

Product: R&S[®] ESCI, R&S[®] ESU, R&S[®] ESR

Click Rate Analyzer for EMI Test Receivers R&S[®] ESCI, R&S[®] ESU and R&S[®] ESR

Application Note

This application note provides a description of the Rohde & Schwarz Click Rate Analyzer software. In conjunction with the R&S[®] ESCI, R&S[®] ESU and R&S[®] ESR EMI Test Receivers, this software performs click rate analysis in accordance with CISPR 16-1 and EN 55014. It features real time graphic display of the max. peak and quasi-peak values. After the measurement, a test report can be displayed and printed.



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1 Overview

Thermostat- or software-controlled devices such as refrigerators, air conditioners, washing machines or tumble driers generate discontinuous interference, which is referred to as click interference. This interference occurs sporadically, and is therefore subject to limit values different from those applicable to continuous interference.

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 electrical and electronic products 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 in conjunction with the R&S®ESCI, R&S®ESU and R&S®ESR EMI Test Receivers.

These EMI Test Receivers feature time domain analysis with selectable observation time for each measurement value. The detectors are digital; measured values are therefore collected without any time gaps and stored in a memory, from where they can be recalled and analyzed individually. The memory can store 1.44 million measured values per detector in time domain analysis. With a measurement time of 5 ms per measured value, the memory depth is large enough to record the peak values and quasi-peak values during the complete program of a washing machine.

2 Software Features

The free-of-charge Windows® Click Rate Analyzer application software can easily be installed on a commercial PC. Via the IEC/IEEE-bus or the LAN interface (option R&S®FSP-B16 for R&S®ESCI), the peak and quasi-peak value levels are transmitted to the controller during the ongoing measurement, the levels being determined with a time resolution of 500 µs.

The software automatically evaluates the measured clicks. It analyzes the measured values in realtime and updates all key results every second: the click rate, the number of clicks 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 a device under test (DUT) complies with the standards.

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 and EN 55014-1
- Communication with R&S®ESCI, R&S®ESU or R&S®ESR via LAN or IEC/IEEE bus interface by means of VISA (Virtual Instrument Software Architecture) universal interface
- Realtime graphic representation of measured values
- 500 μ s time resolution for measuring peak value and quasi-peak value levels
- Standard-compliant click rate analysis at 150 kHz, 500 kHz, 1.4 MHz and 30 MHz, as well as analysis at user-selected frequencies
- Navigating to individual click events on graph by means of cursor buttons
- Marking of click events while measurement is in progress
- Recording of number of clicks and calculation of click rate
- Allowing for exceptions specified by standards
- Generation of detailed test report and printing on Windows default printer
- Electronic archiving of measurements

3 Hardware and Software Requirements

PC Requirements

Recommended system configuration:

- **Operating system:**
Microsoft Windows 2000/XP/7
 - Regional and language settings for unicode (e.g. Asian languages)
 1. Open **Regional and Language Options** in Control Panel.
 2. On the **Advanced** tab, under **Language for non-Unicode programs**, click **English** to be used with non-Unicode programs.
- **General PC requirements:**
 - Pentium II 450 MHz or higher

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- 128 Mbyte RAM
- 12 Mbyte free hard disk space for software installation
- Up to 350 Mbyte for storing results during two-hour measurement session

- **IEC/IEEE bus interface:**
IEEE card or LAN interface

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.

