

# RADIO AMATEUR News & Views

The Official Journal of the Radio Amateurs of Northern Vermont

July • 2020

An ARRL Special Service Club

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## NEXT MEETING:

Tuesday July 14th @7:00pm

## DR. JEFF PRESENTS

The July 14th RANV Meeting on Zoom For our July 14th meeting our very own wizard, N1YD, Dr. Jeff (he's not a really a Doctor – I just bestowed that title on him), will join us to present a few of his great demonstrations. Jeff is a regular at both Ham-Con and Field Day with demonstrations of various science projects like satellite receivers, crystal radios, aircraft trackers, phase measurements and other interesting items.

Unfortunately, FEW of us actually get to see these little jewels as we are stupid busy during both the Convention and Field Day. For our July meeting, Jeff will give a presentation about Othernet, a way to receive selected Internet content from a satellite. He will also demonstrate a mixer, which is the circuit that down converts 12 gigahertz satellite transmissions to a frequency that the radio can handle. Be sure to join us July 14, starting at 6:30 at the RANV Zoom meeting. Contact Mitch if you need to know the meeting ID.



Othernet Internet Satellite

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Meetings: 2<sup>nd</sup> Tuesday • 7:00 PM  
Wheeler House  
1100 Dorset Street  
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Repeater: 145.150, PL 100; WB1GQR

New Hams, Mentoring:  
[RANVMentor@gmail.com](mailto:RANVMentor@gmail.com)

VT State Parks On The Air:  
<https://www.facebook.com/groups/292829457810746/>

Online Dues Payment:  
[www.ranv.org/ranvpay.html](http://www.ranv.org/ranvpay.html)

Mitch [W1SJ](#)

## FIELD DAY 2020 – WE DID IT!

Field Day 2020 will go down as one of the more difficult events to pull off, yet one of the most satisfying in that we rose to the occasion and pulled it off successfully and safely. With the COVID19 infections still active, we had to ensure that we didn't aid in the spread of this virus, especially amongst a group of 15, mostly aged people. Fortunately, there has not been much infection rate in Vermont, but that is not a guarantee. We adopted 6 foot spacing, mask wearing and single tent occupancy in the phone and CW tents to arrest any spread. Phone operators had to have their own headsets, which created some interesting technical and logistical problems.

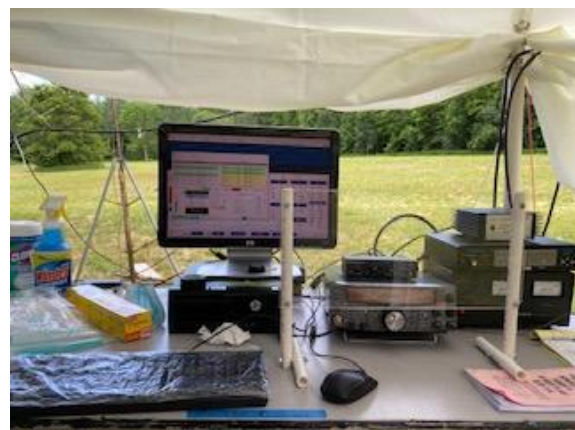
Radio screens and lots of cleaner were used to clean touched areas and everyone was warned to disinfect their hands often. Setup was modified to make sure we didn't have clusters of people on top of each other. Sadly, communal food and some of the socializing was cancelled. Initially, we were concerned that we wouldn't have enough people to even run Field Day, but we fielded a somewhat smaller, but stronger crew. With all of these conditions, we held Field Day which despite some of these changes, was pretty much like most every other Field Day. Few other groups accomplished this. Looking at our phone logs, we only worked 338 stations in the "A" category (3 or more participants in the field). In 2019, we worked 1212 such stations. Clearly, most folks stayed home. One would think that we would work a lot of people with everyone staying home.

