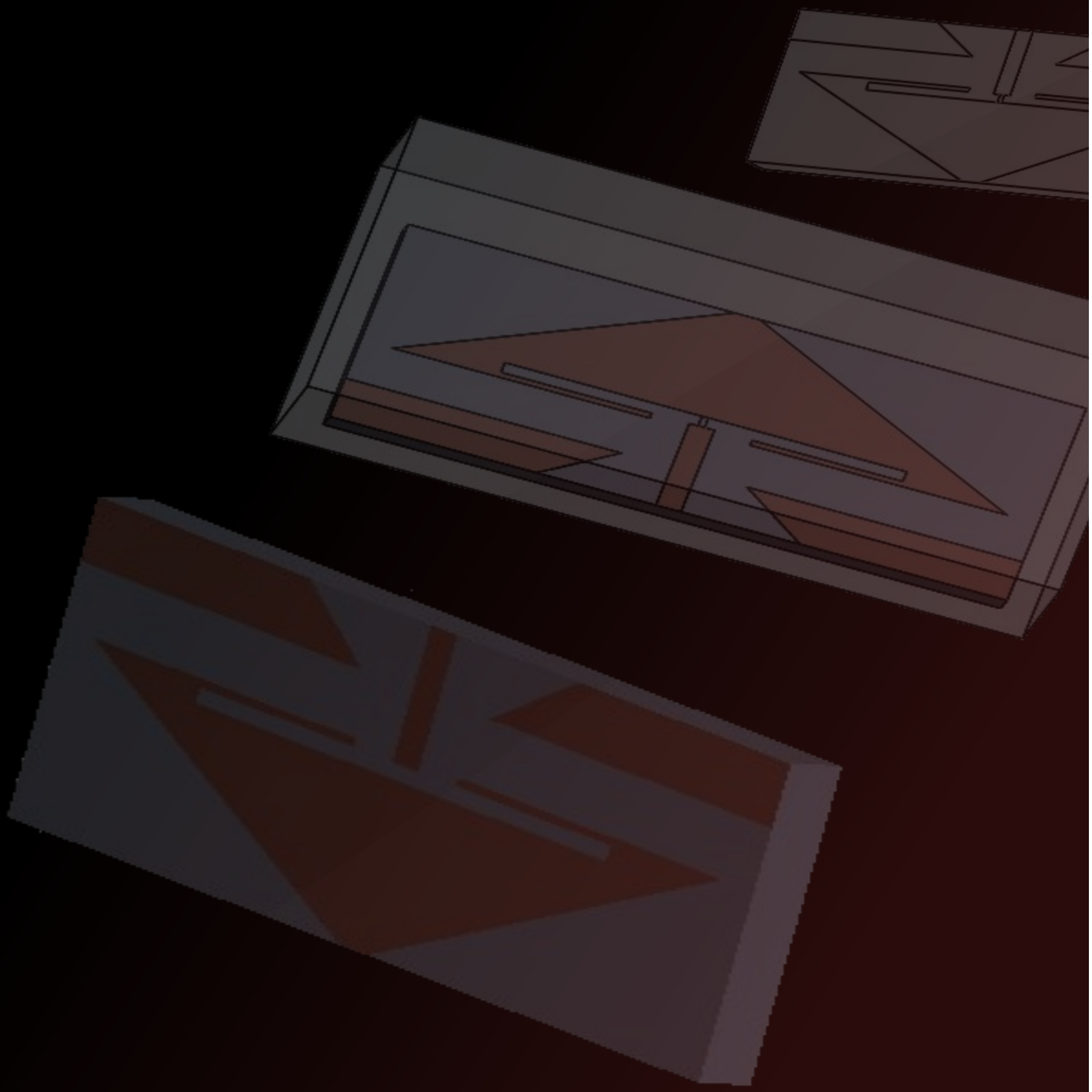
RFID TAG ANTENNA



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RFID Tag Antenna Simulation

Radio Frequency Identification (RFID) is a tracking/identifying system used these days in many industries such as person tracking, goods tracking, access management, payment collection and many other things. This technology is based on the high frequency data transfer from an electronic label (the "tag") to a base (the "reader") to process the data. The RFID tag which should be reasonably small can be both active or passive. Regardless of the type, all RFID tags have two main components: an antenna which transmits and receives data and an integrated circuit (IC) called transponder that handles the data processing, data storing and signal modulating. In this example, we have simulated an antenna designed for an RFID tag. This antenna has been reported in an IEEE publication in 2009 by LU et al.

