Experimenters
On A New Amateur Radio Band

By Bart Lee, K6VK (CHRS*, AWA)

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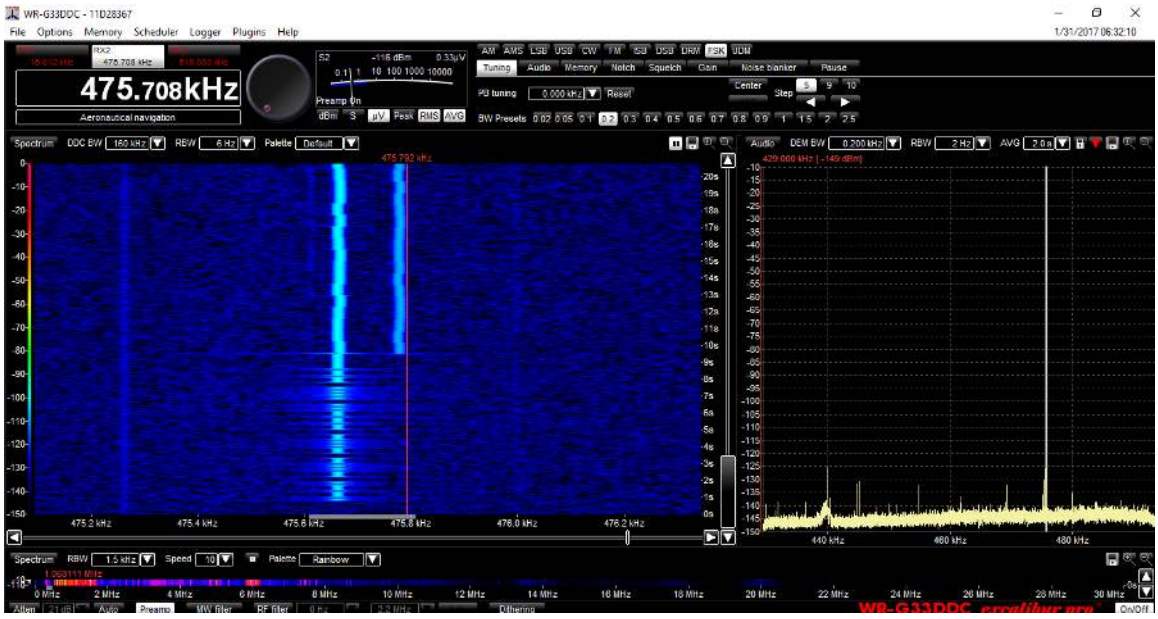
Well, it was a lively night February 4th investigating the historical and legacy medium frequency (MF) band of 630 meters! For many decades the primary marine frequency was 500 KHz at 600 meters. As the sunspots go away, maybe forever, these lower frequencies become more interesting. The new band at 630 meters, 472 KHz, attracts many experimenters. U.S. amateur radio operators do not yet have general permission to operate, although Canadians and Europeans do. Still, many U.S. experimental stations may be heard, and with a software-defined radio (SDR) they may be seen as well (I use a WinRadio G33).

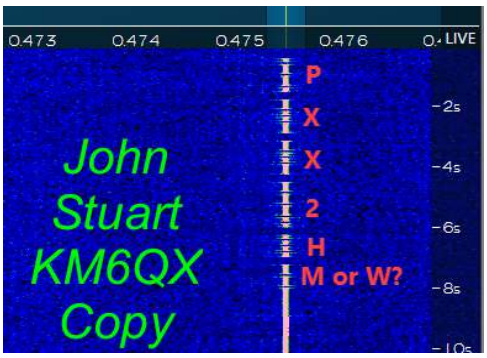
630-Meter Amateur Activity



This first graphic is the SDR trace at K6VK of WH2XXP (Ward Wheaton, K7PO) from Arizona on 475.66 KHz at 0.33 microvolts. He writes:

Thanks for the report, and welcome to 630m! There are a bunch of us on, many much closer to you than I am. WH2XXP current configuration: 30m vertical with 16 sloping top loading wires, QRP Labs U3S driving a HB W1VD design class D amplifier (155W TPO) for ~39W ERP. The amp is just idling along at this power level. At “full throttle" the station is capable of ~250W ERP (my grant is for 100W ERP on 630m).

