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## 1 Relevant CISPR standards

### QUESTION

Which CISPR standards are relevant to set up projects in EMCview?

### ANSWER:

EMCview already contains many pre-defined project. In most cases it is as simple as connecting your DUT to a LISN and the spectrum analyzer, start EMCview, select the applicable standard / project file and click the start button to run a measurement.

The spectrum analyzer parameters have been chosen in order to cover many different analyzer brands and models.

With respect to spectrum analyzer settings, you have to look primarily at CISPR 16-1-1, CISPR 16-2-1, CISPR 16-2-2, CISPR 16-2-3 and CISPR 25.

With respect to emission limits, you need to figure out which of the standards CISPR 11, 13, 14, 15, 22, 25, 32 are applicable for your DUT. Most limit lines for conducted and radiated noise are already predefined in EMCview. EMCview segment files are specified to be on the safe side, rather than to achieve the fastest measurement speed. However, with good knowledge of CISPR 16 and depending on the properties of your DUT and on the capabilities of your analyzer model, you can optimize segment files to speed measurement time.

Below a few screenshots of relevant CISPR 16 and CISPR 25 details. CISPR xx and EN 550xx standards are equivalent. The full standards need to be purchased.

Standards can be obtained in the web shops of national standardization institutes and various other sellers in the internet.

There are also free sources as some countries provide free access to national standards which often are adopted CISPR standards. They may however not always match the latest edition of the relevant base standards. For example:

<https://law.resource.org/pub/in/bis/manifest.litd.9.html>

CISPR 25 / 4.4.1

Parameters when using spectrum analyzers:

**Table 1 – Spectrum analyser parameters**

Service / Frequency range MHz	Peak detection		Quasi-peak detection		Average detection	
	RBW at -3 dB	Scan time	RBW at -6 dB	Scan time	RBW at -3 dB	Scan time
AM broadcast and mobile services 0,15 - 30	9/10 kHz	10 s / MHz	9 kHz	200 s / MHz	9/10 kHz	10 s / MHz
FM broadcast 76 - 108	100/120 kHz	100 ms / MHz	120 kHz	20 s / MHz	100/120 kHz	100 ms / MHz
Mobile services 30 - 1 000						
TV Band I 41- 88						
TV Band III 174 - 230						
TV Band IV/V 470- 890						
DAB 171- 245						
DTTV 470 - 770	100/120 kHz	100 ms / MHz	Does not apply	Does not apply	100/120 kHz	100 ms / MHz
Mobile service 1 000 - 2 500	100/120 kHz	100 ms / MHz	Does not apply	Does not apply	100/120 kHz	100 ms / MHz
GPS L1 civil 1 567 – 1 583	Does not apply	Does not apply	Does not apply	Does not apply	9/10 kHz	1 s / MHz

When a spectrum analyser is used for measurements, the **video** bandwidth shall be at least three times the resolution bandwidth (RBW).

CISPR 16-2-1 / 6.6.2 Measurement times / scan rates for CW signals:

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CISPR 16-2-1:2014 © IEC 2014

**Table 1 – Minimum scan times for the three CISPR bands with peak and quasi-peak detectors**

Frequency band		Scan time $T_s$ for peak detection	Scan time $T_s$ for quasi-peak detection
A	9 kHz to 150 kHz	14,1 s	2 820 s = 47 min
B	0,15 MHz to 30 MHz	2,985 s	5 970 s = 99,5 min = 1 h 39 min
C and D	30 MHz to 1 000 MHz	0,97 s	19 400 s = 323,3 min = 5 h 23 min

**Table 2 – Minimum measurement times for the four CISPR bands**

Frequency band		Minimum measurement time $T_m$
A	9 kHz to 150 kHz	10,00 ms
B	0,15 MHz to 30 MHz	0,50 ms
C and D	30 MHz to 1 000 MHz	0,06 ms
E	1 GHz to 18 GHz	0,01 ms

Depending on the type of disturbance, the scan time may have to be increased, especially for swept quasi-peak measurements. In extreme cases, the measurement time  $T_m$  at a certain frequency may have to be increased to 15 s, if the level of the observed disturbance is not steady (see 6.5.1).

CISPR 16-2-1 Minimum sweep time

CISPR 16-2-1:2014 © IEC 2014

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## B.7 Frequency scan rate

The scan rate of a spectrum analyzer or a scanning measuring receiver should be adjusted for the CISPR frequency band and the detection mode used. The minimum sweep time/frequency, or the fastest scan rate, is listed in Table B.1:

**Table B.1 – Sweep time/frequency or fastest scan rate**

Band	Peak-detection	Quasi-peak detection
A	100 ms/kHz	20 s/kHz
B	100 ms/MHz	200 s/MHz
C and D	1 ms/MHz	20 s/MHz

For a spectrum analyzer or scanning measuring receiver used in a fixed tuned non-scanning mode, the display sweep time may be adjusted independently of the detection mode, and according to the needs for observing the behaviour of the disturbance. If the level of disturbance is not steady, the reading on the measuring receiver should be observed for at least 15 s to determine the maximum (see 6.5.1).

CISPR 16-2-1 / D.2.1 Scan rates and measurement times for AVG detector

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CISPR 16-2-1:2014 © IEC 2014

**Table D.1 – Pulse suppression factors and scan rates for a 100 Hz video bandwidth**

	Band A	Band B	Bands C and D
Frequency range	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 000 MHz
IF bandwidth $B_{res}$	200 Hz	9 kHz	120 kHz
Video bandwidth $B_{video}$	100 Hz	100 Hz	100 Hz
Max. scan rate	17,4 kHz/s	0,9 MHz/s	12 MHz/s
Max. suppression factor	6 dB	39 dB	61,5 dB

CISPR 16-2-1 / D.4 Measurement of slowly intermittent, unsteady or drifting narrowband disturbances

CISPR 16-2-1:2014 © IEC 2014

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**Table D.2 – Meter time constants and the corresponding video bandwidths and maximum scan rates**

	Band A	Band B	Bands C and D
Frequency range	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 000 MHz
IF bandwidth $B_{res}$	200 Hz	9 kHz	120 kHz
Meter time constant	160 ms	160 ms	100 ms
Video bandwidth $B_{video}$	0,64 Hz	0,64 Hz	1 Hz
Maximum scan rate	8,9 s/kHz	172 s/MHz	8,3 s/MHz

## 2 Measurement time

### QUESTION 1

Measurements take very long. Can't it be accelerated?

#### ANSWER 1:

In short: Yes, measurement times can be accelerated. However it requires good knowledge of the CISPR standards and of the technical specifications of your spectrum analyzer. If the sweep time is too short, the measurement result may not be correct. You can change the sweep time easily by modifying the segment files of your project.

The implementation of sweep times of EMCview is conservative to put you on the safe side and to find a common denominator for all the supported spectrum analyzer models.

Things you need to consider:

CISPR 16 standards

DUT properties – are its emissions mainly CW or are there also slowly fluctuating or short sporadic emissions?

Spectrum analyzer properties such as the number of display points / frequency steps per sweep, sweep settings for its Quasi-Peak detector

The measurement time is dominated by sweep time settings. Next, the number of segments could be reduced by matching it with the number of display points of your analyzer. Less segments means less sweeps and consequently less time for initializing sweeps and read out measurement data via SCPI. However the gain in speed is relatively small, compared to what you can achieve with faster sweep times.

Detailed answer:

We were considering following points when choosing the sweep time settings in the segment files:

- 1) CISPR 16 which specifies measurement equipment, measurement equipment settings and test set ups is done for measurement receivers mainly. There are also some specifications for spectrum analyzers, but for really compliant measurements you must use a measurement receiver. FFT based measurement / real time spectrum analysis can considerably speed up measurement times. Optimizing measurement speed for FFT based analyzers is not considered, as the documented technical properties of various analyzers may not be detailed enough.
- 2) Measurement equipment settings also depend on the properties of the DUT. A DUT which predominantly produces CW emissions can be measured with faster sweep times than a DUT which produces random disturbances. E.g. a device with a microcontroller that carries out various tasks and turns peripherals on/off depending on firmware tasks; a fast measurement could miss noisy events. In practice, the engineer in the test house would observe the DUT emissions for fluctuations first and then determine measurement time.
- 3) It must be clear, it is not a target of EMView to carry out 100% CISPR compliant measurements. First of all, we use a low cost spectrum analyzer and not an expensive measurement receiver. We are carrying out pre-compliance measurements to get an idea, if our DUT behaves well and most likely would pass type approval in the test house. Else, we would improve and re-test the design of the DUT, until we are confident to carry it to the test house.
- 4) We want to make pre-compliance measurements as simple as possible for.
- 5) EMView has to cover many different models of low cost spectrum analyzers.
- 6) We want to find a "common denominator" for the settings in order to cover analyzer models with different specifications
- 7) We want to make the settings to cover as many possible noise scenarios

In order to accomplish the points above, we tried to make a general table for measurement settings based on CISPR 16 specs. These meant, that we had to find the most applicable settings and consequently the sweep time is not optimized for every single case. You can measure too fast to be compliant, but you can't measure too slow.

QP detector measurement times are rather influenced by SA model performance than by CISPR specs. Typically, according to CISPR 16 we could measure faster, but we were looking at the sweep time auto settings of the analyzers, based on RBW and sweep frequency range. Using CISPR 16 parameters, would make the UNCAL message pop up at many spectrum analyzers.

