



nanoVNA

Hva det er,
hva den gjør,
hva den kan brukes til,
og hvordan du gjør det.

Hvis du ikke vet hvor du er og hvor du skal...



'Would you tell me, please, which way I ought to go from here?' asked Alice.

'That depends a good deal on where you want to get to,' said the Cat.

'I don't much care where--' said Alice.

'Then it doesn't matter which way you go,' said the Cat.

'--so long as I get SOMEWHERE,' Alice added as an explanation.

'Oh, you're sure to do that,' said the Cat, 'if you only walk long enough.'



Nyttige måleinstrumenter

Multimeter

- måler strøm, spenning, resistans



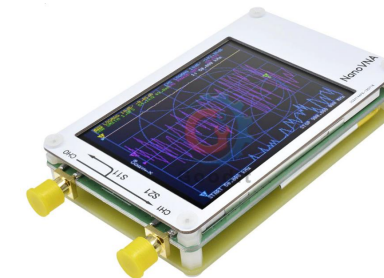
Oscilloskop

- viser amplitude i tidsdomene



Spektrum analysator

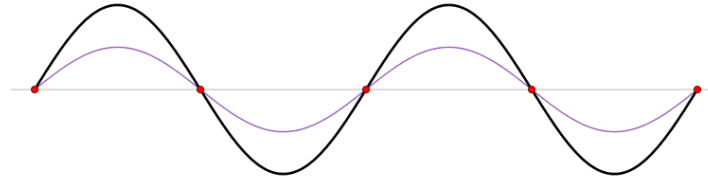
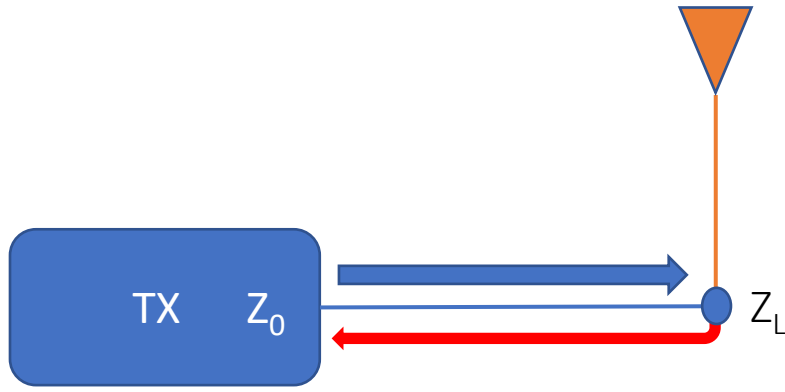
- viser amplitude i frekvensdomene



Vektor nettverk analysator

- viser amplitude og fase

VSWR/Return Loss

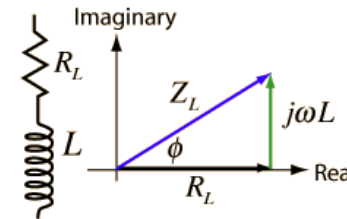


$$Z = R + jX$$

$$\Gamma = (Z_L - Z_0) / (Z_L + Z_0)$$

$$\text{VSWR} = (1 + \Gamma) / (1 - \Gamma) \text{ (linjær kurve)}$$

$$\text{Return Loss} = -20 \log(\text{VSWR} - 1 / \text{VSWR} + 1) \text{ (logaritmisk kurve)}$$

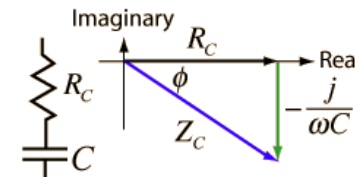


Cartesian form: $Z_L = R_L + j\omega L$

Polar form: $Z_L = |Z_L| e^{j\phi}$

where $|Z_L| = \sqrt{R_L^2 + \omega^2 L^2}$

$$\phi = \tan^{-1} \frac{\omega L}{R_L}$$



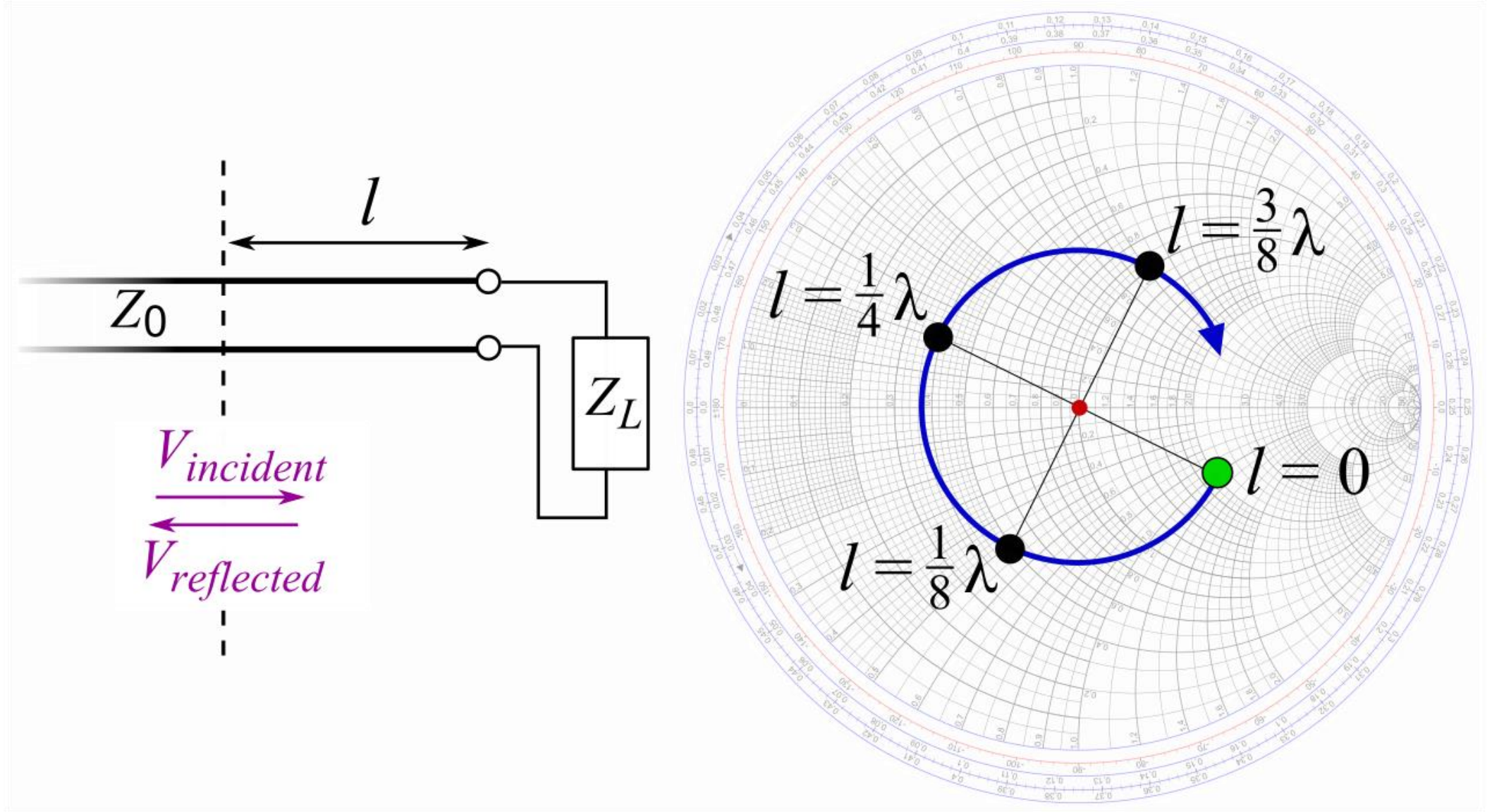
Cartesian form: $Z_C = R_C - \frac{j}{\omega C}$

Polar form: $Z_C = |Z_C| e^{j\phi}$

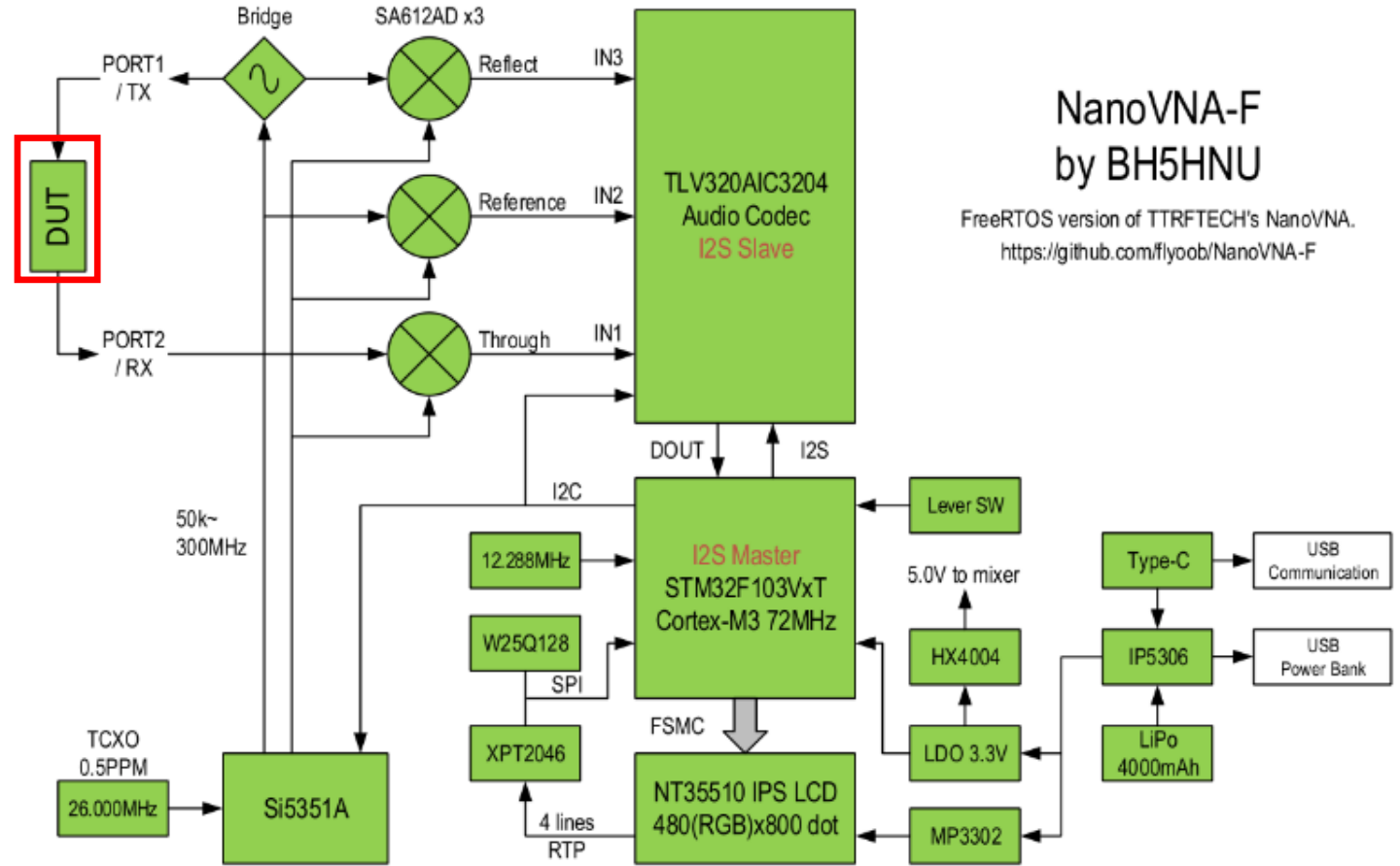
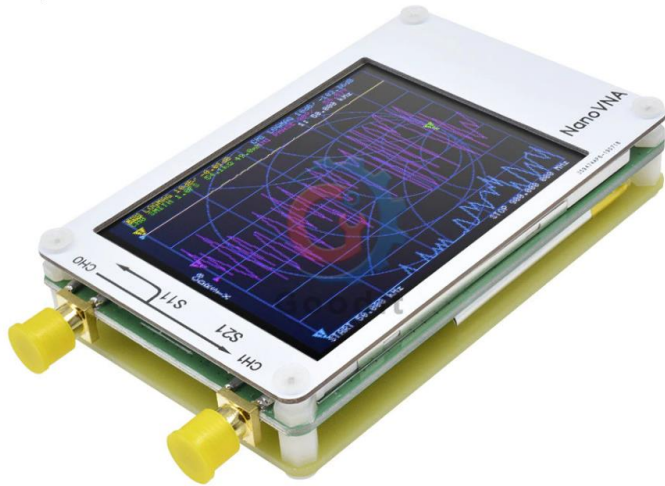
where $|Z_C| = \sqrt{R_C^2 + \frac{-1}{\omega C R_C}}$

