

**JEY Labs Presents**



# **Test Gear For Hams**

**Doug Millar  
K6JEY**

# Modern Choices on a Budget

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Doug Millar K6JEY

# Planning

- Which gear do you use the most?
- What will you need in the future?
- Will you want to keep or get any favorites?

# MULTIMETERS

# They all read correctly with 50ohms

Fluke  
8060a  
(1977)  
87iii  
(2000)



Fluke 77  
(1980)  
Mastech 8906  
(1999)  
Fluke 115  
(2010)



# You Can Keep an old Friend

But-  
You get Tired of-

Too many  
leads  
switches  
scales  
Zeroings  
Warm up time

It is still a good  
RF voltmeter.



# Fluke 115 and 77

## Zeros fast, auto ranging and tough

True RMS  
One handed  
About \$110



\$50



# Kaiweets Auto-Auto DVM

About \$40

Auto  
range  
zero  
*Function*





# UT 181A

- DMM with Android APP
- via Bluetooth..
- Does remote data collection.
- About \$290
- Also a cheaper model
- UT61E+ at \$90
- But no internal data logging
- Or DBm measurement.



# Meet Pencil DMM

Turn the phone  
clockwise for this display

Turn it anticlockwise  
and get the graphing  
display.

You can take pictures of  
the measurements.

**No test lead  
wires!**

Did I say \$35 from  
Amazon?



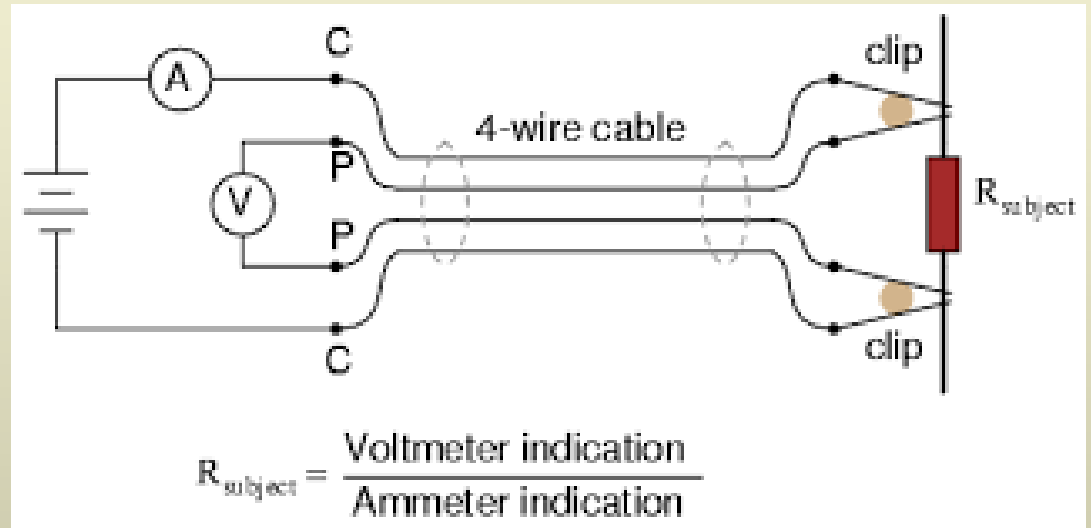


Fluke 8840A with 4 wire ohms  
Cheap, stable and reads to .001ohm!



# 4 Wire Ohms Measurement

The technique extends  
The internal circuit to  
The outside.



Mainly for measurements below 1K ohms



# AC/DC clamp on ammeter UT210E

Reads  
Down to  
1ma DC



About  
\$45

# Power Meter

# Power Meter Bird 4410A

Seven ranges  
per element

5% of reading!



\$300 with  
elements

# Daiwa CN801hp

\$60





# Newer Imported type.

Has battery  
12 watts  
And other  
Ranges.



\$50

# New Kid on the Block

## N-Type RF Power Meter V7 10GHz

0-10Ghz  
-60dbm- 1watt  
Offset  
Charges  
through C

\$85



# Frequency Sources

GPS oscillator  
10MHz output  
Data output

\$150





# GPS Source with display

\$190

Display shows  
Actual Freq.



