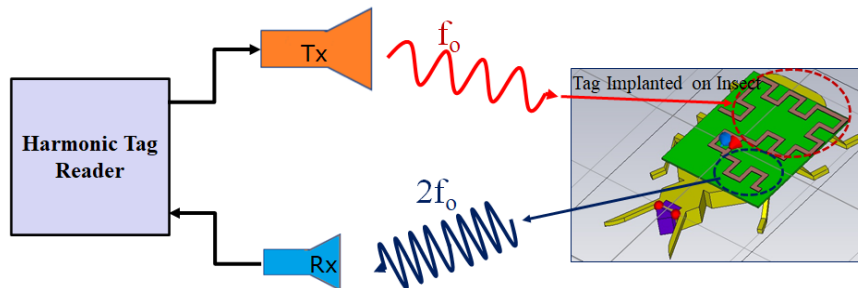


Project name: Harmonic Tags for Insect tracking and beyond

Introduction: Harmonic radar systems have been successfully used to detect and track small passive harmonic tags in a variety of applications. One of the common use case is tracking of tags carried by insects flying at low altitudes as is schematically illustrated in the figure below. The main operating principle in nonlinear radar is that the target of interest is nonlinear so that it produces a return signal at a frequency different of that of the illuminating signal. This allows efficient clutter reflection but introduces a number of unique challenges in the system design.

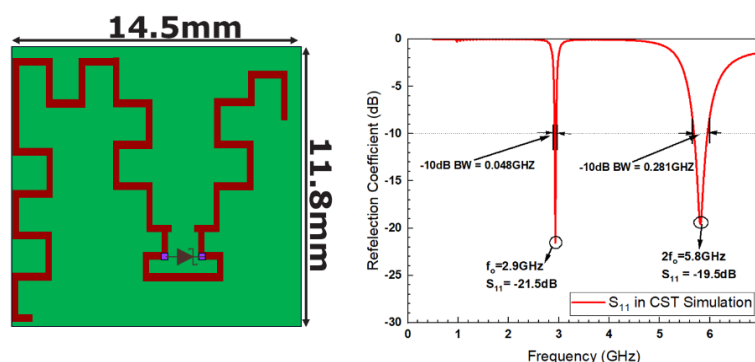


Harmonic Transponder System to Track Insects

Description: In the Radio Systems group we have designed a prototype tag using meander line topology. This tag is optimised to receive radiated signal from the transmitter at fundamental frequency 2.9GHz and re-radiate the tag at second harmonic frequency 5.8GHz. It has a compact size of 14.5x 11.8 mm². With first success in testing, there remains a number of challenges to be addressed in future research such as

- Further minitarization of the design by scaling it for the fundamental frequency for 9.8GHz and second harmonic frequency 18.8GHz. The challenge here is to optimize the tag layout for the higher operating frequencies.
- Investigation of the influence of the properties of the animal body on the design and tag performance.
- Modelling of tag performance in circuit simulation software to evaluate different types of illuminating signal (multiple tones, AM/FM/PM, etc.).

Multiple projects are available on this topic. Depending on the type of project, the work can involve one or more of the following: tag design and simulation in electromagnetic simulation software (e.g., CST, FHSS), tag circuit simulation in AWR Microwave Office, tag manufacturing and measurement in an anechoic chamber, etc.



Prototype harmonic tag design at 2.9/5.8 GHz

- **Student requirements:** Fundamental knowledge on electromagnetics, logical thinking and problem solving, curiosity and interest in antenna design.

If you are interested in this project, please contact Dr. Anastasia Lavrenko at a.lavrenko@utwente.nl