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Test Report

Report Number:

F181583E1

Equipment under Test (EUT):

RFU630

Applicant:

SICK AG

Manufacturer:

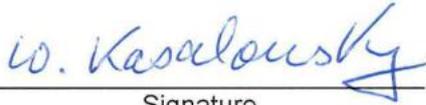
SICK AG

References

- [1] MIC Notice 88-2 appendix 20_1
- [2] MIC Ordinance Regulating Radio Equipment Article 49.9.
- [3] ARIB STD-T106 Ver.1.1 (17 October 2017): 920 MHz-Band Equipment for Specified Low Power Radio Stations

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

| | | | |
|------------------------|-----------------------------|---------------------------------------------------------------------------------------------------|--------------------|
| Tested and written by: | Thomas KÜHN Name |  Signature | 19.10.2018 Date |
| Authorized reviewer: | Wolfgang KASALOWSKY Name |  Signature | 19.10.2018 Date |

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1 Identification

1.1 Applicant

| | |
|----------------------------------------------------------------|--------------------------------|
| Name: | SICK AG |
| Address: | Merkurring 20 22143 Hamburg |
| Country: | Germany |
| Name for contact purposes: | Mr. Michael REHSE |
| Phone: | +49 40 61 16 80 - 248 |
| Fax: | +49 40 61 16 80 - 201 |
| eMail Address: | Michael.rehse@sick.de |
| Applicant represented during the test by the following person: | --- |

1.2 Manufacturer

| | |
|-------------------------------------------------------------------|--------------------------------|
| Name: | SICK AG |
| Address: | Merkurring 20 22143 Hamburg |
| Country: | Germany |
| Name for contact purposes: | Mr. Michael REHSE |
| Phone: | +49 40 61 16 80 - 248 |
| Fax: | +49 40 61 16 80 - 201 |
| eMail Address: | Michael.rehse@sick.de |
| Manufacturer represented during the test by the following person: | --- |

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

1.4 EUT (Equipment Under Test)

| | |
|---------------------|---------------------------------------------------------------|
| Test object: * | UHF RFID read/write device |
| Type: * | RFU630-13106 |
| Serial number: * | 12340041 |
| PCB identifier: * | EK-Frontend 2071805 / EK-Digital 2059896 / EK-Koppler 2060866 |
| Hardware version: * | 0000 |
| Software version: * | T1.40RC07 |

*: declared by the applicant

1.5 Technical Data of Equipment

| | | | | |
|------------|-----|-----------|-----|-----------|
| Channel 5 | RX: | 916.8 MHz | TX: | 916.8 MHz |
| Channel 11 | RX: | 918.0 MHz | TX: | 918.0 MHz |
| Channel 17 | RX: | 919.2 MHz | TX: | 919.2 MHz |
| Channel 23 | RX: | 920.4 MHz | TX: | 920.4 MHz |

| | | | | | | |
|-------------------------------|--------------------------------------------------------------------------------------------------------|-----------|-------------|-----------|-------------|-----------|
| Rated RF output power: * | 30 dBm at external antenna ports, 30 dBm at internal antenna port | | | | | |
| Antenna type: | Internal antenna RFA630-001 or external antenna type according "Overview_antennas_GXJ-Certificate.xls" | | | | | |
| Antenna gain: * | Internal antenna gain 6.0 dBi, external antenna gain according "Overview_antennas_GXJ-Certificate.xls" | | | | | |
| Antenna connector: * | None (internal antenna version), reverse TNC (for external antenna) | | | | | |
| Modulation: * | PR-ASK / DSB-ASK | | | | | |
| Adaptive frequency agility: * | No | | | | | |
| Emission designator: | 105KA1D | | | | | |
| Supply Voltage: * | $U_{nom} =$ | 24.0 V DC | $U_{min} =$ | 10.0 V DC | $U_{max} =$ | 30.0 V DC |
| Temperature range: * | -30 °C to +60 °C | | | | | |
| Ancillary used for test: | A switchbox type CDB620-001 was used to connect the EUT to the power supply. | | | | | |

*: declared by the applicant

The following external I/O cables were used:

| Identification | Connector | | Length * |
|-----------------------------------|----------------------|-------------------------|----------|
| | EUT | Ancillary | |
| Power / RS485 | 4-pin M12-connector | RJ45 | 2.0 |
| Power / RS422 and external Sensor | 17-pin M12-connector | SubD 15pin (CDB620-001) | 2.0 |
| - | - | - | - |

*: Length during the test if no other specified.

1.6 Dates

| | |
|---------------------------------|------------|
| Date of receipt of test sample: | 08.10.2018 |
| Start of test: | 09.10.2018 |
| End of test: | 09.10.2018 |

2 Operational States

All tests were carried out with an unmodified sample with integral antenna and three external antenna ports.

During the all tests the RFU630 was powered by an external 24.0 V DC power supply via the switchbox CDB620-001.

The operation mode could be chosen with the help of a laptop computer with a test-software, communicates with the EUT via the Ethernet line.

