



MINISTÈRE DE LA DÉFENSE

# Comparaison des outils électromagnétiques Evaluation comparative

Jean-François Legendre – TEC/SPC  
19 mars 2014



DIRECTION GÉNÉRALE DE L'ARMEMENT





# Les outils du test

- ✓ Outil n°1 (MoM)
  - ✓ Outil n°2 (FDTD)
  - ✓ Outil n°3 (FDTD)
  - ✓ Outil n°4 (MoM)
  - ✓ Outil n°5 (MoM)
- Quatre cas test :
- simulation de l'antenne VHF sur un VAB
  - découplage sur avion à 4 GHz
  - simulation d'une antenne PIFA
  - simulation entre deux véhicules dans un convoi



# Présentation de la plateforme FEROCÉ



# Architecture matérielle de FEROCÉ



HPZ800



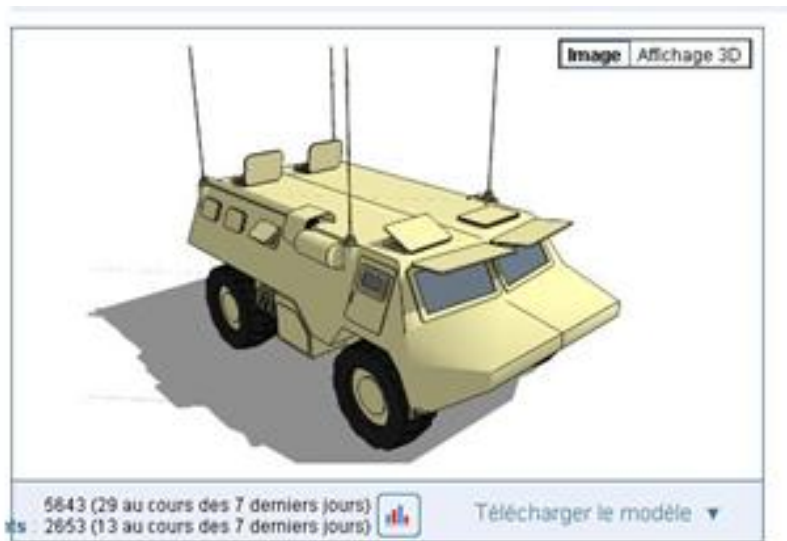


# Simulation de l'antenne VHF sur un VAB

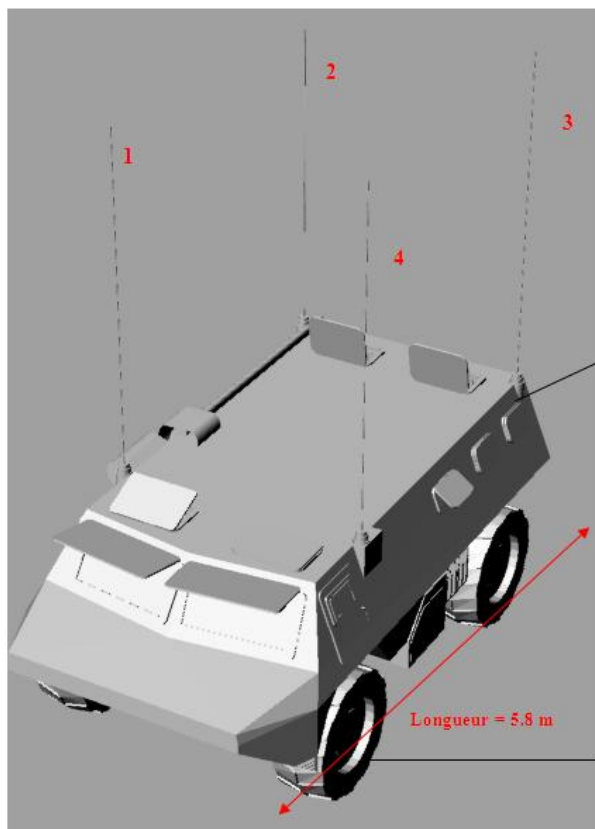


# Description du cas test n°1

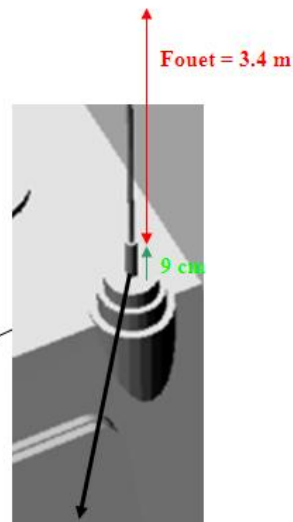
- ✓ VAB sur Google sketchup
- ✓ <http://sketchup.google.com/3dwarehouse/details?mid=5060cc9aa64a125691a8f3629a2b0476&prevstart=0>



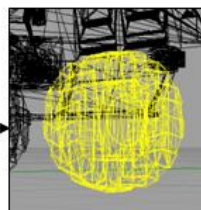
# Description du cas test n°1



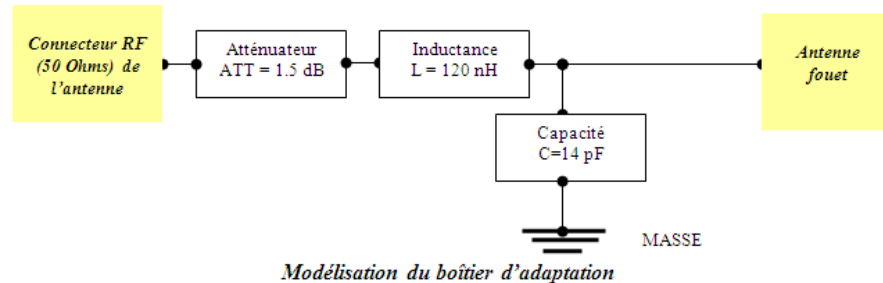
CAO du VAB



Connecteur RF de l'antenne monopole

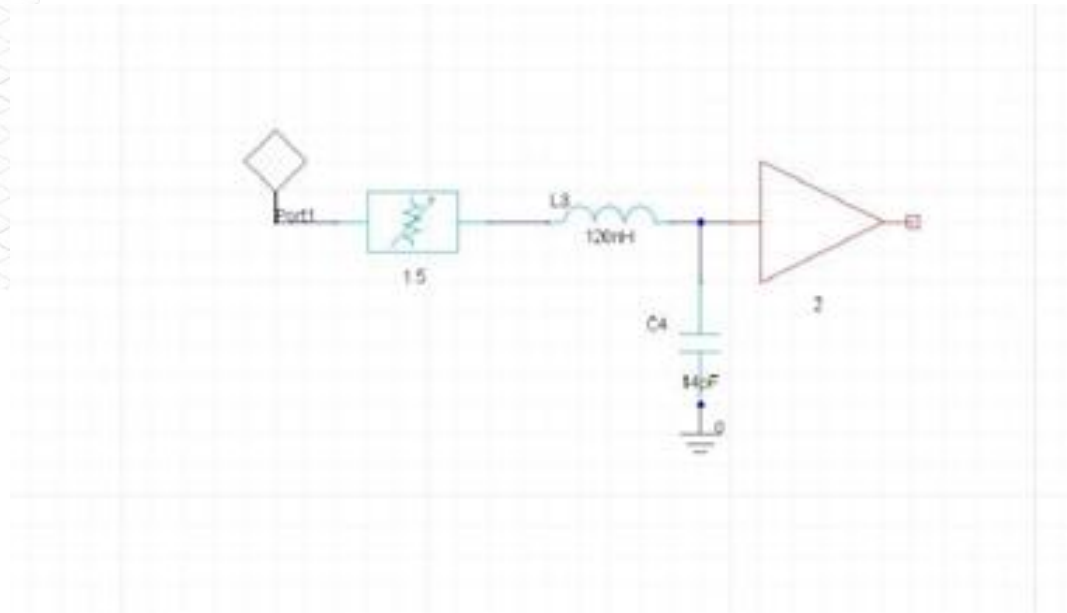
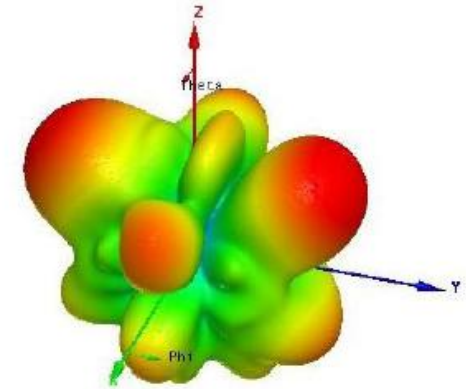
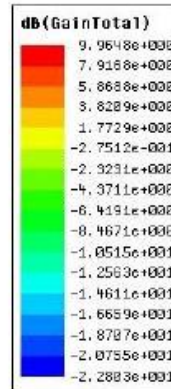
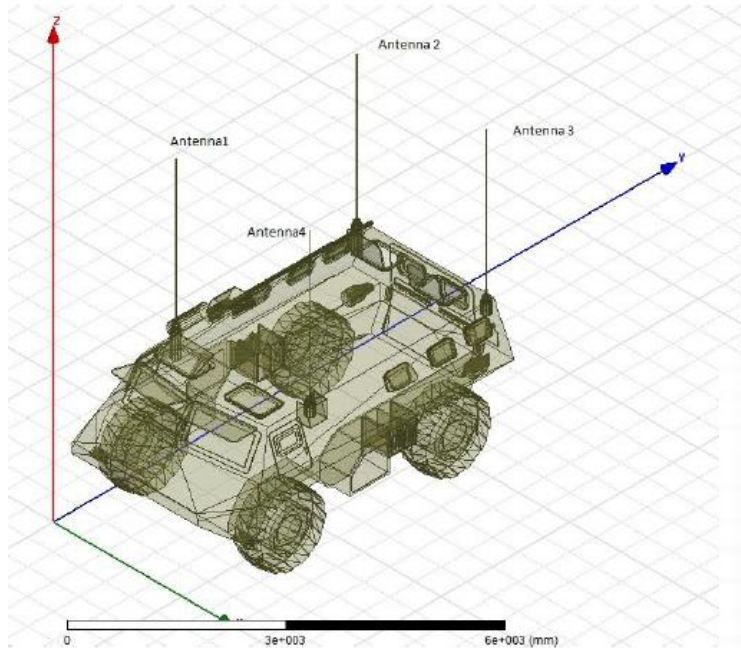