The squiggle is the WSPR beacon mode. This can be decoded with a soundcard. The tail is the station’s Morse code callsign identification. Many stations simply use WSPR without further ID. The WSPR protocol is to transmit for two minutes and to stay silent for two minutes to listen.



WD2SXH is the general callsign of the experimental ARRL set of many 630-meter stations around the country. They have more than 200,000 hours logged so far. The strongest signal on the band on February 4th came from WD2SXH/20 at Eugene Oregon on 471 KHz. This is the station of Rudy Severns, N6LF, a noted antenna expert. His signal came in at 0.75 microvolts over the noise level of 0.33 microvolts. And he has quite an antenna set up as well. See: http://rudys.typepad.com/files/new-600-meter-station-at-wd2xsh-1.pdf . He says: “The fundamental rule for LF-MF antennas is: as much wire as possible, as high as possible!” Although transmit antennas run to the long and large, receive antennas can be as simple as vertical wires and small loops. John Stuart, KM6QX, CHRS uses a “Pixel Loop” and a Flex-6700 SDR receiver.

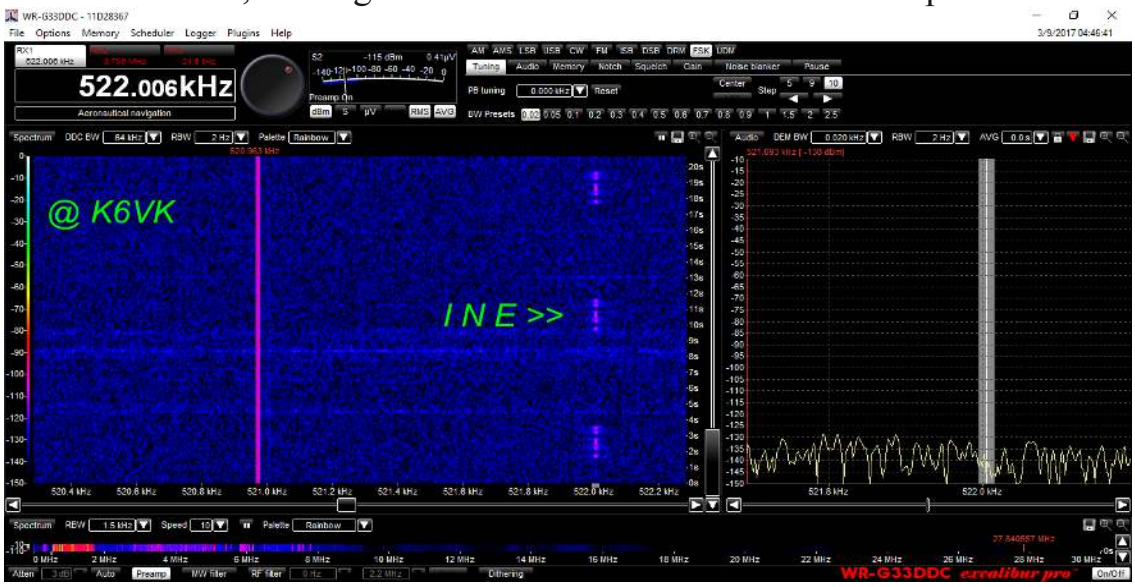
During the February tests, K6VK also copied four Canadian stations running WSPR followed by Morse code IDs:

Callsign	reception	location
CF7MM	2x2	British Columbia, Canada
VE7BDQ	2x2	BC
CG7CNF	2x2	BC
VE7SL	2x2	BC

WH2XXP is running maybe 39 watts (ERP), he says, on his experimental license. The 2x2 Canadians run a lot less power. I did copy at least the callsign of each. (Although 2x2 is just about ESP level, these are repetitive beacons, after all). All in all, I could copy with some difficulty every west coast station on the band. There were several other WSPR stations I could see but without a CW ID.