The EUT is equipped with an internal antenna and three external antenna ports. As declared by the applicant the output of the EUTs power amplifier is switched to a multiplexer that switched the power amplifier to one single port at the same time. Therefore no combiner was necessary for measurements at the antenna ports. All conducted measurements were carried out at antenna port 1, because there was no measurable difference to the other ports.

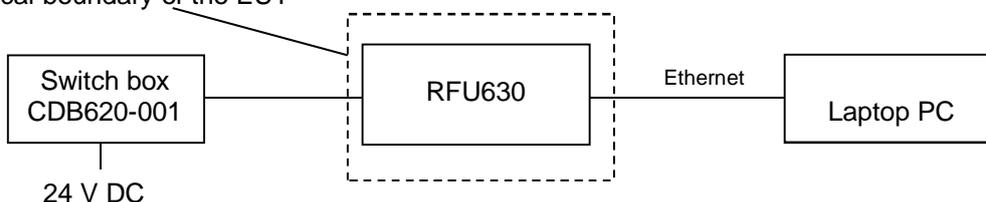
For all measurements the output power of the EUT was set to 30 dBm (maximum value).

The following operation modes were used during the tests:

| Test case | Operation mode | Operation channel | Antenna | Modulation type (worst case) |
|----------------------------------------|-------------------------|-------------------|---------|------------------------------|
| Vibration test * | Continuous transmission | 5, 11, 23 | NA | DSB-ASK (LP 0) |
| Temperature and humidity test * | Continuous transmission | 5, 11, 23 | NA | DSB-ASK (LP 0) |
| Frequency tolerance * | | 5, 11, 23 | NA | None |
| Occupied bandwidth & frequency range * | Continuous transmission | 5, 11, 23 | NA | DSB-ASK (LP 0) |
| Unwanted emission intensity * | Continuous transmission | 5, 11, 23 | NA | LP 2 (PR-ASK) |
| Antenna power and power tolerance * | Continuous transmission | 5, 11, 23 | NA | LP 2 (PR-ASK) |
| Adjacent channel power * | Continuous transmission | 5, 11, 23 | NA | DSB-ASK (LP 0) |
| Collateral emission of receiver * | Continuous receiving | 5, 11, 23 | NA | None |
| Construction protection | - | 5, 11, 23 | NA | - |

*: The results of these tests are documented under PHOENIX TESTLAB GbmH test report reference F134582E1.

Physical boundary of the EUT



3 Additional Information

As declared by the applicant the EUT is available in different variants. For these variants the model name is extended as described below:

RFU630-10106 Internal antenna only.

RFU630-13106 Internal antenna and three external antenna ports.

RFU630-04106 No internal antenna and four external antenna ports.

The tests documented in this test report were carried out with an RFU630-13106.

Reason for this test report is the extension of temperature range of the EUT. It was changed from -25 °C to -30 °C and from +55 °C to +60 °C. Therefore the Occupied bandwidth and frequency range test was repeated at -30 °C, +20 °C and + 60 °C.

As declared by the applicant, the measurements documented in this test report were carried out with the same EUT as it was described under PHOENIX TESTLAB GmbH F134582E2 without changing.

4 Overview

| Item: | Test case: | Status: | Refer page: |
|-----------------------------|------------------------------------------------|---------|----------------------------|
| [1] | Vibration test | Passed | 10 of F134582E1 |
| [1] | Temperature-humidity test | Passed | 8 and 11 of F134582E1 |
| 5 [2] | Frequency tolerance | Passed | 12 of F134582E1 |
| 6 [2] | Occupied bandwidth and frequency range | Passed | 13 of F134582E1 |
| 7 [2] | Unwanted emission intensity | Passed | 14 et seq. of F134582E1 |
| 49.9.1) e + f [2] | Adjacent channel leakage power | Passed | 18 of F134582E1 |
| 14.7) [2], 49.9.1) d [2] | Antenna power and antenna power tolerance | Passed | 19 of F134582E1 |
| 24.15 [2] | Limitation of collateral emissions of receiver | Passed | 20 of F134582E1 |
| 49.9.1) d [2] | Transmission time limiting device | - * | |
| 49.9.1) d [2] | Carrier detection | - * | |
| 49.9.1) b [2] | Antenna gain | - ** | |
| 49.9.1) a [2] | Construction protection | Passed | 21 of F134582E1 |

*: Requirements not applicable in case of using channels 5, 11, 17 and 23 only.