#### **Our considerations for sweep segment size:**

- 1) The frequency step size must be equal to half of the resolution bandwidth (band A: 200 Hz, band B: 9 kHz, band C/D: 120 kHz) or less.
- 2) The number of frequency steps is determined by the number of pixels on the frequency axis of the display
- 3) Taking a Rigol DSA815 with its relatively small display with 601 measurement points per sweep as a common denominator.

As an example for the 150 kHz – 30 MHz band, we have RBW = 9kHz, -> frequency step size = 4.5 kHz, maximum sweep bandwidth = 600 \* 4.5 kHz = 2.7 MHz

To simplify the creation of segment files, we use a sweep bandwidth of 2.5 MHz

This results in following sweep segments: 150 kHz – 2.5 MHz, 2.5 MHz – 5 MHz, 5 MHz -7.5 MHz, 7.5 MHz – 10 MHz, .....27.5 MHz – 30 MHz

(easier to write down, copy and paste, etc. than 150 kHz – 2.7 MHz, 2.7 MHz – 5.4 MHz, 5.4 MHz – 8.1 MHz, 8.1 MHz – 10.8 MHz .....)

Optimizing sweep range to every analyzer would not significantly increase measurement time. The time reduction would come from less segments requiring less time to set up the sweep and read out the measurement results via SCPI.

**Our sweep time selection is based on the following table:**

Frequency range	CISPR Band	CISPR RBW	VBW	spacing between adjacent measurement points (=RBW/2)	min. Peak detection sweep time	min. QP detection sweep time	min. AVG detection sweep time
9 kHz - 150 kHz	Band A	200 Hz	$\geq 3 \times \text{RBW}$	100 Hz	100 ms/kHz	20 s/kHz	100 ms/kHz
150 kHz - 30 MHz	Band B	9 kHz	$\geq 3 \times \text{RBW}$	4.5 kHz	10 s/MHz	200 s / MHz	10 s/MHz
30 MHz - 300 MHz	Band C	120 kHz	$\geq 3 \times \text{RBW}$	60 kHz	100 ms/MHz	20 s/MHz	100 ms/MHz
300 MHz - 1 GHz	Band D	120 kHz	$\geq 3 \times \text{RBW}$	60 kHz	100 ms/MHz	20 s/MHz	100 ms/MHz
1 GHz - 18 GHz	Band E	1 MHz	$\geq 3 \times \text{RBW}$	500 kHz	100 ms/MHz	n.a.	100 ms/MHz

It is conservatively taking values from various CISPR tables and selecting the slowest sweep times as common denominator. Anyhow, every user can easily modify it upon his own considerations.

## QUESTION 2

EMCview uses the default settings for measurement points per sweep. Can't I accelerate the measurement time by changing the settings to a higher number of measurement points per sweep?

## ANSWER 2:

Any manual settings of the spectrum analyzer will be overwritten by an initialization sequence of EMCview to ensure a defined state prior to starting any measurement.

Furthermore, the dominating factor is the sweep speed in [MHz/s] specified by the standards. Changing the number of measurement points per sweep would enable larger sweep segments, but the overall measurement time would remain unchanged, as the sweep speed in [MHz/s] cannot be changed. There would also hardly be any gain in speed with respect to the time needed in between segments to download the measurement data from the analyzer. Though fewer segments would mean less breaks in between the sweeps, the time to download data would increase due to an increased number of measurement points or in other words – fewer breaks, but longer breaks. A disadvantage of segments with a wider frequency span is increased measurement time, when measuring single segments.

To summarize – increasing the number of measurement points will not result in reduced overall measurement time.

## 3 Segment files

### QUESTION

In the software, if I want to select a different STEP frequency, e.g. 5 KHz (inside the CN RBW) to get more information or 20 KHz (more than CN RBW) to speed up the measuring, how can I do?

I think that I must change the low and high limit for each SEG1 band that compose the test configuration file right? But how many points for each band to increase or decrease the frequency step? Can you explain better with a little example?

### ANSWER:

Inside EMCview segment files you specify a series of single sweeps.

Example:

.....

FRQa\_\_1=150.000

Author: Mayerhofer



FRQb\_\_1=2.500.000

BW\_\_1=9000

Sweep\_1=25000

Att\_\_1=0

PreAmp1=off

Detector1=VAV

FRQa\_\_2=2.500.000

FRQb\_\_2=5.000.000

BW\_\_2=9000

Sweep\_2=25000

Att\_\_2=0

PreAmp2=off

Detector2=VAV

.....

In the above example, each segment has a start and stop frequency. With exception of the very first sweep, we always use 2.5 MHz sweep bandwidth between 150kHz and 30 MHz. Reason is that CISPR16 specifies two adjacent frequency points shall not be separated more than half of the RBW. Now CISPR 16 specifies in parallel the RBW for the frequency ranges 9kHz to 150kHz (RBW 200Hz), 150kHz to 30MHz (RBW 9kHz), 30 MHz to 1GHz (RBW 120kHz) and above 1 GHz (RBW 1 MHz).

Coming back to the above example, the step size shall be  $9 \text{ kHz} / 2 = 4.5 \text{ kHz}$ . Given the default number of measurement points of Rigol analyzers per sweep, 601 points, you can make a single sweep not larger than  $(601-1) * 4.5 \text{ kHz} = 2.7 \text{ MHz}$ . For easier segment file creation, I use 2.5 MHz per sweep. Siglent has a larger display and hence 710 points per sweep. Means, in order to be compliant with CISPR 16, you can make sweeps of  $(710-1) * 4.5 \text{ kHz} = 3.2 \text{ MHz}$ . You could make segments of 150 kHz – 3.35 MHz, 3.35 MHz – 6.55 MHz, 6.55 MHz to 9.75 MHz and so on all the way up to 30 MHz. This would be perfectly compliant with CISPR 16.

In our segment files we use 2.5 MHz segments, because the segment file is easy to read and it is CISPR 16 compliant for all analyzers supported by EMCview plus some margin.

If you want any other step size, e.g. 1 kHz and you use a Siglent with 710 measurement points, simply change the segment file using a text editor to:

.....

FRQa\_\_1=150.000

FRQb\_\_1=860.000

BW\_\_1=9000

Sweep\_1=25000

Att\_\_1=0

PreAmp1=off

Detector1=VAV

FRQa\_\_2=860.000

FRQb\_\_2=1.570.000

BW\_\_2=9000

Sweep\_2=25000

Att\_\_2=0

PreAmp2=off

Detector2=VAV

.....

However, CISPR 16 specifies one more parameter – the sweep time. For the band 150 kHz to 30 MHz, CISPR 16 specifies a sweep time of 100 kHz/second. This is why for 2.5MHz sweep segments, the segment file sets the sweep time to 25000 (=25000ms = 25 sec). Means that you could change the above segment file to:

.....

FRQa\_\_1=150.000

FRQb\_\_1=860.000  
BW\_\_1=9000  
Sweep\_1=7100  
Att\_\_1=0  
PreAmp1=off  
Detector1=VAV  
FRQa\_\_2=860.000  
FRQb\_\_2=1.570.000  
BW\_\_2=9000  
Sweep\_2=7100  
Att\_\_2=0  
PreAmp2=off  
Detector2=VAV

.....

The sweep is faster now, but you have more segments. Neglecting the time needed to read out the results of a sweep and starting a new sweep, the total sweep time remains the same. It would be no different, if you would increase the step size. Your sweep bandwidth becomes larger, but since you have to adjust the sweep time, the time would remain the same. At least unless you want to operate outside CISPR 16 specs, which you already would do by increasing the step size above RBW/2 anyway.

I have seen that it is possible into the SEG file to change the time sweep (expressed in ms) but they are very high value (500000ms for QP Detector or 200000ms for AVG Detector). I have tried some tests and checked that if more long is the value and more detailed are the result of final sweep. From your side what are the best value to use (compared to EMI Receiver) for Peak, Qpeak and Avg detectors?

#### ANSWER:

A part of this question is already covered by the answer to the previous question. Of course CISPR 16 sweep times differ depending on frequency range and detector type. Have a look at our CN application notes for more details.

When it comes to QP sweep times, we could use any sweep time equal or higher specified in CISPR 16. Now the sweep times specified for QP detectors specified by CISPR 16 would be too fast for the Rigol and Siglent analyzers. Using CISPR 16 QP sweep time would make an UNCALIBRATED message or icon pop up on the Siglent or Rigol analyzer. Uncalibrated means, that the sweep time is too fast for the chosen resolution bandwidth and sweep bandwidth. The filter would not have sufficient time to settle and the displayed amplitude would be lower than in reality. You would also see a frequency shift due to the delay of the filter response. Of course, you can change any settings in the segment file according to your will, however watch for the UNCALIBRATED message/icon on your analyzer.

## 4 Span / final scan

#### Question:

There is a term called "SPAN" which I do not understand. Normally span is regarded as the total frequency coverage from start to stop and is often used when a centre frequency is selected and the span then prescribes the frequency range which will operate about that centre. I do not see this as the case in the software so maybe, as is often the case with the EMC View software the terminology is not correct and it applies to something else.

