Dielectric_Resonator_Antenna

Where To Find This Example

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Open Install Example

Design Notes

Dielectric Resonator Antenna

This example illustrates a dielectric resonator antenna on an infinite ground plane

Overview

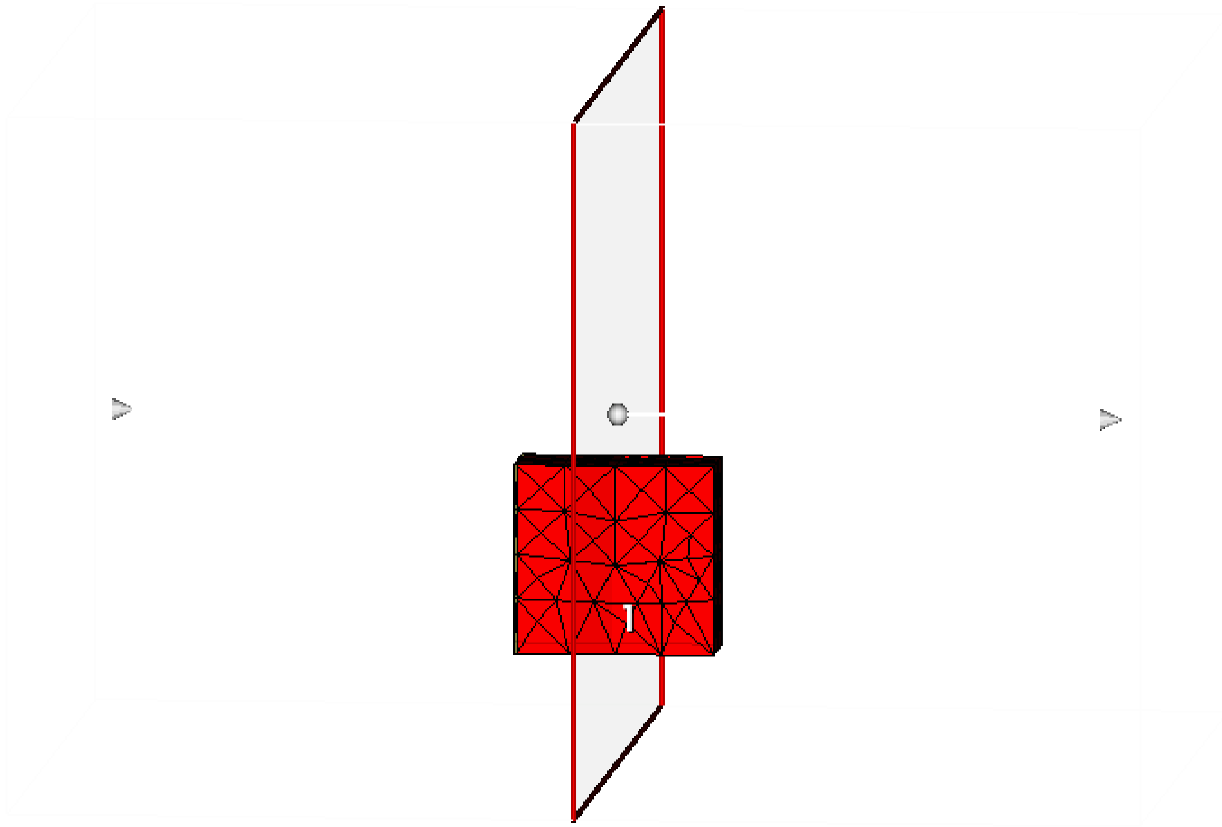
The antenna consists of a rectangular solid box of a ceramic material (ER=16, tand=0.0007) shorted from one end, and fed by extended inner conductor of a coaxial cable from below. The excitation model is a short patch connected to the bottom of the probe, which is then excited as a lumped port. There is a narrow gap between the bottom ground and the probe.

The port impedance is affected if it is entirely immersed in the ceramic. Therefore the excitation region is modified by drilling a small air cavity below the patch. The distance between ground and the probe is 100um while the probe height is 8.8mm. The 100um gap visibility is increased by a factor of 10 in z-dimension for better viewing.

