Wireless Power Transmission

and its applications for powering Drones

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Summary

I. Introduction
II. History of Wireless Power Transmission
III. Description of the Proposed System
IV. Transmitter
V. Receiver
   A. Antennas
   B. RF-DC
VI. Experiments with the Drone
VII. Conclusions

Introduction

- **Unmanned Aerial Vehicles (UAV):**
  - non-crewed aircrafts that can either be **autonomous** or **remotely controlled**;
  - associated with **several successful applications**;

Fig. 1: Parrot AR.Drone 2.0 [1].

[1] **Gadget Of The Week: The Parrot AR.Drone 2.0** (May , 2012). Retrieved from: http://techcrunch.com/2012/05/25/gadget-of-the-week-the-parrot-ar-drone-2-0/

Introduction

Major drawback

Reduced autonomy

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Introduction

- **We propose:**

Fig. 2: Representation of a drone charging with resort to microwave power transmission.

History Of Wireless Power Transmission

Fig. 3: Nikola Tesla in his laboratory [2].

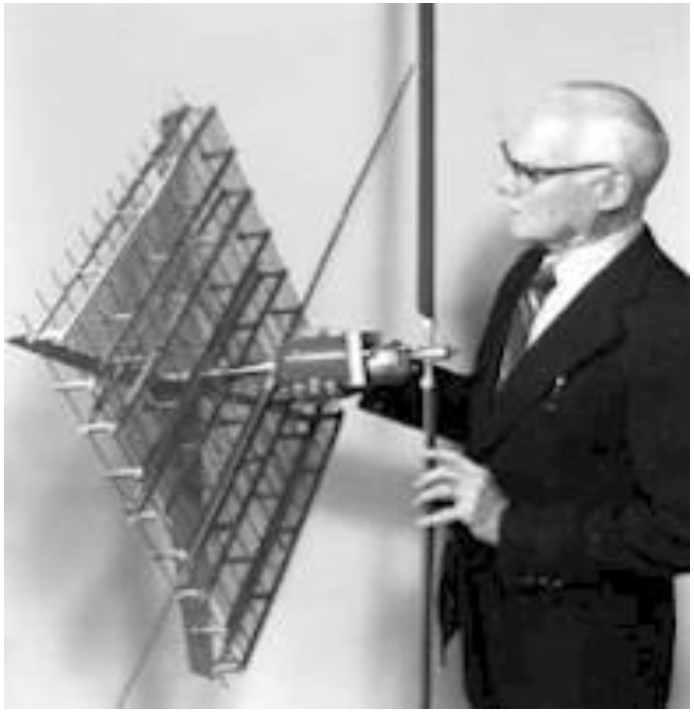


Fig. 4: William C. Brown holding the wireless power helicopter [3].

[2] **Ahead of his time: the genius of Nikola Tesla** (February, 2013) Retrieved from: http://lucidthoughts.com.au/wordpress/?p=1268/

[3] **William C. Brown** (November, 2014). Retrieved from: http://mainland.cctt.org/istf2008/brown.asp

