

MOUNTAIN SPARK GAPS

**NPARC—The Radio Club for the
Watchung Mountain Area**



**Website: <http://www.nparc.org>
Club Calls: N2XJ, W2FMI
Facebook: New Providence Amateur Radio Club
(NPARC)**

VOLUME 54 NO. 1 January 2021

Regular Meetings
Second & Fourth Mondays
“ZOOM” until we can all
get together again

Upcoming Events

Digital Net Mondays at 9:00 PM
PSK on 80 or 10 meters
CW training Net, Thursday at 9:00 PM
Watch for Email announcements.

Meeting Schedule

Regular Meeting: 7:30—9:00 PM
**2nd & 4th Monday
of each month** at the
New Providence Hall
Elkwood Ave. NP

Everyone is Welcome

If a normal meeting night is a holiday,
we usually meet the following night.
Call one of the contacts below
or check the web site

Club Officers for 2018

President: W2PTP Paul Wolfmeyer
201-406-6914
Vice President: K2GLS Bob Willis
973-543-2454
Secretary: K2AL: Al Hanzl
908-872-5021
Treasurer: K2YG Dave Barr
908-277-4283
Activities: KC2OSR: Sam Sealy
973-462-2014

—On the Air Activities

Club Operating Frequency
145.750 MHz FM Simplex

Sunday Night Phone Net

Murray Hill Repeater (W2LI) at 9:00 PM
Transmit on 147.855 MHz
With PL tone of 141.3 Hz
Receive on 147.255 MHz
Net Control K2AL

Digital Net

Mondays 9 PM
28,084 — 28,086
Will be using PSK and RTTY
Net control K2YG

Club Internet Address

Website: <http://www.nparc.org>
Webmaster KC2WUF David Bean
Reflector: nparc@mailman.qth.net
Contact K2JV, Barry

MOUNTAIN SPARK GAPS

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Editor: K2EZR Frank McAneny

Contributing Editors:
WB2000 Rick Anderson
W2PTP Paul Wolfmeyer
K2UI Jim Stekas

Climatological Data for New Providence for December 2020

The following information is provided by
Rick, WB2000, who has been recording daily
weather events at his station for the past
39 years.

TEMPERATURE -

Maximum temperature this December, 60 deg. F
(December 25)

Last December (2019) maximum was 55 deg.
F.

Average Maximum temperature this December,
41.4 deg. F

Minimum temperature this December, 15 deg. F
(December 19)

Last December (2019) minimum was 13 deg. F.
Average Minimum temperature this December,
29.0 deg. F

Minimum diurnal temperature range, 6 deg.
(29-23 deg.) 12/16

Maximum diurnal temperature range, 33 deg.
(60-27 deg.) 12/25

Average temperature this December, 35.2 deg.
F

Average temperature last December, 34.7 deg.
F

PRECIPITATION -

Total precipitation this December- 3.92"
rain/snow melt; 5.5" snow.

Total precipitation last December- 6.09"
rain/snow melt; 5.4" snow.

Maximum one day precip. event this December-

December 16, 4.5" snow/sleet.

Measurable rain fell on 7 days this Decem-
ber, 10 days last December.

YTD Precipitation - 47.28"

=====

Rick Anderson

1/19/2021

243 Mountain Ave.

New Providence, NJ

(908)464-8911

rick243@comcast.net

Lat = 40 degrees, 41.7 minutes North

Long = 74 degrees, 23.4 minutes West

Elevation: 380 ft.

CoCoRaHS Network Station #NJ-UN-10

Presidents Column January 2021

Well, I'm in the "winter doldrums" with stay-at-home and cold weather. Our ZOOM meetings are a bright spot, however.

Good to just "check in" at our first January meeting.

And our second meeting featured Ria Jairam, N2RJ, our Hudson Division Director, with a fine talk on drones (including some application to ham radio, particularly antenna checking and line hoisting). Her talk gave us a nice overview of regulations, drones available, and some applications. I sent out the ZOOM recording info but here it is again:

<https://us02web.zoom.us/rec/share/IJGpEUJP-SeG1bjPzXEWYYDQRoEHWT3Jsz56DFpg4EGtzpXlGDKviZQx8e4niLb-.E3-mrWAU7Xis6CI2> Passcode: b@o33*uP

On our February 8th meeting, Andrea Black, K2EZ, will talk about roving. I've seen her "rover vehicle"—it's quite impressive. You can check it out on her QRZ.com page.

