PORTXVNSA SA5 Spectrum Analyzer and Signal Generator User Guide

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PORTXVNSA SA5 Spectrum Analyzer and Signal Generator

Product Usage Instructions

Spectrum Analyzer Mode
The SA5 offers Normal mode covering 0.1-800MHz and Ultra mode for level calibration up to 5.3GHz, observing signals up to 12GHz.

Signal Generator Mode
Generate sine waves between 0.1-800MHz, square waves up to 4.4GHz, or RF calibration signals.

Frequently Asked Questions (FAQ)

Q: Can the SA5 be used for monitoring radio channels?
A: Yes, radio enthusiasts can utilize the SA5 to monitor radio channels, identify nearby radio signals, detect interference, and] optimize antenna direction for better reception quality.

SA5 Product Features

The SA5 is a compact spectrum analyzer and signal generator, equipped with several impressive capabilities:

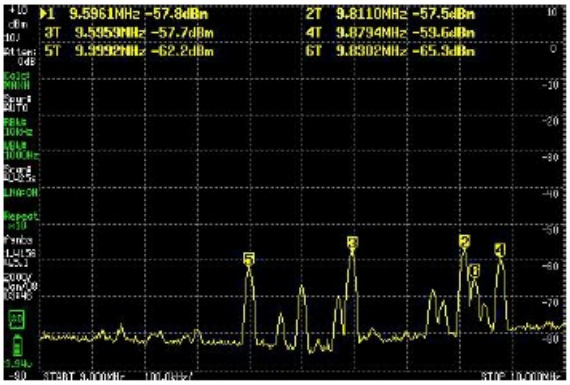
- Screen Size: 4 inches IPS LCD, featuring a large knob for easy operation.
- Spectrum Analyzer: Normal mode 0.1-800MHz, Ultra mode provides level calibration up to 5.3GHz, and can observe signals up to 12GHz.
- Signal Generator: Outputs sine waves between 0.1-800MHz, square waves up to 4.4GHz, or RF test signals up to 5.3GHz when not used as a spectrum analyzer.
- Switchable resolution bandpass filters: from 200Hz to 850kHz.
- Optional LNA: Built-in 20dB Low Noise Amplifier (LNA).
- Spectrum Display: Display up to 450 points, Display four independently configured trace
- Storage: MicroSD card slot for storing measurements, settings, and screen captures.
- Input Attenuator: Step attenuator adjustable from 0dB to 31dB (not usable with LNA).
- Calibration: Includes a built-in calibration signal generator for automatic self-test and input calibration.
- PC Connectivity: Connects via USB to function as a PC-controlled spectrum analyzer or signal generator.
- Battery: 5000mA, Rechargeable battery providing at least 10 hours of portable use.
- Max Input Level: +10dBm. Ensure not to exceed this to avoid damage.

Specification	Details
Input Frequency Range	100kHz to 800MHz in normal mode; up to 6GHz with ULTRA mode enabled
Input Impedance	50 ohm when input attenuation set to 10dB or more
Input Attenuation	Selectable manual and automatic input attenuation between 0dB and 31dB in 1 dB steps when LNA not active
Maximum DC Input	±5V DC
Absolute Maximum Input Level	+6dBm with 0dB internal attenuation
Absolute Maximum Short-Term Peak Input Power	+20dBm with 30dB internal attenuation
Suggested Maximum Input Power	+0dBm with internal attenuation in automatic mode
Best Measurement Input Power	Below -25dBm
Input Intercept Point (IIP3)	+15dBm with 0dB internal attenuation
1dB Compression Point	-1dBm with 0dB internal attenuation
Power Detector Resolution	0.5dB
Linearity vs Frequency	±2dB below 5.3GHz, ±5dB between 5.3GHz and 6GHz
Absolute Power Level	±2dB after power level calibration

