LT102V2 Antenna Report

Rev. 1.0

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1 Revision History

Rev	Date	Description
1.0	30th, May., 2024	Issued

2 Introduction

The LT102V2 device is a single-PCB (Printed Circuit Board) micro-radar module. It is a pulsed radar operating into the 6.5GHz-8.5GHz frequency range. It includes an RF transceiver, directive antennas and a microprocessor for data processing and transceiver management.
The LT102V2 includes a transmitter, a receiver, an antenna connected to transmitter and an antenna connected to the receiver.
Antennas are part of the PCB module and they cannot be changed by the user.

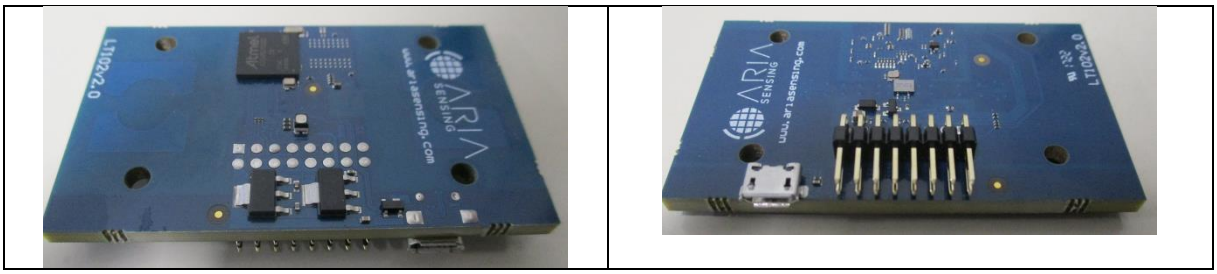


Figure 1 Picture of LT102V2

The typical applications of the LT102V2 include:

- Presence detection
- Distance measuring
- Breathe detection

2.1 Antenna Description

The antennas are specifically designed to operate with the selected front-end (X4). The RF front-end has fully nominal 100Ω ports at both Tx and Rx side. Two differential CPWG (Grounded CoPlanar WaveGuide) lines brings the signal from the X4 RF I/Os to the antenna.

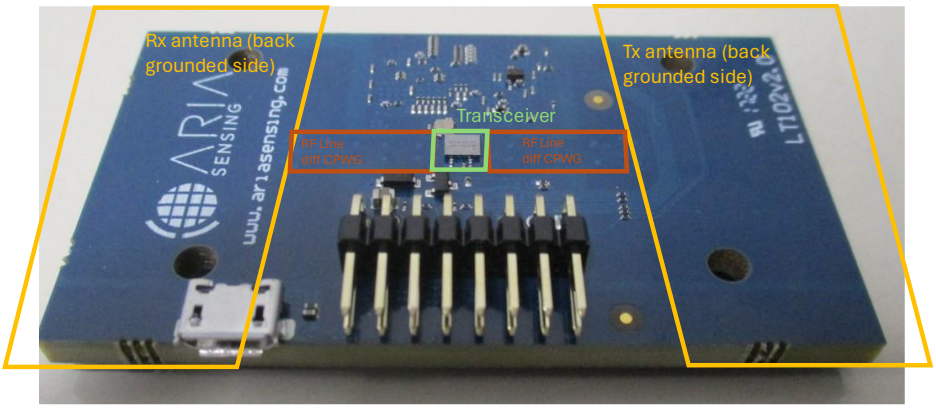


Figure 2 Picture with RF part, Antennas and Antennas Feeding lines highlighted (bottom side)

