

Application Note

CLICK RATE ANALYZER FOR CISPR 14-1 / EN55014-1 TESTING

This software performs click rate analysis on household appliances in accordance with CISPR 14-1 / EN 55014-1. It features real-time graphic display of the maximum peak and quasi-peak values. After the measurement, a test report can be displayed and printed.

Products:

- ▶ R&S®ESR
- ▶ R&S®ESU
- ▶ R&S®ESCI

Jens Medler | 1EE25 | Version 05:01 | 04.2024



Contents

1	Overview	3
2	Software features	4
3	Hardware and Software Requirements	5
3.1	PC Requirements	5
3.2	Software Requirements	5
3.3	Device Requirements	5
3.3.1	4-channel Operation with R&S®ESR	5
3.3.2	1-channel Operation.....	6
4	Operation	7
4.1	Installing the Software	7
4.2	EUT setup	7
4.3	Starting the Software.....	8
4.4	Configuration of the Click Rate Analyzer	8
4.4.1	Setting the Measurement Parameters.....	10
4.4.2	Setting the Channel Parameters	11
4.4.3	Setting the Click Rate Parameters	13
4.4.4	Setting the LISN Parameters.....	14
4.4.5	Functions and Options Contained in Menu Bar of Main Menu	14
4.4.6	Configure the RS Printer (PDF) on R&S®ESR	17
4.5	Operating the Click Rate Analyzer	19
4.6	Analysis and Test Report	21
5	Validation of Clicks	24
5.1	Click Rate Analyzer Performance Test.....	24
5.2	Sample Protocol - Test No. 1	24
6	Ordering information	25

1 Overview

Household appliances with thermostats such as refrigerators, air conditioners, washing machines or tumble driers generate discontinuous disturbances, which are referred to as click disturbances. These clicks occur sporadically, and are therefore subject to limit values different from those applicable to continuous disturbances.

Click rate analysis is governed by the Standard CISPR 14-1 of the Comité International Spécial des Perturbations Radioélectriques, and by the European Standard EN 55014-1, which closely follows CISPR 14-1. These standards require manufacturers of household appliances and electric tools to perform click rate analysis by measuring the click duration, click repetition rate and click level.

To meet these requirements, Rohde & Schwarz offers the free-of-charge Windows® Click Rate Analyzer application software for automatic, standard compliant click rate analysis at 150 kHz, 500 kHz, 1.4 MHz and 30 MHz. In conjunction with the R&S®ESR EMI Test Receiver all four frequencies can be measured in parallel. With R&S®ESU and R&S®ESCI EMI Test Receivers it is limited to one frequency.

The R&S®ESR, R&S®ESU and R&S®ESCI EMI are featuring digital detectors with selectable observation time for each measurement point. Values are therefore collected without any time gaps and stored in a memory, from where they can be recalled and analyzed individually.

The memory depth is large enough to record the peak values and quasi-peak values for a maximum of 2 hours as requested in CISPR 14-1/EN 55014-1.

2 Software features

The free-of-charge Windows® Click Rate Analyzer application software can easily be installed on a commercial PC or on the R&S®ESR EMI Test Receivers directly. Via the IEC/IEEE-bus or the LAN interface the peak and quasi-peak levels are transmitted to the controller during the ongoing measurement, the levels being determined with a time resolution of $\leq 500 \mu\text{s}$.

The software automatically evaluates the measured clicks. It captures the measured values in real-time and updates all key results every second: the number of clicks, the click rate, the number of continuous disturbances and the increased limit value, which is dependent on the number of clicks.

The software also documents results in the form of a detailed test report. The report provides statistical information as well as information about whether exceptions specified by the standards were used. And, last but not least, the Click Rate Analyzer outputs a PASSED or FAILED statement, which indicates whether or not an equipment under test (EUT) complies with the standard.

The controller stores all individual measured values, which are then available for subsequent analysis. Click Rate Analyzer software functions at a glance:

- ▶ Compliant with CISPR 14-1:2005/EN 55014:2006, CISPR 14-1:2016/EN 55014-1:2017 and CISPR 14-1:2020/55014-1:2021
- ▶ Communication via LAN or IEC/IEEE bus interface by means of VISA (Virtual Instrument Software Architecture) universal interface
- ▶ Real-time graphic representation of measured values
- ▶ With the R&S®ESR 4-channel standard compliant click rate analysis at 150 kHz, 500 kHz, 1.4 MHz and 30 MHz in parallel
- ▶ $\leq 500 \mu\text{s}$ time resolution for precise measurement of the click duration using the peak detector and determination of compliance using the quasi-peak detector
- ▶ Recording of number of clicks and calculation of click rate
- ▶ Allowing for exceptions specified by standards
- ▶ Remote control of R&S®ENV216, R&S®ENV432, R&S®ENV4200, R&S®ESH2-Z5 and R&S®ESH3-Z5 V-networks (LISN)
- ▶ Generation of detailed test report and printing on Windows default printer
- ▶ Electronic archiving of measurements



The accuracy of click duration measurements shall not be worse than $\pm 5 \%$ in accordance with CISPR 16-1-1. Based on the smallest click duration of 10 ms it requires a time resolution of $\leq 500 \mu\text{s}$.

3 Hardware and Software Requirements

3.1 PC Requirements

Recommended system configuration:

- ▶ Operating system
 - Microsoft Windows 7/10
 - Regional and language settings for Unicode (e.g. Asian languages):
 - Open Regional and Language Options in Control Panel
 - On the Advanced tab, under Language for non-Unicode programs, click English to be used with non-Unicode programs
- ▶ General PC requirement
 - Intel Core or compatible models
 - 2 Gbyte RAM
 - 12 Mbyte free hard disk space for software installation
 - Up to 480 Mbyte for storing results during two-hour measurement session
 - LAN or IEC/IEEE bus (GPIB) interface

3.2 Software Requirements

NI VISA is needed for both GPIB and LAN control. If you use a National Instruments GPIB controller (AT-GPIB, PCI-GPIB or PCMCIA-GPIB), the NI VISA runtime version is available free of charge. If, for LAN control, no NI hardware or software (LabWindows/CVI or LabVIEW) is installed, please note the National Instruments licensing regulations (for details see <http://www.ni.com>).

	NI VISA 3.2	NI GPIB 2.10	RSIB Passport 1.4
GPIB	X	X	
LAN	X		X

For LAN control, the RSIB Passport software from Rohde & Schwarz is required. This software is available in the Rohde & Schwarz Application Note 1EF47 (for latest revision see <http://www.rohde-schwarz.com>), which can be downloaded from the Rohde & Schwarz homepage.

3.3 Device Requirements

3.3.1 4-channel Operation with R&S®ESR

4-channel operation of the Click Rate Analyzer application software is applicable in conjunction with the R&S®ESR EMI Test Receiver in the following configuration.

- EMI Test Receiver Firmware Version 2.27 or later
- Option R&S®ESR-B50 Hardware for Time Domain and Real-Time Analysis

3.3.2 1-channel Operation

1-channel operation of the Click Rate Analyzer application software is applicable in conjunction with the R&S®ESR, R&S®ESU and R&S®ESCI EMI Test Receivers in the following configuration.

