

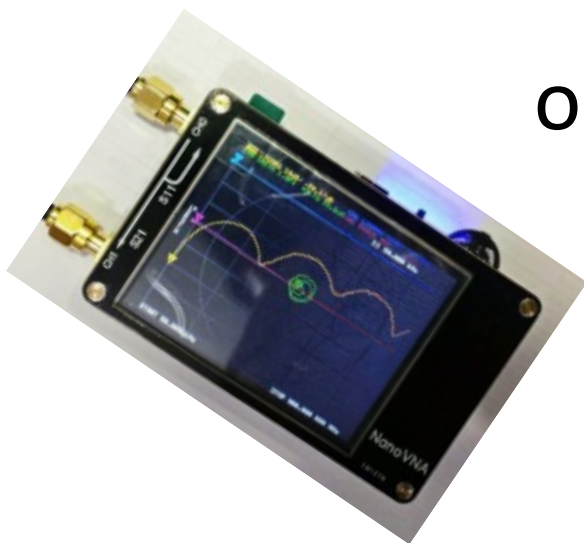
Antenna Analyzers:

a review and comparison of SEVEN inexpensive units

Presented by Larry Goga, AE5CZ

at the 2019 Duke City HamFest

on September 21, 2019



7 Inexpensive Antenna Analyzers

- All under \$200 USD.
- Most under \$100 USD.
- Some between \$50 to \$60 USD.
- Some will be kits. Some will be pre-built.
- Frequency ranges thru HF to VHF to UHF.
- Some have displays. Others need computer.
- Some will be much better than others.
- All are available for Show-and-Tell.

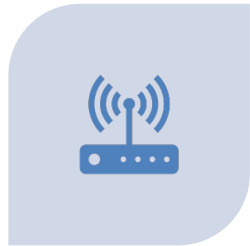
7 Inexpensive Antenna Analyzers

- VK5JST Antenna Analyzer(s)
- Fox Delta AAZ-0914A
- Fox Delta AAZ-0217MX
- Rig Expert AA-30.ZERO
- Funk Amateur VA-5
- KAI-201 Analyzer/Sig Gen/WSPR Xmitter
- NanoVNA

What is an Antenna Analyzer?

- A device for measuring the resistance (R), reactance (X) and impedance (Z) of antennas.
- Two basic types: with & w/o Sign of X .
- Some are simple SWR meters. Others are sophisticated Vector Network Analyzers.
- Either one can be used in troubleshooting antennas and feedlines.
- Also used to fine tune antenna performance.

Basic Parts of an Antenna Analyzer?



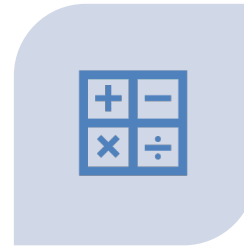
OSCILLATOR

- Frequency
- Distortion
- Analog
- DDS
- Output Level
- Uniformity



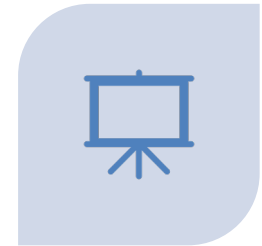
SENSOR

- Single Resistor
- Wheat. Bridge
- Diode Detect.
- Precision Rect.
- RMS Detector
- Return Loss
- Bridge
- Directional Coupler



MATH PROC.

- Analog
- Digital
- ADC
- μ Controller
- Calculations
- Output
- External Soft.



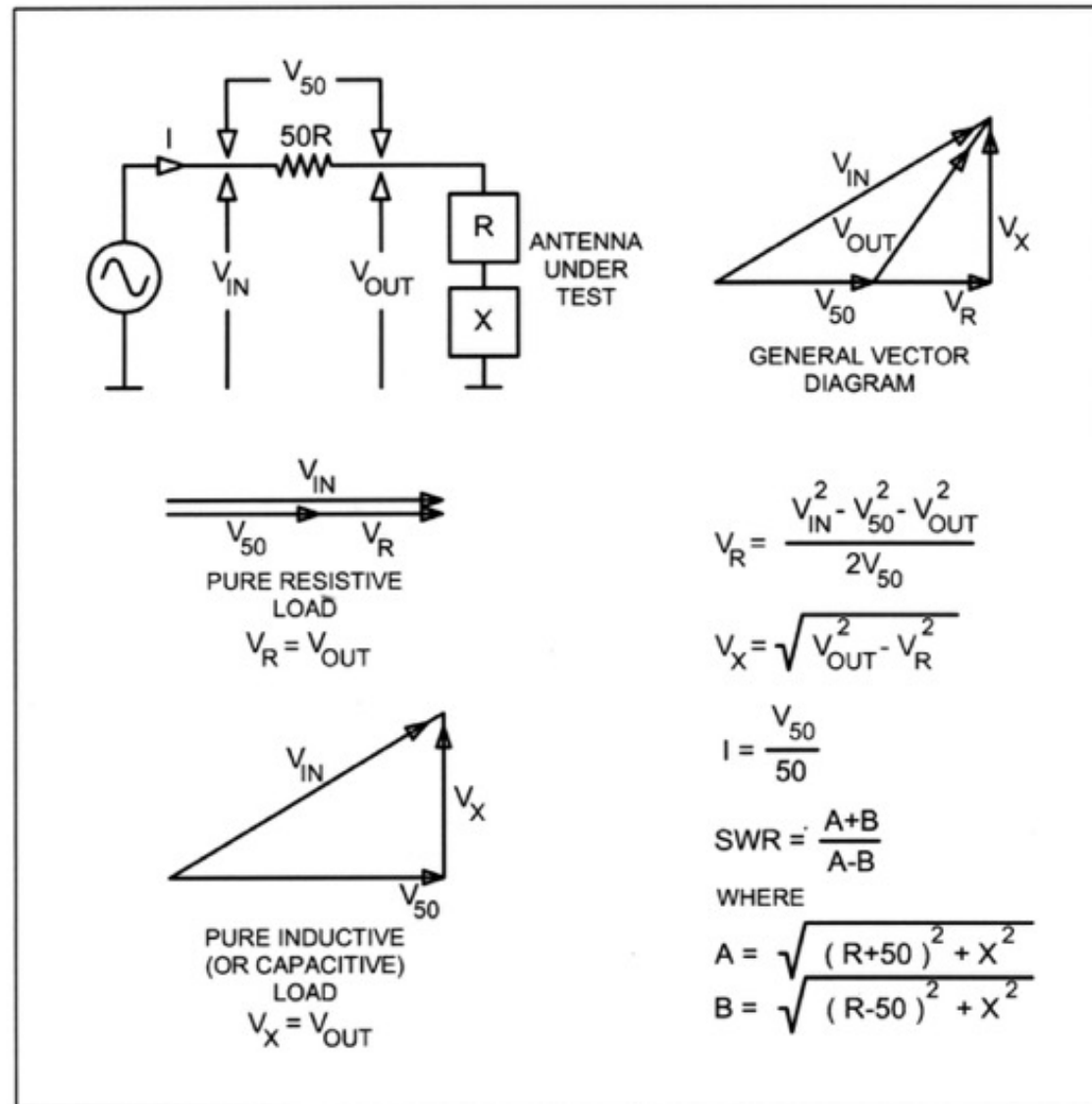
DISPLAY

- No display
- Simple Display
- USB to Laptop
- Graphic Disp.
- Data Storage
- Data Compare

“A short review of antenna and network analyzers” by RigExpert

- An excellent overview of the various types of antenna analyzer designs and their capabilities.
- Written by Denis Nechitailov, UU9JDR
- There are lots of clickable links to other sources of information.
- Last updated on September 15th, 2014.
- <http://www.rigexpert.com/index?s=articles&f=aas>
- Pass around printout for review.

The Mathematics that make it work!