#### Answer:

I assume your question refers to the entry box below



Detector	PDS
Sweep [ms]	250
RBW [Hz]	9k
Span [Hz]	50000
PreAmp	on
Attenuator [dB]	0

This is explained in chapter 10 of the manual. The “span” refers to the span of the final scan/peak re-measurement. It has no influence on standard measurement mode. When re-measuring peaks, it may happen that the frequency of the peak has drifted away in the meantime. This is what we observed with other EMC tools, which simply make a single frequency peak measurement. When we measured power supplies, we saw peaks disappearing due to the temperature related frequency drift of the switched mode regulators free-running oscillators. Consequently we developed EMCview and specified a “span” where EMCview sweeps around the frequency of the peak frequencies in order to find the maximum of potentially drifted peaks.

## 5 Manual setting of spectrum analyzer parameters / VBW

### Question:

I want to manually set the video bandwidth upfront to a measurement, however it always jumps to VBW “auto”,

### Answer:

We can't enable setting VBW manually upfront to the measurement. As we need to have a defined state for the initialization of the measurement, we issue a preset command to the analyzer first. Consequently the VBW BW gets preset to auto and once in remote mode, there is no manual access anymore, except by pressing the escape button which would abort communication between EMCview and the analyzer.

With EMCview REV 5.xxx you will be able to choose between VBW = Auto and VBW = 3\*RBW.

## 6 Modified settings don't seem to have any effect

### Question:

I changed the detector type and the sweep time, but it did not have any effect on the settings of the analyser when running a measurement

### Answer 1:

You most likely changed the settings for peak re-measurement and then ran a “Set 1” or “Set 2” measurement.

seg-set2	none
Detector	QPEAK
Sweep [ms]	250
RBW [Hz]	9k
Span [Hz]	50000
PreAmp	on
Attenuator [dB]	0
Remnt	none

settings for peak  
re-measurement  
only

These settings are for re-measuring peaks (or doing a final scan as it is called sometimes). There is a chapter in the manual, explaining peak re-measurements.

In order to change the settings for “set 1” or “set 2” measurements, you need to change the settings in the segment files. This can either be done with any text editor or with the built in editor in the SETTINGS menu of EMCview.

**Answer 2:**

If you change a segment file, while EMCview is open, you have to press the “Reload Project Files” button in the right upper corner of the window, after saving the modified segment file.

**Answer 3:**

If you set a spectrum analyzer parameter manually, before starting EMCview, it will be reset to default when EMCview starts. Means, manual spectrum analyzer settings will not have any effect. EMCview needs to start from a known configuration of parameters to ensure consistent measurements.

## 7 Graph / Traces

**Question:**

If I want to compare some traces in the same windows, I need to save each sweep in CHART mode? And is it possible to load the previous sweep and make a traces compare?

**Answer:**

Go to the FILE/UTILITIES menu and click SAVE CHART. You then can load up to three charts as reference traces in FILE/UTILITIES/LOAD REFERENCE TRACE/TRACE1,2,3

You would then see your latest chart plus 3 loaded charts (reference traces) in the graph window. In total you could see up to 8 curves – 4 charts composed of two graphs (set1/set2). The selected traces will then be listed on top of the graph window. By clicking on either the chart name or trace name, you can move it into the foreground. You can also compare curves against each other using the math function. E.g. subtract two curves from each other to explicitly show the difference.

## 8 ADC overload / IF overload

**Question 1:**

When I make measurements, the analyzer beeps and displays the warning ADC overload or IF overload. What is the reason?

**Answer 1:**

ADC overload or IF overload warnings report that the input of the spectrum analyzer is overdriven. Overdriven does not necessarily mean that the maximum permitted RF input power is exceeded.

If the internal attenuator setting is 0 and/or the pre-amplifier is on, strong input signals can drive the IF or ADC section into saturation. Increase the internal attenuation and / or turn off the pre-amplifier in the EMCview segment file.

**Question 2:**

When making conducted noise measurements with a Tekbox RF-current probe I get ADC / IF overload warnings? However I do not see any noise with excessive amplitude.

**Answer 2:**

The useful frequency range of Tekbox RF-current probes starts in the very low kHz range. You may measure an automotive switched mode regulator, starting conductive noise testing at 150 kHz according to CISPR 25. Have a look at the frequency range below 150 kHz. Your switched mode regulator may produce sub – harmonics, which you are not aware of. Sub-harmonics typically have high amplitude. The RF current probe picks it up and the amplitudes are high enough to saturate the spectrum analyzer. Use a 150 kHz high pass filter to suppress the sub harmonics, without losing dynamic range in the main frequency range of your measurement.

## 9 Base noise at low frequencies

### Question:

When I make measurements using a pre-configured project, even with the DUT not powered, I see that the base noise at very low frequencies is higher and then decreases towards higher frequencies. Is this normal?

### Answer:

There are two reasons, why you see higher noise at very low frequencies. The architecture of spectrum analyzers causes "0" Hz falling into the pass-band of the IF filter. As the filter curve does not have a perfectly rectangular shape, sideband noise appears at low frequencies, decreasing with increasing frequency. This noise behavior can also be observed without using EMCview. Second, when applying frequency response correction for LISN or RF-current probes, there is increased transmission loss towards low frequencies. Means conducted emission levels need to be compensated for the frequency response of the LISN or RF-current probe. This compensation also shifts the base noise of the analyzer to higher levels, similar as you would see on your analyzer in manual mode, when increasing the internal attenuator value.

## 10 Manually adding frequency points to the peak list

### Question 1:

I want to add some spurious which are close to the limits to the list of peaks?

### Answer 1:

Set a margin line, so that these spurious cross the margin line. Next press display peaks and all peaks crossing the margin line will be listed for consecutive peak measurement.

### Question 2:

I want to manually add frequencies to the peak list?

### Answer 2:

Press the MARKER button in the upper right corner of the EMCview screen. Select the measurement graph to which you want to add a marker (Set1/M1 or Set2/M2). Place a marker at the frequency, which you want to get added to the peak list. Press the COPY MARKERS button and the frequency will be copied into the peak list for consecutive peak measurement.

## 11 How to merge two measurement graphs to a worst case graph

### Question 1:

I carry out conducted noise measurements on Line and Neutral, or on the positive and negative supply line. How can I merge the two graphs to a worst case graph, showing the maximum spurious levels of both measurements in a single graph?

### Answer 1:

Carry out the measurement runs and save the results as chart. Click the MATH button in the right upper corner of the EMCview screen. In the File menu, load both graphs as traces, e.g. the measurement result of the positive supply line as Trace 1 and the measurement result of the negative supply line as Trace 2. Select the two traces, using the mathematical operations box at the right side of the EMCview screen. Select MAX as mathematical operation. Press the CALC button and a graph with the merged result will be displayed.

## 12 How to recalculate an existing measurement using different correction files

### Question 1:

I figured out, that my measurements were done choosing wrong correction files. Can I avoid re-measuring the set up and instead recalculate the graph with the right correction files?

### Answer 1:

Yes, this can be done by using the DISPL. PEAKS feature. Searching peaks also re-calculates and re-displays the graph. A chart file is composed of the graph data, plus limit lines and correction lines. However, the chart file stores limit lines and correction lines as data only, not containing their file names. In order to avoid overlaying newly chosen correction files with previous correction data, proceed as follows:

Start EMCview and load the chart that you want to re-calculate with new correction files. If you loaded the chart, without loading a project before, all configuration file boxes will be empty. Next, click the RELOAD PROJECT FILES button in the right upper corner of EMCview. Next click the DISPL. PEAKS button. This action stripped any correction files from the chart and displays the raw data as received from the spectrum analyzer.

Next, load the desired correction file and click the DISPL. PEAKS button. The resulting graph will then be re-calculated using the right correction file.

### Answer 2:

Starting with EMCview V5.44, you have the option to load the raw data of any previously saved chart. The FILE / UTILITIES / LOAD CHART menu was updated to load RAW DATA only. The chart raw data can then be combined with any correction file and re-calculated accordingly, using the DISPL. PEAKS feature. This way, you don't need to strip existing correction data using the process described in Answer 1.

Additional comment: You can load raw data of any chart, and then save this chart. The resulting chart file will not contain any correction data then. Note, that such files can only be re-loaded as chart then. If you would want to load it as trace, you had to re-calculate it with the DISPL. PEAKS feature while all correction files are set to NONE and then save as chart. Such charts, despite not containing real correction data, can also be loaded as trace.