- R&S®ESR with Firmware Version 2.26 or later but **without** Option R&S®ESR-B50
- R&S®ESU with Firmware Version 3.93 or later
- R&S®ESCI with Firmware Version 3.32 SP3 or later

4 Operation

4.1 Installing the Software

ClickRateAnalyzer.exe is a self-extracting zipped file containing:

- Setup.exe
- Setup.lst
- ClickRateAnalyzer.CAB

When extracting the Zip file, the Setup.exe file will be executed automatically and the installation wizard will be activated. Follow the instructions of the wizard. Choose a directory in which to install the software.

The Click Rate Analyzer requires approximately 12 MByte of hard disk space. The wizard adds an entry for the Click Rate Analyzer in the controller's Start → Programs menu. No other parameters are required for installation.

For de-installation, use Add or Remove Programs in the Windows Control panel.

WARNING

De-installation will remove not only the program files but the complete directory in which the Click Rate Analyzer is installed. Therefore, make sure that you have archived any other files or subdirectories of this directory before you de-install the software.

4.2 EUT setup

The EUT generated RFI voltage is coupled out by means of an artificial mains network, e.g. the R&S®ENV216 Two-Line V-Network connected between the EUT and the measuring receiver, see Figure 1.

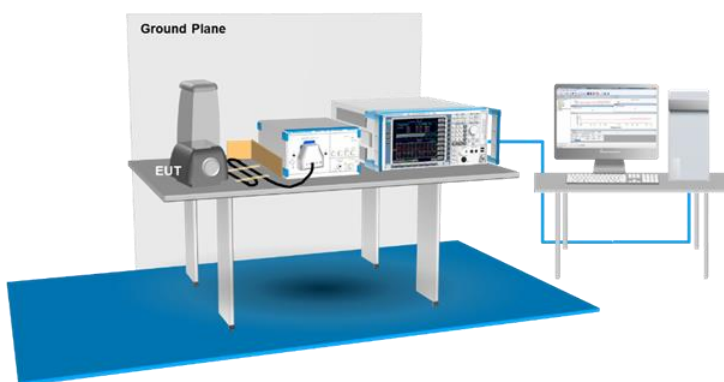


Fig. 1 EUT setup

4.3 Starting the Software

To start the software, select Click Rate Analyzer from the Program submenu in the Windows Start menu.

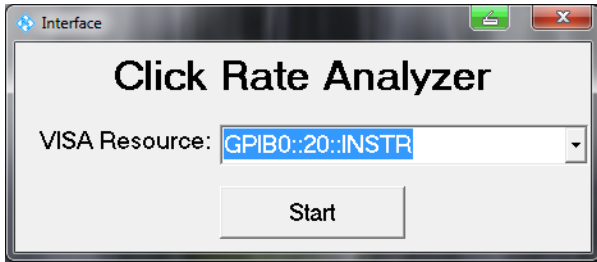


Fig. 2 Interface window for entering the VISA address

The interface window is displayed automatically upon starting the software. It prompts you to enter the VISA resource of the test receiver.

- GPIB control: e.g. GPIB0::20::INSTR
- LAN control: e.g. TCPIP::169.254.38.83::INSTR

After you have entered the correct address and clicked the Start button, the software establishes a connection between the controller and the measuring instrument. If the connection is set up successfully, the measurement window is displayed.

When the Click Rate Analyzer runs on R&S®ESR it is not needed to enter communication parameters. Software and receiver communicate internally.

For measuring repetitive igniters, the Click Rate Analyzer can be forced to start in single channel mode and active measurement function for repetitive igniters. For doing so start the software with the following parameters from the command line:

- `-c s` for single channel mode
- `-m ri` for repetitive igniters mode

Command line Example: "ClickRateAnalyzer.exe `-c s -m ri`".

4.4 Configuration of the Click Rate Analyzer

The central element of the measurement window is the graphical user interface which comprises the setting folders for Click Rate, Measurement, Channel, LISN, Trace and Info. If the Click Rate Analyzer is installed on a PC the contents of the Info folder is shown permanently underneath the main window, see Figure 3.

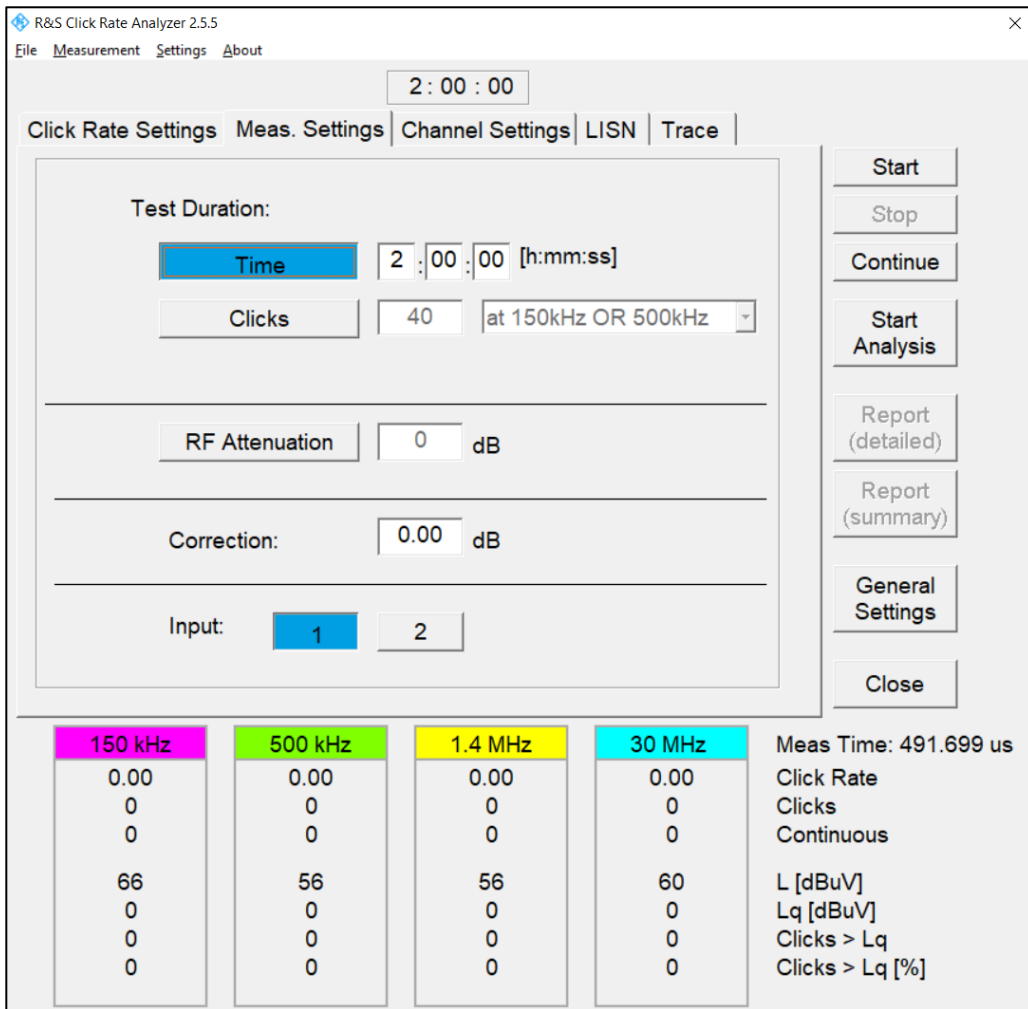


Fig. 3 Graphical user interface of PC version with permanent Info display

To the right eight buttons for measurement, analysis, report control and general settings are provided.