The VK5JST “Aerial” Analyzer



- Comes from Australia
- Purchased as a kit
- 17,000 sold
- Buy PCB only for \$20
- Been around since 2005
- Covers all the HF bands
- Provides direct readout of R, X, SWR but no sign of X
- PCB here for inspection

The NEW VK5JST Antenna Analyzer



- New as of May 1st, 2019
- Still purchased as a kit
- Now cheaper at \$99 USD
- Includes postage
- Covers HF and 6 Meters
- Provides direct readout of R, X, SWR but no sign of X
- Optional μ controllers
- Optional Z readout meter

Fox Delta Amateur Radio Kits and Projects

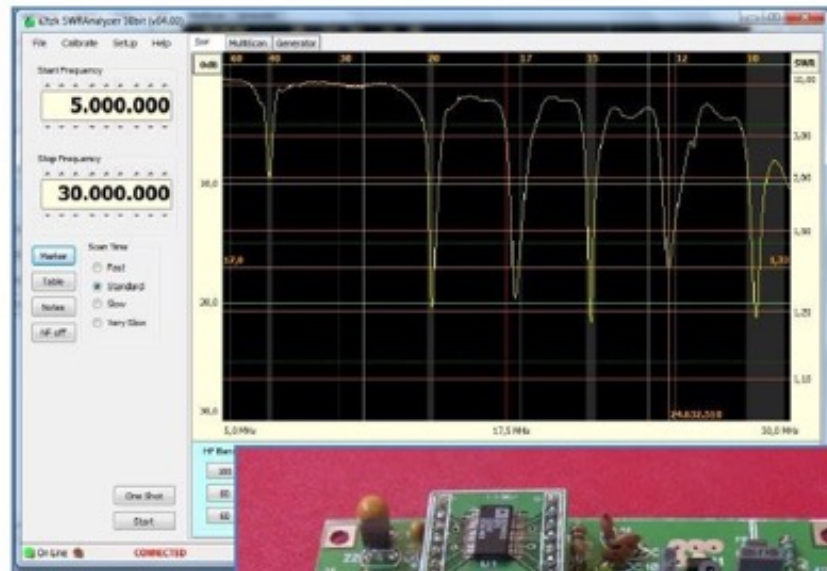
- <http://foxdelta.com>
- All sorts of kits and projects
- Good documentation
- Good variety
- Surface mount (SMT) parts come already mounted

The screenshot shows the homepage of the Fox Delta website. At the top, there is a navigation bar with links: Home, Fox Delta, Projects, School Projects, Buy PCBs, Buy Kits, and Contact. A small fox logo is in the top right corner. Below the navigation bar, a red banner reads "WELCOME TO FOX DELTA". The main content area is titled "Fox Delta Amateur Radio Projects & Kits" and contains a list of links: "Complete Project List", "Buy Available Kits", "Fox Delta School Projects", and "Buy Project PCBs". A warning message states: "WARNING: We have never appointed any Dealers or resellers, anywhere in the World. All Kits that we develop are available for Direct sales from this web site only." Below this, a paragraph explains that radio amateurs are free to copy designs and make their own PCBs. It also mentions "Fox Delta School Projects" and "73s Fox Delta Team". At the bottom, there is a section titled "Fox Delta Kits at Japan Ham Fair by JA1OGS & JA6NKA" with two photographs of the fair booth. On the right side, there are several sidebar sections: "Project Categories" with links like Wireless, Radio Astronomy, APRS Tracker, etc.; "Site Verification" with a "VERIFIED & SECURED" badge; "Support Sections" with links like Buy On-Line, Shipping Charges, etc.; and "Amateur Radio Resources" with links like What is Amateur Radio, Ham Radio Theory, etc.

Fox Delta Amateur Radio Antenna Analyzer Kits



The “old” FD Antenna Analyzer kit



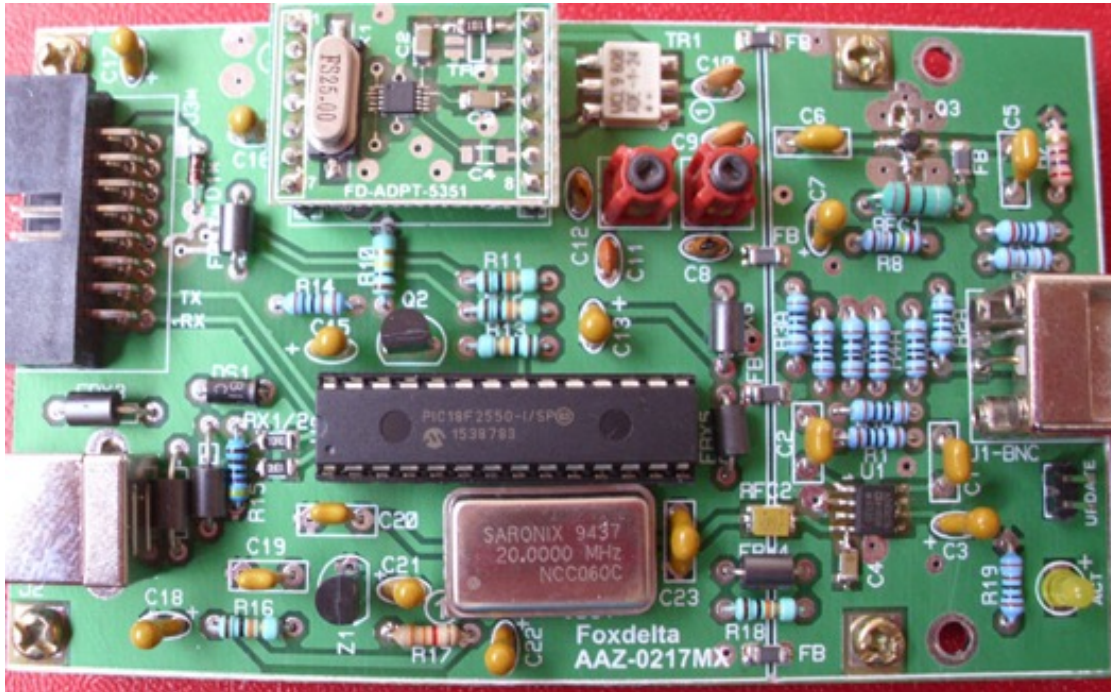
AAZ-0914A



- Comes from India
- Only \$54
- Software is free
- SMT parts are pre mounted
- Model number is AAZ-0914A
- No longer avail.

