Distance measurement of RFID-Tags

key words: RFID | distance measurement | localization | ranging | existing tags

An algorithm has been developed to determine the distance between an RFID-reader and a tag involved in the communication. Although based on wideband TOF (time of flight) algorithm, this algorithm can be applied for existing tags without the need for modification. The algorithm can be used for passive, semi-passive, and active tags which use backscattering-communication. In combination with AOA (angle of arrival) algorithms and/or multiple RFID-readers tags can be localized.

Background
Distance information is essential for many applications in RFID. While this can be solved in many ways for dedicated ranging enabled tags (battery powered, expensive, non-standard), no satisfying solution exists for regular tags. The signal level received by the reader only gives inaccurate information about the distance reader to tag. Classical TOF-methods cannot be applied due to regulatory requirements and/or the fact that these algorithms are not able to distinguish between static reflections and the one from the tag. Other algorithms like triangulation require a calibrated setup of multiple readers which is difficult to deploy.

The patented algorithm allows tag-ranging (and localization when combined with AOA) for any backscattering-tags without the need for modifications of the tag. The algorithm only needs a single reader but can utilize multiple readers for increased accuracy as well.

Technology
A broadband modulated signal is superimposed onto the reader-tag communication still fulfilling regulatory requirements for RFID-readers. The algorithm utilizes the fact, that the backscattering-modulation of the tag also influences the phase of the reflected broadband signal. It is possible to suppress static echoes and emphasize the reflection of the tag involved in the communication only. While existing algorithms would detect room echoes as well (straight forward correlation), the patented method’s correlation maximum clearly indicates the distance of the tag.

Benefits
- Almost any RFID-tags/labels can be used (e.g. regular EPC-UHF-RFID tags)
- Works with passive, semi-passive, and active tags
- Ranging algorithm does not influence tag-to-reader communication
- Localization of tags with a single reader

Potential applications
- Any RFID-tag ranging and/or localization application
- Security applications which require defined communication distances

Development Status
A test-setup based on lab-equipment and MATLAB post-processing was used to successfully verify the algorithm. Currently, TU Vienna is pursuing a subspace-based approach for better multi-path resolution.

Cooperation Options
License agreement, R&D cooperation

Status of the IPR
Patent application in AT
PTC application filed