$$\phi = \tan^{-1} \frac{-1}{\omega C R_C}$$

Smith diagram



nanoVNA



NanoVNA-F by BH5HNU

FreeRTOS version of TTRFTECH's NanoVNA.
<https://github.com/flyoob/NanoVNA-F>

Hva en nanoVNA brukes til

Single port målinger (S11)

Refleksjon

- SWR/Return Loss for en antenne
- Komplekse impedanser
- Komponenter (RLC)
- Matekabel lengder/distance-to-fault (TDR)

To port målinger (S21)

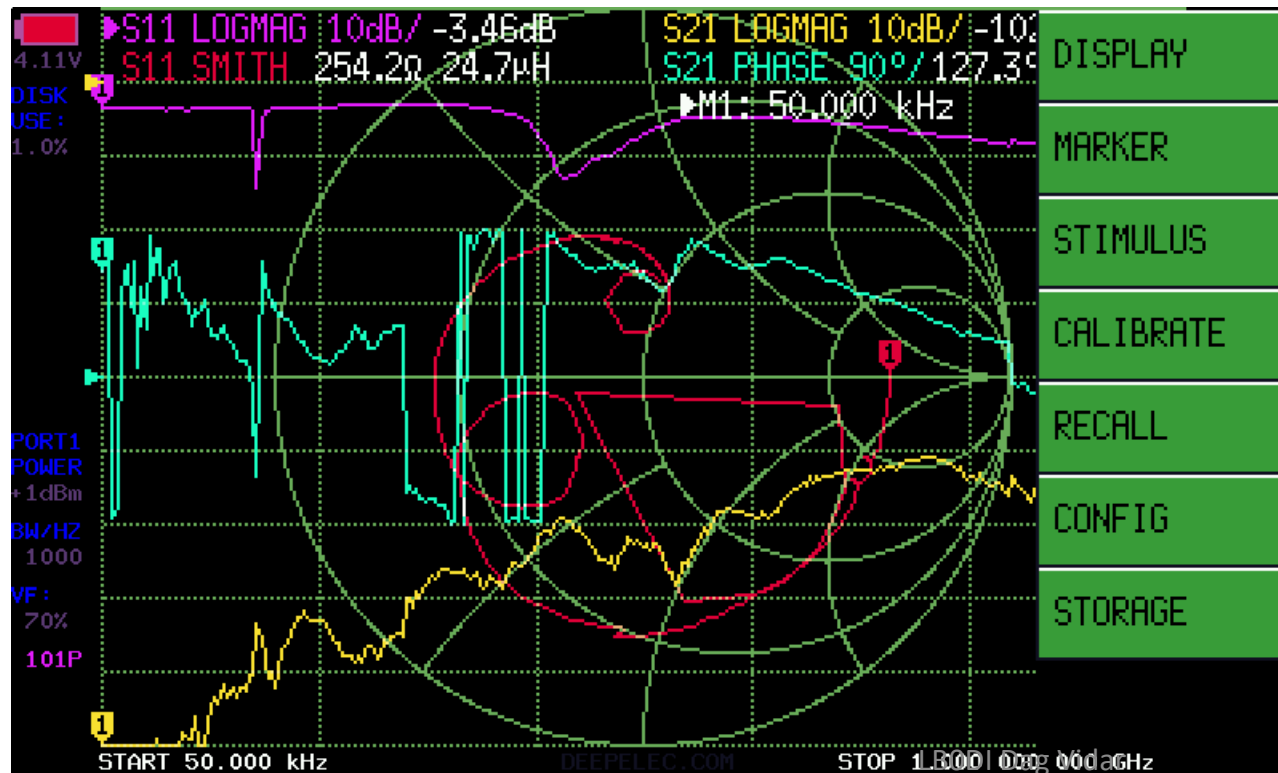
Transmisjon

- Filter kurve og -tap
- Tap i matekabler
- Forsterkning og frekvensrespons

En VNA gjør oss i stand til å måle antenner, filter, spoler, splitterer, baluner, chokes, diplexere, forsterkere, attenuatorer, etc.

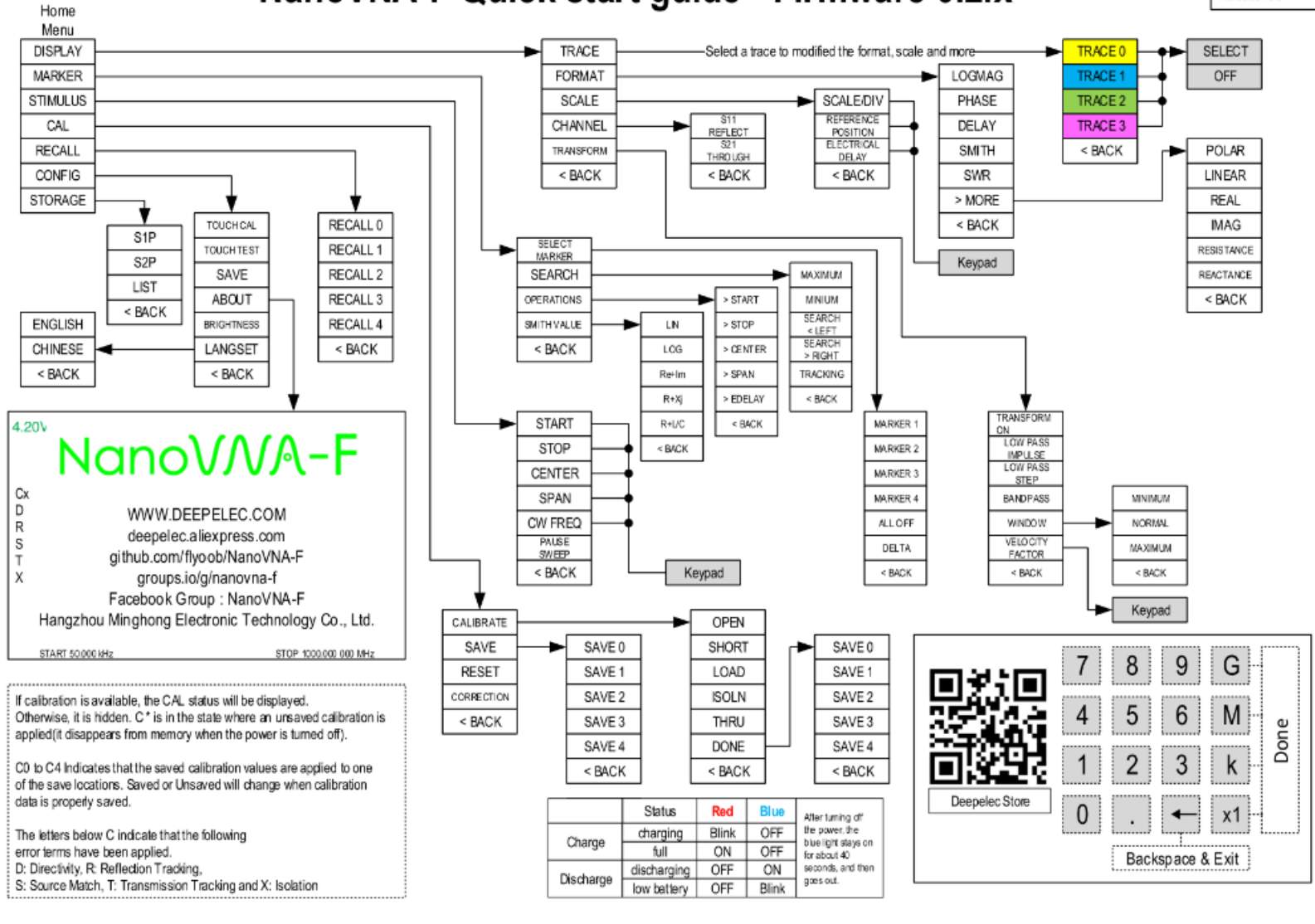
nanoVNA display

- Return Loss LOGMAG
- VSWR SWR
- Komplex impedans Smith Chart
- Flere andre kurver som Delay, Phase, Q factor, etc
- Time Domain Reflektrometry (TDR) TRANSFORM