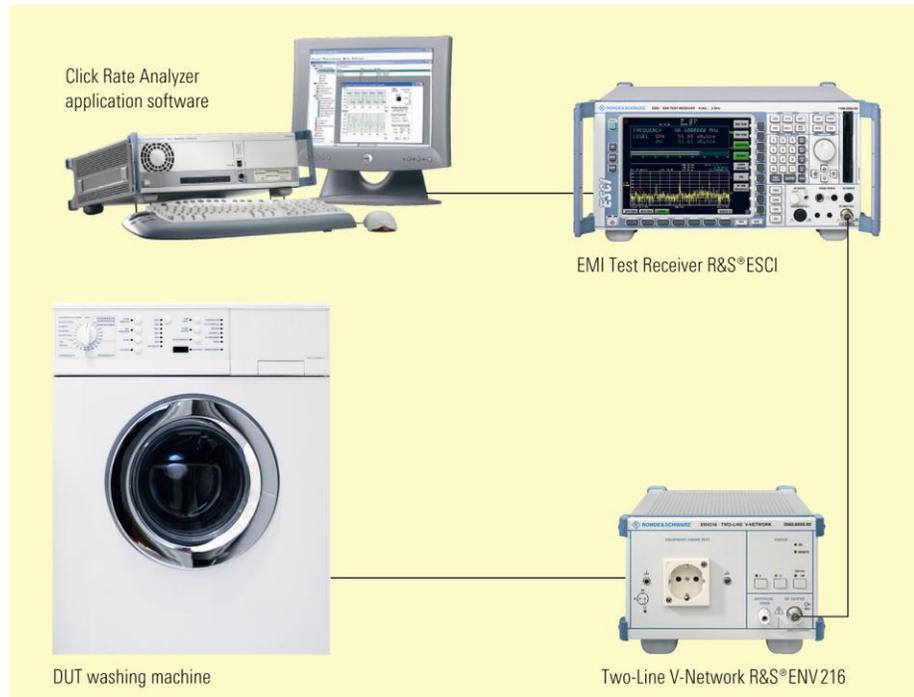
Device Requirements

The program operates only in conjunction with following EMI Test Receivers:

EMI Test Receiver	Firmware Version
R&S® ESCI	3.32 SP3
R&S® ESU	3.93
R&S® ESR	1.78

4 Connecting the Computer to the Instrument

Connect the PC with the Click Rate Analyzer software installed to the EMI Test Receiver via the IEC/IEEE bus or the LAN interface. Connect the DUT (e.g. a washing machine or a refrigerator) to the RF input of the EMI Test Receiver via a line impedance stabilization network, e.g. the R&S® ENV216 Two-Line V-Network.



DUT-generated RFI voltage is coupled out by means of a line impedance stabilization network connected between the DUT and the instrument

The controller addresses the EMI Test Receiver via the VISA (Virtual Instrument Software Architecture) universal interface, which in turn supports several other interfaces (e.g. IEC/IEEE bus and LAN). VISA is a standardized software interface library that provides input and output functions for communication with measuring instruments.

This enables communication both with GPIB (IEC/IEEE) and RSIB (LAN) interfaces. There is only one condition: a VISA driver must be installed in the controller. For analysis via the LAN interface, the RSIB Passport software from Rohde & Schwarz must additionally be installed in the controller (the RSIB Passport software is available in the R&S Application Note 1EF47 (for latest revision see <http://www.rohde-schwarz.com>), which can be downloaded from the Rohde & Schwarz homepage. With this software installed, measuring equipment from Rohde & Schwarz will support the LAN interface based on the VISA universal interface.

5 Installing the Software

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

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

To install the Click Rate Analyzer, execute the Setup.exe file by double-clicking it. The installation wizard is 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.

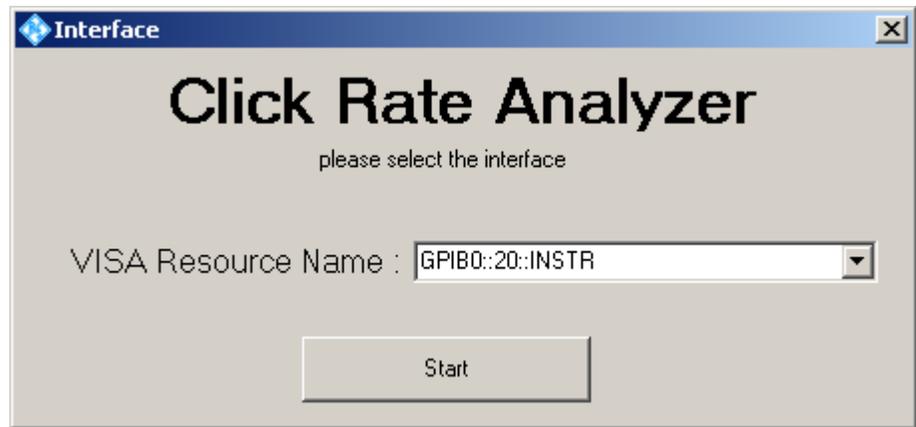
Click Rate Analyzer

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.

