SV6301A

Handheld Vector Network Analyzer

User Manual

Rev. 4.0

(For firmware 0.7.3)

Hangzhou SYSJOINT Technology Co., Ltd.

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1. Introduction

1.1. About SV6301A

SV6301A is a handheld Vector Network Analyzer (VNA) with frequency range of 1MHz ~ 6.3GHz. It can be used for S11 and S21 measurements. The S21 dynamic range of SV6301A is 75 dB, and the S11 dynamic range is 50 dB.

SV6301A is suitable for antenna testing of MF/HF/VHF/UHF bands, such as shortwave antennas, ISM band antennas, WiFi antennas, Bluetooth antennas, GPS antennas, etc. It can also be used to measure filters, amplifiers, attenuators, cables, power dividers, couplers, duplexers and other RF components. SV6301A supports a variety of trace formats: Log Mag, Linear Mag, Phase, Smith R+jX, Smith R+L/C, VSWR, Polar, Group delay, Resistance, Reactance, etc. In addition, SV6301A supports TDR function which is useful for cable lengths and characteristic impedance measurement.

SV6301A is designed with metal case, which is durable and can effectively shield electromagnetic interference. The dimension of SV6301A is 190mmx130mmx30mm, and a back bracket is designed for desktop use. The RF interface of SV6301A are N-type femal connectors and N-to-SMA adapters are included, which can be used to connect DUTs with SMA ports.

With the optimally designed signal processing system, the sweep speed of SV6301A is 500 points/s, which enables a quasi-real-time measurement, and the maximum sweep points is up to 1001.

The screen of SV6301A is 7-inch high-brightness IPS LCD with capacitive touch panel, which allows users to see the screen content clearly in outdoor. SV6301A adopts a full touch screen design, with 4 physical buttons, users can quickly set frequency range, ordinate scale, turn on/off traces, move markers, add/delete markers, take screenshots, and so on. The operation is quite convenient and smooth.

SV6301A is equipped with two 18650 lithium batteries, and the battery life is up to 3 hours. The charging port of SV6301A is USB Type-C, and the included Type-C cable can be used to charge the device and also for data transfer.

Besides, SV6301A has a built-in 8GB memory card, which can be used to store calibration states, snp files, screenshots, etc.

1.2. Features

- Frequency range：1MHz – 6.3GHz;
- S21 dynamic range：75dB，S11 dynamic range：50dB;
- 7-inch high-brightness IPS capacitive touch screen, clearly visible outdoors;
- Metal case, effectively shield electromagnetic interference;
- N-type RF connector, stable and durable;
- Full touch screen + 4 physical buttons, convenient and smooth operation;
- Dimensions: 190mmx130mmx30mm;
- Designed with a back bracket for desktop use;
- Supports local screenshot, able to save screenshots to the built-in memory card;
- Built-in 8GB memory card to store calibration states, snp files, screenshots, etc;
- 2 x 3350mAh 18650 lithium batteries with a battery life of up to 3 hours;
- TDR function for cable length and characteristic impedance meausrement;
- Up to 4 reference traces;
- Up to 8 markers, and the marker table can be dragged to anywhere on the screen;
- 18 save/recall slots, and supports save/recall calibration state from files;
- Supports automatic analysis of antenna and filter frequency bands;
- Supports snp file save, loading and parsing;
- Charging via USB Type-C port, and the charging voltage is 5V DC;
- Designed with a 5V/1A USB power output port;
- Firmware upgrade via virtual U disk with USB Type-C cable;
- Comes with SMA calibration kit and 2 x 50cm SMA-JJ coaxial cables;
- Backlight brightness adjustable;
- Supports console commands and PC software;
- Comes with a nice package;

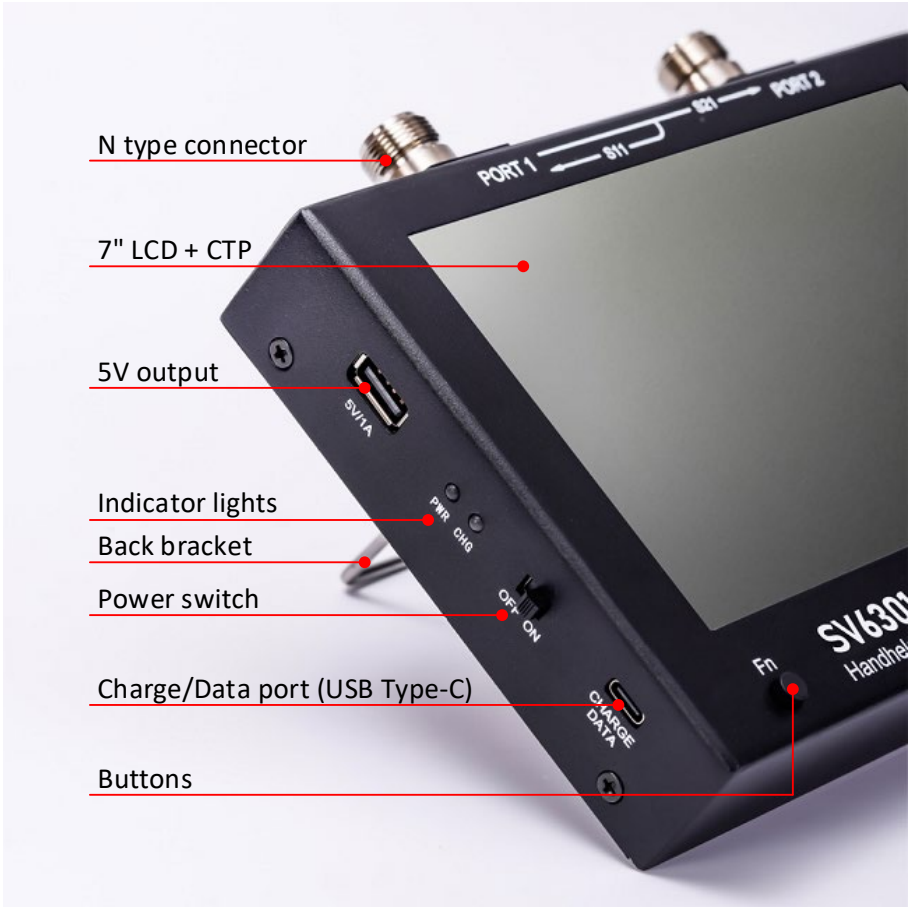
1.3. Specifications

Parameter	Specification	Condition
Frequency range	1MHz ~ 6.3GHz	
RF power out	-40dBm ~ -10dBm	step：1dB
RF connectors	N-type female	Come with N-to-SMA adapters
RF power in	0dBm (Max)	DC < 5V
Frequency accuracy	< ±1 ppm	
Frequency step	10kHz (Min)	
S21 dynamic range[1]	75dB	< 3GHz
	60dB	> 3GHz
S11 dynamic range[1]	50dB	< 3GHz
	40dB	> 3GHz
Sweep points	1001	Configurable from 101 to 1001
Sweep speed	500 pts/s	f > 25MHz
IFBW	12.5kHz (default)	12.5k/6.25k/3.12k/1k/300Hz/100Hz/30Hz
Smoothing	Arithmetic mean	Average times: 1 ~ 25
Traces	9	4 data traces, 4 reference traces, 1 TDR trace
Markers	8	
Calibration state storage	18	Calibration states can be stored as files to the built-in memory card
Storage capacity	8GB	TF card
Display	7-inch IPS LCD	Resolution: 1024x600
Operation mode	Capacitive touch and physical buttons	
Screenshot	On device	

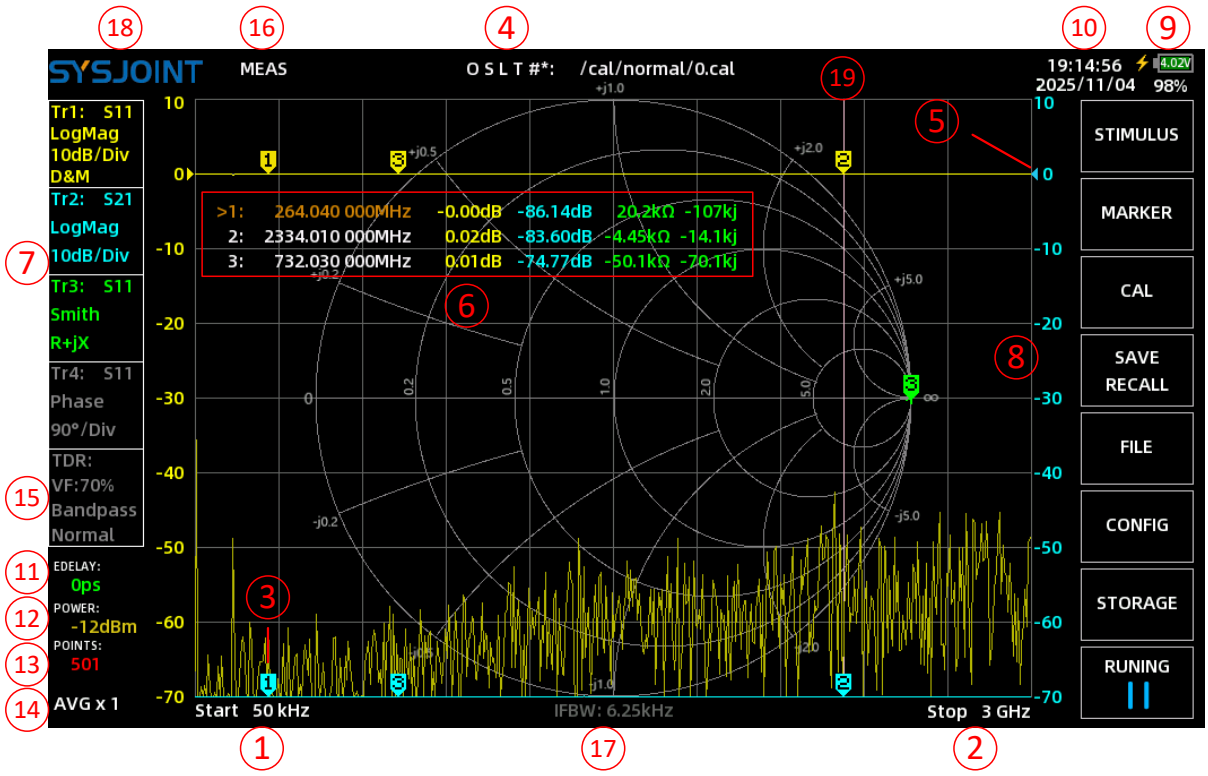
Power consumption	6.5W	
Battery life	3 hours	50% brightness
Battery	18650 lithium battery	3.6V/3350mAh×2
Charge/data port	USB Type-C	
Charge voltage	4.7V ~ 5.5V	Recommended to charge with 5V/2A
USB power output	5V/1A	
Dimensions	190mmx130mmx30mm	RF connector not included
Shell material	Iron	
Weight	1.2kg	
	1.7kg	Includes accessories and packaging
Operating temperature	0℃-45℃	

1. Dynamic range specifications are reported under the condition of 12.5kHz IFBW and 1x averaging. Reducing the IFBW and increasing the averaging times will improve dynamic range, while the sweep speed will drop.

2. Appearance



3. Main screen



① Start frequency

The start frequency is displayed in this area.

Touch on this area to quickly set the start frequency.

② Stop frequency

The stop frequency is displayed in this area.

Touch on this area to quickly set the stop frequency.

③ Marker

Up to 8 markers can be displayed at the same time on the screen.

You can move the marker with the following 2 ways:

(1) Push the button ◄ or ► ;

(2) Directly drag the marker on the screen;

④ Calibration states

O Indicates that OPEN calibration has been performed;

S Indicates that SHORT calibration has been performed;

L Indicates that LOAD calibration has been performed;

T Indicates that THROUGH calibration has been performed;

'#' Indicates that the device has been calibrated;

'*' Indicates that the calibration state has not been stored and will be lost after powered off;

The string following **'#'** corresponds to the calibration file path;

To quickly recall the calibration state, please select **【SAVE/RECALL】→【RECALL】→【RECALL n】** from the main menu;

To recall the calibration state from .cal file, please select **【SAVE/RECALL】→【RECALL】→【RECALL FILE】** from the main menu, then select the specified file to recall the calibration state.

⑤ Reference position

A triangular arrow indicates the reference position of the trace, and the arrow has the same color with the trace.

Long-press on the trace control box will call up the trace setting menu, select **【Ref position】** to set the reference position of the corresponding trace. The bottom grid line corresponds to reference position 0, and the top grid line corresponds to reference position 8.

⑥ Marker table

Up to 8 sets of marker information can be displayed at the same time in the marker table, and each of the marker information set includes frequency and 4 other parameters.

The marker table can be dragged freely on the screen.

To quickly activate a marker, you should touch on the frequency value region of the corresponding marker information set of the marker table. A **'>'** symbol indicates the current active marker.

You can open, select, or close a marker by:

【MARKER】→【SELECT MARKER】→【MARKER n】

The display style of the marker table is configurable by **【MARKER】→【INFO SET】**.

⑦ Trace control box

There are 4 slots in the trace control box.

You can get the information of channel, format, scale, memory trace, math and on/off status of the corresponding trace from the trace control box.

Touch the trace control slot will turn on/off the corresponding trace.

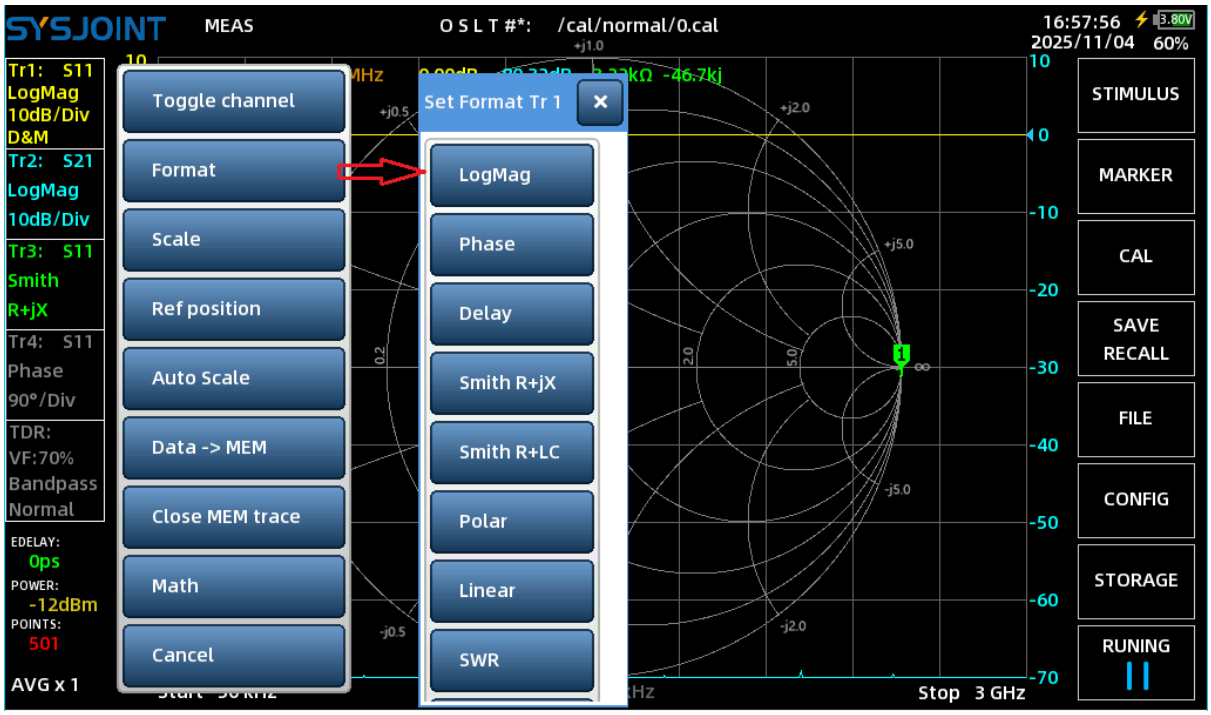
In the above figure Tr2 is taken as an example, read it as follows:

Tr2：S21 indicates that the trace presents S21, the format of Tr2 is **Log Mag**. **10dB/Div** indicates that the ordinate is 10dB per division.

If the text color of the trace control slot is gray, that means the trace has been turned off, as Tr4 shown in the above figure.

There shows the 'D&M' in the Tr1 box, which means the trace data have been stored to the memory, where 'D' represents 'Data', and 'M' represents 'Memory'. When it shows 'D & M', the data trace and memory trace are both displayed. If we turn off the memory trace, it will show 'DAT'.

Long-press trace control slot will call up the trace setting menu, and you will be able to quickly set the channel, format, scale, and reference position of the corresponding trace, as shown in the figure below.



⑧ Ordinate

The left ordinate corresponds to the scale of Tr1 by default, and the right ordinate corresponds to the scale of Tr2 by default.

It is also possible to reconfigure the ordinate by **【MARKER】→【INFO SET】**.

You can touch on the ordinate area to quickly set the trace scale.

⑨ Battery info

This area shows the battery voltage, battery level and charging status (⚡).

A low battery warning sign (⚠) will appear when the battery level is too low.

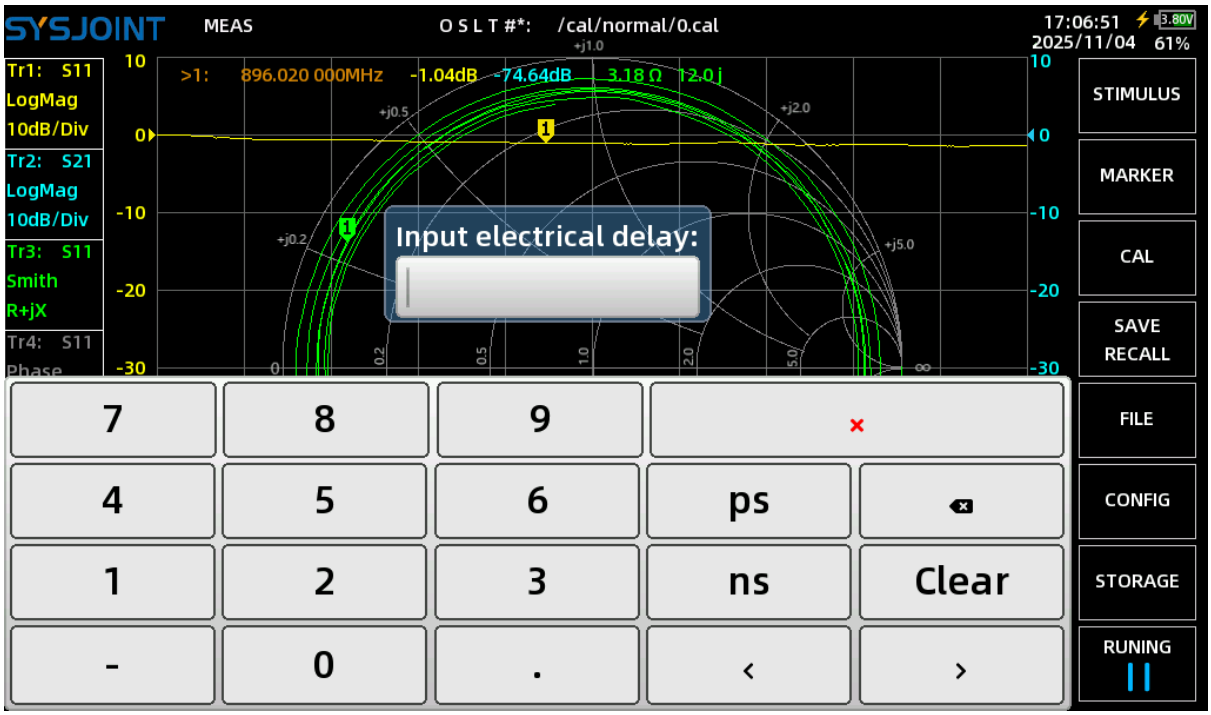
⑩ Time and date

This area displays the time and date.

To set the time and date, please navigate to **【CONFIG】** on the main menu.

⑪ Electrical delay

Electrical delay value is displayed here.
Touch on this area to set the electrical delay.
Electrical delay is used to specify a delay time in nanoseconds (ns) or picoseconds (ps) to compensate the delay introduced by connectors or cables.



⑫ RF output power

RF output power of PORT1 is displayed here.

Touch on this area to set the RF power: -42 ~ -12dBm.

⑬ Sweep points

Sweep points is displayed here.

Touch on this area to set the sweep points: 101 ~ 1001.

⑭ Average

Average times is displayed here.

Touch on this area to set average times: 1 ~ 25.

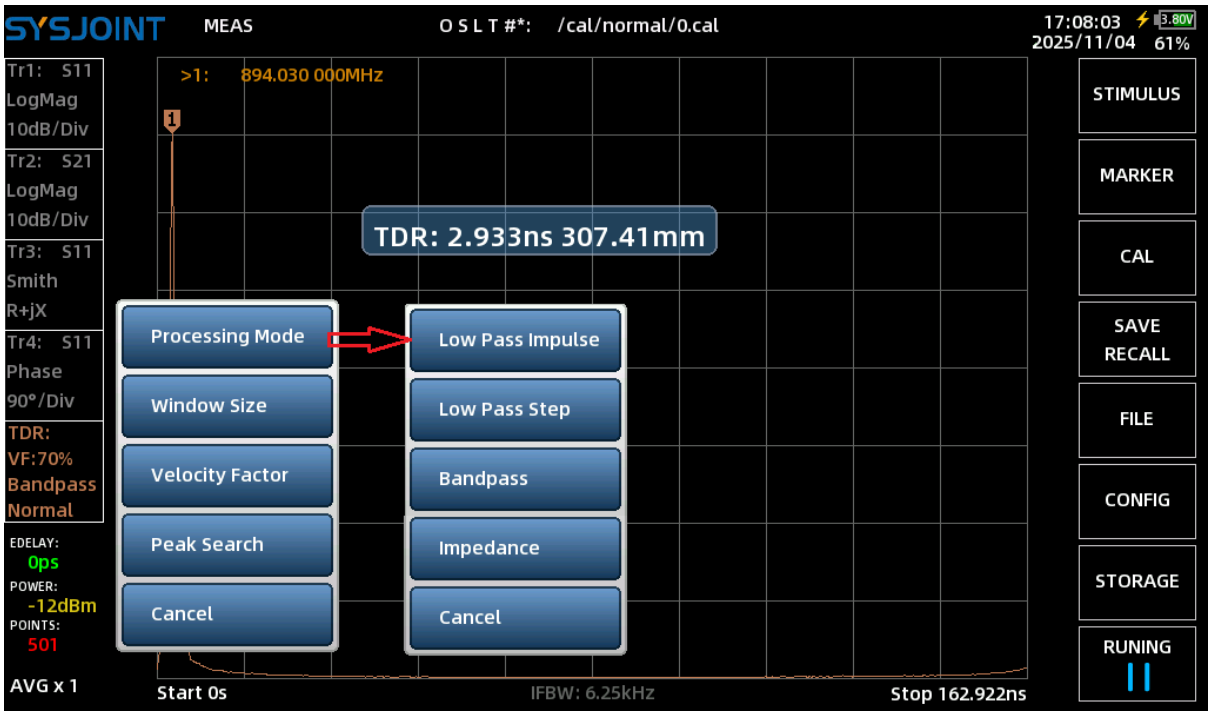
⑮ TDR control box

SV6301A can be used as a Time Domain Reflectometry (TDR), which is meaningful for S11 only.

Touch 

to turn on TDR, then a brown TDR trace will appear.

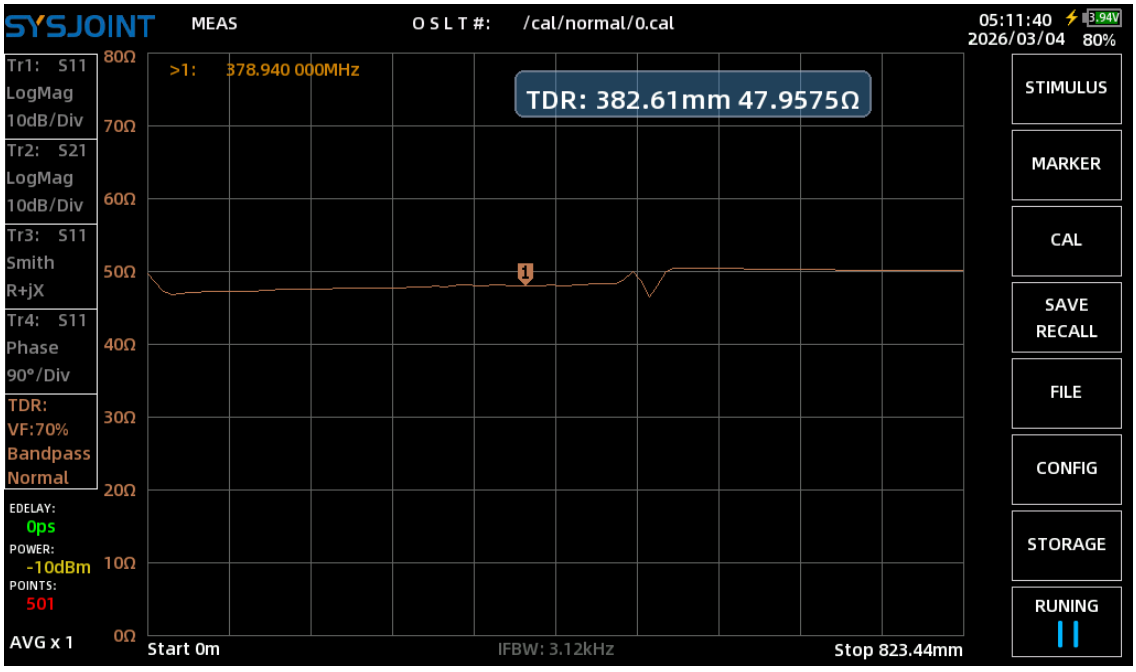
Connect a cable to PORT1, keep the other end of the cable open or shorted, then move the marker to the peak of TDR trace, the estimated cable length will be reported on the screen.



Long-press on TDR: VF:70% Bandpass Normal to call up the TDR setting menu.

【**Filter Type**】is used to specify the filter type of signal processing. There are 3 kinds of digital processing mode available:【**Low Pass Impulse**】,【**Low Pass Step**】,【**Bandpass**】,【**Impedance**】, and the default setting is bandpass.