However, conditions for the first 5 hours stunk. Phone, CW and GOTA all reported very poor rates during this time. Signals were weak and in and out of the noise. Many CQ's had to be issued during times when pileups would be the norm. Fortunately, things kicked back into high gear on 20 meters in the early evening. Sunday morning brought great short skip rates on 40 meters and insane rates on 15 meters for the last couple of hours and we were able to recoup some of the losses from the poor hours. But we were still down in QSO's on CW, which hurt the score the most. Also hurting the score was some of the bonus points which had to be bypassed in order to keep safe virus spacing. Next month, I'll report on all of the numbers, facts and figures and list of participants. We are one of the best Field Day groups in the country. Other groups have already commented on that. And despite a plethora of challenges this year, we were back on the air proving that we can and will communicate no matter what else is going on. Thank you and congratulations to the crew, both on site and at home, who made it all possible.

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Stew [KC1IFK](#)

## FIELD DAY 2020 – Pictures





Mitch [W1SJ](#)

## RANV ACTIVITIES COMING UP

Despite the virus situation swirling around us, RANV has been able to hold activities both on-line and in limited outside engagements. We are one of the most active clubs around. We have done a park activation in May and just completed Field Day. Coming up, we have 2 other activities we can do safely this summer. Saturday, August 8<sup>th</sup> is the RANV Picnic at Kill Kare State Park. Our attendance at this event typically hovers around 10, so this is a safe and manageable number. Everyone will have to bring their own food, drink, utensils, chairs and tables. We also encourage attendees to bring their own grill, if they can, and additionally, we'll assign times to separately use the park grill.

We'll put the tables and chairs in a large 25' circle and eat and converse. However, there will be no communal bag of chips being passed around! We can even set up a radio to operate and do a park activation, but everyone needs to bring their own headset. We'll get out, get some fresh air, and enjoy the day safely. We also plan one or two park activations, time and location not yet decided. These typically involve 3-4 people outside in a park. More details on these activities as we set them up. One former activity we used to do, which we CAN do safely is the Fox Hunt. For those new to this, in a Fox Hunt, someone drives to a hiding spot and transmits at regular intervals while the hunters use direction finding techniques, divining rods, or mostly guess to figure out where the Fox is located. No one needs to get out of their car, ensuring a virus safe activity. The complaint is that I win these events quite regularly (I practice a lot). So, I will volunteer to be the hider. What we need to know: Are you willing to engage in this activity and what day/time will work best. Clearly, 2 or 3 people will not be sufficient to make this a worthwhile exercise – more are needed. Send along your thoughts to me. Unfortunately, this virus is the gift that keeps on giving. As Mr. Spock would say, "I always would like to think there are possibilities". This, meaning that maybe the virus will go away by itself or we develop a miracle cure. If I were a betting person, I wouldn't take that bet, and it is quite likely we'll be in the same predicament in 6 months. We already know that the Fall Near-Fest will not happen and Ham Xpo (aka Boxboro) cannot possibly happen in November. It is very likely that the RANV Holiday party, the January breakfast and HAM-CON will not happen. We can replace the eating parties with Zoom meetings and self cooking, but the hamfests are out. So for the next couple of months, enjoy the in-person ham radio events outside this summer as much as you can safely.

We will continue to sponsor the weekly RANV chat sessions on Zoom Tuesday night at 6:30. On the 2nd Tuesday, we will hold a long form RANV meeting with a formal presentation and on the 3rd Tuesday, we will hold our Steering Wheel, or Board meeting. The weekly chats are a good place for everyone to find a place to meet up and discuss anything on their mind. We are also planning some training at these meetings. One idea is to do a several week mini-class on



becoming an effective FT8 user. Other concepts will be added to this and we hope the chats will be a valuable place to learn new ham radio skills. Despite all the bad stuff swirling around us, RANV will continue to be active and we hope you will join us at all these activities. Stay safe and happy!

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Stew **KC1HFK**

### 13 Colonies Clean Sweep

Just landed GB13COL for the clean sweep! The “Other” on the log is my first FT4 contact in a contest. Tonight, was the first time I heard GB on the air, so I decided to be one of those guys, and cranked the amp up to 1000w and he came back to me on my first call through a wicked pile up! Put enough fire in the old G5RV to make her sing all the way across the pond! I work primarily FT8, but this event and field day has convinced me that I should spend more time on phone getting some paper! I also got my first shipment of DX QSL cards from the bureau yesterday. (Thanks Carl, AB1DD, for assuring me the email was not a scam!) July is coming up aces so far! Man I love this hobby!