## 13 Display Issues

### Question:

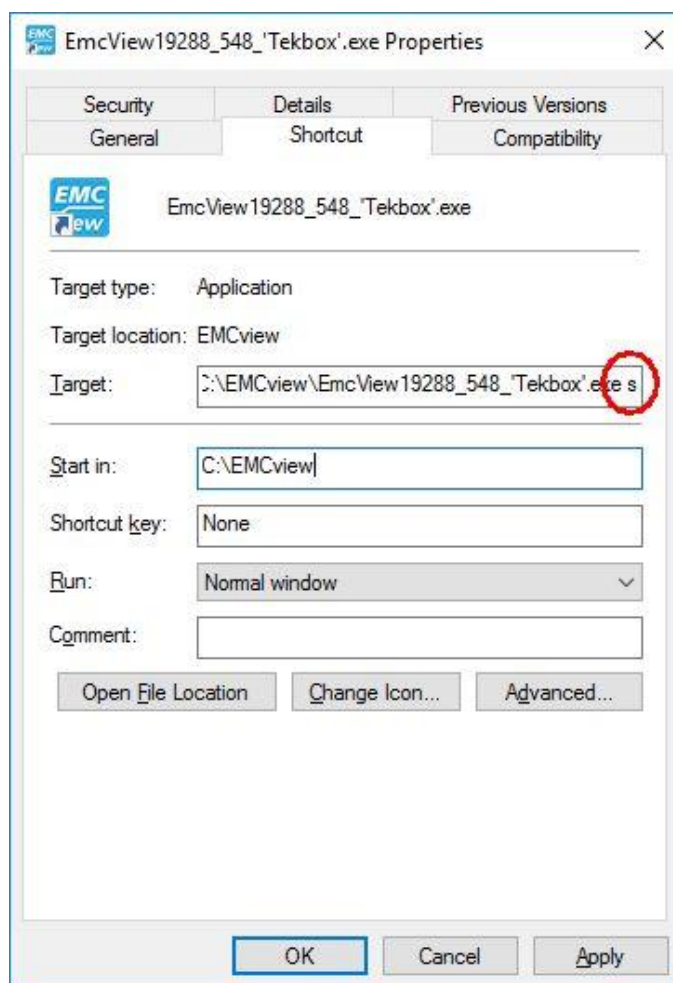
I run EMCview on a tiny laptop and don't get the complete EMCview window displayed on the screen. Is there any solution?

### Answer:

Create a desktop shortcut of EMCview.exe, then right click the EMCview icon, click properties, enter the parameter [space]s to the link and click the Apply button.

Upon starting EMCview, scrollbars will be added to the EMCview windows and you can scroll around to get access to the complete EMCview window

## FAQ Tekbox EMCview



## 14 Control of additional equipment with EMCview

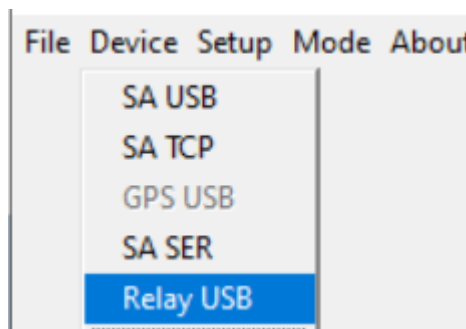
### Question:

I would like to automatically switch between antennas during an EMCview measurement run. Is this possible?

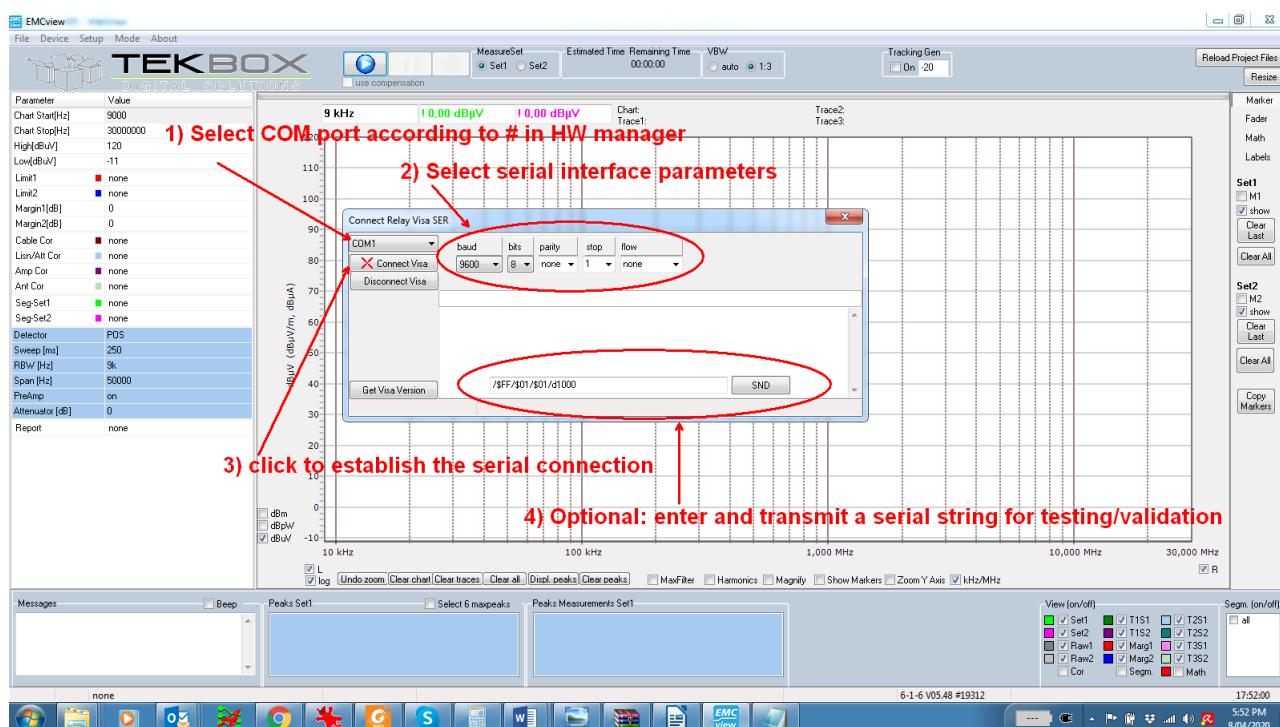
### Answer:

With EMCview V5.48 or higher, commands for ASCII controllable devices can be added to the segment files. You can use a device such as KMTronic 4UCRB Relay Controller to switch coaxial antenna relays or external attenuators.

Go to menu DEVICE to connect to the relay controller:



Next select the COM port and set up the parameters for the serial interface of the relay controller or any other serial device. Establish the connection and optionally transmit a string for testing/validation:



In order to automatically transmit test strings, they need to be entered into the desired segment file. You can add two serial command strings to each segment. Command SCPI\_A will be executed before the sweep of the corresponding segment. Command SCPI\_B will be executed after the sweep of the corresponding segment.



Example: Segment file with commands for the KMTronic 4UCRB Relay Controller

```
[Application]
Software=TekBox RP-W32-D10
Version=Release
Date=18.02.2020 13:52:22
[General]
Name=CN_CISPR15_SEGMENTS_AUG_relais.seq
[Data]
FRQa__1=150000
FRQb__1=2500000
BW____1=9000
Sweep_1=25000
Att___1=10
PreAmp1=off
Detector1=UAV
SCPI_A_1=/$FF/$01/$01/d1000
SCPI_B_1=/$FF/$01/$00/d1000
FRQa__2=2500000
FRQb__2=5000000
BW____2=9000
Sweep_2=25000
Att___2=10
PreAmp2=off
Detector2=UAV
```

SCPI\_A\_x: command sent at the beginning of the segment



SCPI\_B\_x: command sent at the end of the segment



#### Explanation:

**SCPI\_A\_x** with x being the segment number; command sent at the beginning of the segment

**SCPI\_B\_x** with x being the segment number; command sent at the end of the segment

**SCPI\_B\_x** is optional. A single command at the beginning of the segments would be sufficient to turn ON/OFF a relay.

**/\$FF/\$01/\$01**: serial string to turn on output 1 of the KMTronic 4UCRB Relay Controller. It will send the characters FF 01 01. This string is not EMView specific. Its syntax has to be chosen according to the manual of the corresponding device. FF 01 01 means turn ON Output 1 of the 4UCRB. EMView will send whatever string is entered in this place.

**/d1000**: wait 1000 ms before starting the sweep. Maximum value: 9999 ms

Special control commands can be entered as **/\$XX** (upper case, always 2 characters)

Example:

**/\$0A** LF, Line Feed (not **/\$0a**)

**/\$0D** CR, Carriage Return (not **/\$cr**)

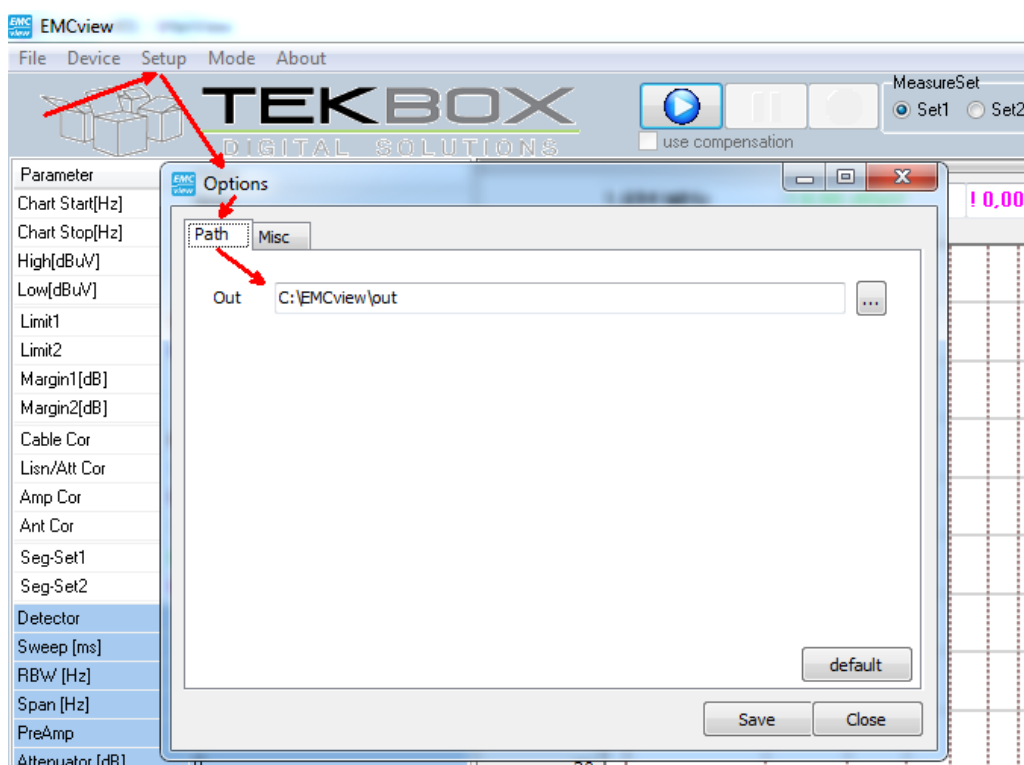
## 15 Setting the output path

### Question:

How can I make EMView remember the path where to save charts or reports?

