

Noise Figure Measuring Software „NoiseAnalyzer V1.00“

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1. Introduction

The „NoiseAnalyzer V1.00“ Software is used to identify the noise figure, noise factor respectively and amplification of quadripoles at different frequencies by Y-factor method.

For this purpose an F calculator is available entering manually the level value measured and to calculate the noise figure and the amplification. Furthermore, another calculator is available to identify noise figures and IP3 of cascaded quadripoles.

In addition to that, a modus is implemented automatically carrying out and showing noise figure and amplifying measurements by a spectrum analyzer or test receiver operated by the „NoiseAnalyzer V1.00“ Software.

The latest modus described is available as a commercial version only, whereby the version restricted to the F calculator can be downloaded from the K&S Mechatronik GmbH webside for free.

The software is tested and runs on Windows2000, Windows XP and Windows Vista.

If the Software does not cooperate with your spectrum analyzer or test receiver please contact us.

We cannot guarantee that all calculations are correct. However, we are doing our best that all errors brought to our attention are being corrected instantly. Therefore, please contact us if any errors occur. Thank you.

2. Software Installation

In order to install the Software, please save the data files „NoiseAnalyzer_V10.exe“ and „qtintf70.dll“ in a directory and start the executable data file.

3. Registered Version of „NoiseAnalyzer V1.00“

If you are interested in the registered version of „NoiseAnalyzer“ please contact us.

Please note that the registered version does only run on the system on which it was initially installed and therefore cannot be used in a computer network.

In case you intend to use a new computer and would like to use the version installed on the old computer, please be so kind as to contact us.

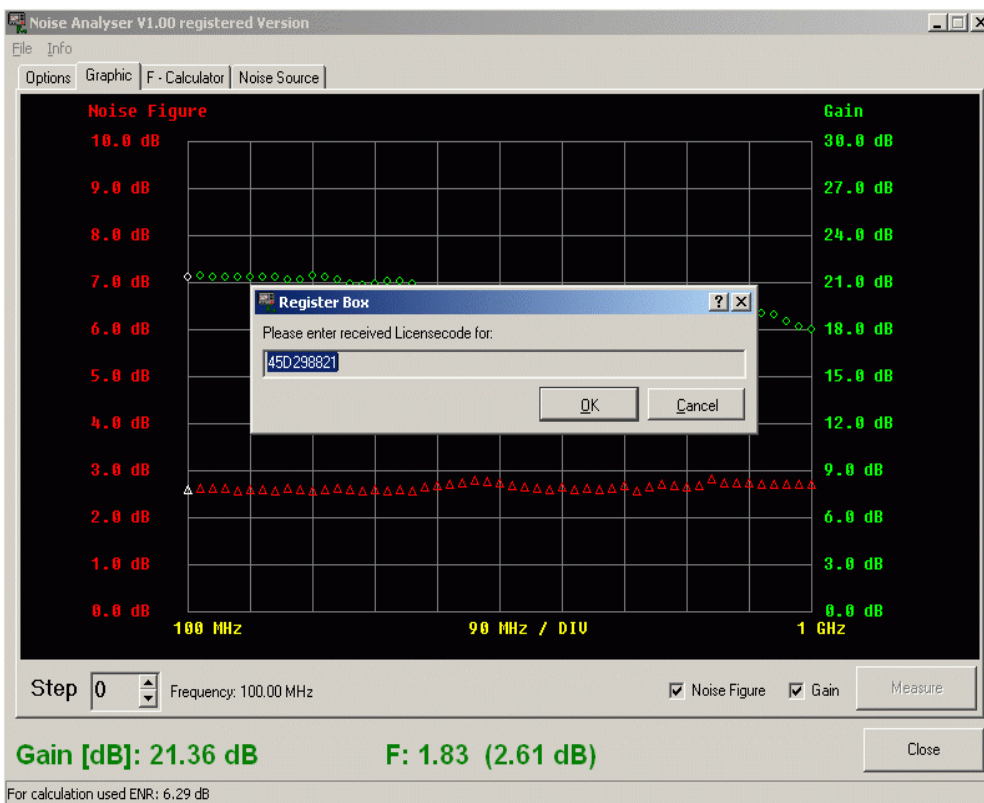
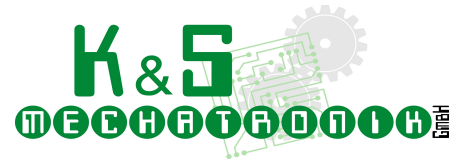


Figure 1: License Code (Menu Information)

As soon as the registered version has been activated successfully, you will see the following text on top of the screen: „registered version“.



