285 Tech Connect Radio Club TechFest 2023

NanoVNA

Low-cost, pocket sized tools for antenna and RF circuit measurements

Antenna analyzers

(A specific application of electrical component and circuit measurement tools)

Antenna analyzers (until recently)

Grid Dip Oscillator (GDO)

Autek RF Analyst

Field Strength Meter

MFJ 209-259-etc.

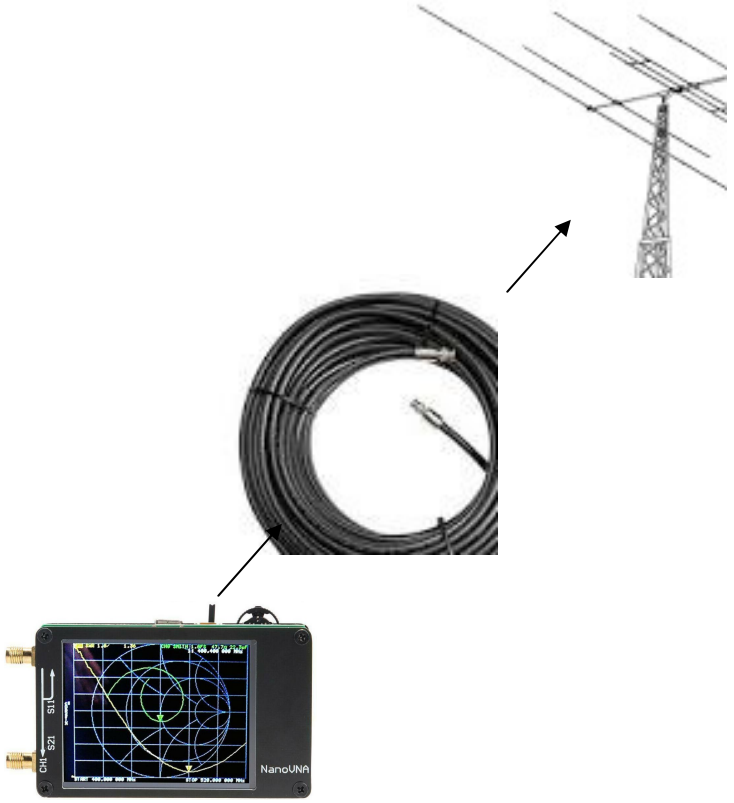
SWR reading is of antenna *going through* feedline

SWR reading is result solely of antenna

Vector Network Analyzer

Calibration reading result of calibration kit through feedline
You can do this at ground level