And the second meeting of February is planned to feature a presentation where you can see your signal, as it's seen by others, on a youtube—Intriguing!!

For me, I continue to work FT4 which I just started toward the end of December. I'm up to 45 states and 20 countries confirmed. I just stop by the rig three or four times a day, see what's on 20 or 40, and respond...or call CQ. For those who think FT4 is too fast a cycle to click on those calling CQ—it can be frustrating. So do something different—look for a clear spot on the "waterfall" click on the "Hold Tx" and then click on someone you want to work who is elsewhere in the band and click on "enable". Your transmission won't interfere with whoever they are currently working and they will pick you up soon—works slick...or call CQ at that open spot...

Ok, try the NPARC nets—phone on Sunday, digital on Monday (it's hitting 7 or 8 attendees regularly) and CW on Thursday (break out that key and dive in)...

73

Wolf W2PTP

201-404-6914

W2ptp@arrl.net

Care and Feeding of a Dipole Antenna

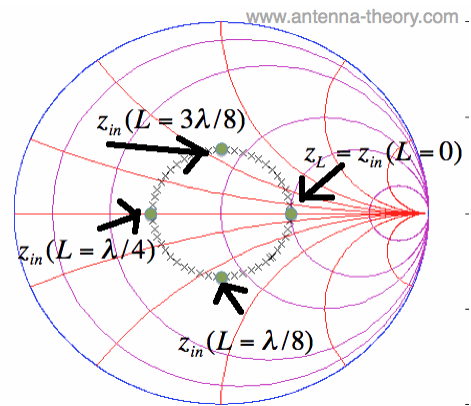
Jim Stekas - K2UI

I have heard some discussion recently about optimizing the feedline of a dipole antenna. This has been a popular subject of discussion among hams for many years, particularly in the context of the G5RV antenna. “Can I use a 300 ohm balanced line instead of 450 ohm ladder line?” “Would the length need to change?” “Do I need a balun between the balanced line and coax.” “How long can the coax be?” “Can I use 75 ohm coax?” etc. etc. etc.

Usually, the motivation for adjusting the feed line is to get a better match (i.e. lower SWR) at the transmitter. If the SWR is 5:1 and you are using $50\ \Omega$ coax, you can add (or subtract) as much coax as you want but it won't change the SWR. Adding coax will take you around the SWR=5 circle centered on $50\ \Omega$.

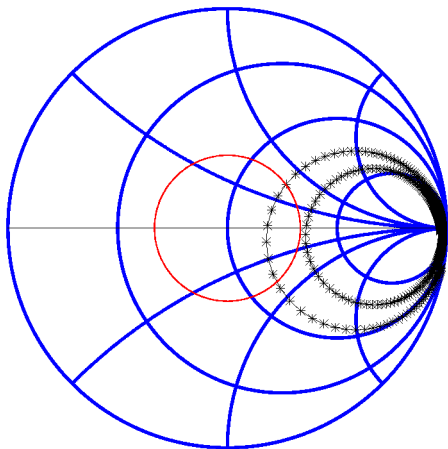
In the example at right, we start at $L=0$ with $Z_0=250\ \Omega$.¹

If we add $\frac{1}{4}$ wavelength of coax we end up with $Z_{\lambda/4}=10\ \Omega$. Other points on the circle have complex impedances. The $50\ \Omega$ circle runs through the center of the chart and intersects the SWR circle at two points (roughly 1 and 5 o'clock). The impedance at these points is $50 \pm j90$ and a single capacitor (or inductor) can cancel the reactive component $\pm j90$ and give a perfect 1:1 match.



Adding $50\ \Omega$ coax won't change the SWR but it could make it easier (or harder!) for you tuner to match.

40m Dipole Sweep w/ SWR=2 circle.