Now, you are able to carry out automatized measurements on noise figure and amplification. If your spectrum analyzer does not cooperate with the software, please contact us in order to find out if an implementation is possible. Basically, there are no restrictions on the manufacturer of the spectrum analyzer, so that the software can be used for spectrum analyzers of different manufacturers. Fundamental criteria is the technical qualification of the spectrum analyzer for the measurements.

4. Measuring Preconditions

In addition to the software and computer you will need the following:

- Spectrum Analyzer/Test Receiver
- Pre-amplifier
- Noise Source
- Thermometer for Precise Measurements

5. Hints for Making Successful Noise Figure Measurements

Please keep to the following instructions in order to achieve successful measurements:

- The noise factor to be measured shall not exceed 10 dB above the ENR of the noise source used, otherwise a noise source with a higher ENR is necessary.
- The system noise figure of the spectrum analyzer/test receiver (including pre-amplifier) shall be lower than the ENR of the noise source used.
- All high frequency connectors must be of high quality and be treated carefully. High frequency connectors are mechanical precision parts!
- High frequency connectors shall be mounted with the appropriate torque. We recommend using a torque spanner.
- Irradiations on the measurement setup must be prevented. Radiation sources shall be kept away. Carry out the measurements in shielded rooms.
- If possible, please do not use adapters and cables behind the noise source; each attenuation minimizes the measuring accuracy.

6. Measuring Arrangements

Accurate measurements are predominantly defined by the relative levels and their drifting. The absolute level values are less important. In order to consider these effects, the measuring gauges should warm up for about one hour before starting measuring in order to avoid a drifting of the measuring results due to the warm up of the measuring gauges.

Attention:

A pre-amplifier not input terminated which is upstreamed to the spectrum analyzer and oscillates can lead to a damage of its front end.

Prior to working with the noise measuring system, the ENR value or the ENR table of the noise source has to be entered at the menu item „Noise Source“. The values entered can be saved; we recommend using the serial number or the item number of the noise source as name as otherwise data can be mixed up leading to incorrect measuring results when using several noise sources of the same type.

When using ENR tables, the ENR values of the measurements are linear interpolated between the calibration points of the noise source.

A thermometer defining the ambient temperature is only required for very precise measurements. In case of incorrect temperature, the level of the error expected can be estimated by specifically varying the temperature while checking the F-value calculated.

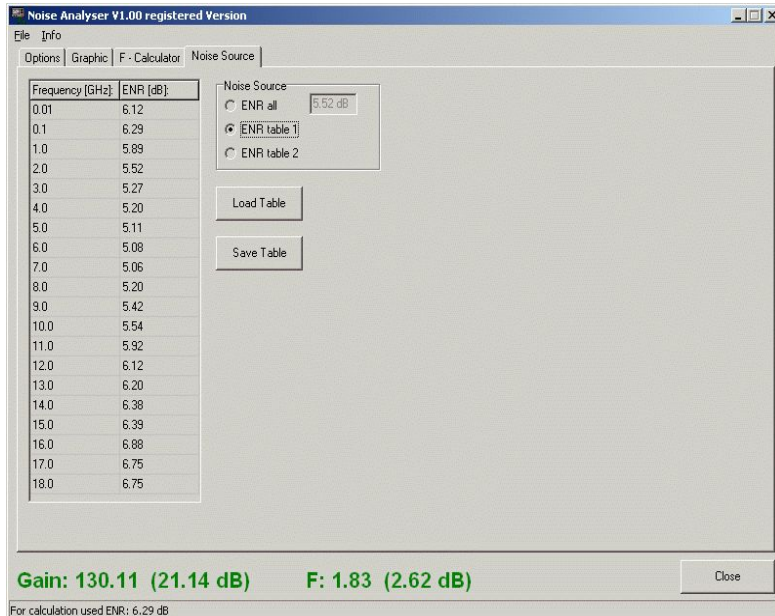
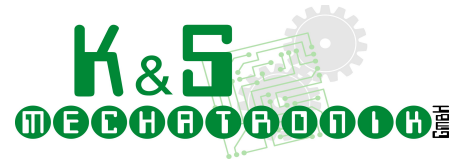
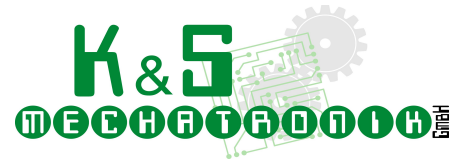


