COMPUTATIONAL DESIGN OF MINIATURIZED MICROSTRIP ANTENNA FOCUSED ON CUBE SATELLITES

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CONTENT

- Introduction to microstrip antennas on cubesats
- Main Purpose
- Simulations and results
- Analysis of results
- Conclusions
- Proposed future work

INTRODUCTION TO MICROSTRIP ANTENNAS ON CUBESATS

As is well known a microstrip antenna is compossed by a patch, a ground plane, a dielectric and a transmission line.

The "patch" dimensions are chosen so that dissipates power as radiation.

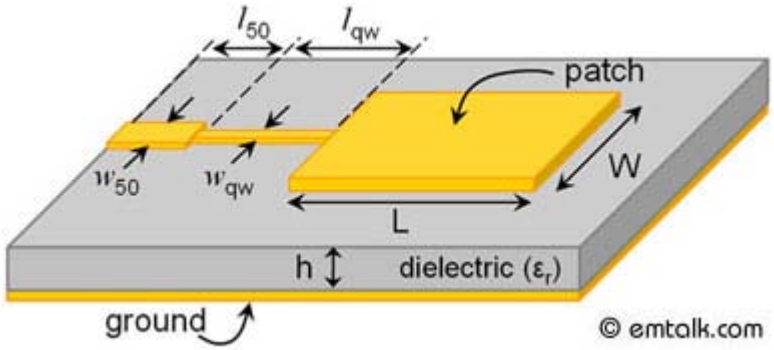
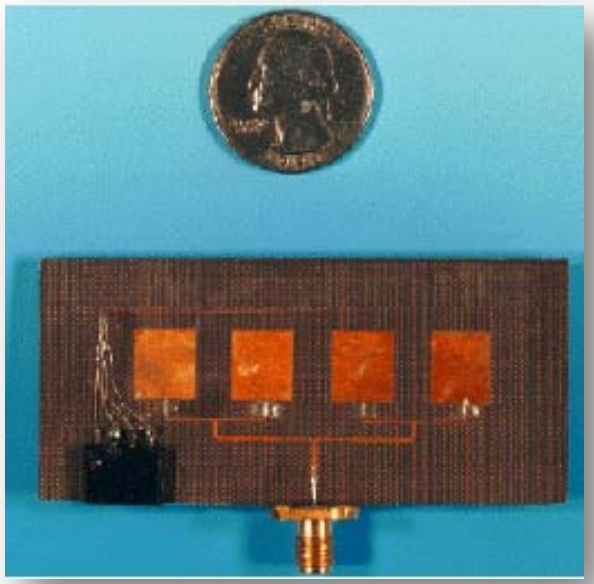


Image taken from: http://www.raymaps.com/index.php/e-field-of-a-patch-antenna/patch_antenna_labelled/

INTRODUCTION TO MICROSTRIP ANTENNAS ON CUBESATS

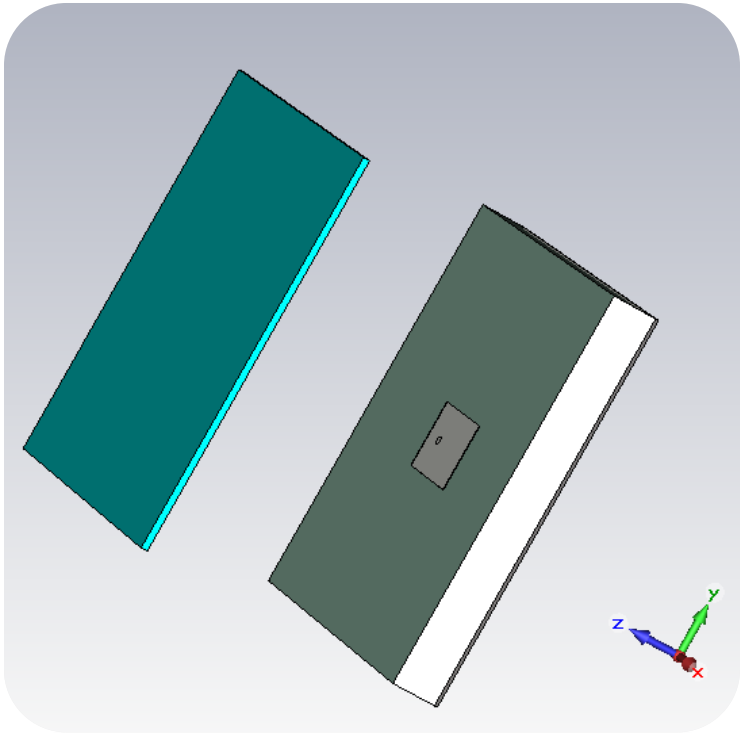
Microstrip antennas are often used on satellite missions because their fabrication is easy and cheap, they are robust and they can be used in telemetry.



http://www.upv.es/antenas/Documentos_PDF/Transparencias_reducidas/Tema_9.pdf

MAIN PURPOSE

The main purpose is to simulate a microstrip antenna with a film above the structure. The idea is to miniaturizate dimensions having the same radiation pattern in order to save space and reduce weight in a cubesat.



MAIN PURPOSE

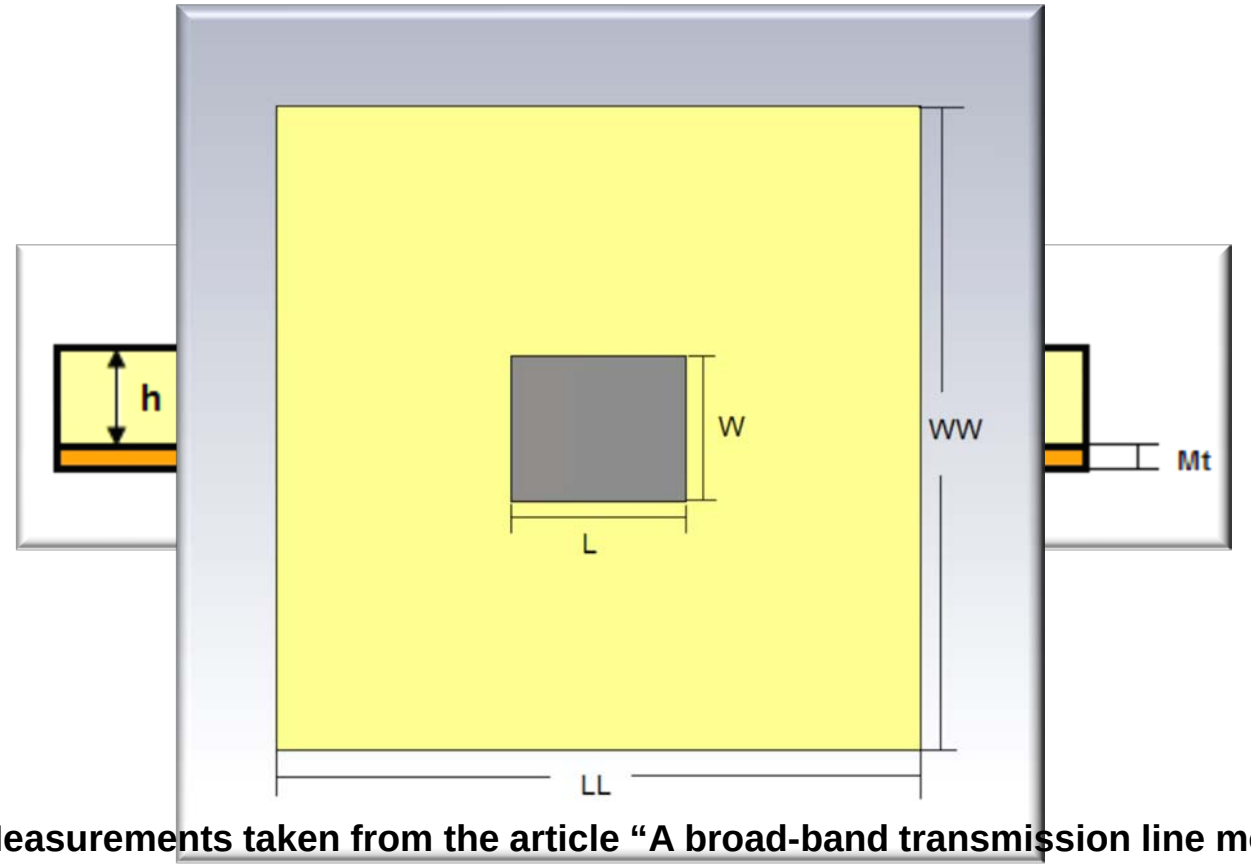
To achieve that objective we are going to use the software CST in order to simulate the behavior in the antenna that was proposed.