Roue avec permittivité = 3





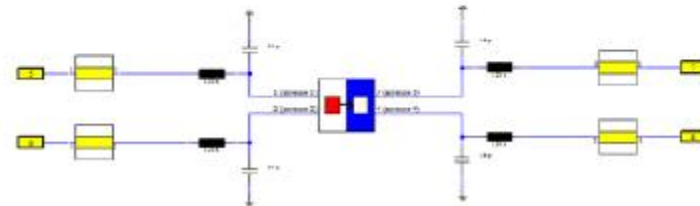
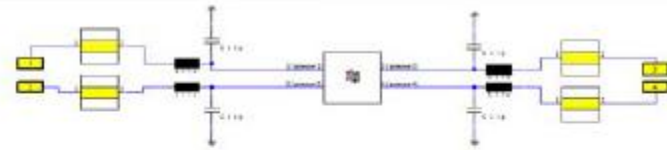
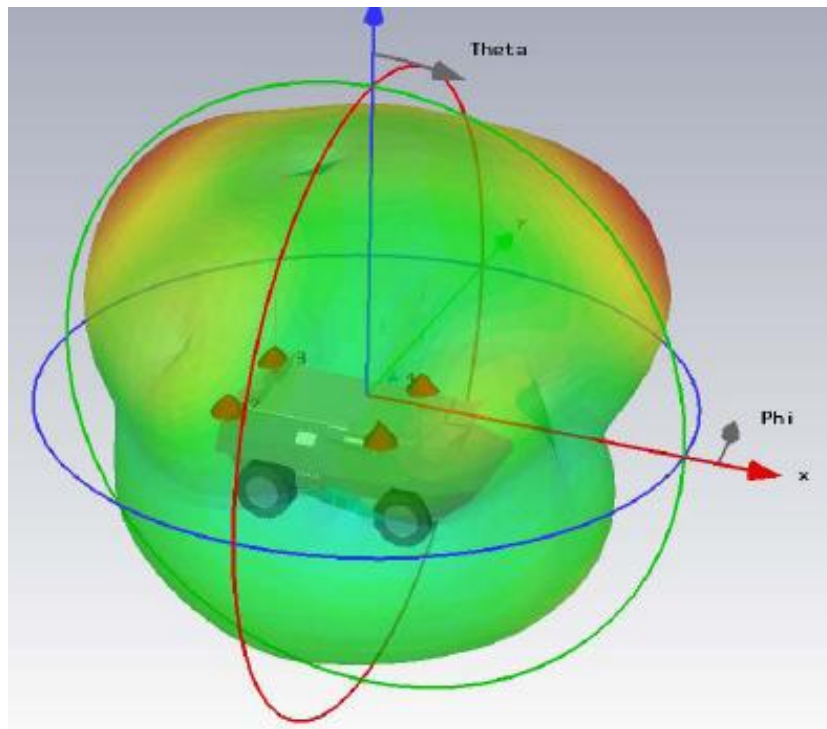
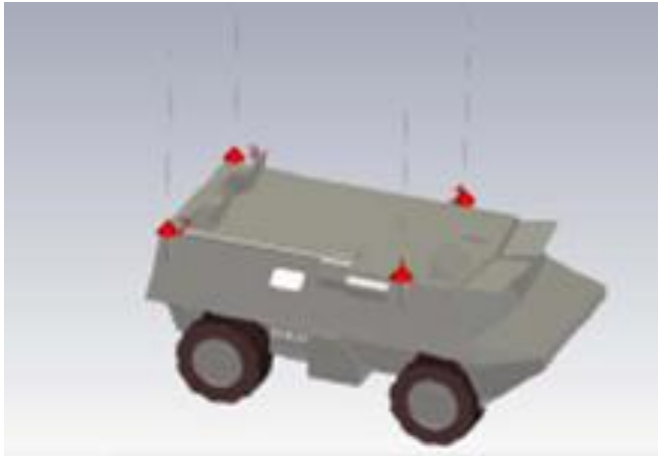
# Outil n°1





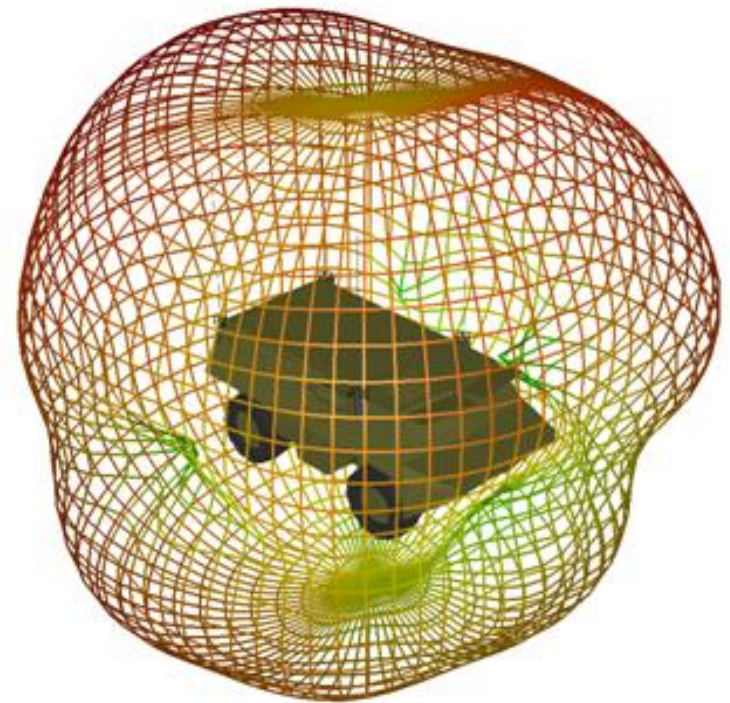
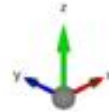
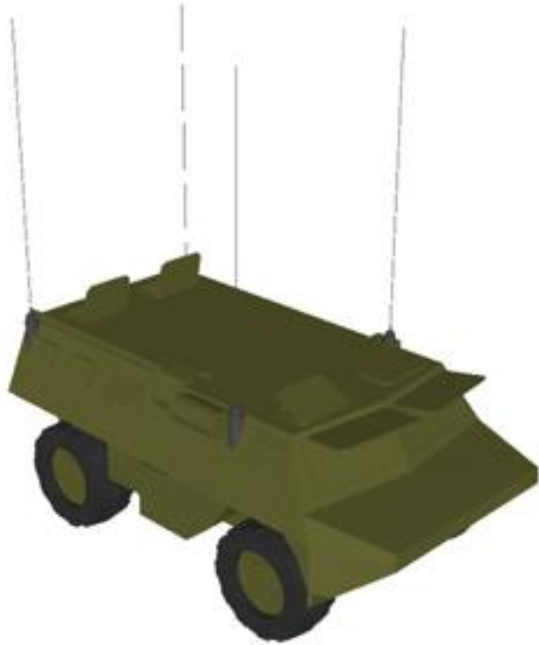


# Outil n°2

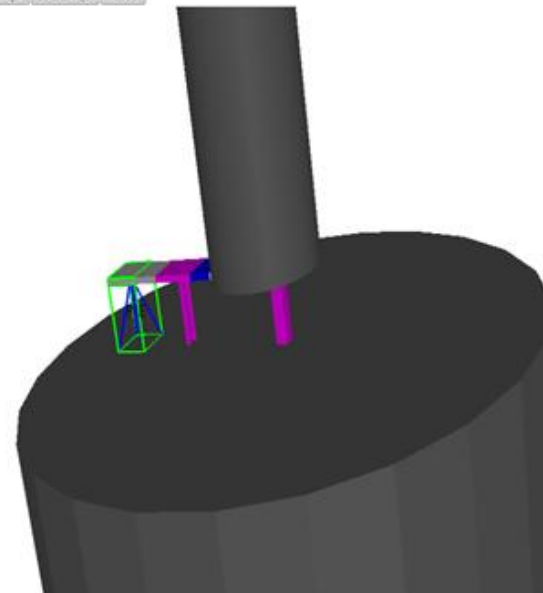




# Outil n°3

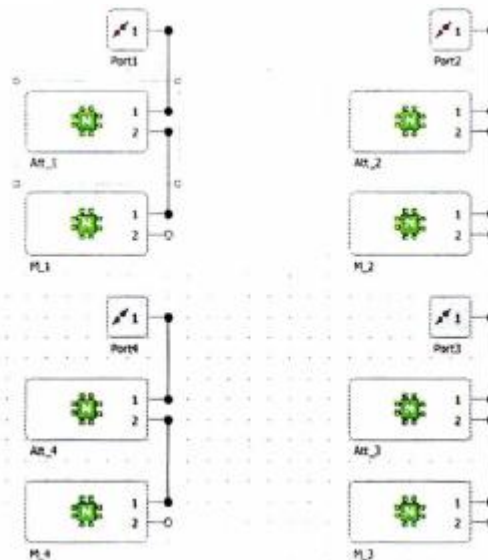
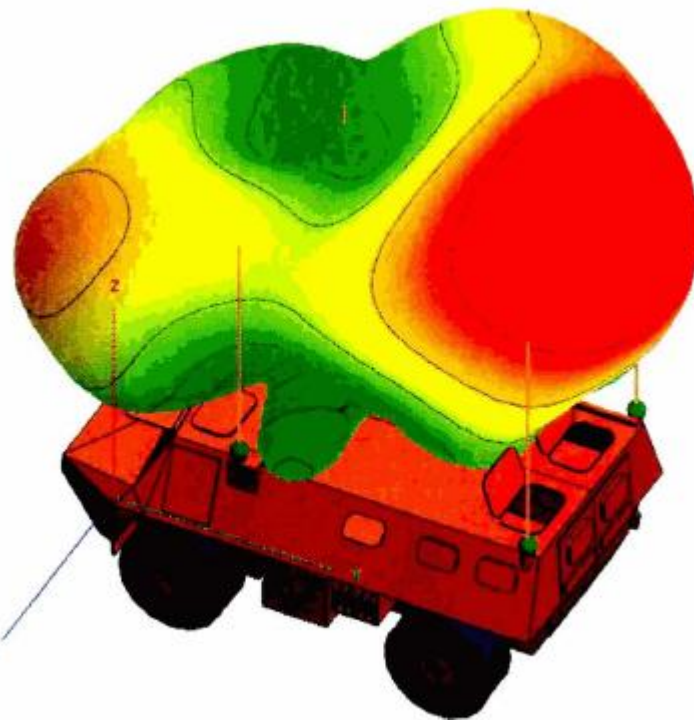
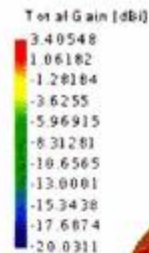
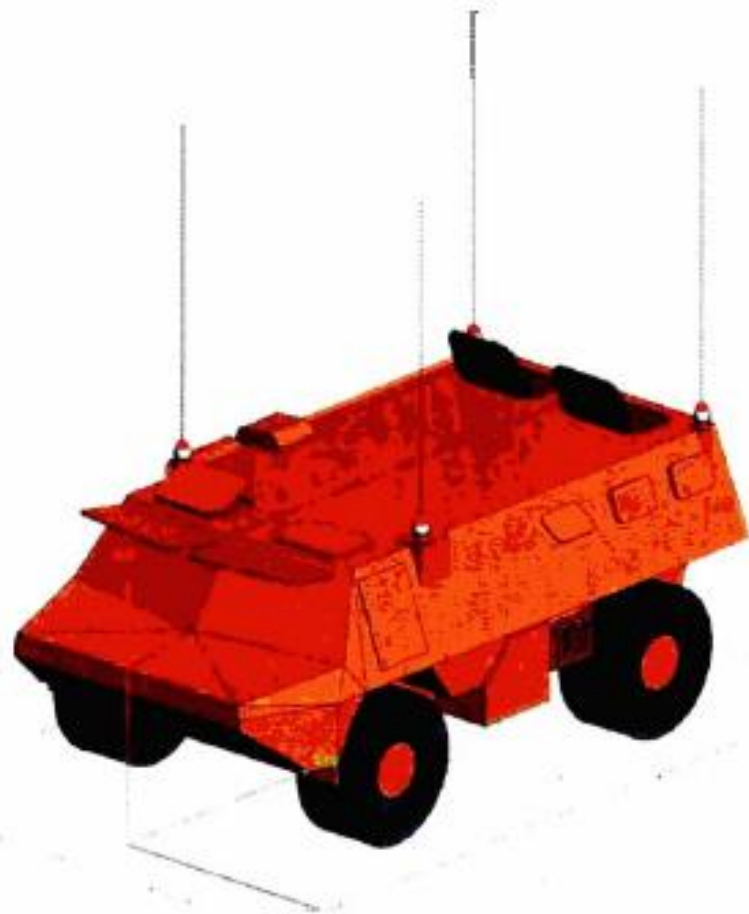


