

tiny Spectrum Analyzer



Presented by Bob Fay – WBØNPN

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Donated by

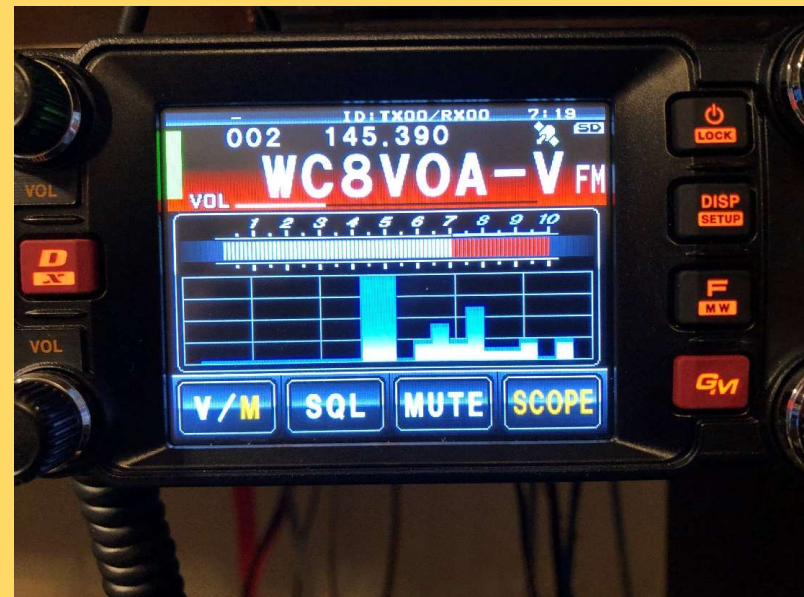
Ron Leedy – WB8ONG



- A **spectrum analyzer** measures the magnitude of an input signal versus frequency within the full frequency range of the instrument. The primary use is to measure the waveform and power of the spectrum of known and unknown signals.
- By analyzing the spectra of electrical signals, dominant frequency, power, distortion, harmonics, bandwidth, and other spectral components of a signal can be observed that are not easily detectable in time domain waveforms.
- The display of a spectrum analyzer has frequency on the horizontal axis and the amplitude displayed on the vertical axis

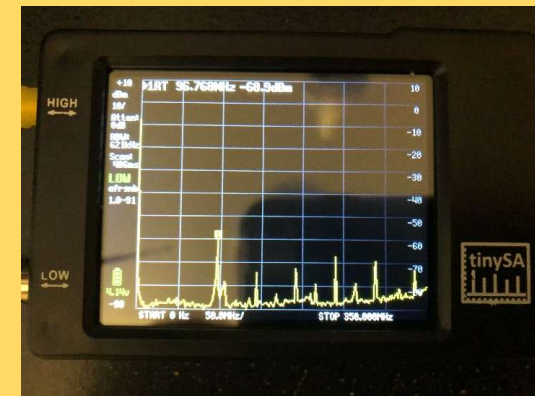


Common Experience With Spectrum Display



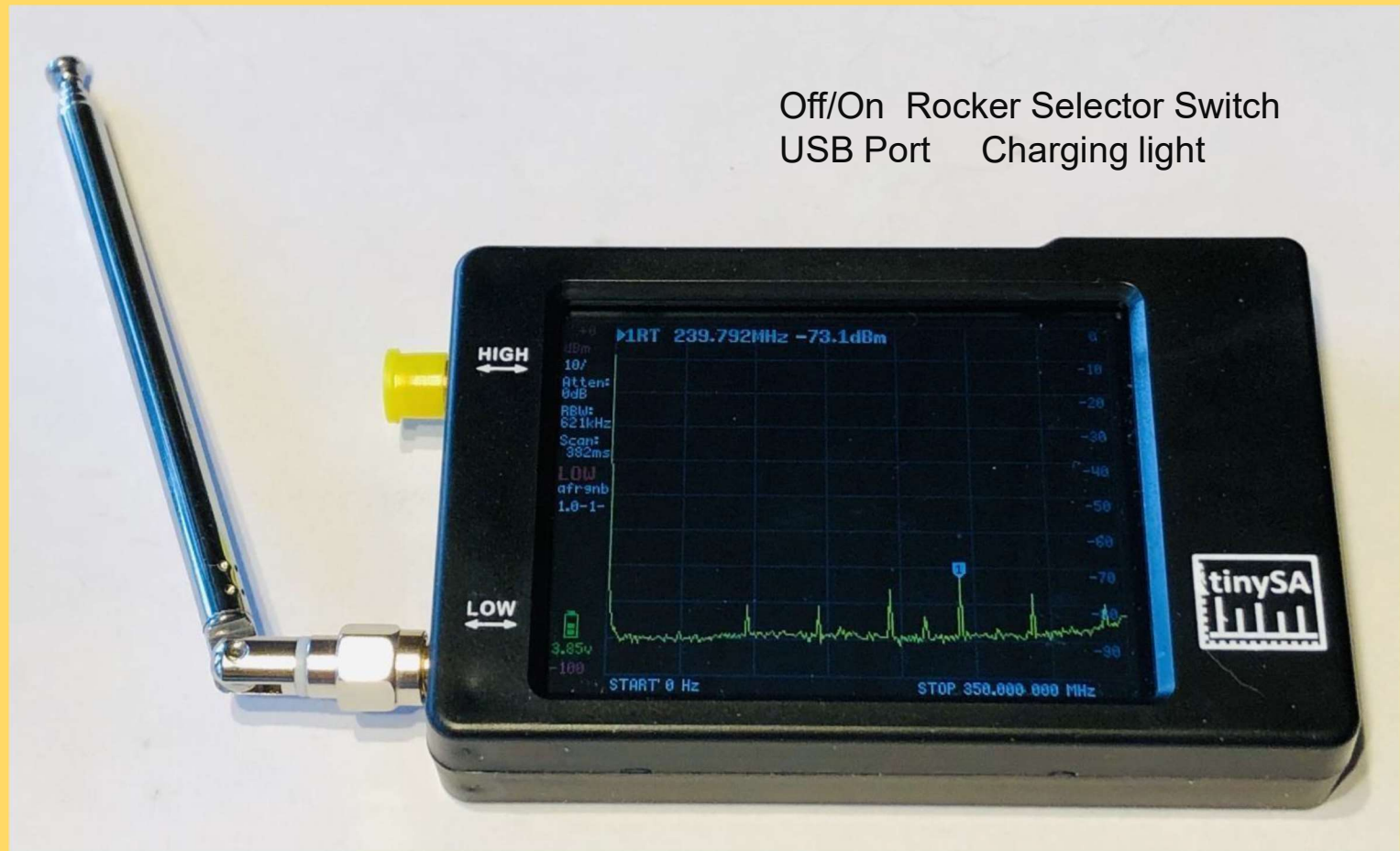
Spectrum Analyzer Uses

- Survey of a broad spectrum.
- Analysis of a developmental circuit.
- Examination of a transmitted signal.



tiny SA Controls

- The tinySA functions as a receiver and a signal generator.
- Low level range 100 KHz to 300 KHz sinus.
- High level range 240 MHz to 960 MHz square wave.