Description Of The Proposed System

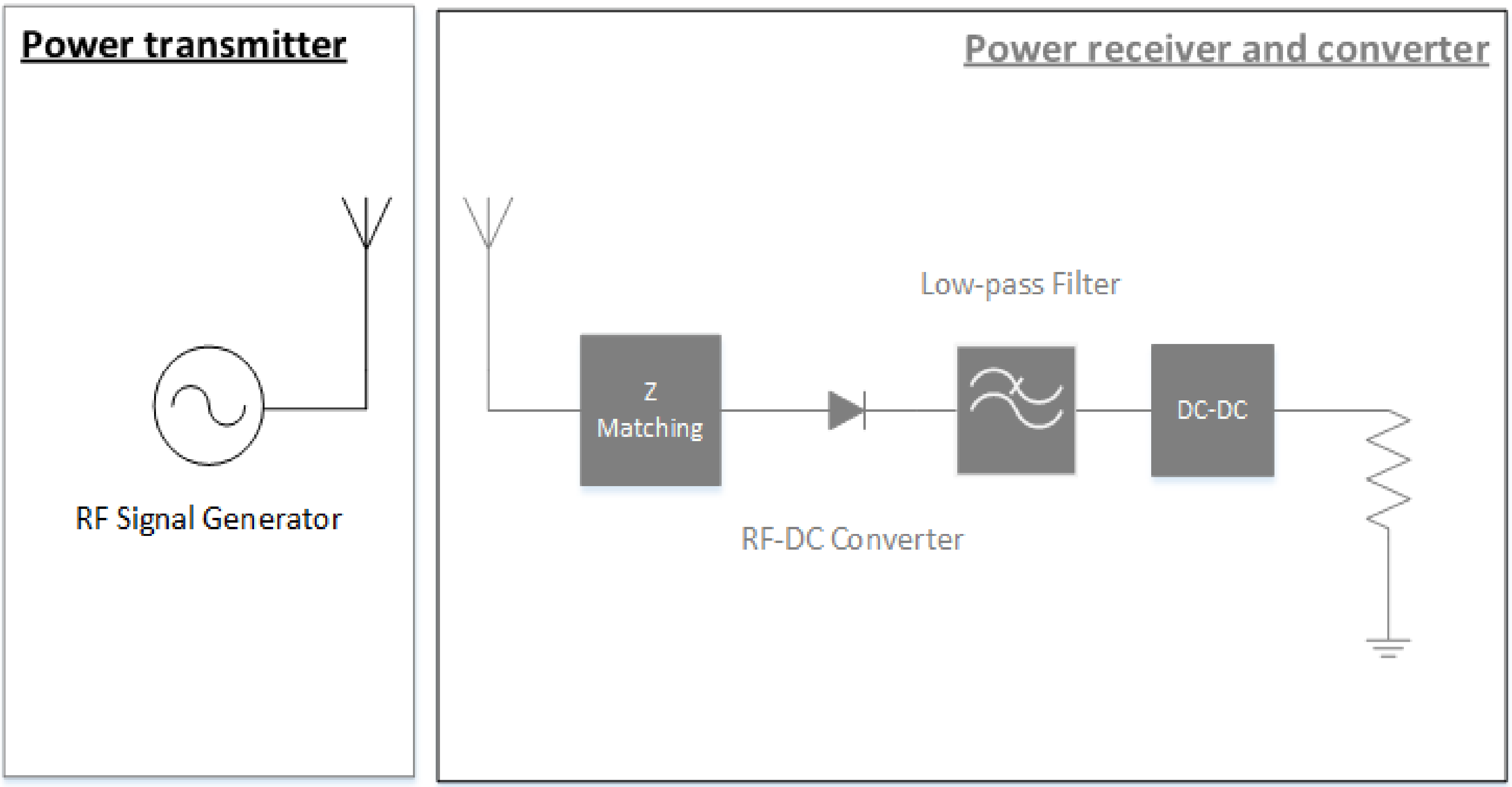


Fig. 6: Wireless power transfer system consisting of a transmitter and receiver section.

