

Application Note

# POWER CONSUMPTION ANALYSIS TOOL FOR R&S®NGX POWER SUPPLIES

## Products:

- ▶ R&S®NGL200
- ▶ R&S®NGM200
- ▶ R&S®NGU201
- ▶ R&S®NGU401

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<http://www.rohde-schwarz.com/appnote/1SL380>

**ROHDE & SCHWARZ**

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# Contents

<b>1</b>	<b>Introduction.....</b>	<b>3</b>
<b>2</b>	<b>Prerequisites .....</b>	<b>3</b>
2.1	Requirements to controlling PC and software installation .....	3
2.2	Download and licensing .....	3
2.3	Instrument Firmware .....	3
<b>3</b>	<b>User Interface of the R&amp;S power consumption analysis tool.....</b>	<b>4</b>
3.1	Interfaces .....	4
3.2	Establishing a connection to the power supply.....	5
3.3	Setting up the measurement .....	5
3.3.1	Instrument settings .....	5
3.3.2	Logging settings .....	6
3.4	Starting logging .....	6
3.5	Analyzing power consumption data.....	7
3.6	Performing measurements .....	8
3.7	Exporting and Importing Data.....	9
<b>4</b>	<b>Ordering Information .....</b>	<b>10</b>

# 1 Introduction

Battery life time is usually one of the most important specifications for battery-powered devices. Depending on the application, life time requirements can range from tens of hours for typical wearables like smart watches to ten years for smart sensors. Understanding where and when energy is used in order to minimize power consumption is therefore key for any of these devices.

The power consumption analysis tool was developed to make it easier for customers to analyze power consumption data collected with either the NGL, NGM or NGU power supplies from Rohde & Schwarz. It allows to easily capture power consumption data and analyze using basic measurements.

## 2 Prerequisites

### 2.1 Requirements to controlling PC and software installation

The R&S power consumption analysis tool runs on standard Microsoft Windows PCs and requires the Microsoft .NET 5.0 framework, which can be downloaded from the Microsoft website. If the framework is not installed, a popup will appear, which points to the right location on the Microsoft website.

There is no VISA installation required with this application.

A minimum free disc space of 1 GByte is recommended in order to allow for longer recording times.

### 2.2 Download and licensing

The R&S power consumption analysis tool can be downloaded from the Rohde & Schwarz website at the location of this application note. It is a royalty-free Rohde & Schwarz software solution provided under the Rohde & Schwarz terms and conditions for royalty-free products. A copy of the terms and conditions is included in the installation package of the software.

For installation, copy the installer file 1SL380\_Setup.exe to your local hard drive of the PC and start it. Follow the instructions on the screen.

### 2.3 Instrument Firmware

Please make sure that the power supply you use is updated to the latest firmware available on the Rohde & Schwarz website to benefit for potential improvements or bug fixes.

# 3 User Interface of the R&S power consumption analysis tool

The R&S power consumption analysis sw allows to log voltage and current measurement data from the NGL, NGM and NGU power supplies. For the NGL the standard logging function with a maximum of 10 measurements per second, for the NGM and NGU the fastlog logging function with up to 500 kSa/s is used. Logging is possible from one channel at a time.