When choose【**Impedance**】, the characteristic impedance measurement function is enabled (connect the DUT cable to PORT1 and connect a 50ohm loader to the other end of the cable). The characteristic impedance measurement result is as the figure below:

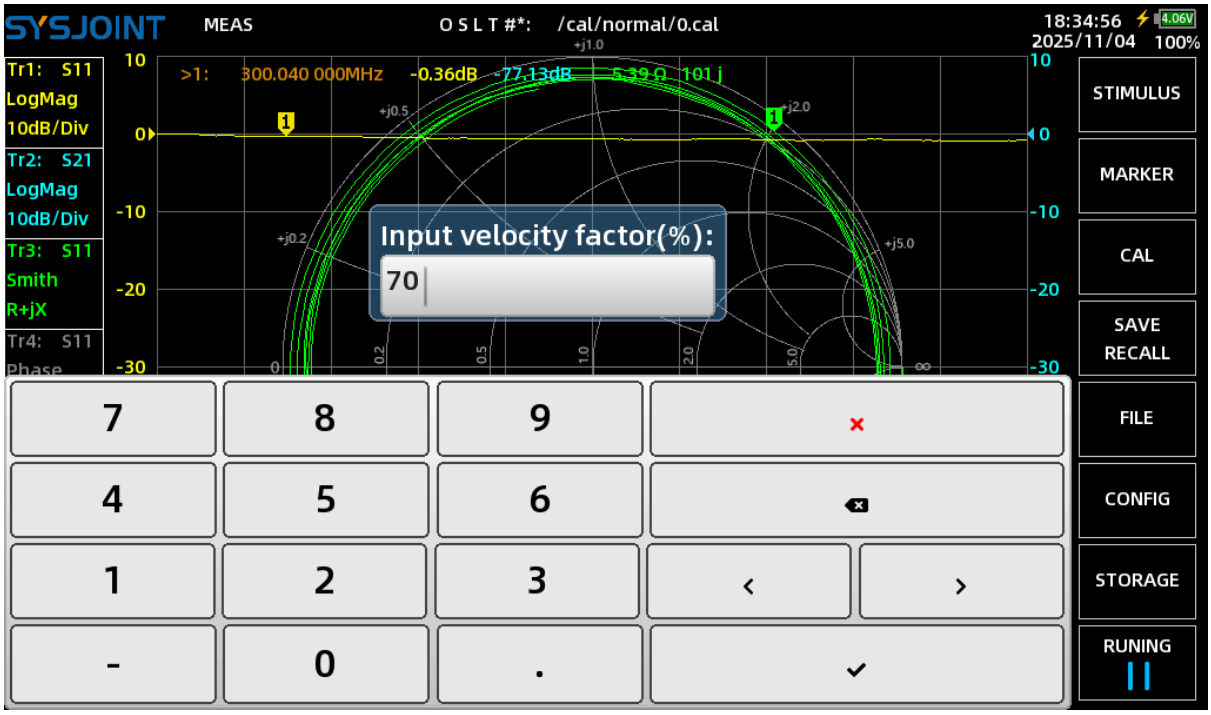


Touch right bottom of the screen where displayed **Stop xxx mm** to set an appropriate measurement range based on the length of the DUT cable.

【Window Size】 is used to specify the window size of signal processing. There three levels of window size: **【Max】**, **【Normal】**, **【Min】**, and the default setting is normal.

【Velocity Factor】 is used to specify the velocity factor of the cable under test. Velocity factor is defined as the ratio of the electromagnetic wave speed in the transmission line to the electromagnetic wave speed in vacuum.

E.g., the typical velocity factor of RG405 cable is 70%, to get the length of a RG405 cable, you should touch on the area of **【Velocity Factor】**, then input 70 on the virtual keyboard and end up with '√'.



Touch on **【Peak Search】** to automatically move the marker to the peak of the TDR trace.

When using TDR, setting appropriate frequency range and sweep points will help us make the testing more efficient.

The maximum cable length (Lmax) that can be measured by TDR is determined by the following formula:

$$\mathrm{Lmax} = \frac{1}{2} \times \frac{1}{\Delta f} \times c \times VF$$

Where C represents the electromagnetic wave speed in vacuum, VF is velocity factor, Δf is the frequency step which is determined by the frequency SPAN and sweep points:

$$\Delta f = \frac{\mathrm{SPAN}}{\mathrm{N} - 1}$$

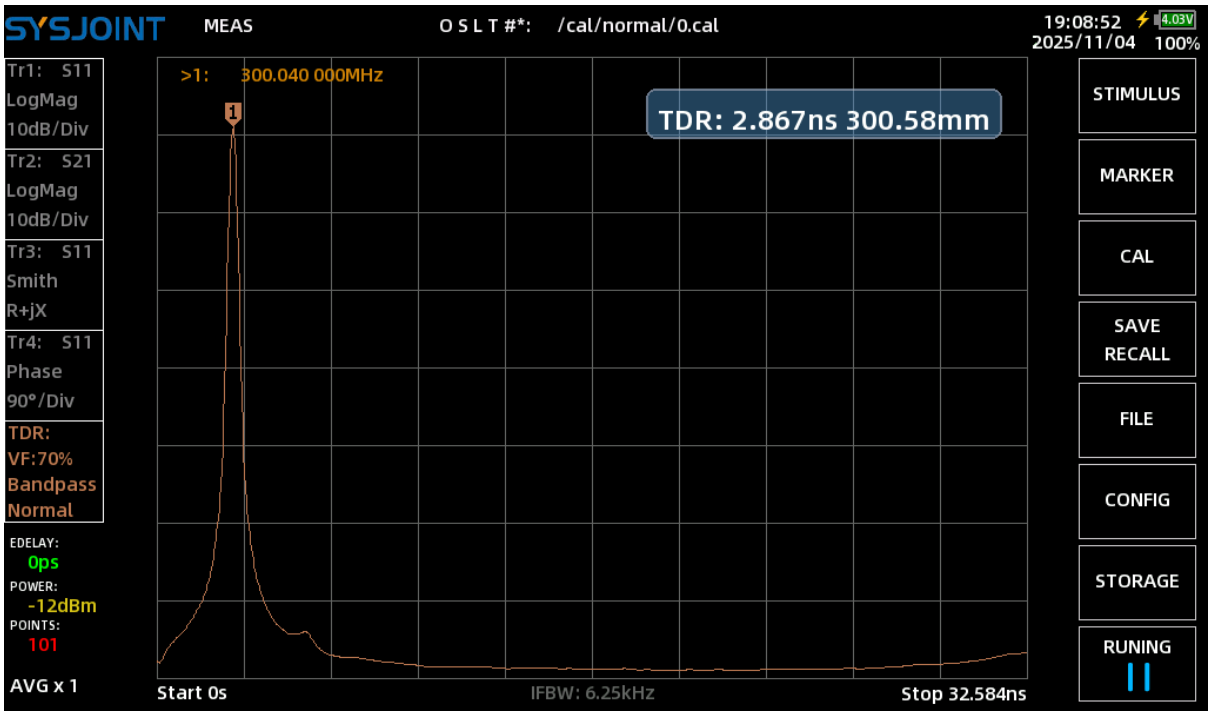
Where SPAN is the frequency span in Hz. N represents the sweep points.

When SPAN = 3GHz and sweep points N = 501, Δf will be 6MHz, as VF is 70%, Lmax is calculated 17.5 meters.

As the time domain transformation points is fixed 1024 points in SV6301A, the range resolution will be 17.5 m/1024=17.08 mm, which is not precise enough for short cables.

Notice that Lmax is inversely proportional to Δf, and Δf is determined by the SPAN and sweep points. If the sweep points reduced, Δf will increase, thereby Lmax decreased, and the range resolution get improved.

Change the sweep points to 101, and the Lmax will be 3.5 meter, so the range resolution is improved to 3.4mm, and the TDR measurement result is more accurate.



⑯ Scan status info

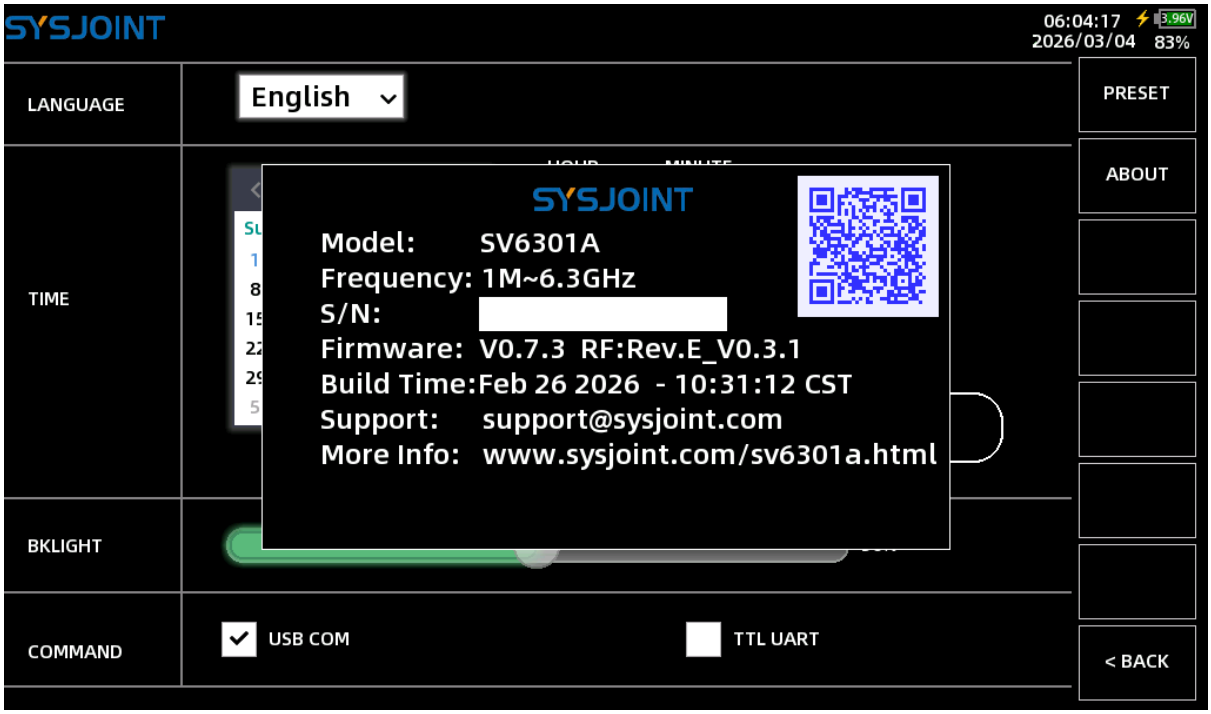
Info display	Description
MEAS	Normal scanning
PAUSE	Scan paused
Hold (Max)	Max hold
Hold (Min)	Min hold

⑰ IFBW

The IF bandwidth is displayed here.

⑱ About

Touch on the logo SYSJOINT in the upper left corner of the screen or go to the menu【CONFIG】→【ABOUT】to view the device information: model, frequency range, serial number, firmware version, etc.



⑲ Marker Aux Line

The marker aux line is used to view the specific values of memory traces, the frequency values of all intersections on this line are the same (except Smith and polar).
Go to the menu【MARKER】→【INFO SET】to open the DISPLAY SET dialog, and turn on/off the MKR AUX LINE.

4. Menus

4.1. STIMULUS

【STIMULUS】menu contains menu items of【SET FREQUENCY】,【ANALYSIS】,【IFBW】,【POWER】,【AVG】,【SWEEP POINTS】,【SIGNAL GENERATOR】.

4.1.1 SET FREQUENCY

SV6301A supports two sweep modes: non-single-frequency sweep and single-frequency sweep.

For non-single frequency sweep, the frequency range can be set in two ways:

(1) Specify start and stop frequencies;

(2) Specify center frequency and span.

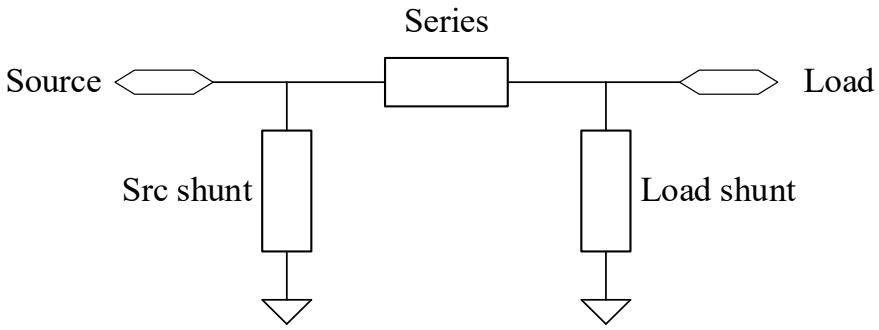
For single-frequency sweep, you should specify the CW FREQ.

4.1.2 ANALYSIS

There are three analysis functions: 【L/C MATCH】,【LIMIT TEST】and【SWEEP ANALYSIS】.

4.1.2.1 L/C MATCH

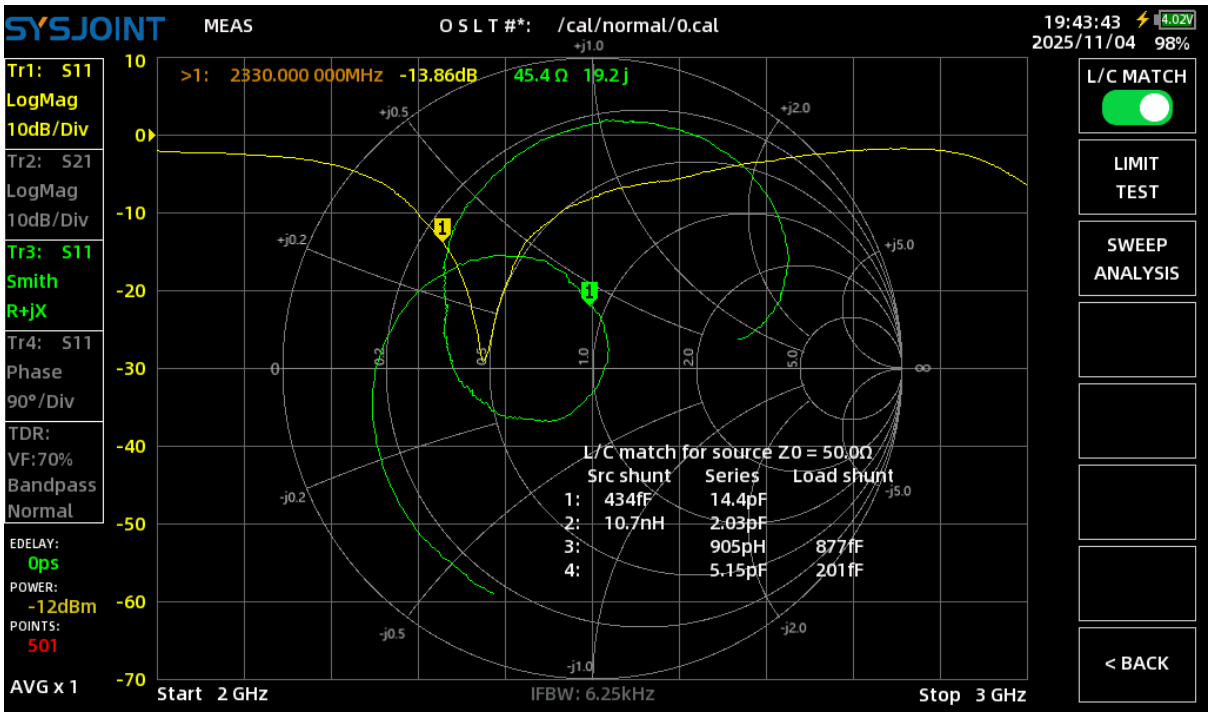
SV6301A supports automatic calculation of L/C matching parameters, and enables matching the load impedance to a source impedance of 50 ohms.
The structure of the L/C matching network is shown in the following figure:



L/C matching example:

In the figure below, load impedance is 45.4+19.2j, and SV6301A automatically generates 4 matching methods:

① 434fF capacitor for source shunt and 14.4pF capacitor in series;
② 10.7nH inductor for source shunt and 2.03pF capacitor in series;
③ 877fF capacitor for load shunt and 905pH inductor in series;
④ 201fF capacitor for load shunt and 5.15pF capacitor in series.



4.1.2.2 LIMIT TEST

See section 6.4 for details.

4.1.2.3 SWEEP ANALYSIS

SV6301A supports automatic filter scanning analysis, which allows for quick analysis of filter

characteristics and VSWR.

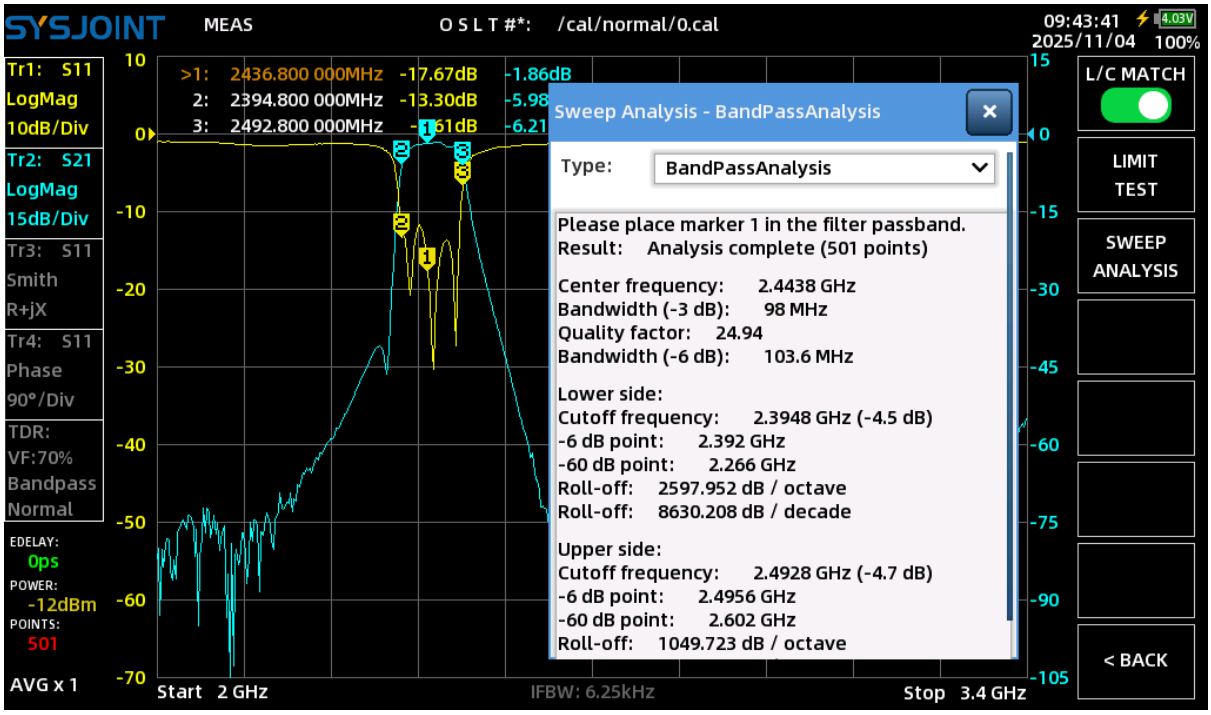
The following is an example of using **SWEEP ANALYSIS** to analyze a band-pass filter:

① Set an appropriate frequency range;

② Turn off all markers except for Marker 1;

③ Move marker 1 to the passband of the S21 trace;

④ Touch on 【**SWEEP ANALYSIS**】 to open the sweep analysis dialog, select **[Band Pass Analysis]** from the dropdown box, Then we will obtain the center frequency, passband bandwidth, quality factor, and other information of the filter.

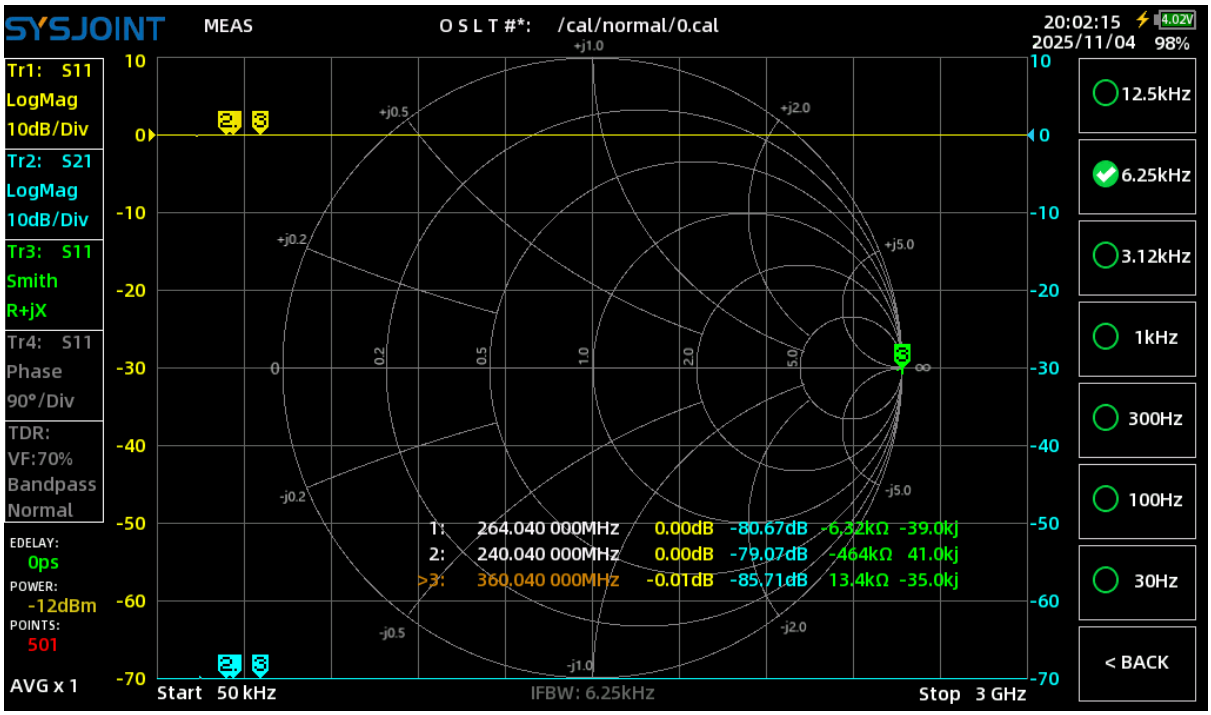


4.1.3 IFBW

IFBW refers to the bandwidth of the IF filter of the receiver inside the VNA. A wider IF bandwidth will increase the sweep speed of the VNA, but causes more noise to enter the receiver inside the VNA, which will reducing dynamic range.

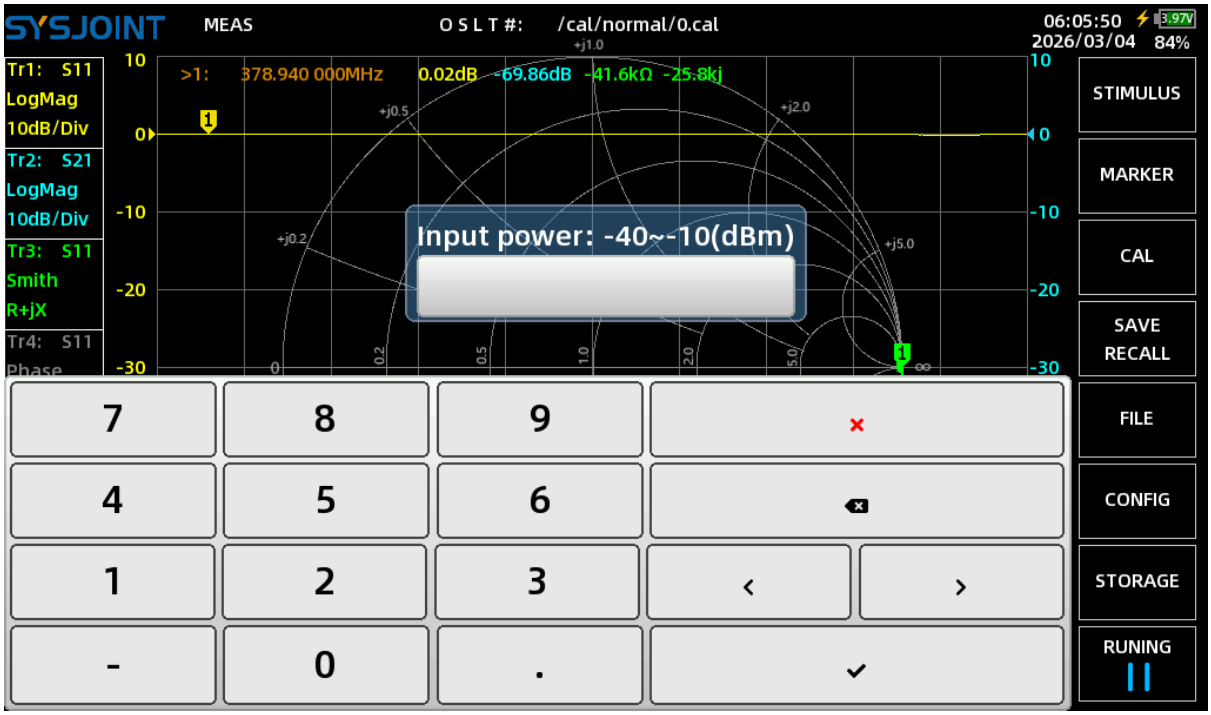
Reducing the IFBW will improve dynamic range, while the sweep speed drops.

The default IFBW is 12.5kHz, which can be set to 12.5kHz, 6.25kHz, 3.12kHz, 1kHz, 300Hz, 100Hz, and 30Hz by selecting 【**STIMULUS**】→【**IFBW**】 from the main menu.



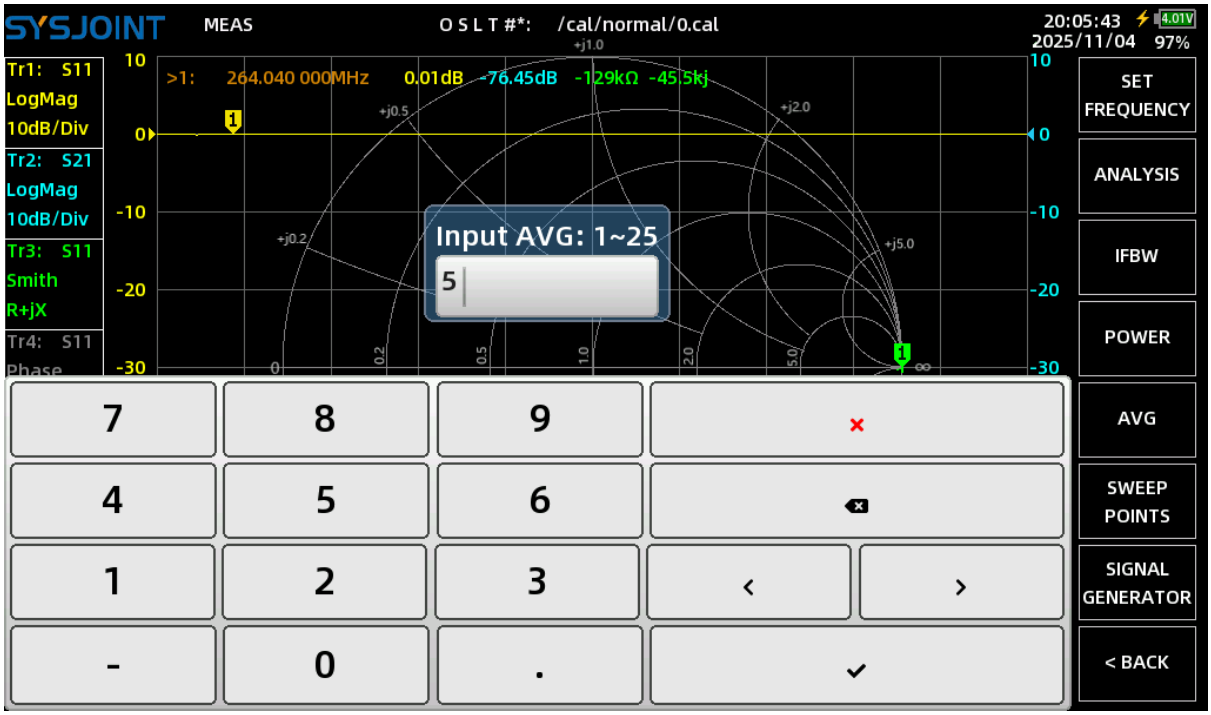
4.1.4 POWER

The RF output power of SV6301A is adjustable from -42dBm to -12dBm. A lower RF output power is suitable for testing the input impedance of amplifier.