Analysis and Reports (detailed or summary) can be started by clicking Start Analysis after the measurement has been stopped or completed.

4.4.1 Setting the Measurement Parameters

The central element of the **Measurement Settings Window** is the parameter definition for the Test Duration, RF Attenuation, overall Correction factor and Input selection, see Figure 4.

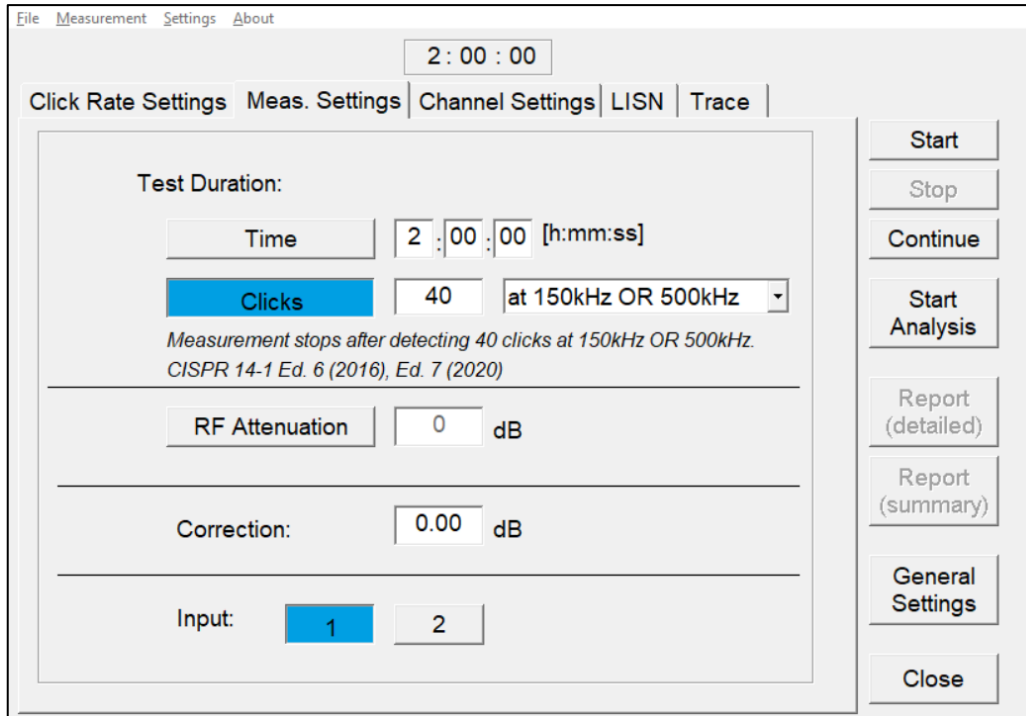


Fig. 4 Measurement Settings

In the upper part of the window, the test duration of the click measurement can be defined. The minimum observation time for measuring discontinuous disturbances is either 120 minutes or the time to register 40 clicks on both frequencies 150 kHz and 500 kHz or on either one of the two frequencies. The software stops automatically if the defined number of clicks, e.g. 40 is registered.

Measurement Setting Parameters			
	Description	Range	Default
Test Duration by Time	Stops the measurement when the defined time is reached	0 to 240 minutes	2 minutes
Test Duration by Clicks	Stops the measurement at the defined number of clicks	0 to 1000 clicks	40 clicks
	Stop criteria at channel frequencies or at the defined time CISPR 14-1 Ed.5 (2005): AND CISPR 14-1 Ed.6 (2016), Ed.7 (2020): OR	150kHz AND 500kHz 150kHz OR 500kHz	AND
RF Attenuation	Defines the RF Attenuation, considering overall and channel correction a value of 20 dB below the lowest limit is set by default	10 to 70 dB	35 dB
Correction	Defines the overall correction to be applied for each frequency, e.g. for using external attenuator	0 to 100 dB	0 dB
Input	Defines the RF Input	1 or 2	1

4.4.2 Setting the Channel Parameters

The **Channel Settings Window** is used for parameter definition of the test frequencies, continuous disturbance limits, margins for peak detector and channel correction factors, see Figure 5.

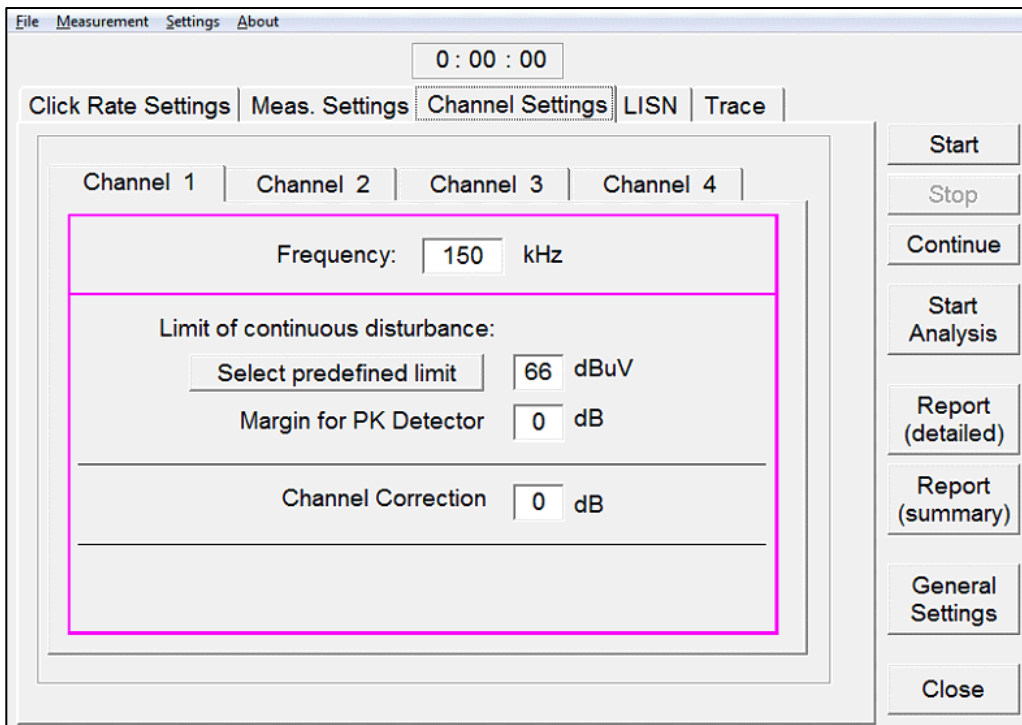


Fig. 5 Channel Settings

The R&S®ESR with option R&S®ESR-B50 features 4-channel click analysis at the predefined channel frequencies 150 kHz, 500 kHz, 1.4 MHz and 30 MHz in parallel. In this case 4 corresponding folders for

entering the channel specific settings are displayed; the test frequency cannot be changed. In case of 1-channel click analysis with any of the supported receivers one folder for entering the channel specific settings is displayed; the test frequency can be user-defined, which provides maximum flexibility for design and research purposes.

In some cases, all measured **PK-Detector** values may exceed the limit. This can be caused by background noise or pulses. In this case, a margin for the peak detector can be defined for correct analysis of the measurement results (see test signal No. 2 and 3 in Table 17 of CISPR 16-1-1:2010). For example, if the noise floor of the peak detector is 5 dB above the quasi-peak limit, enter a margin of 10 dB to make sure, that only clicks will be evaluated.