The idea is to do a comparisson between the propossed antenna (with covering) and the antenna with no covering.

Image taken from: http://www.cst.com

SIMULATIONS AND RESULTS

Considered antenna



W: 31.4 mm

h: 1.568 mm

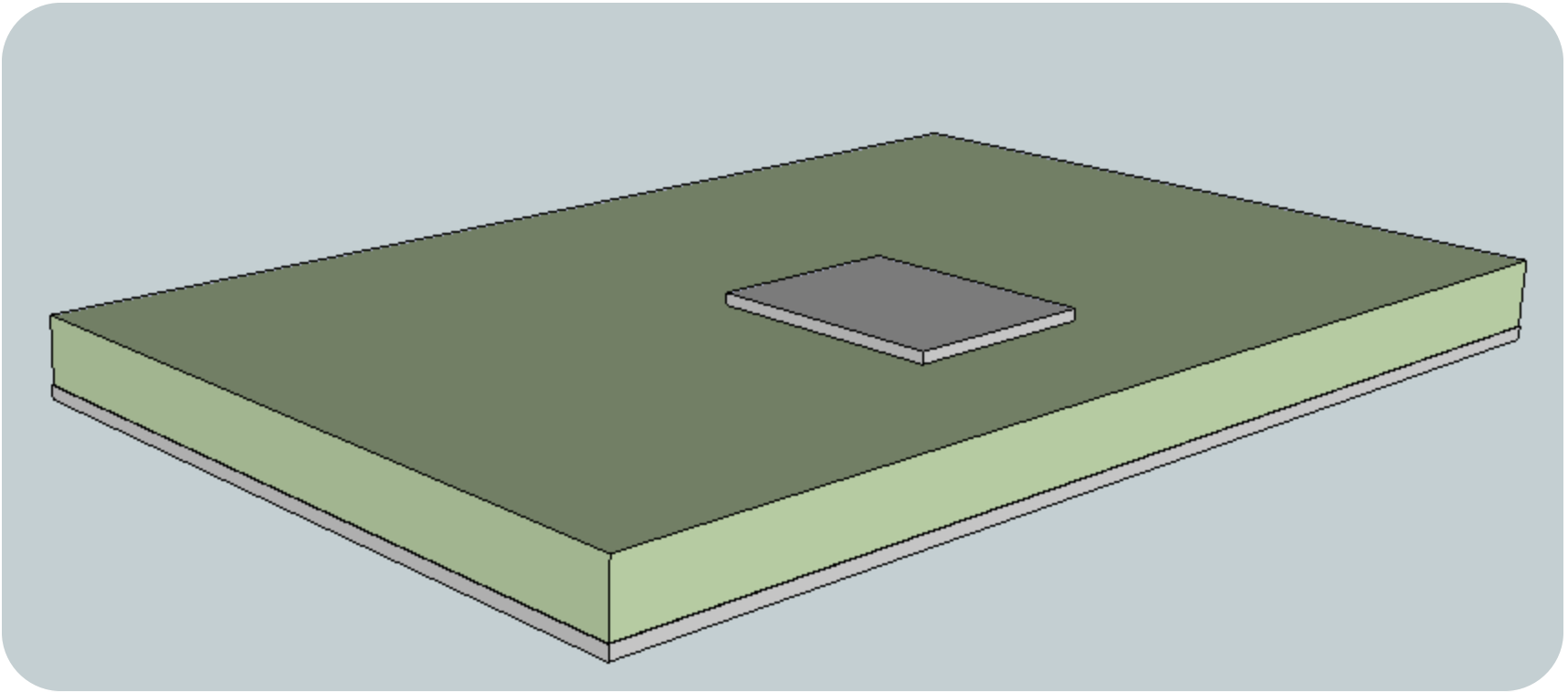
Mt: 0.1 mm

LL: 14 cm

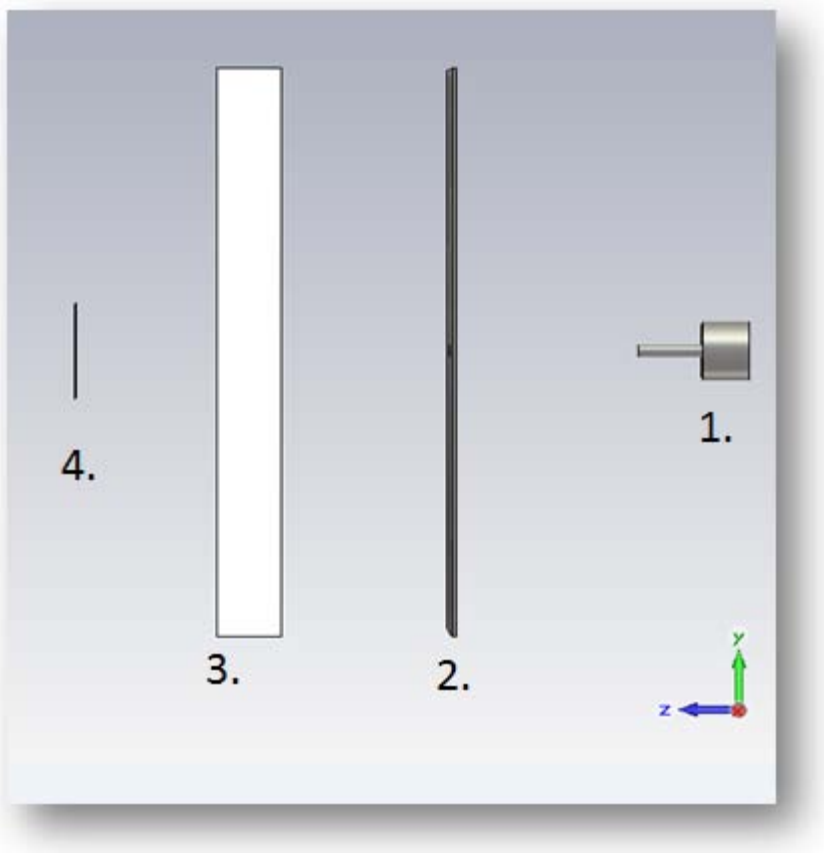
Measurements taken from the article “A broad-band transmission line model for a rectangular microstrip antenna” By:Russell W. PEARNLEY and ALAINR. F. BAREL.