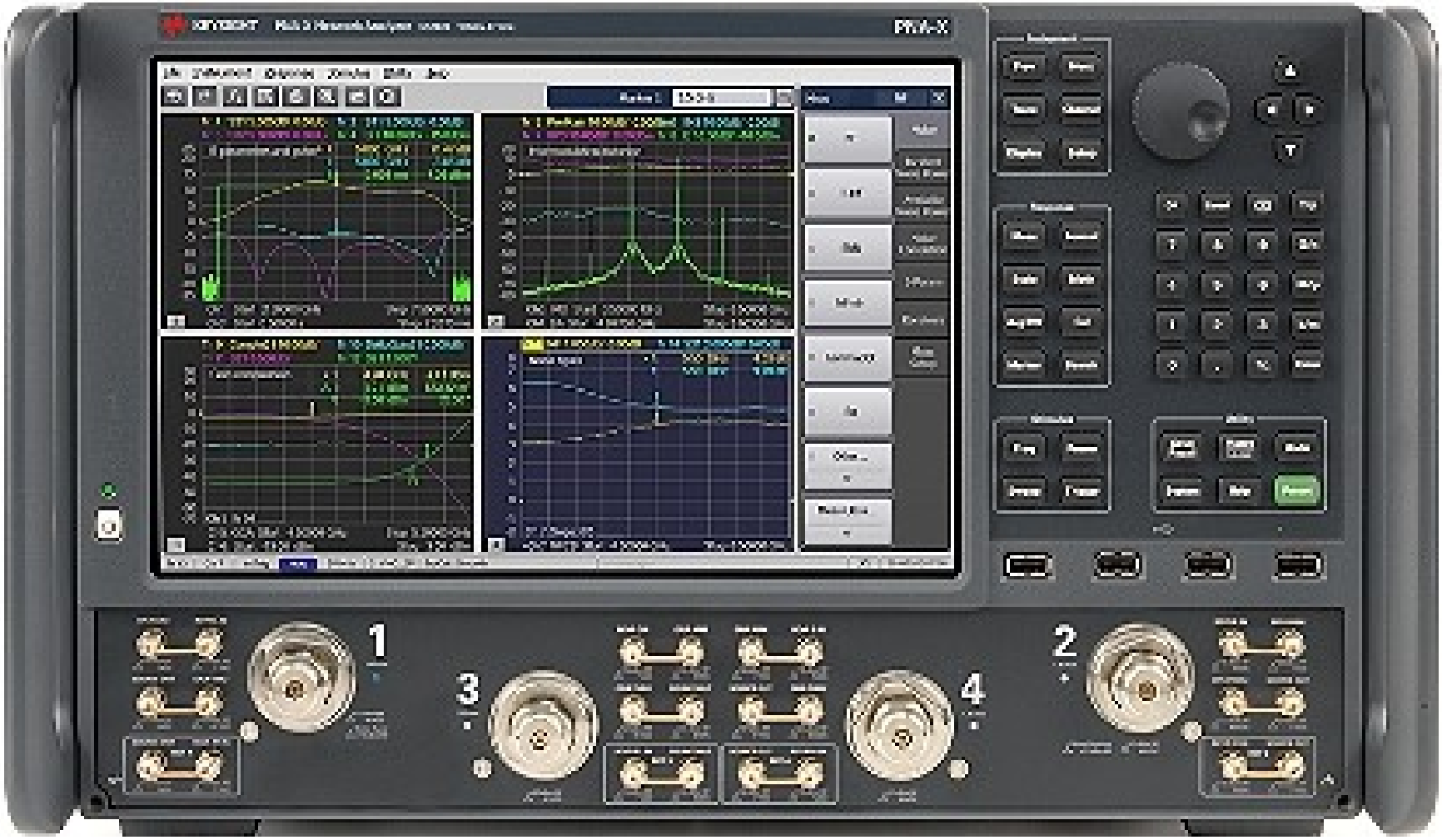
“Uncorrected” reading result of antenna through feedline



“Corrected” reading result of antenna *net of (without)* feedline

So get a vector network analyzer!

For every ham…



For every ham…

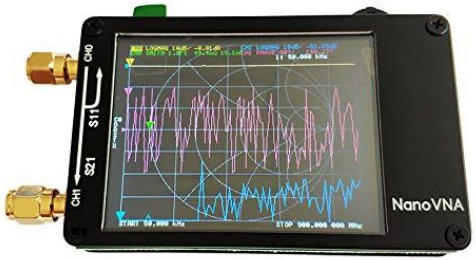
Electrical Network Analyzer

No transmitter/transceiver needed

100 microwatts

100 watts

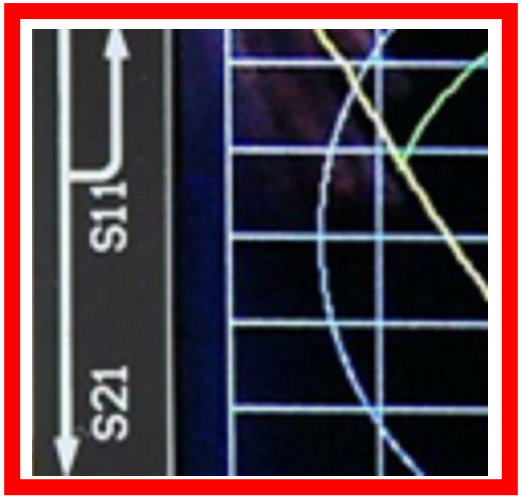
No transmitter/transceiver allowed!

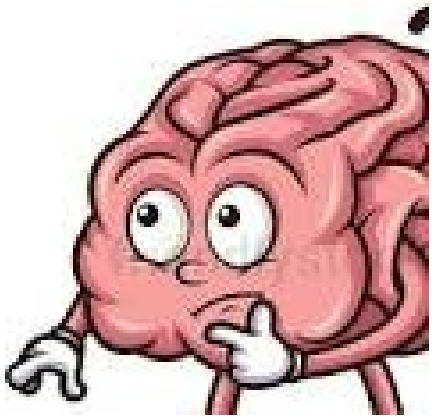


Calibration

Calibration – what?