LF/MF Nav Beacons as Indicators

I enjoy winter DXing of beacon (navigation) stations in the LF and MF ranges. A few nights prior in January I copied Ontario, Canada low power beacon YHD on MF on 413 KHz. The Montana low power beacons at 515 (SAK) and 521 KHz (INE) come in well every winter night. In the nearby graphic, INE's carrier is 521 KHz and the modulated (upper) sideband appears at 522 KHz. These beacon receptions bode well for MF amateur radio operation, at least in winter, because they are usually less than 50-watt stations, although the Canadians run somewhat more power.



The K6VK Receiving Station

My experience now copying stations from VLF at 11.9 KHz (Siberia) to MF at 521 KHz (Montana) is that vertical antennas, especially when paired, outperform my other antennas, including two big loops. They are less

noisy by far, no 60 cycle harmonics, good sensitivity although way less than the loops. My long wire is just all noise.

Some antenna experimentation showed that the best (and quietest) signal-in as measured on the SDR came from paralleling a 43 foot vertical wire with the nearby 33 foot (+ 6' mount) Hustler 6BVT. (They are both just E-field probes at these frequencies). The "Very Kinky Loop" of old copper pipe, 8.5 square meters capture area, did well, but suffers from 60 cycle harmonics. And when it rains it picks up electrostatic discharge from the raindrops — who knew? It is also highly directional, which was OK for the 630-meter tests as most stations were to the North. The ground system here at K6VK features about 600 square feet of ground screen, multiple radials both elevated and ground level, and two 8' ground rods.

So, my conclusion is that for everything from ELF to MF, for receiving the best antenna is wires as high up as possible, as many as possible, paralleled, over a good ground. ("Your mileage may vary.") What has surprised me is the relative immunity from local noise of the vertical wires at these frequencies (but not at HF). On MF, there were atmospheric "static" crashes in on all antennas; I understand the frustration of the old wireless men with static!

It was helpful to turn off everything that I had plugged into the 110 volt house power, and run the SDR from one heavy duty linear power supply (and the laptop battery). I have since set up long term battery power for the SDR and laptop.

As a test, I ran my Icom 7000 transceiver parallel to the SDR. It imposed weird spurious signals on the SDR at 630 meters. On the other hand, it seems equally sensitive and selective at 472 KHz. This test told me the Icom 7000 with the same good antenna and ground system sounded about as good as the G33 SDR. Whether that would translate into WSPR reception *and* decode I don't know. The SDR has no WSPR decode mode and I can't see any easy way to get one. That is, the G33 SDR does not have an automatic decode for WSPR as it does, for example, NAVTEX.

I don't (yet) know how to interface the SDR with the WSPR software. With the Icom 7000 and a sound card like SignaLink® it would be straightforward. So for WSPR, the Icom 7000 will work fine with an external sound card. The G33 SDR demodulates many modes, including

USB and will accept user-defined modes, so perhaps there's a WSPR mode available from users.

The WinRadio G33DDC "Excalibur Pro" is a wonderful radio, and I haven't had so much radio fun since I built a regenerative three tube radio in 1957. But it is in a way its own ecosystem. Moreover the unhappy fact that I am not much of a computer guy makes for challenges. For transmitting (until some good commercial gear comes out) I'd be inclined to try military gear or even home-brew — alas, also not a skill of mine.

For hard to copy Morse CW I tried the old HAL "Telereader" but "No Joy" unless the signal was loud and clear. It did help with WD2SXH/20 and gave me a clue about "Eugene." It does work really well with KPH / KSM on MF, but that's ground wave.

