

10 GHz operation. Most of the 10 GHz ham band operators in Iowa are rovers and we head to Minnesota eventually. The main 10 GHz contest is ARRL 10G and up that occupies a weekend mid August and another weekend mid September. The scoring in the contest is the computed distance between the centers of 6 digit Maidenhead grids. Mine at home is EN32FH. The Minnesota organization is the Northern Lights Radio Society <http://www.nrls.org> There are 30 or so members with 10 G rover equipment. In 2018 I worked 23 unique calls. There is W0LQG near Crescent in the Loess Hills that has a home station in Iowa. There are a couple rovers in the Cedar Rapids area. In the NRLS W0ZQ and WB0LJC plan each year's events. NRLS meets at a conference called Aurora (listed at arrl.org hamfests) in White Bear Lake Minnesota. The morning of the event (April 25, 2020) is outside in a large church parking lot with lots of visiting, antenna testing, and a swap meet. The afternoon meeting in the church basement has technical presentations, the annual NLRS business meeting and discussion of the summer contest plans.



View from Buck Hill.

Ten to twenty years ago a group of 25 or so stations set up on Buck Hill in Burnsville a couple miles north of where I35 splits into I35E and I35W. Buck Hill is a man made ski hill and it has good visibility south and west. Signals here at Ellsworth were very workable at a distance of nearly 200 miles. There is a new owner of Buck Hill and he has summer slope events and won't let the NLRS occupy the hill top. In those years the rovers joined me at the overpass 2 miles south of Ellsworth and we worked or way mostly east along US-20, then north and west sometimes approaching the Minnesota border. We have worked W0LQG from that I-35 overpass several times.



A 2015 rover group ready to make contacts.

Most recently the fixed group has been at K0KFC's home near St. Croix Falls and the first day rovers have started at Spring Valley MN then working south into Iowa, sometimes as far south as Oelwein to stay overnight and work north and west on Sunday.

A couple years the paths worked for one weekend crossed lake Superior north shore to Kenewah Peninsula and stations on the very east shore in Canada.. The rovers on the north shore got as close to the lake as possible. Lakes and oceans evaporate some water into the low atmosphere and make a temperature inversion that makes microwave signals travel at least 350 miles, stronger than over dry land. There is a small mountain on that upper Michigan penninsula that makes up for the temperature inversion and gets good signals all across the lake.

In 2018 one weekend involved a fixed group at Montecello MN on a hill top in a municipal park and we rovers started at Elbow Lake and we worked our way north west to Fargo. We also worked VE4MA in Winnipeg and a North Dakota home station. Longest distance for VE4MA was 486 km. Sunday we worked our way back towards Montecello on different paths.

First weekend in 2019 the rovers started at Hutchinson, MN and worked a fixed group in South Dakota while we headed south towards Fairmont MN. I messed up the operation of my IF rig late in the day that I have fixed since then. With hail in the overnight forecast I gave up the operation and the reserved motel in Fairmont and came home seeing severe storms most of the way south from Albert Lea. Then

the second weekend it rained all over Minnesota and Iowa. Rovers tend to carry a trash bag big enough to cover the rover rig so it can be operated in rain. And thunderstorms can lead to very long distance by rain scatter from the tops of the thunderheads. I claimed a 620 km contact by rain scatter one contest weekend in the past decade or so.

Over the last decade I have scored high enough that the ARRL contest certificate has said 4th or 5th in the world. NRLS members tend to be in that group with a bit higher scores than me.

RIGS

Long ago 10 GH operation was FM using door opener signal sources. Range was tough at 40 miles. Since then everybody has gone to transverters and operating CW or SSB. Occasionally FM for rain scatter off of a thunderstorm. I have found SSB to work OK for rain scatter.



Transverters are available in kit for or assembled from Down East Microwave <https://www.downeastmicrowave.com/category-s/1513.htm>, DB6ST in Germany, <https://shop.Kuhnwelectronic.com>, and Paul Wade W1GHZ who has his published on line. <http://www.w1ghz.org/MBT/multiband.htm> He does sell circuit boards. Nearly all these circuits use small surface mount transistors and integrated circuits so you need to be capable of assembling surface mount to assemble the kits.

Typical transmitter power is 3 to 10 watts. Some transverters need a low noise preamp but I'm not using a preamp and only a 3 watt PA and I make as many contacts as the rest of the stations in the rover group I'm with.

KU band offset dishes about 18" diameter or a bit larger work decently with a 10 GHz feed. Nearly everybody has the transverter and the IF rig mounted on the dish or below the dish and the assembly mounted on a sturdy camera tripod. I used a couple tractor hitch parts to make my mount. I have a web page on that mount. <http://www.geraldj.networkiowa.com/papers/CSVHF2010/xvtr857align.pdf> I extend the legs of the tripod as far out as they will go and then raise the top post as high as it will go. It allows for rotating the equipment which is needed because at 10 GHz an 18" dish has a 3 degree beamwidth. My mounting also has a tilt adjustment because the gravel roads we rove on are never perfectly level and sometimes the distant stations aim higher than their horizon and we have to look up to share the atmospheric scattering volume. W1GHZ has an antenna book on line with lots of details for 10 GHz antenna construction or conversion and use. <http://www.w1ghz.org/antbook/preface.htm>