tinySA Screen



tinySA Features

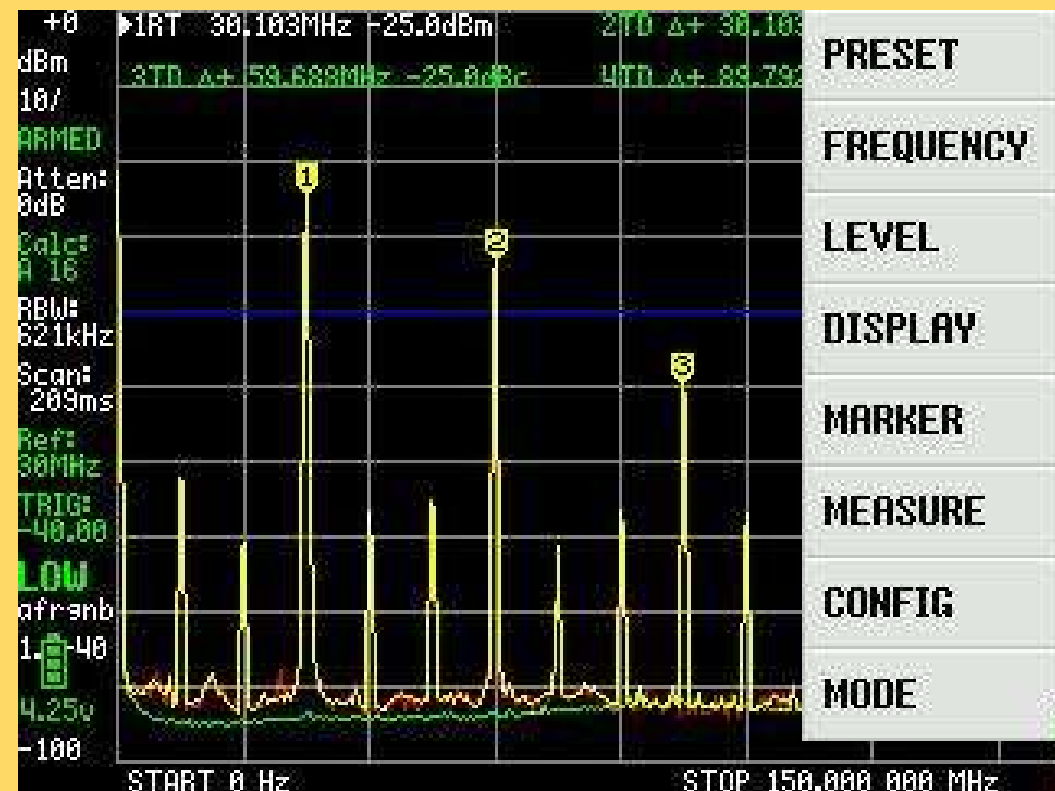
- Spectrum Analyzer with two inputs, high quality MF/HF/VHF input for 0.1MHz-350MHz, lesser quality UHF input for 240MHz-960MHz.
- Switchable resolution bandpass filters for both ranges between 2.6kHz and 640kHz
- Color display showing 290 scan points covering up to the full low or high frequency range.
- Input Step attenuator from 0dB to 31dB for the MF/HF/VHF input.
- When not used as Spectrum Analyzer it can be used as Signal Generator, MF/HF/VHF sinus output between 0.1MHz-350MHz, UHF square wave output between 240MHz-960MHz.
- A built-in calibration signal generator that is used for automatic self test and low input calibration.
- Connected to a PC via USB it becomes a PC controlled Spectrum Analyzer
- Rechargeable battery allowing a minimum of at least 2 hours portable use

tinySA Measurement Capabilities

- Measuring [Harmonics](#)
- Measuring [Spectral Purity](#)
- Measuring [Phase Noise](#)
- Measuring [Third Order Intermodulation](#)
- Measuring [IQ Balance](#)
- Measuring [Spur Free Dynamic Range](#)
- Measuring [Low Frequencies](#)
- Capturing [ISM Transmissions](#)
- Tuning [Sweep Settings](#)
- [Coax Cable Impact](#)
- Measuring the [harmonic content of an Ultimate3 transmitter](#) by AE5X
- Measuring [FM deviation](#)
- Measuring [AM modulation](#)
- Measuring [One dB Compression Point](#)
- Adding an [LNA](#)
- Using a Tracking Generator to measure a [Mixer](#)
- Measuring the [Noise Factor of an Amplifier](#)

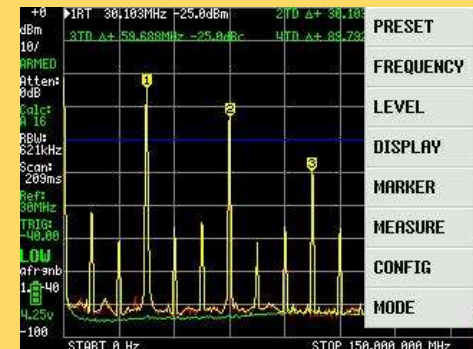
Screen Structure

- **Info panel** at the left
- **Marker info** at the top
- **Scan info** at the bottom
- **Measurement panel** in the middle
- **Menu** at the right

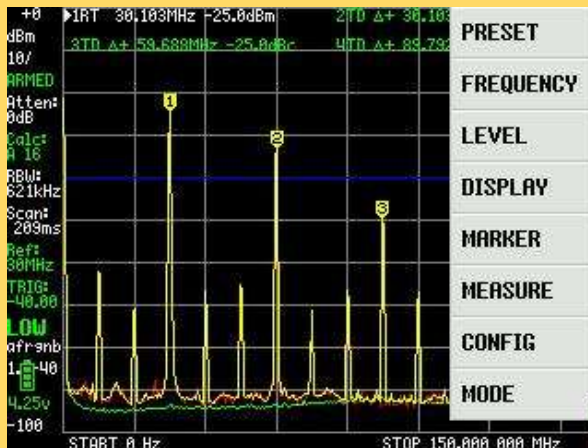


Menu Structure

- [PRESET](#) loads or saves configurations.
- [FREQ](#) sets everything related to the frequency range to scan.
- [LEVEL](#) sets everything related to the level of the signals being measured.
- [DISPLAY](#) controls various aspects of how the signals are being displayed.
- [MARKER](#) controls the markers on the display.
- [MEASURE](#) helps to quickly set the tinySA for certain measurements.
- [CONFIG](#) activates the configuration menu.
- [MODE](#) activates the mode switching menu

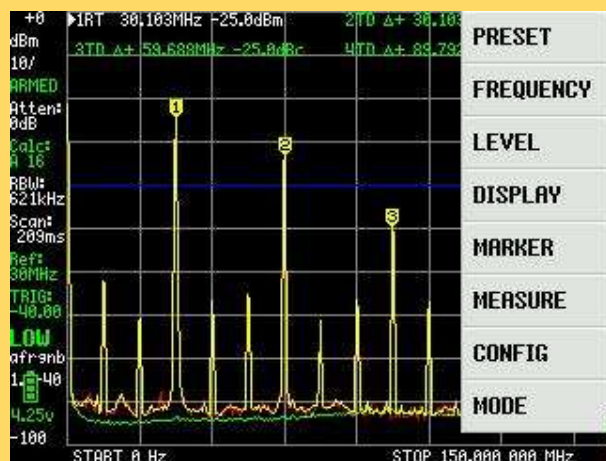


- **PRESET** loads or saves configurations. **LOAD STARTUP** reloads the startup presets.
- **LOAD X** loads the settings from slot x
- **STORE** supports updating the stored presets
 - **STORE AS STARTUP** sets the current settings as the startup preset.
 - **STORE X** stores the current settings in slot X.
 - **FACTORY DEFAULTS** resets the startup preset to the factory defaults