Accuracy	
Built-in Optional LNA	20dB LNA with Noise Figure of 5dB
Lowest Discernible Signal without LNA	-102dBm at 30MHz using a resolution bandwidth of 30kHz
Lowest Discernible Signal with LNA	-145dBm at 30MHz using a resolution bandwidth of 200Hz
Frequency Accuracy	Equal to the selected resolution bandwidth
Phase Noise	-108dB/Hz at 100kHz offset and -115dB/Hz at 1MHz offset at 30MHz
Spur-Free Dynamic Range	70dB when using a 30kHz resolution bandwidth
Resolution Filters	0.2, 1, 3, 10, 30, 100, 300, 600, and 850 kHz
On-Screen Resolution	51, 101, 145, 290, or 450 measurement points
Scanning Speed	Over 1000 points/second using largest resolution filters
Automatic Optimization of Scanning Points	Ensures coverage of the whole scan range regardless of the chosen resolution bandwidth
Spur Suppression Option	For assessing if certain signals are internally generated or actually present in the input signal
Headphone Output	For listening to the demodulated audio (AM only). Stereo connector only, high impedance is louder, short protected

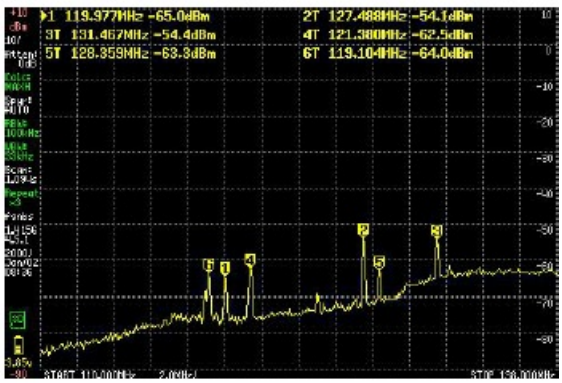
SA5 Application Examples

1. Radio enthusiasts can use the SA5 to monitor radio channels and identify nearby radio signals. They can also detect potential interference signals and adjust the antenna direction to optimize reception quality.

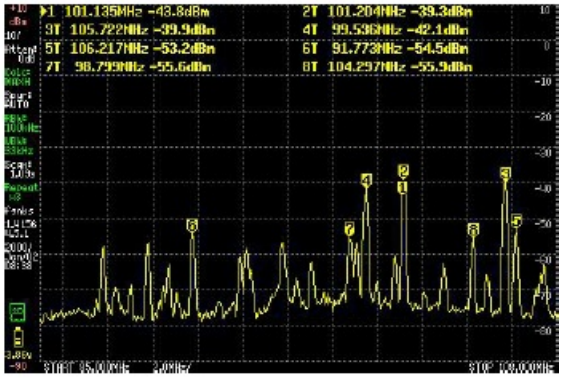


This diagram shows the measurement of active channels and signal strength in the SW band using the SA5. A high-performance loop antenna is connected to the SA5 spectrum analyzer, with the frequency range set to 9MHz to 10MHz. Using the MAX HOLD mode, six active channels were measured.

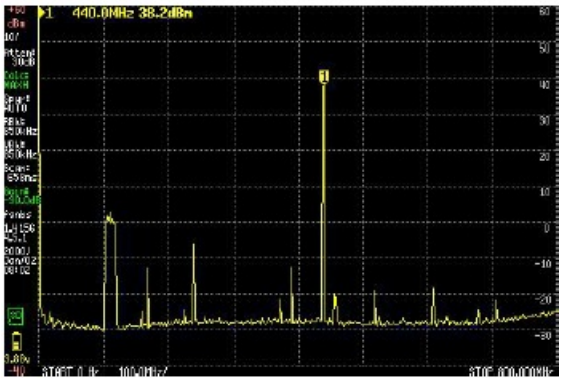
1. This diagram shows the measurement of active channels and signal strength in the aviation band using the SA5. A
   high-performance loop antenna is connected to the SA5 spectrum analyzer, with the frequency range set to 110MHz to 138MHz. Using the MAX HOLD mode, six active channels were measured.
2.