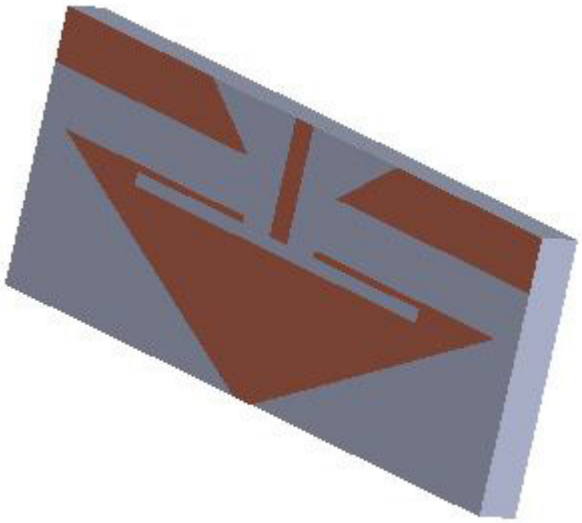


Figure 1: RFID Tag Antenna

SIMULATION

Low-frequency (LF: 125 - 134.2 kHz and 140 - 148.5 kHz) and high-frequency (HF: 13.56 MHz) RFID tags can be used globally without a license. Ultra-high-frequency (UHF: 868 MHz-928 MHz) cannot be used globally as there is no single global standard.

As we can see on the figure, RFID tags can be used in multiple frequency ranges; The one that we adopted for this tutorial is around 2.45 GHz. Therefore, We create an antenna study, with a fast sweep frequency plan of 101 frequency distributed around 2.5 GHz and between 2 and 3 GHz. In a further step, we run a single point individual simulation at 2.45 GHz.