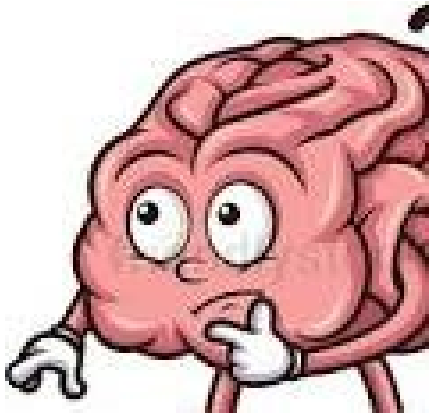
Uncalibrated





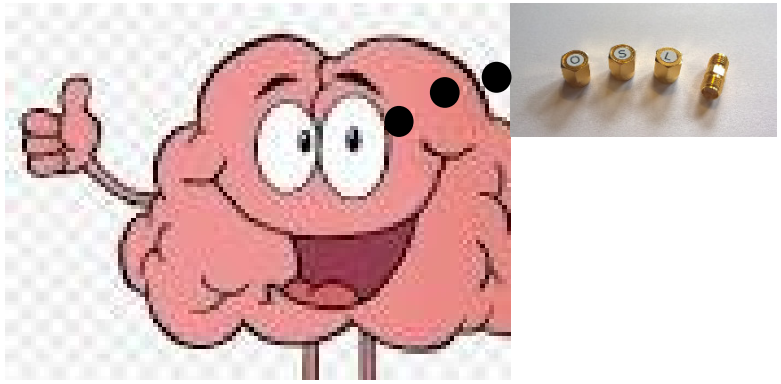
Calibration – how?

Calibration Kit

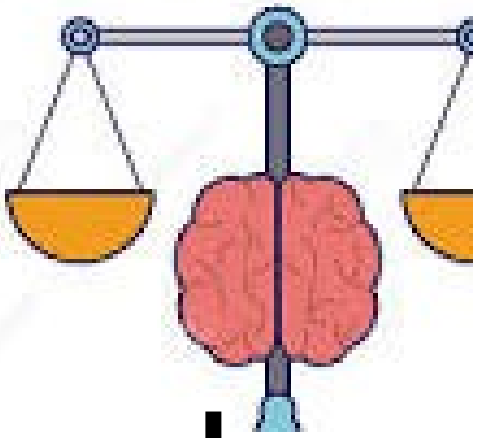


Calibration – how?

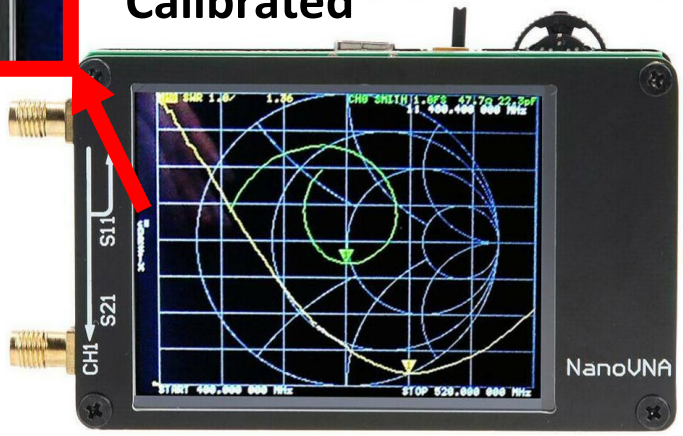
Calibration Procedure



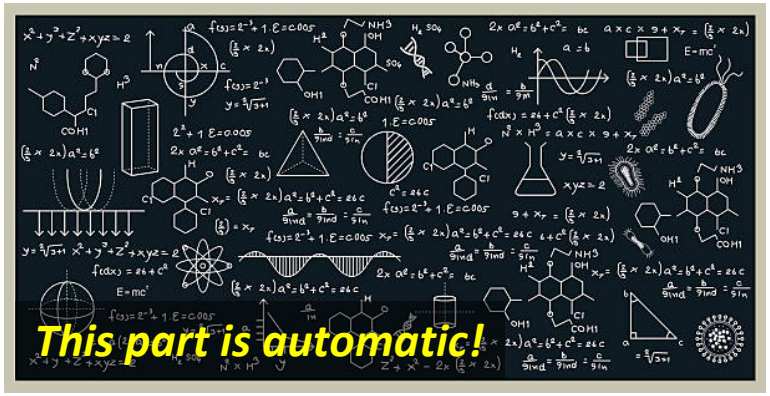
Calibration – why?

