



RF - TEST REPORT

- Human Exposure -

Type / Model Name : SPB209A

Product Description : WLAN module

Applicant : Avnet Embedded GmbH

Address : Ludwig-Erhard-Str. 10c

85375 NEUFAHRN, GERMANY

Manufacturer : H&D Wireless AB

Address : Färögatan 33

164 51 KISTA, SWEDEN

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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Test Report No. : 80205072-01 Rev_1	01. April 2025 Date of issue
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Deutsche
Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

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ATTACHMENT A as separate supplement

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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 .
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

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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 Equipment type, category

WLAN - Client, mobile device

2.5 Short description of the equipment under test (EUT)

The EUT is a part 15C certificated WLAN module with an external antenna.

Number of tested samples: ---
Serial number: ---

2.6 Variants of the EUT

There are no variants.

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2.7 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

WLAN

Channel plan WLAN Standard 802.11b, g, n HT 20:

Channel	Frequency (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

Channel plan WLAN Standard 802.11n HT 40:

Channel up	Channel down	Frequency (MHz)
1 up	5 down	2422
2 up	6 down	2427
3 up	7 down	2432
4 up	8 down	2437
5 up	9 down	2442
6 up	10 down	2447
7 up	11 down	2452

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Channel plan IEEE-Standard 802.15.1:

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402	28	2429	55	2456
2	2403	29	2430	56	2457
3	2404	30	2431	57	2458
4	2405	31	2432	58	2459
5	2406	32	2433	59	2460
6	2407	33	2434	60	2461
7	2408	34	2435	61	2462
8	2409	35	2436	62	2463
9	2410	36	2437	63	2464
10	2411	37	2438	64	2465
11	2412	38	2439	65	2466
12	2413	39	2440	66	2467
13	2414	40	2441	67	2468
14	2415	41	2442	68	2469
15	2416	42	2443	69	2470
16	2417	43	2444	70	2471
17	2418	44	2445	71	2472
18	2419	45	2446	72	2473
19	2420	46	2447	73	2474
20	2421	47	2448	74	2475
21	2422	48	2449	75	2476
22	2423	49	2450	76	2477
23	2424	50	2451	77	2478
24	2425	51	2452	78	2479
25	2426	52	2453	79	2480
26	2427	53	2454		
27	2428	54	2455		

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BLE

Channel plan:

Channel	Frequency	Channel	Frequency
37	2402	18	2442
0	2404	19	2444
1	2406	20	2446
2	2408	21	2448
3	2410	22	2450
4	2412	23	2452
5	2414	24	2454
6	2416	25	2456
7	2418	26	2458
8	2420	27	2460
9	2422	28	2462
10	2424	29	2464
38	2426	30	2466
11	2428	31	2468
12	2430	32	2470
13	2432	33	2472
14	2434	34	2474
15	2436	35	2476
16	2438	36	2478
17	2440	39	2480

2.8 Transmit operating modes

WLAN

The EUT use DSSS or OFDM modulation and may operate under operating mode 2 and provide following data rates with auto-fall-back:

- 802.11b mode	11, 5.5, 2, 1 Mbps	(Mbps = megabits per second)
- 802.11g mode	54, 48, 36, 24, 18, 12, 9, 6 Mbps	(Mbps = megabits per second)

BT

- synchronous mode (SCO or eSCO traffic, for HV, DV or DM packets) for transmitting voice or data,
- asynchronous mode (ACL traffic, for DM or DH packets) for transmitting data,
- mixed transfer mode (for voice and data).

The most important mode is the ACL mode at a data rate of 3 Mbps for the worst case

Packets:

A summary of the packets in ACL mode and their characteristics is shown in the following table:

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Modulation types:

For the DH5 packet the pay load modulation GFSK, for 2-DH5 the modulation $\pi/4$ -DQPSK, for 3-DH5 the modulation 8DPSK is used. The packet 3-DH5 shows most of modulation side bands and means the worst case.

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Symmetric Max. Rate (kb/s)	Asymmetric Max. Rate (kb/s)	
						Forward	Reverse
DM1	1	0 - 17	2/3	yes	108.8	108.8	108.8
DH1	1	0 - 27	no	yes	172.8	172.8	172.8
DM3	2	0 - 121	2/3	yes	258.1	387.2	54.4
DH3	2	0 - 183	no	yes	390.4	585.6	86.4
DM5	2	0 - 224	2/3	yes	286.7	477.8	36.3
DH5	2	0 - 339	no	yes	433.9	723.2	57.6
AUX1	1	0 - 29	no	no	185.6	185.6	185.6
2-DH1	2	0 - 54	no	yes	345.6	345.6	345.6
2-DH3	2	0 - 367	no	yes	782.9	1174.4	172.8
2-DH5	2	0 - 679	no	yes	869.1	1448.5	115.2
3-DH1	2	0 - 83	no	yes	531.2	531.2	531.2
3-DH3	2	0 - 552	no	yes	1177.6	1766.4	235.6
3-DH5	2	0 - 1021	no	yes	1306.9	2178.1	177.1

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The EUT uses GFSK modulation and may provide following data rates:

- 1000 kbps

(kbps = kilobits per second)

2.9 Antennas

The following antennas shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (GHz)	Peak Gain (dBi)
1	Omni	Taoglas PC14.03.3000D	None	2.4 – 5.2	5.6

2.10 Power supply system utilised

Power supply voltage, V_{nom} : 12 V DC

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3 TEST RESULT SUMMARY

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, 8.2.3	Co-location, Co-transmission	not applicable

The mentioned RSS Rule Parts in the above table are related to:
 RSS-102, Issue 6, December 2023

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80205072-01	0	27 May 2024	Initial test report
	1	01 April 2025	Update to RSS-102 issue 6

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 : ---

Testing concluded on : ---

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Franz-Xaver Schrettenbrunner
Radio Team

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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.

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5 HUMAN EXPOSURE

5.1 Maximum permissible exposure (MPE)

5.1.1 Description of the test location

Test location: NONE

5.1.2 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).

5.1.3 Description of Determination

The maximum rated peak output power (radiated) is used for EIRP. MPE is calculated with the Friis transmission formula, in a defined distance away from the product (r=20cm).

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)

The output power of the device is taken from the power measurement in the test report 80205072-00 Rev0 of the accredited test laboratory CSA Group Bayern GmbH, Ohmstraße 1-4, 94342 Straßkirchen, Germany.

Max. EIRP: 23.2 dBm 208.93 mW

$$S = 208.93 \text{ mW} / (4 \times \pi \times [20 \text{ cm}]^2)$$
$$S = 0.042 \text{ mW/cm}^2$$

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5.1.4 Determination of MPE according to FCC

Calculated power density of the EUT is $S = 0.042 \text{ mW/cm}^2$ in the frequency range $f > 1500 \text{ MHz}$.

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

5.1.5 Determination of MPE according to ISED:

Max. EIRP of the EUT: $EIRP = 208.93 \text{ mW}$
 Calculation of the limit for $f = 2400 \text{ MHz}$ $P_{\text{Limit}} = 2.67 \text{ W}$

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

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 $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;

The requirements are **FULFILLED**.

Remarks: None.