animation | Scene Viewport | Render Viewport | 3D Motion





# Outil n°4



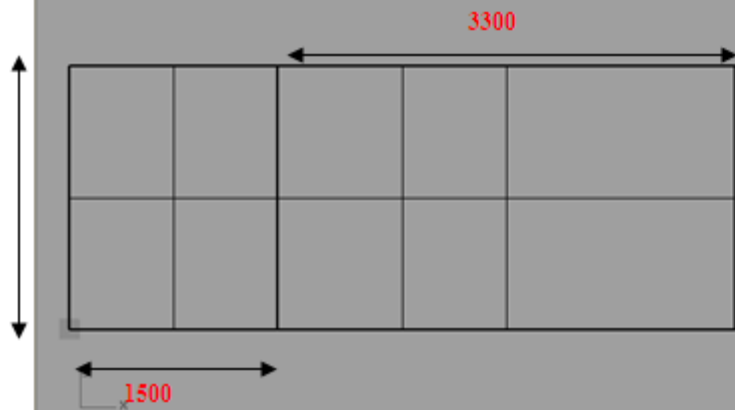


# Simulation d'une antenne PIFA

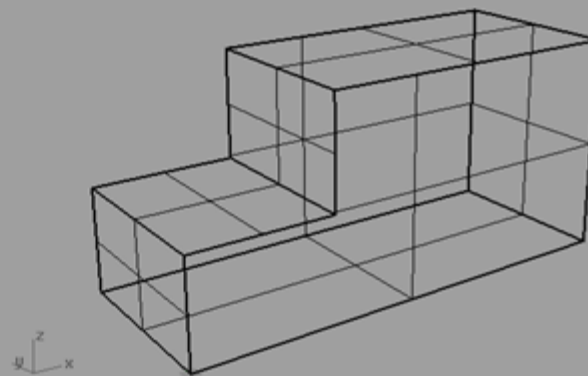
# Description du cas test n°2

VEHICULE

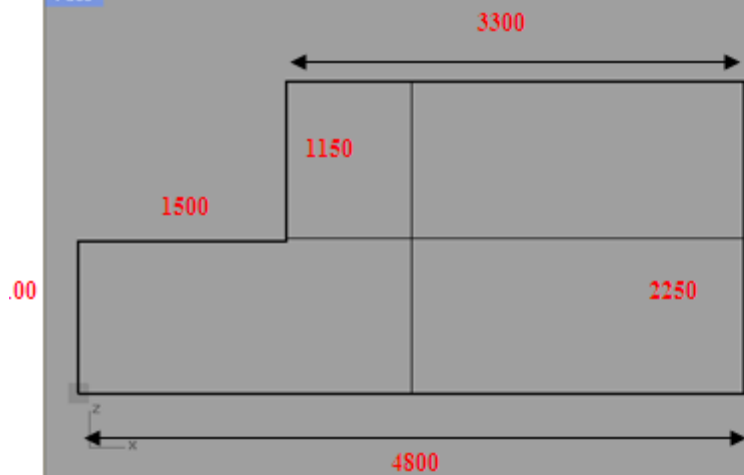
Dessus



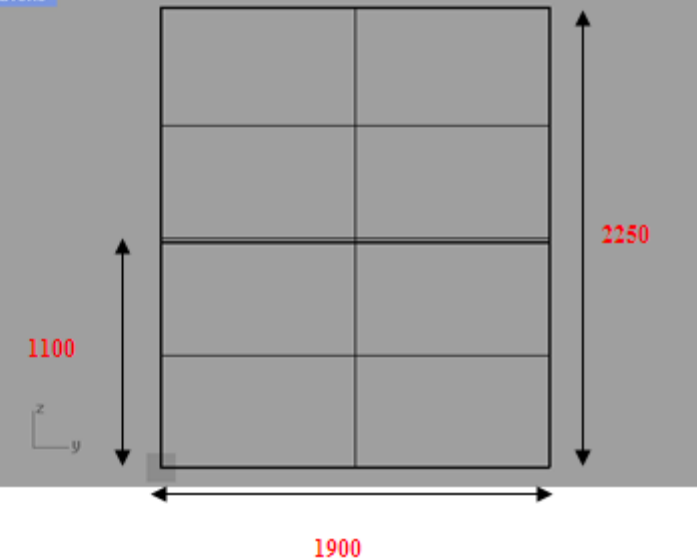
Perspective



Face

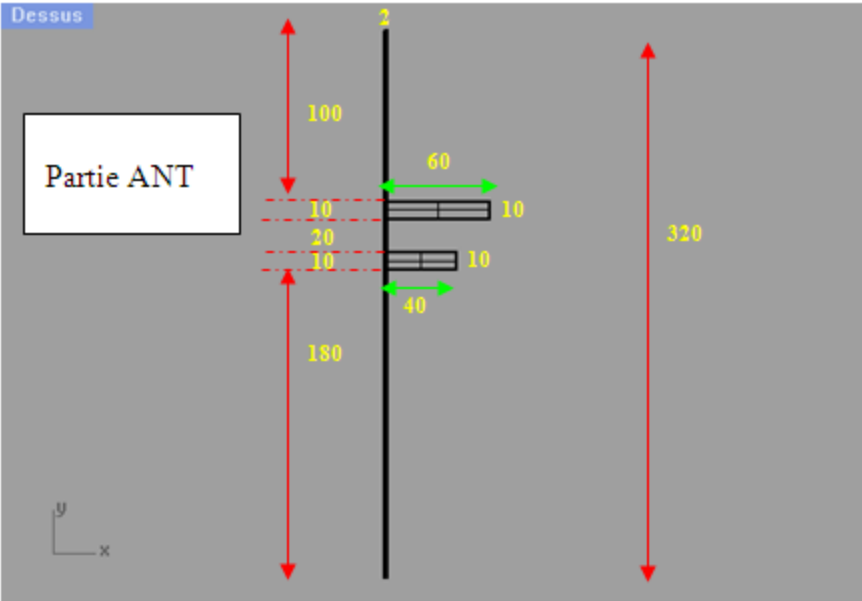


Droite

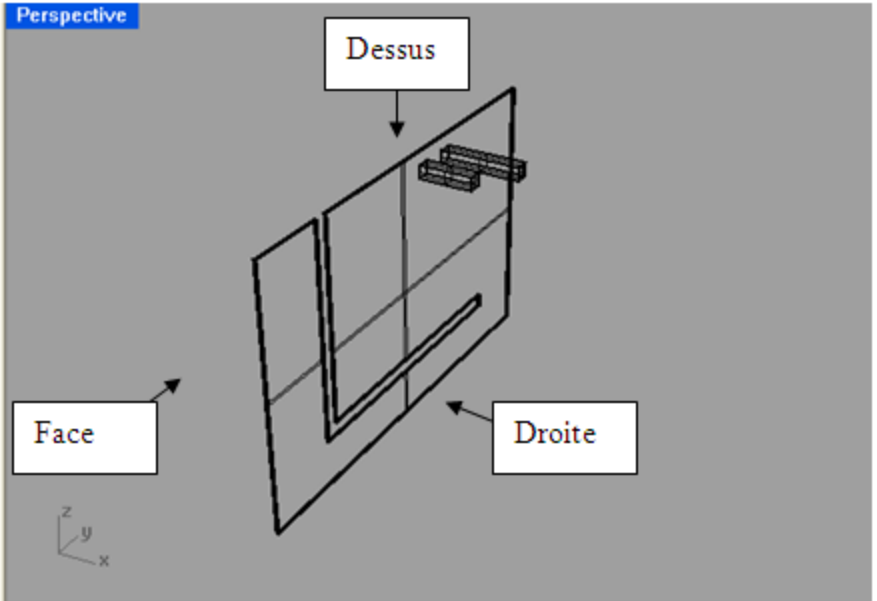


# Description du cas test n°2

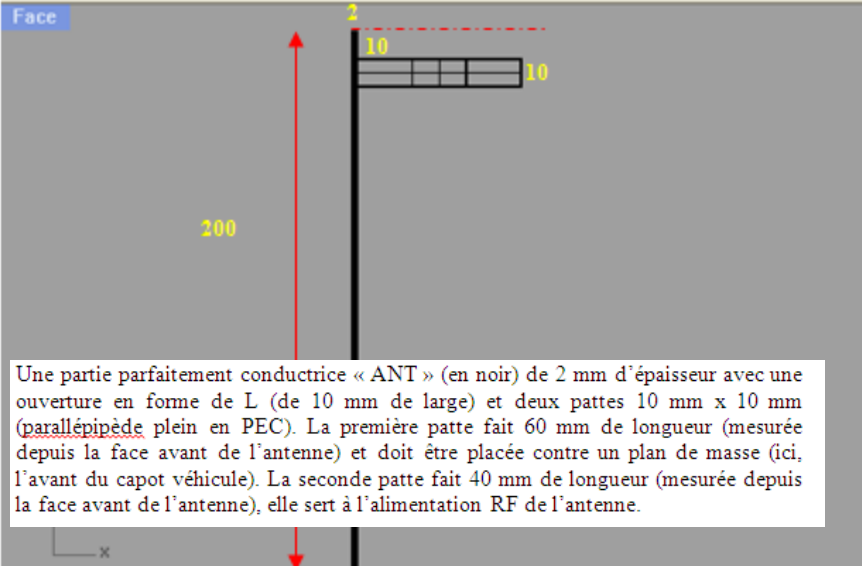
Dessus



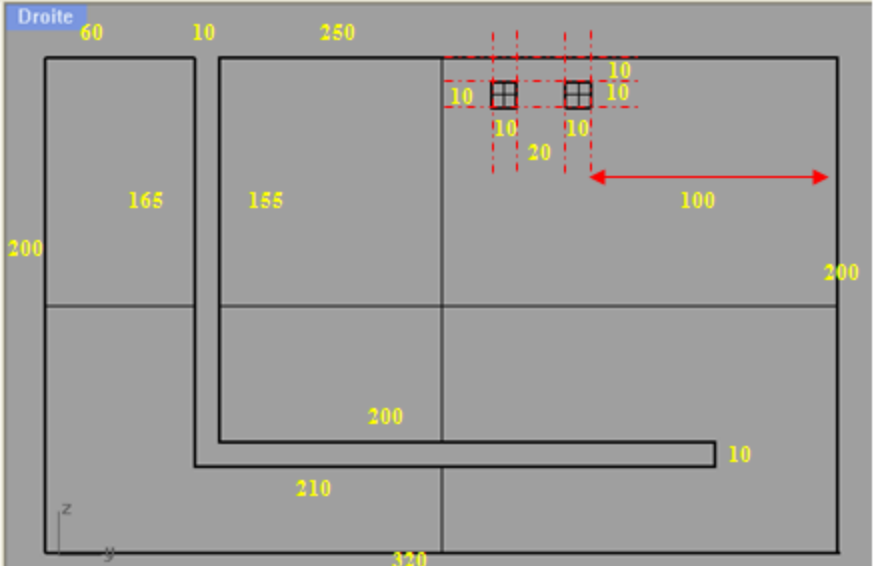
Perspective



Face

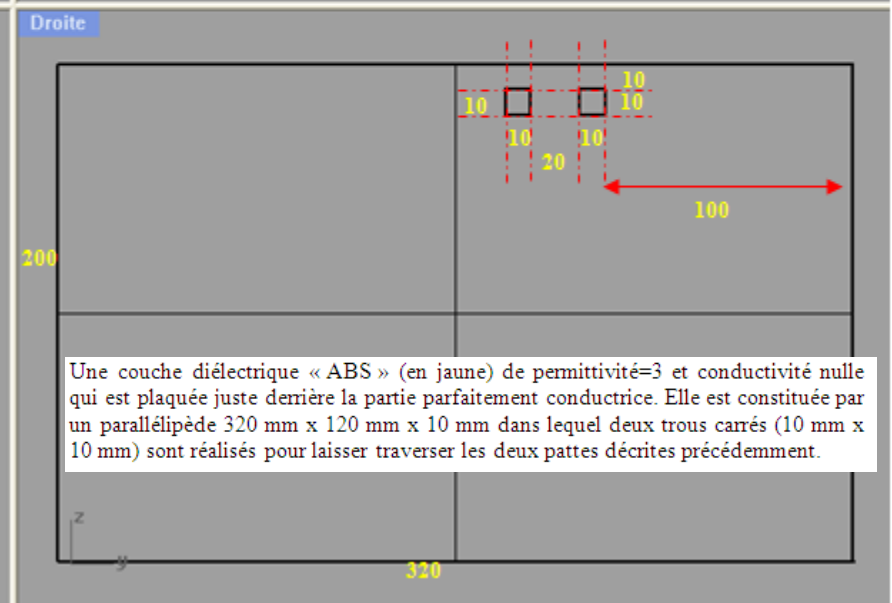