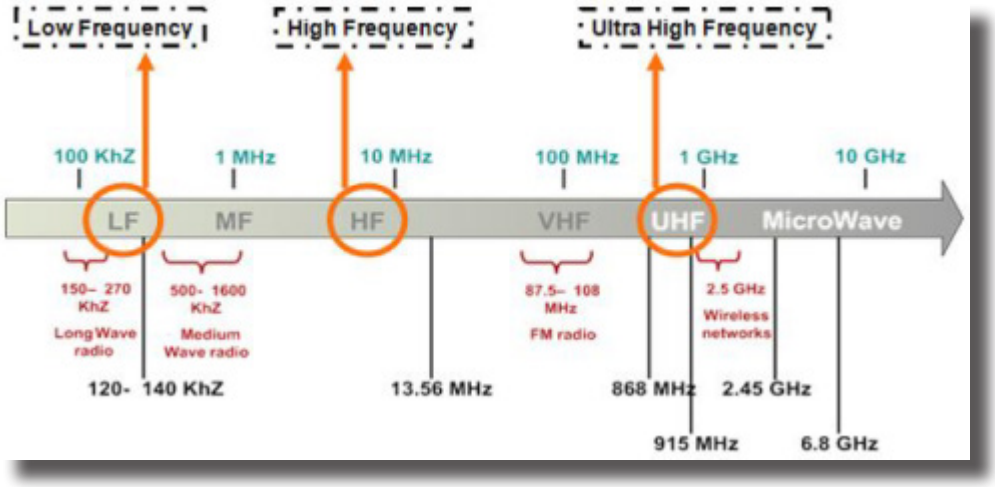


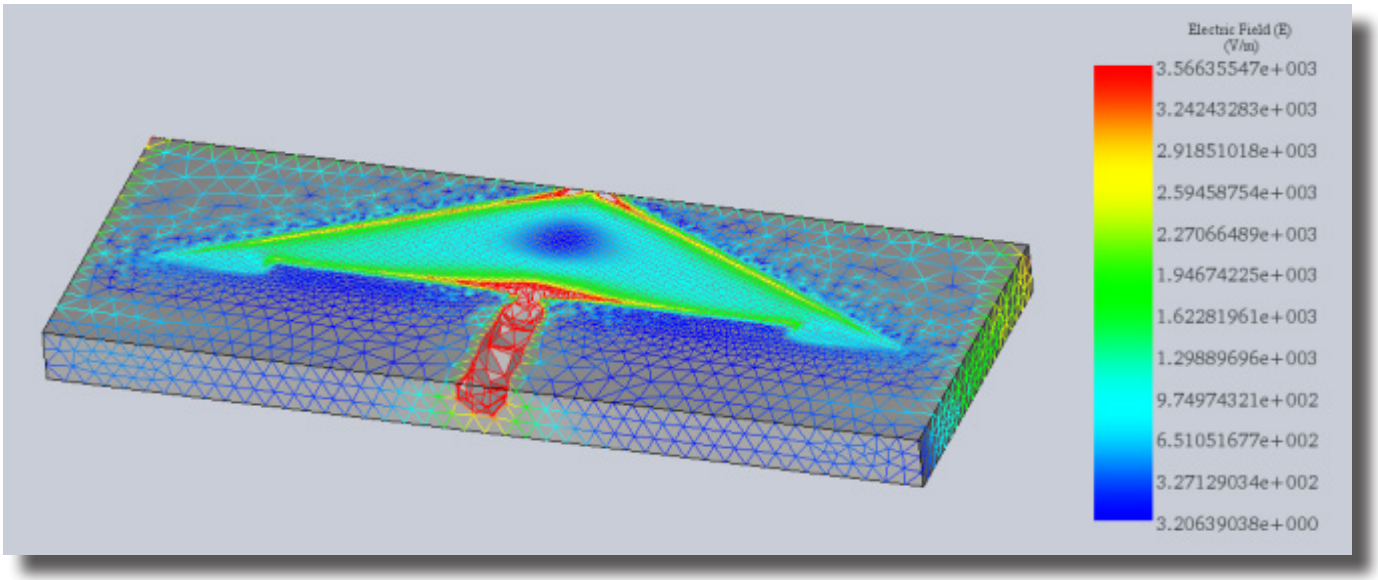
Figure 2: Frequency-ranges used for RFID systems shown with the corresponding field strength and power levels [1]

BOUNDARY CONDTIONS

The antenna is built on a Duroid 6006 substrate and the printed layer is assigned a PEC boundary condition.

RESULTS

At the user defined center-frequency, we can view the electric and magnetic field in different settings: i.e. iso and section clipping, animating the field through varying its omega-T phase, changing the colors of the chart to show intensity and so on. Here is a capture of an electric field distribution spotted within the surface of the antenn's board.



