R&S®EPL-K59
Click Rate Analyzer
User Manual

ROHDE & SCHWARZ

Make ideas real

This manual applies to the following R&S®EPL1000 models with firmware version 1.10 and higher:

- R&S®EPL1000 (1350.4444K10)

The following firmware options are described:

- R&S®EPL-K59 Click Rate Analyzer (1350.4509.02)

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®EPL1000 is indicated as R&S EPL1000.

Contents

1 Documentation overview

This section provides an overview of the R&S EPL1000 user documentation. Unless specified otherwise, you find the documents at:

1.1 Getting started manual

Introduces the R&S EPL1000 and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc.

A printed version is delivered with the instrument. A PDF version is available for download on the Internet.

1.2 User manuals and help

Separate user manuals are provided for the base unit and the firmware applications:

- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.

- Firmware application manual
  Contains the description of the specific functions of a firmware application, including remote control commands. Basic information on operating the R&S EPL1000 is not included.

The contents of the user manuals are available as help in the R&S EPL1000. The help offers quick, context-sensitive access to the complete information for the base unit and the firmware applications.

All user manuals are also available for download or for immediate display on the Internet.

1.3 Service manual

Describes the performance test for checking compliance with rated specifications, firmware update, troubleshooting, adjustments, installing options and maintenance.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

https://gloris.rohde-schwarz.com

1.4 Instrument security procedures

Deals with security issues when working with the R&S EPL1000 in secure areas. It is available for download on the internet.

1.5 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

1.6 Specifications and brochures

The specifications document, also known as the data sheet, contains the technical specifications of the R&S EPL1000. It also lists the firmware applications and their order numbers, and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

1.7 Release notes and open source acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current software version, and describe the software installation.

The software uses several valuable open source software packages. An open source acknowledgment document provides verbatim license texts of the used open source software.

1.8 Application notes, application cards, white papers, etc.

These documents deal with special applications or background information on particular topics.

1.9 Video tutorials

Video tutorials that show you how to get started and perform basic tasks with the R&S EPL1000 are available on the Rohde & Schwarz internet site:

https://www.rohde-schwarz.com/manual/r-s-fpl1000-trying-out-basic-measurement-tasks-manuals_78701-567115.html

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: https://www.youtube.com/@RohdeundSchwarz

1.10 Calibration certificate

The document is available on https://gloris.rohde-schwarz.com/calcert. You need the device ID of your instrument, which you can find on a label on the rear panel.

2 Welcome to the click rate analyzer application

The R&S EPL1000 click rate analyzer provides functionality to perform automatic, standard compliant click rate analysis at 150 kHz, 500 kHz, 1.4 MHz and 30 MHz. Optionally, it is also possible to measure at 550 KHz frequency using the Denan law. In conjunction with the R&S EPL1000 Receiver all four frequencies can be measured in parallel.

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

The application automatically evaluates the measured clicks. It captures the measured values in real time and updates the following key results every 10 seconds:

- Number of clicks
- Click rate
- Number and limit of continuous disturbances

The software also documents results in the form of a detailed test report. The report provides statistical information and information about whether exceptions specified by the standards were used. In addition, the click rate analyzer outputs a PASSED or FAILED statement, which indicates whether the equipment under test (EUT) complies with the standard.

Installation

You can find detailed installation instructions in the R&S EPL1000 getting started manual or in the release notes.

2.1 Starting click rate analyzer

The click rate analyzer is a separate application on the R&S EPL1000.

To activate click rate analyzer measurements

1. Select the [MODE] key

   A dialog box opens that contains all operating modes and applications currently available on your R&S EPL1000.

2. Select the "Click Rate Analyzer" item.
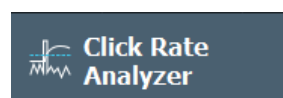
   The R&S EPL1000 opens a new channel for the application.

Note: Unlike other measurement methods, the click rate analyzer application cannot have multiple tabs open at the same time.

The measurement is started immediately with the default settings. It can be configured in the click rate analyzer overview dialog box, which is displayed when you select the "Overview" softkey from any menu Chapter 4.1, "Configuration overview", on page 20.

2.2 Understanding the display information

The following figure shows a measurement diagram during click rate analyzer measurements. All different information areas are labeled. They are explained in more detail in the following sections.
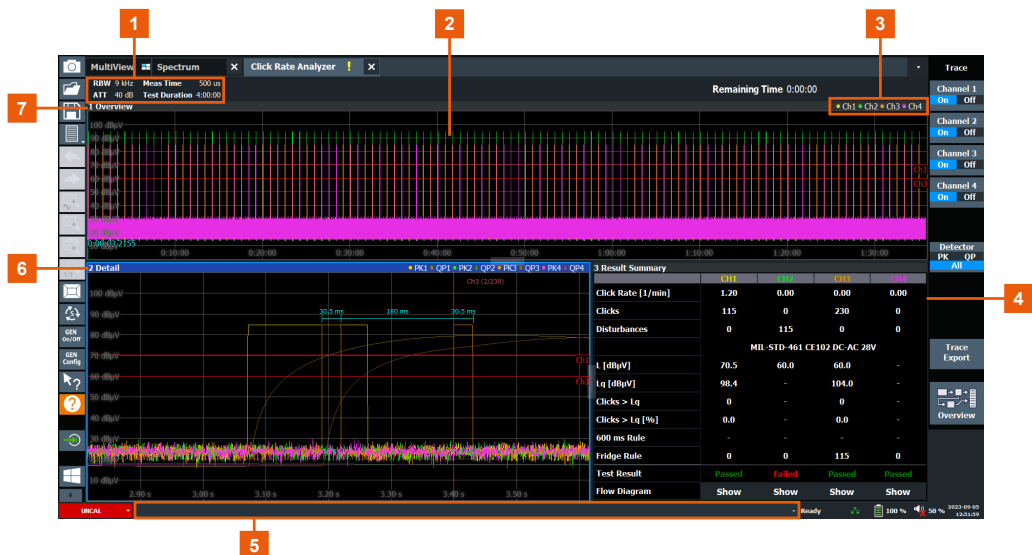
1 = Bar for firmware and measurement settings
2 = Diagram area
3 = Channel bar
4 = Result summary of all four channels
5 = Instrument status bar with error messages and date/time display
6+7 = Window title bar with diagram-specific (trace) information

Channel bar information

In the click rate analyzer application, the click rate analyzer shows following settings:

RBW	Resolution bandwidth. The default value is 9 kHz and cannot be changed.
Att	Current attenuation of the analyzer.

Meas Time	Length of the signal capture. The default value is 500 µs and cannot be changed.
Test Duration	Duration of the measurement

Window title bar information

Each window can contain several channels. Each window can display either a graph or a table as a result of the measurement. The window's title bar indicates which type of evaluation is displayed.

Information on the displayed traces is indicated in the window title bar.
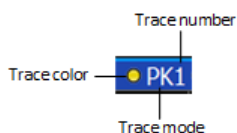
For further information on the window title bar, refer to the R&S EPL1000 user manual.

Status bar information

Global instrument settings, the instrument status and any irregularities are indicated in the status bar beneath the diagram. Furthermore, the progress of the current operation is displayed in the status bar.

3 Measurements and result displays

Access: "Overview" > "Display Config"

Or: [MEAS]

The click rate analyzer application performs a measurement that is testing an equipment under test (EUT) to ensure that its radio frequency emissions (RF) are within the specified limits. The measurement procedure involves measuring the RF emissions generated by the analyzer across different frequency ranges and comparing them to the limits specified by the standard (e.g. CISPR 14-1/EN 55014-1).

The click rate analyzer application has the following advantages:

● Allows you to measure in four different channels in parallel.

● Provides the possibility to display the results in a flow chart.

● Allows a measuring time of four hours.

● Enables the modification of the limit line after the initial measurement without requiring a new measurement to be conducted.

The data that was measured by the R&S EPL1000 can be displayed in various different ways. In the click rate analyzer application, multiple result displays can be used simultaneously.

3.1 Overview
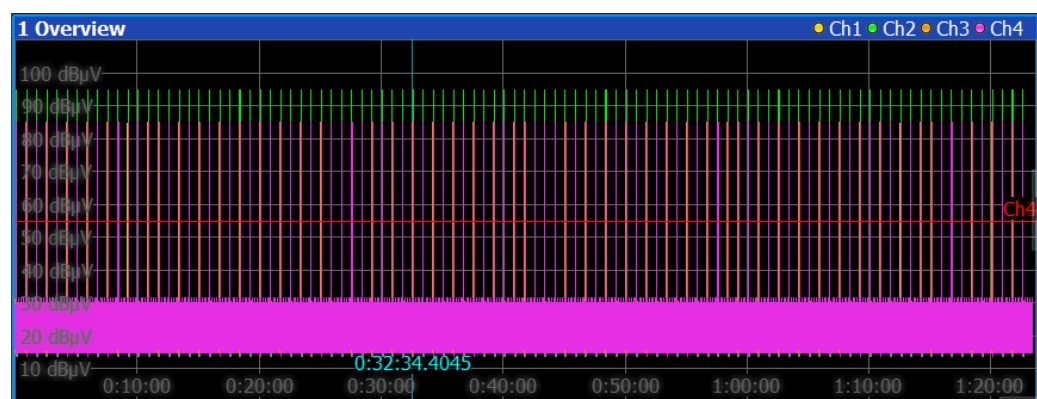
Displays the peak values of the measured signal in the time domain. The x-axis represents the measurement time in seconds. The y-axis represents the level of the measured signal. The Window title bar shows which channels are currently displayed.

In the overview window, the following functions are possible:

- Adjusting the measurement time point displayed in the detail window.
- Moving along the time axis by rotating the rotary knob. The step size corresponds to 1/4 of the displayed time range in the detail window.
- Turning the rotary knob provides click-to-click functionality when the overview window is selected (see "Auto X-Axis" on page 14).
  In addition, the "Click Number" input field needs to open ("Click Number" on page 14).
- Pressing the rotary knob, provides the option to switch to the detail window.

3.2 Traces

Access: [TRACE]

Channels
The traces in the diagram are each assigned to a channel. The color of each trace indicates which channel is being represented. The corresponding assignments are shown below:

- : Channel 1
  – Displays the measured signal at a frequency of 150 Khz.
- : Channel 2
  – Displays the measured signal at a frequency of 500 kHz or 550 kHz if the Denan Law is applied. See "Denan Law" on page 28
- : Channel 3
  – Displays the measured signal at a frequency of 1.4 MHz.
- : Channel 4
  – Displays the measured signal at a frequency of 30 MHz.

Each channel measures on a different frequency. The frequencies of the four channels are fixed. For an overview of the different frequency values and their channels, see Chapter 4.2.3, "Channel configuration", on page 23.

In addition to the traces of the channels, there is also a red trace that represents the limit of continuous disturbance. The limit of continuous disturbance depends on the selected limit line. If no limit line is active, a default value of 55 dBµV applies.

Detector
Provides the option to show or hide the positive peak detector, the quasi peak detector, or both detectors on the graph.

For more information about the detectors, refer to the R&S EPL1000 user manual.

PK	Selects positive peak detector.
QP	Selects quasi peak detector.
All	Selects positive peak and quasi peak detector.

Lines
Access: [LINES]

Provides the option to show or hide the limit line of each channel:

- Limit Line Channel 1
- Limit Line Channel 2
- Limit Line Channel 3
- Limit Line Channel 4

3.3 Detail

Access: [MEAS CONFIG]
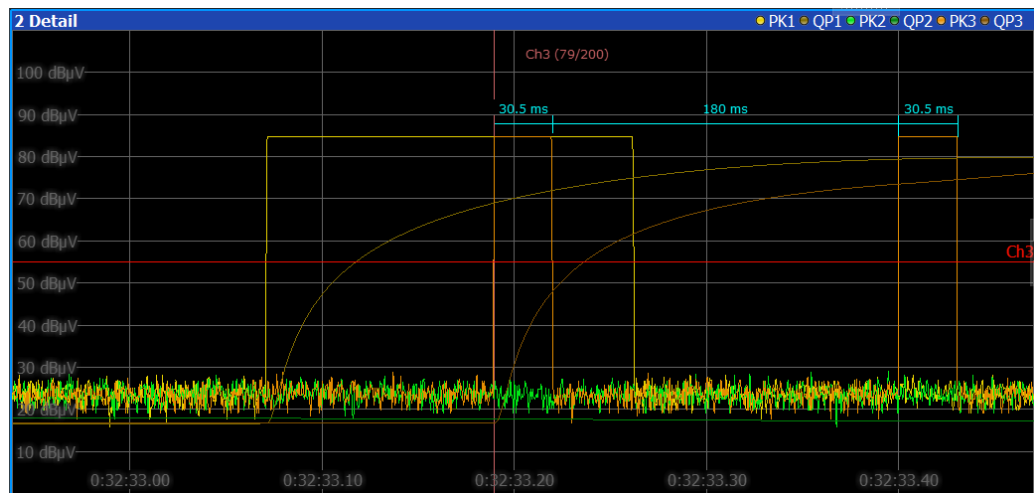
Displays the measured clicks in detail. The detail window can display the measurement traces of all four channels, the values of the peak detector and quasi-peak detector. The window title bar shows which traces are currently displayed.