SIMULATIONS AND RESULTS

General idea of the considered antenna

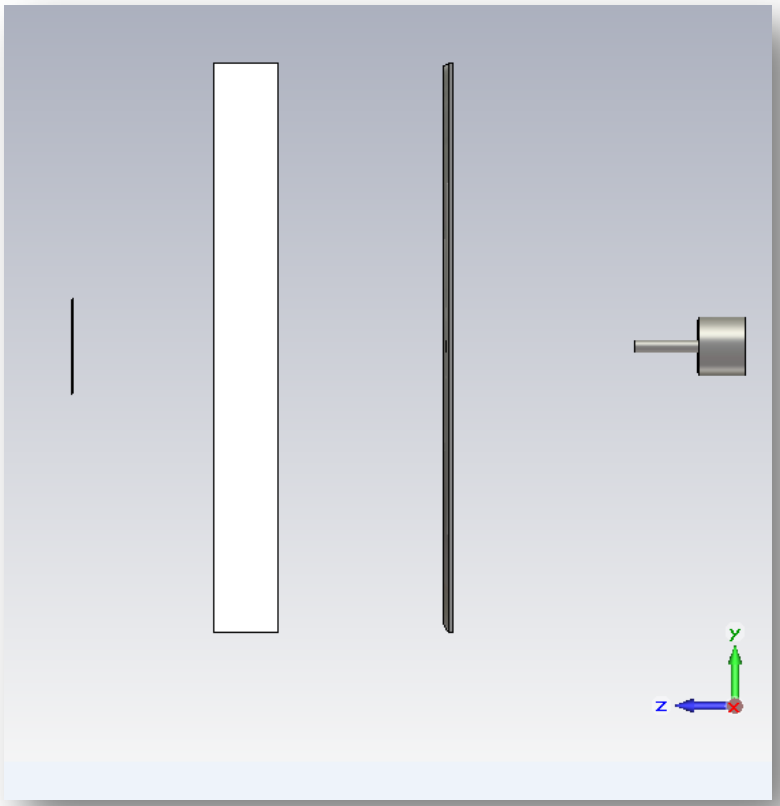


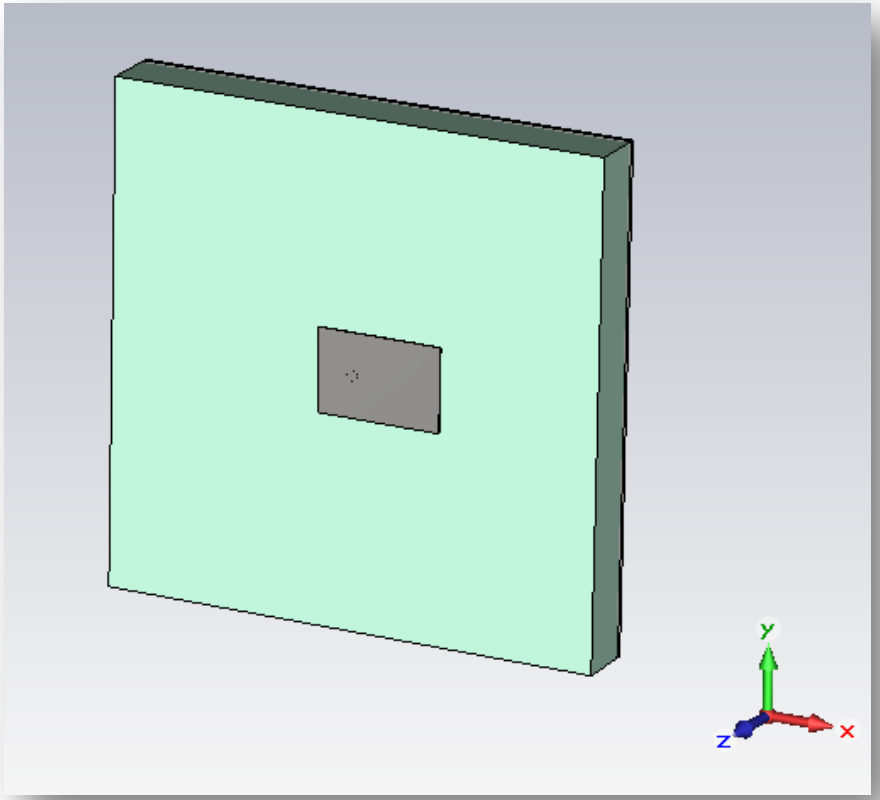
SIMULATIONS AND RESULTS



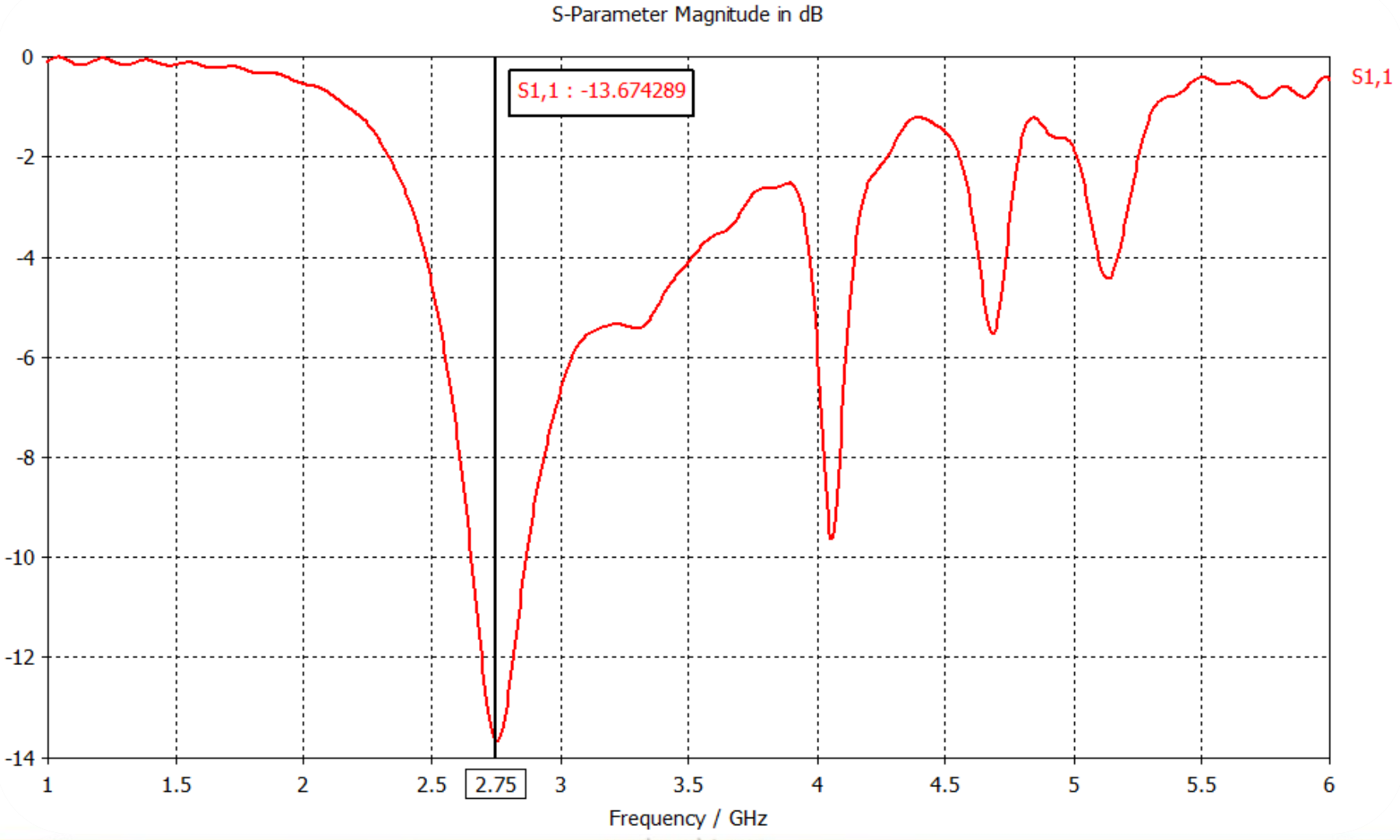
1. Coaxtial line
2. Ground plane (PEC)
3. Substrate (Alumina)
4. Patch (PEC)