# Signal Generators

# Elecraft XG3 Signal Generator



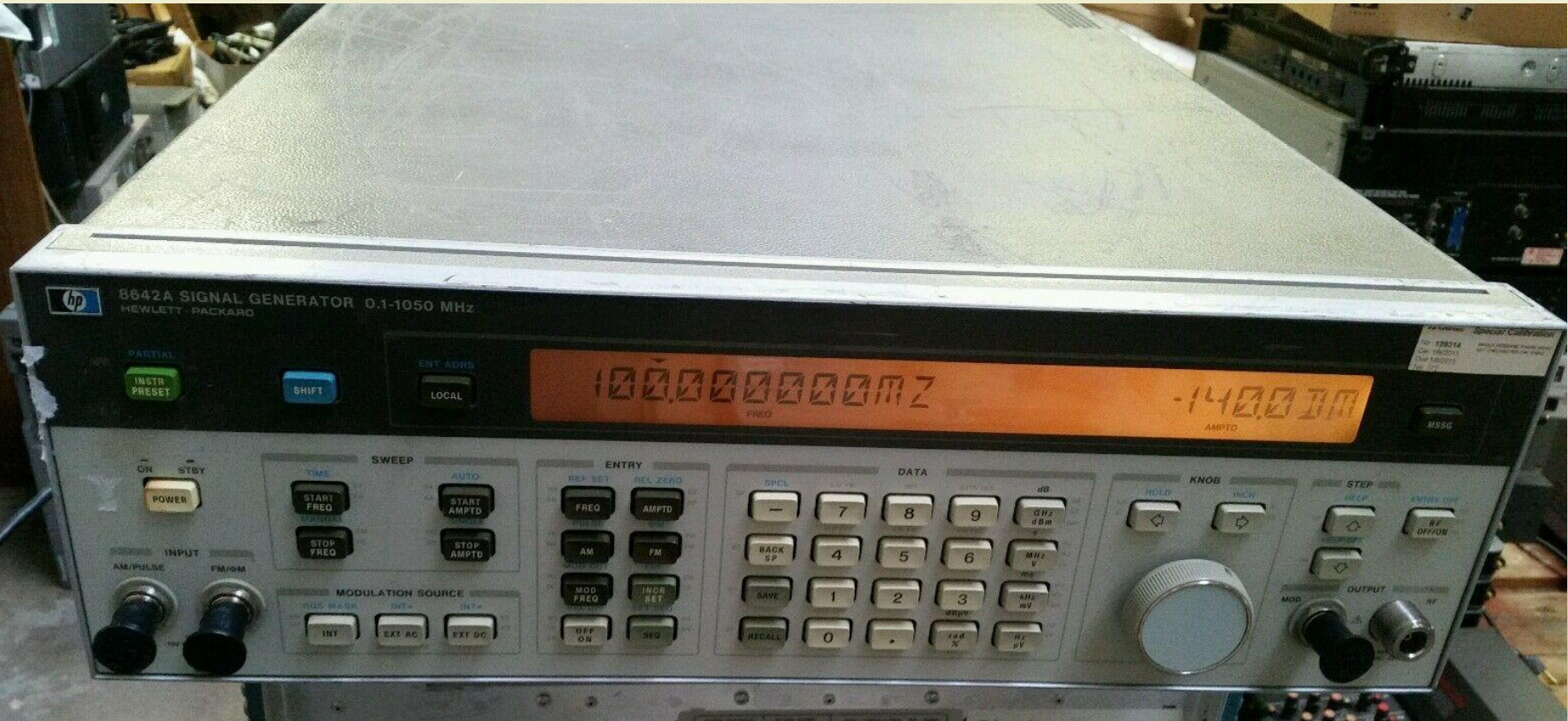
\$260

Accurate versatile  
Ham band oriented  
Generator.

# HP8642A/B

## DC to 2GHz generator

\$500



Nothing newer beats it for frequency and attenuation  
(Be sure and change the fan!).

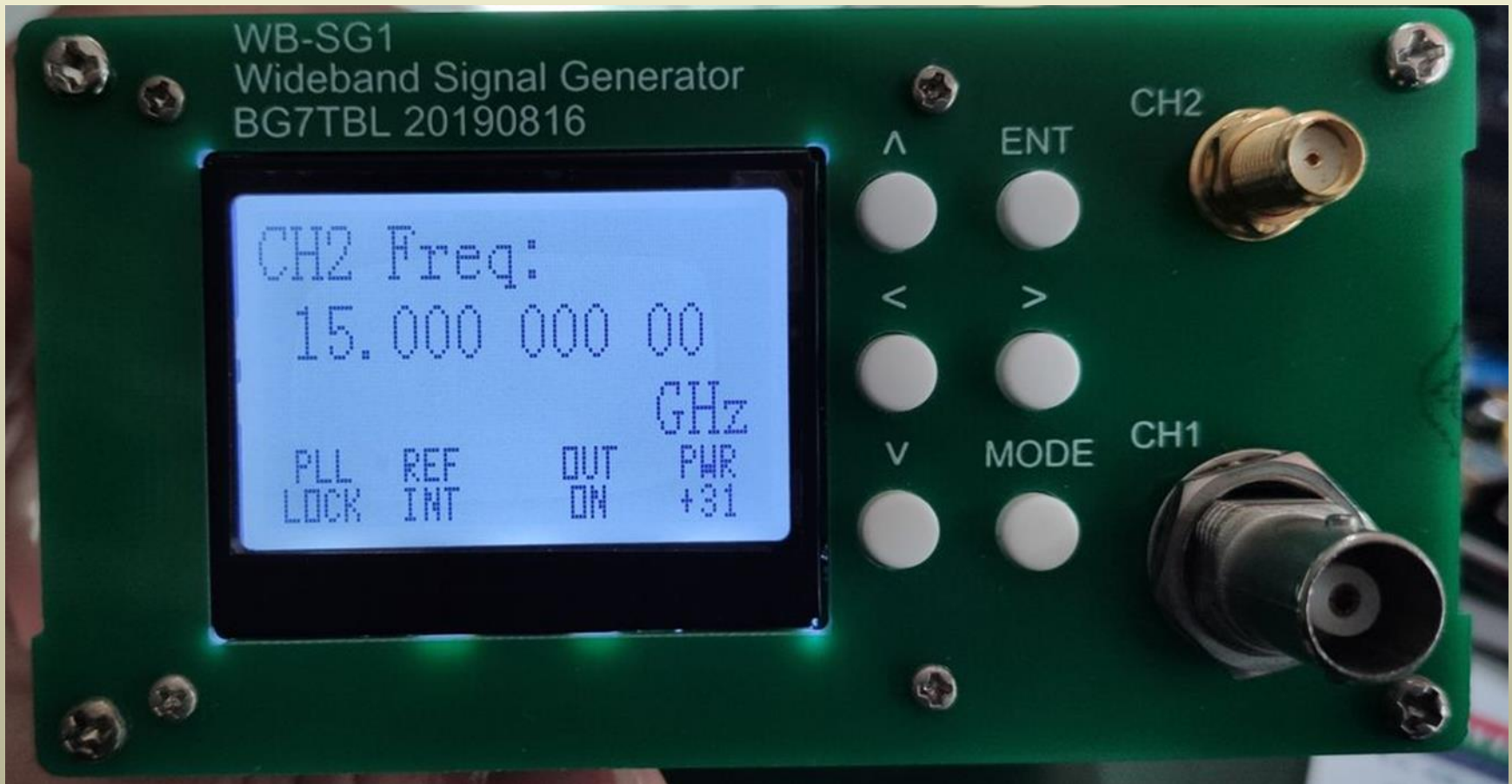


# Agilent 8647/48 A-D



WB-SG1      \$168

You will also need an external attenuator  
\$50-100



# External Attenuators

Narda  
Step Atten.



Narda  
Variable  
Atten.