The span can be changed by turning the knob when the detail window is selected. Changing the span automatically adjusts the view of the detail window and can be enlarged or reduced. Pressing the rotary knob, provides the option to switch to the overview window.

Detail Pos
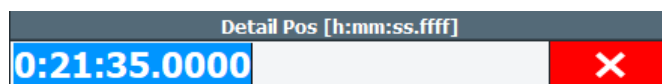
Adjusting the detail position, provides the possibility to move along the x-axis of the detail window. The detail position is specified in seconds. Increasing the detail position moves the field of view to the right. Decreasing the detail position shifts the field of view to the left.

Remote command:
not supported

Detail Span
Alternative access: [SPAN]
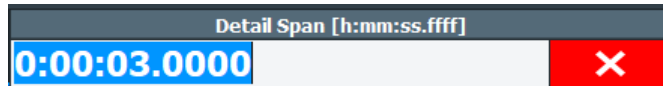
Adjusting the detail span changes the size of the detail diagram. The detail span is specified in seconds. Increasing the detail span makes the detail window smaller. Reducing the detail span enlarges the detail window. Zooming in is useful, for example, when the measurement time is high.

Remote command:
not supported

Click Number

Entering a click number allows you to display a specific click. Alternatively, the rotary knob can be turned to jump from one click to the next.

The currently displayed click is shown inside the detail diagram along with the total number of clicks.

Remote command:
not supported

Auto X-Axis
When activated, it automatically adjusts the detail span to its optimal setting. The result is that the focus in the detail window is directed to the click.

The "Auto X-Axis" also provides the click-to-click functionality when enabled. To do so, the overview window needs to be selected and the "Click Number" input field has to be opened ("Click Number" on page 14). Afterward, it is possible to switch between clicks by turning the knob.

Remote command:
not supported

3.4 Click info

Provides information about the measured clicks.

```
4 Click Info
Channel 3: 73/200
Click Type                                      > 20ms, <= 200ms
Pulse Duration                                           30.5ms
Separation                                                180ms
Adjacent Pulse                                           30.5ms
Fridge Rule Used                                         37/100
Time                                                0:30:03.1895
```

Click list

Besides the click info window, it is also possible to query all data of one or all clicks with the help of the following remote commands:

- CALCulate<n>:CSEarch:CLISt<cli>:ALL? on page 81
- CALCulate<n>:CSEarch:CLISt<cli>[:DATA]? on page 84

Channel
Displays the channel and the respective click in relation to the total click number.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:CHANnel? on page 81

Click Type
Indicates the click type of the respective click. There are three different click types:

- Duration less than 10ms
- 10ms <= duration < 20ms
- 20ms <= duration < 200ms
- Continuous disturbance

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:TYPE? on page 83

Pulse Duration
Displays how long the pulse of the click lasted.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:DURation? on page 81

Separation

Shows the fridge rule distance in seconds of a single click to the adjacent click.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:SEParation? on page 82

Adjacent Pulse

Displays the fridge-rule duration in seconds of the adjacent click.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:ADJacent? on page 80

Fridge Rule Used

Indicates if the fridge rule was used on a click.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:FRIDge? on page 79

600ms Rule Used

Displays if the 600ms rule was used on a click.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:R600? on page 79

Time

Shows the time at which the click was measured.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:TIME? on page 83

3.5 Result summary

3 Result Summary	CH1	CH2	CH3	CH4
Click Rate [1/min]	1.20	0.00	0.00	0.00
Clicks	100	0	200	200
Disturbances	0	100	0	0
		No Limit Line selected		
L [dBµV]	55.0	55.0	55.0	55.0
Lq [dBµV]	83.0	-	99.0	99.0
Clicks > Lq	0	-	0	0
Clicks > Lq [%]	0.0	-	0.0	0.0
600 ms Rule	-	-	-	-
Fridge Rule	0	0	100	0
Test Result	Passed	Failed	Passed	Passed
Flow Diagram	Show	Show	Show	Show

Provides the functionality to display the results of all four channels. For more information on how the values are calculated, refer to chapter Chapter 4.2.4, "Analysis", on page 26 .

Click Rate [1/min]

Shows the number of clicks per minute. The click rate is determined by the number of clicks per minute during the observation time. It is calculated every 10 seconds.

Remote command:
CALCulate<n>:MEASurement:CHANnel<ch>:CLICk:RATE? on page 78

Clicks

Displays the number of recorded clicks.

Remote command:
Total number: `CALCulate<n>:CSEarch:CLISt<cli>:SIZE?` on page 82
Amount of one channel: `CALCulate<n>:MEASurement:CHANnel<ch>:CLICk:`
`COUNt?` on page 77

Disturbances
Indicates the number of recorded periods of disturbance.

Remote command:
not supported

Limit Line
Shows the predefined and activated limit line.

Remote command:
All commands for the limit line are listed in Chapter 7.3.5, "Configuring limit line settings", on page 54

L [dBuV]
Displays the limit for disturbances.

Remote command:
not supported

Lq [dBuV]
Shows the click limit.

Remote command:
not supported

Clicks > Lq
Indicates the number of clicks that exceed the calculated click limit.

Remote command:
`CALCulate<n>:MEASurement:CHANnel<ch>:LQ:CGReater[:COUNt]?`
on page 79

Clicks > Lq [%]
Displays the percentage of clicks that exceed the calculated click limit to the total number of clicks recorded.

If the CISPR 14-1 Ed.6 standard is active, the number of allowed clicks above Lq is displayed for channels 3 and 4 instead of the percentage.

Remote command:
`CALCulate<n>:MEASurement:CHANnel<ch>:LQ:CGReater:PERCent?`
on page 78

600 ms Rule
Indicates whether the 600 ms rule allowed by the standard was used in the measurement.

Remote command:
`CALCulate<n>:CSEarch:CLISt<cli>:R600?` on page 79

Fridge Rule

Indicates whether the fridge rule allowed by the standard was used in the measurement.

Remote command:

CALCulate<n>:CSEarch:CLISt<cli>:FRIDge? on page 79

Test Result

Displays the overall result. The green "Passed" statement indicates conformance, the red "Failed" statement nonconformance with the standards.

Remote command:

CALCulate<n>:MEASurement:FAIL? on page 77

Flow Diagram

Clicking "Show" adds the flow diagram of CISPR 14-1 for showing the click rate analysis steps in graphical form.

This button is not available if the repetitive igniters standard has been selected as the measurement standard.

For more information, see Chapter 5.2, "Flow diagram", on page 32.

Remote command:

CALCulate<n>:MEASurement:CHANnel<ch>:FAIL? on page 76

4 Configuration

When you activate the click rate analyzer application, a click rate analyzer measurement for the input signal is started automatically with the default configuration. It can be configured in the click rate analyzer "Overview" dialog box.

4.1 Configuration overview

Throughout the measurement configuration, an overview of the most important currently defined settings is provided in the "Overview". The "Overview" is displayed when you select the "Overview" icon, which is available at the bottom of all softkey menus.
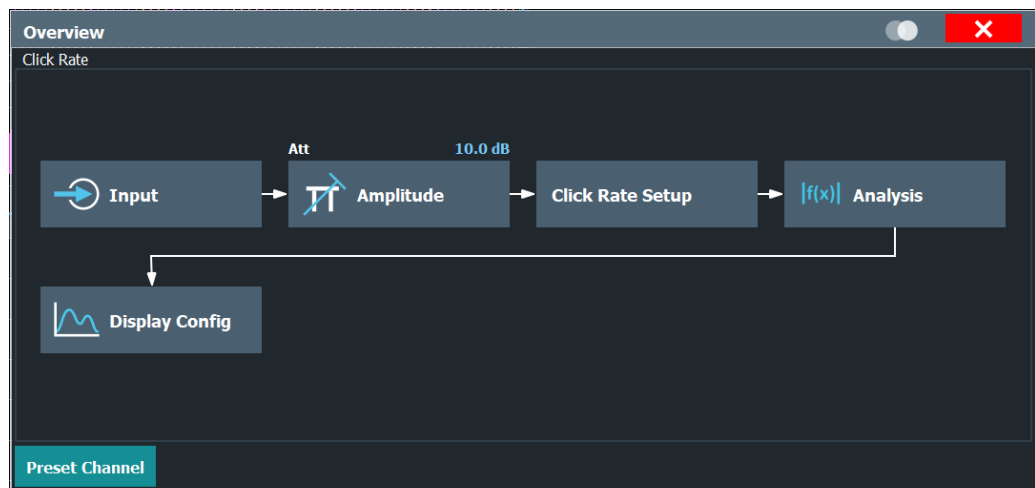
In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. Thus, you can easily configure an entire click rate analyzer measurement channel from input over processing to output and analysis by stepping through the dialog boxes as indicated in the "Overview".

Preset Channel
Select the "Preset Channel" button in the lower left-hand corner of the "Overview" to restore all measurement settings *in the current channel* to their default values.

Remote command:
SYSTem:PRESet:CHANnel[:EXEC] on page 43

4.2 Measurement configuration

Access: [Meas Config] > "Meas Config"

The central element of the "Measurement Config" is the parameter definition for the basic measurement parameters.

4.2.1 Test duration

Access: "Overview" > "Click Rate Setup" > "Test Duration"
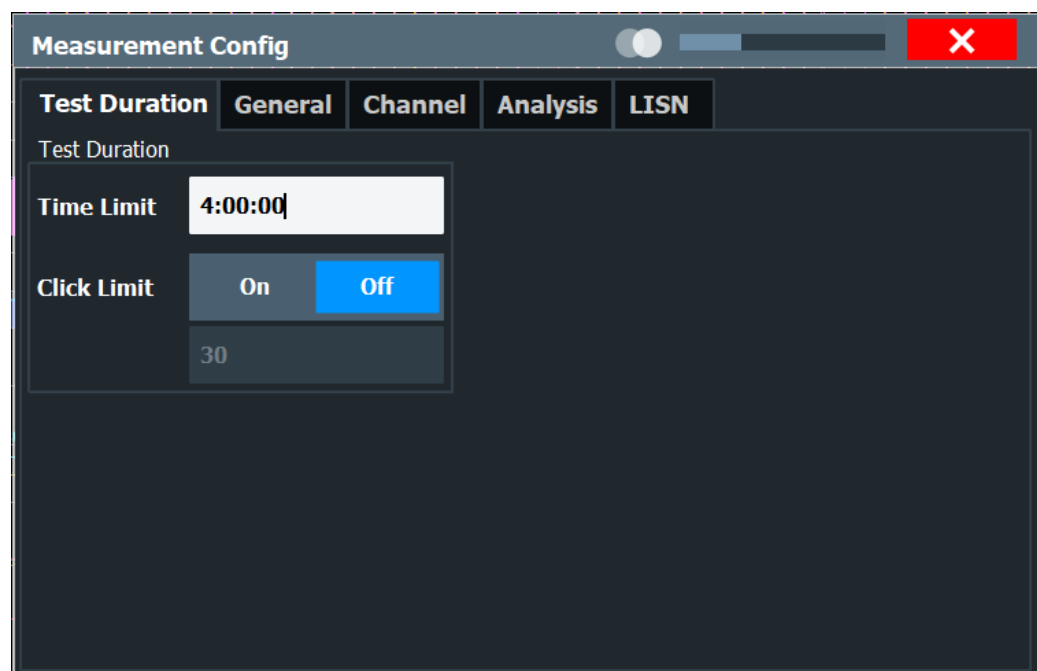
Time limit

Reaching the defined time stops the measurement.

As long as the click limit is disabled, the measurement time is only based on the time limit.

Remote command:
Configure time limit: [SENSe:]CONFigure:DURation on page 49
Request remaining time: CALCulate<n>:MEASurement:DREMain? on page 76

Click limit

Stops the measurement at the defined number of clicks.

If the click limit is enabled, the time limit is still applied. If the click limit is not reached, the measurement ends after the set time limit expires.

Remote command:
[SENSe:]CONFigure:CLICk[:STATe] on page 50
[SENSe:]CONFigure:CLICk:COUNt on page 50

4.2.2 General configuration

Access: "Overview" > "Click Rate Setup" > "General Config"

Or: "Overview" > "Input"
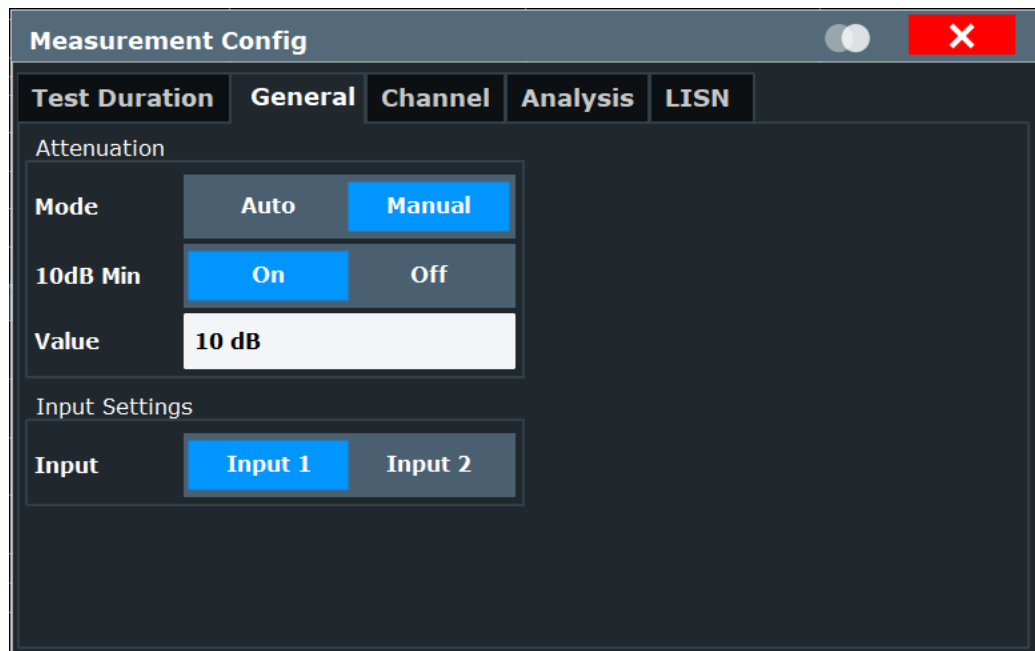
Attenuation Mode
Defines the attenuation of the signal.

