PicoVNA®

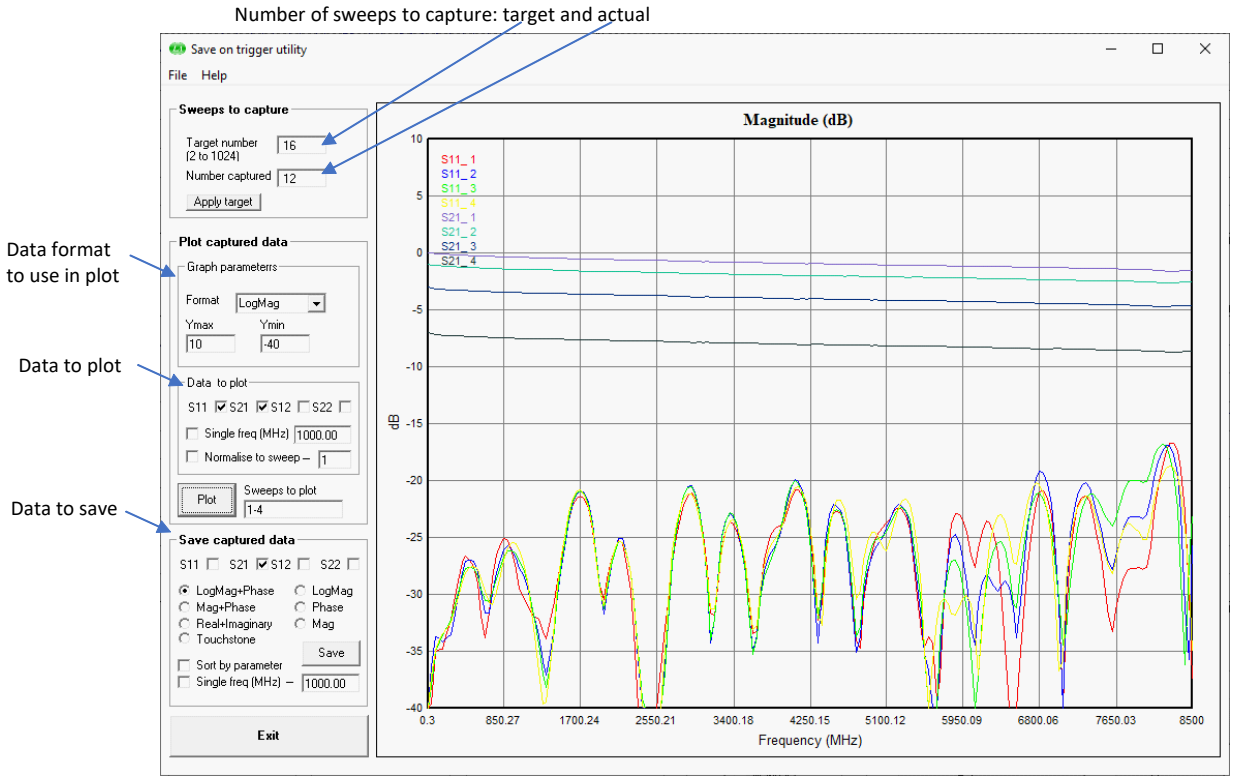
Vector Network Analyzers

Save On Trigger Guide

1 Save-on-trigger measurements

The **Save on Trigger** facility (**Utilities** menu) provides a convenient way of measuring multi-state devices such as adjustable gain amplifiers and attenuators or phase shifters.

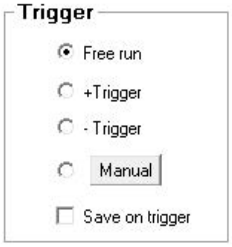
The Save on Trigger mode works by saving each triggered measurement sweep. Once the desired numbered of sweeps have been captured (or you stop the measurement), you can selectively plot the available data in various formats. The data can also be saved in a number of formats and sorted by parameter if so desired. A further option is to save the *entire data set* (menu option in the **File** drop-down menu) for later use. A copy of the Save on Trigger form (in **Utilities** menu) is shown below.