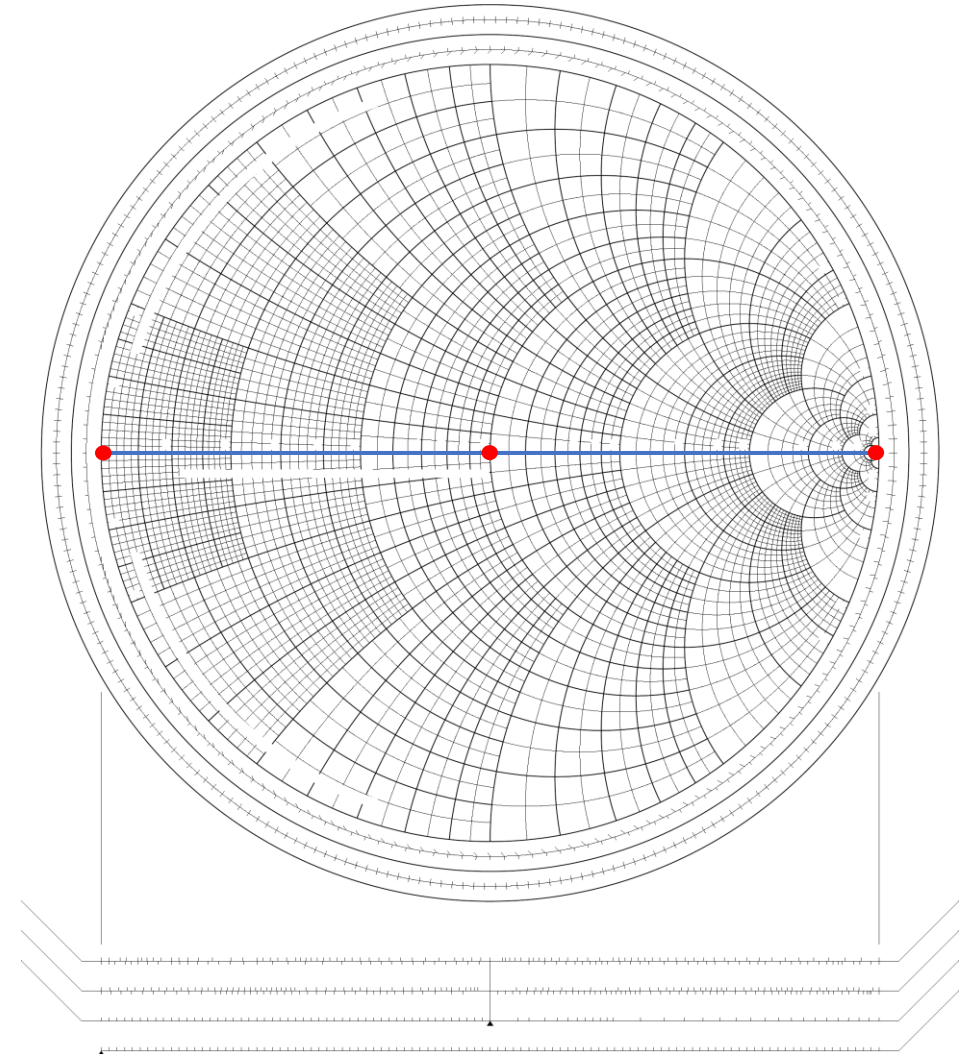
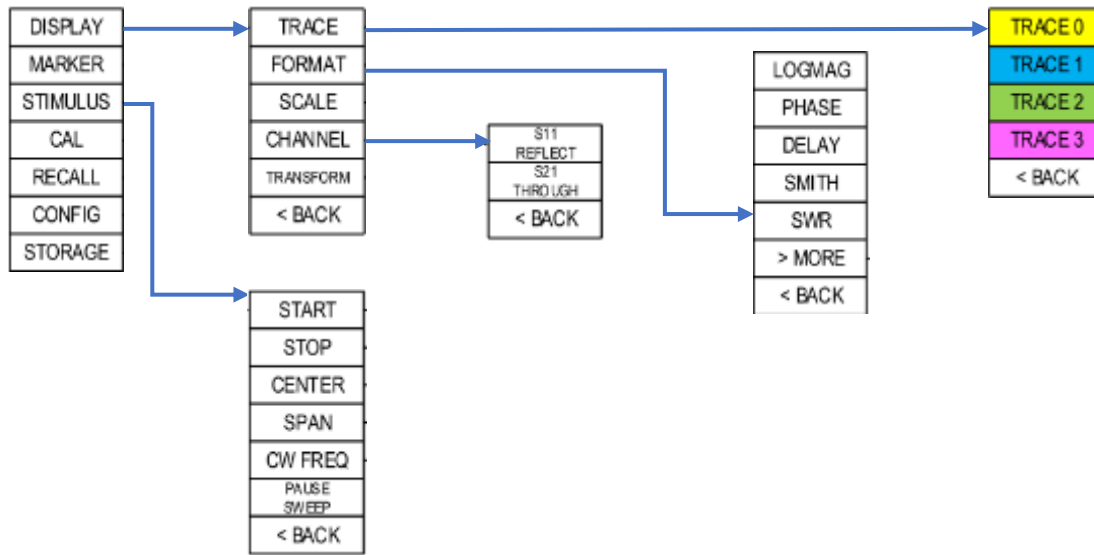
NanoVNA-F Quick start guide - Firmware 0.2.x

By: BH5HNU
Date: 14 Jul 2020
Release: 3.0



nanoVNA brukergrensesnitt

- Jeg bestemmer hva jeg vil måle, i dette tilfelle en antenne for 2m og 70 cm
- Jeg setter opp TRACES
- Jeg velger frekvensområde – SPAN
- Jeg kalibrerer



nanoVNA kalibrering

Du må kalibrere hver gang du skifter frekvensområde.

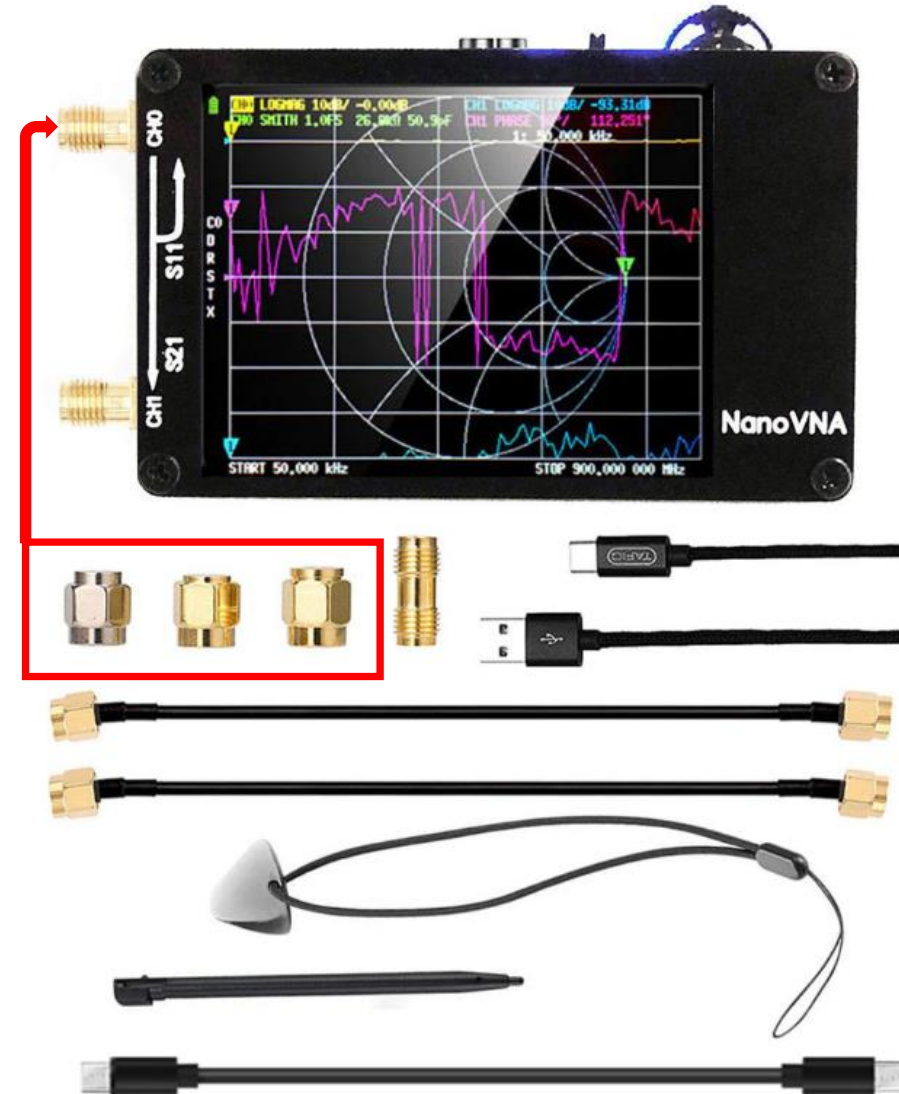
Det er bare 101* målepunkt pr sweep, så avstanden blir SPAN/101.

Hvis du sweeper mellom 3-30 MHz, blir avstanden mellom hvert punkt 267,3 kHz.

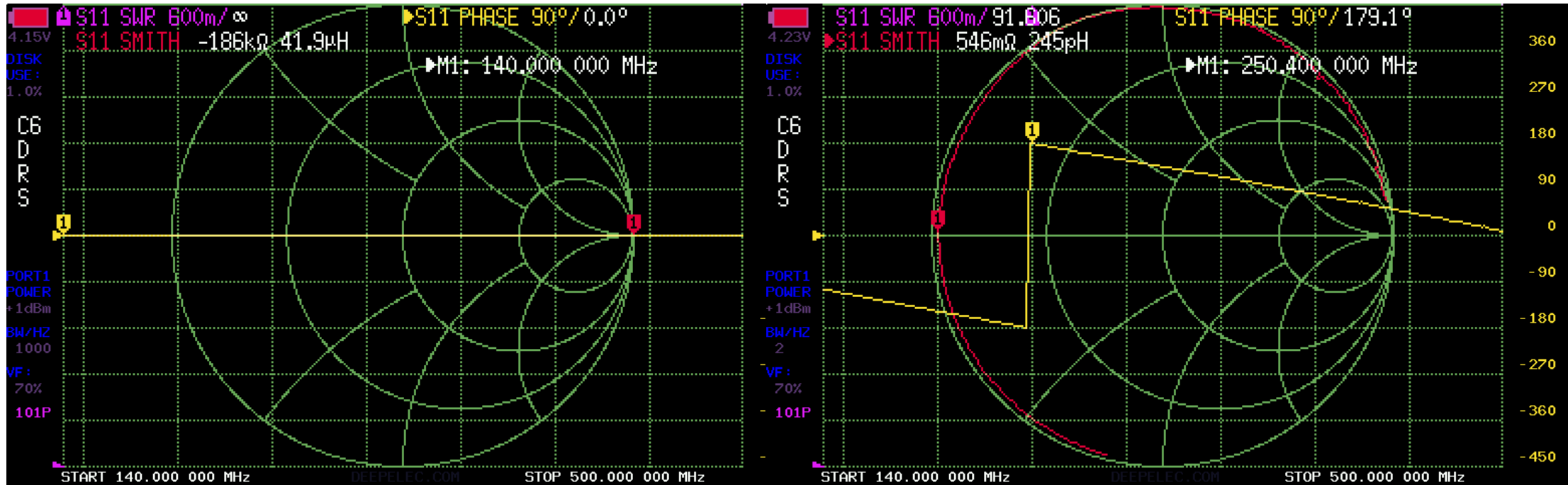
Ved kalibrering benytter du **Open, Short og Load**.

