Meta-Material
Case n°5

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Target description

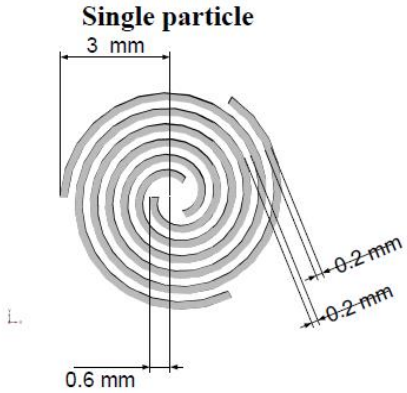

Figure 1: the unit cell: one 3 elements spiral

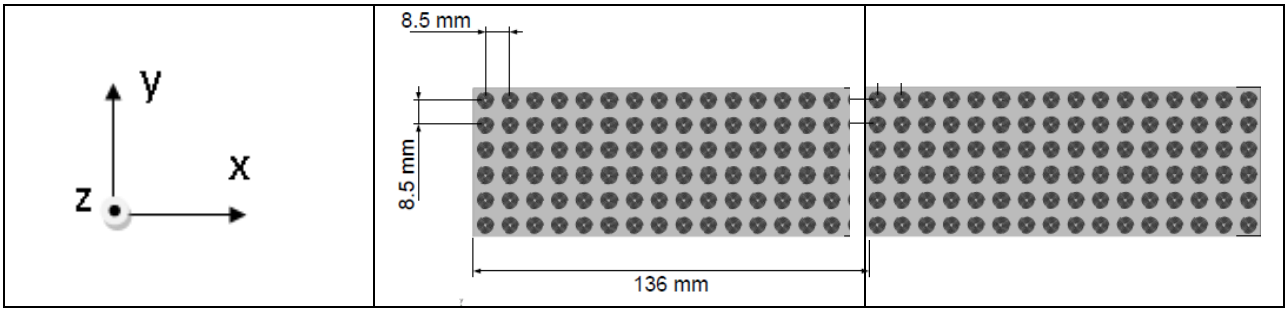

Figure 2 top view

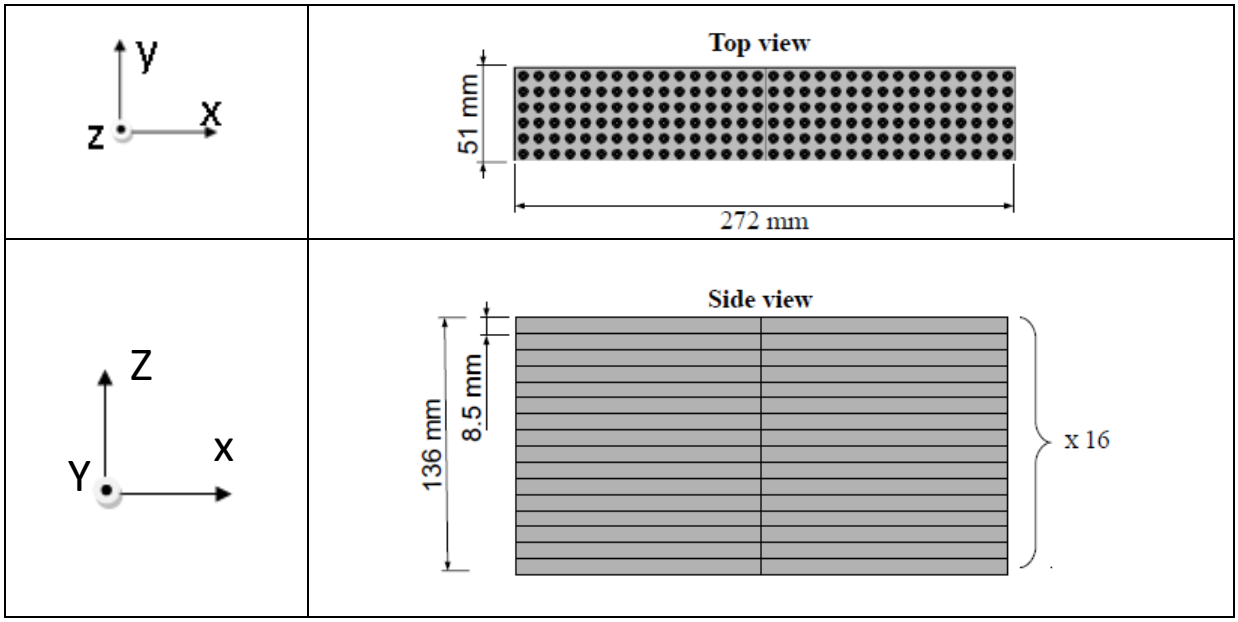

Figure 3 : Top view and side view

The target is a 272 x 136 x 51 mm meta-material structure composed of 16 layers of periodic metallic spirals impressed on a dielectric substrate. It presents a resonant behavior around 2.5 GHz.

The main characteristics of the target are:

Unit cell:
- Circuit width 200 µm;
- Inter-circuit width 200 µm;
- Period 8.5 mm.
- Spirals: Thickness 0 and infinity conductivity

Substrate:
- Polymer with relative permittivity 3.9
- Loss tangent 0.011
- Thickness 8.5mm

Angular definitions

The zenith angle Theta is measured from the z axis.
The azimuth angle Phi is measured from the x axis.

1. Backscattered field of a unit cell

The objective is to evaluate the ability to compute the resonance of a spiral with a very weak "k.a". The structure to study is a unit cell; the 3 elements spiral + one layer of substrate. Its thickness is 8.5 mm. The unit cell is a cube with an edge equal to 8.5 mm.

The Backscattered field is to calculate for:

- frequencies from 1.5 GHz to 3.5 GHz with a step of 10MHz
- Theta = 90° ; Phi = 45° to 135° with a step equal to 0.1°
- 2 polarizations:
  - the E field is in the xy plane (HH) (case 1)
  - the E field is perpendicular to the xy plane (VV) (case 2)
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2. Backscattered field of a unit layer

The structure is composed of 32 x 6 cells with only one layer of substrate.