This diagram shows the measurement of active channels and signal strength in the FM band using the SA5. A high-performance loop antenna is connected to the SA5 spectrum analyzer, with the frequency range set to 85MHz to 108MHz. Using the MAX HOLD mode, multiple active channels were measured.

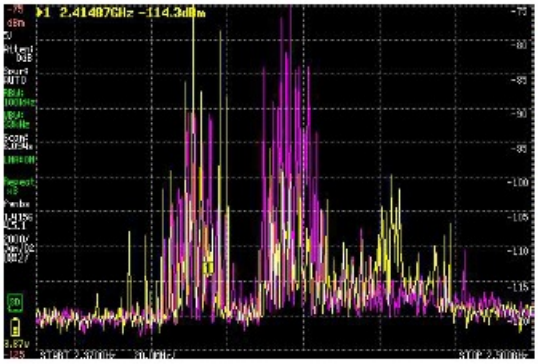


2. Radio enthusiasts can use the SA5 to evaluate the performance of transmitters, such as walkie-talkies, radio stations, mobile radios, handheld radios, and others. (Be sure to add an attenuator at the input to avoid damage to the spectrum analyzer.) They can measure the power of the transmitted signal, as well as harmonics and spurious signals.



This diagram shows the measurement of a walkie-talkie's transmission power using the SA5. A -30dB attenuator is connected between the walkie-talkie and the input of the spectrum analyzer. The measurement result indicates that the actual transmission power of the walkie-talkie is 38.2dB.

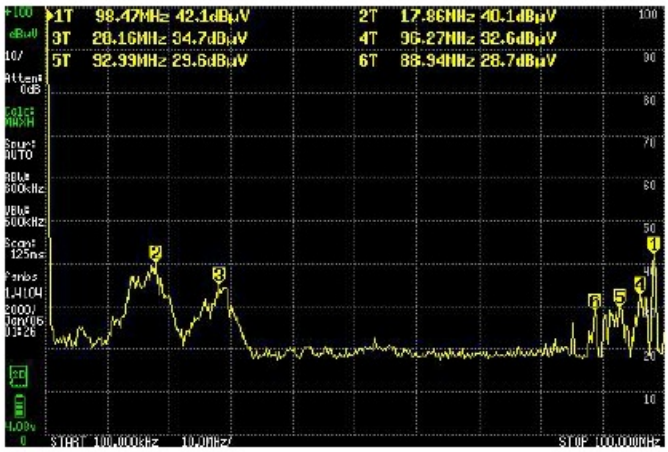
3. Field service and maintenance teams can use the SA5 for quick spectrum analysis and troubleshooting in scenarios such as wireless network optimization, antenna installation adjustments, communication system maintenance, industrial equipment diagnostics, broadcast system maintenance, and security system setup.



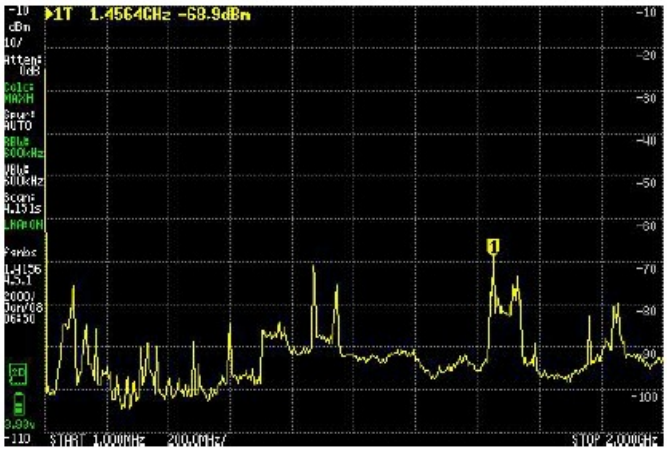
This diagram shows the measurement of WiFi signal strength at different locations on the same floor using the SA5. The yellow line represents the signal strength at location A, while the pink line represents the signal strength at location B.

