EMI – TEST REPORT

- Human Exposure -

Type / Model Name	:	BSW200200 Series
Product Description	:	FMCW radar
Applicant	:	Symeo GmbH
Address	:	Professor-Messerschmitt-Straße 3
		85579 NEUBIBERG, GERMANY
Manufacturer	:	Symeo GmbH
Address	:	Professor-Messerschmitt-Straße 3
		85579 NEUBIBERG, GERMANY
Licence holder	:	Symeo GmbH
Address	:	Professor-Messerschmitt-Straße 3
		85579 NEUBIBERG, GERMANY

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

Test Report No. : T43516-00-03HS	13. December 2018 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

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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 1, Subpart 2, Section 2.1091	Radiofrequency radiation exposure evaluation: **mobile devices**.
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: **portable devices**.

OET Bulletin 65, 65A, 65B Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
ETSI TR 100 028 V1.3.1: 2001-03,	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – See ATTACHMENT A

2.2 Equipment category

The EUT is a field disturbance sensor.

2.3 Short description of the equipment under test (EUT)

The EUT is a field disturbance sensor with frequency emissions in customer settable ranges the operating band of 57.5 GHz to 63.5 GHz.

Number of tested samples: 1
Serial number: D44AH40023
Firmware ID: V0.10.0-11

EUT configuration:
(The CDF filled by the applicant can be viewed at the test laboratory.)

2.4 Variants of the EUT

Ther are the following variants of the EUT:

Device type	Software functionality		
	Primary radar	Secondary radar	Debugging
BSW200200	x	x	x
BSW200220	x	-	-
BSW200240	-	x	-
BSW200260	-	x	-
BSW200281	-	x	-
BSW200290	x	x	-

2.5 Operation frequency and channel plan

The operating frequency is 57.0 GHz to 64.0 GHz.

Channel block	Bandwidth mode	Frequency range (GHz)	Guard (MHz)	Channel number
0	R&D	57.0 - 64.0	-	0 - 199
1	0.5 GHz	57.0 - 57.5	10	200 - 299
2	0.5 GHz	57.5 - 58.0	10	300 - 399
3	0.5 GHz	58.0 - 58.5	10	400 - 499
4	0.5 GHz	58.5 - 59.0	10	500 - 599
5	0.5 GHz	59.0 - 59.5	10	600 - 699
6	0.5 GHz	59.5 - 60.0	10	700 - 799
7	0.5 GHz	60.0 - 60.5	10	800 - 899
8	0.5 GHz	60.5 - 61.0	10	900 - 999
9	0.5 GHz	61.0 - 61.5	10	1000 - 1099
10	0.5 GHz	61.5 - 62.0	10	1100 - 1199
11	0.5 GHz	62.0 - 62.5	10	1200 - 1299
12	0.5 GHz	62.5 - 63.0	10	1300 - 1399
13	0.5 GHz	63.0 - 63.5	10	1400 - 1499
14	0.5 GHz	63.5 - 64.0	10	1500 - 1599
15	1 GHz	57.5 - 58.5	10	1600 - 1799
16	1 GHz	58.5 - 59.5	10	1800 - 1999
17	1 GHz	59.5 - 60.5	10	2000 - 2199
18	1 GHz	60.5 - 59.5	10	2200 - 2399
19	1 GHz	61.5 - 62.5	10	2400 - 2599
20	1 GHz	62.5 - 63.5	10	2600 - 2799
21	2 GHz	57.5 - 59.5	10	2800 - 3199
22	2 GHz	59.5 - 61.5	10	3200 - 3599
23	2 GHz	61.5 - 63.5	10	3600 - 3999
24	3 GHz	57.5 - 60.5	20	4000 - 4399
25	3 GHz	60.5 - 63.5	20	4400 - 4799
26	4 GHz	59.5 - 63.5	20	4800 - 5199
27	5 GHz	58.5 - 63.5	40	5200 - 5599
28	6 GHz	57.5 - 63.5	40	5600 - 5999
29	7 GHz	57.0 - 64.0	40	6000 - 6399

Note. The marked frequencies are determined for testing.