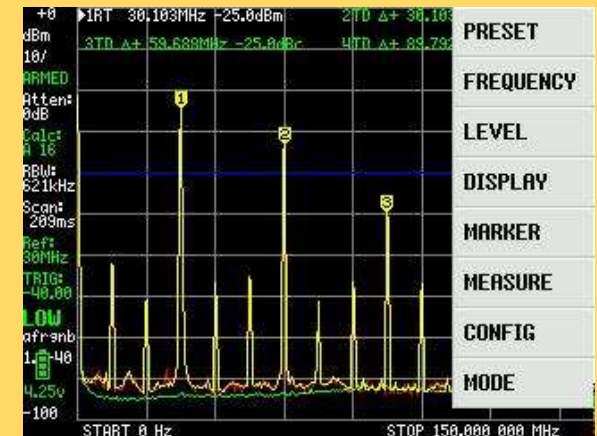
- **FREQ** sets everything related to the frequency range to scan. **START** sets the scanning to start/stop mode and sets the start frequency
- **STOP** sets the scanning to start/stop mode and sets the stop frequency
- **CENTER** sets the scanning to center/span mode and sets the center frequency
- **SPAN** sets the scanning to center/span mode and sets the frequency span
- **ZERO SPAN** sets the scanning to center/span mode, sets the span to 0Hz and sets the center frequency
- **RBW** sets the resolution bandwidth. Keep in mind a low RBW may increase scanning time substantially.
- **SPUR REMOVAL** activates the two spur removal mechanisms.

- **LEVEL** sets everything related to the level of the signals being measured. **REF LEVEL** sets the level in selected unit of the top of the display.
- **SCALE/DIV** sets the amount of selected unit per division of the display.
- **ATTEN** sets the amount of [attenuation](#) applied to the low input/output.
- **CALC** selects various calculation options over time such as averaging or max hold.
- **UNIT** selects the display unit. dBm, dBmV, dBuV, Volt or Watt
- **EXTERN AMP** sets the level offset in dB caused by an external amplifier or attenuator.

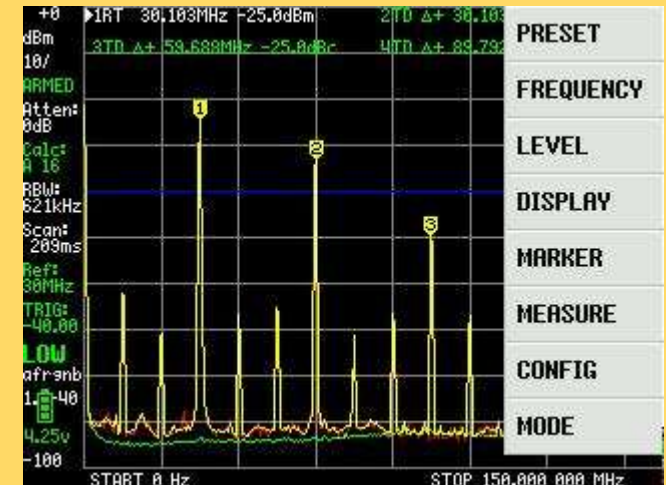


- **TRIGGER** selects the trigger mode **AUTO** is the normal spectrum analyzer scanning mode, triggering is not active.
- **NORMAL** will display a new scan as soon as a signal in the scan causes a trigger event.
- **SINGLE** will wait for a signal to cause a trigger event and display the scan.
- **LEVEL** activates a keypad for entering the trigger level.
- **UP EDGE** generates a trigger event when the input level goes from below the set trigger level to above the set trigger level
- **DOWN EDGE** generates a trigger event when the input level goes from above the set trigger level to below the set trigger level

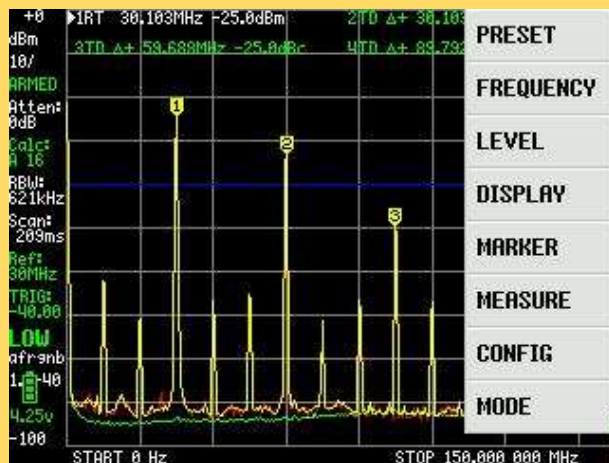
- **DISPLAY** controls various aspects of how the signals are being displayed. **PAUSE SWEEP** pauses the scanning
- **STORE TRACE** writes the current measurement to the blue trace. Click again to store again.
- **CLEAR STORED** removes the stored trace
- **SUBTRACT STORED** subtracts the stored trace from the current measurement.
- **NORMALIZE** will store the current scan and subtract this stored scan from future measurements.
- **WATERFALL** displays the power level over time in a waterfall map.
- **SWEEP SETTINGS** menu contains various settings on how to sweep the selected frequency or time span.
 - **NORMAL** sets the default sweeping mode
 - **PRECISE** sets the precise scanning mode.
 - **FAST** sets the fast sweeping mode.
 - **SWEEP TIME** sets the target time for a complete sweep in seconds.
 - **SWEEP POINTS** allows setting the number of sweep points.
 - **FAST SPEEDUP** allows setting the acceleration factor for fast sweeping.



- **MARKER** controls the markers on the display.
 - **MODIFY MARKER** allows selecting a marker and shows a submenu to modify the **MARKER TYPE**.
 - **MARKER OPS** allows setting the frequency display range based on the active marker
 - **SEARCH MARKER** allows positioning a non-tracking marker on signal maxima or minima.
- **MEASURE** helps to quickly set the tinySA for certain measurements.
 - **OFF** switches of any measurement related setting and behavior and returns the tinySA to regular operation
 - **HARMONIC** switches to a marker configuration for measuring the level of harmonics of a signal
 - **OIP3** switches to a marker configuration for measuring the Output IP3 level of a signal
 - **PHASE NOISE** switches to a marker configuration for measuring phase noise of a signal

