



RF - TEST REPORT

- FCC Part 15.247, RSS-247 -

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. :

80178099-01 Rev_0

03. June 2024

Date of issue



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

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ATTACHMENT A as separate supplement

ATTACHMENT B as separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (November 2023)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (November 2023)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204 modifications	External radio frequency power amplifiers and antenna
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

ANSI C63.10: 2013 Testing Unlicensed Wireless Devices

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

KDB 558074 D01 v05r02 Guidance for compliance measurements on DTS; FHSS and hybrid system devices operating under Section 15.247 of the FCC rules, April 2, 2019.

ISED Canada Rules and Regulations (November 2023)

RSS-Gen, Issue 5 + Amendment 1 + 2 General Requirements for Compliance of Radio Apparatus

RSS-247, Issue 3 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

ANSI C63.10: 2013 Testing Unlicensed Wireless Devices

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 General remarks

This report covers the emissions of the module "SMB" (FCC ID 2AHES-SMB / IC: 21152-SMB) in combination with the host device S2.

Performed tests:

- AC powerline conducted Emissions
- Transmitter unwanted emissions, radiated

2.4 Photo documentation

Attachment A : Detailed photos of EUT
Attachment B : Photo documentation of test setup

2.5 Equipment type

BLE device.

2.6 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 or power setting. The EUT supports the 2.4 GHz frequency band and supports no beam forming.

Tested sample:	: 1 radiated sample
Serial number	: 8001215303000440335000001216
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
Tested sample:	: 1 conducted sample
Serial number	: 8001215303000440335000001222
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

2.7 Variants of the EUT

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

- S2-V11
- S2-V12

2.8 Operation frequency and channel plan

The operating frequency band is 2400 MHz to 2483.5 MHz.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
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

2.9 Transmit operating modes

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

- 1000 kbps

(kbps = *kilobits per second*)

2.10 Antenna

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

The following antennas shall be used with the EUT:

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

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

For conducted tests a special prepared sample with an U.FL Port instead of Ant0 was used.

2.11 Power supply system utilised

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

2.12 Peripheral devices and interface cables

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

- USB to serial converter cable Model : -
- Laptop Model : -

2.13 Determination of worst-case conditions for final measurement

Measurements are made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position.

For the final test the following channels and test modes are selected:

BLE V5	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.15.1	0 - 39	37, 39	P6	DSSS	GFSK	1 Mbps

2.13.1 Test jig

No test jig is used.

2.13.2 Test software

The test software is controlled by a terminal program (PuTTY) and a set of commands. The test software allows to set the EUT into TX continuous modulated mode and set different channel.

3 TEST RESULT SUMMARY

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS-Gen, 8.8	AC power line conducted emissions	passed
15.247(a)(2)	RSS-247, 5.2(a)	-6 dB DTS-BW	Not tested
15.247(b)(3) 15.247(b)(4)	RSS-247, 5.4(d)	Maximum peak conducted output power	Not tested
15.247(d) 15.209	RSS-247, 5.5 RSS-Gen, 8.9	Spurious emissions	passed
15.247(e)	RSS-247, 5.2(b)	PSD	Not tested
15.35(c)	RSS-Gen, 8.2	Pulsed operation	Not tested
15.203		Antenna requirement	Not tested
-	RSS-Gen, 6.7	99 % Bandwidth	Not tested

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80178099-01	0	15 January 2024	Initial test report
80178099-01	1	03 June 2024	Reduced report to AC power line conducted emissions & spurious emissions

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 : 09 November 2023

Testing concluded on : 17 November 2023

Checked by: Tested by:

Jürgen Pessinger
Radio Team

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.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
20 dB Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
99% Occupied Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Peak conducted output power	902 MHz to 928 MHz	95%	± 0.35 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB

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.

4.5 Measurement protocol for FCC and ISED

4.5.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011
ISED: DE0009

4.5.2 General Standard information

The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices".

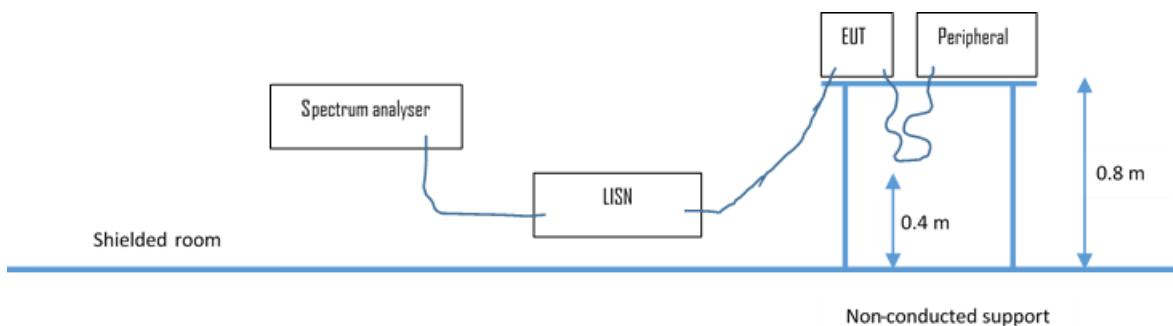
4.5.2.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions.

