vna/J 2.6.15
Users guide

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DL2SBA

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Table of contents

Changes

Version	Date	Who	Changes
2.0.2	14.02.2010	DL2SBA	Updated for new GUI and functions
2.1.0	15.02.2010	DL2SBA	Update new logic for calibration. Extended overview
2.1.3	17.02.2010	DL2SBA	Added first version of sample section Added hints and tips section. Statusbar updated.
2.2.0	18.02.2010	DL2SBA	Generator support explained. Driver info dialog added. DDS calibration explained.
2.2.1	19.02.2010	DL2SBA	Minor corrections
	20.02.2010	DL2SBA	Extensions
2.3.2	23.02.2010	DL2SBA	Extended description
2.4.0	26.02.2010	DL2SBA	Shortcut for calibration loading New marker panel Automatic scaling on scales Cable measurement extended
2.4.1	28.02.2010	DL2SBA	Added description for scheduler
2.4.3	05.03.2010	DL2SBA	GUI further described. Custom scaling added. Automatic reloading of calibration data added.
2.4.4	12.03.2010	DL2SBA	Fixed scheduler problem with multiple executed tasks. Added search functions to SWR, loss and phase marker. Added colour setup dialog for diagram area. Added export into S-parameter file.
2.4.10	09.04.2010	DL2SBA	Added descriptions for Data-analysis- and Smith-chart-dialogs. Added JAVA section for Mac OS
2.4.11	10.04.2010	DL2SBA	Corrected bug in "how to launch in a different language" chapter. Changed chapter "enable logging". Updated chapter "Application start Windows"
2.5.0	30.04.2010	DL2SBA	Support for miniVNApro enabled
2.5.1	03.05.2010	DL2SBA	Detailed frequency calibration for miniVNA PRO. Generator dialog for miniVNA PRO added
2.5.4	08.05.2010	DL2SBA	Updated section " Frequency calibration ". Updates section " How to launch in a different language"

Version	Date	Who	Changes
2.6.0	06.06.2010	DL2SBA	Added - Marker math - Simple-tune dialog - Multi-tune dialog - Network support Updated - Sample calibration sets for miniVNA and miniVNAPRO - Error reporting details - S-Parameter export - Z-Plots export
	11.07.2010	DL2SBA	Added - Generator output waveforms - Load raw in main diagram
	05.09.2010	DL2SBA	Updated - Installation on 64bit Mac OS X machines
2.6.9	02.11.2010	DL2SBA	Updated installation sections for - MS Windows machines - Mac OS X machines
2.6.11	14.11.2010	DL2SBA	Moved installation and application-start sections to new installation document. Moved technical details for drivers and network support to new driver development document.
2.6.12	03.01.2011	DL2SBA	Corrected links for new website
2.6.14	21.01.2011	DL2SBA	Added - Description of over scan feature in calibration section - Special section for miniVNA pro in calibration section - Added measurement sample and simulation to samples section Updated - Description of smith chart - Updated parameter replacement in export section - Updated section describing the analyser menu.

Acknowledgements

- First of all I want to thank my wife **Monika, DL6SCF** being incredibly understanding, supportive, and most of all, patient.
- **Davide, IW3HEV** and **his team** for these fine two little blue boxes.
- **Andy, G0POY**, for his permanent quality assurance of new releases, proof-reading this document, providing an excellent installation description for SUSE LINUX and giving useful tips regarding usability etc.
- **Dan, AC6LA**, author of ZPLOTS, for his support on writing ZPlots and SnP formats correctly.
- **Tamas, HG1DFB**, for his translation to Hungarian
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- **Bertil, SM6ENG**, for testing and useful tips.
- The numerous users worldwide giving me permanent feedback.
- And last but not least my cat **Ina**, which helped me many times solving complex situations at the keyboard ;-)

Overview

The **miniVNA** and **miniVNApro** instruments by mRS *http://www.miniradiosolutions.com* are popular and very useful test instruments.

The miniVNA instrument is a small blue box with two BNC connectors and a USB connector.

The newer miniVNApro is also small blue box now with two SMA connectors and much enhanced precision.

All the control of the instrument is performed by a software application running on a PC.

Many people have contributed to the development of this software, but the focus has been mainly on the Microsoft Windows operating system. There was a Linux based application but this is no longer supported, and the advancement of the various Linux distributions has rendered it inoperable.

I've started in 2007 to develop a control application based on the Java programming language. Initial ideas were taken from the Visual-Basic-Application that was provided by mRS.

Java is a cross-platform language, which allows the identical application binary to run on any supported Java enabled Operating System.

Currently I've tested the application on Windows98, WindowsXP, Windows7-32bit, WindowsVISTA-64bit, MacOSX 32-bit versions and MacOSX 64-bit versions.

Andy has tested it successful on SUSE LINUX 11.1 and 11.2

Remark:

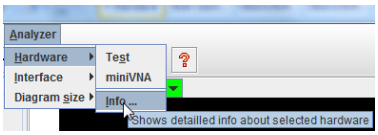
Not all screenshots in this documentation are taken from the latest application version.

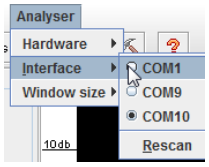
Where it is necessary for understanding, the latest screenshots are used.

This user manual contains the following chapters:

Chapter	Main content	Read before 1st usage
Quick-start guide	Ten steps to do the first measurement	✓
GUI	A detailed description of the user interface	✓
Export	A detailed description, how to export data to images, PDF documents and other file formats.	
Tools	Describes the available tools in the application	
Measurement basic	Basic information of how to do measurements using this application	✓
Calibration	How to get good results	
Application start	How to start this application on various platforms	
Configuration	How to do internal configuration	
Installation	How to install the application on various platforms	
Samples	Shows some measurements taken with the miniVNA	
Hints & Tips	Some useful information	
Driver developer guide	Describes in detail, how to implement custom hardware drivers for this application.	
Links	Where to find more information	

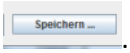
Quick-Start-Guide (32-bit Windows/OSX)

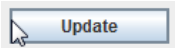
1. Plug-in the miniVNA into a free USB port on your PC.
2. Install the required FTDI serial port drivers for your PC.
3. Download the latest application version from http://vnaj.dl2sba.com
4. Download the latest serial support driver from http://vnaj.dl2sba.com
5. Start the application using the command **java -jar vnaJ_X_Y_Z.jar**
6. Select your analyser hardware via the 

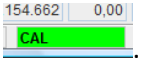
menu
7. Select the used communication port via this 

menu
8. Select the mode 

9. Open the calibration dialog via this toolbar button 

10. Follow the instructions for transmission or reflection mode calibration.
11. You can save the calibration data via this button 

.
A meaningful filename is proposed.
12. Press 

and the program is ready to work 

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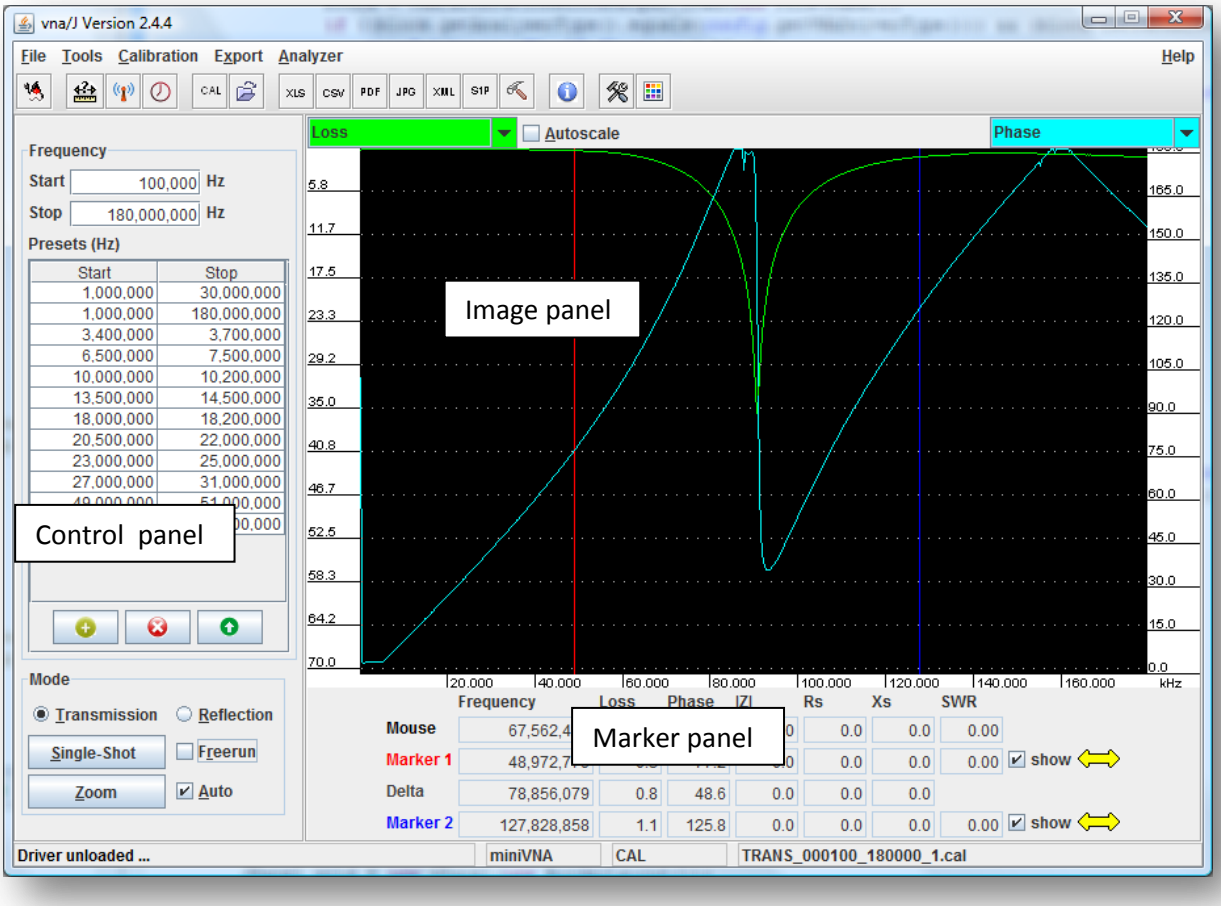
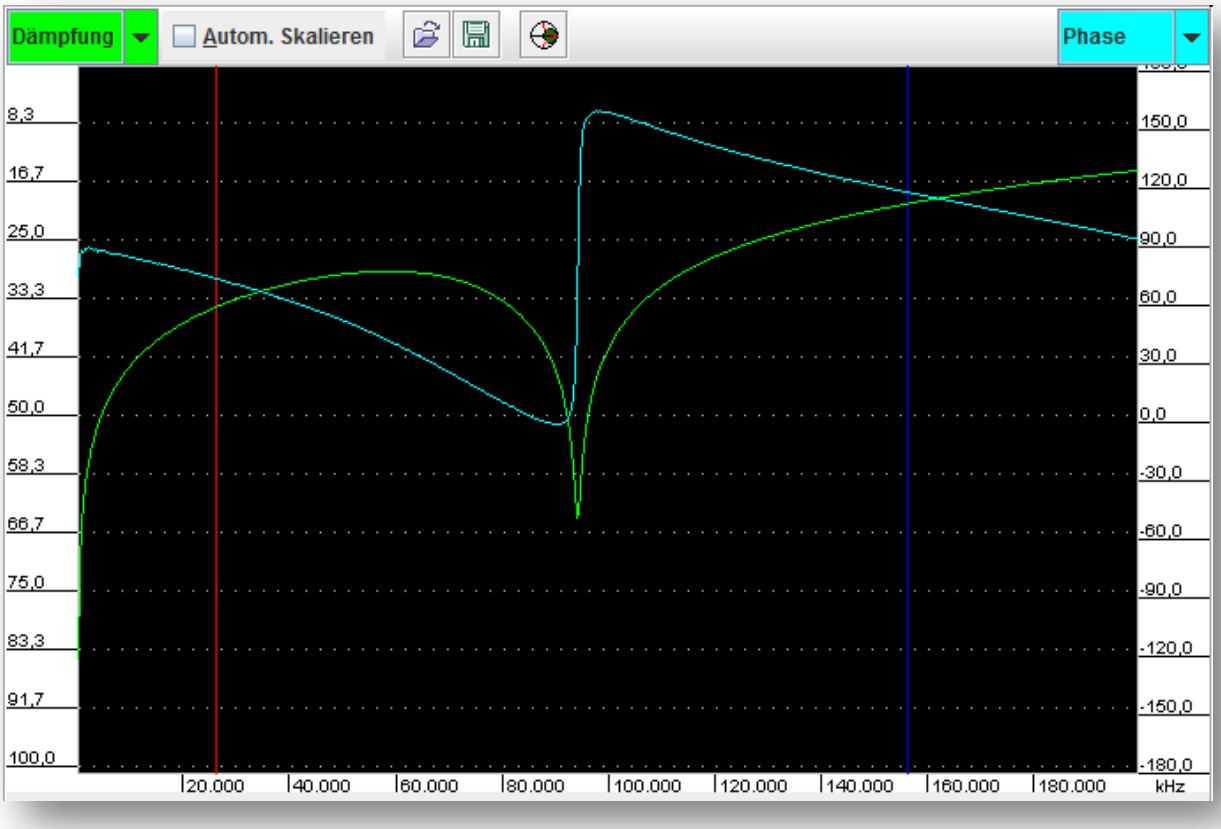
Remark: In case of problems with the above procedure, please be so kind and check the detailed installation manuals on http://vnaj.dl2sba.com prior to asking for support!

GUI

The applications main window contains the graphical representation of the scanned values in the image panel, as well as the control panel and the marker panel.



The image panel



The image panel contains the following parts:

- The scale selection drop down list boxes for the left and the right scale .
- The vertical scales matching the selected scale types in the drop down list boxes.
- The frequency scale at the bottom of the image panel.
- The display area showing the scanned results from the analyser.

For each tick on the left scale, a dotted line is drawn in the diagram area.

Scales

Currently the following measurements are available in the scale select dropdown lists:

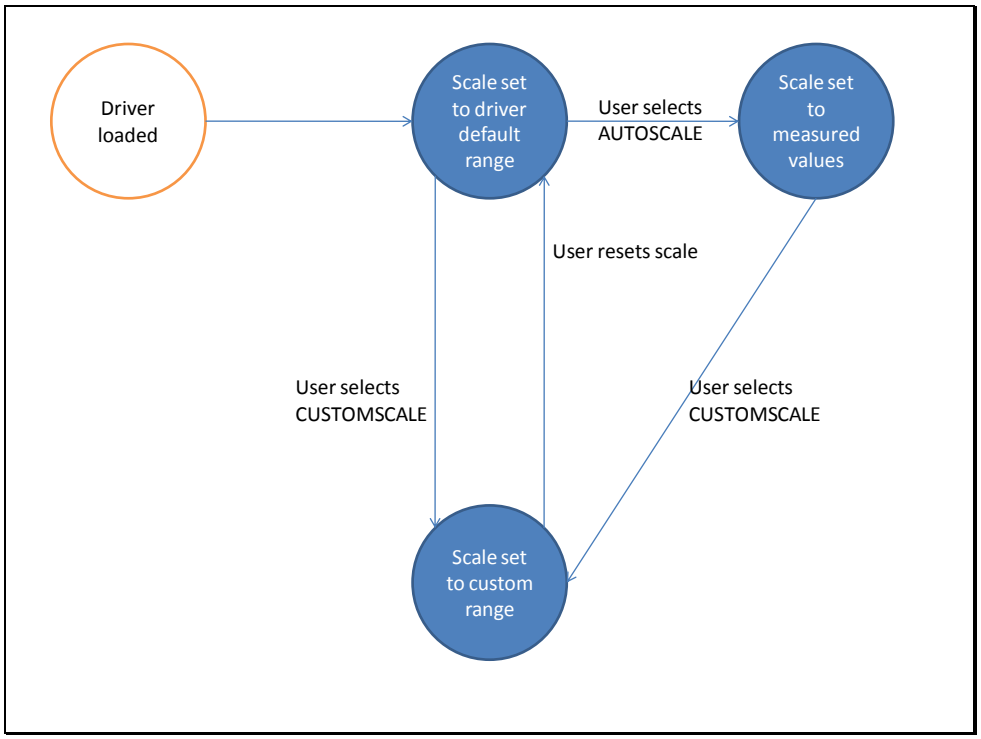
Name	Content	miniVNA minimum	miniVNA maximum	Auto scale
Loss	Display transmission or reflection loss	0dB	70dB	✓
Phase	Display the phase value	0°	180°	✓
SWR	Displays the SWR	1:1	1:10	-
|Z|	**ZComplex** is the complex impedance of the DUT referred to 50 ohm. |Z| the magnitude of the complex impedance.	0	1000	✓
Rs	Displays the series equivalent resistance of the load also called Rs	-3000	3000	✓
Xs	Displays the series equivalent reactance of the load also called Xs	-3000	3000	✓

Basically the ranges are dependent on the select analyzer hardware.

Scale-lifecycle

Each scale has currently three states:

State	
Scale set to driver default range	The range of the scale is set to fixed range. The scales Phase and Loss are scaled based on the used driver. The other scales have a identical range independent of the loaded driver.
Scale set to measured values	The user has selected the auto-scale option. The scales range is determined by the measured data. Except the SWR scale, all scales support auto-scaling.
Scale set to custom range	The scale is set to a fixed range. The range must be entered by the user. The range may not exceed the specified ranges of the scale.



Auto-scaling

Except the SWR scale, all scales are able to scale themselves to the measured data.

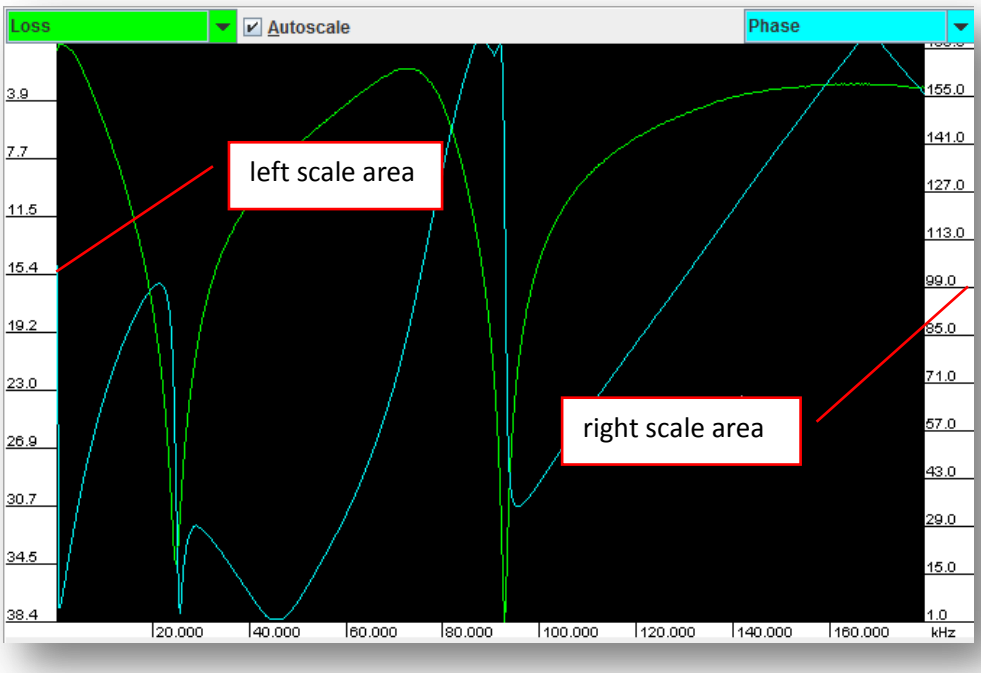
Selecting the AUTOSCALE checkbox above the diagram enables this auto scale functionality.

When deselecting the AUTOSCALE box, the scale uses the minimum and maximum values as described in the previous table.

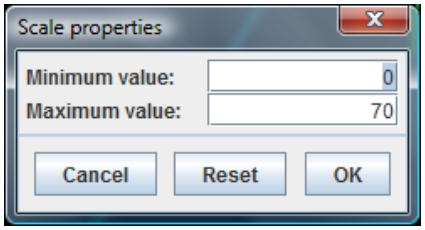
Clicking twice on the deselected AUTOSCALE box can be used to reset both scales to their default values.

Custom-scaling

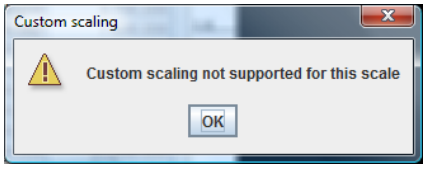
Except the SWR scale, all scales can be scaled by a user-entered range.



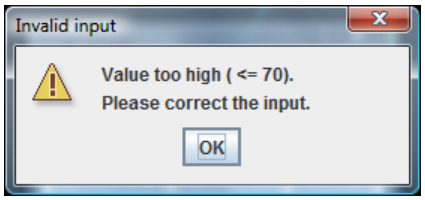
Clicking with the left mouse button on the scale area opens a small dialog, in which the user can enter the minimum (value at top of scale) and the maximum (value at bottom of scale):



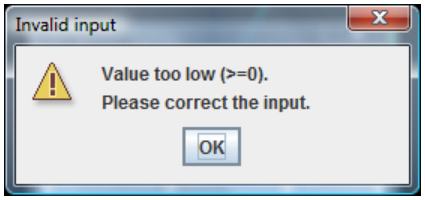
If custom scaling is not supported for this scale, a message is shown:



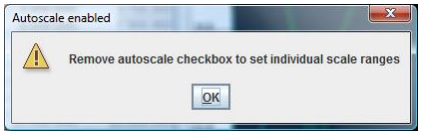
When the entered values is too low for the active scale, a message is displayed showing the maximum value.



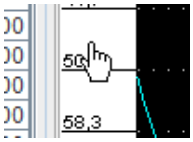
When the entered values is too high for the active scale, a message is displayed showing the maximum value.



Clicking on the scale area, when auto-scaling is enable notifies the user, to remove first the auto-scaling option.



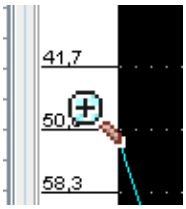
The scale ranges can also be set using the mouse. When the mouse is positioned on a scale area, the mouse cursor turns into a pointing hand.



Two modes are available:

- **Zoom**-in our zoom-out the scale.
- **Move** the scale up or down.

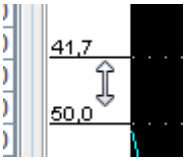
Zoom-mode



Pressing the **left** mouse button turns the mouse cursor into a loupe. Moving the mouse with pressed left button inside the scale area up or down increases or decreases the scale range.

… hard to explain - simply try it.

Move-mode



Pressing the **right** mouse button turns the mouse cursor into a double arrow. Moving the mouse with pressed right button inside the scale area up or down moves the scales range up or down up to the values given by the selected driver.

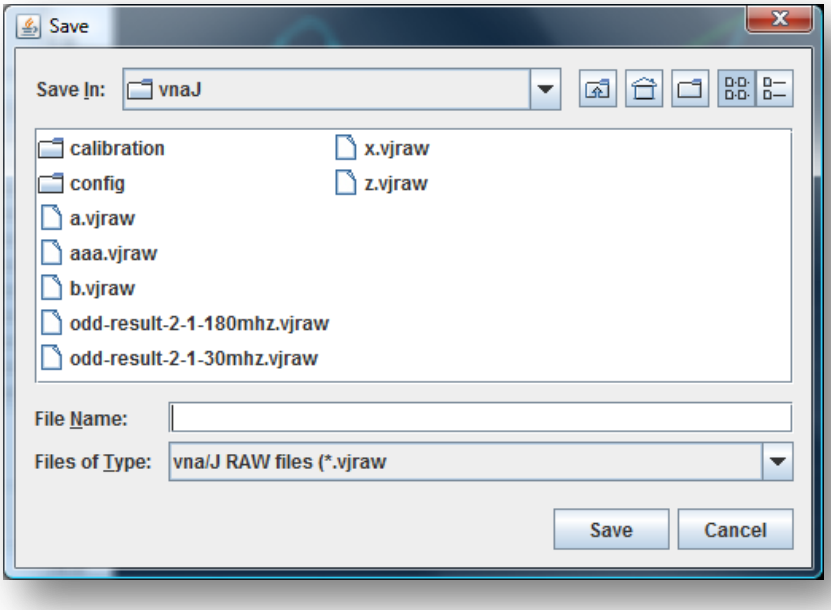
… hard to explain - simply try it.

Saving measured data

Selecting the SAVE button

saves the currently displayed data to an external file.

The location of the file can be selected in the default SAVE dialog:



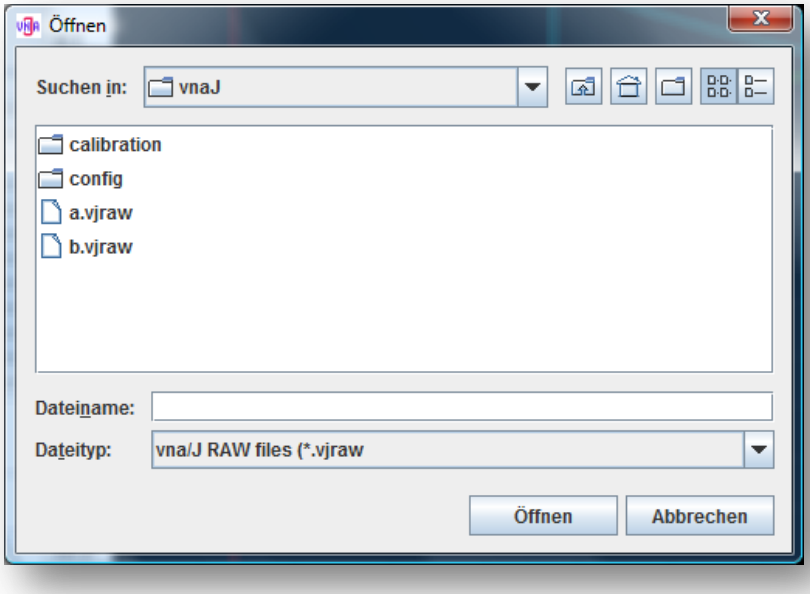
This data then can be later displayed in the analysis dialog (See chapter "Data analysis" on page 59) or reloaded into the diagram area to do cursor measurements etc.

Note: The exported files of type **vjraw** are simple XML-files which are compressed in GZIP-format. Adding the extension **.gz** to a file enables i.e. WINZIP to open the file correctly and show the contained XML-data.

Loading measured data

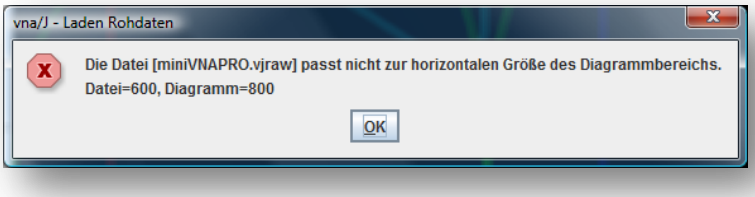
Selecting the LOAD button

opens the standard file-open dialog



The available raw-files are displayed and can be selected for loading.

If the horizontal size of the selected file does not match the current diagram width the file cannot be loaded and a message is shown:

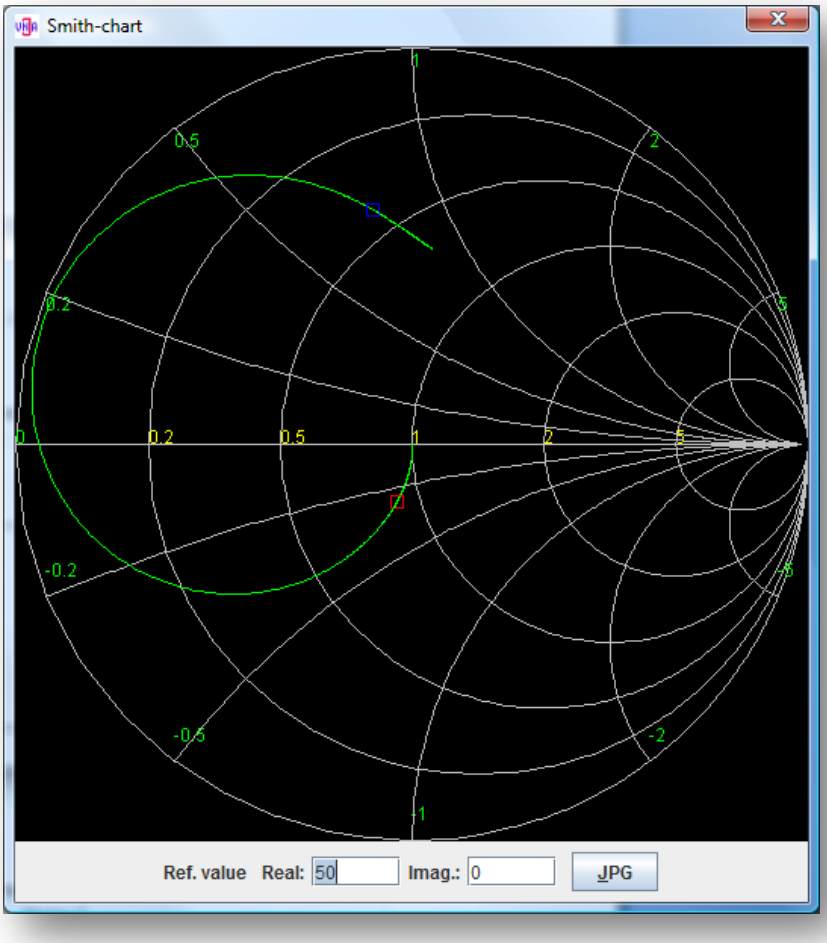


Note: This function is more or less to play around with the previously saved data and do basic measurements with the cursors etc.

Display Smith-chart

Selecting the Smith-chart checkbox

opens a non-modal dialog, that displays the current measured data inside a Smith-chart:



If the markers 1 or 2 are selected in the main window, a small rectangle in the marker colour is drawn on the smith-chart.

***Note**: The relevant data for a Smith-chart is only available in reflection mode. In transmission mode, the miniVNA is not capable providing the relevant data.*

*The data in the smith-chart is updated whenever a **new** scan is done in the main window.*

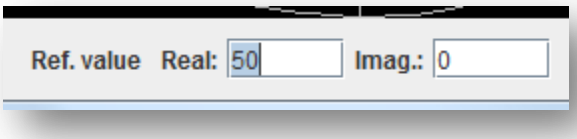
Export to JPG-file

The diagram can be exported using the JPG-button right to the detail data. Selecting this button, opens the default SAVE default where the name and location of the diagram can be set.

The size (number of x/y-pixels) of exported JPG image is determined by the size of the Smith-chart inside the dialog. To get higher resolution, simply resize the dialog to the desired size and then use the export function.

Reference value

In the input field the user can enter a complex reference resistance which is used in normalizing the diagram.