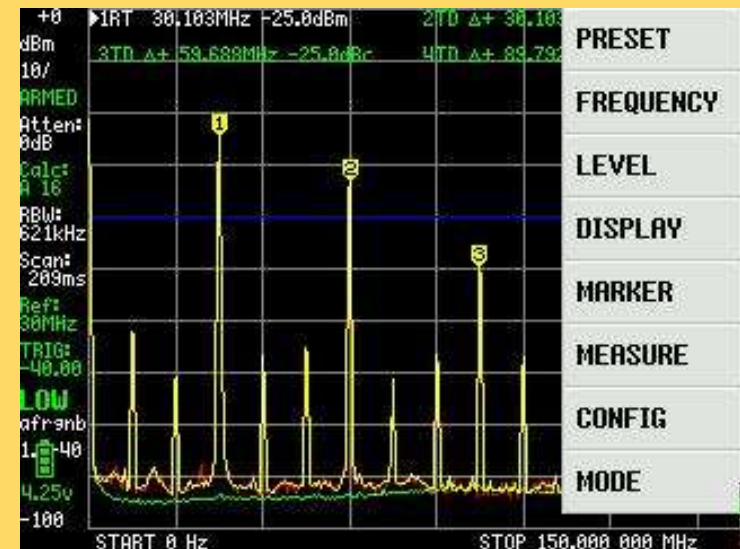


- **CONFIG** activates the configuration menu. **TOUCH CAL** enables the calibration of the touch panel. The results are stored in NVM.
- **TOUCH TEST** is used to verify touch calibration.
- **SELF TEST** is used after a cable is used to connect the low and high input/output.
- **LEVEL CAL** is used to calibrate the power measurement levels.
- **VERSION** shows the SW version information

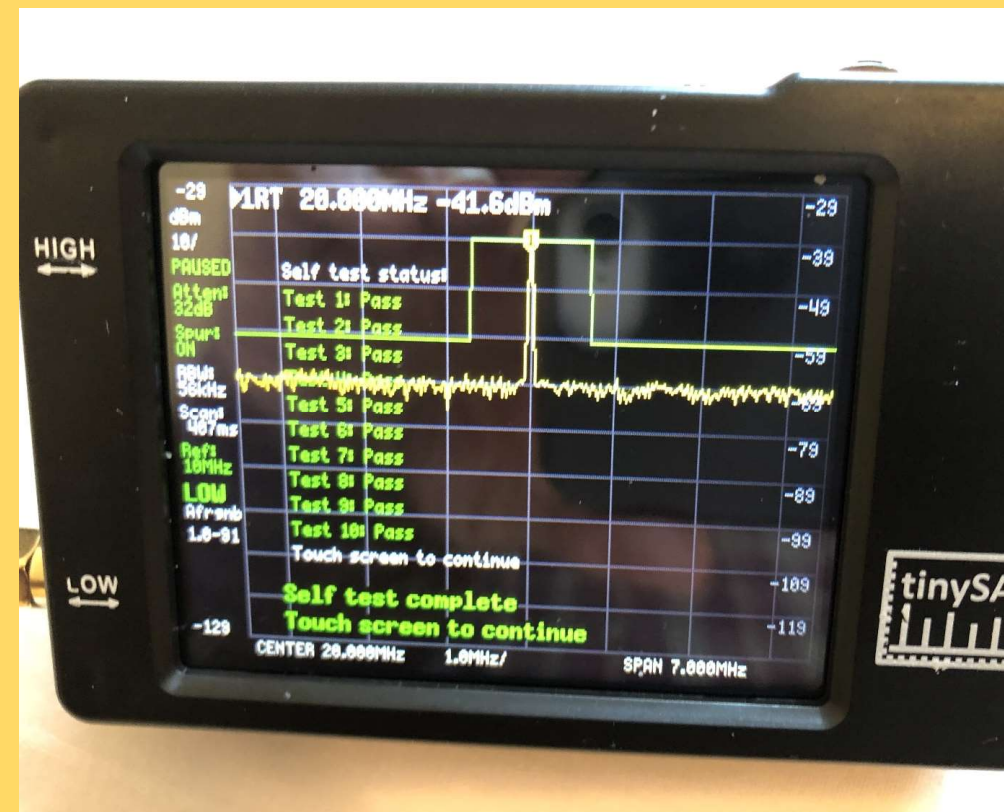
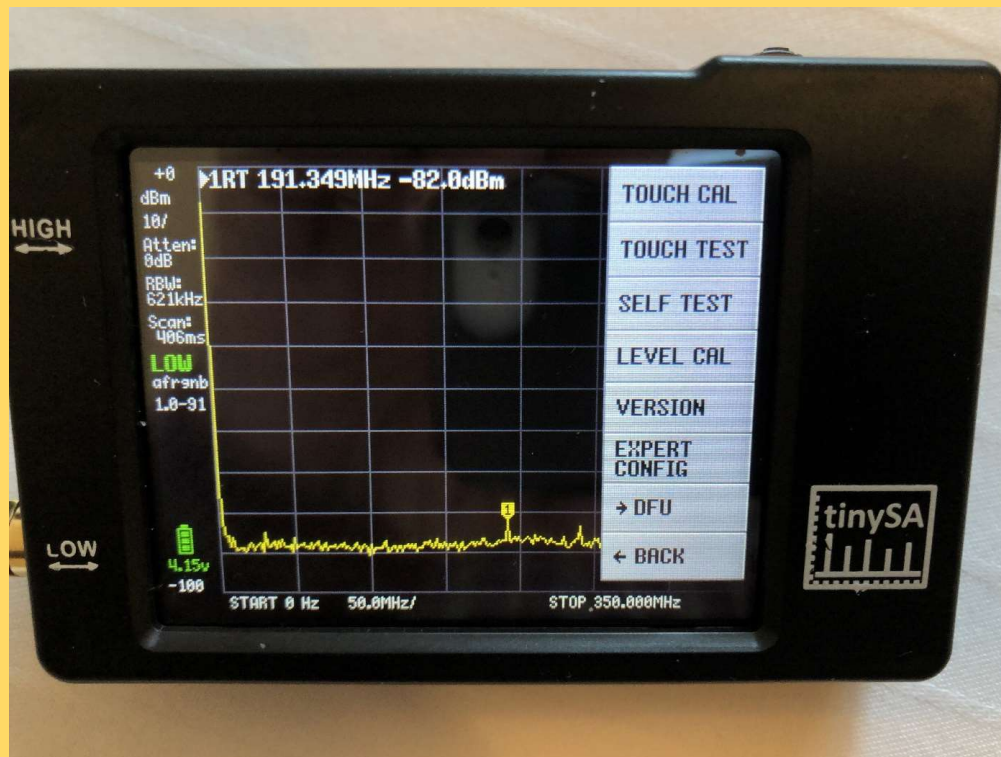


- **EXPERT CONFIG** activates the expert configuration menu
- **LO OUTPUT** enables the output of the first LO through the high connector
- **ACTUAL POWER** allows calibration of the dBm reading by entering the known level of the signal under marker 1.
- **IF FREQ** allows entering the IF frequency used in low mode.
- **SCAN SPEED** allows setting the speed of scanning.
- **REPEATS** sets the number of repeat measurements at each frequency.
- **MIXER DRIVE** sets the power output to the mixer.
- **AGC** enables/disables the built-in Automatic Gain Control.
- **LNA** enables/disables the built-in Low Noise Amplifier.
- **BPF** enables measurement of the performance of the internal Band Pass Filter.
- **BELOW IF** switches the LO to below the IF when measuring below 190MHz.
- **HOLD TIME** sets the number of scans after which a maximum measured with **MAX DECAY** will start to decay.
- **NOISE LEVEL** sets the expected noise band in dB.
- **ACTUAL FREQUENCY** sets the measured frequency of the 10MHz CAL OUTPUT

