RF – TEST REPORT

- Human Exposure -

Type / Model Name	:	S2
Product Description	:	Radio Module 802.11a/b/n/ac & BLE
Applicant	:	BSH Hausgeräte GmbH
Address	:	Carl-Wery-Straße 34
		81739 München
Manufacturer	:	BSH Hausgeräte GmbH
Address	:	Carl-Wery-Straße 34
		81739 München

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

Test Report No. : 80178099-04 Rev_1	03. June 2024 Date of issue

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

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Contents

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**.
KDB 447498 D01	RF Exposure procedures and equipment authorisation policies for mobile and portable devices, April 20, 2021.
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 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 his/her instructions.

2.3 Photo documentation of the EUT – See ATTACHMENT A

2.4 Short description of the equipment under test (EUT)

The EUT is a communication module for assembling into household devices. The firmware does not support ad-hoc modes and gives the user no possibility to choose the data transmission of power setting. The EUT supports the 2.4 GHz and 5 GHz frequency bands and supports no beam forming.

Tested sample:	:	1 conducted sample
Serial number	:	800121530300004403350000001222
SW	:	BSH Embedded Linux Platform (SMM S2pro default) - debug [HWTEST] 62.1.0-104-g5104f097c
WLAN Firmware version		1.28 RC0.0 wl0: Nov 16 2022 18:14:34 version 7.45.251 (16ca9cf CY WLTEST) FWID 01-95f2057d

2.5 Variants of the EUT

Tests in this report are performed with the fully populated variant S2-V99.
Other variants are:

- S2-V11
- S2-V12

2.6 Antenna

The EUT has only an integrated PCB antenna, no temporary connector and no external antenna to be connected.

Number	Characteristic	Model number	Plug	Frequency range (GHz)	Gain (dBi)
1	Omni	PCB antenna (Ant0)	-	2.4	4.16
2	Omni	PCB antenna (Ant1)	-	2.4	4.82

1	Omni	PCB antenna (Ant0)	-	5	5.83
2	Omni	PCB antenna (Ant1)	-	5	6.84

The EUT is equipped with two internal antennas with diversity mode.
Only one antenna (Ant0) was active for testing.

2.7 Power supply system utilised

Power supply voltage, V_{nom} : 5 V_{DC}

3 TEST RESULT SUMMARY

FCC Rule Part	RSS Rule Part	Description	Result
KDB 447498, 7.1	RSS 102, 2.5.2	MPE	passed

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

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80178099-04	0	15 January 2024	Initial test report
80178099-04	1	03 June 2024	Updated 2.4 Short description & MEP calculations

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

3.2 Final assessment

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

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

Testing commenced on : 03 June 2024

Testing concluded on : 03 June 2024

Checked by:

Jürgen Pessinger
2024.06.03 14:52:12
+02'00'

Jürgen Pessinger
Radio Team

Tested by:

Lukas Scheuermann
2024.06.03 14:13:31
+02'00'

Lukas Scheuermann
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 Maximum permissible exposure (MPE)

5.1.1 Applicable standard

According to FCC Part 15, Section 15.247(i):
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).

5.1.2 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/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)

5.1.3 Determination of MPE according FCC

BLE								
Channel	rated Output Power	max. Ant. Gain	Tune-up Tolerance	EIRP incl. Tune-Up	P_d	Limit	Margin	Exposure ratio
No.	dBm	dBi	dB	mW	mW/cm²	mW/cm²	mW/cm²	%
37	4.0	4.8	1.5	10.72	0.0021	1.0	-0.9979	0.21
39	4.0	4.8	1.5	10.72	0.0021	1.0	-0.9979	0.21

802.11b								
Channel	rated Output Power	max. Ant. Gain	Tune-up Tolerance	EIRP incl. Tune-Up	P_d	Limit	Margin	Exposure ratio
No.	dBm	dBi	dB	mW	mW/cm²	mW/cm²	mW/cm²	%
1	14.5	4.8	1.5	120.23	0.0239	1.0	-0.9761	2.39
11	14.5	4.8	1.5	120.23	0.0239	1.0	-0.9761	2.39

802.11g								
Channel	rated Output Power	max. Ant. Gain	Tune-up Tolerance	EIRP incl. Tune-Up	P_d	Limit	Margin	Exposure ratio
No.	dBm	dBi	dB	mW	mW/cm²	mW/cm²	mW/cm²	%
1	10.5	4.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
11	10.5	4.8	1.5	47.86	0.0095	1.0	-0.9905	0.95

802.11n HT20								
Channel	rated Output Power	max. Ant. Gain	Tune-up Tolerance	EIRP incl. Tune-Up	P_d	Limit	Margin	Exposure ratio
No.	dBm	dBi	dB	mW	mW/cm²	mW/cm²	mW/cm²	%
1	10.5	4.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
11	10.5	4.8	1.5	47.86	0.0095	1.0	-0.9905	0.95