***Note**: Usually you only enter a real resistance value!*

Marker panel

The marker panel displays the actual data of the three markers:

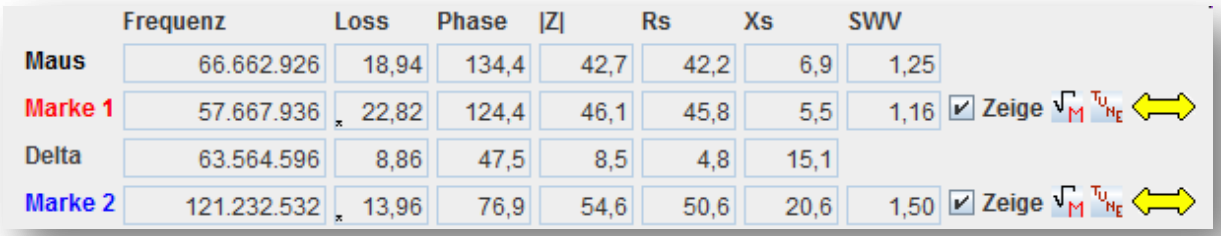


Image 1 - marker panel

Mouse Displays values, when the mouse cursor is inside the image panel.

Marker 1 can be set by moving the mouse into the diagram panel and clicking the **left** mouse button.

Marker 2 can be set by moving the mouse into the diagram panel and clicking the **right** mouse button.

Delta Calculates the absolute differences between most of the Marker 1 and Marker 2 data.

Operations

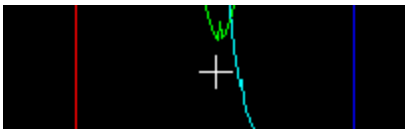
Un-checking the option button **right** to the marker, removes the marker from the diagram panel.

Clicking with left mouse button on the yellow double-arrow moves the marker one unit to the left.

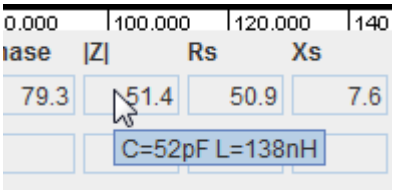
Clicking with right mouse button on the yellow double-arrow moves the marker one unit to the right.

Using the mouse-wheel is also possible, when the mouse cursor is positioned on the double-arrow.

When the mouse is positioned inside the diagram panel, the current values at the mouse position are displayed in the marker named **Mouse.**



When the mouse is positioned over the |Z| field, the calculated inductivity and capacity is displayed in the tool tip.



The formula for the capacity is: $C = \frac{1}{2\,\pi\,f\,|Z|}$

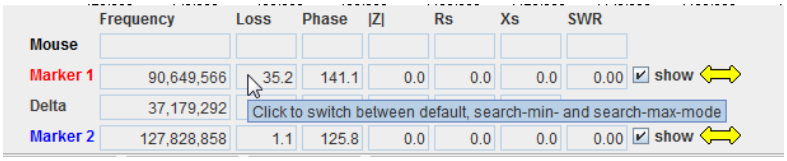
The formula for the inductivity is: $L = \frac{|Z|}{2\,\pi\,f}$

This works only for marker 1 and 2.

The LOSS, PHASE and SWR fields support search mode.

When the search mode is selected, the marker is automatically positioned on the maximum- or minimum-value in the diagram.

The search mode is selected by clicking on the respective fields in marker 1 or marker 2.



Two search-modes are supported:

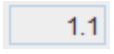
- min-search mode

- max-search mode

Min-search mode is indicated by a small * at the lower-left corner of the field:

Max-search mode is indicated by a small * at the upper-left corner of the field:

Standard-mode of the marker is enabled, if no * is visible in the field.



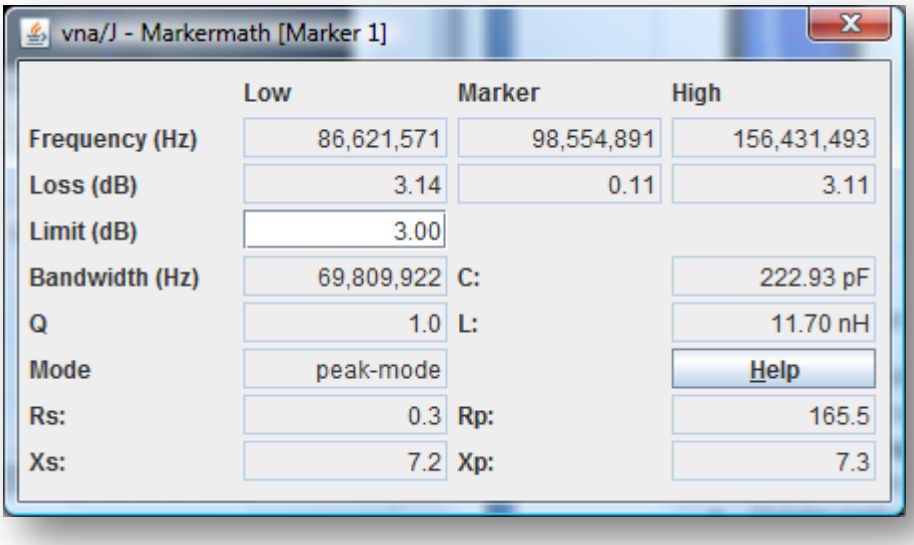
Opens or closes the marker math dialog for this marker

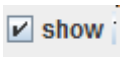
Opens or closes the tune dialog for this marker

Marker-math dialog

This dialog can be used i.e. to tune an antenna filter to a given centre frequency an a defined bandwidth.

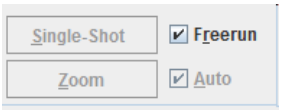
The marker-math dialog is bound to one of the two markers. The data displayed in this dialog is the data of this marker.





The dialog is available, when the corresponding marker is visible.

The dialog can be displayed by clicking on the toggle button.
The first click opens the dialog, a second click removes the dialog. The position, size and the entered limits are stored separately for each tune dialog.

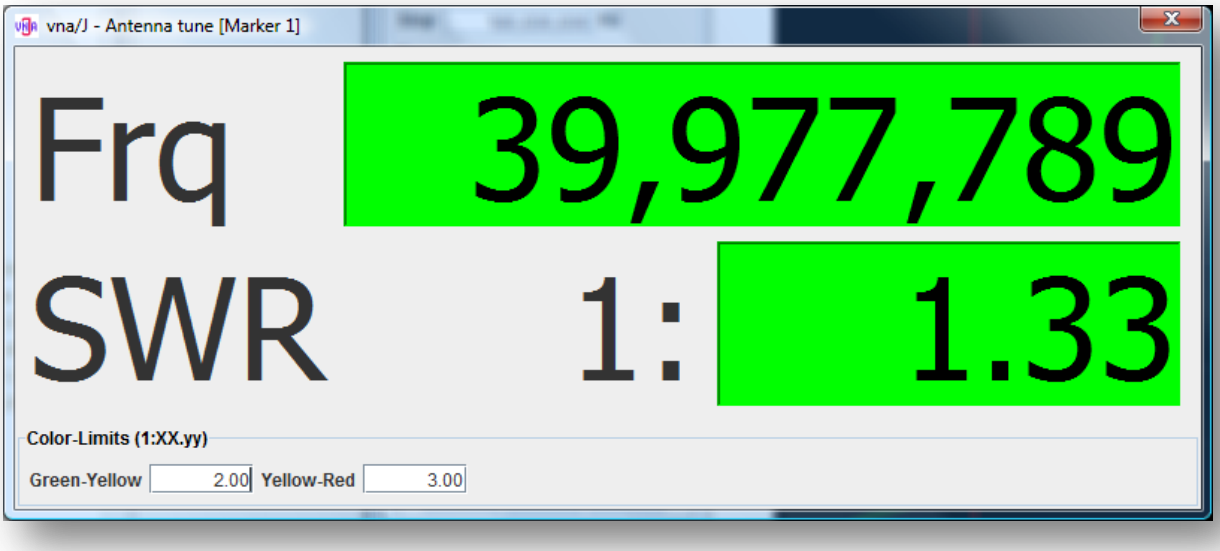


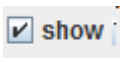
For a continuous reading ensure, that the free-run mode is enabled.

Remark: The data in the dialog is updated **after** a scan!

Tune-dialog

This dialog can be used i.e. to tune an antenna when the PC display is some distance away. The tune dialog is bound to one of the two markers. The data displayed in the tune-dialog is the data of this marker.





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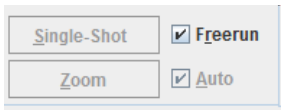
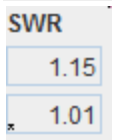
The dialog can be displayed by clicking on the toggle button.
The first click opens the dialog, a second click removes the dialog. The position, size and the entered limits are stored separately for each tune dialog.



For a continuous reading ensure, that the free-run mode is enabled.

If you want to display the SWR at a **fixed frequency**, ensure, that the marker search mode is **not enabled**, means no small star is shown in the marker fields.



If you want to display the minimum or maximum SWR value in the given scan range, enable the marker search mode for the SWR marker field.

The background colour of the frequency and SWR fields can be controlled by these two fields.
The background is green, if the SWR is below the entered value in field **Green-Yellow**. The background is yellow, if the SWR is between **Green-Yellow** and **Yellow-Red**. The background turns red, if the SWR is above the value in the field **Yellow-Red.**

Remark: The Close icon in the dialog does not work!

The control panel

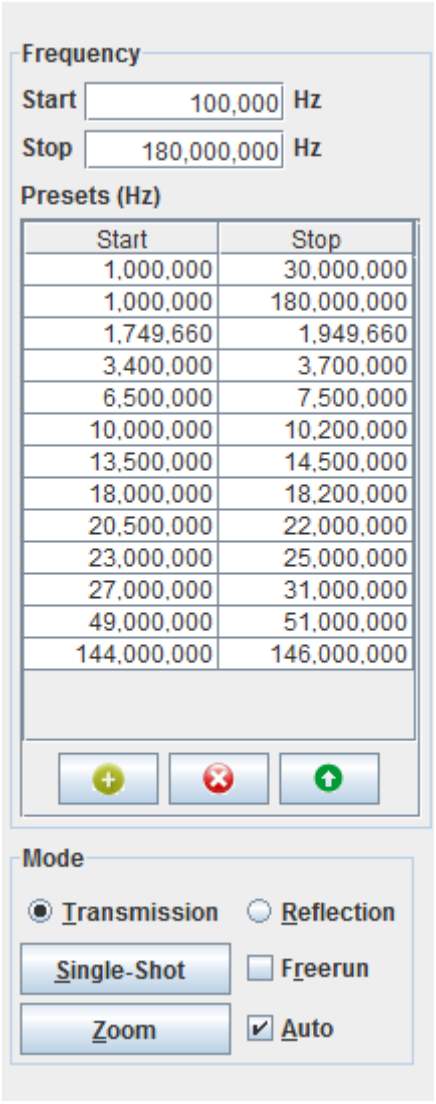


Image 2 - Control panel

Frequency

In the frequency control panel, you can enter the desired start and stop frequencies for the scan.

The frequencies entered must be between the lower and upper maximum which the selected analyzer device can handle. The range can be checked using the driver info (see chapter …).

You can enter the frequencies in Hz, kHz or MHz

Examples:	144750000	144.750.000 Hz
	144m	144.000.000 Hz
	7200k	7.200.000 Hz

The start frequency should be below the stop frequency.

By double-clicking with the left mouse button on an entry in the presets list, you can quickly set the start/stop frequencies to the desired range. A selected list entry can also be used clicking the  button.

Entries in the presets list can be deleted by selection an entry in the list and clicking on  .
A currently entered frequency can be added to the list clicking on the  button.

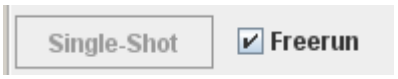
The presets for the common HAM bands are loaded at first application start.

The preset list is stored to the file system and loaded on application start.

Mode

Whether the VNA runs in **reflection** or **transmission** measurement mode can be selected with these radio buttons:

Selecting the checkbox enables the continuous measurement with the given parameters in the frequency and mode group. If the checkbox is deselected, the scanning of the VNA stops and the pushbutton for single shot is active.



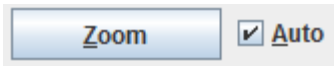
During continuous scanning, most of the menu entries and toolbar buttons are disabled to ensure a correct measurement.

Clicking the button triggers a single scan of the analyzer.

Zoom

There are two types of zoom modes supported:

- Min-Max-zoom
- Percentage zoom

If the AUTO checkbox right to the zoom button 

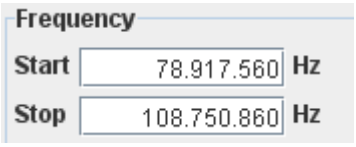
is checked, the analyzer automatically performs a scan after the ZOOM button was pressed.

Min-Max-zoom

When both markers are visible inside the diagram, clicking the 

button sets the start and stop frequencies to the range selected by the two markers.

Setting the markers to

And clicking the zoom button sets the scan range to 

.

Percentage-zoom

When only one marker is visible in the diagram, clicking the zoom button zooms into the current diagram with:

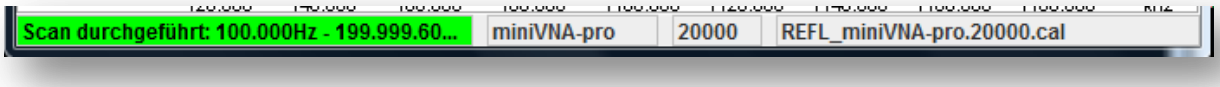
- The centre frequency is the marker frequency
- A frequency range of 20% of the current frequency range.

For example:

- Currently selected scan range from 1MHz to 100MHz. Marker is set to 60MHz.
- Now press ZOOM.
- New scan range is 50MHz to 70MHz with a centre frequency of 60MHz.

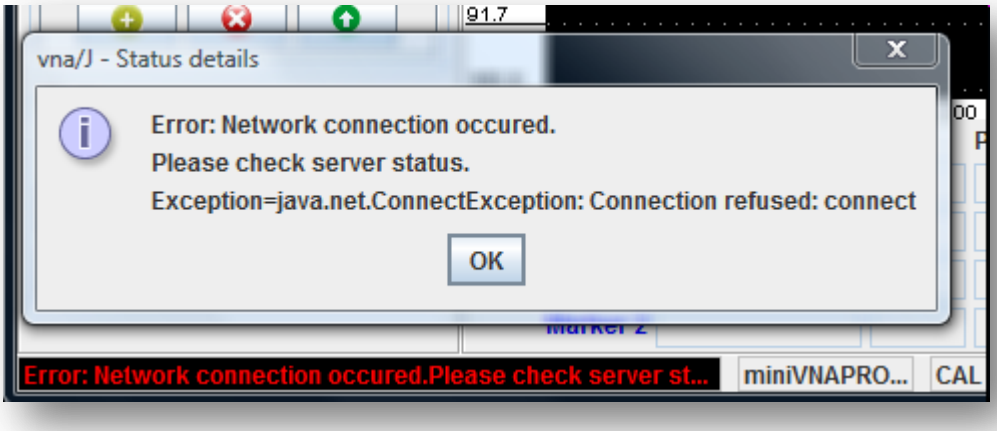
The status bar

The status bar at the bottom of the screen contains four sections:



1. In the leftmost section, tool tips for the menu entries and status information of running data acquisitions are displayed. Green or white background for info messages. Red for errors.
2. The selected type of the analyser is displayed here.
3. When calibration data is loaded, here the number of calibration steps is displayed. If no data is loaded UNCAL is displayed.
4. In the rightmost section, the filename of the currently loaded main calibration dataset shown.

Remark: If any text displayed in the status bar is not completely visible, simply click on it with the mouse to display a popup dialog, displaying the complete message.



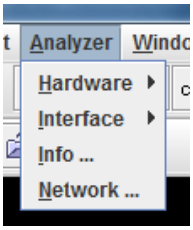
The tool bar

The tool bar below the menu bar contains useful shortcuts to commonly used commands.

Icon	Description
	Exit the application, same as menu FILE/EXIT
	Opens the cable length measurement dialog. Same as menu TOOLS/CABLELENGTH. For details see chapter"Cable length measurement" on page 49.
	Opens the generator dialog. Same as menu TOOLS/GENERATOR For details see chapter "Generator" on page 50.
	Opens the scheduler dialog. Same as menu TOOLS/SCHEDULER. For details see chapter "Scheduler" on page 55.
	Opens the data analysis dialog. For details see chapter "Data analysis" on page 59.
CAL	Opens the calibration dialog. Same as menu CALIBRATION/LOSS. For details see chapter "Calibration" on page 67.
	Opens the load calibration dialog. Same as menu CALIBRATION/LOAD. For details see chapter "Loading existing calibration data" on page 73.
XLS CSV PDF JPG XML S1P	Exports the measured data to a file in the selected format (XLS, CSV, PDF, JPG, XML or S1P). Same as menu MENU/XLS .. MENU/S-parameter. For details see chapter EXPORT
	Opens the export settings dialog. Same as menu EXPORT/SETTINGS. For details see chapter "Settings" on page 36.
	Opens the driver info dialog. Same as menu ANALYZER/HARDWARE/INFO. For details see chapter "Info" on page 31.
	If a network driver is selected, the network configuration dialog can be displayed using thing button. Same as menu ANALYZER/NETWORK. For details see chapter …tbd…
	Open the application settings dialog. Same as menu FILE/SETTINGS. For details see chapter "Configuration" on page 82.
	Configure the colours of the diagram area.

Analyzer

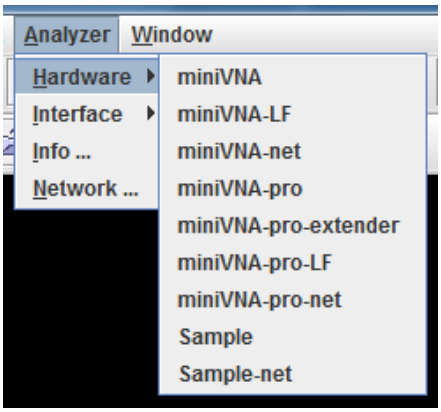
The configuration of the analyzer hardware can be found in the analyzer menu.



Hardware

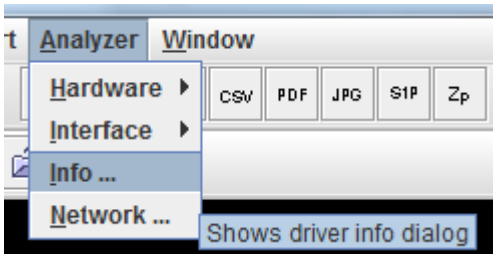
Currently these hardware drivers are available for vna/J:

- ***mini RADIO SOLUTIONS miniVNA***.
- ***mini RADIO SOLUTIONS miniVNA pro***
- a ***sample*** driver for testing without hardware.



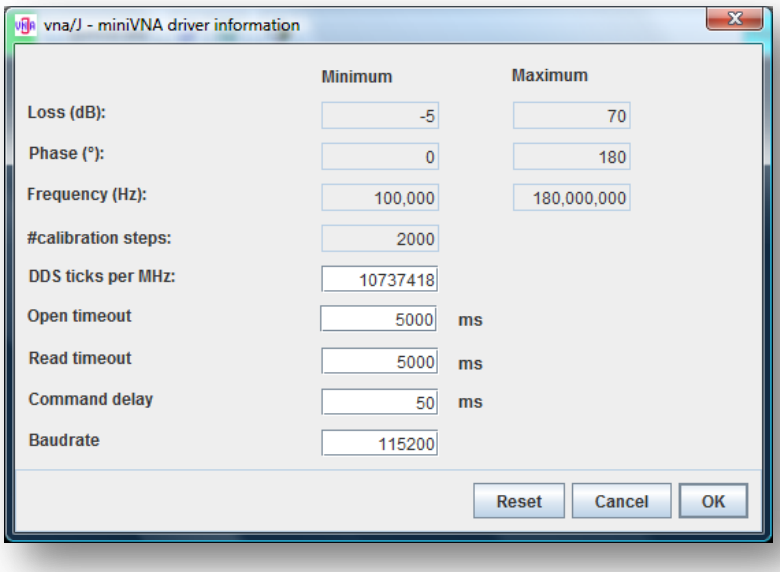
Info

After selecting the correct hardware, a driver information dialog is available, which shows the hardware specific parameters.



Depending on the selected driver one of the following driver dialogs is displayed:

miniVNA

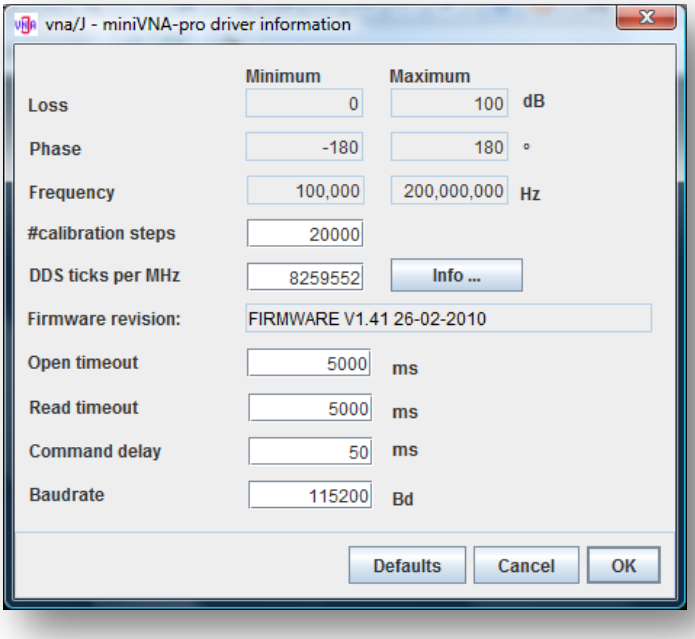


The following parameters are available for change:

Parameter	Description	Range
DDS ticks per MHZ	Sets the number of DDS ticks used for a step of 1MHz	A good start is 10.737.418. Must be between 999.999 and 999.999.999,
Open timeout	Time to wait for opening the communication port.	Usually done within milliseconds. Only on slow machines, it may take longer. 5.000ms is a good choice. Must be between 500ms and 99.000ms
Read timeout	Maximum wait time between sending a command to the vna and no character is received.	Usually within 500milliseconds. Only on slow machines, it may take longer. 5.000ms is a good choice. Must be between 500ms and 99.000ms
Command delay	Time between sending the individual command characters to the vna.	Usually 50 milliseconds is fine for the miniVNA. Must be between 500ms and 99.000ms
Baudrate	Baudrate used to communicate with vna.	Must be between 1.200 and 115.200

Parameter	Description	Range
	For standard miniVNA it set fixed to 115.200 Bd.	

miniVNA pro



The following parameters are available for change:

Parameter	Description	Range
#calibration steps	Determines the number of calibrations steps, that are acquired during calibration.	For standard scan 2.000 is fine. The valid range is between 2.000 and 25.000
DDS ticks per MHZ	Sets the number of DDS ticks used for a step of 1MHz	A good start is 10.737.418. Must be between 999.999 and 999.999.999,
Open timeout	Time to wait for opening the communication port.	Usually done within milliseconds. Only on slow machines, it may take longer. 5.000ms is a good choice. Must be between 500ms and 99.000ms

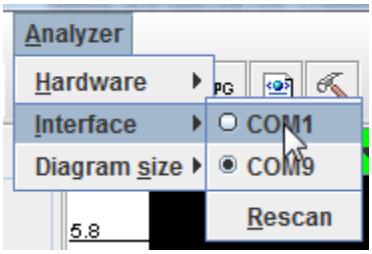
Parameter	Description	Range
Read timeout	Maximum wait time between sending a command to the vna and no character is received.	Usually within 500milliseconds. Only on slow machines, it may take longer. 5.000ms is a good choice. Must be between 500ms and 99.000ms
Command delay	Time between sending the individual command characters to the vna.	Usually 50 milliseconds is fine for the miniVNA. Must be between 500ms and 99.000ms
Baudrate	Baudrate used to communicate with vna. For standard miniVNA it set fixed to 115.200 Bd.	Must be between 1.200 and 115.200

As the miniVNA pro is delivered in two hardware version, a help dialog is displayed showing the default value for the parameter **DDS ticks per MHZ** depending on the DDS frequency.

For further details see also chapter "miniVNA PRO" on page 80.

Interface

After selecting the correct hardware, the driver performs a scan for available serial ports in the system.



The found ports are listed in this menu.

A rescan can be executed by clicking on the RESCAN menu entry. This may be useful when connecting the analyzer after application start to the computer.

Remark: *The name of the interfaces found on the systems depends on the operation system running.*

Diagram size

To get optimum performance and reduced influence of missing calibration data, the application supports only a fixed number of window sizes.

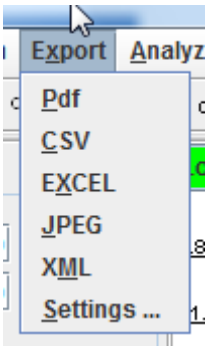
Menu	# of samples	Vertical resolution Phase	Vertical resolution Loss
600 x 400	600	0.450°	0.18 dB
800 x 600	800	0.300°	0.12 dB
1000 x 800	1000	0.225°	0.09 dB

Export

Currently the application supports 4 ways to export the measurement data into an external files:

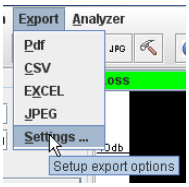
Format	Comment
PDF	Exports the currently displayed diagram along with the optional displayed markers
CSV	Exports the pure numerical data into a comma-separated file
EXCEL	Exports the pure numerical data into Microsoft© EXCEL Worksheet.
JPEG	Exports the currently display diagram into a JPEG-compatible file or to the clipboard.
XML	Exports the currently displayed data into an XML compatible file.
S1P	Export the currently displayed data into an S-parameter (S1P) comatible file.

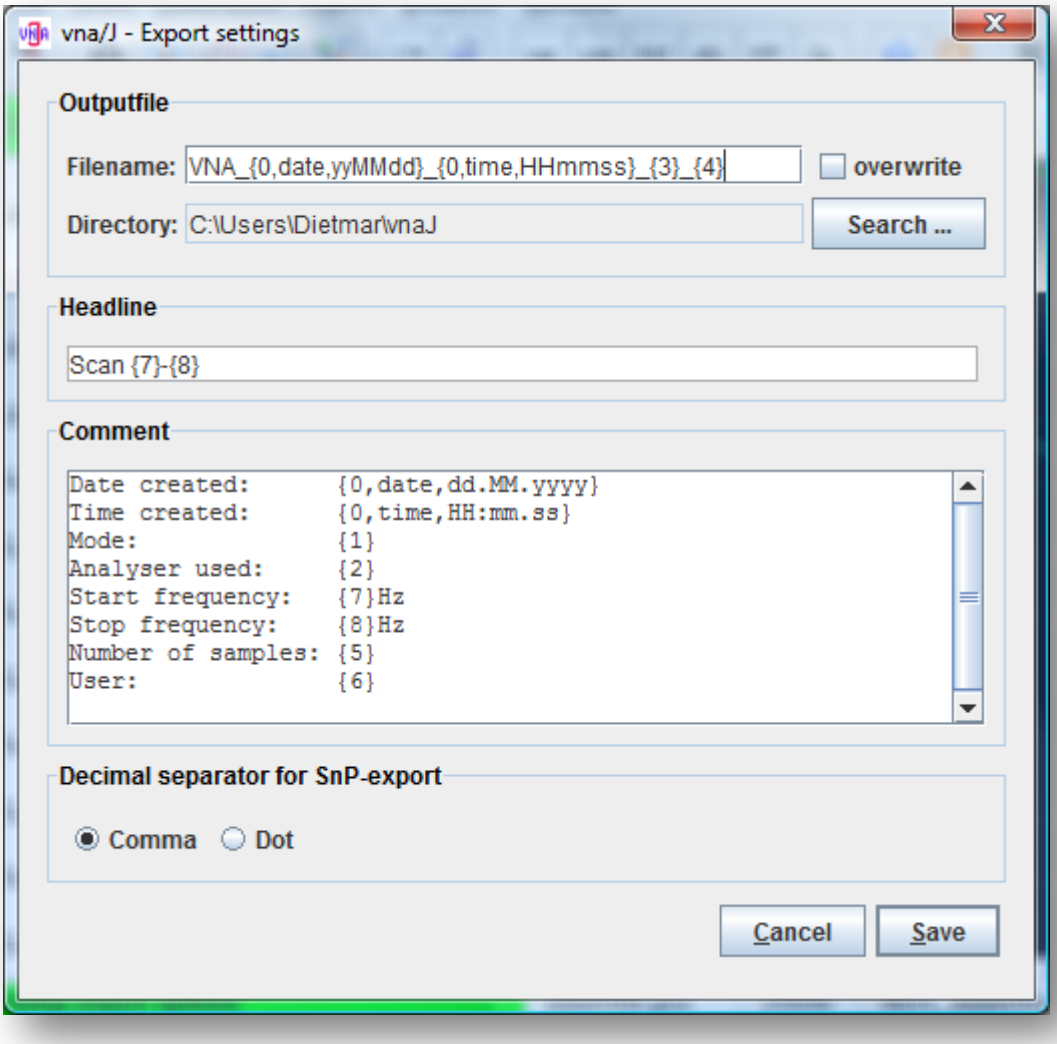
The export functions are available via the EXPORT menu or the corresponding toolbar buttons:



Settings

The settings dialog sets common parameters for all export formats.

It can be reached via the toolbar button  or the menu entry 



Filename

Here you can enter the name for the exported files. Depending on the export type, the correct file-name extension (XLS, PDF, JPG and CSV) is appended to this name.

As a special feature, the filename supports parameter replacement. The following parameters are supported:

{0} timestamp (see next chapter)
{1} transmission (TRAN) or reflection (REFL) mode
{2} short name of the analyser
{3} start frequency for the scan (without thousand-separators)
{4} stop frequency for the scan (without thousand-separators)
{5} number of samples
{6} user name from operation system
{7} start frequency for the scan (with thousand-separators)
{8} stop frequency for the scan (with thousand-separators)

Timestamp

When calling the export function, the current timestamp is provided in parameter {0}. Here are some formatting examples for this timestamp 2010-02-15 17:12:45:

Format	Result
VNA_{0,date,yyMMdd}	VNA_100215.xls
VNA_{0,time , HHmmss }	VNA_171245.xls

The following replacement parameters are currently supported:

Shortcut	Represents	Example	Shortcut	Represents	Example
y	Year	1996; 96	H	Hour in day (0-23)	0
M	Month in year	07	k	Hour in day (1-24)	24
w	Week in year	27	K	Hour in am/pm (0-11)	0
W	Week in month	2	h	Hour in am/pm (1-12)	12
D	Day in year	189	m	Minute in hour	30
d	Day in month	10	s	Second in minute	55
F	Day of week in month	2	a	Am/pm marker	PM
E	Day in week	Tuesday			

Directory

Here the directory is displayed, into which all export files are written. The directory can be selected using the SEARCH button.

Overwrite

If the checkbox OVERWRITE is set, an existing file with the same name as the file to be created is overwritten.