For more information, see the Preamplifier description in the EPL1000 user manual.

The auto ranging feature in the receiver remains active even if you change the attenuation and preamplifier properties in other measurement channels and then return to the receiver application.

Auto Mode   In the click rate analyzer application the attenuation is not adjusted during the measurement. If automatic attenuation is activated, the attenuation is set to a value 20 dB below the lowest limit.

                   Remote command:
                   INPut:ATTenuation:AUTO on page 50

Manual Mode	You can attenuate the signal in 1 dB steps. The range is specified in the datasheet.
	Attenuation of less than 10 dB is only possible if you turn off 10 dB Minimum Attenuation.

Remote command:
INPut:ATTenuation[:VALue] on page 51

10 dB Minimum Attenuation

Turns the availability of attenuation levels of less than 10 dB on and off.

When you turn on this feature, the attenuation is always at least 10 dB. This minimum attenuation protects the input mixer and avoids accidental setting of 0 dB, especially if you measure EUTs with high RFI voltage.

When you turn it off, you can also select attenuation levels of less than 10 dB.

The setting applies to a manual selection of the attenuation as well as the automatic selection of the attenuation.

Remote command:
INPut:ATTenuation:PROTection[:STATe] on page 51

4.2.3 Channel configuration

Access: "Overview" > "Click Rate Setup" > "Channel Config"

Or: "Meas Config" > "Channel Config"

The measurement is performed on four different channels at four different frequencies. The channel configuration tab provides various limits and measurement corrections for the measurement.

Frequency

Displays the test frequencies. The four channel frequencies are fixed and cannot be changed.

The colors of the channels correspond to the traces in the diagram. See Chapter 3.2, "Traces", on page 12.

Remote command:
CALCulate<n>:CSEarch:CLISt<cli>:CHANnel? on page 81

Select Limit Line
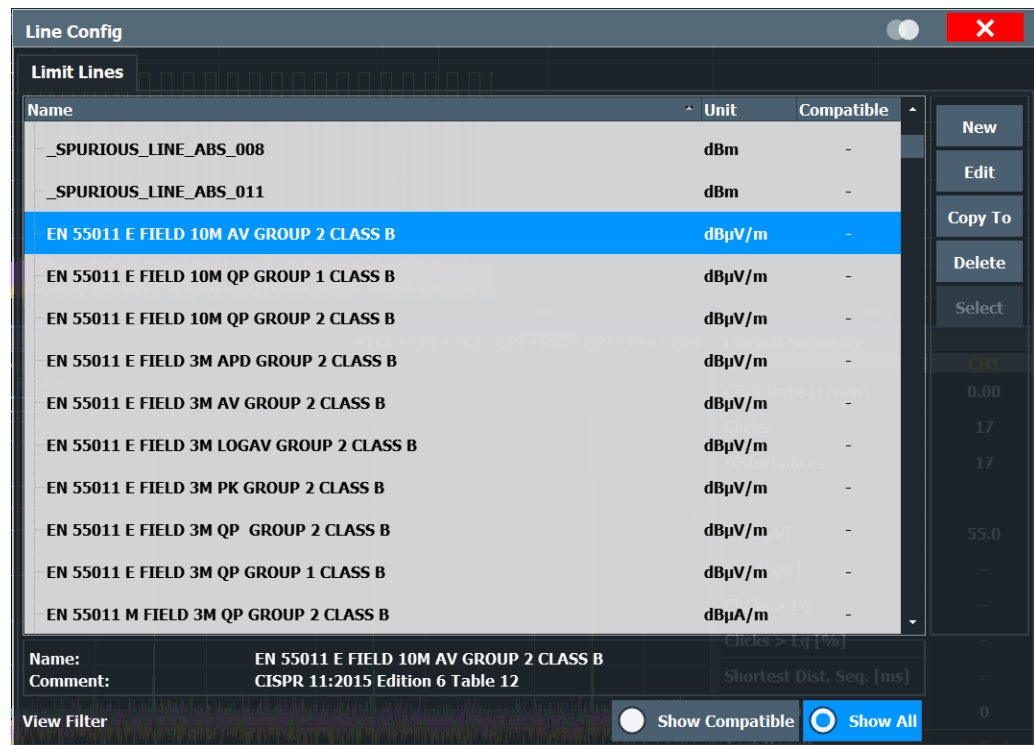
Provides the functionality to select a predefined limit line.

The limit line must be selected depending on the type of measurement. Depending on the selection, the limit of continuous disturbance of each channel adjusts accordingly. It is possible to select a limit line from the default settings or define a new one. Confirm the Selection with "Select".

It is possible to select a limit line before and after the measurement. If the limit line is selected after a measurement has been performed, no new measurement is necessary. Pressing the "Update Analysis" key updates the result summary according to the newly selected limit line.

For more information about configuring a limit line, refer to the R&S EPL1000 user manual.

Remote command:
[SENSe:]LIMit:SELect on page 60

Limit of continuous disturbance
Displays the quasi-peak limit for the measurement. Selection of predefined limits according to CISPR 14-1/EN 55014-1 can be made via the limit line dialog box ("Select Limit Line" on page 24).

Remote command:
Not supported

Transducer
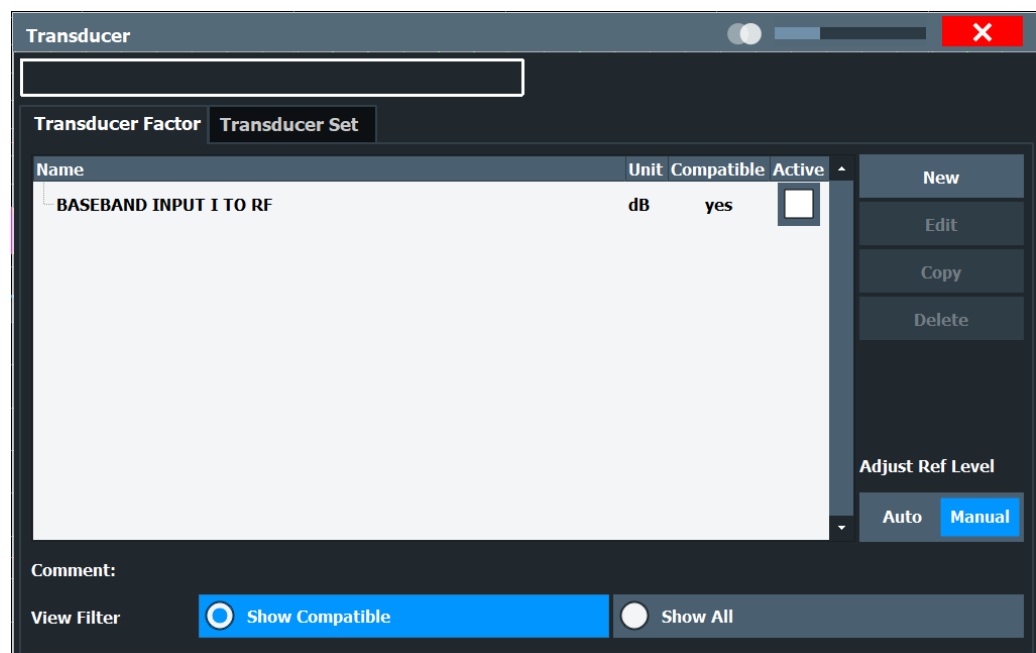
Opens a dialog where you can configure the transducer factors and sets.

- Only transducer with the units dB and dBµV can be activated.
- Transducer sets are not supported in the click rate analyzer application.

Note: Transducers active in other measurement channels are only used in the click rate analyzer application if they are compatible, i.e. if they have the unit dB or dBµV.

For more information about configuring a transducer, refer to the R&S EPL1000 user manual.

Channel Correction
Displays the correction values set by selecting a transducer factor.

The correction values can be changed by editing the transducer factor.

Remote command:
Not supported

Margin Peak Detector

Enables the input of a margin for the determination of the click duration.

Sometimes, all measured peak detector values 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.

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 are evaluated.

Remote command:
[SENSe:]LIMit:PMARgin<ch> on page 52

4.2.4 Analysis

Access: "Overview" > "Click Rate Setup" > "Analysis"

Or: "Meas Config" > "Analysis"

The click rate is the average number of clicks per minute. There are two methods for determining the click rate, depending on the type of EUT:

- Measuring the number of clicks.
- Counting the number of switching operations.
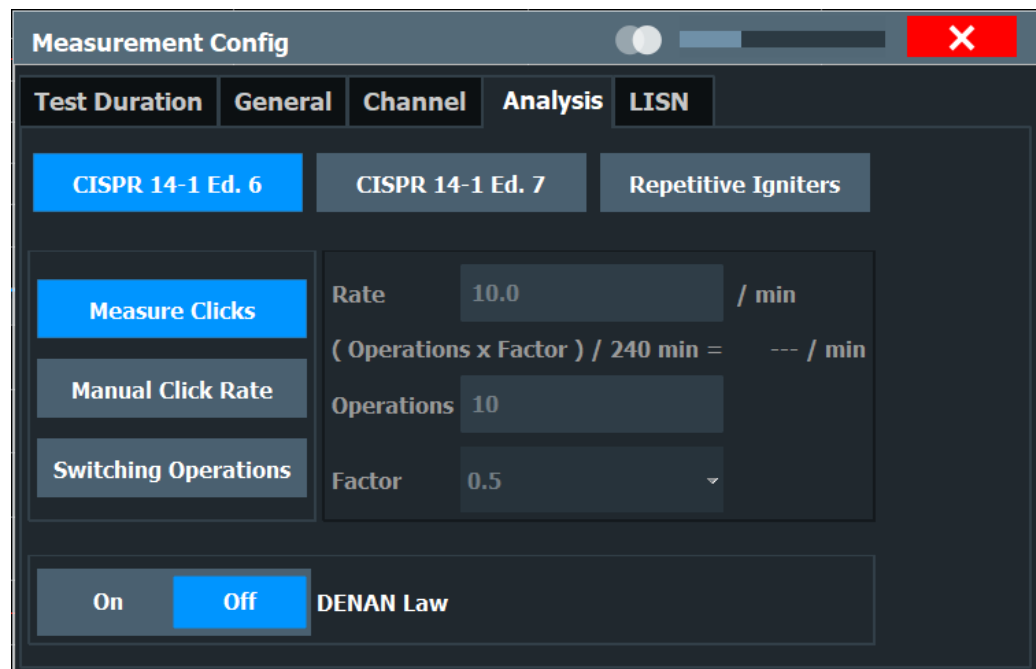
CISPR 14-1 Ed.6

Determines the frequency range, bandwidth and measurement time according to CISPR 14-1 Ed.6.

The determined click rate at 500 kHz is used for the calculation of the click limit. The resulting number of clicks exceeding the limit is used for the upper quartile analysis at 1.4 MHz and 30 MHz.

Remote command:

CALCulate<n>:CSEarch:CONFigure:STANdard on page 53

CISPR 14-1 Ed.7

Determines the frequency range, bandwidth and measurement time according to CISPR 14-1 Ed.7.

The click rate is determined for each channel frequency and is used for the calculation of the click limit. The number of clicks which are allowed to exceed the limit is 1/4 of the clicks determined at each channel frequency.

Remote command:

CALCulate<n>:CSEarch:CONFigure:STANdard on page 53

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.
- No exception rules such as 600ms and Fridge Rule are applied.
- The click with the longest duration and the shortest distance between two clicks are determined.
  - These two values are displayed in the results summary instead of the exception rules.

Remote command:

CALCulate<n>:CSEarch:CONFigure:STANdard on page 53

Measure Clicks

Selects the number of switching operations and calculates the click rate automatically. The click rate is calculated every 10 seconds.

Remote command:

CALCulate<n>:CSEarch:CONFigure:TYPE on page 53

Manual Click Rate

Enables a manual setting of the click rate by specifying the factor that determines the click rate based on the number of switching operations.