802.11n HT20								
Channel	rated Output Power	max. Ant. Gain	Tune-up Tolerance	EIRP incl. Tune-Up	P_d	Limit	Margin	Exposure ratio
No.	dBm	dBi	dB	mW	mW/cm²	mW/cm²	mW/cm²	%
36	10.5	6.8	1.5	75.86	0.0151	1.0	-0.9849	1.51
64	10.5	6.8	1.5	75.86	0.0151	1.0	-0.9849	1.51
100	10.5	6.8	1.5	75.86	0.0151	1.0	-0.9849	1.51
140	10.5	6.8	1.5	75.86	0.0151	1.0	-0.9849	1.51
149	10.5	6.8	1.5	75.86	0.0151	1.0	-0.9849	1.51
165	10.5	6.8	1.5	75.86	0.0151	1.0	-0.9849	1.51

802.11n HT40								
Channel	rated Output Power	max. Ant. Gain	Tune-up Tolerance	EIRP incl. Tune-Up	P_d	Limit	Margin	Exposure ratio
No.	dBm	dBi	dB	mW	mW/cm²	mW/cm²	mW/cm²	%
38	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
62	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
102	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
134	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
151	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
159	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95

802.11ac VHT80								
Channel	rated Output Power	max. Ant. Gain	Tune-up Tolerance	EIRP incl. Tune-Up	P_d	Limit	Margin	Exposure ratio
No.	dBm	dBi	dB	mW	mW/cm²	mW/cm²	mW/cm²	%
42	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
58	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
106	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95
155	8.5	6.8	1.5	47.86	0.0095	1.0	-0.9905	0.95

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	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

The requirements are **FULFILLED.**

Remarks: None.

5.1.4 Determination of MPE according ISED

BLE							
Frequency	EIRP	Tune-up Tolerance	EIRP incl. Tune-up	Factor	$f^{0.6834}$	Limit	Margin
MHz	dBm	dB	mW		W	W	W
2402	8.8	1.5	10.72	0.0131	204.3072	2.676	-2.6657
2480	8.8	1.5	10.72	0.0131	208.8182	2.736	-2.7248

802.11b							
Frequency	EIRP	Tune-up Tolerance	EIRP incl. Tune-up	Factor	$f^{0.6834}$	Limit	Margin
MHz	dBm	dB	mW		W	W	W
2412	19.3	1.5	120.23	0.0131	204.8881	2.684	-2.5638
2462	19.3	1.5	120.23	0.0131	207.7812	2.722	-2.6017

802.11n HT20							
Frequency	EIRP	Tune-up Tolerance	EIRP incl. Tune-up	Factor	$f^{0.6834}$	Limit	Margin
MHz	dBm	dB	mW		W	W	W
2412	15.3	1.5	47.86	0.0131	204.8881	2.684	-2.6362
2462	15.3	1.5	47.86	0.0131	207.7812	2.722	-2.6741

802.11n HT20							
Frequency	EIRP	Tune-up Tolerance	EIRP incl. Tune-up	Factor	$f^{0.6834}$	Limit	Margin
MHz	dBm	dB	mW		W	W	W
2412	15.3	1.5	47.86	0.0131	204.8881	2.684	-2.6362
2462	15.3	1.5	47.86	0.0131	207.7812	2.722	-2.6741

802.11n HT20							
Frequency	EIRP	Tune-up Tolerance	EIRP incl. Tune-up	Factor	$f^{0.6834}$	Limit	Margin
MHz	dBm	dB	mW		W	W	W
5180	17.3	1.5	75.86	0.0131	345.4403	4.525	-4.4494
5320	17.3	1.5	75.86	0.0131	351.7937	4.608	-4.5326
5500	17.3	1.5	75.86	0.0131	359.8851	4.714	-4.6386
5700	17.3	1.5	75.86	0.0131	368.7779	4.831	-4.7551
5745	17.3	1.5	75.86	0.0131	370.7651	4.857	-4.7812
5825	17.3	1.5	75.86	0.0131	374.2857	4.903	-4.8273

802.11n HT40							
Frequency	EIRP	Tune-up Tolerance	EIRP incl. Tune-up	Factor	$f^{0.6834}$	Limit	Margin
MHz	dBm	dB	mW		W	W	W
5190	15.3	1.5	47.86	0.0131	345.8959	4.531	-4.4834
5310	15.3	1.5	47.86	0.0131	351.3416	4.603	-4.5547
5510	15.3	1.5	47.86	0.0131	360.3321	4.720	-4.6725
5670	15.3	1.5	47.86	0.0131	367.4503	4.814	-4.7657
5755	15.3	1.5	47.86	0.0131	371.2060	4.863	-4.8149
5795	15.3	1.5	47.86	0.0131	372.9673	4.886	-4.8380

802.11ac VHT80							
Frequency	EIRP	Tune-up Tolerance	EIRP incl. Tune-up	Factor	$f^{0.6834}$	Limit	Margin
MHz	dBm	dB	mW		W	W	W
5210	15.3	1.5	47.86	0.0131	346.8062	4.543	-4.4953
5290	15.3	1.5	47.86	0.0131	350.4367	4.591	-4.5429
5530	15.3	1.5	47.86	0.0131	361.2255	4.732	-4.6842
5775	15.3	1.5	47.86	0.0131	372.0871	4.874	-4.8265

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

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;

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: None.