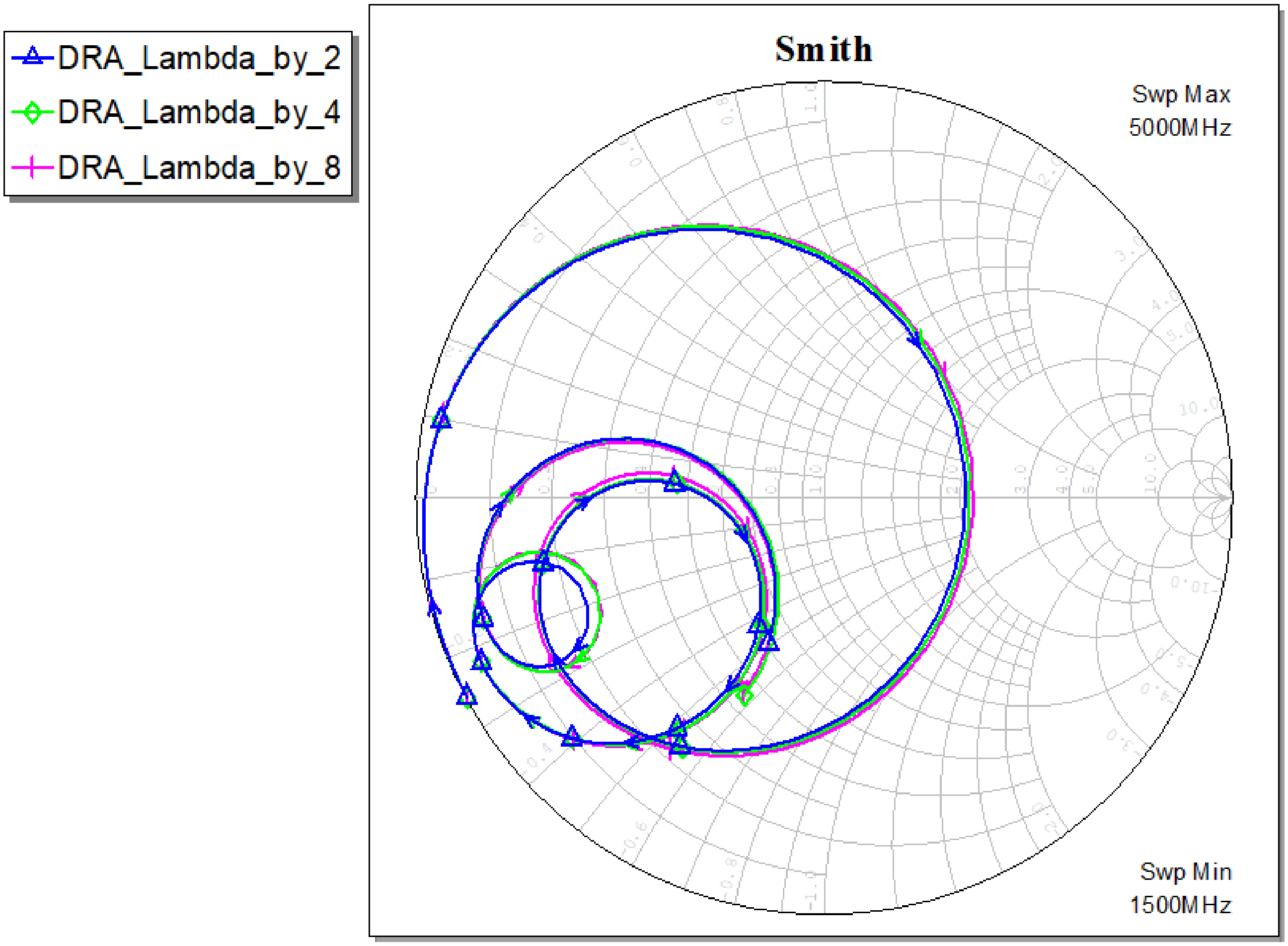
The dielectric dice height is 15.9mm and it is introduced as a dielectric "via". The topmost air layer thickness depends on how far the **Perfectly Matched Layer** absorbing **Boundary Condition** is placed. The minimum frequency of interest is 1.5GHz which is 200mm lambda. The antenna is simulated for lambda/2 (100mm), lambda/4 (50mm) and lambda/8 (25mm) and named accordingly. The response is insensitive to the distance of the Perfectly Matched Layer, even if it is brought closer than the recommended lambda/4. On the other hand, the computational overhead is small between lambda/8 and lambda /4, while lambda/2 is considerably more expensive. Thus lambda/4 appears to be a justified recommendation.

