



RAIN and NFC Coexistence in Commercial Smart Device

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Introduction



- RAIN RFID reader becomes a major tool to interact with the IoT world
 - RFID tags are deployed massively (from 8.9 billion tags sold in 2015 to 10.4 billion in 2016)
 - RFID is often seen as a prerequisite for the IoT



Research Goals



- RAIN RFID needs to coexist with all wireless connectivity, including NFC, to be effective in IoT i.e. convergence of technologies
- Implement a widely used IoT sensor, i.e., the RAIN RFID reader, into the smartphone system and utilize the low power management framework to control it



Major Challenges



- No existing interface that enables the RAIN RFID reader to establish a direct high-speed connection to the lower level smartphone hardware without significant modifications on the phones hardware framework
- Severe signal interferences amongst different RF and communication modules while the RFID reader antenna is active
- Unbearable battery life degradation of a consumer smartphone when the RAIN RFID reader is up and running

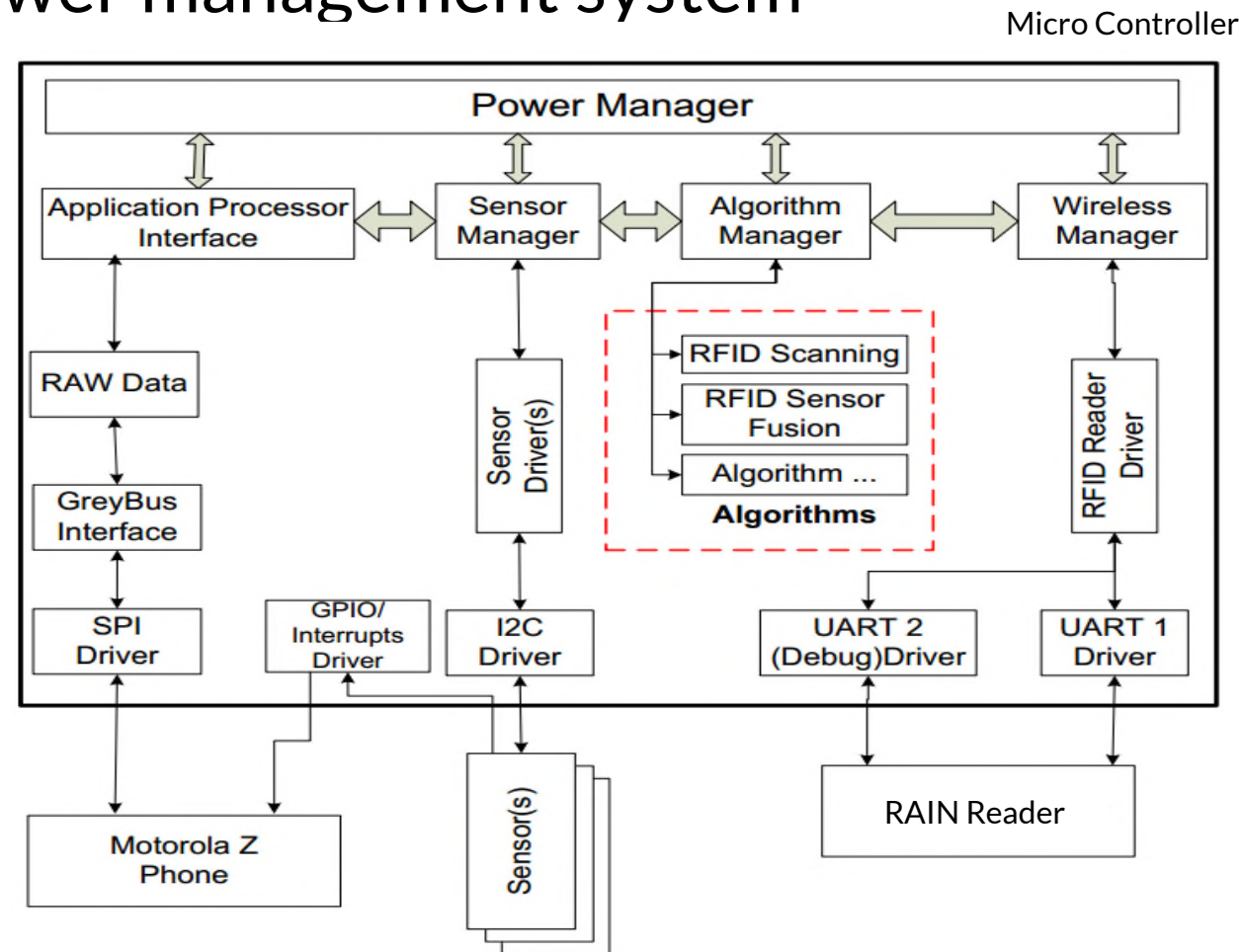
System Overview



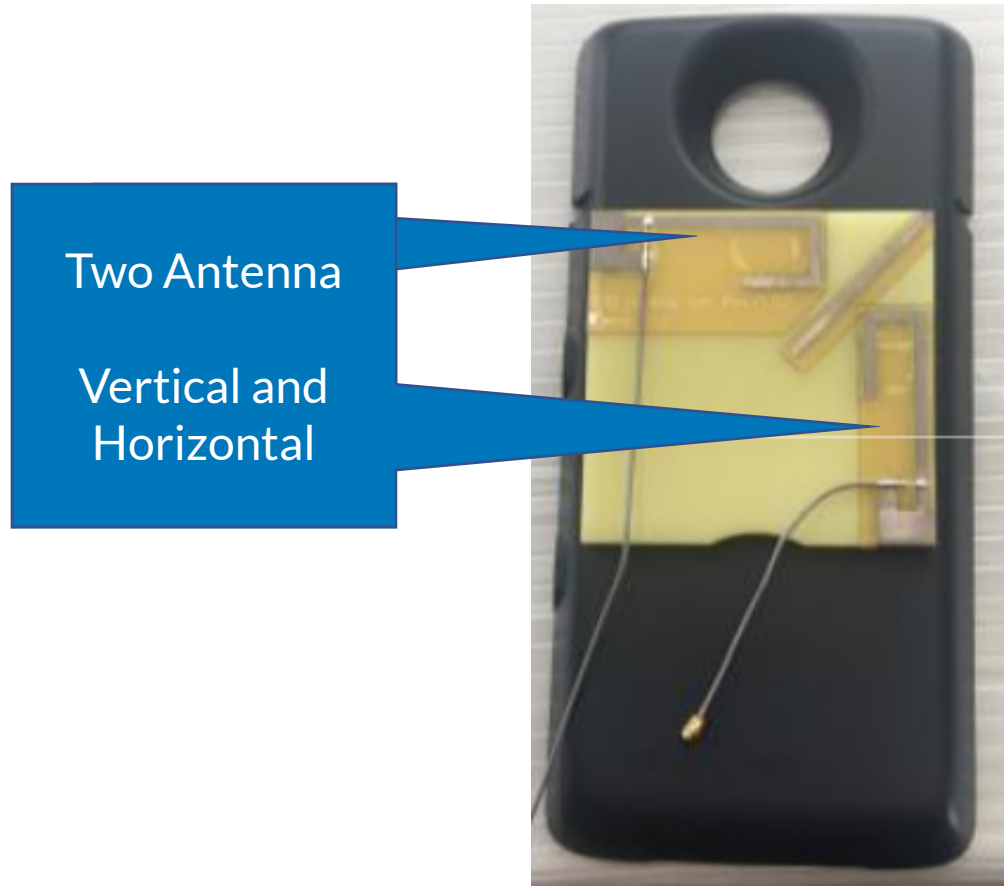
- Four subsystems:
 - RAIN RFID Reader MOD Subsystem
 - MOD Low Power Management Subsystem
 - MOD Support Subsystem
 - Battery and Antenna Subsystem



