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)

February 2024

Volume 57 No. 2

Regular Meetings

Second & Fourth Mondays

Feb 12 - Business Meeting at SBS & Zoom
Feb 26 - Meeting at SBS & Zoom.

Upcoming Events

Check Reflector & www.nparc.org for details.

Feb 24 - NPARC Auction

Digital Net Mondays at 9 PM – 28.086 MHz (+/-)
CW Net, Thursdays at 9 PM – 28.050+QRM

Meeting Schedule

Regular Meeting: 7:30—9:00 PM
2nd & 4th Monday
of each month
Watch for Emails

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 2024

President: K2UI, Jim Stekas
908-868-4970
Vice President:W2EMC Brian DeLuca
973-543-2454
Secretary: K2AL: Al Hanzl
908-872-5021
Treasurer: K2YG Dave Barr
908-277-4283
Activities: KC2OSR, Sam Sealy
973-635-8966

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 K2AL, Al

MOUNTAIN SPARK GAPS

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The Watchung Mountain Area Radio Club
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Editor Emeritus: K2EZR Frank McAneny
Acting Editor: K2UI Jim Stekas
Contributing Editors:
WB2QOQ Rick Anderson

Climatological Data for New Providence - December 2023

The following information is provided by Rick, WB2QOQ, who has been recording daily weather events at his station for the past 43 years.

TEMPERATURE -

Maximum temp this December, 60 F (Dec 10, 18)
Last December(2022) maximum was 57 F.
Average Maximum temp this December, 46.5 F

Minimum temp this December, 22 F (Dec 22)
Last December(2022) minimum was +4 F.
Average Minimum temp this December, 34.2 F

Minimum diurnal temp range, 4 F (51 - 47 F) 12/28
Maximum diurnal temp range, 23 F (60 - 37 F) 12/18

Average temp this December, 40.4 F
Average temp last December, 33.8 F

PRECIPITATION -

Total precipitation this December 8.96" rain
Total precipitation last December 5.26" rain

Maximum one day precip. event - December 18, 3.03" rain.
Measurable rain fell on 11 days this December
9 days last December.

YTD Precipitation – 58.61"

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Rick Anderson 1/5/2024
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

President's Column

February is the month that comes in like a polar bear and goes out with the NPARC auction. The auction gives us something to daydream about while we are scraping ice off the windshield.

This year's auction will be held at Salt Brook School on February, 24 (see the flyer on the last page of this newsletter.) We will follow the same playbook as the 2023 auction with one significant addition for 2024.

Generally folks come to the auction to hang out with fellow hams and check out the wide range of equipment that shows up. Lot's of items change hands at bargain prices in the $1-100 range. But when a highly desirable piece of gear shows up, like a K3S, very few have the cash on hand to make a fair bid. To encourage folks to bring quality gear to the auction we will publish a list of such items on-line at NPARC.org. The hope is to match quality gear and interested buyers so each goes home with a happy new owner and not the optimistic seller that brought it.

If you plan to bring a ***valuable*** piece of gear to the auction and want to let potential buyers know about it, email K2UI@arrl.net or K2AL@arrl.net about what you plan to bring.