6 Starting the Software

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



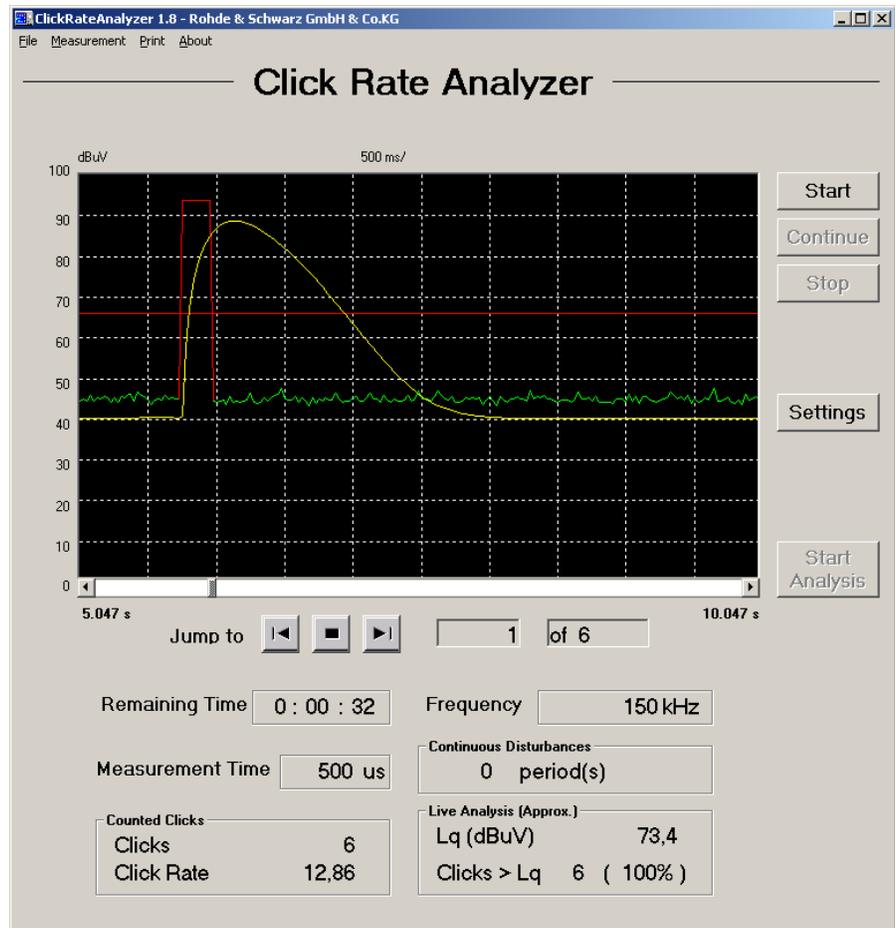
Interface window for entering the VISA address

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

Operating the Click Rate Analyzer

The central element of the measurement window is the graphic display with the peak and quasi-peak value characteristics. To the right of the display, five buttons for analysis control and measurement settings are provided.

Click Rate Analyzer



Measurement window

The uppermost 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 default settings are as follows:

Duration: 1 minute
Frequency: 150 kHz
Limit: 66 dB μ V
RF attenuation: 10 dB
Meas. time: 500 μ s
All checkboxes are deactivated.

The *Stop* button stops the measurement, and the *Continue* button continues it, provided the measurement duration has not yet elapsed. *Settings* activates the entry window for setting the measurement parameters (see "Setting the Measurement Parameters"). Analysis can be started by clicking *Start Analysis* after the measurement has been stopped or completed.

Current measured values are shown below the graphic display. *Remaining Time* indicates the time left until the end of a measurement; *Frequency* indicates the active frequency setting.