Du kan lagre opp til 5* kalibreringer. Når du starter nanoVNA vil den komme opp i CAL0.

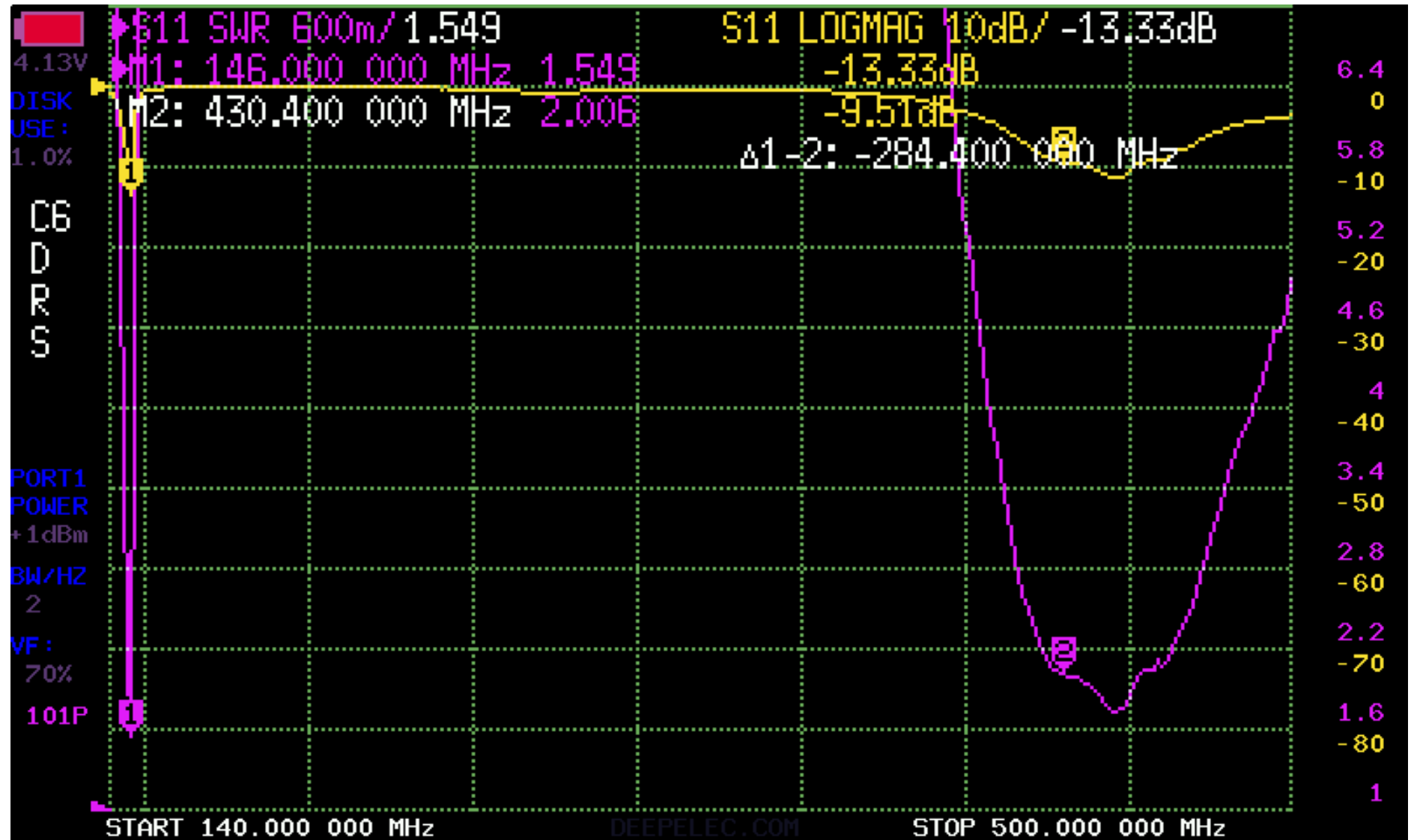
OPEN	
SHORT	
LOAD	
ISOLN	
THRU	
DONE	
< BACK	
	SAVE 0
	SAVE 1
	SAVE 2
	SAVE 3
	SAVE 4
	< BACK



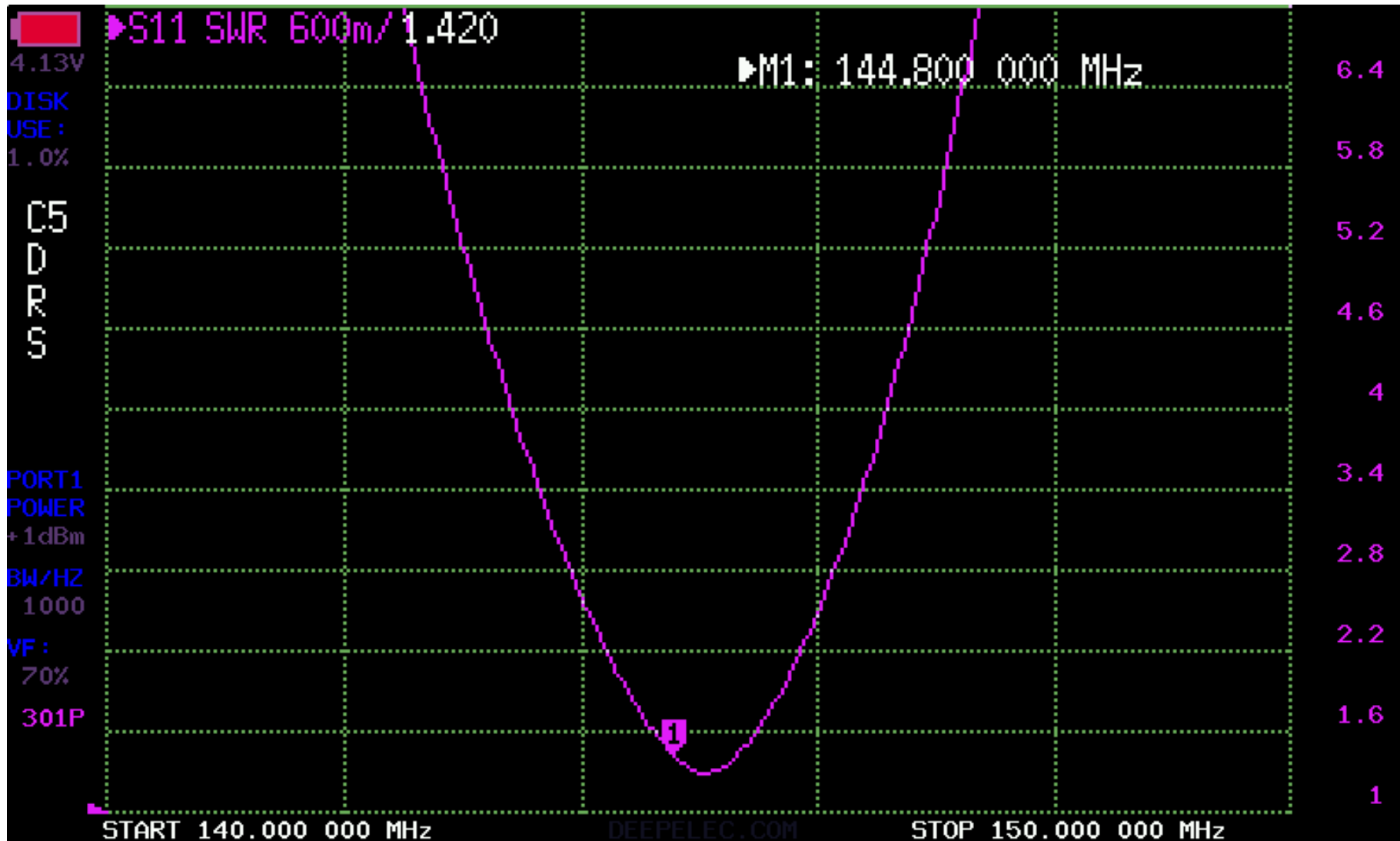
nanoVNA kalibrerings plan



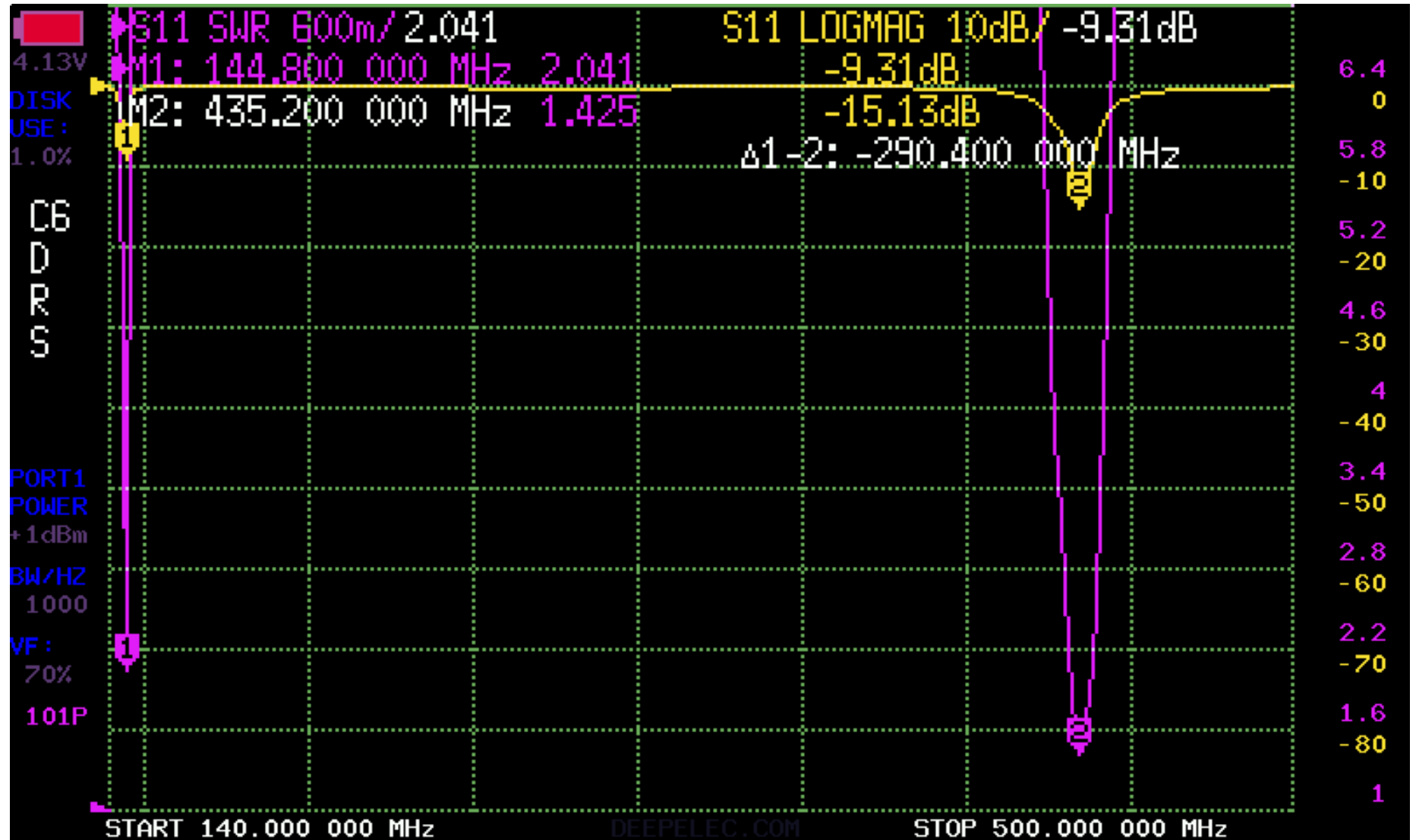
nanoVNA antennemåling dual band 2m/70 cm



