RFID Characterization System based on LabVIEW

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Abstract

This poster describes an RFID characterization approach using LabVIEW. The work is focused on RFID characterization, wireless power transmission and electromagnetic energy harvesting applications. The use of PXI module and the implementation of a LabVIEW code for mixed-domain (RF and DC) characterization and modeling is presented. For this purpose, an RFID reader and the respective LabVIEW code has been developed, in order to demonstrate the applicability of modular instrument.

RFID Reader

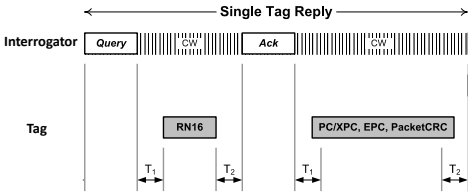
Goals

- Developed an RFID Reader for the Ultra High Frequency (UHF) in PXI from NI using LabVIEW code.
- Used International Standards Organization (ISO) 18000-6C RFID communication protocol.
- Used the VSG, VSA, NI 5792 and NI 5793 like front-ends.

Specifications

Reader carrier frequency	915 MHz
Bandwidth of the transmission channel	500 kHz
Distance between channels	None, because the transmission channels are adjacent
Maximum output power	4W – Effective Isotropic Radiated Power (EIRP)
Delta frequency	1 MHz
Environment	Dense-Interrogator
Modulation	OOK
Encoding	PIE
Coding	FM0

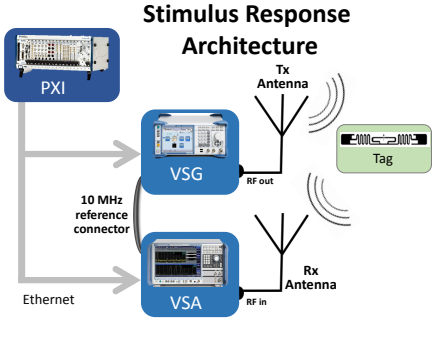
Command sequence between the reader and the tag



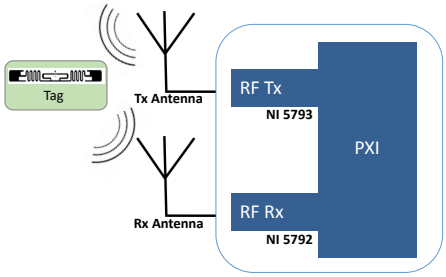
T1 - Time from Interrogator transmission to Tag response for an *immediate* Tag reply.
T2 - Time from Tag response to Interrogator transmission.

RFID Reader Architecture

Stimulus Response Architecture

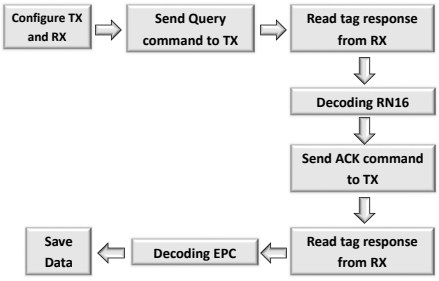


Real-Time Interrogator Emulation Architecture



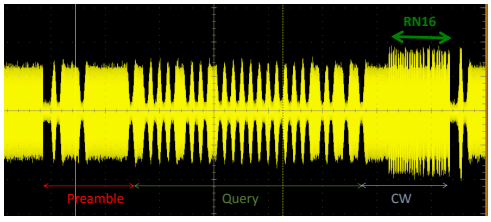
Block Diagram

RFID Reader Block Diagram

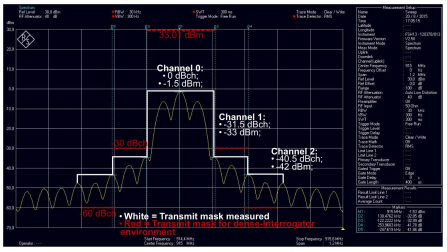


Results

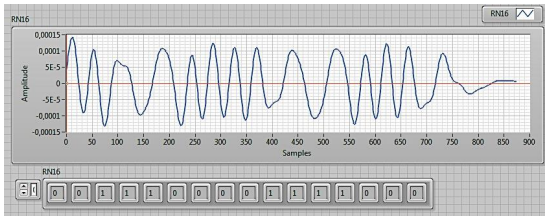
Tag response (RN16) after sending a Query command



Power Transmission Mask



RN16 Decoding



Conclusion

- The LabVIEW-based RFID reader developed in this paper was step forward in the design of mixed-domain (RF-to-DC) characterization tools.
- This system will be the key sub-system of a complete mixed-signal multi-domain characterization solution.
- After performing some measurements, it was concluded that the system responds to a minimum power of -9 dBm for a fixed distance of 5.5 cm. For a maximum power of 30 dBm (1 Watt) the system can respond up to an average distance of 93 cm.
- The big difficulty in this work was to try to overcome the very severe timing limits defined in the RFID standard for the reader data processing and respective tag replies.
- Future work includes developing and improving the proposed RFID characterization system using FPGA implementation.

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