There are two resonances in the antenna. It is recommended to look at the field profile at the resonant frequencies. The conventional way is to make copies of the EM document, simulate it at a frequency of interest, and click the **Show Currents/Fields** annotation button on the toolbar after simulation. For first resonance at 2050MHz , looking at power flow in a y-directed cut plane of "DRA_Lambda_by_8_2050MHz" 3D view shows that the probe and the short circuit are strongly coupled, while the other side of the dice is cold. For the second resonance at 3100MHz, looking at the power flow in DRA_Lambda_by_8_31000MHz" is very different, representing essentially dielectrically loaded probe's monopole type resonance. To see the fields, click and drag in the 3D view to move the cut plane across the center of the antenna.

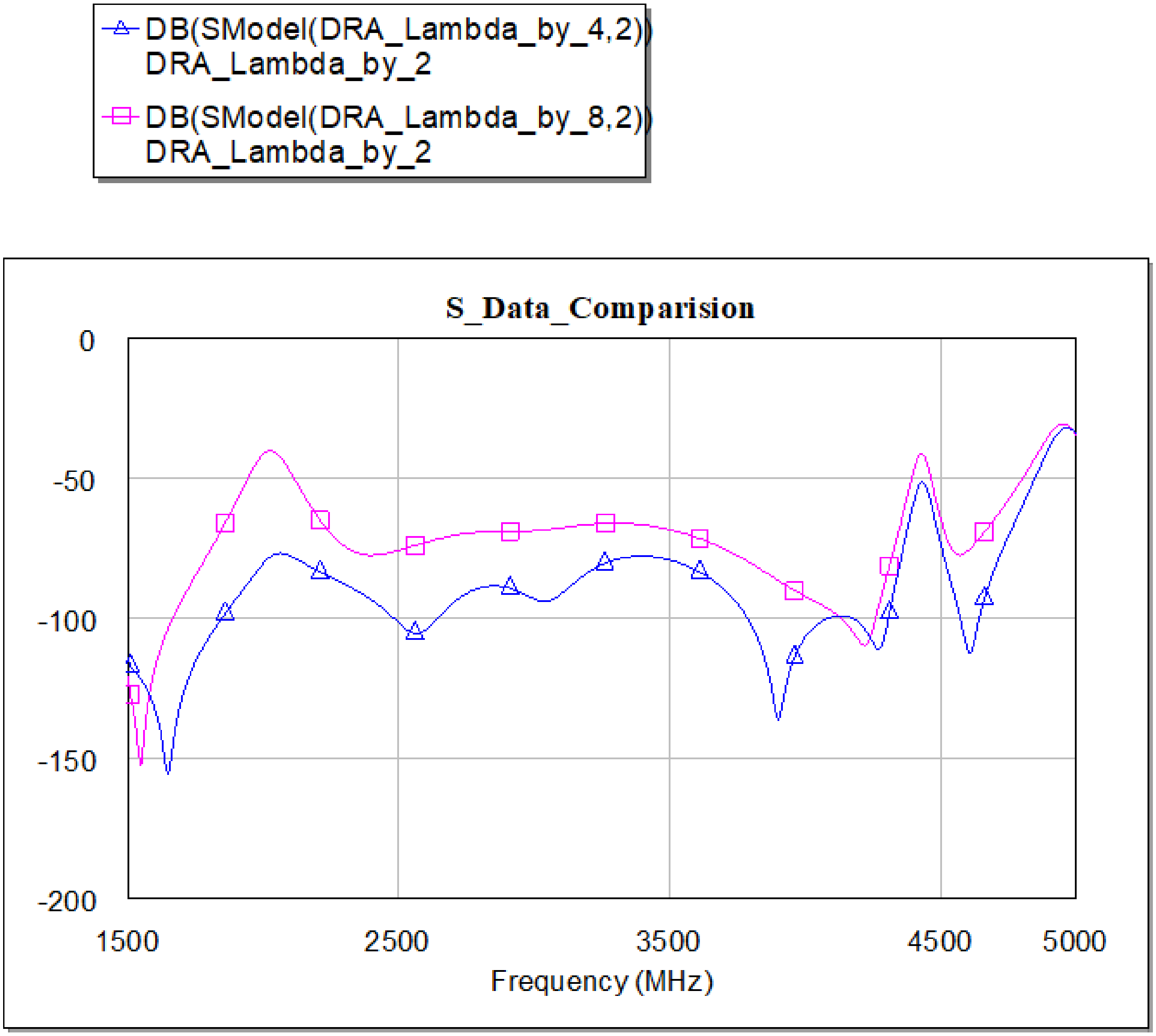
EM Structure 3D - DRA_Lambda_by_8_3100MHz