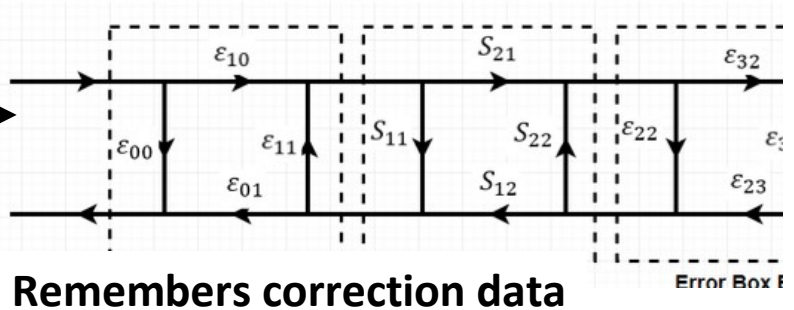


Calibrated



Calibration – when?

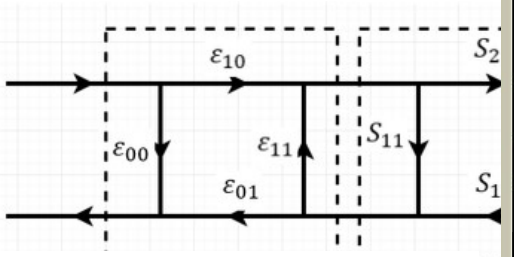




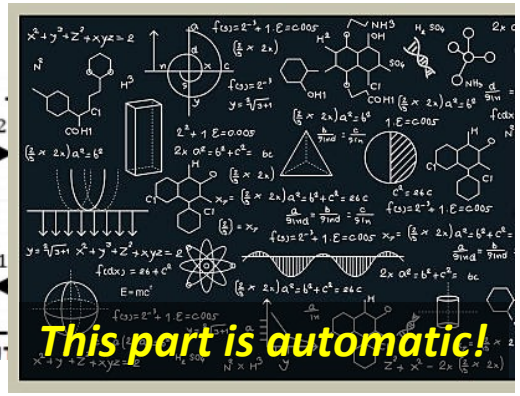
Remembers correction data

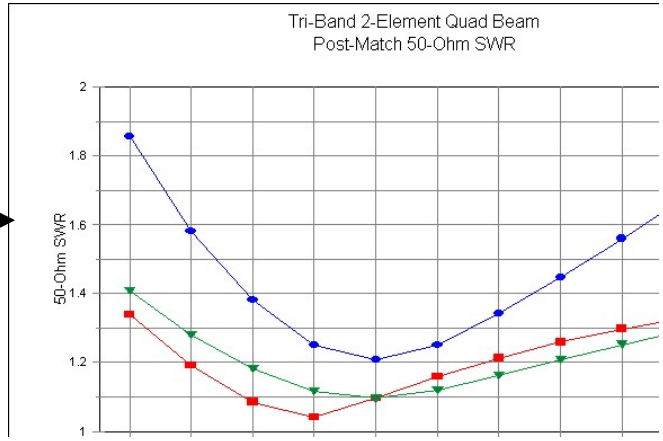
Calibration step – do this at least once (when you receive your NanoVNA)

Calibration – result!



Recalls correction data





Measurement step – calibration data is automatically "applied" to improve accuracy

Calibration – invent!

☺ make your own “cal kit” ???? Yes!

