

# Parameters in Scope mode



In *Scope* mode, the Selective Radiation Meter can display the time characteristic in real time of a signal captured using frequency selection. As with an oscilloscope, you can measure pulse widths and periodic times and set triggers. The settable time intervals range from 24 hours down to microseconds, with a resolution down into the nanosecond range.

The *resolution bandwidth (RBW)*, *sweep time* and *time resolution* parameters are related, and there are some limits imposed on the wide setting ranges due to purely physical constraints or because of the selected measurement method. This Technical Note takes a closer look at this.

## ▲ Center frequency (Fcent)

Users can select the center frequency anywhere within the entire frequency range covered by the measuring antenna being used. If the exact frequency is known, it can be entered numerically or by using the rotary control. Alternatively, it can be determined using *Spectrum Analysis* mode and the center frequency set from there. This center frequency setting is automatically transferred to *Scope* mode using the *Extras/Scope* softkey.

## ▲ Resolution bandwidth (RBW)

The resolution bandwidth (RBW) can also be chosen from any of the values available from the analyzer, i.e. from 40 kHz to 32 MHz with 10 steps per decade. For example, if you want to measure a GSM frequency channel, the choice is simple: 200 kHz. If the spectral distribution of the signal is unknown, the bandwidth can be determined in *Spectrum Analysis* mode by setting Fcent and Fspan so that the signal fills the entire screen. When you then switch to *Scope* mode using *Extras/Scope*, the instrument automatically sets the resolution

*The Selective Radiation Meter SRM-3006 from Narda Safety Test Solutions has been specially developed for environmental and safety measurements in electromagnetic fields. Using isotropic measuring antennas, the instrument covers the entire frequency range from 9 kHz to 6 GHz. It can therefore be used equally well to investigate safety in the near field region of long wave transmitters, make measurements on radio and TV broadcast transmitters, and determine exposure levels caused by the latest generation of mobile telecommunications services.*

**Unique:  
Time domain -  
frequency-selective**

### Parameter transfer

<i>Spectrum Analysis</i>	▶	<i>Scope</i>
<i>Fcent</i>	▶	<i>Fcent</i>
<i>Fspan</i>	▶	<i>RBW</i>

bandwidth to match this frequency span or to the nearest available higher value.

## Sweep Time and Time Resolution

The X-axis in Scope mode is the time axis. The scaling of this axis is determined using the *Sweep Time* parameter. When the sweep time has elapsed, the analyzer has filled the display exactly once with results. The sweep time can be set between 500 ns and 24 hours.

The *Time Resolution* parameter determines how many measurement results are displayed. The time resolution can be varied between 31.25 ns and 90 minutes.

The SRM-3006 helps users avoid making settings that don't make sense with these large time periods; a sweep time less than the time resolution would be an example. The instrument only allows settings that result in at least 16 measured values per sweep.

On the other hand, the number of measured values must be kept within limits. A sweep time of 24 hours with a time resolution of 31.25 ns would result in almost 3 trillion measured values! In such cases, the SRM-3006 combines several measurement results for a time interval and displays the maximum, minimum, and average value of all the results that lie within this interval. This allows you to see a peak level or dropout lasting around 100 ns even in a sweep time of 24 hours!

Information on how to make settings is found in the Operating Manual, Section 6.11 (Parameter transfer) and Section 10.3 (Measurement parameters, Scope mode).

The next section gives you detailed information about the physical relationships between parameters.

<i>Parameter</i>	<i>Limitation</i>	<i>Result Type</i>
<i>Fcent, RBW</i>	<i>none</i>	
<i>Time Resolution</i>	<i>= 1/RBW</i> <i>&gt; 1/RBW</i>	<i>Act</i> <i>Max, Avg, Min</i>
<i>Sweep Time</i>	<i>≥ 16/RBW</i>	

## ▲ Physical relationships

The measurement method used generates results at regular time intervals corresponding exactly to the inverse of the resolution bandwidth RBW. Each individual measured value represents the actual instantaneous value and is designated by the Result Type **Act**.