Channel Setting Parameters			
	Description	Range	Default
Frequency Channel 1 Channel 2 Channel 3 Channel 4	Defines the test frequency In 4-channel mode frequencies are fixed In 1-channel mode frequency can be user-defined in range 0.15 to 30 MHz	150 kHz 500 kHz or 550 kHz 1.4 MHz 30 MHz	150 kHz 500 kHz 1.4 MHz 30 MHz
Limit of continuous disturbance Channel 1 Channel 2 Channel 3 Channel 4	Defines the Quasi-peak limit for the measurement Selection of predefined limits acc. to CISPR 14-1/EN 55014-1 can be made via click box Select predefined limit	0 to 200 dB μ V 0 to 200 dB μ V 0 to 200 dB μ V 0 to 200 dB μ V	66 dB μ V 56 dB μ V 56 dB μ V 60 dB μ V
Margin for Peak detector	Defines the margin for determining the click duration	-100 to 100 dB	0 dB
Channel Correction	Defines the individual channel correction, e.g. for considering the frequency response of the LISN	0 to 100	0 dB

Activate [Select predefined limit](#) for choosing the terminal type or rated power class for testing electric tools. The corresponding quasi-peak limits according to CISPR 14-1 and EN 55014-1 will be displayed in the right limit column, see Figure 6.

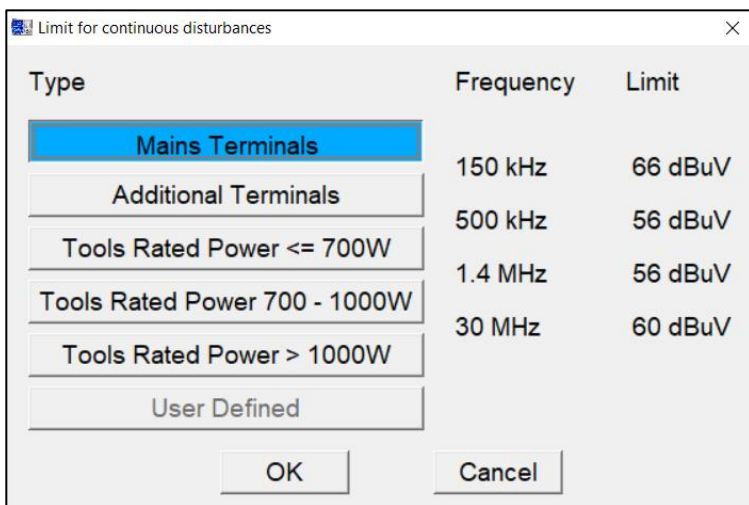


Fig. 6 Predefined Limit Selection

4.4.3 Setting the Click Rate Parameters

The central element of the **Click Rate Settings Window** is the parameter definition for determining the click rate, see Figure 7. The click rate N is determined by the number of clicks per minute during the observation time.

Activate **Measuring Clicks** for automatic calculation of the Click Rate N during the measurement based on the recorded number of clicks. The click rate is calculated every second. Activate **Manual** for user-defined click rate setting.

For certain household appliances (e.g. room heating equipment, freezers, irons, etc.) the Click Rate N is derived from the number of switching operations and the Factor f as mentioned in the relevant operating conditions. In the latter case activate **Switching Operations** for entering the user-defined number of switching operations and select the Factor f as given in Table A.2 of Annex A in CISPR 14-1.

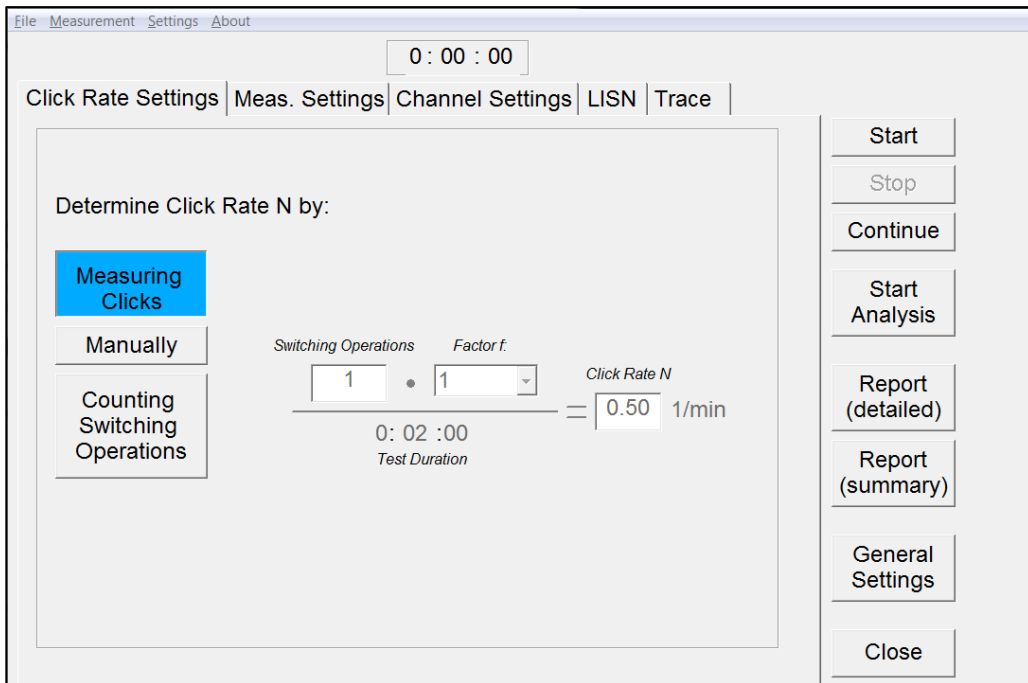


Fig. 7 Click Rate Settings

Click Rate Settings Parameters			
	Description	Range	Default
Switching Operations	Defines the number of switching operations for calculating the Click Rate N	0 to 10,000	0
Factor f	Defines the Factor f for determining the click rate by number of switching operations Factor f as given in Table A.2 in Annex A of CISPR 14-1	1 0,66 0,5	1
Click Rate N	Defines the click rate by number of switching operations, e.g. for the determination of the click limit Lq	0 to 1,000	0

4.4.4 Setting the LISN Parameters

The **LISN Window** is used for selecting the LISN type and test path (Phase) of the V-network to the test receiver, see Figure 8. The Click Analyzer software allows remote control of R&S®ENV216, R&S®ENV4200, R&S®ENV432/R&S®ESH2-Z5 and R&S®ESH3-Z5 V-Networks via the user port of the R&S EMI Test Receivers. If R&S®ENV216 is selected the built-in 150 kHz Highpass Filter can be activated.