** : Not tested, because the applicant provided an antenna data sheet.

5 Results

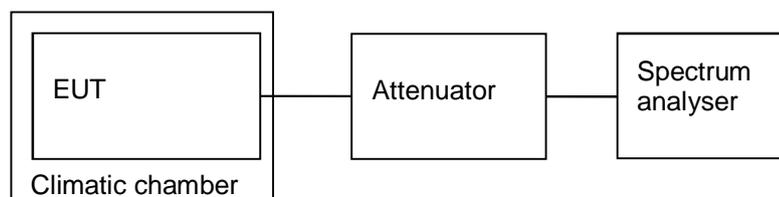
5.1 Occupied bandwidth and frequency range measurement

| | | | |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 22 °C | Relative humidity: | 47 % |
|----------------------|-------|--------------------|------|

5.1.1 Test procedure:

1. The EUT has to be placed inside the climatic chamber.
2. The EUT has to be switched off.
3. Add the following temperature conditions:
+20 °C (normal test conditions for reference)
-30 °C (lowest temperature as declared by the applicant),
+60 °C (highest temperature as declared by the applicant).
4. After each temperature is reached, one hour has to be waited, after this the EUT has to be powered on and the occupied bandwidth and frequency range measurement as described below shall be carried out, were the EUT has to stay in the frequency range 916.7 MHz to 920.5 MHz.
5. The following spectrum analyser setting shall be used:
RBW = VBW = 3 kHz;
Span = 400 kHz;
Center frequency = the center of the actual channel;
Sweep time = Auto;
Sweep mode = Continuous sweep;
Detection mode = Positive peak;
Trace mode = Max hold.
6. The EUT have to transmit with the modulation signal occupies the maximum frequency range on a fixed channel.
7. Use the 99 % bandwidth function of the spectrum analyser to find the lowest frequency, were the sum of total power drops below 0.5 %. This value shall be noted as f_L .
8. Use the 99 % bandwidth function of the spectrum analyser to find the highest frequency, were the sum of total power drops below 0.5 %. This value shall be noted as f_H .
9. The occupied bandwidth will be calculated as follows:
Occupied bandwidth = $f_H - f_L$.
10. All frequencies (f_H and f_L) shall be between 916.7 MHz to 920.5 MHz.
11. The EUT has to be switched off again.

5.1.2 Test set-up:



5.1.3 Test result:

Power supply conditions: Normal

| Nominal operation frequency | 916.8 MHz | 918.0 MHz | 920.4 MHz |
|------------------------------|--------------------------------------------------------------|--------------|--------------|
| Lower bandedge at 20 °C | 916.7487 MHz | 917.9494 MHz | 920.3487 MHz |
| Upper bandedge at 20 °C | 916.8513 MHz | 918.0506 MHz | 920.4500 MHz |
| Occupied bandwidth at 20 °C | 102.6 kHz | 101.3 kHz | 101.3 kHz |
| Lower bandedge at 60 °C | 916.7462 MHz | 917.9462 MHz | 920.3462 MHz |
| Upper bandedge at 60 °C | 916.8532 MHz | 918.0532 MHz | 920.4532 MHz |
| Occupied bandwidth at 60 °C | 107.1 kHz | 107.1 kHz | 107.1 kHz |
| Lower bandedge at -30 °C | 916.7513 MHz | 917.9500 MHz | 920.3494 MHz |
| Upper bandedge at -30 °C | 916.8494 MHz | 918.0487 MHz | 920.4481 MHz |
| Occupied bandwidth at -30 °C | 97.1 kHz | 98.7 kHz | 98.7 kHz |
| Limit | 200 kHz | 200 kHz | 200 kHz |
| Result | Passed | Passed | Passed |
| Measurement uncertainty | 10^{-7} (frequency), 0.66 dB / -0.72 dB (level) | | |

Test equipment used (refer clause 6):

1 - 5

6 Test equipment used for tests

| No. | Test equipment | Type | Manufacturer | PM-No | Serial No. | Cal. Date | Cal. Performed by |
|-----|--------------------|-----------------|-----------------|--------|------------|---------------------------|--------------------|
| 1 | Spectrum analyser | FSU 46 | Rohde & Schwarz | 480956 | 200125 | 01.03.2018 | Rohde & Schwarz |
| 2 | Climatic chamber | MK 240 | Binder | 480462 | 05-79022 | 02.07.2018 | ThermoTEC Weilburg |
| 3 | Power supply | TOE8752-32 (DC) | Toellner | 480010 | 31566 | Calibration not necessary | |
| 4 | Digital multimeter | 971A | Hewlett Packard | 480721 | JP39009358 | 31.01.2018 | PHOENIX Contact |
| 5 | Attenuator | WA8 / 18-20-34 | Weinschel | 481450 | - | Calibration not necessary | |

7 Report History

| Report Number | Date | Comment |
|---------------|------------|---------------------|
| F181583E1 | 18.10.2018 | Initial Test Report |
| | | |
| | | |
| | | |

8 List of Annexes

Annex A Photographs

8 pages

181583_a.JPG: RFU630, test setup climatic chamber
 181583_1.JPG: RFU630, front view
 181583_2.JPG: RFU630, rear view
 181583_3.JPG: RFU630, bottom view
 181583_4.JPG: RFU630, left hand view
 181583_5.JPG: RFU630, top view
 181583_6.JPG: RFU630, right hand view
 181583_7.JPG: RFU630, internal view

Annex B Measurement Results

5 pages