# Spectrum Analyzers



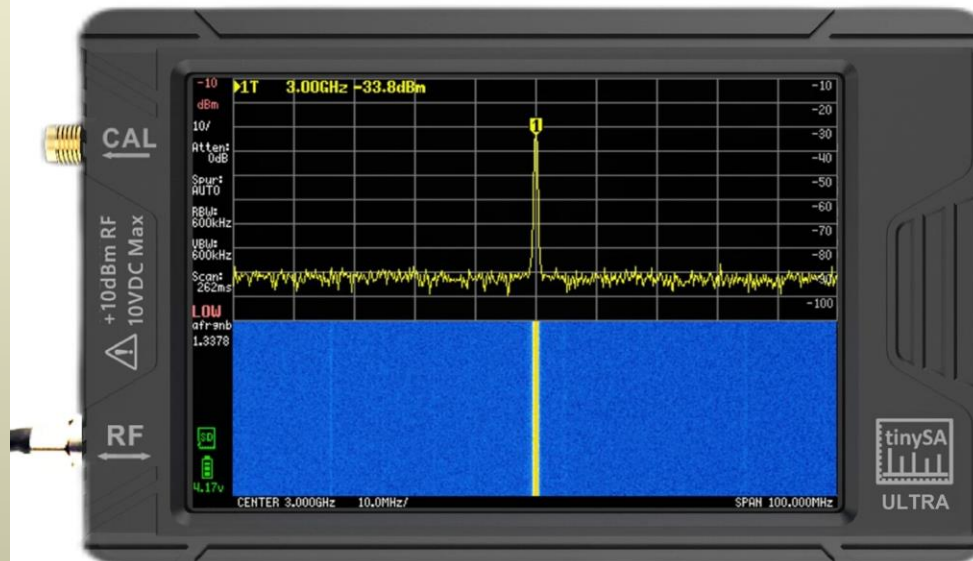
# Tiny SA Ultra

## tinySA ULTRA

NEW ULTRA MODE 100KHZ-5.3GHZ

Has 200Hz  
Resolution BW

Will go to 10GHz



100kHz-5.4GHz RF Generator

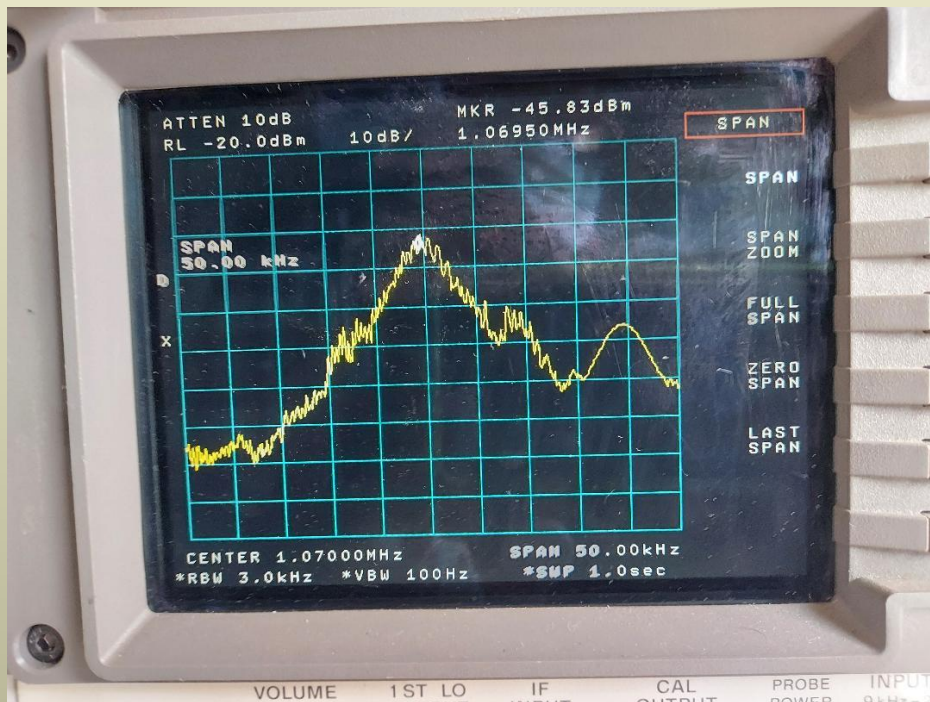
RBW 200Hz-850KHz LNA & Attenuator

Phase noise -92dBc@10kHz DANL -166dBm/Hz

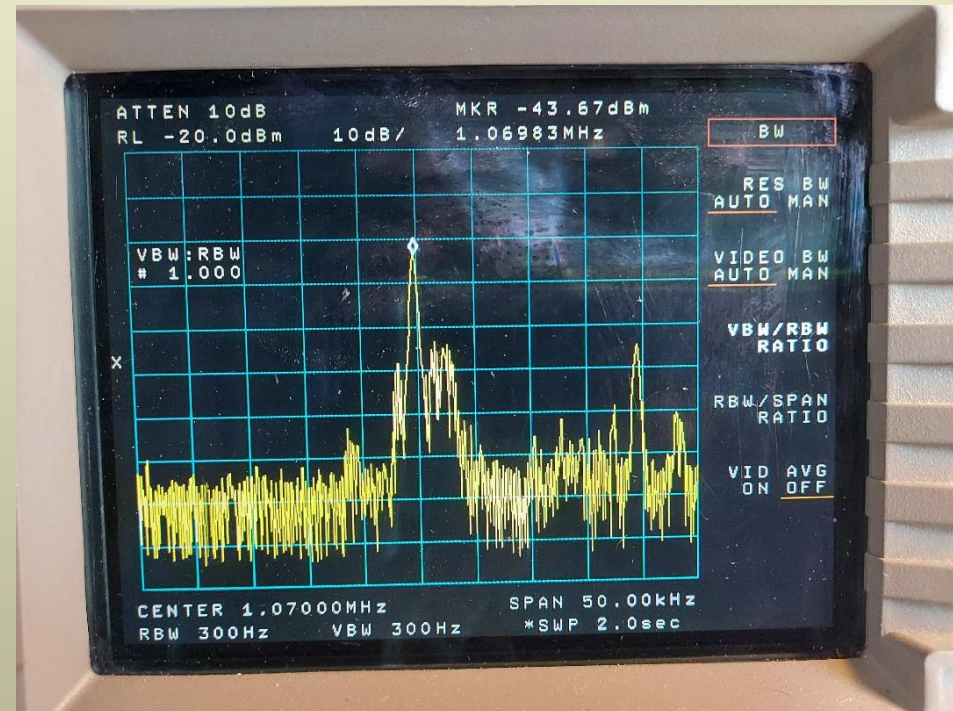
