

Influence of EUTs vertical cables to different results in fully and semi-anechoic chamber

Many reasons encourage people in academic and standardisation world to suggest the new method for measuring radio-frequency emission in fully anechoic chamber (FAC).

There are two main reasons:

- Smaller and cheaper room for testing and
- Shorter time of measuring caused by no need of antenna scan.

Standards prepared by ETSI already allowed both methods. The results can't be the same because the EUT has physically length particular in vertical way.

Many authors compared the results in SAC and FAC. The calculation of the correction factor, which should be used for the same limit, is based on different normalised site attenuation (NSA) in both chambers. The NSA for i polarisation in OATS or semi anechoic chamber represent the equation (1)

$$A_{iOATS} (dB) = -20 \log f_M + 48.92 - E_{Di}^{\max} (dB\mu V / m) \quad (1)$$

For the free space or FAC we get NSA:

$$A_{iFAC} (dB) = -20 \log f_M + 48.92 - 20 \log(d_i) \quad (2)$$

d_i is a distance between transmit antenna (or EUT) and receive antenna in FAC :

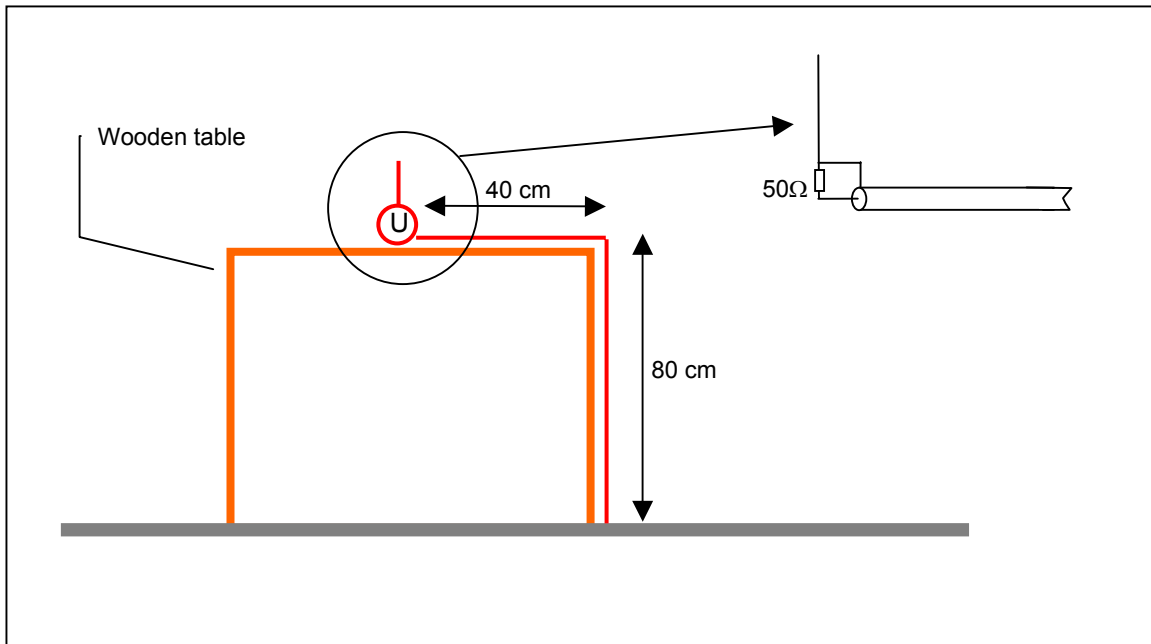
$$d_i = [R^2 + (h_1 - h_2)^2]^{1/2}$$

The difference in NSAs could be used as a correction factor.

$$\Delta A = -\Delta E = A_{iOATS} (dB) - A_{iAC} (dB) = 20 \log(d_i) - E_{Di}^{\max} (dB\mu V / m) \quad (3)$$

Similar equation we can found in many articles.

If we approach with part of EUT (e.g. power cord) to the horizontal reference ground plane, we'll get completely different radiated pattern of EUT than those in free space or fully anechoic chamber. The EUT, which have a contact with the ground plane, represent the



antenna structure with different resonance than those without contact with a ground plane. We made a model of simple wire end model (WEM) of EUT. The results have been calculated by numerical moment method (MOM) in the frequency range where the cables have predominant influence to radiated emission (30MHz –300 MHz).