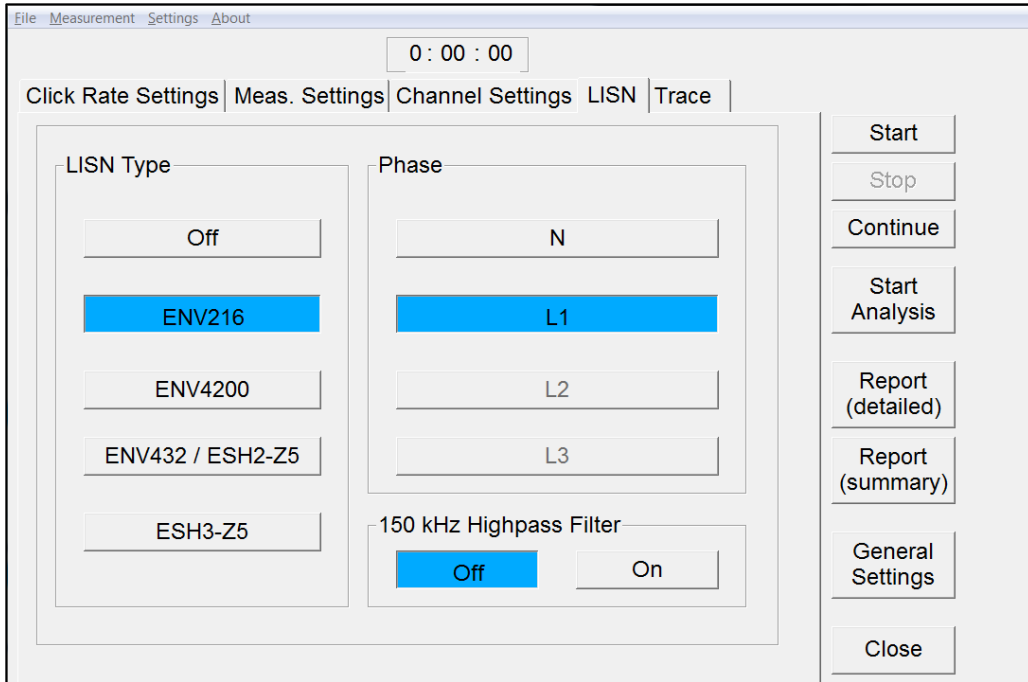


Fig. 8 LISN Settings

LISN Parameters			
	Description	Range	Default
LISN Type	Defines the LISN type for remote control of the test path (Phase)	Off ENV216 ENV4200 ENV432/ESH2-Z5 ESH3-Z6	ENV216
Phase	Defines the test path to be measured For single phase LISNs R&S®ENV216 and R&S®ESH3-Z6 only N (Neutral) and L1 (LINE) can be selected	N L1 L2 L3	L1
150 kHz Highpass Filter	Activates the 150 kHz Highpass Filter for the suppression of outband signals Only available with R&S®ENV216	On Off	Off

4.4.5 Functions and Options Contained in Menu Bar of Main Menu

The **File Menu** contains the Load, Save, Report and Quit options. Save stores the results of a measurement session as a text file to the controller hard disk. Load recalls the results of a stored measurement session; this is possible only when no measurement is in progress. Report allows the test report to be output to the Windows default printer. Quit closes the Click Rate Analyzer.

COMPANY RESTRICTED

The **Measurement Menu** contains the same functions provided by the buttons to the right of the graphic display in the trace window.

The **Settings Menu** contains General and Report setting options.

General settings comprise the number of measurement channels, selection of CISPR 14-1 edition and activation of the live analysis. It also allows activation of specific test routines for Repetitive Igniters and Denan Law, see Figure 9.

For default click Reset Settings.

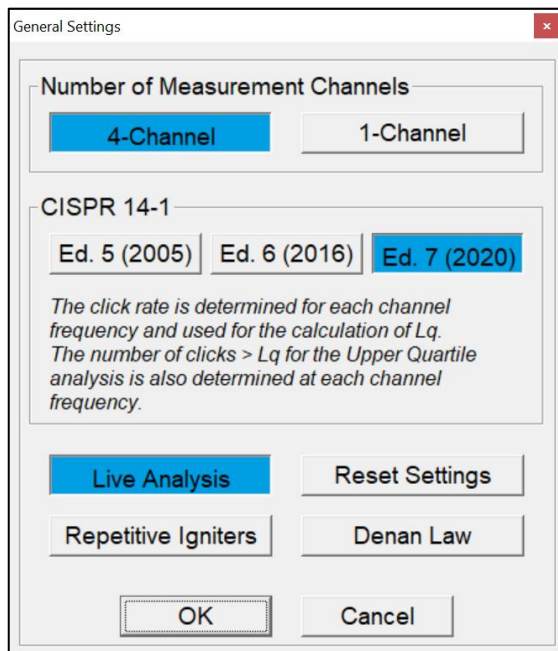


Fig. 9 General Settings

General Settings			
	Description	Range	Default
Number of measurement channels	Selects 4-channel or single channel operation	4-Channel 1-Channel	4-Channel (if applicable)
CISPR 14-1	Selects the CISPR 14-1 edition and corresponding flow diagram for showing the click rate analysis steps. CISPR 14-1 Ed. 5 (2005), Ed. 6 (2016): The determined click rate at 500 kHz is used for the calculation of the click limit Lq and the resulting number of clicks that exceeding the limit is used for the Upper Quartile analysis at 1.4 MHz and 30 MHz. CISPR 14-1 Ed.7 (2020): The click rate is determined for each channel frequency and is used for the calculation of the click limit Lq. The number of clicks which are allowed to exceed the limit is 1/4 of the clicks determined at each channel frequency.	Ed. 5 (2005) Ed. 6 (2016) Ed. 7 (2020)	Ed. 7 (2020)
Live Analysis	Activates the Live Analysis It comprises the number of recorded clicks, the current click rate, number and limit of/for continuous disturbances as well as the click limit Lq and the number of clicks that exceed Lq Switch off for doing the analysis after the measurement only	On Off	On
Repetitive Igniters	Activates the specific test routine for testing repetitive igniters. It comprises a specific report, disables the flow chart and sets a click limit Lq of 24 dB above the continuous disturbance limit.	On Off	Off
Denan Law	Activates the specific test routine for testing against Japanese Denan Law. It sets the test frequency of the second channel to 550 kHz instead of 500 kHz as used for testing against CISPR 14-1.	On Off	Off

Report settings comprises the default report name and report folder, see Fig. 10.

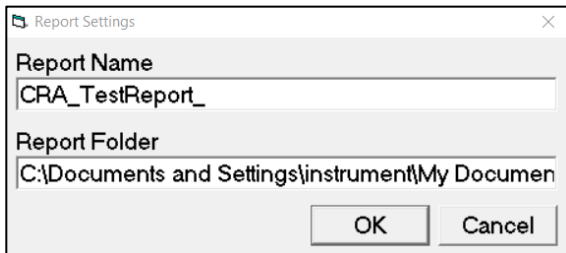


Fig. 10 Report Settings

Report Header settings comprises the default entries for the test report, see Fig. 11.

The screenshot shows a 'Print test report' dialog box. On the left, there are three input fields: 'Enter company name', 'Enter device name', and 'Enter operator name'. Below these are several rows of test parameters, each with a numerical input field (mostly '0') and a label. The parameters include: Clicks (<= 10 ms), Clicks (> 10 ms, <= 20 ms), Clicks (> 20 ms, <= 200 ms), Clicks > Lq (Number), Clicks > Lq (Percent), Continuous Disturbances, Overload Occurred?, Overall Correction, Factor f, and Attenuation. On the right side of the dialog, there is a 'Save' button at the top, followed by a 'Print report' button. Below these is a vertical stack of buttons: 'Test Results' (highlighted in blue), 'All Clicks', 'Exceptions Only', and 'Flow Diagram'. A 'with' label with a downward arrow is positioned between 'Print report' and 'Test Results'. At the bottom of the dialog, there is a large empty rectangular box.

Fig. 11 Report Header Settings

The **About Menu** informs the user about the installed version of the Click Rate Analyzer.