PC & SD 4 inch display 3000mAh

# 3KHz vs 300Hz RBW

KNX at 3KHz RBW

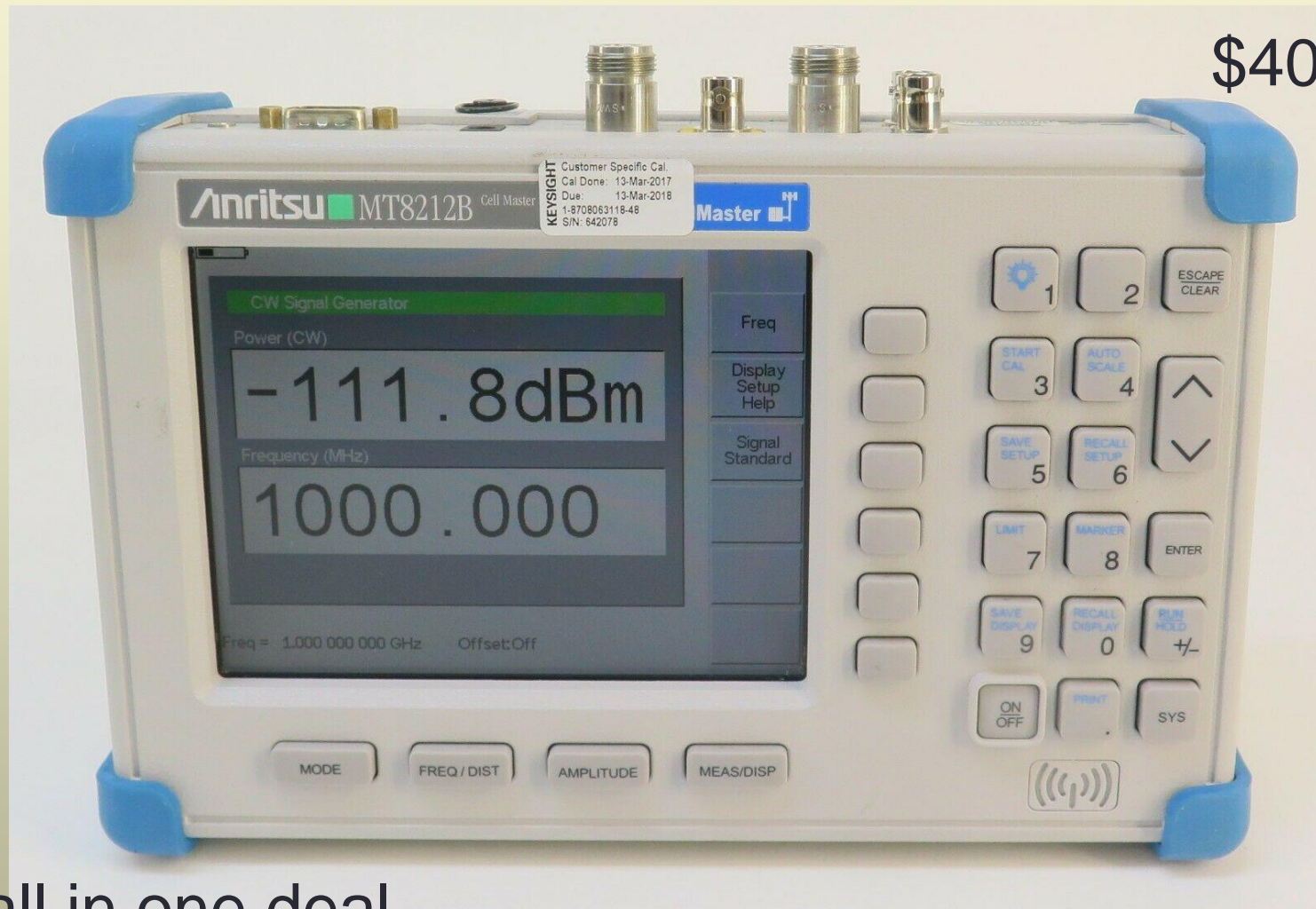


KNX at 300Hz



# Anritsu MT8212B

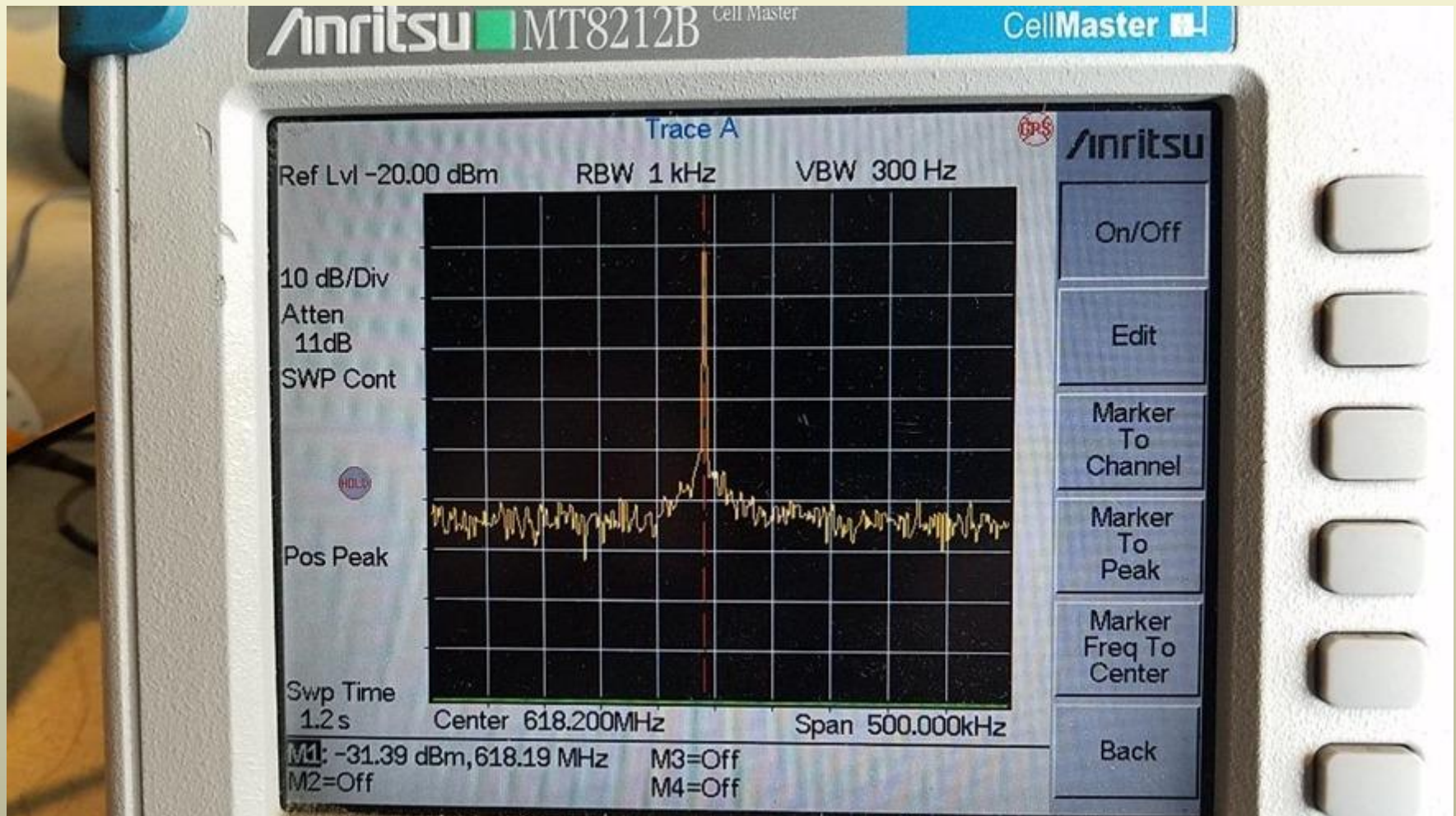
\$400-800



Best all in one deal-



# MT8212b Screen





# Anritsu MS2712E 9Kc to 4GHz

Battery operated, hand held, GPS frequency correction.