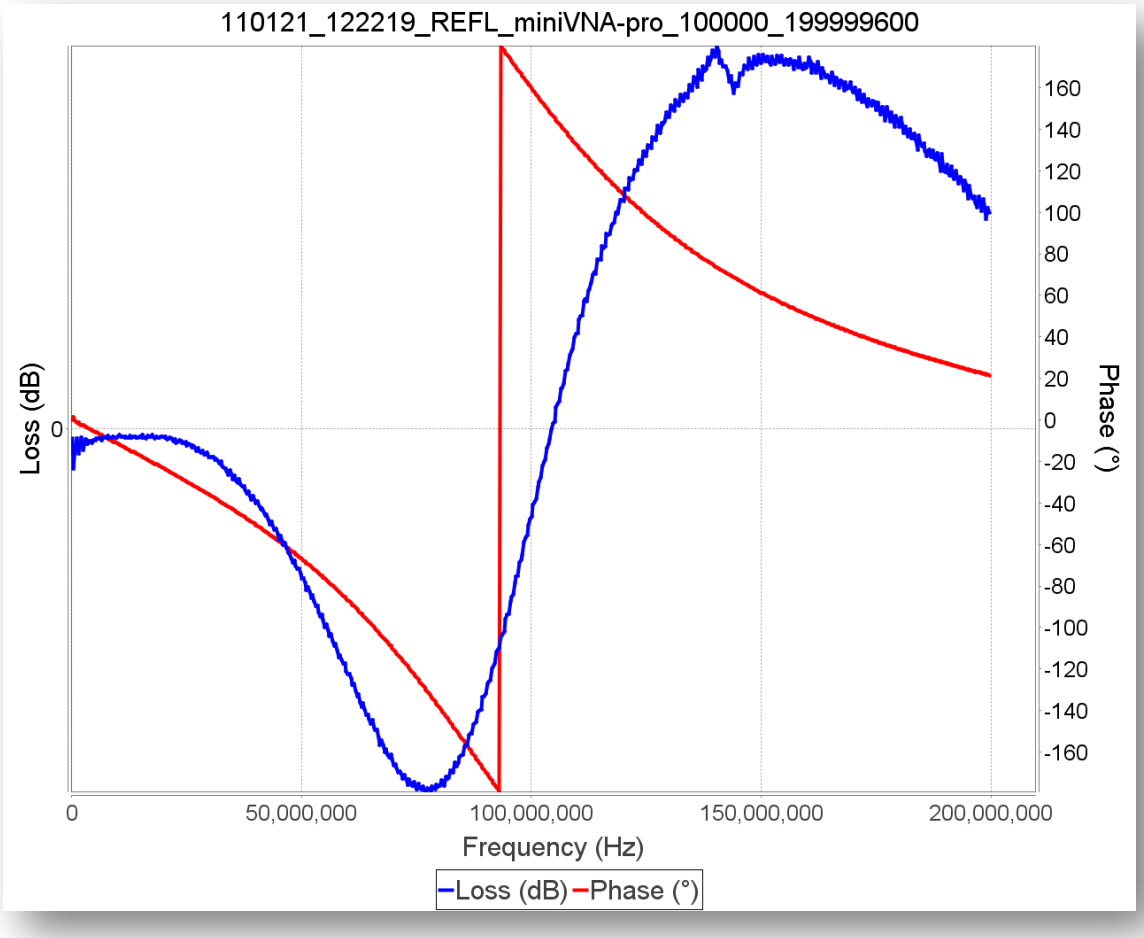
If the checkbox OVERWRITE is not set, a message is shown and you are asked, whether you want to overwrite this file.

Note: *When a part of the filename is dynamic (i.e. inserted date or time parts) the overwrite warning is only shown, when exactly the same filename is already existing at the export location.*

If you plan to use the scheduler to generate automatically export, ensure, that this checkbox is not set or that every time the scan runs, a different filename is generated!

Title

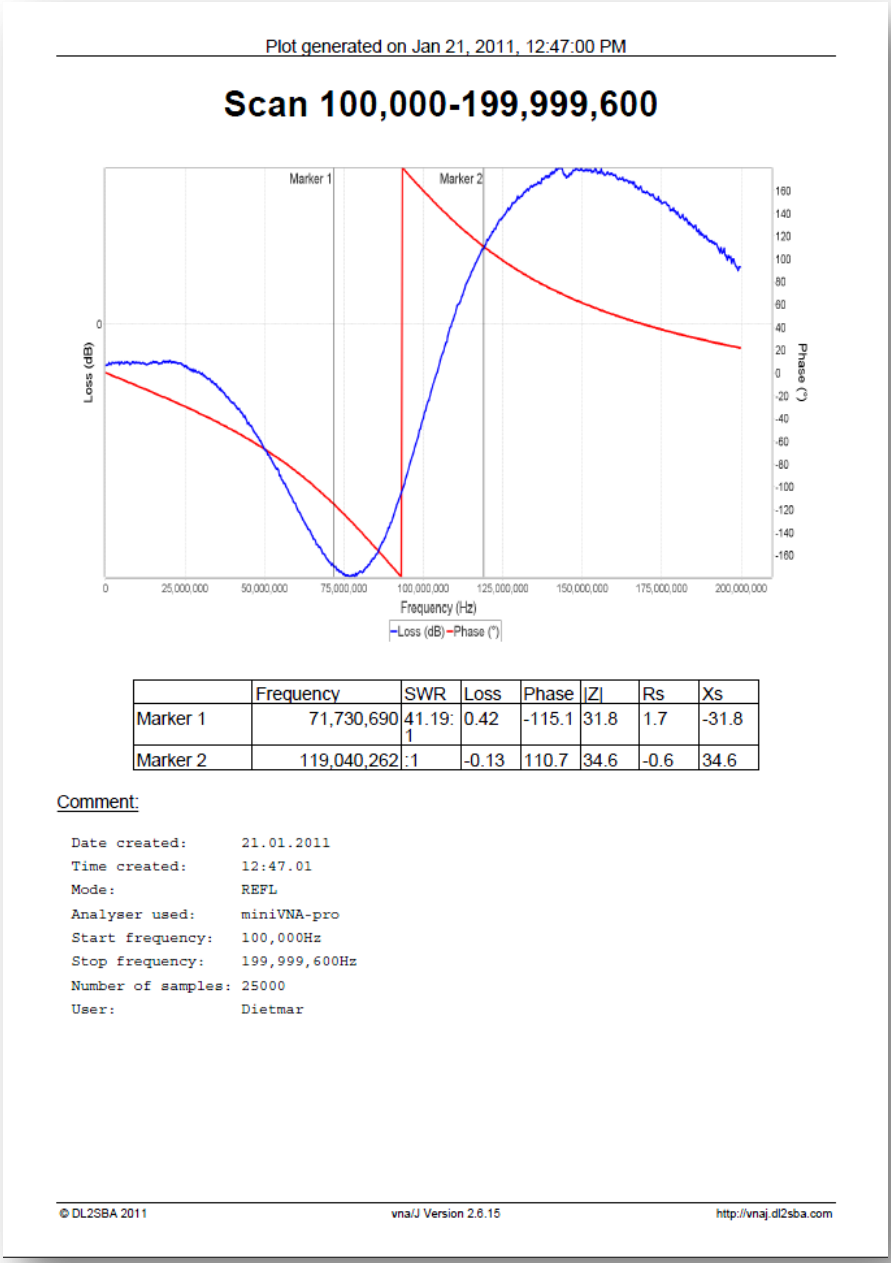
Here you can enter a diagram title which is displayed in the head section of the exported diagrams (JPG and PDF format).



The same replacement parameters are supported as for the filename field.

Comment

Here you can enter a detailed comment for the measurement which is printed in the generated PDF-document below the diagram.



For printing a fixed-space-font is used, so fundamental formatting can be done using SPACES. The same replacement parameters are supported as for the filename field.

CSV export

Currently only the values

- frequency
- phase and
- loss

are exported in CSV format.

For EN/US locales, the comma is used as value separator. The dot is used as decimal separator:

```
1  Frequency;Phase;Returnloss
2  100;120,7;9,5
3  733433;122,6;3,9
4  1466766;124,0;0,6
5  2200099;124,8;-3,1
6  2933432;124,8;-4,4
7  3666765;123,9;-4,6
8  4400098;122,5;-3,3
9  5133431;120,0;-1,1
10 5866764;117,0;2,0
11 6600097;113,1;6,7
12 7333430;108,6;10,4
```

For DE/CH/AT locales, the semicolon is used as value separator. The comma is used as decimal separator.

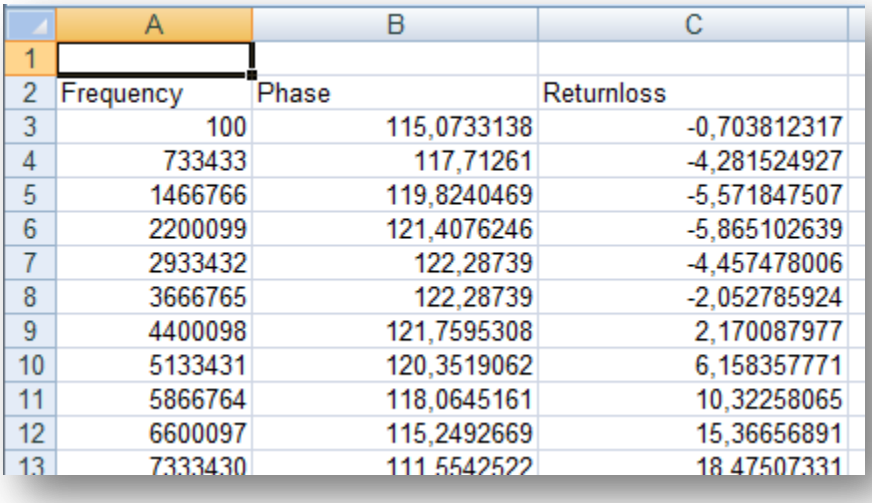
```
1  Frequency;Phase;Returnloss
2  100000;116,3;0,5
3  399833;5,1;0,0
4  699666;5,1;0,1
5  999499;7,2;0,1
6  1299332;9,9;0,1
7  1599165;12,5;0,2
8  1898998;15,1;0,2
9  2198831;17,9;0,2
10 2498664;20,4;0,4
11 2798497;23,0;0,5
12 3098330;25,7;0,6
```

Microsoft© Excel export

Currently only the values

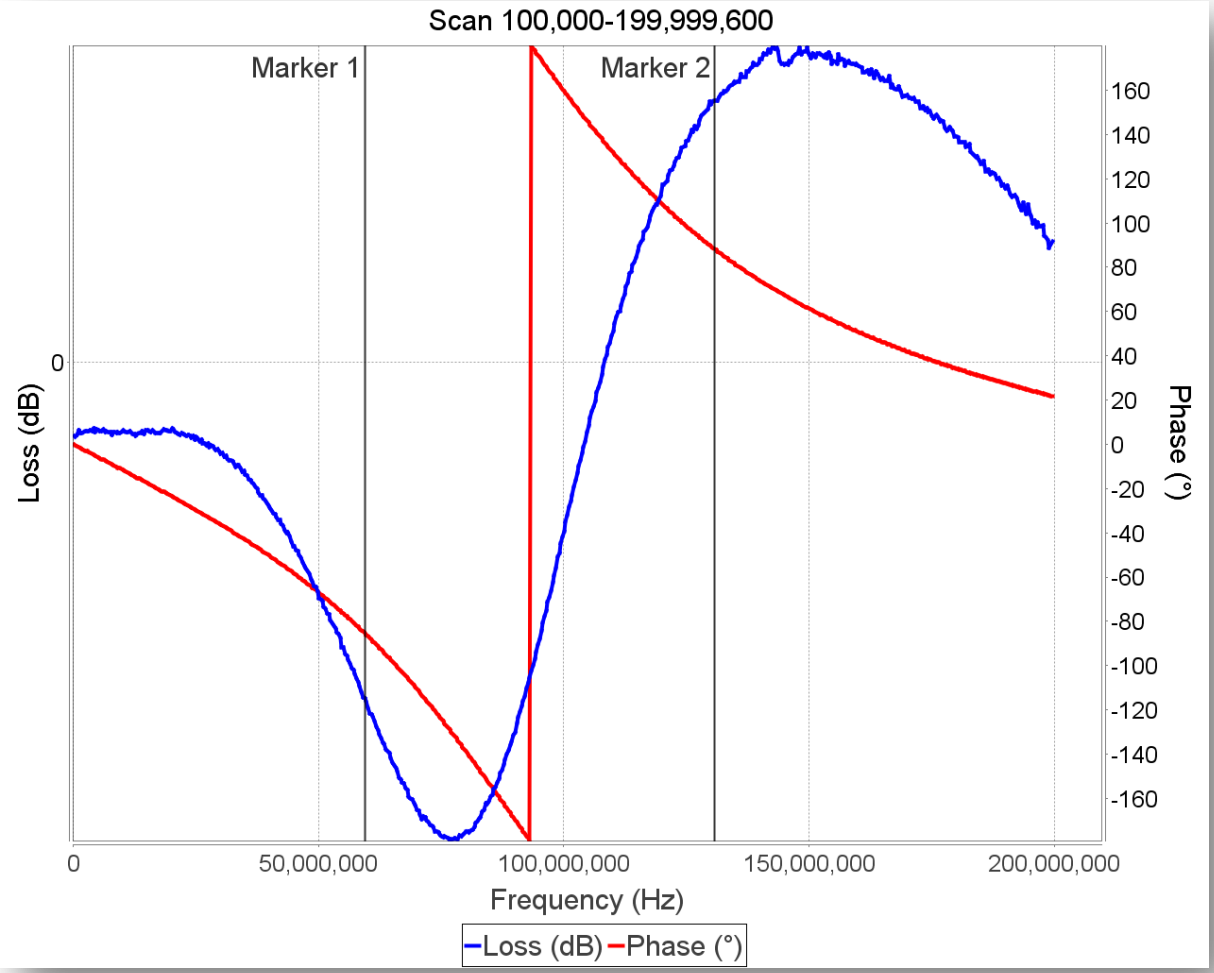
- frequency
- phase and
- loss

are exported in XLS format.



	A	B	C
1			
2	Frequency	Phase	Returnloss
3	100	115,0733138	-0,703812317
4	733433	117,71261	-4,281524927
5	1466766	119,8240469	-5,571847507
6	2200099	121,4076246	-5,865102639
7	2933432	122,28739	-4,457478006
8	3666765	122,28739	-2,052785924
9	4400098	121,7595308	2,170087977
10	5133431	120,3519062	6,158357771
11	5866764	118,0645161	10,32258065
12	6600097	115,2492669	15,36656891
13	7333430	111,5542522	18,47507331

Jpeg export



When selecting the menu item or clicking the toolbar button, the diagram is saved in JPEG-format to an external file.

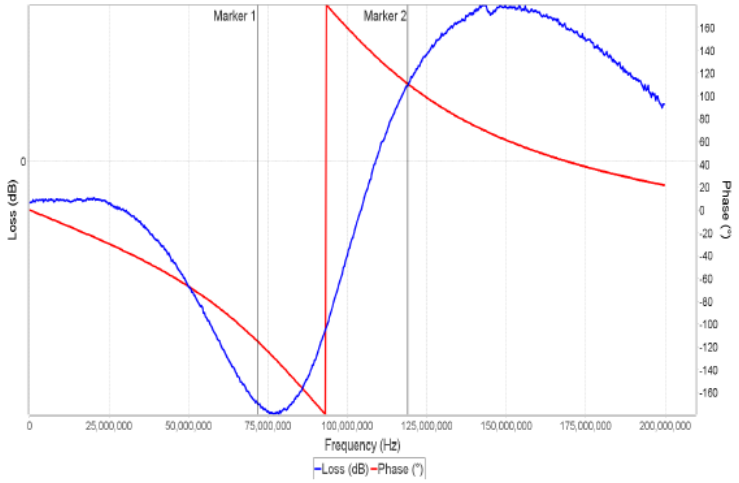
Hint: *When left-clicking the toolbar button with pressed shift-key on the keyboard, the image is copied to the systems clipboard as image. The image can be inserted in various applications like MS Word etc.*

Most of the screenshots in this document are created this way.

PDF export

Plot generated on Jan 21, 2011, 12:47:00 PM

Scan 100,000-199,999,600



	Frequency	SWR	Loss	Phase	|Z|	Rs	Xs
Marker 1	71,730,690	41.19:1	0.42	-115.1	31.8	1.7	-31.8
Marker 2	119,040,262	:1	-0.13	110.7	34.6	-0.6	34.6

Comment:

```
Date created:       21.01.2011
Time created:       12:47.01
Mode:               REFL
Analyser used:      miniVNA-pro
Start frequency:    100,000Hz
Stop frequency:     199,999,600Hz
Number of samples:  25000
User:               Dietmar
```

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S-parameter export

This function can be used to export the measurement data for 3rd-party applications, that require data in Touchstone® File Format Specification format.

This format was published 2002 by Agilent. A detailed specification can be found here:

http://www.eda.org/pub/ibis/connector/touchstone_spec11.pdf

The parameters are defined for this model:

Currently the miniVNA is only capable of measuring the parameter S11 in reflection mode and S21 in transmission mode. The other parameters can only be measured, when manually reversing the DUT/DET connectors.

S1P-parameter export

```
! created by Dietmar at Sun Jan 09 14:04:29 CET 2011
! generated using vna/J Version 2.6.13a
# Hz S DB R 50
000100000 -9.49989937 179.89638452
000281727 -9.53339600 -178.05930305
000463454 -9.51310366 -178.62377450
000645181 -9.50860638 -178.98732835
000826908 -9.51054483 -179.21463248
001008635 -9.51286286 -179.37451796
001190362 -9.49335249 179.61961335
001372089 -9.49579097 179.68376976
001553816 -9.49995498 179.69380940
001735543 -9.50188852 179.70142705
001917270 -9.50428947 179.69231205
002098997 -9.49179148 179.20646062
002280724 -9.49825286 179.22579596
```

In reflection mode a file with the extension S1P is generated with the following layout:

S2P-parameter export

In transmission mode a file with an S2P extension is generated, having this layout:

```
! created by Dietmar at Sat Jan 15 18:25:27 CET 2011
! generated using vna/J Version 2.6.14
# Hz S DB R 50
000100000 0,00000000 0,00000000 -80,23578137 57,12928109 0,00000000 0,00000000 0,00000000 0,00000000
000433166 0,00000000 0,00000000 -95,32855265 1,43052530 0,00000000 0,00000000 0,00000000 0,00000000
000766332 0,00000000 0,00000000 -94,86099094 35,38237030 0,00000000 0,00000000 0,00000000 0,00000000
001099498 0,00000000 0,00000000 -92,97648596 37,04807005 0,00000000 0,00000000 0,00000000 0,00000000
001432664 0,00000000 0,00000000 -89,57465163 41,86639735 0,00000000 0,00000000 0,00000000 0,00000000
001765830 0,00000000 0,00000000 -87,99524294 50,89351500 0,00000000 0,00000000 0,00000000 0,00000000
002098996 0,00000000 0,00000000 -87,16774724 56,23363292 0,00000000 0,00000000 0,00000000 0,00000000
002432162 0,00000000 0,00000000 -85,34411694 60,74176424 0,00000000 0,00000000 0,00000000 0,00000000
002765328 0,00000000 0,00000000 -84,43999756 62,55547269 0,00000000 0,00000000 0,00000000 0,00000000
003098494 0,00000000 0,00000000 -83,27488260 66,38424641 0,00000000 0,00000000 0,00000000 0,00000000
003431660 0,00000000 0,00000000 -82,38957639 68,21135108 0,00000000 0,00000000 0,00000000 0,00000000
003764826 0,00000000 0,00000000 -81,33380965 70,68546654 0,00000000 0,00000000 0,00000000 0,00000000
004097992 0,00000000 0,00000000 -81,00615524 71,73744515 0,00000000 0,00000000 0,00000000 0,00000000
004431158 0,00000000 0,00000000 -80,10638941 73,33220381 0,00000000 0,00000000 0,00000000 0,00000000
004764324 0,00000000 0,00000000 -79,50912750 75,37084967 0,00000000 0,00000000 0,00000000 0,00000000
005097490 0,00000000 0,00000000 -78,89885552 74,90592187 0,00000000 0,00000000 0,00000000 0,00000000
005430656 0,00000000 0,00000000 -78,21486462 75,70425552 0,00000000 0,00000000 0,00000000 0,00000000
005763822 0,00000000 0,00000000 -77,68663682 76,72801637 0,00000000 0,00000000 0,00000000 0,00000000
006096988 0,00000000 0,00000000 -77,04692131 76,86682799 0,00000000 0,00000000 0,00000000 0,00000000
006430154 0,00000000 0,00000000 -76,76901577 79,19230128 0,00000000 0,00000000 0,00000000 0,00000000
006763320 0,00000000 0,00000000 -76,50695369 78,63688039 0,00000000 0,00000000 0,00000000 0,00000000
007096486 0,00000000 0,00000000 -76,08058443 77,89209831 0,00000000 0,00000000 0,00000000 0,00000000
007429652 0,00000000 0,00000000 -75,48116332 79,30219448 0,00000000 0,00000000 0,00000000 0,00000000
007762818 0,00000000 0,00000000 -75,09469369 79,31937869 0,00000000 0,00000000 0,00000000 0,00000000
```

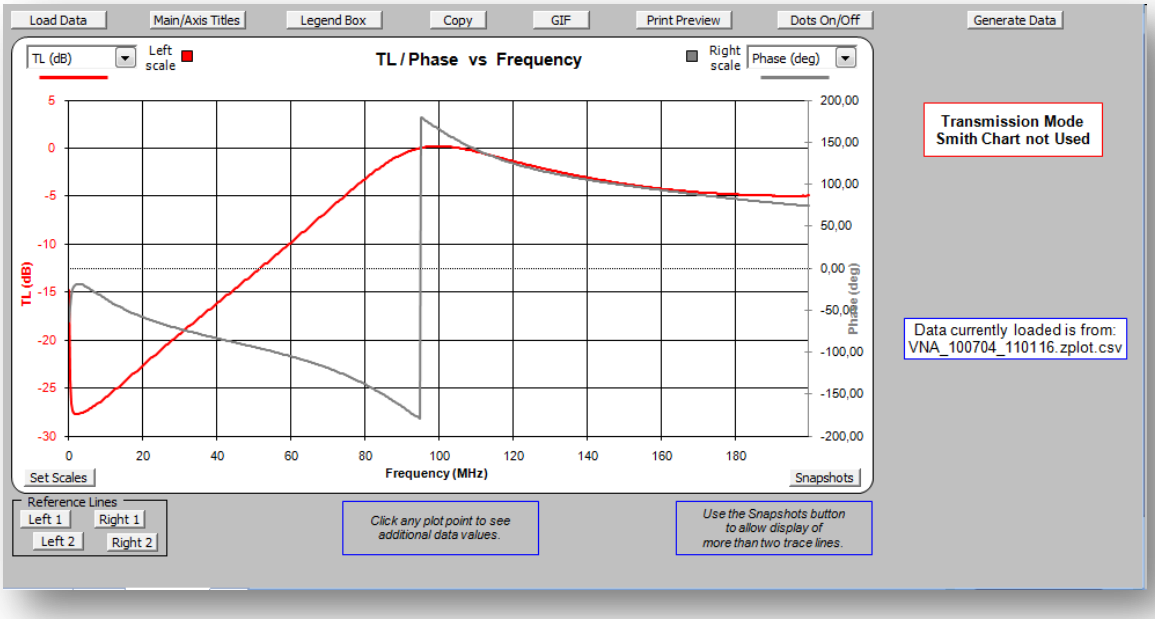
Only the parameter S21 is set in the generated file, all other parameters are set to dummy values, here 0.

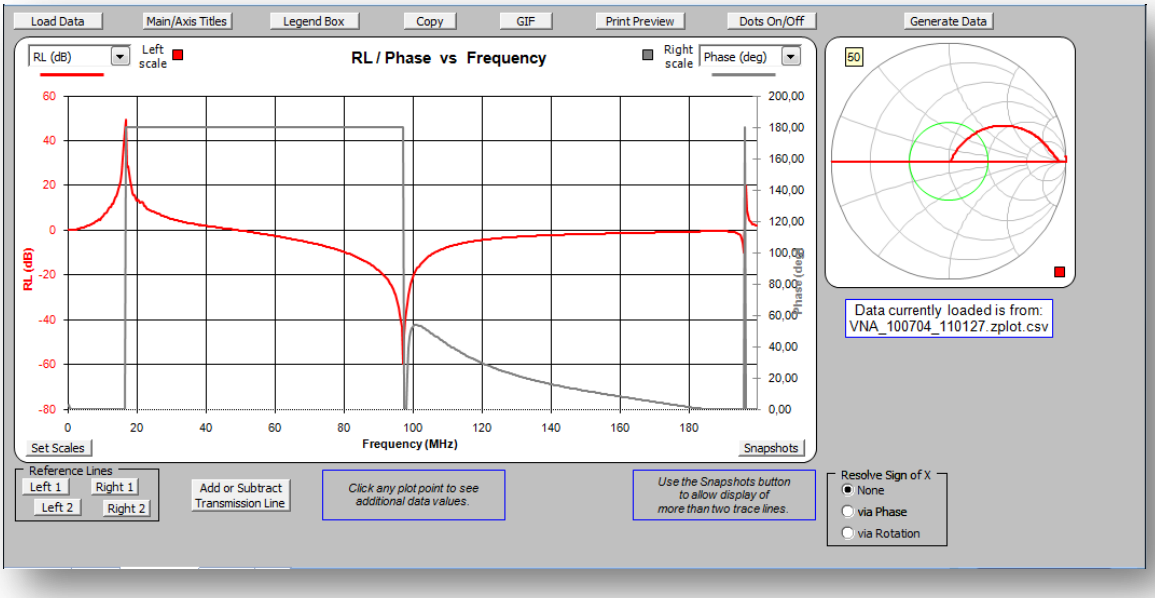
ZPlots export

This function exports the measurement data in a format, that can be read by the popular Zplots-EXCEL-Spreadsheet provided by Dan, AC6LA (http://www.ac6la.com/zplots.html).

The export filename also ends with **.csv**, so that Excel can load it without any renaming.

Importing the data into Zplots enables the user, to use the features of the Zplots-Spreadsheet even with newer MS-Office versions, where the serial port support currently no longer works.





Tools

Currently four tools are available in addition to the network analyser functionality:

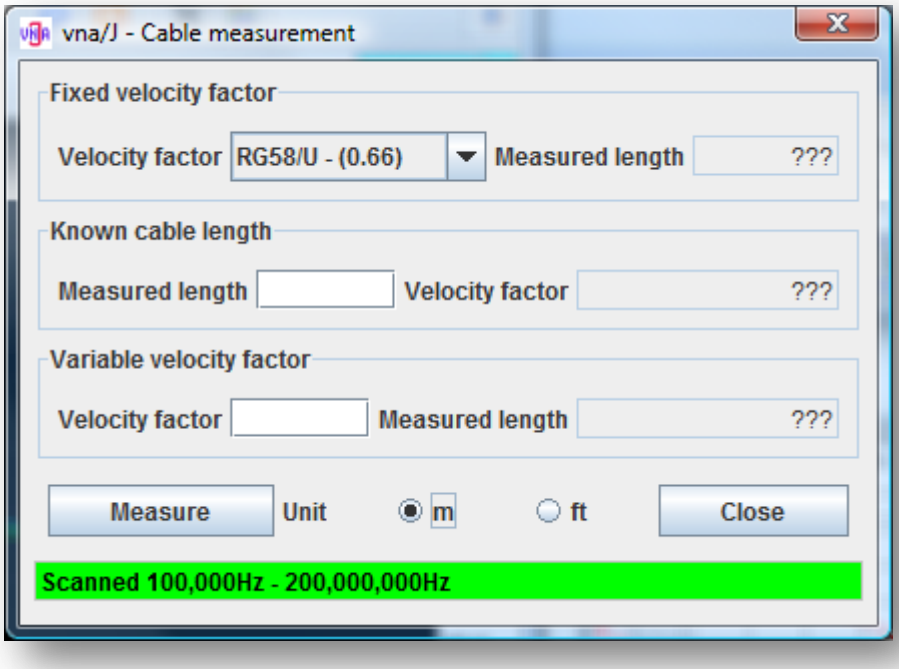
- Determine the length of a coaxial cable of a know type
- Use the miniVNA as a simple HF-signal generator
- Scheduler for measurements
- Display and compare previously saved data

These functions can be reached via the TOOLS menu or the corresponding toolbar buttons:

Cable length measurement

This tool enables the user

- to determine the length of a coaxial cable with known velocity factor
- to determine the velocity factor of a cable with known length



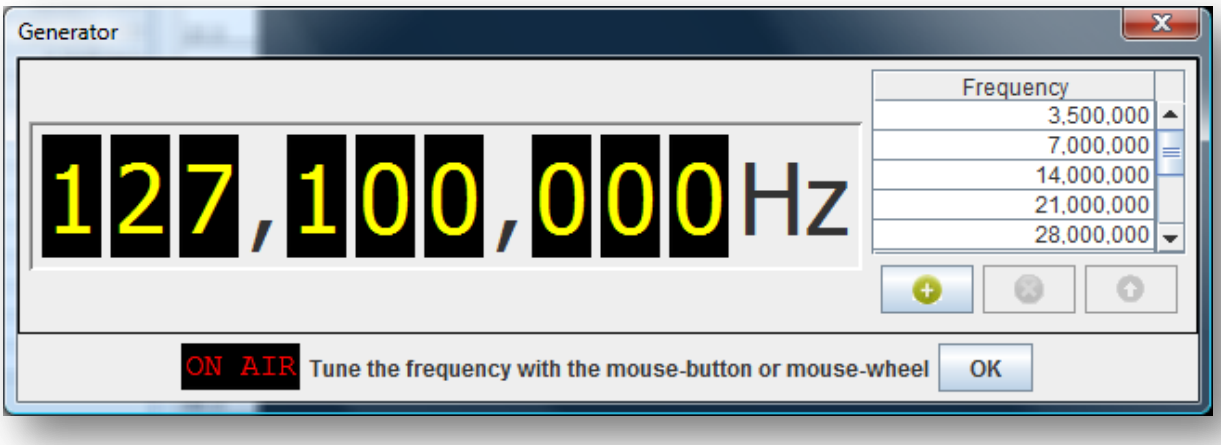
Pressing the MEASURE button starts a full scale scan of the attached analyser in reflection mode.

Depending on which values are filled in by the user, the results are calculated:

The length unit can be selected using the radio buttons for **m** and **ft**.

Generator miniVNA

Using this dialog, the attached VNA can be used as a simple frequency generator.



The frequency range is determined by the loaded driver. Details can be viewed in the driver info dialog.

Output control

The output is switched on, when clicking 

. When the output is active, this field is inverted: 

. To switch off the output, click on this field again.

Frequency control

Every digit 

of the frequency panel can be controlled with the mouse:

- A left-click increases the number by one.
- A right-click decreases the number by one.
- The digit can also be controlled using the mouse-wheel.