Description Of The Proposed System

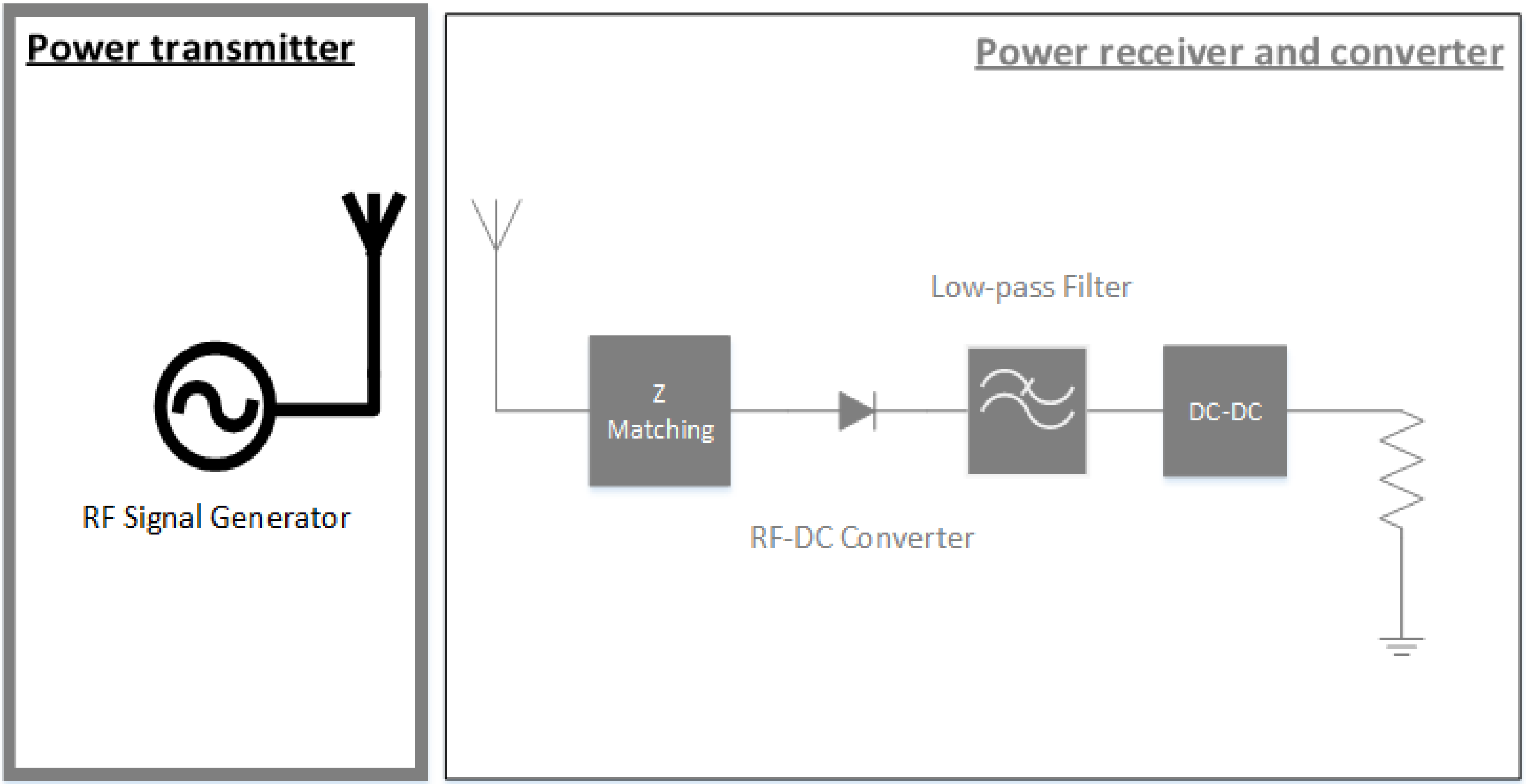


Fig. 6.1: Power transmitter.

Transmitter

- Linearly polarized, 16 element array;

- Total dimension: 14 x 14 cm;

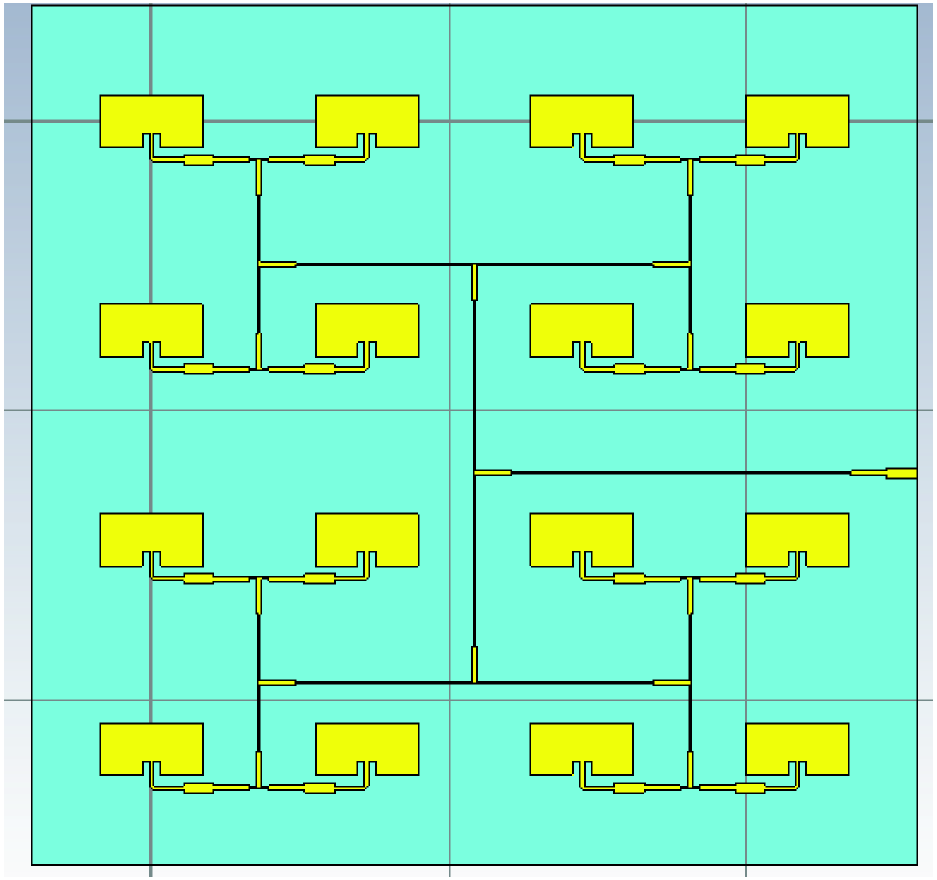


Fig. 7: Final array layout.

Transmitter

- Measured return loss of 9.8 dB at 5,8 GHz.