\$1500

\$1500

# Anritsu m2712E Screen



# Oscilloscope

- You want one with auto set
- Analogue like display- 256 levels of intensity



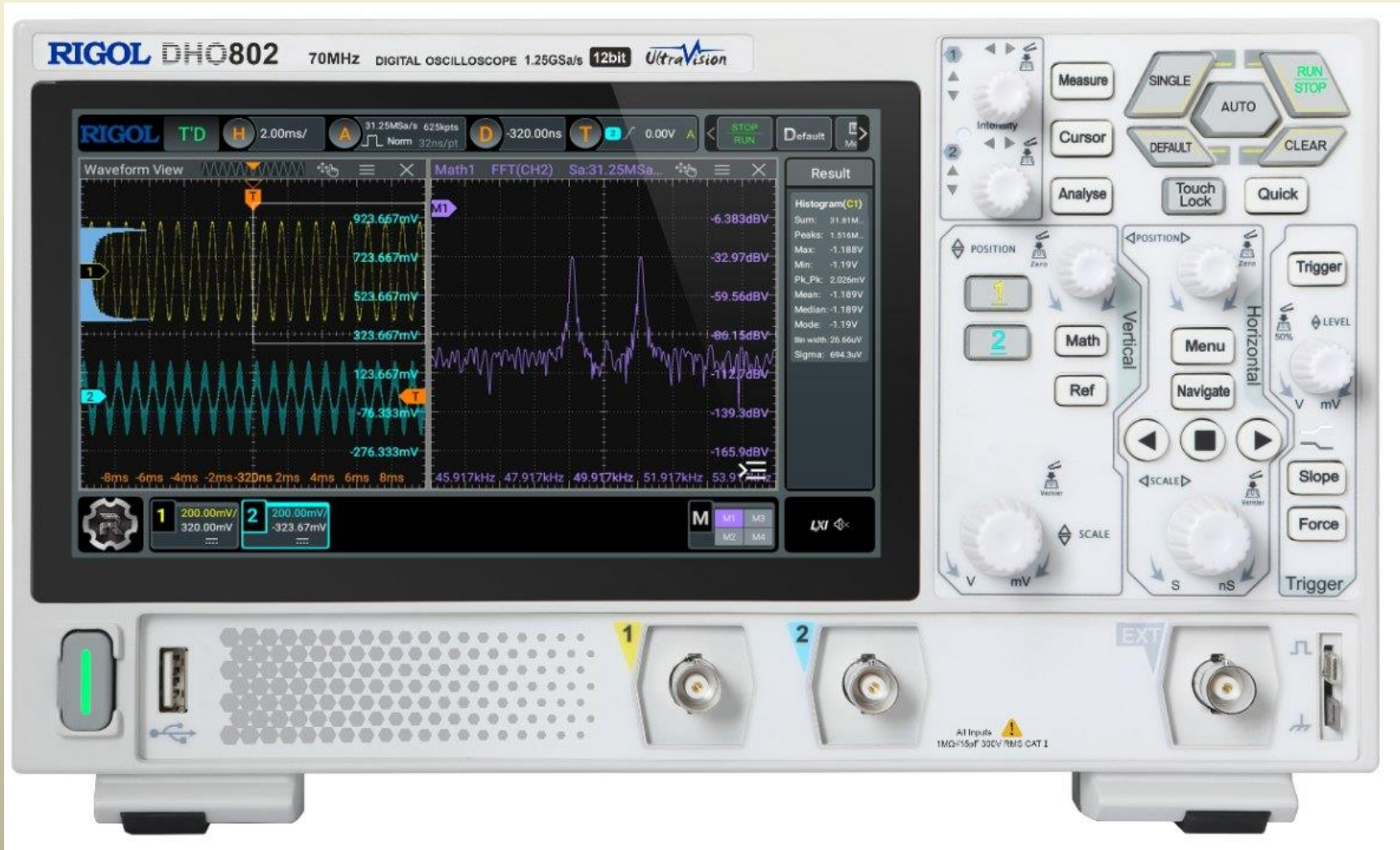
Excellent  
100MHz  
scope <\$100





70MHz- \$329 USB c  
Touchscreen, HDMI

# Rigol DHO802



# Counter

# Frequency Counter

\$115

13 digits

0-6GHz



# Miscellaneous



# LCR Meter DE 5000

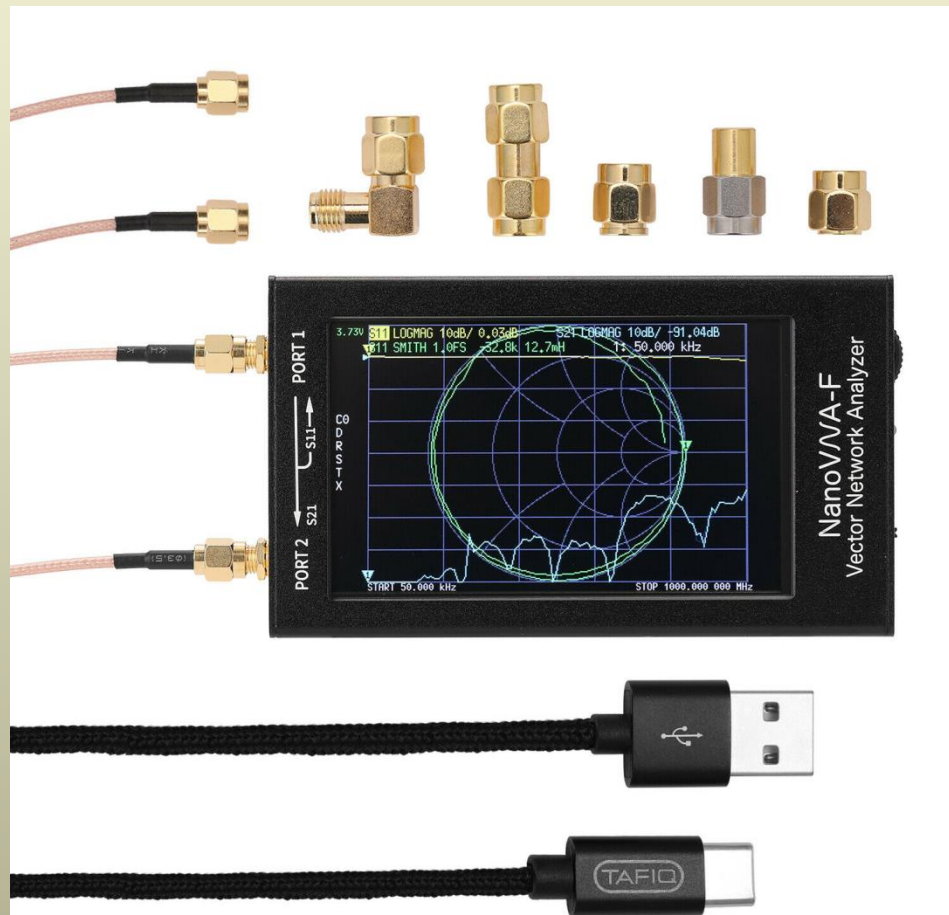
