SPARK SR1020 Filtered Monopole Antenna

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CONFIDENTIAL

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Abstract

This primer outlines the specifications and features of the monopole antenna used in the RF modules of the SR1020 evaluation kit.

Contents

1 General Description

The monopole antenna used in the SR1020 evaluation kit has an omni-directional radiation pattern. This means that it radiates the electromagnetic waves uniformly in all directions around its axis. It has a linear (vertical) polarization and best performance is achieved when the Tx and Rx are aligned vertically with the antenna pointing upward.

The RF front-end consists of a low-pass filter for spurious harmonics rejection, and the antenna patch itself with a 5.8 GHz rejection notch filter as depicted in Fig. 1. This structure being a single ended circuit, requires a balun to connect to the SR1020 radio chip. The module is designed on a 4 layer FR4 PCB with a relative permittivity of 4.2.

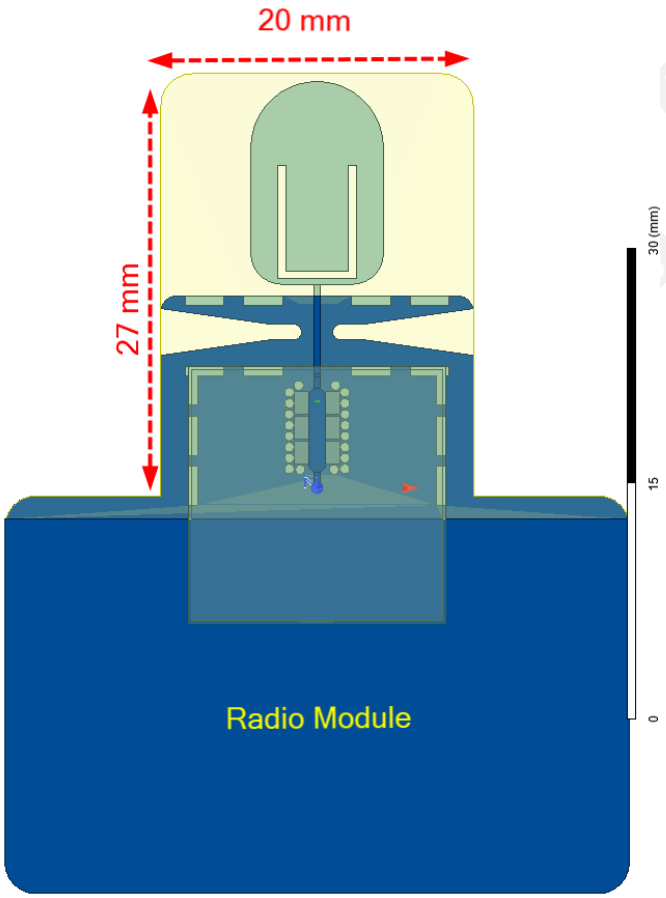

Figure 1: Monopole anttenna mounted on the evaluation kit.

2 Simulated Performance

The simulated S_{11} of the antenna and filter structure are presented in Fig. 2. As it can be observed, the -10 dB impedance bandwidth is from 6.33 GHz to 9. 45 GHz covering all the required frequencies for the operation of the SR1020 radio.