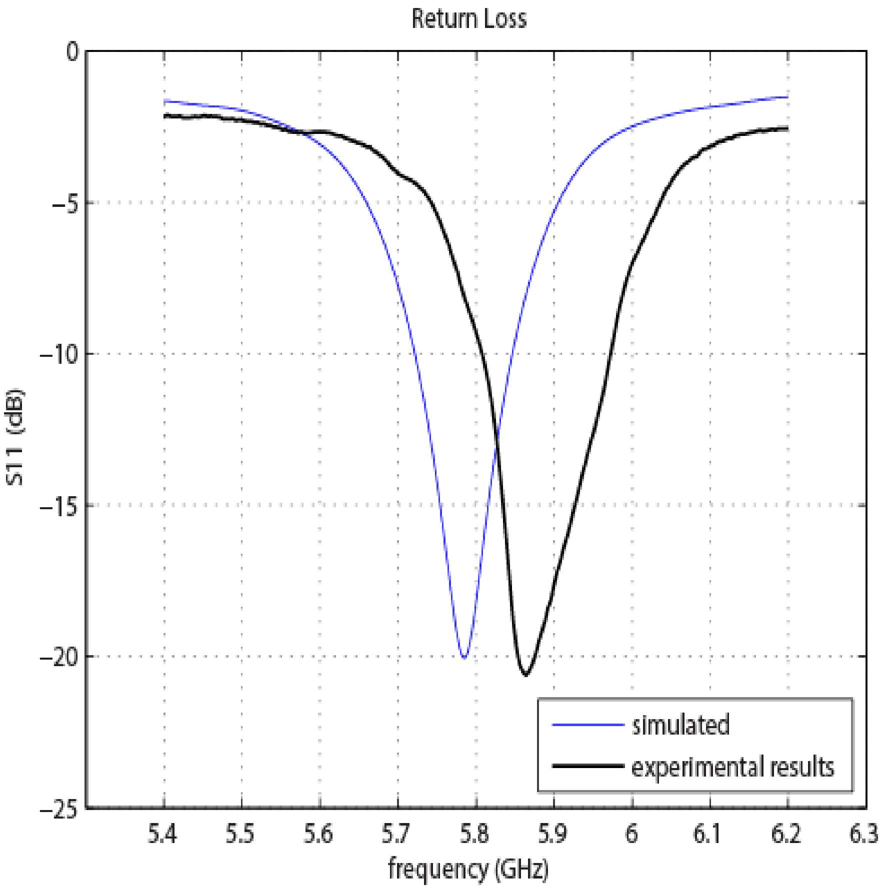


Fig. 8: Comparison between the measured and simulated S11 of the full array.

Transmitter

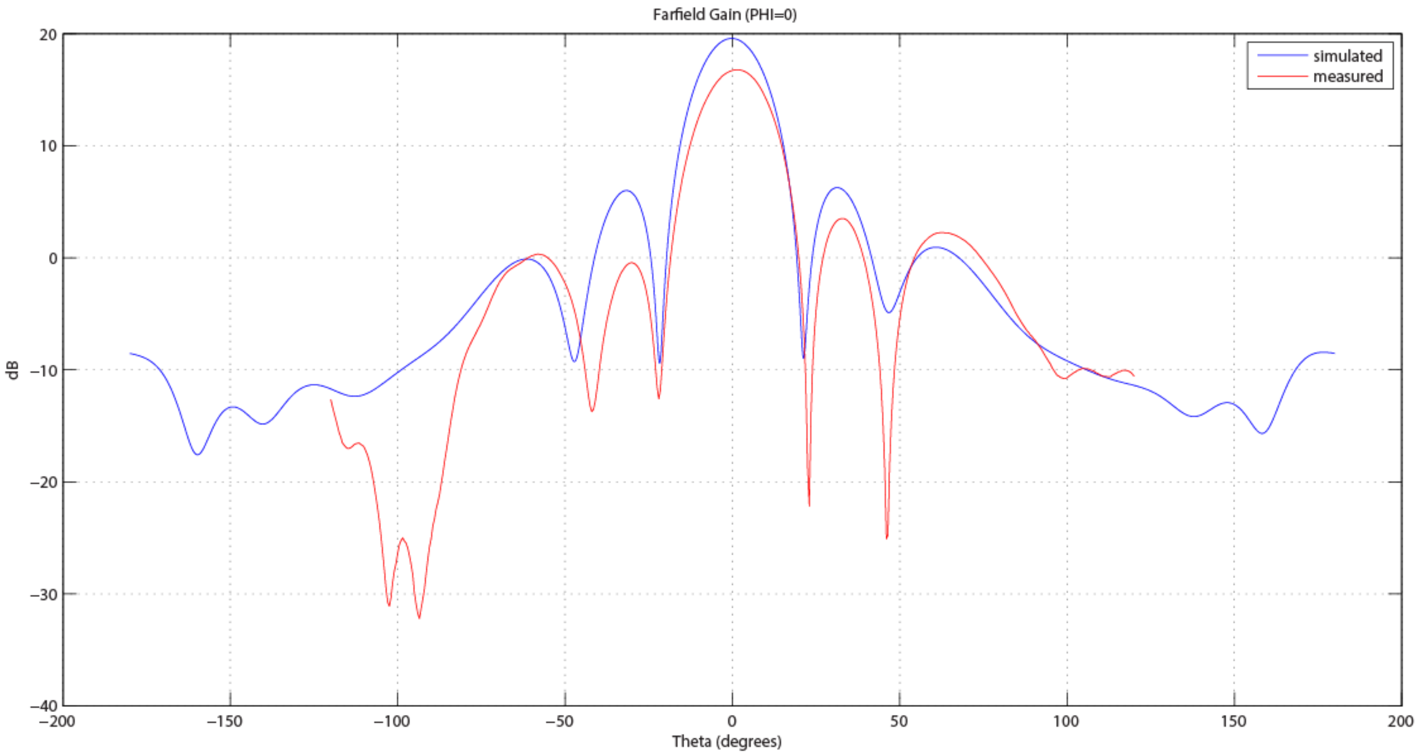


Fig. 9: Simulated and measured gain variation with theta of the 4x4 patch antenna array.