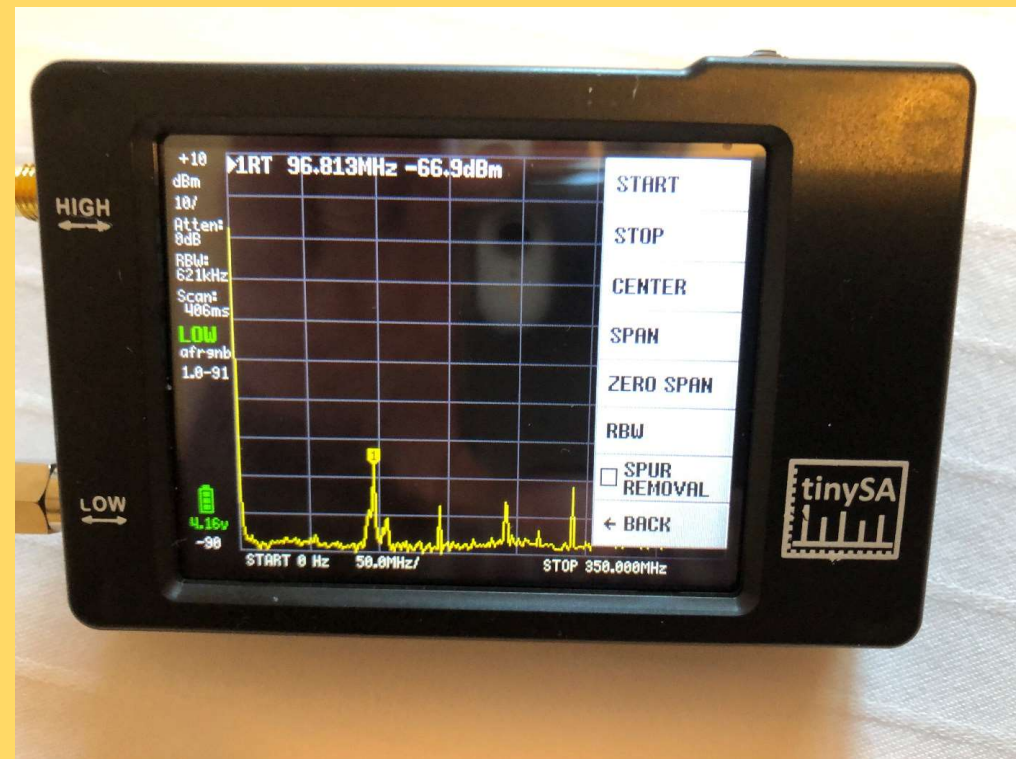
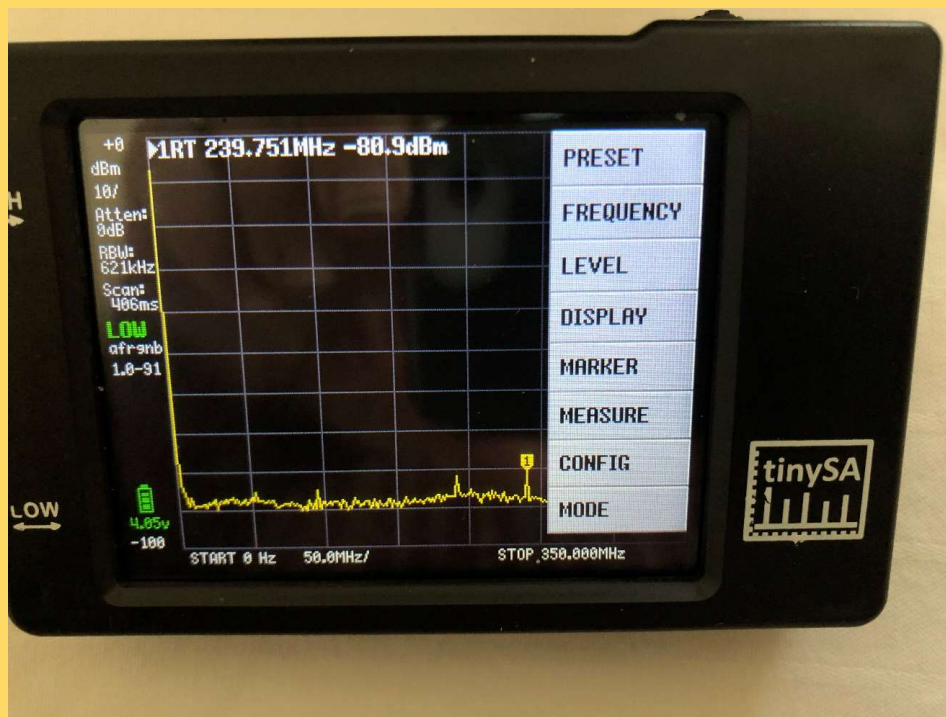
- **MODE** activates the mode switching menu. **LOW INPUT** activates the 0.1-350MHz input mode
- **HIGH INPUT** activates the 240MHz-960MHz input mode
- **LOW OUTPUT** activates the 0.1-350MHz output mode
- **HIGH OUTPUT** activates the 240MHz-960MHz output mode
- **CAL OUTPUT** controls the build in calibration reference generator.