4.5.3 Details of test procedures

4.5.3.1 Conducted emission

Test setup according ANSI C63.10



The final level, expressed in $\text{dB}\mu\text{V}$, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between $\text{dB}\mu\text{V}$ and μV , the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

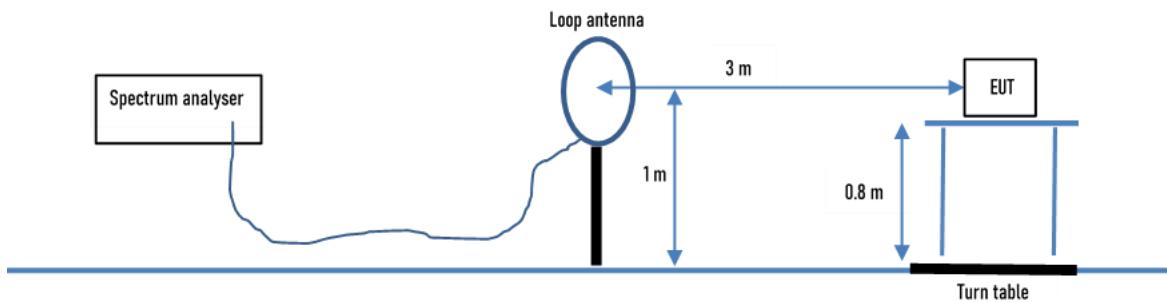
$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with $50 \Omega / 50 \mu\text{H}$ (CISPR 16) characteristics. The receiver is protected by means of an impedance matched pulse limiter connected directly to the RF input. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission is re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.5.3.2 Radiated emission

4.5.3.2.1 OATS1 test site (9 kHz - 30 MHz):

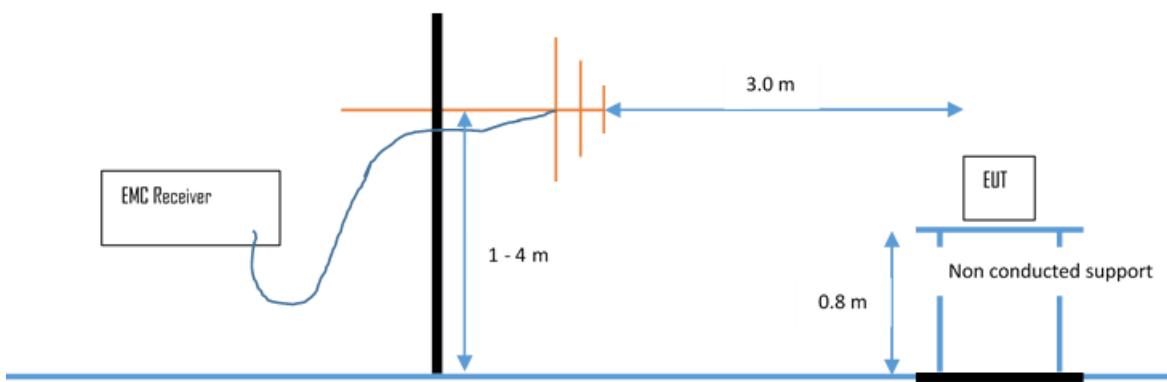
Test setup according ANSI C63.10



Emissions from the EUT are measured in the frequency range of 9 MHz to 30 MHz using a tuned receiver and a calibrated loop antenna. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied along the site axis and the EUT is rotated 360 degrees.

4.5.3.2.2 OATS1 test site (30 MHz - 1 GHz):

Test setup according ANSI C63.10.



Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees. The final level in dB μ V/m is calculated by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors and cable loss factor (dB). The FCC limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

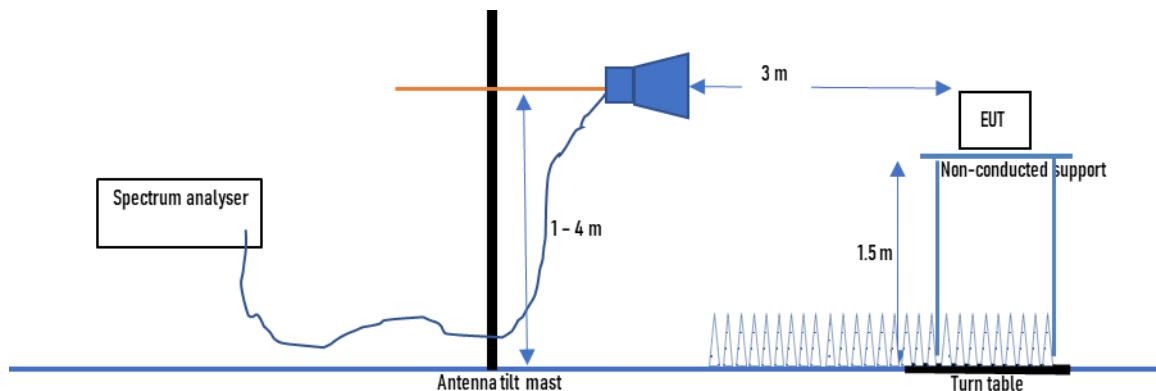
30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	-	Limit (dB μ V/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

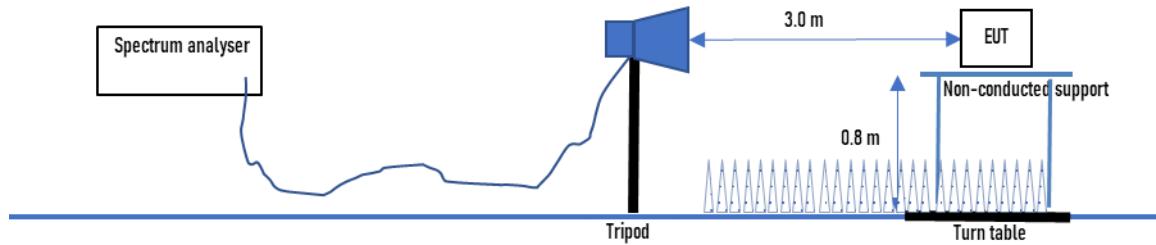
4.5.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

Test setup according ANSI C63.10.



Radiated emissions from the EUT are measured in the frequency range 1 GHz up to 18 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 1.5 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the centre, forming a bundle 30 cm to 40 cm long. Measurements are made in in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements.

4.5.3.2.4 Anechoic chamber 1 (18 GHz – 40 GHz)



Emissions from the EUT are measured in the frequency range 18 GHz up to 40 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 0.8 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the centre, forming a bundle 30 cm to 40 cm long. Measurements are made in in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty. The limit is adopted.