### Answer:

When saving reports or charts, use the windows file dialog to change the path, if required. However, EMView always first points to the default **\\EMView\\out** directory. If you want to change the default directory, enter the **SETUP / OPTIONS** menu and set whatever path you want:



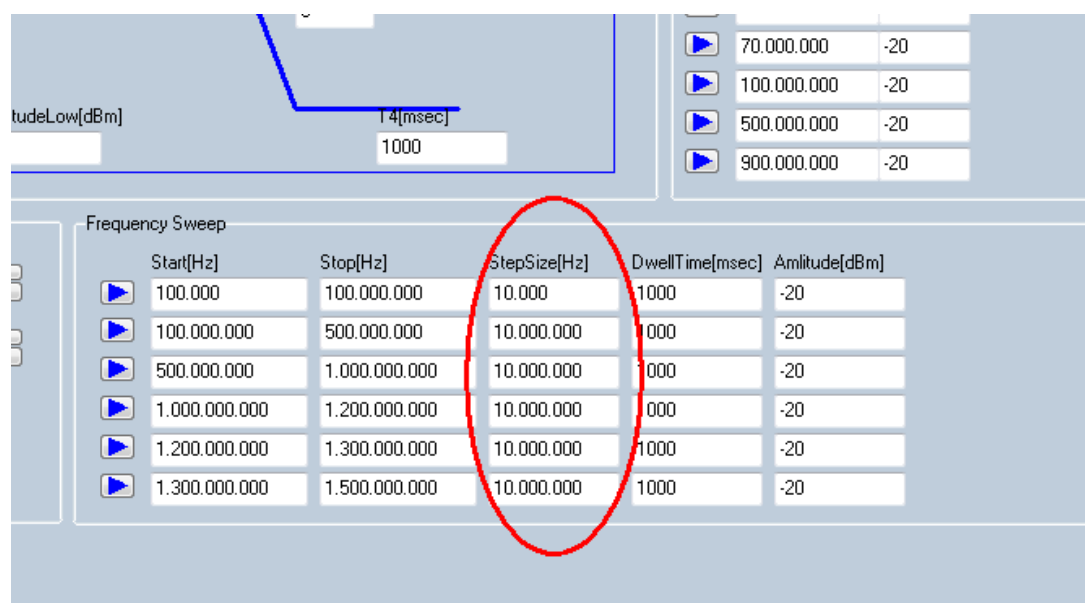
## 16 Sweep step size in Hz or in %

### Question:

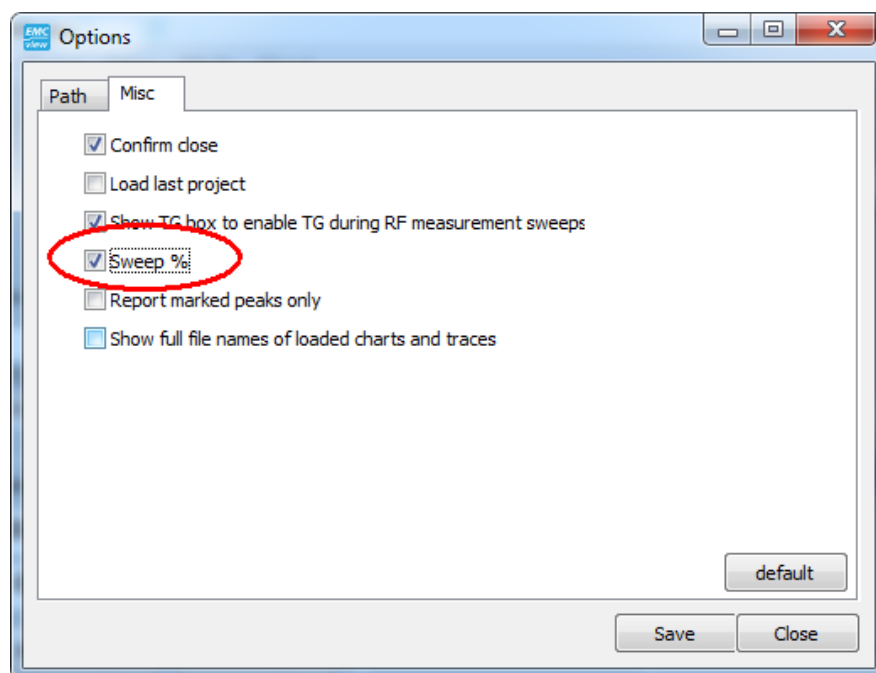
Can I change the sweep step size from Hz to %, in Generator mode?

### Answer:

By default, the step size of Frequency Sweeps is set to Hz:

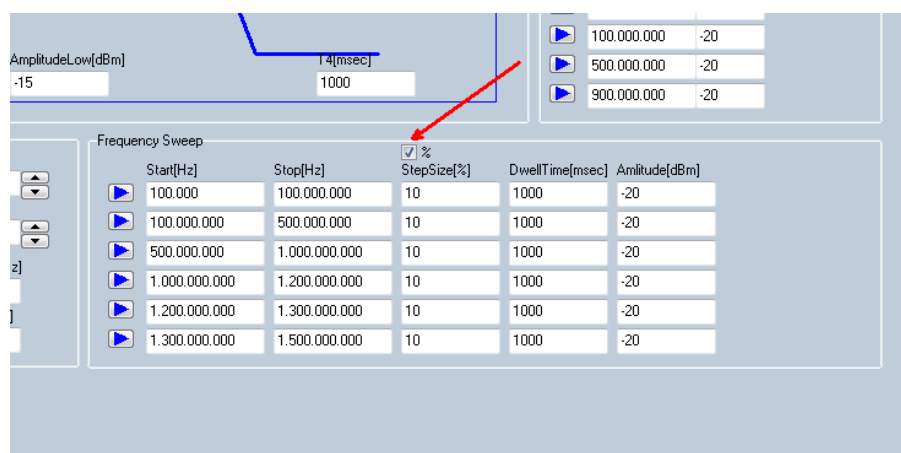


In order to change the step size to %, enter the **SETUP / OPTIONS** menu. In **MISC**, tick the % sweep box:



Click **Save** and **CLOSE**.

In the Frequency sweep window, a % tick box will appear. By activating/deactivating it, you can switch between step size in Hz or in %.



## 17 Correct sign for the values in correction / compensation files

### Question:

I am not sure, which sign I have to enter for the values in the correction/compensation files. How does EMCview calculate the amplitude values of the graph?

### Answer:

Graph amplitude = Raw amplitude [dBμV] – cable file [dB] – LISN file [dB] + ant file [dB] – amp file [dB]

Raw amplitude: spectrum analyzer measurement values

For more information, such as how to deal with current monitoring probe trans-impedance, antenna factors, unit conversion and other operations that can be carried out using the correction files, have a look at our EMCview application notes.

## 18 Internal vs. external attenuation; ADC overload

### Question:

I have an ADC overload issue. Should I apply internal or external attenuation? Why isn't EMCview automatically dealing with ADC overload? What is the impact of increasing or reducing attenuation?

### Answer:

#### ADC / IF overload:

An ADC overload event is only reported via buzzer beep and a message on the spectrum analyzer display. None of the spectrum analyzers supported by EMCview provides any means to remotely query the ADC/IF overload status.

#### Internal versus external attenuation:

Unless the maximum amplitude of the signal at the RF input of the spectrum analyzer is known, it is safer to use external attenuation. In contrary to an external attenuator, the internal attenuator of the spectrum analyzer does not offer increased protection with respect to excessive RF input power and frontend damage. From analyzer protection point of view, apply as much attenuation as possible without running into noise and sensitivity issues. Depending on the emission limits of the relevant standards, you have more or less margin for attenuation. Various standards, such as for example CISPR 25 Class 5 have limits close to the base noise of spectrum analyzer and not only require zero attenuation, but even use of a pre-amplifier to avoid crossing the limits with the analyzer base noise.

Most of the EMCview segment files are configuring minimum base noise, so review it with respect to your DUT and increase attenuation, if you are not sure about potentially harmful emission levels.