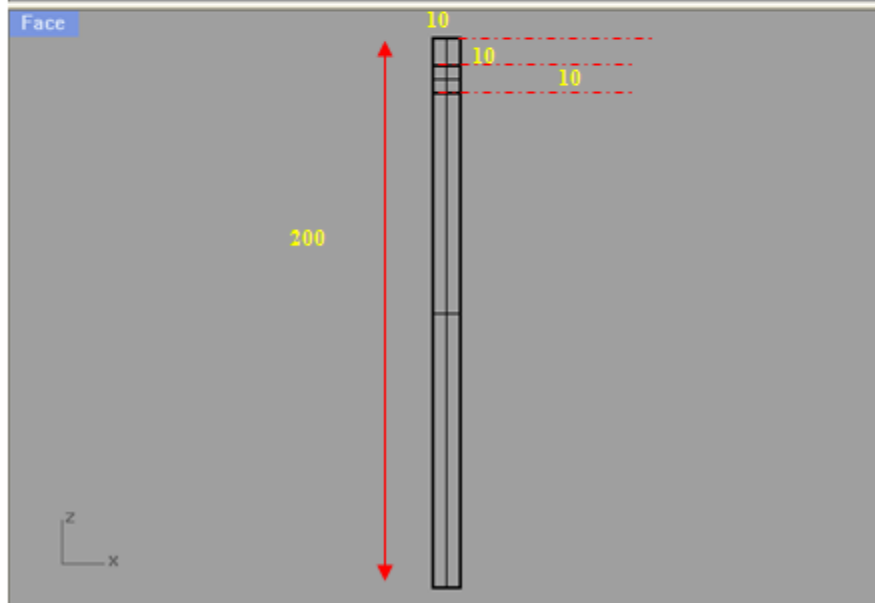
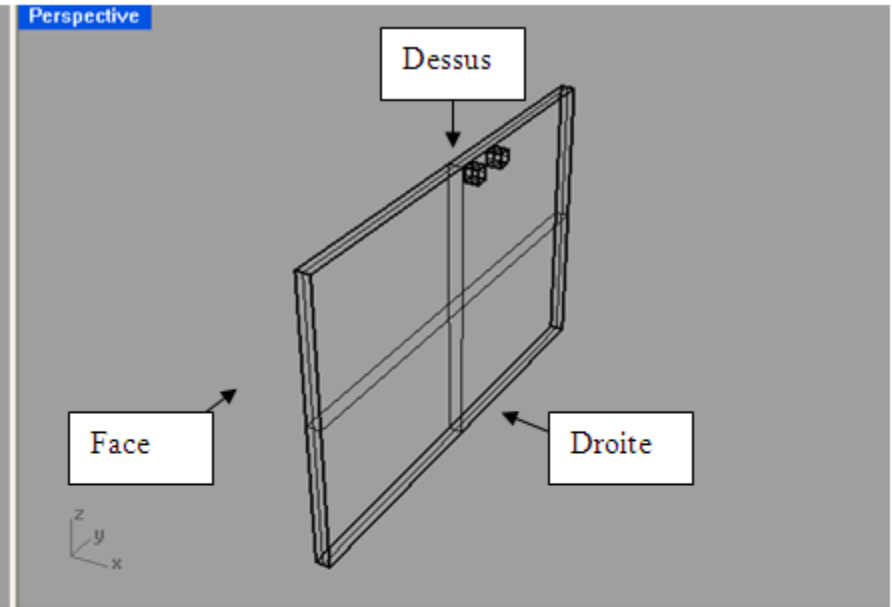
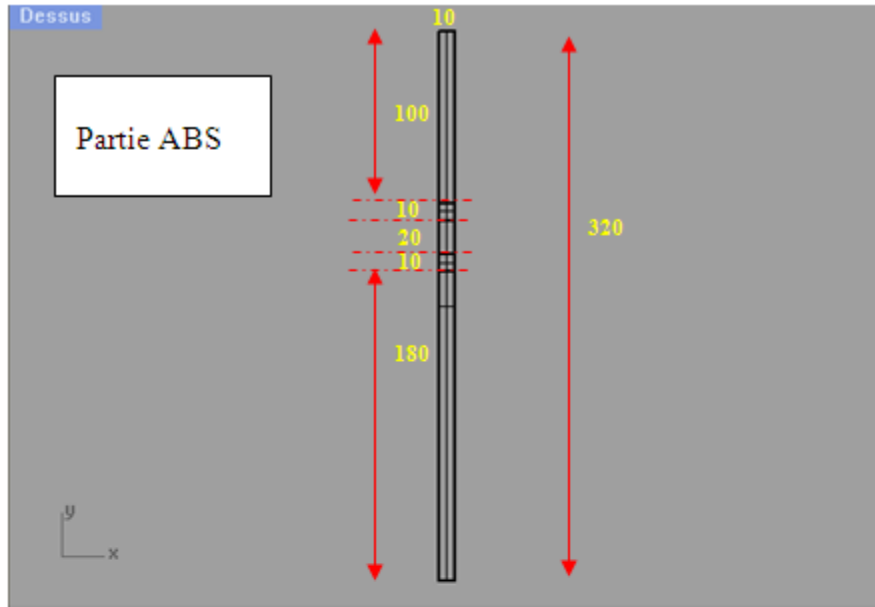


Droite

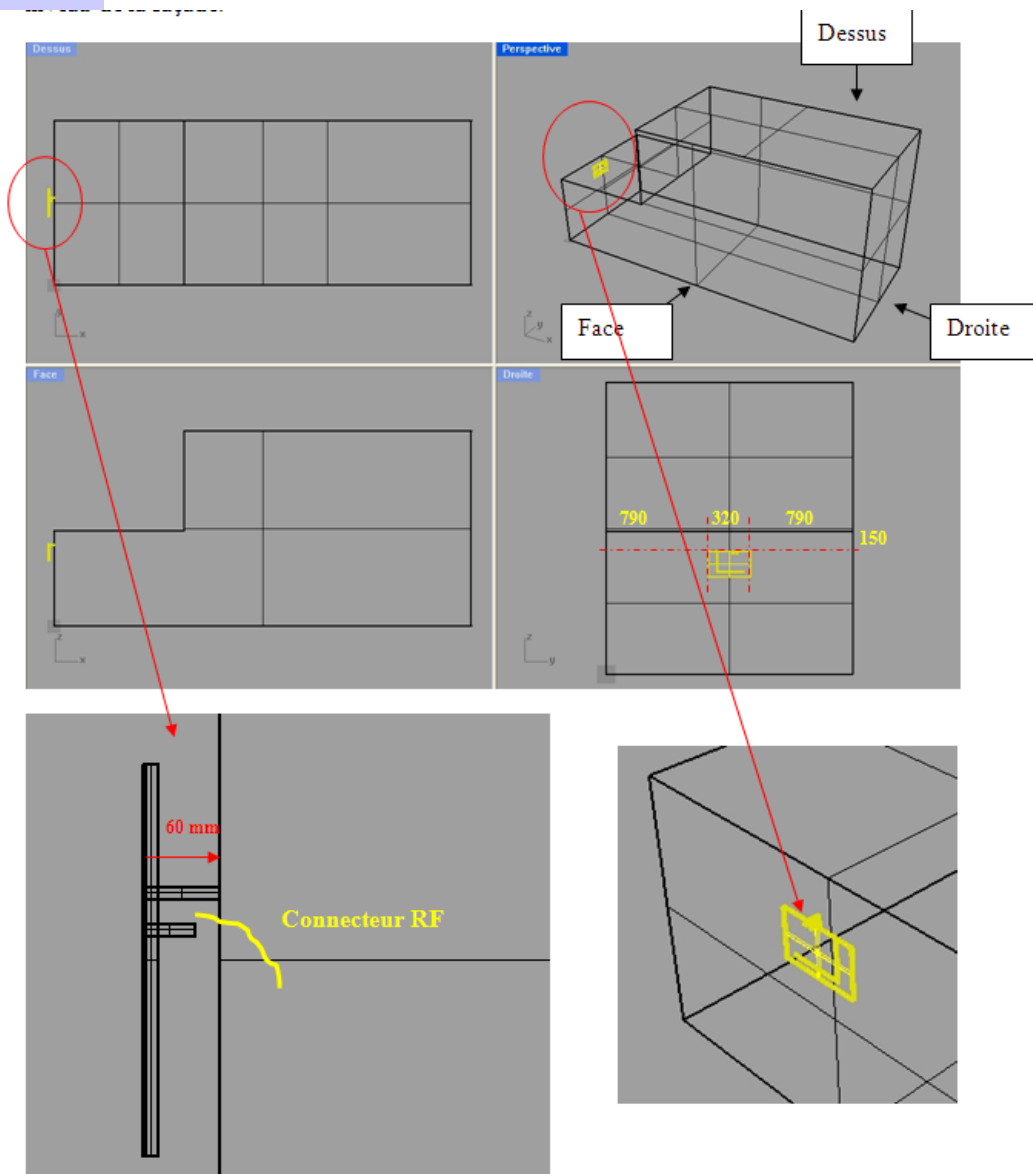


Une partie parfaitement conductrice « ANT » (en noir) de 2 mm d'épaisseur avec une ouverture en forme de L (de 10 mm de large) et deux pattes 10 mm x 10 mm (parallépipède plein en PEC). La première patte fait 60 mm de longueur (mesurée depuis la face avant de l'antenne) et doit être placée contre un plan de masse (ici, l'avant du capot véhicule). La seconde patte fait 40 mm de longueur (mesurée depuis la face avant de l'antenne), elle sert à l'alimentation RF de l'antenne.

