

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:	<u>Thomas KÜHN</u> Name	 Signature	<u>19.10.2018</u> Date
Authorized reviewer:	<u>Wolfgang KASALOWSKY</u> Name	 Signature	<u>19.10.2018</u> Date

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1 Identification

1.1 Applicant

Name:	SICK AG
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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.

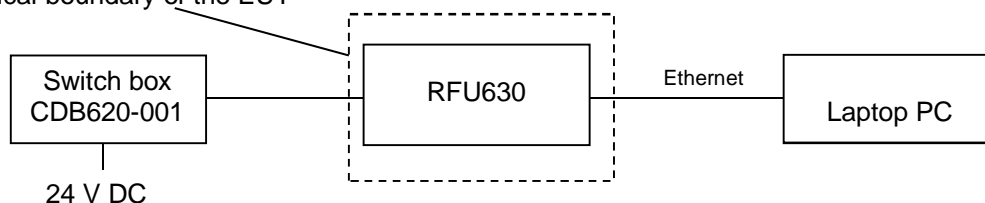
For all measurements the output power of the EUT was set to 30 dBm (maximum value).

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

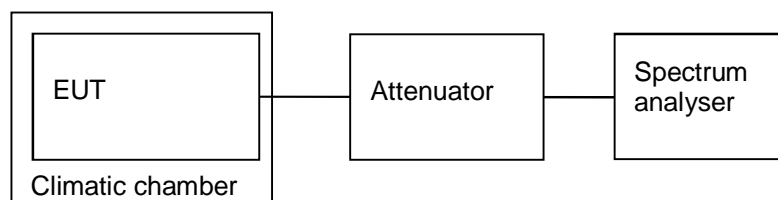
5.1 Occupied bandwidth and frequency range measurement

Ambient temperature:	22 °C	Relative humidity:	47 %
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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