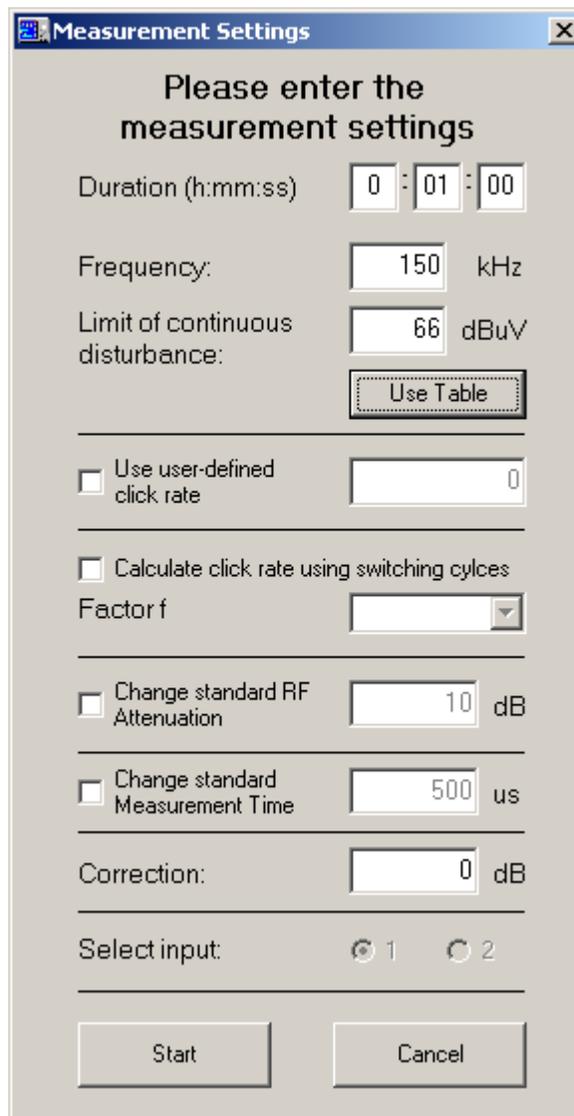
Click Rate Analyzer

The *Counted Clicks* field shows the number of recorded clicks and the current click rate. The click rate is calculated every second.

The *Continuous Disturbances* field indicates the number of recorded periods of continuous disturbance. The *Live Analysis (Approx.)* field indicates the Lq value, which is calculated every second, as well as the number of clicks that exceed Lq.

Setting the Measurement Parameters

Clicking the *Settings* button opens a new window where measurement parameters can be set.



The screenshot shows a dialog box titled "Measurement Settings" with a close button (X) in the top right corner. The main text inside the dialog reads "Please enter the measurement settings". The settings are organized into several sections, each separated by a horizontal line:

- Duration (h:mm:ss):** Three input fields showing "0", "01", and "00".
- Frequency:** An input field showing "150" followed by "kHz".
- Limit of continuous disturbance:** An input field showing "66" followed by "dBuV". Below this is a button labeled "Use Table".
- Use user-defined click rate:** A checkbox that is unchecked, followed by an input field showing "0".
- Calculate click rate using switching cycles:** A checkbox that is unchecked, followed by a dropdown menu labeled "Factor f".
- Change standard RF Attenuation:** A checkbox that is unchecked, followed by an input field showing "10" followed by "dB".
- Change standard Measurement Time:** A checkbox that is unchecked, followed by an input field showing "500" followed by "us".
- Correction:** An input field showing "0" followed by "dB".
- Select input:** Two radio buttons labeled "1" and "2". Radio button "1" is selected.

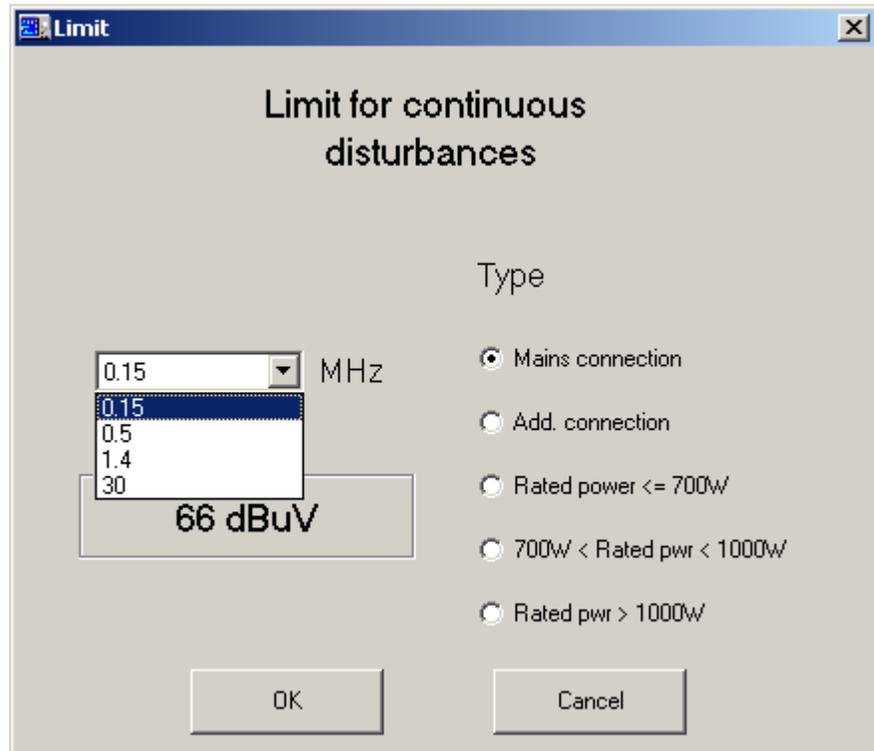
At the bottom of the dialog are two buttons: "Start" and "Cancel".