5 TEST CONDITIONS AND RESULTS

5.1 AC power line conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.3 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.4 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -17.6 dB

Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Limit according to RSS-Gen 8.8:

Frequency of Emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

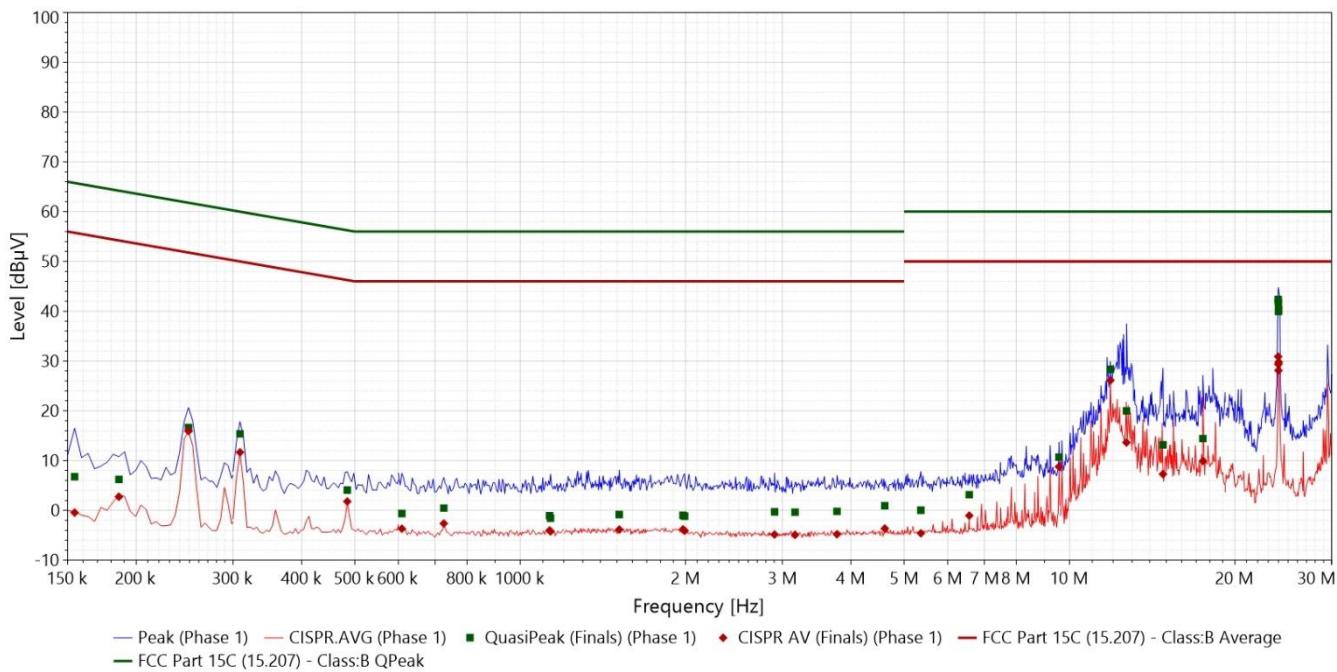
The requirements are **FULFILLED**.

Remarks: For detailed test result please see the following test protocols

5.1.5 Test protocol

Test point: L1
 Operation mode: BLE 2402 MHz TX continuous

Result: passed



Frequency (MHz)	SR#	QuasiPeak (dBμV)	QP Margin (dB)	QP Limit (dBμV)	CISPR AV (dBμV)	CISPR AV Margin (dB)	AV Limit (dBμV)	Line	RBW	Meas. Time	Correction (dB)
0,1545	1	6,75	-59,00	65,75	-0,45	-56,20	55,75	Phase 1	9k	1,00	10,10
0,186	1	6,23	-57,98	64,21	2,74	-51,47	54,21	Phase 1	9k	1,00	10,11
0,249	1	16,64	-45,15	61,79	15,94	-35,85	51,79	Phase 1	9k	1,00	10,13
0,309	2	15,38	-44,62	60,00	11,67	-38,32	50,00	Phase 1	9k	1,00	10,14
0,4845	2	4,07	-52,19	56,26	1,79	-44,48	46,26	Phase 1	9k	1,00	10,19
0,609	3	-0,63	-56,63	56,00	-3,68	-49,68	46,00	Phase 1	9k	1,00	10,20
0,726	3	0,45	-55,55	56,00	-2,63	-48,63	46,00	Phase 1	9k	1,00	10,21
1,131	3	-1,06	-57,06	56,00	-4,04	-50,04	46,00	Phase 1	9k	1,00	10,27
11,355	3	-1,59	-57,59	56,00	-4,21	-50,21	46,00	Phase 1	9k	1,00	10,27
1,515	4	-0,84	-56,84	56,00	-3,85	-49,85	46,00	Phase 1	9k	1,00	10,31
19,785	4	-1,01	-57,01	56,00	-3,82	-49,82	46,00	Phase 1	9k	1,00	10,31
1,992	4	-1,18	-57,18	56,00	-4,08	-50,08	46,00	Phase 1	9k	1,00	10,32
2,904	5	-0,31	-56,31	56,00	-4,85	-50,85	46,00	Phase 1	9k	1,00	10,39
3,165	5	-0,37	-56,37	56,00	-4,91	-50,91	46,00	Phase 1	9k	1,00	10,40
37,725	5	-0,21	-56,21	56,00	-4,80	-50,80	46,00	Phase 1	9k	1,00	10,43
46,095	5	0,93	-55,07	56,00	-3,64	-49,64	46,00	Phase 1	9k	1,00	10,49
53,625	6	0,03	-59,97	60,00	-4,60	-54,60	50,00	Phase 1	9k	1,00	10,55
65,685	6	3,15	-56,85	60,00	-1,05	-51,05	50,00	Phase 1	9k	1,00	10,66

