BENCH MARK UHF RFID tag

Test Platform:

- **Standard:**
UHF EPC Class 1 Gen 2
norm ISO 18000-63
R => T encoding PIE
T => R decoding Miller
and FM0

- **Functions tested:**
Wake up power
RN16 response
Time response
Repeatability response
Data rate max: BLF
Modulation depth
Distance max
Modulation FM0/ Miller

- **Parameter tunable**
Frequency
  [800MHz to 1Ghz],
Power input
  [0dBm to 15dBm],
data rate,
time to wake up,
short/long preamble,
preamble,
data value
timing Tari,
timing R=> T cal and T=>
R cal
Modulation type.

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Main feature of the Test Platform :

➢ Standard UHF EPC Class 1 Gen 2
➢ Test in the air
➢ Test wake up power
➢ Generate query to the tag, PIE encoding
➢ Record RN16 response's tag, Miller or FM0 modulation.

Bench Mark Results: (pre–results)

	Unit	SPEC	tag 1	tag 2	tag 3	tag 4	tag 5	tag 6	tag 7	tag 8	tag 9
Tag area	cm		9.5 x 0.7	9.5 x 0.7	7.0 x 1.5	9.5 x 0.5	5.0 x 3.0	5.0 x 3.0	9.3 x 3.8	9.3 x 3.8	9.4 x 3.8
Set up 1: FM0*	dBm										
Wake up Power versus RN16	dBm		9	10	15	9	10	13	11	10	8
Operating Power maximum	dBm	15	15	15	15	15	15	15	15	15	15
Operating Frequency min	MHz	860	825	825	960	860	860	860	830	840	830
Operating Frequency max	MHz	960	1000	985	960	1005	995	890	915	925	985
Average BLF	kHz	180	172	173	182	173	173	171	184	170	169
Response time average	us		57	58	58	57	58	58	57	57	57
Repeatability average	%	> 50	89	94	20	99	90	97	82	99	96
Modulation depth |I,Q|	%	?	2.5	2.6	0.5	2.6	1.8	2.5	1.0	5.5	3.4
Miller M=2 , M=4, M=8	-										

* distance 60cm - antenna used: Laird Technologies S8658WP12SMM - modulation FM0 - BLF= 180 kHz - Tari=25 us
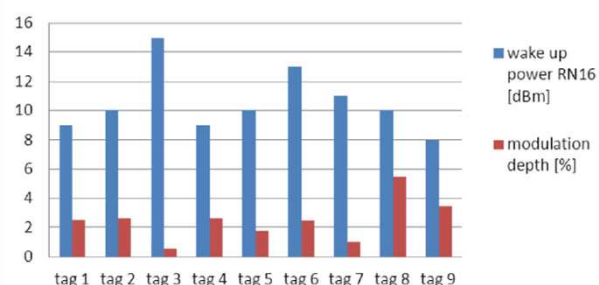
Conclusion of the bench mark: Best tag is "tag 9" with a modulation of 3.4 %, minimum wake up power 8dBm and all frequency domain 860MHz to 960Mhz is responding at 60cm.

The UHF RFID Test Platform benefits from the Expertise of NRFLab in RF test transceiver.

The UFH RFID test Platform provides outstanding measurements accuracy and flexibility making the development and optimization of the tag efficient and fast. Specific characteristics of the tag includes
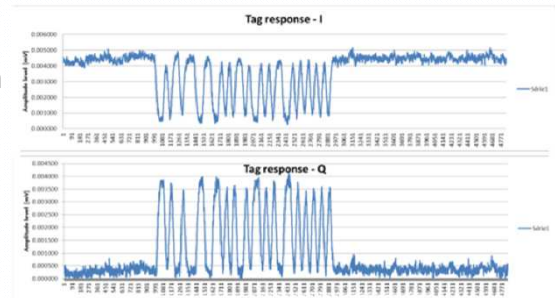
➢ Wide range of power and frequency (from 800MHz to 1000 Mhz by step of 50Mhz, and from 15dBm to 8dBm by step of 1dB)
➢ Very long reading range: up to 60 cm
➢ High flexibility in the data format sent to the tag
➢ Fixe and independent environment enabling the repeatability and the comparisons of the tag's performances.
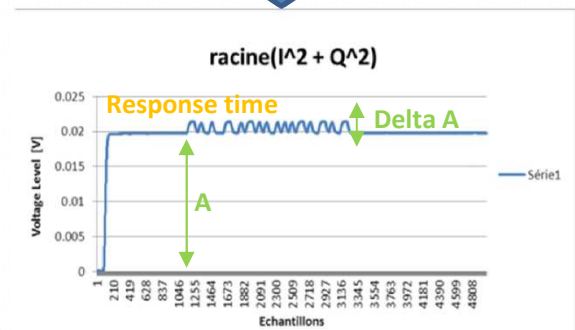
Description:
The data I/Q are recorded at RF frequency. After a down-conversion and DC offset I/Q compensation, the module |I,Q| is processed, then RN16 response analyzed.

graph 1: Tag's response signal downconverted I/Q

The Bench Mark presents the summary of the performances of the tag:

➢ **Response time average:** see graph 2, average value over the Frequency.
➢ **Modulation depth:** see graph 2, [delta A/ A *100] average value over the Frequency.
➢ **Wake up power versus RN16 [dBm]:** minimum input power in dBm over frequency to have a correct RN16 response .
➢ **Operating Power maximum [dBm]** : maximum input power over frequency applied to have a correct RN16 response .
➢ **Operating Frequency min [MHz]** : Over the operating power, minimum frequency range to have a correct RN16 response .
➢ **Operating Frequency max [MHz]**: Over the operating power, minimum frequency range to have a correct RN16 response .
➢ **Repeatability average [%]:** Number of RN16 response correct average, over the operating frequency and operating power.
➢ **Average BLF [kHz]:** BLF average over the operating frequency and operating power input.

graph 2: |I,Q| processing, time response and filtering
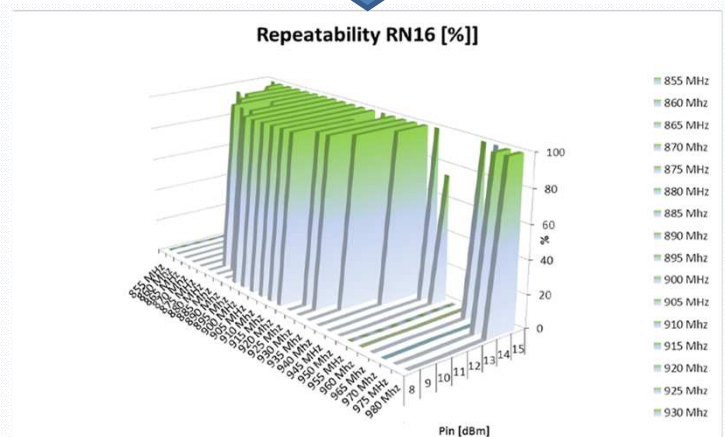
graph 3: repeatability [%] RN16 response over frequency [MHz] and power [MHz]