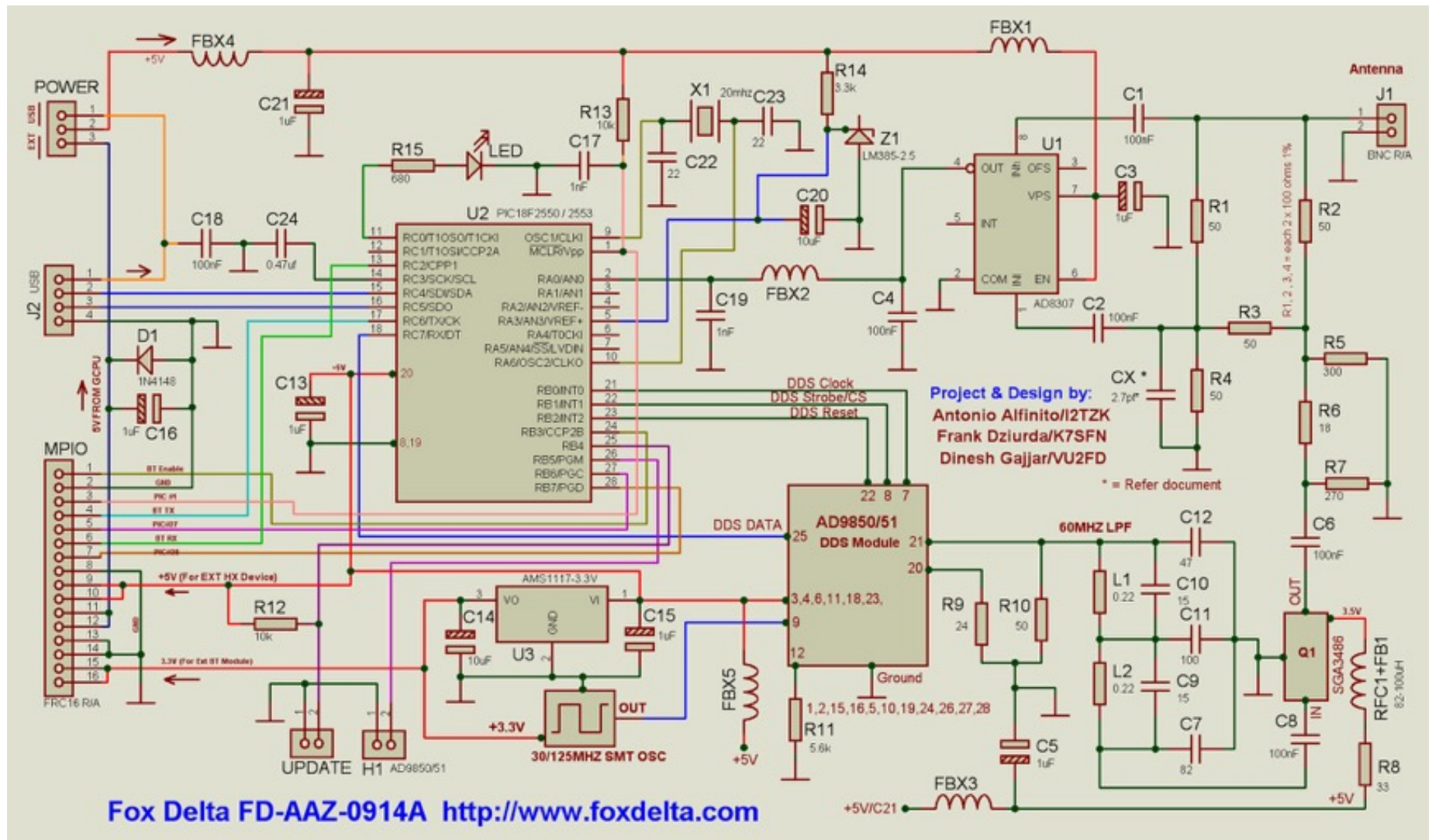
The “new” FD Antenna Analyzer Kit

AAZ-0217MX

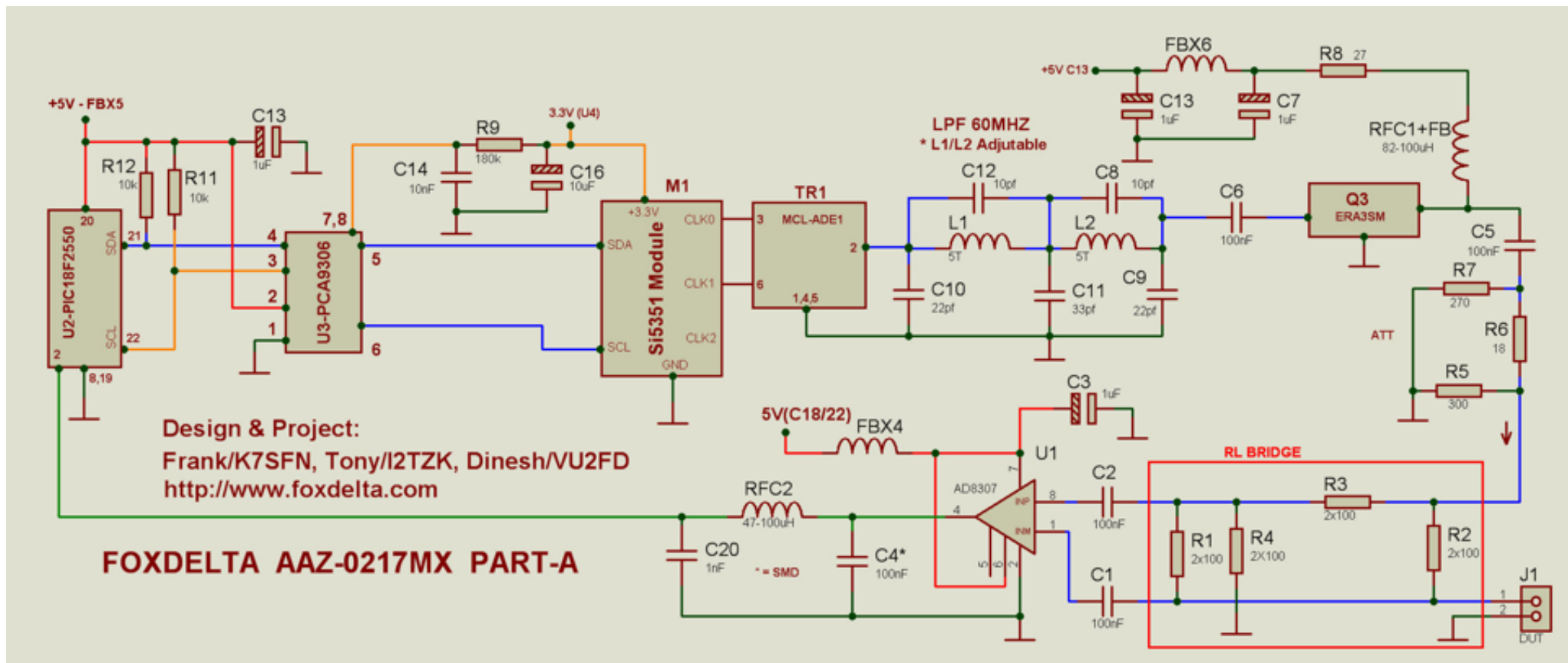


- Uses different DDS chip
- Only \$49
- Software is free
- SMT parts are pre mounted
- Covers 6M Band
- Not as good as AAZ-0914A