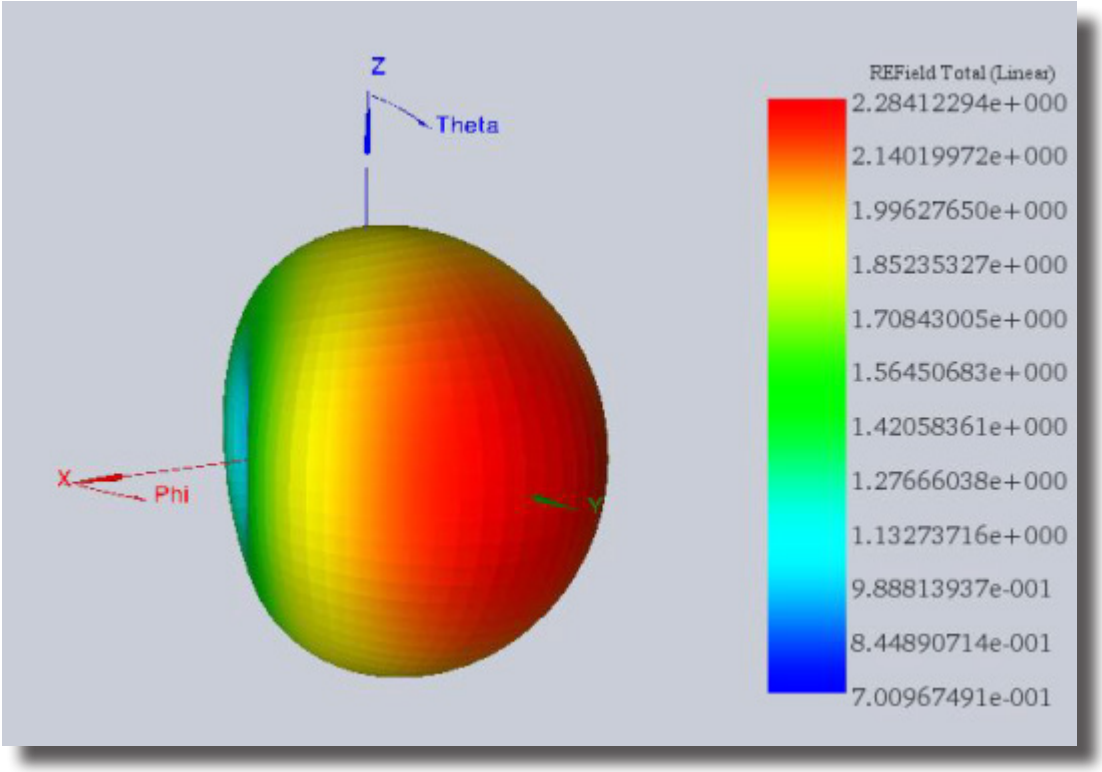


Figure 3: Radiation pattern of the antenna

For antenna's studies, it is always intuitive to fetch the best matching at the input port. For this RFID tag antenna, we have return loss better than 20 dB at 2.45 GHz which is the aimed operating frequency.