- MOD Low power management system



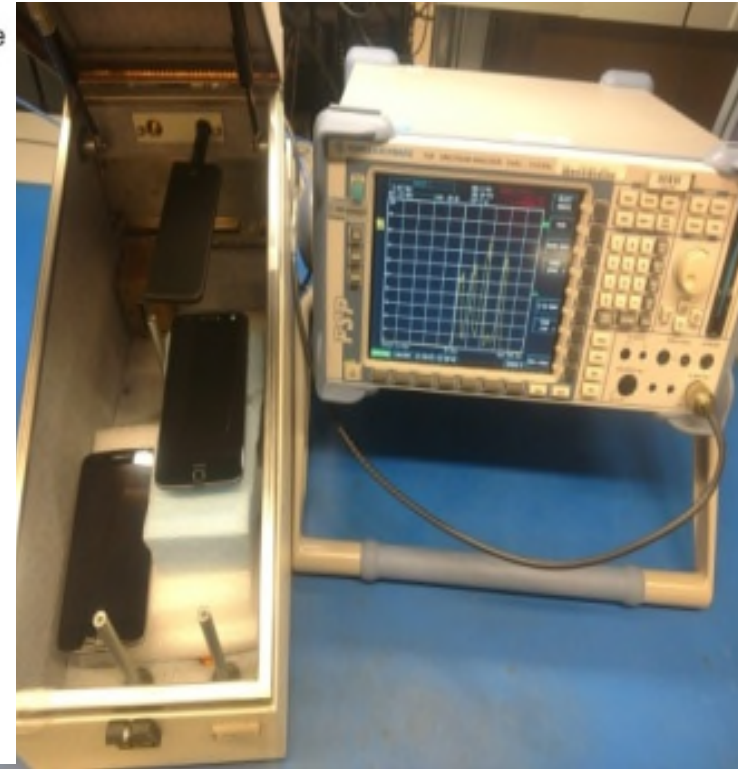
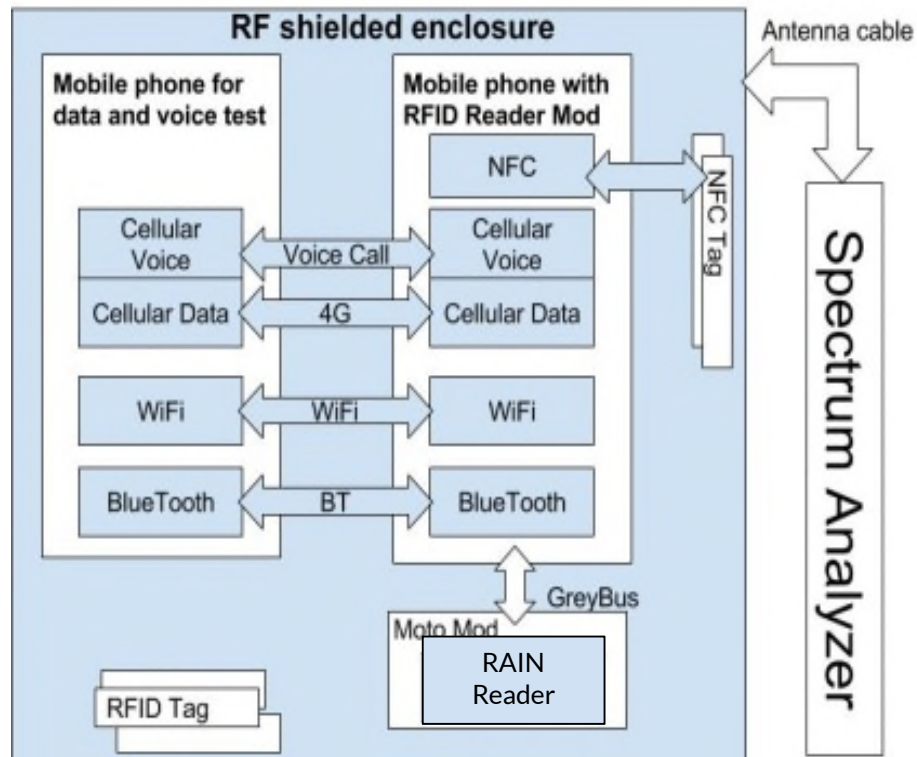
- Battery and Antenna Subsystem