Frequency list

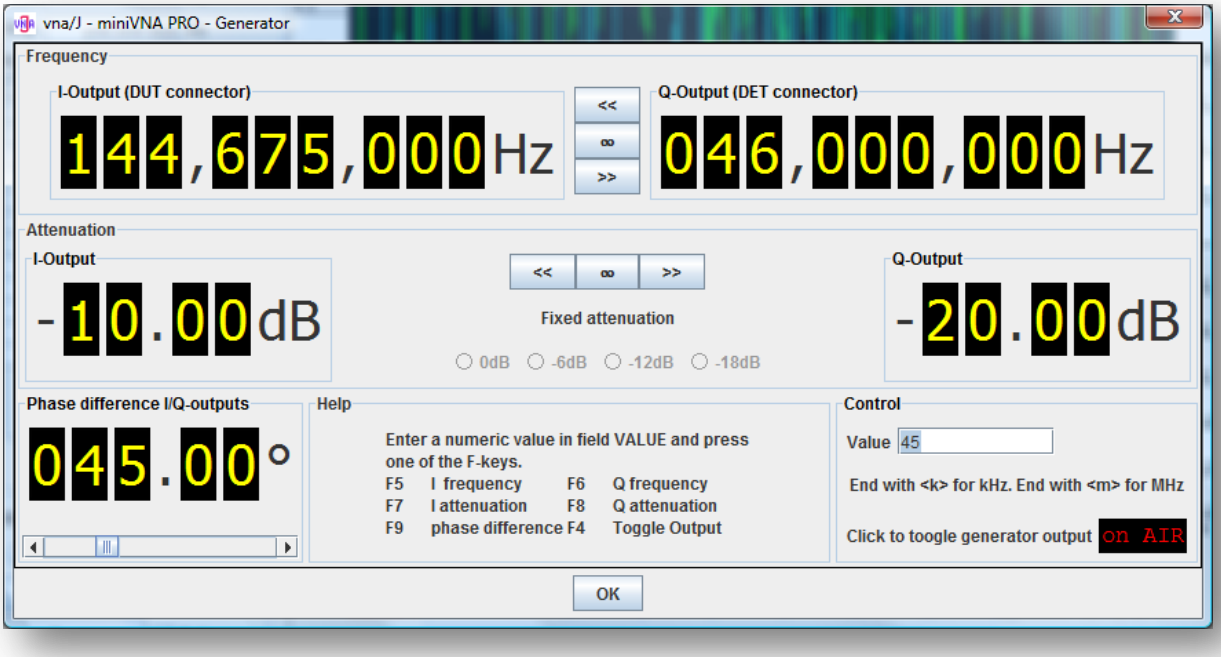
By double-clicking with the left mouse button on an entry in the presets list, you can quickly set the start/stop frequencies to the desired range. A selected list entry can also be used clicking the 
button.

Entries in the presets list can be deleted by selection an entry in the list and clicking on 
.

A currently entered frequency can be added to the list clicking on the 
button.

Generator miniVNA PRO

Using this dialog, the attached miniVNA PRO can be used as a simple frequency generator as well as a versatile I/Q-signal generator



Output control

The output is switched on, when clicking 

. When the output is active, this field is inverted: 

. To switch off the output, click on this field again.

Frequency control

Every digit  of the I or Q frequency panel can be controlled with the mouse:

- A left-click increases the number by one.
- A right-click decreases the number by one.
- The digit can also be controlled using the mouse-wheel.

The values range is 100.000Hz to 200.000.000Hz.

Attenuation control

Every digit  of the I or Q attenuation panel can be controlled with the mouse:

- A left-click increases the number by one.
- A right-click decreases the number by one.
- The digit can also be controlled using the mouse-wheel

The values range is 00.00dB to 60.20dB

Phase control

Every digit  of the I or Q attenuation panel can be controlled with the mouse:

- A left-click increases the number by one.
- A right-click decreases the number by one.
- The digit can also be controlled using the mouse-wheel

The values range is 000.00° to 180.00°

The phase difference can also controlled using the slider below the five digits.

General input

The values can be controlled via the separate digits  of by entering a numerical value in the field **VALUE** and pressing one of the described function keys on the keyboard:

F5 Write the entered value to the I frequency field
F6 Write the entered value to the Q frequency field
F7 Write the entered value to the I attenuation field
F8 Write the entered value to the Q attenuation field
F9 Write the entered value to the phase field

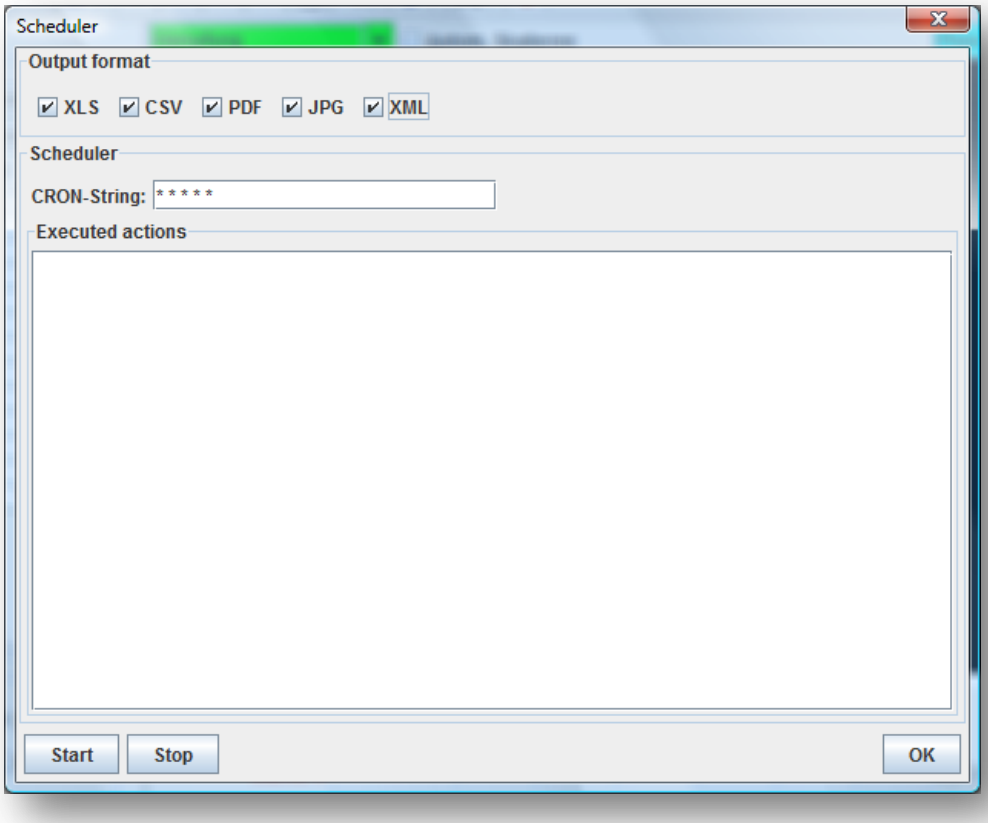
Copies the value from the Q field to the I field

Copies the value from the I field to the Q field

Link the I and Q fields. Means, changing i.e. the I field also changes the Q field by the same amount.

This works only when changing the field values using the digits 

Scheduler



General

The scheduler enables the user, to create analyzer scans on a regular basis. Therefore the user has to define in which time periods a scan should be done. For details see chapter "Time definition" on page 57.

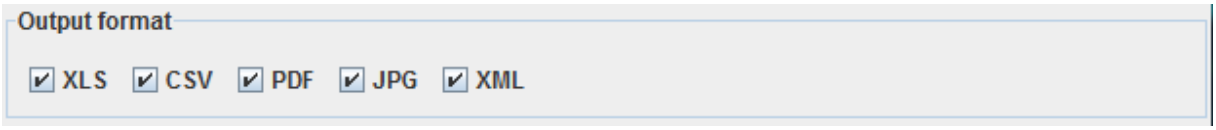
To give reasonable filenames, the user should define a filename pattern in the export settings like this:

```
VNA_{0,date,yyMMdd}_{0,time,HHmmss}
```

More details on filename pattern see chapter "Filename" on page 38.

The scheduler is very similar to the popular LINUX CRON daemon, so for detailed information consult the LINUX documentation.

Output format



The same export formats which are available through the toolbar are also available for scheduled output generation .

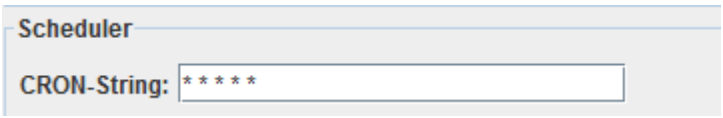
For each selected output format, a separate file is created as defined in the export settings.

Selecting all checkboxes and specifying a filename patter as described on the previous page gives these filenames:

Feb 28, 2010 11:21:01 AM c:\temp\VNA_100228_112101.xls
Feb 28, 2010 11:21:01 AM c:\temp\VNA_100228_112100.pdf
Feb 28, 2010 11:21:00 AM c:\temp\VNA_100228_112100.csv
Feb 28, 2010 11:21:00 AM c:\temp\VNA_100228_112100.jpg
Feb 28, 2010 11:21:00 AM c:\temp\VNA_100228_112100.xml

Time definition

The time definition must be entered in the field name **CRON-String** here:



The time definition consists always of five separate patterns:

Order	Pattern name	Comment	Range
1	Minute pattern	During which minutes of the hour should the task been launched?	0 .. 59
2	Hours pattern	During which hours of the day should the task been launched?	0 .. 23
3	Days of month pattern	During which days of the month should the task been launched?	1 .. 31 L specifies the last day of the month
4	Month pattern	During which months of the year should the task been launched?	1 ..12
5	Days-of-week pattern	During which days of the week should the task been launched?	0 == Sunday .. 6==Saturday

The universal quantifier ***** can be used, to indicate

- every minute
- every hour
- every day
- every month
- every weekday

A list of discrete values can be specified using a comma as separator. I.e. "* 0,12 * * *" means execute the task at noon and midnight.

A range of values can be specified using a hyphen as separator. I.e. "0-4 * * * *" means execute the task every minute in the first five minutes of every hour.

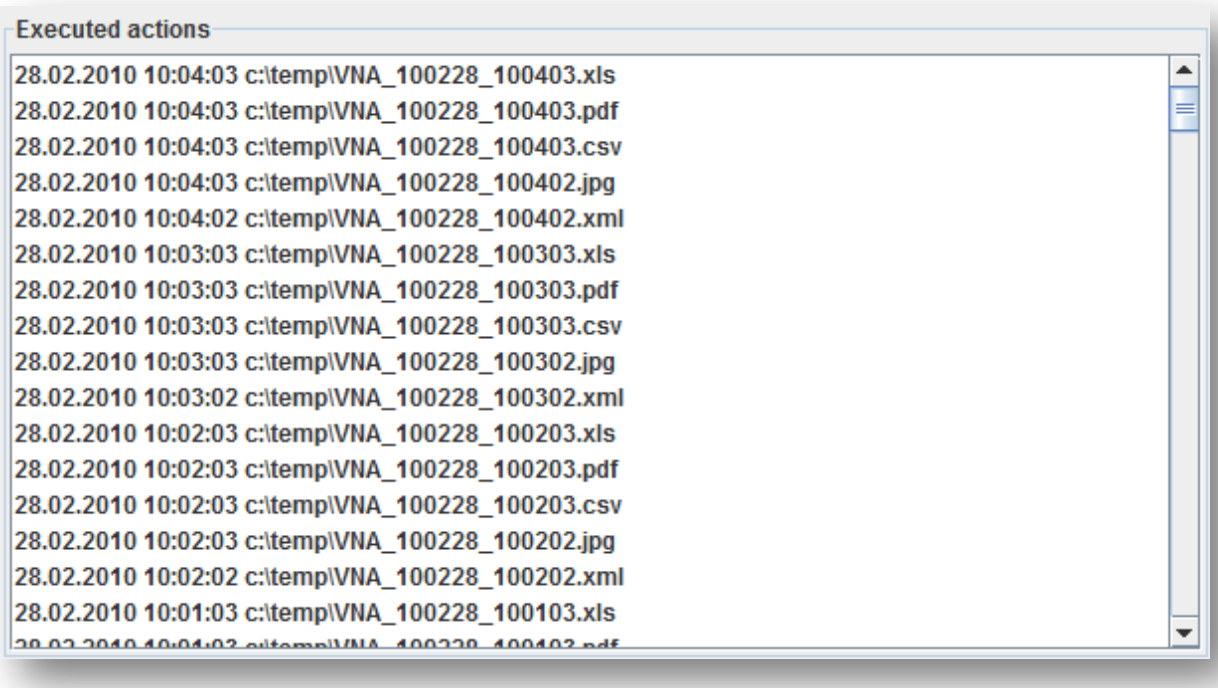
For more details see

http://www.sauronsoftware.it/projects/cron4j/manual.php#p02

or search the internet for "CRON UNIX".

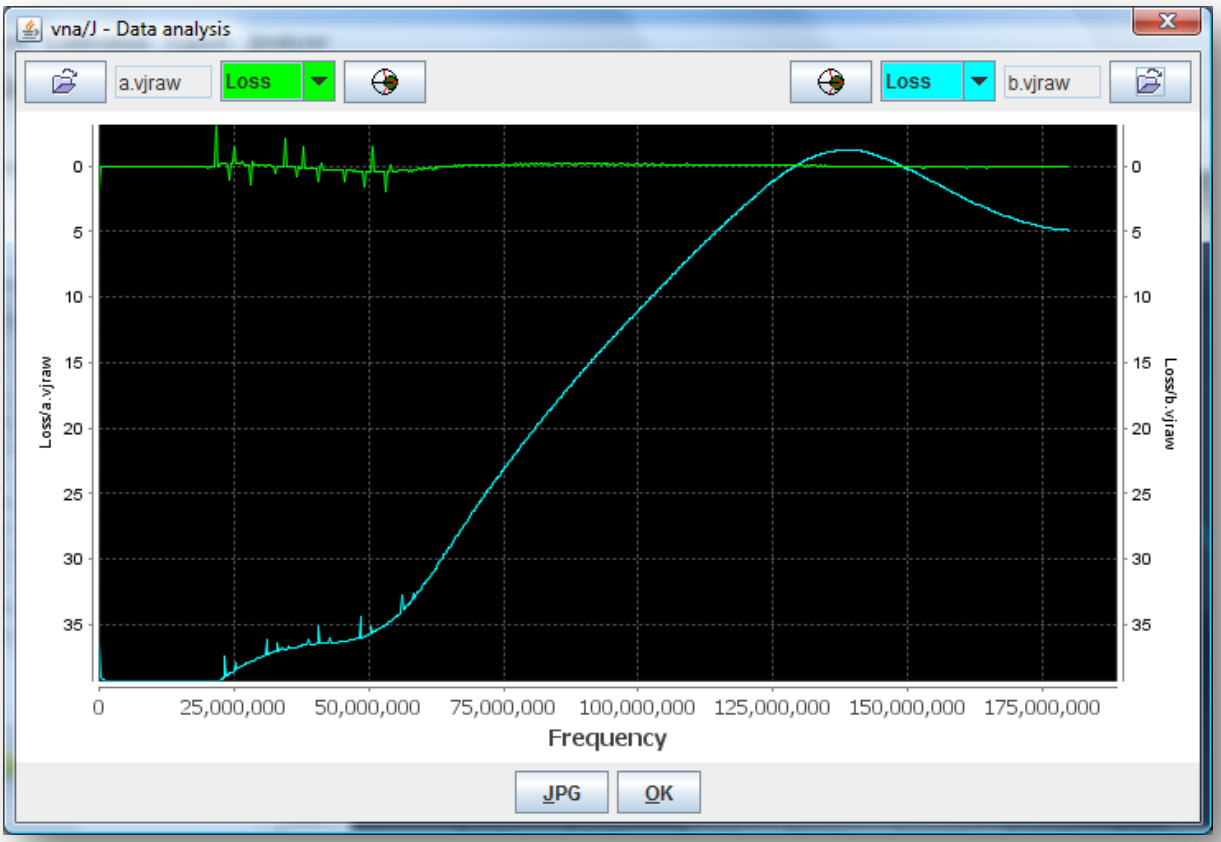
Execution log

Every action that was executed by the scheduler, is reported in the list box:



Data analysis

Previously saved data can be later displayed again, using the Data analysis dialog:



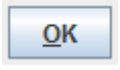
Here the user can load up to two previously recorded datasets. The available operations for the data-sets are:

Opens the default OPEN-dialog, where the user can select a previously recorded data set.
The name of the loaded data file is then displayed near the open icon.

Here the same scales are available as in the main diagram area.

The data-set is displayed inside a Smith-chart in a separate dialog window.
See details in chapter "Display Smith-chart" on page 19.

Export the displayed diagram to a JPEG file.
The size of the exported JPG is set fixed to 1000x800 pixels.



Closes the data analysis dialog.

Multi-tune

The idea of this "multi-tune" dialog is, to support the tuning of multiband antennas or multiband filters inside receivers etc.

The user can create one or more small scan windows with different frequency ranges to cover the necessary spectrum.

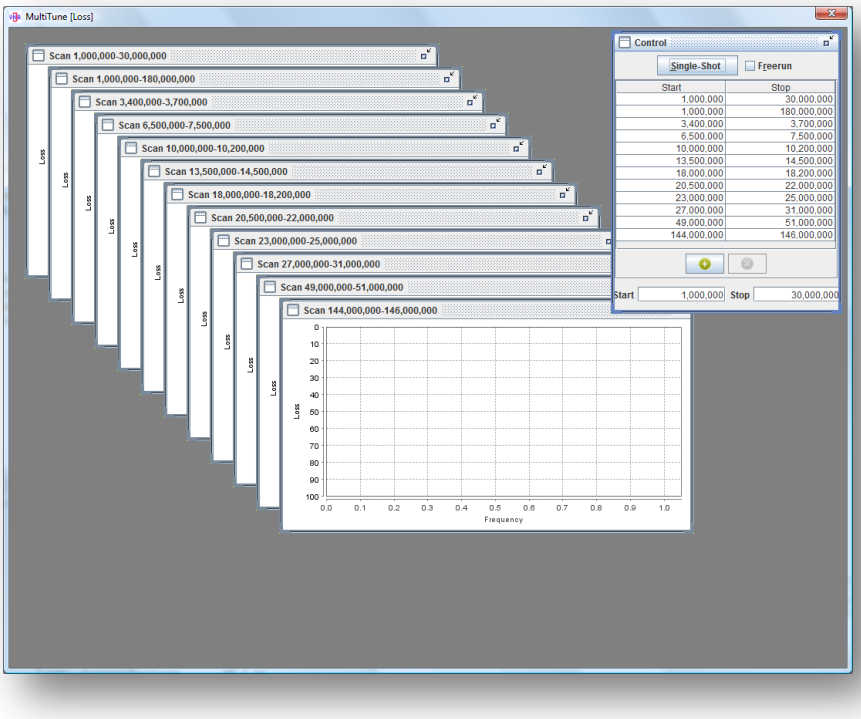
The window can be opened by selecting the menu bar entry TOOLS-MULTI TUNE or the corresponding toolbar button  .

The mode (transmission or reflection) is determined by the selected mode in the main window.

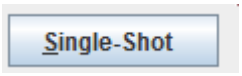
The type of scale displayed is also determined by the scale selected in in the left-scale of the main window.

The window is modal to the main window and must be closed selecting the close-icon  in the upper-right corner.

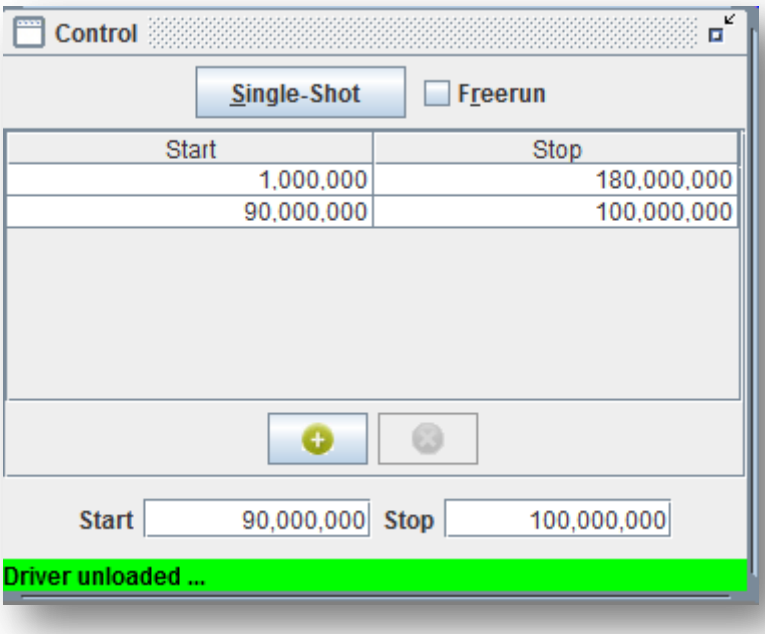
On the very first start of the multi-tune window, the frequency list is populated with the same defaults as the frequency list in the main window:

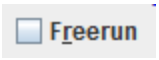


Control window

The window labeled "control" contains a list of scan-ranges that are executed whenever the button 

is pressed.:



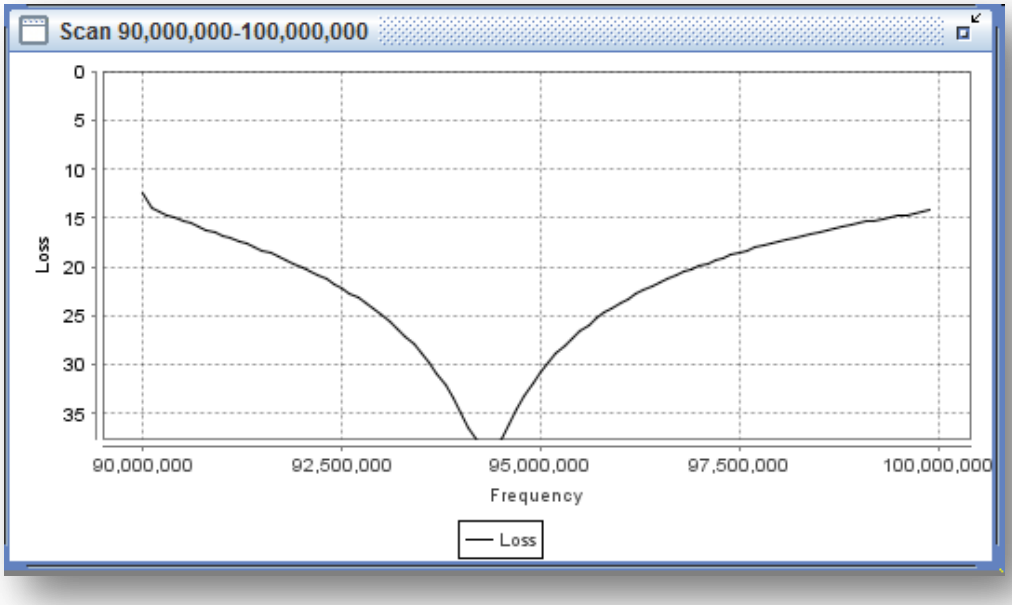
Selecting the checkbox 

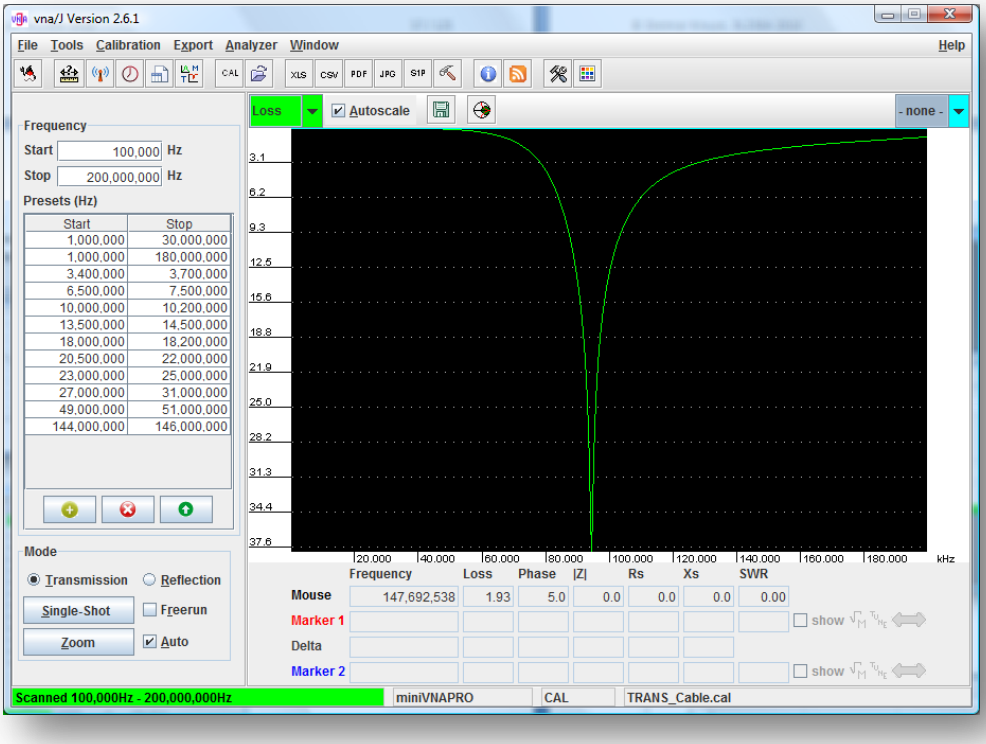
enables a free-running mode, same way as it is handled in the main window.

A new entry can be added to the list by entering the start and stop frequency in the entry fields and pressing the  button. An existing can be deleted by selecting the entry in the list and pressing the  button.

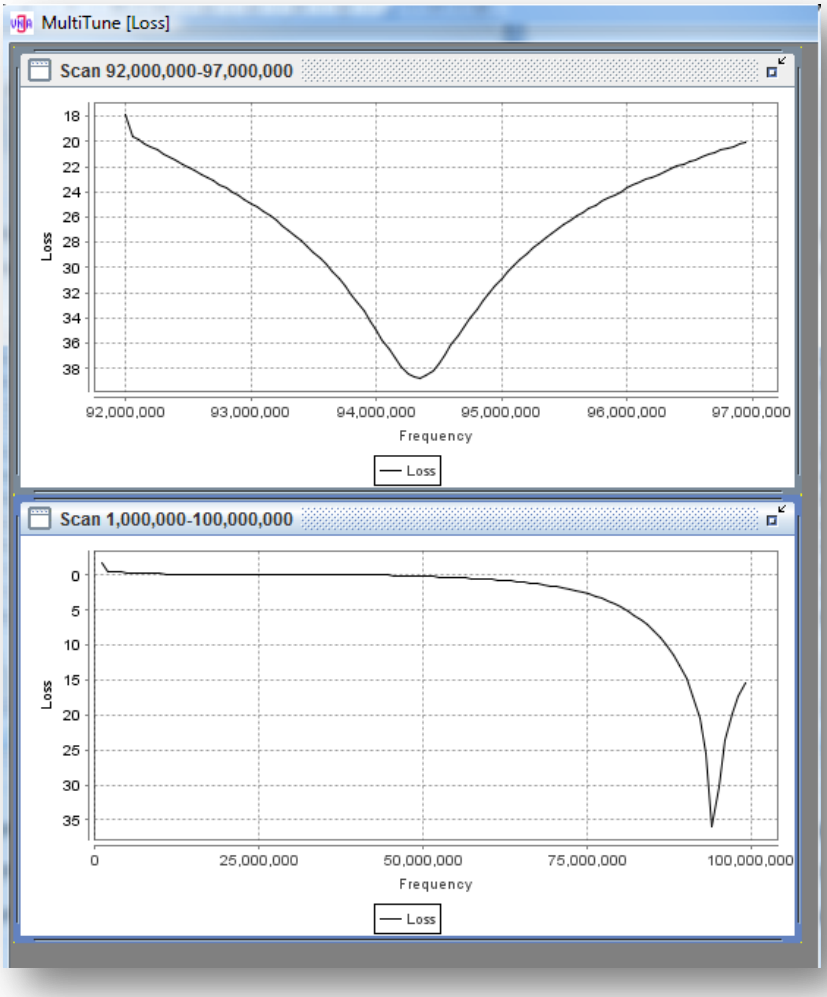
Scan-window

Each scan window contains the data for the given scan range. The measurement parameter (Loss, Phase, SWR, Xs, Rs, |Z|) is determined by the selected type of the left scale in the main window:





Each of the windows have personal-scaling settings:



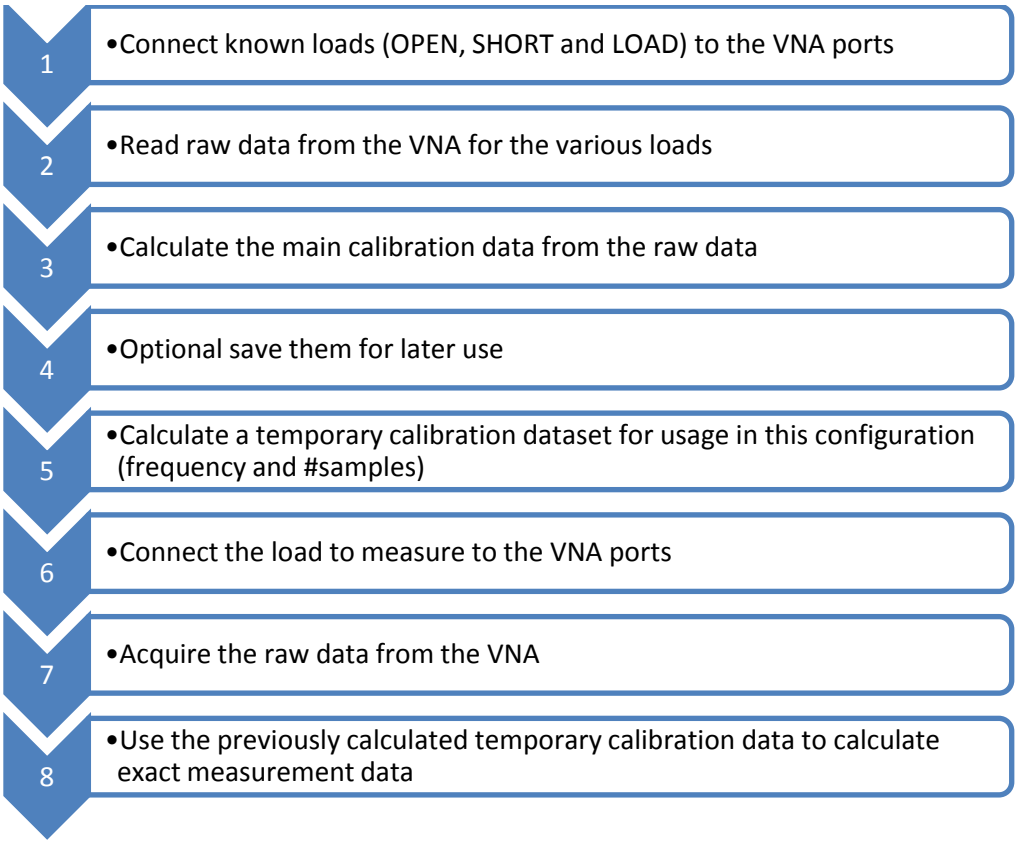
The diagrams support a number of operations like scaling, printing or exporting the data.

Simply click on the diagram area with the right-mouse button and selected the desired option.

Each diagram has its own options. These options are NOT retained when closing and reopening this window!

Measurement basics

The measurement process inside this application is a multi step one:



Calibration

To get maximum precision, the calibration data should match the current measurement parameters, means:

- Analyser type (currently only miniVNA and the sample driver)
- Start frequency
- Stop frequency
- Mode (transmission or reflection)
- Number of measurement steps

If the frequency range is changed, a new calibration set should be created for the new range. The number of calibration steps is directly controlled by the horizontal size of diagram window.