4. EMC Testing: The SA5 can detect and identify frequency bands that may cause EMC issues during the early stages of product development.
   EMI Near-Field Testing: When used with a near-field probe, the SA5 can detect and analyze sources of electromagnetic interference around circuit boards and electronic devices. Engineers can use it to identify EMI

generated by specific circuits or components and implement appropriate shielding or filtering measures.

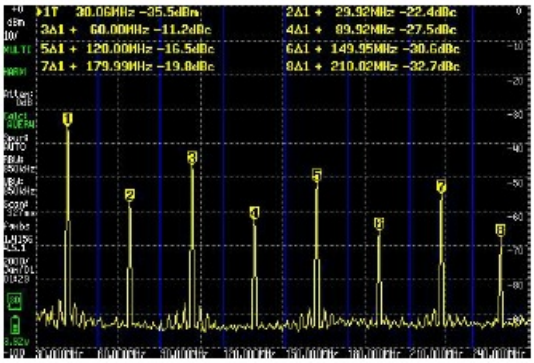


This diagram shows the SA5, with an external telescopic antenna, to test the EMC emissions of a Tesla Model 3 while driving.



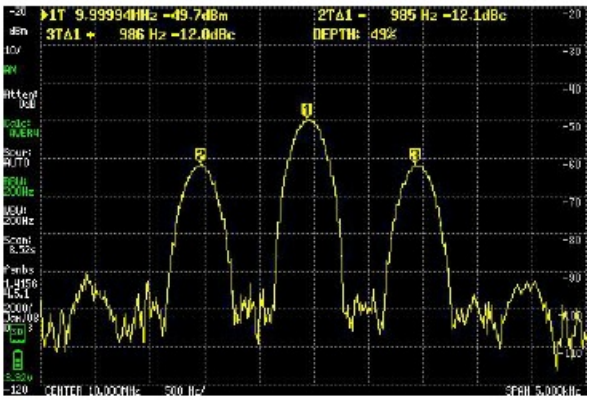
This diagram shows the SA5, with an external near-field probe, to test the EMI emissions inside a computer case.

5. The SA5 can be used for performance evaluation and testing of RF circuits and amplifiers.



This diagram shows the harmonic measurement function in the SA5's measurement menu to measure the harmonics of a 30MHz square wave signal.

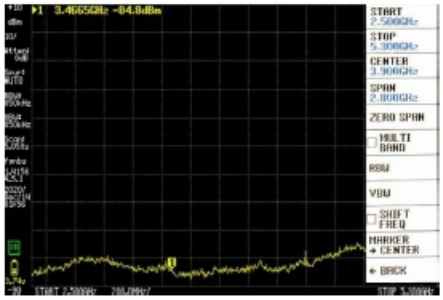
6. The SA5 can be used in teaching to demonstrate and experiment with spectrum analysis of RF signals, helping students understand the concept of the spectrum and identify different frequency components. Students can use the TINYSA Ultra to observe signals with different modulation types, such as AM and FM, and understand the effects of modulation on the signal.



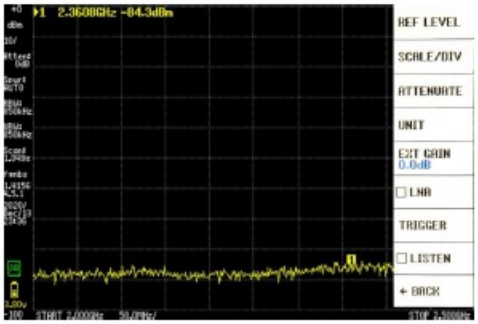
This diagram shows the AM signal analysis function in the SA5's measurement menu to measure an amplitude-modulated signal with a center frequency of 10MHz and a modulation depth of 50%.

SA5 Software Features

- The SA5 is a portable, compact spectrum analyzer that includes most of the software features found in professional instruments, making it highly convenient for signal analysis and measurement. Below are the main software features of the SA5:
  FREQUENCY: The FREQUENCY menu of SA5 offers precise control over start, stop, center frequencies, and spectrum span for specific range scanning. ZERO SPAN mode enables time-domain analysis, and MULTI BAND allows for multiple frequency bands. RBW and VBW adjustments optimize frequency resolution and signal smoothing. The SHIFT FREQ function handles frequency offset calibration, while MARKER CENTER sets the marker position as the center frequency for focused signal analysis. These features make TINYSA versatile and efficient in signal measurement.