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Duane Sherwood, **Secretary**

### RANV Meeting Minutes June 9, 2020

There were about 19 in attendance via Zoom.

#### Meeting Notes and Announcements

The meeting appeared to be underway when I signed into Zoom at 18:58. Several items pertaining to Field Day were discussed.

#### Presentation

Gerry Hull W1VE gave a presentation on his experiences with remote control of radios. This talk was not about how to set up remote stations. A presentation on how to set one up is available at <https://youtu.be/RI8-HR9bQyU>. This talk is about some of his experiences in remote radio control over seven years. He opened the presentation with a photo of a station owned by VY1JA in White Horse in the Yukon Territory. It included a home brew tower, 4 element quad about 25 years old. Gerry has been a ham since 1975 in Virginia. He also has a Canadian license and has used many call signs. He enjoys using all the modes. He was an employee at the ARRL headquarters from 1980 to 1983. What is remote amateur radio? It is a method for remotely controlling an amateur radio station using the internet. A person can operate a station from any location. Remote stations can even be rented.

Why use a remote station? A person may live in a HOA restricted condominium that allows no antennas, or local QRM may be problematic, or the home site is just a poor location for a radio. It also allows partnering opportunities for sharing costs and resources, especially if the owner does not use their

station much. You can even do remote on a cell phone if you have the right gear. It becomes possible to operate during ARRL sweepstakes from as many sections as possible. Gerry has operated from Brazil, Sweden, Canada, USA, Virgin islands, Puerto Rico, and Hawaii. Operating with a remote station gives an alternate view of propagation conditions. Is it hard? No. A radio like the K3 is easy radio to remote. Is it legal? In the USA, yes. Across borders, there are few written laws. It may be best not to ask, because the people you ask likely won't understand. However, there are standards. If you are operating in a foreign country, get their license. A CEPT license is not valid for operating remotely, only for in-country stations.

When operating remotely, follow good practices and self regulate. Don't operate improperly. Follow the regs as if in that country. In some countries, Brazil and Sweden, remote on HF is allowed. Ask local hams about operating remote in a country. A control operator must be there. What else can you do with remote? Demonstrations in local high schools. It allows potential hams to hear possibilities in situations where setting up a working station would be difficult. Gerry finished his talk with description of what he did working at ARRL.

RANV Meeting Minutes

End of meeting

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## ***Coaxial Capacitors for Solid State Amplifiers***

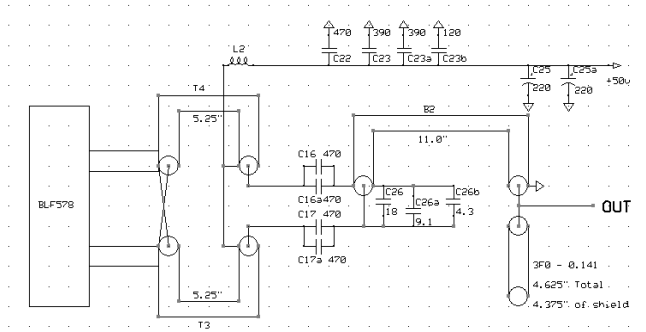
Mike, N1JEZ

For over 10 years now, I've been using solid state amplifiers (SSPA) on 2 meters through 3456 MHz at my station in FN44ar, Newark, VT. For 2M and 222 MHz, these LDMOS based designs are capable of producing in excess of 1000 watts. They have performed very well on SSB/CW.

With the advent of digital modes such as MSK144/JT65/FT8/FT4, these amplifiers have been called on to deliver high power at a high duty cycle. This increases the stress on various components.

The schematic diagram below, shows the output section of my 2M amplifier.