Save on Trigger settings form and display graph

Setting the target and enabling Save on Trigger mode

Save on Trigger operation is enabled using the check box on the trigger selection area on the main application dialog as shown on the right. When the box is first checked, you will be asked to enter the target number of sweeps to be captured. If the trigger mode is set to free run (auto trigger), you will be warned that the Save on Trigger will only operate on a trigger event, i.e. any trigger mode except free run.



Plotting captured data

The captured data for each s-parameter measured can be plotted either in the form of a family of traces (one for each measurement sweep) over the sweep frequency (as in the graph above) or as a single trace displaying the value for a chosen frequency over the sweep number. The latter is useful, for example, to examine the attenuation or phase value of a digital attenuator at each setting at a given frequency.

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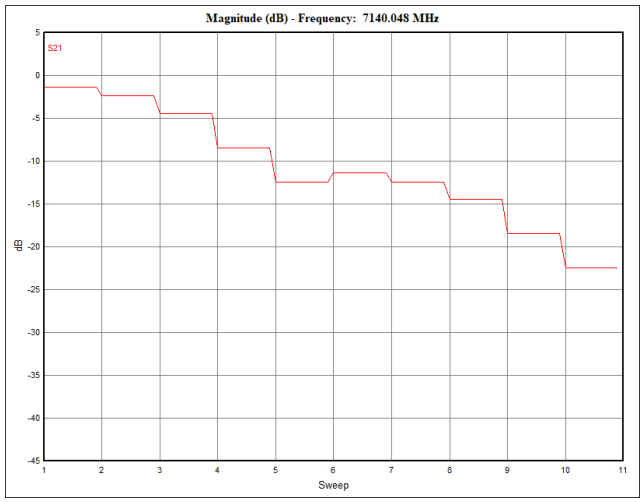
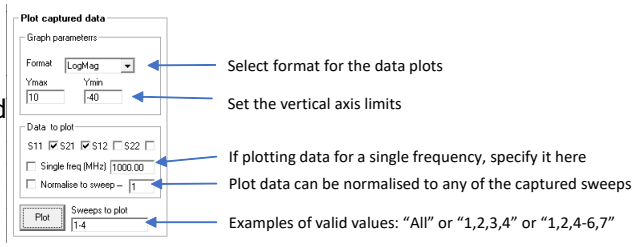
An example of a plot showing the measured data at a single frequency over the sweep number is shown on the right. This is a measurement of 10 states of a programmable attenuator. The horizontal axis represents each of the states measured (each sweep measured a different state) and the vertical axis is set to display the magnitude of S_{21} in decibels. The user-requested frequency for the plot is shown at the top.



The settings for the measurement sweeps to be plotted can be specified as shown below.

Maximum number of graph traces

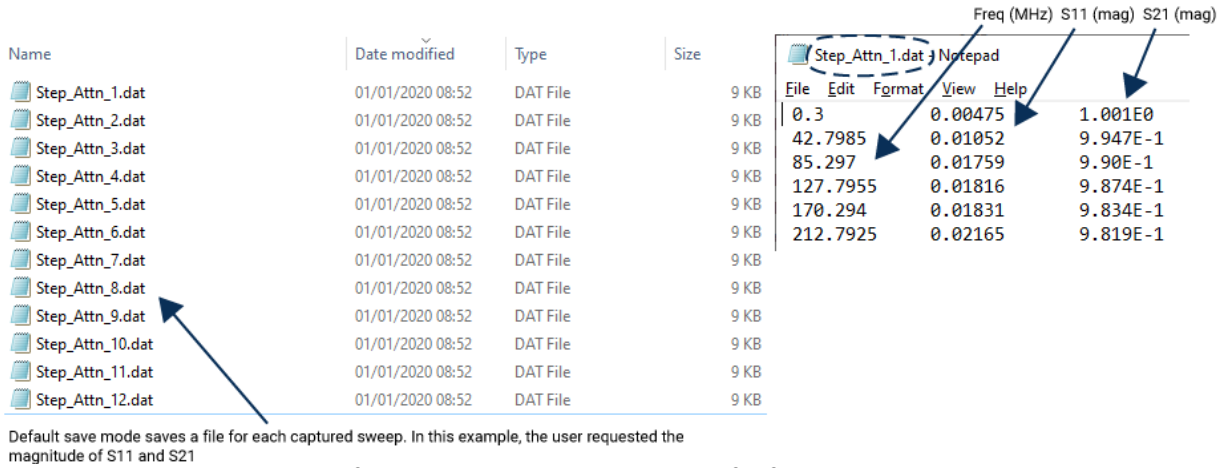
When plotting s-parameter data over the measurement sweep (as on the graph above) the maximum number of traces (one for each measurement sweep) is 16 for each S-parameter. If all 4 S-parameters are being plotted this will result in a total of 64 traces. In any case, the maximum number of trace legends (which identifies the parameter and sweep number of each trace) is limited to 38.