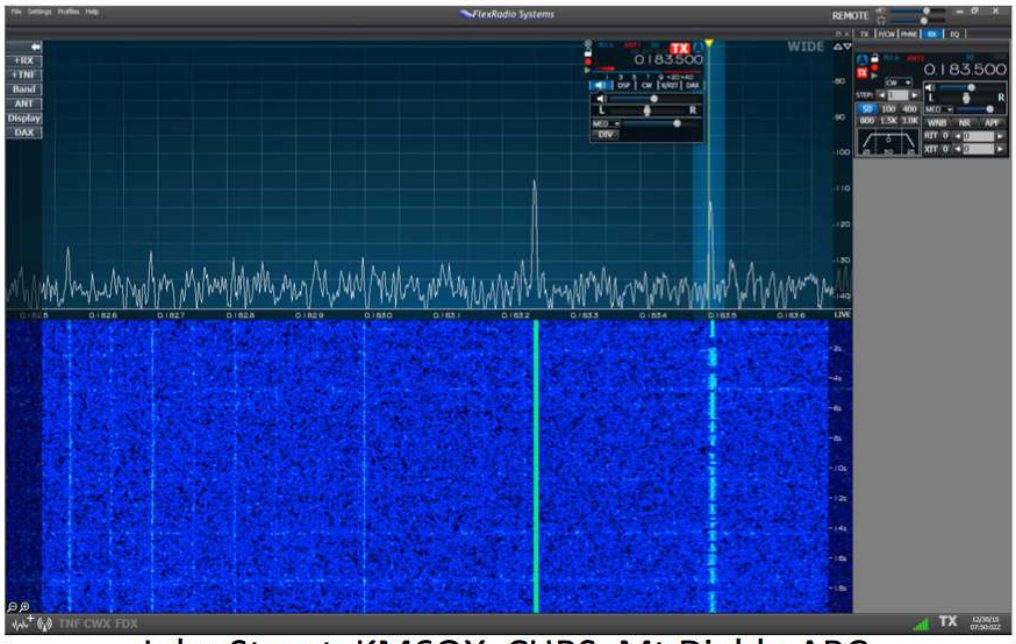
So, can K6VK (and maybe CHRS's W6CF) get on the air on 630 meters? Maybe, at K6VK with both vertical antennas and a lot of inductance on the 43' wire and maybe a capacity hat on the 6BVT.

Soon, VLF For Amateur Radio?

The FCC is looking into making a VLF band available to amateurs, at 137 KHz (2200 meters). Canadians and Europeans already have these privileges. WSPR-15 is designed for that frequency. It uses a 15-minute sequence. Noise is fierce at 137 KHz. But in World War One, the U.S. Army Signal Corps operated its field radios near this frequency throughout France. The Navy long operated on long wave until (and after) World War Two.

KM6QX (John Stuart), W6BM (John Staples) and K6VK of the VLF Interest Group of the California Historical Radio Society recently logged a Southern California experimental LoFer (Low Frequency) beacon at 183.5 KHz — WH2XVN run by David Curry. He operates on an experimental license under Part 5 of the FCC rules. Dave has maintained his interest since the LoFer heydays of the 1980s in Southern California.

LoFer Beacon WH2XVN



John Stuart, KM6QX, CHRS, Mt Diablo ARC;
Pixel Loop and Flex Radio, Lafayette, CA (first heard at K6VK)

Dave Curry says: "The beacon is a Part 5 license that radiates just under a Watt with about 100 Watts input to my class E transmitter working at around 95% efficiency." And "It is heard over the western half of the country. I live in Burbank." The beacon transmits: "WH2XVN WH2XVN WH2XVN WH2XVN davecurry@charter.net. DM04. AR_____"

A New Old Era For Amateur Radio

Amateur Radio started in what we call the VLF, LF and MF frequency ranges as early as 1903. The demands of marine safety, as of 1912, relegated the "hams" to above 1,500 KHz, *i.e.*, 200 meters and down.

But now, marine radio having gone to satellites, the lower reaches of the radio frequency spectrum are again opening up to amateur operation and experimentation. Any radio that can hear under the broadcast band can receive 472 KHz transmissions. They can be decoded with a soundcard. A SDR makes it all visible as well. The new amateur radio frontier is the old frontier of wireless, the Navy and the old salts.

73 de Bart, K6VK