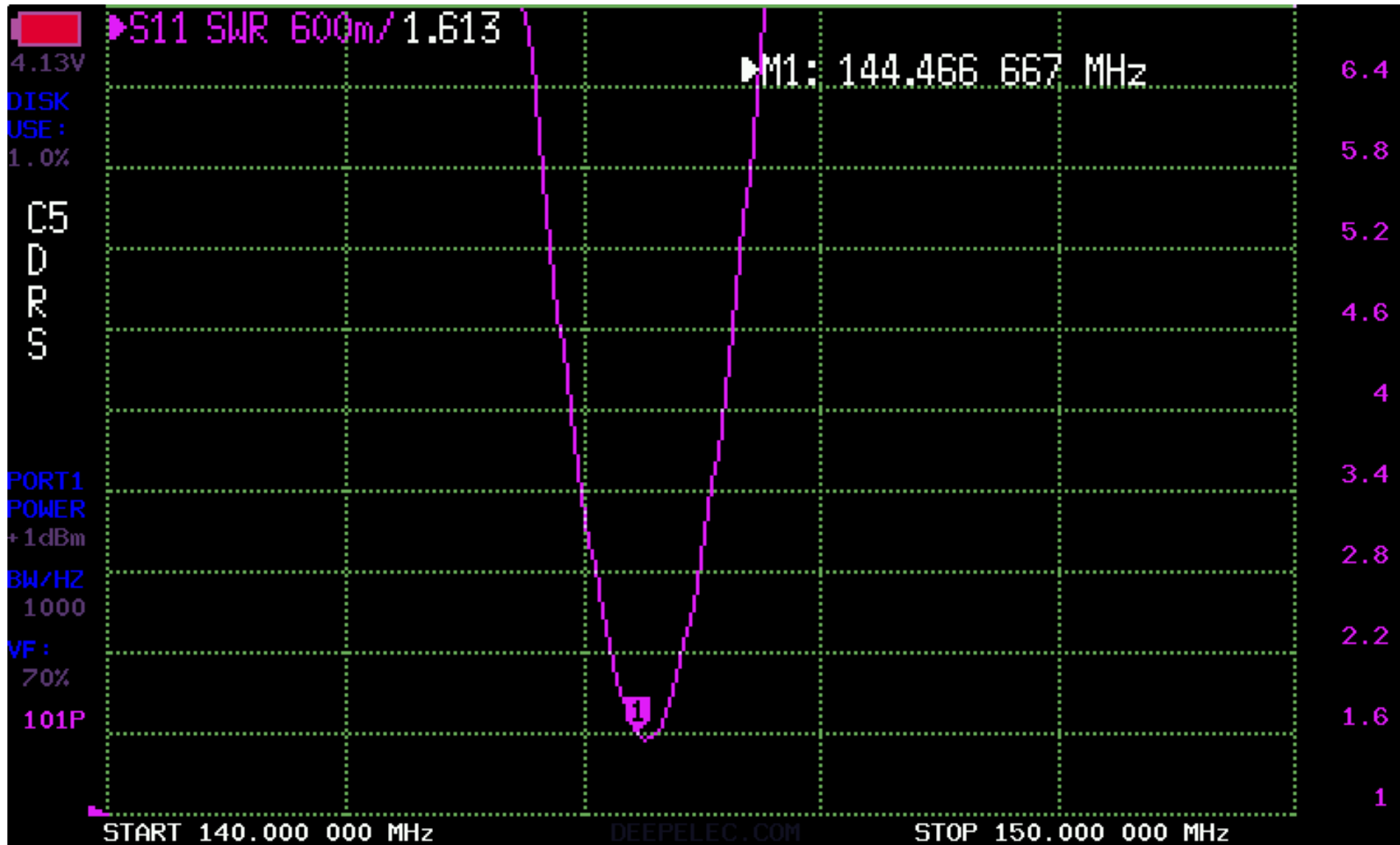
nanoVNA antennemåling



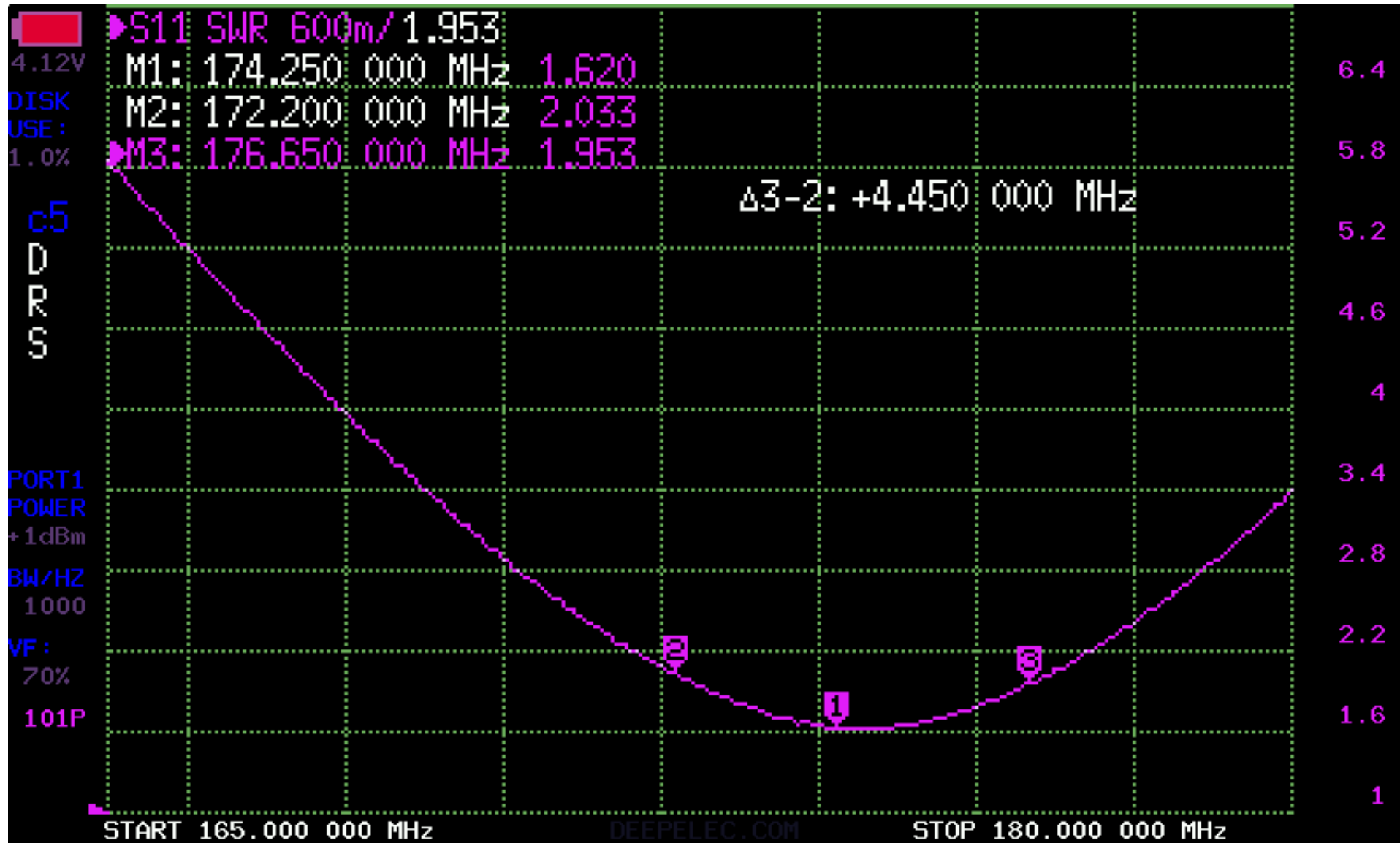
nanoVNA Diamond RH3



nanoVNA Diamond RH3



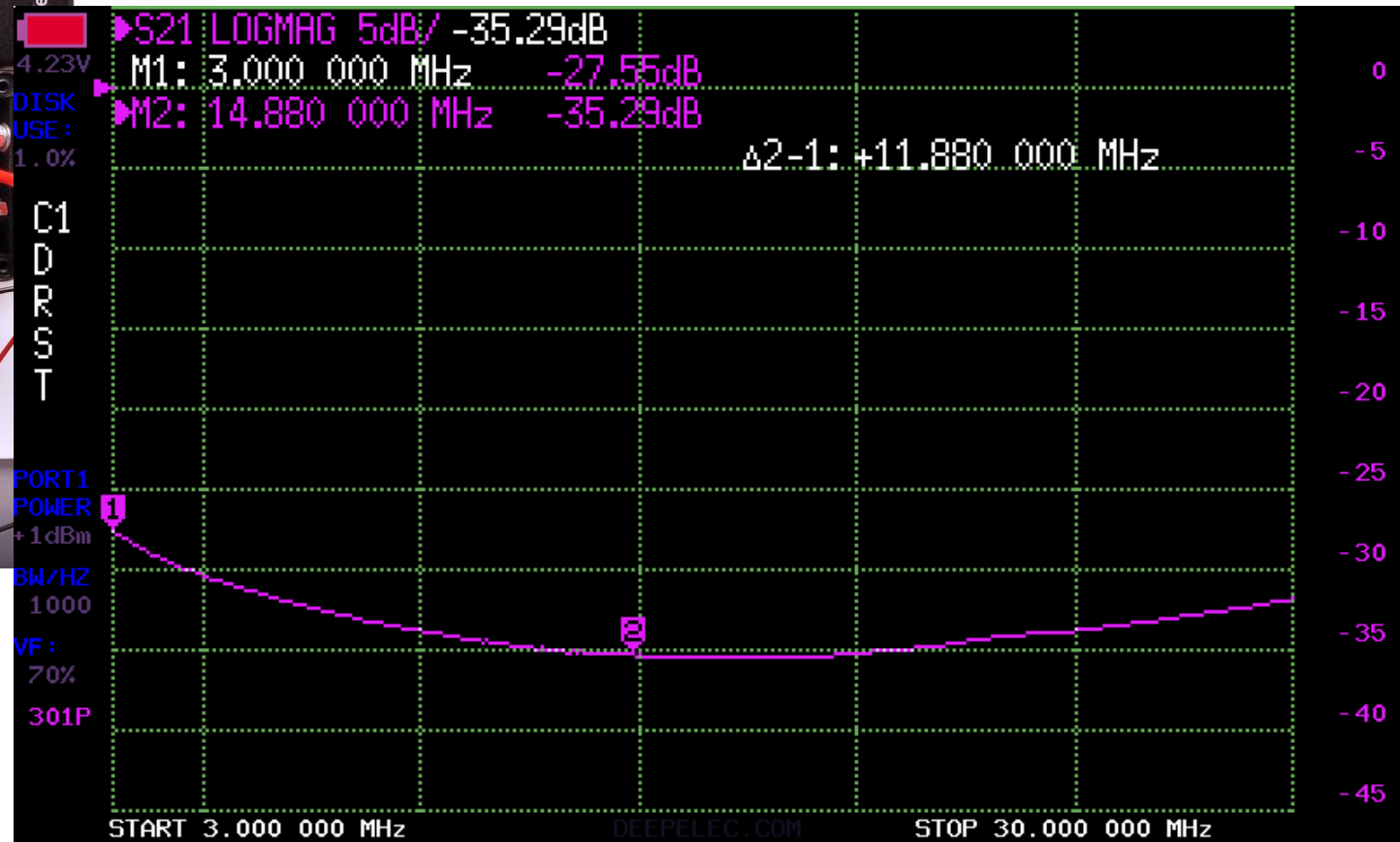