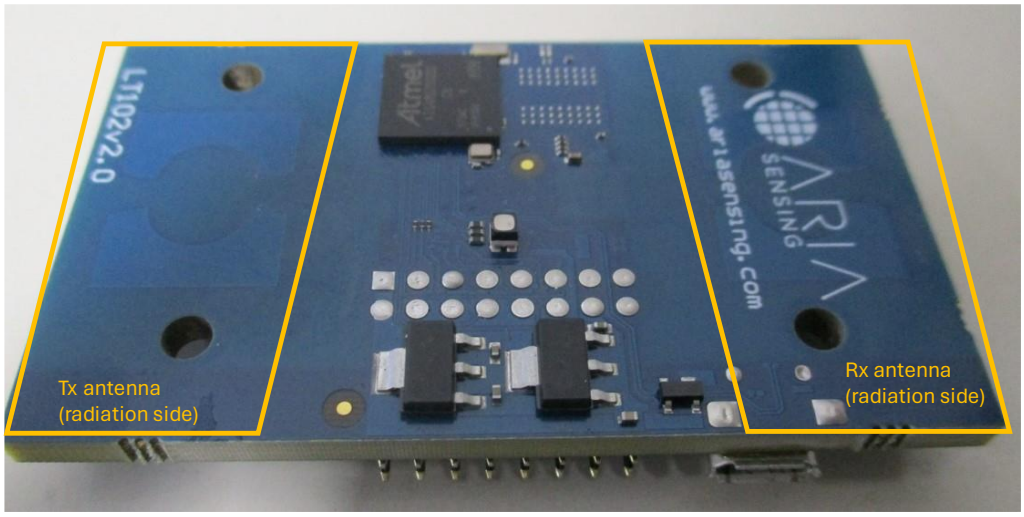


Figure 3 Picture with Antennas highlighted (top side)

Antennas are shown in the previous Figure 2 and Figure 3. On the back side a Ground Plane is clearly visible. Lines to/from RF transceiver are shown. They are differential Grounded Coplanar Waveguides (CPWG) lines and they are designed to provide good power matching in between RF Front-end and the antenna feeding points.

Due to the differential nature of the selected front-end and due to the small pitch of positive/negative signals of the differential pairs (0.4mm pitch at RF Front-end, 0.75mm at antenna feeding points), it is extremely difficult to perform dedicate measurements on the antenna.

The design/validation flow therefore relied on:

1. Selection of high-performance substrate with known and proven repeatability of its RF performances (dielectric constant, loss factor)
2. Validation of the design by means of an industry-approved simulator. This was Keysight® EmPRO® . The design was simulated by means of a full 3D FEM model.
3. Measurements of radiation properties of the entire devices

2.2 Simulation Details

In order to obtain reliable results of the simulations, and considering that those antennas are specifically design for the LT102V2 module, the performances of the antenna are calculated by modeling all geometries of the LT102V2 module.