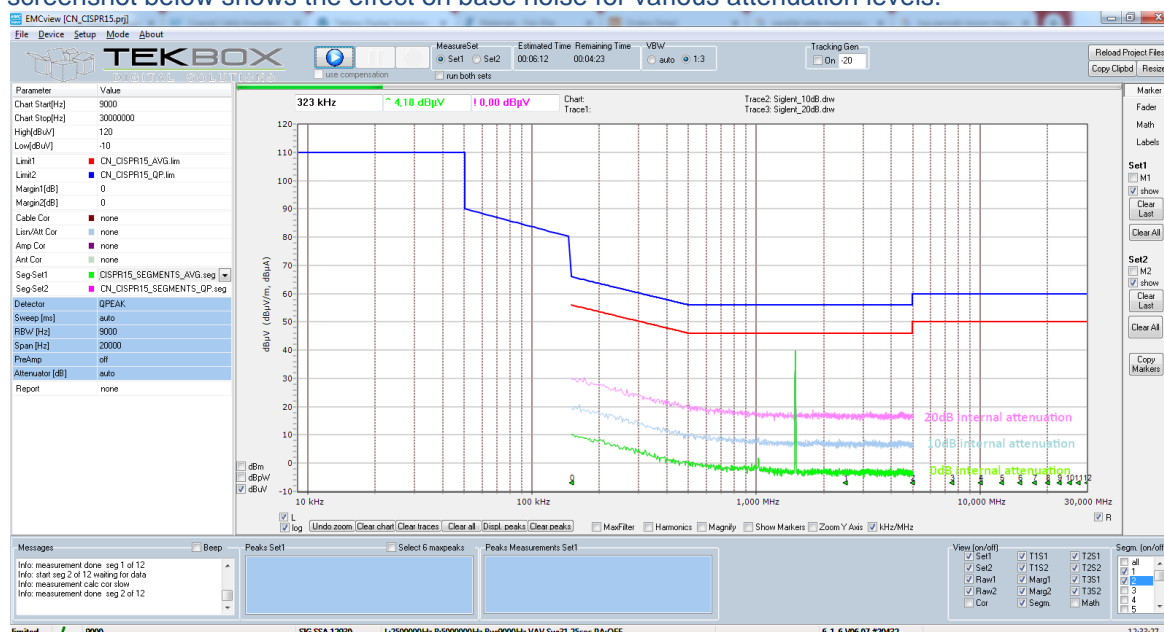
#### Configuring internal attenuation:

Internal attenuation is configured in the segment files, which you find in the SRC folder of EMCview:

```
.....
FRQa__1=150.000
FRQb__1=2.500.000
BW__1=9000
Sweep_1=25000
Att__1=10
PreAmp1=off
Detector1=VAV
.....
```

You can use the EMCview internal editor or any plain text editor to change the attenuation values of the segments. Attenuation has to be entered with positive sign. Press the **Reload Project Files** button, in case that you change any configuration files during run time of EMCview.

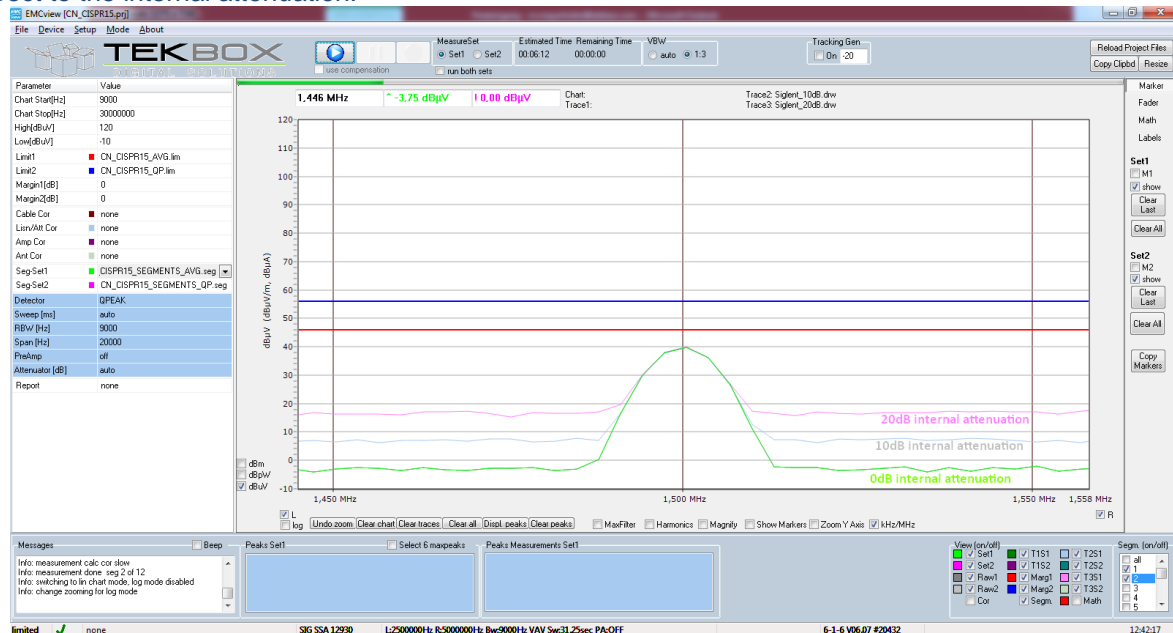
The screenshot below shows the effect on base noise for various attenuation levels:



## FAQ Tekbox EMCview



And here the zoomed view. The amplitude values obtained from the analyzer are already compensated with respect to the internal attenuation.

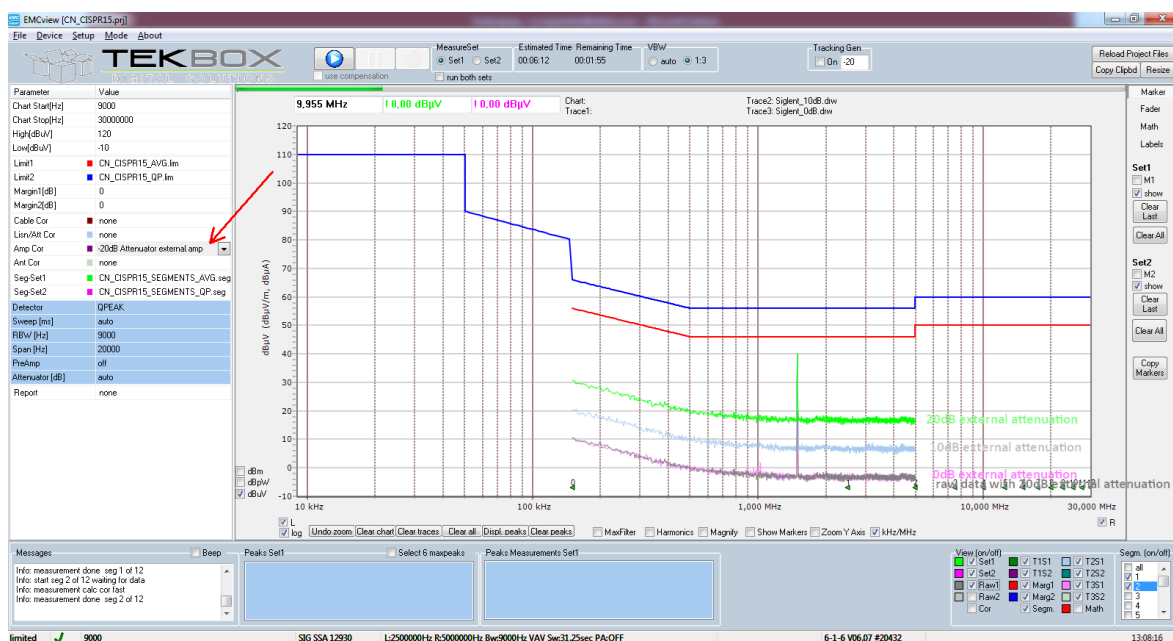


### Configuring external attenuation:

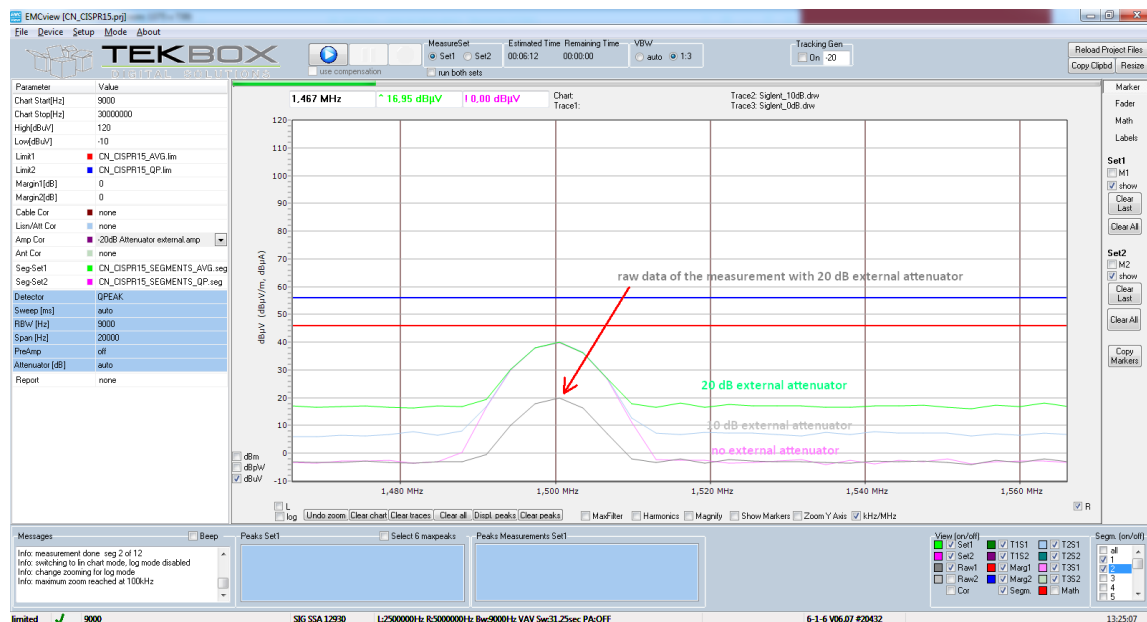
External attenuation is configured in amplifier files, which you find in the SRC folder of EMCview. You can use the EMCview internal editor or any plain text editor to create or edit amplifier files.