Saving the captured data

The default save mode (‘sort by parameter’ and ‘single frequency’ not ticked) creates a data file for each captured sweep. The example below shows the result of saving after capturing 12 measurement sweeps. In this, the user requested the magnitude S_{11} and S_{21}.

As can be seen, 12 data files have been created (each has the name provided by you, with the sweep number appended, e.g. “Step_Attn_5.dat” is the data file for sweep 5) and each data file has 3 columns. The first is the frequency in MHz, the second contains the requested S_{11} magnitude value and the third the requested S_{21} magnitude.



The default save data mode creates a data file for each sweep.

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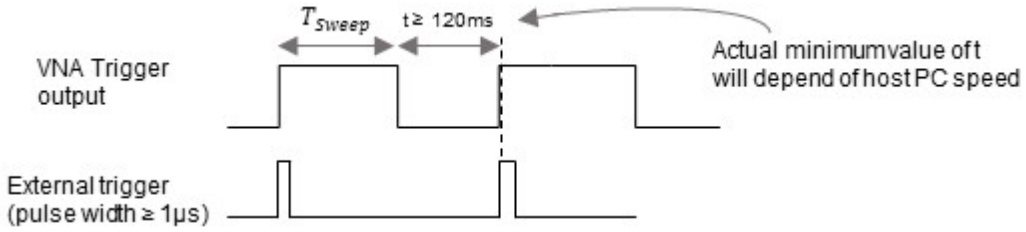
External trigger considerations

The save on trigger mode programs the instrument to perform a specified number of sweeps, each synchronized to an external trigger. You must consider the maximum possible repetition rate of the external trigger. This rate is a function of factors such as the number of sweep points, bandwidth in use and crucially the speed of the host PC's operating system in allocating USB communication resources. If the trigger rate exceeds the maximum, the host PC may miss some trigger events.

The timing diagram that applies to the Save on Trigger mode is shown below. In this it is assumed that the external trigger is set to rising edge.

The measurement sweep time T_{Sweep} is a function of the number of sweep points and measurement bandwidth in use. For example, a plan with 201 points using a bandwidth setting of 140 kHz will have T_{Sweep} of 38.3 ms when measuring all 4 S-parameters. Ideally, the external system that generates the trigger signal will synchronize the trigger signal to the falling edge of the trigger output from the VNA and make allowance for the speed of the host PC and its operating system allocating USB communication resources and processing all data and graphics in time.

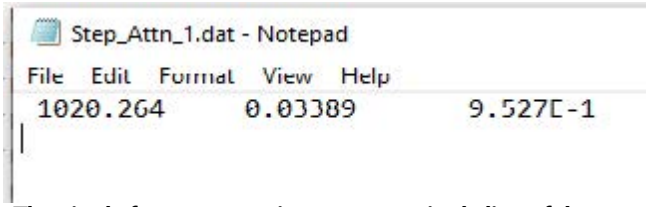


Typically, external trigger should occur 120 ms or more after the end of the sweep but will depend on speed of host PC.