If you sweep an antenna with an analyzer like the NanoVNA and look at the Smith chart display you will see something like the chart at the left. The black circles trace the impedance versus frequency with markers every 50 kHz.

At 7 MHz ($L = \frac{\lambda}{2}$) the impedance falls inside the red SWR=2 circle. At 21 MHz ($L = \frac{3\lambda}{2}$) the impedance falls just outside the red SWR=2 circle. The impedance at frequencies corresponding to an even number of half wavelengths (14 and 28 MHz) is very high and appear at the right edge of the chart.

The impedance as a function of frequency follows a circular trajectory similar to SWR circles centered on a high impedance. Therefore the dipole impedance behaves something like a high impedance transmission line feeding R_{rad} , the radiation resistance of the antenna.

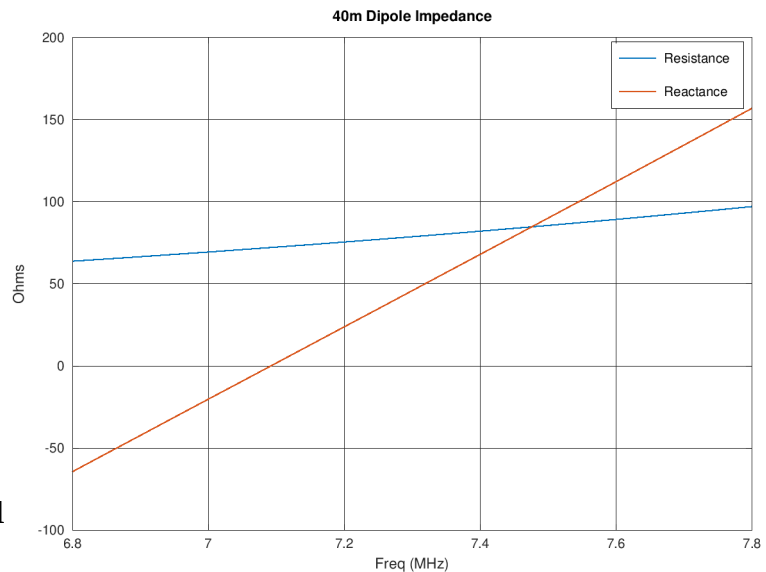
1 How do I know? Since SWR=5, $Z_L = 5 \cdot 50$

Looking at the impedance of a 40m dipole (figure below right) one finds a radiation resistance of about $75\ \Omega$ that changes slowly with frequency (blue line). In contrast, reactance change much more rapidly with frequency and dominates the SWR behavior. SWR is minimum at resonance where the antenna reactance equals zero, which happens around 7.1 MHz where $SWR \sim 1.5^2$.

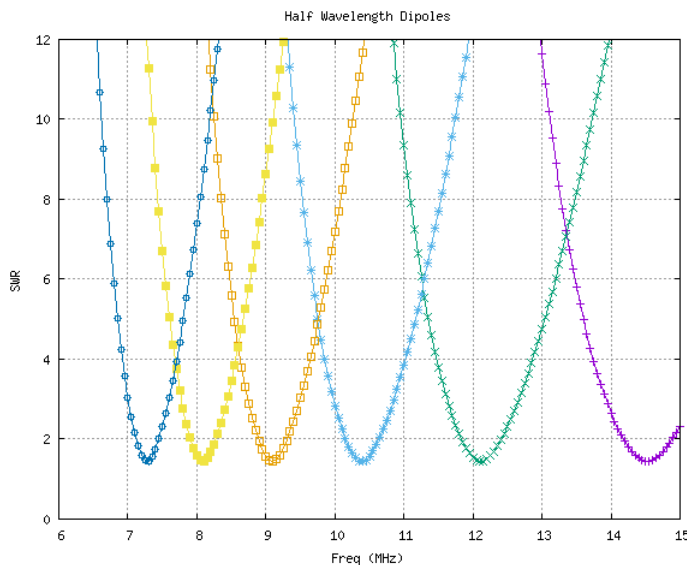
The at right plot shows the impedance of a half wave dipole cut for 7.1 MHz when excited at different frequencies. Alternatively, we could change the x-axis to a length scale³ so that our plot would give the impedance at 7.1 MHz vs. antenna length.