Description Of The Proposed System

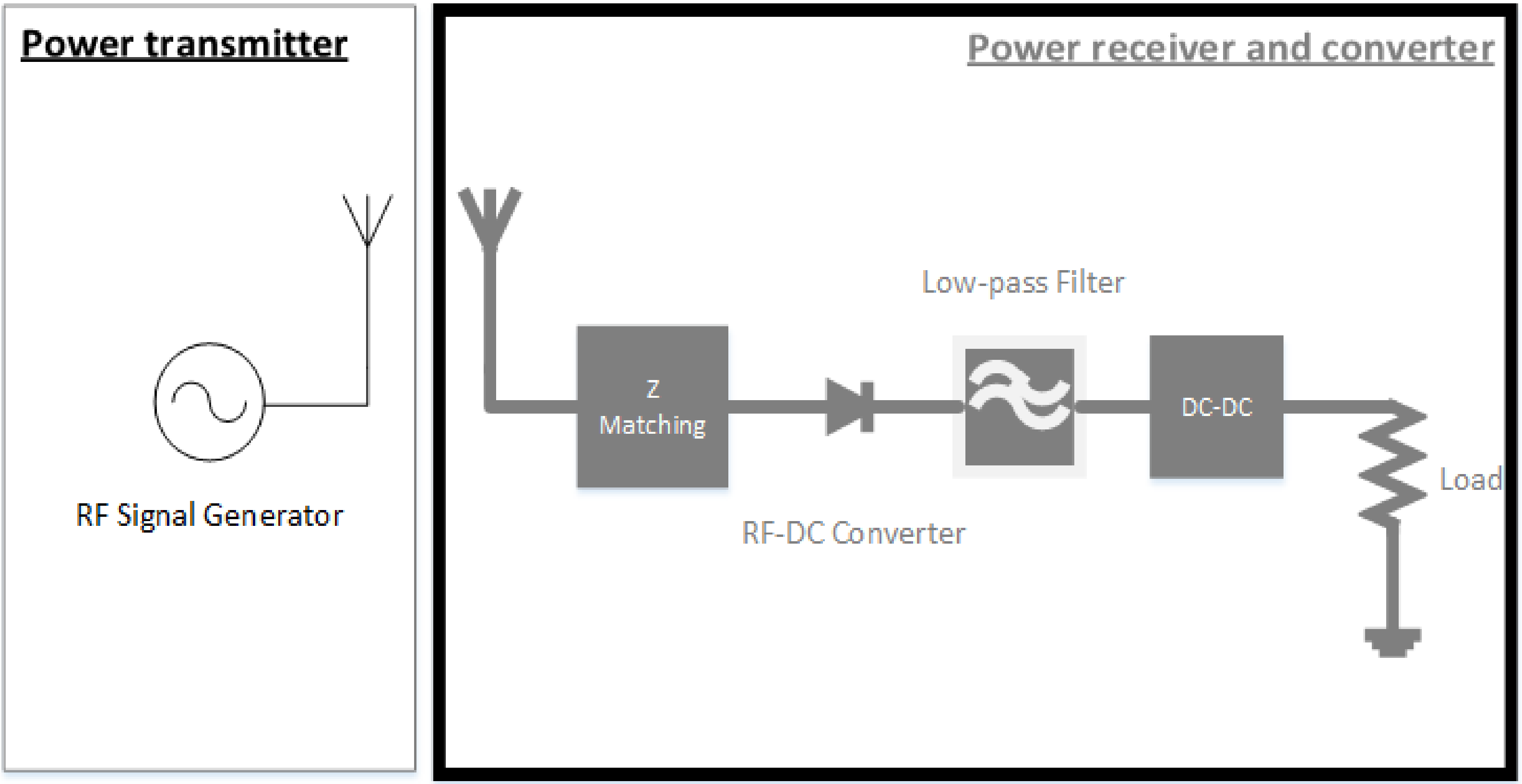


Fig. 6.2: Power receiver and converter.

Antennas

- Patch antennas:
  - Can be easily applied to the hull of the drone;

