Voyantic

Testing OSRFID Light-on-object Tag with Kiloway LED IC with Tagformance Pro

Application Note

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1 Background

OSRFID provides a LED light-on-object tag with a Kiloway KX2005X IC. The LED is not powered simply by powering up the tag, but it is activated using a specific RFID command. This kind of operation might come very useful in different inventorying applications, particularly if the user is trying to find something, e.g., a book on a shelf.

2 LED activation sequence

LED is activated by issuing a standard read command to a certain memory location in the Reserved memory, to which the tag responds with an error code since the location is out of bounds. In practice, it might also be a good idea to apply select to avoid interference from the other tags in the antenna field-of-view.

LED is activated by issuing a 1-word Read command to Reserved memory bank (00), word pointer 4 (0000 0100).

Use the standard read command to read the address 4 of the RFU area, the length is 1, the voltage output of the LED Pad can be triggered, and the output voltage range is 0.8V-2.2V.

Frame Header	Command Code	Storage Area	Address	Length	RN16	CRC16
0	11000010	00	00000100	00000001	RN16	CRC16

Since there is no actual data in address 4 of the RFU area, the return code of the read command is an error code, which can be ignored.

Generally, the turn-on voltage of the red LED tube is 1.8V. When the tag distance is appropriate, the output voltage of the LED Pad is greater than 1.8V, and the LED can be lit.

Frame Header	Error Code	RN16	CRC16
1	00000011	RN16	CRC16

Picture. LED activation command from Kiloway KX2005X datasheet

3 LED activation with Tagformance with Response test

The easiest way to test the LED activation is to use the response test with a standard read command. Read parameters are set the same way as for the reader and the use of select is advised to avoid external tags interfering with the tests. Carrier suppress settings can be adjusted to reduce the blinking of the led.