95,655	6	10,70	-49,30	60,00	8,77	-41,23	50,00	Phase 1	9k	1,00	10,75
11,868	7	28,32	-31,68	60,00	26,12	-23,88	50,00	Phase 1	9k	1,00	10,95
12,696	7	19,97	-40,03	60,00	13,64	-36,36	50,00	Phase 1	9k	1,00	11,01
14,793	7	13,16	-46,84	60,00	7,29	-42,71	50,00	Phase 1	9k	1,00	11,15
174,885	7	14,43	-45,57	60,00	9,91	-40,09	50,00	Phase 1	9k	1,00	11,27
23,979	8	42,35	-17,65	60,00	30,88	-19,12	50,00	Phase 1	9k	1,00	11,61
240,015	8	41,72	-18,28	60,00	29,36	-20,64	50,00	Phase 1	9k	1,00	11,61
24,006	8	39,95	-20,05	60,00	28,10	-21,90	50,00	Phase 1	9k	1,00	11,61
240,285	8	40,29	-19,71	60,00	29,78	-20,22	50,00	Phase 1	9k	1,00	11,61

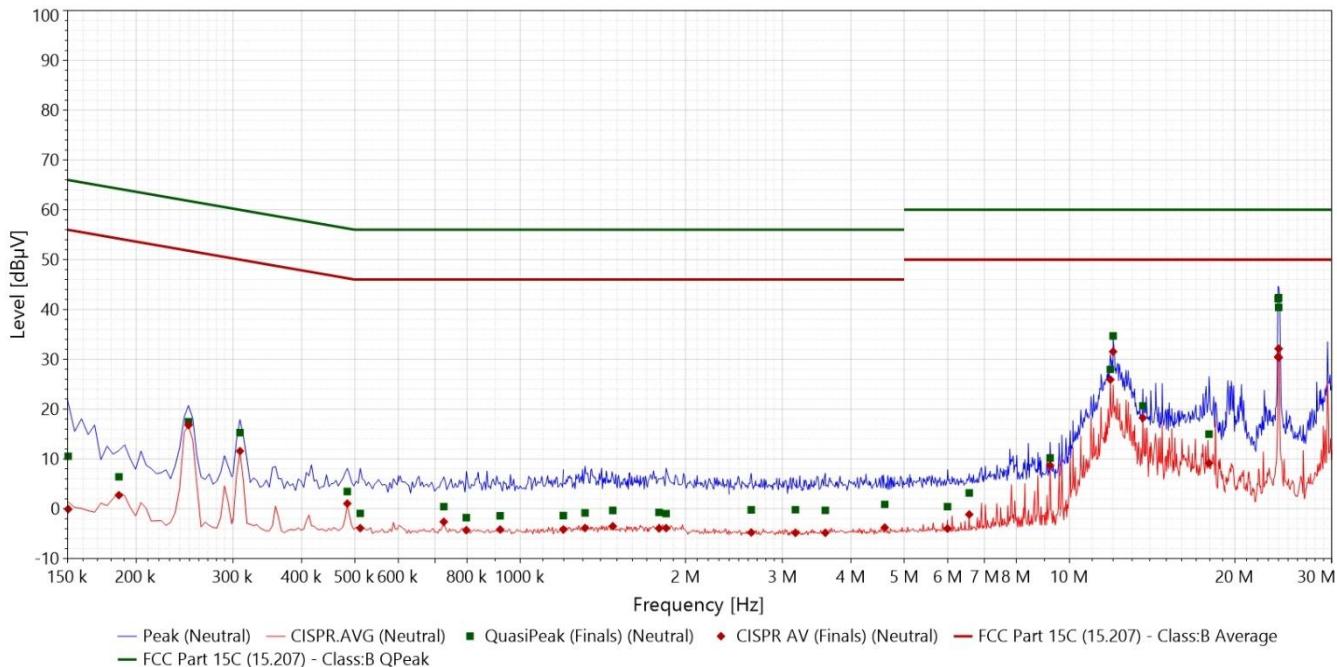
Test point

N

Result: passed

Operation mode:

BLE 2402 MHz TX continuous



Frequency (MHz)	SR#	QuasiPeak (dB μ V)	QP Margin (dB)	QP Limit (dB μ V)	CISPR AV (dB μ V)	CISPR AV Margin (dB)	AV Limit (dB μ V)	Line	RBW	Meas. Time	Correction (dB)
0,15	9	10,54	-55,46	66,00	-0,07	-56,07	56,00	Neutral	9k	1,00	10,13
0,186	9	6,41	-57,81	64,21	2,72	-51,50	54,21	Neutral	9k	1,00	10,14
0,249	9	17,48	-44,31	61,79	16,79	-35,00	51,79	Neutral	9k	1,00	10,16
0,309	10	15,26	-44,73	60,00	11,58	-38,42	50,00	Neutral	9k	1,00	10,18
0,4845	10	3,46	-52,80	56,26	1,04	-45,22	46,26	Neutral	9k	1,00	10,21
0,5115	10	-0,94	-56,94	56,00	-3,89	-49,89	46,00	Neutral	9k	1,00	10,21
0,726	11	0,41	-55,59	56,00	-2,62	-48,62	46,00	Neutral	9k	1,00	10,24
0,798	11	-1,80	-57,80	56,00	-4,29	-50,29	46,00	Neutral	9k	1,00	10,25