.....  
 Name=-20dB Attenuator external  
 Freq\_Interplot\_Mode=log  
 Level\_Interplot\_Mode=log  
 [Data]  
 Freq1=9000  
 Lev1=-20  
 Freq2=3000000000  
 Lev2=-20  
 .....

this file configures 20 dB attenuation in the frequency range 9 kHz to 3 GHz. In the amplifier file, attenuation is considered as negative gain and consequently has to be entered with negative sign. the amplifier file is loaded using the Amp Cor field of EMCview.



And here the zoomed view. The amplitude values (raw values) obtained from the analyzer are not compensated with respect to the internal attenuation. EMCview compensates the raw values based on the content of the amplitude file.



## 19 Radiated emission measurements

### Question:

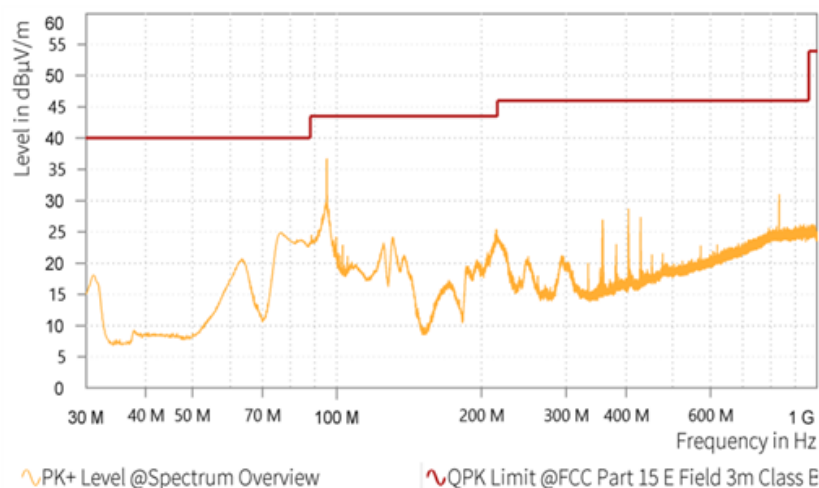
How shall I carry out pre-compliance radiated emission measurements?

### Answer:

The majority of standards require radiated emission measurements using the quasi peak detector. However, quasi peak measurements are extremely slow. It would take hours to carry out any radiated emission measurement.

Let's have a look at two measurement plots from a test-house to see how they proceed:

### Radiated emissions FCC Part 15 Class B



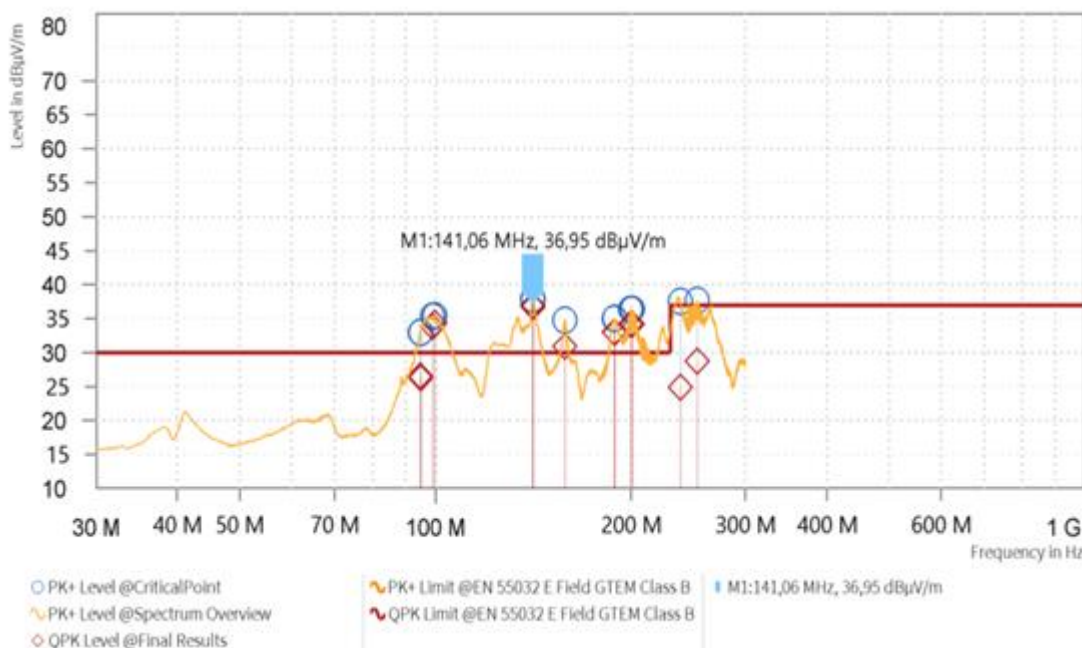
In the legend of the screenshot you can see QP limits, but the measurement was carried out using the peak detector. Peak detector measurement results are far faster than QP measurements and Peak detector



measurements always deliver a higher value than QP measurements. As in the above case, the Peak result is not crossing the QP limits, you know that the radiated noise test is passed and there is no need to make a QP measurement.

Here another screenshot:

Radiated emissions EN 55032 Class B



Again QP limits and a peak detector measurement. Now, several spurious cross the QP limits and as QP detector amplitudes are always lower than peak detector amplitudes, there is a chance that the spurious are still below the QP limit line. Consequently, at the frequencies with the highest spurious levels, QP measurements are carried out. You can see that the emissions in the 100 MHz and 250 MHz region still pass QP limits. However, at frequencies from 150 MHz to 250 MHz, both peak and QP amplitudes are above limits and the DUT does not pass the test. The procedure of first making a peak measurement and thereafter a QP re-measurement at the critical frequencies saves a lot of time.

EMCview contains radiated emission measurement projects with QP limits and corresponding segment files using QP detector scans. In order to create projects most suitable for your spectrum analyzer, take any of the segment files, change the QP detector entry to Peak detector and reduce the sweep time.

EMCview radiated emission segment files are also split into various frequency bands, as changing antennas according to CISPR 16 would be necessary. Furthermore, project files are split, considering analyzers may cover 1.5 GHz, 3 GHz or 6 GHz frequency ranges.

Below a segment file example for a setup, using a TEM cell or a hybrid antenna, covering a frequency range of 30 MHz to 1 GHz. Segment size is 25 MHz, considering spectrum analyzers with  $\geq 600$  measurement points per sweep and CISPR 16 requirements for the maximum spacing between adjacent frequency points. RBW is 120 kHz, sweep time is 10 seconds. Peak detector.

[Application]

Software=TekBox RP-W32-D7

Version=Demo

Date=30/01/2017 6:56:06 PM

[General]

Name=RN\_30M\_1G\_PK.seg

[Data]