4.4.6 Configure the RS Printer (PDF) on R&S®ESR

The device RS Printer (PDF) is used for printing the test report in PDF format if the Click Rate Analyzer application software is installed on the R&S®ESR EMI Test Receiver. For using the RS Printer (PDF) the device needs to be set as default printer in WINDOWS®7/10 Devices and Printers.

The RS Printer (PDF) features multiple prints into one file, e.g. for printing the detailed test reports of all four test frequencies into one file. For this purpose, the device needs to be set to **File Mode "Append to existing file"** in the Image folder under printing preferences, see Figure 12.



The PDF viewer is starting immediately after the print of the first page has been initiated. Therefore, only one page is displayed by the viewer even the print job has accumulated several pages, e.g. for printing graphs of all recorded click events. As a consequence, the viewer needs to be restarted for displaying the complete report!

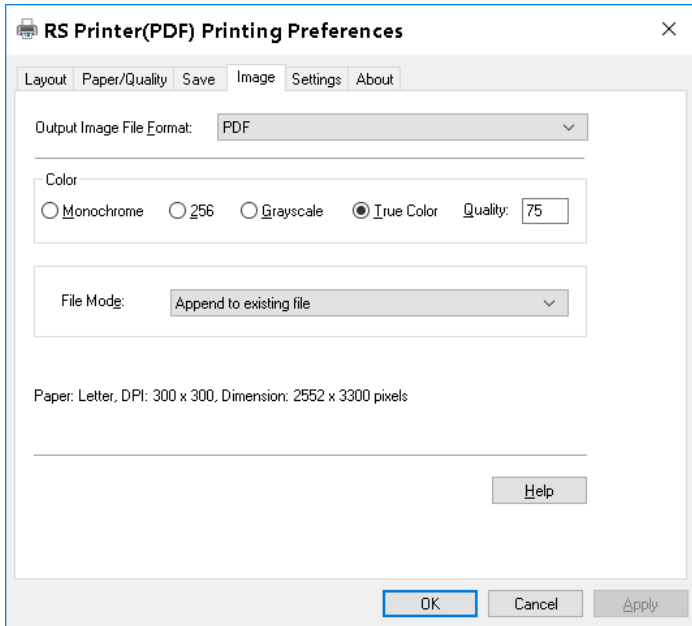


Fig. 12 RS Printer (PDF) Printing Preferences - Image Parameter Settings

4.5 Operating the Click Rate Analyzer

The central element of the **Trace Window** is the graphic display with the peak and quasi-peak traces. The user can select the traces to be shown. Activate **PK** for displaying peak and **QP** for displaying quasi-peak characteristic, see Figure 13. Every trace in the graphic display can be switched on/off during measurement. The time box shows the remaining time left until the end of a measurement.

To the right three buttons for controlling the measurement are provided. The upper-most button, labeled Start, starts a measurement using the parameter settings last active. In the initial measurement after program start, the Click Rate Analyzer uses the default settings, unless these were changed. The Stop button stops the measurement, and the Continue button continues it, provided the measurement duration has not yet elapsed.

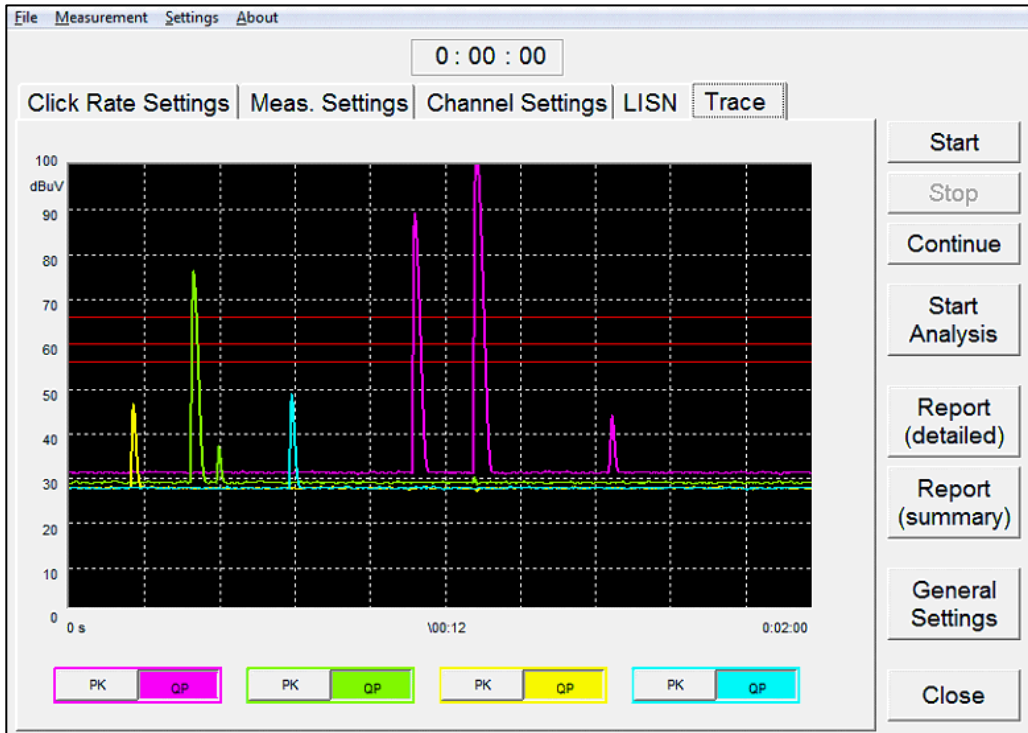


Fig. 13 Trace window with QP traces activated only

A Live Analysis is shown in the **Info Window** for each frequency (Figure 14). It comprises the current click rate and the number of recorded clicks. The click rate is calculated every second. The Continuous Disturbances field indicates the number of recorded periods of continuous disturbance. The Live Analysis also includes fields that indicates the predefined Limit L for continuous disturbances, the Click Limit L_q, which is calculated every second, as well as the number of clicks that exceed L_q.

L_q is calculated by $L + 44 \text{ dB}$ for $N < 0.2$, or $20 \log(30/N) \text{ dB}$ for $0.2 \leq N < 30$.