SIMULATIONS AND RESULTS

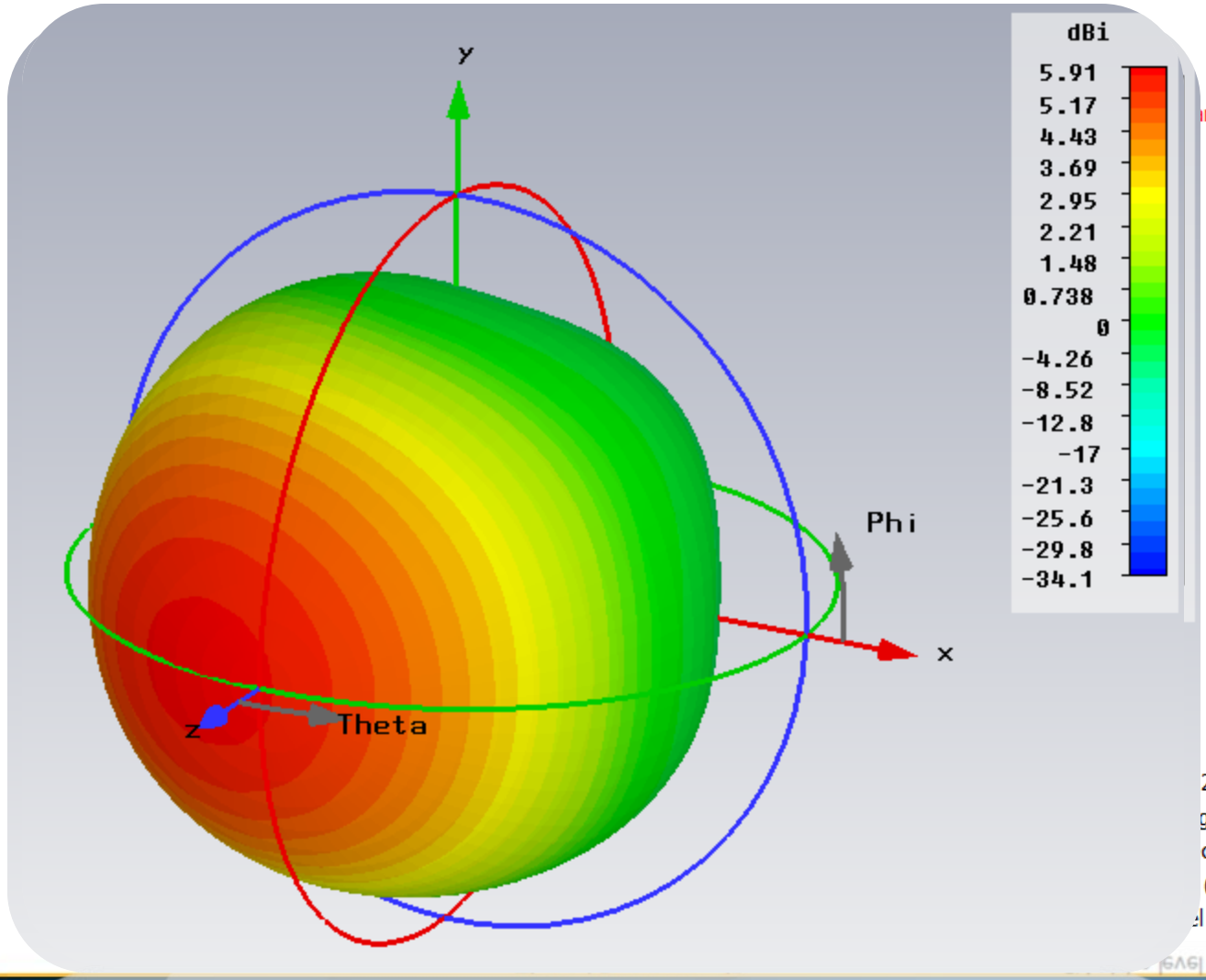




SIMULATIONS AND RESULTS



SIMULATIONS AND RESULTS



rfield (f=2.7) [1]

2.7
gnitude = 5.8 dBi
ction = 0.0 deg.
(3 dB) = 91.5 deg.
l = -13.5 dB

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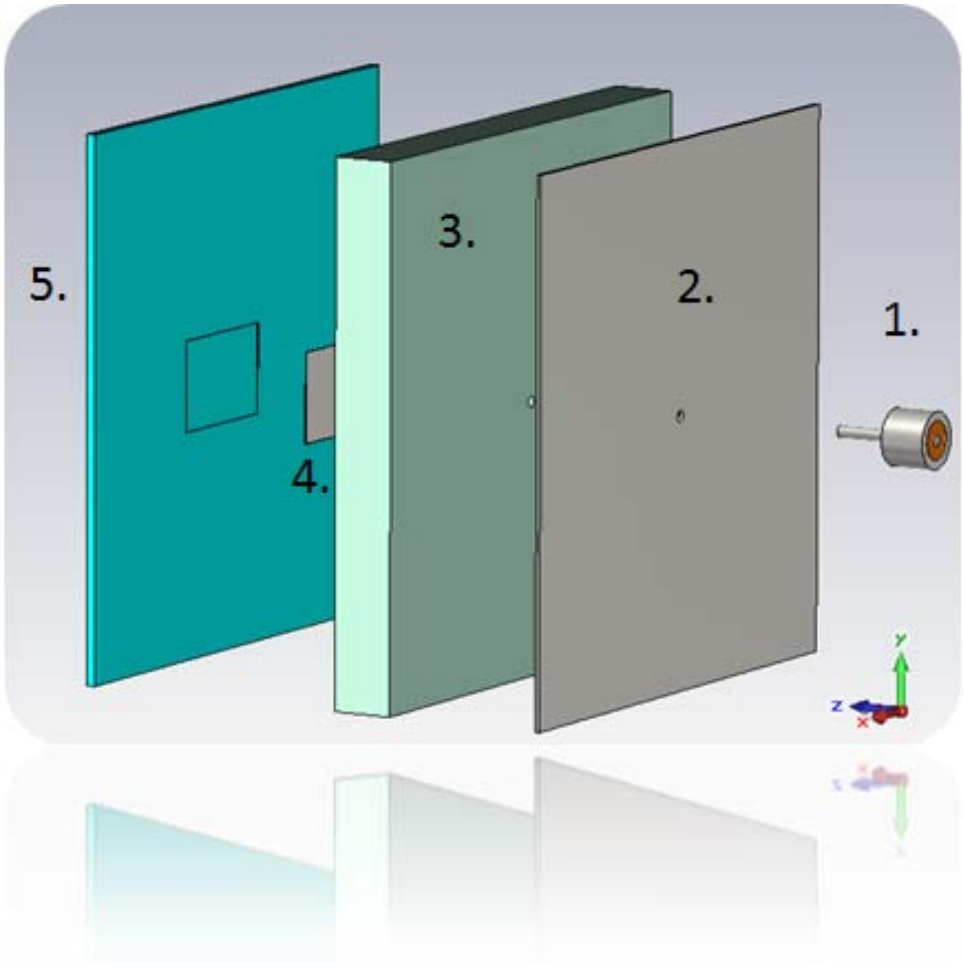
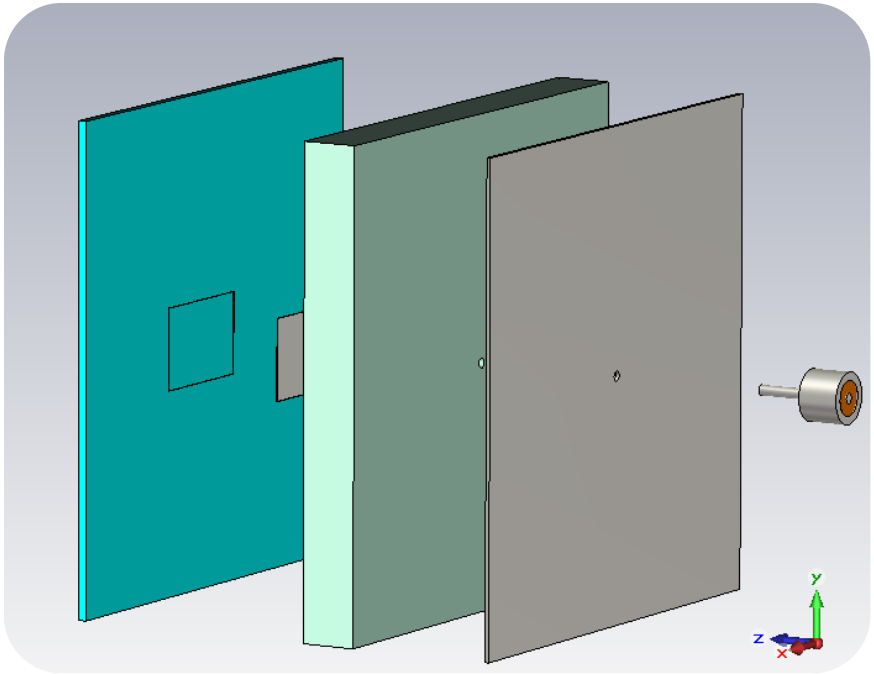
SIMULATIONS AND RESULTS