SHORT✓

OPEN✓

LOAD✓

SMA

HAM vs. SMA 1

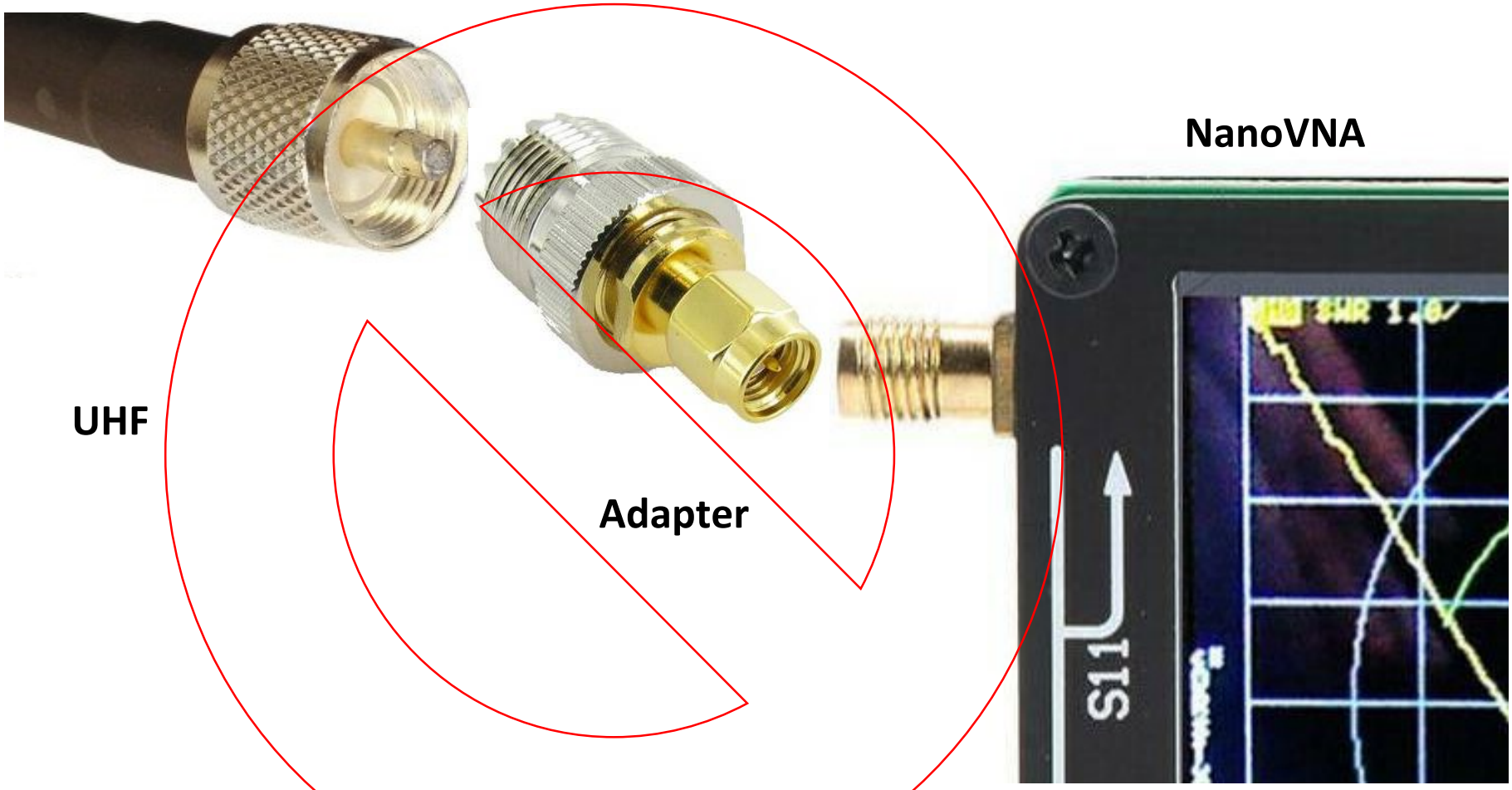
UHF

BNC

N-Type

SMA

HAM vs. SMA 2



HAM vs. SMA 3

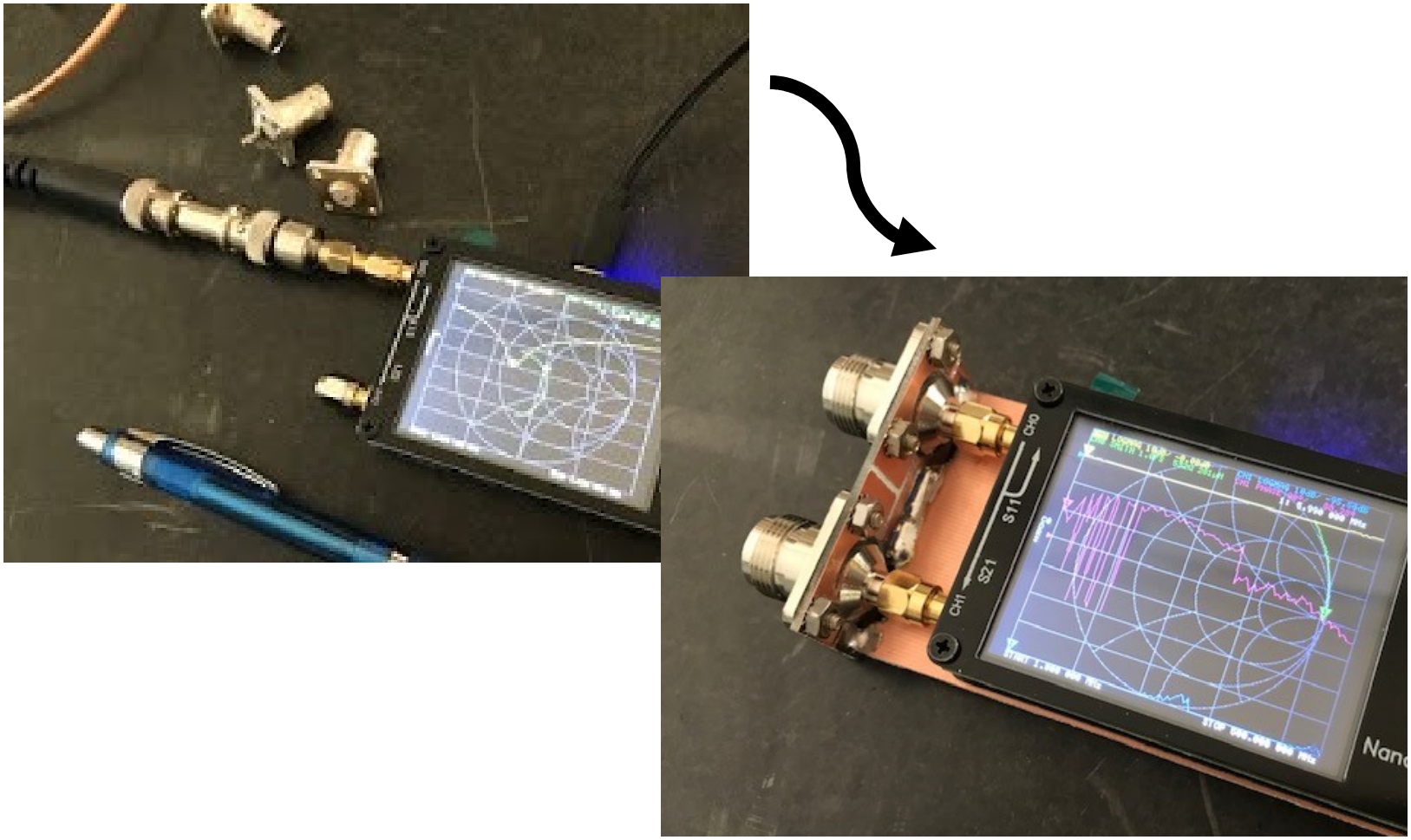
SMA flexible patch cable

UHF

Adapter

NanoVNA

HAM vs. SMA 3



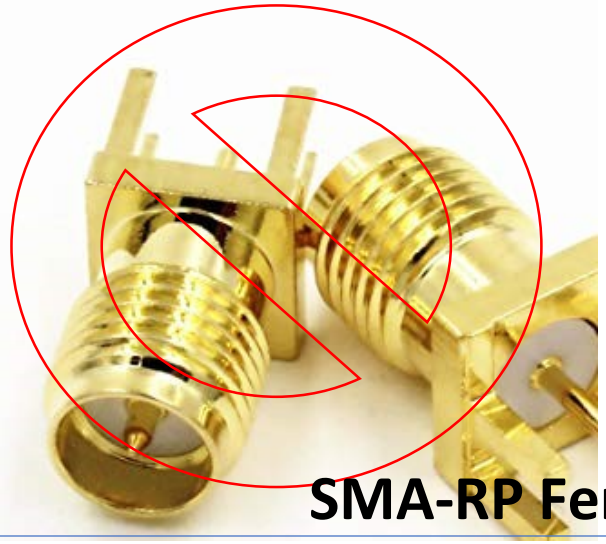
http://k6jca.blogspot.com/2019/09/n-connectors-for-nanovna.html

HAM vs. SMA 4

- A *little* more than finger tight is best *(a little!)*
- Max about 4 inch-pounds (or 0.45 newton-meter)
- Torque wrench (professional)
- Under-tightening risks noisy/bad measurements
- Over-tightening risks damage to connector as well as VNA *(SMA jacks just soldered onto NanoVNA PC board!)*

HAM vs. SMA 5

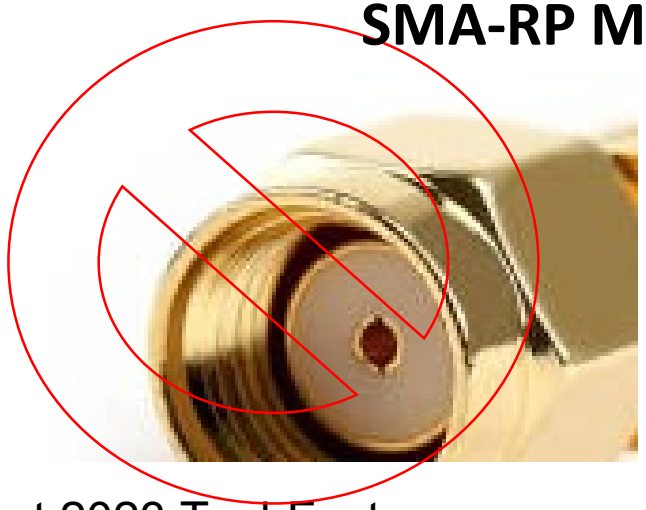
SMA Female - OK



SMA-RP Female – *NO!*

SMA Male - OK

SMA-RP Male – *NO!*



Your own NanoVNA?

Get a NanoVNA?

EDY555

hugen79

????????

