



Radientum

WIRELESS PERFORMANCE MATTERS

Abel Delft B.V

LoRa Antenna Design – measurement results #3394

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Timo Huusari & Rasmus Luomaniemi

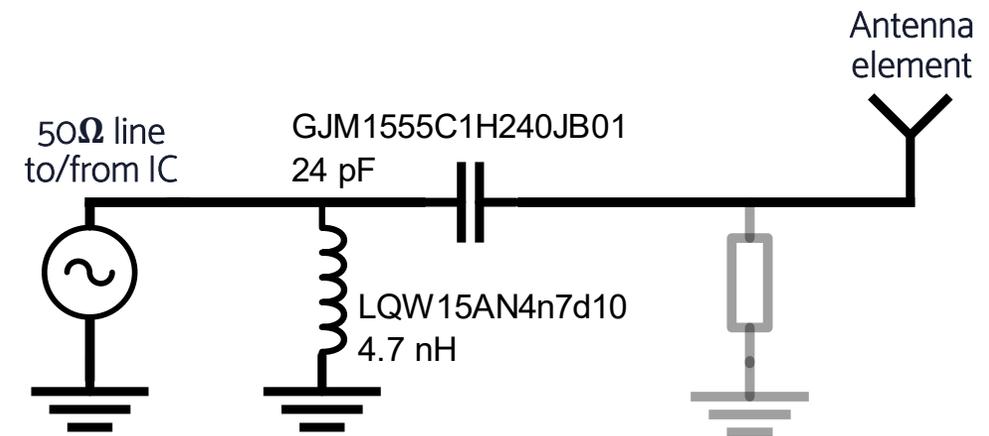
Recommendation

- New antenna PCB has been tuned to cover both 868 MHz and 915 MHz LoRa bands with better than -6 dB total efficiency
- Two matching components from Murata are used to tune the antenna to the wanted bands
 - The used components are series 24 pF capacitor and 4.7 nH parallel inductor as shown in the circuit below
 - Parallel inductor creates a DC path to ground, if this would be an issue for the IC, a large series capacitor could be used to create a DC block