Remote command:

CALCulate<n>:CSEarch:CONFigure:TYPE on page 53
CALCulate<n>:CSEarch:CONFigure:MCRate on page 52

Switching operations

Enables a manual setting of the number of operations and the factor.

In certain cases, the click rate is derived from the number of switching operations and the corresponding factor. In that case activate "Switching Operations" for entering the user-defined number of switching operations and select the "Factor".

Remote command:
CALCulate<n>:CSEarch:CONFigure:TYPE on page 53
CALCulate<n>:CSEarch:CONFigure:SOPeration on page 53
CALCulate<n>:CSEarch:CONFigure:FACTor on page 52

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.

Remote command:
CALCulate<n>:CSEarch:CONFigure:DLAW on page 54

4.2.5 LISN

Access: "Overview" > "Click Rate Setup" > "LISN"

Or: "Meas Config" > "LISN"
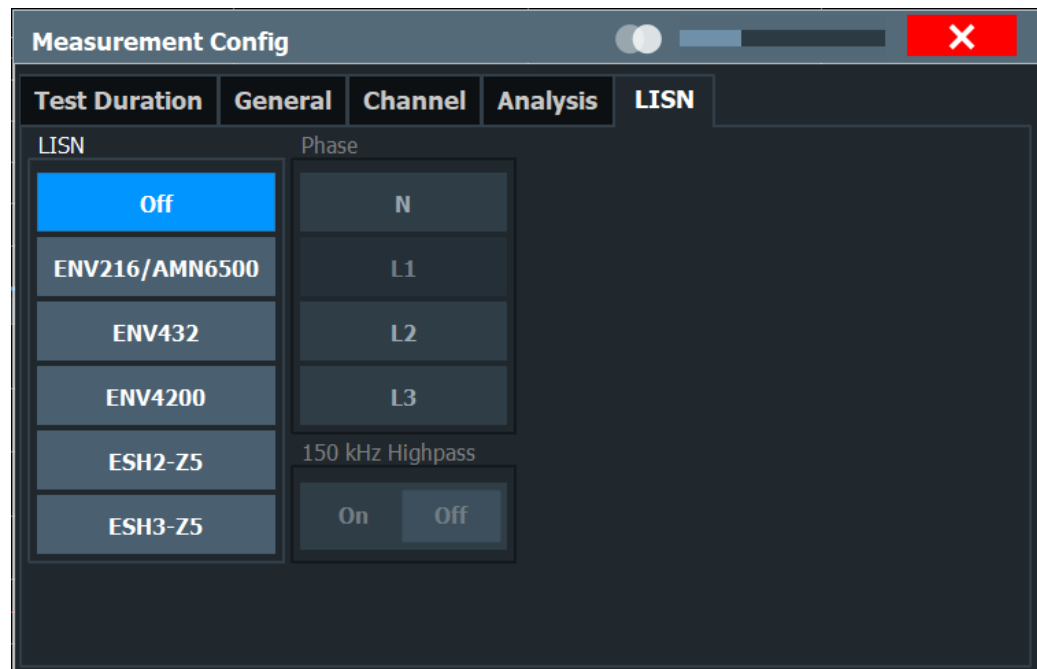
LISN type

Selects the LISN used for the measurement.

The following LISNs are supported by the R&S EPL1000:

● R&S ENV216

- R&S AMN6500
- R&S ENV432
- R&S ENV4200
- R&S ESH2-Z5
- R&S ESH3-Z5

Select "Off" when you are performing measurements without a LISN.

For more information about configuring and using a LISN, refer to the EPL1000 user manual.

Remote command:
INPut:LISN[:TYPE] on page 64

4.3 Sweep settings

Access: [SWEEP]

Run / Run Single
Select "Run" or [RUN SINGLE] to start the measurement.

The measurement starts and ends after the preset measurement time has elapsed.

Note: In the click rate analyzer application the function of the [RUN CONT] is not supported. Use only [RUN SINGLE] to start the measurement.

The results are not deleted until a new measurement is started.

Remote command:
INITiate<n>[:IMMediate] on page 66

Stop
Stops the entire measurement. Enables premature completion before the predefined measurement time has elapsed.

The measurement must be restarted afterwards.

To pause the measurement, press "Hold".

Remote command:
ABORt on page 65

Hold
Pauses the running measurement.

While the measurement is paused, it is not possible to change the measurement settings.

Remote command:
HOLD on page 66

Update Analysis
Starts the evaluation of the performed measurements.

Can be pressed either immediately after a measurement or after configuring the analysis parameters to update the results.

Remote command:

INITiate<n>:UANalysis on page 67

5 Analysis

Access: "Overview" > "Analysis"

5.1 Exception rules

The click rate analyzer application supports two exception rules, which will be further described below.

5.1.1 Fridge rule

For devices with a click rate below five, two disturbances each lasting 200 ms or less are counted as two separate clicks. Even if the time between them is less than 200 ms. When applying this exception, the click rate must remain below five.

5.1.2 600ms rule

The 600ms rule indicates that clicks that do not meet the definition of click and having a duration of less than 600 ms can be considered as continuous disturbances. This means that they can be evaluated differently in the click rate analysis than longer discontinuous disturbances.

Specifying a time period of 600 ms helps to distinguish between short duration, impulsive noise, often generated by household appliances such as refrigerators. It also helps distinguish other longer disturbances that originate from other appliances or sources.

5.2 Flow diagram
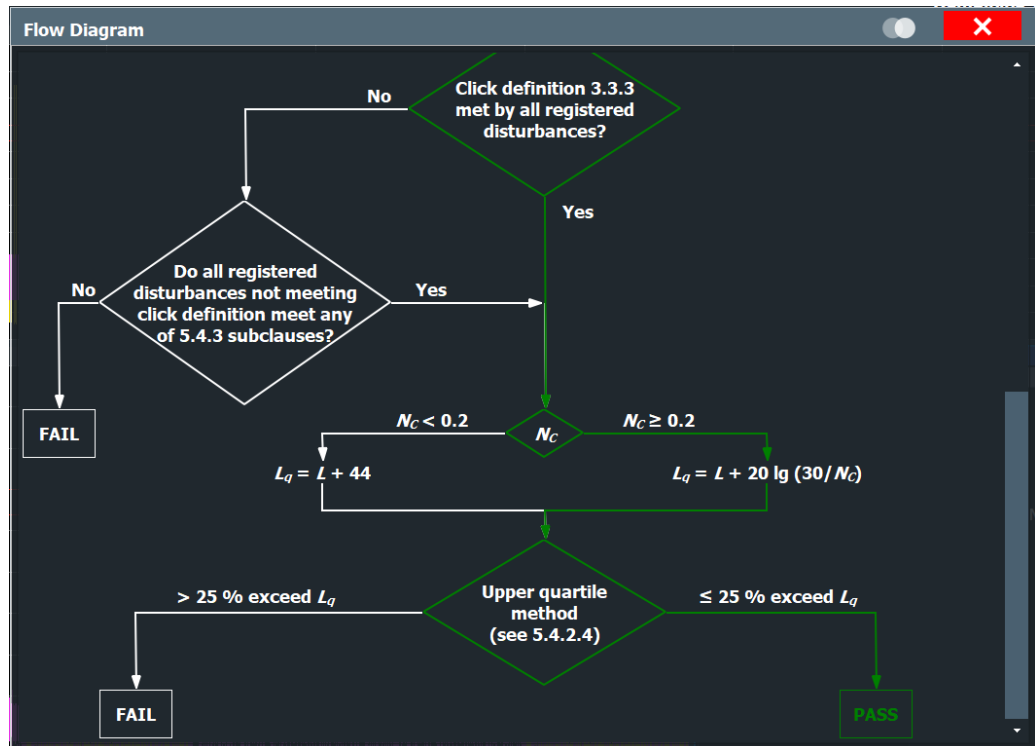
The R&S EPL-K59 enables an evaluation via a flow diagram. For displaying the diagram, press "Show" in the result summary.

The criteria of the measurement standards are defined in the flow chart. Depending on the selected measurement standard, the flowchart evaluates the measurement results according to the criteria and visualizes them accordingly.

5.3 Marker

Up to four markers or delta markers can be activated for each channel simultaneously.

For background knowledge on marker settings and functions, refer to the R&S EPL1000 user manual.

5.3.1 Marker usage

Access: [MKR]

Select Marker (1-4)

"Marker X" activates the corresponding marker and opens an edit dialog box to enter the marker position ("X-value"). Pressing the softkey again deactivates the selected marker.

Marker 1 is always the default reference marker for relative measurements. If activated, markers 2 to 4 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Type" function.

Several markers can be configured very easily using the "Marker" dialog box, see Chapter 5.3.2, "Marker settings", on page 33.

5.3.2   Marker settings

Access: [Mkr] > "Markers Config"

Selected Marker

Marker name. The marker which is currently selected for editing is highlighted orange.

Remote command:
Marker selected via suffix <m> in remote commands.

Marker State
Activates or deactivates the marker in the diagram.

Remote command:
CALCulate<n>:MARKer<m>[:STATe] on page 73
CALCulate<n>:DELTamarker<m>[:STATe] on page 69

Marker Position X-value
Defines the position (x-value) of the marker in the diagram.

For normal markers, the absolute position is indicated. For delta markers, the position relative to the reference marker is provided.

Remote command:
Normal marker
X-axis: CALCulate<n>:MARKer<m>:X[:VALue] on page 74
Y-axis:CALCulate<n>:MARKer<m>:Y? on page 75
Delta marker
Relative (x-axis): CALCulate<n>:DELTamarker<m>:X:RELative on page 70

X-axis: `CALCulate<n>:DELTamarker<m>:X[:VALue]` on page 70

Y-axis: `CALCulate<n>:DELTamarker<m>:Y?` on page 71

Marker Type

Toggles the marker type.

The type for marker 1 is always "Normal", the type for delta marker 1 is always "Delta". These types cannot be changed.

Note: If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal"   A normal marker indicates the absolute value at the defined position in the diagram.

"Delta"   A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:

`CALCulate<n>:MARKer<m>[:STATe]` on page 73

`CALCulate<n>:DELTamarker<m>[:STATe]` on page 69

Reference Marker

Defines a marker as the reference marker which is used to determine relative analysis results (delta marker values).

Remote command:

`CALCulate<n>:DELTamarker<m>:MREFerence` on page 71

Assigning the Marker to a channel

The "Channel" setting assigns the selected marker to an active channel. The trace of the channel determines which value the marker shows at the marker position.

If the marker was previously assigned to a different channel, the marker remains on the previous time, but indicates the value of the trace of the new channel. If a channel is turned off, the assigned markers and marker functions are also deactivated.

Remote command:

`CALCulate<n>:MARKer<m>:CHANnel` on page 73

`CALCulate<n>:DELTamarker<m>:CHANnel` on page 72

Detector

Selects the trace the marker is positioned on.

PPK   Positions the marker on the positive peak detector trace.

QPK   Positions the marker on the quasi peak detector trace.

Remote command:

`CALCulate<n>:MARKer<m>:DETector` on page 75

Marker click left

Sets the x-position of the normal or delta marker number to the previous click.

Remote command:

Normal marker: `CALCulate<n>:MARKer<m>:CLICk:LEFT` on page 74

Delta marker: `CALCulate<n>:DELTamarker<m>:CLICk:LEFT` on page 72

Marker click right

Sets the x-position of the normal or delta marker number to the next click.

Remote command:
Normal marker: `CALCulate<n>:MARKer<m>:CLICk:RIGHt` on page 74
Delta marker: `CALCulate<n>:DELTamarker<m>:CLICk:RIGHt` on page 72

All Markers Off

Deactivates all markers in one step.

Remote command:
`CALCulate<n>:MARKer<m>:AOFF` on page 73

5.3.3 Marker results

Normal markers point to a trace point on the x-axis and display the associated numeric value for that trace point. Delta markers indicate an offset between the level at the delta marker position and the level at the position of the assigned reference marker, in dB.

The results can be displayed directly within the diagram area or in a separate table. By default, the first two active markers are displayed in the diagram area.

Marker information in diagram area

By default, the results of the last two markers or delta markers that were activated are displayed in the diagram area.

The following information is displayed there:

● The marker type (M for normal, D for delta, or special function name)
● The marker number
● The assigned trace number in square brackets [ ]
● The marker value on the y-axis
● The marker position on the x-axis

5.4 Trace configuration

Access: [Trace]

In the Trace sidebar menu, the various traces of the channels can be enabled and disabled.

The PK trace, QP trace, or both can be displayed simultaneously in the details window.

Trace export

The R&S EPL1000 provides various evaluation methods for the results of the performed measurements. If you want to evaluate the data with other, external applications, you can export the measurement data to a standard ASCII format file (`DAT` or `CSV`).

Note: The standard data management functions (for example saving or loading instrument settings) that are available for all R&S EPL1000 applications are not described here.

Refer to the R&S EPL1000 user manual for a description of the standard functions.

6 How to perform click rate analysis

The following step-by-step instructions demonstrate how to perform a click rate measurement with the R&S EPL1000-K59 option.

1. Press the [MODE] key on the front panel to select the "Click Rate Analyzer" operating mode.

2. Select "Overview" to display the "Overview" for an click rate analyzer measurement.

3. Select "Display Config" to select the displays of your interest (see Chapter 3, "Measurements and result displays", on page 11).
   Arrange them on the display to suit your preferences.