This is another way of stating what we already know:

1. given a frequency F we can find a dipole length L that resonates at F, and
2. given a dipole of length L, it will have some resonant frequency F.



Normally, we get a dipole to resonate where we want it to by increasing or decreasing its length. We know that if the resonant frequency is 10% too low we need to decrease its length by 10%. But, our Smith chart plots show that a dipole's impedance change with frequency behaves much like a transmission line.⁴ So it would be expected that we could change the effective length of the antenna by adding or removing some transmission line. Is that really possible?!



The plot on the left shows the SWR for 6 dipoles of different half-lengths ranging from 5m to 10m. (A half-length is the length of one leg of the dipole.)

The reason for using half-lengths is that a $\frac{1}{2}$ wavelength dipole has two $\frac{1}{4}$ wavelength wires. If we run both legs in parallel our dipole would turn into a $\frac{1}{4}$ wavelength balanced transmission line, which has similar impedance properties to a half-wave dipole.

2 At resonance, $SWR = 75/50 = 1.5$.

3 We would replace each frequency with a length $L_f = \frac{f}{7.1} L_{7.1}$ to give impedance at 7.1 MHz vs. length.

4 A transmission lines behavior depends on its length in wavelengths. Raising frequency reduces the wavelength, and makes the effective length of the transmission line longer.

Lets add some $450\ \Omega$ ladder line to each of our antennas such that the length from the tip of each antenna to the feed point is 10m. An SWR sweep of these antennas and ladder line appears below.

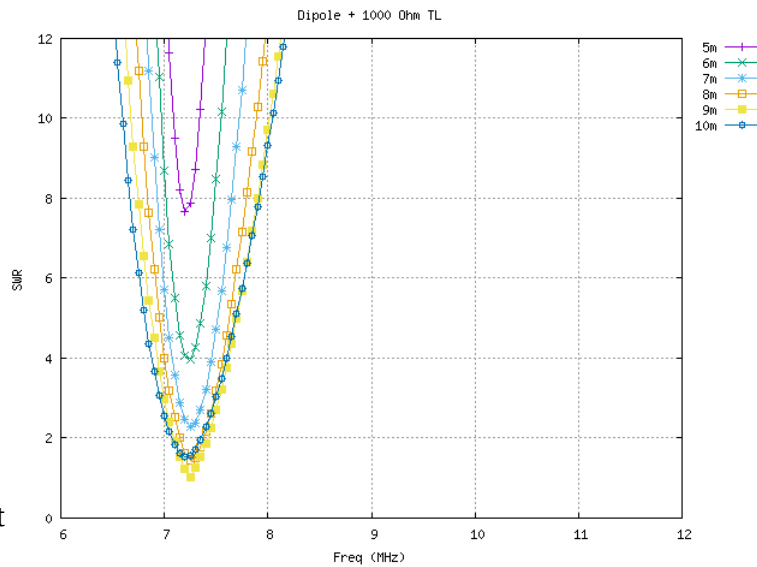
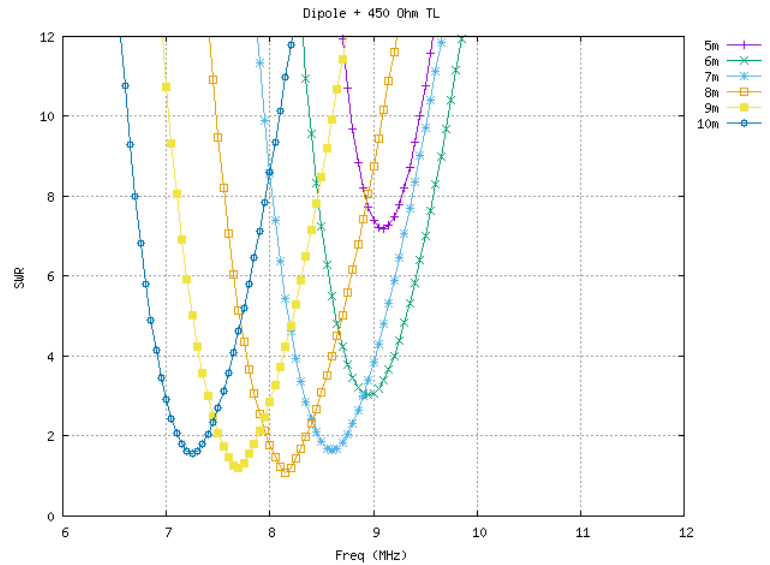
After adding the ladder line all these antennas now resonate between 7 and 10 MHz.