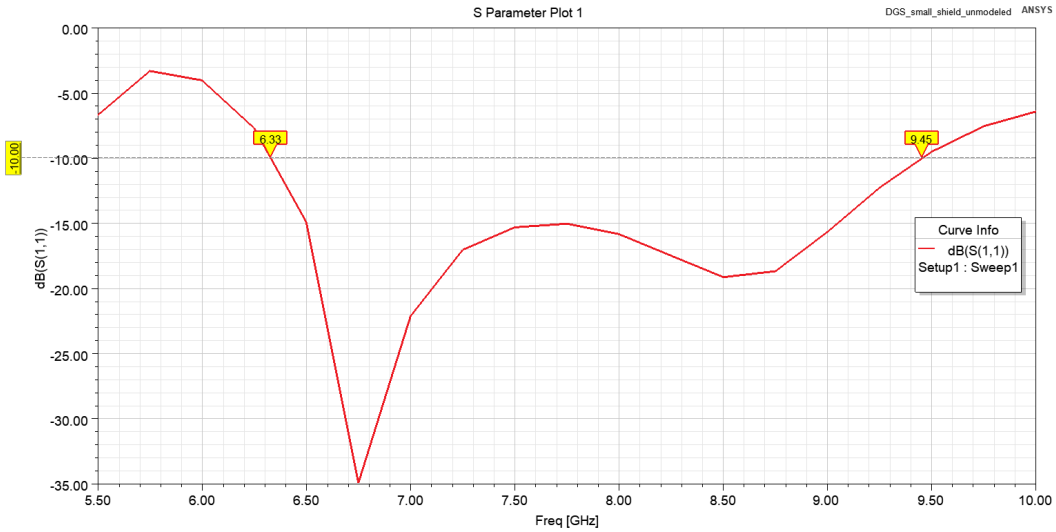

Figure 2: Simulated S_{11} result of the RF front-end.

The radiation efficiency is obtained by calculating the ratio of radiated power over the incident power at the input of the filter as depicted in Fig. 3. This is an accurate way of calculating the efficiency since it includes the impedance matching and insertion losses of the filter and microstrip lines.

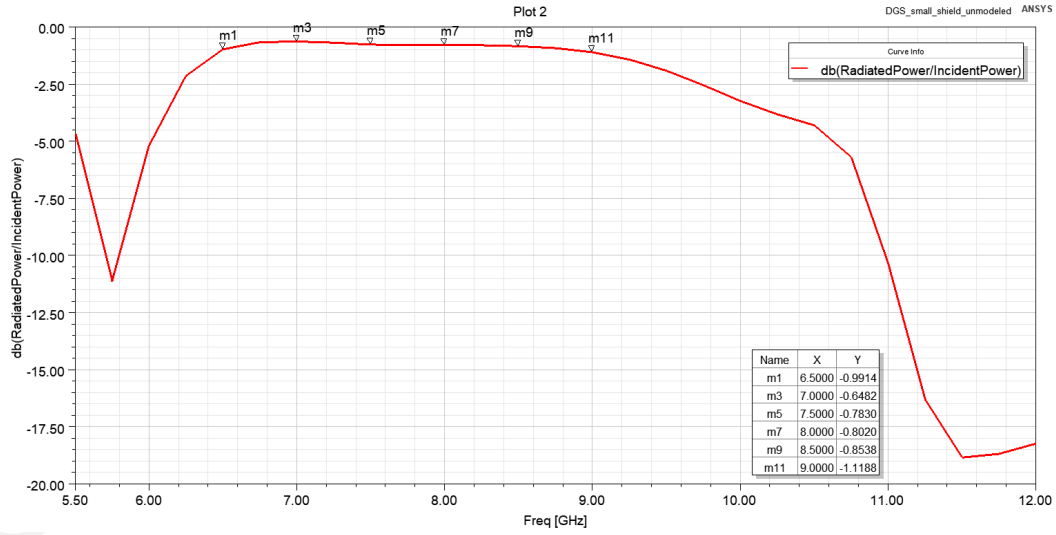

Figure 3: Radiation efficiency of the RF front-end.

The antenna peak realized gain is shown in Fig. 4 with a maximum of 3.55 dBi at 7 GHz.