FRQa\_\_1=30.000.000

FRQb\_\_1=50.000.000

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```

BW____1=120000
Sweep_1=10000
Att____1=0
PreAmp1=on
Detector1=POSPEAK
FRQa__2=50.000.000
FRQb__2=75.000.000
BW____2=120000
Sweep_2=10000
Att____2=0
PreAmp2=on
Detector2=POSPEAK
FRQa__3=75.000.000
FRQb__3=100.000.000
BW____3=120000
Sweep_3=10000
Att____3=0
PreAmp3=on
Detector3=POSPEAK
FRQa__4=100.000.000
FRQb__4=125.000.000
BW____4=120000
Sweep_4=10000
Att____4=0
PreAmp4=on
Detector4=POSPEAK
.
.
.
FRQa__37=925.000.000
FRQb__37=950.000.000
BW____37=120000
Sweep_37=10000
Att____37=0
PreAmp37=on
Detector37=POSPEAK
FRQa__38=950.000.000
FRQb__38=975.000.000
BW____38=120000
Sweep_38=10000
Att____38=0
PreAmp38=on
Detector38=POSPEAK
FRQa__39=975.000.000
FRQb__39=1000.000.000
BW____39=120000
Sweep_39=10000
Att____39=0
PreAmp39=on
Detector39=POSPEAK

```

The entire range from 30 MHz is covered with 39 segments with 10s sweep time each. Assuming another 10 seconds per segment for the transmission of the measurement values from spectrum analyzer to PC results in a measurement time of 13 minutes. Critical frequencies can then be measured with QP detector using the peak re-measurement feature of EMCview.

## 20 Additional limit lines

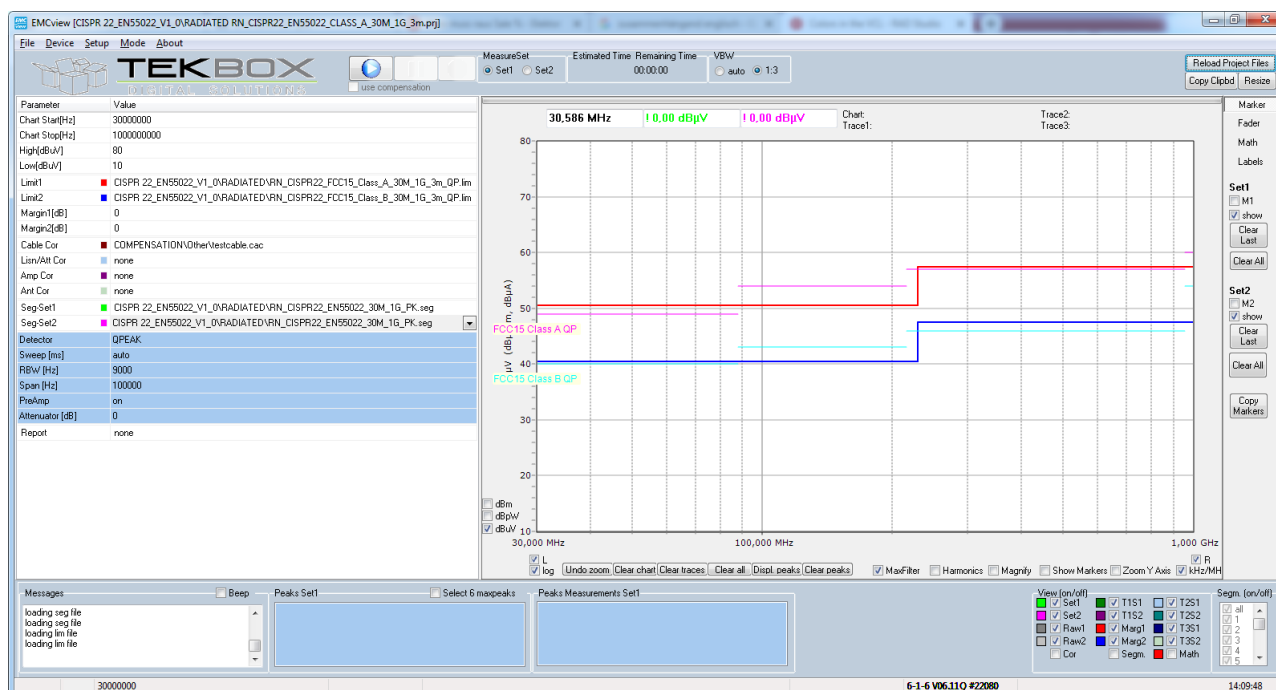
### Question:

Is it possible to display more than two limit lines in a graph?

### Answer:

With EMCview V7.0, every limit file can contain a main limit line plus up to 15 auxiliary limit lines. In addition, EMCview can display a margin line for each main limit line. The main limit line will be used as reference for margin lines and to calculate peaks, which exceed the major limit line or the margin line. Auxiliary limit lines are basically graphic content which cannot be used for any processing purpose. Main limit lines must be coherent, whereas auxiliary limit lines can be segmented / interrupted.

Example: CISPR22 Class A and Class B as main limit lines and FCC 15 Class A and FCC 15 Class B as auxiliary limit lines



### Limit File structure:

[Application]

Software=TekBox RP-W32-D7

Version=Demo

Date=18.01.2017 09:42:29

[General]

Name=RN\_CISPR22\_FCC15\_Class\_A\_30M\_1G\_3m\_QP.lim

Freq\_Interplot\_Mode=lin

Level\_Interplot\_Mode=log

[Data]

Freq1=30.000.000

Lev1=50.5

Freq2=230.000.000

Lev2=50.5

Freq3=230.000.010

Lev3=57.5

Freq4=1.000.000.000

Lev4=57.5

[Data\_Limit1]

\* start header

- \* Main limit line (CISPR 22 Class A)
- \* first frequency point [Hz]
- \* amplitude level of the first frequency point [dBμV]
- \* second frequency point
- \* amplitude level of the second frequency point [dBμV]
- \* third frequency point (using a point with 10 Hz offset creates a vertical step and keeps the line coherent)
- \* amplitude level of the last point of the main limit line
- \* start first auxiliary limit line

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Caption=FCC15 Class A QP

Color=\$FF00FF

Style=psSolid

Freq1=30.000.000

Lev1=49.6

Freq2=88.000.000

Lev2=49.6

Break2=1

Freq3=88.000.000

Lev3=54

Freq4=216.000.000

Lev4=54

Break4=1

Freq5=216.000.000

Lev5=56.9

Freq6=960.000.000

Lev6=56.9

Break6=1

Freq7=960.000.000

Lev7=60

Freq8=1.000.000.000

Lev8=60

[Data\_Limit2]

Caption=enter label here

Color=\$FFFF00

Style=psDash

Freq1=.....

.....

\* text label for 1<sup>st</sup> auxiliary limit line

\* line color "Fuchsia" (alternatively enter clFuchsia instead of the Hex value)

\* line style "solid"

\* first frequency point of auxiliary limit line [Hz]

\* amplitude of the first frequency point of the first limit line [dBμV]

\* second frequency point of auxiliary limit line [Hz]

\* amplitude of the second frequency point of the first limit line [dBμV]

\* suppress the limit line between second and third frequency point

\* third frequency point of auxiliary limit line [Hz]

\* end of 1<sup>st</sup> auxiliary limit line\* start 2<sup>nd</sup> auxiliary limit line

\* text label for auxiliary limit line

\* line color "Aqua" (alternatively enter clAqua instead of the Hex value)

\* line style "dashed"

Colors:

Value	Meaning	Hex Value	Color
clBlack	Black	\$000000	
clMaroon	Maroon	\$000080	
clGreen	Green	\$008000	
clOlive	Olive Green	\$008080	
clNavy	Navy Blue	\$800000	
clPurple	Purple	\$800080	
clTeal	Teal	\$808000	
clGray	Gray	\$808080	
clSilver	Silver	\$C0C0C0	
clRed	Red	\$0000FF	
clLime	Lime Green	\$00FF00	
clYellow	Yellow	\$00FFFF	
clBlue	Blue	\$FF0000	
clFuchsia	Fuchsia	\$FF00FF	
clAqua	Aqua	\$FFFF00	
clWhite	White	\$FFFFFF	
clMoneyGreen	Mint Green	\$C0DCC0	
clSkyBlue	Sky Blue	\$F0CAA6	
clCream	Cream	\$F0FBFF	
clMedGray	Medium Gray	\$A4A0A0	
clNone	Represents no colors (black)	\$1FFFFFFF	

Line styles:

psSolid  
psDash  
psDot  
psDashDot  
psDashDotDot

## 21 Visibility of peak markers

### Question:

How can I set peak markers to front/back?

### Answer:

use CTRL-O to move circles to front or back

use CTRL-P to move crosses to front or back

use CTRL-M to move markers to front or back

use CTRL-J to move auxiliary limit lines to front or back

## 22 New SRC directory structure / installation of EMView V7.0 and higher

With EMView V7.0, the structure of the SRC directory, which contains limit files, segment files, project files and hardware related compensation files, such as LISN files, current probe trans-impedance files, antenna factor files and signal gain/loss files changed to give an easier access to standard related projects.

Furthermore, all project files were updated and many new project files were added. All project files are now documented.

The installation directory of EMView 7.0 contains an additional directory with all documentation, such as manual, FAQ document, application notes and project file documentation.

### Installation of EMView V7.0 or higher:

- 1) First installation of EMView:
  - Download the latest NI-VISA drivers from the National Instruments website
  - Download EMView from the Tekbox website
  - Create a directory, e.g. C:\EMView\
  - Unzip the downloaded file into the installation directory
  - Execute EMView\*.exe
  - The installation routine will create the EMView directory structure
  - Copy the license file into the installation directory
  - Execute EMView\*.exe to run the SW
- 2) **You already use an earlier version of EMView:**
  - Either delete the SRC folder of the existing installation directory, or create a new installation directory – e.g. C:\EMView\_New\ and install EMView into the new directory.
  - Add your license file into the new directory
  - Reason for the new directory: In order to protect user defined projects, EMView never updates/overwrites the SRC directory. In order to get the new SRC directory installed, the existing one has to be deleted or EMView has to be installed into another empty installation directory.

## 23 History

Version	Date	Author	Changes
V 1.0	30.08.2019	Mayerhofer	Creation of the document
V 1.1	31.08.2019	Mayerhofer	corrections
V 1.2	30.08.2019	Mayerhofer	Chapter 8, 9 added
V 1.3	27.02.2020	Mayerhofer	Chapter 10, 11 added
V 1.4	28.03.2020	Mayerhofer	Chapter 12, 13, 14, 15, 16 added
V 1.5	28.03.2020	Mayerhofer	Chapter 17, 18, 19 added
V 1.6	25.09.2020	Mayerhofer	Chapter 20, 21, 22 added