2.6 Transmit operating modes

As soon as the equipment is powered on, TX starts operating independent of a possible connected PC in last operation mode was set before the devices switched off.

Two operation modes are available:
Primary radar 0.5, 1, 2, 3, 4, 5, 6 GHz OBW
Secondary radar 0.5, 1, 2, 3, 4, 5, 6 GHz OBW

Co-location of 2 units

4.4.2 Diversity Mounting Bracket – MTM102512

For mounting two LPR®-1DHP-200 for operation in the diversity radar mode a diversity mounting bracket is available from Symeo.

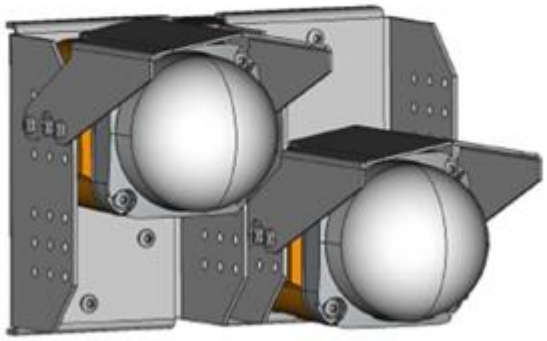

Figure 4.8: Two LPR®-1DHP-200 mounted in the diversity mounting bracket.

2.7 Antenna

The following integrated antennas are used with the EUT:

- Integrated linear polarised strip patch array antenna, gain 8.5 dBi additional lense antenna 20 dBi, effective gain 28.5 dBi.

The antennas cannot be unattached by the user.

2.8 Power supply system utilised

Power supply voltage : 115 VAC, (DC-Input 11 - 36 VDC)

2.9 Peripheral devices and interface cables

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

- DC power cable, 2 m Model : Self-made
- LAN cable, 2 m Model : Self-made
- _____ Model : _____

2.10 Determination of worst case conditions for final measurement

Stand alone mode.
Co-location mode.

3 TEST RESULT SUMMARY

WLAN device using digital modulation:

FCC Rule Part	RSS Rule Part	Description	Result
1.1310	RSS 102, 2.5.2	MPE	passed
2.1093	RSS 102, 2.5.1	SAR exclusion consideration	not applicable
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	not applicable

The mentioned RSS Rule Parts in the above table are related to:
RSS 102, Issue 5, March 2015

3.1 Final assessment

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

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

Testing commenced on : 19 October 2018

Testing concluded on : 19 October 2018

Checked by:

Klaus Gegenfurtner
I confirm the correctness and integrity of this document.
2018.12.13 15:49:16 +01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Hermann Smetana
I am the author of this document.
2018.12.13 15:06:59 +01'00'

Hermann Smetana
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 acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. 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.

Measurement Type	Range	Confidence Level	Calculated Uncertainty
AC power line conducted emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
Output power ERP, radiated	40000 MHz to 110000 MHz	95%	± 5.41 dB
Field strength of the fundamental	1000 MHz to 40000 MHz	95%	± 2.34 dB
Field strength of the fundamental	40000 MHz to 110000 MHz	95%	± 5.41 dB
Power spectral density	40000 MHz to 110000 MHz	95%	± 5.41 dB
Spurious Emissions, conducted	9 kHz to 10000 MHz	95%	± 2.15 dB
Spurious Emissions, conducted	10000 MHz to 40000 MHz	95%	± 3.47 dB
Spurious Emissions, radiated	9 kHz to 30 MHz	95%	± 3.53 dB
Spurious Emissions, radiated	30 MHz to 1000 MHz	95%	± 4.44 dB
Spurious Emissions, radiated	1000 MHz to 40000 MHz	95%	± 2.89 dB
Spurious Emissions, radiated	40000 MHz to 60000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	60000 MHz to 90000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	75000 MHz to 110000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	110000 MHz to 170000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	140000 MHz to 220000 MHz	95%	± 5.04 dB

5 HUMAN EXPOSURE

5.1 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPR 3**.