The figure 1 shows the wire end model (WEM). First calculation is made for EUT with cable

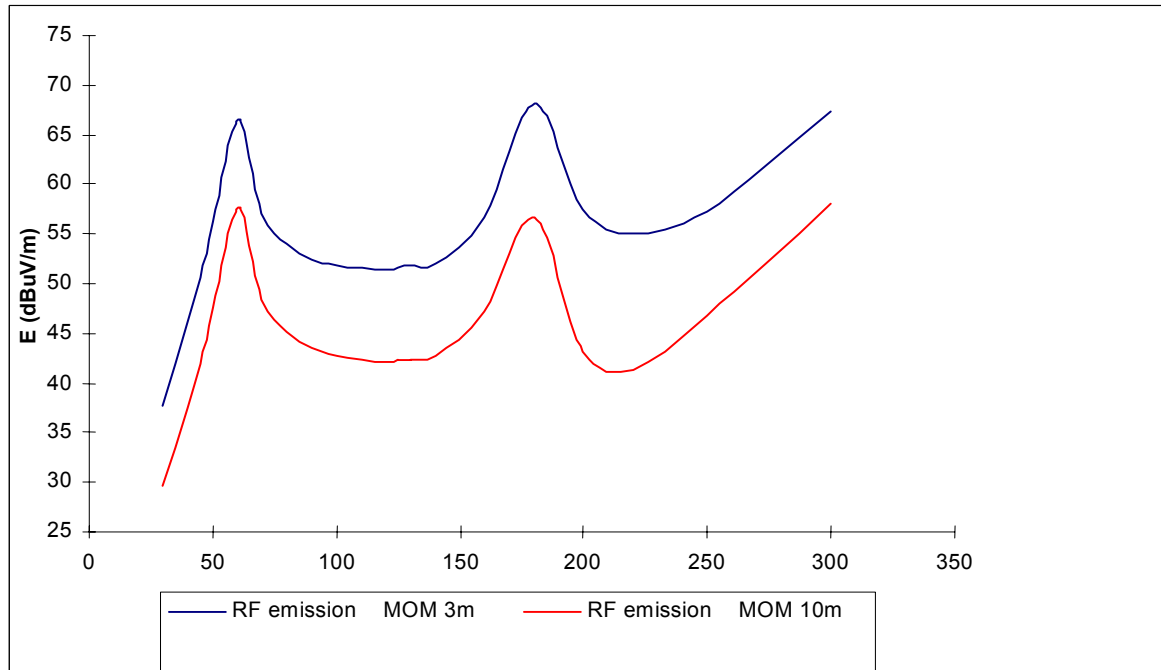


Figure 2: Radiated emission from wire end model (WEM) with good contact of cable to the ground plane.

contacted to the ground plane. The results for 10m and 3m distance are shown on a diagram 2. The first resonance occur at 60Mhz, because at that frequency the total length of EUT with cable is $\lambda/4$.

We can see the radiated emission of end wire model in the fully anechoic chamber if we ended the model with ideal absorbing clamp on figure 3. The first resonance occurs at