0,9195	11	-1,42	-57,42	56,00	-4,16	-50,16	46,00	Neutral	9k	1,00	10,25
11,985	11	-1,38	-57,38	56,00	-4,16	-50,16	46,00	Neutral	9k	1,00	10,29
13,125	12	-0,85	-56,85	56,00	-3,87	-49,87	46,00	Neutral	9k	1,00	10,31
14,745	12	-0,34	-56,34	56,00	-3,51	-49,51	46,00	Neutral	9k	1,00	10,33
17,895	12	-0,73	-56,73	56,00	-3,94	-49,94	46,00	Neutral	9k	1,00	10,35
18,435	12	-0,98	-56,98	56,00	-3,89	-49,89	46,00	Neutral	9k	1,00	10,34
2,634	13	-0,23	-56,23	56,00	-4,76	-50,76	46,00	Neutral	9k	1,00	10,42
31,695	13	-0,20	-56,20	56,00	-4,84	-50,84	46,00	Neutral	9k	1,00	10,44
35,925	13	-0,32	-56,32	56,00	-4,84	-50,84	46,00	Neutral	9k	1,00	10,45
46,095	13	0,88	-55,12	56,00	-3,77	-49,77	46,00	Neutral	9k	1,00	10,51
5,997	14	0,42	-59,58	60,00	-3,98	-53,98	50,00	Neutral	9k	1,00	10,60
65,685	14	3,17	-56,83	60,00	-1,14	-51,14	50,00	Neutral	9k	1,00	10,65
9,219	14	10,18	-49,82	60,00	8,68	-41,32	50,00	Neutral	9k	1,00	10,74
11,868	15	27,96	-32,04	60,00	25,92	-24,08	50,00	Neutral	9k	1,00	10,88
12,003	15	34,67	-25,33	60,00	31,54	-18,46	50,00	Neutral	9k	1,00	10,88
13,596	15	20,65	-39,35	60,00	18,24	-31,76	50,00	Neutral	9k	1,00	11,00
179,475	15	14,98	-45,02	60,00	9,16	-40,84	50,00	Neutral	9k	1,00	11,15
23,979	16	42,13	-17,87	60,00	30,50	-19,50	50,00	Neutral	9k	1,00	11,25
24,024	16	42,37	-17,63	60,00	32,12	-17,88	50,00	Neutral	9k	1,00	11,25
240,285	16	40,41	-19,59	60,00	30,34	-19,66	50,00	Neutral	9k	1,00	11,25

5.2 Spurious emissions radiated

For test instruments and accessories used see section 6 Part **SER1, SER 2, SER 3**.

5.2.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 1
Test distance: 3 m

5.2.2 Applicable standard

According to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

5.2.3 Description of Measurement

The restricted bands are measured radiated. The span of the spectrum analyser is set wide enough to capture the restricted band and measure the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The restricted bands are measured falling emissions into it and the nearest restricted band are checked for emissions also the restricted band for the harmonics of the carrier.

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.10. If the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise the emission will be measured in average mode again and reported.

The restricted bands are measured radiated. The span of the spectrum analyser is set wide enough to capture the restricted band and measure the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The restricted bands are measured falling emissions into it and the nearest restricted band are checked for emissions also the restricted band for the harmonics of the carrier.

Measurements are performed in following order:

1) Measurement of emissions according to General Limit specified in section 15.209(a):

Test receiver settings for SER1, SER2:

9kHz-150kHz	RBW: 200 Hz	Detector: Quasi peak*	Meas. Time: 1 s,
150kHz-30MHz	RBW: 9 kHz	Detector: Quasi peak*	Meas. Time: 1 s,
30MHz-1GHz	RBW: 120 MHz	Detector: Quasi peak	Meas. Time: 1 s,

*AV Detector in the ranges 9-90kHz and 110-490kHz

Spectrum analyser settings for SER3:

1GHz-26GHz	RBW: 1 MHz	Detector: Max. peak	Trace: Max. hold	Sweep: Auto
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2) If emissions outside the Restricted Bands are above General Limit additional measurements of emissions according to Spurious Emissions Limit specified in section 15.247(d) are performed:

Spectrum analyser settings:

RBW: 100 kHz VBW: 300 kHz

Detector: Max. peak

Trace: Max. hold

Sweep: Auto

5.2.4 Test result

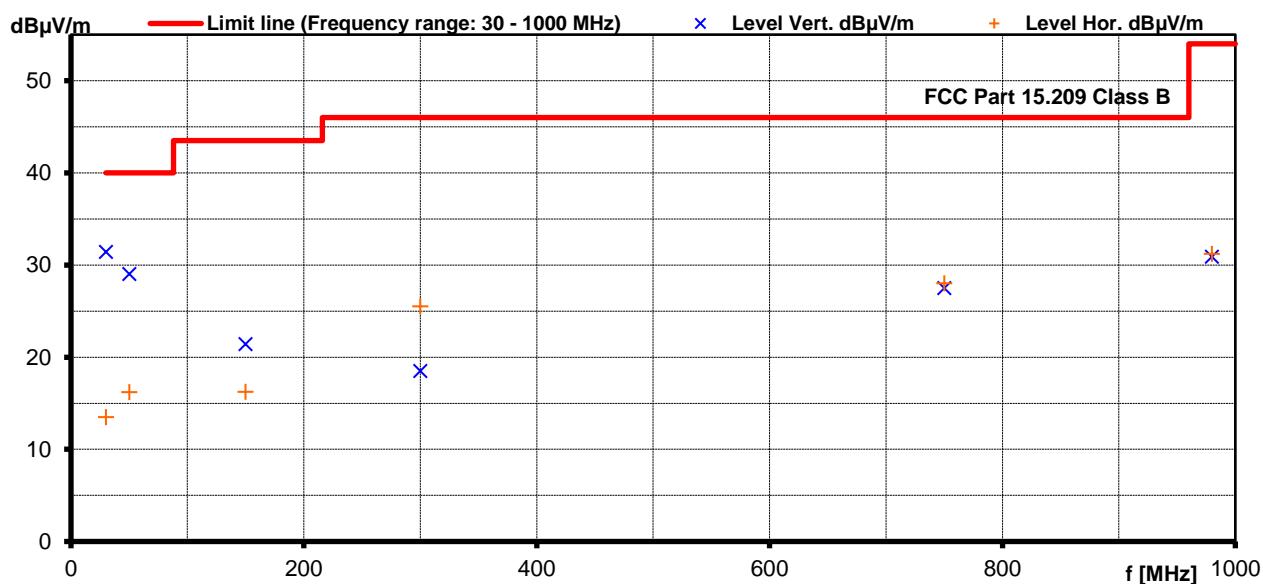
9 kHz < f < 30 MHz

Frequency (MHz)	Reading (dB μ V)	Correction * (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Dlimit (dB)
0.009	-4.0	-58.8	-62.8	48.5	-111.3
0.100	-10.4	18.3	-72.1	27.6	-99.7
0.700	4.4	18.2	-17.4	30.7	-48.1
5.000	6.0	17.5	-16.5	30.0	-46.5
20.000	5.4	19.0	-15.6	30.0	-45.6

Note: No emissions detected in the frequency range 9 kHz to 30 MHz. The recorded values are solely noise values of the OATS.