LCR meter  
ESR measurement  
.01 ohm resolution

Less than **\$80**



# NanoVNA-F

Double check the calibration load



\$120

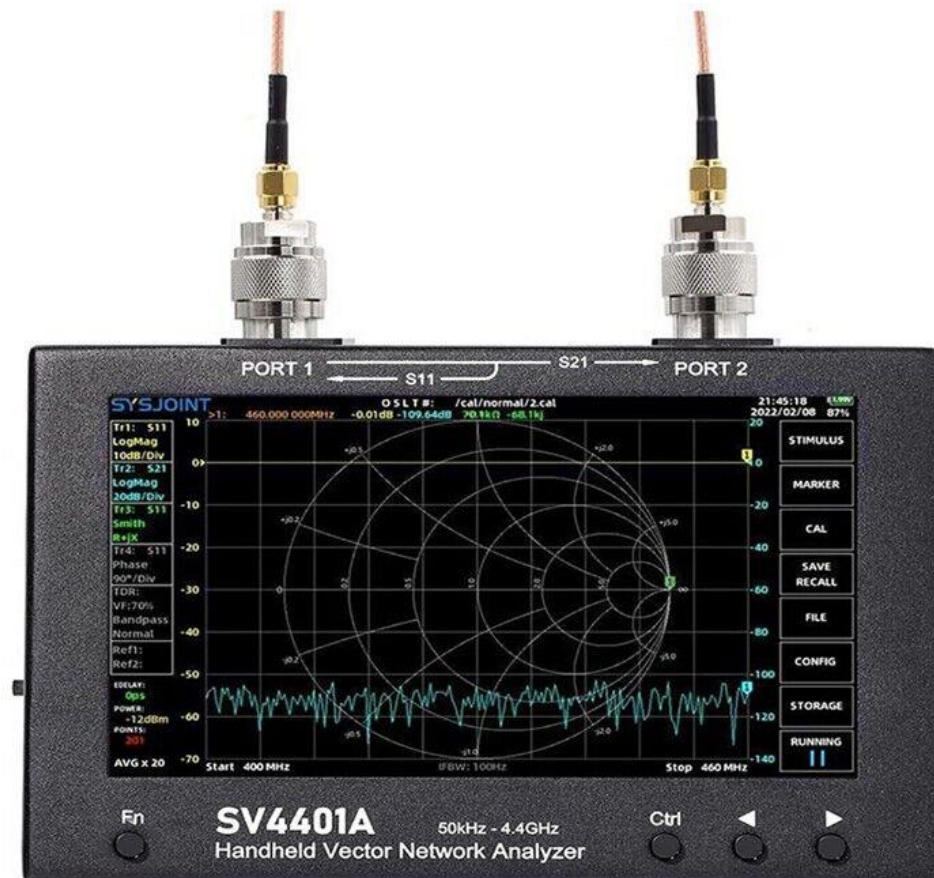
# SV34401

50KHz-4.4GHz

100db Dynamic Range

Full featured  
Does TDR

\$300



# Resistance vs. Return Loss

	<b>Resistance</b>	<b>SWR</b>	<b>Return Loss</b>
•	• 50.5 ohms	1.01	46db
	• 51.0	1.02	40
	• 51.5	1.03	36
	• 52.0	1.04	34
	• 52.5	1.05	32