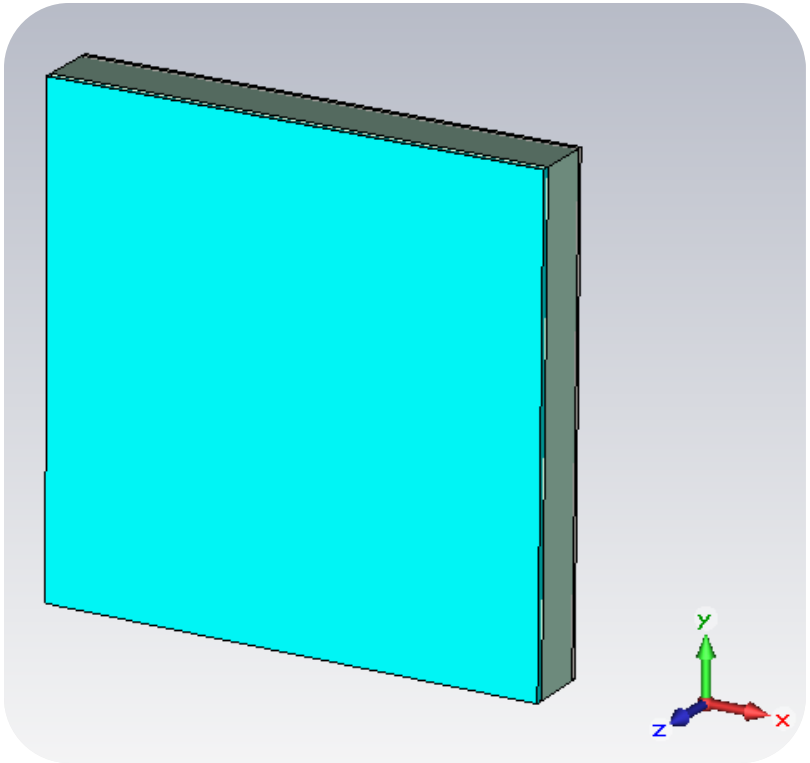
1. Coaxial line
2. Ground plane (PEC)
3. Substrate (Alumina)
4. Ground plane (PEC)
5. Coating (Ɛr= 30)

