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Impact of antenna height and tilt on measurements above 1GHz in the anechoic chambers

Abstract. *Article presents the influence of antenna height and tilt on the results of radiated emission measurements above 1 GHz.*

Streszczenie*. W artykule pokazano jak zmiana kąta pochylenia anteny wpływa na pomiary zaburzeń promieniowanych w zakresie powyżej 1 GHz.* ***Jak zmiana kąta pochylenia anteny wpływa na pomiary zaburzeń promieniowanych w zakresie powyżej 1 GHz?***

Keywords: antenna tilt, emission measurements, anechoic chamber.
Słowa kluczowe: pochylenie anteny, pomiary emisji, komora bezodbiciowa

Introduction

The conditions of measurement of radio disturbance emission are defined in EN55022 standard [1]. It defines the de-tailed requirements of the measuring system and the methodology of the test. In case of the measurement above 1 GHz the antenna scan is not required but knowing that height and tilt of the antenna in relation to the radiation source affect its characteristics [2,3] it can lead to omit the configuration at which the field strength is the highest. So this article presents the impact of antenna height and tilt on measurements above 1 GHz.

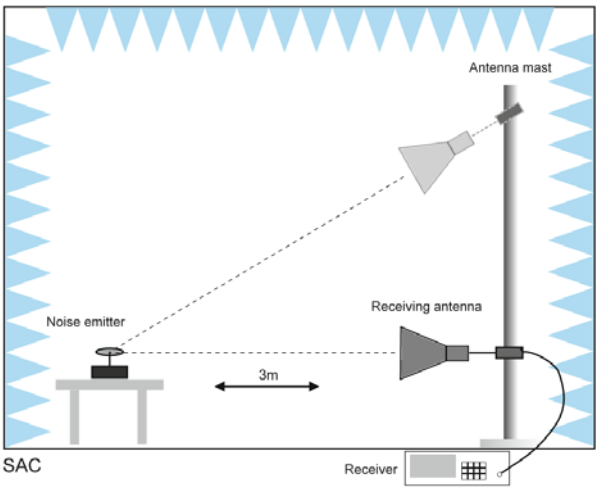

Fig. 1. Test setup with antenna mast with tilt option.

Table 1. Test equipment

Name	Manufacturer	Model
Anechoic chamber	MVG-EMC	SAC-3
Receiver	R&S	ESU26
Antenna 30-1000 MHz	Schwarzbeck	VULB 9168
Antenna 1-6 GHz	Schwarzbeck	BBHA 9120 D
Antenna mast	Maturo	TAM 4.0E
Mast controller	Maturo	NCD

Table 2. Equipment settings

	30 – 1000 MHz	1 – 3 GHz
Detector	PEAK	
Start frequency	30 MHz	1000 MHz
Stop frequency	1000 MHz	3000 MHz
Frequency step	1 MHz	1 MHz
RBW	120 kHz	1 MHz
Dwell time	50ms	50ms

Test setup

The measurements were carried out in test-setup shown in figure 1 by use of equipment from table 1 with settings shown in table 2.

The Comparison Noise Emitter CNE-III by York EMC Services Ltd. was used as broadband noise source for all measurements.

Measurements below 1GHz

The measurements below 1 GHz were carried out at first stage of work. It has been shown that use of antenna tilt allow to find the disturbances which stay undetected during measurements without tilting – figure 2.

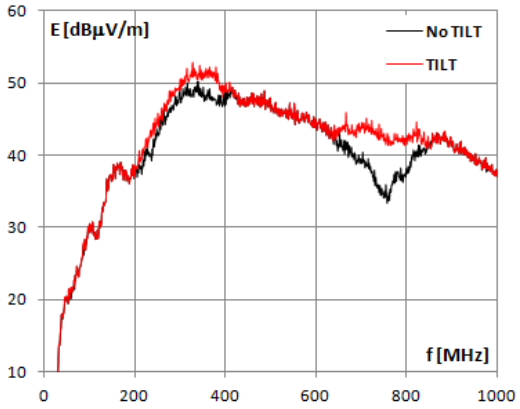

Fig.2. Impact of antenna tilt on radiated disturbances emission measurement within 30-1000 MHz range.

Measurements below 1 GHz are described in article [4].