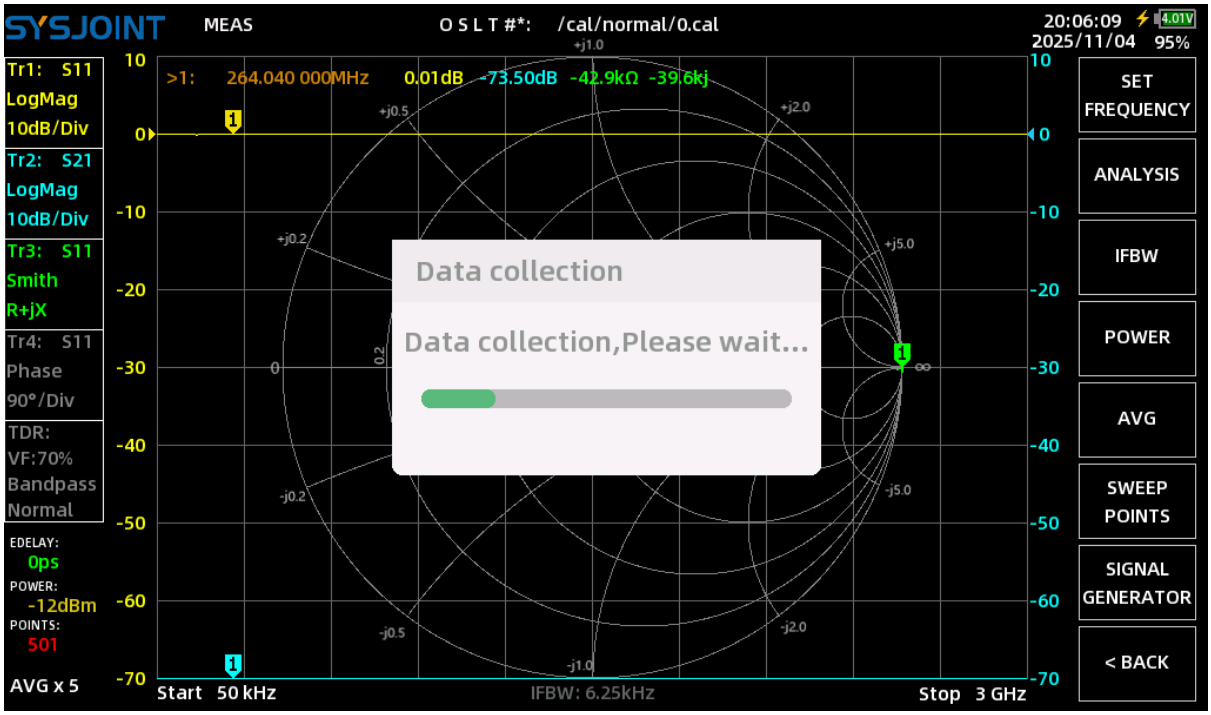


4.1.5 AVG

SV6301A supports data averaging to reduce trace noise, average times: 1 ~ 25.

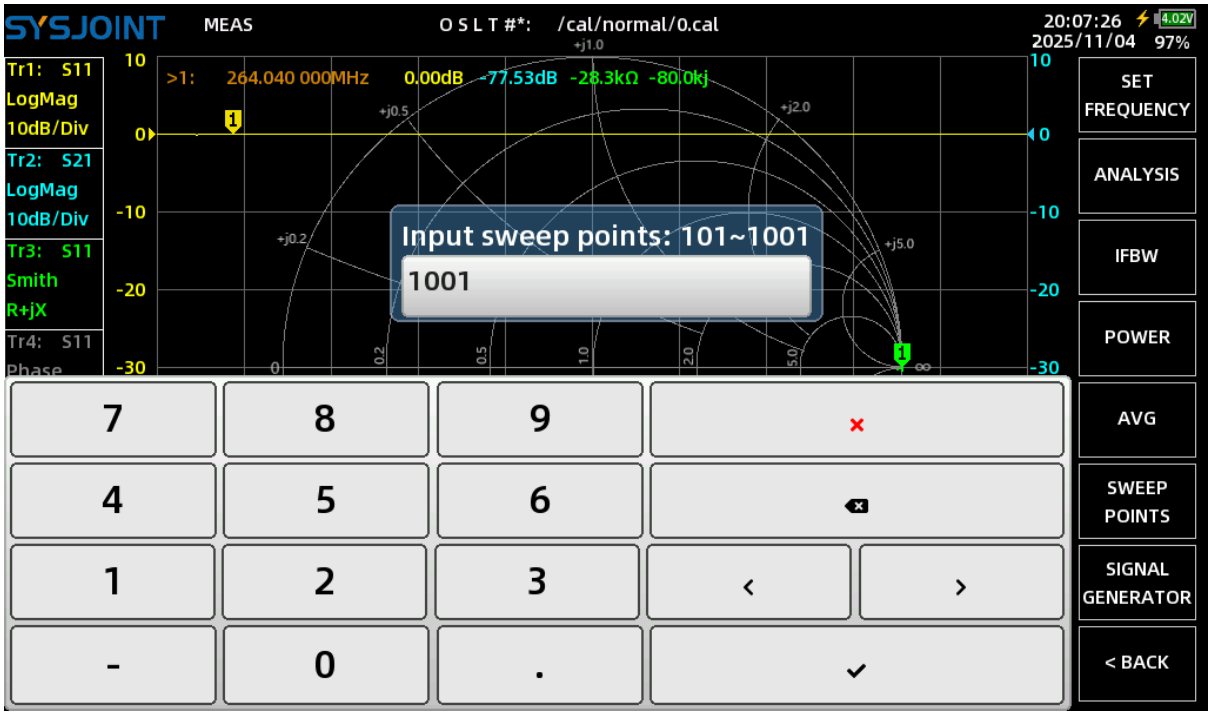


When averaging is set, a data collection progress bar will appear.



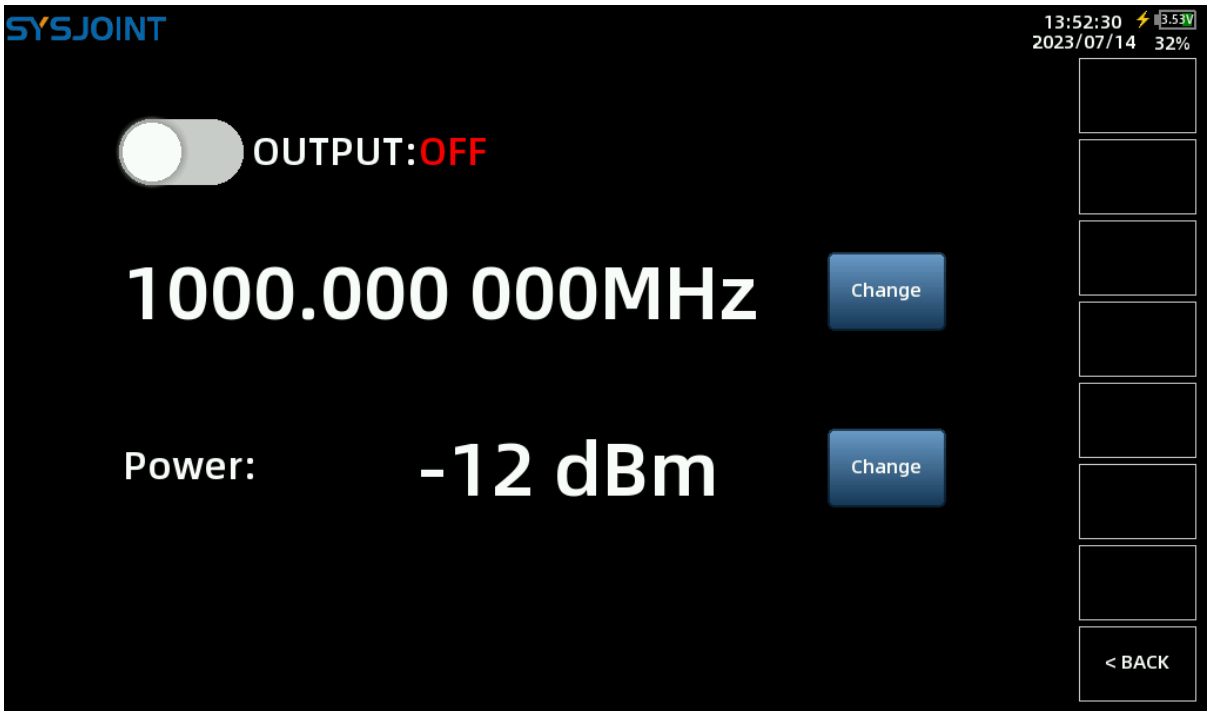
4.1.6 SWEEP POINTS

The sweep points can be set from 101 to 1001.



4.1.7 SIGNAL GENERATOR

The SV6301A has a simple signal generator function with a frequency range of 50kHz to 4.4GHz and a power range of -42dBm to -12dBm, with 1dB steps. It should be noted that the output signal approaches a square wave at the low-frequency range.

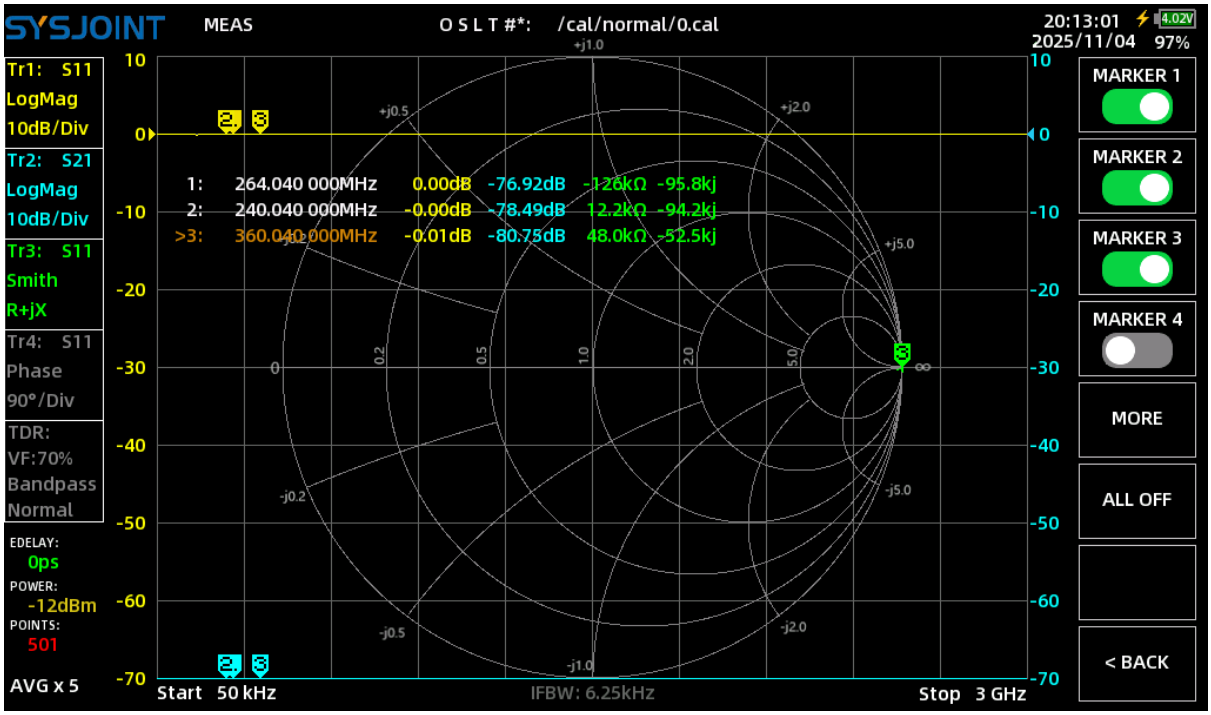


4.2. MARKER

【MARKER】menu contains menu items of【SELECT MARKER】,【SEARCH】,【INFO SET】,【DRAG ON】,【OPERATIONS】.

4.2.1 SELECT MARKER

【SELECT MARKER】menu contains menu items of【MARKER 1】,【MARKER 2】,【MARKER 3】,【MARKER 4】,【MORE】,【ALL OFF】.



【MARKER n】is used to turn on, turn off or activate a marker. If a marker is turned off (take marker 3 in the above figure as an example), touch on【MARKER 4】will turn on marker 4, and a '>' symbol will appear ahead marker 4 on the marker table, indicating that marker 4 is activated. Touch on【MARKER 4】again will turn off marker 4.

Touch on the menu item corresponding to a turned-on marker will activate the marker. Take the above figure as an example, marker 3 is the active marker, when you touch on【MARKER 1】the '>' symbol will move to the first row of the marker table, indicating that marker 1 has become the active marker.

【ALL OFF】is used to turn off all the markers at a time.

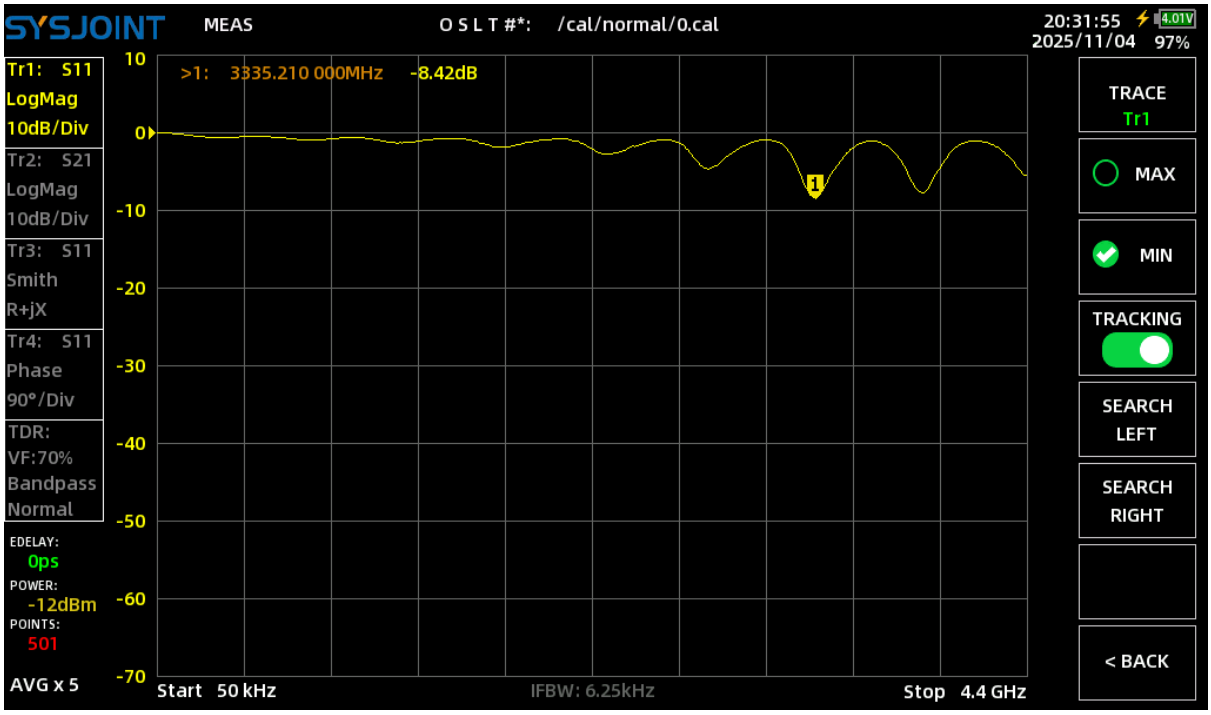
4.2.2 SEARCH

With the【SEARCH】menu you can configure tracking for each marker individually. The setup steps are as follows:

① Select a marker;

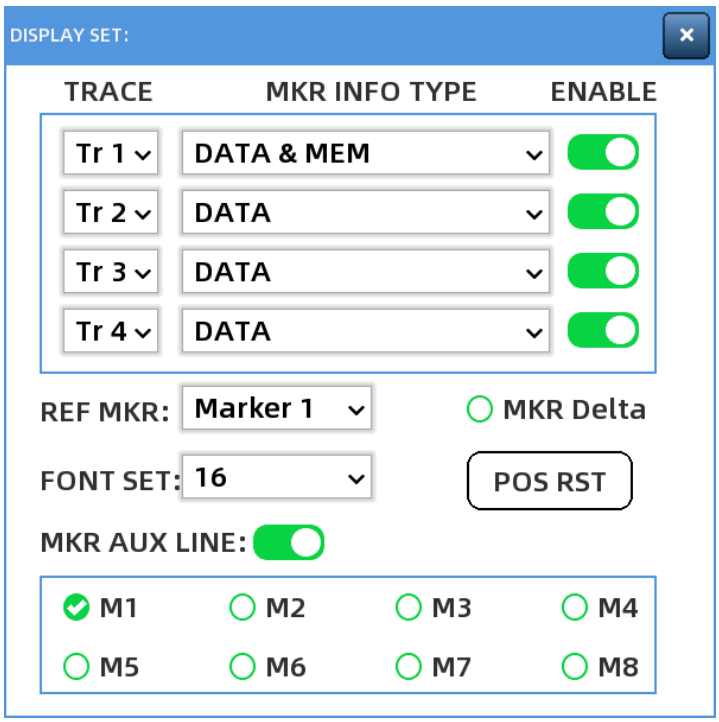
② Bind the selected marker to the specified trace by【SEARCH】→【TRACE】;

③ Select the search type (MAX or MIN), and the marker will immediately move to the position of the maximum or minimum value of the trace;
④ Turn on 【TRACKING】 to let the marker track the maximum or minimum value of the trace;
⑤ Use 【SEARCH LEFT/RIGHT】 to move the marker to the left or right to search for another extreme value.



4.2.3 INFO SET

Touch on 【INFO SET】 to call up the 'DISPLAY SET' dialog. There are settings of **MARKER INFO TYPE, MKR Delta, FONT SET, MKR AUX LINE, etc.**



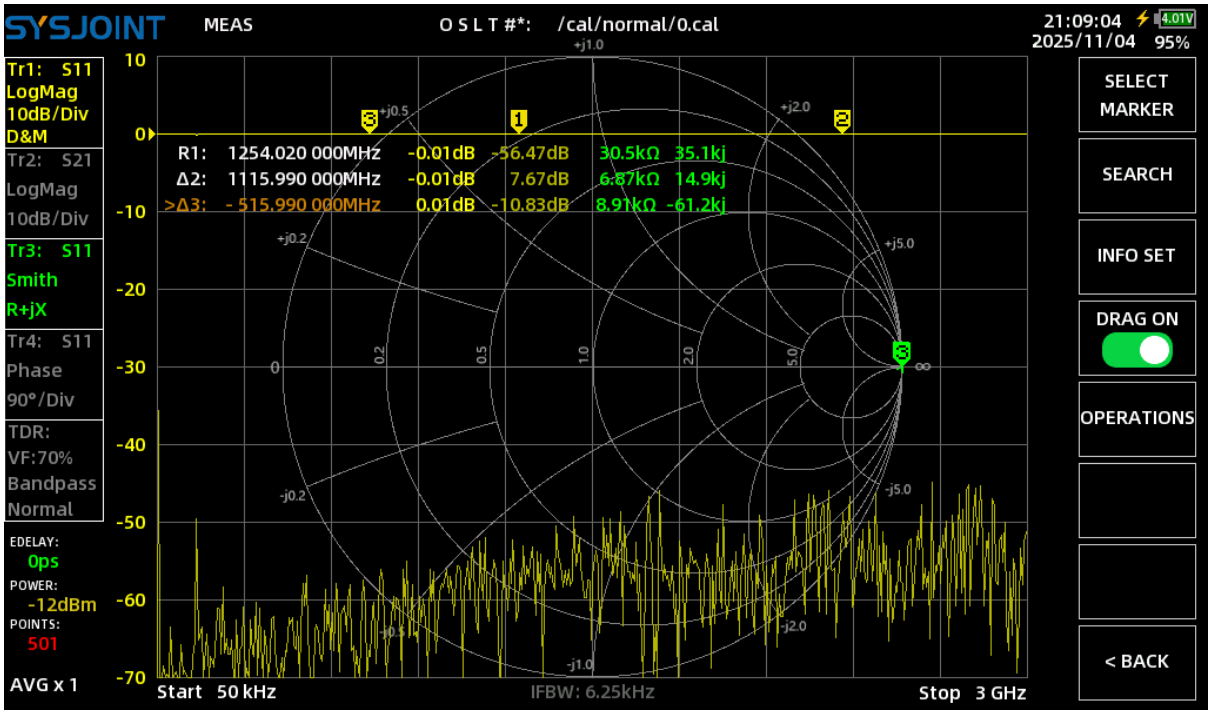
【MKR INFO TYPE】 is used to set which of traces and what kind of the marker info will be displayed on the marker table.

The first column is configured with the corresponding traces, selectable from Tr1 to Tr4. The left scale axis will display the scale corresponding to the trace selected in the first row. The right scale axis will display the scale corresponding to the trace selected in the second row.

The description of the contents displayed in the second column is as follows:

Marker info type	Description
DATA	Display the data trace only
DATA & MEM	Display the data trace and the memory trace
DATA & ΔY (DATA, MEM)	Display the data trace and the absolute value of the difference between the data trace and the memory trace

【MKR Delta】 When enabled, a Δ symbol will appear in front of the non-reference marker, and the reference marker will be marked with an R in front. The frequencies and values in the marker table indicate the difference from the reference marker, as shown in the figure below:



【FONT SET】 is used to set the font size of marker table, available font sizes are 16, 18, 20, and 24.

【POS RST】 is used to reset the display position of the marker table.

【MKR AUX LINE】 is used to turn on/off the marker aux line.

4.2.4 DRAG ON

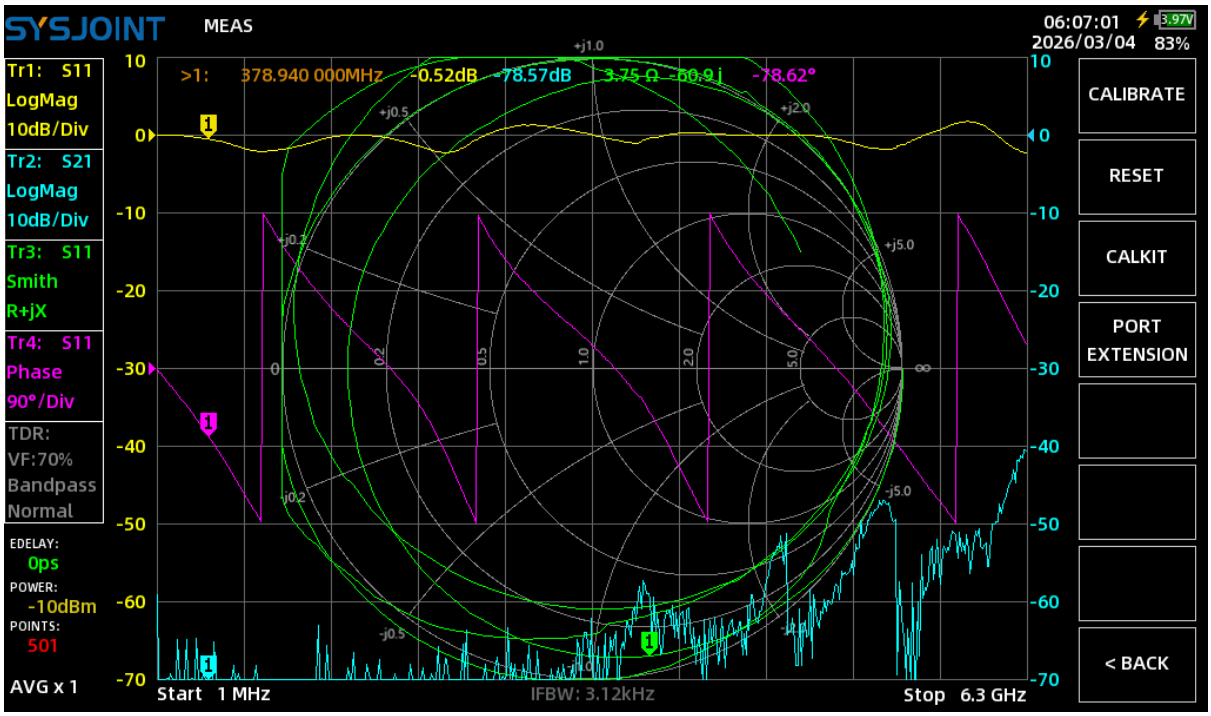
【DRAG ON】 is used to enable/disable the draggable attribute of the marker.

4.2.5 OPERATIONS

Operations	Description
>START	Use the frequency of the selected marker as the start frequency
>STOP	Use the frequency of the selected marker as the stop frequency
>CENTER	Use the frequency of the selected marker as the center frequency
>SPAN	Use the frequency of the selected marker as the span frequency

4.3. CAL

【CAL】menu contains menu items of【CALIBRATE】,【RESET】,【CALKIT】,【PORT EXTENSION】.

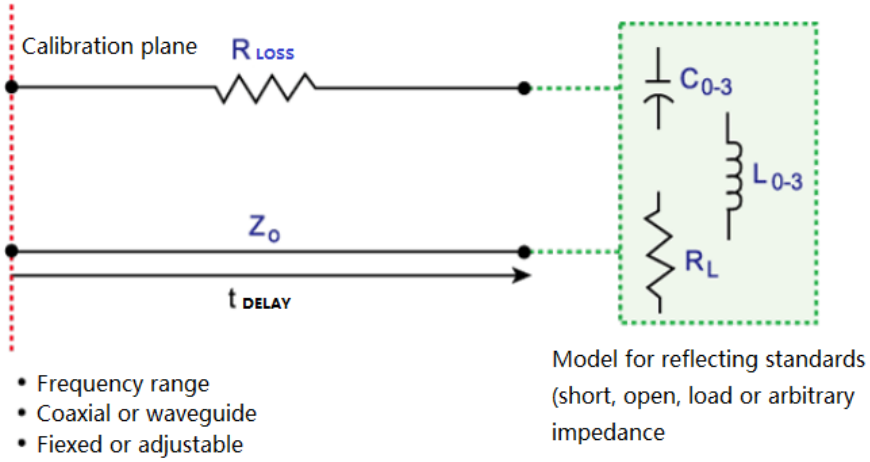


4.3.1 RESET

Touch on【RESET】will clear the calibration states in the RAM, and the calibration states indicators **'OSLT#*'** will also disappear, but the calibration states stored in the memory card will not be deleted, and they will be recalled by selecting【SAVE/RECALL】→【RECALL】→【RECALL n】from the main menu.

4.3.2 CALKIT

The SV6301A supports calibration kit editing to achieve higher measurement accuracy.
The menu【CALKIT】contains menu items of【EDIT CALKIT】,【SAVE CALKIT】and【RECALL CALKIT】.
The following figure shows the parameters used to define the standard reflection model (short-circuit, open-circuit, or load):



- Z0

The bias impedance between the standard to be defined and the actual measurement plane. Z0 is usually set to the characteristic impedance of the system.