Figure 2: Menu item „Noise Source“



The last step in preparing the measurements is to tune the spectrum analyser with the following values:

- Resolution Bandwidth (RBW)
Basically, high values like 1 MHz, 3 MHz shall be used for the resolution bandwidth, except for test devices with restrictions to the bandwidth, like selective amplifiers. In this case, the resolution bandwidth shall be smaller than the bandwidth of the test device.
- Video Bandwidth
Very small bandwidths at around 10 Hz are advantageous for the video bandwidth, so that the noise is kept low for the level measurements.
- Reference Level
When defining the reference level please note that it must be small enough in order to achieve the sensitivity necessary but at the same time large enough in order to avoid clipping the test system.
Levels at around -20dBm are possible at the input port of a spectrum analyzer when using high bandwidths and test devices with high gain amplifiers
- Input Attenuator
The input attenuator should be completely turned off (0dB) for sensitive measurements. The attenuation shall only be turned on if the spectrum analyzer is likely to be oversteered by highly amplifying test devices/pre-amplifiers at high bandwidths.
- SPAN
The SPAN has to be regulated low on 0Hz (Zero SPAN).
- Average Determination
In case a function to determine the average is available it should be used for improving the measurement accuracy. If so, the measuring time increases by the number of the averaged values. A compromise between measuring speed and measuring accuracy must be defined individually for each application.



7. Measuring

Prior to the actual measuring, the test device (spectrum analyzer including pre-amplifier, if existent) has to be calibrated.

In order to achieve this, the noise source has to be connected **directly** with the input port of the spectrum analyzer or the pre-amplifier.

The test device has to be calibrated on the required frequency or frequency range before measuring. This is done by directly connecting the noise source with the test device and defining the levels while the noise source is turned on and off.

Then, the test device has to be interposed and the levels are again defined while the noise source is turned on and off. The noise source has to be connected **directly** with the test device. Each cable or adapter interposed reduces the measuring accuracy.

Then, the four values measured can be entered in the F calculator (lower area). In addition to that, the frequency has to be added when using an ENR table. The software automatically calculates the ENR out of the table which is required for the calculation. After having clicked the „Calculate!“ button, the noise figure and amplification is shown in green letters at the bottom of the window. The measuring accuracy is increased when recording the temperature.

When using a registered version of „NoiseAnalyzer“ with a remote-controlled spectrum analyzer, the values are not entered manually. Please see chapter 8 for further details.

Besides the calculation of noise figures and amplification, the F calculator allows calculating noise figures, noise factor, amplification and IP3 of cascaded quadripoles after entering the parameter of the individual steps.

It is possible to calculate with five steps maximum, whereby each step can be switched on or off. Due to this fact, the parameters of a system can be compared with an identical system connected with a pre-amplifier at the suitable place.

Data entry regarding the noise performance can either be done by noise figure or by noise factor (dB); the software calculates always the other value required. As a result, the software can also be used for converting these two ways of data.