AAZ-0914A Schematic Diagram



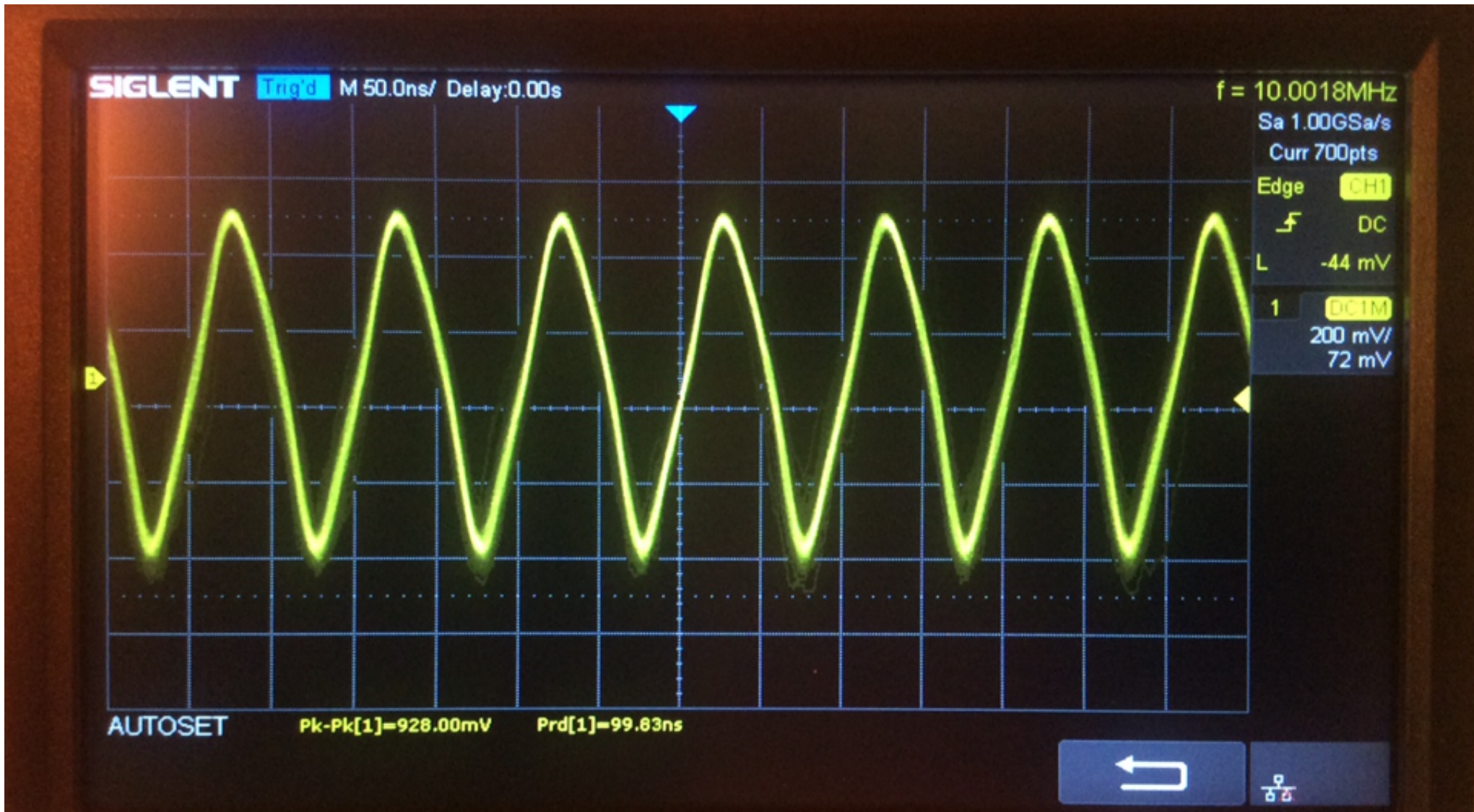
AAZ-0217MX Schematic Diagram



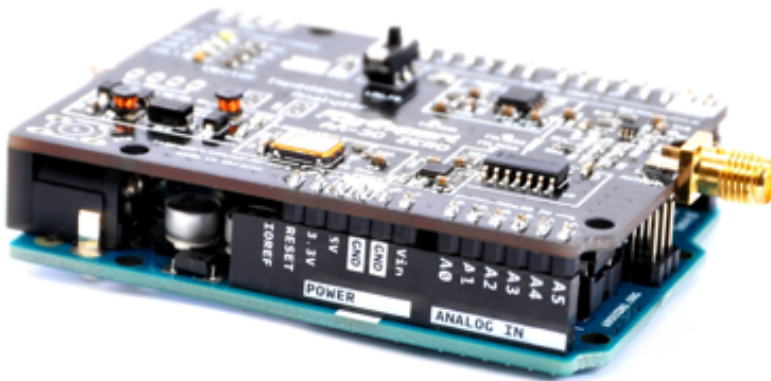
AAZ-0914A 10 MHz. Output



AAZ-0217MX 10 MHz. Output

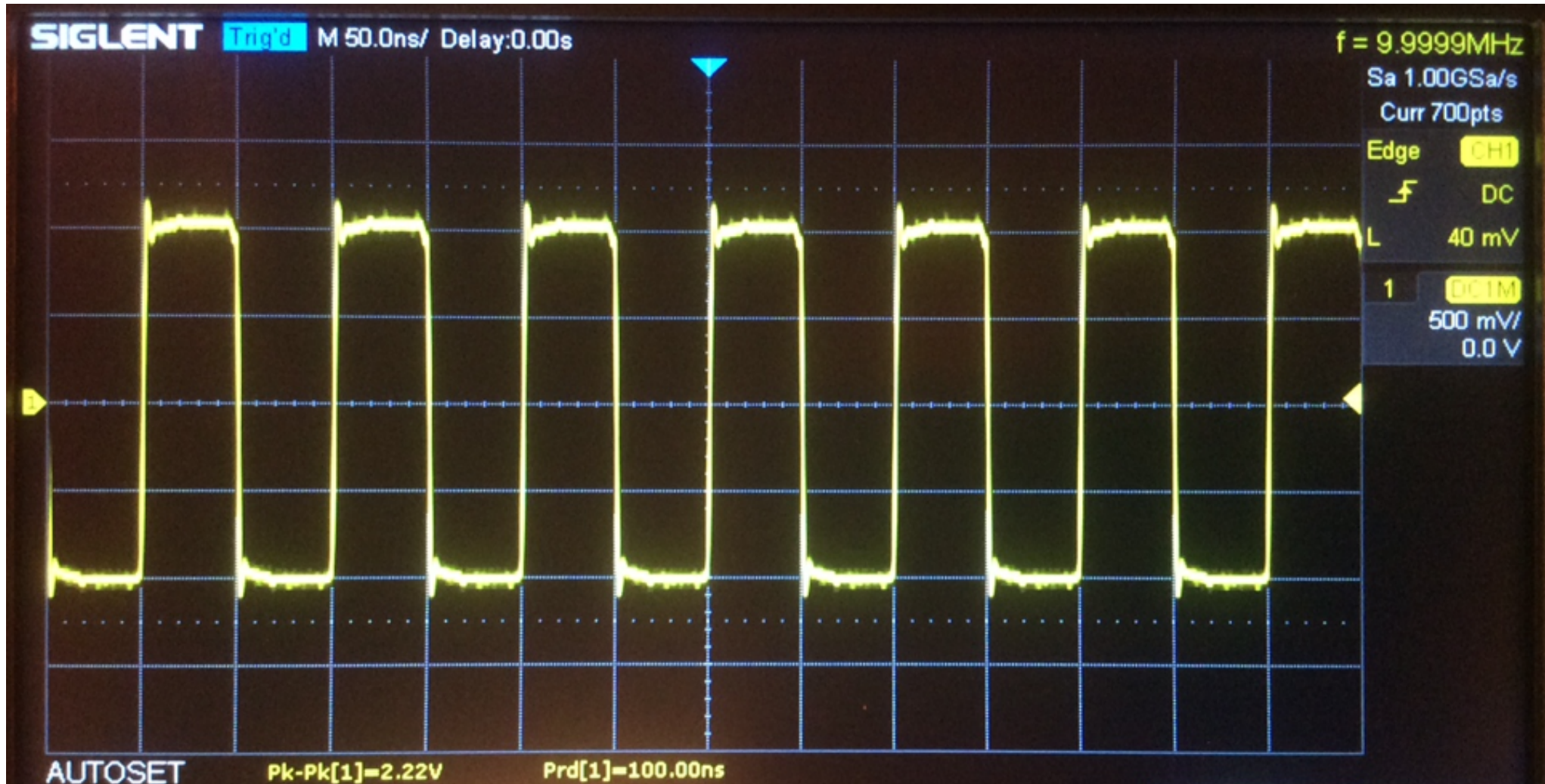


Rig Expert AA-30.ZERO

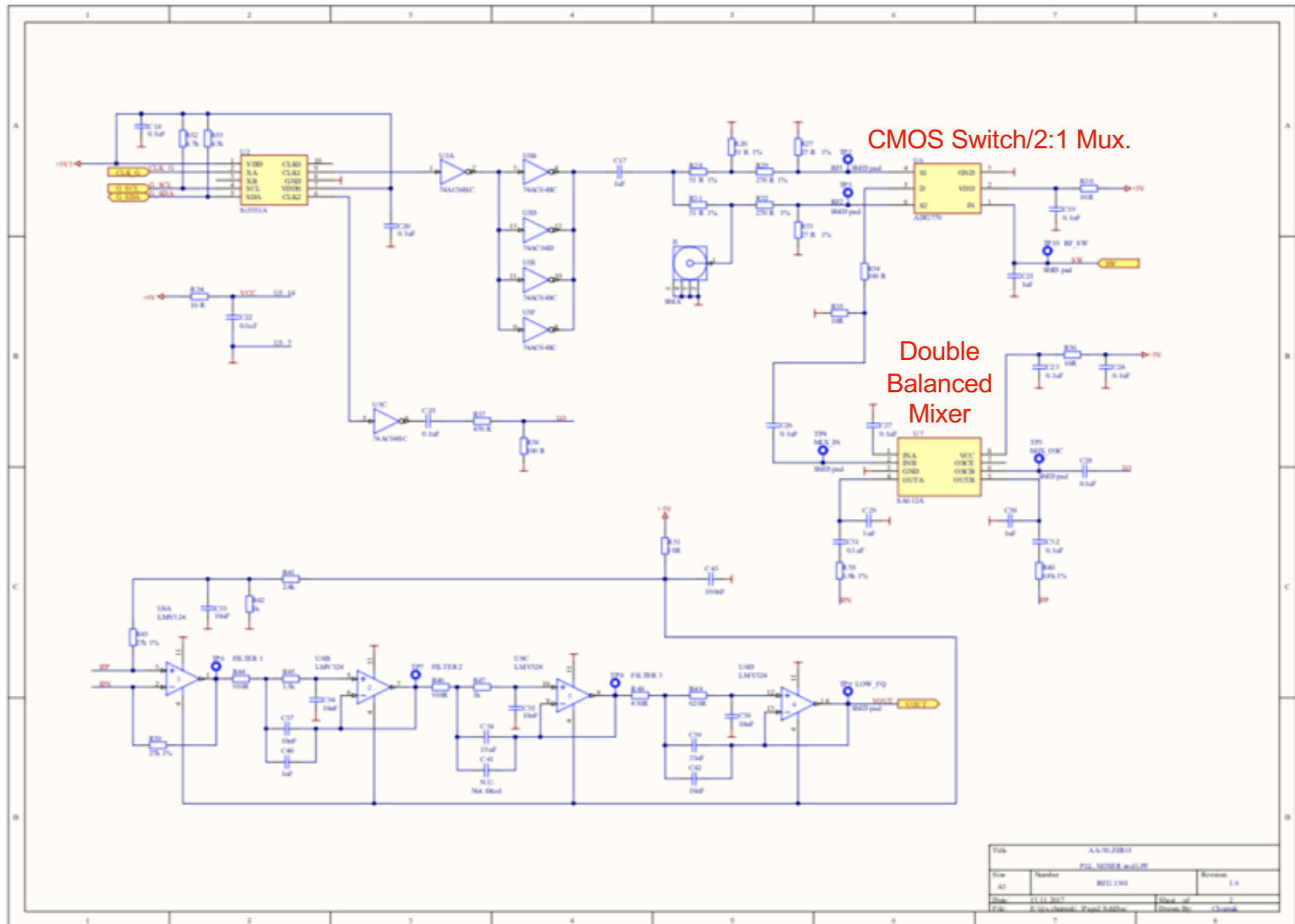


- Avail. From GigaParts or DX Engineering
- Only \$75
- Software is free
- No enc., display, no keyboard
- Covers HF only
- Designed for Integration
- Use w/Arduino

AA-30.ZERO 10 MHz. Output



Part of AA30.ZERO Schematic



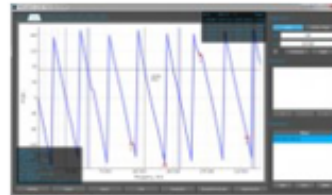
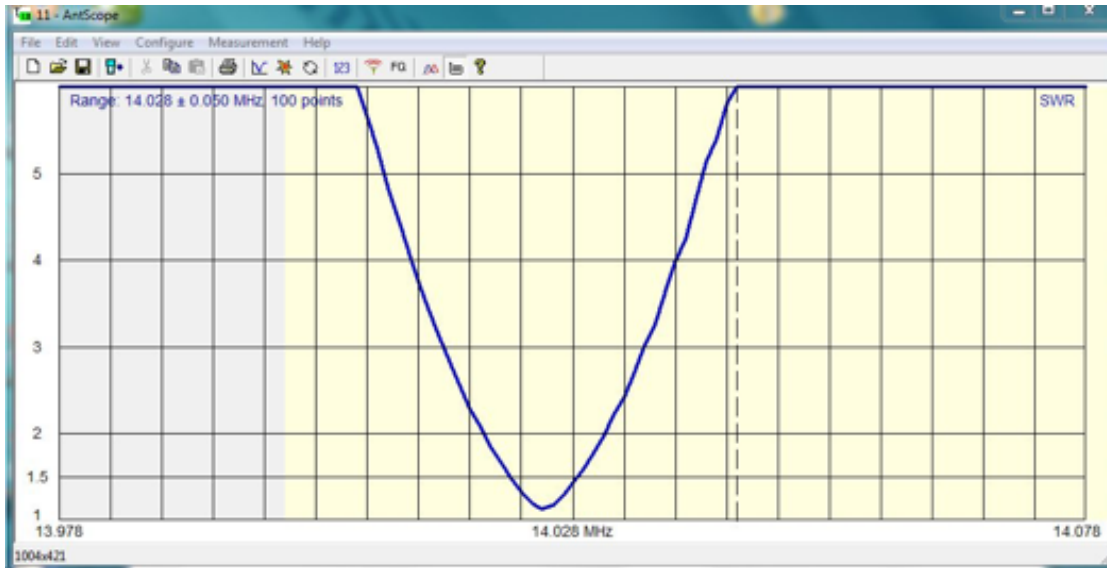
Rig Expert AA-35



List Price \$228.95 at
DX Engineering.

- Rapid check-out of an antenna
- Tuning an antenna to resonance
- Comparing characteristics of an antenna before and after specific event (rain, hurricane, etc.)