# Description du cas test n°2



# Description du cas test n°2







# Outil n°1

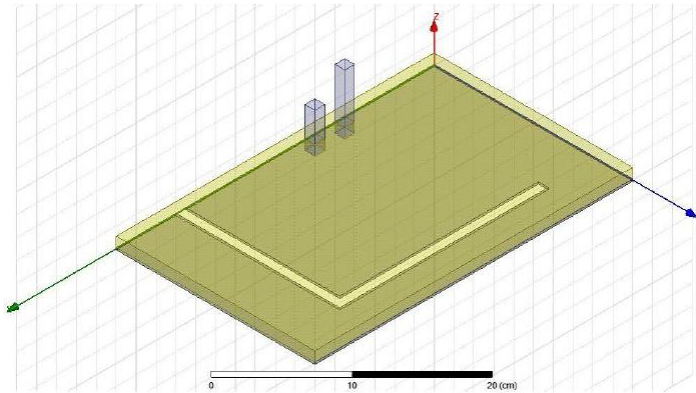
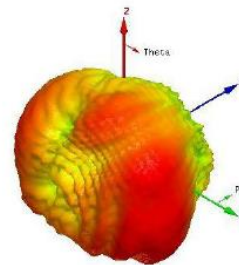
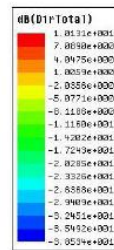
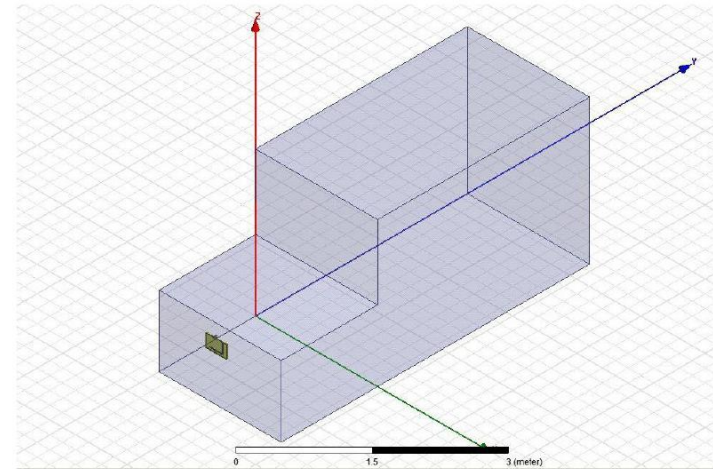
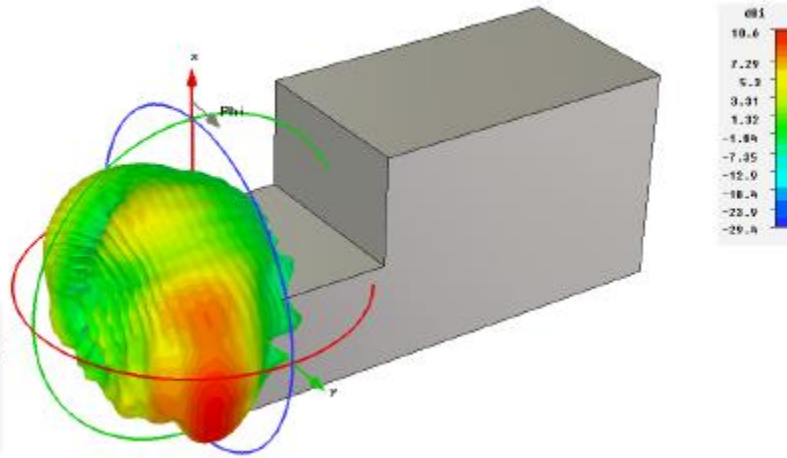
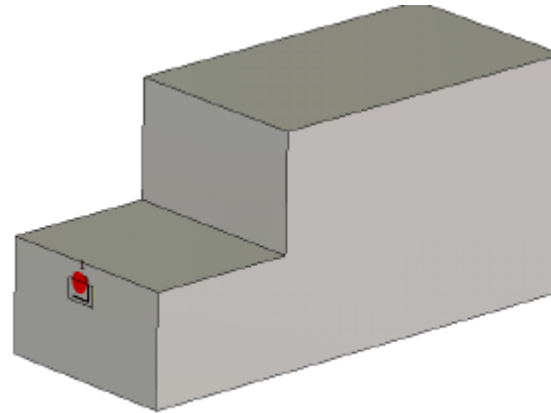
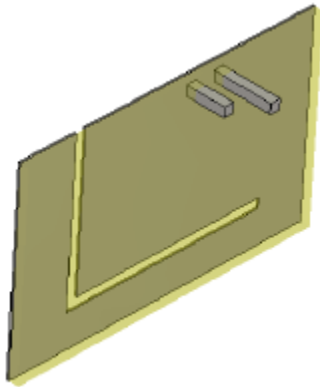


Figure 16- CAO de l'antenne PIFA





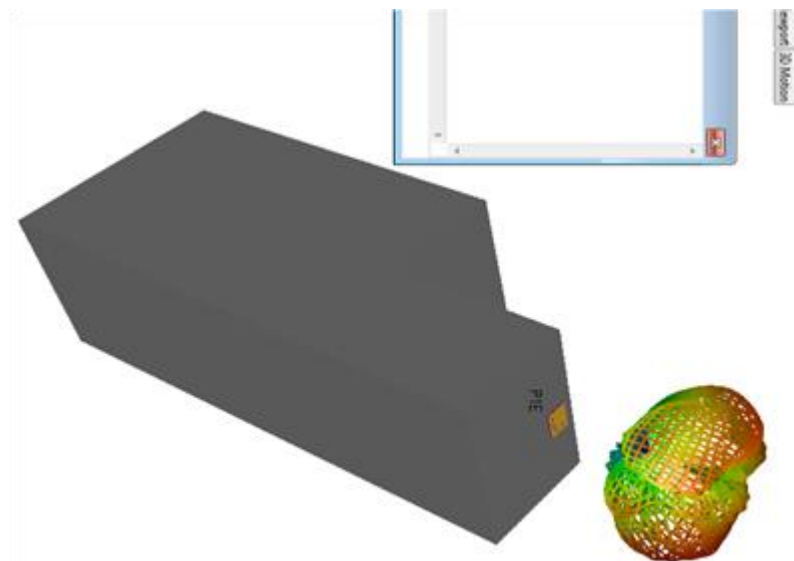
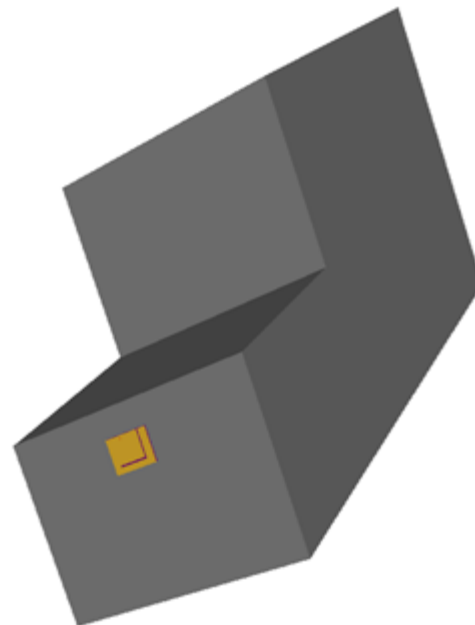
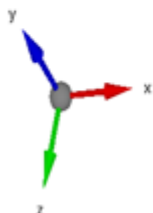
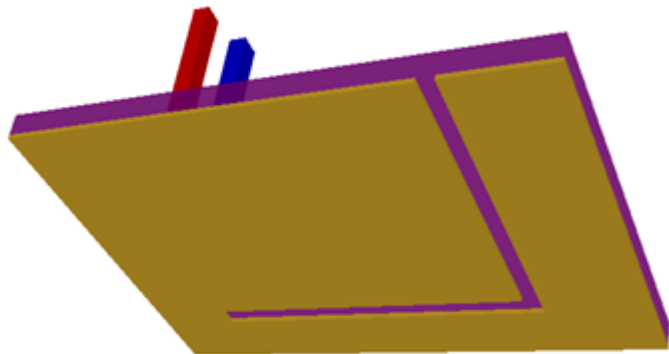
# Outil n°2



Type	Farfield
Approximation	equation (RE >> 1)
Monitor	Farfield (F=2) [1]
Component	abs
Output	Directivity
Frequency	2
Rad. effic.	0.01075 dB
tot. effic.	-8.2059 dB
dir.	10.60 dB

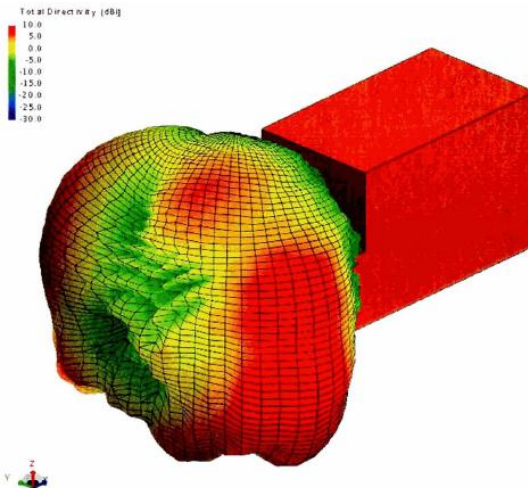
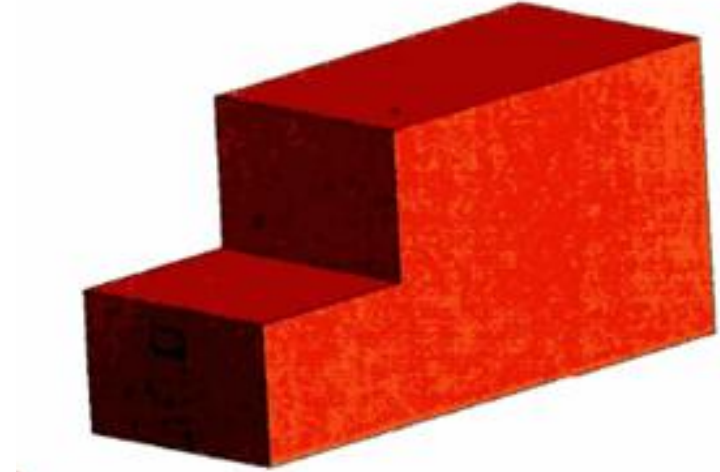
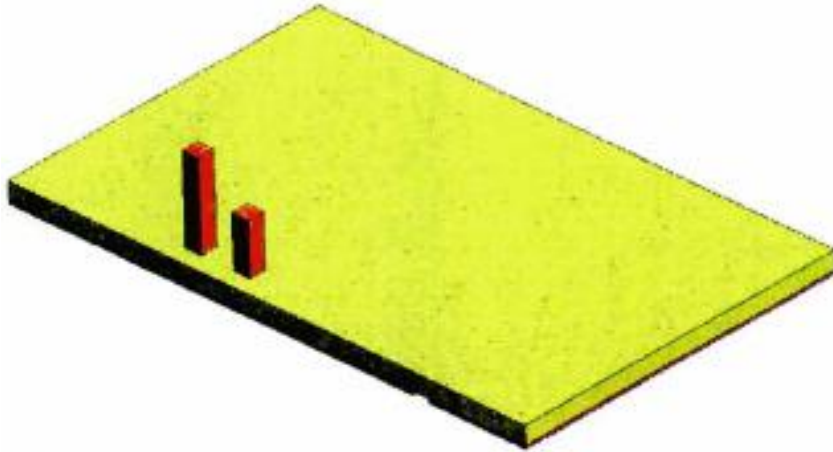


# Outil n°3





# Outil n°4

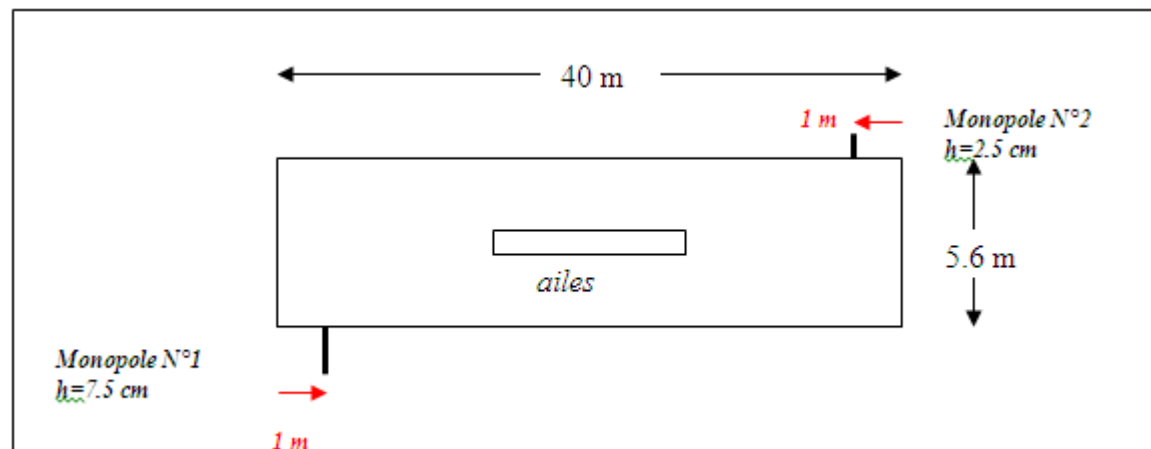




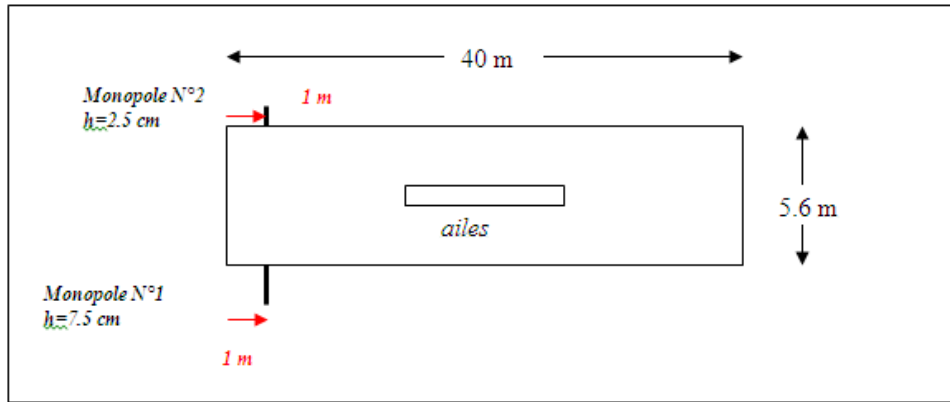
# Simulation d'un monopole 4 GHz sur avion