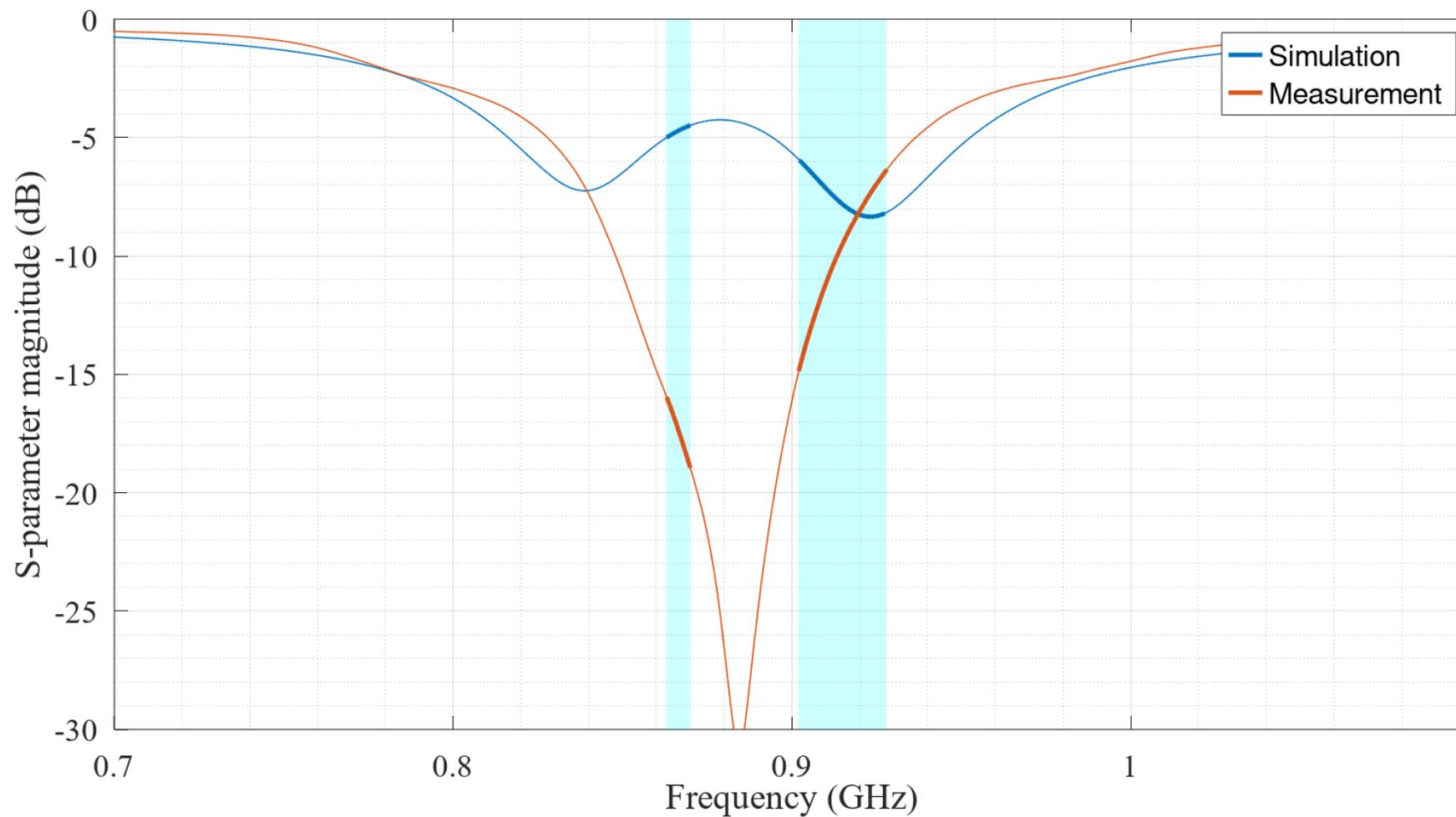


Measurement setup and matching components

- The new LoRa-antenna PCB has been tuned to cover both 868 MHz and 915 MHz LoRa bands
- The tuning and measurements have been done with the following mechanics setup:
 - The new antenna PCB has been placed in the mechanics of the previous LTE-antenna project so that everything else is kept the same except the new antenna board
- The resulting matching components are shown in the bottom-right figure
- Only two components are needed and the 1st one (seen from antenna towards IC) is left open
 - Parallel inductor creates a DC path to ground, if this would be an issue for the IC, a large series capacitor could be used to create a DC block