73 and CU at the auction,

Jim – K2UI

February 2024 Contest Calendar

Dave Barr – K2YG

Contest Name	Dates	Mode	Exchange	Notes & Websites
Vermont QSO Party	2/2 Fri 7pm to 2/4 Sun 7pm	All	VT: RS(T)+Cnty Non VT: RS(T)+State	hp/lp/qrp classes. Details and county lists at: www.ranv.org
Mexico RTTY Contest	2/3 Sat 7am to 2/4 Sun 7pm	RTTY	XE: RST+State Non XE: RST+Serial #	hp/lp classes (no qrp). Details at: rtty.fmre.mx
Minnesota QSO Party	2/3 Sat 9am-7pm	CW-RTTY; Phone	MN: Name+Cnty Non MN: Name+State	hp/lp/qrp classes; no FT. www.w0aa.org
British Columbia QSO Party	2/3 Sat 11am-11pm 2/4 Sun 11am-11pm	CW SSB	BC: RS(T)+Dist Non BC: RS(T) +State/Prov	hp/lp/qrp www.orcadxcc.org
CQ WW RTTY WPX Contest	2/9 Fri 7pm to 2/11 Sun 7pm	RTTY	RST + Serial #	hp/lp/qrp classes. Details at: www.cqwpxrtty.com
ARRL Inter. DX Contest, CW	2/16 Fri 7pm to 2/18 Sun 7pm	CW	W-VE: RST+state/prov DX: RST+power	hp/lp/qrp classes. Details at: www.arrl.org
South Carolina QSO Party	2/24 Sat 10am-9pm	CW Digital Phone	SC: RS(T) + County Non SC: RS(T) + State	hp/lp/qrp classes. Details at: scqso.com
North American QSO Party RTTY	2-24 Sat 1pm-1am	RTTY	Name & State/DC/Prov/or NA Country. DX: Name only	LP and QRP only. Details at: www.ncjweb.com
North Carolina QSO Party	2/25 Sun 10am-8pm	CW Phone Digital (No FT)	NC: County Non-NC: State/Prov/DX	hp/lp/qrp classes. Details at: ncqsoparty.org

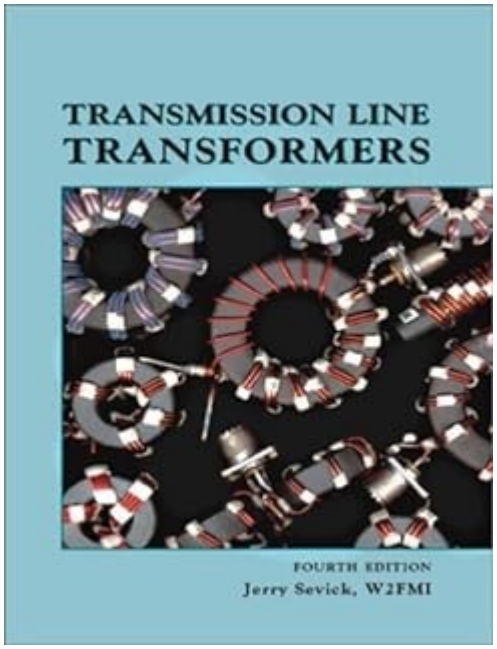
More contests and detailed information for all contests are available through WA8BNM's Contest Calendar website: www.contestcalendar.com

Good Luck -- Dave, K2YG

NanoVNA Measurement of Transmission Line Impedance

Jim Stekas - K2UI

A recent homebrew project of mine was the construction of a 40m Off-Center-Fed (OCF) dipole. Because the OCF has a higher impedance than a center-fed dipole, they are generally matched using a 4:1 balun. I constructed a 4:1 Guanella current balun using two FT240-43 ferrite cores. To test the balun I terminated the high impedance side with a 200Ω resistor and connected my NanoVNA to the low impedance side (50Ω). A frequency sweep showed an SWR of 1.1 on 80m rising to 1.5 on 10m, which was far worse than I expected. A similar balun built by VK6YSF showed a flat SWR of 1.0 from 1.8-30 MHz[1]. Why was my balun so lousy?



Jerry Sevick (W2FMI) has written extensively on implementing baluns and ununs using transmission line transformers (TLTs). What I took away from Sevick's ham publications was mostly "transformers" and hardly any "transmission lines." After reading Ruthroff's original paper, filling many pages with algebraic calculations, and doing computer simulations, I realized my intuitive understanding of how TLTs work was completely wrong. Actually, it is the properties of transmission lines dictate how TLTs perform impedance matching.[2] Ruthroff showed that when the TLT transmission line had a design impedance of $Z_0 = \sqrt{R_{\text{in}} R_{out}}$ problematic frequency dependent terms cancel and the TLT performance is independent of frequency[ref 1]. For my application, that means bifilar wingdings with a characteristic impedance of 100Ω. Wonderful, but how does one determine the characteristic impedance of the bifilar winding without access to Sevick's Bell Labs instrumentation?