# Description du cas test n°3

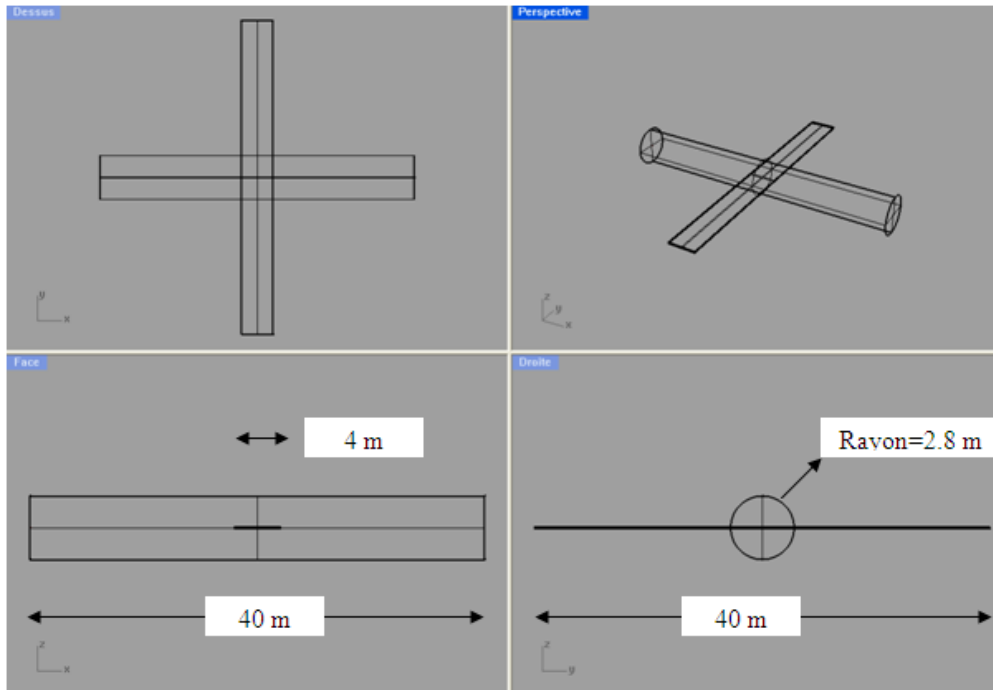
- ✓ L'avion pris en compte est un modèle simplifié, parfaitement conducteur (PEC), constitué d'un fuselage (un cylindre de rayon 2.8 m et d'une longueur 40 m) et d'ailes (un parallépipède rectangle de 40 m de long, de 4 m de large et 20 cm d'épaisseur, centré au milieu du cylindre).



# Description du cas test n°3

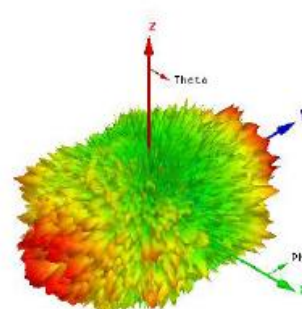
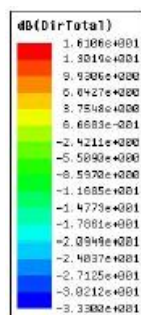
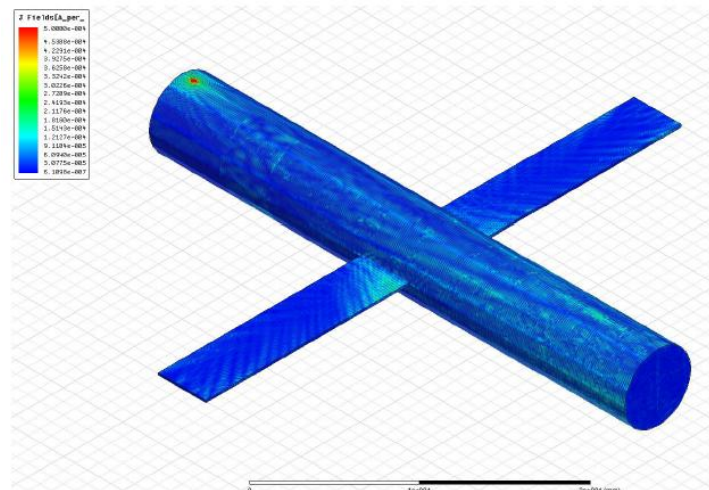
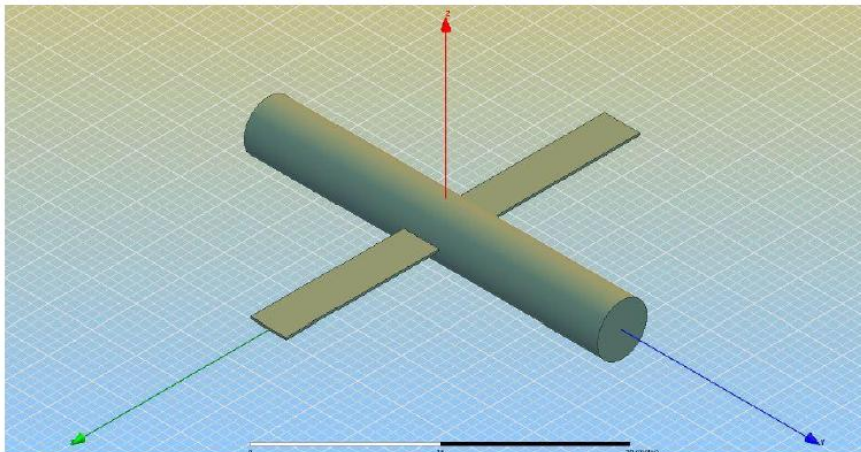


Configuration n°2





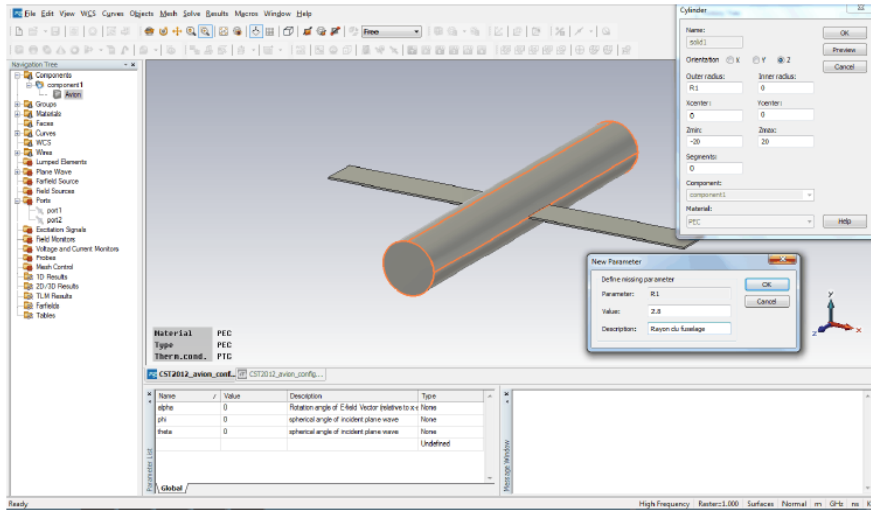
# Outil n°1





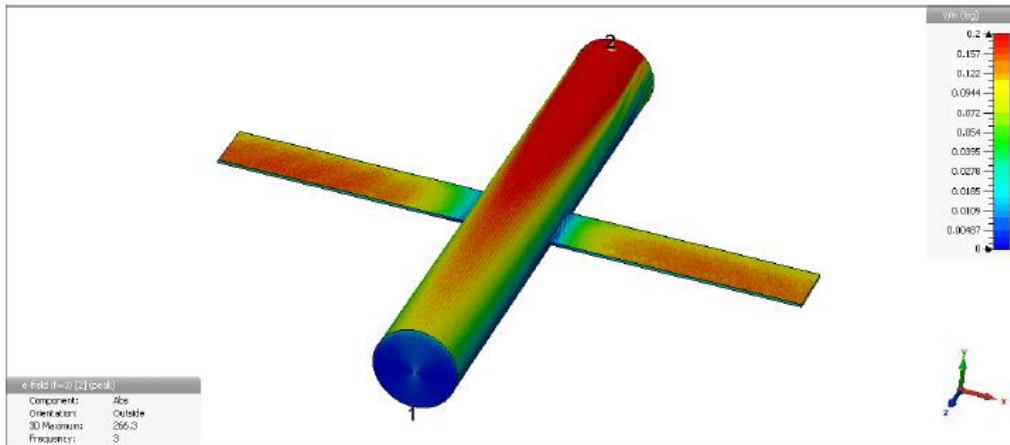
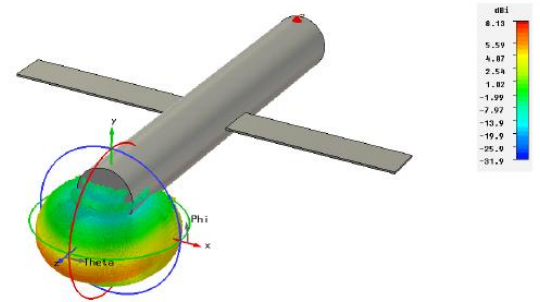


# Outil n°5



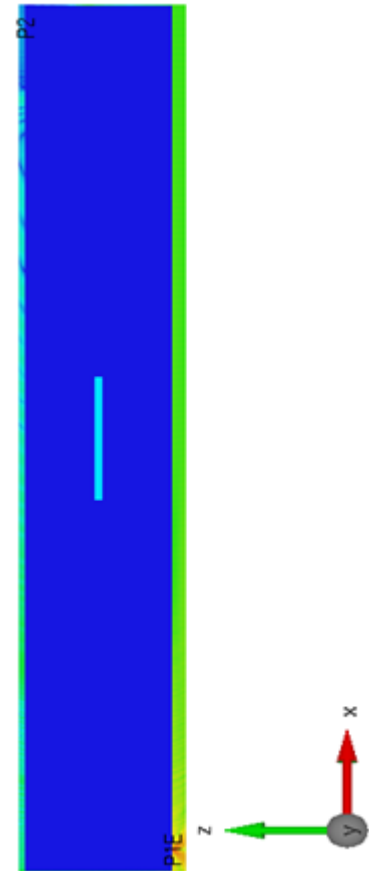
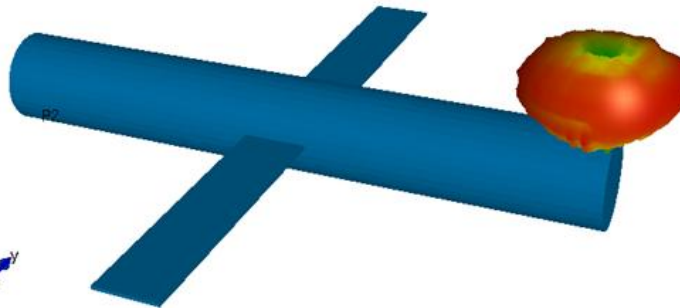
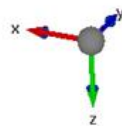
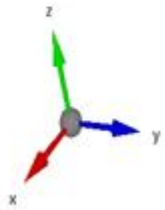
```

Type: Farfield
Approximation: enabled (kR >> 1)
Monitor: Farfield (F+1) [1(1)]
Component: abs
Output: Directivity
Frequency: 1
Rad. effic.: 1.292e-009 dB
Tot. effic.: -2.08232 dB
D1r.: 0.494 dBi
  