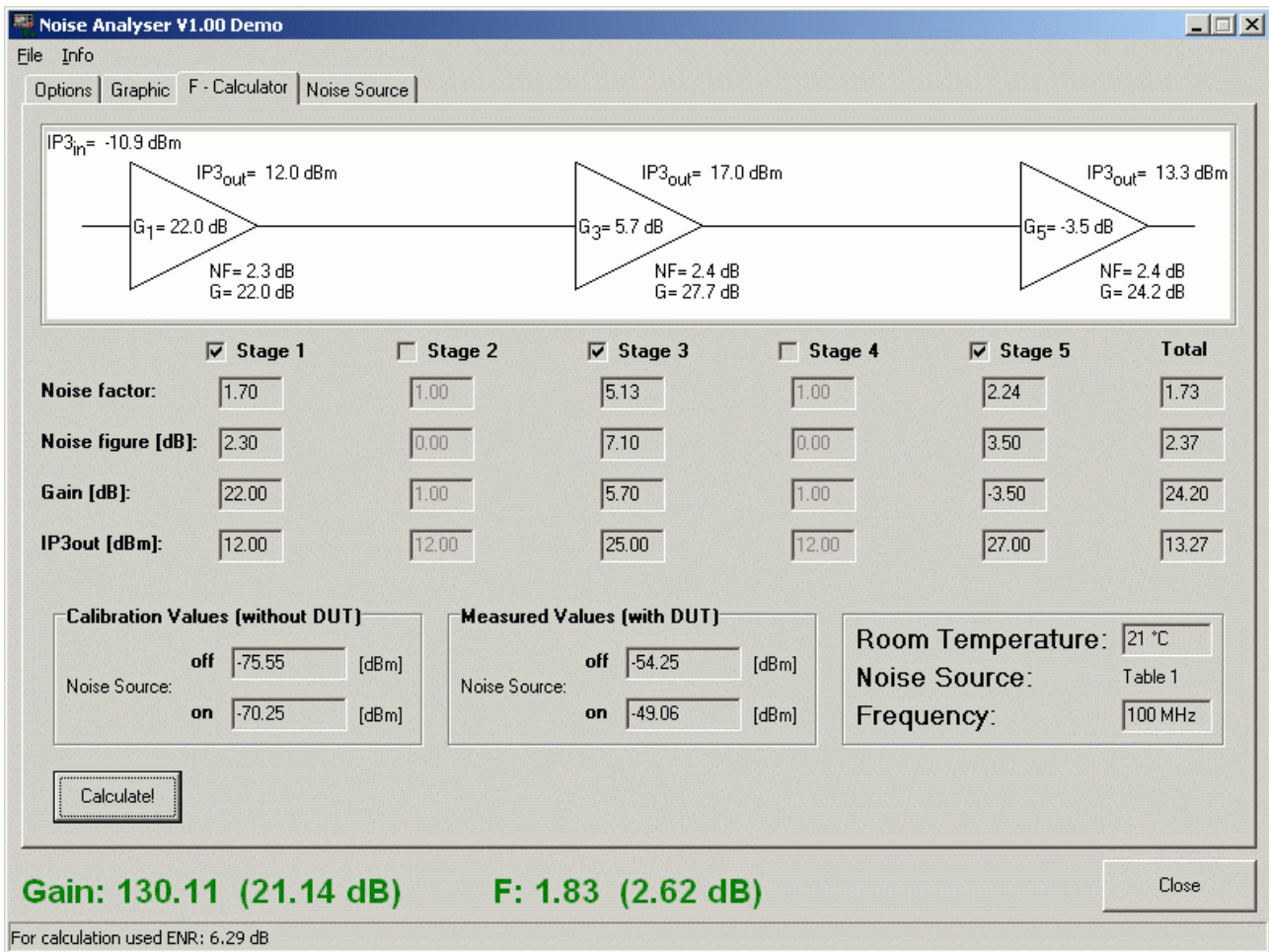


Figure 3: Menu item „F-Calculator“

8. Automized Measurements

When using the registered version of „NoiseAnalyzer“ the spectrum analyzer is controlled by the interface and allows automized measurements.

