



RF - TEST REPORT

- Human Exposure -

Type / Model Name : KY-LOC 1D.02.01

Product Description : Radar sensor

HVIN: 1.1.1.1.2

Applicant : Kymati GmbH

Address : Am Hochacker 5

85630 GRASBRUNN, GERMANY

Manufacturer : Kymati GmbH

Address : Am Hochacker 5

85630 GRASBRUNN, GERMANY

Test Result according to the standards
listed in clause 1 test standards:

POSITIVE

Test Report No. : 80146142-03 Rev_1

18. April 2024

Date of issue



Deutsche
Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>EQUIPMENT UNDER TEST</u>	4
2.1	Information provided by the Client	4
2.2	Sampling	4
2.3	Photo documentation of the EUT – see Attachment A	4
2.4	Equipment type, category	4
2.5	Short description of the equipment under test (EUT)	4
2.6	Variants of the EUT	4
2.7	Operation frequency and channel plan	4
2.8	Transmit operating modes	5
2.9	Antennas	5
2.10	Power supply system utilised	5
2.11	Peripheral devices and interface cables	5
2.12	Determination of worst-case conditions for final measurement	6
3	<u>TEST RESULT SUMMARY</u>	7
3.1	Revision history of test report	7
3.2	Final assessment	7
4	<u>TEST ENVIRONMENT</u>	8
4.1	Address of the test laboratory	8
4.2	Environmental conditions	8
4.3	Statement of the measurement uncertainty	8
5	<u>HUMAN EXPOSURE</u>	9
5.1	RF output power	9
5.2	Maximum permissible exposure (MPE)	10
5.3	Co-location and Co-transmission	12
5.4	SAR test exclusion considerations	12
5.5	Exemption limits for routine evaluation - SAR evaluation	12

ATTACHMENT A as separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310

Radiofrequency radiation exposure limits

Part 2, Subpart J, Section 2.1091

Radiofrequency radiation exposure evaluation: mobile devices.

KDB 447498 D01

RF Exposure procedures and equipment authorisation policies for mobile and portable devices, April 20, 2021.

RSS-102, Issue 6

Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according to his/her instructions.

2.3 Photo documentation of the EUT – see Attachment A

2.4 Equipment type, category

The EUT qualifies under FCC §15.255(c)(2)(v) / §15.255(c)(2) as a field disturbance sensor, and under RSS-210 2.1(a) as a field disturbance sensor for fixed operation.

2.5 Short description of the equipment under test (EUT)

The EUT is a radar sensor in the operating band 61.0 GHz to 61.5 GHz and 60 GHz to 64 GHz. It determines the distance in primary or secondary radar mode. The front panel is equipped with a lens which enhances the gain of antenna 2.

Number of tested samples:	1
Serial number:	02065
Firmware ID:	D3.02

2.6 Variants of the EUT

There are no variants of the EUT.

2.7 Operation frequency and channel plan

Operating frequency range 1: 61.0 GHz to 61.5 GHz

Operating frequency range 2: 60.0 GHz to 64.0 GHz.

2.8 Transmit operating modes

Two operation modes with two operating frequency ranges are available:

Primary radar mode	0.5 GHz OBW for operating frequency range 1 or 4 GHz OBW for operating frequency range 2, FMCW, passive reflection
Secondary radar mode	0.5 GHz OBW for operating frequency range 1 or 4 GHz OBW for operating frequency range 2, FMCW and FSK (The communication link between device 1 and device 2 uses the FSK), two way ranging, active reflection

2.9 Antennas

The following antennas shall be used with the EUT:

- Antenna 2 Integrated linear polarised micro strip antenna (max gain of antenna + lense: 22.5 dBi)

Note: There are two additional antennas 0 and 1 which are not equipped with an additional lense and therefore are not used in this model configuration.

2.10 Power supply system utilised

Power supply voltage	: 9 – 36 V/DC
Alternative power supply PoE	: 53.5 V/DC

2.11 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- Notebook	Model : ThinkPad
- AC adaptor notebook	Model : Lenovo ADLX65YLC3A
- Switch with PoE+	Model : tp-link TL-SG1005P
- AC adaptor PoE switch	Model : Tp-link T535131-2-DT
- LAN cable	Model : CAT6 M12-RJ45

2.12 Determination of worst-case conditions for final measurement

Exploratory measurements have been made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting the EUT produces the maximum of the emissions. For the further measurement, the EUT is set in X position while the receiving antenna is in vertical polarisation (in co-polarisation with EUT antennas).

As worst case, the following channels and test modes are selected for the final test:

Operating frequency range 1:

Frequency range (GHz)	Power setting	Used antenna	Modulation	Modulation type
61.0 - 61.5	P0	2	FMCW and FSK	CW

Operating frequency range 2:

Frequency range (GHz)	Power setting	Used antenna	Modulation	Modulation type
60.0 – 64.0	P24	2	FMCW and FSK	CW

Note: Only secondary mode was tested, as this mode is considered as worst case.