4. Exit the SmartGrid mode.

5. Select "Amplitude" to configure the attenuation settings.

6. Close the window to return to the "Overview" screen.

7. Select "Click Rate Setup" to set the measurement duration.

8. Close the window to return to the "Overview" screen.

9. Select "Analysis" to choose one of the three measurement standards, see Chapter 4.2.4, "Analysis", on page 26.

10. If necessary, activate the DENAN Law by selecting "On".

11. To start the measurement, select [RUN SINGLE].

    The measurement starts and ends after the preset measurement time has elapsed. If a click limit is set, the measurement ends when the defined number of clicks has occurred.

12. To pause the measurement, select "Hold".

13. To stop the measurement prematurely, select "Stop".

How to configure the analysis settings

After the measurement, you can modify the analysis settings. These modifications have a significant impact on how the measured signals are evaluated and how the final test result turns out.

1. Select "Update Analysis" to evaluate the results of the completed measurement.

   The summary displays which channel passed or failed the measurement based on the predefined settings.
   Furthermore, it is possible to display the results using a flow diagram.

2. Select [MKR] to make use of the advanced analysis functions in the displays.

   a) Configure markers and delta markers to determine deviations and offsets within the signal. See Chapter 5.3, "Marker", on page 32.

3. Select "Channel" to see the current values for the limit of continuous disturbance and channel correction.

4. Select "Select Limit Line" to choose a limit line for the measurement.

   The limit of continuous disturbance changes according to the limit line.

5. Select "Transducer" to choose a transducer factor for the measurement.

   The values for the channel correction change according to the transducer factor.

6. If necessary, modify the values for the margin peak detectors.

7. After adjusting the analysis settings, click on "Update Analysis" to update the results.

   The results are updated based on the previously measured signal and the latest analysis parameters.

7 Remote commands for click rate analyzer measurements

The following conventions are used in the remote command descriptions:

- **Command usage**
  If not specified otherwise, commands can be used both for setting and for querying parameters.
  If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.

- **Parameter usage**
  If not specified otherwise, a parameter can be used to set a value, and it is the result of a query.
  Parameters required only for setting are indicated as **Setting parameters**.
  Parameters required only to refine a query are indicated as **Query parameters**.
  Parameters that are only returned as the result of a query are indicated as **Return values**.

- **Conformity**
  Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the R&S EPL1000 follow the SCPI syntax rules.

- **Asynchronous commands**
  A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.

- **Reset values (*RST)**
  Default parameter values that are used directly after resetting the instrument (`*RST` command) are indicated as ***RST** values, if available.

- **Default unit**
  The default unit is used for numeric values if no other unit is provided with the parameter.

- **Manual operation**
  If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

In the click rate analyzer application, the following common suffixes are used in remote commands:

Table 7-1: Common suffixes used in remote commands in the click rate analyzer application

Suffix	Value range	Description
<m>	1..4	Marker
<n>	1..16	Window (**in the currently selected channel**)
<t>	1..4	Trace
	1 to 8	Limit line
<k>	1..8 (Limit line) 1 | 2 (Display line)	Selects a limit or display line.

Suffix	Value range	Description
<pk>	1..3000	Selects a peak.
<ou>	irrelevant	
<cli>	1..n	Selects a click.

Selecting windows in multiple channels

Note that the suffix <n> always refers to a window in the currently selected channel.

7.1 Selecting the application

DISPlay:ATAB <State>

This command switches between the MultiView tab and the most recently displayed channel. If only one channel is active, this command has no effect.

Parameters:

<State>   ON | OFF | 0 | 1

OFF | 0
Switches off the function.

ON | 1
Switches on the function.

INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

Adds a measurement channel. You can configure up to 10 measurement channels at the same time (depending on available memory).

Parameters:

<ChannelType>	Channel type of the new channel. For a list of available channel types, see `INSTrument:LIST?` on page 42.
<ChannelName>	String containing the name of the channel. Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.
Example:	`INST:CRE SAN, 'Spectrum 2'` Adds a spectrum display named "Spectrum 2".

INSTrument:CREate:REPLace <ChannelName1>, <ChannelType>, <ChannelName2>

Replaces a channel with another one.

Setting parameters:

<ChannelName1>	String containing the name of the channel you want to replace.
<ChannelType>	Channel type of the new channel. For a list of available channel types, see `INSTrument:LIST?` on page 42.
<ChannelName2>	String containing the name of the new channel. **Note**: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see `INSTrument:LIST?` on page 42). Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".
Example:	`INST:CRE:REPL 'Receiver',REC,'REC2'` Replaces the channel named "Receiver" by a new channel of type "Receiver" named "REC2".
Usage:	Setting only

INSTrument:DELete <ChannelName>

Deletes a channel.

If you delete the last channel, the default "Receiver" channel is activated.

Setting parameters:

<ChannelName>	String containing the name of the channel you want to delete. A channel must exist to delete it.
Example:	`INST:DEL 'Receiver'` Deletes the channel with the name 'Receiver'.
Usage:	Setting only

INSTrument:LIST?

Queries all active channels. The query is useful to obtain the names of the existing channels, which are required to replace or delete the channels.

Return values:

<ChannelType>, <ChannelName>	For each channel, the command returns the channel type and channel name (see tables below). Tip: to change the channel name, use the `INSTrument:REName` command.

Example:	`INST:LIST?`
	Result for 2 channels:
	`'REC','Receiver','REC','Receiver 2'`

Example:	`INST:LIST?` `'CRA','Click Rate Analyzer'`
Usage:	Query only

Table 7-2: Available channel types and default channel names

Application	<ChannelType> Parameter	Default Channel setup Name*)
Analog Modulation Analysis	ADEMod	Analog Demod
Click Rate Analyzer	CRANalyzer	Click Rate Analyzer
I/Q Analyzer	IQ	IQ Analyzer
Real-Time Spectrogram	RTSGram	Real-Time Spectrogram
Receiver	RECeiver	Receiver
Spectrum	SANalyzer	Spectrum
Note: the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.		

INSTrument:REName <ChannelName1>, <ChannelName2>

Renames a channel.

Setting parameters:

<ChannelName1>	String containing the name of the channel you want to rename.
<ChannelName2>	String containing the new channel name. Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs. Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".
Example:	`INST:REN 'Receiver','REC'` Renames the channel with the name 'Receiver' to 'REC'.
Usage:	Setting only

INSTrument[:SELect] <ChannelType> | <ChannelName>

Activates a new channel with the defined channel type, or selects an existing channel with the specified name.

Also see

- INSTrument:CREate[:NEW] on page 40

Parameters:

<ChannelType>   Channel type of the new channel.
                     For a list of available channel types see INSTrument:LIST? on page 42.

<ChannelName>   String containing the name of the channel.

Example: INST IQ
                     Activates a channel for the I/Q Analyzer application (evaluation mode).
                     INST 'MyIQSpectrum'
                     Selects the channel named 'MyIQSpectrum' (for example before executing further commands for that channel).

SYSTem:PRESet:CHANnel[:EXEC]

Restores the default instrument settings in the current channel.

Use INST:SEL to select the channel.

Example: INST:SEL CRA
                     Selects the channel for "Click Rate Analyzer".
                     SYST:PRES:CHAN:EXEC
                     Restores the factory default settings to the "Click Rate Analyzer" channel.

Usage: Event

Manual operation: See "Preset Channel" on page 20

7.2 Configuring the screen layout

LAYout:WINDow<n>:REPLace <WindowType>

Changes the window type of an existing window (specified by the suffix <n>) in the active channel.

The effect of this command is identical to the `LAYout:REPLace[:WINDow]` command.

To add a new window, use the `LAYout:WINDow<n>:ADD?` command.

Suffix:

<n>   Window

Setting parameters:

<WindowType>   Type of measurement window you want to replace another one with.
See `LAYout:ADD[:WINDow]?` on page 46 for a list of available window types.

Example: `LAY:WIND2:REPL MTAB`
Replaces the result display in window 2 with a marker table.

Usage: Setting only

LAYout:WINDow<n>:ADD? <Direction>,<WindowType>

Adds a measurement window to the display. Note that with this command, the suffix <n> determines the existing window next to which the new window is added. Unlike `LAYout:ADD[:WINDow]?`, for which the existing window is defined by a parameter.

To replace an existing window, use the `LAYout:WINDow<n>:REPLace` command.

Is always used as a query so that you immediately obtain the name of the new window as a result.

Suffix:

<n>   Window

Query parameters:

<Direction>   LEFT | RIGHt | ABOVe | BELow

<WindowType>   Type of measurement window you want to add.
See `LAYout:ADD[:WINDow]?` on page 46 for a list of available window types.

Return values:

<NewWindowName>   When adding a new window, the command returns its name (by default the same as its number) as a result.

Example: `LAY:WIND1:ADD? LEFT,MTAB`
Result:
`'2'`
Adds a new window named '2' with a marker table to the left of window 1.

Usage: Query only

LAYout:WINDow<n>:IDENtify?

Queries the **name** of a particular display window (indicated by the <n> suffix) in the active channel.

Note: to query the **index** of a particular window, use the `LAYout:IDENtify[: WINDow]?` command.

Suffix:

<n>   Window

Return values:

<WindowName>   String containing the name of a window.
                        In the default state, the name of the window is its index.

Example: `LAY:WIND2:IDEN?`
                        Queries the name of the result display in window 2.
                        Response:
                        `'2'`

Usage: Query only

LAYout:WINDow<n>:REMove

Removes the window specified by the suffix <n> from the display in the active channel.

The result of this command is identical to the `LAYout:REMove[:WINDow]` command.

Suffix:

<n>   Window

Example: `LAY:WIND2:REM`
                        Removes the result display in window 2.

Usage: Event

LAYout:CATalog[:WINDow]?

Queries the name and index of all active windows in the active channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

Return values:

<WindowName>   string

                        Name of the window.
                        In the default state, the name of the window is its index.

<WindowIndex>   **numeric value**
                        Index of the window.

Example:	LAY:CAT?
	Result:
	`'2',2,'1',1`
	Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).
Usage:	Query only

LAYout:MOVE[:WINDow] <WindowName>, <WindowName>, <Direction>

Setting parameters:

<WindowName>	String containing the name of an existing window that is to be moved. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the LAYout:CATalog[:WINDow]? query.
<WindowName>	String containing the name of an existing window the selected window is placed next to or replaces. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the LAYout:CATalog[:WINDow]? query.
<Direction>	LEFT | RIGHt | ABOVe | BELow | REPLace Destination the selected window is moved to, relative to the reference window.
Example:	LAY:MOVE '4','1',LEFT Moves the window named '4' to the left of window 1.
Example:	LAY:MOVE '1','3',REPL Replaces the window named '3' by window 1. Window 3 is deleted.
Usage:	Setting only

LAYout:ADD[:WINDow]? <WindowName>, <Direction>, <WindowType>

Adds a window to the display in the active channel.

Is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the LAYout:REPLace[:WINDow] command.

Query parameters:

<WindowName>	String containing the name of the existing window the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the LAYout:CATalog[:WINDow]? query.

<Direction>	LEFT | RIGHt | ABOVe | BELow
	Direction the new window is added relative to the existing window.
<WindowType>	text value
	Type of result display (evaluation method) you want to add. See the table below for available parameter values.

Return values:

<NewWindowName>	When adding a new window, the command returns its name (by default the same as its number) as a result.

Usage: Query only

LAYout:IDENtify[:WINDow]? <WindowName>

Queries the **index** of a particular display window in the active channel.

Note: to query the **name** of a particular window, use the `LAYout:WINDow<n>: IDENtify?` query.

Query parameters:

<WindowName>	String containing the name of a window.

Return values:

<WindowIndex>	Index number of the window.

Example:	`LAY:IDEN:WIND? '2'`
	Queries the index of the result display named '2'.
	Response:
	`2`

Usage: Query only

LAYout:REMove[:WINDow] <WindowName>

Removes a window from the display in the active channel.

Setting parameters:

<WindowName>	String containing the name of the window. In the default state, the name of the window is its index.

Example:	`LAY:REM '2'`
	Removes the result display in the window named '2'.

Usage: Setting only

LAYout:REPLace[:WINDow] <WindowName>,<WindowType>

Replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active channel while keeping its position, index and window name.

To add a new window, use the `LAYout:ADD[:WINDow]?` command.

Setting parameters:

<WindowName>   String containing the name of the existing window.
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowType>   Type of result display you want to use in the existing window. See `LAYout:ADD[:WINDow]?` on page 46 for a list of available window types.

Example: `LAY:REPL:WIND '1',MTAB`
Replaces the result display in window 1 with a marker table.