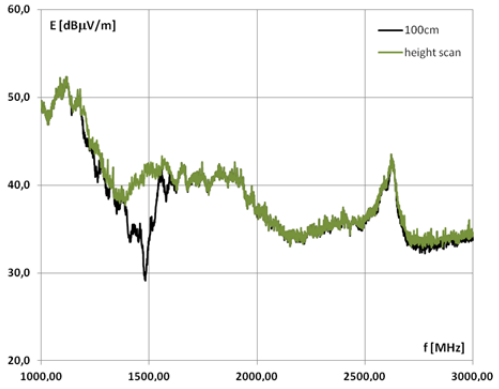

Fig. 3. Impact of antenna height scan on radiated disturbances emission measurement within 1-3 GHz range.

Measurements above 1GHz

Measurements with no tilt were done as first. The antenna height was changed in 4 steps: 100, 200, 300 and 400 cm. The comparison is shown in figure 3. “Height scan” plot is the “max hold” result of radiated emission for all heights.

As we can see in figure 3 the height scan allows to find emissions which were undetected at 100 cm. The difference is biggest at about 1,5 GHz an is more than 10 dBμV/m.

In the next step the measurement with height scan and tilt was carried out – the result is shown in figure 4.

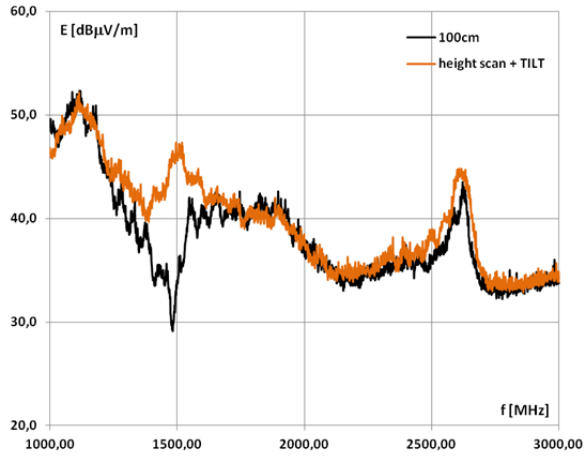

Fig. 4. Impact of antenna height scan with tilt on radiated disturbances emission measurement within 1-3 GHz range.

As we can see in figure 4 the difference between both emissions increased with tilt: now it is more than 15 dBμV/m at about 1,5 GHz. In figure 5 measurement with height scan and tilt was compared to measurement with height scan without tilt.

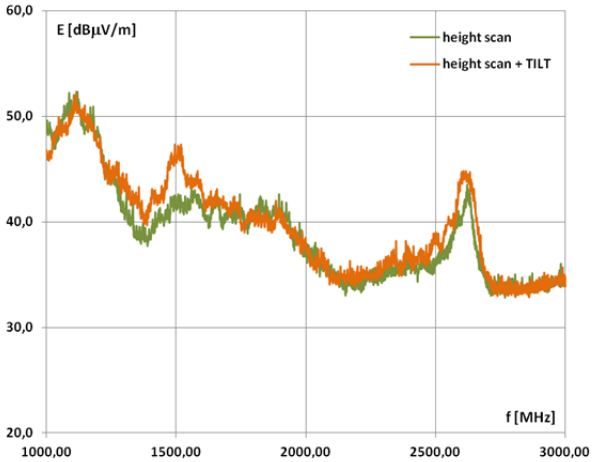

Fig. 5. Impact of antenna tilt during height scan on radiated disturbances emission measurement within 1-3 GHz range.

Radiated disturbances measured during height scan with tilt option are higher than without this option. The difference is greatest at 1,5 GHz and is about 5 dBμV/m.

Summary

The impact of antenna height and tilt on measurements within 1-3 GHz range was investigated in this work. Measurements were done according to the normative requirements at 100 cm antenna height and next at 200, 300 and 400 cm with and without tilt option. The highest emission level was observed usually at 200 cm – it was a little higher than at 100 cm in almost full range of frequency, and for about 1,5 GHz the difference reached 10 dBμV/m. Emission level recorded with tilt option was even more and reached 15 dBμV/m. It may be an aggregate effect of:

- changing of antenna characteristic in relation to its height and tilt,
- specific radiation pattern of EUT.

The aim of the article is to start discussion about introducing the measurement with height scanning and tilt option into international standardization.

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