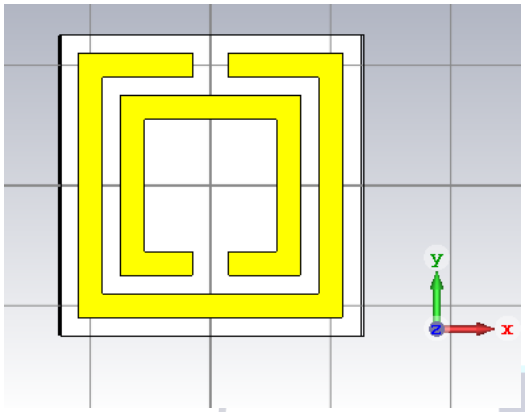
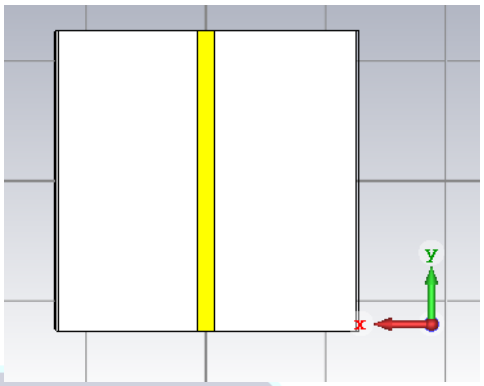
# METAMATERIAL ANTENNA

## Problem Statement 1

**To design a Metamaterial Unit Cell on a FR-4 (Lossy) substrate. The frequency is 7 GHz to 13 GHz and the thickness is 0.25 mm, dielectric constant = 4.3.**




| Parameter | Value(mm) | Description | Parameter | Value(mm) | Description |
|---|---|---|---|---|---|
| g | 0.3 | gap | h | 0.25 | substrate height |
| L1 | 2.2 | outer ring width | L2 | 1.5 | inner ring width |
| Ls | 2.5 | sub length | Lw | 0.14 | wire length |
| s | 0.15 | split wid | t | 0.017 | thickness |
| w | 0.2 | ring width | | | |

**USAGE**: ELECTROMAGNETIC CLOAKING, NOVEL ANTENNAS HIDING AN OBJECT, NOVEL FILTERS, NEW MW DEVICES

**STEP1** Modelling of Substrate Plane Brick Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -Ls/2 | Ls/2 | -Ls/2 | Ls/2 | -h | 0 |

Material: **FR-4 (Lossy)**

**STEP2** Modelling of Ring 1 ➡ Brick ➡ Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -L1/2 | L1/2 | -L1/2 | L1/2 | 0 | t |

Material: **Copper Annealed**

**STEP3** Modelling of Cut 1 ➡ Brick ➡ Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -(L1/2)+w | (L1/2)-w | -(L1/2)+w | (L1/2)-w | 0 | t |

Material: **Copper Annealed**

**STEP4** Modelling of Slot 1 ➡ Brick ➡ Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -g/2 | g/2 | -w | 0 | 0 | t |

Material: **Copper Annealed**

**STEP5** *Transform: Translate Slot 1 to **upper** portion on Ring 1*

Perform **Boolean Substraction [ Ring 1 – Slot 1]** to form **SPLIT RING 1**

**STEP6** Modelling of Ring 2 ➡ Brick ➡ Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -(L1/2)+w+s | (L1/2)-w-s | -(L1/2)+w+s | (L1/2)-w-s | 0 | t |

Material: **Copper Annealed**

**STEP7** Modelling of Cut 2 ➡ Brick ➡ Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -(L1/2)+w+s+w | (L1/2)-w-s-w | -(L1/2)+w+s+w | (L1/2)-w-s-w | 0 | t |

Material: **Copper Annealed**

**STEP4** Modelling of Slot 2 ➡ Brick ➡ Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -g/2 | g/2 | -w | 0 | 0 | t |

Material: **Copper Annealed**

**STEP8** *Transform: Translate Slot 2 to **bottom** portion on Ring 2*

Perform **Boolean Substraction [ Ring 2 – Slot 2]** to form **SPLIT RING 2**

**STEP9** *Pick Back Face of Substrate*

*Align Local Coordinate System*

Modelling of Wire ➡ Brick ➡ Esc

| Xmin | Xmax | Ymin | Ymax | Zmin | Zmax |
|---|---|---|---|---|---|
| -Lw/2 | Lw/2 | -Ls/2 | Ls/2 | 0 | t |

Material: **Copper Annealed**

**STEP9** Boundary Conditions

**STEP10** Edit Background

**STEP11** Create Port1 and Port2.

**STEP12** Simulate

# Problem Statement 2

**To design a Complementary Split-Ring Resonator-Loaded. The frequency is 1 GHz to 10 GHz and the thickness is 0.25 mm, dielectric constant = 4.3**

**USAGE:** Microfluidic Ethanol Chemical Sensor

| Parameter | Value(mm) | Parameter | Value(mm) |
|---|---|---|---|
| L | 12 | LM | 6.75 |
| W | 11.3 | c | 0.3 |
| d | 0.3 | r | 0.75 |
| LSUB | 27 | WQT | 0.4 |
| LQT | 4.1 | g | 0.3 |
| WSUB | 33 | b | 3.8 |
| a | 5 | WM | 2.38 |