The backscattered field is to calculate for:

- frequencies from 1.5 MHz to 3.5 GHz with a step of 10MHz
- Theta = 90° ; Phi = 45° to 135° with a step equal to 0.1°
- 2 polarisations:
  - the E field is in the xy plane (HH) (case 1)
  - the E field is perpendicular to the xy plane (VV) (case 2)

3. Backscattered field of a semi infinite layer

The structure is the one defined at previous section with one modification. The substrate length is extended to infinity along the x axis.

The Backscattered field is to calculate for:

- frequencies from 1.5 MHz to 3.5 GHz with a step of 10MHz
- Theta = 90° ; Phi = 45° to 135° with a step equal to 0.1°
- 2 polarisations:
  - the E field is in the xy plane (HH) (case 1)
  - the E field is perpendicular to the xy plane (VV) (case 2)

4. Backscattered field of the whole structure

The structure is the one shown on Figure 3: 32 x 6 cells per layer and 16 layers in total.

The Backscattered field is to calculate for:

- frequencies from 1.5 MHz to 3.5 GHz with a step of 10MHz
- Theta = 90° ; Phi = 45° to 135° with a step equal to 0.1°
- 2 polarisations:
  - the E field is in the xy plane (HH) (case 1)
  - the E field is perpendicular to the xy plane (VV) (case 2)

5. Deliveries

Each participant will send ASCII files named
Case5-subCase-xx-CompanyName.txt

xx being 1 to 4
one file per subcase containing per line the 6 following data:

Phi (in degrees) frequency (in MHz) Backscattered field -HH (Real, Imaginary) Backscattered field -VV (Real, Imaginary)

For an unitary incident field.

Increasing Phi for a given frequency, then iterating on the frequency