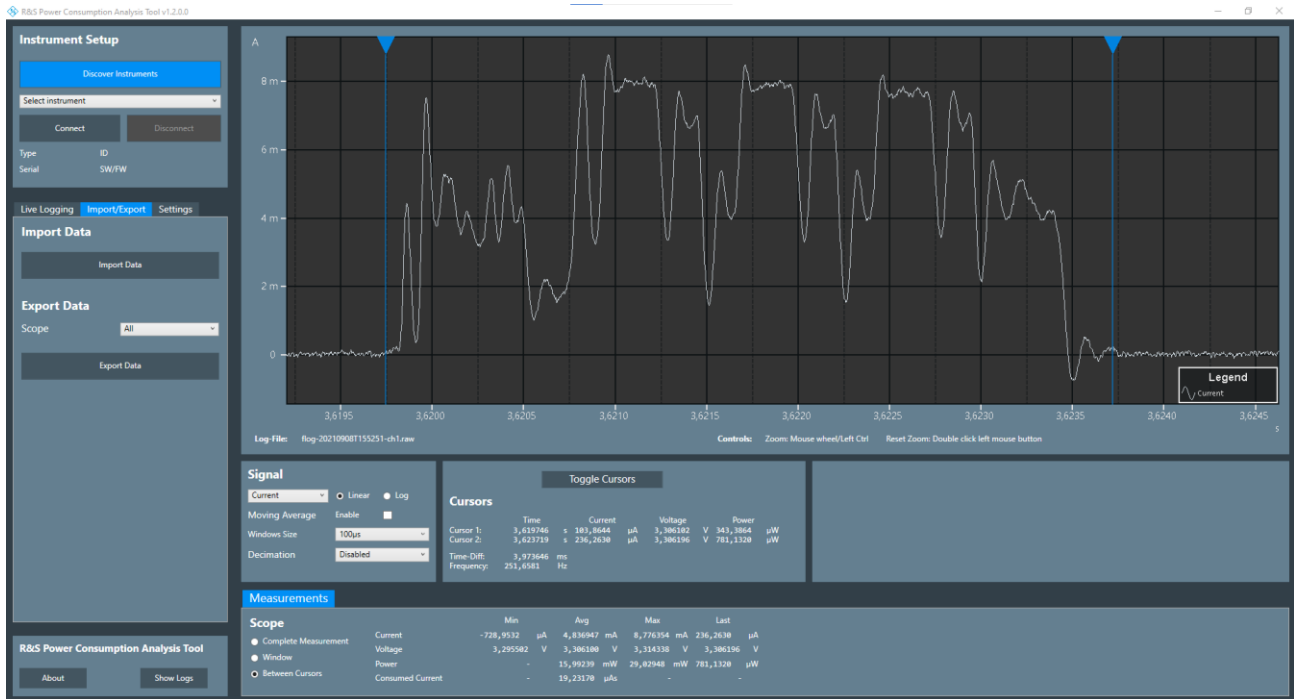


Figure 3-1 User interface of the R&S power consumption analysis tool

## 3.1 Interfaces

The R&S power consumption analysis tool supports LAN and USB connection to the power supply. In case of using a USB connection, please make sure that the “USB Class” setting in the sub-menu “Device → Interfaces” of the power supply is set to “TMC”.

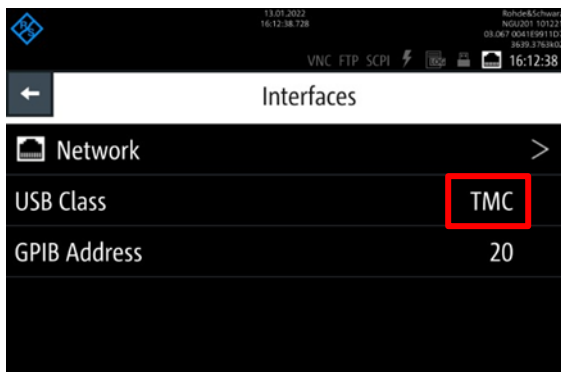


Figure 3-2 USB class setting of the power supply, "TMC" setting is required for the power consumption analysis tool

## 3.2 Establishing a connection to the power supply

An automatic discovery functionality discovers all t&m instruments connected to one of the USB ports of the PC or to the LAN segment, which is connected to the LAN adapter of the PC. The discovery function is started when clicking on the corresponding button. As a result, the USB or IP addresses of all discovered instrument are shown in a drop-down list. At this point in time, there is no communication on application layer with the instrument, i.e. during discovery, instruments are not disturbed if they are used by somebody else, at the same time.