This implementation has the big drawback, in that whenever you zoom into a diagram, a new set of calibration data must be used.

To overcome this limitation, in the current implementation a **main calibration dataset** with 2.000 points is recorded and stored.

To correct a recorded set of raw data, a **temporary calibration dataset** is created from the **main calibration dataset** and used to transform the raw data.

Mathematics

… Mathematics will be detailed later …

Calibration

Basics

As described in section "Measurement basics" on page 65, a **main calibration dataset** is always required for using the application.

Depending of the analyser type and mode, a number of calibration data sets is needed:

Analyzer	Mode	OPEN	SHORT	LOAD
miniVNA	Transmission	-	✓	-
	Reflection	✓	-	-
miniVNApro	Transmission	✓	✓	-
	Reflection	✓	✓	✓
Sample	Transmission	✓	✓	✓
	Reflection	✓	✓	✓

Storage

Location

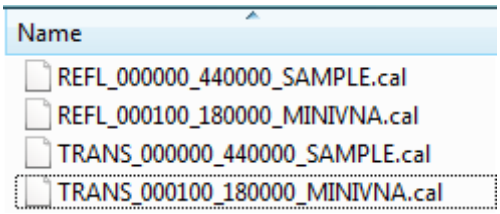
The **main calibration dataset** can be stored (see "Saving calibration data" on page 72) and retrieved from you local disk (see "Loading existing calibration data" on page 73).

The calibration files are stored in the following location on your local hard disk:

Platform	Location
Windows XP	C:\Einstellungen und Dokumente\<UserName>\vnaj\calibration C:\documents and settings\<UserName>\vnaj\calibration
Windows VISTA	C:\Benutzer\<UserName>\vnaj\calibration C:\users\<UserName>\vnaj\calibration
Windows7	??? /vnaj/calibration
Mac OSX	??? /vnaj/calibration
SUSE Linux 11	??? /vnaj/calibration

Format

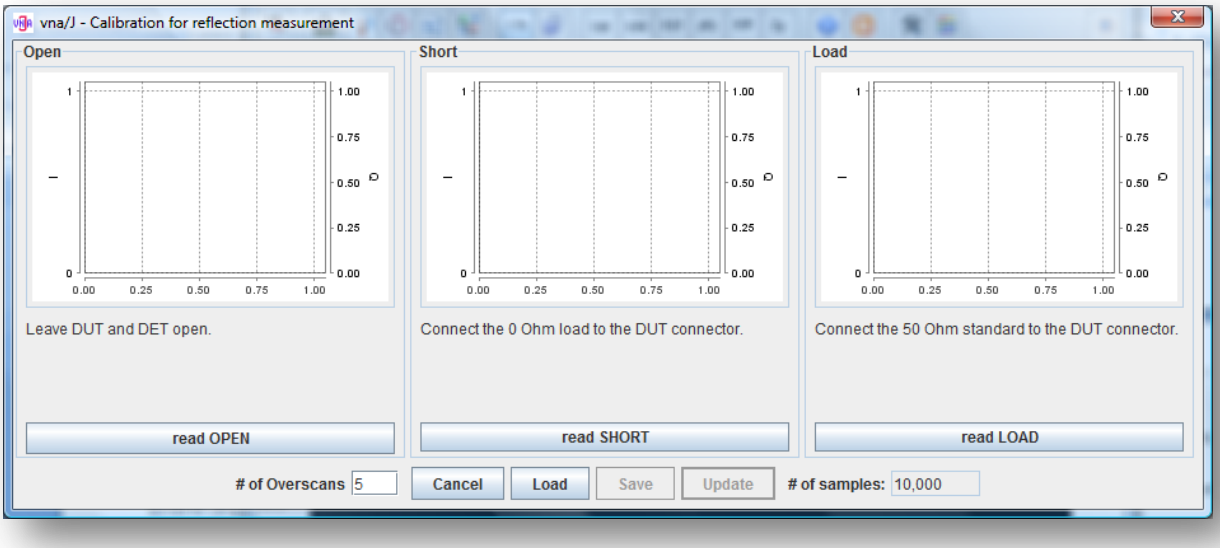
The calibration files are stored binary on the filesystem with the extension **.cal**.

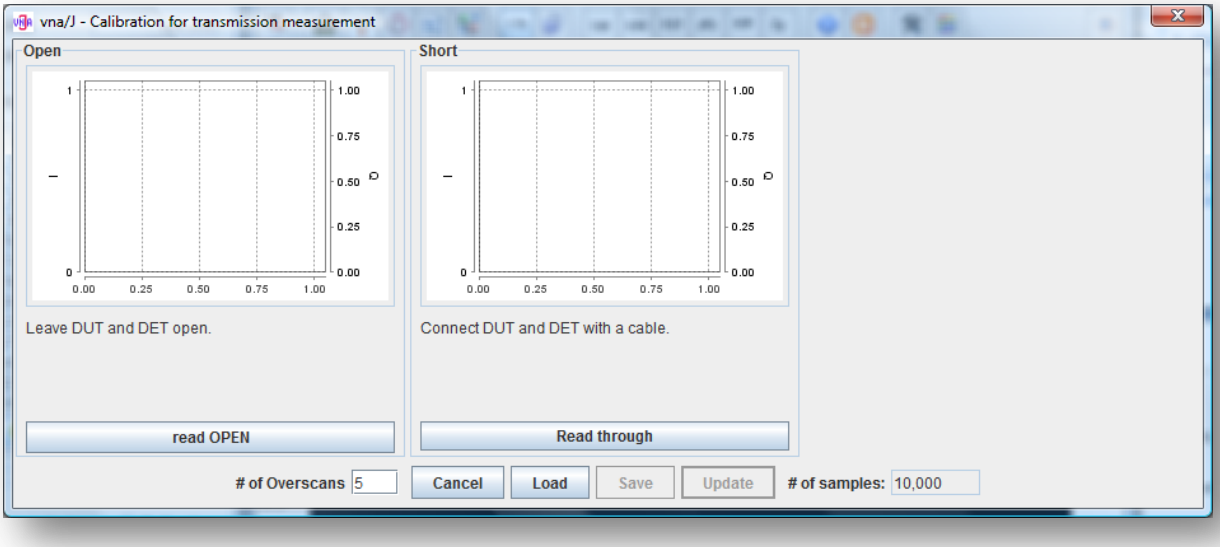


Procedure

The calibration dialog is opened by selecting the menu CALIBRATION/LOSS or the corresponding button in the toolbar.

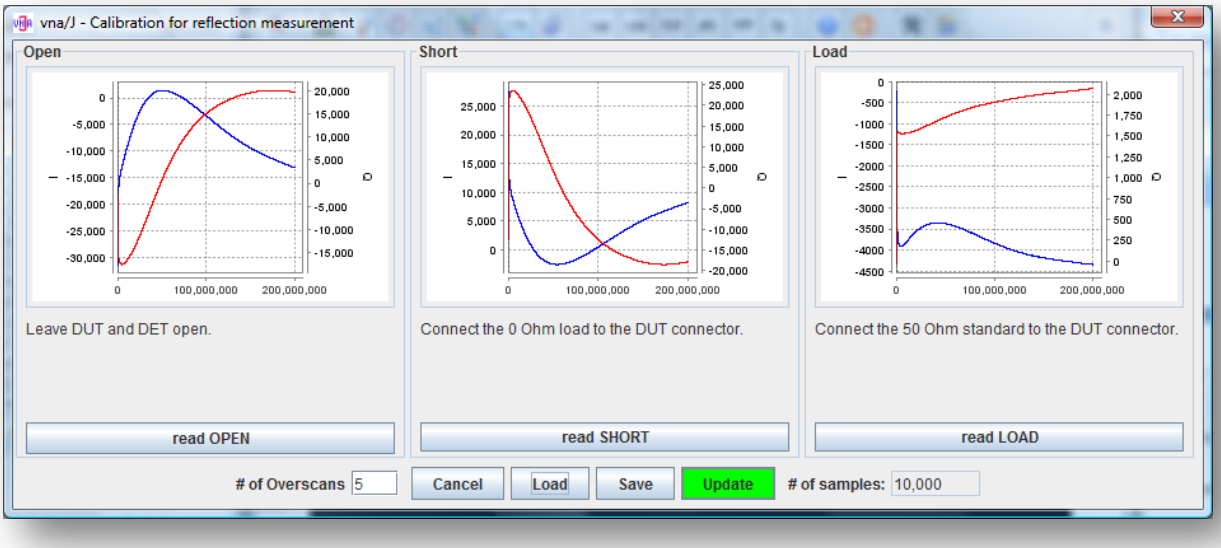
In the title bar of the calibration dialog, the currently selected mode (reflection or transmission) is always displayed.





There are three diagram areas on this dialog. Depending of the selected mode and analyser type, one or more diagram areas are visible.

For every visible diagram, a measurement must be made to create a valid main calibration dataset. When all the required calibration data has been created, the SAVE button gets enabled and the UPATE button receives a green background to indicate, that a complete main calibration dataset is now recorded.



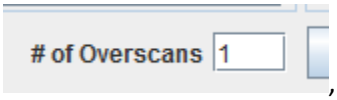
The created main calibration dataset can now be used in the application by simply pressing the UPDATE button, which will also close the dialog..

If one or more curves do not match the expectations simply rerun the needed calibration by pressing the button below the diagram again.

When closing the dialog using the UPDATE button, the calibration status in the status bar is updated.

Over scan

To get smoother scans when the measured object s resistance is near one of the calibration references (means i.e. the measured resistance is 50Ohm real which is identical with the reference value 50Ohm) an overscan feature is added.

In the calibration dialog exists an input field 

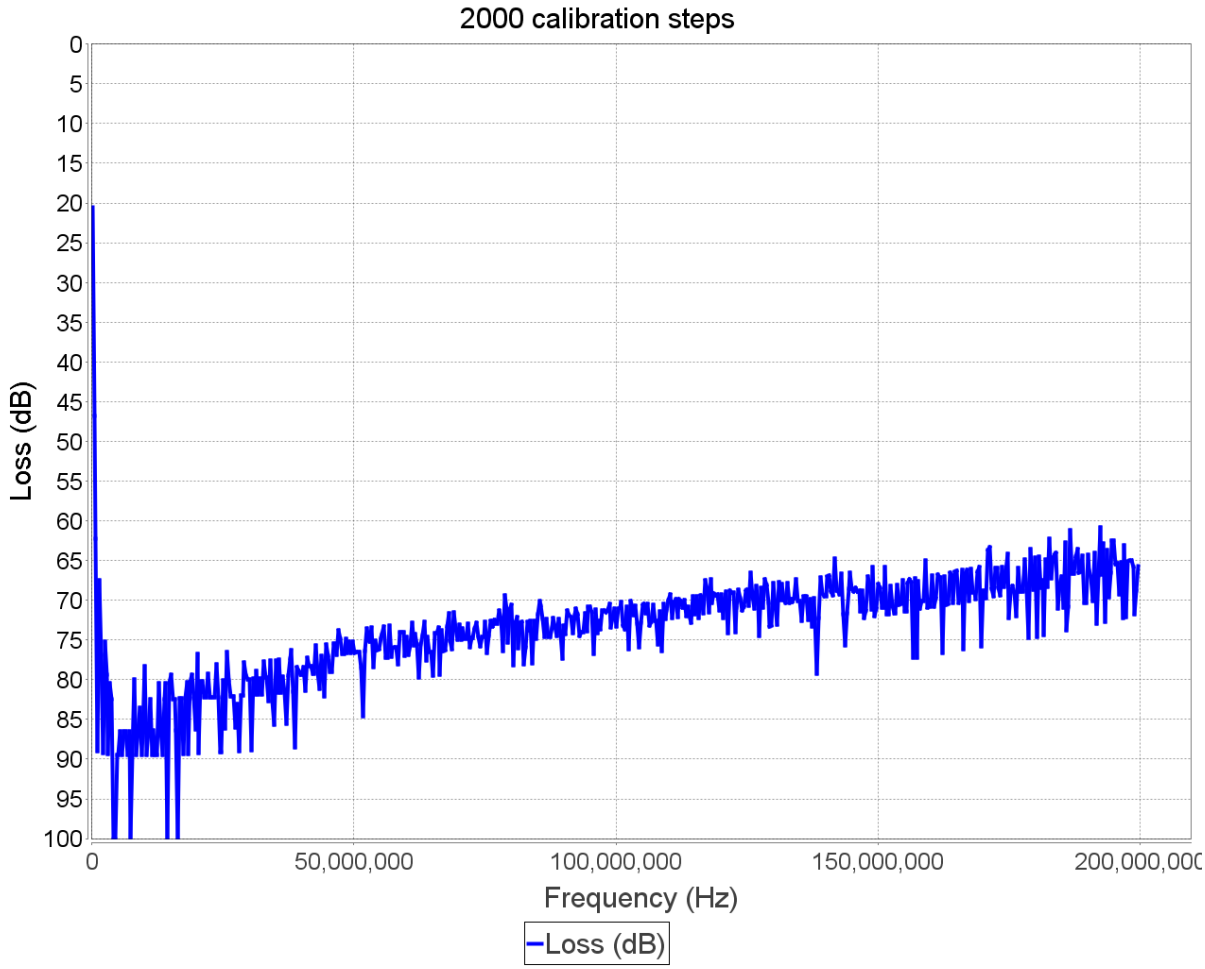
, where the number of scans can be entered. This number of scans is executed when the readXXX button is pressed. The calibration curve used is the arithmetic mean of all scans executed. The higher the number, the smoother the calibration data is.

Remark: *The time needed to create a i.e. 5x over scan is about 5 times the duration needed for a 1x over scan.*

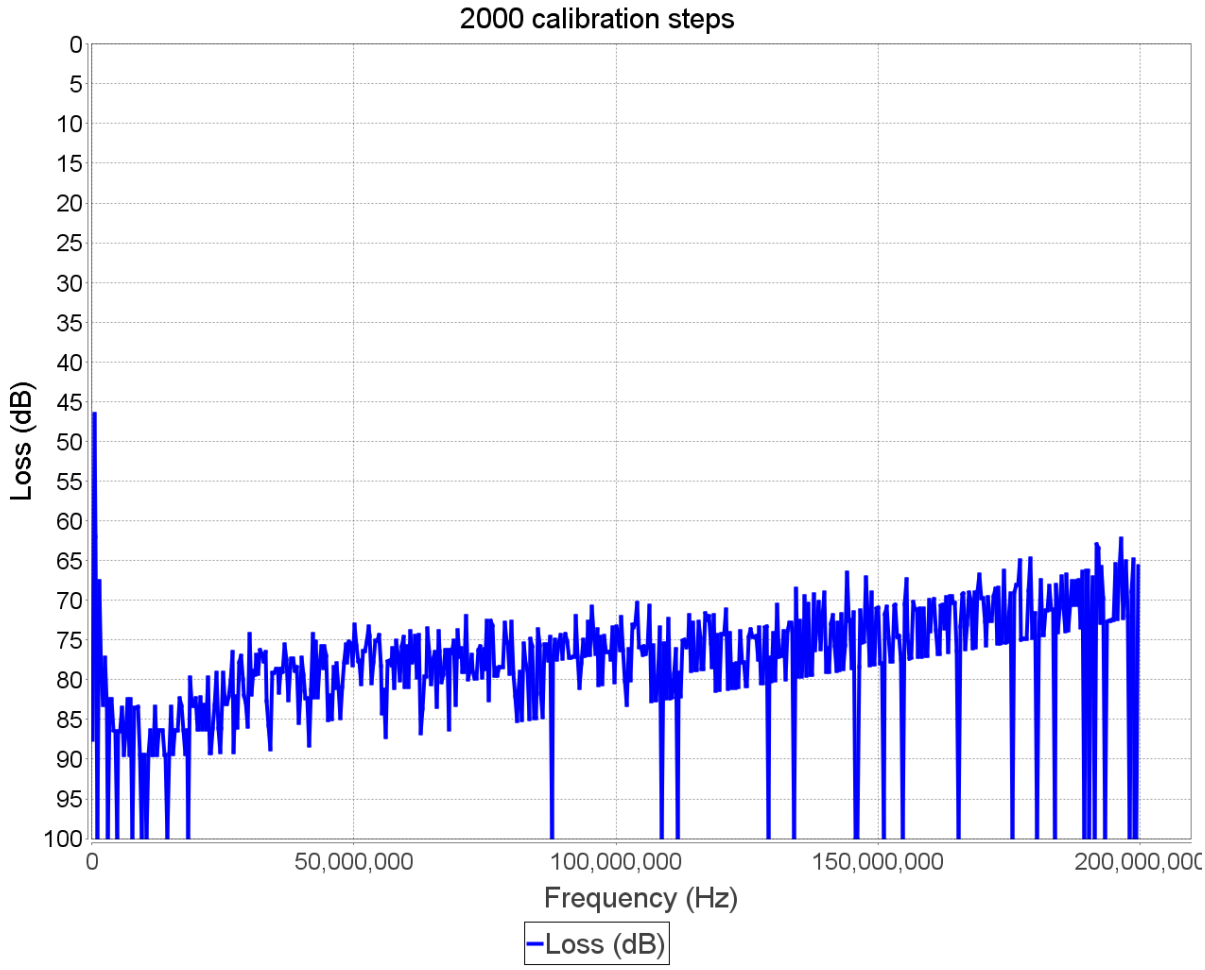
The resulting calibration data file contains no information how many over scans where used during creation

The results are explained here with a 50Ohm resistor connected to DUT in reflection mode.

2.000 calibrations points and 5x over scan

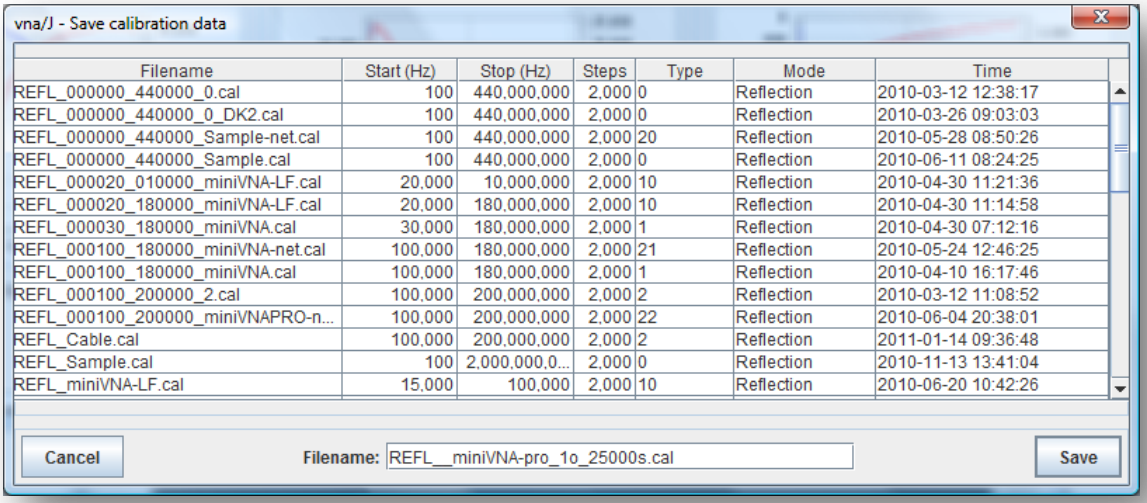


2.000 calibration points and 1x over scan



Saving calibration data

After creating a complete calibration data set in the calibration dialog, it is possible to save this calibration data set for later use by pressing the SAVE button. This opens this dialog:



In the upper list, all existing calibration files are listed for information.

The filename of the new calibration files is preset. This filename is constructed following this pattern:

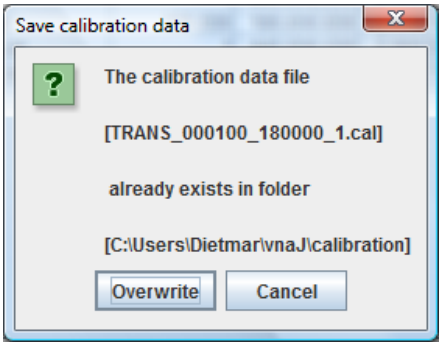
```
<Mode>_<Analysertype>_<#Over>o_<#Sam>s.cal
```

Mode	REFL | TRANS
Analyzertype	miniVNA |miniVNA-pro | …
#Over	number of over samples
#Num	number of calibration samples

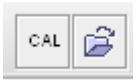
The name can be overwritten by the user.

Caution:

When an already existing file is selected, a warning is shown and when confirming it, the existing file is overwritten

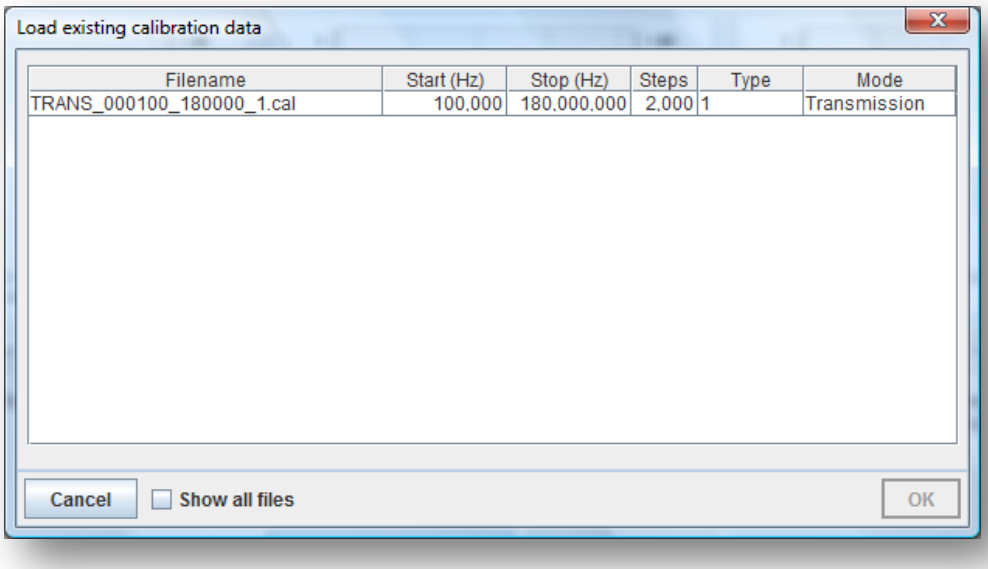


Loading existing calibration data

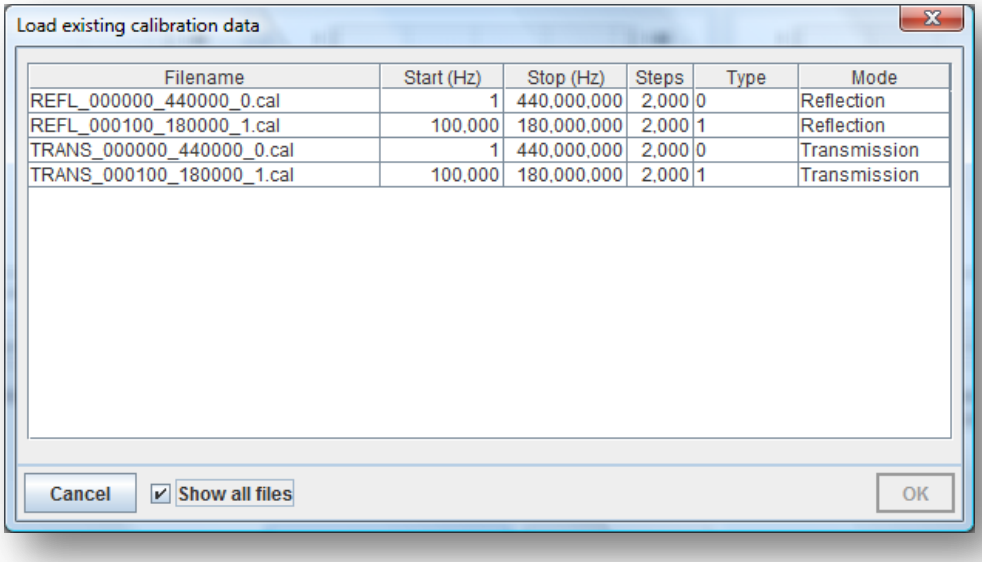
Existing calibration data files can be loaded via the OPEN icon 

in the toolbar or inside the calibration dialog, it is also possible to load a previously saved calibration data file.

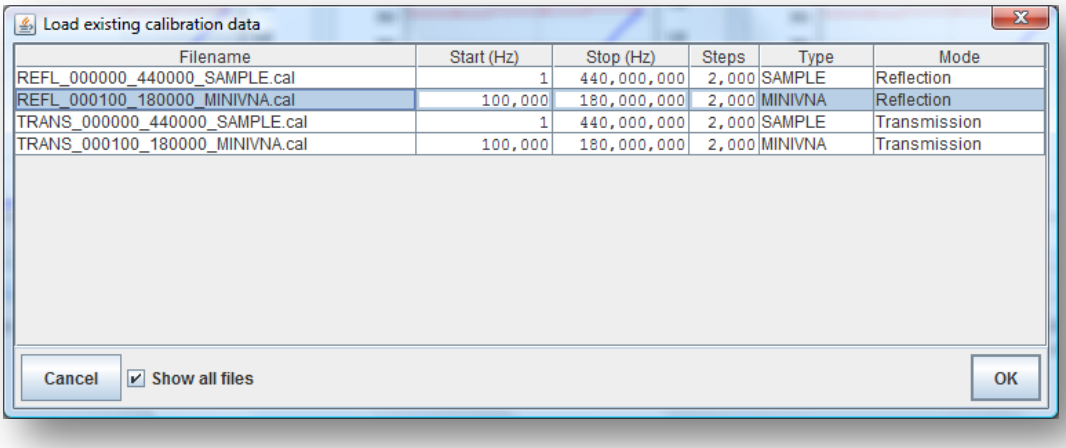
When pressing the LOAD button inside the calibration dialog, a special selection dialog opens, which shows detailed information on matching calibration files in the preferred directory.



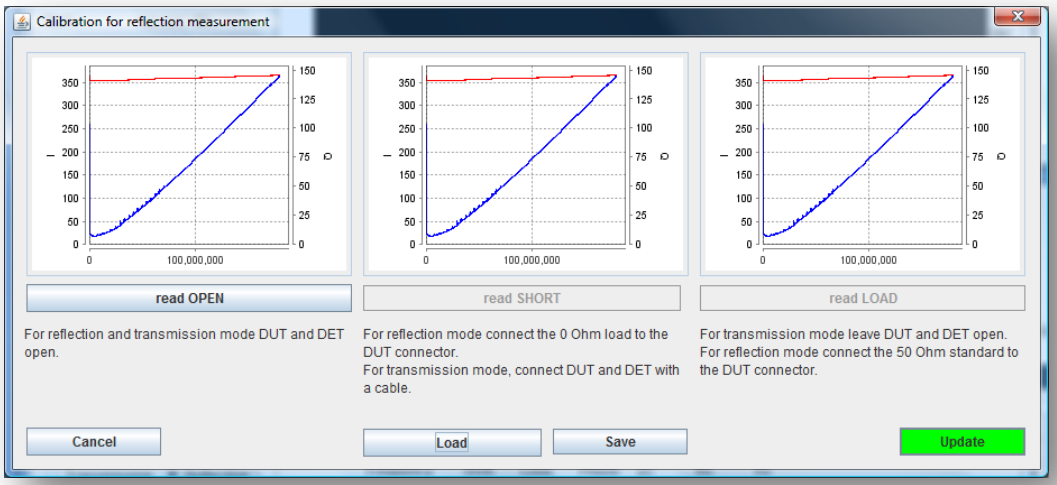
When selecting the SHOW ALL FILES checkbox, all calibration files in the preferred directory are displayed:



When the selected entry matches the current configuration (mode, frequency range, analyser type) the OK button is enabled.



Pressing the OK button loads the selected calibration data into the calibration dialog:



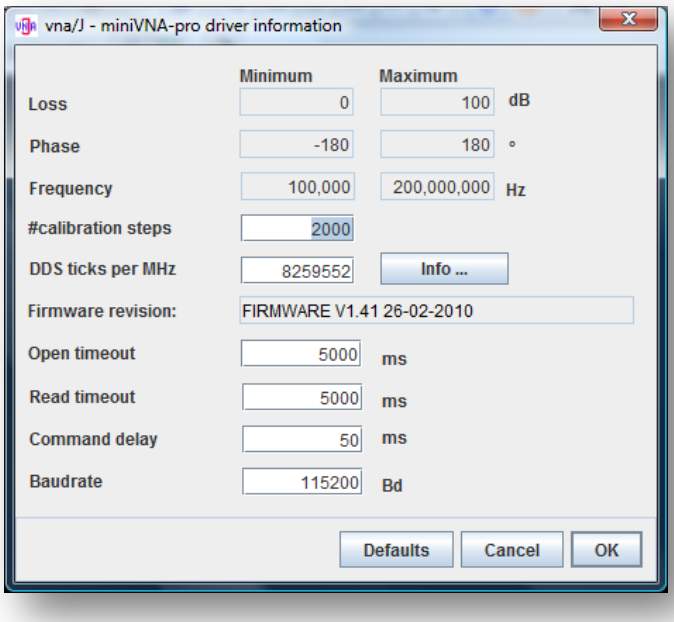
The calibration points are recalculated based on the current formulas implemented in the application to ensure also correct loading after update to internal mathematics…

Note: *The type columns displays the internal number of the selected driver and is just for information purposes.*

It is only possible to load calibration data sets, that exactly match the selected hardware in the aspects of analyzer-type, frequency-range, reflection or transmission mode and number of calibration steps.

miniVNA pro feature

Only the drivers for mRS ***miniVNA pro*** are able to set the number of calibrations steps.



In the field **#calibration steps** the user can enter a number between 2.000 and 25.000.

The number of calibration steps has no measurable influence on the regular scan time. Only the time for creating a calibration dataset increases more or less linear to the number of calibration steps.

