Shielding effectiveness of a metallic enclosure with a thin rectangular aperture

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Test case description

Aim of the study

We study the shielding effectiveness of a metallic rectangular enclosure having thin walls which presents a thin rectangular aperture. We look for the total electromagnetic field at two distinct observation points (referred to as points "A" and "B") inside the enclosure.

Geometry of the case

The geometry consists of a PEC enclosure with thin walls (walls are assumed to have no thickness), whose dimensions are L_x, L_y and L_z, which is centered in $\mathcal{O}$. A rectangular aperture with dimensions $l_s = 3$ m and $w_s = 0.002$ m is located on the top enclosure wall, i.e. on the face $z = 1$ m (see figures below for more details).

A plane wave, horizontally polarized, impinges on the enclosure along the $-z$ direction, the incident unit electric and magnetic fields being along the x and y directions, respectively.
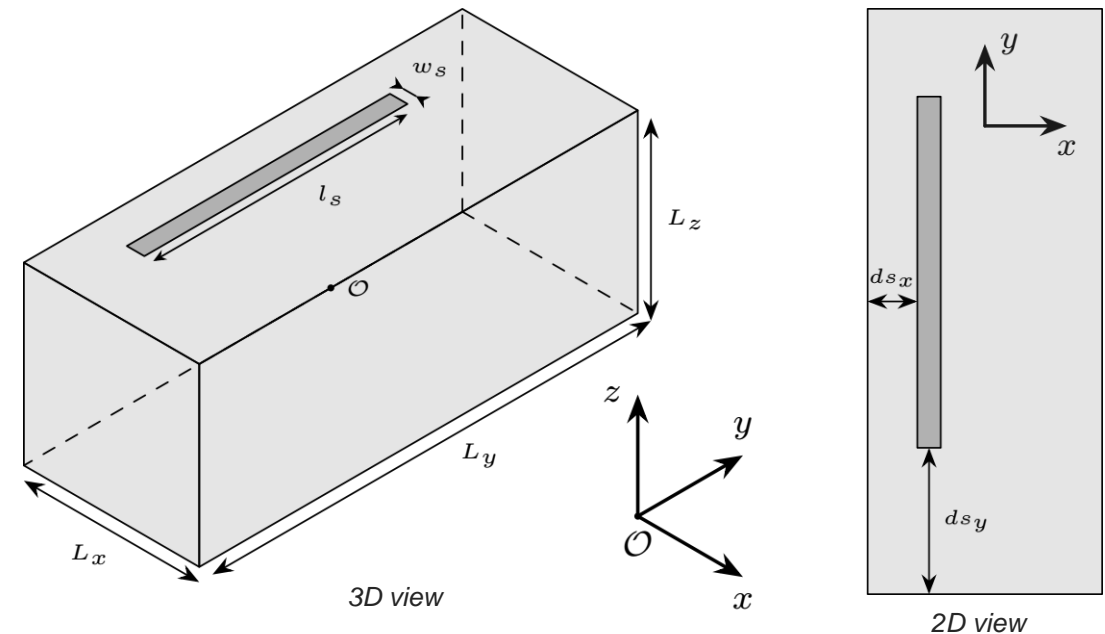
Two configurations will be considered.

❑ **Config. #1**

Enclosure dimensions: $L_x = 2$ m, $L_y = 5$ m, $L_z = 2$ m.

Aperture location: $ds_x = 0{,}474$ m, $ds_y = 1{,}1$ m.

❑ **Config. #2**

Enclosure dimensions: $L_x = 2{,}006$ m, $L_y = 5$ m, $L_z = 2$ m.

Aperture location: $ds_x = 0{,}477$ m, $ds_y = 1{,}1$ m.

3D view

2D view

Results to be provided

❑ We look for the electric and magnetic shielding effectiveness :

$$SE_u = 20 \log_{10} \left(\frac{|\boldsymbol{u}(\boldsymbol{x}_p)|}{|\boldsymbol{u}^i(\boldsymbol{x}_p)|} \right),$$

with $\boldsymbol{u}$ being the electric field $\boldsymbol{E}$ (resp., magnetic field $\boldsymbol{H}$), and $\boldsymbol{u^i}$ the incident electric (resp. magnetic) field. Both SE_E and SE_H are calculated at two distinct points : $\boldsymbol{x}_A = (0,0,0)$ and $\boldsymbol{x}_B = (-0.8, -2.3, 0.8)$ m as a function of frequency in the band $[10, 140]$ MHz for the horizontal polarization.

The <u>choice of the frequency step</u> can be

■ either left to the participants (for those who use frequency-adaptive methods),

■ or defined such that any sampling frequency must be a multiple of 0,1 MHz.

❑ Expected results shall be stored in ASCII files named `SE_config_obspoint.res`, with `SE` being one of the keywords: `SEE` or `SEH` according to the electric or magnetic field results; `config` being one of the keywords: `config1` or `config2`; and `obspoint` being one of the keywords: `ptA` or `ptB`.

❑ Each file shall have seven columns : frequency (in MHz), $\Re(u_x)$, $\Im(u_x)$, $\Re(u_y)$, $\Im(u_y)$, $\Re(u_z)$, $\Im(u_z)$; with u being the electric field E or the magnetic field H.