30 MHz < f < 1000 MHz:

Frequency (MHz)	Reading Vert. (dB μ V)	Reading Hor. (dB μ V)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dB μ V/m)	Level Hor. (dB μ V/m)	Limit (dB μ V/m)	Dlimit (dB)
30.00	15.8	-3.6	15.6	17.1	31.4	13.5	40.0	-8.6
50.00	11.4	-2.6	17.6	18.8	29.0	16.2	40.0	-11.0
150.00	1.9	-2.6	19.5	18.9	21.4	16.3	43.5	-22.1
300.00	-1.7	4.7	20.2	20.8	18.5	25.5	46.0	-20.5
750.00	-3.2	-3.1	30.7	31.1	27.5	28.0	46.0	-18.0
980.00	-2.9	-3.0	33.8	34.2	30.9	31.2	54.0	-22.8

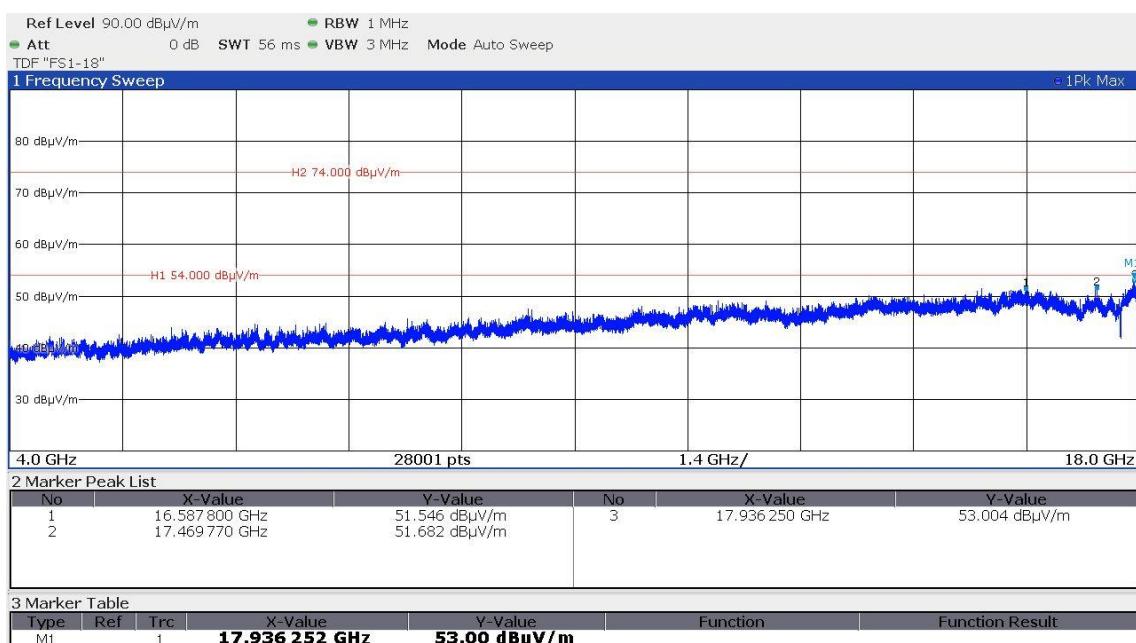
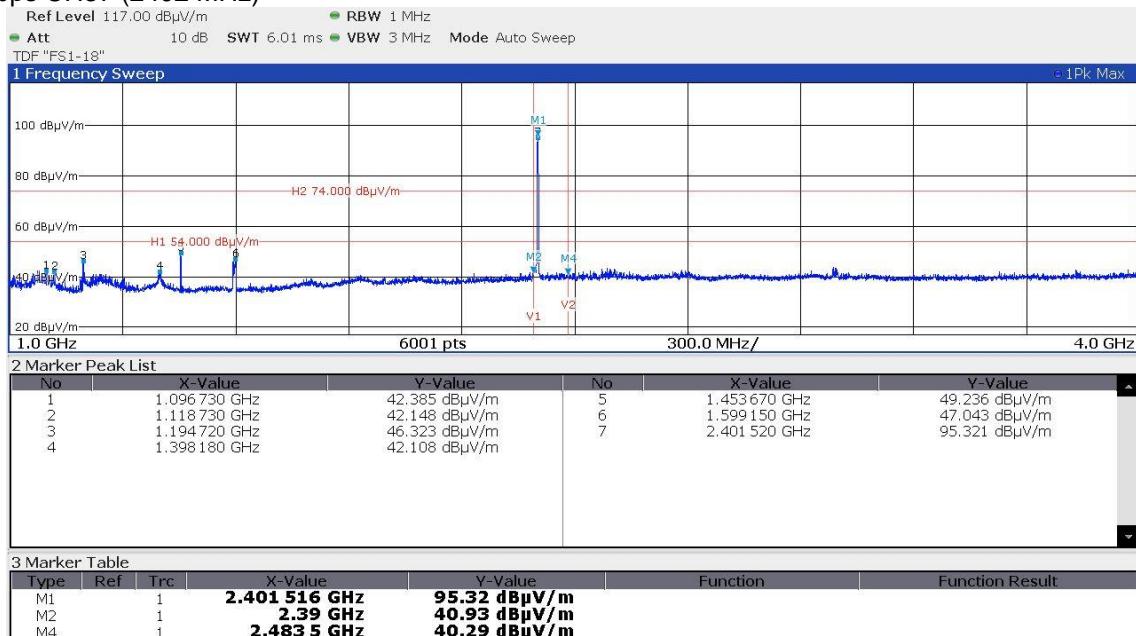