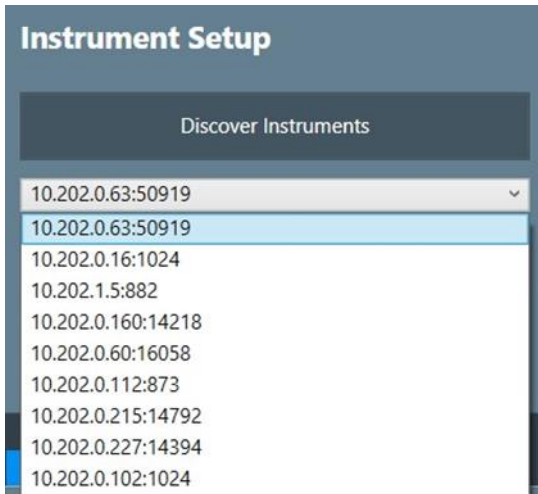


Figure 3-3 Example drop-down list with instruments discovered on the LAN segment

Pressing “Connect” establishes a connection with the corresponding instrument. At this point in time, the software sends the first SCPI commands to the instrument in order to get basic type and serial number data.

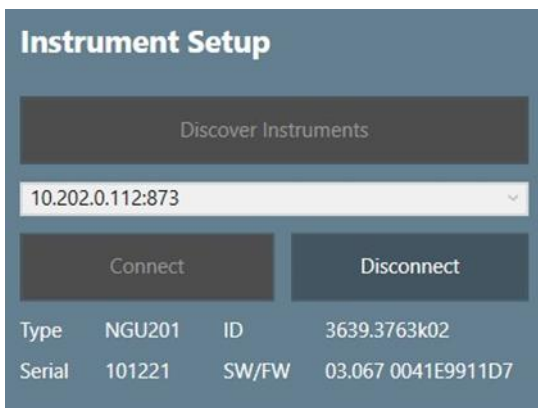


Figure 3-4 Basic instrument data after connection has been established.

## 3.3 Setting up the measurement

### 3.3.1 Instrument settings

- ▶ DUT specific settings have to be done directly on the power supply, please make sure to set them correctly before enabling the output of the power supply in order to avoid any damage of your DUT:
- ▶ Output voltage
- ▶ Optional output current limits

- ▶ Capacitance mode settings
- ▶ Overvoltage, overcurrent and overpower protection
- ▶ Optional battery simulation settings
- ▶ ...

### 3.3.2 Logging settings

Logging settings are done in the power consumption analysis software. These are

- ▶ Sample rate
- ▶ Channel
- ▶ Optional logging duration
- ▶ Autorange settings under “Settings” tab
- ▶ Special output settings under “Settings” tab

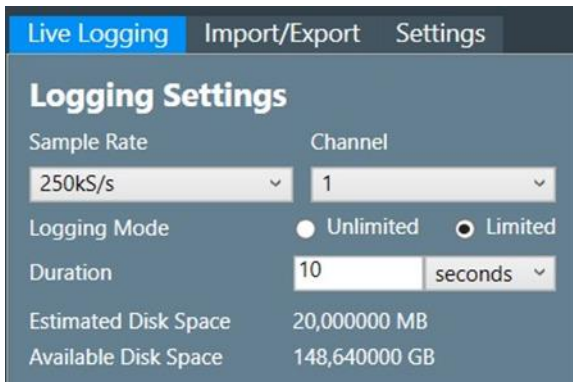


Figure 3-5 Logging settings

The logging is started manually by clicking on “Start Logging”. Logging can either be manually stopped or an automatic logging duration can be configured. If a logging duration is configured, the estimated necessary disk space together with the totally available disk space is shown in order to provide feedback about the amount of data that is collected.

Autorange behavior can be controlled in the “Settings” tab. Also, some special Output settings are under the “Settings” tab.

### 3.4 Starting logging

Logging starts as soon as the “Start Logging” Button is pressed and continues either until it is manually stopped with “Stop Logging” or automatically if a predefined logging time has passed.