Given a short length of transmission line we can determine its characteristic impedance (R_{TL}) by:

1. Measuring the capacitance, C, of the line with the far end open.
2. Measuring the inductance, L, of the line with the far end shorted.
3. Computing $Z_0 = \sqrt{L/C}$

Using my DE-5000 LCR meter I measured the inductance (left, end shorted) and capacitance (right, end open) of the bifilar winding on one of the balun cores. The results indicate a TL impedance of

$$Z_0 = \sqrt{\frac{0.698\,\mu H}{43.57\,pF}} = 126.5\Omega \quad \pm 5\%$$

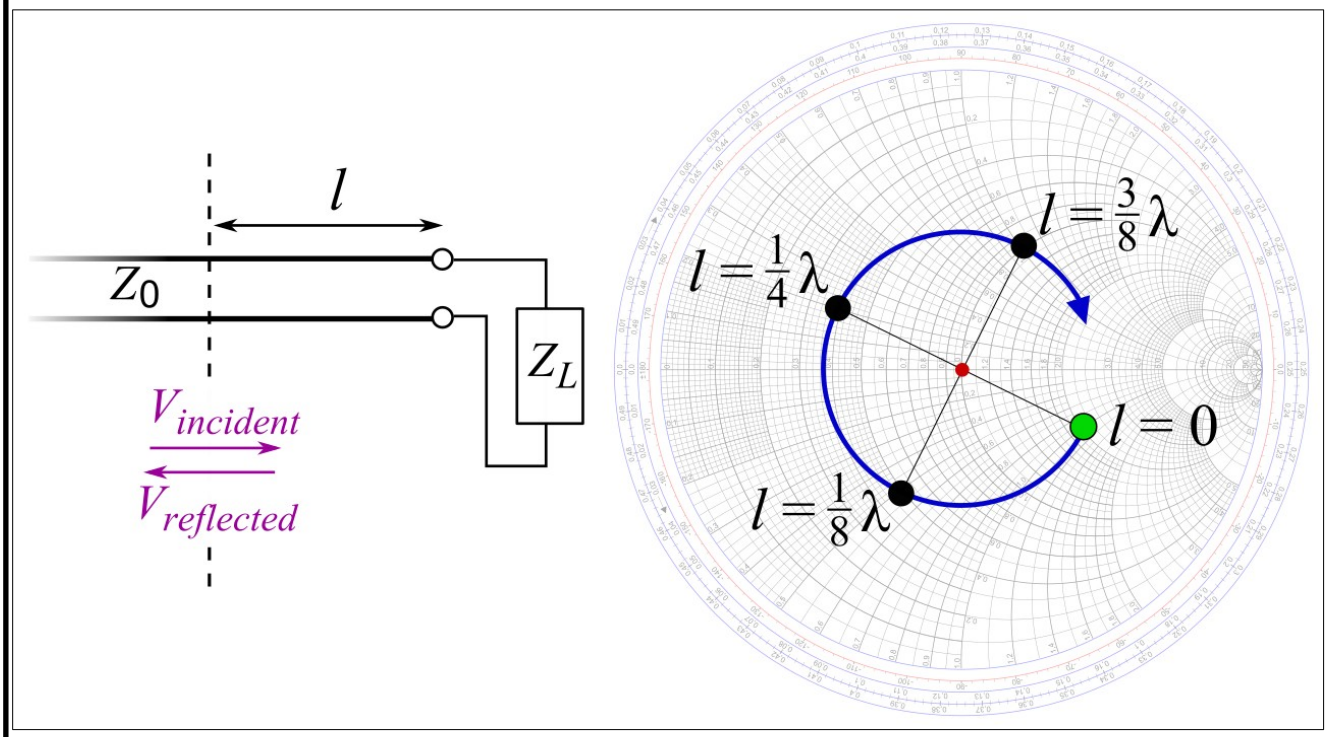
which is 25% greater than the desired 100Ω.