# Resistance Measurements of a Group Of SMA 50 Ohm Loads

50.41

50.017  (M1408)

49.89

49.5

50.22

49.85

50.22

51.16

50.12

50.67

48.19 

49.87

50.35

50.20

50.15

All below are 26.5GHz+

50.058 HP909d

50.080 Anritsu 40Ghz

50.040 Anritsu 40GHz

50.070 Winchel 40GHz

50.012 Anritsu 28V50

65GHz

50.264 HP85138 50GHz

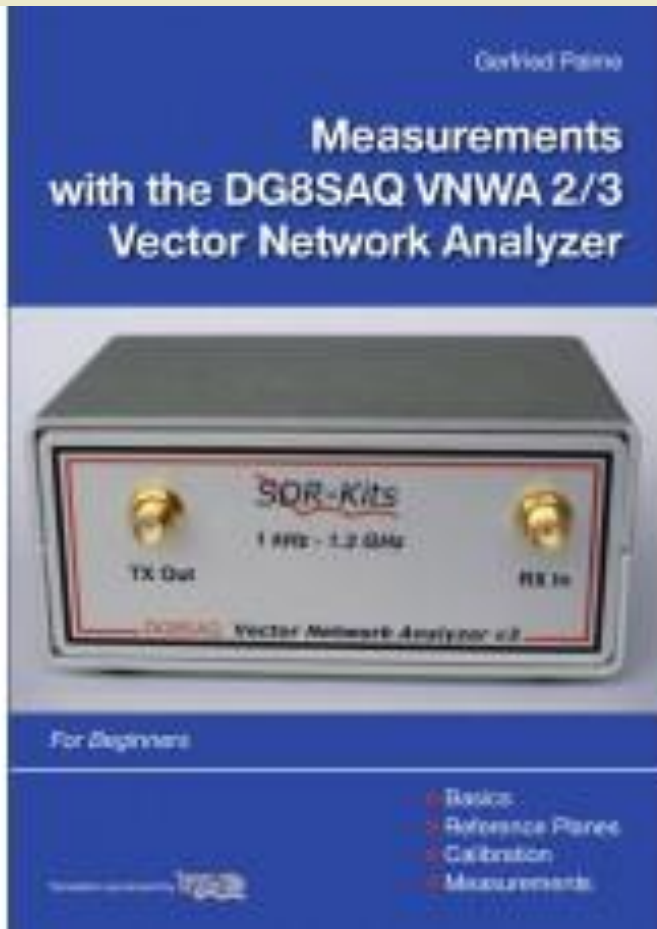
## Notice the difference in Strain relief

Cable shield and dielectric  
To connector interface is the  
problem..



# VNA Resources

From SDR-Kits \$35



User's Manual  
**HP 8720B VNA**

(Download a PDF)



# Calibrators

# RCL Box

- Handy calibration tool and cheap
- Resistance
- Capacitance
- Inductance

EBay- “High Precision  
Inductance Resistor Capacitor  
LRC Calibrate Reference Module Box”  
• Calibration to 5 digits. or so.