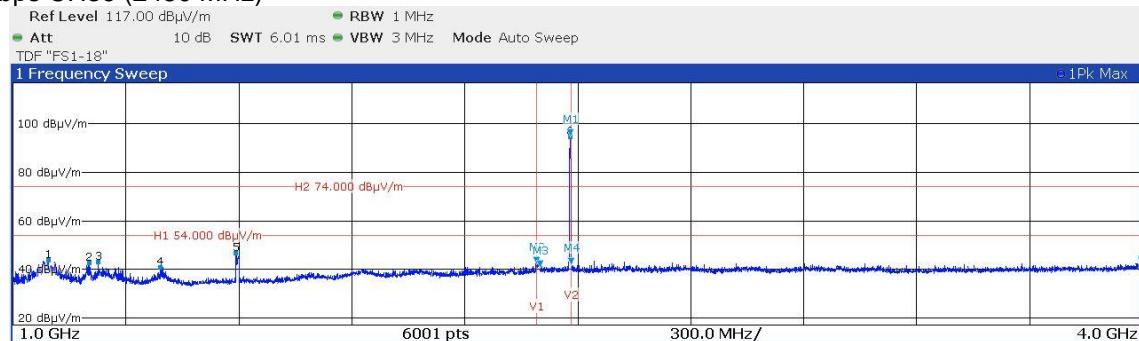
Note: No emissions detected in the frequency range 30 MHz to 1 GHz. The recorded values are solely noise values of the OATS.

1) Measurement of emissions according to General Limit specified in section 15.209(a) / RSS-Gen 8.9:

1 GHz < f < 18 GHz

BLE 1 Mbps CH37 (2402 MHz)

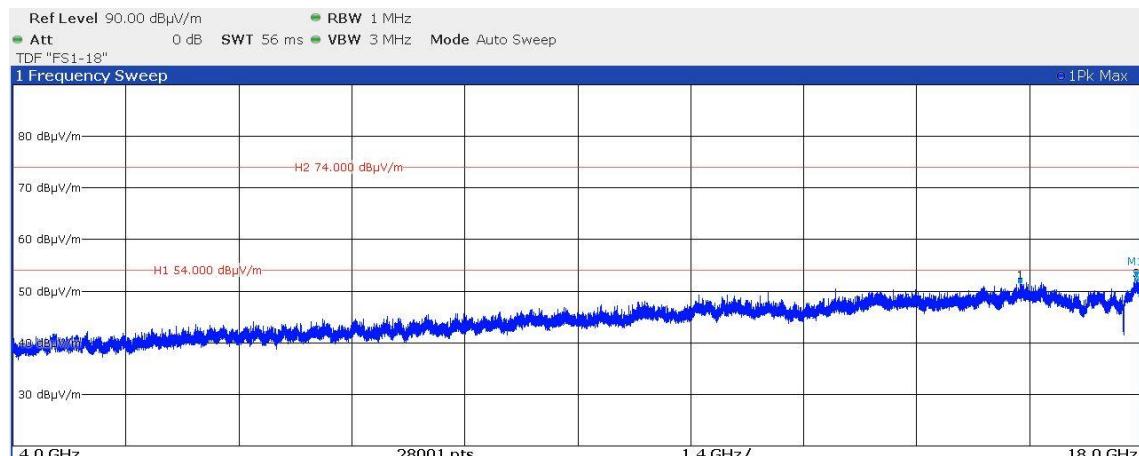


BLE 1 Mbps CH39 (2480 MHz)

2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value	
1	1.093 730 GHz	43.681 dB μ V/m	5	1.592 650 GHz	46.702 dB μ V/m	
2	1.201 720 GHz	42.684 dB μ V/m	6	2.479 500 GHz	94.550 dB μ V/m	
3	1.227 210 GHz	42.970 dB μ V/m	7	3.994 250 GHz	44.908 dB μ V/m	
4	1.391 680 GHz	40.883 dB μ V/m				

3 Marker Table

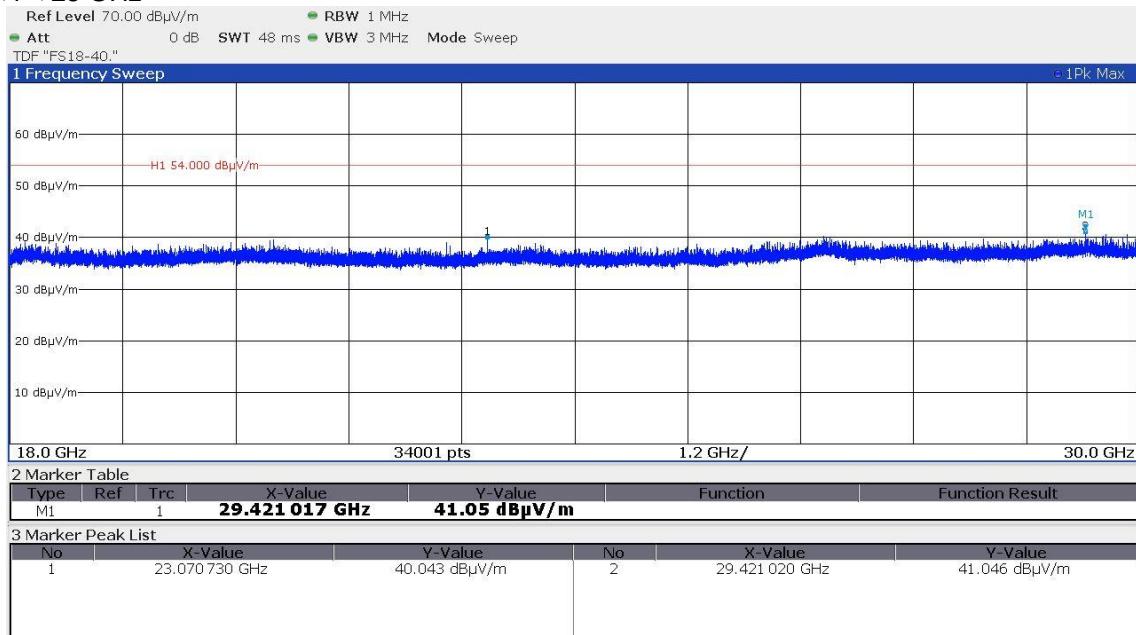
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1		2.479 503 GHz	94.55 dBμV/m		
M2	1		2.39 GHz	41.86 dBμV/m		
M3	1		2.4 GHz	40.55 dBμV/m		
M4	1		2.483 5 GHz	41.57 dBμV/m		