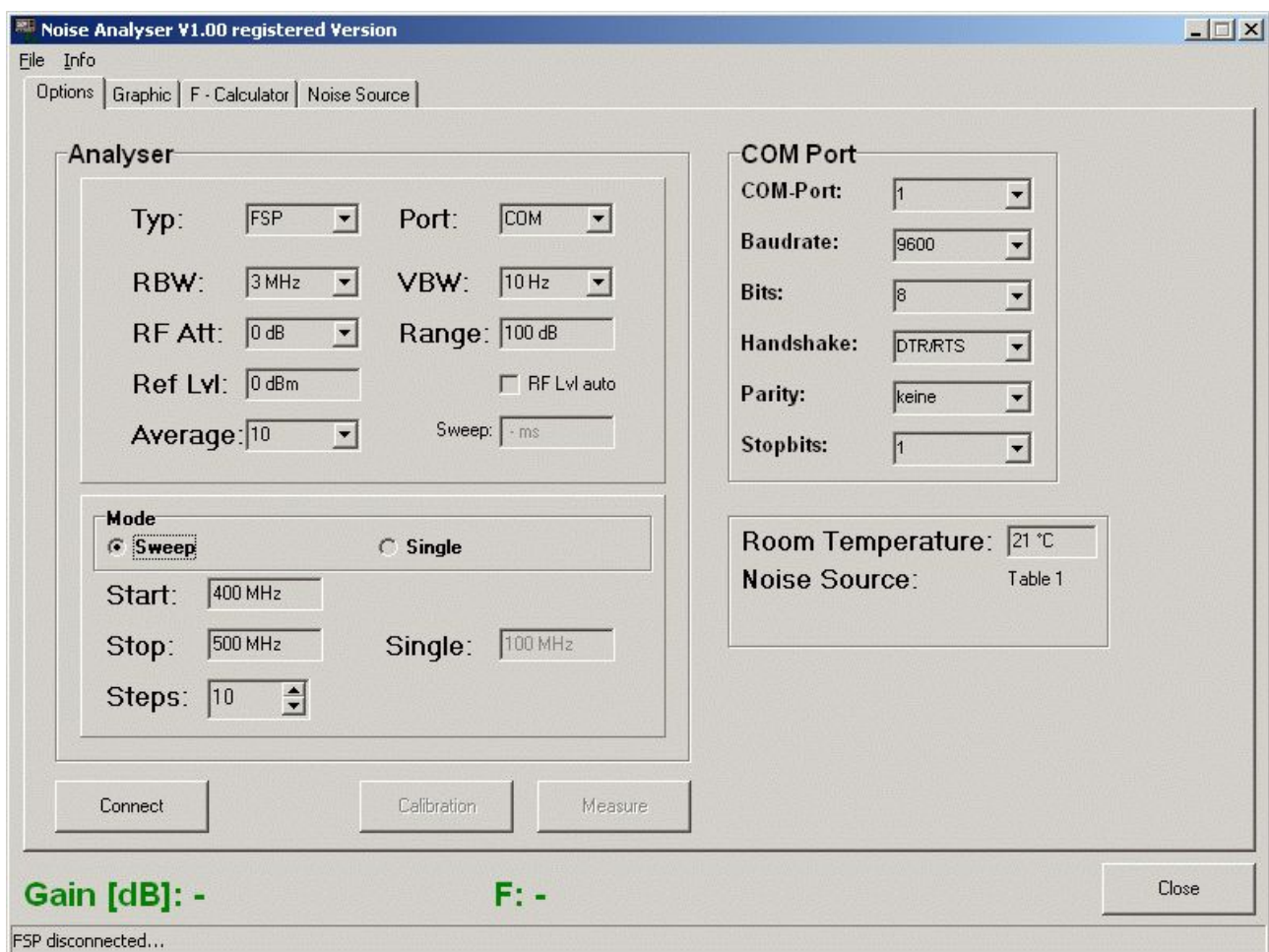


Figure 4: Menu item „Options“

As for the settings of the spectrum analyzer made in the menu item „Options“, the same rules apply as described in chapter 6.

The software is already equipped with pre-settings achieving good results for common measurements.

When working with an automatized measuring method it is very convenient to measure and display noise figure and amplification for a defined frequency range within a short period of time.