During logging, a live preview of the data is shown in the chart. The user can select between a “rolling” or a “full” display of data. Rolling means that a predefined horizontal scale is used and only the most recent data is shown. Full means, that all data is shown in the chart. Because of the big amount of data that is received, in particular for high sampling rates, the software automatically decimates the data using averaging. As soon as logging has been stopped, the whole data set is loaded into the chart in order to be able to zoom in and analyze in detail.

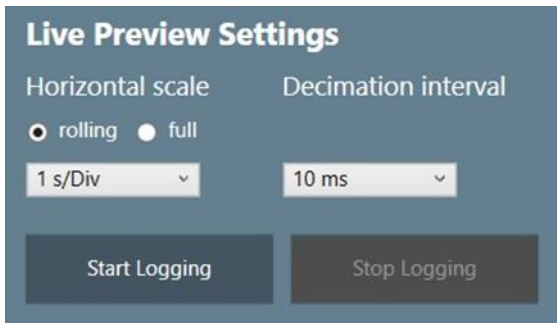


Figure 3-6 Logging control with live preview settings

### 3.5 Analyzing power consumption data

Both current and voltage data is logged from the power supply. Based on that, either current, voltage or power can be shown. It is possible to show data either in linear vertical scale, or for better overview of also very small currents, in logarithmic scale. In addition to that, a moving average data line can be added to the chart. This is particularly useful when remaining 50 Hz noise is visible in the current consumption data. Using a window size of 20 ms for the moving average filter allows to largely suppress any remaining 50 Hz noise.

Beside the moving average it's also possible use data decimation to analyze the data. The data will be decimated in a 2 ms range with selected decimation strategy (max, average or min). This can help to reduce possible noise of the raw data.

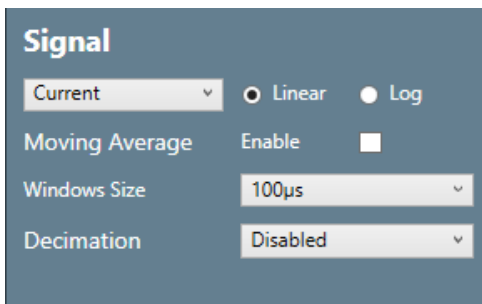


Figure 3-7 Controls to select signal to show, switch between linear and logarithmic display as well as optional moving filter enabled for 20 ms averaging time to suppress remaining 50 Hz noise