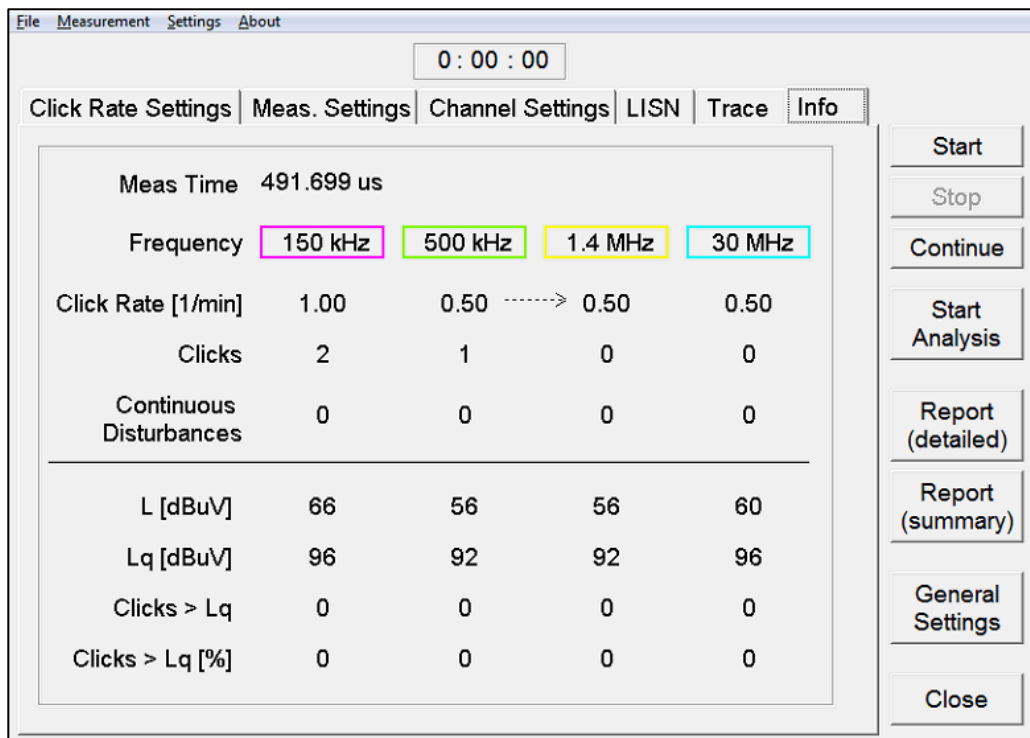


Fig. 14 Information window

If the Click Rate Analyzer is installed on a PC the contents of the Info folder is shown permanently underneath the main window, see Figure 3.



The result of the Live Analysis may differ from the Final Analysis, because in the latter case the exception rules will be taken into account.

4.6 Analysis and Test Report

Analysis and reports can be started by clicking Start Analysis, Report (detailed) or Report (summary) after the measurement has been stopped or completed.



At the end of the test, it is possible to reevaluate the test results. For example, if a wrong value for the limit of continuous disturbance was selected, just change the value and click Start Analysis again.

The test report window displays all relevant measurement results at a glance. The name of the company, the device designation, the operator name, a user-selectable comment and the operating conditions can be entered. When the test report is printed, the above information will be included on all pages to facilitate assignment of the measurement, see Figure 15.

The screenshot shows a 'Print test report' window with the following fields and controls:

- Test report header:**
 - Enter company name
 - Enter device name
 - Enter operator name
 - Change default entries for report header in Settings -> Report Header...
 - Enter operation condition
- Measurement Parameters:**
 - Clicks (<= 10 ms): 0
 - Clicks (> 10 ms, <= 20 ms): 0
 - Clicks (> 20 ms, <= 200 ms): 0
 - Clicks > Lq (Number): 0
 - Clicks > Lq (Percent): 0
 - Continuous Disturbances: 0
 - Overload Occurred?: No
 - Frequency: 150 kHz
 - Test Duration (h:mm:ss): 0:00:00
 - Click Rate per Minute: 0.00
 - L (dBuV): 66
 - Lq (dBuV): 110.0
 - 600 ms Rule used: No
 - Number of Refrigerator Rule Used: 0
 - LISN Phase: L1
 - Margin for PK Detector: 0
 - Overall Correction: 0
 - Factor f: -
 - Attenuation: 0
- Actions and Results:**
 - Close
 - Print report
 - with
 - Test Results (highlighted in blue)
 - All Clicks
 - Exceptions Only
 - Flow Diagram
 - PASSED (highlighted in green)
 - Flow Diagram

Fig. 15 Test Report window

The left half of the test report window shows complete information on the disturbances recorded. This includes the number of clicks, which are categorized in three groups according to their duration (<=10 ms, >10 ms to <=20 ms and >20 ms to <=200 ms). It also includes the number of clicks above the calculated Click Limit Lq, as well as their percentage of the total number of clicks recorded. The number of continuous disturbances is also listed. Moreover, the test report indicates whether an overload condition has occurred during the measurement.

The right half of the test report window shows the measurement frequency and duration. The click rate, the predefined Limit L for continuous disturbances and the Click Limit Lq are also shown. Moreover, the test report indicates whether exception rules admitted by the standard were used in the measurement.

The test report shows only the relevant results. If e.g. a test failed because of a Click Rate N > 30 clicks per minute the test report will not show any results for the number of clicks or exceptions.

COMPANY RESTRICTED

In the lower section of the test report essential test parameter settings are shown. It comprises the overall correction, which is the sum of the Correction in the Measurement Settings Window and the Channel Correction; the Factor f according to Table B.1 in Annex B of CISPR 14-1:2016/CISPR 14-1:2020; the step attenuator setting for the measuring receiver; the selected LISN Phase and Margin for Peak detector.

Finally, the overall result is given: The green PASSED! Statement indicates conformance, the red FAILED! Statement nonconformance with the standards.

Clicking **Print report** allows the test report to be output to the Windows default printer. In addition, the **All Clicks** function allows the graphs of all recorded click events to be printed or as an alternative to print only the graphs of exceptions by clicking **Exceptions Only**. Clicking **Flow Diagram** adds the flow diagram of CISPR 14-1 for showing the click rate analysis steps in graphical form.

Clicking **Report (summary)** displays all relevant measurement results for all four frequencies on one page, see Figure 16.