Many years ago at Bell Labs in Murray Hill, Serge Schelkunoff developed an antenna theory of dipoles with thin conical arms that he solved exactly by treating the antenna as a transmission line connecting the transmitter to free space. The impedance of his dipole transmission line model is given by:

$$Z_{wire} \approx 120 \cdot \ln\left(\frac{2h}{r}\right)$$

where h is the half-length and r is the wire radius. For our 40m antenna this comes out to be about $1000\ \Omega$ so let's try that ...

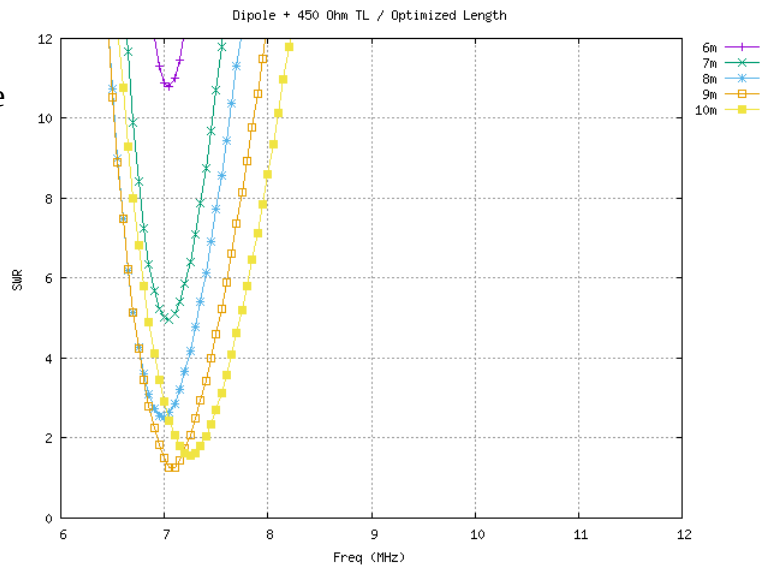
The results are shown at the right. Note that the SWR minima all line up with the full size dipole, but the SWR minima are different. This is because smaller antennas have lower radiation resistance. Adding 5m of ladder line to the 5m dipole makes it resonate around 7.1 MHz, but its radiation resistance is only $12\ \Omega$, the match is not very good. The 7m antenna resonates at 10.5 MHz and after adding 3m of ladder line it resonates with a decent SWR at 7.1 MHz.



For the above cases we added ladder line so that the total wire length of antenna + feed was the same for all the antennas. This worked well when we used a transmission line with the characteristic impedance given by Schelkunoff, namely $1000\ \Omega$. Unless we want to roll our own $1000\ \Omega$ ladder line, we can try to do better with the $450\ \Omega$ ladder line by optimizing the length to be added. Given a measurement of the antenna's impedance at the desired operating frequency it is a simple matter to calculate a feed line length that minimizes SWR using a Smith chart, either paper or electronic.

Using “optimized” lengths of $450\ \Omega$ we get the following results ...

Even when 20% of the antenna length is replaced by ladder line, the match is still quite good. For an 80m dipole, 20% is 26ft, which could be the difference between fitting in the backyard or not.



In general, an antenna with ladder line will load nicely on frequencies where the half-length of the dipole + ladder line is an odd multiple of $\frac{1}{2}$ wavelength. Be sure to include the velocity factor of the ladder line (~ 0.9) in your calculation! And don't forget, “Measure twice, cut once.”