Study of a Monopulse System with RFID Antennas for Applications oriented to Retail Industry

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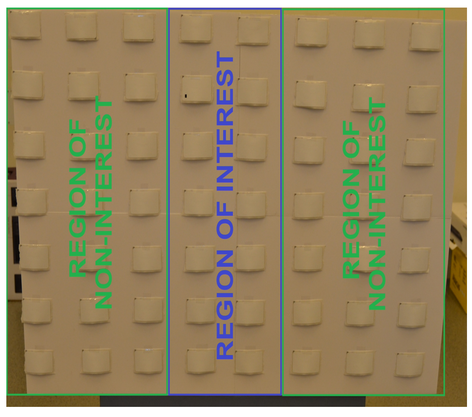
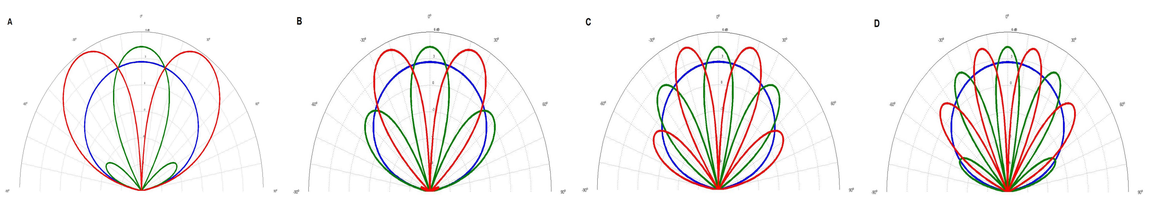
Introduction

- Radio Frequency Identification (RFID) technology at UHF band (Read Distance of few meters).
- Current systems are not capable of locating items accurately. It is necessary a method to get a narrower beam.
- It could be applied on retail store. E.g., Avoid to read tags from adjacent fitting rooms.

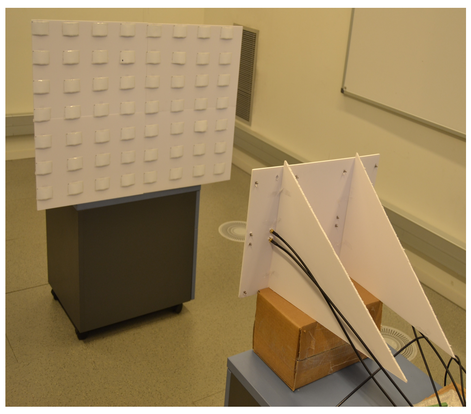


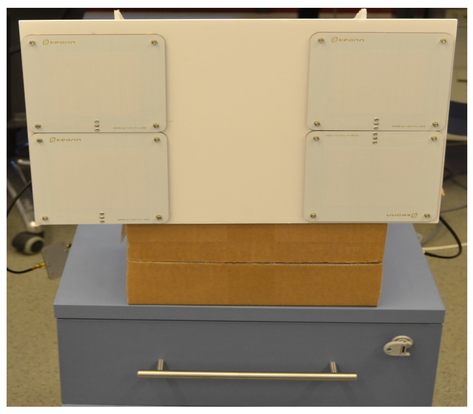
Methods



- The monopulse system is used as a radar for tracking objects. It uses RF beams to detect and exactly locate the object.
- By using pairs of antennas sum and difference RF beams can be generated (green and red RF beam respectively).
- When the antennas' separation change, also RF beams do.