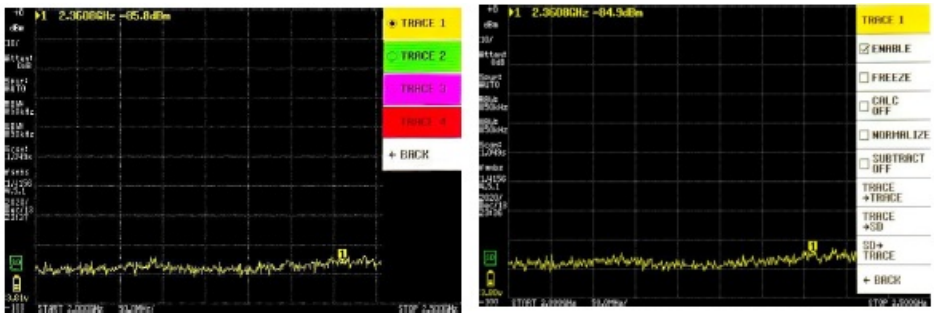


- LEVEL: The LEVEL menu of TINYSA offers a range of practical signal adjustment and display settings, allowing users to fine-tune signal gain, attenuation, reference level, scale/division, measurement units, and external gain, as well as set trigger conditions and enable the listen function. These combined features enable users to precisely control signal characteristics and display parameters across various measurement and analysis scenarios, ensuring accurate and repeatable measurement results.

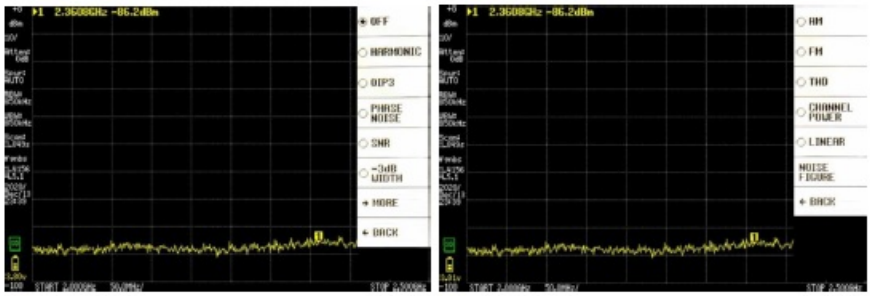


- TRACE: The TRACE menu of TINYSA Ultra offers a powerful set of signal tracking and processing features, allowing users to monitor and analyze signals through multiple trace channels (TRACE1, TRACE2, TRACE3,

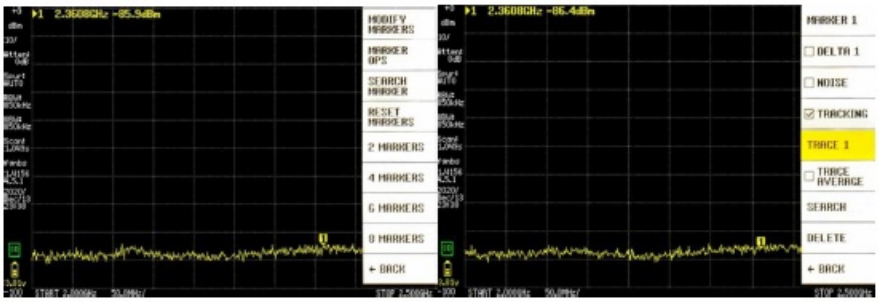
TRACE4). Users can enable or freeze trace data, perform various calculations and normalization operations, use the max hold (MAXHOLD) and average (AVER) functions to stabilize the display, and apply quasi-peak (QUASI PEAK) detection for more precise signal analysis. These integrated features make signal tracking and analysis more flexible and efficient, catering to a wide range of measurement and analysis needs.