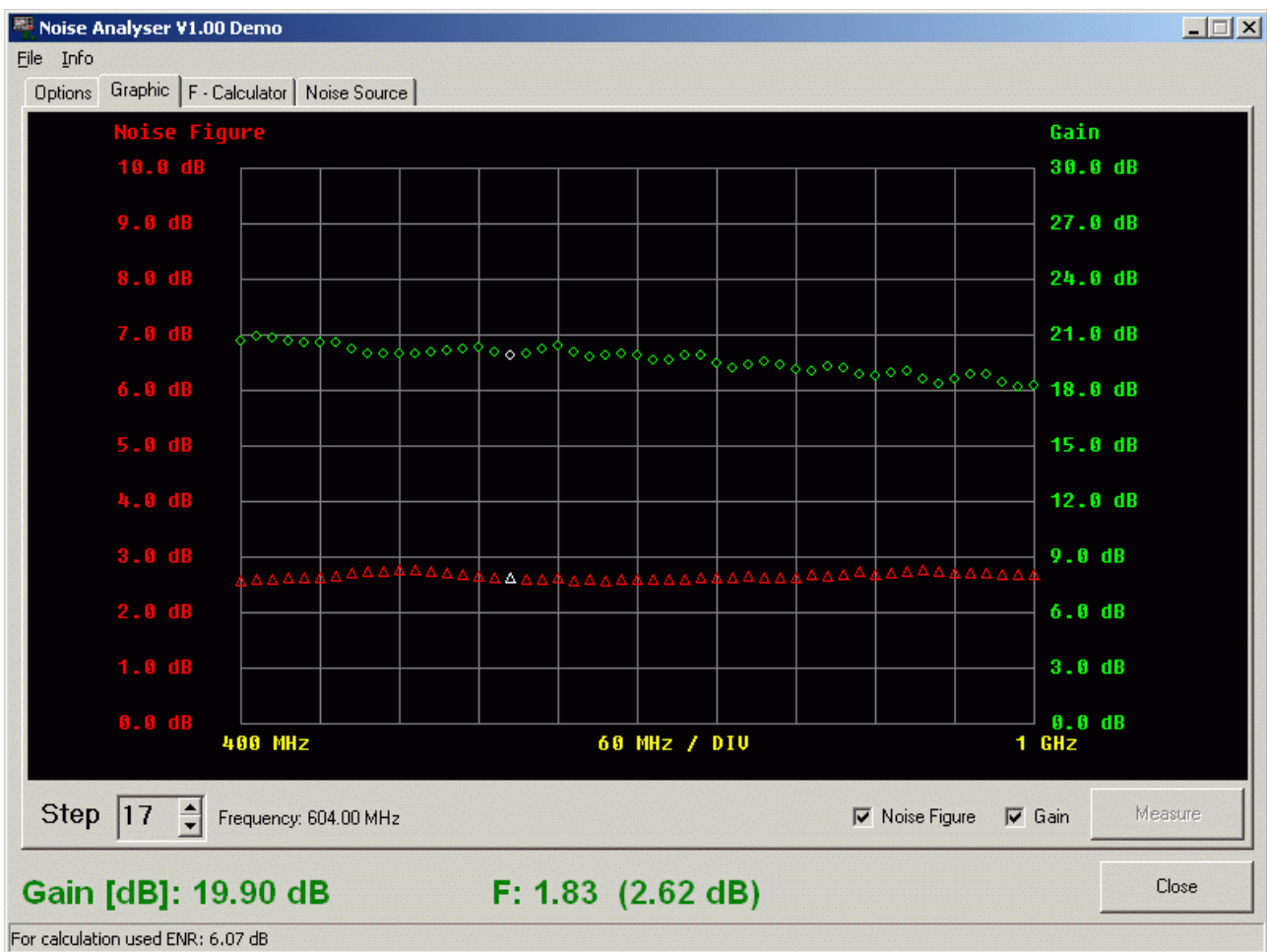


Abb. 5: Menu item „Graphic“

9. History

V1.00 Primary version, published on 08.01.2009