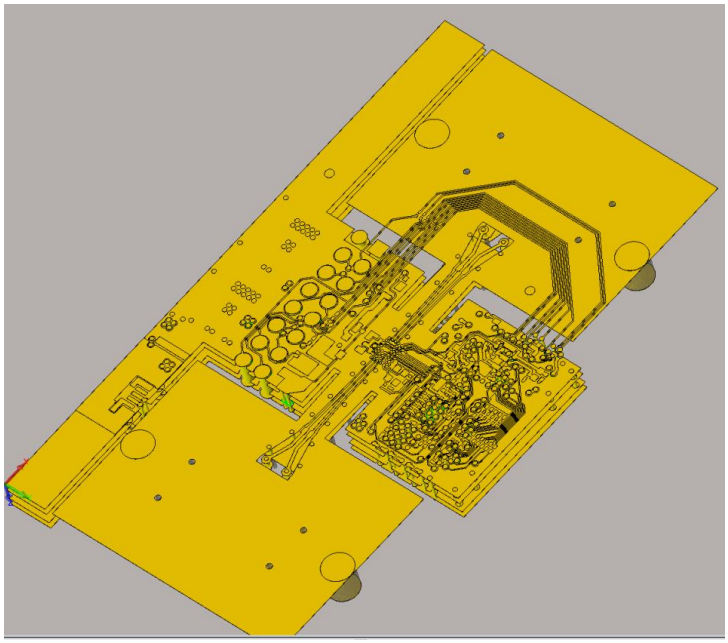
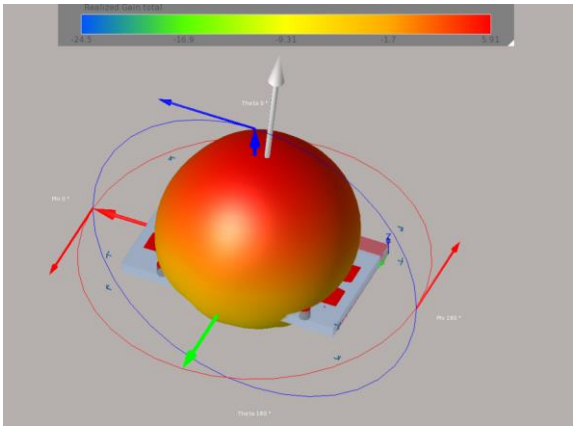
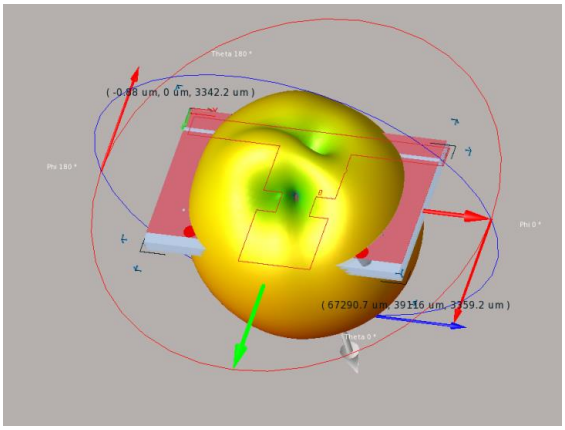
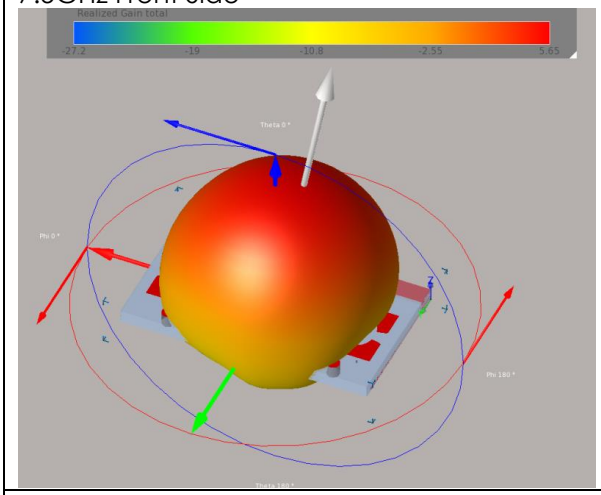
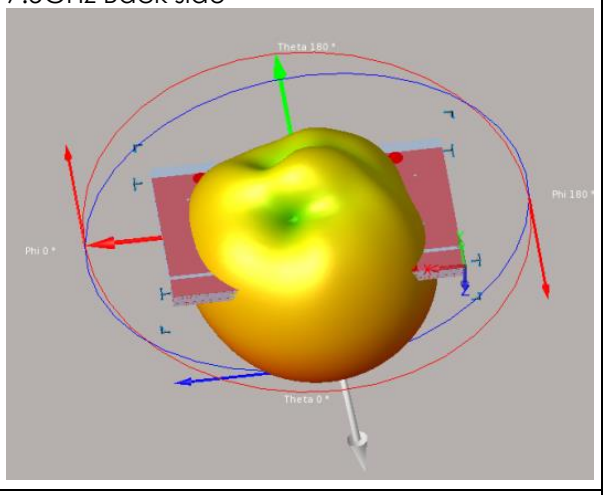
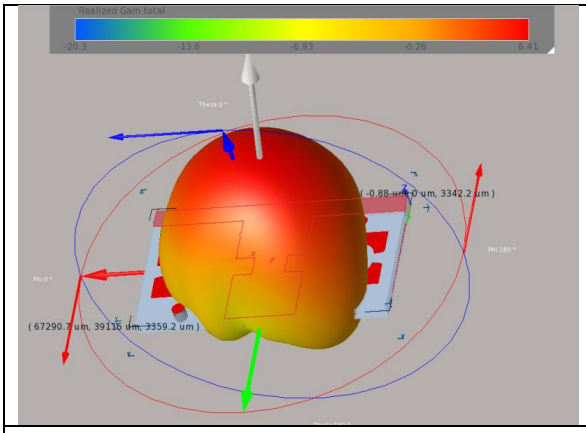