SIMULATIONS AND RESULTS

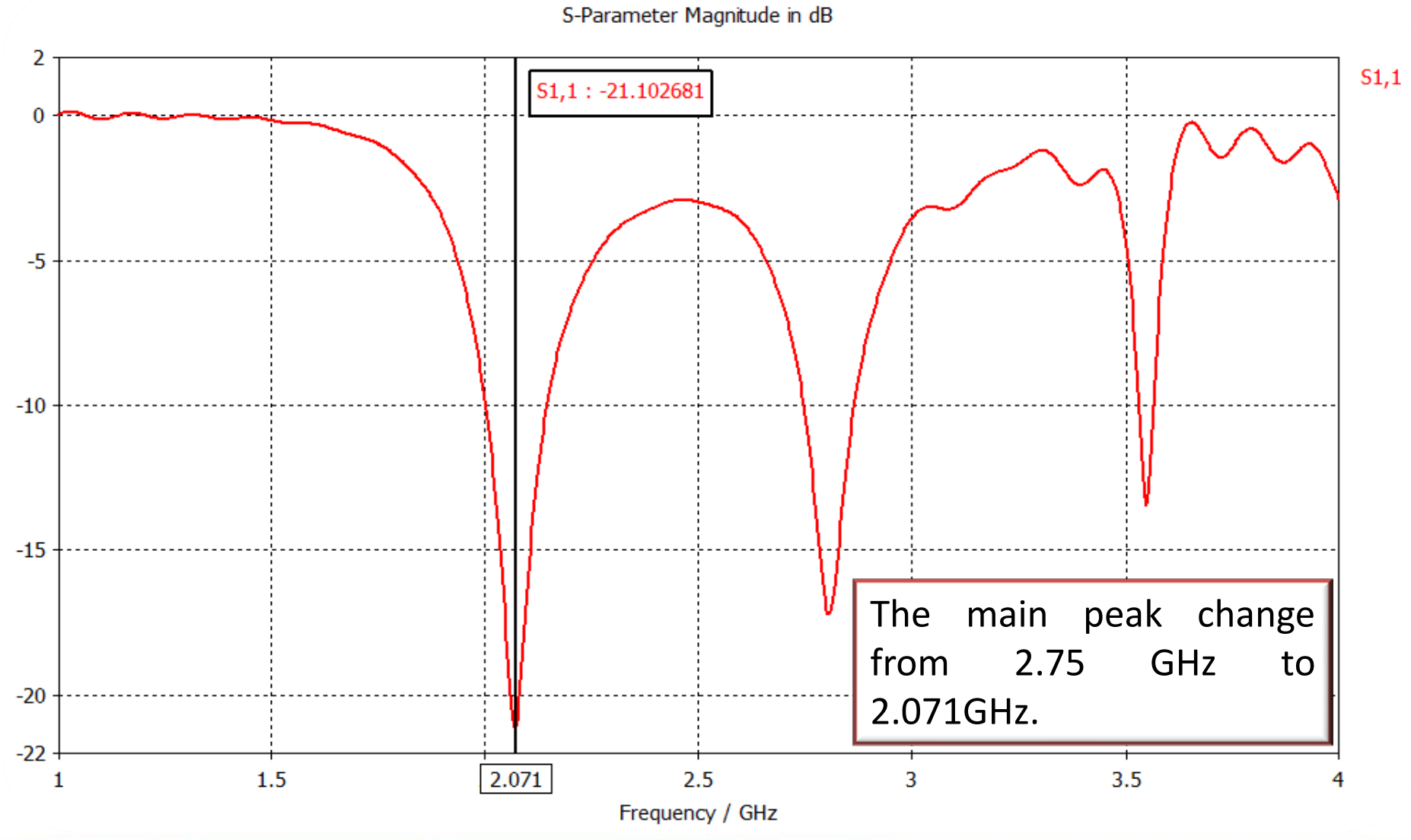
Parts of the antenna



Final antenna

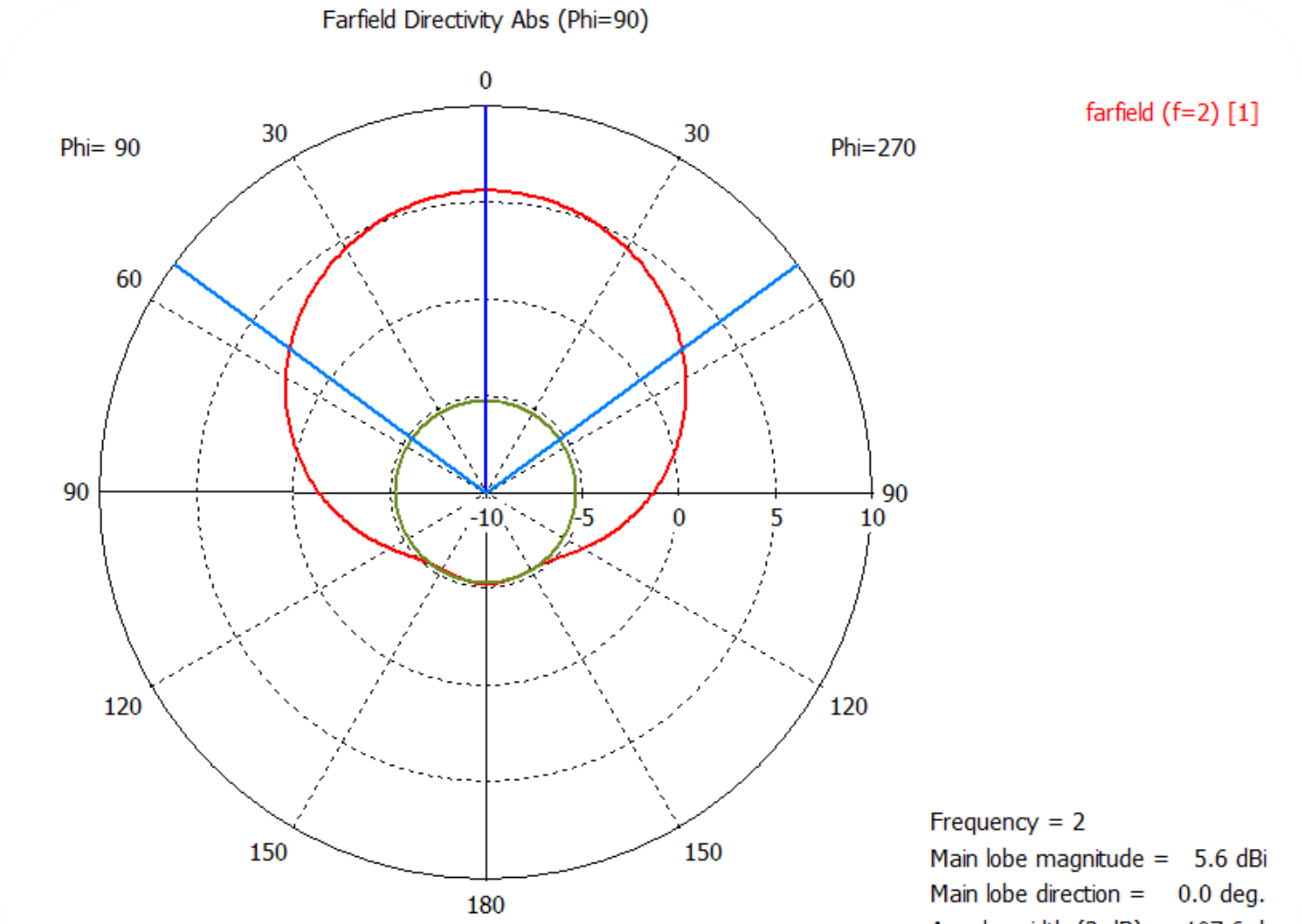


SIMULATIONS AND RESULTS



The main peak change from 2.75 GHz to 2.071GHz.

SIMULATIONS AND RESULTS



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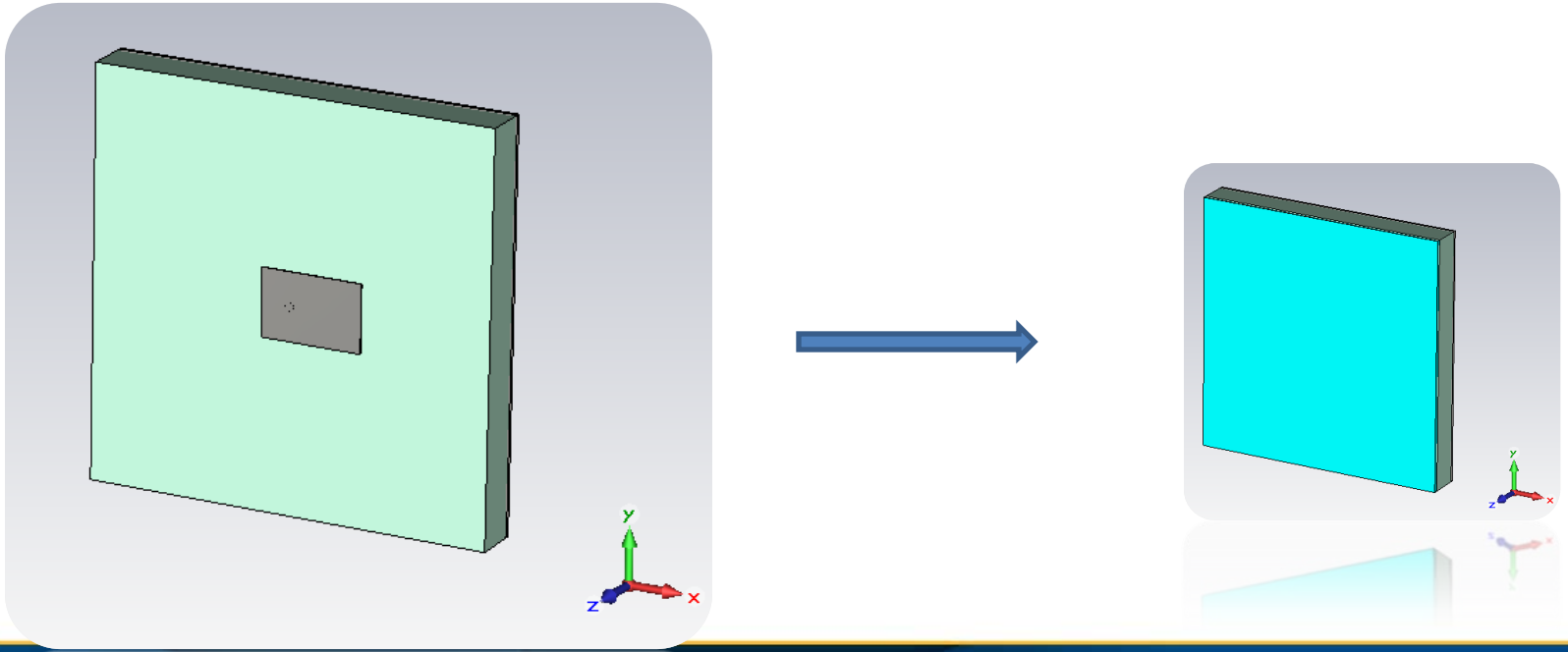
ANALYSIS OF RESULTS

The results show the possibility to obtain a radiation pattern that resonates in a higher frequency putting a substrate above the antenna and conserving the same dimensions in the structure.



CONCLUSIONS

- We obtained positive results in simulations about the reduction in antenna dimensions.

- It is possible to obtain a radiation pattern associated with a bigger antenna using a covering above the patch of a microstrip.

CONCLUSIONS

- These researches can be applied in cubesat missions in order to optimized space and weight in the structure.

