Applying antenna factors in EMCview

1. Introduction

When you connect an antenna to a spectrum analyzer or measurement receiver, it will display the field strength in dBm or dBµV, depending on settings. EMCview reads measurement values in dBµV. However, radiated emission limits are given in dBµV/m or dBµA/m. In order to perform the necessary conversion of the spectrum analyzer or measurement receiver readings, it is necessary to know the antenna factors of the involved antennas.

CISPR 16 specifications

Among many other details, CISPR 16 splits the frequency range into several bands and specifies measurement resolution bandwidth and measurement antennas.

Band	Frequency Range	RBW	Antenna
A	9 kHz – 150 kHz	200 Hz	Magnetic loop antenna
B	150 kHz – 30 MHz	9k Hz	Magnetic loop antenna, electric monopole antenna
C	30 MHz – 300 MHz	120 kHz	Biconical antenna
D	300 MHz – 1GHz	120 kHz	Logarithmic periodic antenna
E	1GHz – 18 GHz	1 MHz	Horn antenna

Furthermore, CISPR also specifies different chamber sizes based on frequency (wavelength).

Magnetic field antennas

In order to calculate the magnetic field strength based on the measurement value of the spectrum analyzer or measurement receiver, following formula has to be applied:

H-Field Strength [dBµA/m] = measured voltage [dBµV] + H-Field Antenna Factor [dBΩ/m]

The formula above is based on H-Field Antenna Factors given with negative sign.
Note that the H-Field Antenna Factor is frequency dependent. Measurement antenna manufacturers always supply a table or graph of the H-Field Antenna Factor with their antennas. The next chapter will show how to create a suitable antenna correction file for EMCview.

Electric field antennas

In order to calculate the electric field strength based on the measurement value of the spectrum analyzer or measurement receiver, following formula has to be applied:

E-Field Strength [dBµV/m] = measured voltage [dBµV] + E-Field Antenna Factor [dB/m]

Note that the E-Field Antenna Factor is frequency dependent. Measurement antenna manufacturers always supply a table or graph of the E-Field Antenna Factor with their antennas. The next chapter will show how to create a suitable antenna correction file for EMCview.

Additional correction factors

A radiated emission measurement needs to consider more than the antenna factors. Besides an antenna, amplifiers and coaxial cables are used in typical measurement setups:

E-Field Strength [dBµV/m] = measured voltage [dBµV] + E-Field Antenna Factor [dB/m] – Amplifier gain [dB] + cable loss [dB]

EMCview provides correction files for all these components.

2. Implementation in EMCview

EMCview provides many preconfigured projects for radiated emission measurements. Project files, segment files, limit files and correction files are all stored in the SRC-directory of EMCview. Taking CISPR 22 Class B as an example, you will find following pre-configured project files:

RN_CISPR22_CLASS_B_30M_300M_10METER_QP.prj
RN_CISPR22_CLASS_B_300M_1G_10METER_QP.prj
RN_CISPR22_CLASS_B_1G_1.5G_3METER_AVG_PK.prj
RN_CISPR22_CLASS_B_1.5G_3G_3METER_AVG_PK.prj
RN_CISPR22_CLASS_B_3G_4.5G_3METER_AVG_PK.prj
RN_CISPR22_CLASS_B_4.5G_6G_3METER_AVG_PK.prj

The radiated emission measurement is split into several separate projects to take into account:

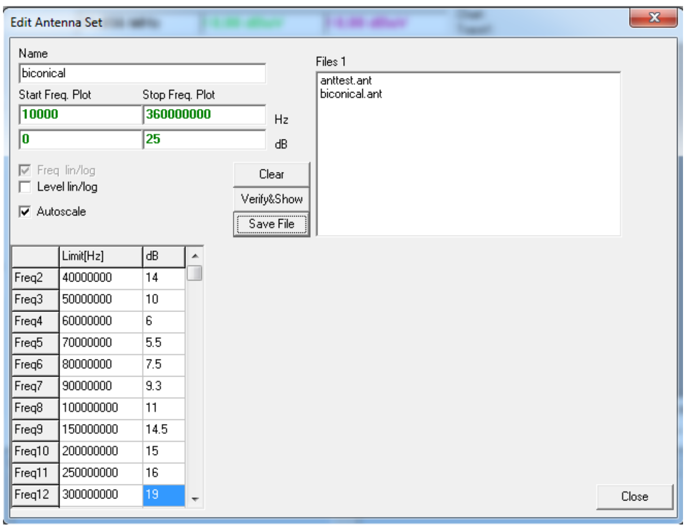
- Antenna change – different CISPR bands require different antennas. It is not practical to exchange antennas during an ongoing measurement manually.
- Chamber size – CISPR 16 specifies different chamber sizes for different frequency bands.
- Spectrum analyzer model – the frequency range of the involved spectrum analyzer may typically be in the range 9 kHz to 1GHz, 1.5 GHz, 3 GHz or 6 GHz. Of course, if your analyzer is capable of a wider frequency range, you can merge some of the above projects to a project with a wider frequency range.