- Making coaxial stubs or measuring their parameters
- Cable testing and fault location, measuring cable loss and characteristic impedance
- Measuring capacitance or inductance of reactive loads

AntScope2 Free Software



AntScope2

The AntScope2 software is designed to support various models of RigExpert antenna analyzers for your Windows PC or Mac.

AntScope2 for Windows & MacOS:

- Click for downloading the latest version of the Antscope2 for your [Windows PC](#).
- Click for downloading the latest version of the Antscope2 for your [MacOS](#).
- Click for downloading the latest version of the Antscope2 for your [Ubuntu](#).

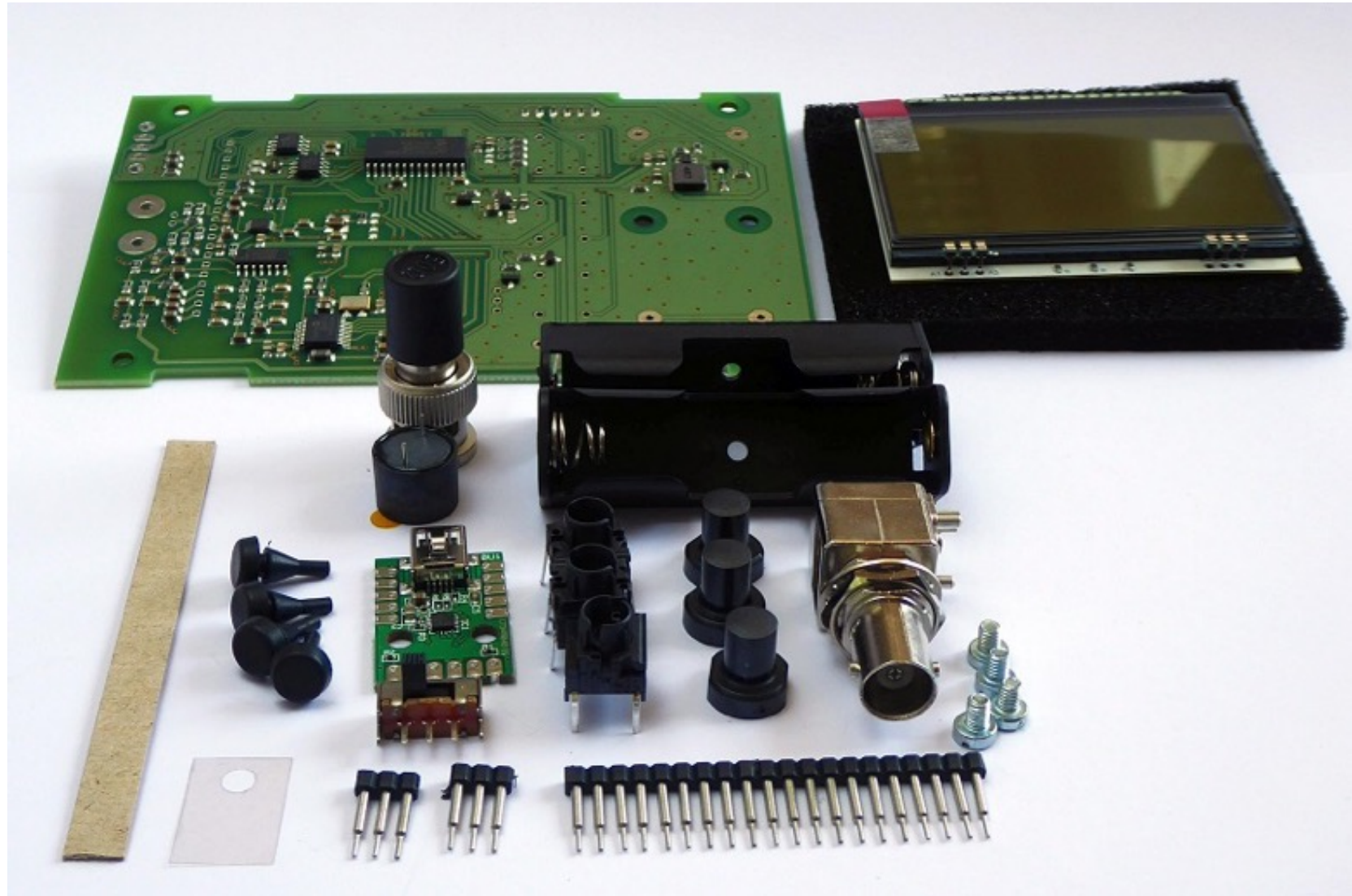
This program is open source, please see github.com/rigexpert/AntScope2.