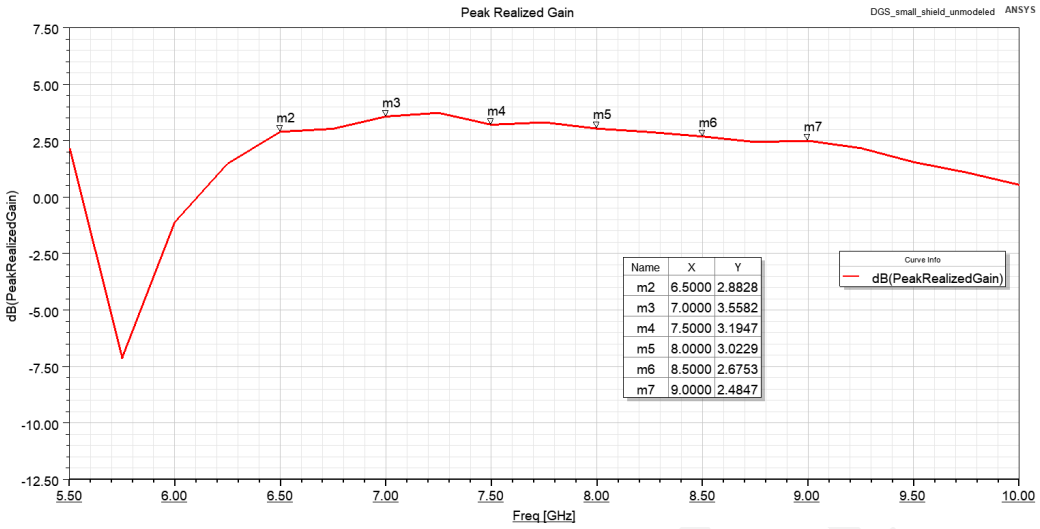

Figure 4: Peak realized gain of the RF front-end.

3 Simulated Radiation Patterns

The radiation pattern of the antenna is presented for the three main cuts of x-y, x-z, and y-z and for 6.5 to 8.5 GHz in Fig. 5-7. The 3D radiation pattern of this antenna at 7.5 GHz is also plotted in Fig. 8.

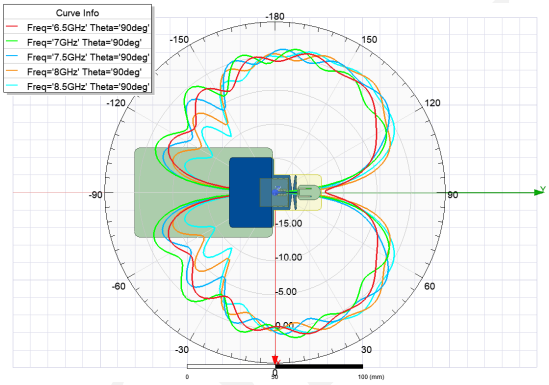

Figure 5: Realized gain (dB) (xy-plane).

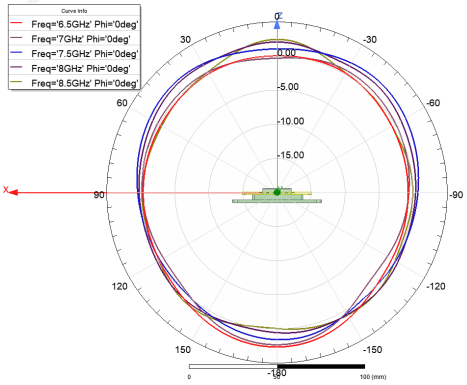

Figure 6: Realized gain (dB) (xz-plane).

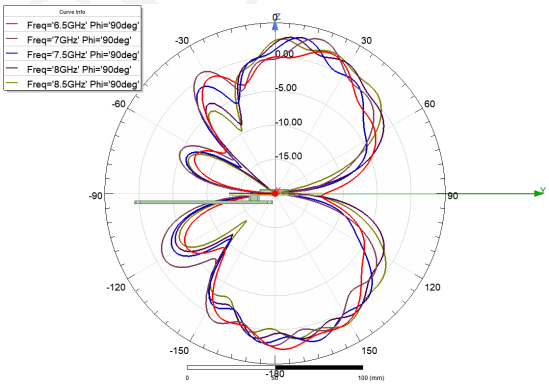

Figure 7: Realized gain (dB) (yz-plane).

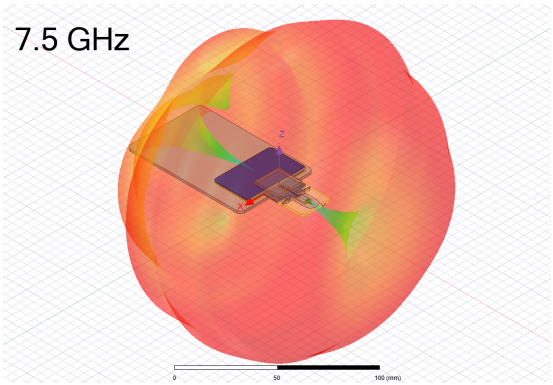

Figure 8: 3D radiation pattern at 7.5 GHz.