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. 11 November 2019

Regular Meetings

12/9 &12/23 Monday 7:30
DeCorso Community Center

Upcoming Events

Annual Holiday Luncheon
Chimney Rock 12/7

Kid's Day
1/4/2020

Auction
2/22/2020

Meeting Schedule

Regular Meeting: 7:30—9:00 PM
2nd & 4th Monday
of each month at the
NP Senior & Adult Center
15 East Forth Street
New Providence

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: KA2MPG Brian Lynch
973-738-7322

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
First & Third 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 K2UI, Jim

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Contributing Editors:
WB2QOQ Rick Anderson
W2PTP Paul Wolfmeyer
K2UI Jim Stekas

Climatological Data for New Providence for October 2019

The following information is provided by Rick, WB2QOQ, who has been recording daily weather events at his station for the past 38 years.

TEMPERATURE -
Maximum temperature this October, 86 deg. F (October 2)
Last October(2018) maximum was 77 deg. F.
Average Maximum temperature this October, 64.4 deg. F
Minimum temperature this October, 36 deg. F (October 19)
Last October(2018) minimum was 37 deg. F.
Average Minimum temperature this October, 49.9 deg. F
Minimum diurnal temperature range, 6 deg. (61-55 deg.)10/8;(57-51)10/9
Maximum diurnal temperature range, 22 deg. (58-36 deg.)10/19;(64-42)10/24

Average temperature this October, 57.2 deg. F
Average temperature last October, 55.9 deg. F

PRECIPITATION -
Total precipitation this October - 7.22" rain
Total precipitation last October - 3.52" rain

Maximum one day precip. event this October -

October 27, 1.92" rain
Measurable rain fell on 15 days this October, 15 days last October.

YTD Precipitation - 55.85"

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Rick Anderson
11/18/19
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 Climato-

President's Column November 2019

This month we welcome Craig WB2BOI and Terry KD2STE to membership in NPARC! Craig is a returning member.

Congratulations to the club on Field Day results in the December QST. We were first in NNJ in class 2A!

At last Monday's meeting (November 11), the nominations committee (David KC2WUF and Tim KD2EKN) presented the following slate for 2020.

President	Paul Wolfmeyer W2PTP
Vice President	Bob Willis K2GLS
Secretary	Al Hanzl K2AL
Treasurer	Dave Barr K2YG
Activities Manager	Sam Sealy KC2OSR

At our November 25 meeting, additional nominations will be received. If you nominate someone, please have their agreement (commitment) to serve if elected. Then elections will be conducted by the Secretary.

Thanks to Al K2AL for ordering shirts for those desiring them. And thanks to Barry K2JV for the recent badge order; badges now received!

Your treasurer Dave K2YG is ready to accept your checks for the Holiday banquet at $30 per head. And he will accept checks for next year's dues at $20.

Thanks to Al K2AL and Dave K2YG for their program November 11 on the ARRL Sweepstakes Contest. November 25's program will be Bob K2GLS on digital QSOs.
Future dates:
December 7—first Saturday in December—our holiday party!
Saturday January 4—Kid's Day. Contact Kevin N2TO if you can participate!
Saturday February 22—our annual auction.

73 for now
Wolf W2PTP, 201-404-6914, w2ptp@arrl.net

The NanoVNA

Jim Stekas - K2UI

At the Nov. 11 NPARC meeting Jon Pawlik (AC2xx) told me about a new gadget he had acquired: a NanoVNA. I checked it out on the Interwebs when I got home. The NanoVNA is compact 2-port Vector Network Analyzer that covers 50kHz-900MHz and sells for about $50 all over the web. I ordered one from Amazon that very evening, and this is what arrived at my door on Wed:

Shown above is the basic $40 package that includes the VNA, USB cable, and an SMA calibration kit including a 50 Ohms terminator, a short, and an open(!). This packages is all you need to do frequency sweeps of your antennas, measure complex impedances, and anything else an MFJ antenna analyzer can do.

The NanoVNA is constructed as a sandwich of PC boards that is open at the sides. It is only slightly larger than its 2.8” touch screen display (about the size of an Altoids tin) and will easily fit in a shirt pocket. A thumb wheel interface is also provided, but there isn’t anything you can do with it that isn’t more easily done via the touch screen. The USB cable is used to charge the internal Li ion battery and/or provide a data interface into a PC.

Something that isn't provided is a manual, but you can download a skimpy PDF manual from the web. Fortunately, there many text and video tutorials available (see references) as well as discussion groups that will provide you all the info you need to get started using your NanoVNA.