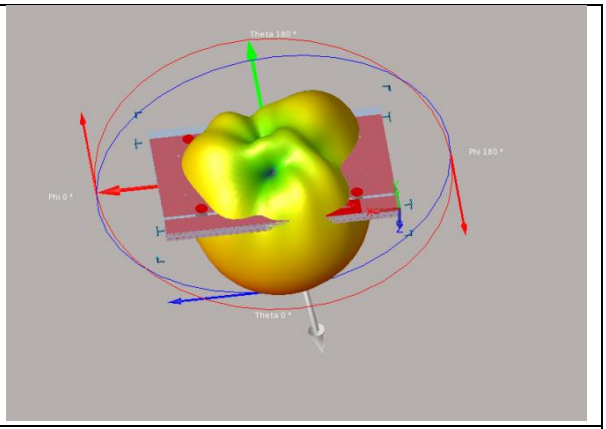
Figure 4 EM Model

2.3 Antenna Simulated Performances

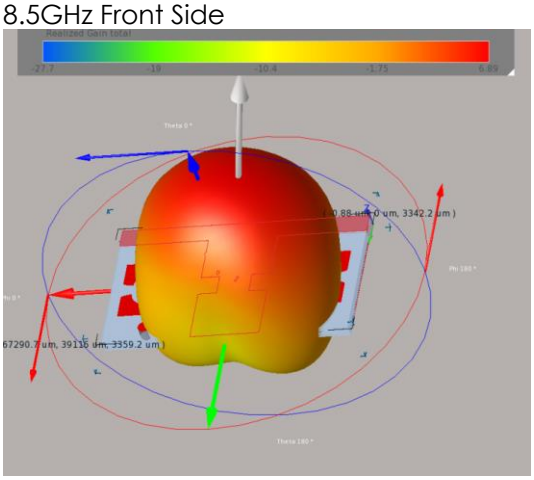
The 3D radiation diagram of the Tx antenna is reported in the next pictures (same colormap apply also to the left pictures).