```



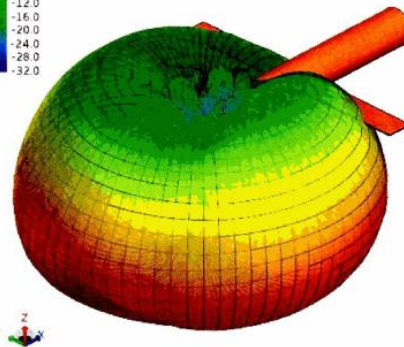
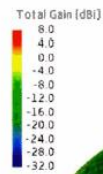
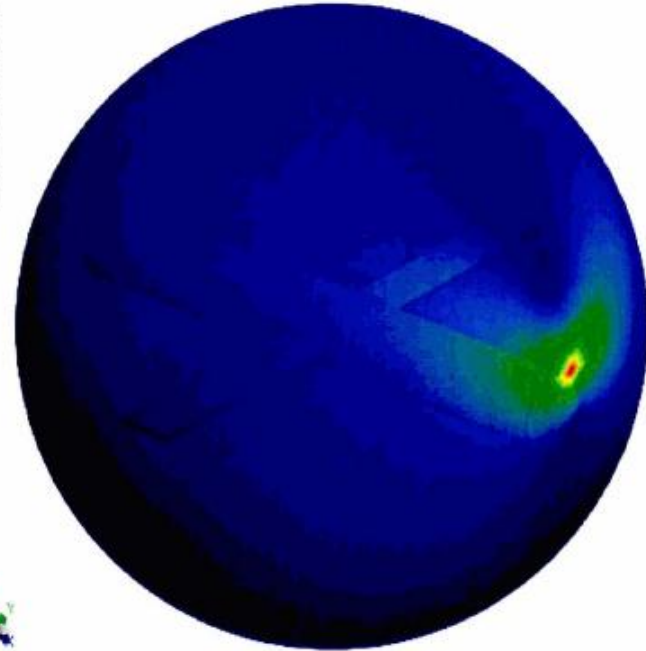
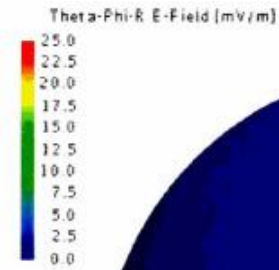
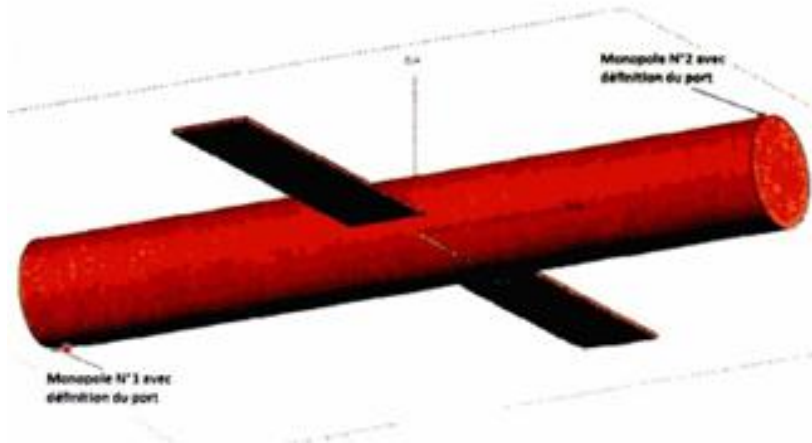


# Outil n°3





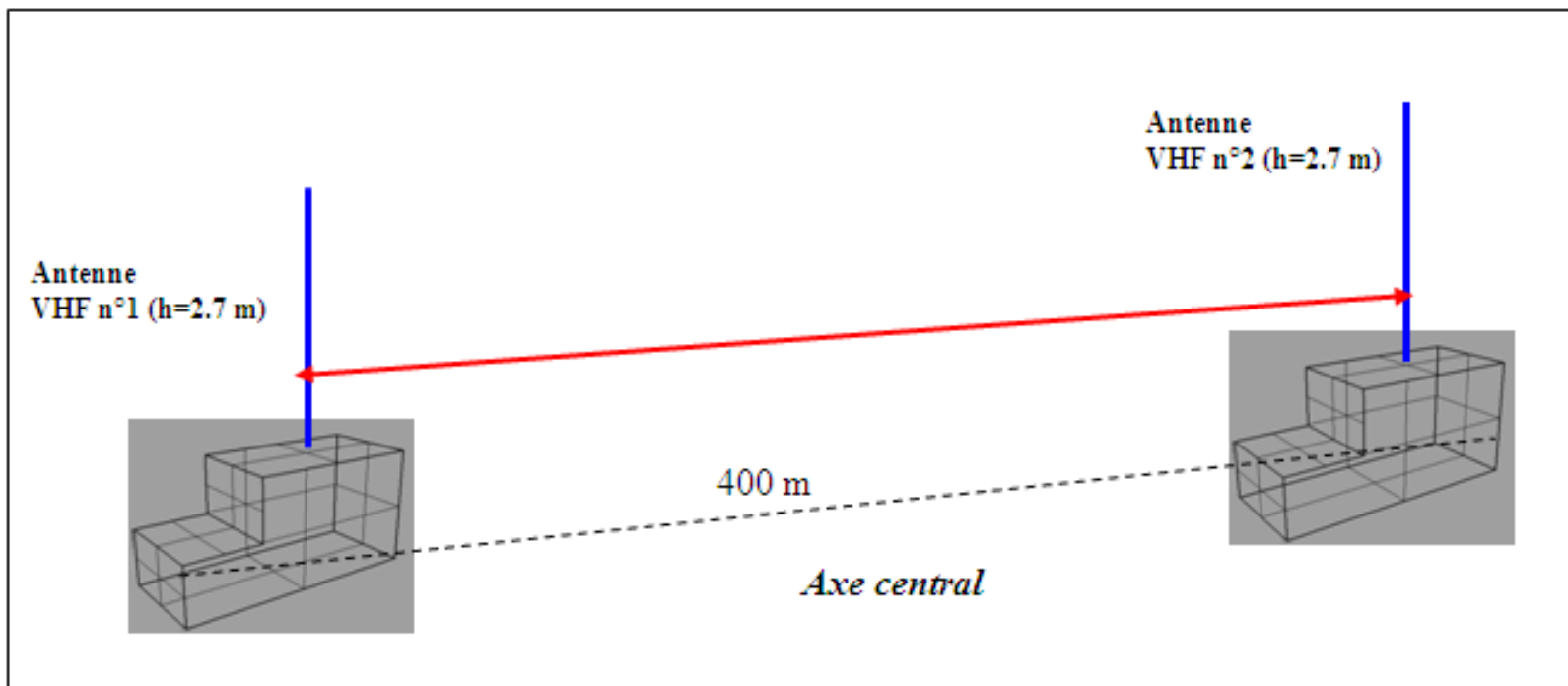
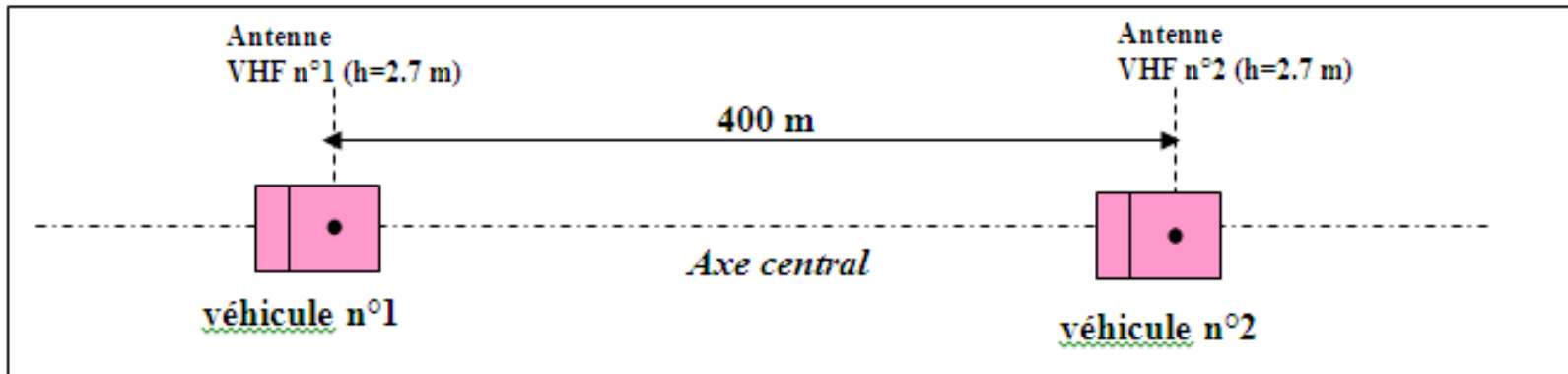
# Outil n°4





# Simulation entre deux véhicules dans un convoi

# Description du cas test n°4





# Outil n°1

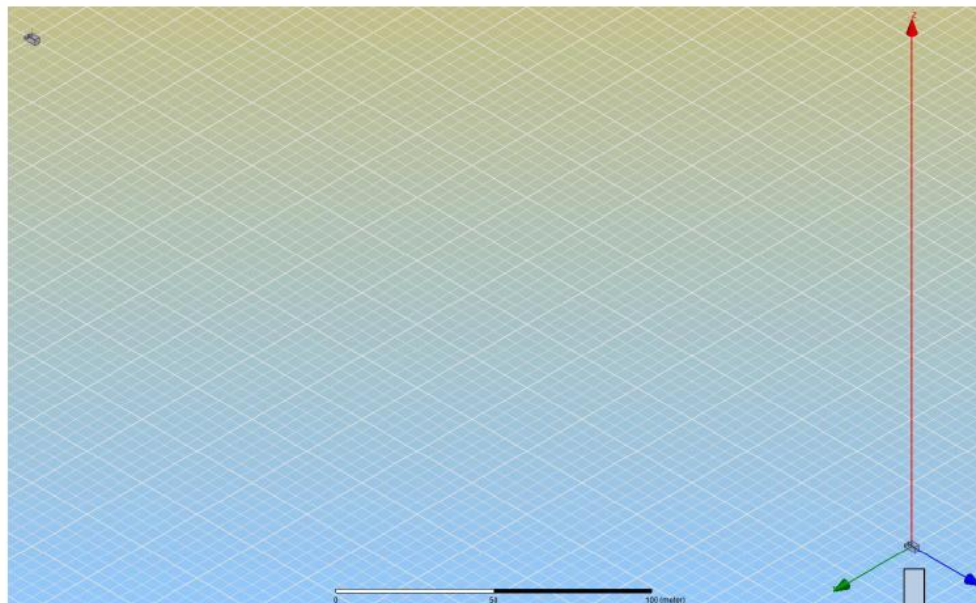


Figure 7- Deux véhicules distants de 400m

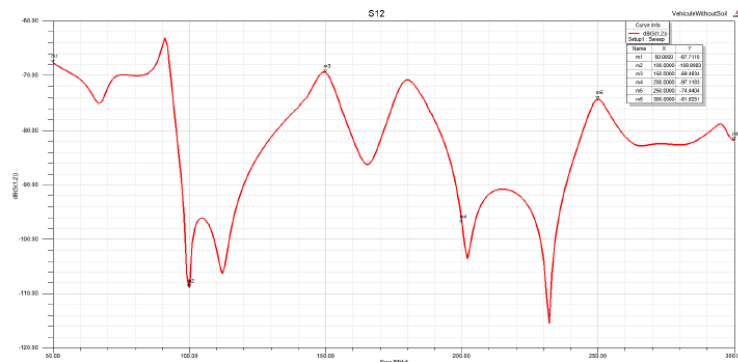
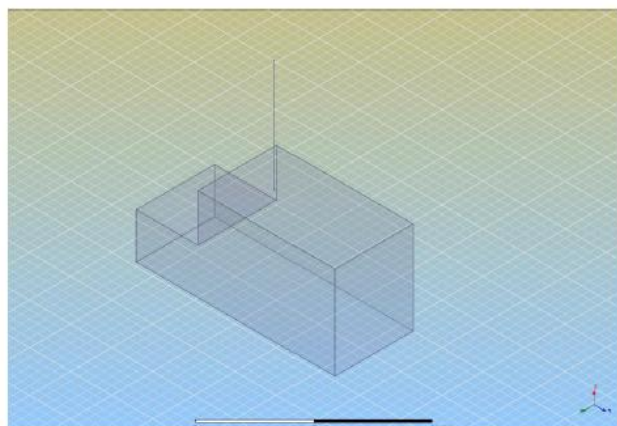