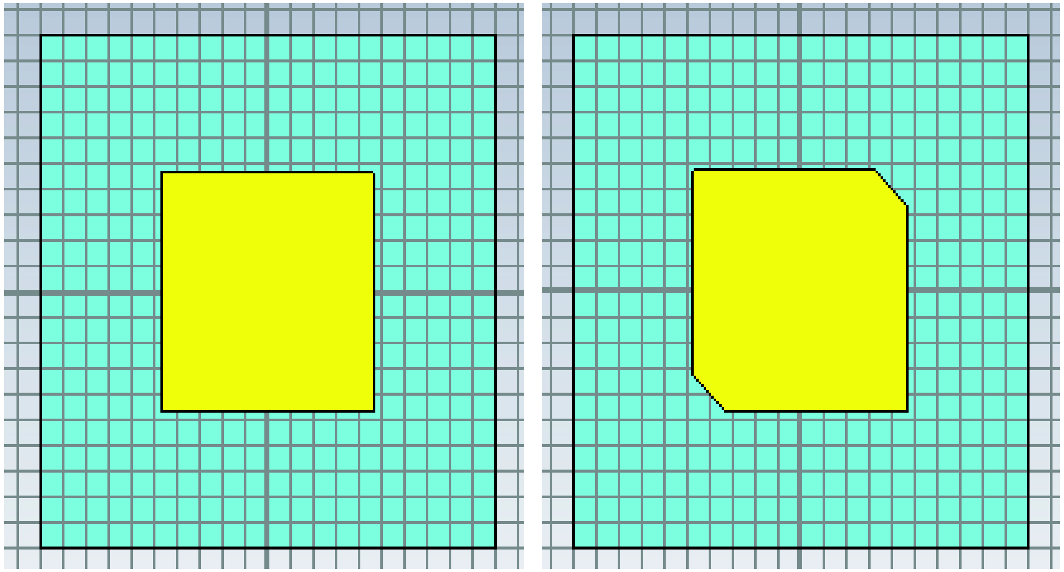


Fig. 11: Receiver antennas.

Antennas

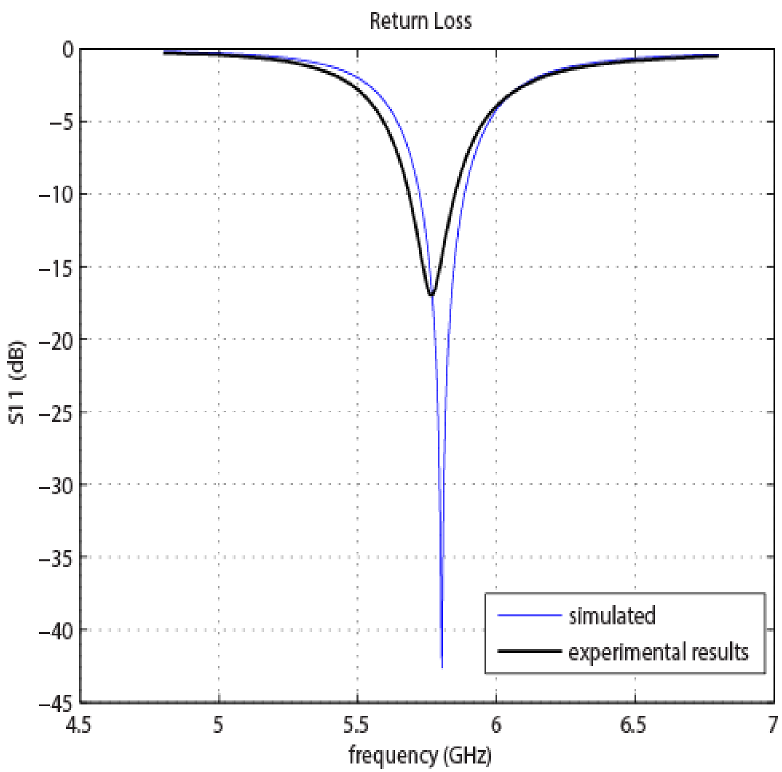


Fig. 12: Comparison between simulated and measured value for the linearly polarized square patch.

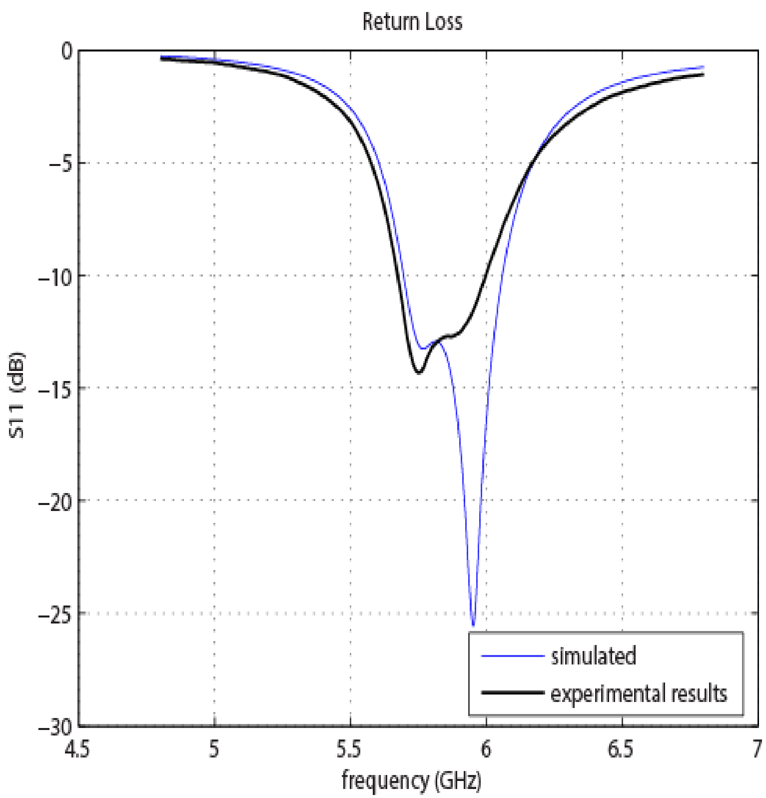


Fig. 13: Comparison between simulated and measured values for the right hand circularly polarized patch.