2.12.1 Test jig

No test jig is used.

2.12.2 Test software

For test mode TX CW and secondary radar mode, the Kymati Commander Software provided by the customer is used.

3 TEST RESULT SUMMARY

Operating in the 61.0 - 61.5 GHz band and in the 57 - 71 GHz band:

FCC Rule Part	RSS Rule Part	Description	Result
KDB 447498, 7.1	RSS-102, 6.6	MPE	passed
KDB 447498, 4.3.1	RSS-102, 6.3	SAR exclusion consideration	not applicable
KDB 447498, 7.2	RSS-102, 7.1.5	Co-location, Co-transmission	not applicable

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80146142-03	0	11 July 2023	Initial test report
80146142-03	1	18 April 2024	Update to RSS-102 Issue 6; 5.1 + 5.2 results updated

The test report with the highest revision number replaces the previous test reports.

3.2 Final assessment

The equipment under test fulfils the requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 18 April 2024

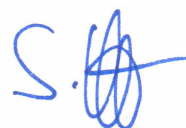
Testing concluded on : 18 April 2024

Checked by:

**Thomas
Weise** Digitally signed by
Thomas Weise
Date: 2024.04.18
18:09:33 +02'00'

Thomas Weise
Laboratory Manager

Tested by:



Sabine Kugler
2024.04.18
16:40:30 +02'00'

Sabine Kugler
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY**

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15 - 35 °C

Humidity: 30 - 60 %

Atmospheric pressure: 86 - 106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule ($w = 0$).

Details can be found in the procedure CSA_B_V50_29.

5 HUMAN EXPOSURE

5.1 RF output power

5.1.1 Test result

The output power of the device is taken from the power measurement in the test report 80146142-02 Rev_2 issued by CSA Group Bayern GmbH.

Peak EIRP:

Operating range	Start freq. (GHz)	Stop freq. (GHz)	Antenna	Power setting	Level PK (dBm)	Limit PK (dBm)	Margin PK (dB)
1	61.01	61.46	2	P0	31.9	43.0	-11.1
2	60.01	63.921	2	P24	9.6	10.0	-0.4

Remarks: As worst case the power values are not averaged over time.

5.2 Maximum permissible exposure (MPE)

5.2.1 Applicable standard

According to FCC Part 15, Section 15.255(g):

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

5.2.2 Description of Determination

The maximum rated output power conducted included the tune up tolerance is used to calculate the EIRP. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, can be calculated the MPE in a defined distance away from the product.

Friis transmission formula:

$$P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

Where:

P_d = power density (mW/cm²)

P_{out} = output power to antenna (mW)

G = gain of antenna (linear scale)

r = distance between antenna and observation point (cm)

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device. The EUT is designed to be used that radiating structures are 20 cm outside of the body of the user. ($r = 20$ cm)

5.2.3 Determination of MPE according FCC

Operating range	EIRP	Tune-Up	max EIRP	r	S	Limit S_{eq}	Margin	Exposure ratio
	(dBm)	(dBi)	(mW)	(cm)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)	(%)
1	31.9	3.0	3090.3	20.0	0.615	1.0	-0.385	61.5
2	9.6	3.0	18.2	20.0	0.004	1.0	-0.996	0.4

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 1.34	614	1.63	100	30
1.34 – 30	824/f	2.19/f	180/ f ²	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100000	---	---	1.0	30

f = Frequency in MHz

5.2.4 Determination of MPE according ISCED:

Operating range	EIRP	Tune-up	max EIRP	Limit S_{eq}	Margin	Exposure ratio
	(dBm)	(dBi)	(mW)	(W)	(W)	(%)
1	31.9	3.0	3090.3	5.0	-1.910	61.8
2	9.6	3.0	18.2	5.0	-4.982	0.4

Exemption limits for routine Evaluation – RF exposure evaluation according to RSS-102, section 6.6:

At or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

The requirements are **FULFILLED**.

Remarks: None

5.3 Co-location and Co-transmission

Applicable standard:

OET Bulletin 65, Edition 97-01, Section 2: Multiple-transmitter sites and Complex Environments

The FCC's MPE limits vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100 % in terms of percentage.

Remarks: Not applicable, the TX antennas can be used alternating but can not transmit at the same time.

5.4 SAR test exclusion considerations

5.4.1 Applicable standard

According to RF exposure guidance:

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Remarks: Not applicable, EUT is not portable.

5.5 Exemption limits for routine evaluation - SAR evaluation

5.5.1 Applicable standard

According to RSS-102, section 6.3:

Devices operating at or below the applicable output power levels (adjusted for tune-up tolerance) specified in table 11, based on the separation distance, are exempt from SAR evaluation. The separation distance, defined as the distance between the user and/or bystander and the antenna and/or radiating element of the device or the outer surface of the device, shall be less than or equal to 20 cm for these exemption limits to apply.

Remarks: Not applicable, EUT is not portable.

- End of test report -