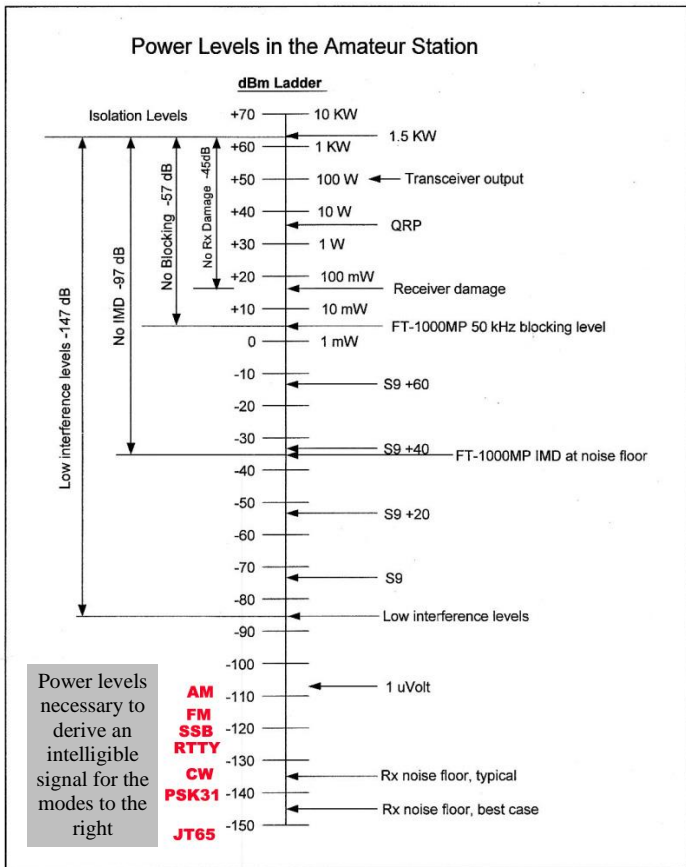
What is the club's stance on DMR? Right now there isn't really one. We are all sitting here watching the "digital war" and wondering who is going to win. Over the last few months however, it does appear that DMR offers significant advantages.

On 2 meters, we have too many people with analog rigs to switch over to any digital mode. There's too much chatting & other activity on 2 meters with existing radios. Our 70 cm repeater is another story ... it gets very little use. It would make a great test bed for DMR and its time slot 2 could be linked to many other local area repeaters. This would make it a wide area repeater and since it would be linked. to other machines, it would probably be busy (a good thing). Time slot 1 would be purely for local chat and it would not be as busy.

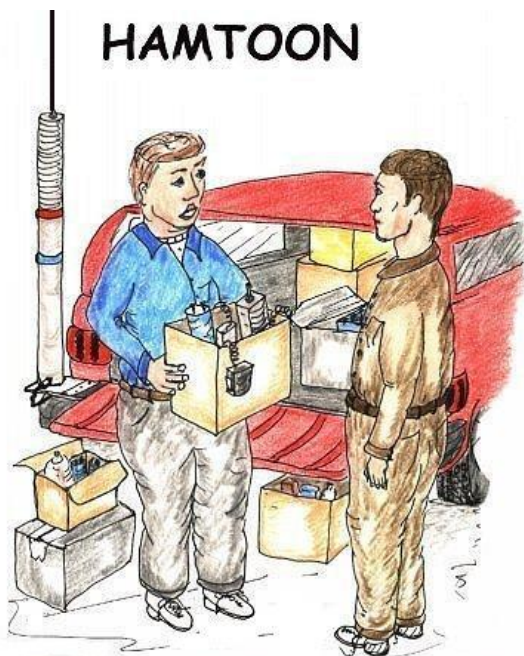
How many of you would be interested in getting on DMR? We are a progressive club and eventually have to embrace a digital voice mode. I know that some members prefer a repeater that isn't always busy, and some enjoy linking to other sites. With DMR you can have both worlds. Going to DMR means the repeater is DMR only, it will not work with your analog radio. Listening to the lack of activity on our 440 machine, , I don't think that this will be an issue.