Example: The condition below is met if the settings are: RBW = 1 MHz and Time Resolution = 1  $\mu$ s.

### Time Resolution = 1/RBW

In this case, the SRM-3006 displays the **Act** values – assuming that the observation period or Sweep Time is not longer than 16 ms (see Saving measured values, below).

If instead you select a time resolution and RBW where the relationship is

### Time Resolution > 1/RBW,

the SRM-3006 will then determine the average value from the actual values occurring within the Time Resolution period and displays the maximum, average, and minimum values as Result Types **Max**, **Avg**, and **Min**.

## ▲ Saving measured values

One reason for summarizing individual measured values as statistical values is the amount of memory space required. The device can store a maximum of 16,000 instantaneous values per sweep (Sweep Time). If the settings would result in more than this number of values, the instrument switches automatically from Result Type **Act** to Result Type **Max**, **Avg** and **Min** and selects a larger Time Resolution.

The SRM-3006 takes at least eight instantaneous values to ensure a reliable average, i.e. it automatically ensures that the condition

### Time Resolution $\geq$ 8/RBW

is fulfilled. The upper limit for the number of values that the SRM-3006 can form an average from is around  $10^9$ /RBW.

**Time Resolution = 1/RBW**

► Result Type **Act**

**Time Resolution > 1/RBW**

► Result Types **Max, Avg, Min**

Set internally by the instrument:

**Time Resolution  $\geq$  8/RBW**

Number of separate measured values, *n*, within a time period:

**$n = \text{Time Resolution} \times \text{RBW}$**



**Notional example: Summarization of 20 actual instantaneous values into a group of three values: Maximum, average, and minimum.**

**The Max, Avg, and Min traces are formed from large numbers of such groups of three values.**

Example: The settings  $RBW = 1\text{ MHz}$  and  $\text{Time Resolution} = 1\ \mu\text{s}$  match the condition of  $\text{Time Resolution} = 1/RBW$ . Nevertheless, if you change the Sweep Time from 16 ms to 17 ms, the number of measured values per sweep will exceed 16,000. The device therefore sets the Time Resolution to  $8\ \mu\text{s}$  automatically.

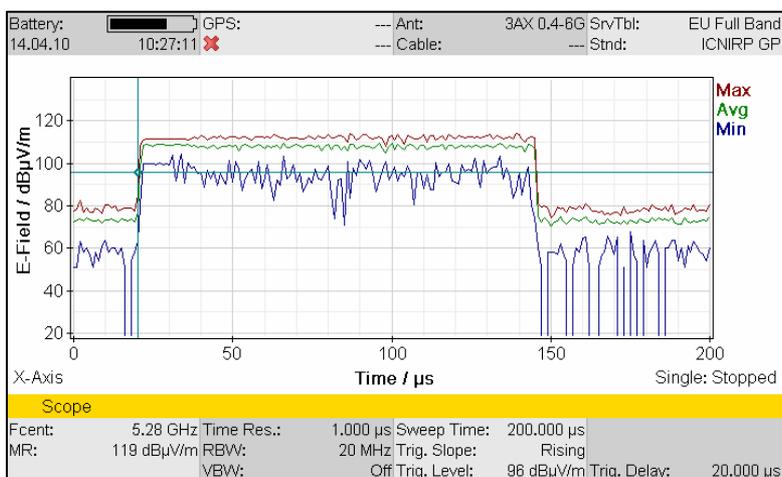
Because the maximum, average, and minimum results are saved, the instrument does not miss any peaks even over long recording periods. There is only a reduction in the accuracy of determining the time of an event. This is not a problem for the application, e.g. investigating environmental electromagnetic compatibility.

## Display

The memory of the SRM-3006 can store considerably more measured values than can be shown on the display, so there is only an indirect relationship between the display and the measurement value memory.

The screen display area has a width of 600 pixels. If the Sweep Time is exactly 600 times the Time Resolution, each point on the X-axis represents one measured value or a trio of values. This is usually not the case, however.