- DELAY

The delay that occurs depends on the length of the transmission line between the standard to be defined and the actual measurement plane. In open, short, or load standards, the delay is defined as the one-way propagation time (in seconds) from the measurement plane to the standard. In a thru standard, the delay is defined as the one-way propagation time (in seconds) from one measurement plane to another. The delay can be determined by measurement or by dividing the exact physical length of the standard by the velocity factor.

- LOSS

Loss is used to determine the energy loss caused by the skin effect along the length of a coaxial cable (one-way). Loss is defined in units of Ω/m at 1 GHz. In many applications, using a value of 0 for loss should not result in significant errors. Standard loss can be determined by measuring the delay (seconds) and the loss at 1 GHz, and then substituting the measured values into the formula below.

$$Loss\left(\frac{\Omega}{s}\right) = \frac{loss(dB) \times Z_0(\Omega)}{4.3429(dB) \times delay(s)}$$

- C0, C1, C2, C3

Open-circuit standards rarely have ideal reflection characteristics at high frequencies. This is due to the edge capacitance of the open-circuit standard, which causes a phase shift that varies with frequency. For the internal calculations of the analyzer, an open-circuit capacitance model is used. This model is represented as a frequency function of a third-order polynomial. The coefficients in the polynomial can be defined by the user. The formula for the capacitance model is as follows:

$$C = (C0) + (C1 \times F) + (C2 \times F^2) + (C3 \times F^3)$$

Where,

F: measurement frequency

C0: a constant with the unit of Farad(F)
C1: a constant with the unit of F/Hz
C2: a constant with the unit of F/Hz^2
C2: a constant with the unit of F/Hz^3

- L0, L1, L2, L3

Short-circuit standards rarely exhibit ideal reflection characteristics at high frequencies. This is due to the residual inductance of the short-circuit standard, which causes a frequency-dependent phase shift. This effect cannot be eliminated. For internal calculations of the analyzer, a short-circuit inductance model is used. This model is represented as a frequency function of a third-order polynomial. The coefficients in the polynomial can be defined by the user. The formula for the inductance model is shown as follows:

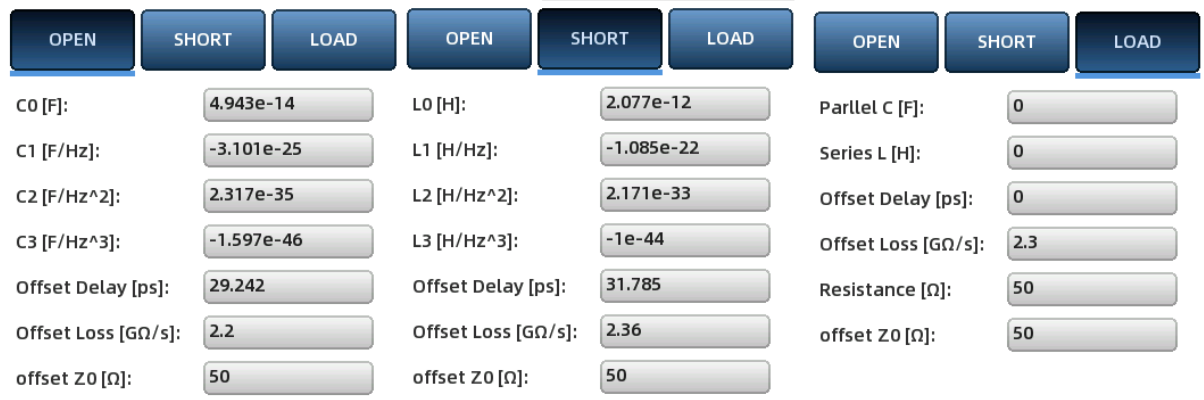
$$L = (L0) + (L1 \times F) + (L2 \times F^2) + (L3 \times F^3)$$

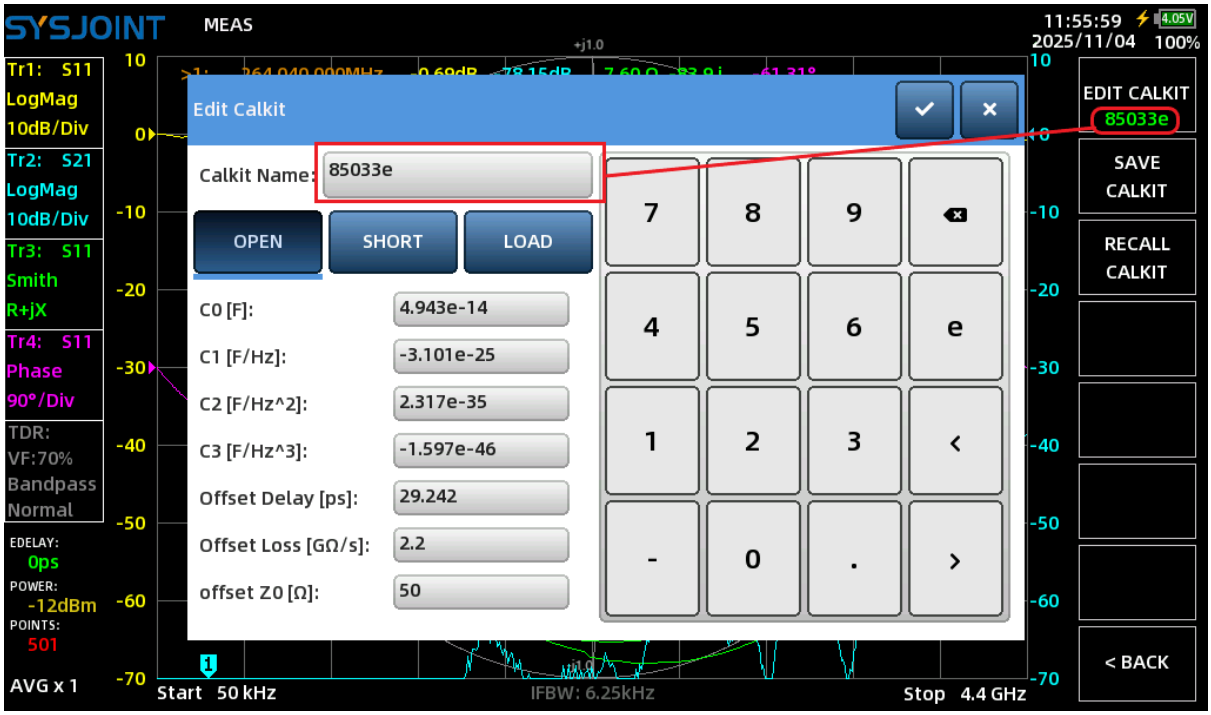
Where,
F: measurement frequency
L0: a constant with the unit of Henry(H)
L1: a constant with the unit of H/Hz
L2: a constant with the unit of H/Hz^2
L2: a constant with the unit of H/Hz^3

Taking the example of importing the Agilent 85033E calibration kit parameters:

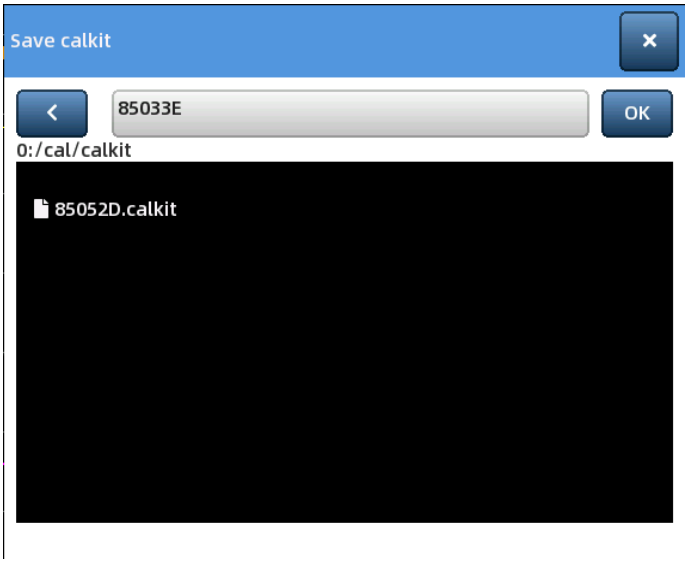
Table: Parameters of the 3.5-mm male Agilent 85033E Standards

Parameter	Unit	OPEN	SHORT	MATCH
C_0	$\times 10^{-15}$ [F]	+49.43		
C_1	$\times 10^{-27}$ [F/Hz]	-310.1		
C_2	$\times 10^{-36}$ [F/Hz^2]	+23.17		
C_3	$\times 10^{-45}$ [F/Hz^3]	-0.1597		
L_0	$\times 10^{-12}$ [H]		+2.077	
L_1	$\times 10^{-24}$ [H/Hz]		-108.5	
L_2	$\times 10^{-33}$ [H/Hz^2]		+2.171	
L_3	$\times 10^{-42}$ [H/Hz^3]		-0.01	
termination resistance	[Ω]			50
offset Z_0	[Ω]	50	50	50
offset delay	[ps]	29.242	31.785	0
offset loss	[GΩ/s]	2.2	2.36	2.3

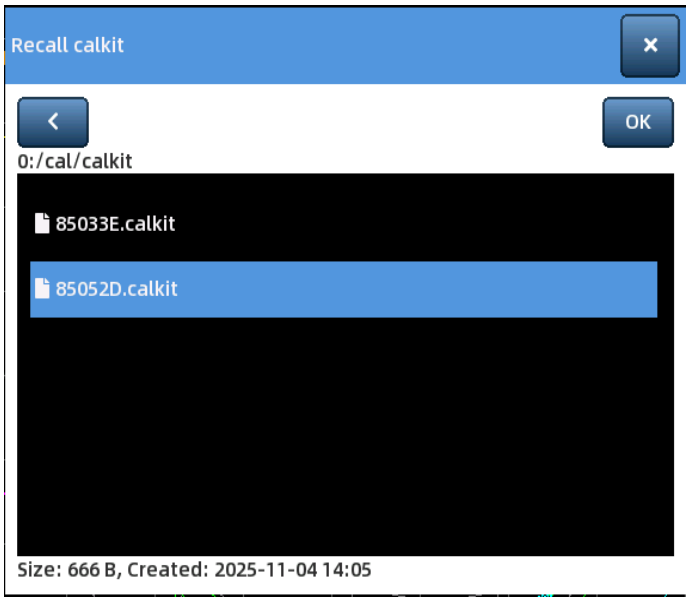




Calibration kit parameters can be saved as a file in XML format. Touch【SAVE CALKIT】, a file save dialog will pop up, confirm the path and enter the file name, and click【OK】to save.



The calibration kit parameter can also be recalled. Touch【**RECALL CALKIT**】, a file explorer dialog will pop up, select the calibration kit file you want to recall, and click【**OK**】to load the selected calibration kit.



4.3.4 CALIBRATE

【**CALIBRATE**】is used for calibration.

The following accessories should be prepared before calibration:

(1) N-to-SMA adapters;
(2) SMA OPEN calibration piece;
(3) SMA SHORT calibration piece;
(4) SMA LOAD calibration piece;
(5) SMA-JJ coaxial cable;
(6) SMA-KK adapter (optional).

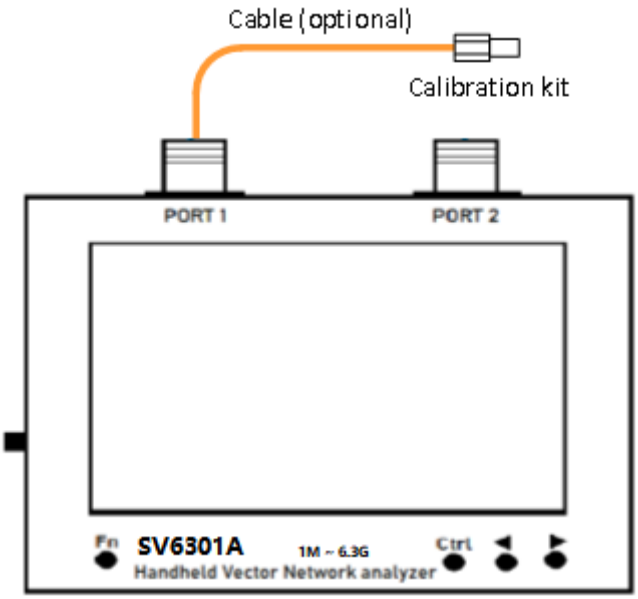
Firstly, you need to set an appropriate frequency range, see section 4.1.1 for details.

Touch on【**CALIBRATE**】to enter the calibration menu, and perform the calibration according to the following steps:

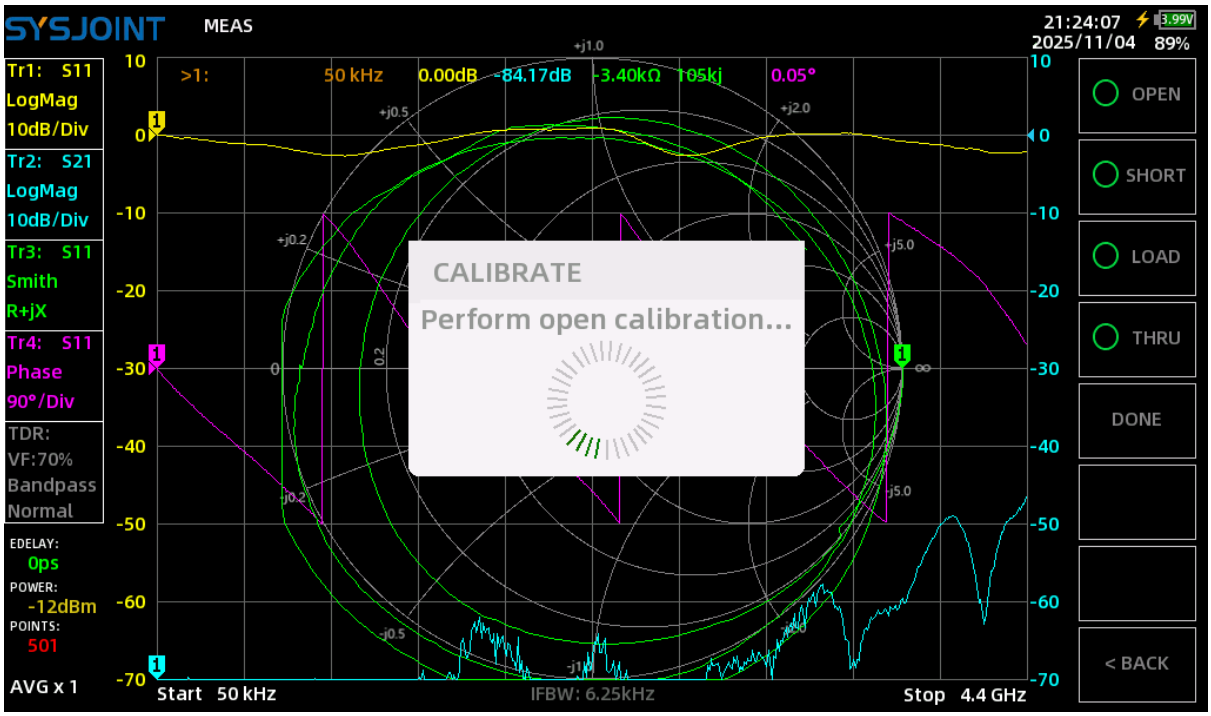
Step ①

Connect N-to SMA-adapters to PORT1 and PORT2, then connect the OPEN calibration piece to

PORT1 or the end of the cable connected to PORT1, as shown in the figure below.



Touch on 【**OPEN**】 to perform OPEN calibration. After the open calibration is completed, a '√' sign will appear on the 【**OPEN**】 menu item, and the letter '**O**' will appear on the upper part of the screen at the same time, indicating that the device has been performed the open calibration.



NOTE: We usually need to connect the DUT to VNA with cables, in this time, the cable becomes a part of the measuring system, and the end of the cable becomes the VNA port.

Step ②

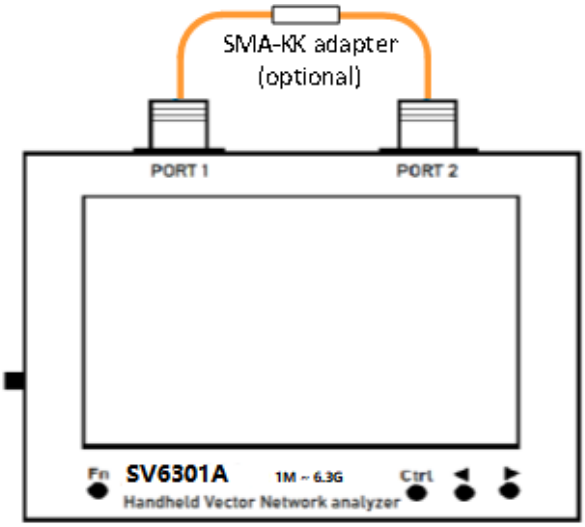
Connect the SHORT calibration piece to PORT1 or the end of the cable connected to PORT1, then touch on 【**SHORT**】 to perform the short calibration.

Step ③

Connect the LOAD calibration piece to PORT1 or the end of the cable connected to PORT1, then touch on **【LOAD】** to perform the load calibration.

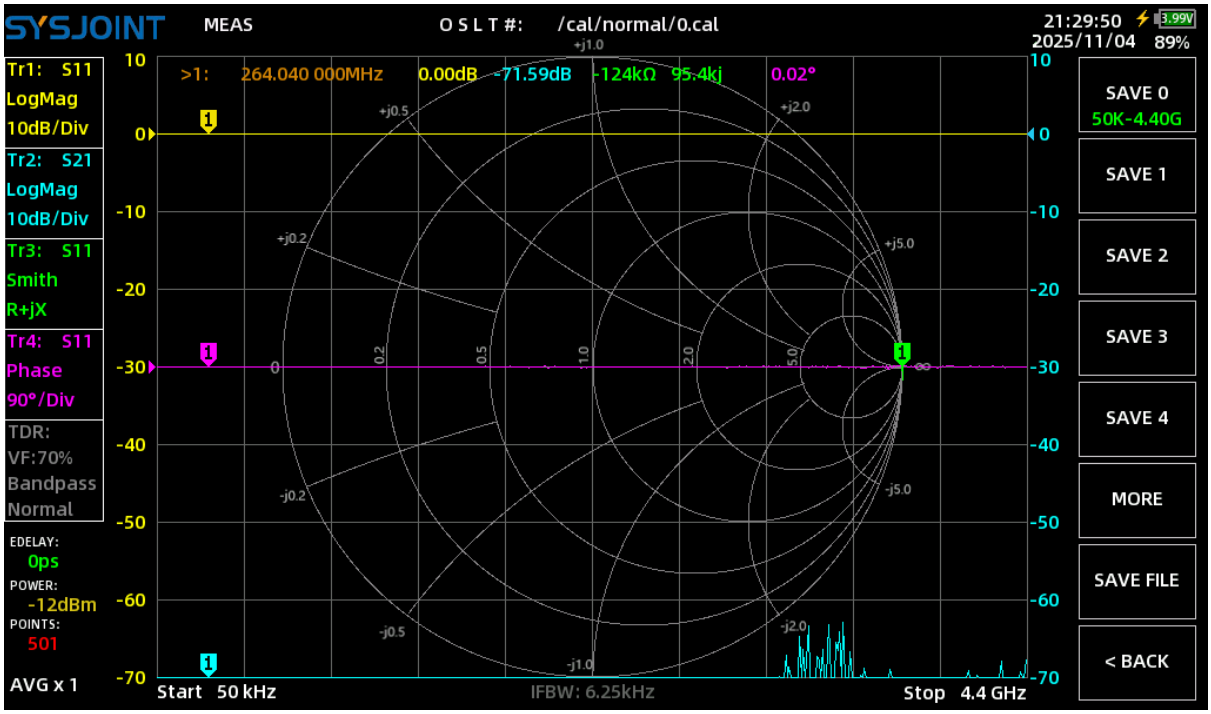
Step ④

Connect PORT1 and PORT2 with cable and adapter (optional), as shown in the figure below, then touch on **【THRU】** to perform the through calibration.



Step ⑤

Touch on **【DONE】**, the string '**OSLT #***' will appear on the upper part of the screen, indicating that the calibration state has been generated but not yet saved. Touch on **【SAVE n】** to save the calibration state, and the frequency range of the calibration state will be display on the menu item. You can also touch on **【SAVE FILE】** to save the calibration state into a file with a custom file name.



When properly calibrated, the VNA should have the following characteristics:

(1) When PORT1 is open-circuited, the S11 Smith trace converges on the far-right side of the Smith chart, the value of S11 LOGMAG is near 0dB, for S21 LOGMAG trace, the lower the better.

(2) When PORT1 is short-circuited, the S11 Smith trace converges on the far-left side of the Smith chart, the value of S11 LOGMAG is near 0dB, for S21 LOGMAG trace, the lower the better.

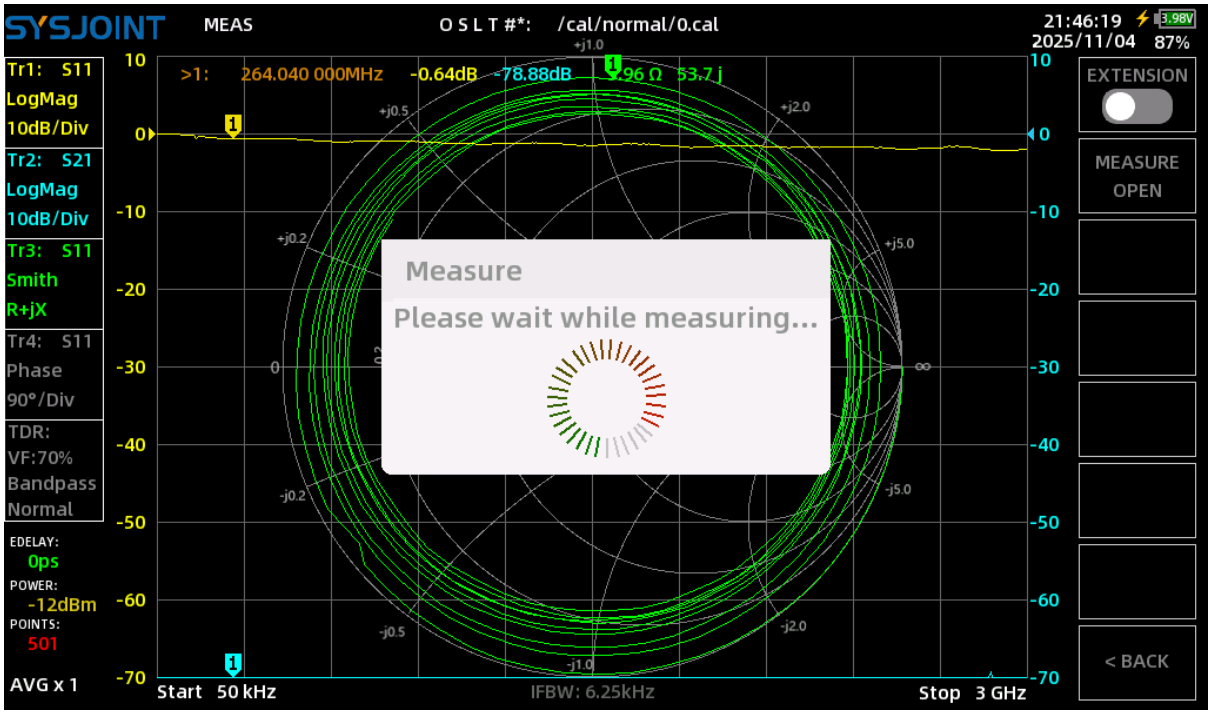
(3) When PORT1 is connected to a 50-ohm load, the S11 Smith traces converge at the center of the Smith chart. For S11 and S21 LOGMAG trace, the lower the better.

(4) When PORT1 and PORT2 are directly connected with a RF cable, the S11 Smith trace is near the center of the Smith chart, and the S21 LOGMAG value is near 0dB. For S11 LOGMAG trace, the lower the better.

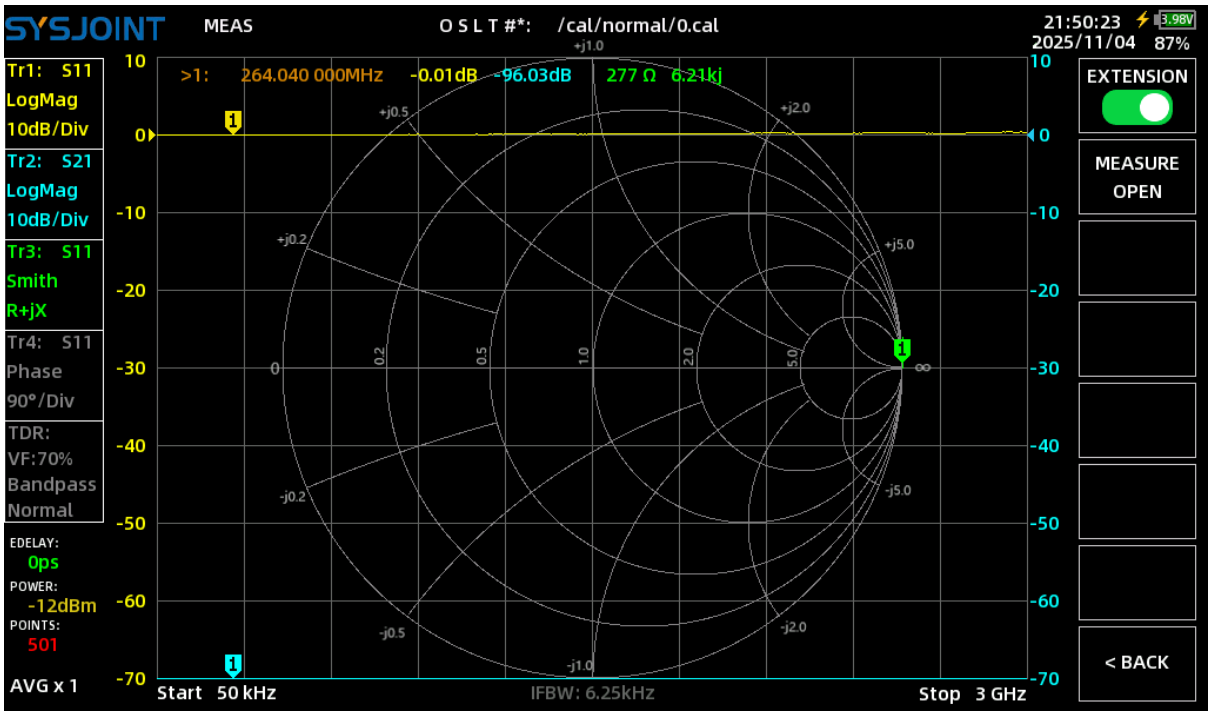
4.3.4 PORT EXTENSION

The SV6301A supports the port extension, which eliminates the effects of cables/fixtures by measuring the open state of the cables/fixtures. Port extension is very useful when the DUT may be located at a long distance or in a position that is not easily connected directly to the VNA.

The operation steps for port extension are as follows:
① Ensure that the SV6301A has been properly calibrated.
② Connect the cable or fixture to PORT1, keeping the end of the cable or fixture open.
③ Touch on 【**MEASURE OPEN**】 and wait for the measurement to complete.