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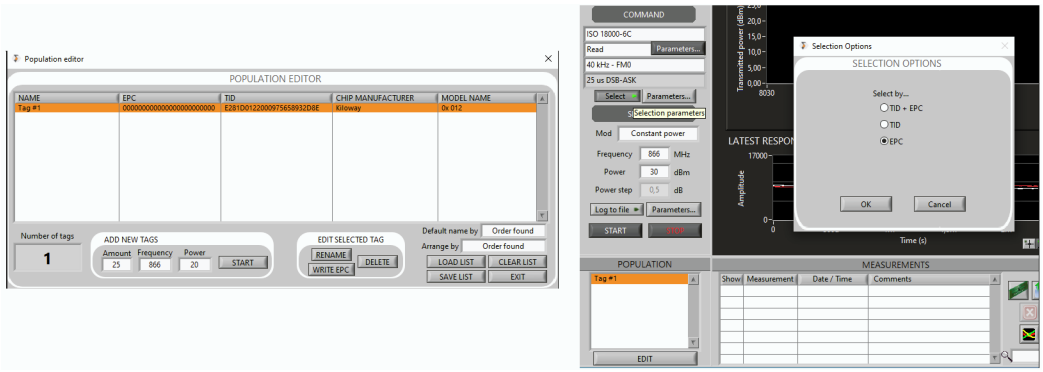
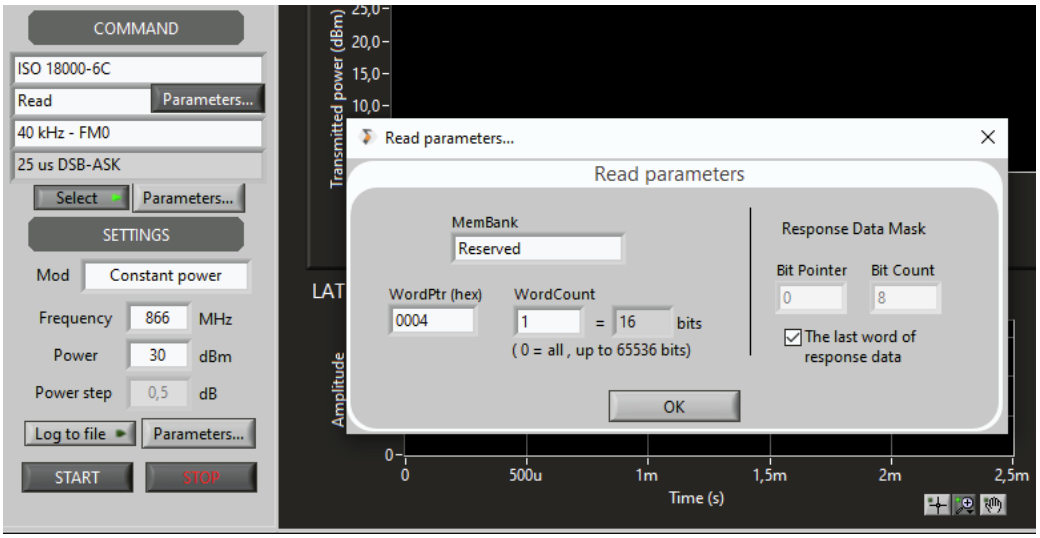
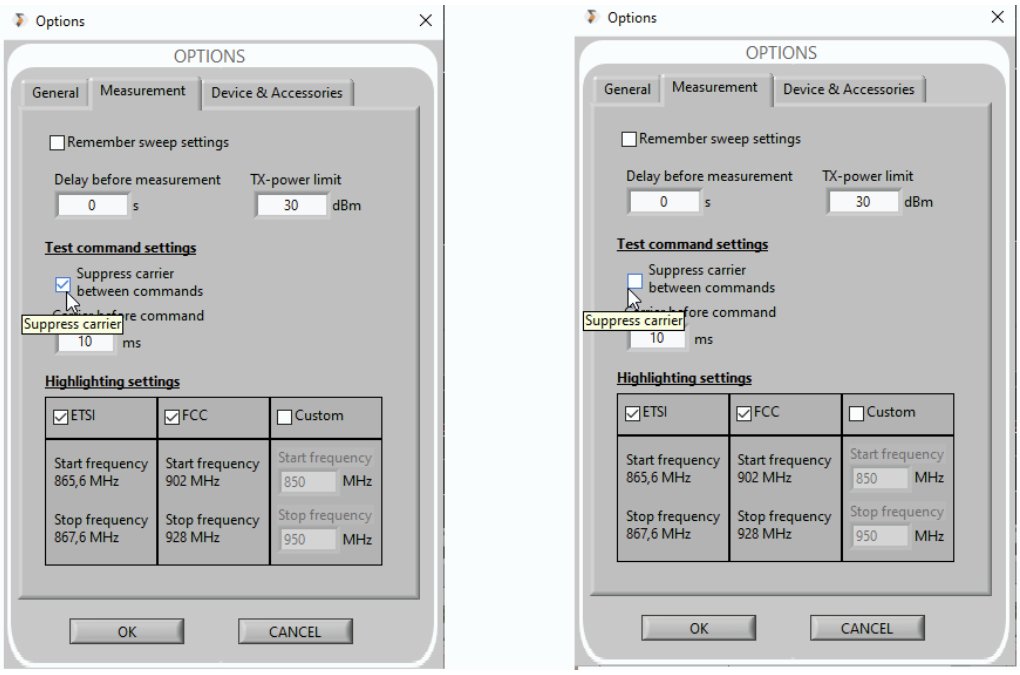


Build population and use select to avoid external tags affect the testing



Use standard read command for the test (Reserved memory, Word pointer 0x04, Word count 1)