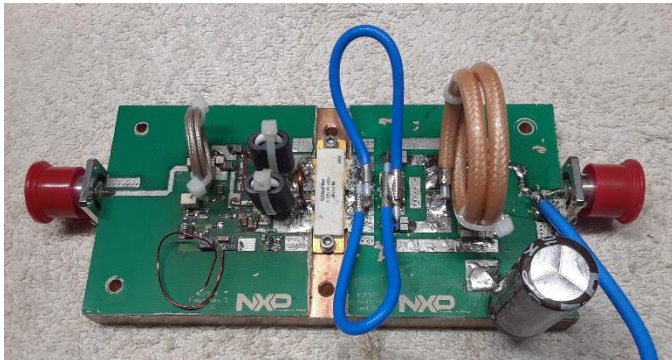




The LDMOS device is an NXP BLF-578 1200 watt part mounted in the middle of the copper heat spreader. The design utilizes a coaxial transformer for impedance transformation followed by a balun to convert the balanced transformer output to an unbalanced feed for my antenna.

A ~1:4 impedance transformation is accomplished using 25 ohm coax for T3/4. The balun at B2 is 50 ohm coax. All the coax used is PTFE/Teflon for high temperature operation.

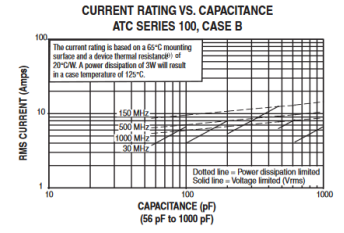
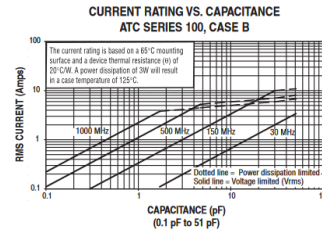
In the picture below, the output transformer is the blue 25 ohm coax. The balun is the light brown coax to the right.



To the far right, there is a piece of blue 50 ohm coax that is used as an open  $1/4\lambda$  stub, cut to the proper length, to attenuate the third harmonic at 432 MHz.

The amplifier is a push-pull design. Even order harmonics tend to be attenuated in these designs, but odd order harmonics can be higher than acceptable. The stub helps reduce the third harmonic before entering the final LPF.

The components we are concerned about are C26/C26a/C26b on the input of the balun. These are American Technical Ceramics (ATC) 100B capacitors. ATC publishes curves for current ratings versus value/frequency.



Fred, N1DPM has been running his 2M LDMOS amplifier for years on EME at the kW level using JT65. Recently he experienced a spectacular failure.

In this picture, these are the three ATC 100B capacitors used at C26/a/b. The 'blob' on the right is what's left of one capacitor after the incident. The capacitor melted.



Brian, WA1ZMS performed a circuit analysis on the capacitors at 1000 watts output and found, based on the published ATC curves, that they were right at or above their current handling capacity; thus the meltdown.

While contemplating replacement, Fred had the idea of using coaxial cable as a capacitor. We know that coaxial cable can be used for stub filters. We don't usually think much about the fact that coaxial cable does have a 'capacitance/ft' specification.

Here's the data sheet on the 25 ohm coaxial cable I use in the amplifier.

#### Electrical & Mechanical Data

Characteristic Impedance	25Ω (±2)
Operating Frequency	dc - 6 GHz (max. 8 GHz)
Cutoff Frequency	29 GHz
Velocity of Propagation	70%
Signal Delay	4.7 ns/m
Capacitance	182 pF/m
Operating Temperature	-65 / +165 °C (-85 / 329 °F)
Working Voltage	1500 V <sub>RMS</sub> (max.)
Weight	52.6 Kg/Km
Min. Bending Radius	10 mm (single), 40 mm (multiple)

What we're interested in is the capacitance value that is listed as 182 pF/m or 4.6 pF/inch. 25 ohm coax was chosen because it has a higher capacitance/inch value than the equivalent 50 ohm coax so the capacitor will use a shorter and more compact length.