The size of the calibration set and the scan time depends on the number of calibration steps:

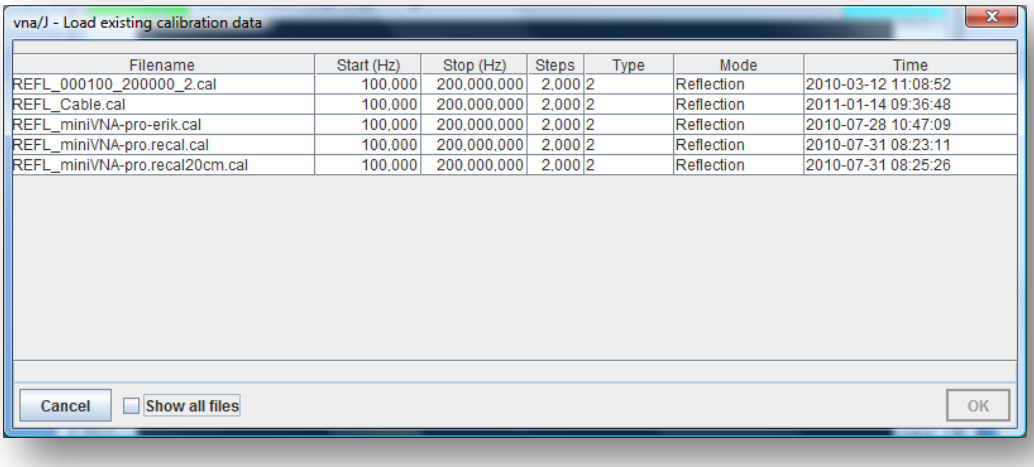
Number of steps	File size in kBytes	Average Scan time
2.000	107 kB	7s
10.000	528 kB	34s
25.000	1.319 kB	84s

Loading/Saving

As explained in previous chapters, the number of calibration steps is fix set to 2.000 steps for most of the drivers. When loading a calibration data set, only those datasets can be loaded that match in:

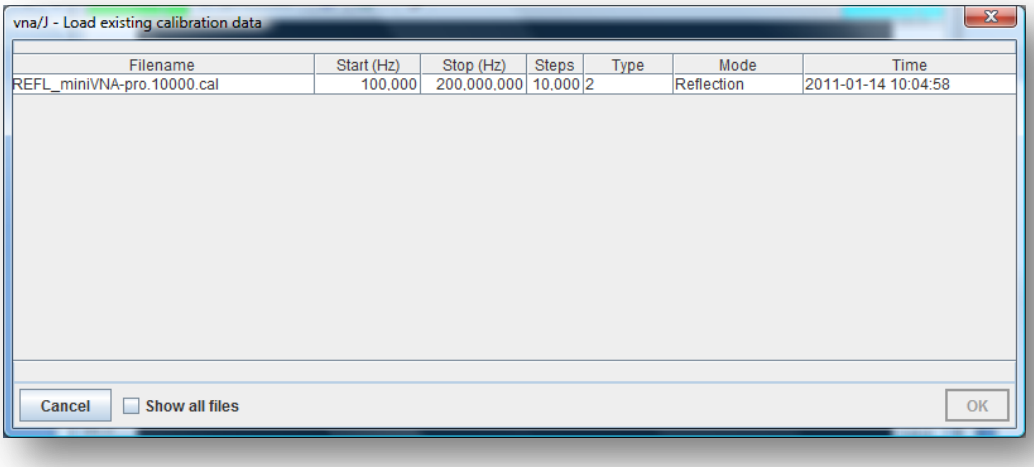
- analyzer-type
- frequency-range of analyser
- reflection or transmission mode
- number of calibration steps

Setting i.e. 2.000 as number of steps results in a file list in the load-dialog:

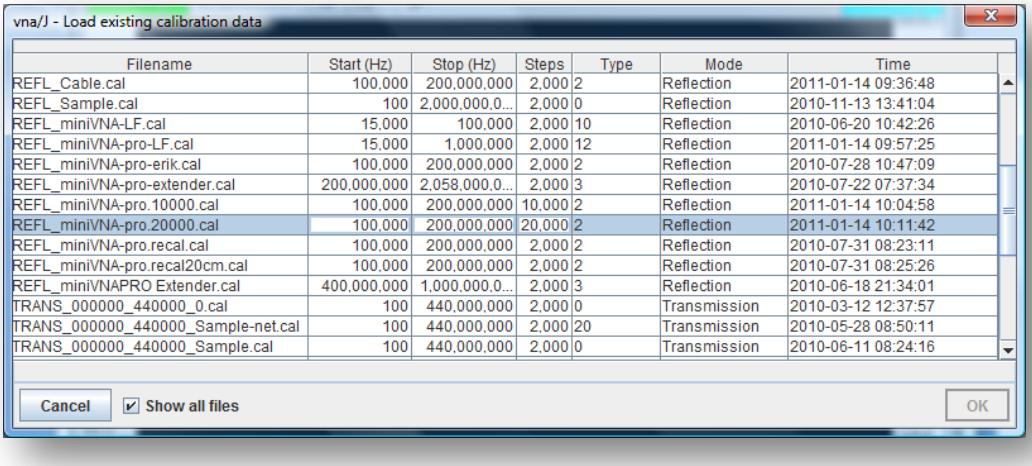


Only files with 2.000 calibration steps are displayed.

Setting the number i.e. 10.000 results in a different file list:



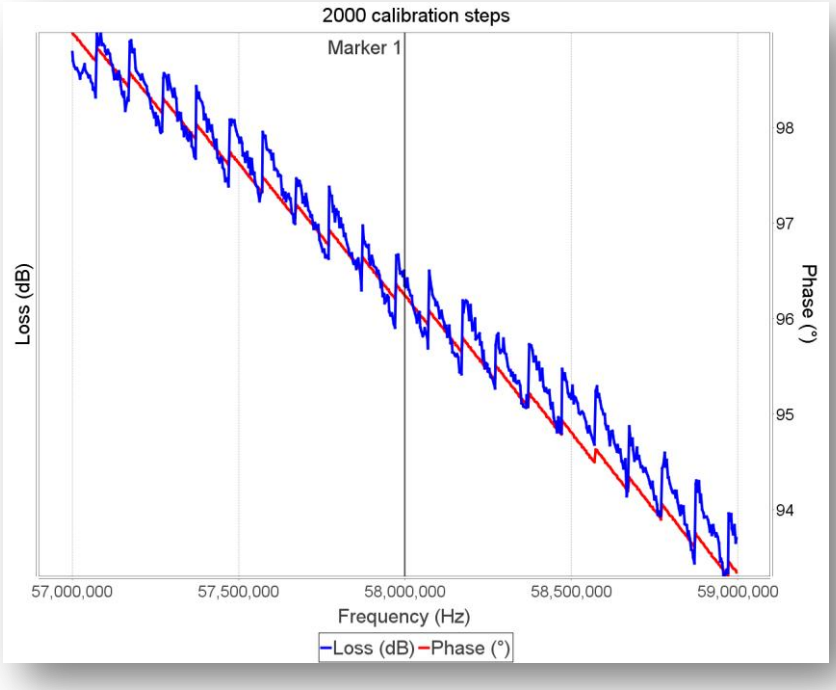
To check, what calibration datasets are available for loading, simply check the "Show all files" box:



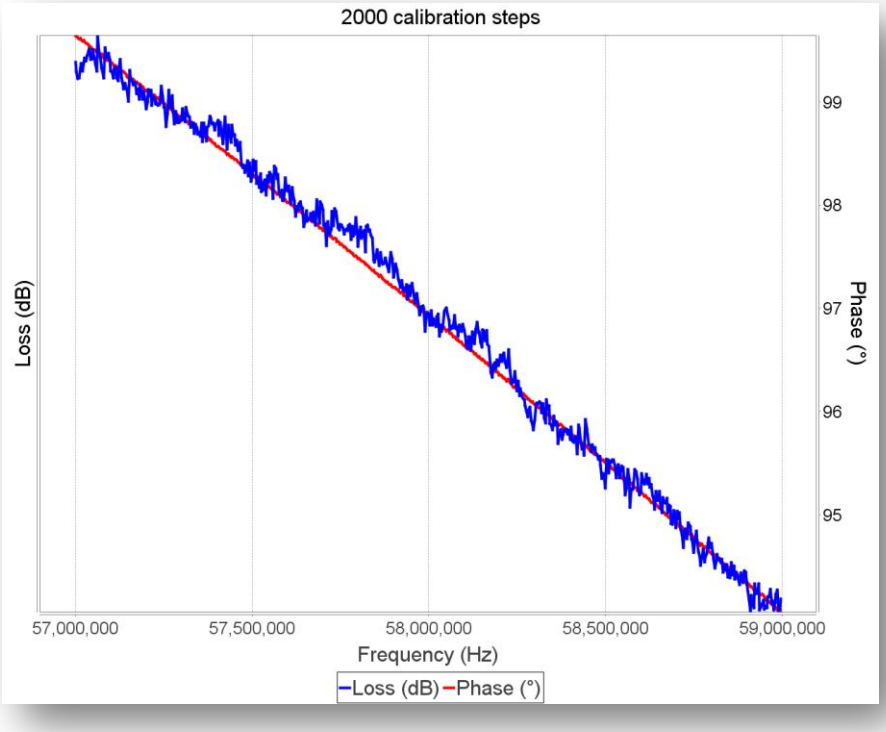
Scan quality

The number of calibration steps has a direct impact on the quality of small scan-ranges.

Lets take the default number of 2.000 steps. This gives a frequency span of about 100kHz per calibration step. So when you execute a scan from i.e. 57.000 MHz to 59 MHz this range is covered by 20 calibration points.



If the number of calibration steps is increased to 20.000 steps. This gives a frequency span of about 10kHz per calibration step. Now the same range is covered by 200 calibrations points.



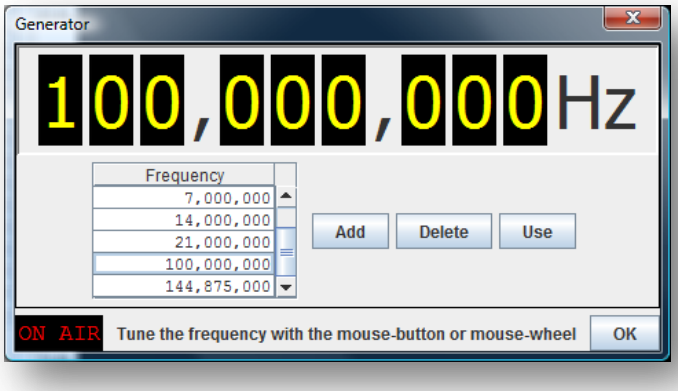
This results in a far more smooth measurement curve.

Frequency calibration

The calibration can be done easily using a frequency counter connected to the DUT port.

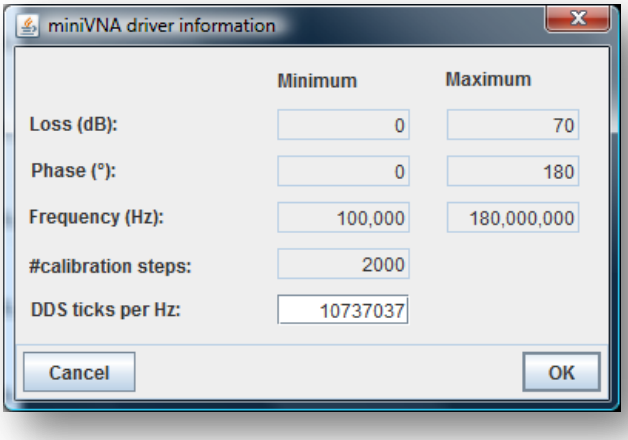
Execute the following steps:

1. Open the generator dialog
2. Enter as frequency 100 MHz

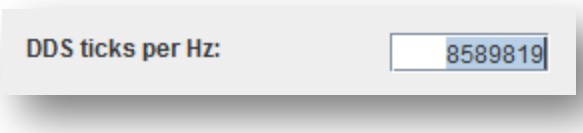


3. Switch on the generator signal by clicking ON-AIR 

4. Now fine tune the frequency until 100.000.000 Hz are displayed on the frequency counter
5. Copy the frequency factor to the clipboard by right-clicking the ON-AIR field
6. Close the generator dialog



7. Open the driver info dialog.
8. Enter in the field **"DDS ticks per Hz"** the value from the clipboard.



9. Close the info dialog by pressing OK

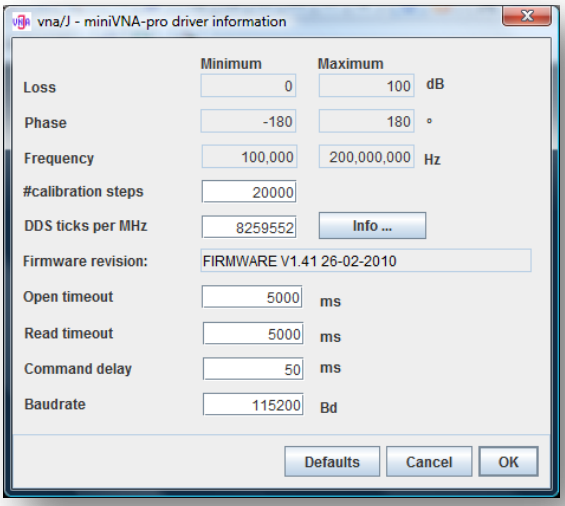
When closing the application, the correction value is saved to the file system and will be reloaded whenever the driver is loaded.

miniVNA PRO

The frequency calibration for the miniVNA PRO depends on which model of the miniVNA PRO you own. Currently two version exists:

- Internal DDS-clock 500MHz
- Internal DDS-clock 520MHz

In the **driver information** dialog for the miniVNA PRO there is an INFO button to explain these differences:



In the **DDS clock rate** dialog, the start values for the two DDS types are shown:

General information

The frequency calibration values (DDS ticks per MHz) can be calculated using this formula:

DDS-range	$Ticks_{max}$= 4294967296
DDS-Clockrate	f_{dds}
DDS-Ticks per MHz	$Ticks_{MHz}=Ticks_{max} / f_{dds}$
Testfrequency	f_{test} = 100 MHz
Frequency value	$Ticks_{test} = Ticks_{MHz} * f_{test}$

This gives as starting values:

Analyzer	F_{dds}	$Ticks_{MHz}$	f_{test}	$Ticks_{test}$
miniVNA	400MHz	10737418	100MHz	1073741800
miniVNApro	500MHz	8589934	100MHz	858993400
	520MHz	8259552	100MHz	825955200

Configuration

All configuration data is stored in a user specific folder on the file system. No entries are made to the system registry or any other system configuration files.

All configuration and calibration files can be found here:

Platform	Location
Windows XP	C:\Einstellungen und Dokumente\<UserName>\vnaj C:\documents and settings\<UserName>\vnaj
Windows VISTA	C:\Benutzer\<UserName>\vna C:\users\<UserName>\vnaj
Windows7	??? \vnaj
Mac OSX	??? /vnaj
SUSE Linux 11	/home/user/<UserName> /vnaj

Remark: If you want to delete everything, simply delete the vnaJ directory, the used JAR-file and everything is gone.

Settings

The settings for the vna/J application are stored inside an XML-file named **vna.settings.xml**.

This file is created after first application start and successful termination and contains a set of valid parameters.

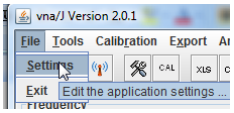
Platform	Location
Windows XP	C:\Einstellungen und Dokumente\<UserName>\vnaj\config C:\documents and settings\<UserName>\vnaj\config
Windows VISTA	C:\Benutzer\<UserName>\vna\config C:\users\<UserName>\vnaj\config
Windows7	??? \vnaj\config
Mac OSX	??? /vnaj/config
SUSE Linux 11	??? /vnaj/config

Additional configuration files may be created inside this directory.

Editing

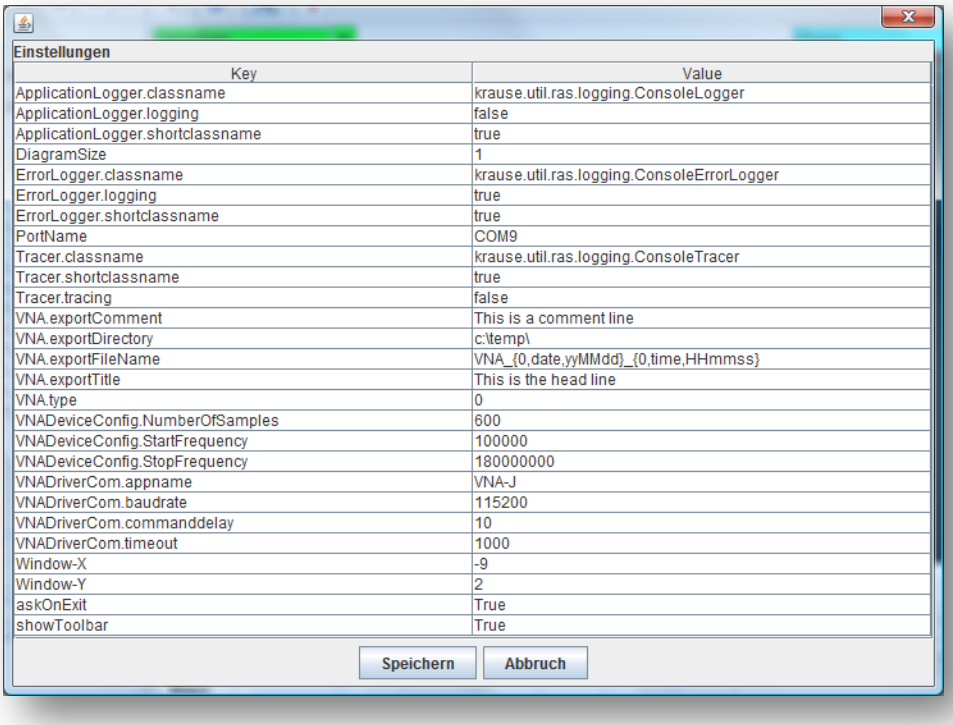
CAUTION: Make changes inside the configuration window with care! When the application does not work correctly, first try to delete the configuration files and start from scratch.

See chapter "Application does not start" on page 105

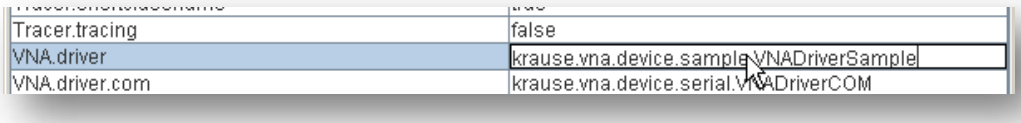
You can open the configuration dialog via the menu entry 

or this toolbar button 

The internal configuration variables for the vna/J application are then displayed:



You can edit an entry (right column) by clicking in the value field and pressing F2:



End the editing by clicking on another entry in the table.

When finished, click the 

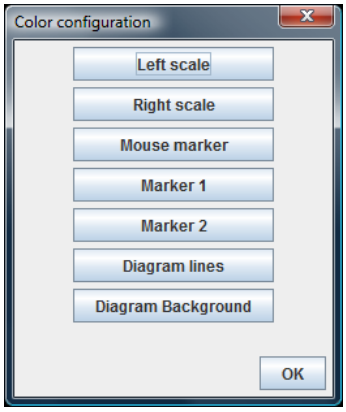
button, to write it to the active configuration set. The configuration data is saved to disc when you close the application.

Colour settings

The colours used in the diagram area can be customized by the user.

Clicking on the toolbar icon  or using the FILE/COLORS menu entry opens the colour configuration dialog:

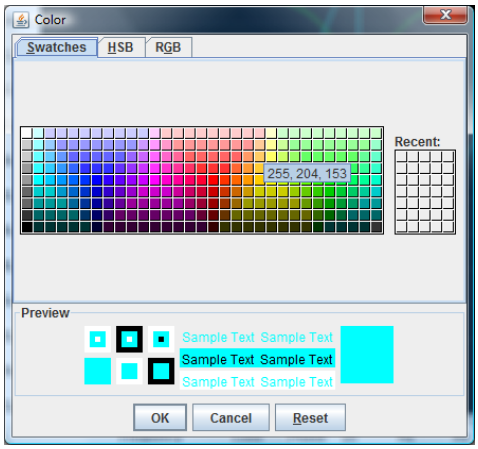
Here the user can change the colours of the following image panel components:



- The colour used to draw the values for the scale selected in the left dropdown list.
- The colour used to draw the values for the scale selected in the right dropdown list.
- The colour of the MOUSE marker text field. As the mouse marker is not drawn on the diagram, this sets only the colour of the marker name.
- The colour of MARKER 1. This sets the colour which is used to draw it on the diagram as well as the name of the marker.
- The colour of MARKER 2. This sets the colour which is used to draw it on the diagram as well as the name of the marker.
- The colour of the horizontal dotted-lines in the diagram
- The background colour of the diagram area.

Clicking the OK button uses the selected colours, updates the image panel and saves them to the configuration file on application termination.

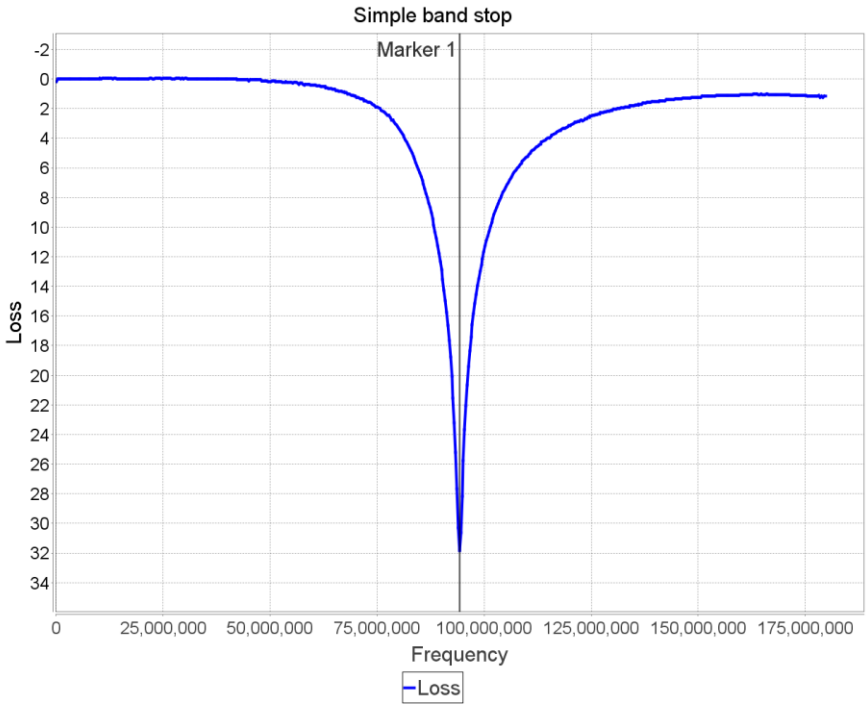
Clicking on one of the buttons opens a colour selection dialog, where the user can fine tune the colour of the selected element.



Samples

Transmission mode

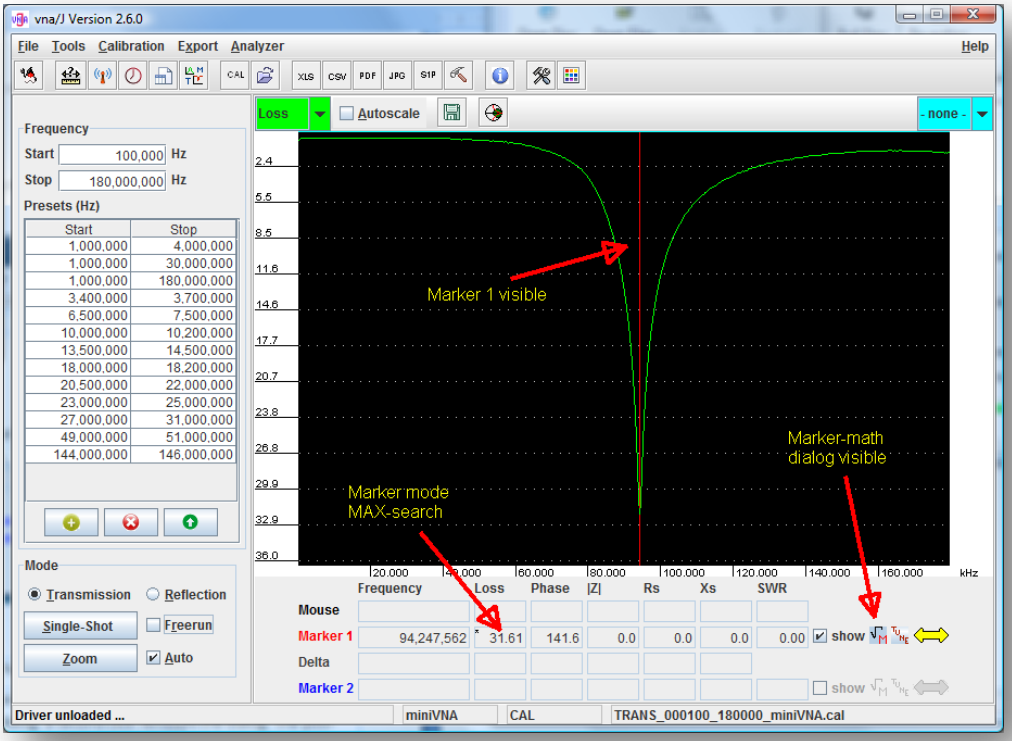
We have a simple serial LC filter used as a band stop. This gives a measurement curve with vna/J:



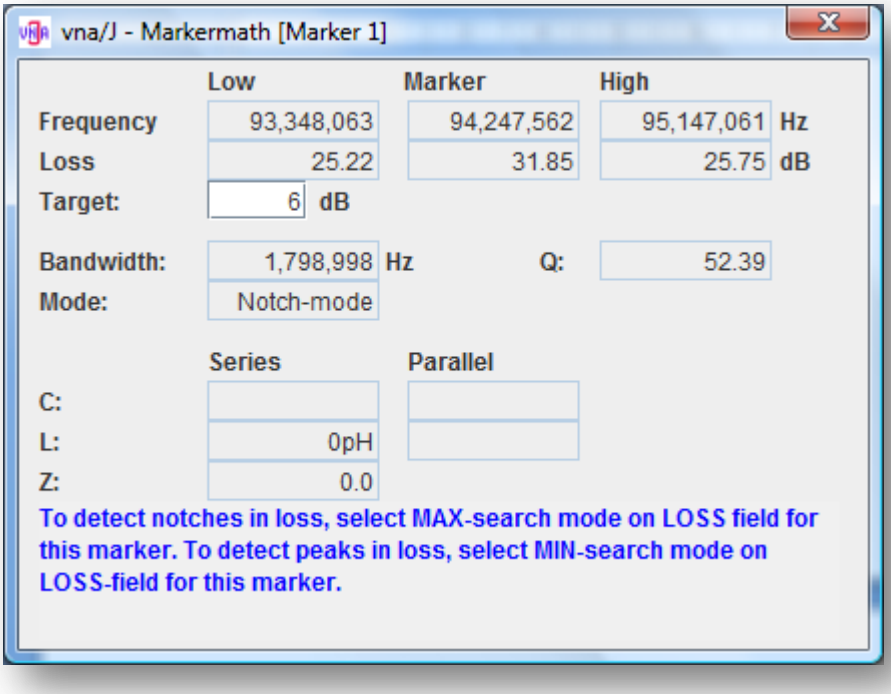
To measure the data for this filter, follow this procedure:

- Switch to transmission mode.
- Switch to free-run mode to get constant updates of the values.
- Click on the diagram area with the left-mouse button
- Select the MAX-search mode for the loss field of marker 1
- Click the math-symbol for marker 1.

The main window should look like this:

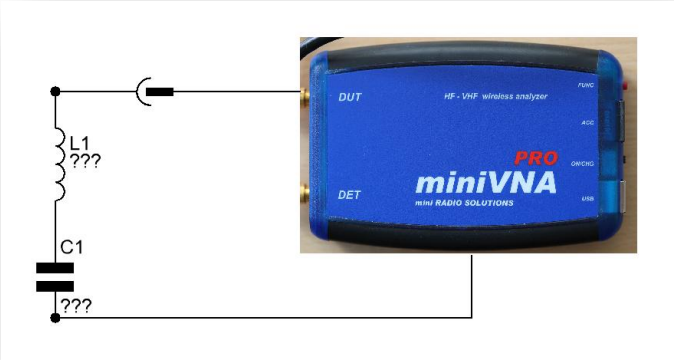


and the marker-math dialog should display these values:

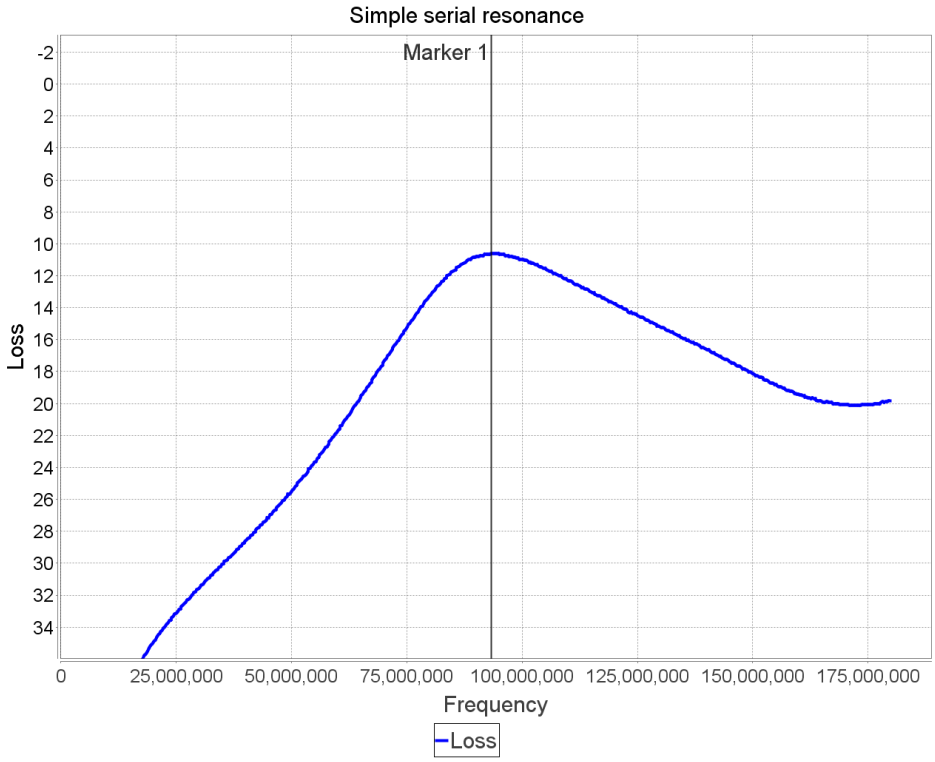


Reflection mode

We have a simple serial LC circuit connected to DUT.



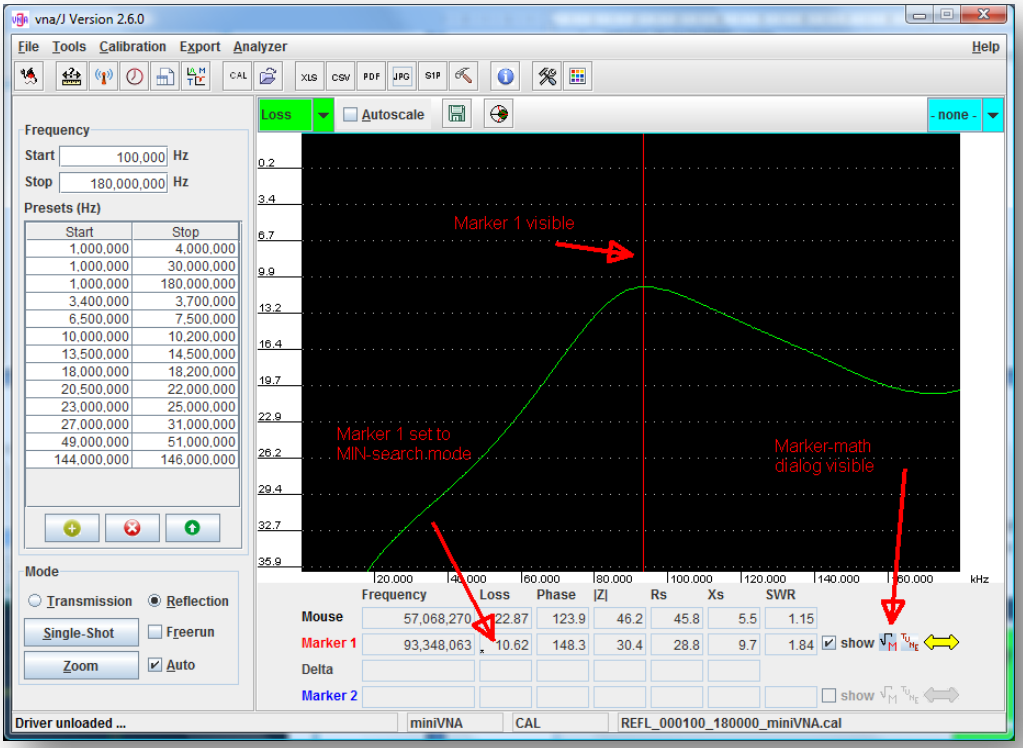
This gives a measurement curve with vna/J.