Figure 8- Coefficient de transmission « Sans sol »

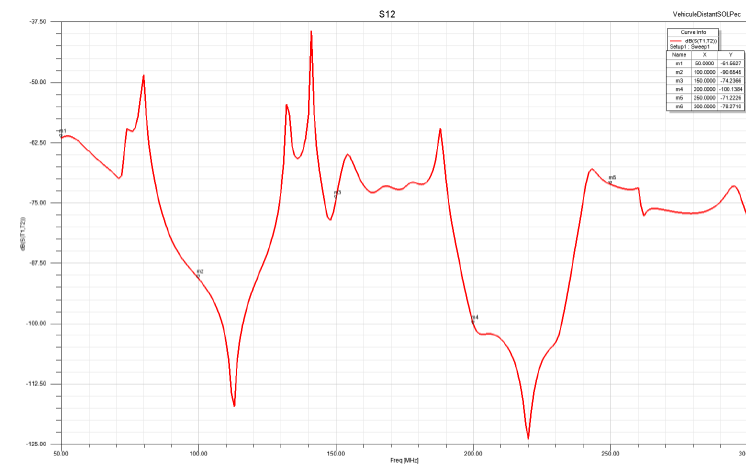
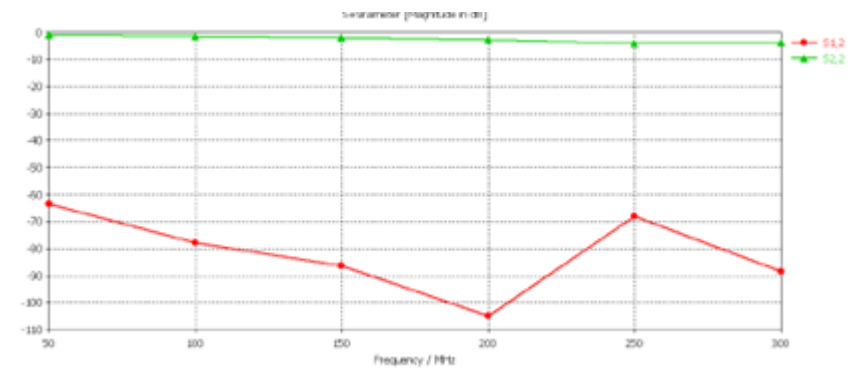
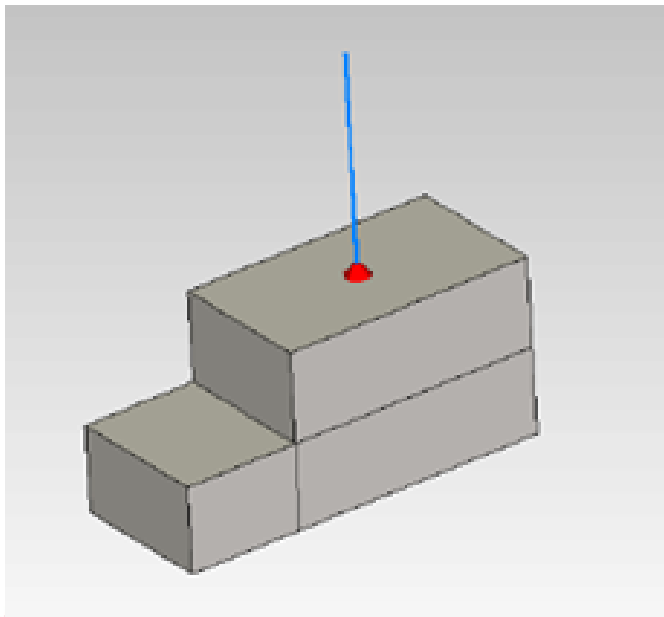
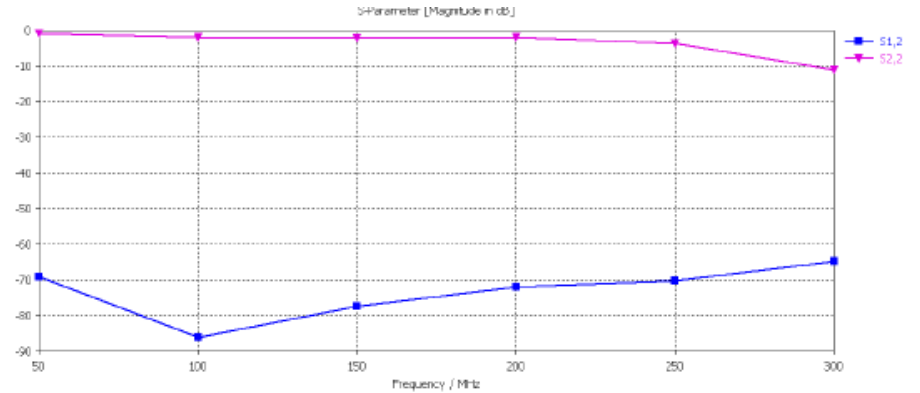


Figure 9- Coefficient de transmission « Sol PEC »

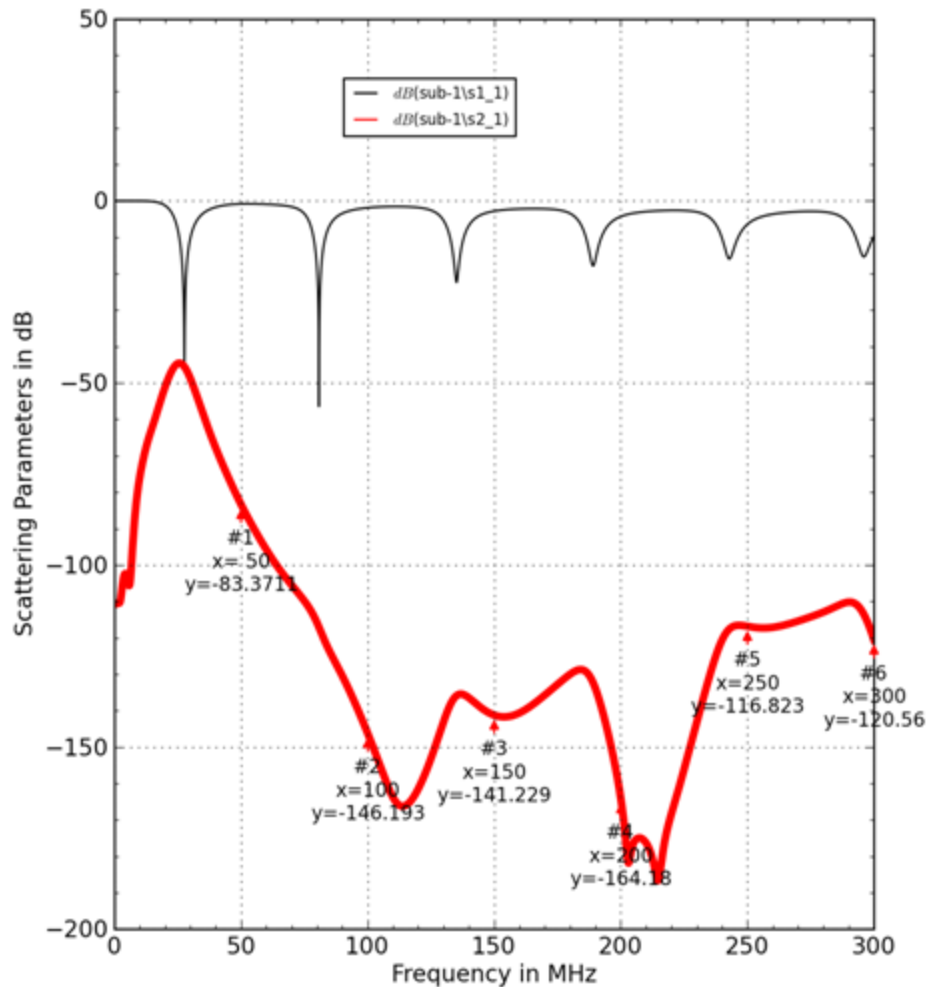
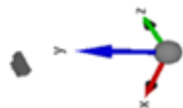


# Outil n°5





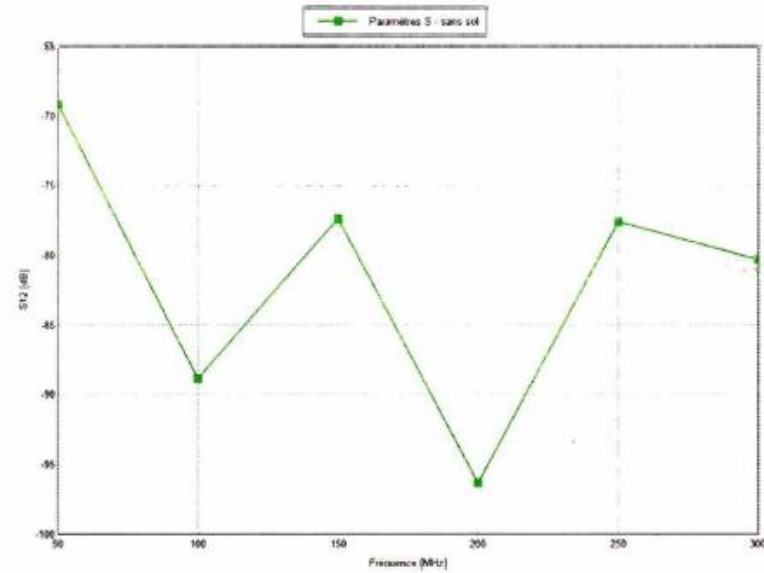
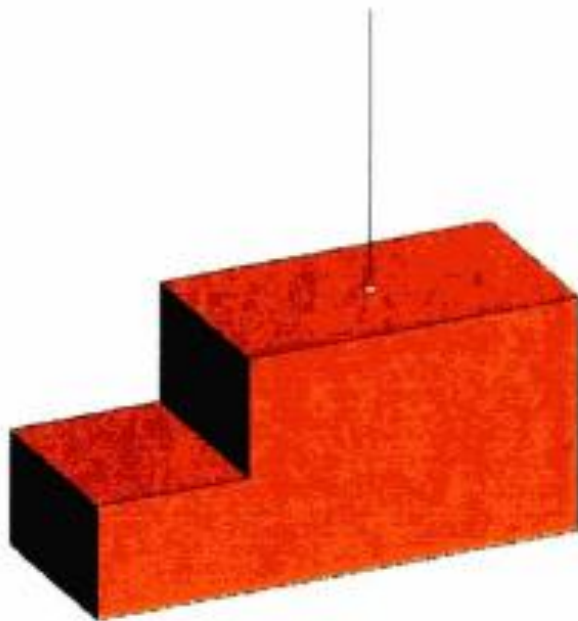
# Outil n°4







# Outil n°4





Thank  
You

*For your attention*