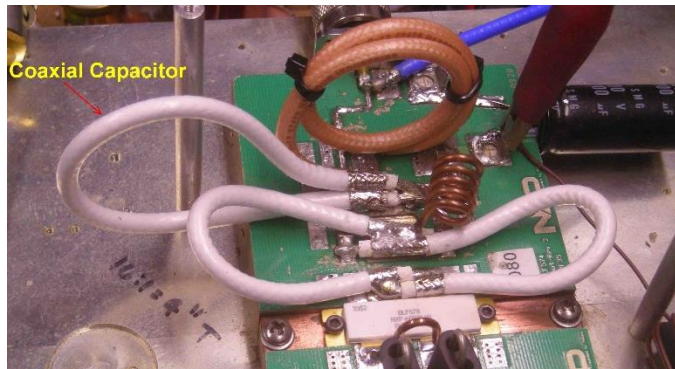
Probably the most significant factor is that the coax can easily handle the anticipated current in the output circuit.

The value used at C26/a/b is 31.4 pF. The 25 ohm coax Fred used is rated at 4.72 pF/in, so the length is 6.65". The 25 ohm coax I use is 4.62 pF/in so my length is 6.8".

We could have used 12.5 ohm coax which is rated at 330pF/m or 8.38 pf/inch. This would have cut the length to 3.75", but it is much stiffer and tough to fold at that length.

Characteristic Impedance	12.5Ω (-1/+2)
Operating Frequency	dc - 12 GHz
Cutoff Frequency	24 GHz
Velocity of Propagation	70%
Signal Delay	4.7 ns/m
Capacitance	330 pF/m
Operating Temperature	-65 / +165 °C (-85 / 329 °F)
Shield Effectiveness	> 90 dB
Working Voltage	1000 V <sub>RMS</sub> (max.)

Here is a picture of Fred's amp. He opted to "fold" the coax back on itself. This has the effect of negating any 'open transmission line' characteristics that the coax has leaving it to function just as a capacitor.



Here's my amplifier.



After the modification, tests showed no change in output characteristics. The following data shows the typical performance of these amps.

As you can see, P1dB is 750 watts with efficiency of 77%. At 1040 watts, it is P1.5 dB and efficiency of 87.4%. The performance is a function of how the amplifier is tuned. It is possible to tune for a lower output with very high efficiency at the expense of high P1dB. This is often done in commercial situations such as FM Broadcast where the duty cycle is 100%. Another trick is to reduce voltage which has the effect of making the amp more robust to output issues. This generation of devices are normally run at 44-50 volts. There is a newer generation of devices rated at 65 volts and upwards of 1800 watts output.

As you can see, these amplifiers need very little drive. 2.3 watts input will yield a kW out.