1 https://vk6ysf.com/balun_guanella_current_1-4.htm

2 - Common mode current suppression relies only the choking ability of tl

For short lengths of transmission line, L and C are very small, and cheap LCR meters (like the ones we built as an NPARC project, right) just won't cut it. To get L and C measurements good enough to determine transmission line impedance you will need shell out $100+ for a "real" LCR. But direct L and C measurements are not the only way to measure transmission line impedance.

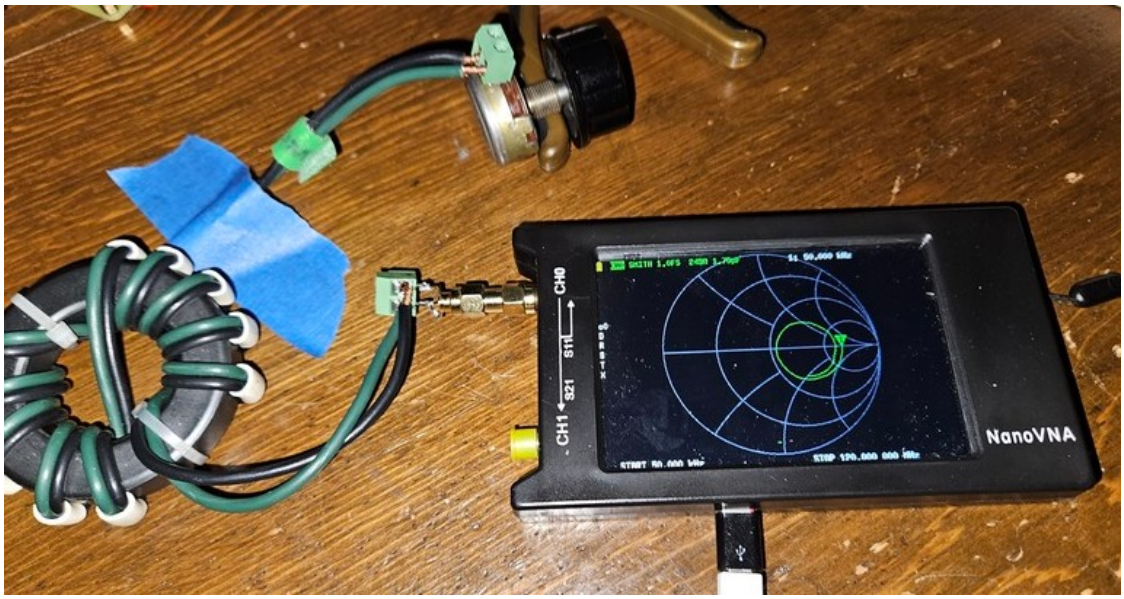
A simpler and cheaper approach uses the NanoVNA.[3] The NanoVNA measurement technique involves the generation of "SWR circles" on the Smith chart display and varying the load on the transmission line until the SWR circle shrinks to a point.



