 Specification for RFID Air Interface

UHF RFID Tag Architecture
And RF-to-DC Converter

Mohammad Reza Ghaderi
mrghaderi@ece.ut.ac.ir
Outline

- UHF regulations for RFID in Iran
- Basic RFID Tag Architecture
- Voltage Regulation System
- Voltage Multipliers
- Self-boosting technique
- Threshold Voltage Reduction technique
- Conclusion
Ultra High Frequency (UHF) regulations

- Regulatory status for using RFID in the UHF spectrum 24 November 2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Status</th>
<th>Frequency</th>
<th>Power</th>
<th>Technique</th>
<th>Comments</th>
<th>Regulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iran, Islamic Rep.</td>
<td>OK</td>
<td>865-869 MHz</td>
<td>2W ERP</td>
<td>Approved August 2006</td>
<td>OK: Regulations are in place or will be in place shortly ERP: Effective Radiated Power</td>
<td></td>
</tr>
</tbody>
</table>

OK: Regulations are in place or will be in place shortly
ERP: Effective Radiated Power
RFID Tag Architecture

[Wooi-2006]
Radio Front End Example

[Diagram of a radio front end example with components labeled]

[Wooi-2006]
Voltage Regulation System

[Diagram showing the components of a voltage regulation system, including an incoming RF from reader, a rectifier that converts RF to DC, a limiter, a voltage regulator, and a power supply to the chip.]

[Ganesh-2006]
Simple Voltage Multiplier

- Uses Schottky diodes

[Udo-2003]  [Ganesh-2006]
Double Side Voltage Multiplier

- Uses silicon-on-sapphire technology

[Jari-2005]
Standard CMOS Voltage Multiplier

• Standard CMOS

[Faith-2005]
Full-wave bridge rectifier

\[ v_{\text{in}} \]

\[ v_{\text{rect}} \]

[Alessio-2006]
Threshold Voltage Reduction

[Toshiyuki-2006]
Implementation of the proposed circuit

[Toshiyuki-2006]
Entire circuit with rectifier

Toshiyuki-2006

IC size 0.8mm x 0.8mm
Input admittance 0.29mS + j1.4mS
PLS pulse frequency 100Hz
V_{in} voltage 0.53V
Output DC voltage 1.5V @Pin = -14dBm
Output DC current 0.4μA @Pin = -14dBm
Sensitivity improvement 10dB @DC output voltage = 1.5V
Rectification efficiency 1.2% @Pin = -14dBm
Current consumption 0.2mA

[Toshiyuki-2006]
Conclusion

• Two key approaches are introduced to make the long range RFID chips simple and cheap
References