Usage: Setting only

LAYout:SPLitter <Index1>, <Index2>, <Position>

Changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Note that windows must have a certain minimum size. If the position you define conflicts with the minimum size of any of the affected windows, the command does not work, but does not return an error.
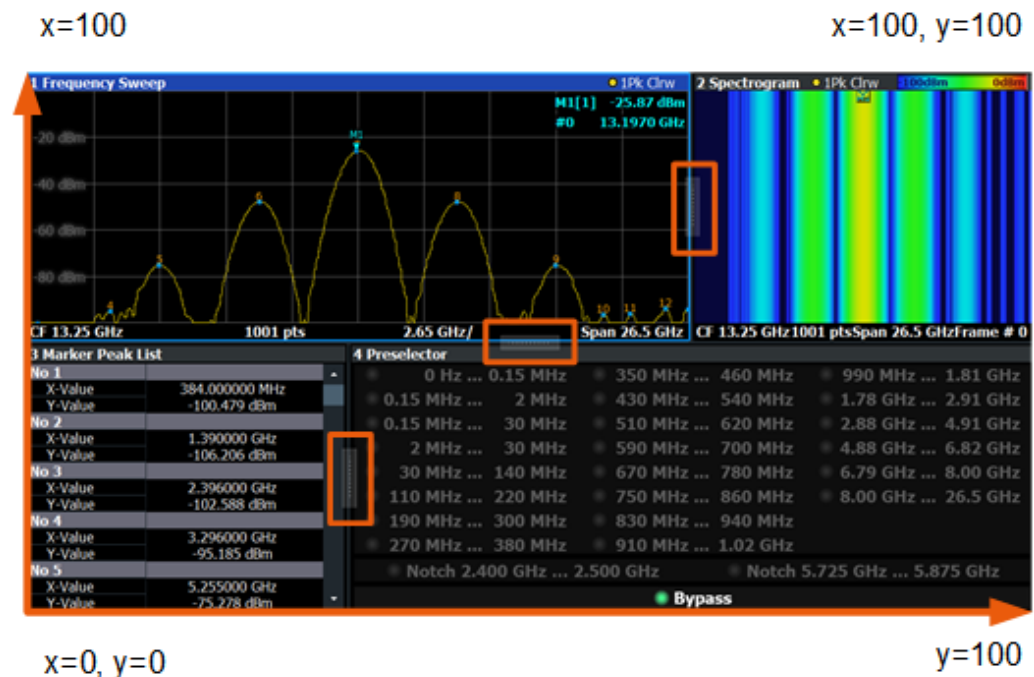

Figure 7-1: SmartGrid coordinates for remote control of the splitters

Setting parameters:

<Index1>   The index of one window the splitter controls.

<Index2>   The index of a window on the other side of the splitter.

\<Position\>	New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu). The point of origin (x = 0, y = 0) is in the lower left corner of the screen. The end point (x = 100, y = 100) is in the upper right corner of the screen. (See Figure 7-1.) The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically. Range: 0 to 100
Example:	`LAY:SPL 1,3,50` Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Table"') to the center (50%) of the screen, i.e. in the figure above, to the left.

Example:	`LAY:SPL 1,4,70`
	Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Peak List"') towards the top (70%) of the screen.
	The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.
	`LAY:SPL 3,2,70`
	`LAY:SPL 4,1,70`
	`LAY:SPL 2,1,70`

Usage:	Setting only

7.3   Configuration

7.3.1   Configuring test duration

[SENSe:]CONFigure:DURation \<MeasTime\>

Queries or sets the measurement time.

Parameters:

<MeasTime>   <numeric value>

Default unit: S

Example: //Set measuring time to 100 seconds.
`SENS:CONF:DUR 100`

Manual operation: See "Time limit" on page 21

[SENSe:]CONFigure:CLICk:COUNt <Clicks>

Sets the click-count limit that stops the measurement.

Parameters:

<Clicks>   <numeric value>

Range: 1 to 1000

Example: //Define click count limit.
`SENS:CONF:CLIC:COUN 1000`

Manual operation: See "Click limit" on page 21

[SENSe:]CONFigure:CLICk[:STATe] <ClickCountLimitState>

Activates or deactivates the click limit.

Parameters:

<ClickLimit>   ON | OFF | 1 | 0

ON | 1
Activates the click limit.
OFF | 0
Deactivates the click limit.

Example: //Activate click limit.
`SENS:CONF:CLIC:STAT ON`

Manual operation: See "Click limit" on page 21

7.3.2 Configuring amplitude settings

INPut:ATTenuation:AUTO <State>

This command turns automatic determination of the attenuation level on and off.

When you turn it on, the R&S EPL1000 selects an attenuation that results in a good signal-to-noise ratio without overloading the RF input.

Parameters:

<State>	ON | OFF
	ON
	Selects automatic attenuation mode.
	OFF
	Selects manual attenuation mode.
	*RST: ON

Example:	//Turn on auto ranging
	`INP:ATT:AUTO ON`

Manual operation:	See "Attenuation Mode" on page 22

INPut:ATTenuation:PROTection[:STATe] <State>

This command turns the availability of attenuation levels of 10 dB or less on and off.

Parameters:

<State>	ON | OFF | 1 | 0
	*RST: 1

Example:	//Turn on input protection
	`INP:ATT:PROT ON`

Manual operation:	See "10 dB Minimum Attenuation" on page 23

INPut:ATTenuation[:VALue] <Attenuation>

This command defines the attenuation at the RF input.

To protect the input mixer, attenuation levels of 10 dB or less are possible only if you have turned off the input protection with `INPut:ATTenuation:PROTection[:STATe]` on page 51.

Parameters:

<Attenuation>	Range: 0 dB to 55 dB
	*RST: 10 dB
	Default unit: dB

Example:	//Define attenuation
	`INP:ATT 40dB`

Manual operation:	See "Attenuation Mode" on page 22

7.3.3   Configuring channel settings

[SENSe:]LIMit:PMARgin<ch> <Margin>

Queries or sets the margin for the peak detector of a single channel.

Suffix:

<ch>	1..4
	Number of requested channel.

Parameters:

<Margin>	<numeric value>
	Default unit: dB

Example: //Set the margin peak detector to 0.3 dB.
SENS:LIM:PMAR 0.3

Manual operation: See "Margin Peak Detector" on page 26

7.3.4 Configuring analysis settings

CALCulate<n>:CSEarch:CONFigure:FACTor <Factor>

Requests or modifies the factor for switching operations.

Suffix:

<n>	irrelevant

Parameters:

<Factor>	F1 | F66 | F5
	F1
	1.0
	F66
	0.66
	F5
	0.5

Example: //Set the factor for switching operations to 0.66.
CALC1:CSE:CONF:FACT F66

Manual operation: See "Switching operations" on page 27

CALCulate<n>:CSEarch:CONFigure:MCRate <ManualClickRate>

Requests or modifies the manual click rate in clicks per minute.

Suffix:

<n>	irrelevant

Parameters:

<ManualClickRate>	<numeric value>

Example: //Set the click rate to 30 clicks per minute.
`CALC1:CSE:CONF:MCR 30`

Manual operation: See "Manual Click Rate" on page 27

CALCulate<n>:CSEarch:CONFigure:SOPeration <Operations>

Requests or modifies the number of operations for the switching operations.

Suffix:

<n>	irrelevant

Parameters:

<Operations>	<numeric value>

Example: //Set the value of operations to 12.
`CALC1:CSE:CONF:SOP 12`

Manual operation: See "Switching operations" on page 27

CALCulate<n>:CSEarch:CONFigure:STANdard <Standard>

Requests or modifies the measurement standard.

Suffix:

<n>	irrelevant

Parameters:

<Standard>	**CED6** CISPR-14-1-Ed.6.
	CED7 CED7: CISPR-14-1-Ed.7.
	RIGNiters Repetitive-igniters.

Example: //Select the CISPR-14-1 Ed. 7 Standard.
`CALC1:CSE:CONF:STAN CED7`

Manual operation: See "CISPR 14-1 Ed.6" on page 27
See "CISPR 14-1 Ed.7" on page 27
See "Repetitive Igniters" on page 27

CALCulate<n>:CSEarch:CONFigure:TYPE <ClickRateType>

Requests or modifies the measurement type.

Suffix:

\<n\>	irrelevant

Parameters:

\<ClickRateType\>   MCLicks | MCRate | SOPeration

MCLicks
Measure Clicks

MCRate
Manual Click Rate

SOPeration
Switching operations

Example: //Set the measurement type to 'Measure Clicks'.
CALC1:CSE:CONF:TYPE MCL

Manual operation: See "Measure Clicks" on page 27
See "Manual Click Rate" on page 27
See "Switching operations" on page 27

CALCulate\<n\>:CSEarch:CONFigure:DLAW \<DENANLawActive\>

Activates or deactivates the Denan law.

Suffix:

\<n\>	Irrelevant

Parameters:

\<DENANLawActive\>   ON | OFF | 1 | 0

ON | 1
Activates Denan law.

OFF | 0
Deactivates Denan law.

Example: //Activate Denan law.
CALC1:CSE:CONF:DLAW ON

Manual operation: See "Denan Law" on page 28

7.3.5 Configuring limit line settings

CALCulate<n>:LIMit<li>:CATalog?

Displays the catalog of limit lines.

Suffix:

<n>   Irrelevant

   Irrelevant

Example: `CALC1:LIM1:CAT?`
`//Result`
`'EN 55011 E FIELD 10M AV GROUP 2 CLASS`
`B.LIN',962,'EN 55011 E FIELD 10M QP GROUP 1`
`CLASS B.LIN',700,'EN 55011 E FIELD 10M QP GROUP`
`2 CLASS B.LIN',962, ...`

Usage: Query only

CALCulate<n>:LIMit<li>:COMMent <Comment>

Defines a comment for a limit line.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<Comment>   String containing the description of the limit line.

CALCulate<n>:LIMit<li>:CONTrol:DOMain <SpanSetting>

Selects the domain of the limit line.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<SpanSetting>   FREQuency | TIME

FREQuency
For limit lines that apply to a range of frequencies.

TIME
For limit lines that apply to a period of time.

*RST: FREQuency

Example: `CALC:LIM:CONT:DOM FREQ`
Select a limit line in the frequency domain.

CALCulate<n>:LIMit<li>:CONTrol:MODE <Mode>

Selects the horizontal limit line scaling.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<Mode>   **ABSolute**
Limit line is defined by absolute physical values (Hz or s).

RELative
Limit line is defined by relative values related to the center fre-
quency (frequency domain) or the left diagram border (time
domain).

*RST: ABSolute

CALCulate<n>:LIMit<li>:CONTrol:OFFSet <Offset>

Defines an offset for a complete limit line.

Compared to shifting the limit line, an offset does not actually change the limit line defi-
nition points.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<Offset>   Numeric value.
The unit depends on the scale of the x-axis.

*RST: 0
Default unit: HZ

CALCulate<n>:LIMit<li>:CONTrol:SHIFt <Distance>

Moves a complete limit line horizontally.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Distance>	Numeric value.
	The unit depends on the scale of the x-axis.
	Default unit: HZ

CALCulate<n>:LIMit<li>:CONTrol:SPACing <InterpolMode>

Selects linear or logarithmic interpolation for the calculation of limit lines from one horizontal point to the next.

Suffix:

<n>	Window
	Limit line

Parameters:

<InterpolMode>	LINear | LOGarithmic
	*RST: LIN

Example: CALC:LIM:CONT:SPAC LIN

CALCulate<n>:LIMit<li>:CONTrol[:DATA] <LimitLinePoints>...

Defines the horizontal definition points of a limit line.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<LimitLinePoints>	Variable number of x-axis values.
	Note that the number of horizontal values has to be the same as the number of vertical values set with CALCulate<n>:LIMit :LOWer[:DATA] or CALCulate<n>:LIMit :UPPer[:DATA]. If not, the R&S EPL1000 either adds missing values or ignores surplus values.
	*RST: -
	Default unit: HZ

CALCulate\<n\>:LIMit\<li\>:COPY \<Line\>

Copies a limit line.

Suffix:

\<n\>   Window

\<li\>   Limit line

Parameters:

\<Line\>   **1 to 8**
number of the new limit line

                         \<name\>
String containing the name of the limit line.

Example: `CALC:LIM1:COPY 2`
Copies limit line 1 to line 2.
`CALC:LIM1:COPY 'FM2'`
Copies limit line 1 to a new line named FM2.

CALCulate\<n\>:LIMit\<li\>:DELete

Deletes a limit line.

Suffix:

\<n\>   Window

\<li\>   Limit line

CALCulate\<n\>:LIMit\<li\>:LOWer:MARGin \<Margin\>

Defines an area around a lower limit line where limit check violations are still tolerated.

Suffix:

\<n\>   irrelevant

\<li\>   Limit line

Parameters:

\<Margin\>   **numeric value**
*RST: 0
Default unit: dB

CALCulate\<n\>:LIMit\<li\>:LOWer:MODE \<Mode\>

Selects the vertical limit line scaling.

Suffix:

\<n\>   Window

	Limit line

Parameters:

<Mode>   **ABSolute**
Limit line is defined by absolute physical values.
The unit is variable.

RELative
Limit line is defined by relative values related to the reference level (dB).

*RST: ABSolute

CALCulate<n>:LIMit<li>:LOWer:OFFSet <Offset>

Defines an offset for a complete lower limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Suffix:

<n>   Window

   Limit line

Parameters:

<Offset>   Numeric value.

*RST: 0
Default unit: dB

CALCulate<n>:LIMit<li>:LOWer:SHIFt <Distance>

Moves a complete lower limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Suffix:

<n>   Window

   Limit line

Parameters:

<Distance>   Defines the distance that the limit line moves.