- There *is no* “NanoVNA company” (nor factory, nor brand), no warranty, no factory support, etc.
- There *are* reputable distribution channels (R&L Electronics in Ohio for example)
- Technology (hardware designs, embedded software code maintained and developed by volunteers (thank you to DiSlord, OwOwOwOwO123, and other experts)
- nanovna-users@groups.io is the large user community; developers typically “hang out” on github (example, https://github.com/DiSlord/NanoVNA-D

NanoVNA-specific resource

- nanovna-users@groups.io
- The largest online nanovna community by far
- 13200 current users as of November 2023
  - Among the largest (participant numbers) radio/technology communities on groups.io
- *Very* high signal/noise ratio (technical discussions yes, unrelated discussions no, beginners welcome)
- Started in June 2019 by WB0GAZ (on road trip back from Dayton Hamvention)
  - Co-owner: KC0WJN/4 since shortly after group started
  - Co-owner: W0LEV since early 2023

RF Network Analysis Resources 1

- joel p dunsmore - "handbook of microwave component measurements"
  ISBN 978-1-119-97955-5

- http://download.ni.com/evaluation/rf/Introduction_to_Network_Analyzer_Measurements.pdf

- https://www.eevblog.com/forum/testgear/book-on-vna/?action=dlattach;attach=551660

RF Network Analysis Resources 2

- https://www.microwaves101.com/encyclopedias/resonance-of-rlc-circuits

  https://www.microwaves101.com/encyclopedias/smith-chart-basics

  https://www.microwaves101.com/encyclopedias/capacitor-mathematics

  https://www.microwaves101.com/encyclopedias/inductor-mathematics

  https://www.microwaves101.com/encyclopedias/s-parameters

  https://www.microwaves101.com/encyclopedias/self-resonant-frequency

  https://www.microwaves101.com/encyclopedias/inductors

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