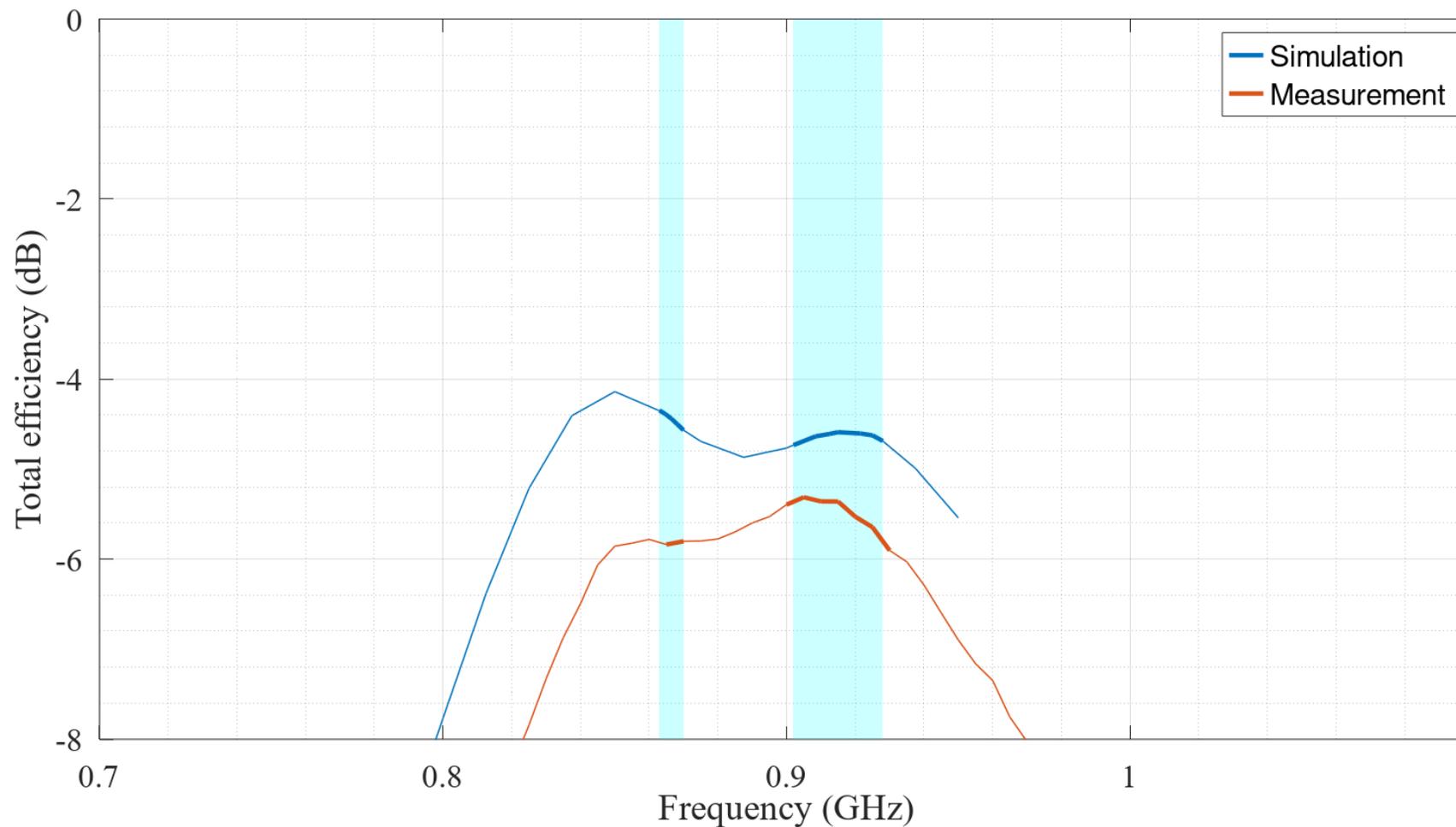


Results - matching



- Matching on both bands is good, better than - 6 dB
- Measured matching is better on most of the bands compared to the simulated results