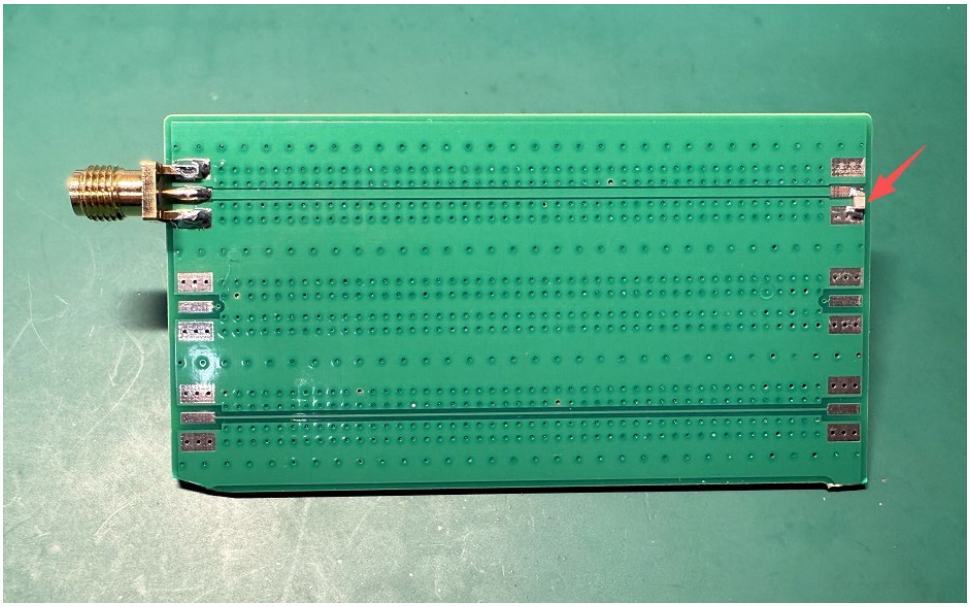


④ Touch on 【**EXTENSION**】 to enable port extension, and the Smith trace will converge at the right-side open point.

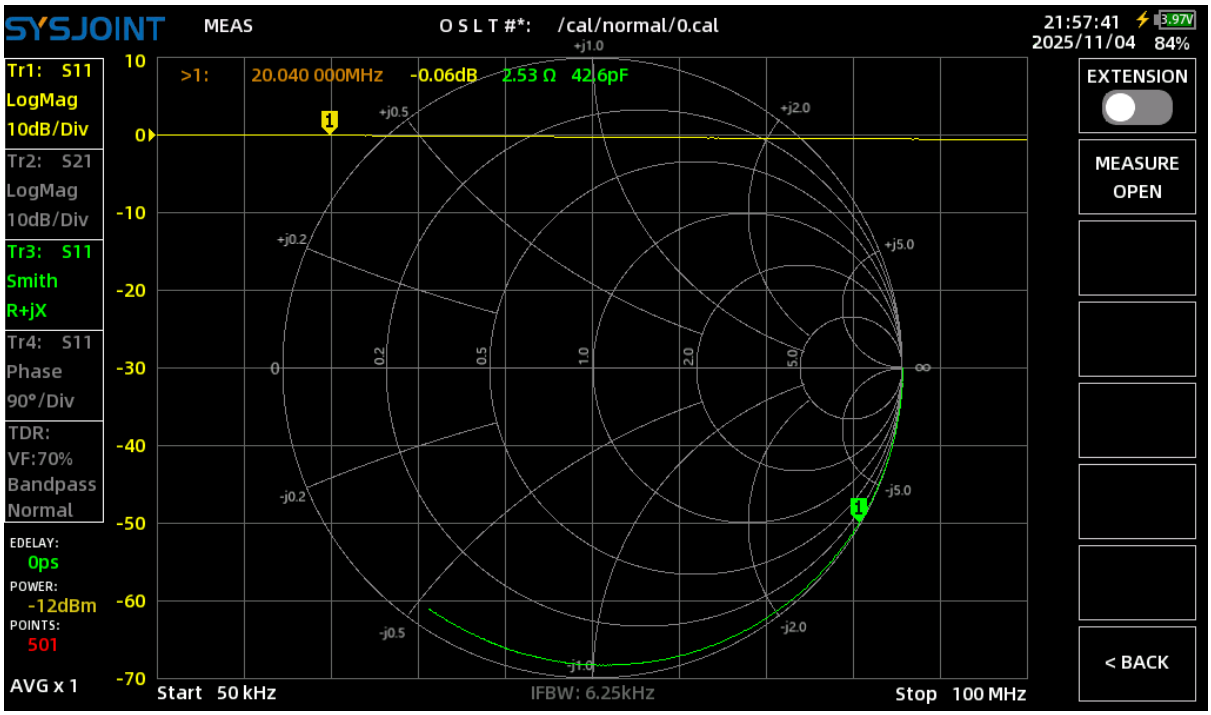


The following is a typical application case of port extension:

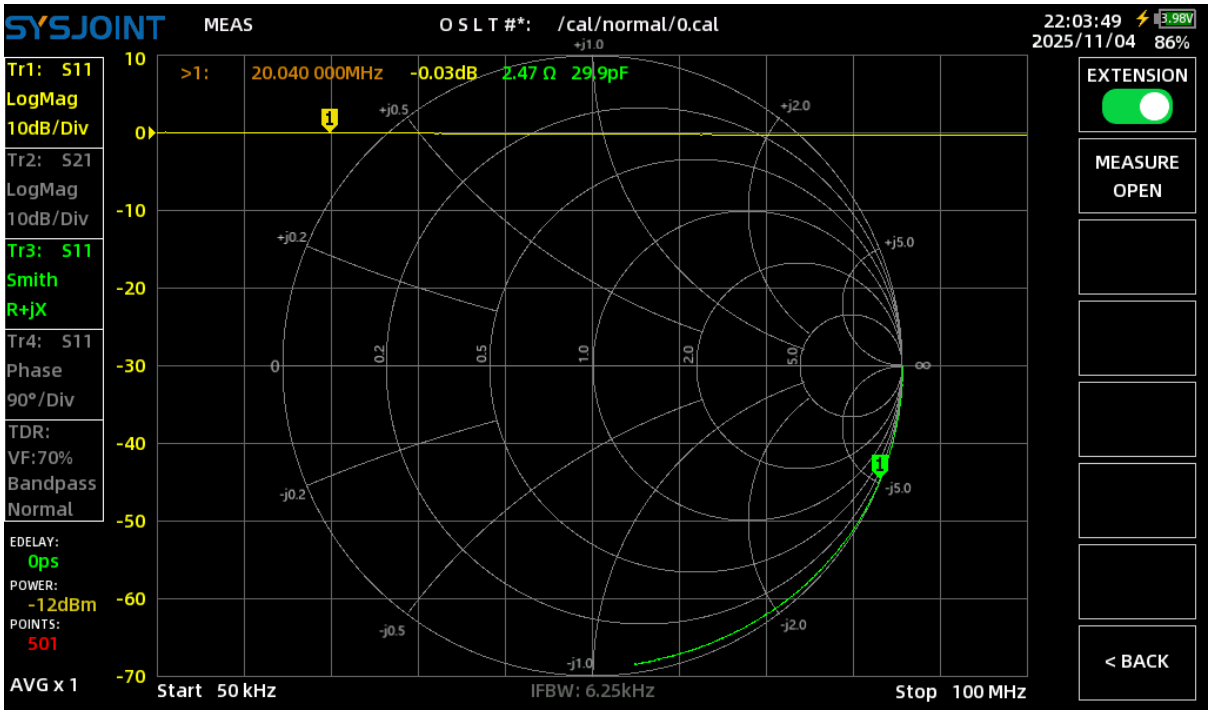
The device under test is a surface-mount capacitor with a nominal value of 30pF and an 0805 package, located on the right side of the circuit board, and connected to the SMA connector on the left side through a section of PCB trace, as shown in the figure below:



When testing, it is usually necessary to use a cable to connect the SMA connector of the above circuit board to the test port of the VNA. Although we can eliminate the effect of the cable on the measurement results by calibrating at the end of the cable, the electrical delay and loss introduced by the traces on the circuit board are often difficult to eliminate. If measured directly, we will obtain the following result: the measured capacitance is 42.6 pF, which deviates significantly from the nominal value.



Change to port extension testing method: first, remove the capacitor from the circuit board, connect the SMA connector to the PORT1 of the SV6301A with the same cable, touch on 【**MEASURE OPEN**】, then touch on 【**EXTENSION**】, and finally install the capacitor back on the circuit board to obtain the following results:



It can be seen that the capacitance value obtained using the port extension method is 29.9 pF, which is almost the same as the nominal value, indicating that using port extension to eliminate the influence of cables/fixtures is very effective.

4.4. SAVE/RECALL

【SAVE/RECALL】contains menu items of【RECALL】and【SAVE】.

4.4.1 RECALL

Touch on【RECALL n】to recall calibration state from slot n.
Touch on【RECALL FILE】to call up the 'Recall from file' dialog, and choose a .cal file to recall the corresponding calibration state. The user named calibration files are under the path of /cal.

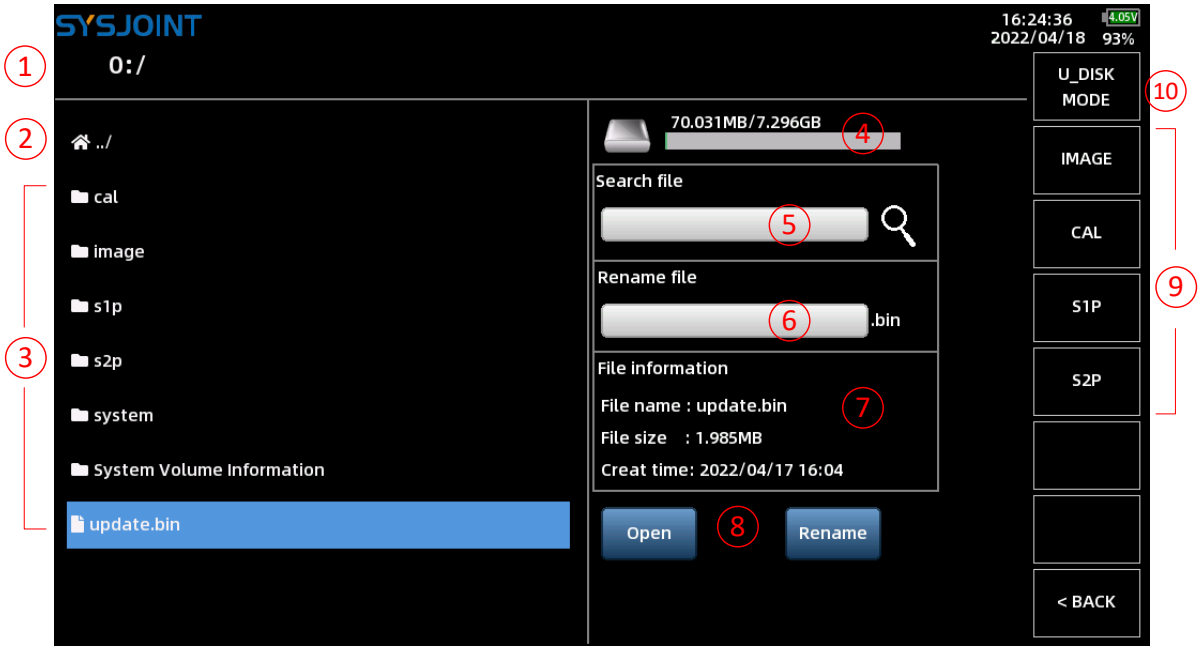
4.4.2 SAVE

Touch on【SAVE n】to save the calibration state, and the frequency range of the calibration state will be display on the menu item.

You can also touch on【SAVE FILE】to save the calibration state as a file with a custom file name. The automatically generated file name is a string containing information of start and stop frequencies, RF output power, IF bandwidth, and sweep points. You can change the filename by the virtual keyboard.

4.5. FILE

Touch on【FILE】to enter the file management interface.
You will be able to access files on SV6301A and do file browsing, searching, copying, pasting, renaming, deleting, etc.



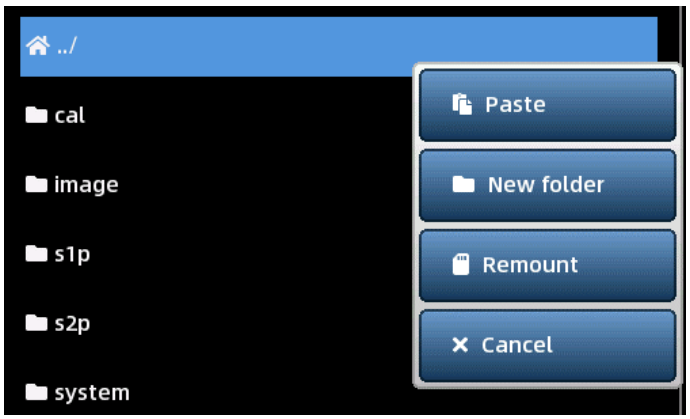
① File path

The current path is displayed here.

② Home icon

Touch on the home icon (🏠) to return to the parent directory. If the current path is the root directory, touching on the home icon will refresh the directory.

Long-press on the home icon will call up the quick menu of **【Paste】**, **【New folder】** and **【Remount】**.



Touch on **【Paste】** to paste the copied file or folder to the root directory. This menu item will not appear if the user has no copy or cut operations before.

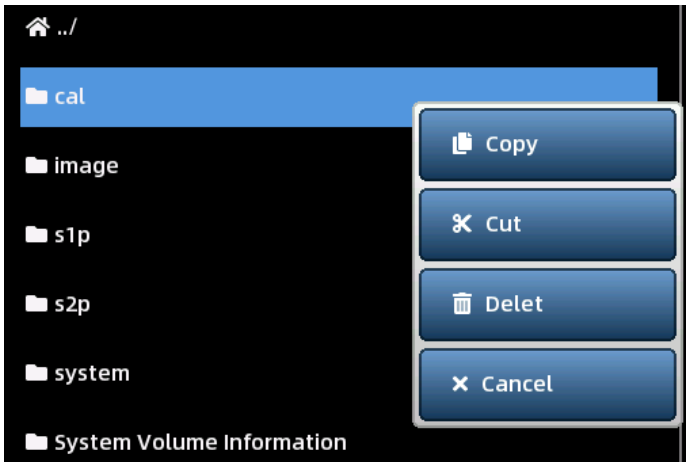
Touch on **【New folder】** to create a new folder under the root directory.

Touch on **【Remount】** to remount the memory card when file access error occurs.

③ File list

Touch on a folder will enter the sub-directory of the folder. Touch on a file will select the file, and you will be able to view the file information on the right side, and you can also open or rename the selected file.

Long-press on a file or folder will call up the quick menu of **【Copy】**, **【Cut】** and **【Delete】**.

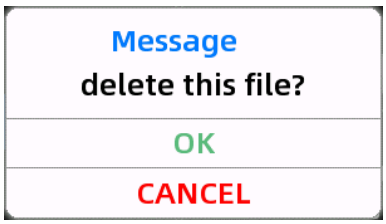


Touch on **【Copy】**, then enter the target directory and Long-press the home icon, select **【Paste】** to copy the file or folder to the target directory.

Touch on **【Cut】**, then enter the target directory and Long-press the home icon, select **【Paste】**

to move the file or folder to the target directory.

【Delete】 is used to delete a file or folder. A confirmation dialog will appear when deleting a file or folder. Select 'OK' to confirm the deletion, select 'CANCLE' to cancel the deletion.



④ Memory card usage

The usage of the internal memory card is displayed here.

⑤ Search file

Touch on the search bar to enter keywords, then touch the magnifying glass icon to launch searching. The search results will list all files that contain the keywords under the current directory.

⑥ Rename file

To rename a file, please select a file firstly, then touch on the rename bar to enter the new filename, then touch on 【Rename】 button to execute renaming.

For renaming a folder, please firstly Long-press on the folder to call up the quick menu, then select 【Cancel】, and the folder will become selected. After doing this, you can enter the new name and execute renaming.

⑦ File information

The file name, size and creation time of the currently selected file will be displayed here.

⑧ Open and Rename

Touch on 【Open】 button to open the selected file (only valid calibration files, snp files or screenshots can be opened).

Touch on 【Rename】 button to rename the selected file or folder.

⑨ Quick search menu

Search all directories on the memory card according to the file type. If there are a large number of files, the search may take a long time.

【IMAGE】 Search all the screenshots on the memory card;

【CAL】 Search all the cal-files on the memory card;

【S1P】 Search all the s1p files on the memory card;

【S2P】 Search all the s2p files on the memory card;

⑩ U_DISK MODE

【U_DISK MODE】: Connect SV6301A to your Windows PC with the USB Type-C cable, then touch on 【U_DISK MODE】, a new disk will appear on your PC, and you will be able to access files in SV6301A memory card from PC. Pay attention that screenshotting is not available under U-disk mode.

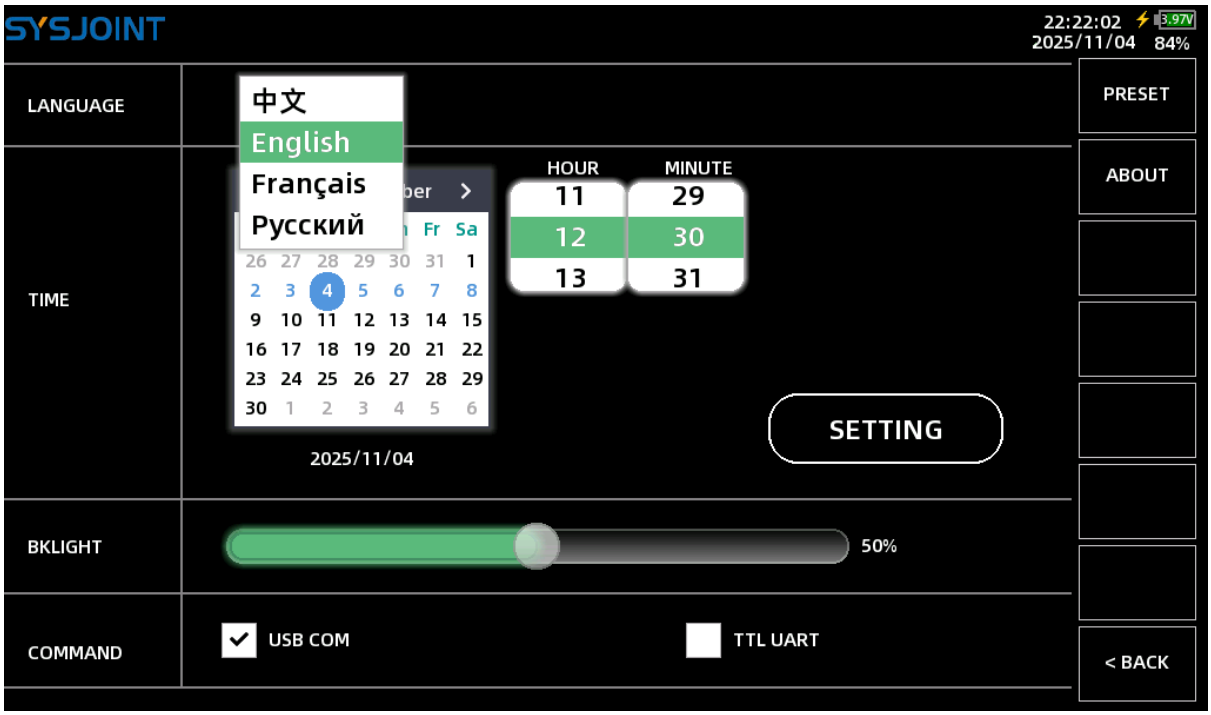
4.6. CONFIG

There are 4 configuration items on the settings page: **LANGUAGE**, **TIME**, **BKLIGHT** and **COMMAND.**

LANGUAGE: Chinese/ English/ French/ Russian.

TIME: User can set the year, month, and date through the calendar, set the hour and minute through the virtual wheel, and touch on the 【SETTING】 button to complete the setting.

BKLIGHT: Slide to adjust the backlight brightness.



COMMAND: Select USB COM or TTL UART mode.

When select **USB COM**, user can use the included USB cable to connect the device's side USB Type-C port to the PC's USB-A port for charging or data transfer.

When select **TTL UART**, user can interact with the SV6301A through TTL UART. The USB-A interface on the side of the SV6301A is a TTL-UART interface, with the baud rate fixed at 115200. The signal definitions of this interface are as follows:

4.7. STORAGE

【STORAGE】menu contains menu items of【SAVE S1P】,【SAVE S2P】, 【AUTO SAVE】, 【SAVE TRACE】.

4.7.1 SAVE S1P

Touch on【SAVE S1P】to save the s-parameter data to S1P file, and the file can be exported to PC through the USB Type-C port.

4.7.2 SAVE S2P

Touch on【SAVE S2P】to save the s-parameter data to S2P file.

4.7.3 SAVE TRACE

Save the currently opened trace formatting results to a local disk as a .csv file, which can be exported to a PC via a USB interface. The data format is as follows:

	A	B	C	D	E
1	#File created by SV6301A FW:0.7.3;				
2	#File created time: 2025/12/25/09:16:21;				
3	#VNA Calibrate: O S L T #: /cal/normal/1.cal;				
4	#Tr1 对数幅度 S11;				
5	#Tr2 对数幅度 S21;				
6	#Tr3 史密斯 S11;				
7	#Tr4 相频图 S11;				
8	Hz	dB	dB	NA	°
9	50000	-0.0480836	-91.5716	16.5kΩ -5.13kj	-0.0988997
10	6049900	-0.00293024	-88.3334	2.70 Ω -893 j	-6.40916
11	12049800	-0.00592079	-80.6488	1.39 Ω -448 j	-12.7166
12	18049700	-0.000432317	-79.54	45.7mΩ -298 j	-18.9935
13	24049600	0.00813248	-85.4001	-487mΩ -222 j	-25.3065
14	30049500	0.0118314	-84.3395	-457mΩ -176 j	-31.6597
15	36049400	0.013091	-85.5993	-355mΩ -145 j	-37.9836
16	42049300	0.0121783	-76.3729	-246mΩ -122 j	-44.332
17	48049200	0.0153873	-81.3475	-241mΩ -105 j	-50.686
18	54049100	0.00119991	-77.002	-15.1mΩ -92.0 j	-57.0673
19	60049000	0.00585043	-79.3389	-60.9mΩ -80.9 j	-63.4531
20	66048900	-0.000221331	-82.2446	1.94mΩ -71.5 j	-69.8958
21	72048800	-0.00312945	-82.9506	23.6mΩ -63.7 j	-76.2467

4.7.4 AUTO SAVE

This function can be used to save a continuous segment of scanned data. After setting the parameters, every time new scanned data comes in after the specified delay, it will be automatically saved according to the set rules.

For example, if you want to save the scanned data within one minute after a 3-second delay:

【Save Type】 Used to select the type of data;

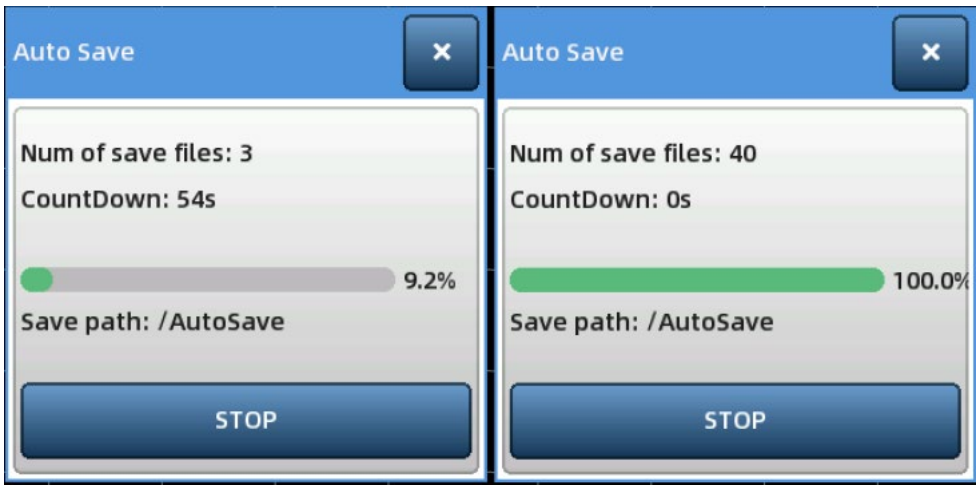
【Condition】 It used to set the count or times. For example, if input 20 with select count, it will save 20 times. If input 20 with select second, it will save 20 seconds. Press the " √ " to confirm the

input.

【**Exec Delay**】**Execution delay**, It indicate the waiting time before the auto-save program start,。

【**Save Path**】When the autosave program start running, it will automatically create files. you can change the default folder by 【**Create new folder to save**】.

When everything is set up, you can start the auto-save program by clicking the '√' at the top of the dialog.



Num of save files: the number of files saved by the current program

Count Down: the amount or time remaining in the current program to be saved.

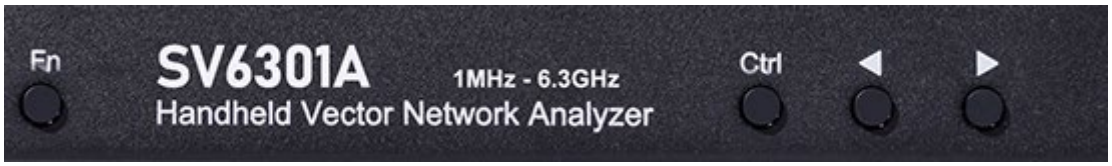
The progress is displayed by the progress bar. The information below it is the name of the saved folder. If you want to terminate the program, you can return to the settings page by the 【**STOP**】 button.

4.8. RUN/PAUSE

Touch to pause scanning, touch again to resume scanning.

5. Physical buttons

SV6301A has 4 physical buttons, which can be used for shortcut operations by single-click, double-click, long-press, and key combination.



5.1. screenshot

Press and hold the **Fn** button, and then click the **Ctrl** button to take a screenshot. Screenshots are named with the time by default and are automatically saved under the path of **/image**.

5.2. Specify marker frequency

Long-press the **Ctrl** button to call up the keyboard. After entering the frequency value, the active marker will move directly to the specified frequency point.

5.3. Add marker

Double click **Ctrl** button to quickly add a new marker, and the new marker is active.

5.4. Delete marker

Double click **Fn** button to quickly delete the active marker.

5.5. Switch active marker

Press and hold the **Fn** button, and then click the ◄ button to inactivate the current marker and activate the marker in front.
Press and hold the **Fn** button, and then click the ► button to inactivate the current marker and activate the marker behind.