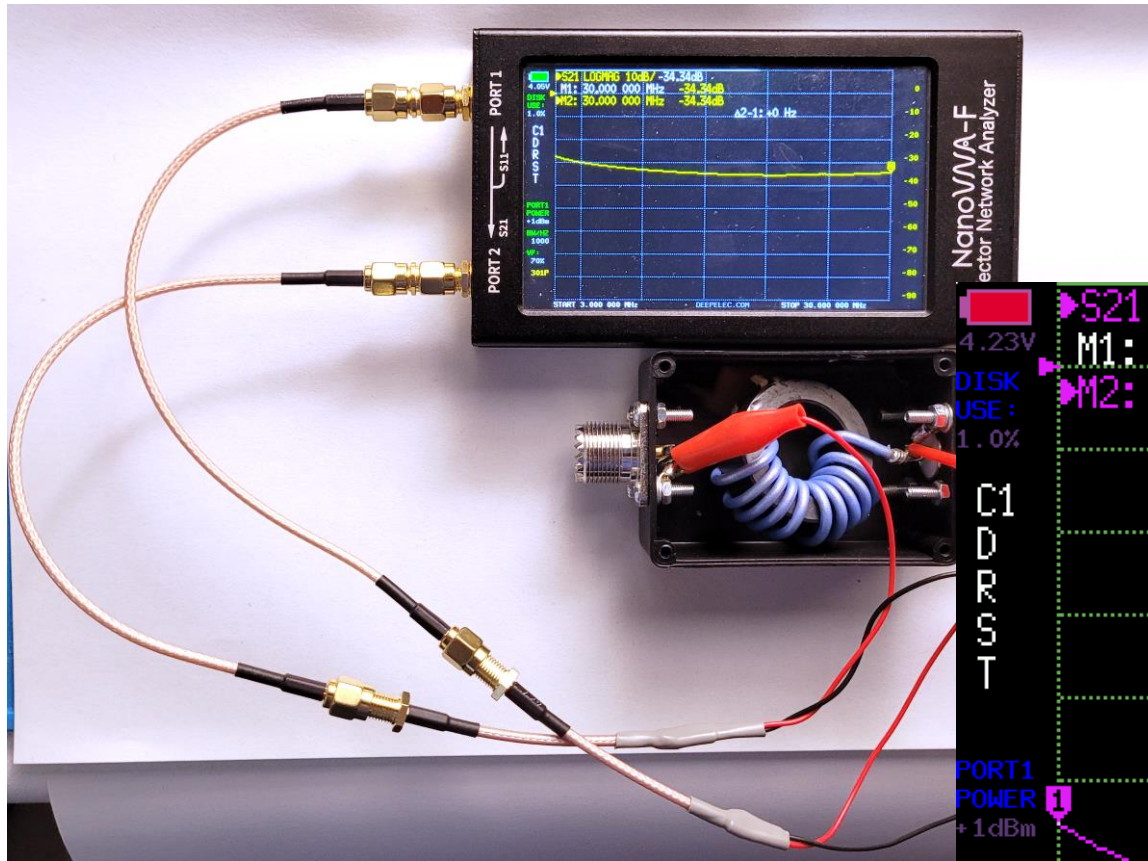
nanoVNA PROCOM HX 2/h



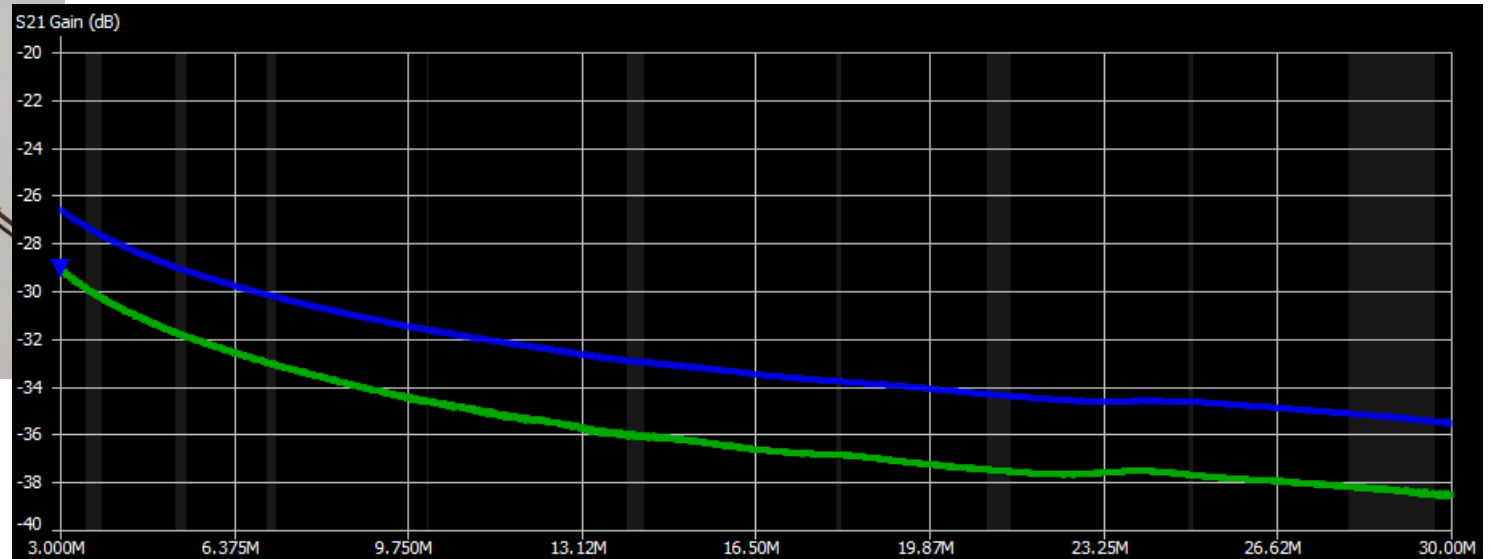
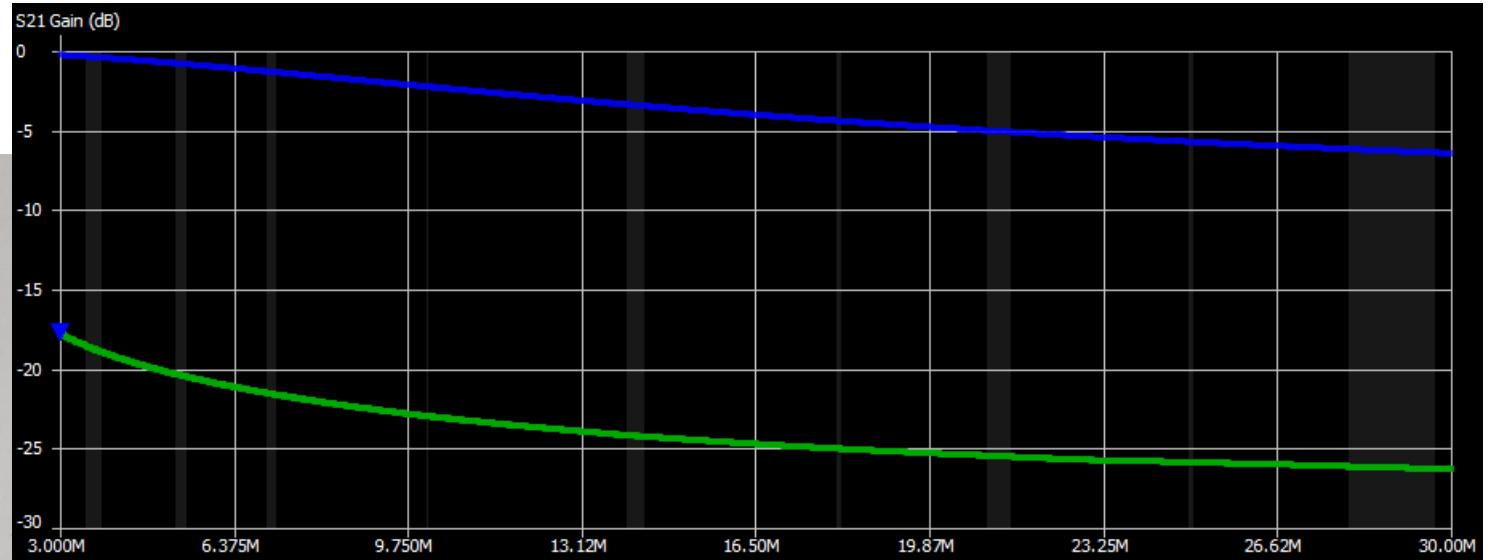
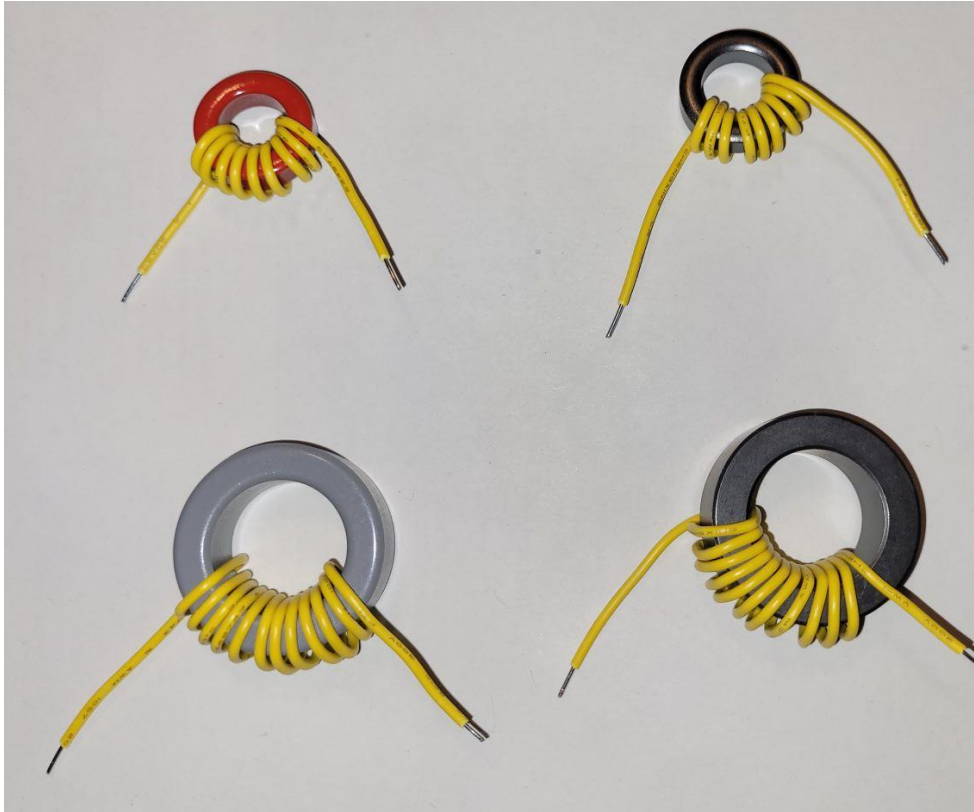
RF choke