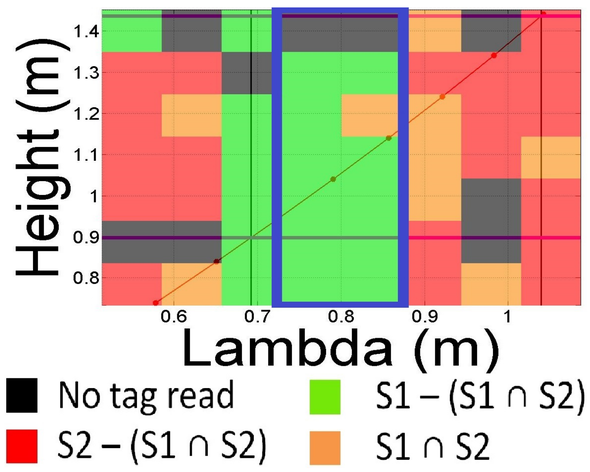
Experiments and Results

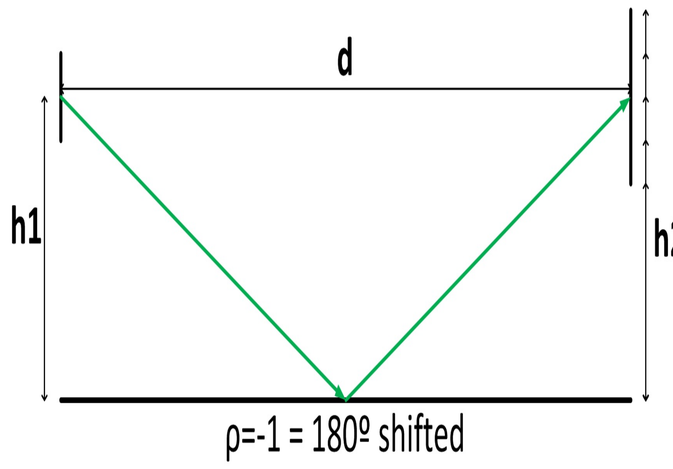


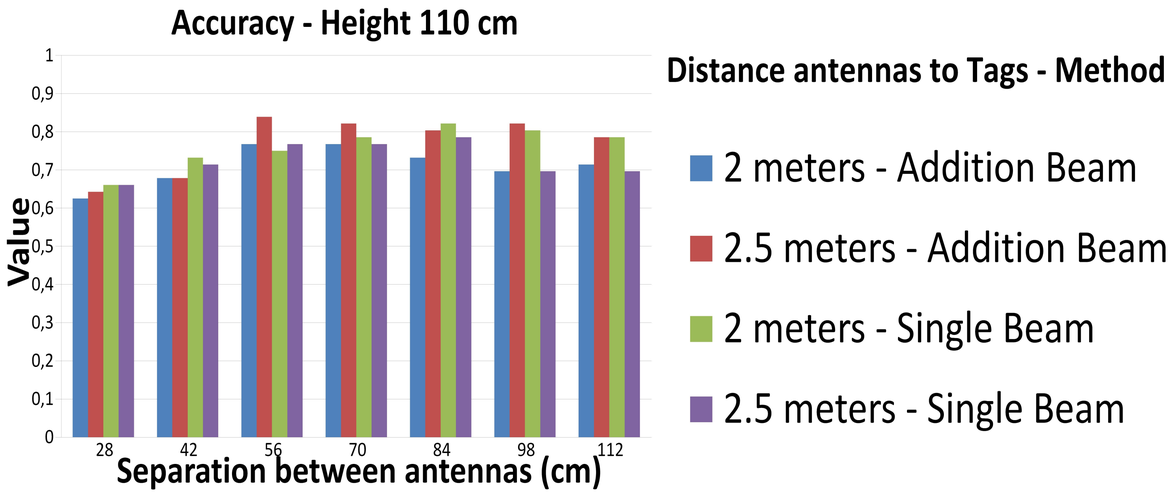


- Experiment composed by two RFID antennas (beam width of 100°) pointing to a cardboard with 56 passive RFID tags (7x8).
- RFID antennas were connected to a power splitter to create the monopulse system.
- Compare Addition or Single Beam (S1) with Subtraction Beam (S2).

- Results showed the expected vertical focused beam on the middle of the cardboard (blue rectangle).
- Multipath effect caused non-read tags and it was studied (Using Pythagoras' Theorem).
- Horizontal magenta lines represent the intersection between results from the study and $n * \lambda$ values.







- Accuracy as the sum of S1 read tags from region of interest (blue rectangle) and those outside this region divided by the total amount of tags.
- This monopulse system got an accuracy of 84%.

Discussion and Future Work

- A monopulse system suitable for RFID technologies.
- Got a narrower beam appropriate for retail industry and other applications.
- Future work from this experiment.
  - Experiment with antennas on zenithal position could be carried out to avoid the multipath effect.
  - Built a microstrip antenna with the monopulse system.
  - Test this system at a real store.

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