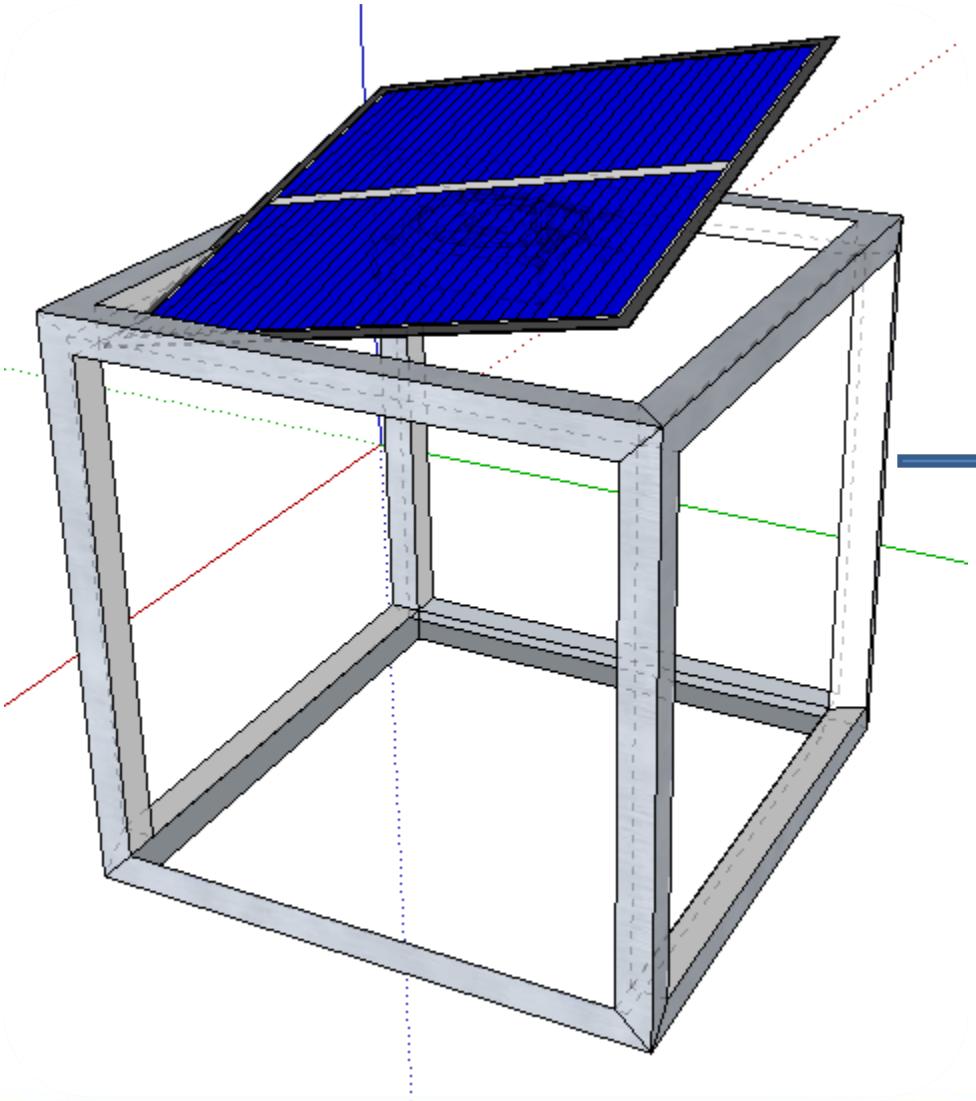
- If the device is covered it behaves as if it were a bigger antenna.

PROPOSED FUTURE WORK

- The main idea is to materialize the results obtained in the software CST according with the covering antenna purposed.

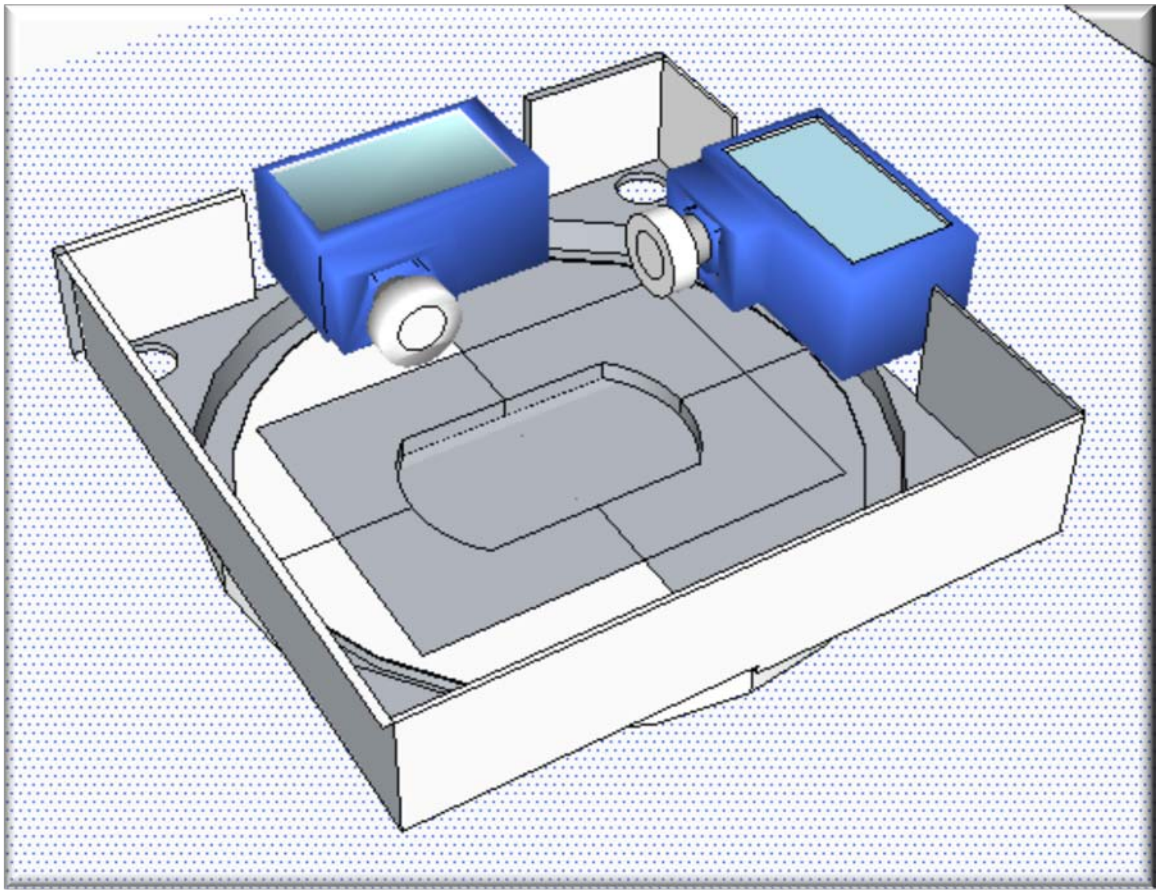
- Generate a satellital culture in South America starting in Antioquia (Medellin-Colombia). Currently we are working in several areas. One of them is the optimization of the power requirements and investigation in the material properties.