6. Additional features

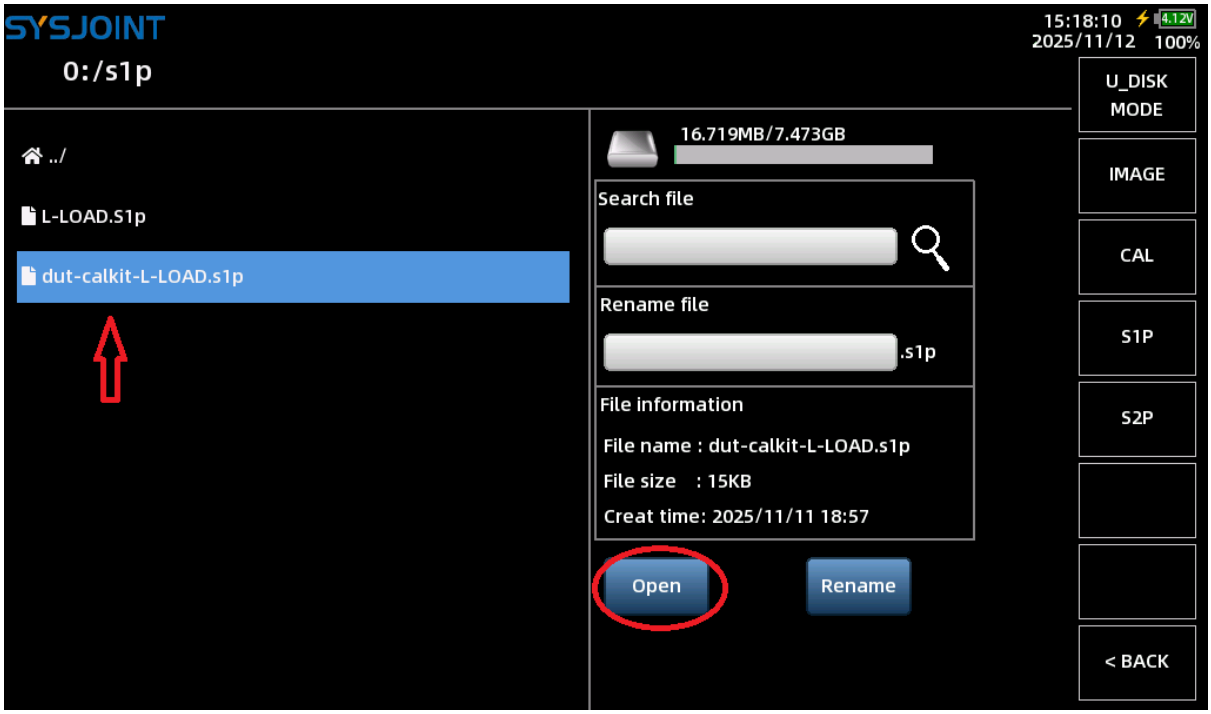
6.1. User defined Info

SV6301A supports displaying user-defined information on the boot screen. The setting method is as follows:

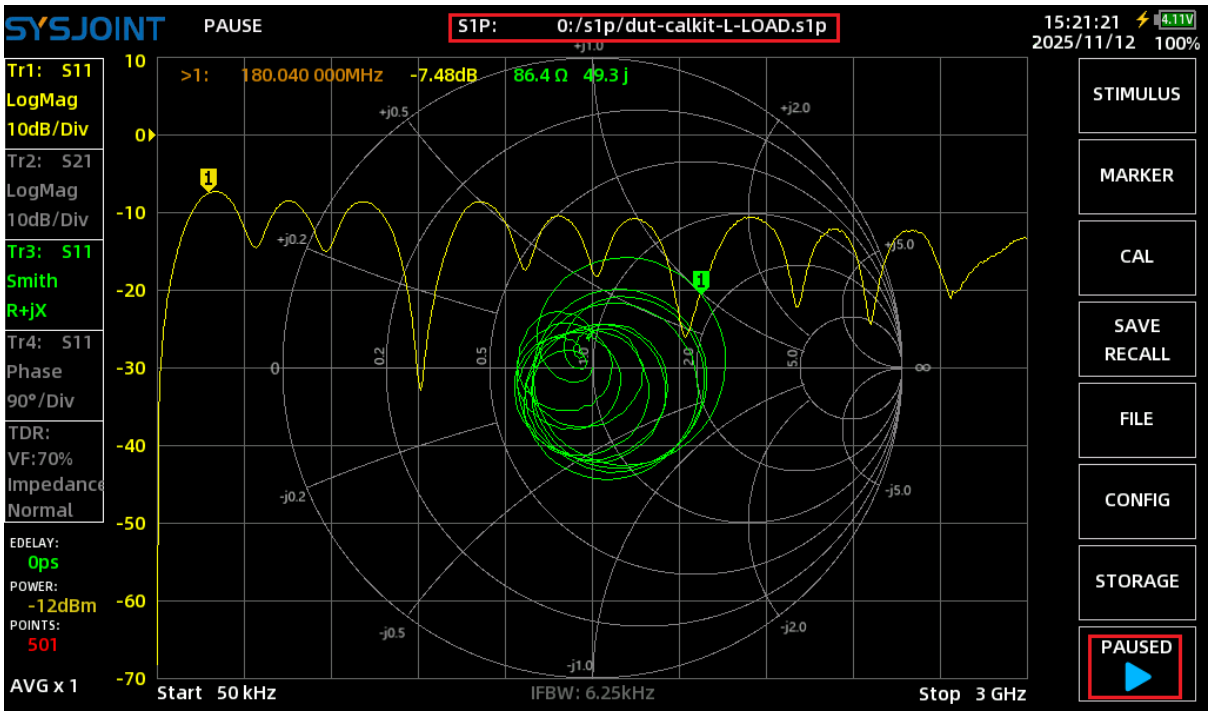
1. Create a text file named 'user_info.txt' on PC;
2. Open 'user_info.txt' and input the string which you want to be displayed on the boot screen (printable ASCII characters only, e.g., support@sysjoint.com). The maximum string length is 50;
3. Connect SV6301A to PC and enter U-disk mode, then copy 'user_info.txt' to the root directory of the U-disk;
4. Restart SV6301A.

6.2. Load snp file

Use the file browser to navigate to the path where the snp file you want to load, and select the snp file, as shown in the figure below:



Touch the **【open】** button, and a prompt will appear indicating whether the opening was successful. At this time, you can touch **【BACK】** to go back to the main window. The scanning will be paused, and at the top of the screen shows the snp file name that is opened.



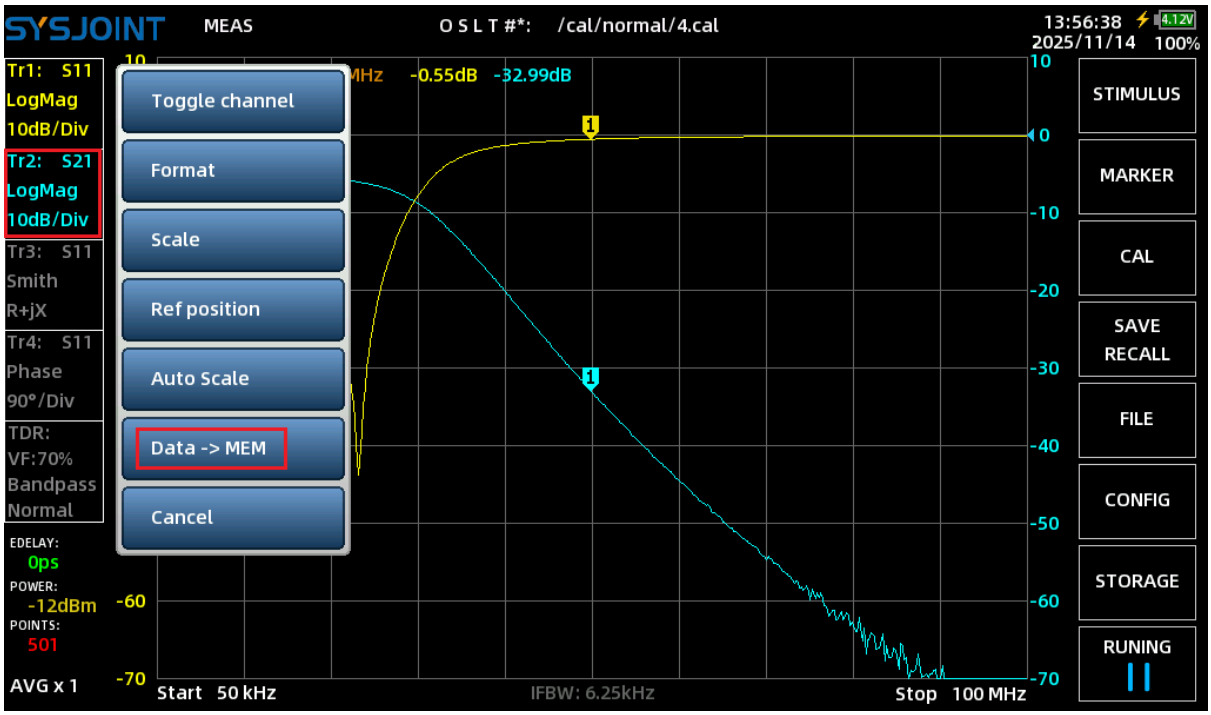
Touch on【**PAUSED**】to exit snp file viewing and resume scanning.

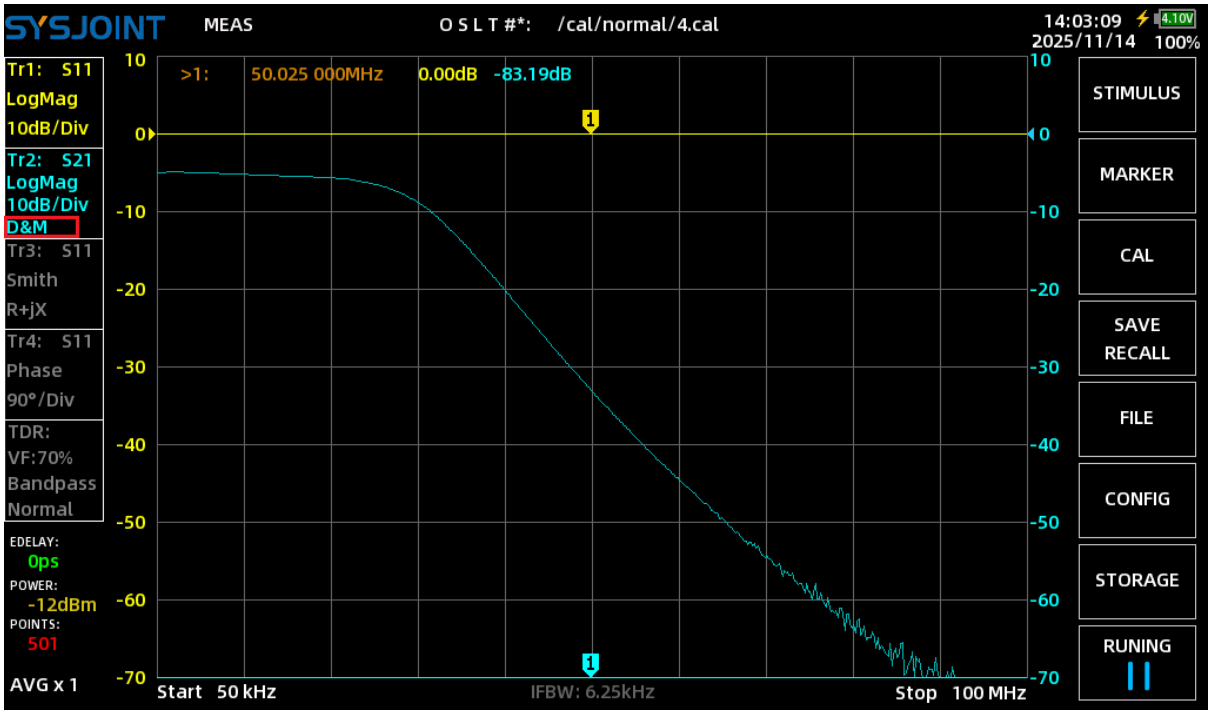
6.3. Ref Trace comparison and Math

The SV6301A supports the trace comparison function, and the setup method is as follows:

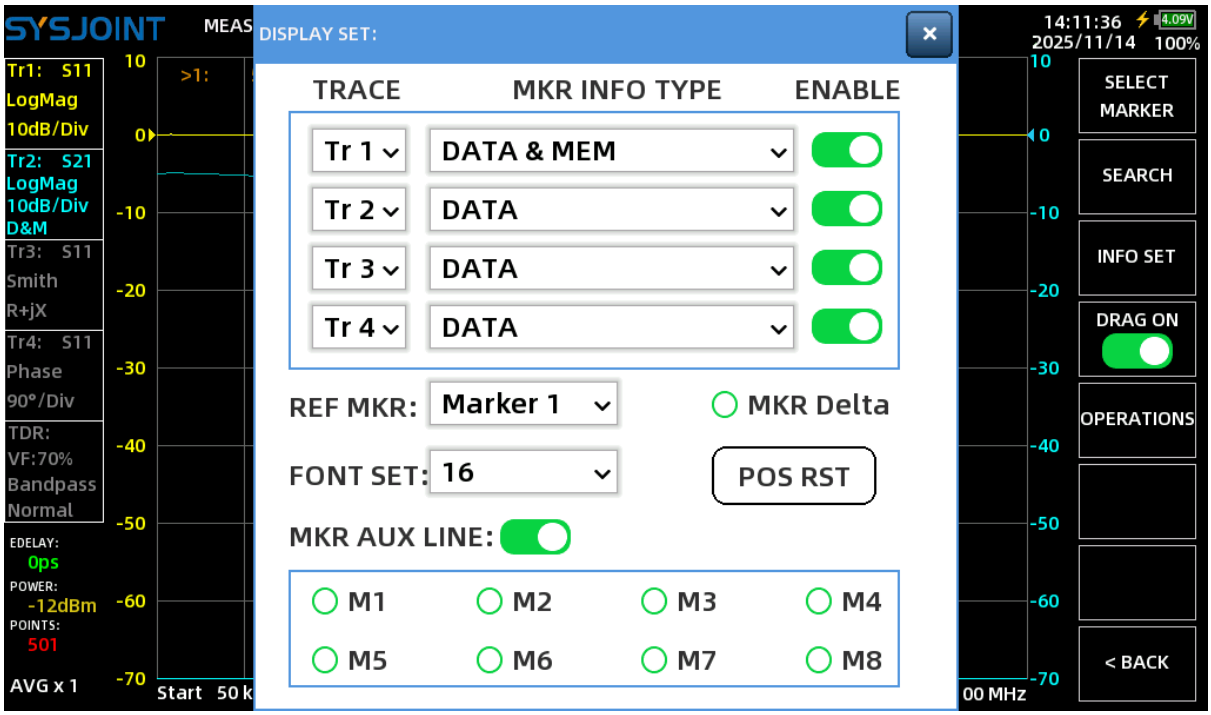
① Firstly, scan or load the SNP file to get a standard DUT data.

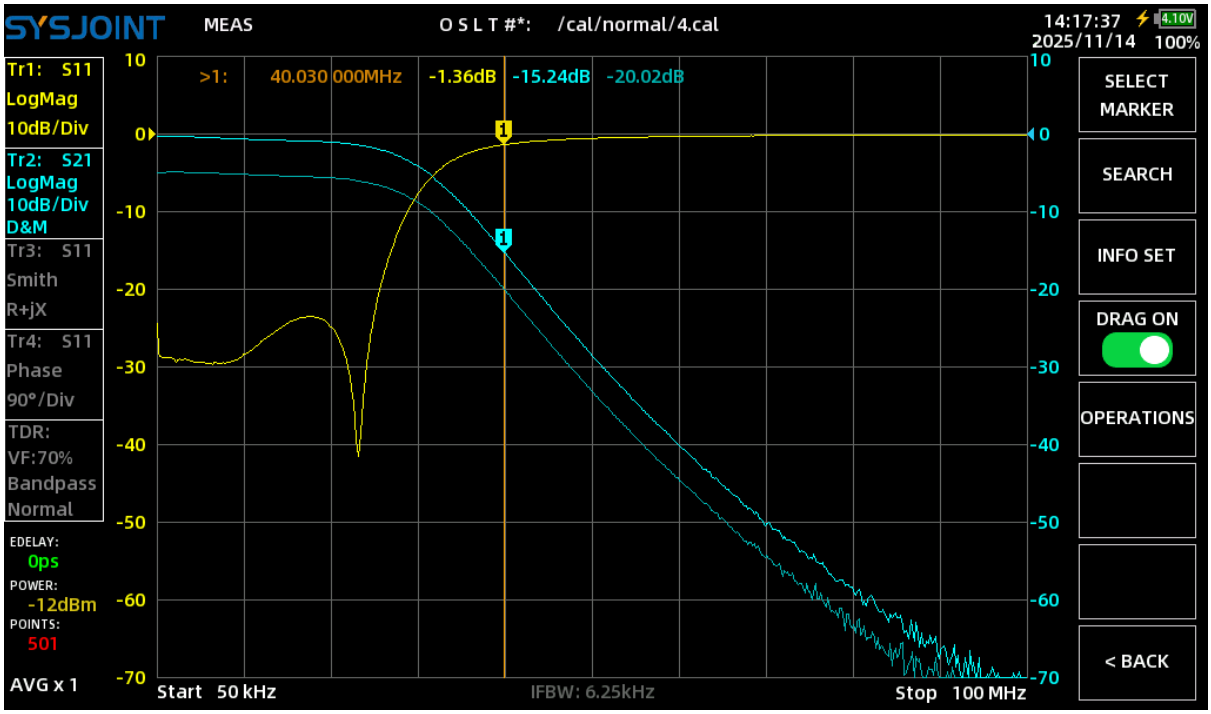
② Long press the trace control box you want to compare, and in the pop-up menu, select【**Data → Memory**】to save the data to memory. At this point, the trace control box on the left will display 'D&M' on the fourth line, indicating that the data has been saved, and both the main trace and the memory trace will be displayed simultaneously. Since the memory trace coincides with the main trace at this time, removing the DUT will reveal the memory trace, which is slightly lighter in color than the main trace.



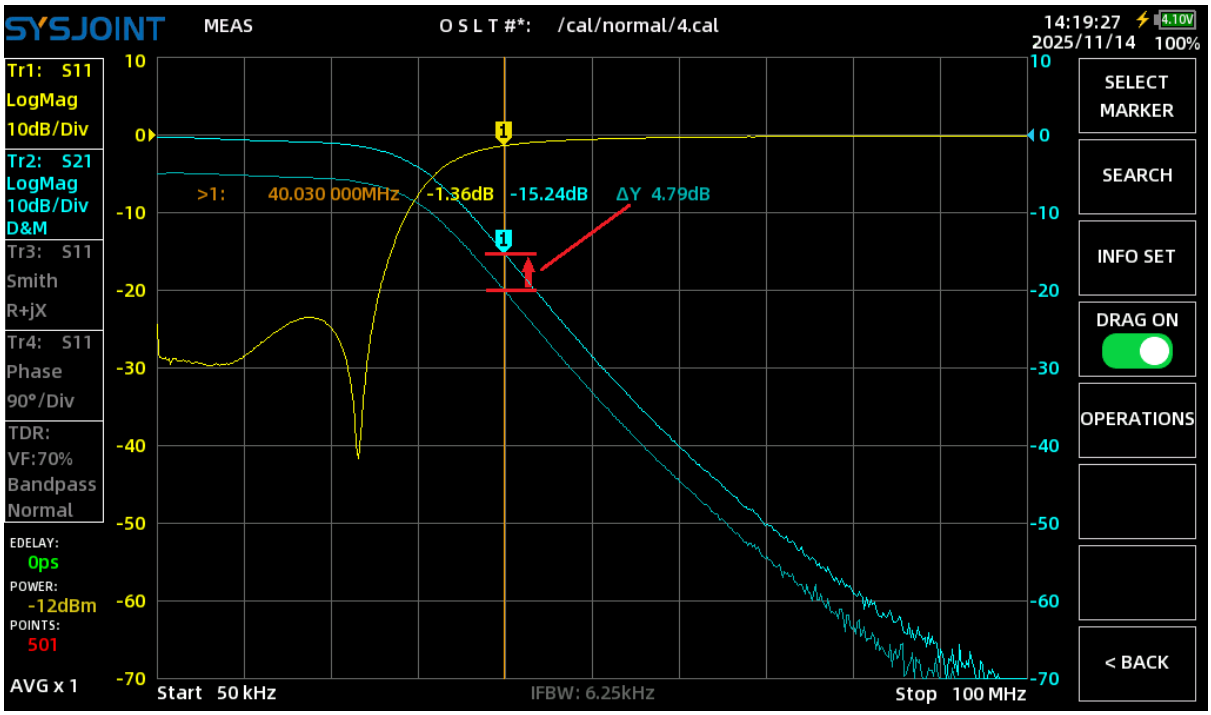


③ If you want to check the values of the comparison traces, you can enable the marker aux line in 【MARKER】→【INFO SET】, and select **DATA & MEM** for the MKR INFO TYPE.

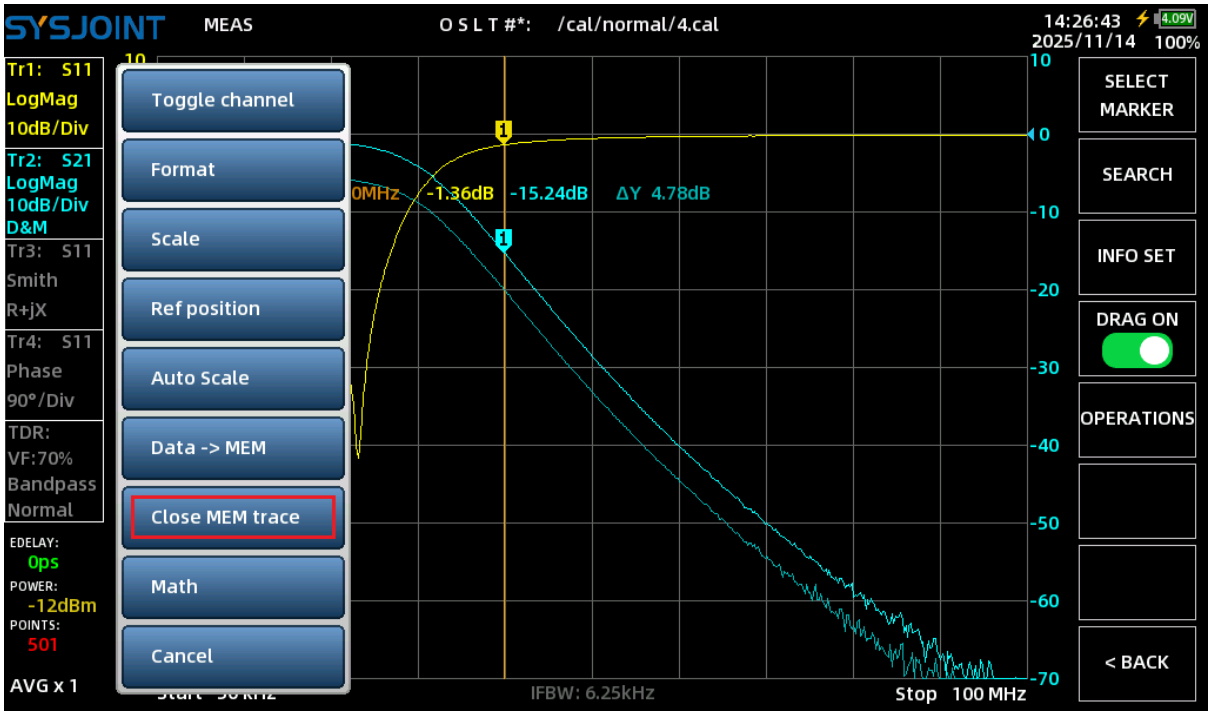




④ If you want to see the difference between the main trace and the memory trace in the marker table, you can select the MKR INFO TYPE of **DATA & ΔY(DATA,MEM)**



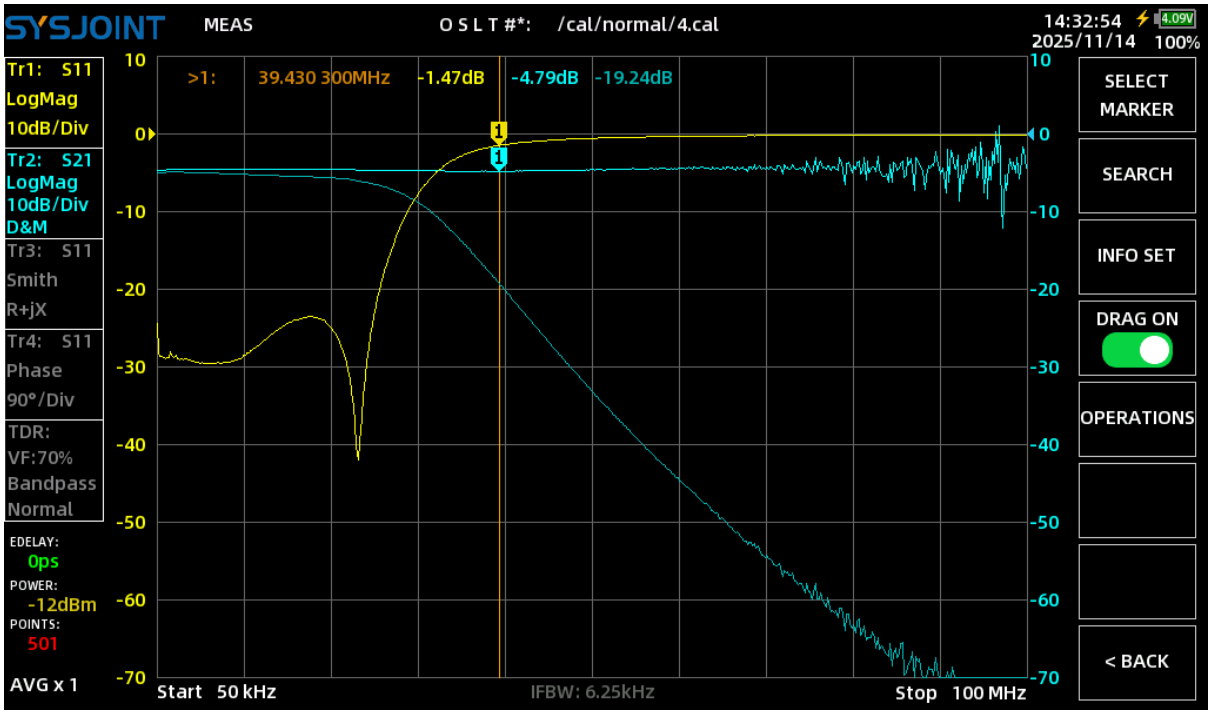
⑤ If you want to turn off the memory trace, you can long-press the trace control box and select **【close MEM trace】** from the pop-up menu. Afterwards, you can also enable the memory trace through **【show MEM trace】**. Note: Turning off the memory trace does not affect calculations or display results.



The SV6301A supports performing mathematical operations between the current scanned data and the data stored in memory. All mathematical operations are carried out before the data (real and imaginary parts) are formatted, at which point the main trace displays the results of the operations.