Funk Amateur FA-VA5



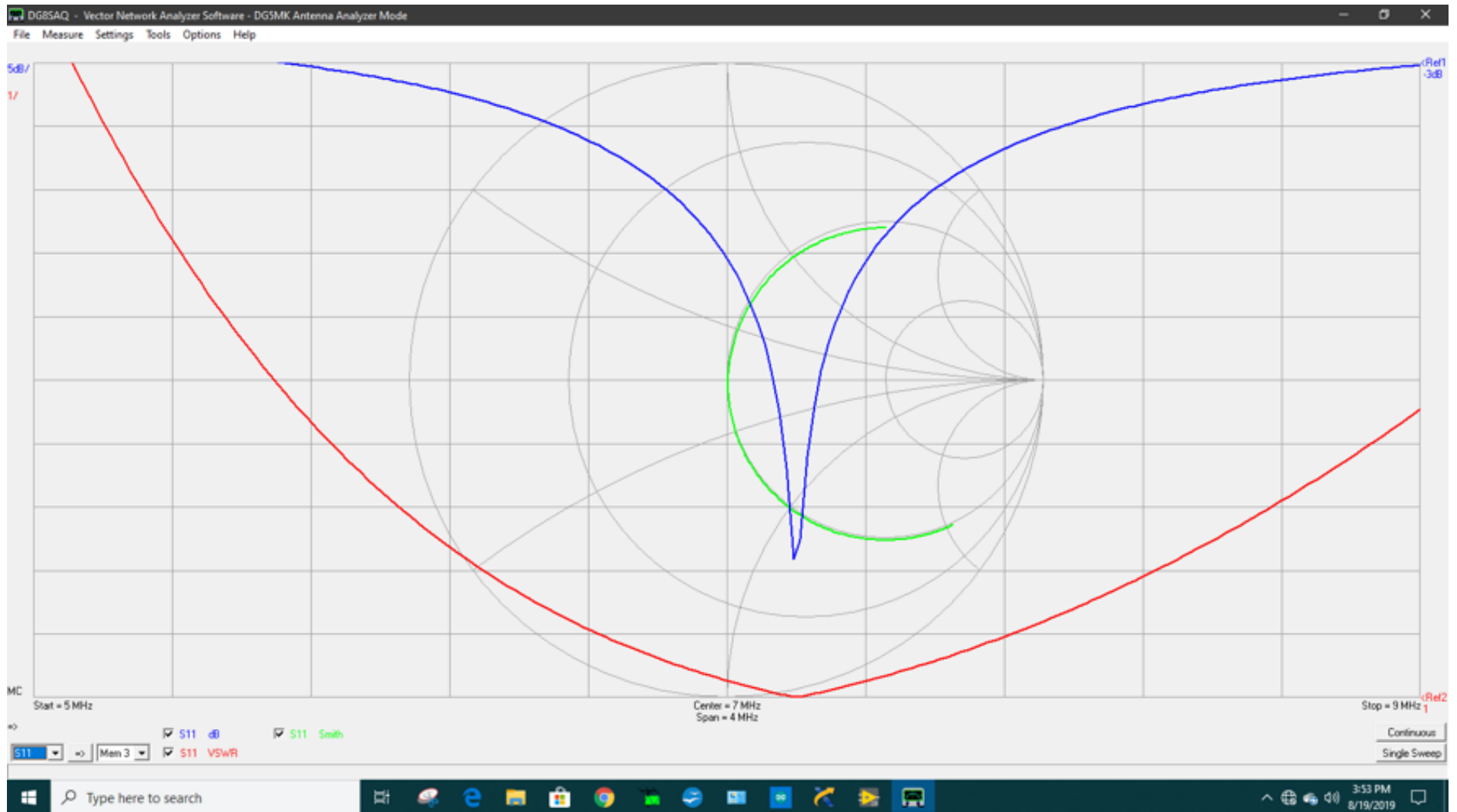
- Frequency Range 10 kHz - 600 MHz
- Small dimensions 15 x 8.5 x 2.2 cm - fully portable
- User friendly - intuitive menus
- Large display with good readability
- Low power consumption (up to 40 hours from 2 AA batteries)
- SOL Calibration function
- USB-interface with support of the DG8SAQ VNWA Software
- Real time clock with backup capacitor
- Audible buzzer alert for minimum SWR alignment
- \$185.20 USD plus freight, accessories, etc.

Funk Amateur FA-VA5 Kit



2 hour build, max. All SMD components already installed and tested.

DG8SAQ Vector Network Analyzer Software



See the presentation by Michael Knitter on YouTube.

FA-VA5 10 MHz. Output



KAI-201 Analyzer/Sig. Gen. Kit

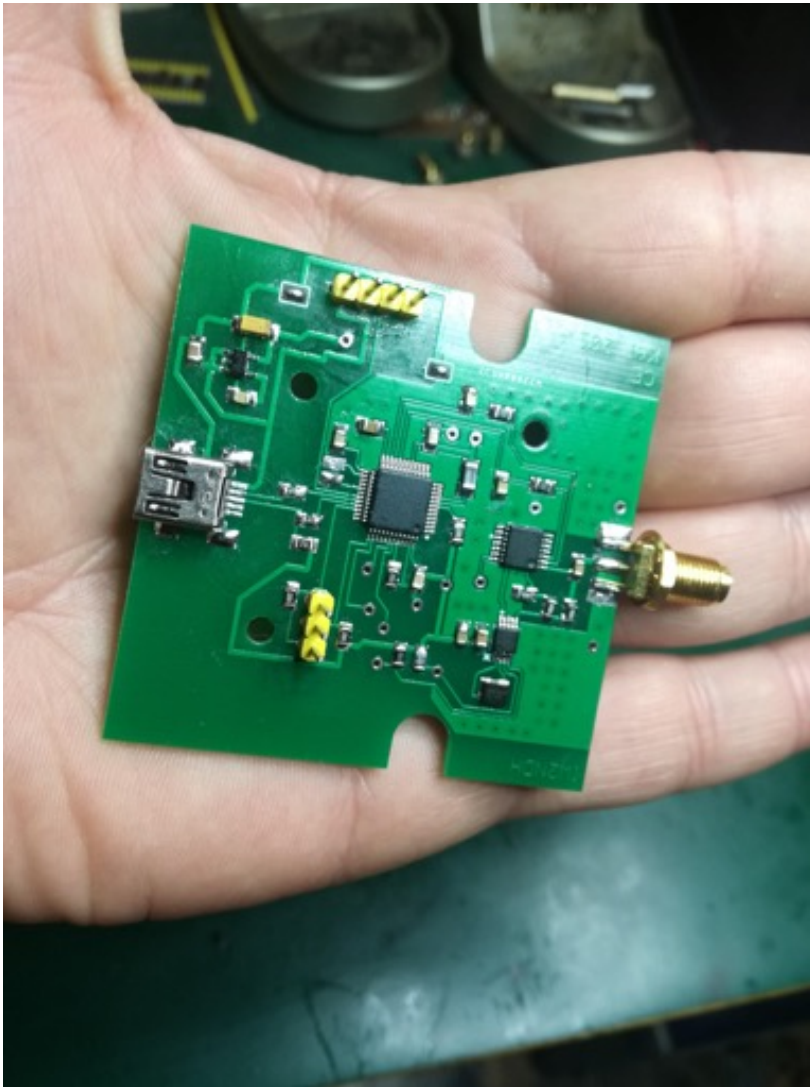
KAI-201X Kit WSPR Transmitter



- This unit is actually TWO products.
- The “201” is a 570 kHz. to 170 MHz. Antenna Analyzer when used with AntScope2. via a USB port.
- It is also a 100 KHz. To 200 MHz. Square Wave Signal Generator.
- You can add a Bluetooth interface and run the unit from an Android phone.
- The “201X” adds a few additional components and now it can be used as a WSPR transmitter.
- External Bandpass filter is required.