PROPOSED FUTURE WORK



Sun tracker System

PROPOSED FUTURE WORK



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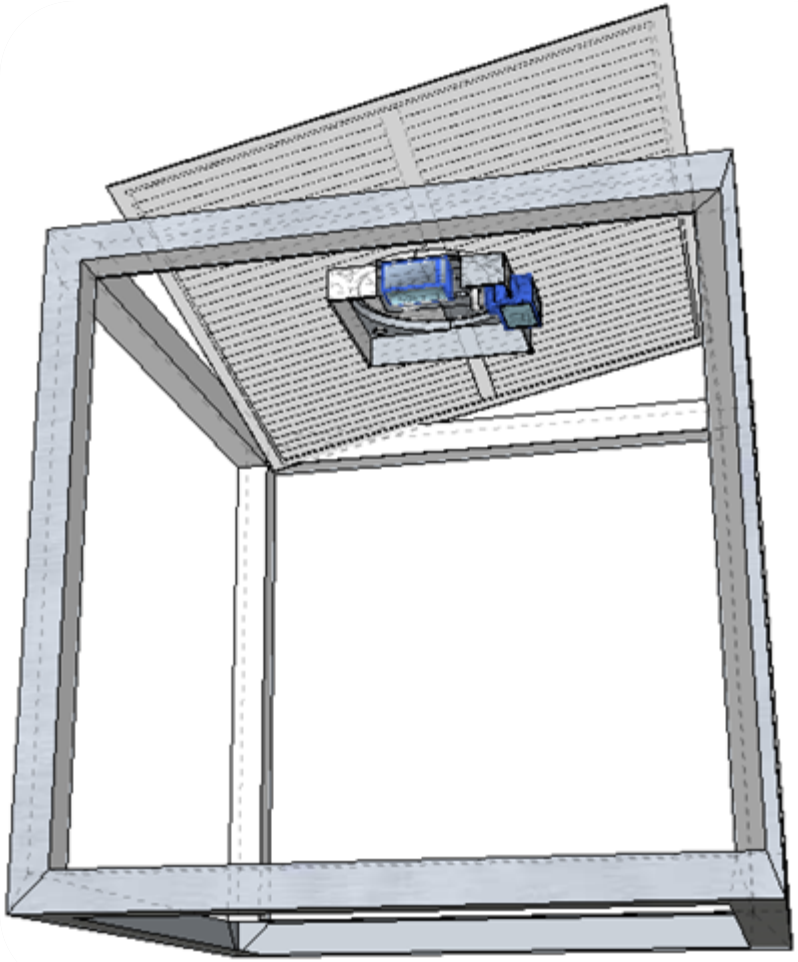

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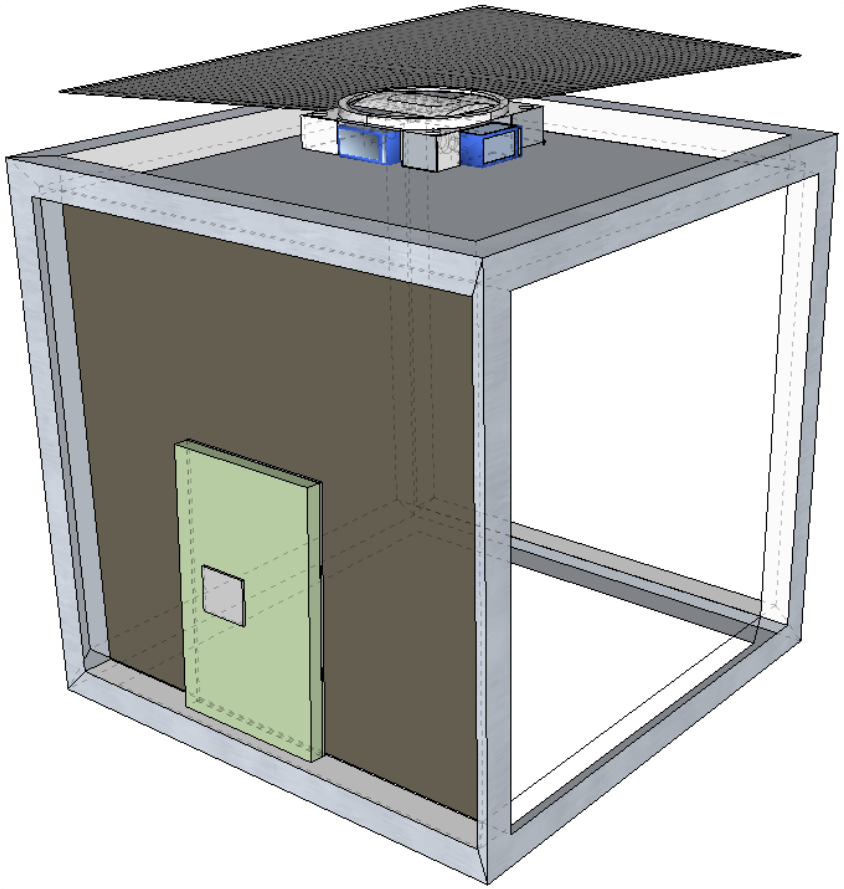
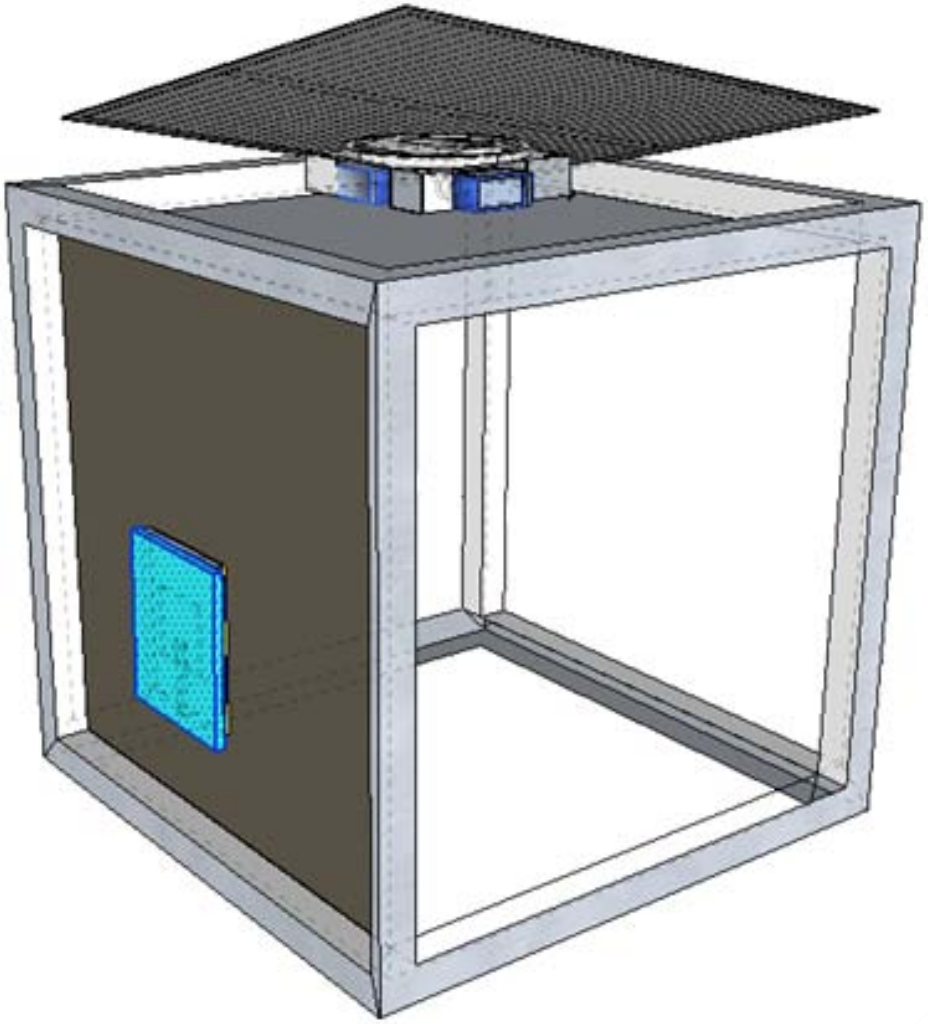


Conventional microstrip antenna

PROPOSED FUTURE WORK



Microstrip antenna with covering

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