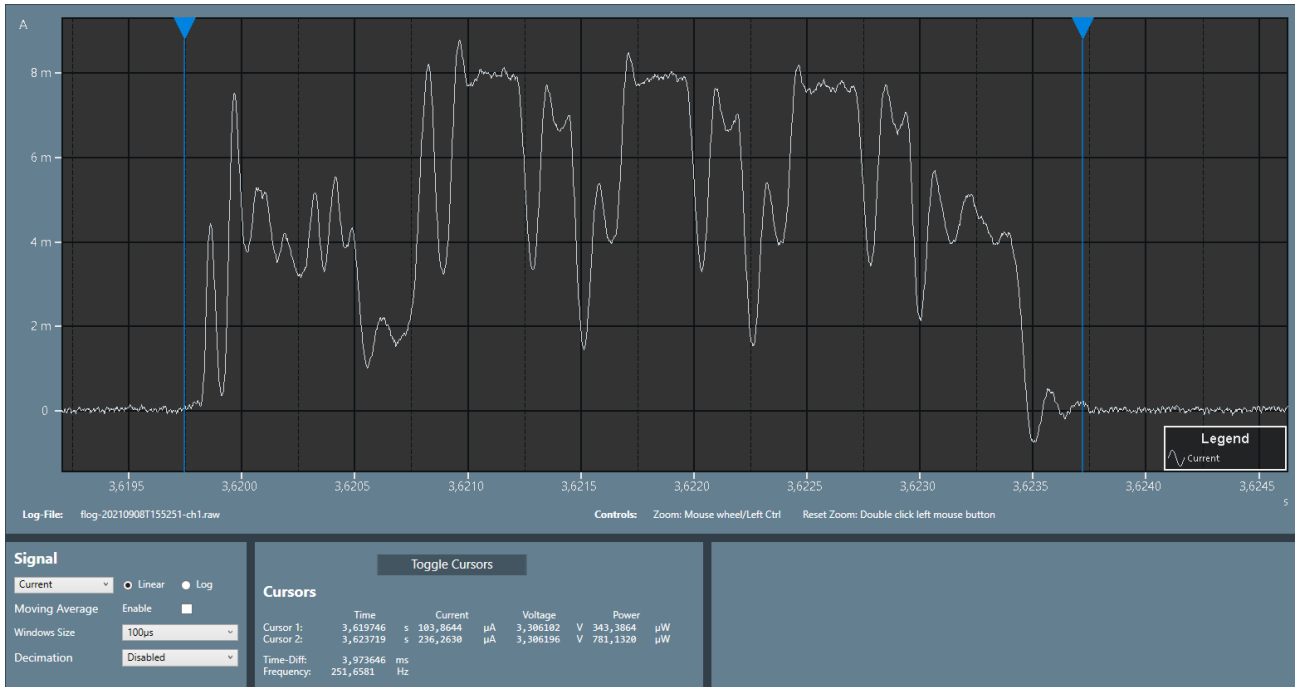


Figure 3-8 Linear display of current in chart with enabled cursors

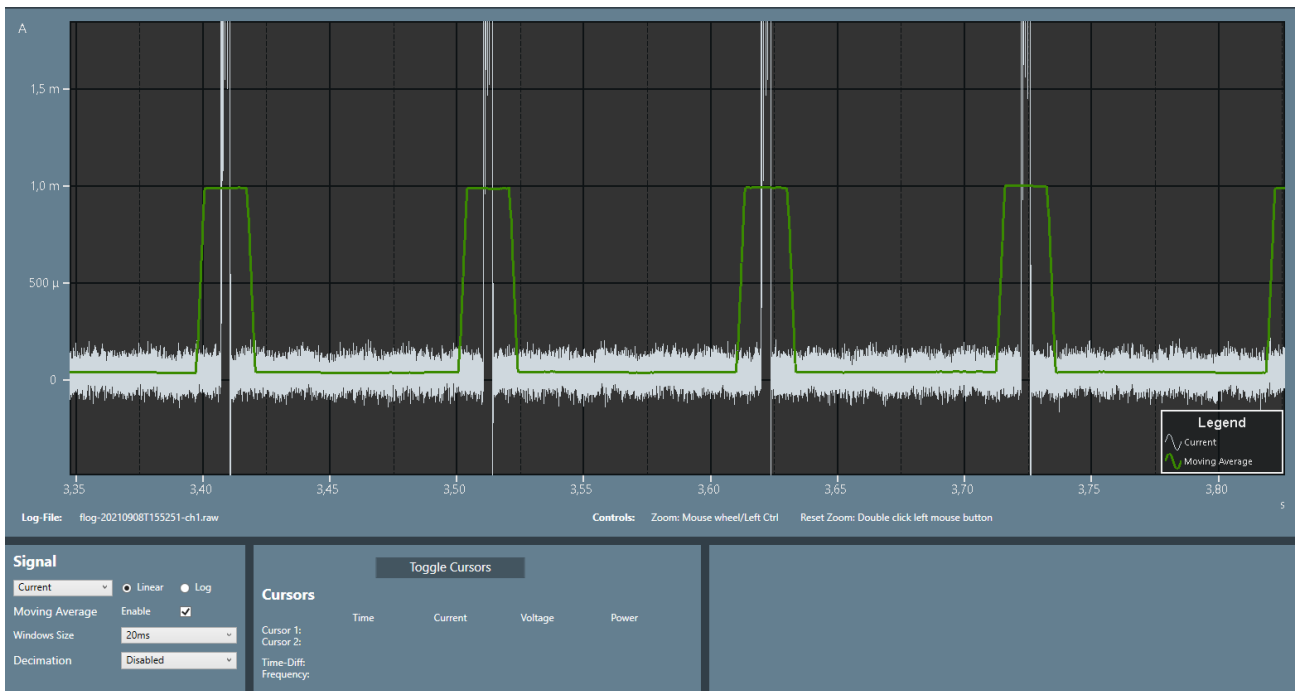


Figure 3-9 Logarithmic display of current for a larger time period with additional moving average line (green)