Default unit: DB

CALCulate<n>:LIMit<li>:LOWer:SPACing <InterpolType>

Selects linear or logarithmic interpolation for the calculation of a lower limit line from one horizontal point to the next.

Suffix:

<n>   Window

   Limit line

Parameters:

<InterpolType>   LINear | LOGarithmic

                        *RST: LIN

[SENSe:]LIMit:SELect <LimitLine>

Sets the requested limit line for all channels.

Parameters:

<LimitLine>   String containing the name of the limit line.

Example: //Set the limit line with the name '123'.
                        SENSe:LIMit:SELect '123'

Manual operation: See "Select Limit Line" on page 24

CALCulate<n>:LIMit<li>:LOWer:THReshold <Threshold>

Defines a threshold for relative limit lines.

The R&S EPL1000 uses the threshold for the limit check, if the limit line violates the threshold.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<Threshold>   Numeric value.
                        The unit depends on CALCulate<n>:LIMit<li>:UNIT
                        on page 61.
                        *RST: -200 dBm
                        Default unit: DBM

CALCulate<n>:LIMit<li>:LOWer[:DATA] <LimitLinePoints>...

Defines the vertical definition points of a lower limit line.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<LimitLinePoints>   Variable number of level values.
                        Note that the number of vertical values has to be the same as
                        the number of horizontal values set with CALCulate<n>:
                        LIMit<li>:CONTrol[:DATA]. If not, the R&S EPL1000
                        either adds missing values or ignores surplus values.
                        *RST: Limit line state is OFF
                        Default unit: DBM

CALCulate<n>:LIMit<li>:NAME <Name>

Selects a limit line that already exists or defines a name for a new limit line.

Suffix:

<n>	Window
	Limit line

Parameters:

<Name>	String containing the limit line name.
	*RST: REM1 to REM8 for lines 1 to 8

CALCulate<n>:LIMit<li>:UNIT <Unit>

Defines the unit of a limit line.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Unit>	If you select a dB-based unit for the limit line, the command automatically turns the limit line into a relative limit line.
	*RST: DBM

CALCulate<n>:LIMit<li>:UPPer:MARGin <Margin>

Defines an area around an upper limit line where limit check violations are still tolerated.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Margin>	**numeric value**
	*RST: 0
	Default unit: dB

CALCulate<n>:LIMit<li>:UPPer:MODE <Mode>

Selects the vertical limit line scaling.

Suffix:

<n>	Window

	Limit line

Parameters:

<Mode>	**ABSolute**
	Limit line is defined by absolute physical values.
	The unit is variable.
	RELative
	Limit line is defined by relative values related to the reference level (dB).
	*RST: ABSolute

CALCulate<n>:LIMit<li>:UPPer:OFFSet <Offset>

Defines an offset for a complete upper limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Offset>	Numeric value.
	*RST: 0
	Default unit: dB

CALCulate<n>:LIMit<li>:UPPer:SHIFt <Distance>

Moves a complete upper limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Distance>	Defines the distance that the limit line moves.

CALCulate<n>:LIMit<li>:UPPer:SPACing <InterpolType>

Selects linear or logarithmic interpolation for the calculation of an upper limit line from one horizontal point to the next.

Suffix:

<n>	Window
	Limit line

Parameters:

<InterpolType>   LINear | LOGarithmic

                 *RST: LIN

CALCulate<n>:LIMit<li>:UPPer:THReshold <Limit>

Defines an absolute limit for limit lines with a relative scale.

The R&S EPL1000 uses the threshold for the limit check, if the limit line violates the threshold.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<Limit>   Numeric value.
                 The unit depends on `CALCulate<n>:LIMit<li>:UNIT` on page 61.

                 *RST: -200
                 Default unit: dBm

CALCulate<n>:LIMit<li>:UPPer[:DATA] <LimitLinePoints>...

Defines the vertical definition points of an upper limit line.

Suffix:

<n>   irrelevant

   Limit line

Parameters:

<LimitLinePoints> Variable number of level values.
                   Note that the number of vertical values has to be the same as the number of horizontal values set with `CALCulate<n>:LIMit<li>:CONTrol[:DATA]`. If not, the R&S EPL1000 either adds missing values or ignores surplus values.

                   *RST: Limit line state is OFF
                   Default unit: DBM

7.3.6 Configuring LISN settings

INPut:LISN:FILTer:HPASs[:STATe] <State>

This command turns the 150 kHz highpass filter of the ENV216 network on and off.

Prerequisites for this command

- Select ENV216 network (`INPut:LISN[:TYPE]`).

Parameters:

<State>   ON | OFF | 1 | 0

                           *RST: OFF

Example: //Turn on high pass filter
                          INP:LISN:TYPE ENV216
                          INP:LISN:FILT:HPAS ON

INPut:LISN:PHASe <Phase>

This command selects one LISN phase to be measured.

The command is available in all applications (spectrum, receiver, I/Q analyzer and analog demodulator).

Parameters:

<Phase>   **L1**

                           L2
                           Available for networks with four phases (R&S ESH2Z5, R&S ENV4200 and R&S ENV432)

                           L3
                           Available for networks with four phases (R&S ESH2Z5, R&S ENV4200 and R&S ENV432)

                           N
                           *RST: L1

Example: //Select phase L1
                          INP:LISN:PHAS L1

INPut:LISN[:TYPE] <Type>

This command turns automatic control of a LISN on and off. It also selects the type of network.

Parameters:

<Type>   **ENV216**
                           R&S ENV 216: two phases and highpass are controllable.

                           AMN6500
                           R&S AMN6500: two phases and highpass are controllable

                           ENV432
                           R&S ENV 432: four phases are controllable.

                           ENV4200
                           R&S ENV 4200: four phases are controllable.

                           ESH2Z5
                           R&S ESH2-Z5: four phases (incl. protective earth) are controllable.

ESH3Z5

R&S ESH3-Z5: two phases (incl. protective earth) are controllable.

FOURphase

R&S ESH2-Z5: four phases (incl. protective earth) are controllable.

OFF

Turns off control of the LISN.

TWOPhase

R&S ESH3-Z5: two phases (incl. protective earth) are controllable.

*RST: OFF

Example: //Select LISN
`INP:LISN:TYPE TWOP`

Manual operation: See "LISN type" on page 28

7.4 Performing measurements

7.4.1 Measurement control

ABORt

This command aborts the measurement in the current measurement channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC` or `*WAI` command after `ABORt` and before the next command.

To abort a sequence of measurements by the Sequencer, use the `INITiate:` `SEQuencer:ABORt` command.

Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish. The remote channel to the R&S EPL1000 is blocked for further commands. In this case, you must interrupt processing on the remote channel first to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the R&S EPL1000 on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa**: `viClear()`
- **GPIB**: `ibclr()`
- **RSIB**: `RSDLLibclr()`

Now you can send the `ABORt` command on the remote channel that runs the measurement.

Example:	`ABOR;INIT:IMM` Aborts the measurement and restarts it.
Usage:	Event
Manual operation:	See "Stop" on page 29

HOLD

Interrupts (holds) a scan.

To resume the scan, use `INITiate<n>[:IMMediate]` on page 66.

Example:	`HOLD` Interrupts the scan.
Usage:	Event
Manual operation:	See "Hold" on page 29

INITiate<n>[:IMMediate]

Initiates a new measurement.

The click rate analyzer application only supports single measurements. The function of continuous measurements is not supported.

For a single measurement, the R&S EPL1000 stops measuring when it has reached the preset measurement duration.

- Synchronization to the end of the measurement is possible with `*OPC`, `*OPC?` or `*WAI`.

Suffix:

<mt>	INITiate1 initiates a bargraph measurement. INITiate2 initiates a scan.

Example:	//Start a single scan (with a scan count = 20), and wait until the measurement is done
	`INIT2:CONT OFF`
	`SWE:COUN 20`
	`INIT2;*WAI`

Usage:	Event

Manual operation: See "Run / Run Single" on page 29

INITiate<n>:UANalysis

Starts the analysis of the measured clicks.

Suffix:

<n>	irrelevant

Example: //Start analysis.
`INITiate1:UANalysis`

Usage: Event

Manual operation: See "Update Analysis" on page 29

7.4.2 Measurement sequences

INITiate:SEQuencer:ABORt

Stops the currently active sequence of measurements.

Usage: Event

INITiate:SEQuencer:IMMediate

Starts a new sequence of measurements by the Sequencer.

Before this command can be executed, the Sequencer must be activated (see `SYSTem:SEQuencer` on page 68).

Example: `SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single sequence mode so each active measurement is performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.

INITiate:SEQuencer:MODE <Mode>

Defines the capture mode for the entire measurement sequence and all measurement groups and channels it contains.

Note: To synchronize to the end of a measurement sequence using `*OPC`, `*OPC?` or `*WAI`, use `SINGle` Sequencer mode.

Parameters:

<Mode>
SINGle
Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence is finished.

CONTinuous
Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence restarts with the first one and continues until it is stopped explicitly.

*RST: CONTinuous

SYSTem:SEQuencer <State>

Turns the Sequencer on and off. The Sequencer must be active before any other Sequencer commands (`INIT:SEQ...`) are executed, otherwise an error occurs.

Parameters:

<State>
ON | OFF | 0 | 1

ON | 1
The Sequencer is activated and a sequential measurement is started immediately.

OFF | 0
The Sequencer is deactivated. Any running sequential measurements are stopped. Further Sequencer commands (`INIT:SEQ...`) are not available.

*RST: 0

Example:
`SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single Sequencer mode so each active measurement is performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.
`SYST:SEQ OFF`

7.5 Analyzing results

- Using markers 69

7.5.1　Using markers

CALCulate<n>:DELTamarker<m>:AOFF

Turns off *all* delta markers.

Suffix:

<n>	Window
<m>	irrelevant

Example:　　　CALC:DELT:AOFF
　　　　　　　　　Turns off all delta markers.

CALCulate<n>:DELTamarker<m>[:STATe] <State>

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker turns on delta marker 1.

Suffix:

<n>	Window
<m>	Marker

Parameters:

<State>　　　　　ON | OFF | 0 | 1

　　　　　　　　　OFF | 0
　　　　　　　　　Switches the function off

　　　　　　　　　ON | 1
　　　　　　　　　Switches the function on

Example:	`CALC:DELT2 ON` Turns on delta marker 2.
Manual operation:	See "Marker State" on page 33 See "Marker Type" on page 34

CALCulate\<n\>:DELTamarker\<m\>:DETector \<Detector\>

Sets a delta marker to the positive peak or quasi peak detector.

Suffix:

\<n\>	Irrelevant
\<m\>	1..4

Parameters:

\<Detector\>	POSitive | QPEak
	POSitive Positive Peak
	QPEak Quasi Peak

Example:	//Set delta marker 2 to quasi peak. `CALC:DELT2:DET QPE`

CALCulate\<n\>:DELTamarker\<m\>:X:RELative \<Position\>

Queries the relative position of a delta marker on the x-axis.

If necessary, the command activates the delta marker first.

Suffix:

\<n\>	Irrelevant
\<m\>	1..4 Marker

Parameters:

\<Position\>	\<numeric value\> Default unit: S

Example:	//Position the delta marker to reference marker +0.1235 sec-
	onds.
	`CALC:DELT3:X:REL 0.1235`

Manual operation:	See "Marker Position X-value" on page 33

CALCulate\<n\>:DELTamarker\<m\>:X[:VALue] \<Position\>

Moves a delta marker to a specific coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker

Parameters:

<Position>	<numeric value>
	Defines the delta marker position on the x-axis.
	Range:　　　The range depends on the current x-axis range. Default unit: S

Example: //Set delta Marker number 3 to 0:20:01.1235.
`CALC:DELT3:X 1201.1235`

Manual operation: See "Marker Position X-value" on page 33

CALCulate<n>:DELTamarker<m>:Y?

Queries the result at the position of the specified delta marker. Always relative to reference marker.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker

Return values:

<Result>	<numeric value>
	Default unit: dBuV

Example: `CALC:DELT2:Y?`
//Result
`-0.44552612305`

Usage: Query only

Manual operation: See "Marker Position X-value" on page 33

CALCulate<n>:DELTamarker<m>:MREFerence <Reference>

Selects a reference marker for a delta marker other than marker 1.

Suffix:

<n>	Window
<m>	Marker

Parameters:

<Reference>

Example:	CALC:DELT3:MREF 2
	Specifies that the values of delta marker 3 are relative to marker 2.
Manual operation:	See "Reference Marker" on page 34

CALCulate<n>:DELTamarker<m>:CHANnel <Channel>

Selects the channel a delta marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Suffix:

<n>	irrelevant
<m>	1..4
	Marker

Parameters:

<Channel>	Channel number the marker is assigned to.
Example:	//Positions delta marker 2 on channel 2.
	CALC:DELT2:CHAN 2
Manual operation:	See "Assigning the Marker to a channel" on page 34

CALCulate<n>:DELTamarker<m>:CLICk:LEFT

Sets the x-position of the delta marker number to the previous click.

The function correlates to the "Marker click left" softkey.