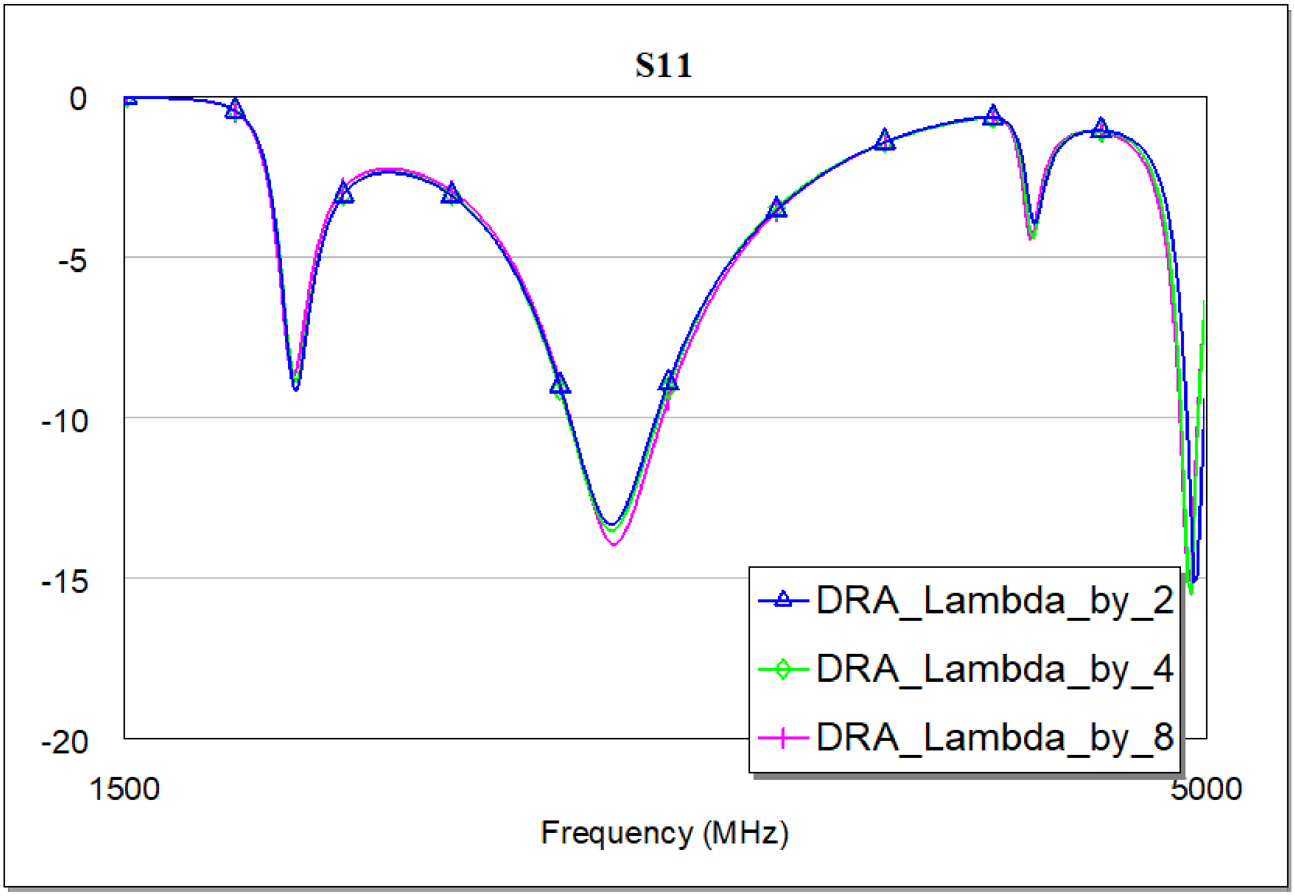
Graph - Smith



Graph - S_Data_Comparision


DB(SModel(DRA_Lambda_by_4,2))
DRA_Lambda_by_2
DB(SModel(DRA_Lambda_by_8,2))
DRA_Lambda_by_2
S_Data_Comparision
0
-50
-100
-150
-200
1500
2500
3500
4500
5000
Frequency (MHz)

Graph - S11


S11
0
-5
-10
-15
-20
1500
5000
Frequency (MHz)
DRA_Lambda_by_2
DRA_Lambda_by_4
DRA_Lambda_by_8