RFID Signal Isolation Analysis



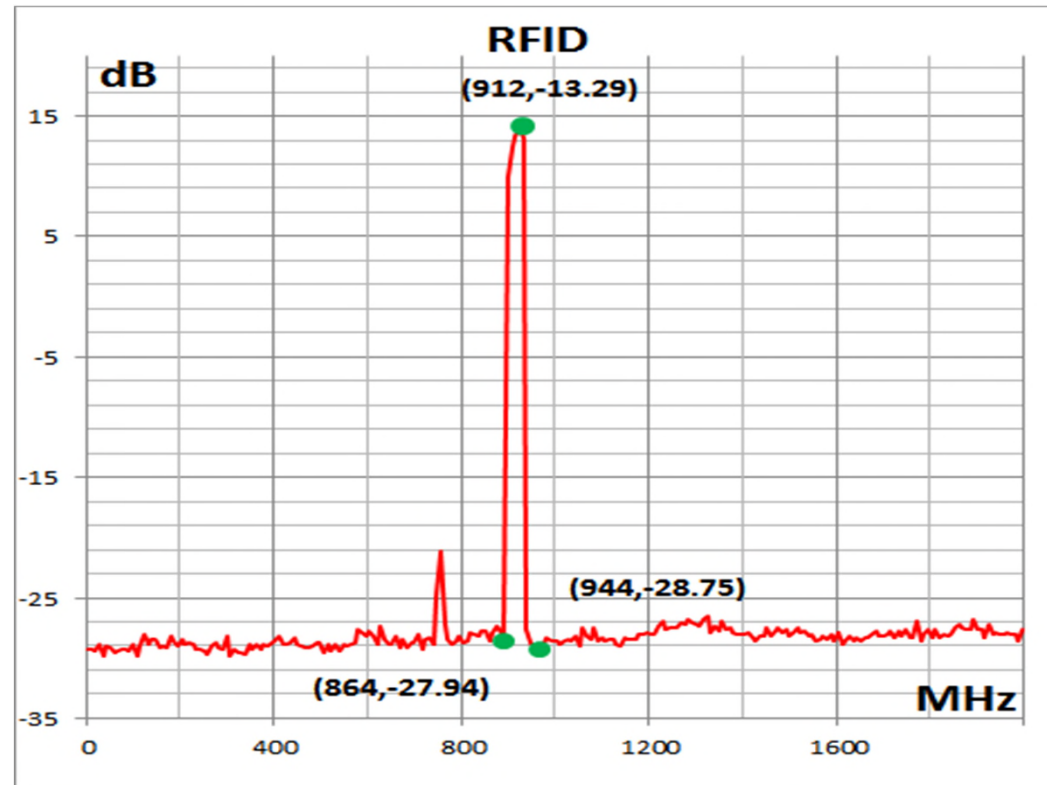
- Experimental Testbed Setup



RFID Signal Isolation Analysis



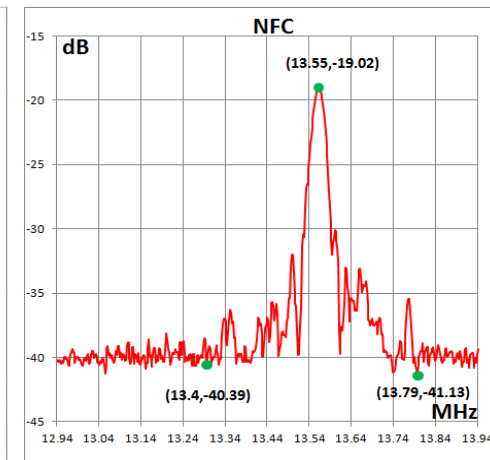
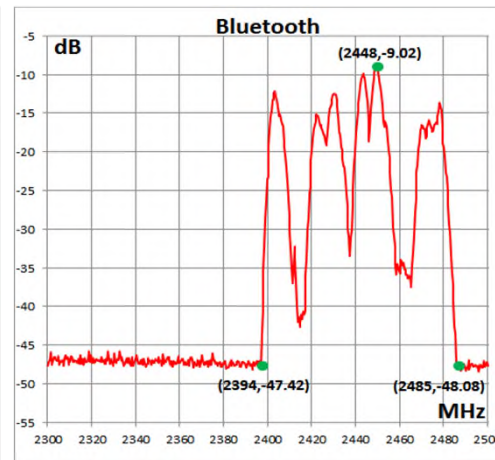