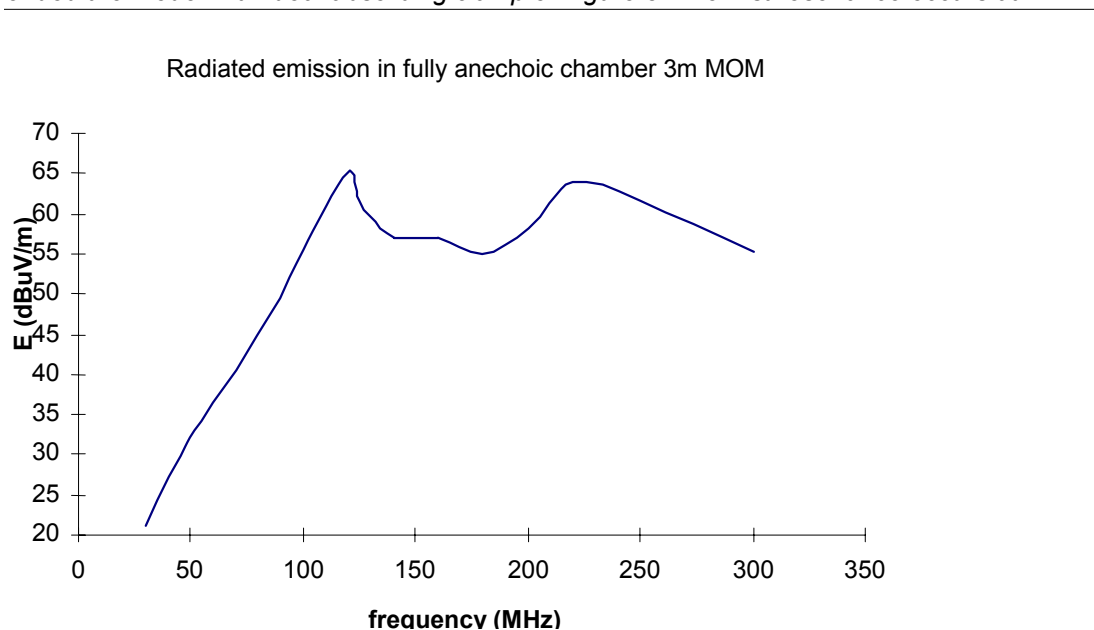


Figure 3: Radiated emission of WEM in fully anechoic chamber.

120MHz, because at that frequency the total length of EUT with cable is $\lambda/2$. The main question is: how to make both methods comparable? The main problem is proximity of the ground plane to the EUT. The first step to better comparison is shown in new standard IEC CISPR 22:2003. The standard requires use of absorbing clamp on the ground plane for the cables of tabletop equipment.

Next step could be additional non-metal (e.g. 20cm high) table also for floor-standing equipment. On figure 4 we can see the results of 3m and 10m distance radiated emission on OATS and fully anechoic chamber. The EUT (wire end model) is ended by absorbing clamp and lifted 40cm from the ground plane.

It is shown in the article, that with some corrections in traditional test method (OATS) the results in fully anechoic chamber and OATS shall be more comparable.

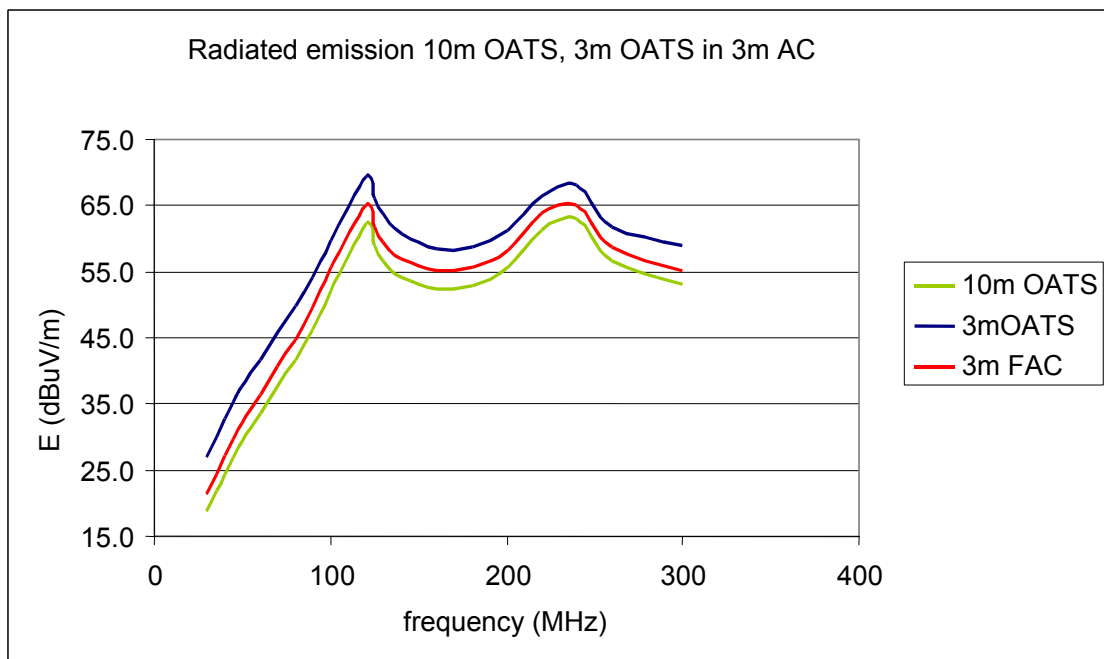


Figure 4: The EUT (WEM) is 40 cm under the ground plane.