Entry window for measurement parameters

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In the upper part of the window, the frequency and duration of the measurement can be defined. Selectable frequencies are not limited to the four values defined by the standards, which are 150 kHz, 500 kHz, 1.4 MHz and 30 MHz. User-defined frequencies can be entered as well, which provides maximum flexibility.

Under *Limit of continuous disturbance (dB μ V)*, the limit value for continuous disturbances is entered. The *Use Table* button opens another window that assists you by automatically calculating the limit value.



Window for determining the limit value

Select a frequency from the selection box in the left part of the *Limit* window. Under *Type*, select the DUT type or characteristic. Click *OK* to confirm the settings; this will cause the calculated limit value to be transferred to the settings window. Click *Cancel* to discard the settings. The program will in either case return to the entry window for setting the measurement parameters.

The lower half of the settings window offers several options that can be activated by setting a checkmark in the corresponding boxes. Only if an option is activated can an entry be made in the corresponding entry field below.

The *Calculate click rate using switching cycles* option introduces an additional factor f into the click rate calculation, which is relevant in a few special cases specified in Appendix A to the Standard EN 55014-1.

Click Rate Analyzer

The *Change standard RF Attenuation* option allows the specified standard attenuation of 25 dB to be changed. The measurement time per measurement value can be set under *Meas. Time (μ s)*. Here, a default value of 500 μ s is set in compliance with the standards.

Note: If you change the standard measurement time of 500 μ s, the measurement is no longer in compliance with standards!

Under *Correction* a correction factor can be defined which is added to the measurement results. This is useful if an additional attenuation is used on the input of the EMI Test Receiver.

With *Select Input* the input of the EMI Test Receiver can be selected to which the DUT is connected to.

Note: Input selection is only available on the R&S®ESU and R&S®ESR

The software checks all settings before starting a measurement. The measurement will not start unless all settings are correct.

Functions and Options Contained in Menu Bar of Main Menu

The menu bar of the main menu offers a number of additional functions:

File:

The *File* menu contains the *Load*, *Save* 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. *Quit* closes the Click Rate Analyzer.

Measurement:

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

Print:

The *Print* menu allows the test report to be output to the Windows default printer. The *Print test report* menu item activates the test report window.

Analysis and Test Report Window

When the measurement is completed, cursor buttons appear in the lower right corner of the measurement window. With these buttons, you can navigate to individual click events on the graph.

The report window can be activated upon completion of the measurement and analysis by selecting *Print -> Print test report*.

The screenshot shows a window titled "Print test report" with a "Test report template" section. It contains several input fields for user information and a table of measurement results. At the bottom, there is a "Result" box showing "PASSED!" in green text.

Measurement Category	Value	Unit / Specification	Limit / Reference
Clicks (< 10ms)	0	Frequency (kHz)	150
Clicks (10ms-20ms)	0	Duration (h:mm:ss)	0:00:00
Clicks (> 20ms)	0	Click Rate per Minute	0
Clicks > Lq (Number)	0	L (dBuV)	66
Clicks > Lq (Percent)	0	Lq (dBuV)	0
Continuous Disturbances	0	600 ms Rule used ? (See EN55014: 4.2.3.2 or CISPR16-1-1: E2 Page 125)	No
Overload Occured ?	No	Number of Refrigerator Rule Used (See EN55014: 4.2.3.4 or CISPR16-1-1: E4 Page 127)	0
Misrepresented due to Overload ?	No		

Test report window

The test report window displays all relevant measurement results at a glance. The name of the company, the DUT designation, the user 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.

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, >20 ms). It also includes the number of clicks above the calculated limit value, 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, and whether this condition has rendered the measurement invalid.

The right half of the test report window shows the measurement frequency and duration. The click rate, the old limit value (L) and the new limit value (Lq) are also shown. Moreover, the test report indicates whether, and in accordance with what specification of the standard, exceptions 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 > 30 clicks per minute the test report will not show results for the number of any clicks or exceptions.

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

In addition, the *Print clicks* function allows the graphs of all recorded click events to be printed.

7 References

The program is based on the Standards CISPR16-1 and EN 55014.

8 Additional Information

If you have any comments or further suggestions, please contact TM-Applications@rsd.rohde-schwarz.com.



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