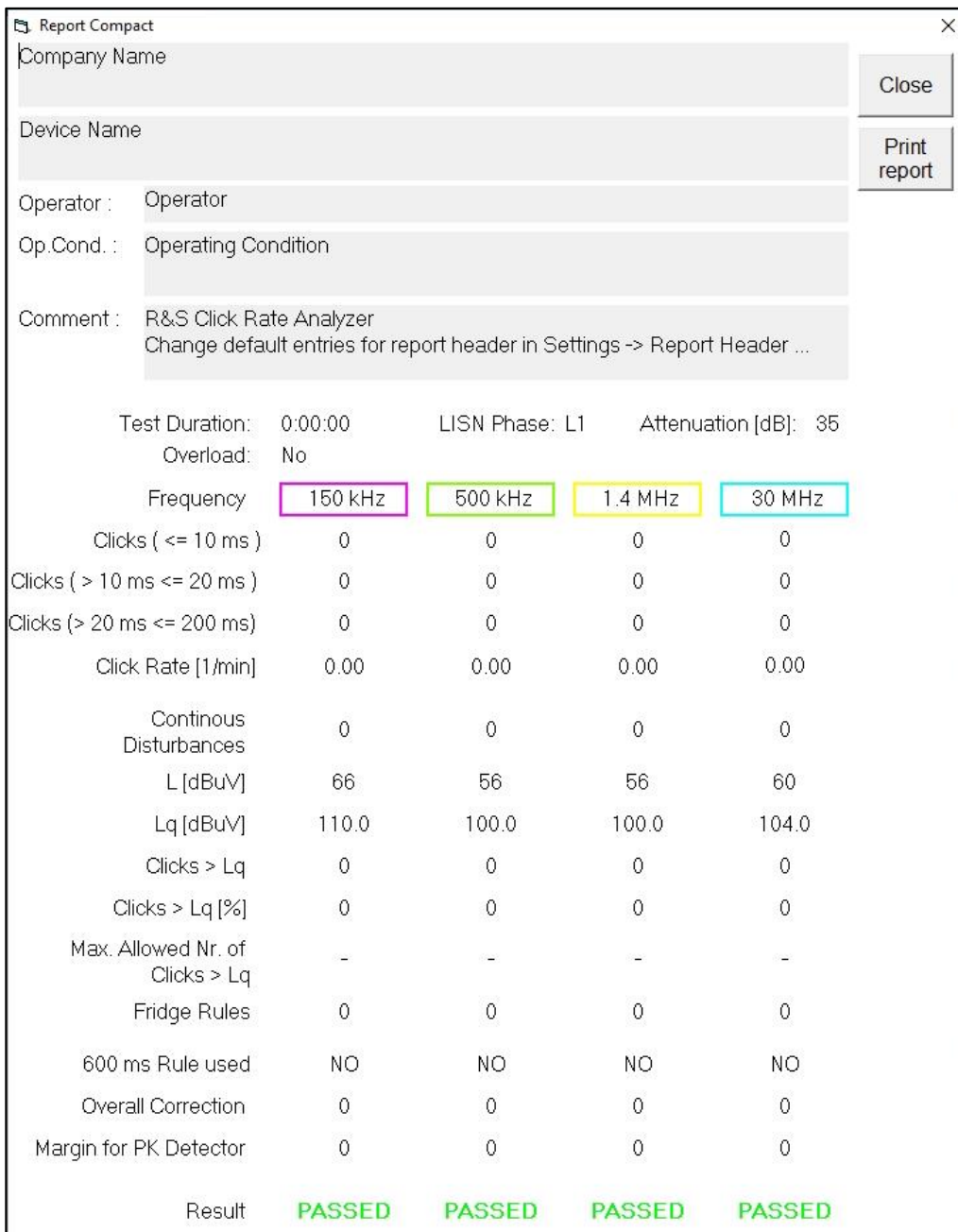


Fig. 16 Report (summary)

COMPANY RESTRICTED

When testing repetitive igniters, the report will show additional information. It comprises two new parameters, the Shortest Disturbance Sequence in ms (time between two subsequent clicks) and the Longest Disturbance in ms. For including the graphs of those two extremes in the report click **Critical Clicks**.

For the evaluation there will no exception rules be applied and for the calculation of the limit L_q a click rate $N=2$ is assumed, which leads to the calculation of $L_q = L + 24$ dB.

The screenshot shows a software window titled "Print test report" with a close button (X) in the top right corner. The window is divided into several sections:

- Input Fields:** Three text boxes at the top left for "Enter company name", "Enter device name", and "Enter operator name".
- Test report section:** A box with the text "Change default entries for report header in Settings -> Report Header..." and another box for "Enter operation condition".
- Parameters Table:** A table of test parameters with input fields for values:

Clicks (≤ 10 ms)	<input type="text" value="0"/>	Frequency	<input type="text" value="150 kHz"/>
Clicks (> 10 ms, ≤ 20 ms)	<input type="text" value="0"/>	Test Duration (h:mm:ss)	<input type="text" value="0:00:00"/>
Clicks (> 20 ms, ≤ 200 ms)	<input type="text" value="0"/>	Click Rate per Minute	<input type="text" value="0.00"/>
Clicks > L _q (Number)	<input type="text" value="0"/>	L (dBuV)	<input type="text" value="66"/>
Clicks > L _q (Percent)	<input type="text" value="0"/>	L _q (dBuV)	<input type="text" value="90.0"/>
Continuous Disturbances	<input type="text" value="0"/>	Shortest Disturbance Sequence (ms)	<input type="text" value="0.0"/>
Overload Occured ?	<input type="text" value="No"/>	Longest Disturbance (ms)	<input type="text" value="0.0"/>
Overall Correction	<input type="text" value="0"/>	LISN Phase	<input type="text" value="L1"/>
Factor f	<input type="text" value="-"/>	Margin for PK Detector	<input type="text" value="0"/>
Attenuation	<input type="text" value="0"/>		
- Buttons:** A "Close" button in the top right, a "Print report" button, and a vertical stack of buttons: "Test Results" (highlighted in blue), "All Clicks", and "Critical Clicks". A dashed arrow labeled "with" points from "Print report" to "Test Results".
- Status:** A large green box at the bottom center contains the word "PASSED".

Fig. 17 Test Report window for Repetitive Igniters

5 Validation of Clicks

5.1 Click Rate Analyzer Performance Test

R&S has performed the click rate analyzer performance test using the test signals for the check against the definition of a click in accordance with Tables 17 and F.1 in CISPR 16-1-1:2015. A full report is combined with this Application Note; a sample report for Test No.1 is shown below.

5.2 Sample Protocol - Test No. 1

Rohde-Schwarz Page 1 8/30/2020 10:02:30 AM

ESR 3.48 SP2 + Click Rate Analyzer 2.5.0

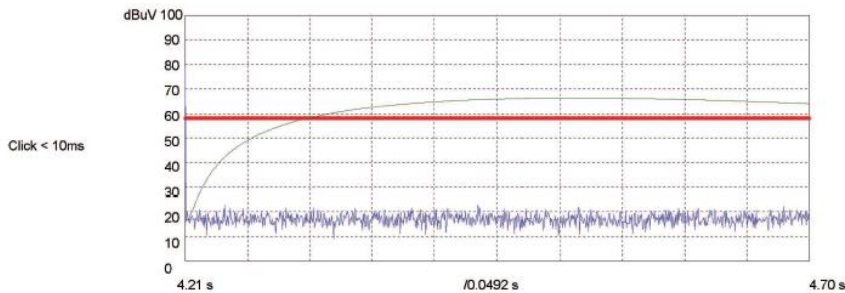
Operator : NK

Op.Cond. :

Comment : CISPR 16-1-1 (2015) Table 17, TestNo. 1
Generator Level Pulse 1 = 95 dBµV

Clicks (< 10 ms)	<input type="text" value="1"/>	Frequency	<input type="text" value="150 kHz"/>
Clicks (10 ms, <= 20 ms)	<input type="text" value="0"/>	Test Duration (h:mm:ss)	<input type="text" value="0:00:10"/>
Clicks (> 20 ms, <= 200 ms)	<input type="text" value="0"/>	Click Rate per Minute	<input type="text" value="6.00"/>
Clicks > Lq (Number)	<input type="text" value="0"/>	L (dBuV)	<input type="text" value="66"/>
Clicks > Lq (Percent)	<input type="text" value="0"/>	Lq (dBuV)	<input type="text" value="80"/>
Continuous Disturbances	<input type="text" value="0"/>	600 ms Rule used	<input type="text" value="No"/>
Overload Occured ?	<input type="text" value="No"/>	Number of Refrigerator Rule Used	<input type="text" value="0"/>
Overall Correction	<input type="text" value="0"/>	LISN Phase	<input type="text" value="-"/>
Factor f	<input type="text" value="-"/>	Margin for PK Detector	<input type="text" value="0"/>
Attenuation	<input type="text" value="35"/>		

PASSED



6 Ordering information

Designation	Type	Order No.
EMI Test Receiver, 9 kHz to 3.6 GHz	R&S®ESR3	1316.3003.03
EMI Test Receiver, 9 kHz to 7 GHz	R&S®ESR7	1316.3003.07
EMI Test Receiver, 9 kHz to 26.5 GHz	R&S®ESR26	1316.3003.26
Hardware option for 4-channel click rate analysis: Hardware for Time Domain Scan and Real-time Analysis	R&S®ESR-B50	1316.3584.02

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.

www.rohde-schwarz.com



Rohde & Schwarz training

www.rohde-schwarz.com/training



Rohde & Schwarz customer support

www.rohde-schwarz.com/support