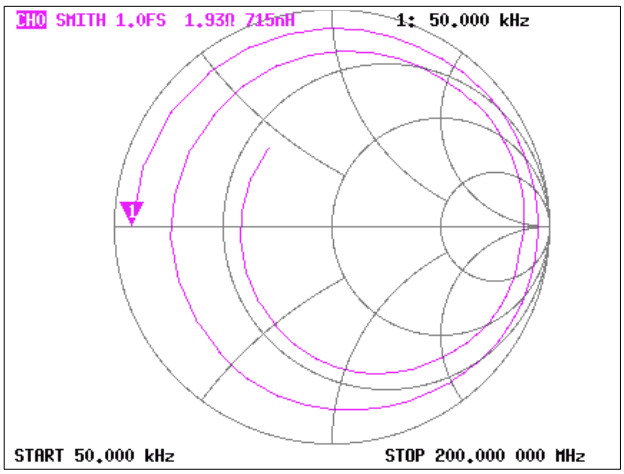
SWR Circle on the Smith Chart

The figure above shows a coax of impedance $Z_0 = 50\Omega$ and length l terminated in a load $Z_L = 100 - j50\,\Omega$. The green dot on the Smith chart represents the scaled load impedance $\frac{Z_l}{50} = 2 - 1j$. As l varies, the impedance seen at the coax input, Z_{in}, traces a circle on the Smith chart, eventually returning to $Z_{in} = Z_L$ when $l = \frac{\lambda}{2}$. The circle is called an "SWR circle" because every impedance on the circle has the same SWR, 2.33 in this example. The center of the circle is Z_0, the characteristic impedance of the transmission line. As $Z_L \rightarrow Z_0$ the circle shrinks until it becomes a point[4] at $Z_L = Z_0$.

3 Any VNA that can sweep 1-100 MHz and display a Smith chart will work.
4 An SWR circle of zero radius corresponds to SWR=1.

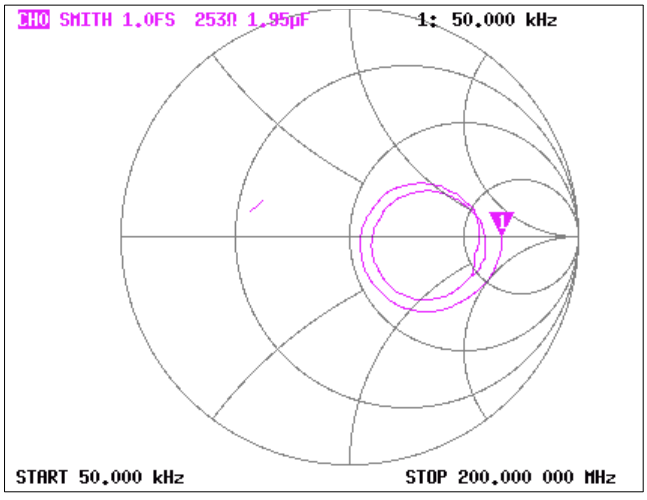


The figure above shows the measurement setup with the NanoVNA. In addition to the NanoVNA, a 250Ω pot serves as the load, R_L , and screw terminals are used to simplify connections to the transmission line. Below are screenshots for different values of R_L .