The way a typical SWR meter works is by measuring the amplitude of the wave headed toward the antenna (FWD) and comparing it to the amplitude of the wave reflected back (REF). Calibration is done manually by adjusting a potentiometer so the meter reads full scale in FWD mode, then switch into REF mode take a reading from the SWR scale. If the SWR reads 1.2, it could be because your antenna impedance is $60\,\Omega$, or perhaps $42\,\Omega$, or maybe a little too long (inductive) or too short (capacitive.) The SWR meter provides no information about phase, and therefore it is a "scalar" measurement.

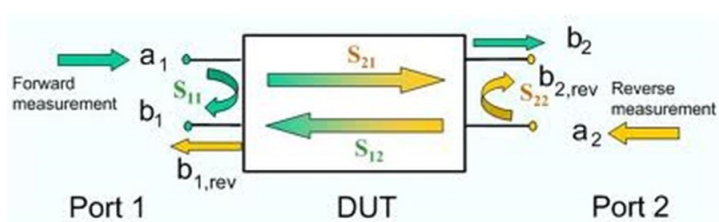
More fundamental than SWR, is the reflection coefficient Γ, a complex number. Since a load can't reflect more energy than it receives, $|\Gamma| \le 1$. Thus valid values of Γ lie within a circle of radius one, and this is exactly what gets plotted on a Smith chart. In terms of Γ, $SWR = \frac{1+|\Gamma|}{1-|\Gamma|}$, which is clearly a scalar independent of the phase of Γ. In the case of SWR=1.2, $|\Gamma| = 0.09$ and all points on a circle[1] of radius 0.09 on the Smith chart will have an SWR=1.2.

The VNA measures both amplitude and phase of Γ, allowing not only the determination of SWR, but the complex load impedance, Z_L:

$$Z_L = \frac{1+\Gamma}{1-\Gamma} Z_S \text{ where } Z_S \text{ is the source impedance (normally } 50\,\Omega\text{).}$$

RF engineers typically build system using building blocks such as filters, amplifiers, mixers, etc. To characterize a block one needs to determine its output vs. input as a function of frequency. S-parameters (see figure below) are used to characterize a linear device. S_{21} is the ratio of the signal amplitude[2] out of Port-2 depends to the amplitude into input to Port-1 versus frequency. It is a complex number usually expressed as a gain/loss in dB and a phase shift in degrees. S_{11} describes fraction of the signal into Port-1 reflected back to the source. The S_{12} and S_{22} parameters apply to the case where Port-2 is the input and Port-1 the output.

The front of the NanoVNA shows a similar diagram with Port-1 labeled CH0 and Port-2 labeled CH1. Connecting input to CH0 and output to CH1 allows S_{21} and S_{11} to be measured. To measure S_{12} and S_{22} swap the input and output.



S_{11} is essentially Γ, and is usually given in dB as a return loss, defined as $RL = -20 \cdot \log(|\Gamma|)$[3]. RL comes directly from comparing power measurements which are accurate to $\pm x\,dB$, where x depends on the quality of the instrument. The key point is that every radio engineer feels comfortable working in dB, and has a good feeling for what a 1dB change means. Not so with SWR. A change in

1 Commonly refered to as an "SWR circle". Adding transmission line will move a point around the circle, but not change the SWR.

2 Amplitude is the magnitude of a signal that when squared gives power. Think of it as a voltage.

3 Return loss is in dB, and dB ***always*** represents a ***power*** ratio. There is no such thing as voltage dB. 20dB gain means 100x the power and 10x the voltage since $P \approx V^2$.

SWR from 1.1 to 1.11 seems very small, while a change from 10 to 20 seems enormous. But both correspond to a 1dB increase in return loss.

If you want to be able to use the network capabilites of the VNA to measure coax loss, sweep filters, etc. you will need some cables. The $50 "deluxe" version (which I bought) includes two 12" SMA cables and an SMA "bullet" to join them together for calibration. You could go with a pair of SMA to SO-239 cables, like the ones on the right (~$10 from Amazon), but you would require some adapters to use the SMA calibration kit. You'll probably need a set of adapters like the ones on the left (~$8 from Amazon) to connect up to your existing coax, so add them to your Black Friday list.

References

1. Google "NanoVNA" and you'll be barraged with tech and buying info. Check out all the YouTube videos!
2. NanoVNA Manual - https://groups.io/g/nanovna-users/attachment/14/0/NanoVNA%20User%20Guide_20190527..pdf
3. Getting Started Guide – Very good 3-part tutorial with PC SW overview. https://hexandflex.com/2019/08/31/getting-started-with-the-nanovna-part-1/
4. Nano Home Page (Chinese) - https://gen111.world.taobao.com/
5. Smith Chart Tutorial - A very good overview from W4FAL. https://www.ieee.li/pdf/viewgraphs/smith_chart_tutorial.pdf
6. S-Parameter Design – App Notes from Agilent. Covers the basics to the impenetrable. A great winter read. http://www.sss-mag.com/pdf/AN154.pdf