RF-DC

- Single shunt rectifier:
  - Maximum expected conversion efficiency of 50 %;

- For the low pass filter a 100 pF capacitor was chosen;
- The HUBSAN X4 drone requires 6,6 W and was considered as a variable resistor;

RF-DC

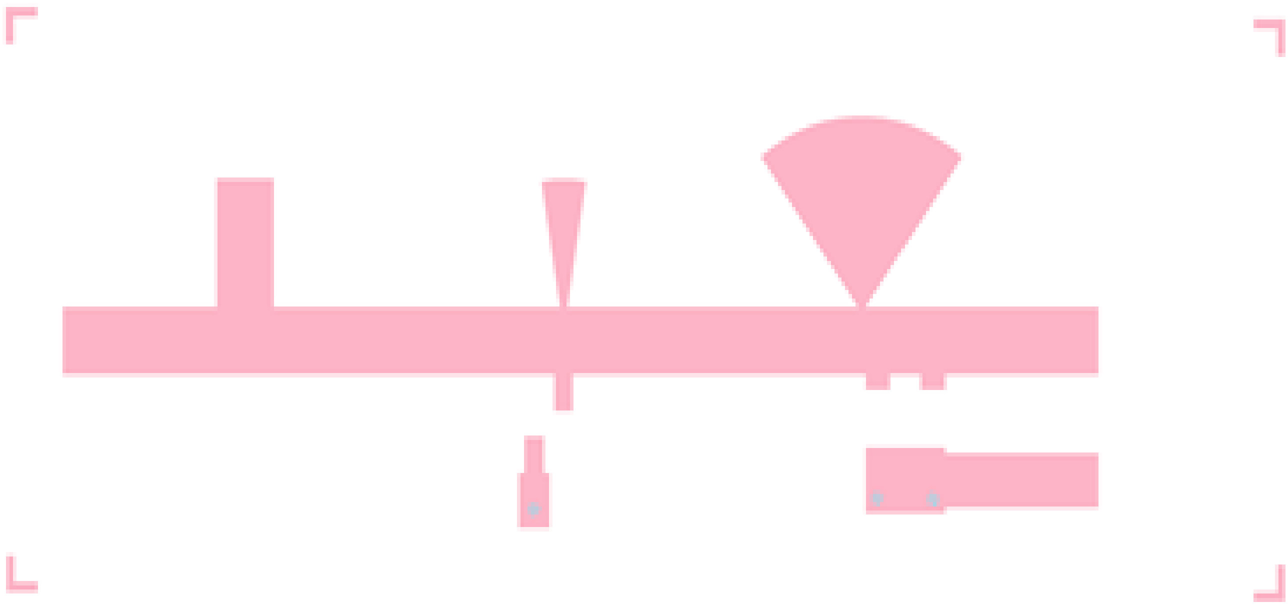


Fig. 14: Single shunt rectifier circuit layout.