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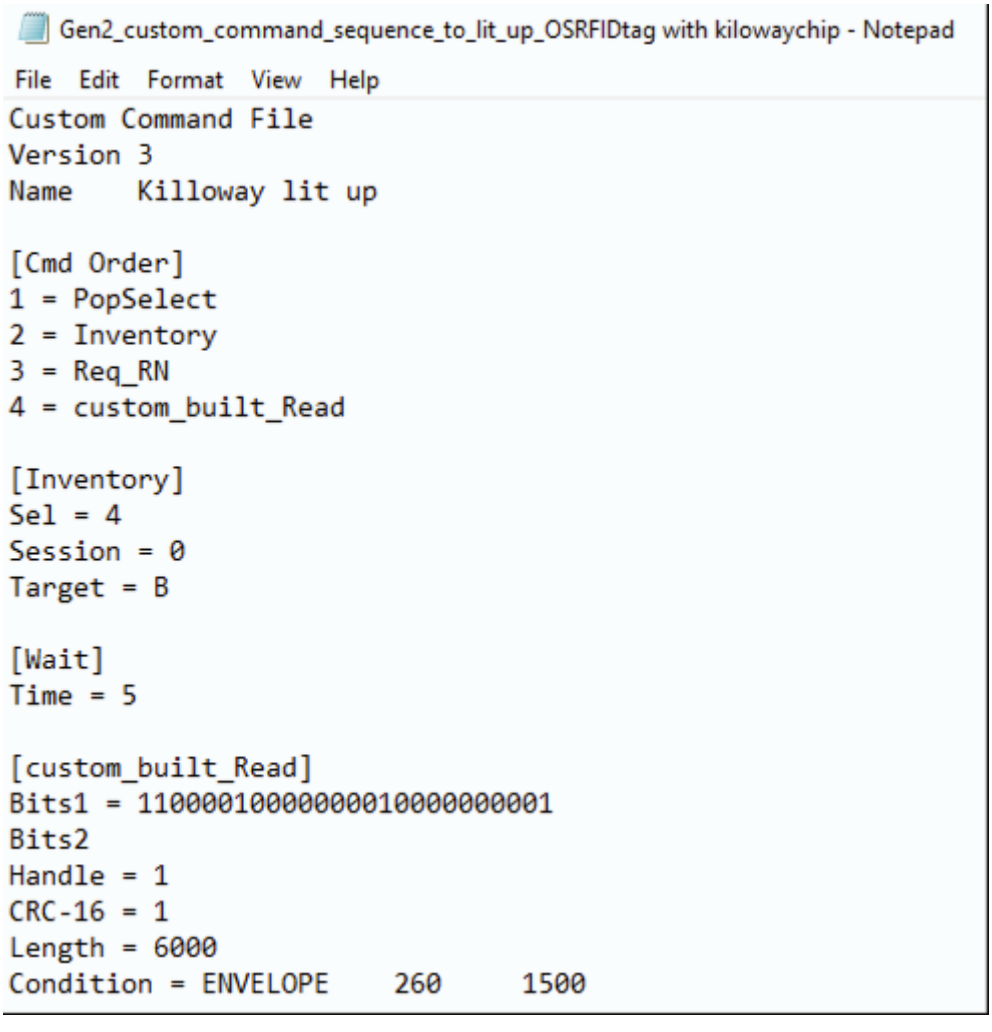
Disable carrier suppress between tests to reduce blinking and make the light appear constant. In practice, the carrier might be momentarily suppressed in certain tests, e.g., if the test frequency would be changed.

4 How much power does the LED take?

While the tag in principle complies with the standard ISO18000-63 command set, the fact that it responds by an error makes testing with Tagformance hard, since the error message is interpreted as a failed test result. Custom command sequence provides options for the user to adjust qualification criteria for the response. Thus, by disabling other requirements than the response strength (ENVELOPE), it was possible to test the performance as well.



Custom command sequence which lights up LED and produces a pass result from Tagformance interpretation

To test the effect of the LED on the tag performance, a backscatter test was run first using the custom command and then by issuing a standard read command to