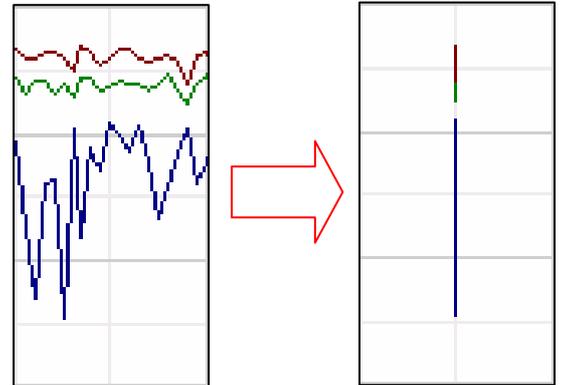
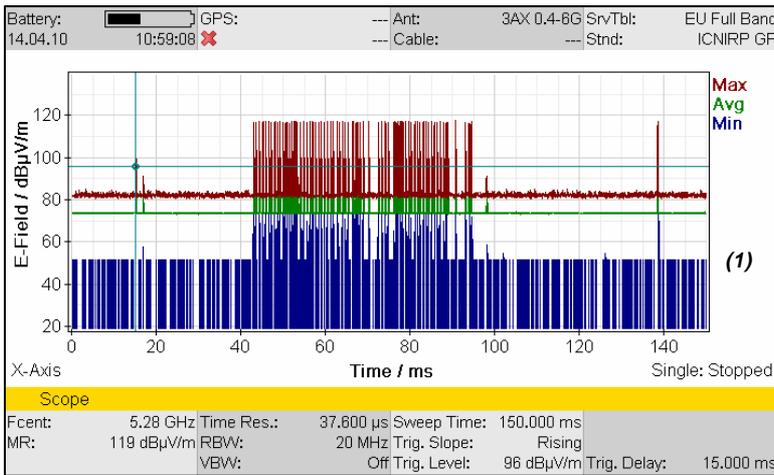
Case 1: There are fewer measured values than pixels. Here, the SRM-3006 links the measured values together to form continuous curves. The cursor will only jump to actual measured values, not intermediate ones.



**Example: Record of a single WLAN burst over 200 µs with a resolution of 1 µs.**

**The SRM-3006 displays 200 trios of measured values over a width of 600 pixels and links them together into curves.**

Case 2: There are more measured values than pixels. In this case, the SRM-3006 displays several measured values or trios for each position on the X-axis. A vertical bar represents the range covered by the values. You can still read out the individual measurement values with the recorded time resolution from the memory using the cursor.



Notional example, above: Representation of 20 trios of values on a single point on the X-axis. The red maximum value bar overlaps the average value bar.

Example, left: This is also a WLAN measurement. Here, though, a complete sequence of WLAN bursts has been recorded over a period of 150 ms with a resolution of 37.6 µs.



The blue "picket fence" representing the minimum values (1) may at first seem puzzling. This occurs because of the logarithmic scale of dBµV/m used for the Y-axis. If the minimum value falls below the detection threshold, it would be shown as zero on a linear scale, but on a logarithmic scale it is minus infinity!

This results in the vertical lines (2), which can be clearly seen in the second example on the left, recorded with a higher time resolution.

## Technical Notes from Narda Safety Test Solutions

These notes report, in no particular order, on the possible applications of Narda measuring equipment. Typical applications for the Selective Radiation Meter SRM-3006 are safety measurements on

- **Radio and TV transmitters (AM, FM, DAB, DVB-T)**
- **Mobile phone stations (GSM-900, GSM-1800, UMTS, CDMA, W-CDMA, LTE)**
- **Wireless communications networks (WiFi, WLAN, WiMAX, DECT, ZigBee, Bluetooth)**
- **Radio controls using ISM frequencies**

The Technical Notes are found on [www.narda-sts.de](http://www.narda-sts.de) under Literature ► High Frequency

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