7GHz Front Side	7GHz Back side
	
7.5GHz Front Side	7.5GHz Back side
	
8GHz Front Side	8GHz Back Side

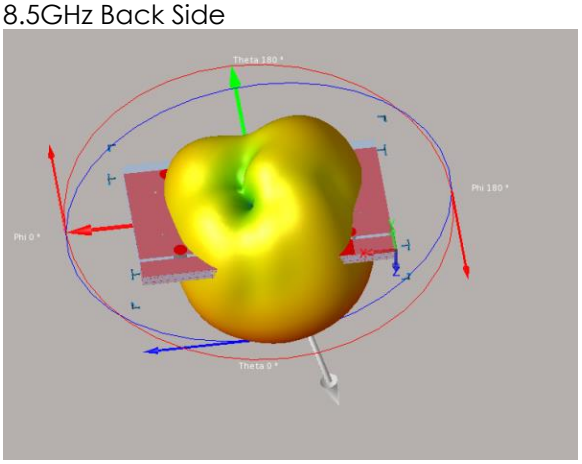




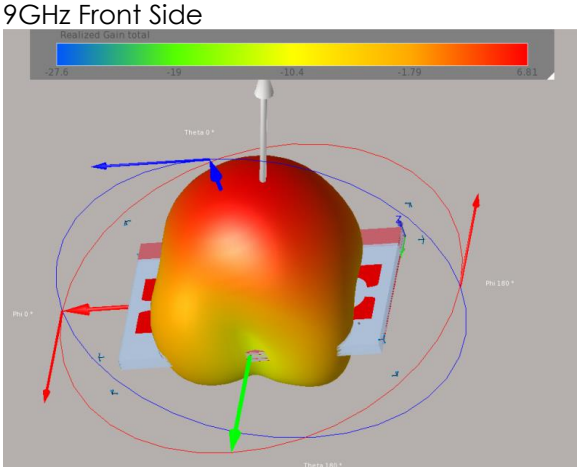
8.5GHz Front Side



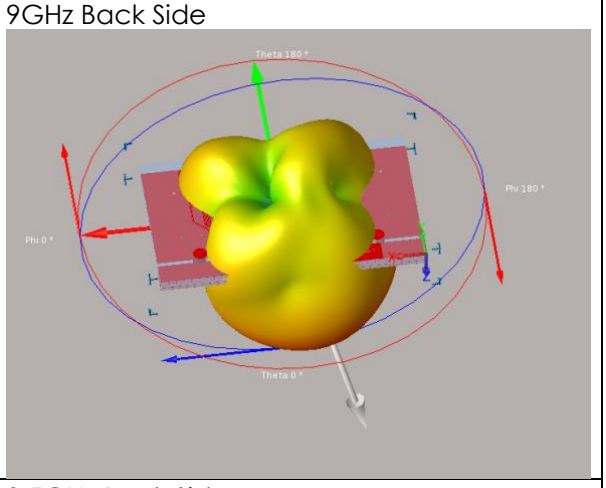
8.5GHz Back Side



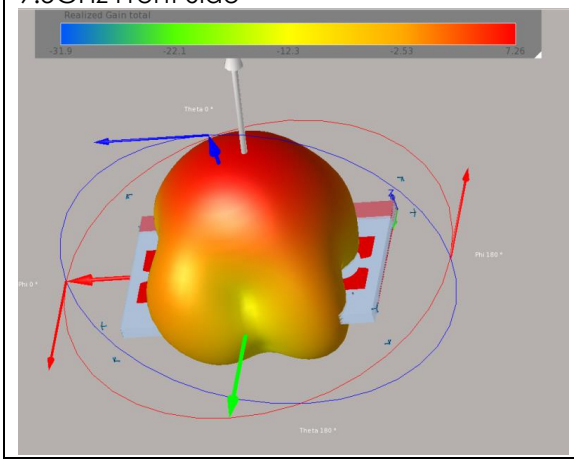
9GHz Front Side



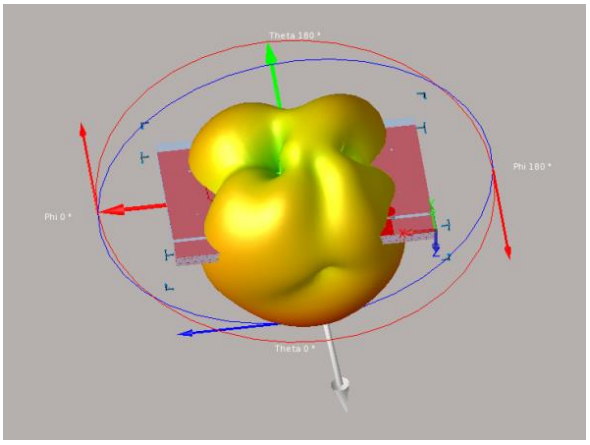
9GHz Back Side



9.5GHz Front Side



9.5GHz Back Side



Other relevant performances are shown in the next table.

Performance @ 7.5GHz	Value
Total Efficiency	70%
Maximum Realized Gain	5.6 dB
3dB Angular Width (azimuth/elevation)	71° / 84°
Front to Back Ratio	15.0dB
Main Lobe Direction (azimuth/elevation)	0° / 5°
Axial Ratio (Az/El Probe Field @	13dB
WiFi 5.8GHz Attenuation (max RlzdGain @ 5.8GHz / max RlzdGain @ 7.5GHz)	14dB
S11<-10dB Bandwidth	7GHz to 9.7GHz