Self Test



Menu Structure – Screen Frequency



Keypad

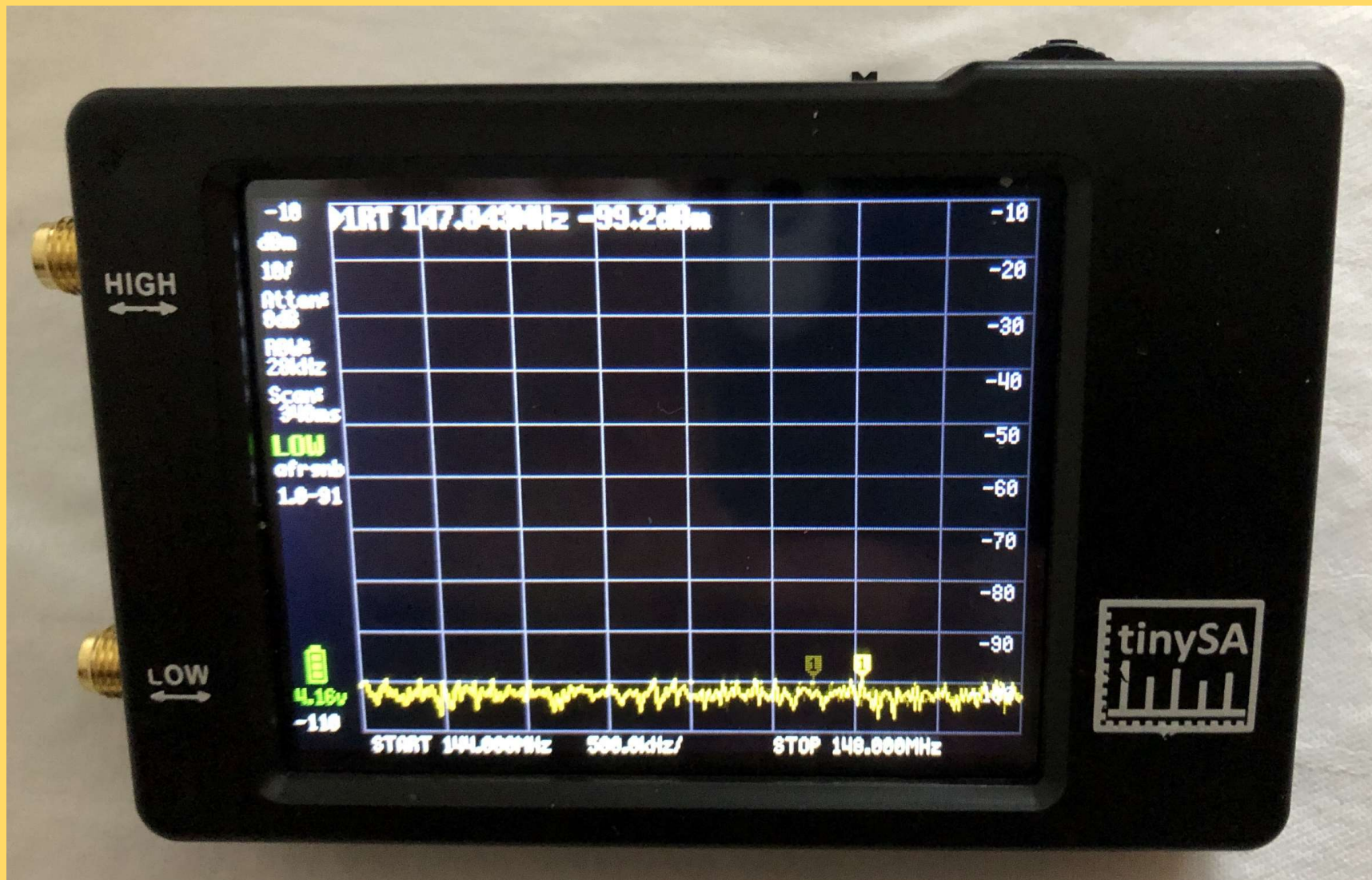


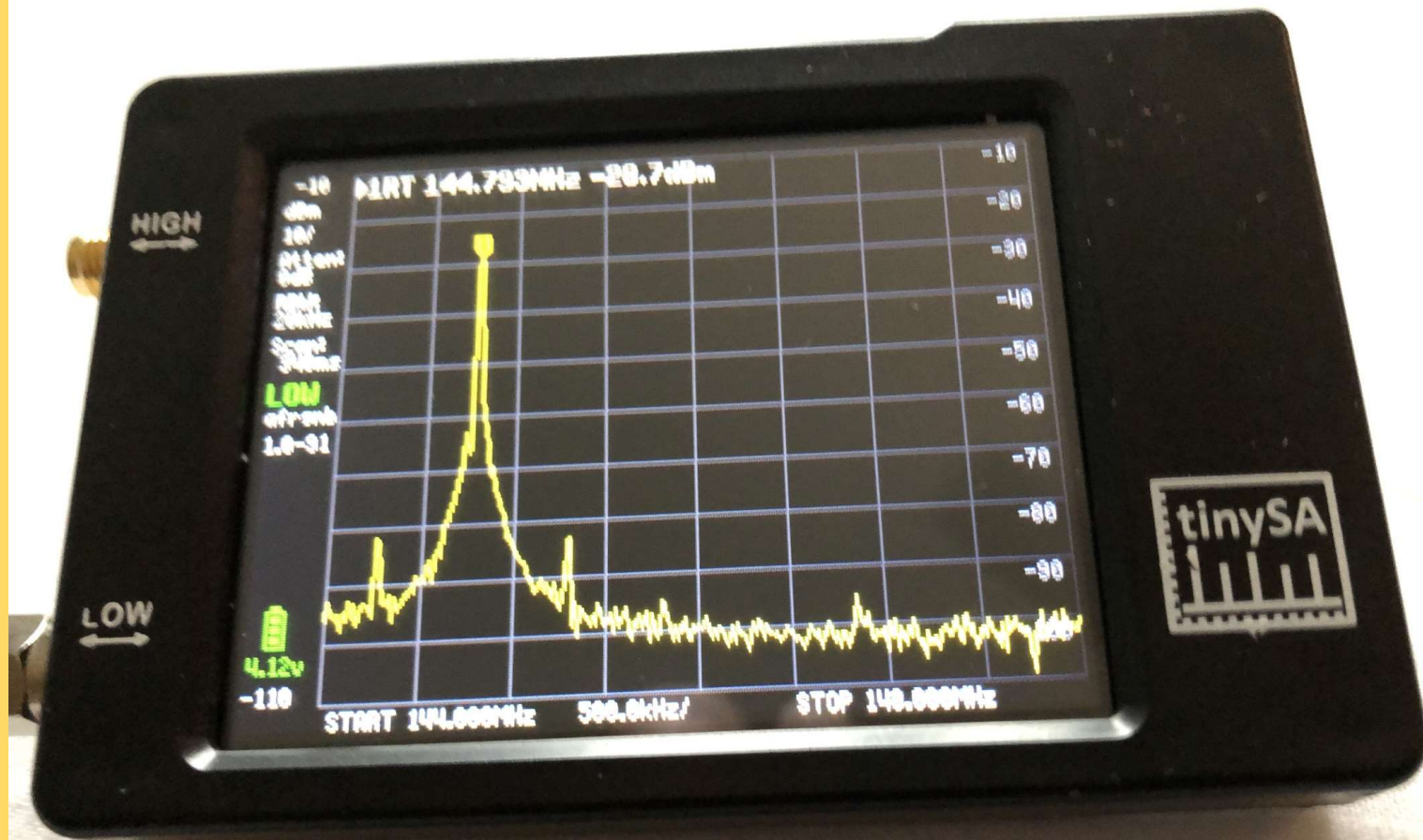
Gigahertz

Megahertz