5.1.1 Description of the test location

Test location: NONE

5.1.2 Applicable standard

According to FCC Part 15, Section 1.1310:
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).

5.1.3 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. 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/cm^2)
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)

5.1.4 Test result

For FCC:
Stand alone mode:
57-71 GHz

Rated output power:	-4.8	dBm	0.330	mW
Tune-up tolerance:	3.0	dB		
Maximum output power:	-1.8	dBm	0.658	mW
Antenna gain max:	28.5	dBi		
Maximum EIRP:	26.7	dBm	466.1	mW
Minimum distance r:	20.0	cm		

Antgain	EIRP	EIRP	G	EIRP	S	Limit S_{eq}	Margin	Exposure ratio
(dBi)	(dBm)	(mW)	linear	(W)	(mW/cm^2)	(mW/cm^2)	(mW/cm^2)	(%)
28.5	26.7	466.14	707.95	0.4661	0.0927	1.0	-0.9073	9.27

Co-location mode:
For co-location it is assumed that both units transmitting at maximum output power and at the same frequency range. For assessment is assumed that this circumstances means a double of output power.

Rated output power:	-1.8	dBm	0.660	mW
Tune-up tolerance:	3.00	dB		
Maximum output power:	1.2	dBm	1.317	mW
Antenna gain max:	28.5	dBi		
Maximum EIRP:	29.7	dBm	932.3	mW
Minimum distance r:	20.0	cm		

Antgain	EIRP	EIRP	G	EIRP	S	Limit S_{eq}	Margin	Exposure ratio
(dBi)	(dBm)	(mW)	linear	(W)	(mW/cm^2)	(mW/cm^2)	(mW/cm^2)	(%)
28.5	29.7	932.27	707.95	0.9323	0.1855	1.0	-0.8145	18.55

Limits for maximum permissible exposure (MPE), FCC Part 1.1310:

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

For ISED:

Stand alone mode:
57-64 GHz

Rated output power:	-4.8	dBm	0.330	mW
Tune-up tolerance:	3.0	dB		
Maximum output power:	-1.8	dBm	0.658	mW
Antenna gain max:	28.5	dBi		
Maximum EIRP:	26.7	dBm	466.1	mW
Minimum distance r:	20.0	cm		

Frequency	Antgain	EIRP	Limit S_{eq}	Margin
GHz	(dBi)	(W)	(W)	(W)
57 - 64	28.5	0.5	5.0	-4.5

Co-location mode:
For co-location it is assumed that both units transmitting at maximum output power and at the same frequency range. For assessment is assumed that this circumstances means a double of output power.

Rated output power:	-1.8	dBm	0.660	mW
Tune-up tolerance:	3.00	dB		
Maximum output power:	1.2	dBm	1.317	mW
Antenna gain max:	28.5	dBi		
Maximum EIRP:	29.7	dBm	932.3	mW
Minimum distance r:	20.0	cm		

Frequency	Antgain	EIRP	Limit S_{eq}	Margin
MHz	(dBi)	(W)	(W)	(W)
57 - 64	28.5	0.932	5.0	-4.1

Exemption limits for routine Evaluation – RF exposure evaluation according RSS102, 2.5.2:

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

The requirements are **FULFILLED.**

Remarks: _____

5.2 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.

Due to the use of a double EUT araise a co-location issue.

1. MPE of System 1: P_d = 0.0927 mW/cm^2
Limit: 1.0 mW/cm^2
Fraction of MPE: 9.27 %

2. MPE of System 2: P_d = 0.0927 mW/cm^2
Limit: 1.0 mW/cm^2
Fraction of MPE: 9.27 %

The sum of fraction of MPE system 1 and fraction of MPE system 2 is 18.54 % < 100 %.

The requirements are **FULFILLED.**

Remarks: _____

5.3 SAR test exclusion considerations

5.3.1 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, the EUT is fixed equipment.

5.4 Exemption limits for routine evaluation - SAR evaluation

5.4.1 Applicable standard

According to RSS-102, item 2.5.1:
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Remarks: Not applicable, the EUT is fixed equipment.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
-	-	-	-	-	-	-