## 3.6 Performing measurements

The R&S current consumption analyzer tool allows for basic measurements like cursor measurements. With “Toggle Cursors”, two cursors get enabled showing the individual values at each cursor position as well as the time difference between the cursors or the corresponding frequency.



**Toggle Cursors**

### Cursors

	Time		Current		Voltage		Power	
Cursor 1:	7,436129	s	3,489279	µA	3,306076	V	11,53582	µW
Cursor 2:	7,440703	s	8,052171	µA	3,305665	V	26,61779	µW
Time-Diff:	4,574404	ms						
Frequency:	218,6077	Hz						

Figure 3-10 Cursor measurements

Furthermore, the minimum, average, maximum and last values in the data set for current, voltage and calculated power are shown. This evaluation can be performed on the entire captured trace or can be restricted to the data shown in the window or between the cursors.

If the decimation is activated, the min and max values of current and voltage will also be calculated from the decimated data.

### Measurements

Scope		Min		Avg		Max		Last	
<input type="radio"/> Complete Measurement	Current	-2,898825	mA	41,66926	µA	22,41822	mA	8,129922	µA
<input type="radio"/> Window	Voltage	3,169005	V	3,298765	V	3,468157	V	3,306216	V
<input type="radio"/> Between Cursors	Power	-		137,8661	µW	74,16051	mW	26,87928	µW
	Consumed Current	-		524,3207	µAs	-		-	

Figure 3-11 Automatic measurements. Measurement can be done for the whole data set or restricted for data shown in the chart window or between cursors

## 3.7 Exporting and Importing Data

Captured trace data can be exported and imported. Export is possible into native (raw) format, .csv file format and Matlab file format. Import is possible only from native (raw) file format. The native (raw) file format is identical to the NGx fastlog file format. This means that fastlog data captured directly on the NGx power supply can be imported into the power consumption analyzer tool.

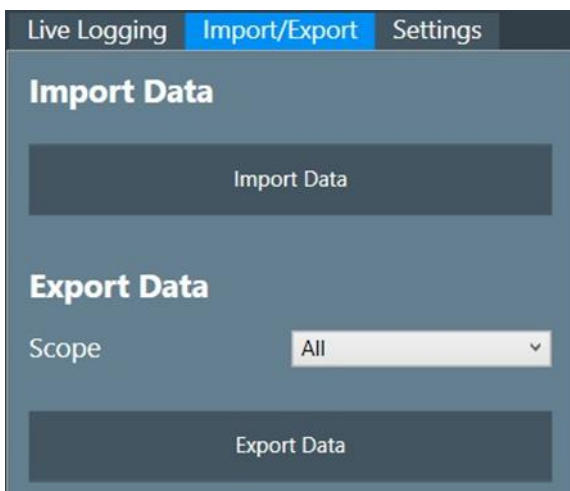


Figure 3-12 Import / export dialog

## 4 Ordering Information

Designation	Type	Order No.
Power Supply	R&S®NGL201	3638.3376.02
Power Supply	R&S®NGL202	3638.3376.03
Power Supply	R&S®NGM201	3638.4472.02
Power Supply	R&S®NGM202	3638.4472.03
Source Measure Unit	R&S®NGU201	3639.3763.02
Source Measure Unit	R&S®NGU401	3639.3763.03

## Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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1SL380 | Version 1e | 04.2022

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Power Supplies

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