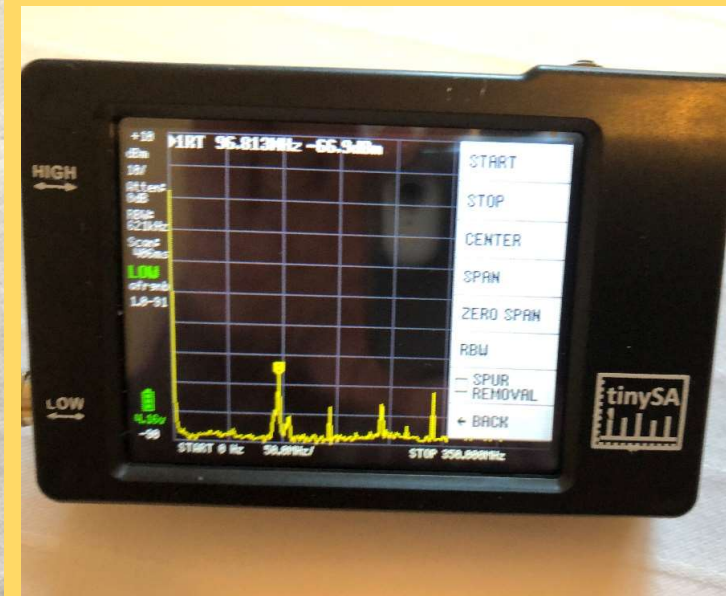
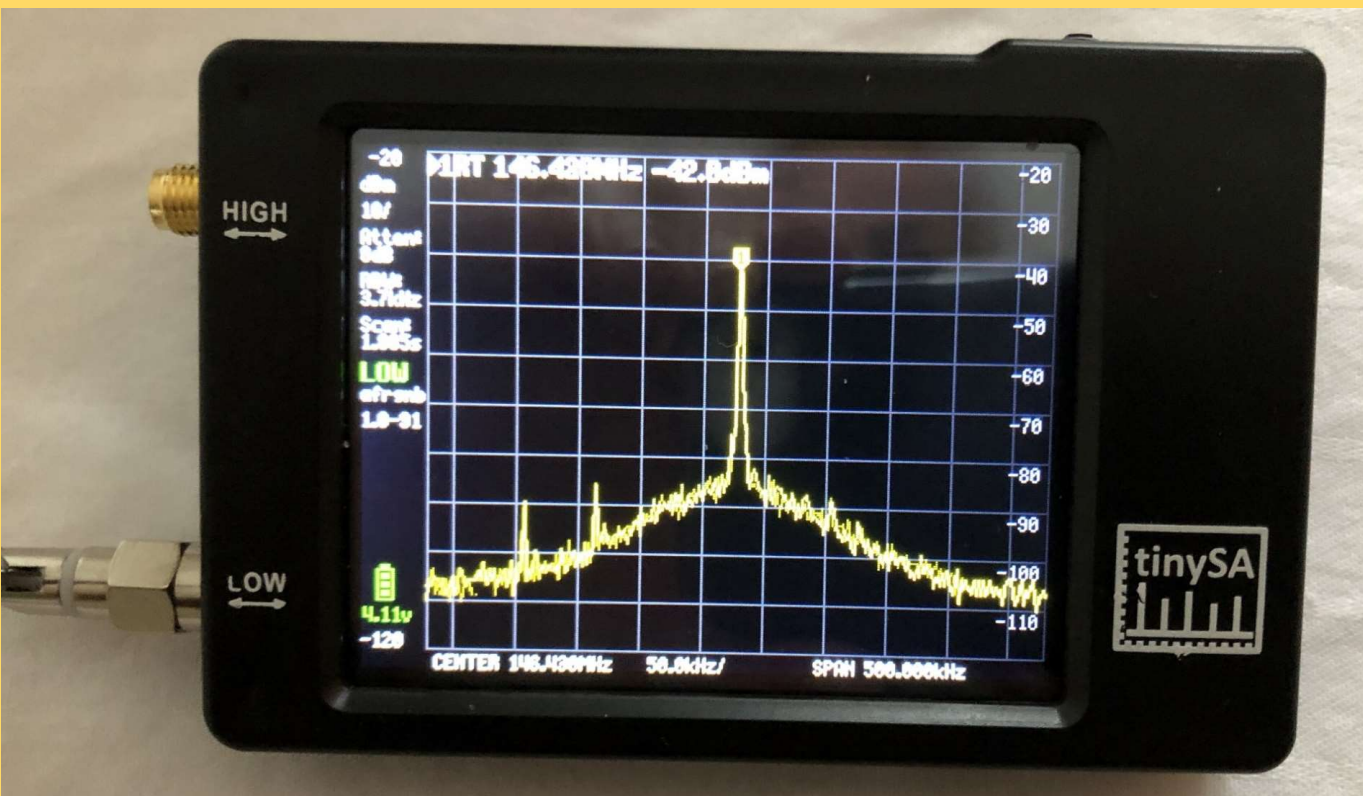
Kilohertz

x1

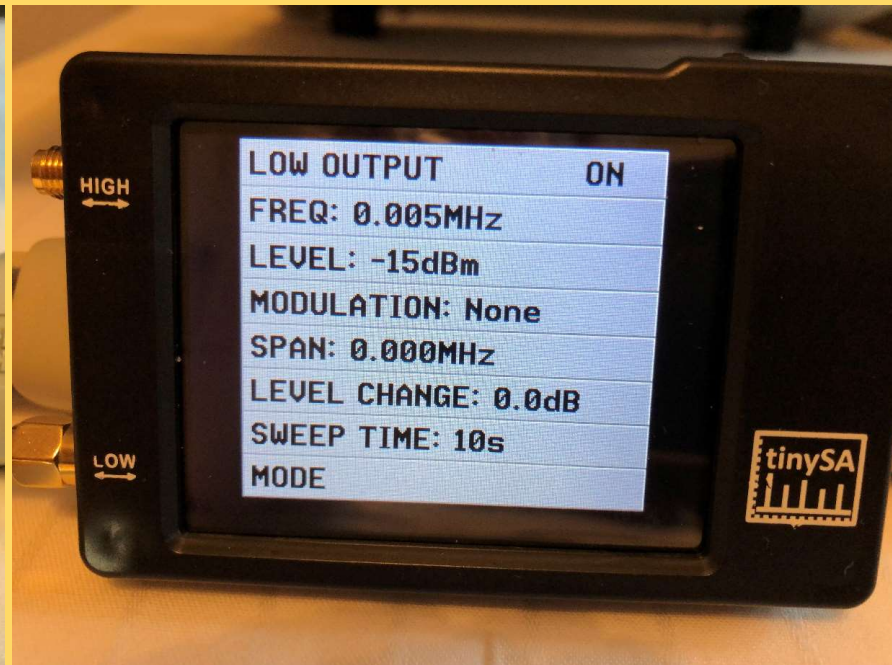
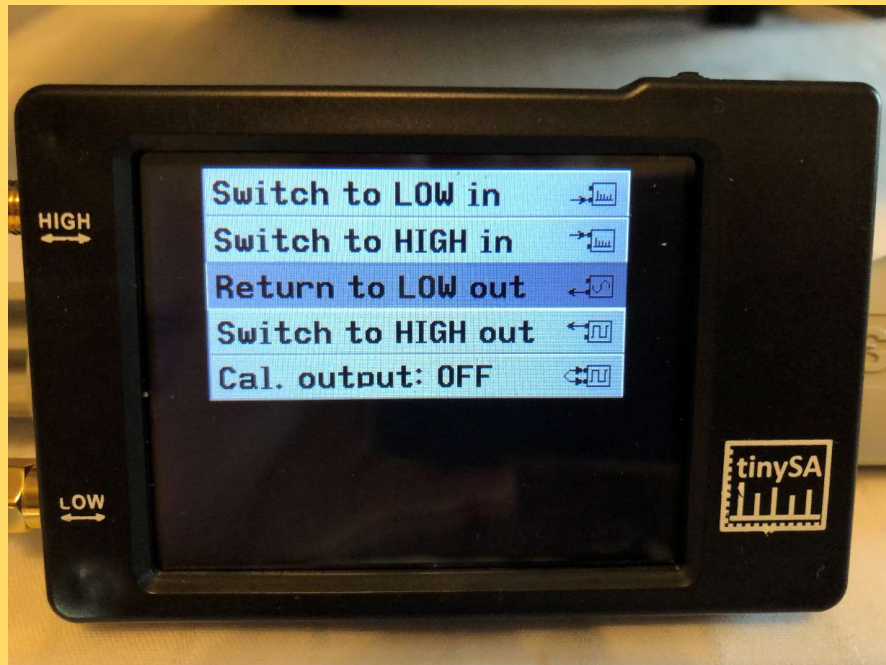