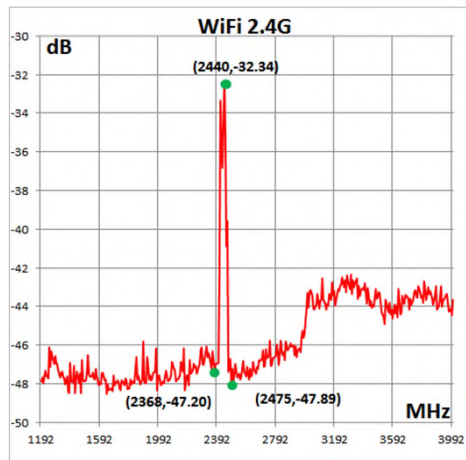
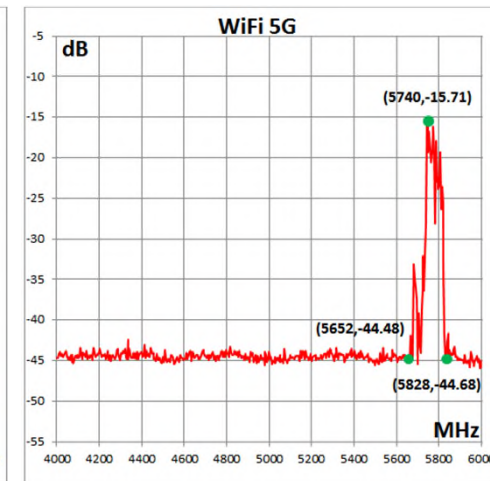
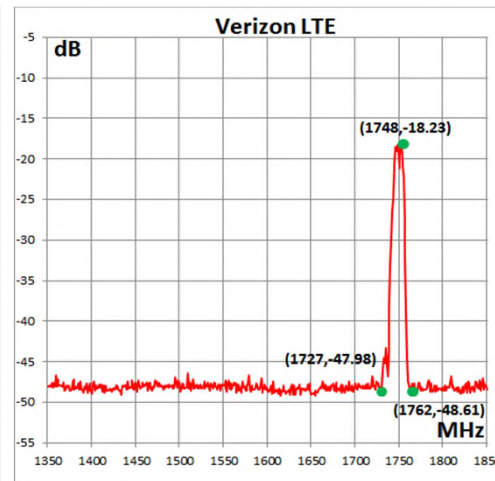
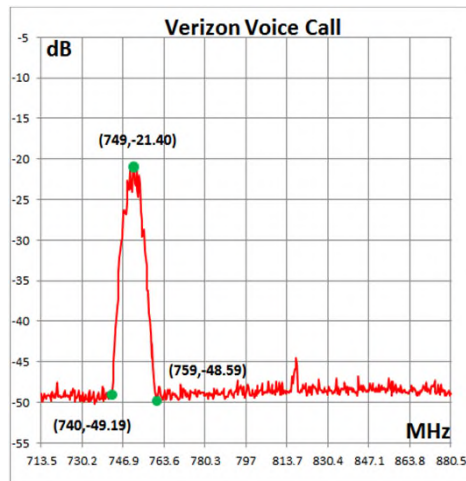
- Radio spectrum of RFID scanning signal



