RF to DC Rectifier

Project Proposal

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Agenda

• Past Project
• Problem Background
• Constraints
• Design Approach
• Subsystem Block Diagram
• Nonfunctional Requirements
• Functional Requirements
• Economic Analysis
• Scheduling
• Societal and Environmental Impacts
• Conclusion
Problem Background (Bradley)

- Project from 2014
- Sergio Sanchez, Tyler Hoge, & Elie Baliss
- Dr. Prasad Shastry
- Wireless Power Transfer System
- Commercial Parts
- 915MHz frequency
- 2 Meters between antennas
Bradley Cont.

- Second system design of rectenna
- Functioned at 5.8 GHz
- 1 Watt power transferred
- Was not completed
- Closely related
Constraints

• Must output DC
• Must connect to an antenna at its input terminal
• Must operate in frequency range between 5.725GHz and 5.875GHz
Design Approach

- HSMS -2860 Schottky Detector Diode
Design Approach

**Input Voltage**

**Output Voltage**
Design Approach

Two Diode Full Wave Rectifier
Design Approach
Design Approach

Input Voltage

Out of Phase Input Voltage

Output Voltage
Design Approach

Diode Bridge Circuit
Design Approach
Design Approach

**Input Voltage**

**Out of Phase Input Voltage**

**Output Voltage**
Design Approach

Input Frequencies

![Input Frequencies Graph](image1)

Output Frequencies

![Output Frequencies Graph](image2)
Design Approach
Design Approach

**Input Voltage**

**Out of Phase Input Voltage**

**Output Voltage**

**Output Voltage**
Design Approach

Efficiency Chart

Friis Transmission Formula

\[ P_r = P_t + G_t + G_r + 20\log_{10} \left( \frac{\lambda}{4\pi R} \right) \]
Design Approach

Subsystem Block Diagram
Nonfunctional Requirements

• Objectives list for RF to DC converter:
  • Conversion should be efficient
  • Should be small
  • Should be safe to use
  • Should be cost efficient to produce
Functional Requirements

• Functions for RF to DC converter:
  • Should convert RF to DC
  • Should filter out harmonic frequencies generated by rectifier circuit
  • DC output filter should create a DC output
  • Should be matched to antenna input impedance
Functional Requirements

• Specifications for RF to DC converter:
  • Will work in the frequency range of 5.725GHz to 5.875GHz
  • Will attach to an antenna at its input
Economic Analysis

• Feasible to produce at a low cost
• Cheap components being used in design
• Massive market
• Not ready for commercial use yet
## Schedule

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<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Start</th>
<th>Finish</th>
<th>Duration</th>
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<td>Spring 2016</td>
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<td>1 Week</td>
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<td>3</td>
<td>Diode Configuration</td>
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<td>Mid Fall 2015</td>
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<td>Impedance Matching</td>
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<td>End Spring 2016</td>
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<td>3 Weeks</td>
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Societal and Environmental Impacts

• Convenience
• Safe
• Potential to be used in the future
• Less efficient than wired power transfer
• Trade-off
Conclusion

• RF to DC rectifier
• Continuation of 2014 project
• Design Approach
• Efficiency
• Endless Possibility
Questions?
Metrics for Objectives

- 0 – 5 point scale
- 5 highest
- 0 lowest
- Efficiency
- Size
- Safety
- Cost
References