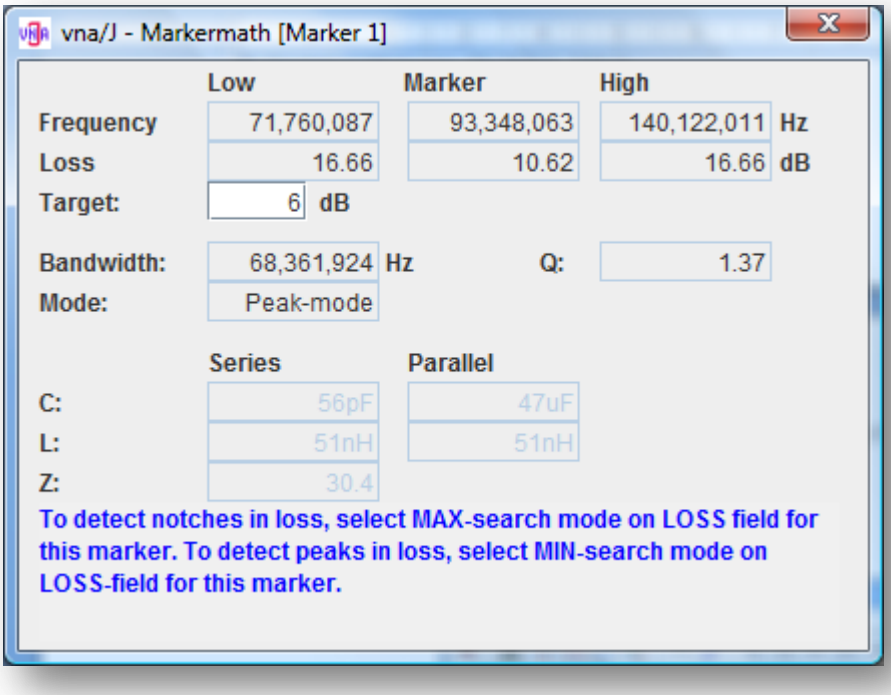
To measure the data for this circuit, follow this procedure:

- Switch to reflection mode
- Switch to free-run mode to get constant updates of the values.
- Click on the diagram area with the left-mouse button
- Select the MAX-search mode for the loss field of marker 1
- Click the math-symbol for marker 1.

The main window should look like this:

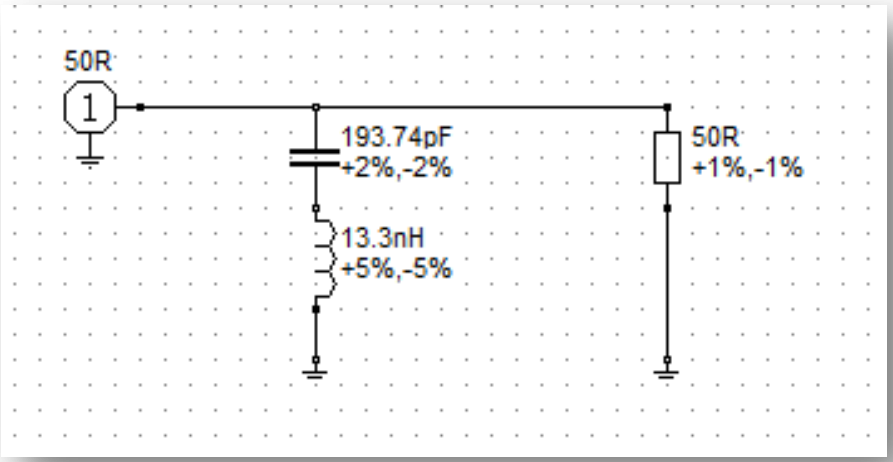


and the marker-math dialog should display these values:

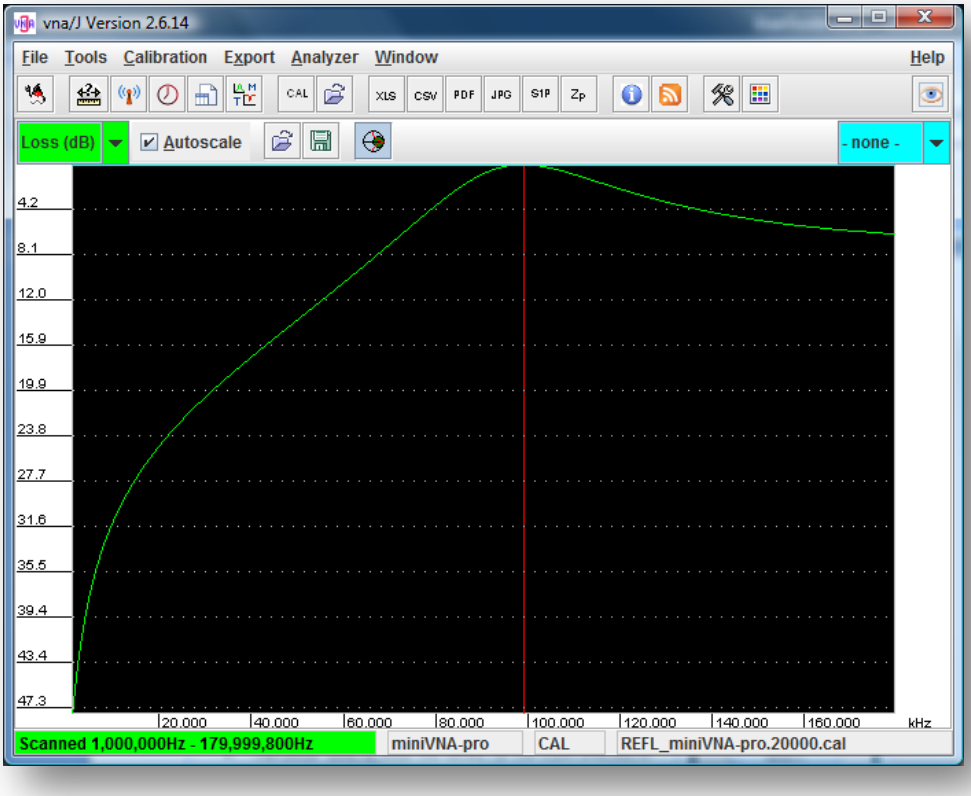


Comparison with simulation

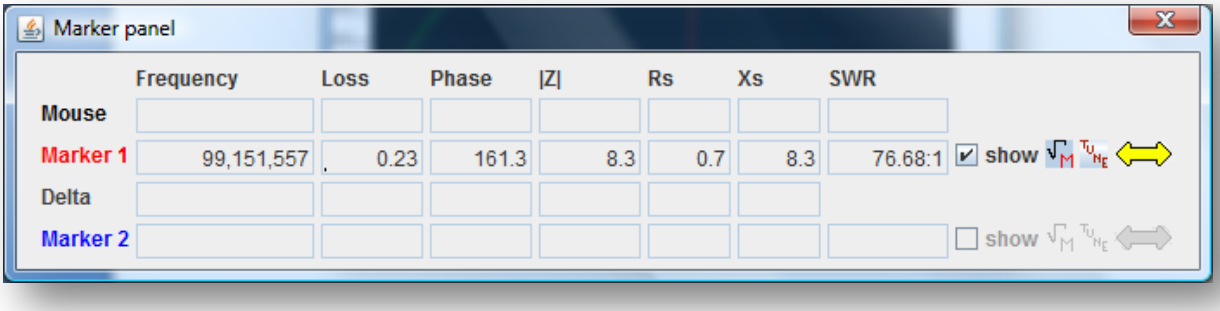
I've build up this simple circuit:



where (1) is the miniVNA pro. Using vna/J with the miniVNA pro I'll get this scan:

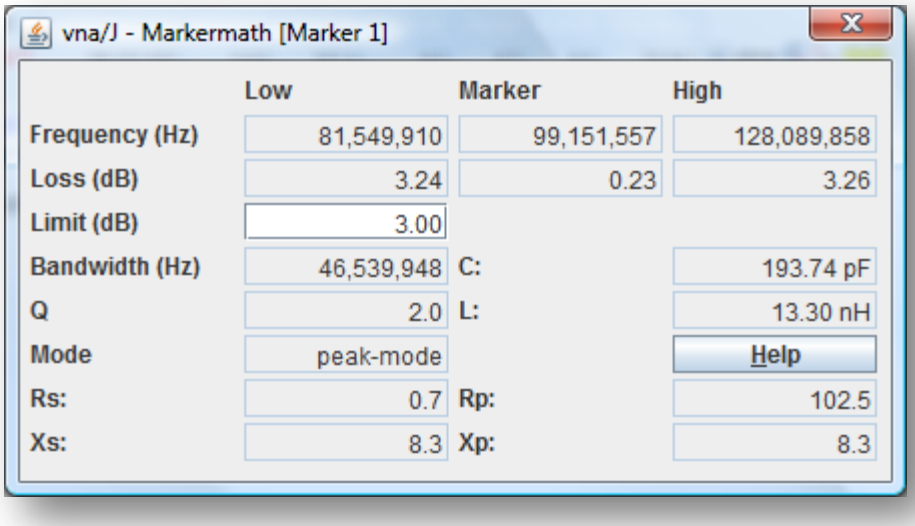


Setting the search-mode of cursor 1 to minimum

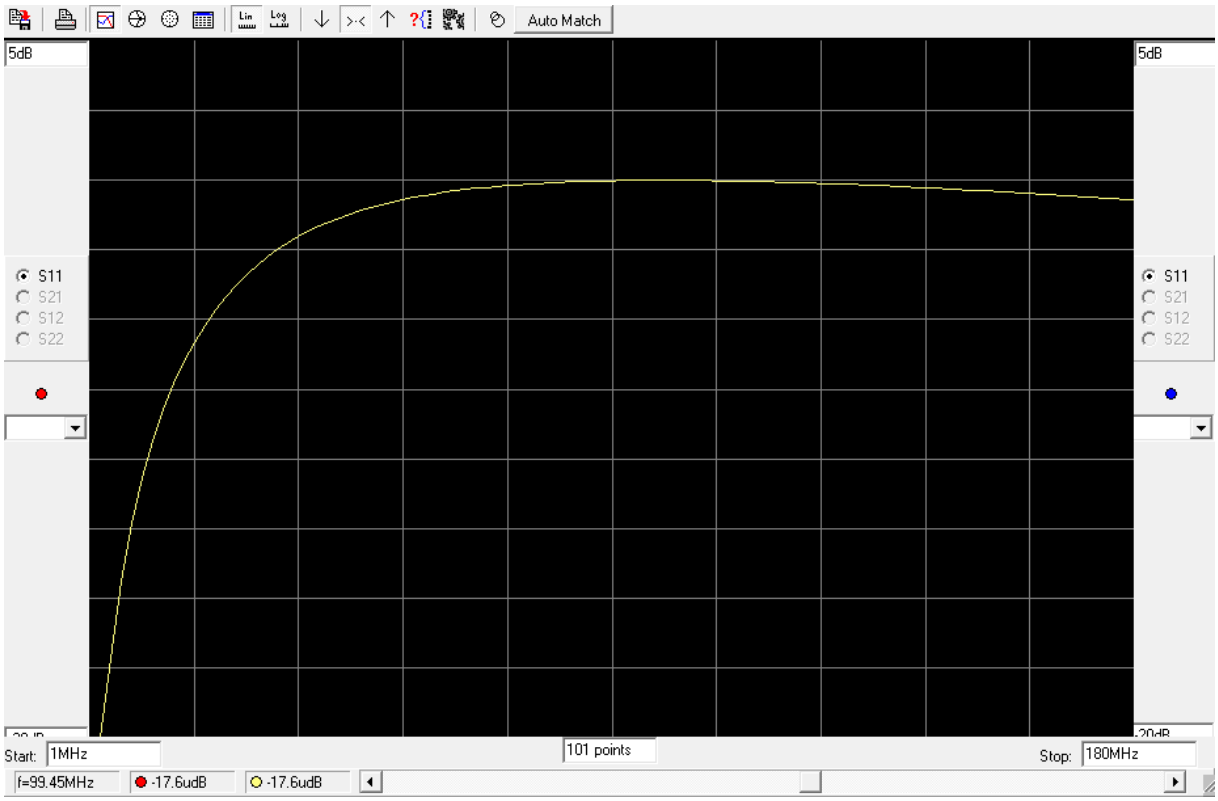


it automatically sets cursor 1 to 99.15 MHz - the minimum loss.

Opening the cursor-math dialog for cursor 1 gives this:



When I enter now the values for C=193,74pF and L=13,3nH I get this simulation inside RFSim99:



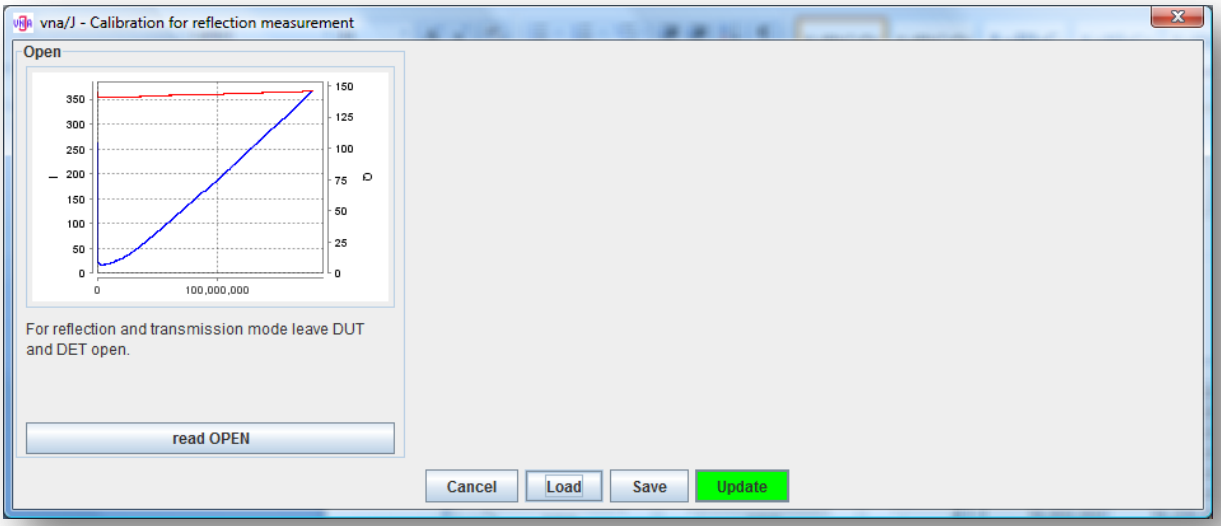
As you can see, the minimum loss is also at about 99,45MHz ☺

RFSim99 can be found here:

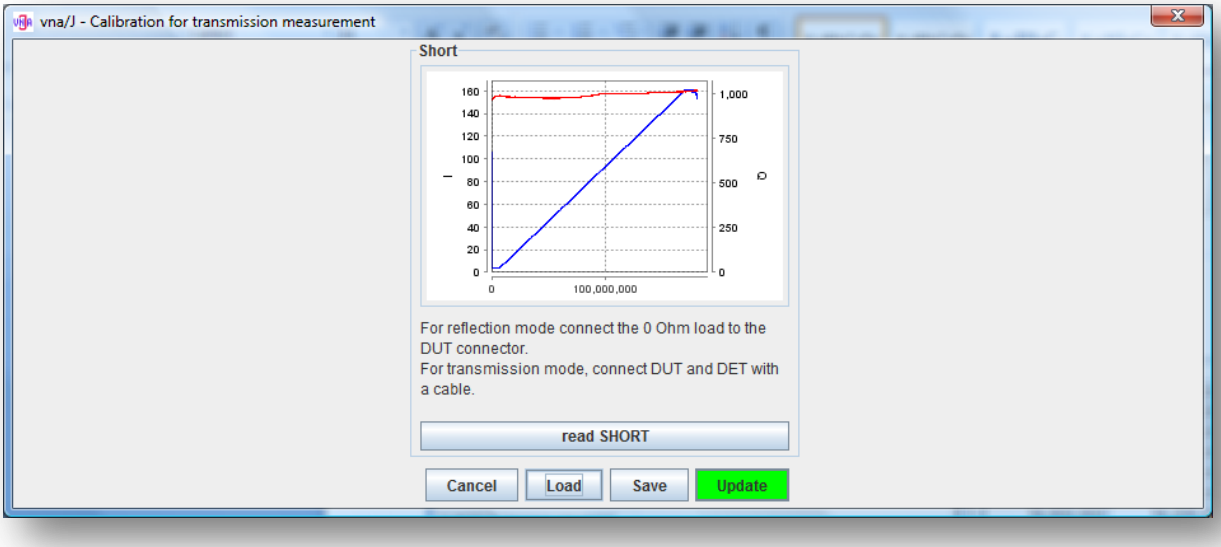
http://elektronikbasteln.pl7.de/rfsim99-filter-berechnung.html

Main calibration datasets miniVNA

Reflection

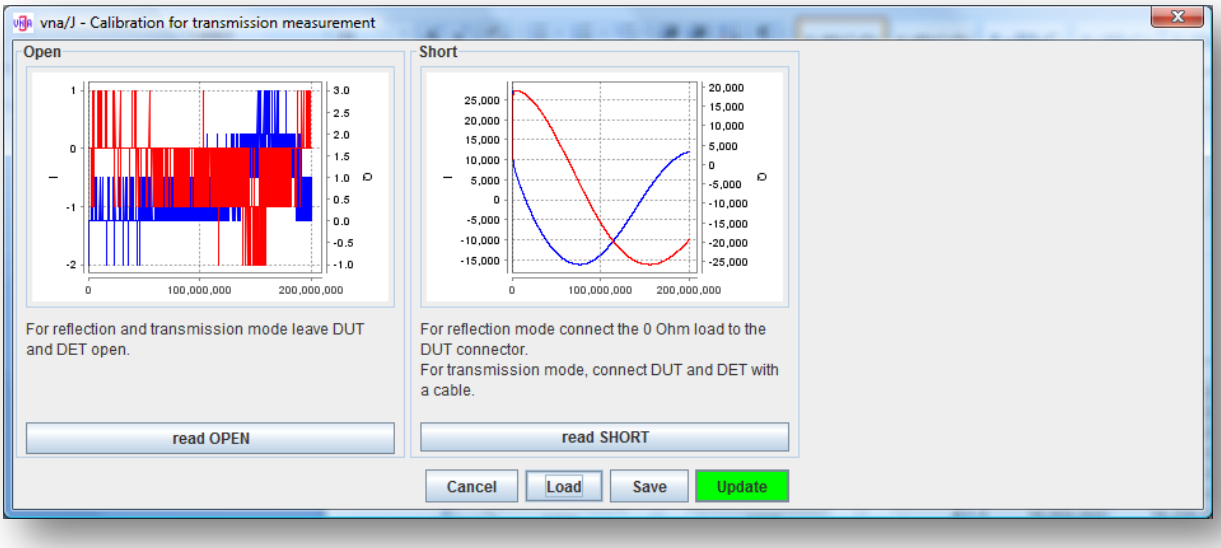


Transmission

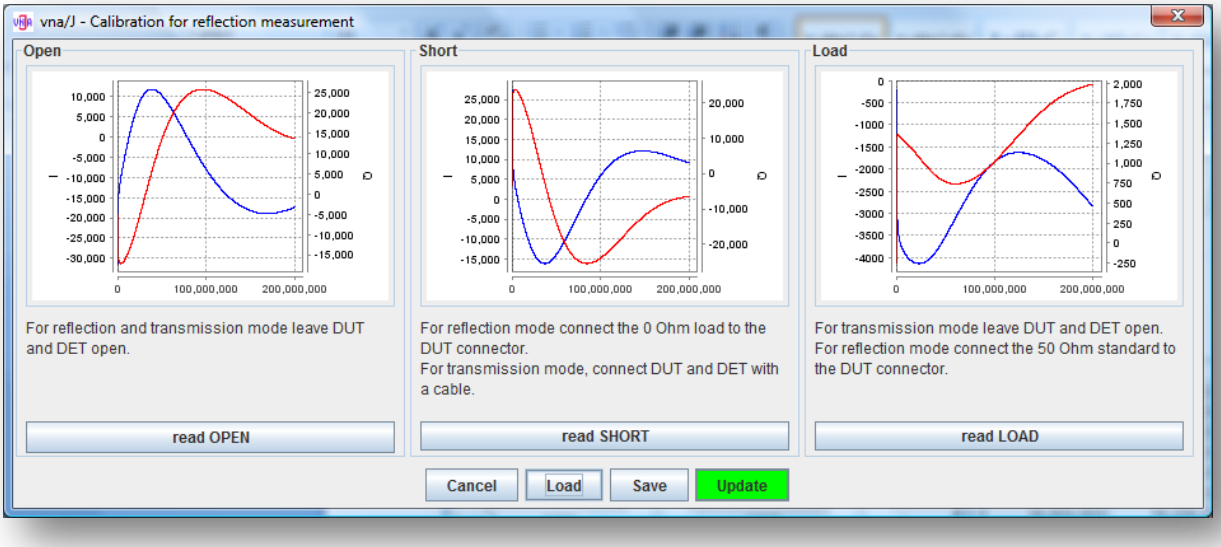


Main calibration datasets miniVNA PRO

Reflection



Transmission

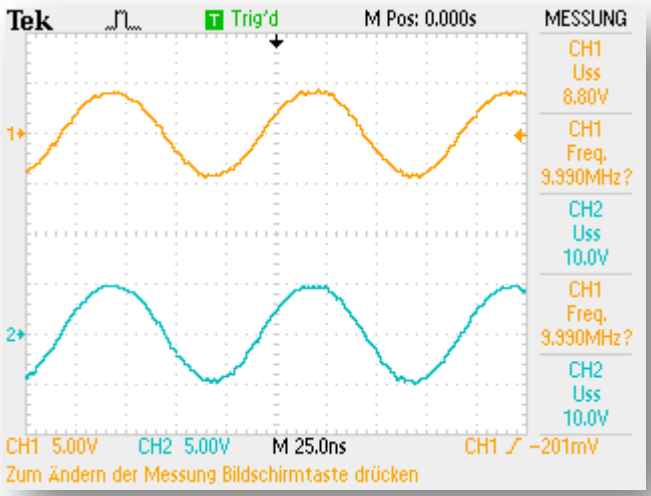


Generator signals

miniVNA pro

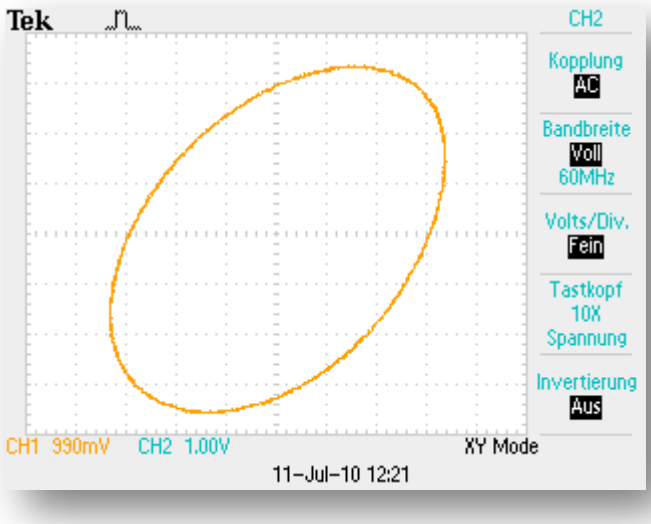
All signal are measured using a Tektronix low-cost digital scope TDS 2002B.

The generator signals are fed into the scope using about 25cm of RG58 coax cable. The cables where terminated with 50Ohm resistors.