On a final note, converting to DMR from our existing analog 70 cm repeater will most likely stimulate a lot of interest. I think that a lot of our newer, younger members will take advantage of it. The user radio equipment is not going to be expensive and a brand new Motorola DMR repeater will cost about \$2000.

Thought should be given to this over the next year. Especially in the light of so many DMR repeaters that are being installed in our local area.



The above chart is a follow-up to the article on pages 5 & 6. Note that CW may be copied right at the noise floor of a typical receiver. PSK31 may be copied slightly below the noise floor and JT65 may be copied considerably below the noise floor of even a "quiet" receiver. While performance of these last two modes may be hard to believe, there have been times while running EME on 2 meters using JT65 I copied the other station on the computer but heard absolutely nothing from the speaker but white noise.



**THIS WAS THE BEST HAM FEST, LOOK AT THESE GREAT BUYS. COULD YOU STORE THEM FOR ME TILL MY WIFE IS OUT OF TOWN ?**



## Keystone VHF Club E-Board Meeting Minutes of Monday, February 20, 2017 By Sandy Goodman, N3ECF – Secretary

President, Mike, N3VQH, brought the Executive Board Meeting to order at 7 PM at the Keystone VHF Club. Attendees: President Mike Stackpoole, N3VQH; 1<sup>st</sup> Vice-President Joe Imgrund, KB3TCM; 2<sup>nd</sup> Vice-President Jack Dellinger, KC3JD; Treasurer Dan Melato, KB3JSV; Assistant Treasurer Tim Snook, KB3WZX; Secretary Sandy Goodman, N3ECF; Assistant Secretary Eric Smyder, KB3CNH; Trustees: Dick Goodman, WA3USG; Tim Barefoot, W3TWB; Jeff Patterson, KB3RCT

### 1. TREASURER:

We reviewed the Audit results.

Dan will keep a log of receipt of any goods or any cash income or payments that aren't directly deposited or paid from the Checking Accounts.

Dan will be setting up a Paypal account. For Dues Payments, that will include the information on the Renewal Forms that we've been using. An email will be sent to the appropriate person: Dick will receive Dues payments, Sandy will receive Donations notice.

When purchases are made, scan and send the receipt to Dan.

For Knappers, Dan will pay ahead, and at the next billing will pay to the end of the year.

Dan will be changing banks (to Members 1<sup>st</sup> Federal Credit Union) to get away from the various fees that BB&T has been adding.

### 2. TRUSTEE:

The Trustees are considering replacing the lights with LED lights. The current fixtures are broken and need to be replaced. Discussion covered possible options. One row of lights will be replaced with LEDs, then tested for noise.

Tim and Dan to coordinate with Double Dog to replace door lock.

A spring clean-up is needed before the May meeting. Scheduled April 8 with a rain date of April 15.

A review of the inventory for insurance is needed. Tim will see if he can get a list from the insurance company so we know what is already covered and need to be updated (deleted or added).

### 3. GENERAL DISCUSSION:

Dish project is still in progress.

It was noted that Rich, W3OKU, fixed the 1000 watt generator that was given to us by York County EMA. Eric, KB3CHN, also fixed the TS2000 radio we had borrowed from York County EMA for the contest.

For Field Day in June, we will encourage members to join either the Hilltoppers or SPCG. SPCG may need to change location due to damage at the pavilion where they usually operate.

We will operate the June VHF contest here at KVHFC June 10-11, 2017. We discussed the September VHF Contest Sept 9-11, 2017 and possibly trying to work at Sam Lewis State Park. However, many of our members will be working at the KTA Challenge Hike on September 9. We will be using the portable 146.97 MHz repeater at KTA.

We scheduled the Ice Cream Social for July 6, prior to the meeting and the Corn Roast/BBQ for August 19, to eat at 1 PM.