Suffix:

<n>	Irrelevant
<m>	1..4
	Marker

Example:	//Set delta marker 1 on the previous click.
	CALC:DELT1:CLIC:LEFT
Usage:	Event
Manual operation:	See "Marker click left" on page 34

CALCulate<n>:DELTamarker<m>:CLICk:RIGHt

Sets the x-position of the delta marker number to the next click.

The function correlates to the "Marker click right" softkey.

Suffix:

<n>	Irrelevant

| <m> | 1..4 |
| | Marker |

| **Example:** | //Set delta marker 1 on the next click. |
| | `CALC:DELT1:CLIC:RIGH` |

| **Usage:** | Event |

| **Manual operation:** | See "Marker click right" on page 35 |

CALCulate<n>:MARKer<m>:AOFF

Turns off all markers.

Suffix:

| <n> | Window |
| <m> | Marker |

| **Example:** | `CALC:MARK:AOFF` |
| | Switches off all markers. |

| **Manual operation:** | See "All Markers Off" on page 35 |

CALCulate<n>:MARKer<m>[:STATe] <State>

Turns markers on and off. If the corresponding marker number is currently active as a delta marker, it is turned into a normal marker.

Suffix:

| <n> | Window |
| <m> | Marker |

Parameters:

<State>	ON	OFF	0	1
	**OFF	0**
	Switches the function off
	**ON	1**
	Switches the function on

| **Example:** | `CALC:MARK3 ON` |
| | Switches on marker 3. |

| **Manual operation:** | See "Marker State" on page 33 |
| | See "Marker Type" on page 34 |

CALCulate<n>:MARKer<m>:CHANnel <Channel>

Selects the channel the marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker

Parameters:

<Channel>	<numeric value>
Example:	//Assign marker 3 to channel 1 `CALC:MARK3:CHAN 1`
Manual operation:	See "Assigning the Marker to a channel" on page 34

CALCulate<n>:MARKer<m>:CLICk:LEFT

Sets the x-position of the normal marker number to the previous click.

The function correlates to the "Marker click left" softkey.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker
Example:	//Set normal marker 1 on the previous click. `CALC:MARK1:CLIC:LEFT`
Usage:	Event
Manual operation:	See "Marker click left" on page 34

CALCulate<n>:MARKer<m>:CLICk:RIGHt

Sets the x-position of the normal marker number to the next click.

The function correlates to the "Marker click right" softkey.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker
Example:	//Set normal marker 1 to the next click. `CALC:MARK1:CLIC:RIGH`
Usage:	Event
Manual operation:	See "Marker click right" on page 35

CALCulate<n>:MARKer<m>:X[:VALue] <Position>

Moves a marker to a specific coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker

Parameters:

<Position>	<numeric value>
	Defines the marker position on the x-axis.
	Range: The range depends on the current x-axis range. Default unit: S

Example: //Set normal Marker number 3 to 0:20:01.1235.
`CALC:MARK3:X 1201.1235`

Manual operation: See "Marker Position X-value" on page 33

CALCulate<n>:MARKer<m>:Y?

Requests the y-position of a marker. Always relative to reference marker.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker

Return values:

<Result>	<numeric value>
	Default unit: dBuV

Example: //Request y-position of marker number 1.
`CALC:MARK1:Y?`
//Result
`22.8459472656`

Usage: Query only

Manual operation: See "Marker Position X-value" on page 33

CALCulate<n>:MARKer<m>:DETector <Detector>

Sets a normal marker to the positive peak or quasi peak detector.

Suffix:

<n>	Irrelevant
<m>	1..4 Marker

Parameters:

<Detector>	POSitive	QPEak

POSitive
Positive Peak

QPEak
Quasi Peak

Example:	//Set normal marker 2 to positive peak. `CALC:MARK2:DET POS`
Manual operation:	See "Detector" on page 34

7.6 Retrieving results

7.6.1 Retrieving measurement results

CALCulate<n>:MEASurement:CHANnel<ch>:FAIL?

Indicates whether the specific channel has failed.

Suffix:

<n>	Irrelevant
<ch>	1..4 Number of requested channel.

Return values:

<Failed>	YES | NO | 1 | 0
	YES | 1 The channel passed the test.
	NO | 0 The channel failed the test.

Example:	//Query the test result of channel 4. `CALC1:MEAS:CHAN4:FAIL`
Usage:	Query only
Manual operation:	See "Flow Diagram" on page 19

CALCulate<n>:MEASurement:DREMain?

Displays the remaining measuring time in seconds

Suffix:

<n>	Irrelevant

Return values:

<RemainingTime>	<numeric value>
	Default unit: s

Example: //Display remaining measuring time.
`CALC1:MEAS:DREM?`

Usage: Query only

Manual operation: See "Time limit" on page 21

CALCulate<n>:MEASurement:FAIL?

Indicates whether one of the channels has failed.

Suffix:

<n>	Irrelevant

Return values:

<Failed>	YES | NO | 1 | 0
	YES | 1
	At least one channel failed the test.
	NO | 0
	All channels passed the test.

Example: //Query if any of the channels have failed.
`CALC1:MEAS:FAIL?`

Usage: Query only

Manual operation: See "Test Result" on page 19

7.6.2 Retrieving result summary

CALCulate<n>:MEASurement:CHANnel<ch>:CLICk:COUNt?

Shows the number of clicks of a channel.

Suffix:

<n>	Irrelevant
<ch>	1..4
	Number of requested channel.

Return values:

<Count>	<numeric value>

Example: `CALC:MEAS:CHAN1:CLIC:COUN?`
//Result
`190`

Usage: Query only

Manual operation: See "Clicks" on page 17

CALCulate<n>:MEASurement:CHANnel<ch>:CLICk:RATE?

Indicates the click rate of a channel.

Suffix:

<n>	Irrelevant
<ch>	1..4
	Number of requested channel.

Return values:

<Count>	<numeric value>
	Default unit: S

Example: `CALC:MEAS:CHAN1:CLIC:RATE?`
//Result
`2.4000`

Usage: Query only

Manual operation: See "Click Rate [1/min]" on page 17

CALCulate<n>:MEASurement:CHANnel<ch>:LQ:CGReater:PERCent?

Displays the percentage of clicks of a channel that exceed the calculated click limit compared to the total number of clicks recorded.

Suffix:

<n>	Irrelevant
<ch>	1..4
	Number of requested channel.

Return values:

<Percent>	<numeric value>
	Default unit: %

Example: `CALC:MEAS:CHAN1:LQ:CGRE:PERC?`
//Result
`86.000`

Usage: Query only

Manual operation: See "Clicks > Lq [%]" on page 18

CALCulate<n>:MEASurement:CHANnel<ch>:LQ:CGReater[:COUNt]?

Displays the number of clicks of a channel that exceed the calculated click limit.

Suffix:

<n>	Irrelevant
<ch>	1..4 Number of requested channel.

Return values:

<Count>	<numeric value>
Example:	CALC:MEAS:CHAN1:LQ:CGRE:COUN? //Result
Example:	80
Usage:	Query only
Manual operation:	See "Clicks > Lq" on page 18

CALCulate<n>:CSEarch:CLISt<cli>:FRIDge?

Get the fridge-rule number within channel.

Suffix:

<n>	Irrelevant
<cli>	1..1000 Number of requested click.

Return values:

<FridgeNumber>	<numeric value>
	-1 (Invalid) Fridge-rule was not used.
Example:	CALC1:CSE:CLIS1:FRID? //Result 4
Usage:	Query only
Manual operation:	See "Fridge Rule Used" on page 16 See "Fridge Rule" on page 19

CALCulate<n>:CSEarch:CLISt<cli>:R600?

Indicates whether the 600 ms Rule was applied to a single click or not.

Suffix:

<n>	Irrelevant

| <cli> | 1..1000 |
| | Number of requested click. |

Return values:

<Click600msRule>	0 | 1
	0
	600 ms rule was used.
	1
	600 ms rule was not used.

Example:	CALC1:CSE:CLIS1:R600
	//Result
	1

| **Usage:** | Query only |

| **Manual operation:** | See "600ms Rule Used" on page 16 |
| | See "600 ms Rule" on page 18 |

7.6.3 Retrieving click info

CALCulate<n>:CSEarch:CLISt<cli>:ADJacent?

Get the fridge-rule duration of the adjacent click.

Suffix:

| <n> | Irrelevant |

| <cli> | 1..1000 |
| | Number of requested click. |

Return values:

<FridgeDuration>	**-1**
	Invalid: fridge-rule not used.
	<numeric value>
	Duration of the fridge rule.
	Range: 0.0000 to 0.0300
	Default unit: ms

Example:	CALC1:CSE:CLIS1:ADJ
	//Result
	0.0135

Usage: Query only

Manual operation: See "Adjacent Pulse" on page 16

CALCulate<n>:CSEarch:CLISt<cli>:ALL?

Get all data of all available clicks.

Suffix:

<n>   Irrelevant

<cli>   Irrelevant

Return values:

<ClickListData>   Channel, ClickType, Duration ,Separation, AdjacentPulse, Fridge-
                        Rule, 600msRule, Time, Reserved: 5x "-1", ...

Example: `CALC1:CSE:CLIS1:ALL`
                     `//Result`
                     `1400000,2,0.0300,0.1805,0.0300,1,0,3.1895,-1,`
                     `-1,-1,-1,-1`
                     `1400000,2,0.0300,-1,-1,-1,0,3.4000,-1,-1,-1,-1,`
                     `-1`
                     `...`

Usage: Query only

CALCulate<n>:CSEarch:CLISt<cli>:CHANnel?

Get the channel frequency of a single click.

Suffix:

<n>   Irrelevant

<cli>   1..1000
                        Number of requested click.

Return values:

<ClickFrequency>   150000 | 500000 | 1400000 | 30000000
                        Default unit: Hz

Example: `CALC1:CSE:CLIS1:CHAN`
                     `//Result`
                     `150000`

Usage: Query only

Manual operation: See "Channel" on page 15
                      See "Frequency" on page 24

CALCulate<n>:CSEarch:CLISt<cli>:DURation?

Get the duration of a single click.

Suffix:

<n>	Irrelevant
<cli>	1..1000 Number of requested click.

Return values:

<ClickDuration>	<numeric value> Default unit: S

Example:
```
CALC:CSE:CLIS1:DUR
//Result
0.1910
```

Usage:　　　　　Query only

Manual operation:　　See "Pulse Duration" on page 15

CALCulate<n>:CSEarch:CLISt<cli>:SEParation?

Get the fridge rule distance of a single click to the adjacent click.

Suffix:

<n>	Irrelevant
<cli>	1..1000 Number of requested click.

Return values:

<ClickSeparation>	**-1** Invalid: fridge rule was not used. Default unit: S

Example:
```
CALC1:CSE:CLIS1:SEP
//Result
0.0300
```

Usage:　　　　　Query only

Manual operation:　　See "Separation" on page 16

CALCulate<n>:CSEarch:CLISt<cli>:SIZE?

Returns the total number of measured clicks.

Suffix:

<n>	Irrelevant
<cli>	Irrelevant

Return values:

<ClickListSize>	<numeric value>

Example:
```
CALC1:CSE:CLIS1:SIZE
//Result.
277
```

Usage:　　　　　　Query only

Manual operation:　　See "Clicks" on page 17

CALCulate<n>:CSEarch:CLISt<cli>:TIME?

Returns the start time of a single click since the start of measurement.

Suffix:

<n>　　　　　　　　Irrelevant

<cli>　　　　　　　　1..1000
　　　　　　　　　　Number of requested click.

Return values:

<ClickStartTime>　　<numeric value>
　　　　　　　　　　Default unit: S

Example:　　　　CALC1:CSE:CLIS1:TIME
　　　　　　　　　　//Result
　　　　　　　　　　3.0710

Usage:　　　　　　Query only

Manual operation:　　See "Time" on page 16

CALCulate<n>:CSEarch:CLISt<cli>:TYPE?

Get the type of a single click.

Suffix:

<n>　　　　　　　　Irrelevant

<cli>　　　　　　　　1..1000
　　　　　　　　　　Number of requested click.

Return values:

<ClickType>　　　　0 | 1 | 2 | 3

　　　　　　　　　　0
　　　　　　　　　　Duration less than 10ms.

　　　　　　　　　　1
　　　　　　　　　　10ms <= duration < 20ms

　　　　　　　　　　2
　　　　　　　　　　20ms <= duration < 200ms

　　　　　　　　　　3
　　　　　　　　　　Continuous disturbance

Example:　　　　CALC1:CSE:CLIS1:TYPE
　　　　　　　　　　//Result
　　　　　　　　　　2

Usage:　　　　　　Query only

Manual operation:　　See "Click Type" on page 15

CALCulate<n>:CSEarch:CLISt<cli>[:DATA]?

Get all data for a single click.

Suffix:

<n>	Irrelevant
<cli>	1..1000 Number of requested click.

Return values:

<SingleClickData>	Channel, ClickType, Duration, Separation, AdjacentPulse, FridgeRule, 600msRule, Time, Reserved: 5x "-1"

Example:

```
//Result
150000,2,0.1910,-1,-1,-1,0,3.0710,-1,-1,-1,-1,
-1
```

Usage: Query only

List of commands

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