RF-DC

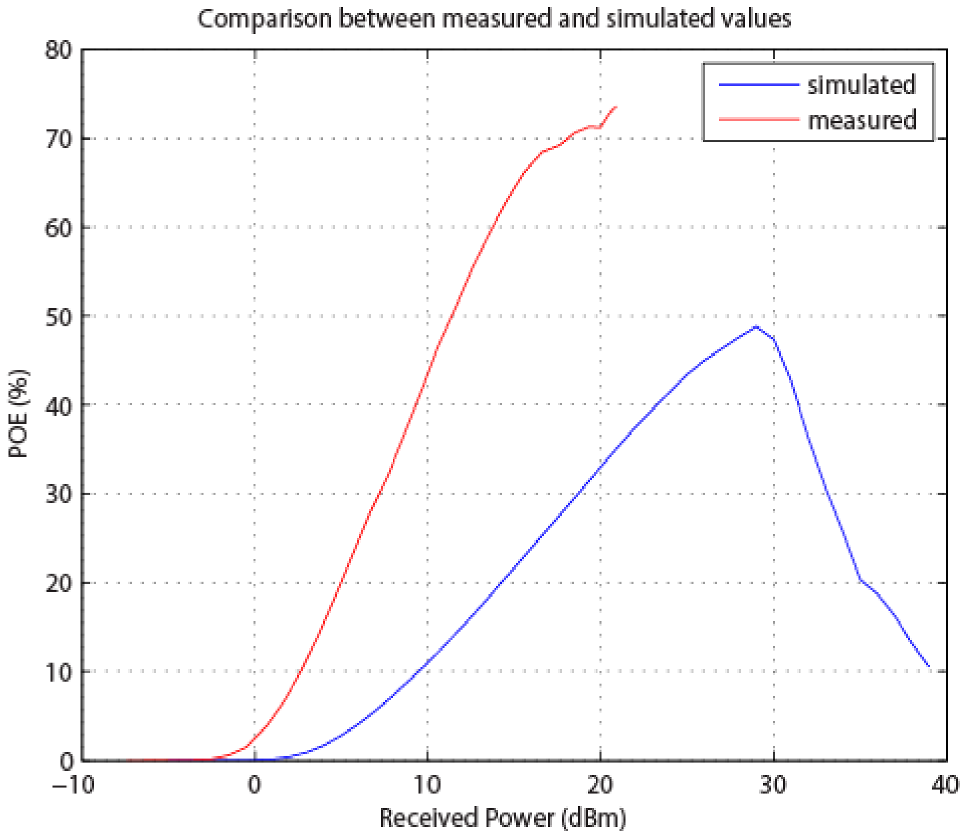


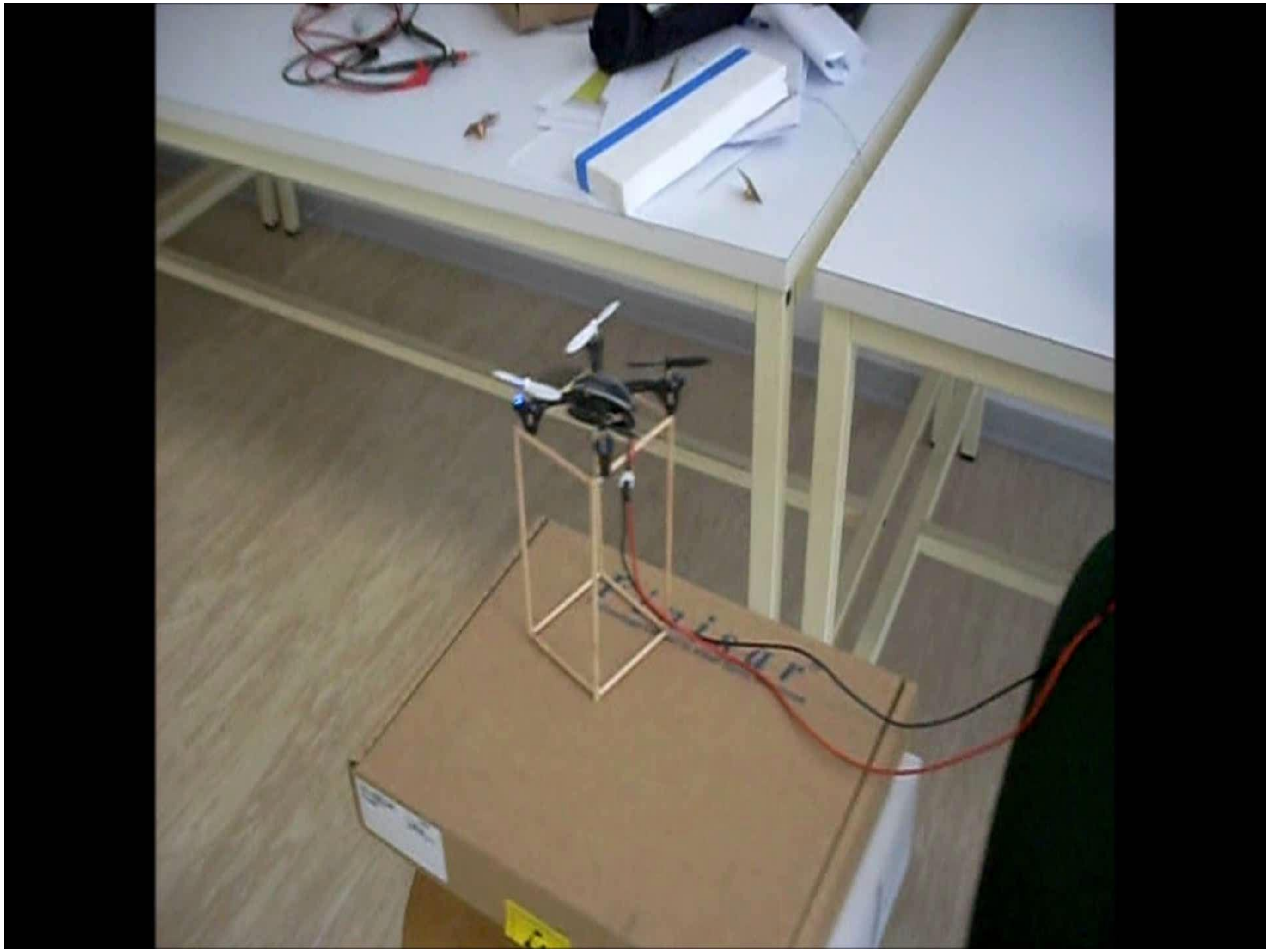
Fig. 16: Simulated versus measured POE of the Momentum simulated RF-DC Converter.

Summary

- A 16 element array was developed for the transmitter;
- 2 diferently polarized patches were printed for the receiver;
- A shunt rectifier was designed for RF-DC conversion;

Experiments With The Drone

Experiments With The Drone



Conclusion

- A wireless power system was proposed to tackle the reduced autonomy of drone;
- Several elements of this system were designed, implemented and tested;
- All the shown components present potential in being further implemented in fully or temporarily charging an unmanned aerial vehicle;

Acknowledgements

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Thank you for you attention!

Are there any questions?