However, all the above projects don´t yet include any correction files, as they depend on the antennas, which are available to the user.

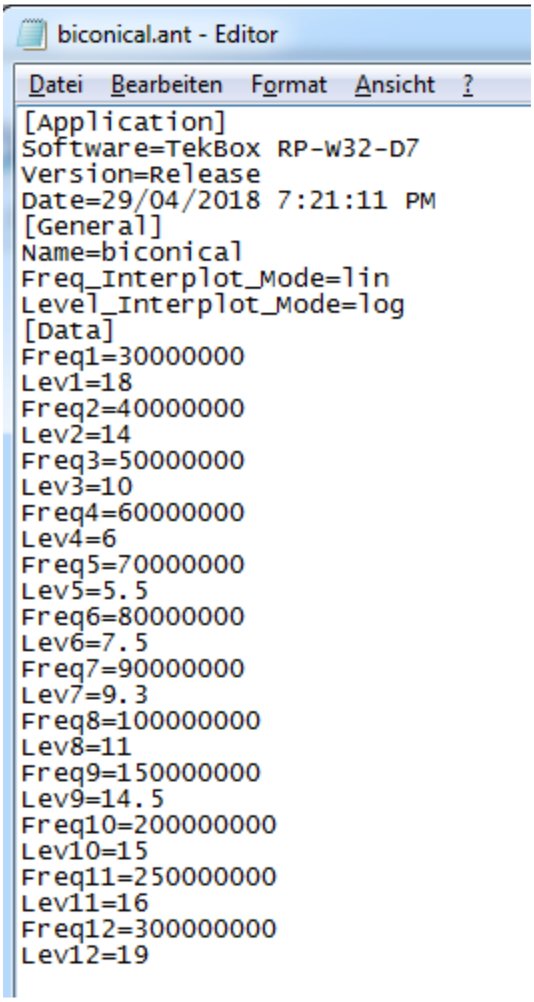
Let's assume that you want to make a CISPR 22 Class B measurement in the range 30 MHz to 300 MHz. Furthermore, let's assume that the datasheet of your biconical antenna specifies following antenna factors:

Frequency [MHz]	Antenna factor [dB/m]
30	18
40	14
50	10
60	6
70	5.5
80	7.5
90	9.3
100	11
150	14.5
200	15
250	16
300	19

Now create following file using the Setup menu of EMCview and save it as biconical(.ant).

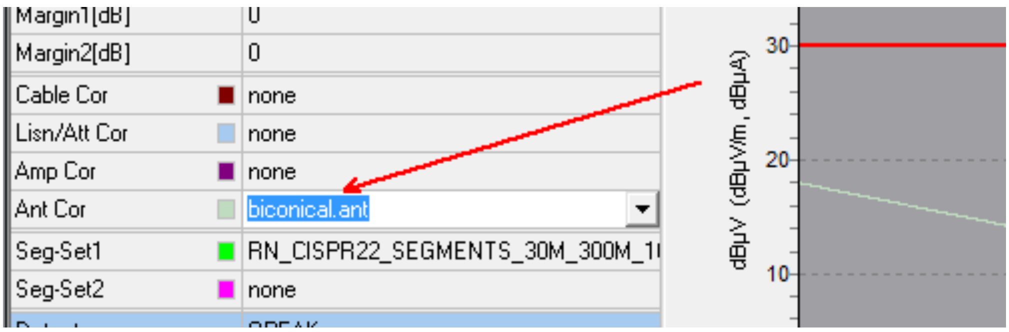


Alternatively, you can create the file with any text editor and save it in the SRC-directory of EMCview. This may be the faster way, especially if you already have other antenna correction files that you can simply modify and save with a different file name:




```
[Application]
Software=TekBox RP-W32-D7
Version=Release
Date=29/04/2018 7:21:11 PM
[General]
Name=biconical
Freq_Interplot_Mode=lin
Level_Interplot_Mode=log
[Data]
Freq1=30000000
Lev1=18
Freq2=40000000
Lev2=14
Freq3=50000000
Lev3=10
Freq4=60000000
Lev4=6
Freq5=70000000
Lev5=5.5
Freq6=80000000
Lev6=7.5
Freq7=90000000
Lev7=9.3
Freq8=100000000
Lev8=11
Freq9=150000000
Lev9=14.5
Freq10=200000000
Lev10=15
Freq11=250000000
Lev11=16
Freq12=300000000
Lev12=19
```

Once you created the necessary antenna correction file, start EMCview, load your project file (RN_CISPR22_CLASS_B_30M_300M_10METER_QP.prj), click the box Ant Cor, select biconical.ant and confirm with the tab key or click any other box.



The amplitude values of the graph are then scaled to dBµV/m.

Version	Date	Author	Changes
V 1.0	29.04.2018	Mayerhofer	Creation of the document