Pin	Pout	Gain	Compression	Vdd	Id	Dissipation	Efficiency	
0.000	0	0	0	48	2	96.0	0.0%	
0.190	118	27.93	0.00	48	7.7	251.6	31.9%	
0.200	124	27.92	0.01	48	7.9	255.2	32.7%	
0.210	130	27.92	0.01	48	8.1	258.8	33.4%	
0.220	136	27.91	0.02	48	8.4	267.2	33.7%	
0.240	148	27.90	0.03	48	8.6	264.8	35.9%	
0.270	167	27.91	0.02	48	8.9	260.2	39.1%	
0.280	173	27.91	0.02	48	9.5	283.0	37.9%	
0.295	184	27.95	-0.02	48	9.7	281.6	39.5%	
0.305	189	27.92	0.01	48	10	291.0	39.4%	
0.310	193	27.94	-0.01	48	10.2	296.6	39.4%	
0.330	205	27.93	0.00	48	10.5	299.0	40.7%	
0.360	225	27.96	-0.03	48	10.7	288.6	43.8%	
0.380	236	27.93	0.00	48	11.2	301.6	43.9%	
0.395	245	27.93	0.01	48	11.4	302.2	44.8%	
0.405	250	27.90	0.03	48	11.6	306.8	44.9%	
0.415	255	27.88	0.05	48	11.9	316.2	44.6%	
0.450	277	27.89	0.04	48	12.2	308.6	47.3%	
0.470	290	27.90	0.03	48	12.6	314.8	47.9%	
0.485	300	27.91	0.02	48	12.9	319.2	48.4%	
0.500	310	27.92	0.01	48	13.1	318.8	49.3%	
0.510	320	27.98	-0.04	48	13.4	323.2	49.8%	
0.530	330	27.94	-0.01	48	13.5	318.0	50.9%	
0.580	365	27.99	-0.06	48	13.7	292.6	55.5%	
0.605	370	27.86	0.07	48	14.2	311.6	54.3%	
0.610	380	27.94	-0.01	48	14.5	316.0	54.6%	
0.650	402	27.91	0.02	48	14.7	303.6	57.0%	
0.675	415	27.89	0.02	48	15	305.0	57.6%	
0.710	425	27.77	0.16	48	15.1	299.8	58.6%	
0.740	450	27.84	0.09	48	15.5	294.0	60.5%	
0.765	460	27.79	0.14	48	15.8	298.4	60.7%	
0.800	475	27.74	0.20	48	16	293.0	61.8%	
0.810	480	27.73	0.20	48	16.2	297.6	61.7%	
0.830	490	27.71	0.22	48	16.5	302.0	61.9%	
0.890	515	27.62	0.31	48	16.6	281.8	64.6%	
0.915	525	27.59	0.34	48	17	291.0	64.3%	
0.950	540	27.55	0.38	48	17.2	285.6	65.4%	
0.970	550	27.54	0.40	48	17.5	290.0	65.5%	
0.990	560	27.53	0.41	48	17.7	289.6	65.9%	
1.050	585	27.46	0.47	48	17.9	274.2	68.1%	
1.080	600	27.45	0.48	48	18.2	273.6	68.7%	
1.140	610	27.28	0.65	48	18.5	278.0	68.7%	
1.220	640	27.20	0.73	48	18.7	257.6	71.3%	
1.250	652	27.17	0.76	48	19.1	264.8	71.1%	
1.300	670	27.12	0.81	48	19.3	256.4	72.3%	
1.340	680	27.05	0.88	48	19.6	260.8	72.3%	
1.390	700	27.02	0.91	48	19.8	250.4	73.7%	
1.470	710	26.84	1.09	48	20	250.0	74.0%	
1.530	740	26.85	1.09	48	20.4	239.2	75.6%	
1.580	760	26.82	1.11	48	20.6	228.8	76.9%	P-1dB
1.620	770	26.77	1.16	48	20.8	228.4	77.1%	
1.680	788	26.71	1.22	48	21	220.0	78.2%	
1.710	800	26.70	1.23	48	21.2	217.6	78.6%	
1.800	825	26.61	1.32	48	21.5	207.0	79.9%	
1.850	845	26.60	1.33	48	21.8	201.4	80.8%	
1.900	860	26.56	1.37	48	22	196.0	81.4%	
1.950	880	26.54	1.39	48	22.5	200.0	81.5%	
2.000	900	26.53	1.40	48	22.7	189.6	82.6%	
2.100	920	26.42	1.52	48	23.2	193.6	82.6%	
2.150	940	26.41	1.52	48	23.5	188.0	83.3%	
2.200	960	26.40	1.53	48	23.6	172.8	84.7%	
2.250	980	26.39	1.54	48	23.9	167.2	85.4%	
2.300	1000	26.38	1.55	48	24.1	156.8	86.4%	
2.350	1020	26.38	1.56	48	24.4	151.2	87.1%	
2.450	1040	26.28	1.65	48	24.8	150.4	87.4%	P-1.5dB



## NEWS&VIEWS

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### NEXT MEETING

Tuesday • July 14<sup>TH</sup> • 7:00pm

Meeting Topic  
**DR. JEFF PRESENTS**

### Upcoming, Notices, & Misc

- Steering Wheel: 3<sup>rd</sup> Tues 6:30; Ninety-Nine Restaurant, Taft Corners, Williston
- VE Exams every 2<sup>nd</sup> Friday; Red Cross Building 29 Mansfield Ave, Burlington
- Dues due? Pay online at [www.ranv.org/ranvpay.html](http://www.ranv.org/ranvpay.html)