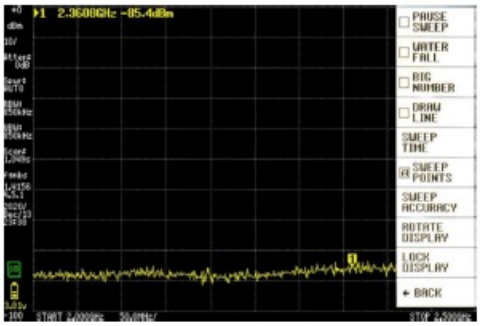
- MEASURE: The MEASURE menu of TINYSA Ultra offers a range of advanced measurement functions designed for in-depth analysis of various signal characteristics. Users can measure harmonics (HARMONIC), third-order intercept points (OIP3), phase noise (PHASE NOISE), signal-to-noise ratio (SNR), -3dB bandwidth (-3dB WIDTH), amplitude modulation (AM) and frequency modulation (FM) parameters, total harmonic distortion (THD), channel power (CHANNEL POWER), linearity (LINEAR), and noise figure (NOISE FIGURE). These features allow users to comprehensively and accurately evaluate and analyze signal performance, addressing a wide array of complex measurement needs.



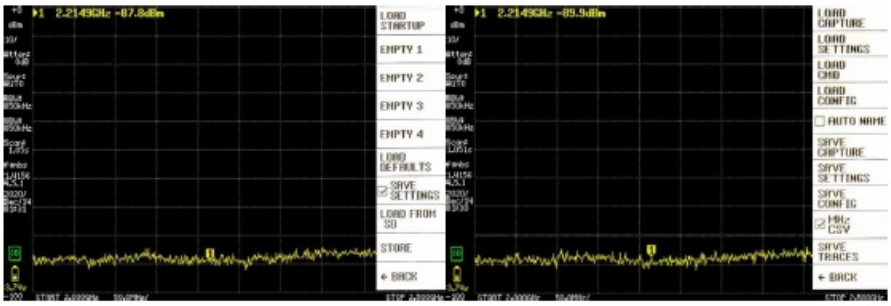
- MARKER: The MARKER menu in the SA5 provides a powerful set of marker management tools that allow users to precisely locate and analyze signal characteristics on the spectrum graph. This menu enables users to modify markers (including DELTA, NOISE, SEARCH, TRACKING), perform marker operations, conduct marker searches, and use up to 8 markers for complex signal analysis. These features make signal measurement and analysis more flexible, precise, and efficient, suitable for detailed spectrum analysis needs in various application scenarios.



- DISPLAY: The DISPLAY menu of TINYSA Ultra offers a range of settings to optimize the user interface and signal visualization. Among these, the waterfall (WATERFALL) feature stands out, displaying the spectrum over time, allowing users to dynamically monitor signal evolution. Additionally, the menu enables users to pause sweeps, adjust the update rate, activate the big number display mode, set drawing line styles, adjust sweep time, choose the number of sweep points, and set sweep accuracy. These combined features allow users to customize display parameters according to their specific needs, ensuring better visual effects and operational efficiency in various measurement and analysis scenarios.



- PRESET AND STORAGE: The PRESET and STORAGE menu functions of TINYSA Ultra provide comprehensive configuration and data management solutions. The PRESET function allows users to save and load preset configurations, streamlining the operation process and enabling quick switching of settings for different measurement scenarios, thereby enhancing work efficiency. The STORAGE function is used to save and manage measurement data, screenshots, and setting files, supporting both internal storage and external storage devices (such as MicroSD cards), ensuring convenient data recording, loading, and transfer. The combination of these two functions enables users to efficiently manage the spectrum analyzer's configurations and data, enhancing overall measurement and analysis efficiency.



Documents / Resources

	PORTXVNSA SA5 Spectrum Analyzer and Signal Generator [pdf] User Guide SA5 Spectrum Analyzer and Signal Generator, SA5, Spectrum Analyzer and Signal Generator, Signal Generator, Generator

References

- User Manual