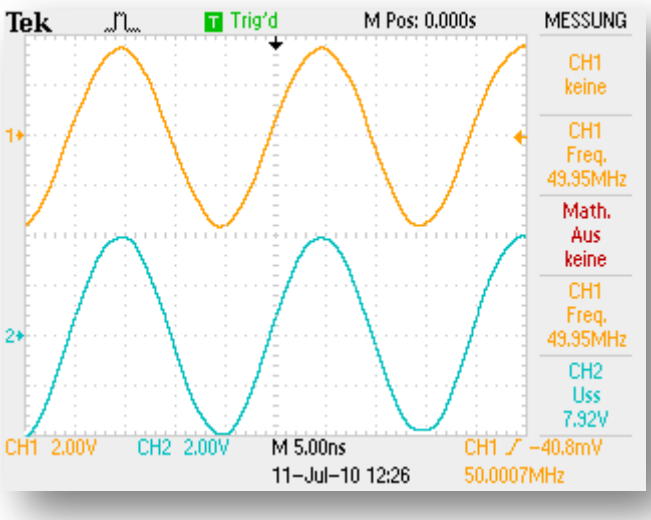


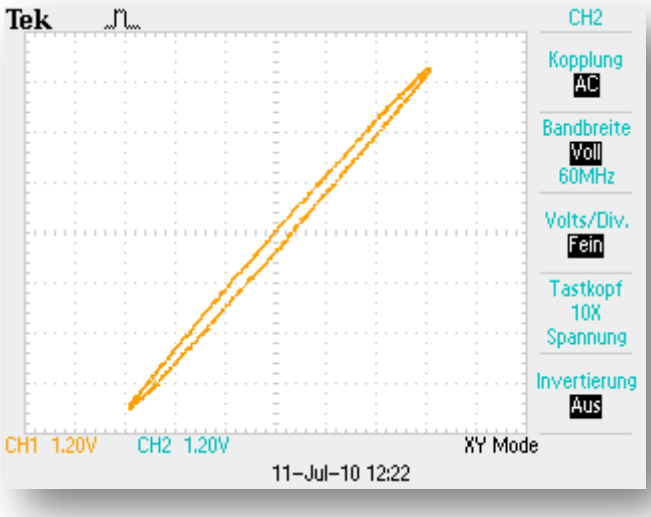
Phase difference

Both channels fed with DUT signal

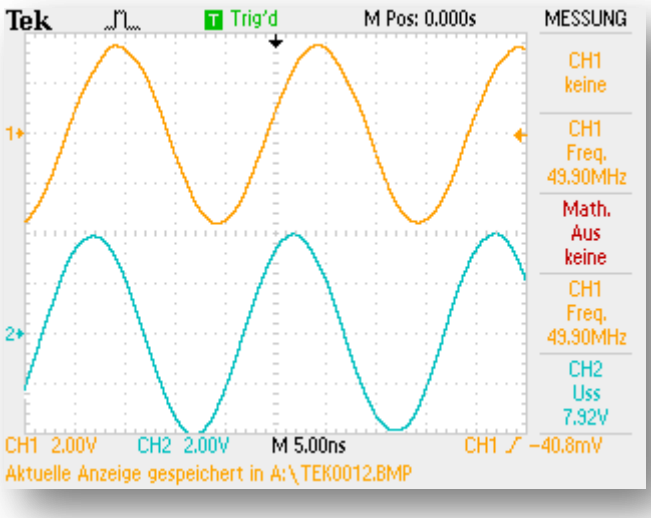


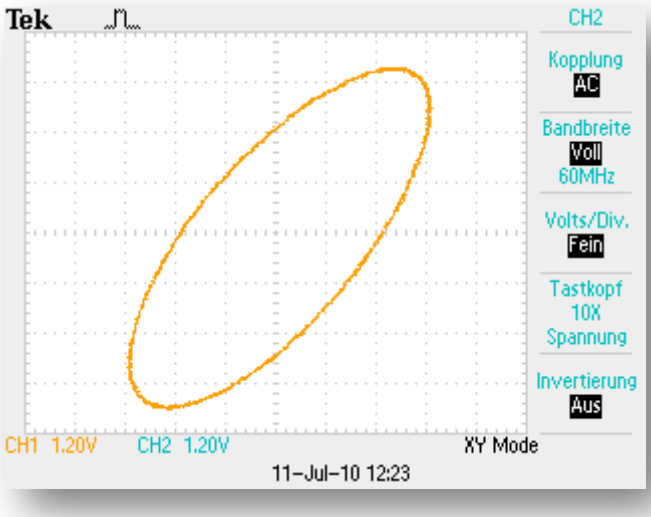
Phase difference 0°



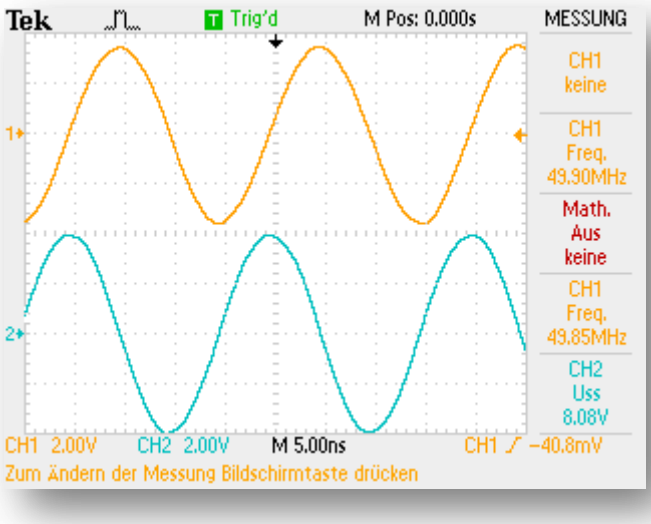


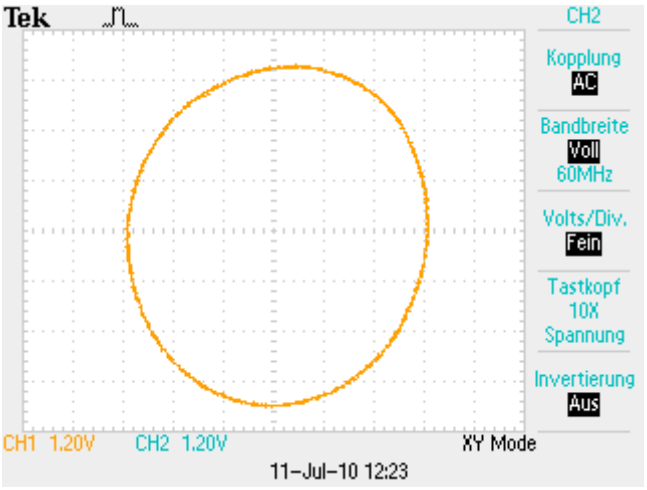
Phase difference 45°





Phase difference 90°

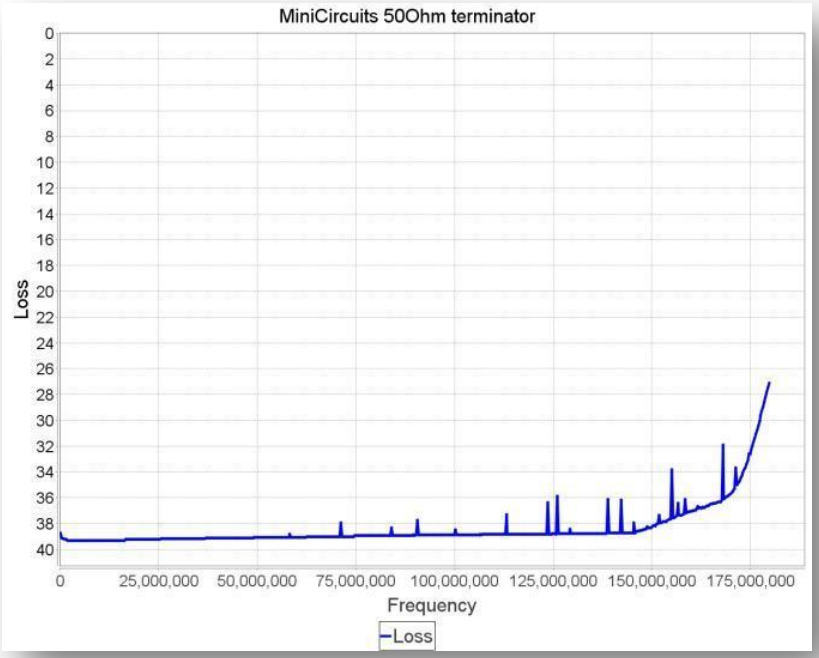




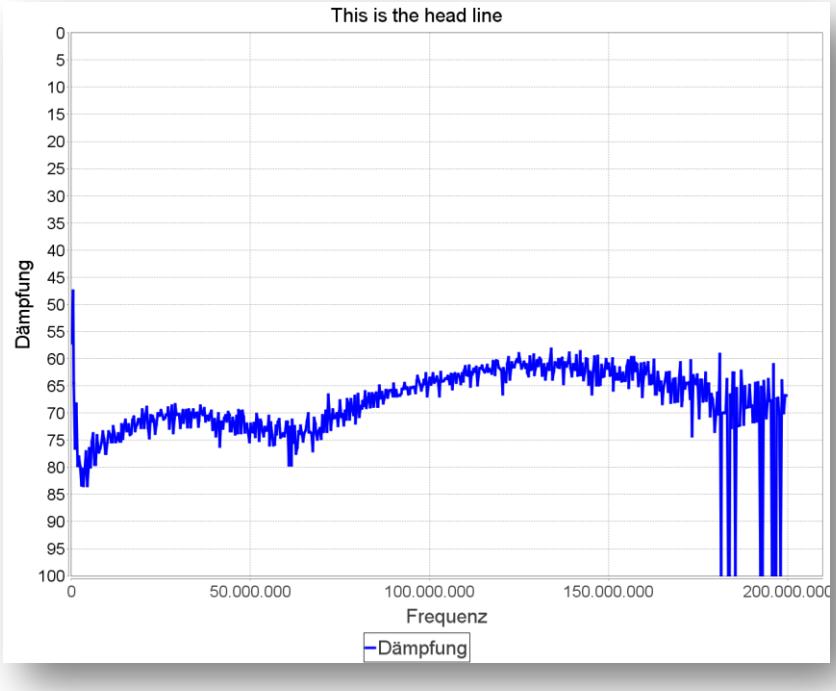
Sample measurement

MiniCircuits 50Ω terminator

miniVNA

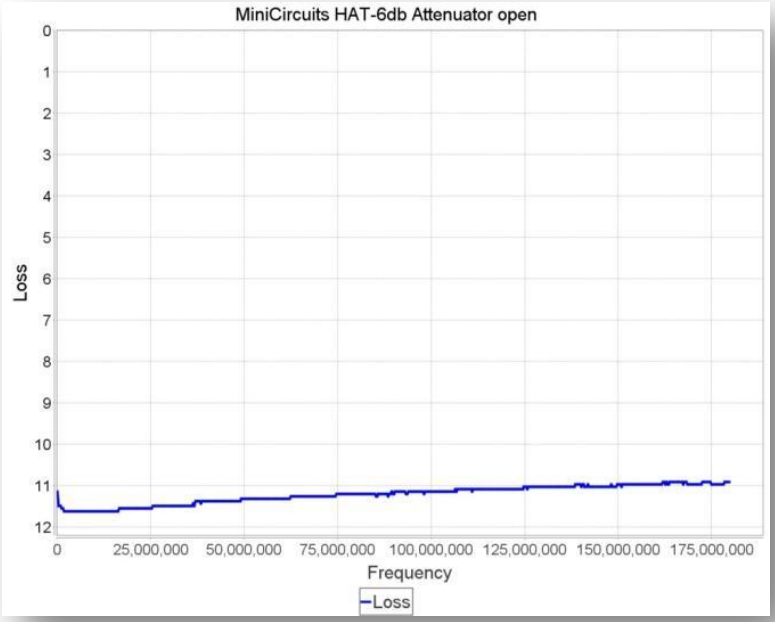


miniVNA PRO

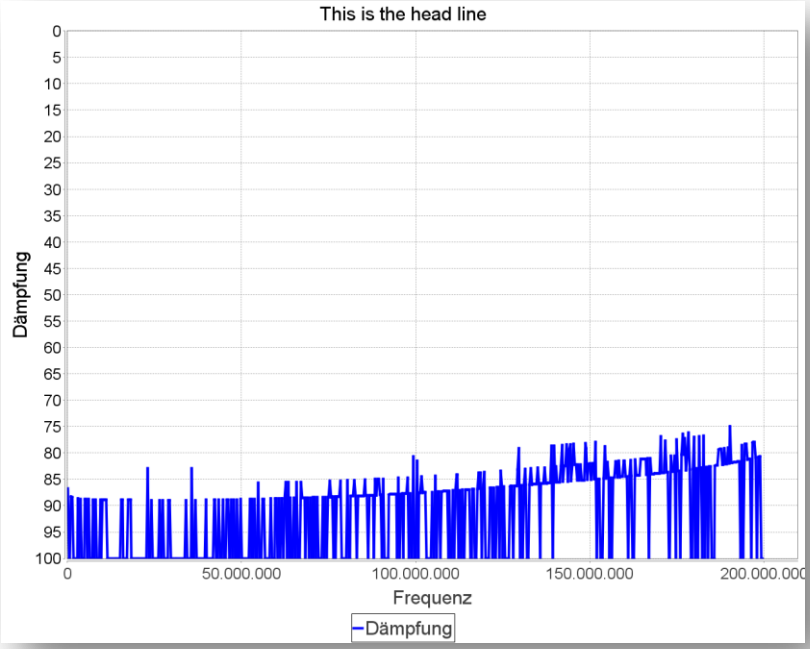


MiniCircuits HAT-6dB attenuator open end

miniVNA

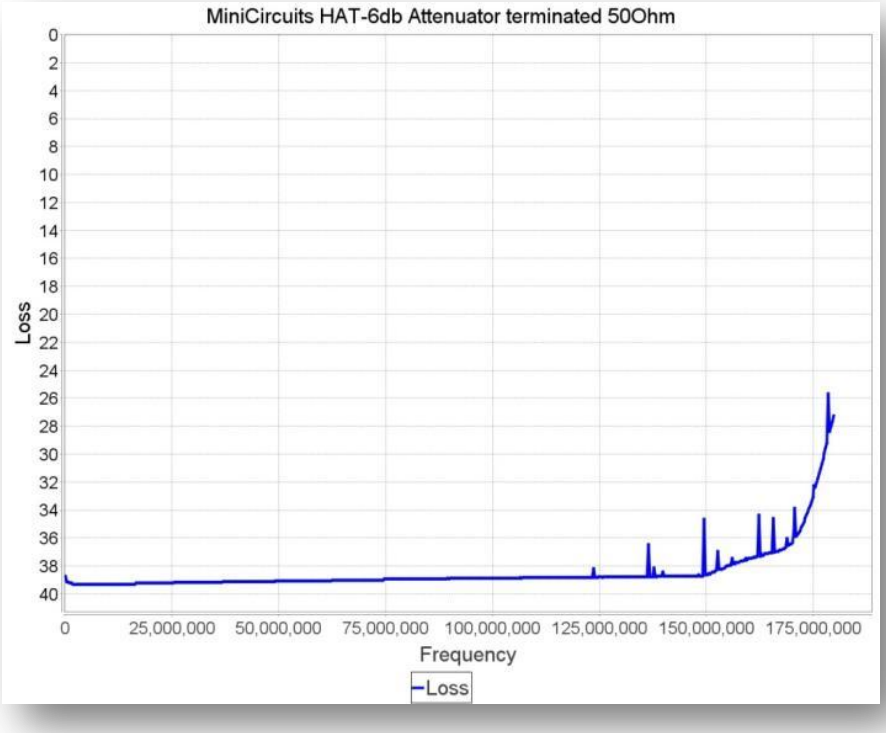


miniVNA PRO

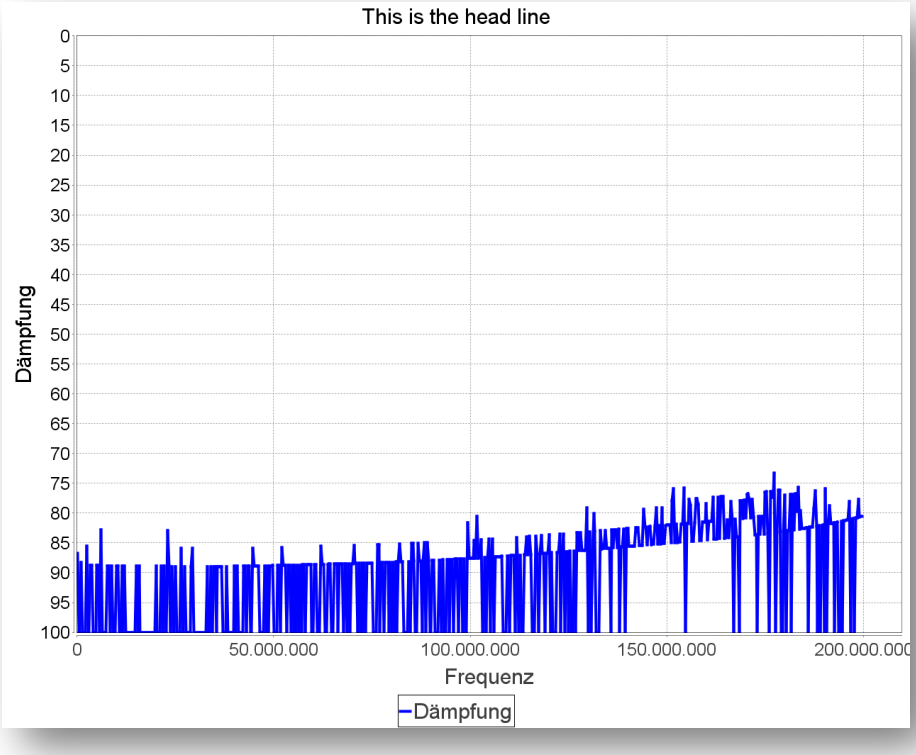


MiniCircuits HAT-6dB attenuator terminated 50Ohm

miniVNA



miniVNA PRO



Hints and tips

How to launch in a different language

The application currently supports German and English as languages for the user interface.

Usually the language for the application is determined by the environment under which the application is launched.

When launching the application on a Windows© PC with locale GERMAN, all messages, GUI elements and printout will be in German.

All other locales will be treated as English and the elements will be labelled in English.

If this detection does not work correctly or you want to force the application to start in a specific locale, the application can be launched from a command window entering:

In German: `java -jar -Duser.language=de -Duser.country=DE vnaJ_2_x_x.jar`

In English: `java -jar -Duser.language=en -Duser.country=US vnaJ_2_x_x.jar`

In Polish: `java -jar -Duser.language=pl -Duser.country=PL vnaJ_2_x_x.jar`

In Italian: `java -jar -Duser.language=it -Duser.country=IT vnaJ_2_x_x.jar`

Automatic: `java -jar vnaJ_2_x_x.jar`

Remark: If someone has some spare-time, he can provide translations for his native language.

Simply send me mail at vnaj@dl2sba.de and I will provide you the necessary files.

Reporting a problem

If you encounter any problems with vna/J please provide me the following details in your error report. Without these information, I cannot assist you effectivly.

Operating system

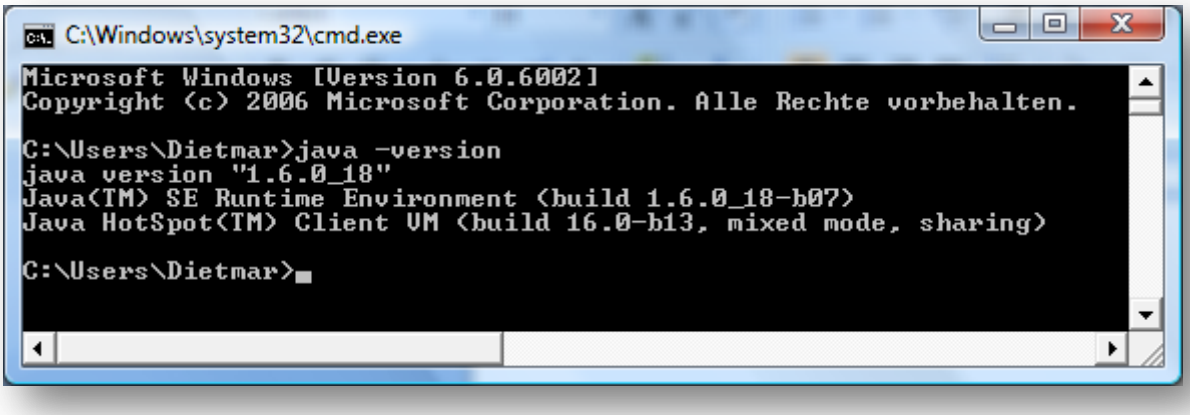
Provide me some details regarding the operating system you're using (i.e. Type, Name, Version, Patchlevel, …)

JAVA environment

Open a command shell in your operating system an enter the following command:

```
java -version
```

This should give you a display like this:



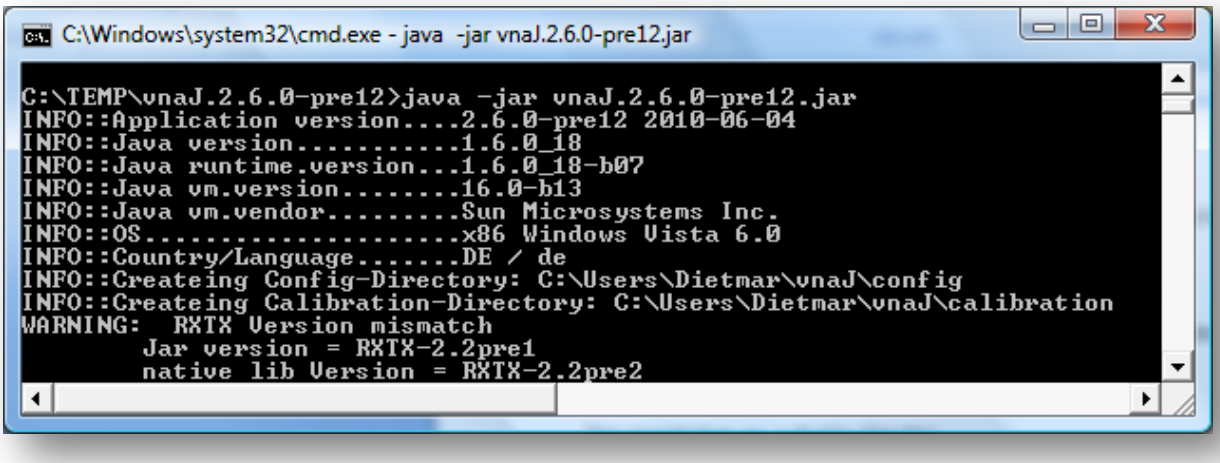
Send me the information displayed after you've entered the command.

vna/J startup info

Open a command shell in your operating system an enter the following command:

```
java -jar vnaJ.2.6.0.jar
```

Replace the name of the jar-file with the one, you're using. This should give a display like this:



Send me the information displayed after you've entered the command.

vna/J

Send me screenshots of the errors, you've found in the application with a detailed description, how I can reproduce this problem.

Enable logging

To debug problems using this application, it may be sometime necessary to enable the build in logging of the application.

Please follow these steps:

1. Open a command line window and navigate to the directory, where you've stored the JAR-file and the rxtx*-files.

2. Launch the application by entering

   ```
   java -jar -DTracer.tracing=true vnaJ????.jar 1>trace.txt 2>error.txt
   ```

   in the command line window.

   Note: Replace ??? with the current name of the JAR you are currently using.

3. Now the application should start as usual.

4. Now try to reproduce the failure etc.

5. When finished, terminate the application via the **FILE/EXIT** menu.

6. As tracing will slow down the application on not so powerful machines, switch off tracing by starting the application again this way:

   ```
   java -jar -DTracer.tracing=false vnaJ????.jar
   ```

7. SAVE and close the application via the menu **FILE/EXIT**

8. Send the files **trace.txt** and **error.txt** together with a detailed description of your environment (hardware, software …) and the found problem to **vnaj@dl2sba.de**.

9. … hope ☺

Application does not start

First of all, try to remove all previously created configuration information.

This can be easily done, by renaming the configuration directory as outlined in chapter "Settings" on page 82.

When the application is restarted, the directory is recreated and the settings are initialized with default values.

If this does not cure the problem please follow the steps described in chapter "Reporting a problem" on page 102 to create detailed logging information.

Links

http://groups.yahoo.com/group/analyzer_iw3hev

An active YAHOO group related to the miniVNA as well as the miniVNA PRO.

In the files sections under **Files > Subjects - Off Topic - (Brainstorming) > SUSE Install for DL2SBA app.** find a detailled guide howto install the stuff on UBUNTU as well as SUSES Linux versions.

http://www.miniradiosolutions.com/

Company that produces the miniVNA as well as the miniVNA PRO

Used Java libraries

http://commons.apache.org

Apache Commons - provides support for complex number mathematics

http://poi.apache.org

Apache POI - provides support for Microsoft Office file export

http://itextpdf.com

iText - provides support for PDF export

http://www.jfree.org/jfreechart

JFreeChart - provides charting support calibration and data export

http://www.sauronsoftware.it/projects/cron4j

Cron4J - providing time scheduler support

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English

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Die Einräumung des Nutzungsrechts gemäß Abschnitt 3 dieser Lizenz erfolgt ausdrücklich nur unter den folgenden Bedingungen:

a. Sie dürfen den Schutzgegenstand ausschließlich unter den Bedingungen dieser Lizenz verbreiten oder öffentlich zeigen. Sie müssen dabei stets eine Kopie dieser Lizenz oder deren vollständige Internetadresse in Form des Uniform-Resource-Identifier (URI) beifügen. Sie dürfen keine Vertrags- oder Nutzungsbedingungen anbieten oder fordern, die die Bedingungen dieser Lizenz oder die durch diese Lizenz gewährten Rechte beschränken. Sie dürfen den Schutzgegenstand nicht unterlizenzieren. Bei jeder Kopie des Schutzgegenstandes, die Sie verbreiten oder öffentlich zeigen, müssen Sie alle Hinweise unverändert lassen, die auf diese Lizenz und den Haftungsausschluss hinweisen. Wenn Sie den Schutzgegenstand verbreiten oder öffentlich zeigen, dürfen Sie (in Bezug auf den Schutzgegenstand) keine technischen Maßnahmen ergreifen, die den Nutzer des Schutzgegenstandes in der Ausübung der ihm durch diese Lizenz gewährten Rechte behindern können. Dieser Abschnitt 4.a) gilt auch für den Fall, dass der Schutzgegenstand einen Bestandteil eines Sammelwerkes bildet, was jedoch nicht bedeutet, dass das Sammelwerk insgesamt dieser Lizenz unterstellt werden muss. Sofern Sie ein Sammelwerk erstellen, müssen Sie auf die Mitteilung eines Lizenzgebers hin aus dem Sammelwerk die in Abschnitt 4.c) aufgezählten Hinweise entfernen.
b. Die Rechteeinräumung gemäß Abschnitt 3 gilt nur für Handlungen, die nicht vorrangig auf einen geschäftlichen Vorteil oder eine geldwerte Vergütung gerichtet sind ("nicht-kommerzielle Nutzung", "Non-commercial-Option"). Wird Ihnen in Zusammenhang mit dem Schutzgegenstand dieser Lizenz ein anderer Schutzgegenstand überlassen, ohne dass eine vertragliche Verpflichtung hierzu besteht (etwa im Wege von File-Sharing), so wird dies nicht als auf geschäftlichen Vorteil oder geldwerte Vergütung gerichtet angesehen, wenn in Verbindung mit dem Austausch der Schutzgegenstände tatsächlich keine Zahlung oder geldwerte Vergütung geleistet wird.
c. Die Verbreitung und das öffentliche Zeigen des Schutzgegenstandes oder ihn enthaltender Sammelwerke ist Ihnen nur unter der Bedingung gestattet, dass Sie, vorbehaltlich etwaiger Mitteilungen im Sinne von Abschnitt 4.a), alle dazu gehörenden Rechtevermerke unberührt lassen. Sie sind verpflichtet, die Rechteinhaberschaft in einer der Nutzung entsprechenden, angemessenen Form anzuerkennen, indem Sie - soweit bekannt - Folgendes angeben:

    i. Den Namen (oder das Pseudonym, falls ein solches verwendet wird) des Rechteinhabers und / oder, falls der Lizenzgeber im Rechtevermerk, in den Nutzungsbedingungen oder auf andere angemessene Weise eine Zuschreibung an Dritte vorgenommen hat (z.B. an eine Stiftung, ein Verlagshaus oder eine Zeitung) ("Zuschreibungsempfänger"), Namen bzw. Bezeichnung dieses oder dieser Dritten;
    ii. den Titel des Inhaltes;
    iii. in einer praktikablen Form den Uniform-Resource-Identifier (URI, z.B. Internetadresse), den der Lizenzgeber zum Schutzgegenstand angegeben hat, es sei denn, dieser URI verweist nicht auf den Rechtevermerk oder die Lizenzinformationen zum Schutzgegenstand.

    Die nach diesem Abschnitt 4.c) erforderlichen Angaben können in jeder angemessenen Form gemacht werden; im Falle eines Sammelwerkes müssen diese Angaben das Minimum darstellen und bei gemeinsamer Nennung mehrerer Rechteinhaber derge-

stalt erfolgen, dass sie zumindest ebenso hervorgehoben sind wie die Hinweise auf die übrigen Rechteinhaber. Die Angaben nach diesem Abschnitt dürfen Sie ausschließlich zur Angabe der Rechteinhaberschaft in der oben bezeichneten Weise verwenden. Durch die Ausübung Ihrer Rechte aus dieser Lizenz dürfen Sie ohne eine vorherige, separat und schriftlich vorliegende Zustimmung des Lizenzgebers und / oder des Zuschreibungsempfängers weder explizit noch implizit irgendeine Verbindung zum Lizenzgeber oder Zuschreibungsempfänger und ebenso wenig eine Unterstützung oder Billigung durch ihn andeuten.

d. Die oben unter 4.a) bis c) genannten Einschränkungen gelten nicht für solche Teile des Schutzgegenstandes, die allein deshalb unter den Schutzgegenstandsbegriff fallen, weil sie als Datenbanken oder Zusammenstellungen von Daten einen immaterialgüterrechtlichen Schutz eigener Art genießen.
e. Bezüglich Vergütung für die Nutzung des Schutzgegenstandes gilt Folgendes:
    i. **Unverzichtbare gesetzliche Vergütungsansprüche**: Soweit unverzichtbare Vergütungsansprüche im Gegenzug für gesetzliche Lizenzen vorgesehen oder Pauschalabgabensysteme (zum Beispiel für Leermedien) vorhanden sind, behält sich der Lizenzgeber das ausschließliche Recht vor, die entsprechende Vergütung einzuziehen für jede Ausübung eines Rechts aus dieser Lizenz durch Sie.
    ii. **Vergütung bei Zwangslizenzen**: Sofern Zwangslizenzen außerhalb dieser Lizenz vorgesehen sind und zustande kommen, behält sich der Lizenzgeber das ausschließliche Recht auf Einziehung der entsprechenden Vergütung für den Fall vor, dass Sie eine Nutzung des Schutzgegenstandes für andere als die in Abschnitt 4.b) als nicht-kommerziell definierten Zwecke vornehmen, verzichtet für alle übrigen, lizenzgerechten Fälle von Nutzung jedoch auf jegliche Vergütung.
    iii. **Vergütung in sonstigen Fällen**: Bezüglich lizenzgerechter Nutzung des Schutzgegenstandes durch Sie, die nicht unter die beiden vorherigen Abschnitte (i) und (ii) fällt, verzichtet der Lizenzgeber auf jegliche Vergütung, unabhängig davon, ob eine Einziehung der Vergütung durch ihn selbst oder nur durch eine Verwertungsgesellschaft möglich wäre. Der Lizenzgeber behält sich jedoch das ausschließliche Recht auf Einziehung der entsprechenden Vergütung (durch ihn selbst oder eine Verwertungsgesellschaft) für den Fall vor, dass Sie eine Nutzung des Schutzgegenstandes für andere als die in Abschnitt 4.b) als nicht-kommerziell definierten Zwecke vornehmen.
f. Persönlichkeitsrechte bleiben - soweit sie bestehen - von dieser Lizenz unberührt.

5. Gewährleistung

SOFERN KEINE ANDERS LAUTENDE, SCHRIFTLICHE VEREINBARUNG ZWISCHEN DEM LIZENZGEBER UND IHNEN GESCHLOSSEN WURDE UND SOWEIT MÄNGEL NICHT ARGLISTIG VERSCHWIEGEN WURDEN, BIETET DER LIZENZGEBER DEN SCHUTZGEGENSTAND UND DIE EINRÄUMUNG VON RECHTEN UNTER AUSSCHLUSS JEGLICHER GEWÄHRLEISTUNG AN UND ÜBERNIMMT WEDER AUSDRÜCKLICH NOCH KONKLUDENT GARANTIEN IRGENDEINER ART. DIES UMFASST INSBESONDERE DAS FREISEIN VON SACH- UND RECHTSMÄNGELN, UNABHÄNGIG VON DEREN ERKENNBARKEIT FÜR DEN LIZENZGEBER, DIE VERKEHRSFÄHIGKEIT DES SCHUTZGEGENSTANDES, SEINE VERWENDBARKEIT FÜR EINEN BESTIMMTEN ZWECK SOWIE DIE KORREKTHEIT VON BESCHREIBUNGEN. DIESE GEWÄHRLEISTUNGSBESCHRÄNKUNG GILT NICHT, SOWEIT MÄNGEL ZU SCHÄDEN DER IN ABSCHNITT 6 BEZEICHNETEN ART

FÜHREN UND AUF SEITEN DES LIZENZGEBERS DAS JEWEILS GENANNTE VERSCHULDEN BZW. VERTRETENMÜSSEN EBENFALLS VORLIEGT.

6. Haftungsbeschränkung

DER LIZENZGEBER HAFTET IHNEN GEGENÜBER IN BEZUG AUF SCHÄDEN AUS DER VERLETZUNG DES LEBENS, DES KÖRPERS ODER DER GESUNDHEIT NUR, SOFERN IHM WENIGSTENS FAHRLÄSSIGKEIT VORZUWERFEN IST, FÜR SONSTIGE SCHÄDEN NUR BEI GROBER FAHRLÄSSIGKEIT ODER VORSATZ, UND ÜBERNIMMT DARÜBER HINAUS KEINERLEI FREIWILLIGE HAFTUNG.

7. Erlöschen

a. Diese Lizenz und die durch sie eingeräumten Nutzungsrechte erlöschen mit Wirkung für die Zukunft im Falle eines Verstoßes gegen die Lizenzbedingungen durch Sie, ohne dass es dazu der Kenntnis des Lizenzgebers vom Verstoß oder einer weiteren Handlung einer der Vertragsparteien bedarf. Mit natürlichen oder juristischen Personen, die den Schutzgegenstand enthaltende Sammelwerke unter den Bedingungen dieser Lizenz von Ihnen erhalten haben, bestehen nachträglich entstandene Lizenzbeziehungen jedoch solange weiter, wie die genannten Personen sich ihrerseits an sämtliche Lizenzbedingungen halten. Darüber hinaus gelten die Ziffern 1, 2, 5, 6, 7, und 8 auch nach einem Erlöschen dieser Lizenz fort.
b. Vorbehaltlich der oben genannten Bedingungen gilt diese Lizenz unbefristet bis der rechtliche Schutz für den Schutzgegenstand ausläuft. Davon abgesehen behält der Lizenzgeber das Recht, den Schutzgegenstand unter anderen Lizenzbedingungen anzubieten oder die eigene Weitergabe des Schutzgegenstandes jederzeit einzustellen, solange die Ausübung dieses Rechts nicht einer Kündigung oder einem Widerruf dieser Lizenz (oder irgendeiner Weiterlizenzierung, die auf Grundlage dieser Lizenz bereits erfolgt ist bzw. zukünftig noch erfolgen muss) dient und diese Lizenz unter Berücksichtigung der oben zum Erlöschen genannten Bedingungen vollumfänglich wirksam bleibt.

8. Sonstige Bestimmungen

a. Jedes Mal wenn Sie den Schutzgegenstand für sich genommen oder als Teil eines Sammelwerkes verbreiten oder öffentlich zeigen, bietet der Lizenzgeber dem Empfänger eine Lizenz zu den gleichen Bedingungen und im gleichen Umfang an, wie Ihnen in Form dieser Lizenz.
b. Sollte eine Bestimmung dieser Lizenz unwirksam sein, so bleibt davon die Wirksamkeit der Lizenz im Übrigen unberührt.
c. Keine Bestimmung dieser Lizenz soll als abbedungen und kein Verstoß gegen sie als zulässig gelten, solange die von dem Verzicht oder von dem Verstoß betroffene Seite nicht schriftlich zugestimmt hat.
d. Diese Lizenz (zusammen mit in ihr ausdrücklich vorgesehenen Erlaubnissen, Mitteilungen und Zustimmungen, soweit diese tatsächlich vorliegen) stellt die vollständige Vereinbarung zwischen dem Lizenzgeber und Ihnen in Bezug auf den Schutzgegenstand dar. Es bestehen keine Abreden, Vereinbarungen oder Erklärungen in Bezug auf den Schutzgegenstand, die in dieser Lizenz nicht genannt sind. Rechtsgeschäftliche Änderungen des Verhältnisses zwischen dem Lizenzgeber und Ihnen sind nur über Modifikationen dieser Lizenz möglich. Der Lizenzgeber ist an etwaige zusätzliche, einseitig durch Sie übermittelte Bestimmungen nicht gebunden. Diese Lizenz kann nur durch schriftliche Vereinbarung zwischen Ihnen und dem Lizenzgeber modifiziert werden. Derlei Modifikationen wirken ausschließlich zwischen dem Lizenzgeber und Ihnen und wirken sich nicht auf die Dritten gemäß Ziffern 8.a) angeboteten Lizenzen aus.

e. Sofern zwischen Ihnen und dem Lizenzgeber keine anderweitige Vereinbarung getroffen wurde und soweit Wahlfreiheit besteht, findet auf diesen Lizenzvertrag das Recht der Bundesrepublik Deutschland Anwendung.