**About \$25**



# RCL Box Cal Data

617.2uh @10KHz  
623.0uh@100KHZ  
5.7980 Ohms  
19.819nf@10KHz  
plus cal. date



# Find yourself a resistance standard

That is labeled

Honeywell



Check for  
ESI SR-1



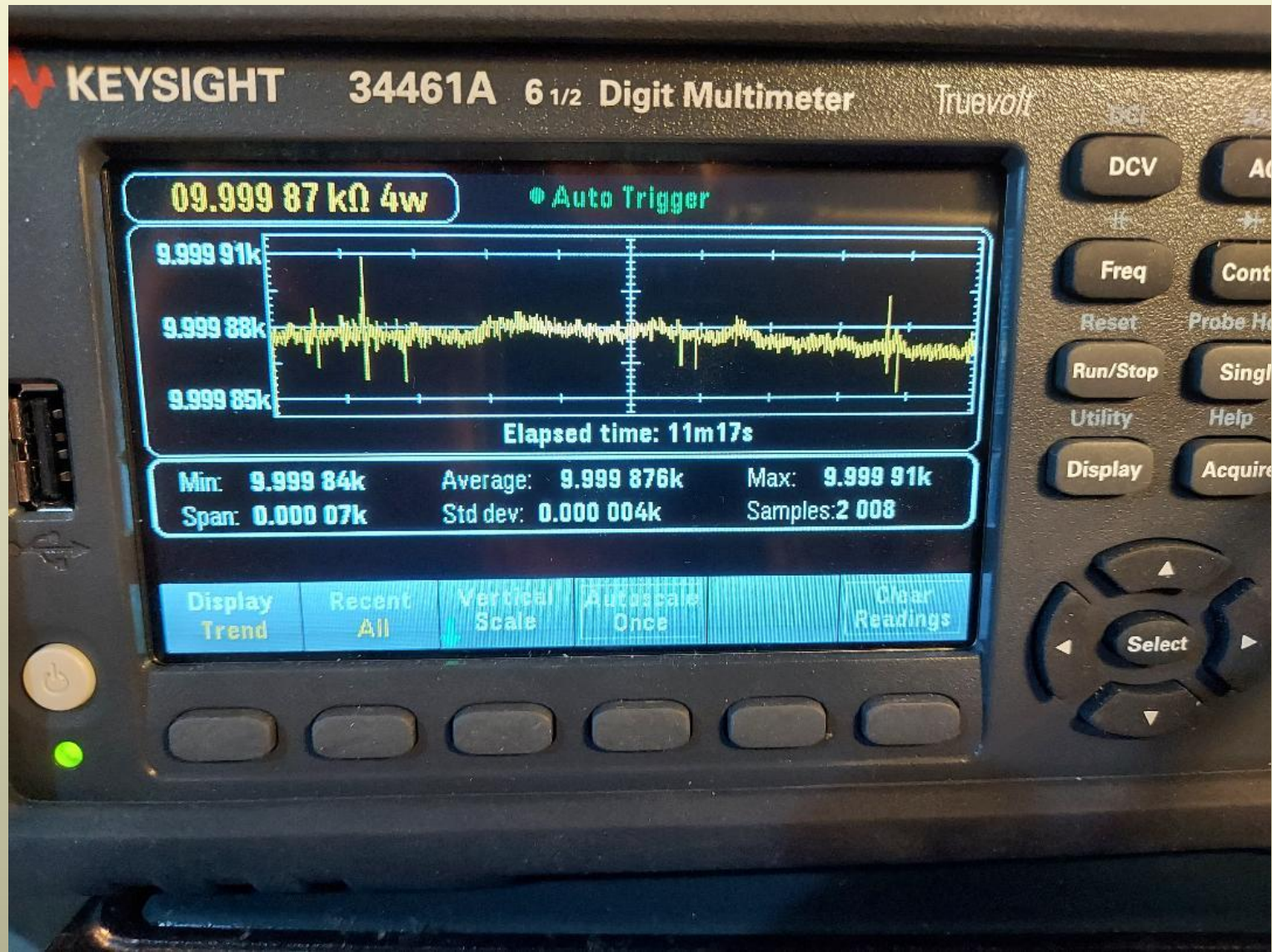
# Make your Own

- You need a good resistor and a two pin banana plug
- .005% at 10K ohm (VR marking)
- **Vishay RNC90Y10K000VR**



\$10 on EBay

# Calibration Data





# Voltage Source

- Lab quality
- Comes with cal. data at \$160

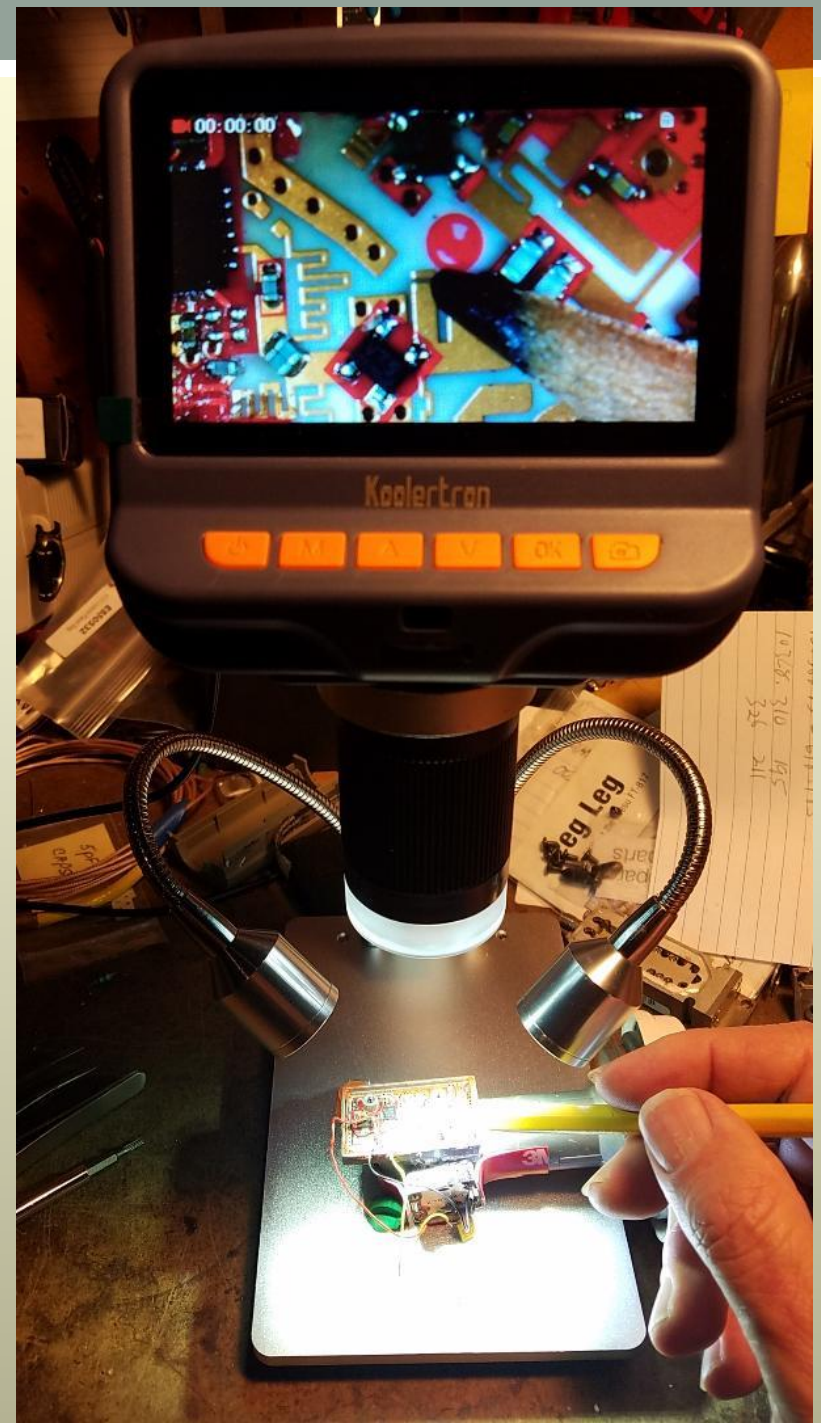
From

“[Voltagestandard.com](http://Voltagestandard.com)”



Save your eyes,  
do better work

Koolertron 4.3"  
screen  
\$70





# Contact Info

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That's it. Any questions?