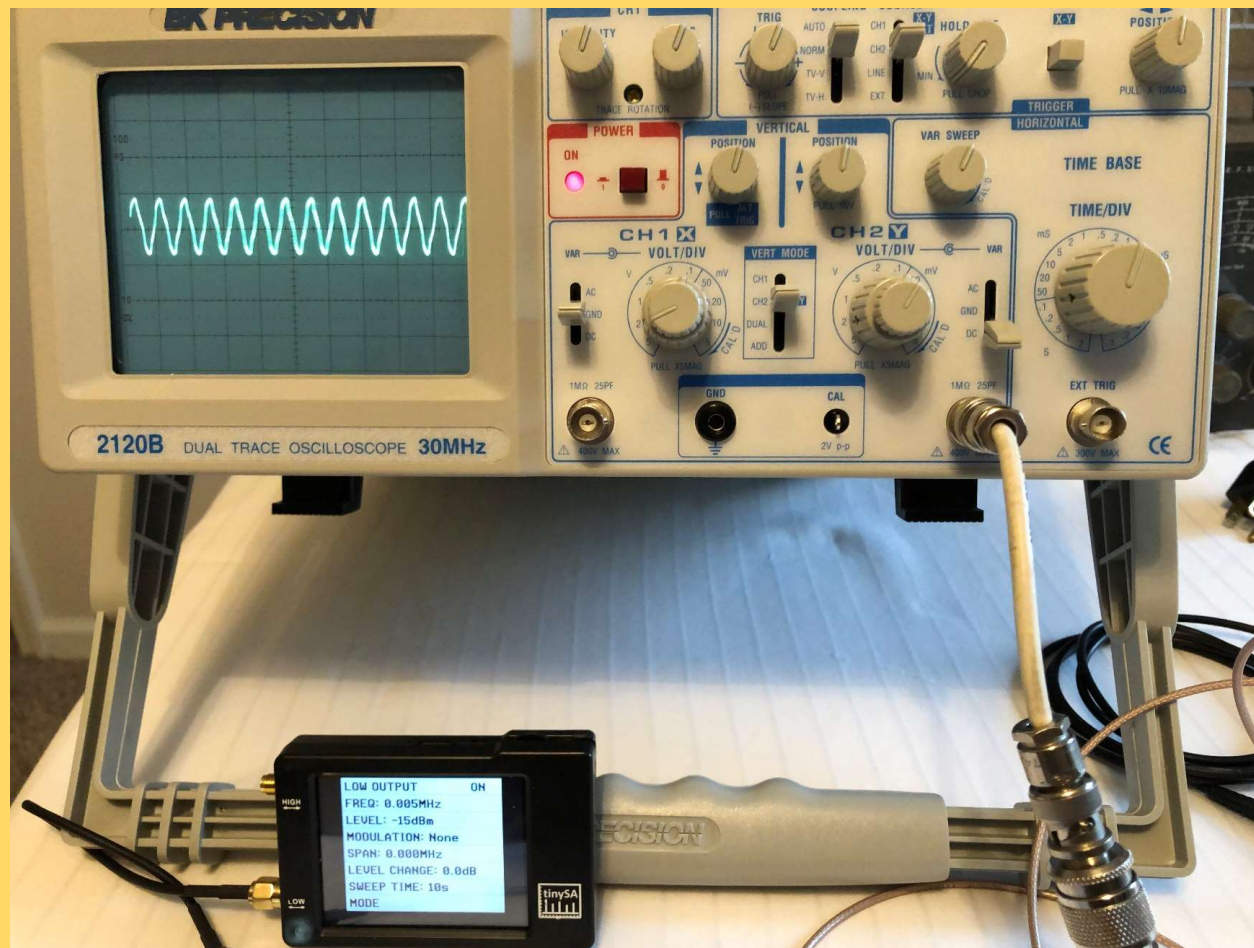
Center Frequency 146.430 MHz - Span 500KHz



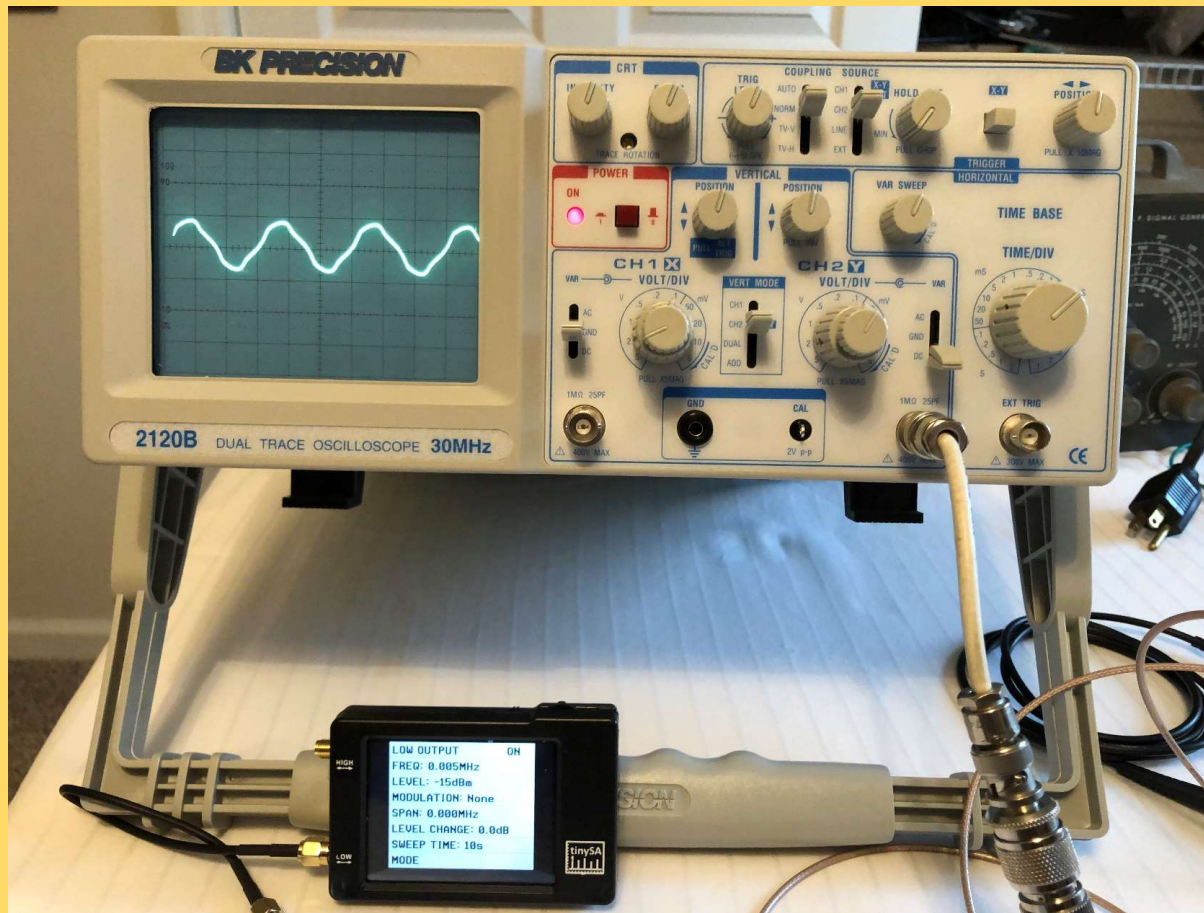
tinySA Signal Generator



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tinySA Information Sources

www.tinysa.org

With links to instruction manual and a multitude of U-Tube videos

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