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IANT22: IRNAS small-square antenna datasheet

Ultra-compact 2.4 GHz PCB antenna

Changelog

Revision	Date	Description
V0.1	18.1.2022	Initial versions
V0.2	25.2.2022	Added real-world performance

Introduction

The PCB antenna used on the IRNAS example design of a small product is described in this application note. Even if the antenna presented is for a custom PCB, it can be used in all 2.4 GHz designs, especially where small space is required for the antenna.

This application note describes the antenna dimensions, the RF performance, and considerations for complying with regulatory limits when using this design.

The suggested antenna design requires no more than 3 x 5 mm of space and ensures a VSWR ratio of less than 2 across the 2.4 GHz ISM band when connected to a 50 ohm source.

Specification

- Operating range: 2400-2500 MHz
- Return Loss S11: < -10dB
- Peak gain: -4.45 dBi
- Polarization: Linear
- Input impedance: 50 ohm
- Dimensions

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Antenna design

The PCB antenna on the small board reference design is a coiled in a square antenna which designed to match an impedance of 50 ohm at 2.45 GHz. Due to the small board size, a pi-network matching is used to optimize the impedance and ensure a good VSWR.

Simulation

The design has been simulated with CST tool and ANSYS for the specific board shape to determine the maximum antenna gain and performance. The particular design due to the size and on the specific board achieves -4.45 dBi peak gain.

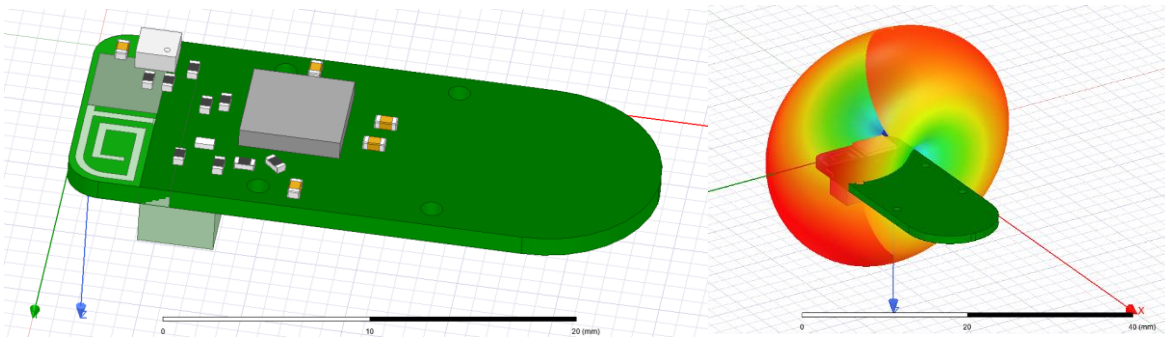

Figure 1 - Antenna simulation of the pattern and the board setup

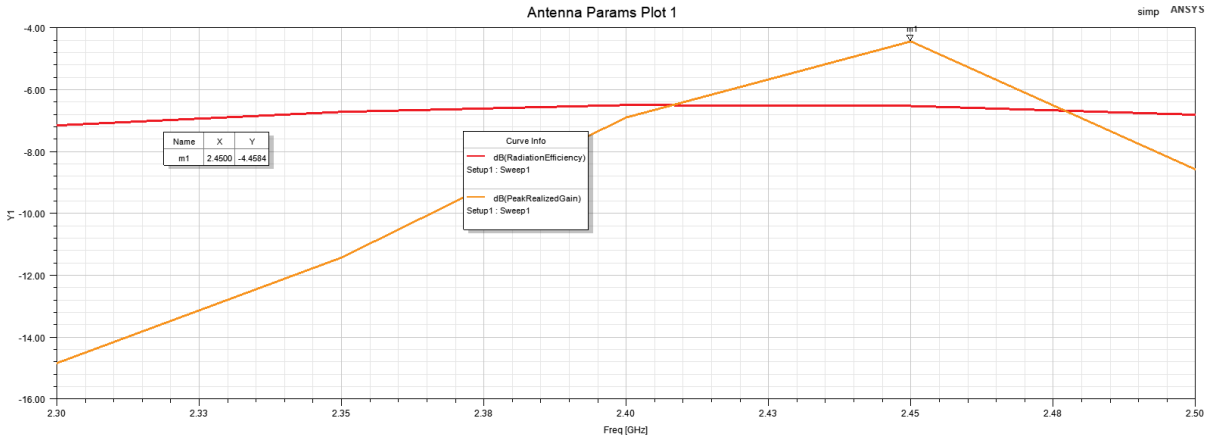

Figure 2 - Antenna parameters plot

Real-world performance

Given the primary use of such an antenna on wrist-worn devices, the performance of a setup has been evaluated with the wrist setup as well as in free-space. Key expected results of the setup are:

- Free-space gain: -5 dBi
- Wrist-worn gain: - 8 dBi

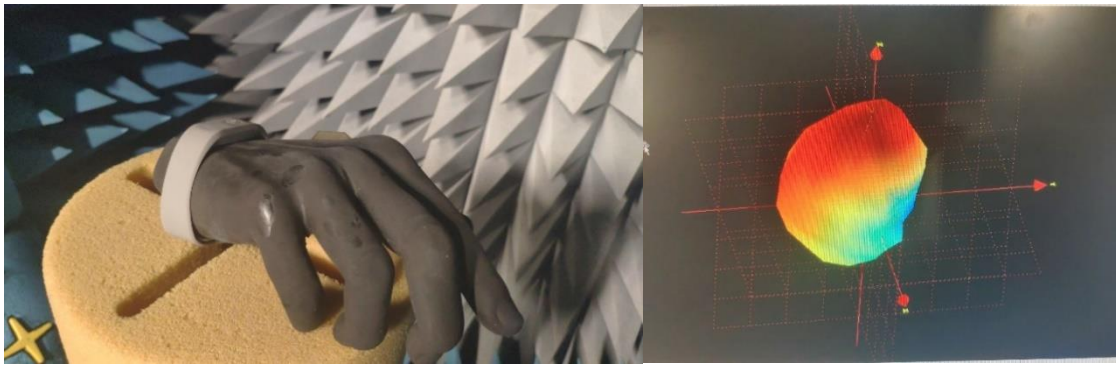

Figure 3 - Wrist-worn vs. Free-space

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