RFID Signal Isolation Analysis



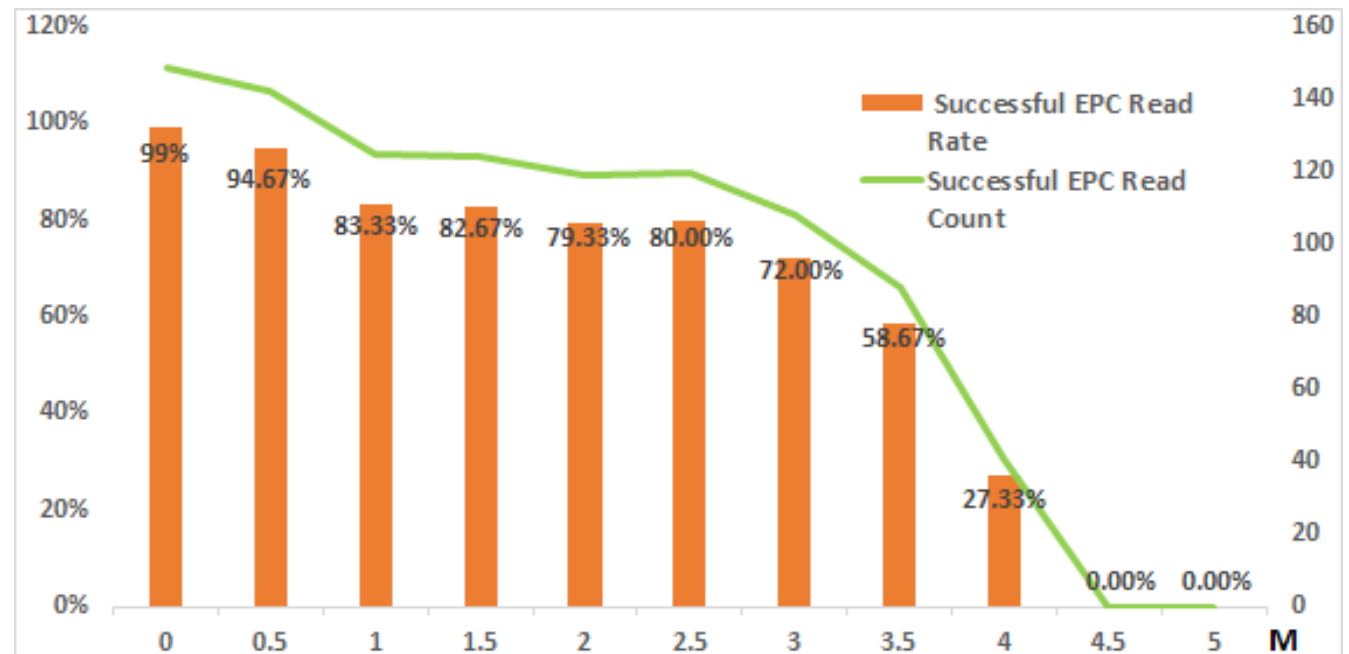
- No RF interference amongst RFID and native wireless modules



RFID Reader CAS Sensor Performance



- Working distance (where the read count rate of a RFID tag is higher than 50%) : 4 M
- Maximum sensing distance: 4.5 M
- Read signal capture status:



Major Contributions



- Design and implement a prototype of modular RFID reader Mods which:
 - Directly connects the RFID module to the lower level structure of a smartphone's hardware
 - Minimizes the RF interference between RFID module and other native wireless components on the smartphone system via special antenna design
 - Compensates the power consumption of the active RFID scan and recovers the smartphone's battery life to normal status

Thank you



- Question ?