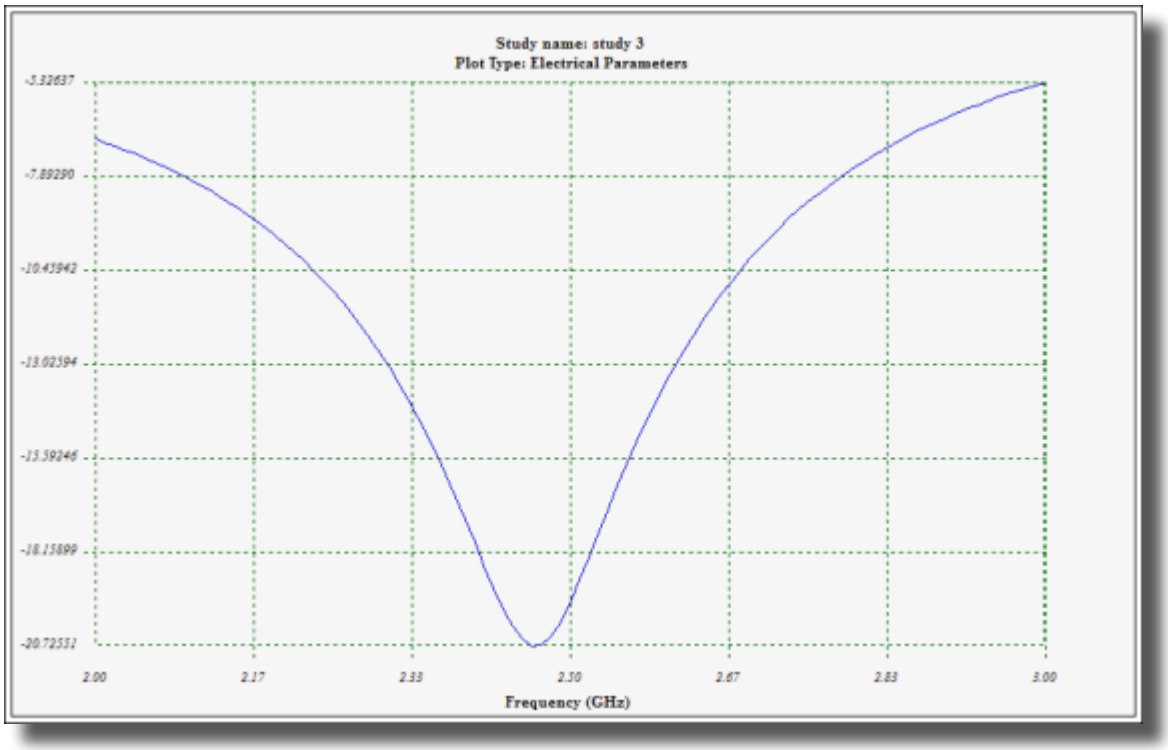


Figure 4: Reflection coefficient at the antenna's port

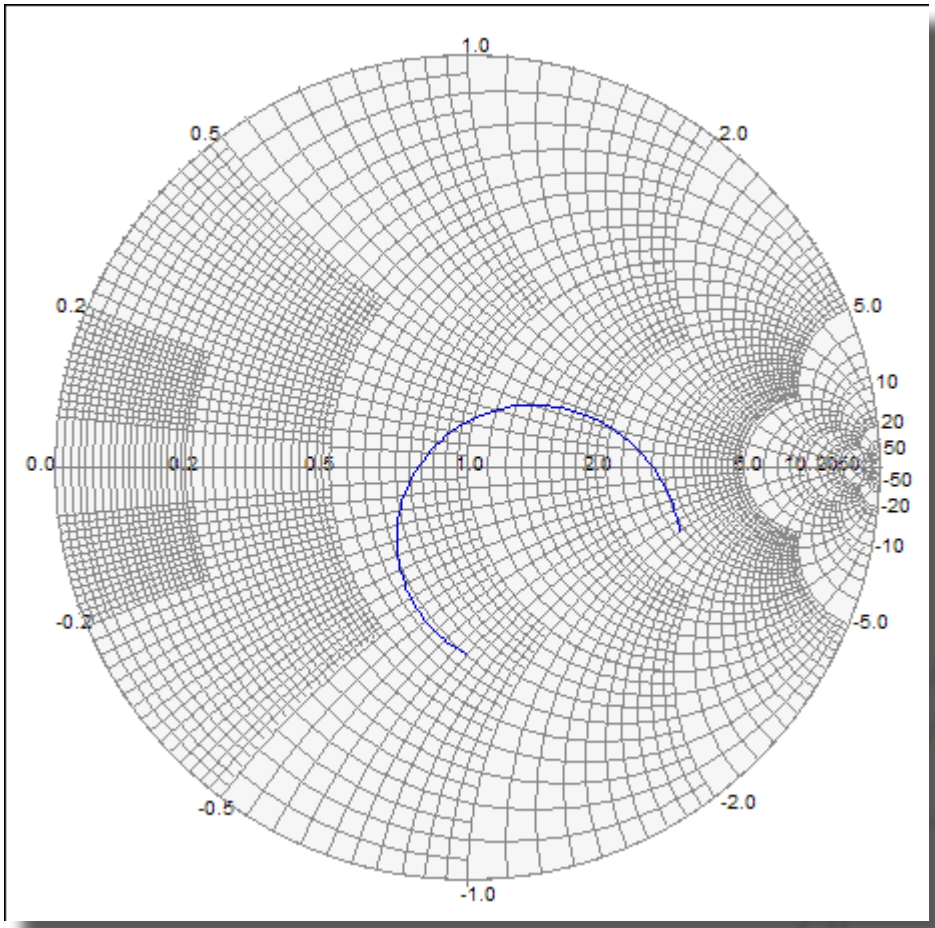
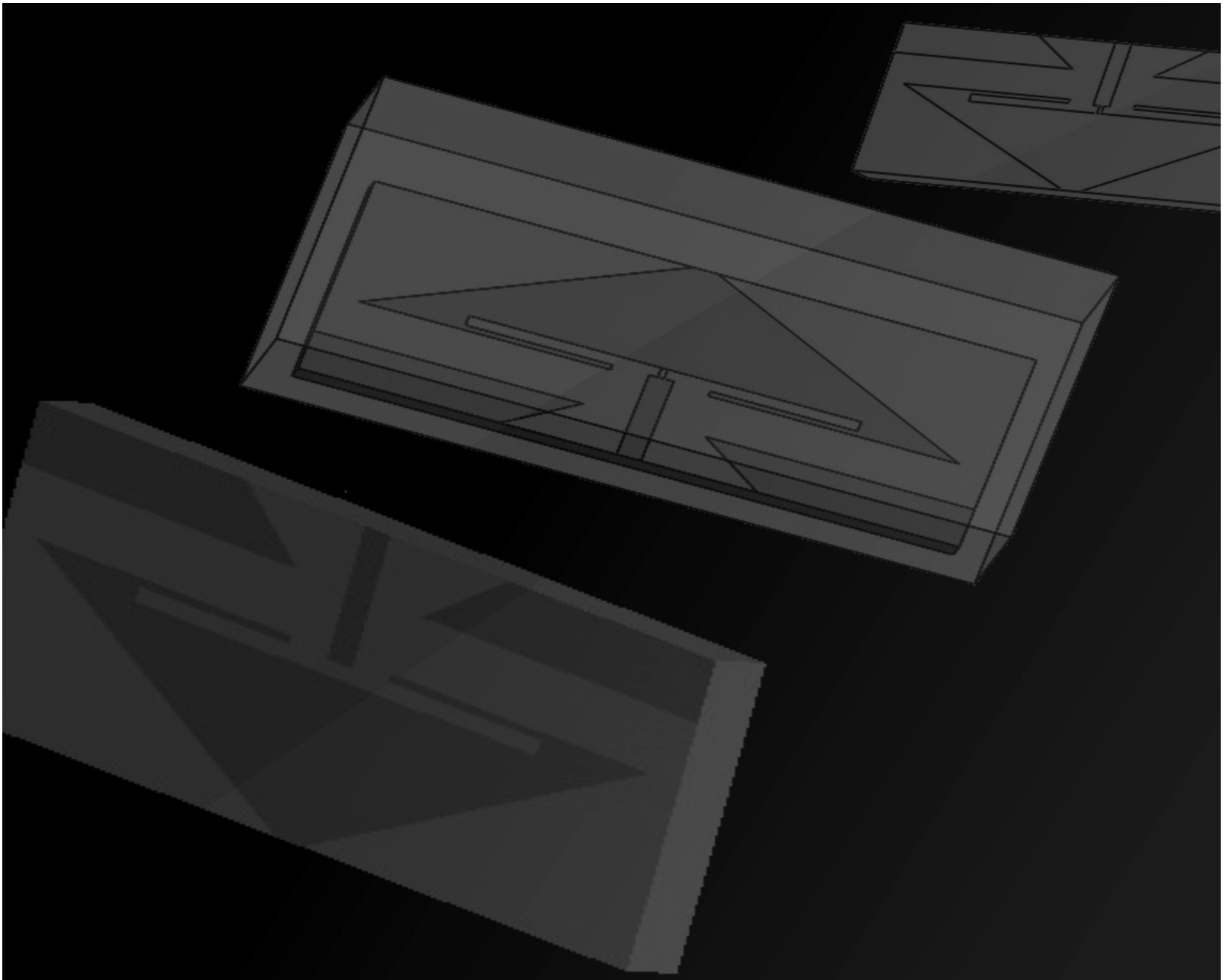


Figure 3: Return Loss of the filter within various configurations

The reflection coefficient can also be plotted on a Smith chart and a marker is available for exploring the curve and discover for each point the convenient frequency.

[1] RFIDEA: Engineering & Applications in electronic traceability



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