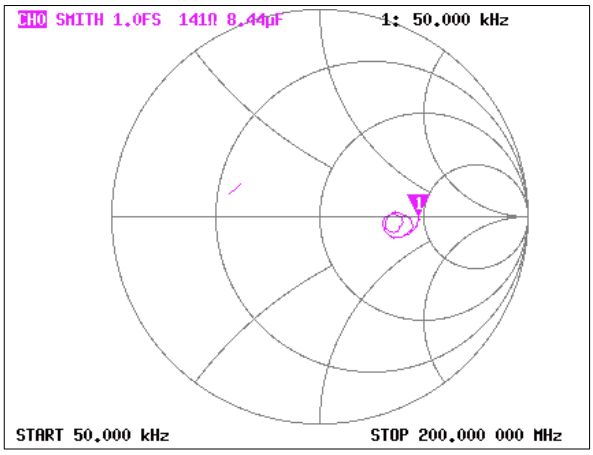


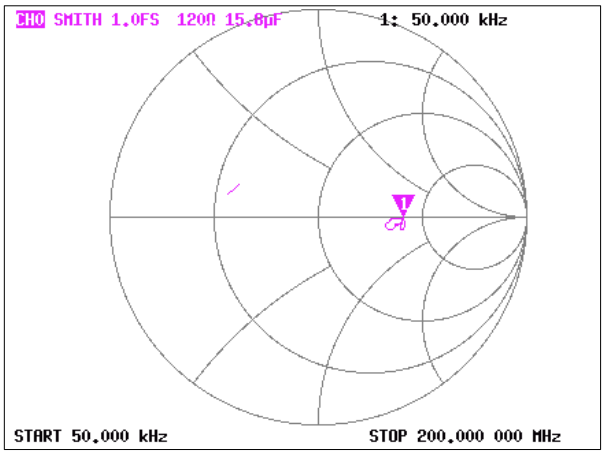
At left is the Smith chart generated for a 2Ω load swept from 50 kHz to 200 MHz. The triangle marks the start of the sweep at 50 kHz. The text along the top gives the impedance and frequency of the marker. Since a wavelength at 50 kHz is 6000m, the length of the transmission line is effectively $l=0$. As the frequency increases, so does the effective length, and an SWR "circle" is generated. The circle does not close due to frequency dependent loss.

To the right, is the Smith chart generated for a 253Ω load. The SWR circles are smaller and the impedance of the transmission line corresponds to the center of the circles, which lies between 50Ω (the origin) and 250Ω (the marker).



Reducing the load to 140Ω results in smaller SWR circles (figure at right) which means we are getting closer to the true value of Z_0 . The circles are centered below 140Ω, so $Z_0 < 140\,\Omega$.





We reduce the load resistance until we get the smallest set of SWR circles possible (left). The bifilar winding is not a transmission line with a well controlled impedance, so as the circles get smaller they turn into "squiggles". The trace is confined to the smallest area when the load resistance is 120Ω , so $Z_0 \approx 120\,\Omega$. The area of the trace gives a measure of the error in our transmission line impedance measurement.

Note that 120Ω is consistent with the value derived from L/C measurements, $126.5\,\Omega \pm 5\%$.

My intuition told me that $Z_0 \approx 120\,\Omega$ should be close enough to the target of 100Ω to give close-to-ideal performance. But measurements and simulations showed that is not the case, and there is no reason to expect it to be. Where the ideal 4:1 balun with $Z_0 = 100\,\Omega$ would give an $SWR = 1.0$ looking into 200Ω we shouldn't be too surprised to see the $SWR \rightarrow 1.2$ when $Z_0 \rightarrow 120\,\Omega$.

The bad news for me is that to get $Z_0 = 100\,\Omega$ the separation of the bifilar centers would need to decrease and/or the diameter of the conductors would need to increase. Neither of these modifications is possible using the existing wires. The lesson to be learned from this exercise in balun construction is "***measure twice, wind once***".

References

1. Ruthroff, C. L., "Some Broad-band Transformers," Proc. IRE, Aug. 1959.
2. Sevick, J., "Transmission Line Transformers", Noble Pub., 4th ed., 2001.

AUCTION

And Flea Market

Mark Your Calendar for

Saturday, February 24, 2024

The New Providence Amateur Radio Club announces:

Annual Auction

Followed by Flea Market

Some of New Jersey's most highly prized Ham Radio, electronic, audio, computer, test equipment, and parts for building your next whatever.

Some Old

Some New

Admission: $10 Donation for Buyers & Sellers
NO COMMISSION charged to sellers
Unlicensed Spouses and Kids Free
Refreshments Available - Door Prizes - Free parking
KJI Electronics will be at the Flea Market

Doors open at 1:00 p.m. Auction starts at 2:00 p.m.

Come at 1:00 p.m. to inspect auction items!

Salt Brook School Cafeteria

40 Maple Street

New Providence NJ 07974

GPS Long -74º 23.420' Lat 40º 42.470'

Talk in on W2LI-VHF 147.255+.600 pl 141.3

For additional information or directions, visit: http://www.nparc.org/auction.html

or Call Al Hanzl at 908-872-5021 or email at k2al@arrl.net