Note: In the case when the external trigger occurs sooner than the host PC can support after the end of the sweep time, it is possible that some trigger events will be missed. Controlling the VNA through the API (using the DLL file supplied) places a lighter load on the host PC (no graphics) so will support significantly faster rates.

Single frequency option

If required, it is possible to request that only data for a single frequency is saved. Ticking the 'single frequency' box and entering the desired frequency results in each saved data file containing a single line of data as shown here on the right. In this example the frequency requested was 1 GHz. The nearest calibrated data point (1020.264 MHz) is chosen as shown.

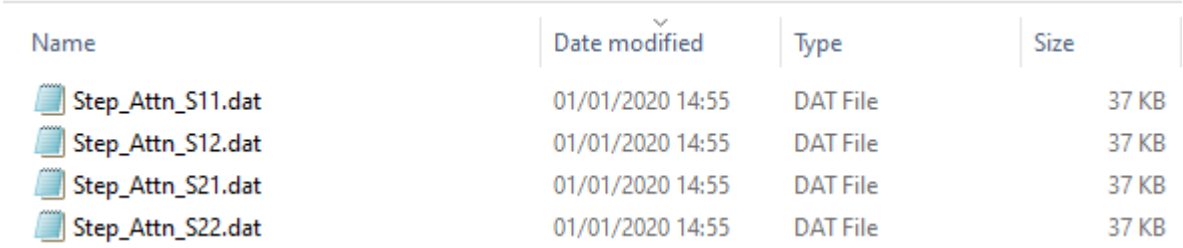


The single frequency option causes a single line of data to be saved.

Sort by parameter option

It is possible to save the data to a disk file on a parameter by parameter basis by selecting the **Sort by parameter** tick box in the **Save captured data** section of the form. So, for example, it is possible to save all the values of S_{21} in a single file with the values for each sweep in separate columns.

For example, choosing to save all 4 s-parameters sorted by parameter will result in 4 separate disk files being created as shown below:



Name	Date modified	Type	Size
Step_Attn_S11.dat	01/01/2020 14:55	DAT File	37 KB
Step_Attn_S12.dat	01/01/2020 14:55	DAT File	37 KB
Step_Attn_S21.dat	01/01/2020 14:55	DAT File	37 KB
Step_Attn_S22.dat	01/01/2020 14:55	DAT File	37 KB

The 'Sort by parameter' option creates a file for each s-parameter.

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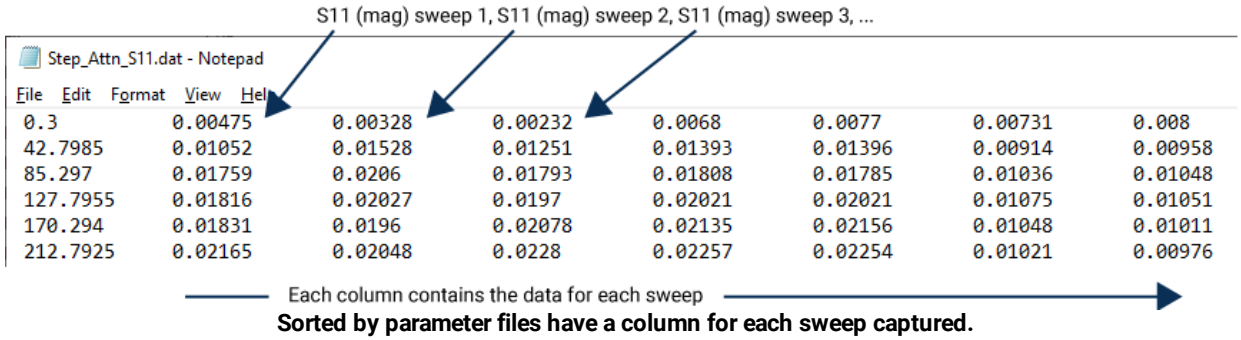
The figure below shows part of the contents of a sorted by parameter file created for the S_{11} values. In this example, the user chose to save magnitude only. As can be seen, the first column has the frequency value in MHz and subsequent columns contains the S_{11} value of the measurement sweeps captured.



Sorted by parameter files have a column for each sweep captured.

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