Yaesu FT817 is a very popular IF rig. The transverters don't need more than a watt or two when transmitting. Actually the mixer really needs only about 10 milliwatts, but the transverters are built with attenuation. My DEMI can handle 20 watts and has a built in dummy load for that power level. It is a bad idea for my transverter that uses a 189.333 crystal oscillator to create the 10224 GHz local oscillator. The oscillator board multiplies the crystal by 6 to get to 1136 MHz. The mixer board multiplies 1136 by 9 to get to 10224 MHz. The extra heat into the IF dummy load heats the crystal oscillator and causes 10 to 20 kHz frequency drift while transmitting. I use a Yaesu FT857D and I dug into the alignment menu and reduced the transmitter gain so it only produces 2 watts on 2meters and solved the heat drift. I have a web page article on that topic. The 857 has a power setting from the front panel but it uses a detector and feedback that allows a 20 watt spike at the beginning of each transmission. That spike is not good for the transverter expecting only 2 watts. Applying DC to the ALC terminal that's there to protect HF and VHF PAs may work, but still may spike. I also added temperature control using a power thermister next to my crystal and a pile of foam insulation around it for better stability. I apply power to the transverter while traveling to keep the crystal heated.. The latest DEMI transverter uses an Apollo synthesizer instead of the crystal and the synthesizer requires an external 10 MHz reference.

I made a tray for my transverter and antenna to ride on in the back of my truck. It supports the antenna as well as the IF rig and transverter. I cover it with a small tarp while traveling. The tarp keeps gravel road dust from getting to the equipment and hides the equipment from people looking in the back of the truck to see what is there. I carry a storage box that carries log sheets, a clip board, a set of headphones, and my GPS. A GPS that gives Maidenhead numbers is important because the 6 character Maidenhead are the standard 10 GHz and up contest transfer. Some GPS that are super on maps don't have the Maidenhead option. Mine also computes direction to the stations I plan to work which is handy. Then a good compass is handy. My GPS is a Garmin Etrex and I've had it at least 12 years.

For my antenna work, I took off the KU band feed and the KU downconverter. I ran a 3/4" drill through the circular waveguide to lower its frequency range. According to an article in an ARRL book, 3/4" copper water pipe makes a nice 10 GHz waveguide. Based on that article I mounted a SMA connector and a quarter wave probe into the side of that waveguide a quarter wave from the end that I closed off with a plate using the downconverter mounting screws. Some also add a tuning screw in the end plate. My antenna has measured a couple DB more gain than others of the same dimensions at a Central States VHF Conference. I mounted the feed waveguide and horn back in its original position.

I bought the KU antenna and downconverter on EBAY. They do exist at hamfests sometimes and in road ditches when owners give up on satellite TV. Mine was made for DirectTV.

I have been collecting microwave test equipment for decades. I have an 8 to 12 GHz signal generator. I have a frequency counter that counts to 15 GHz. I have an HP microwave power meter and power attenuators so I can feed it 3 watts and display milliwatts after the attenuator. For receiver testing I have an HP 5640B VHF/UHF signal generator that has a great built in attenuator and very fine frequency stability. When 10 GHz receiver testing I feed it to a 10 GHz rated mixer with a 10600 MHz LO and take the output through a 10 dB attenuator to the rig being tested. The output attenuator makes sure the threshold of sensitivity is for the receiver, not the test mixer.

For transverter power while roving I carry a 12 volt storage battery in the back of the truck bed and connect it to the trailer light and power connector so it gets charged all the time the truck engine is running which occasionally I idle the engine while at a roving site for a long time. While roving the battery has two cables and connectors connected, one for charging and one for the load. I use old fashioned 400 series Jones connectors that are good for 20 amps per post They are big and antique.. I also mount a voltmeter on the window at the frnt of the topper and connect it to the battery so I can look at it with the inside rear view mirrow and see that the battery voltage is rising shile I'm driving.

There is a lot of 10 GHz discussion on the MW mail list microwave@mailmanlists.us today. Last week there was a 10 GHz trasnverter ovvered for sale by W9JJ and I've not seen a notice it has been sold. <https://swap.qth.com/search-results.php?keywords=w9jj&fieldtosearch=call> and that was on the NEWSVHF mail list. <http://mailman.qth.net/mailman/listinfo/newsvhf>

Events coming nearby and soon include Aurora April 25, 2020 at The Community of GraceLutheran Church,4000 Linden St White Bear Lake, MN. The morning hours are outside swapmeet, antenna testing, and rover demonstratins. Technical programs begin at 1 PM inside and run to 5 PM with a club business meeting in there too. I haven't offered a presentation yet. There could be 10 GHZ equipment for swapping in the morning. www.nlrs.org/home/aurora

Then there is the 54th Annual Central States VHF Society Conference. It will be held at the Radisson hotel in La Crosse, Wisconsin on July 24-25 2020. On line at 2020.csvhfs.org Friday evening will be a swap fest.

Reference materials.

One that has been around a while is the RSGB and ARRL international Microwave Handbook. 2nd Edition dates from 2008 but is the latest on arrl.org. I recall that it was cheaper to pay for shipping from England than to pay ARRL shipping and sale price.

Some Central States VHF proceedings and Microwave Update Proceedings have had stuff on 10 GHz and equipment. They can be bought through ARRL and a printer that printes on request and sometimes shows contents.

And there is the German magazine DUBUS that prints every article in english and german including instruction manuals in past years from Kuhne Electronics. There do exist DUBUS indexes on line and back issues of DUBUS and back issues can be purchased through the US subscription dealers.

73, K0CQ