KAI-201 Analyzer/Sig. Gen. Kit

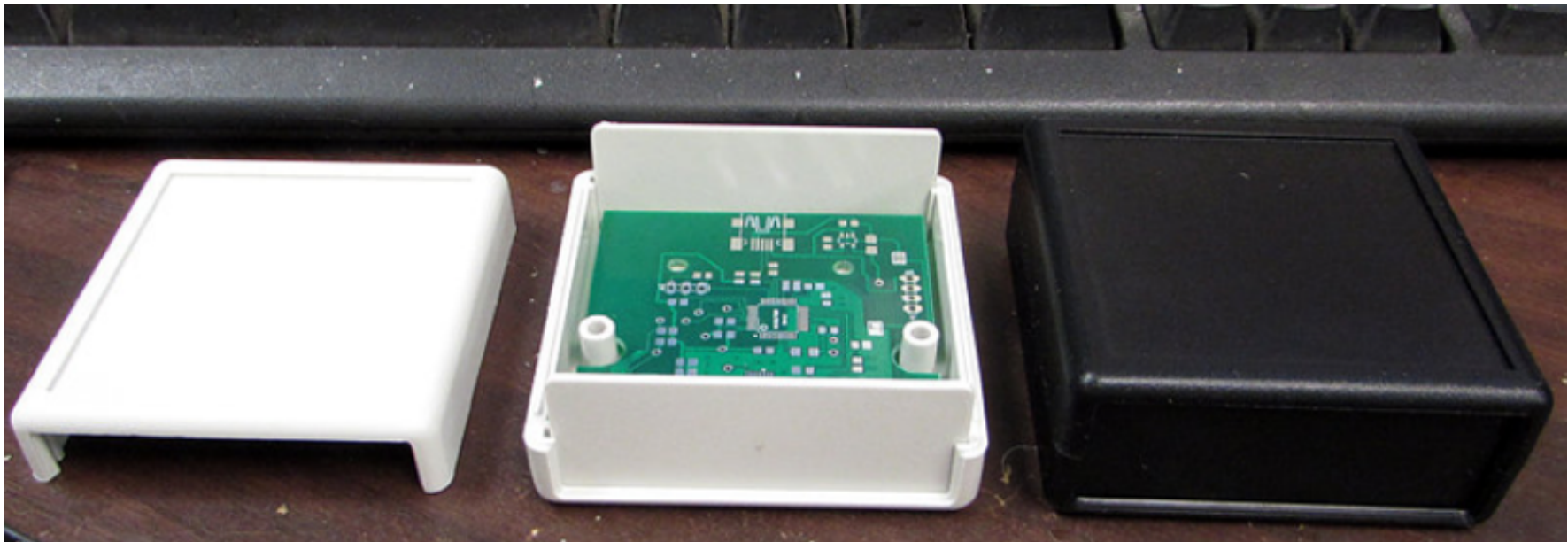
KAI-201X Kit WSPR Transmitter



- The “201” board comes completely assembled and tested.
- The “201X” requires the addition of 2 switches and an LED.
- The “201X” adds a better crystal to meet the WSPR stability reqs.
- The “201” kit sells for \$59.
- The “201X” kit sells for \$64
- Both prices include shipping.
- The Analyzer app. is calibrated using standard SOL components.
- The SigGen app. Is controlled by any external Terminal Emulation program.

KAI-201 Analyzer/Sig. Gen. Kit

KAI-201X Kit WSPR Transmitter



100% SATISFACTION GUARANTEE

We are so confident that you will absolutely LOVE KAI201, we offer all our customers a 14 day 100% no questions asked return policy. If for some reason, your KAI201 is not what you hoped it would be, simply email iw2ndh@gmail.com within 14 days of receiving it to let us know you'll be returning the item. We will then give you the returns address. Once we receive the item back in 'pristine' condition, we will happily refund your purchase price minus the shipping. No questions asked!

OUTSTANDING DESIGN

In a 57x58 mm you have a complete Antenna Analyzer with sophisticated software suitable for PC (windows and mac) Android (Open60) and Arduino with USB and serial interface. KAI201 is ready to fit in hammond box <https://www.hammfg.com/electronics/small-case/plastic/1593> mod 1593KBK

The NanoVNA, a 900 MHz. Vector Network Analyzer for \$60

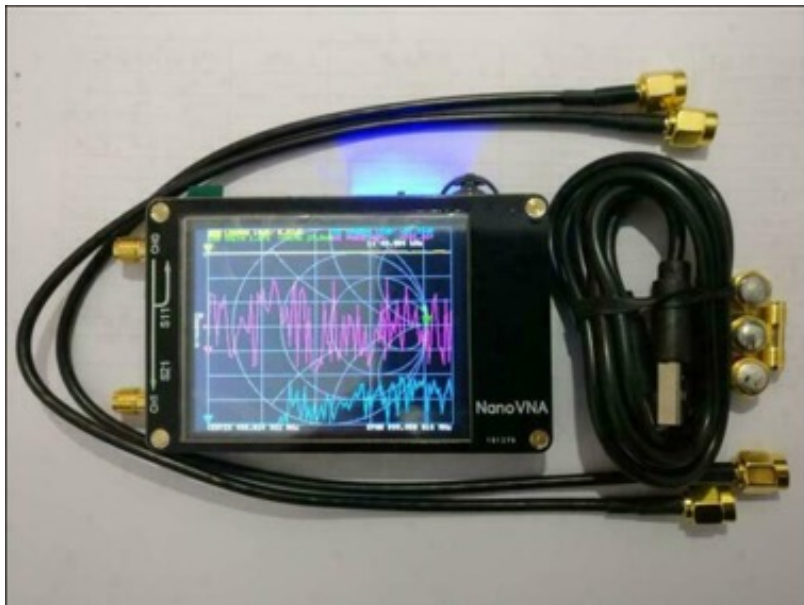
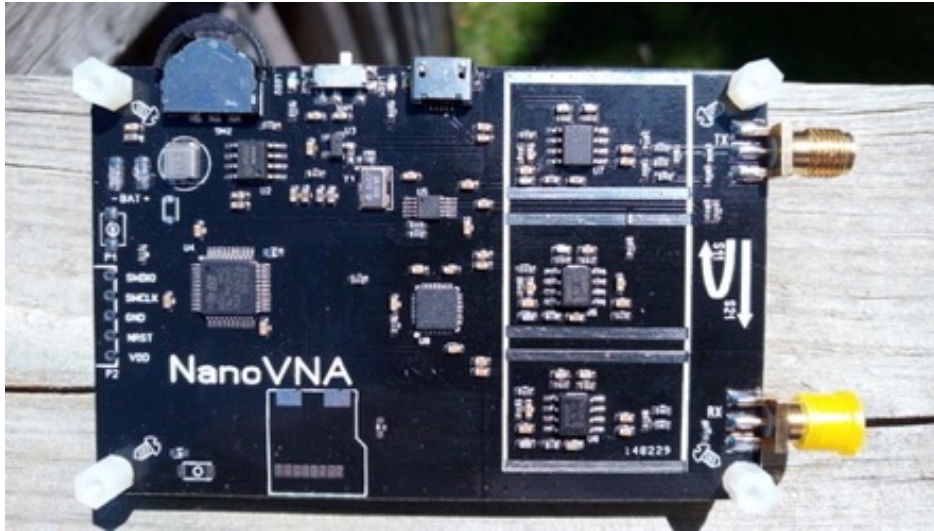


- Size of a credit card, 1/2" thick
- 4 Color Traces w/Touch Screen
- 5 Calibration memories
- S11 and S21 measurements
- Battery operated
- Open Source S/W, a GitHub project
- Multiple Firmware options
- Stand alone or remote control
- Amazing User Group



The NanoVNA is very tiny handheld Vector Network Analyzer (VNA). It is standalone device with an LCD Touchscreen display and battery for portable operation. This project's aim to provide a useful RF instrument for the radio enthusiast.