We talked about giving Lee Lindsay, WB3HNA, a Life Membership for his significant donation to the club.

The club will continue doing group projects (Black Widow antenna & BITX40). Mike asked "What can we do to make the club better?" A Suggestion Box (as link on website) was proposed.

We discussed doing presentations of 15 minutes or less at the monthly meetings. We should pass around a list to sign-up for presentations.

Next Executive Meeting: April 17, 2017, 7 PM at Keystone VHF Club.

Adjourned at 8 PM





## Keystone VHF Club General Meeting Minutes of February 2, 2017

By *Sandy Goodman, N3ECF – Secretary*

The General Club Meeting held at York County Emergency Management Center was called to order by Pres. Mike, N3VQH, at 19:04. There were xx members present and x guest/new member applicant.

**TECHNICAL HAPPENINGS:** Brad, KO3T, showed his BITX40 SSB Transceiver for 40 meters. He got it for \$59 from India. Several members showed some interest in ordering these, and attending a Tech Night to build them.

**SECRETARY REPORT:** Sandy, N3ECF. Jim, N3QZS, moved to accept the January minutes as published, seconded by Dave, KC3GMQ. Motion carried.

**TREASURER REPORT:** Dan, KB3JSV, reported for January: Income: \$6,558.96; Expenses: \$5,277.16. The big expenses were for the HVAC system, \$2,320 and Insurance \$1,319. Balances: Club CD \$7,661.20; Checking Acct \$4,912.72; Trustee Acct \$540.83; Total \$13,114.75. Rich, W3OKU, moved to accept the report; seconded by Ed, KB3WQI. Motion carried.

### COMMITTEE REPORTS:

#### TRUSTEE REPORT –

Dick, WA3USG, reported that the repeater room has been cleaned out and stuff moved to the shed. So the next step is to catalog what's there, then clean up the shed.

Tim, W3TWB, will meet with Double Dog to install the new Key Lock. Tim spent \$100 last month to get a new camera system. There are 5 cameras monitoring the club.

#### TECHNICAL COMMITTEE REPORT -

Tim, W3TWB, reported that the 440 repeater was down after the VHF Contest. It had locked up. It has now been fixed. Work continues on the 2 meter repeater. The Kenwood repeater will go back up. Expect better quality of signal.

#### EMCOMM/PUBLIC SERVICE NEWS –

TMI Drill is April 11, with Decon on April 12. Public service events start in April. Expect requests for help starting in March. A few of our guys made contacts with Winter Field Day operators.

#### VE/ED REPORT -

Ralph is conducting a weekend Technician License class February 18-19, with exams on February 19. Regular VE testing will be held Mar 11. SPCG will be starting a full Technician Class from March through June in Shrewsbury. Contact Nate, WN3I, if you know of anyone interested.

#### CONTEST REPORT -

VHF Contest was a big success with 413 Qs, 55 grids, and 25,965 points. 27 operators were present. Eric, KB3CHN, is working on the TS2000 which was borrowed from York OEM. The 2 meter band wasn't working.

WPX is the second weekend in February. Also coming up are ARRL DX CW and NAQP RTTY.

#### NEWSLETTER/WEBSITE – done.

#### OLD BUSINESS:

Second reading was done for Don Schmitt, K3DCS, who was then voted into membership.

#### NEW BUSINESS:

Charlie Martin, KB3CO, applied for Associate membership. Later research indicated he had been a member back in 1979, so his membership was reinstated. Dan, KB3JSV, is reviewing the computers to plan for a backup system.

He discussed the need to purchase some software. Tim, W3TWB, moved to make the purchase for about \$120. Rich, KR3EE, seconded the motion. Motion carried.