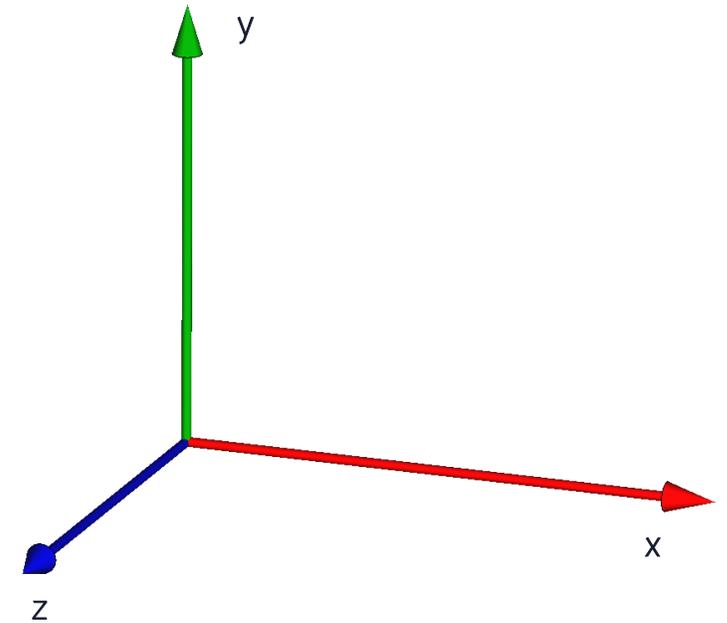
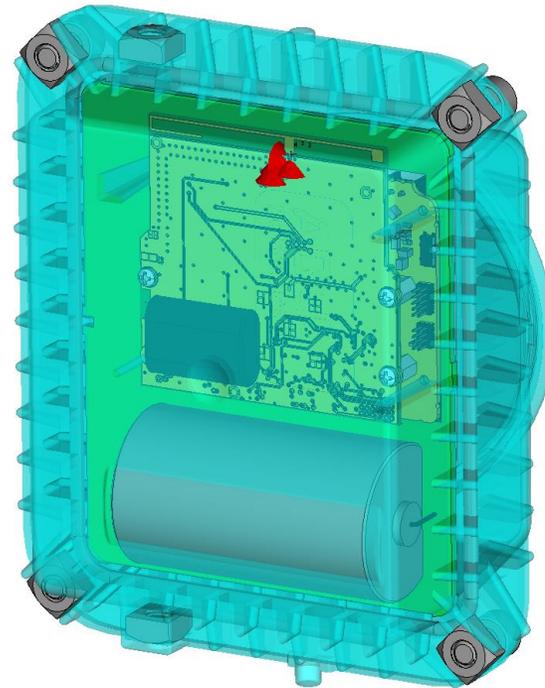
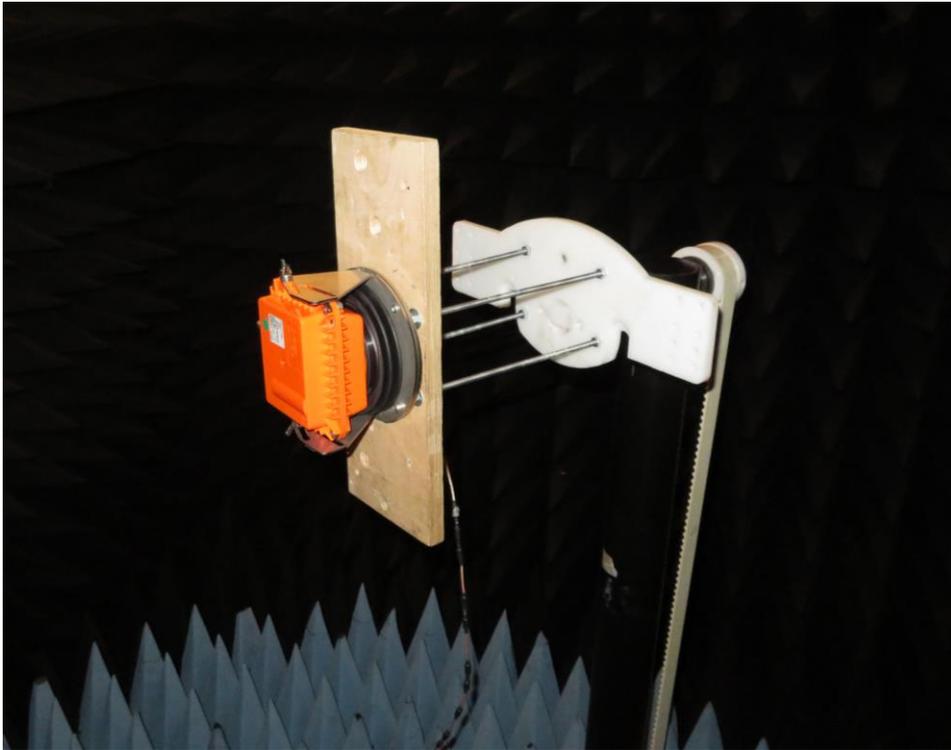
Results – total efficiency



- Total efficiency on both bands is good, above -6 dB level
- Measured efficiency is slightly below the simulated results, about 0.5-1.5 dB. Most likely due to the real model being more lossy than the simulation model

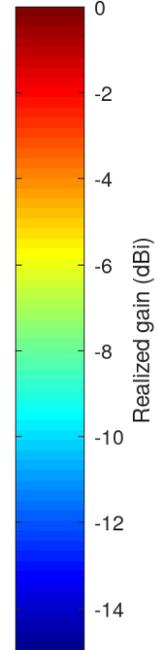
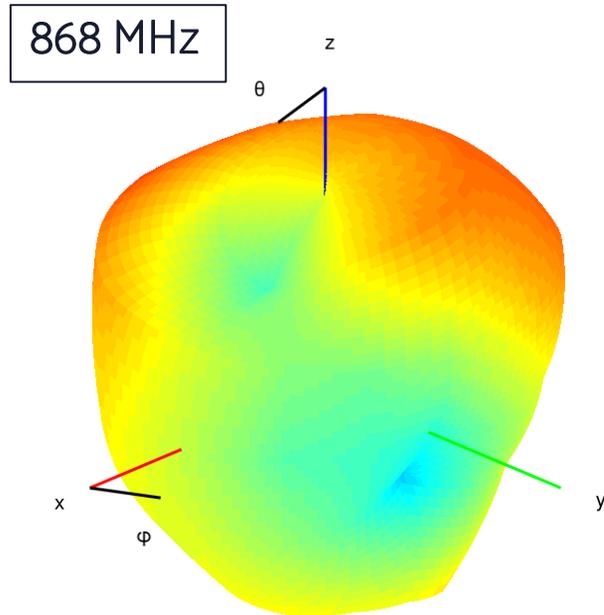
Radiation pattern

