RF to DC Converter

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Abstract

This project requires the development of a RF to DC converter circuit for use in wireless power transfer systems. The rectifier system will be designed to operate with maximum efficiency at a frequency of 5.8 GHz. The RF to DC converter is a passive system that will not require any external power, besides that of the RF/Microwave energy.

Purpose

- In today's world we as a society have become more dependant upon the wireless devices that we carry around every day. This system is being designed to be implemented in a wireless power transfer system that could be used to power these devices.
- Current charging techniques hinder the mobility of the users of these mobile devices. Wireless charging will allow for the users to be free of these hindrances and still be able to charge their devices.

Applications

•Advance in technology
- As this technology advances its applications expand. Users will be able to then use this technology with different devices or varying applications.

•Charging of mobile devices
- The main idea behind developing this technology is being able to convert wireless power to DC and be able to implement it in a wireless power transfer system. These systems will then be used to power mobile devices without the use of cords. Example devices consist of cell phones, smart watches, exercise bands, etc.

Goals

•Maximize efficiency
•Minimize overall size of system
•Be able to function at a frequency of 5.8 GHz
•Have a DC output with less that 1% ripple

Challenges

•Power losses due to transmission
•System efficiency
•Matching network issue

Block Diagram

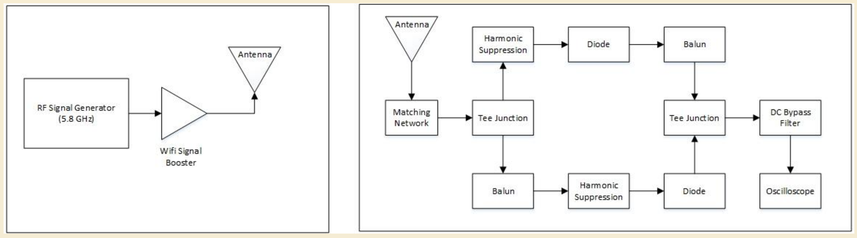


Fig 1. Wireless system block diagram

Design Process

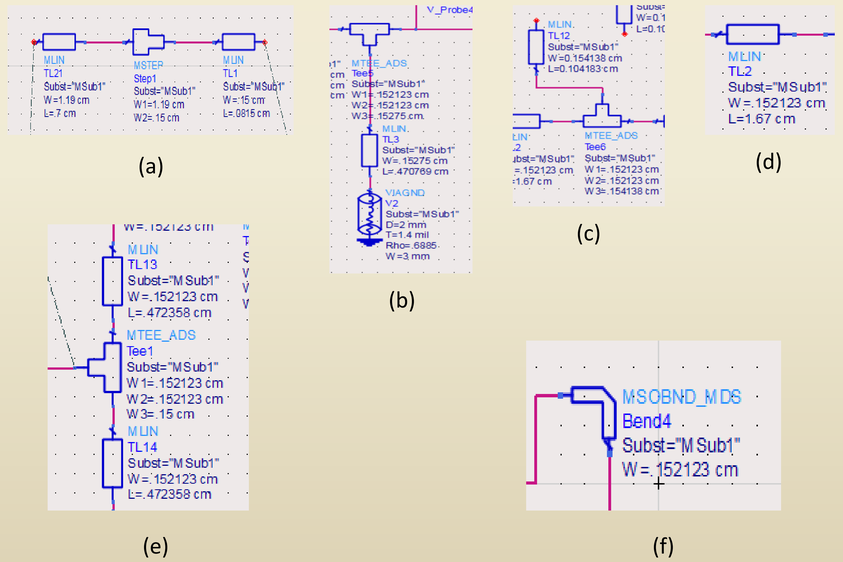
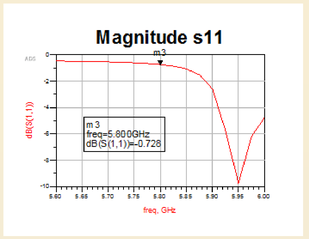
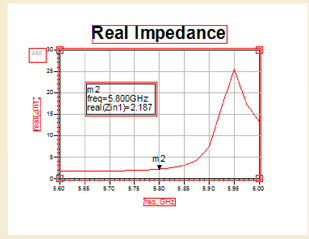


Fig 2. Major ADS schematic design components of RF to DC converter: (a) impedance matching network (b) Second harmonic suppression (c) third harmonic suppression (d) balun (e) tee-junction (f) bend

Simulation & Testing



(a)



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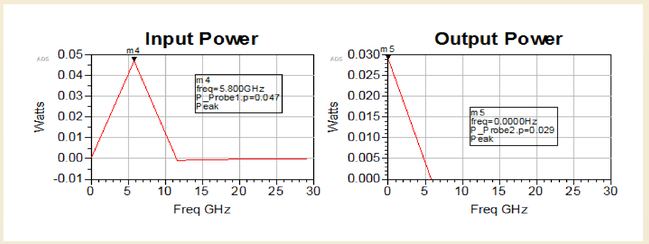

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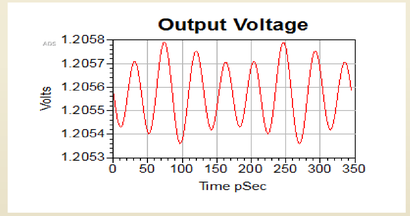

(d)

Fig 3. Simulation results for unmatched system in ADS: (a) Reflection coefficient (b) real impedance (c) power efficiency (d) time domain DC voltage output

Conclusion

This system is still in its infancy and could use further work to better harness this technology. Such improvements as efficiency maximization and size minimization can be done in order to make this project a more feasible commercial product. As the project sits now it has great potential. The system is able to function at varying wireless ranges and gives the minimal ripple DC output desired for use in mobile devices.