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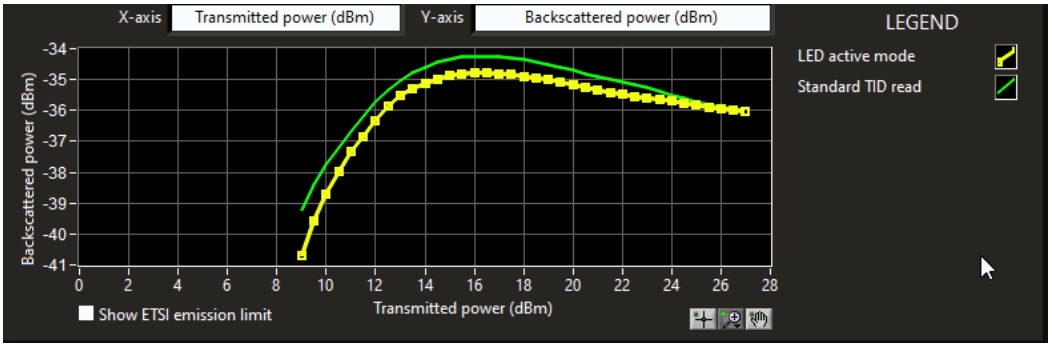
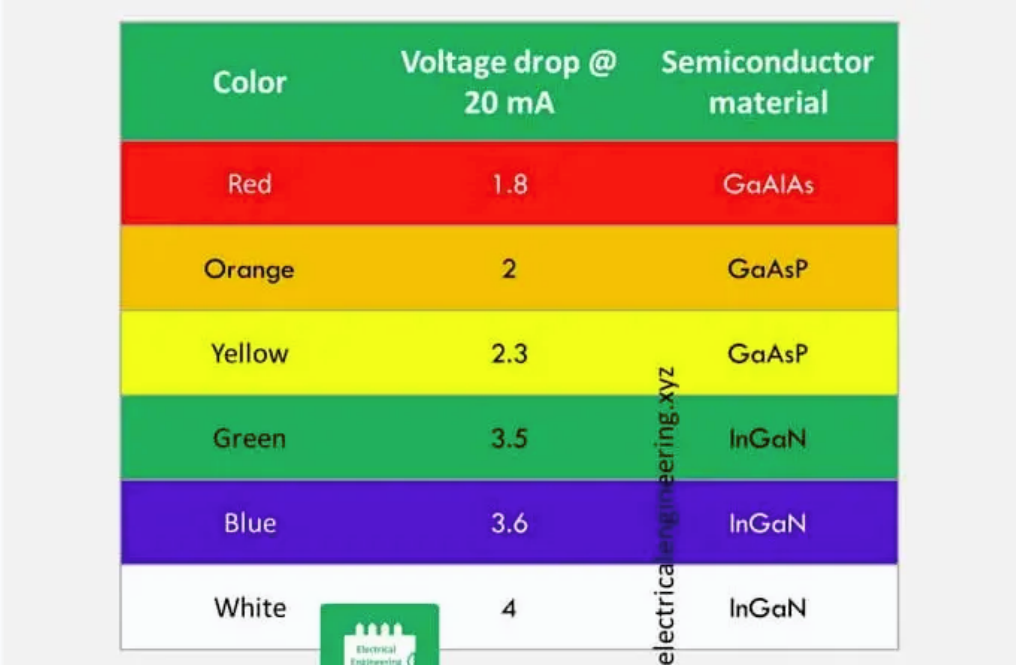
the TID bank. *The activation threshold was similar,* +9 dB at 50cm, but *backscatter 0,5-1dB lower with the LED circuit was activated*. This difference is fairly small in practice and it's quite insignificant. Furthermore, it's also possible that this difference may originate due to the differences in processing custom command responses or standard gen2 command responses.



LED activation did not affect the tag threshold, but backscatter dropped by 0,5-1dB with the LED drive activated. LED lit-up threshold was observed at 3-5dB above the tag threshold.

LED activation threshold wasn't apparent in the curves. By repeating the backscatter sweep a few times, it was possible to see the LED waking up at around 3-5dB above the tag activation threshold. In theory, the activation voltage for the green led is somewhat double in comparison to a red led. So, replacing the green led with a red one could take the LED lit-up threshold closer to the tag threshold.



Picture. LED voltage drop by color from
https://www.electricalengineering.xyz/electronics/led-voltage-drop-by-color/

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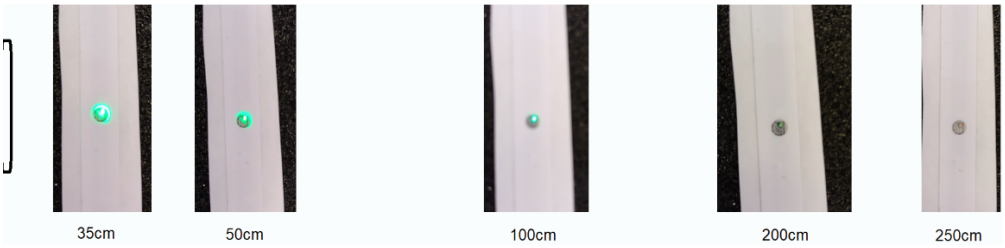
In theory, the green led on the tag requires 3.5 V to activate. Red led implied by the tag manufacturer would only require 1.8 V, which should reduce the LED activation threshold as well.

5 Could the LED brightness be used as a field-strength meter?

Since the tag and the LED activation thresholds were different, the tag showed an interesting feature that might prove useful for certain applications. When the power on the tag was strong, the LED shined bright, and when taken farther away, it slowly dimmed until fully shut down. The tag tested first starts dimming before fully shutting down, which may provide more information than just go/nogo testing on the reading area.



LED brightness can indicate the field strength at the tag position. This could be used to characterize a read zone up to a certain extent after fully characterizing the "sensor" tag.

Test setup for the "Field strength sensor" application

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