The NanoVNA, a 900 MHz. Vector Network Analyzer for \$60

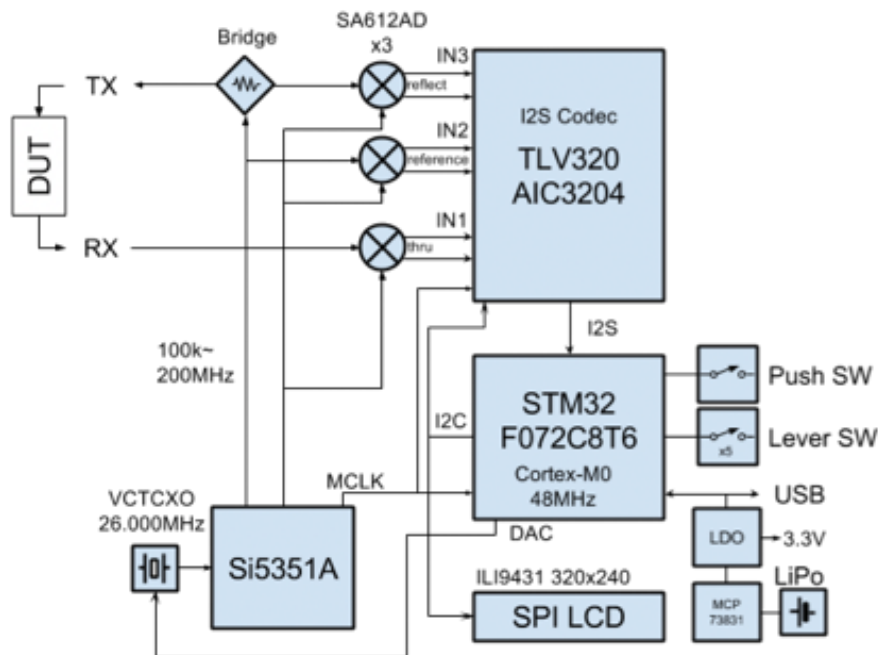


Price includes:

- NanoVNA with battery installed,
 - USB Interface cable,
 - 2 each, SMA-M to SMA-M cables
 - SMA-M Short, Open and 50 ohm, Load (SOL) for Calibration
 - Plastic carrying case.
-
- 3D printed cases are available from 3rd Party suppliers or print files are available for free.

See NanoVNA User Group at
<https://groups.io/g/nanovna-users>

The NanoVNA, a 900 MHz. Vector Network Analyzer for \$60

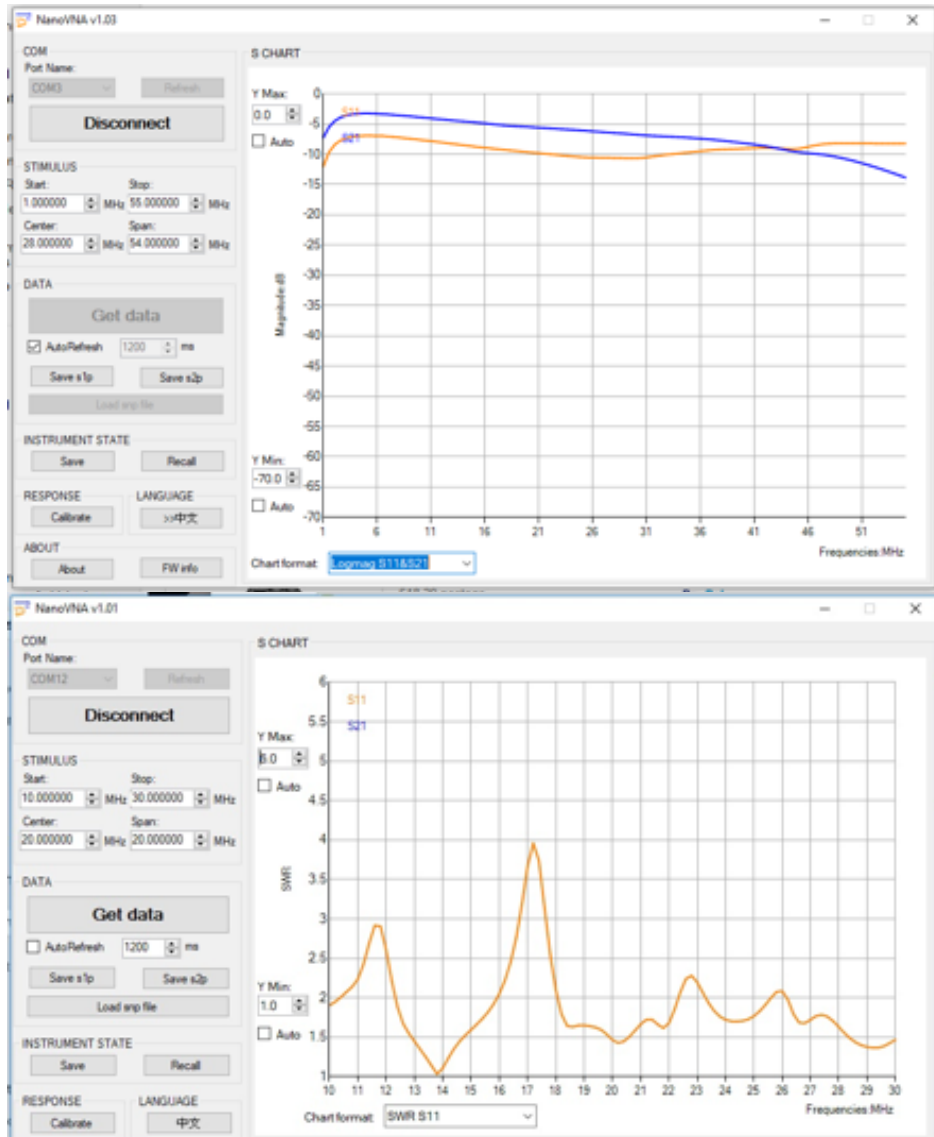


NanoVNA Block Diagram

Basic performance:

- PCB: 54mm x 85.5mm x 11mm (without connectors, switches)
- Measurement frequency: 50KHz -900MHz
- RF output: -13dbm (maximum -9dbm)
- Measurement range: 70dB (50kHz-300MHz), 50dB (300M-600MHz), 40dB (600M-900MHz);
- Port SWR: < 1.1
- Display: 2.8 inch TFT (320 x240)
- USB interface: USB type-C communication mode: CDC (serial)
- Power: USB 5V 120mA, built-in 400mAh battery, maximum charging current 0.8A
- Number of scanning points: 101 (fixed)
- Display Tracking: 4, Marking: 4, Setting Save: 5
- Frequency error:<0.5ppm

The NanoVNA, a 900 MHz. Vector Network Analyzer for \$60



- Data can be imported or exported as S1P or S2P files.
- Data files are in Touchstone format and can be exchanged with other plotting programs.
- USB interface allows for access by other software such as LabVIEW.

That's all folks!

Questions or Comments?

More to follow on the NanoVNA
at the
“Lunch and Learn with Larry”