Option	Description	Display
OFF	No math processing	None
Data + Memory	Add the memory data to the current measurement data	D + M
Data - Memory	The current measurement data minus the memory data	D - M
Memory - Data	The memory data minus the current measurement data	M - D
Data * Memory	Multiply the current measured data by the memory data	D * M
Data / Memory	Current measurement data divided by the memory data	D / M
Memory / Data	The memory data divided by the current measurement data	M / D

For example, in the figure below, the main trace Tr2 is the measurement result of a low-pass filter, and the memory trace is the saved measurement result of the same low-pass filter with a 5 dB attenuator in series. We set the mathematical calculation to **【Memory/Data】**, at which point the fourth row on the right side of the Tr2 trace control box displays **'M/D'**. Since the trace format is logarithmic magnitude, and taking the logarithm after dividing the two data sets is equivalent to subtracting their logarithms, the value of the main trace after the calculation should be around -5 dB. As can be seen from the figure below, the result matches the expectation:

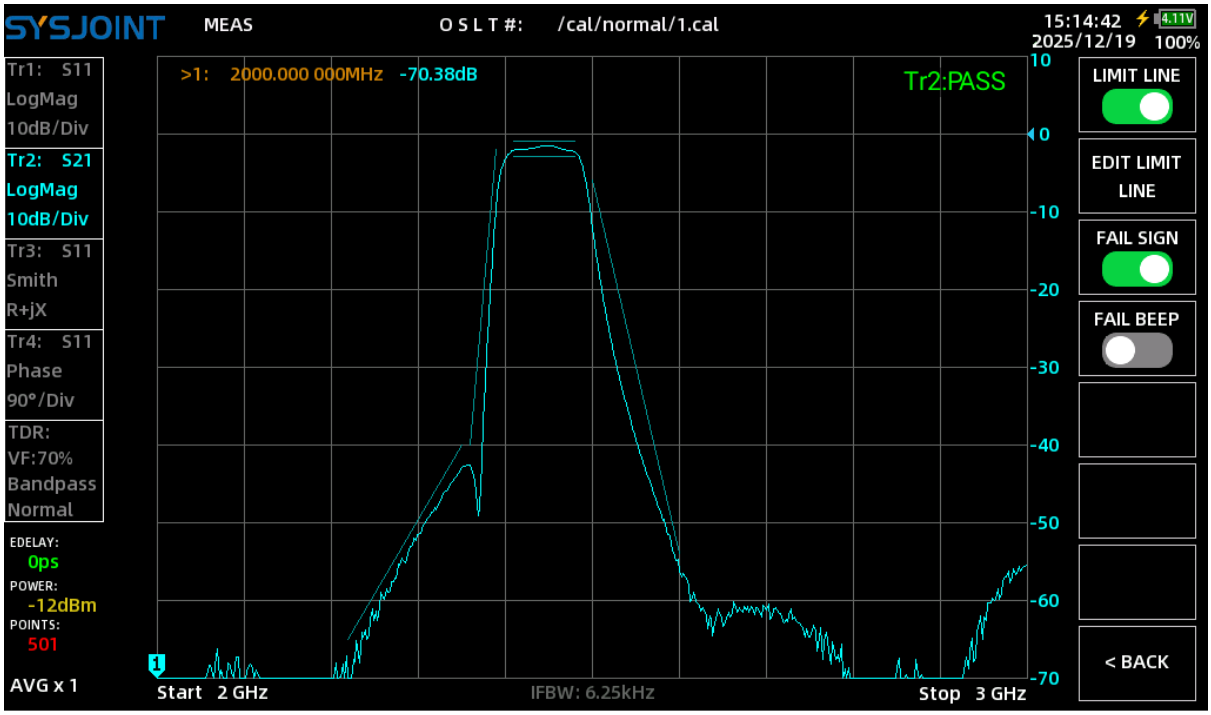


In the SV6301A, memory data and mathematical operations are considered a type of instrument state, which can be saved and recalled along with calibration status and other settings.

Note: The saved memory data and mathematical operations will be automatically cleared after changes to the number of scan points, frequency range, or channel switching.

6.4. Limit testing

Limit testing is a function that determines pass/fail based on the limit lines set according to the extreme table.



In limit testing, if the results do not exceed the upper or lower limits indicated by the limit line, the outcome is judged as qualified; if one or more scan point results exceed the set value, the outcome is judged as unqualified. Measurement points within the excitation range without a limit line are judged as qualified.

It should be noted that limit testing is only applicable to rectangular coordinate formats and is not suitable for Smith charts and polar coordinate formats.

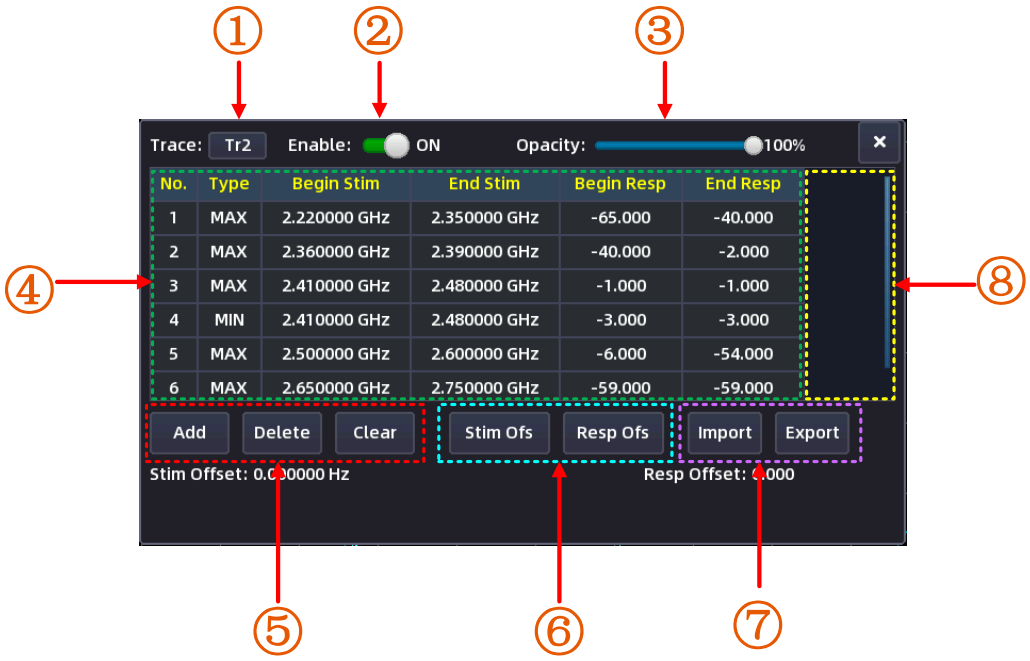
【LIMIT TEST】 menu contains menu items of **【LIMIT LINE】**, **【EDIT LIMIT LINE】**, **【FAIL SIGN】** and **【FAIL BEEP】**.

【LIMIT LINE】: When enabled, the limit lines will be displayed.

【FAIL SIGN】: When enabled, the testing result (PASS or FAIL) will be displayed;

【FAIL BEEP】: When enabled, the buzzer will beep to indicate a failure for each sweep.

【EDIT LIMIT LINE】: When touched, a limit line editing window will pop up, as shown in the figure below:



6.4.1. Select trace

Displays the selected trace number, representing the limit table currently being edited for this trace. Click 【TrN】 to select another trace.

6.4.2. Limit testing On/Off

Used to turn on/off the limit testing for each trace.

6.4.3. Window Transparency

It is used to adjust the transparency of the editing window, with 0 corresponding to fully transparent and 100% corresponding to opaque, the default is 50%. When editing the limit line, by lowering this value, you can see through the editing window to view the limit line that is blocked by the window, making it easier to adjust the limit line.

6.4.4. Limit table

You can define a limit table for each trace, and each limit table can define up to 100 segments, with each segment representing a limit line.
Each row of the limit table represents a limit line, and the data in the table can be modified by clicking on the cells. For operations on the entire row of data, you can select the row by clicking the row number (column No.).
The parameters for the limit line segments are described in the following table:

Parameters	Description	
Type	OFF	Not enabled
	MAX	Set the maximum value for this segment
	MIN	Set the minimum value for this segment
Begin Stimulus	Specify the start frequency of the limit line	
End Stimulus	Specify the stop frequency of the limit line	
Begin Response	Specify the response value of the start point of the limit line	
End Response	Specify the response value of the end point of the limit line	

The following steps describe how to define the segments.

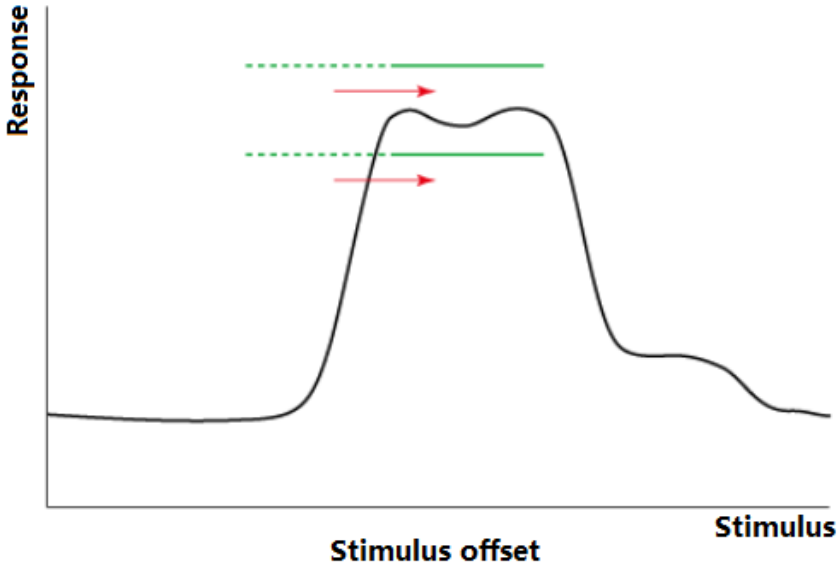
- Open the limit line editing window through the **【EDIT LIMIT LINE】** menu.
- Touch the trace selection button in the limit line editing window to select the trace for which you want to define the limit table.
- Touch the **【Add】** button to add a segment row to the limit table, and modify the parameters.

6.4.5. Operation of the limit table

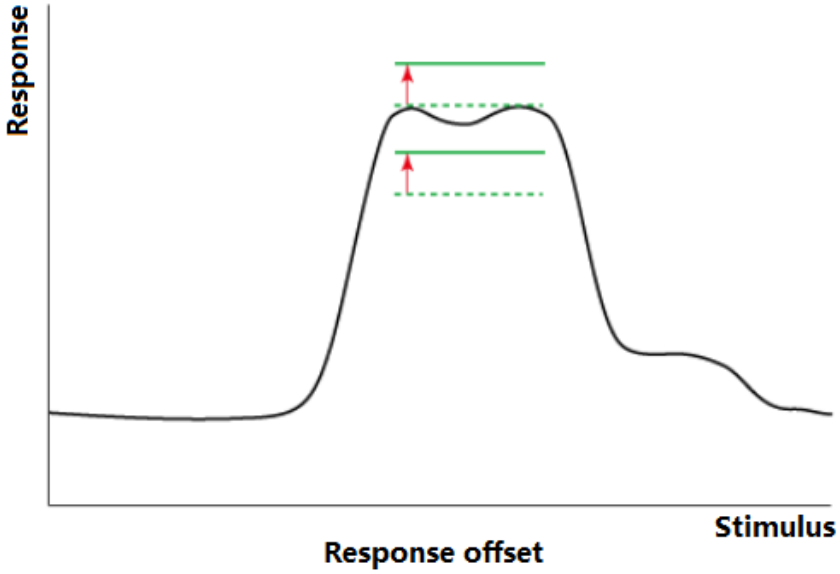
【Add】, **【Delete】**, **【Clear】** are used for adding and deleting rows in the limit table.
【Add】: Add a new row at the end of the table.
【Delete】: Delete the selected row.
【Clear】: Clear the limit table.

6.4.6. Limit table offset

【Stim Ofs】, **【Resp Ofs】** are used to apply an offset to all limit lines in the limit table in segments. Click **【Stim Ofs】** to set the stimulus offset as the following figure:



Click【**Resp Ofs**】to set the response offset as the following figure:



6.4.7. Import and export limit table

The SV6301A supports the import and export of limit table with CSV files, and the file format is as follows:

```
"# Channel 1"
"# Trace 2"
Type,Begin Stimulus,End Stimulus,Begin Response,End Response
MAX,2.220000 GHz,2.350000 GHz,-65.000000,-40.000000
MAX,2.360000 GHz,2.390000 GHz,-40.000000,-2.000000
MAX,2.410000 GHz,2.480000 GHz,-1.000000,-1.000000
MIN,2.410000 GHz,2.480000 GHz,-3.000000,-3.000000
MAX,2.500000 GHz,2.600000 GHz,-6.000000,-54.000000
MAX,2.650000 GHz,2.750000 GHz,-59.000000,-59.000000
MAX,2.920000 GHz,3.000000 GHz,-65.000000,-50.000000
```

If you need to define a relatively large number of limit lines, users can edit them on PC according to the file format, then import them into SV6301A, and load the limit table with the【**Import**】button.

【**Import**】: Select the file you want to import in the pop-up dialog. This operation will clear the current limit table and load the new limit table from the selected file.

【**Export**】: Save the limit table to a CSV file.

6.4.8. Scroll the limit table

Since the limit table can only display 6 rows, when the table exceeds 6 rows it may not display fully, at this time you can drag the slider to scroll the table.

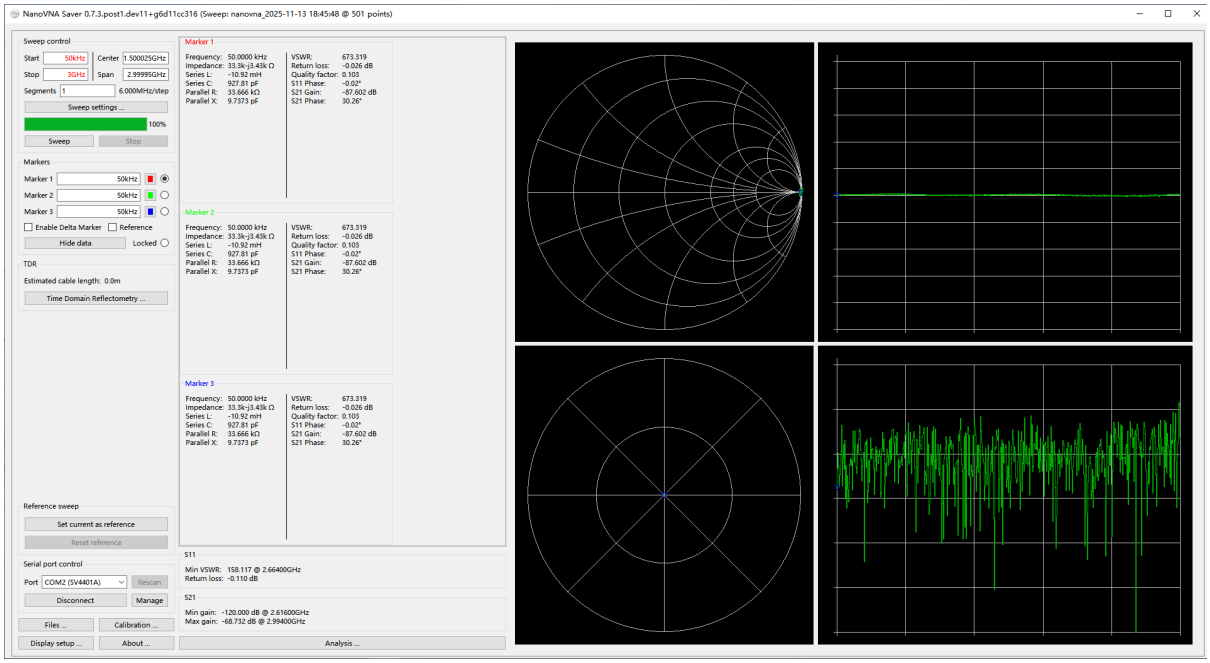
7. PC software

7.1. NanoVNA-Saver

NanoVNA-Saver is open-source software: https://github.com/NanoVNA-Saver/nanovna-saver

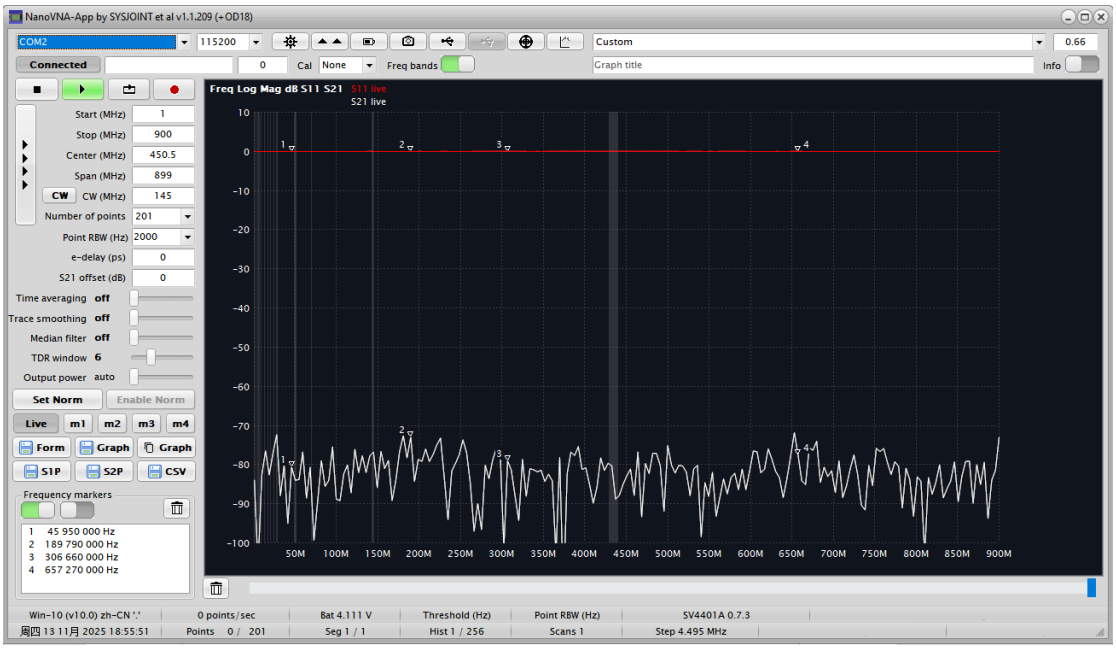
SYSJOINT modified this software based on version 0.7.3 to adapt to SV6301A, and it currently only supports Windows 10 and above, and you can get it from https://github.com/sysjoint-tek/nanovna-saver/releases

For Linux or MacOS users please compile with the source code: https://github.com/sysjoint-tek/nanovna-saver



7.2. NanoVNA-App

NanoVNA-App is open-source software: https://github.com/owenduffy/NanoVNA-App
SYSJOINT modified this software based on version V1.1.209(+OD18) to adapt to SV6301A, and it currently only supports Windows 10 and above, and you can get it from https://github.com/sysjoint-tek/NanoVNA-App/releases
For Linux or MacOS users please compile with the source code: https://github.com/sysjoint-tek/NanoVNA-App

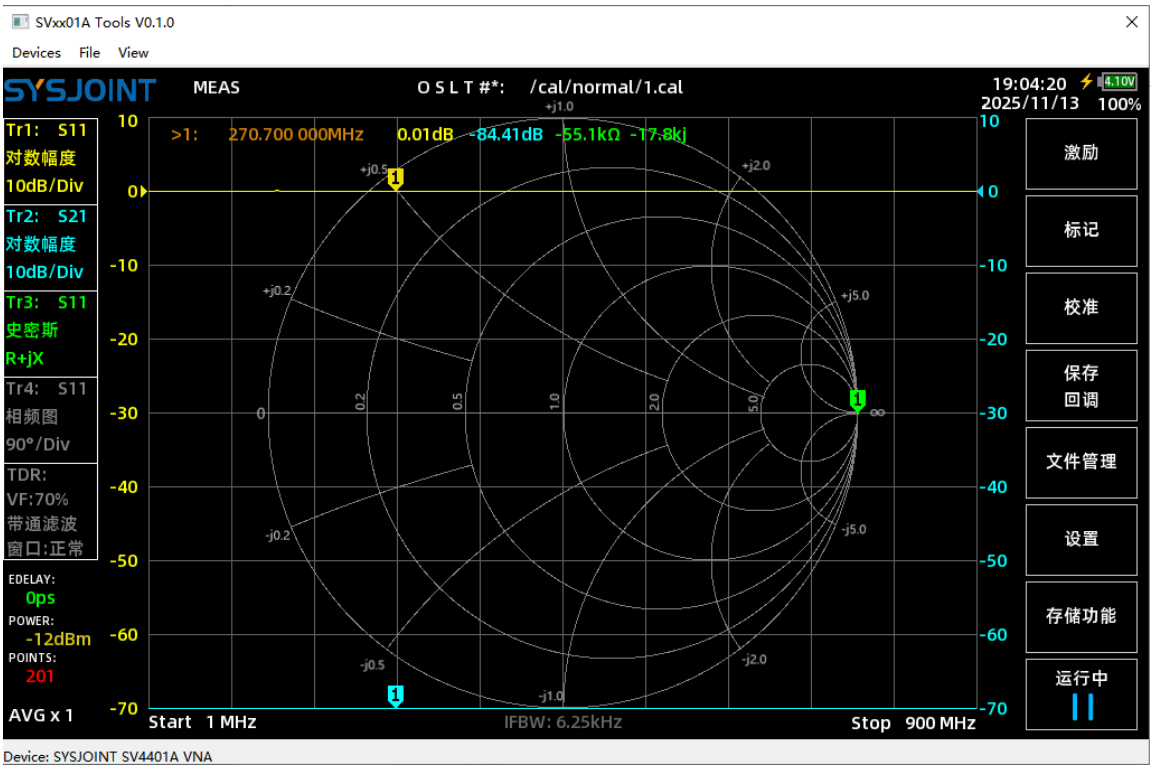


7.3. SVxx01A-Tool

SVxx01A-Tool allows user to cast SV6301A's screen to a PC, enabling control and screen size adjustment on the PC. It is suitable for presentation scenarios and can be used with screen recording software to record operation videos without the need for a phone or camera.

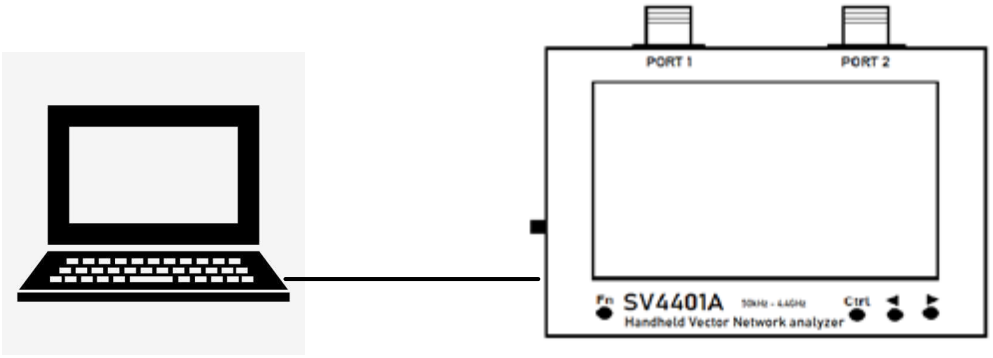
SVxx01A-Tool download: https://www.sysjoint.com/ueditor/php/upload/file/SVXX01A_Tools.zip

Note: SVxx01A-Tool supports only Windows operation system, and only a simulated touch operations with a mouse are supported, input with physical keyboard is not supported.

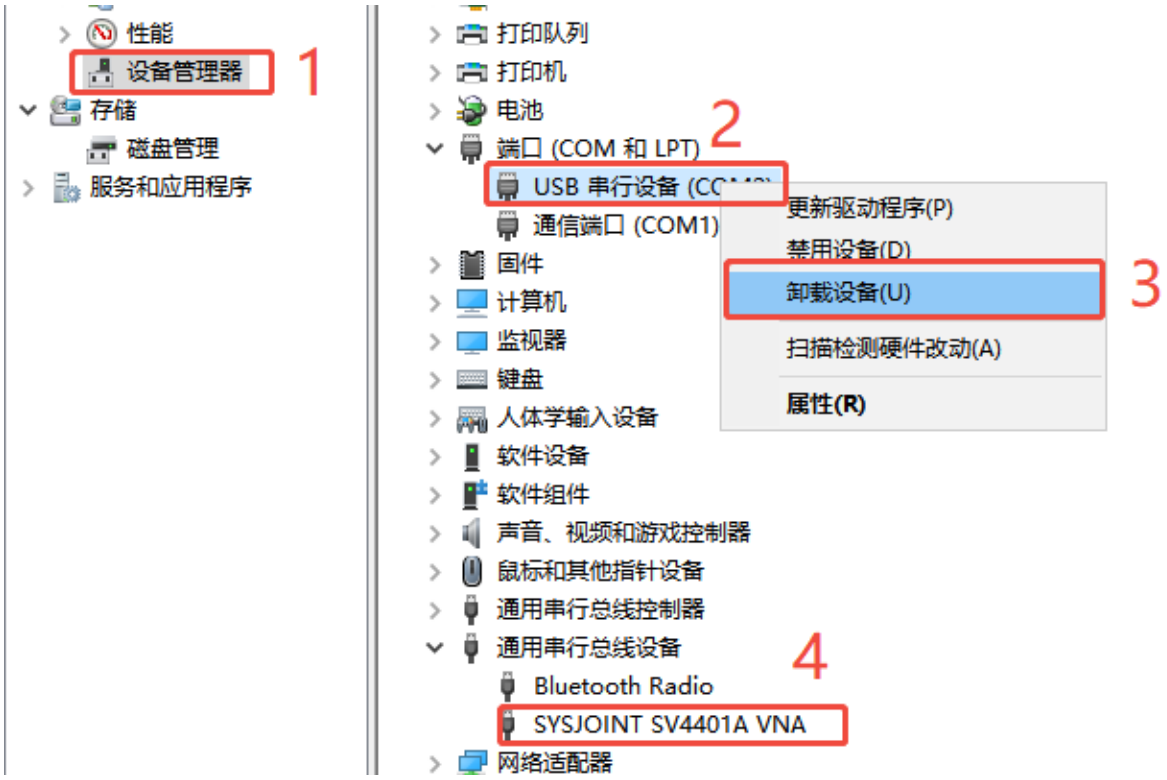


7.4. PC driver installing

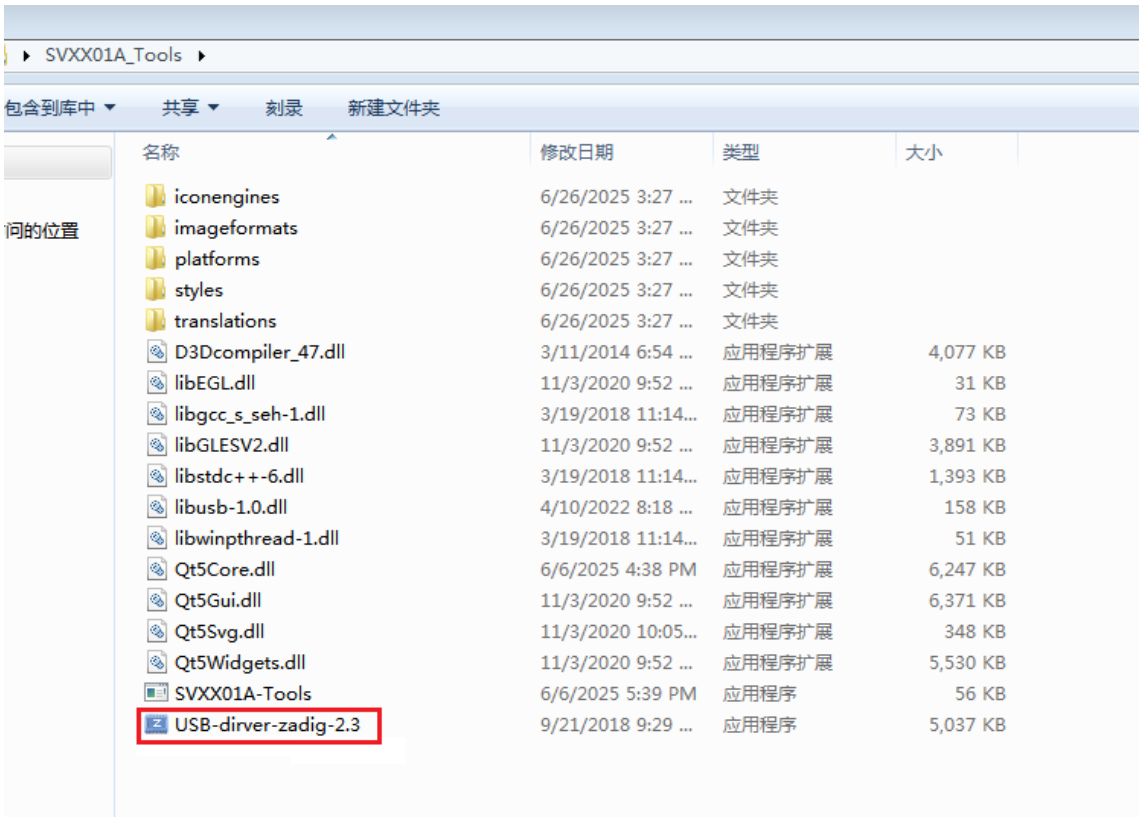
Windows systems of Win10 and above usually do not require installing drivers.
For Win7 systems or when the drivers are abnormal, you can install the drivers according to the following tutorial. Before installing the drivers, please first download the SVXX01A_Tools introduced above, which contains the software needed for driver installation.
PC driver installing steps:
① Use the included USB Type-C cable to connect the SV6301A to the PC's USB-A port, as shown in the figure below:



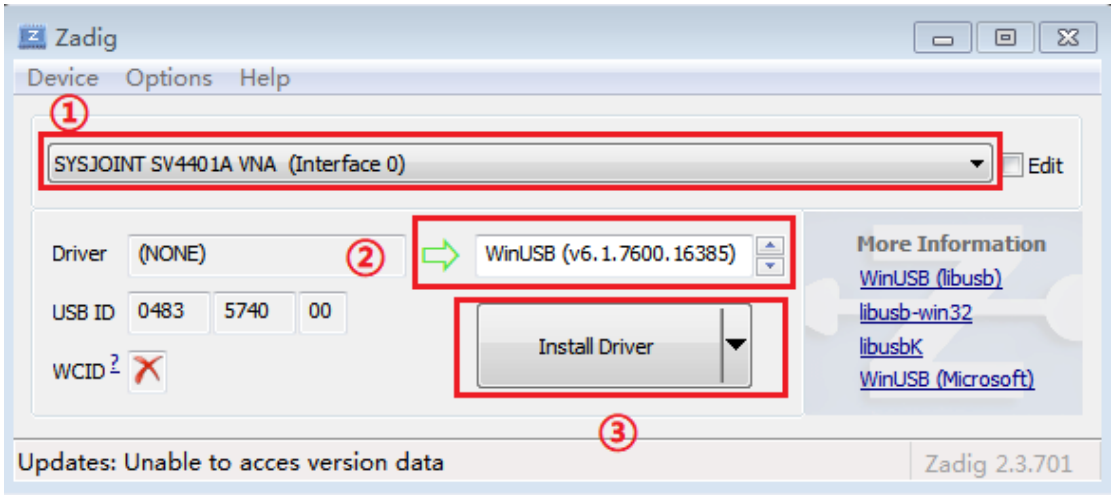
② Uninstall the current driver in [Device Manager] as shown below:



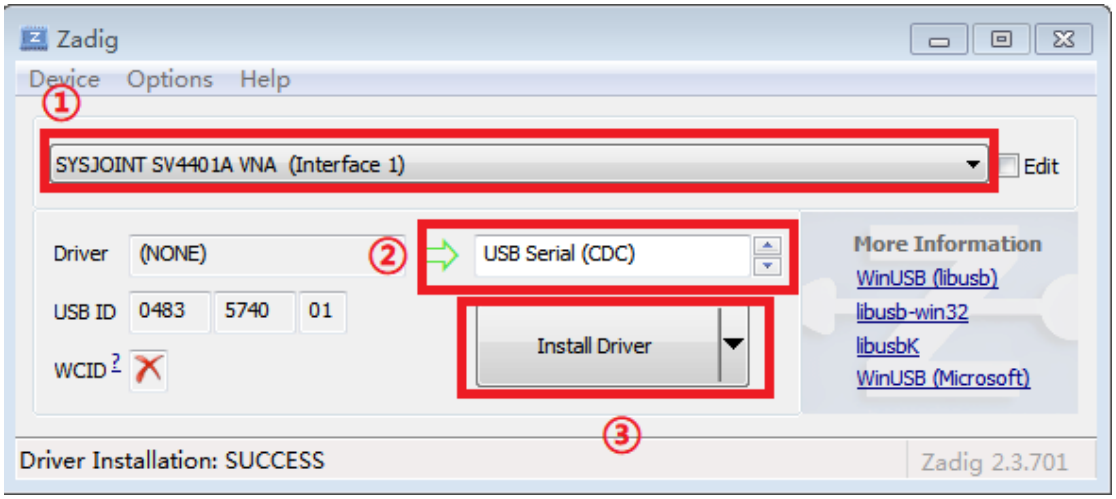
③ After reconnecting SV6301A to the computer, run the USB-driver-zadig-2.3 software in the SVXX01A-Tools folder:



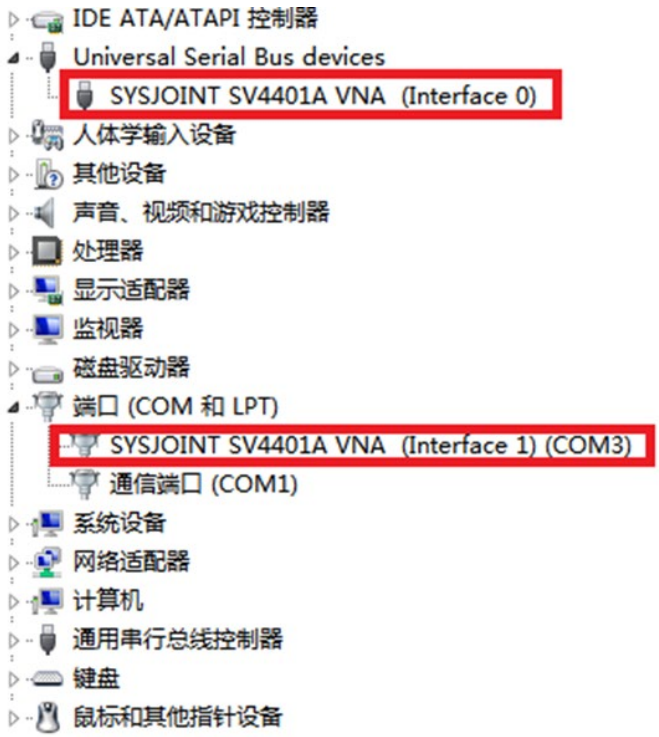
④ Install the WinUSB as the following order:



⑤ Install USB CDC driver:



⑥ After the installation is complete, open Device Manager. If the following device identification appears, it indicates that the driver has been successfully installed.



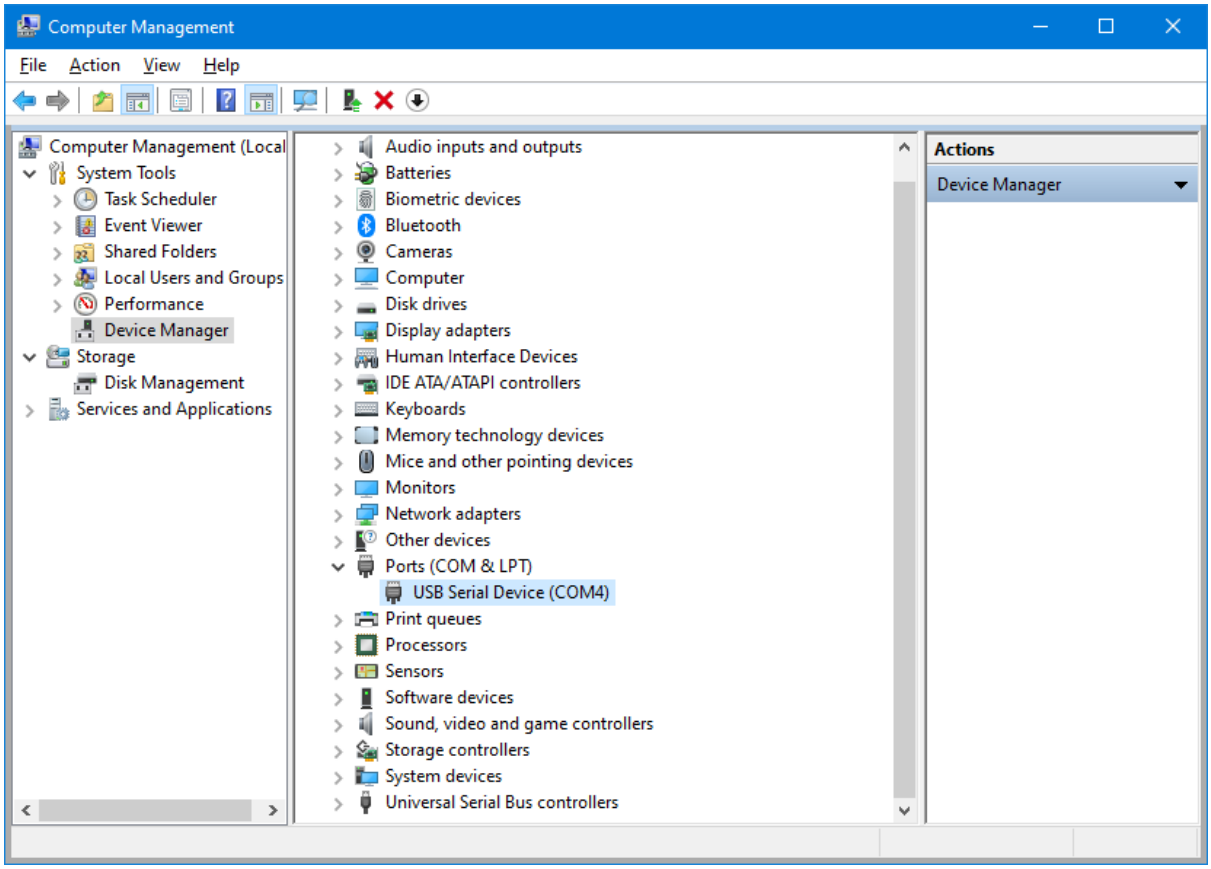
8. Console command

SV6301A supports character console commands, you can interact with the device through serial tools.

It is also possible to design a customized PC software according to the commands.

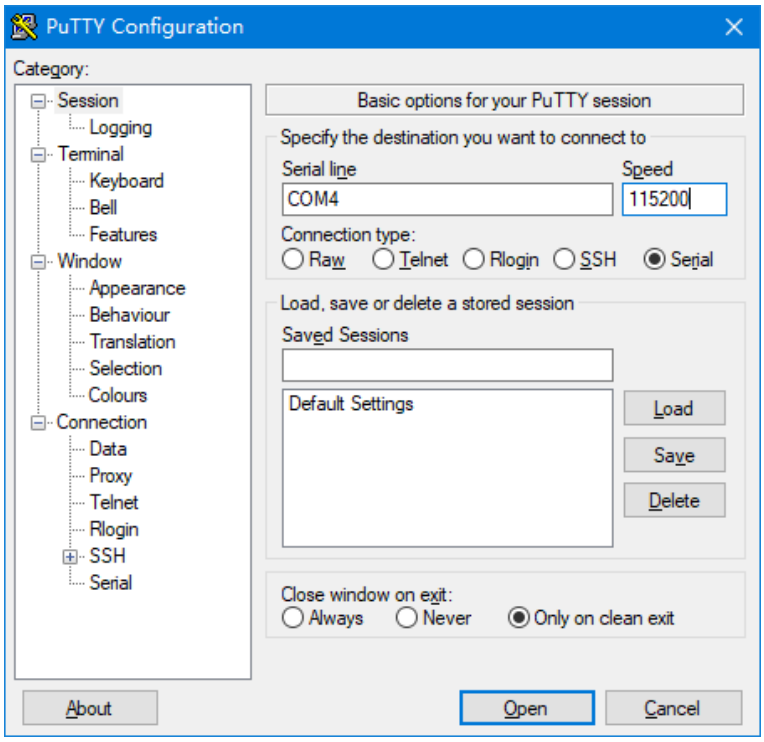
8.1. Get serial port number

Connect SV6301A to PC, right-click on 'This PC', select 'Manage' to call up 'Computer management' dialog, click 'Device Manager' and then click 'Ports (COM & LPT)', you will find the serial port number as shown below.



8.2. Serial tool

For serial tool, it is recommended to use Secure CRT or Putty, and other serial tools can also be used. The serial port baud rate of SV6301A is adaptive, usually we choose a baud rate of 115200, as shown in the figure below:



8.3. Command syntax

A command line is a string of characters sent from PC to SV6301A. A command line has a command, a body, and a terminator. Each command line must begin with a command and must be terminated by a carriage return. The command line is a string of printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command string are ignored. The default terminator is the ASCII <CR> character. The command line interpretation begins upon receipt of the carriage return character. A typical command line is as follows:

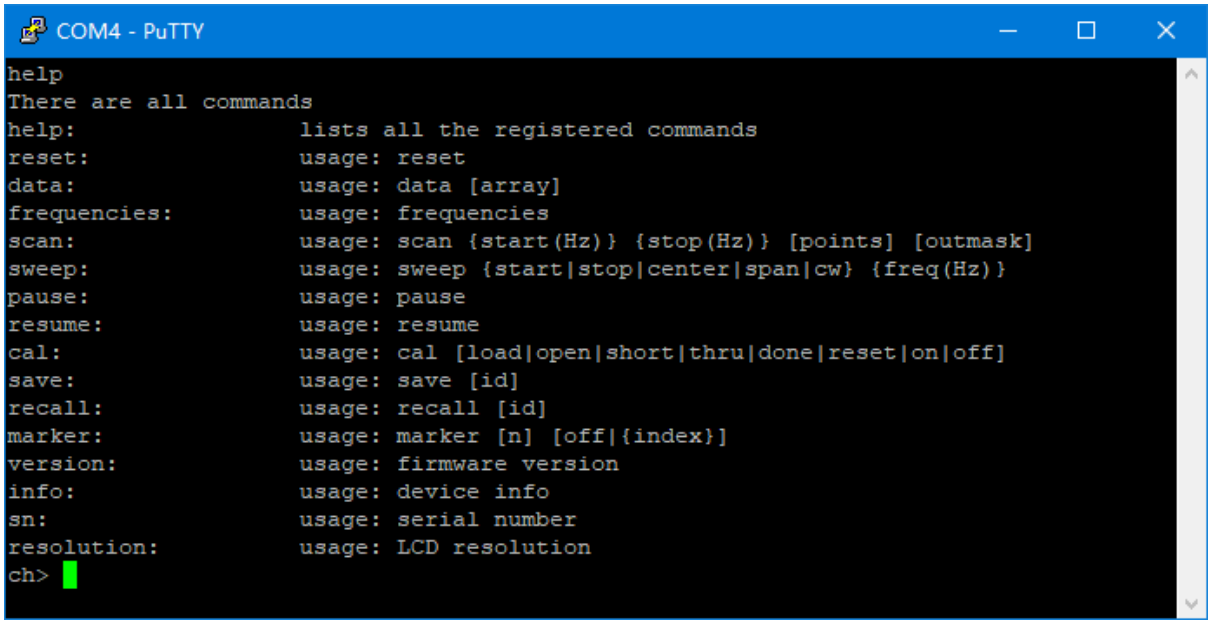
Command {parameter 1} [parameter 2] [parameter 3] [parameter 4|parameter n]

Where { } represents the parameters must be passed in, [ ] stands for optional parameters.

8.4. Command description

8.4.1 help

Use this command to list all the registered commands:



8.4.2 reset

This command is used to reset the device. No parameters are required for this command. After using this command, the device will restart, and the USB will disconnect, so you need to restart the serial tool and reconnect.

8.4.3 data

This command is used to get the measurement data. The optional parameter [array] is used to specify the channel: 0 for s11, 1 for s21. When there is no parameter, executing this command will print s11 data by default.

`data 0`: get S11 data, the first column of data printed is the real part of S11, and the second column of data printed is the imaginary part of S11.

`data 1`: get S21 data, the first column of data printed is the real part of S21, and the second column of data printed is the imaginary part of S21.

8.4.4 frequencies

This command is used to get the frequency list of the sweep. No parameters are required for this command.

8.4.5 scan

This command is used to set start frequency, stop frequency, sweep points, and the printout format of the measurement results.

```
scan {start (Hz)} {stop (Hz)} [points] [outmask]
```

Parameter descriptions:

start	Start frequency in Hz.
stop	Stop frequency in Hz.
points	Sweep points, range from 101 to 1001
outmask	0: No printout; 1: Print the frequency value of each sweep point; 2: Print s11 data of each sweep point; 3: Print frequency value and s11 data of each sweep point; 4: Print s21 data of each sweep point; 5: Print frequency value and s21 data of each sweep point; 6: Print s11 data and s21 data of each sweep point; 7: Print frequency value, s11 data and s21 data of each sweep.

Example:
Set frequency range 200MHz - 500MHz:

```
scan 200000000 500000000
```

Set frequency range 200MHz - 500MHz, 301 points:

```
scan 200000000 500000000 301
```

Set frequency range 200MHz - 500MHz, 301 points, and print the frequency value of each point and the data for both channels.

```
scan 200000000 500000000 101 7
```

8.4.6 sweep

This command is used to set sweep mode, frequency, and sweep points.
There are two ways to use **sweep** command.

Usage1:

```
sweep [start (Hz)] [stop (Hz)] [points]
```

If there is no parameter, executing this command will print the current sweep range and points;
For the case of one integer parameter, the parameter is interpretated as start frequency;
For the case of two integer parameters, parameters are interpretated as start and stop frequencies.
For the case of three integer parameters, the first two parameters are interpretated as start and stop frequencies, the third parameter is interpretated as sweep points.

Example: set start frequency to 200MHz, stop frequency to 500MHz, and sweep points to 156.

```
sweep 200000000 500000000 156
```

Usage2:

```
sweep [start | stop | span | center | cw | points] [value]
```

Parameter descriptions:

start	Set start frequency
stop	Set stop frequency
span	Set span frequency
center	Set center frequency
cw	Set CW frequency
points	Set sweep points, range from 101 to 1001
value	Frequency value in Hz or sweep points

Example: set start frequency to 500MHz.

```
sweep start 500000000
```

8.4.7 pause

Execute this command to pause sweep.

8.4.8 resume

Execute this command to resume sweep.

8.4.9 cal

This command is used to calibrate the VNA.

Usage:

```
cal [open | short | load | thru | done | reset | on | off]
```

Parameter descriptions:

open	Perform OPEN calibration
short	Perform SHORT calibration
load	Perform LOAD calibration
thru	Perform THRU calibration
done	Complete calibration and calculate the calibration data
reset	Clear calibration status in the RAM
on	Apply calibration
off	Do not apply calibration

8.4.10 save

Usage:

```
save [id]
```

'id' is used to indicate the storage slot number, and the value range is 0 - 17.
When sending the 'save' command with no parameters, the storage status of each save/recall slot will be printed.

8.4.11 recall

Usage:

```
recall [id]
```

'id' is used to indicate the storage slot number, and the value range is 0 - 17.
When sending the 'recall' command with no parameters, the storage status of each save/recall slot will be printed.

8.4.12 marker

This command is used to view or set the attributes of markers.
Usage:

```
marker [1|2|3|4] [on | off|{index}|
```

If there is no parameter, sending this command will get the attributes (index, frequency) of all the opened markers.
Example: get the attributes of all the opened markers:

For the case of one parameter, the parameter indicates to the marker number, sending this command will get the attributes (index, frequency) of the corresponding markers.
Example: get the attributes of marker 1:

For the case of two parameters, the first parameter indicates to the marker number, the second parameter can be 'on', 'off' or index value, which is used to turn on/off or move the marker to the specified position.

Example: turn off marker 2:

```
marker 2 off
```

Example: move marker 1 to 56th sweep point:

```
marker 1 56
```

8.4.13 version

This command is used to check the firmware version. No parameters are required for this command.

8.4.14 info

This command is used to get the device information. No parameters are required for this command.

8.4.15 sn

This command is used to get the unique serial number of SV6301A. No parameters are required for this command.

8.4.16 resolution

This command is used to get the LCD resolution. No parameters are required for this command.

9. Firmware upgrade

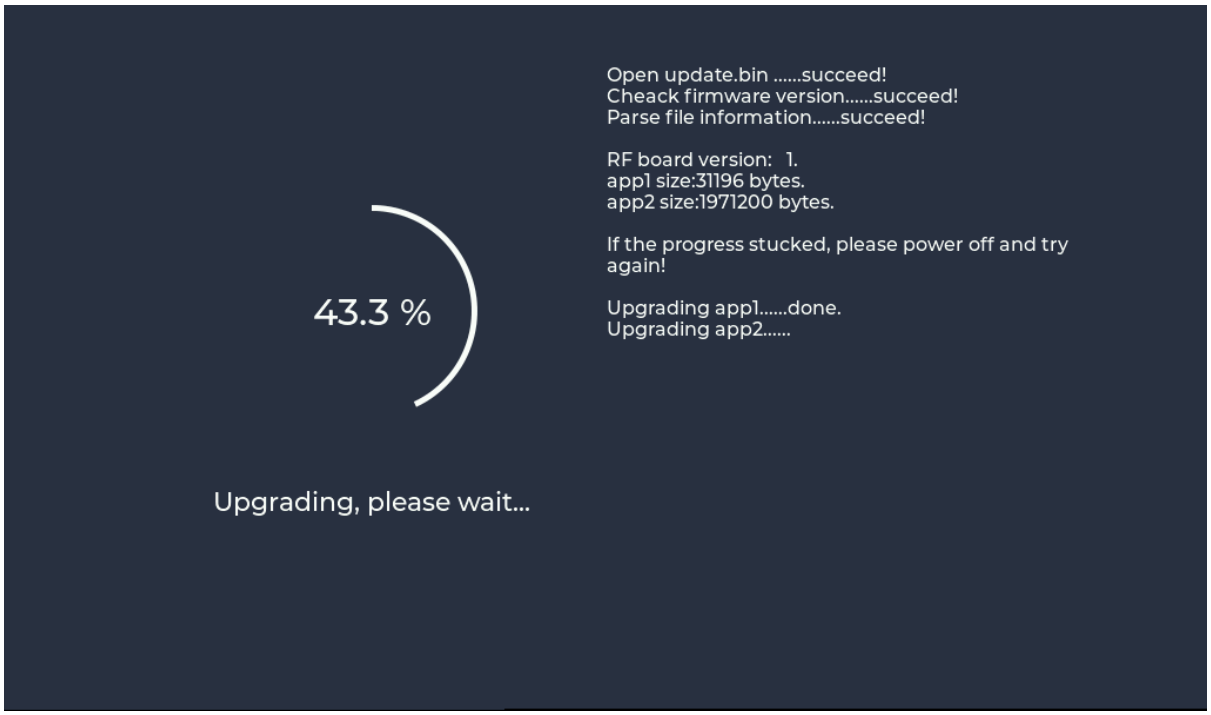
The firmware of SV6301A can be upgraded by virtual U-disk without a programmer (such as J-LINK). Upgrading can be done with a USB Type-C cable.

Connect SV6301A to Windows PC with the USB Type-C cable, press and hold the **Ctrl** button and power on SV6301A, and you will see the following screen:

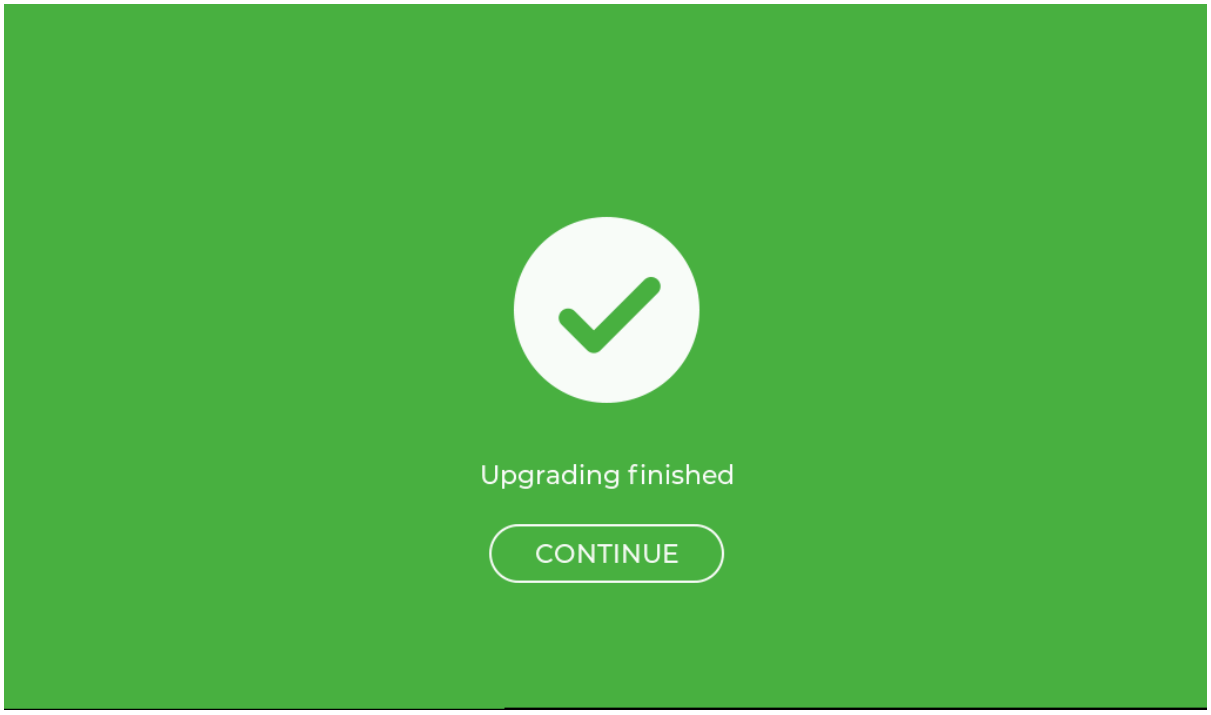
'V0.1.0' on the left represents the bootloader version, and 'RF: V01' on the right represents the hardware version.

Touch on **Udisk** icon, the device will be recognized as a U-disk on Windows PC, and the following screen will appear:

According to the prompt information, the file 'update.bin' is required, which can be downloaded from SYSJOINT official website: https://www.sysjoint.com/sv6301a.html
Download the firmware file and unzip it to get 'update.bin'. Copy 'update.bin' into the U-disk.
Touch on 【**BACK**】 to return to the 'Upgrade Mode' page, then touch on **Upgrade** icon, and the following screen will appear:



The following screen will appear when upgrading is finished. Please restart SV6301A and check the firmware version from the startup screen.



10. Shiping list

- SV6301A (with built-in 8GB memory card and 18650 battery x2) ×1
- SMA OPEN calibration piece ×1
- SMA SHORT calibration piece ×1
- SMA LOAD calibration piece ×1
- N to SMA adapter ×2
- SMA-KK adapter ×2
- SMA-JJ adapter ×1
- 50cm SMA-JJ RG316 coaxial cable ×2
- USB Type-C cable ×1
- Storage bag ×1