Tim, W3TWB, talked about two amplifiers that he would like to purchase from TE Systems. The 2 meter amplifier would run 350 watts, and cost \$675. The 440 amplifier would run 10 or 20 watts, and cost about \$798. He also wants to order another Pro 7 Heil Headset at the cost of \$279.97. The total would be \$1752.97 plus shipping. Brad, KO3T, moved to make the purchases, up to \$2000. Rich, W3OKU, seconded the motion. Motion was approved.

#### GOOD OF THE CLUB –

Dan, KB3JSV, will be establishing a Pay Pal business account for our club. Members will be able to use Pay Pal for new applications, renewals, and donations.

50-50: \$51 was won by Rich, W3OKU, who donated the money to the club.

Adjourned at 19:45.

### Hello All:

It's the time of year where we start asking for volunteers to operate at public service events.

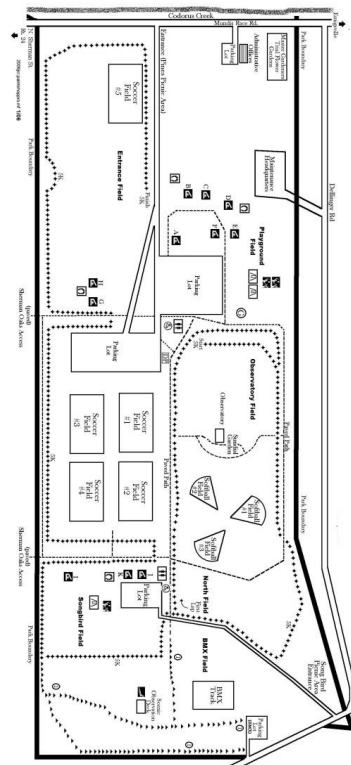
Our first event is the MS Walk on April 23, in John Rudy State Park in York event registration starts at 9 am, with the walk officially starting at 10 am the walk is on the paved path

We man posts around Rudy Park and watch the crowds walk by. This is the perfect event for any one new to public service. We use HTs on simplex. New operators will be paired with experienced operators. We need to cover 9 or 10 positions, including a walker or 2 to join the crowd. The attached map shows the locations where we post operators.

If available, please contact Chip Diamond, W3FJD at [w3fjd@yahoo.com](mailto:w3fjd@yahoo.com) or sign-up at the next Keystone VHF Club or YARS meeting.

Thanks for helping.

Sandy Goodman N3ECF  
Secretary Keystone VHF Club  
York County ACSO/E



# KEYSTONE VHF CLUB OF YORK, PA



# W3HZU



## Membership Application

Name: \_\_\_\_\_ Phone: \_\_\_\_\_ - \_\_\_\_\_

Address: \_\_\_\_\_ Callsign: \_\_\_\_\_ Expires: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Lic Class: \_\_\_\_\_

Occupation: \_\_\_\_\_ E-Mail: \_\_\_\_\_

### Membership Desired

- Full** → Full Club Privileges  
\$25.00 annually & one time \$5.00 Application fee
- Family** → Sponsoring members call: \_\_\_\_\_  
Privileges same as Full membership  
\$6.25 annually & a one time \$5.00 Application fee
- Associate** → Repeater Support  
\$20.00 annually & a one time \$5.00 Application fee

Are you a member of:

- ARRL      Y-N
- ARES      Y-N
- RACES     Y-N
- OCWA      Y-N

### Special Areas of Interest (circle all that apply)

AM Antenna building    ATV    Contesting    CW    Digital (Packet, RTTY, PSK-31, etc)  
DX    FM    HF    QRP    Satellites    SSB    SSTV    SWL    Tower climbing    LF    DSP  
UHF/Microwaves    VHF    Astronomy    Photography    Other: \_\_\_\_\_

### Application & Dues Mailing Address:

Make checks payable to: *Keystone VHF Club Inc.*    Mail to: *PO Box 20143*  
*York, Pa. 17402-0140*

FOR CLUB USE ONLY	
First Reading Date: _____	Second Reading Date: _____
Date voted IN-OUT: _____	Date Dues Collected: _____
Applicant Sponsored by: _____	