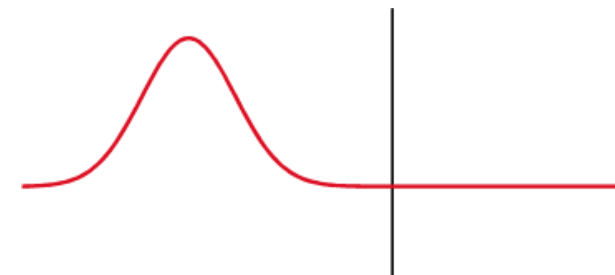
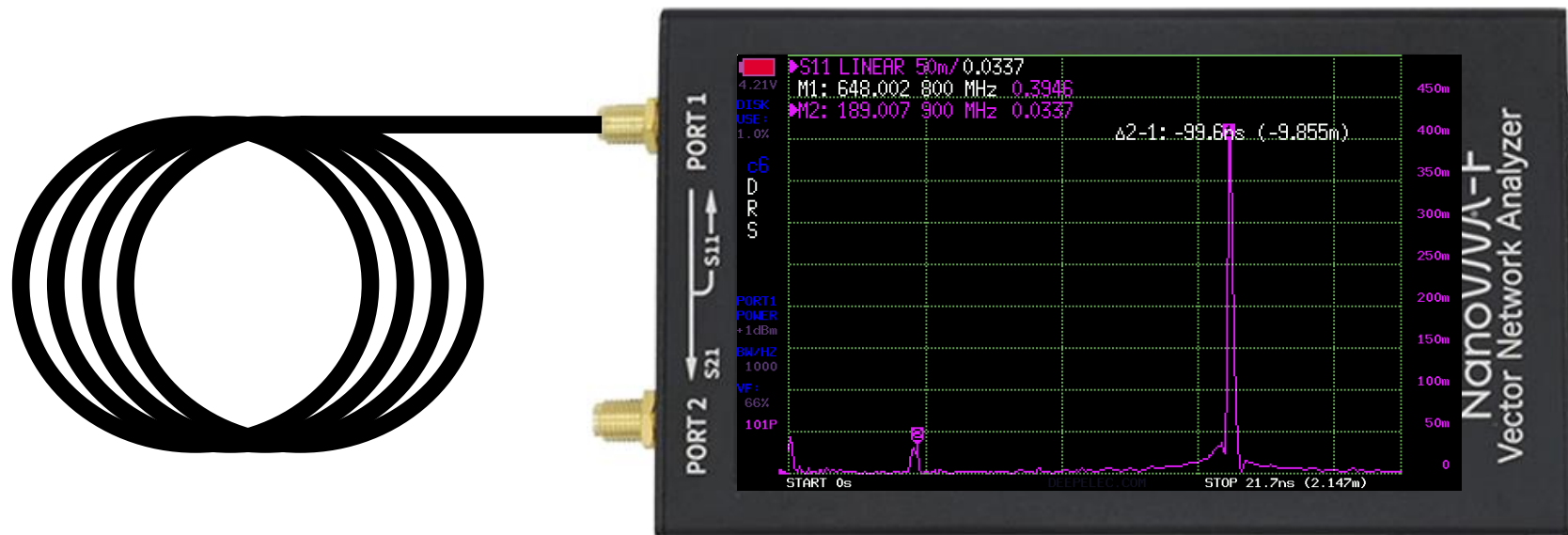
RF choke



Toroid test



Time Domain Reflectometry TDR



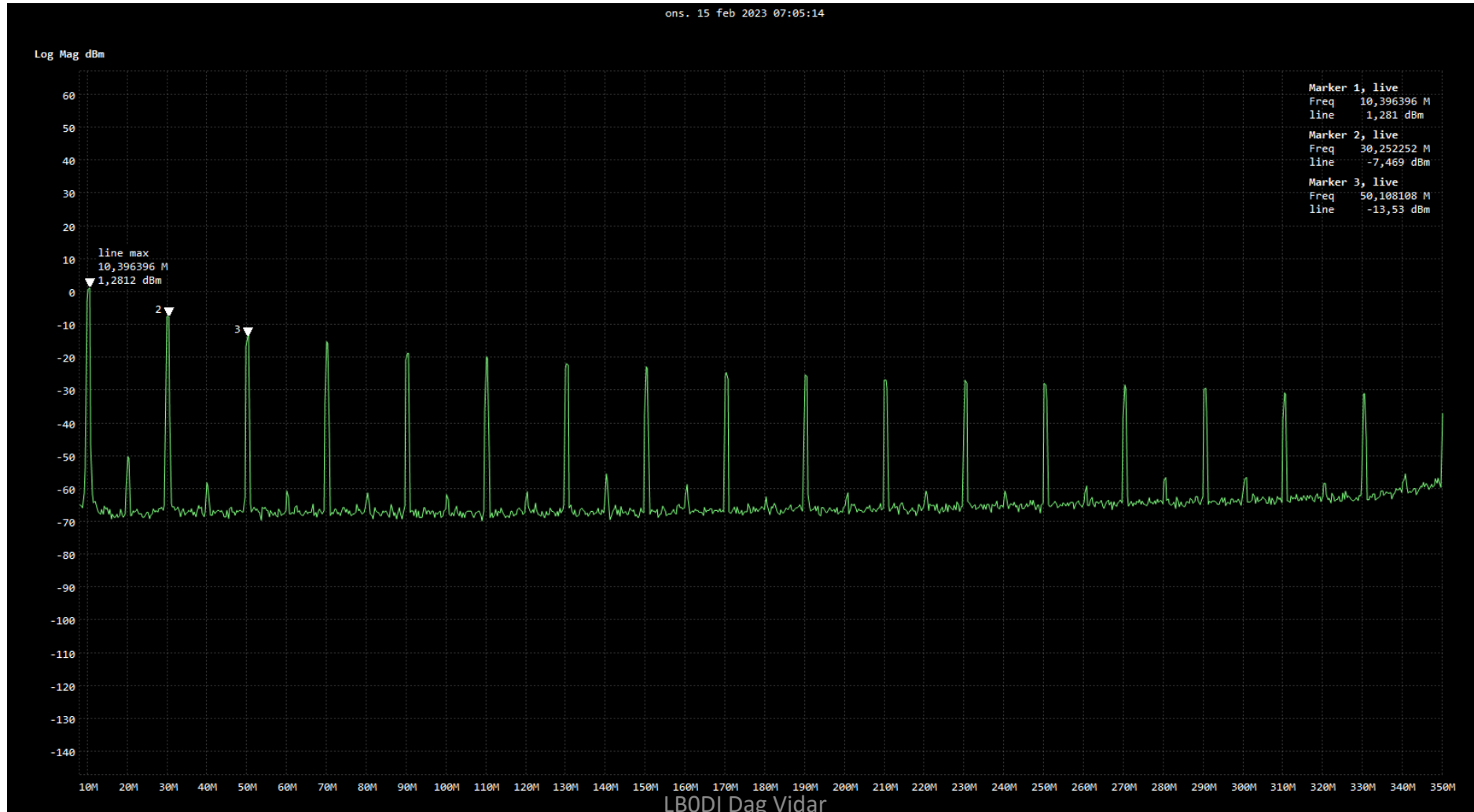
Youtube - w2aew Use NanoVNA to measure coax length