- The radiation patterns have been measured with the setup shown in the bottom left picture
- The coordinate system for the pattern results in the following slides is defined in the bottom right figure

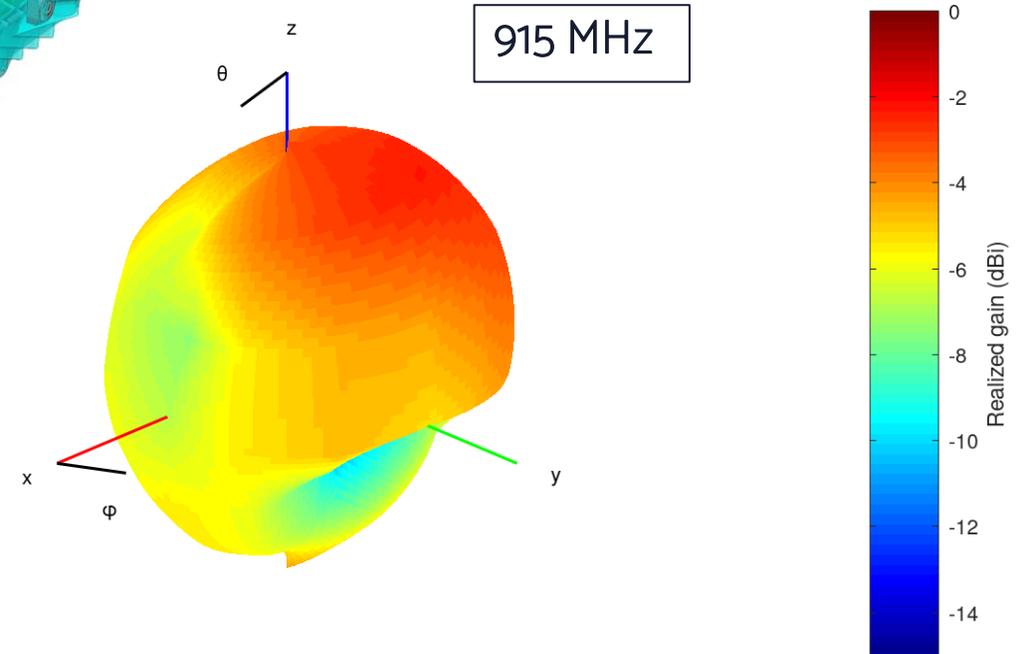


Realized gain patterns - view 1/2

0.868 GHz $G_{\max}=-2.14$ dBi $G_{\min}=-14.73$ dBi



0.915 GHz $G_{\max}=-2.34$ dBi $G_{\min}=-17.65$ dBi

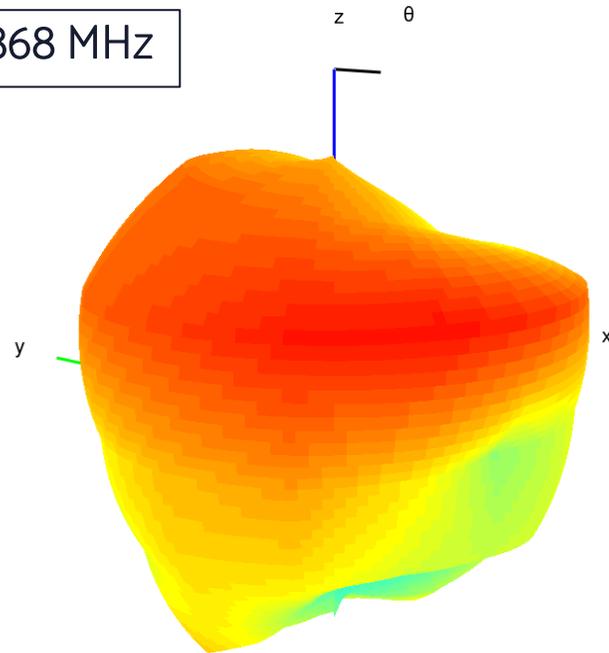


- No very deep nulls in the radiation pattern in either frequency band
- Minima of the pattern points from down from the y-axis towards the negative z-axis
 - Minima has been rotated more from upper hemisphere (+z side) to the lower hemisphere (-z side) compared to the simulations possibly due to the metal structures in the prototype