Kjekt å ha

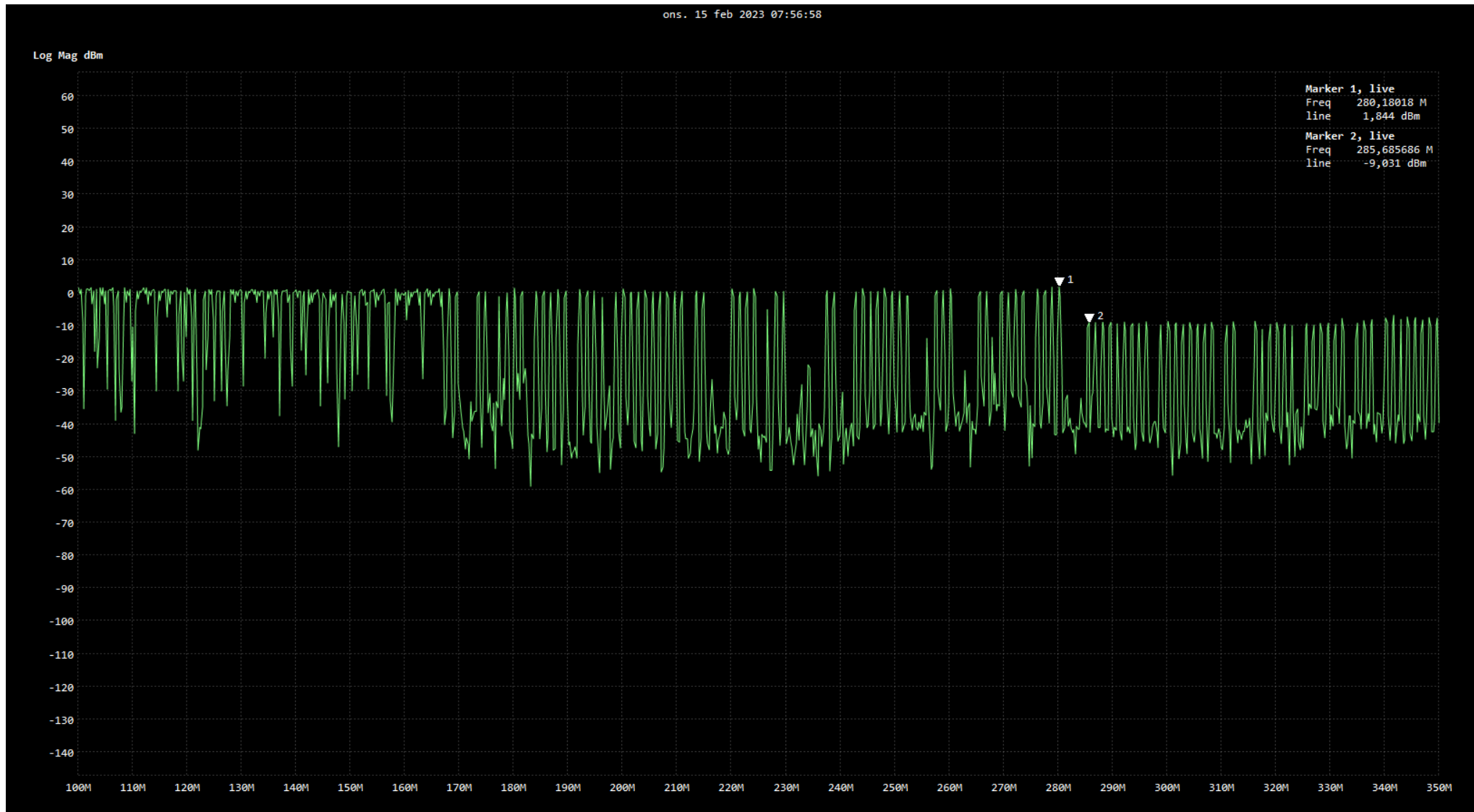


nanoVNA signal generator

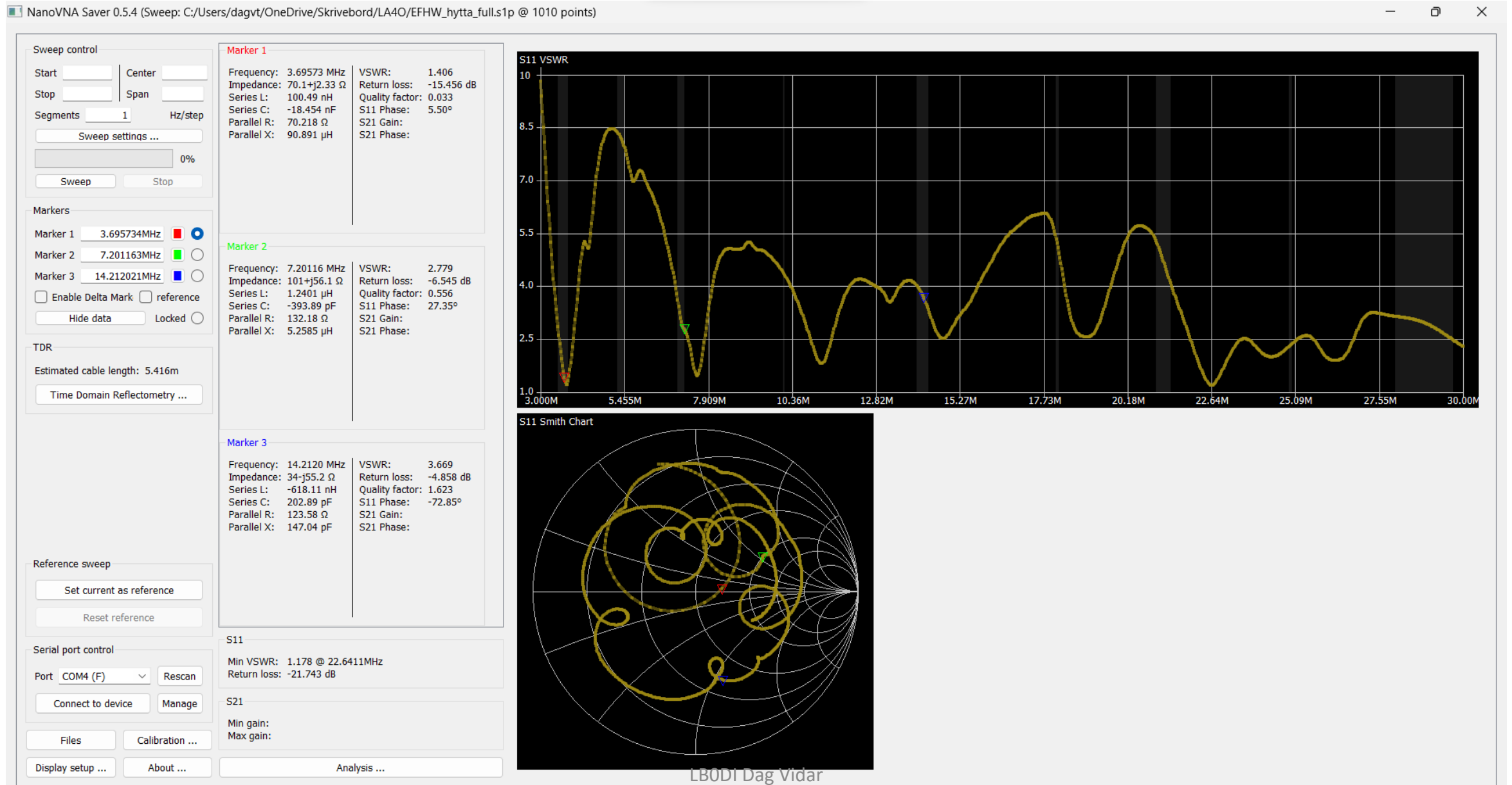
CW FREQ - umodulert firkant bærebølge +2 dBm



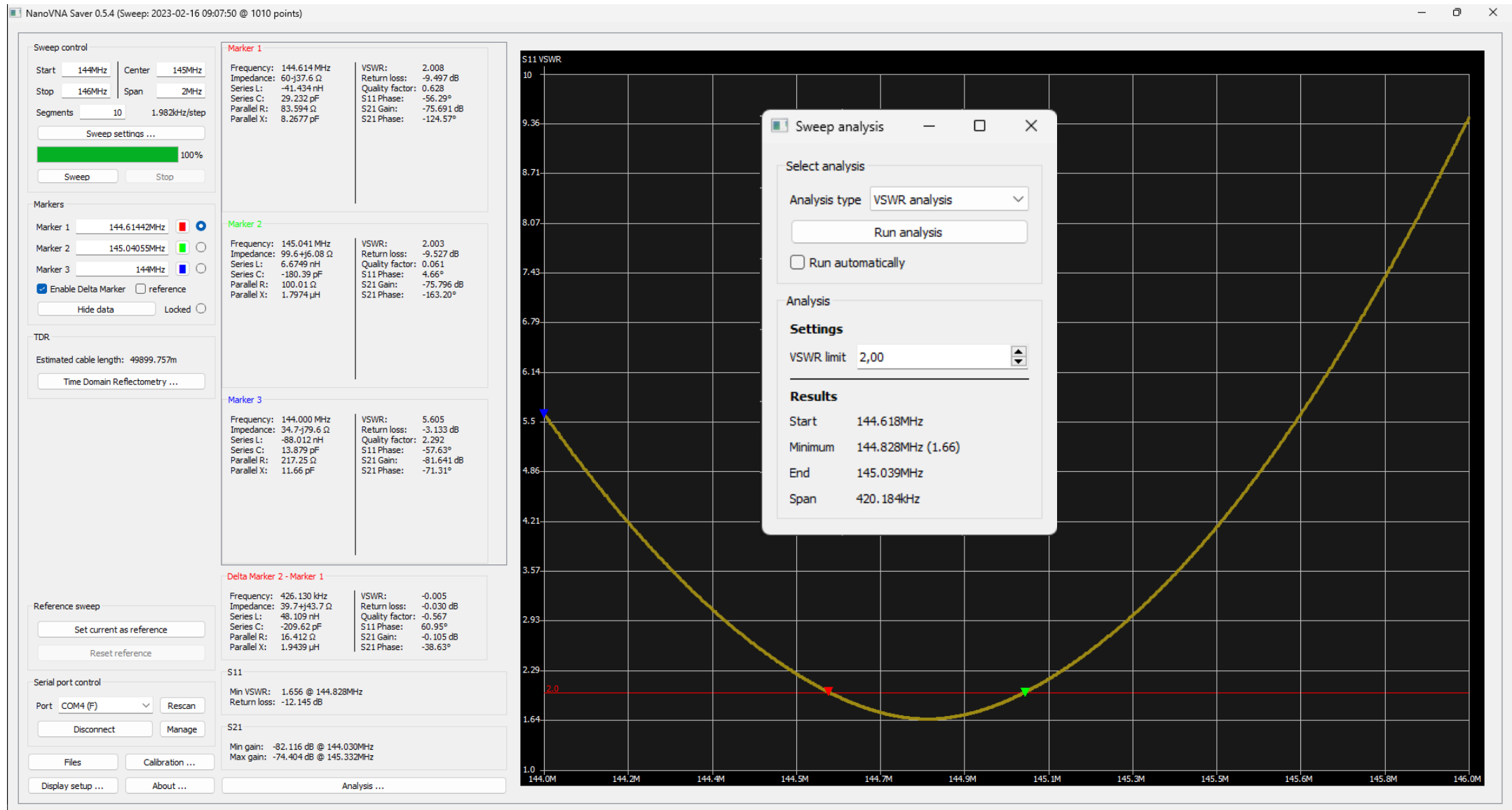
nanoVNA sweep



nanoVNA Saver



nanoVNA Saver



Versjoner

Info

nanovna.com

Versjoner

nanoVNA H	900 MHz
nanoVNA-F	1.5 GHz
nanoVNA V2	4 GHz
LiteVNA	6.3 GHz

Hvordan bruke

youtube [w2aew](#)
[IMSAI guy](#)

AliExpress

nanoVNA H	Zeenko Store
nanoVNA-F	DeepElec Store