Realized gain patterns - view 2/2

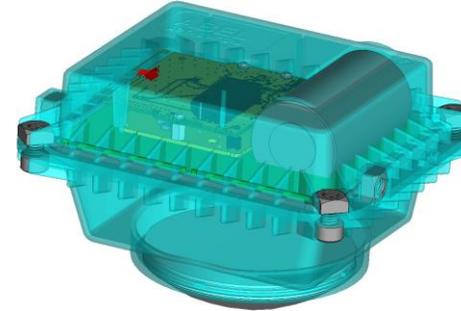
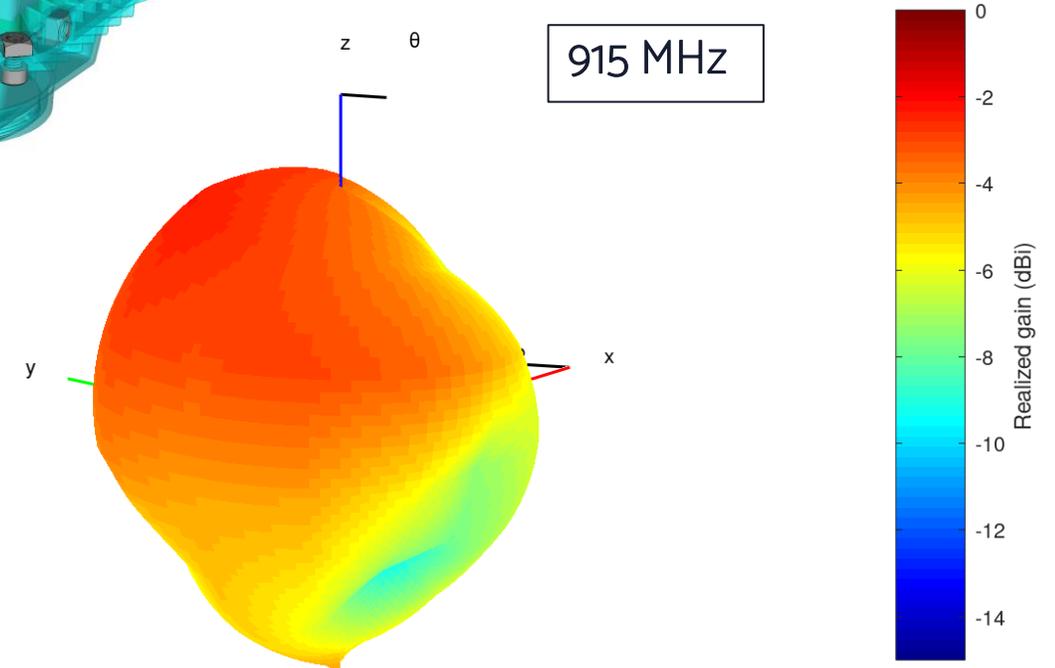
0.868 GHz $G_{\max}=-2.14$ dBi $G_{\min}=-14.73$ dBi

868 MHz



0.915 GHz $G_{\max}=-2.34$ dBi $G_{\min}=-17.65$ dBi

915 MHz



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- Minima of the pattern points from down from the y-axis towards the negative z-axis
 - Minima has been rotated more from upper hemisphere (+z side) to the lower hemisphere (-z side) compared to the simulations possibly due to the metal structures in the prototype

Conclusion

- New antenna PCB has been tuned to cover both 868 MHz and 915 MHz LoRa bands with better than -6 dB total efficiency
- Results for matching, total efficiency, and radiation patterns are presented in this report
- Two matching components are used to tune the antenna to the wanted bands
 - Series 24 pF capacitor and 4.7 nH parallel inductor as shown in the bottom-right circuit