2 Marker Peak List

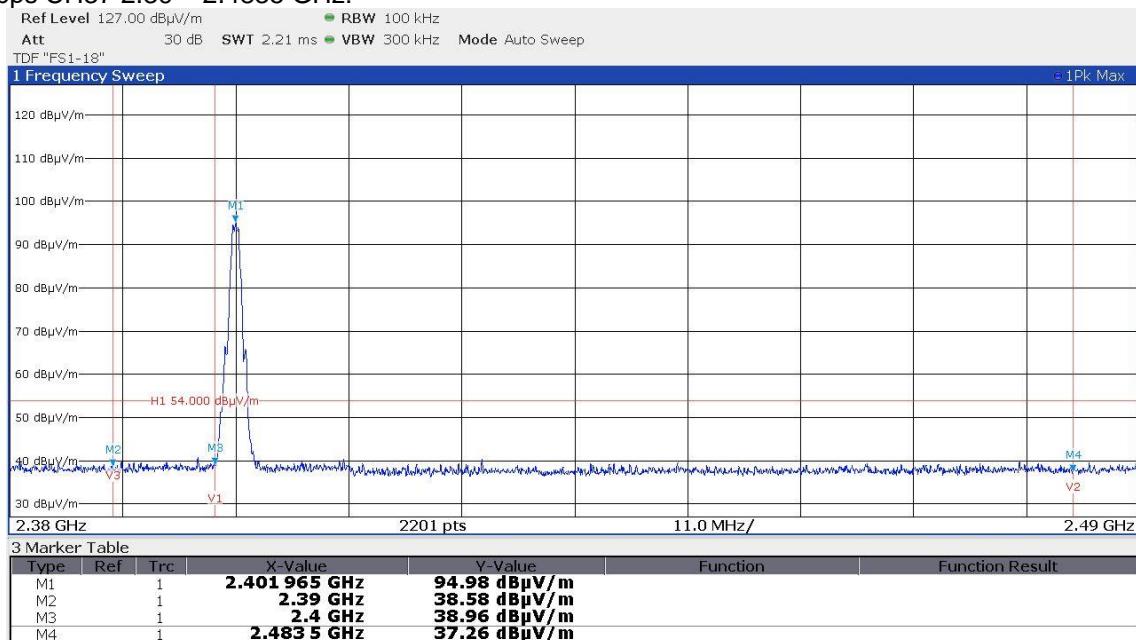
No	X-Value	Y-Value	No	X-Value	Y-Value
1	16.478 300 GHz	51.960 dB μ V/m	2	17.922 750 GHz	52.266 dB μ V/m

3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1		17.922 753 GHz	52.27 dBμV/m		

18 GHz < f < 25 GHz


Note: No emissions detected in the frequency range 18 GHz to 25 GHz. The recorded values are solely noise values of the A1.

2) Measurements of emissions according to spurious emissions limit specified in section 15.247(d) / RSS-247 5.5:
BLE 1 Mbps CH37 2.39 – 2.4835 GHz:


Radiated limits according to FCC Part 15, Section 15.209 for spurious emissions which fall in restricted bands:

Frequency (MHz)	15.209 Limits (μ V/m)	Measurement distance (m)
0.009 - 0.49	2400/f(kHz)	300
0.49 – 1.705	24000/f(kHz)	30
1.705 – 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Radiated limits according to RSS-Gen, 8.9 for spurious emissions which fall in restricted bands:

Frequency (MHz)	RSS-Gen Limits (μ A/m)	Measurement distance (m)
0.009 - 0.49	63.7/f(kHz)	300
0.49 – 1.705	63.7/f(kHz)	30
1.705 – 30.0	0.08	30

Frequency (MHz)	RSS-Gen Limits (μ V/m)	Measurement distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Limit according to FCC Part 15, Section 15.247(d) for emissions falling not in restricted bands:

Frequency (MHz)	Spurious emission limit
Below 1000	20 dB below the highest level of the desired power
Above 1000	20 dB below the highest level of the desired power

Attenuation below the general limits specified in Section 15.209(a) is not required.

Limit according to RSS-247, 5.5 for emissions falling not in restricted bands:

Frequency (MHz)	Spurious emission limit
Below 1000	20 dB below the highest level of the desired power
Above 1000	20 dB below the highest level of the desired power

Attenuation below the general limits specified in RSS-Gen is not required.

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

RSS-Gen, Table 6 – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	12.57675 - 12.57725	399.9 - 410	7.250 - 7.750
0.495 - 0.505	13.36 - 13.41	608 - 614	8.025 - 8.500
2.1735 - 2.1905	16.42 - 16.423	960 - 1427	9.0 - 9.2
3.020 - 3.026	16.69475 - 16.69525	1435 - 1626.5	9.3 - 9.5
4.125 - 4.128	16.80425 - 16.80475	1645.5 - 1646.5	10.6 - 12.7
4.17725 - 4.17775	25.5 - 25.67	1660 - 1710	13.25 - 13.4
4.20725 - 4.20775	37.5 - 38.25	1718.8 - 1722.2	14.47 - 14.5
5.677 - 5.683	73 - 74.6	2200 - 2300	15.35 - 16.2
6.215 - 6.218	74.8 - 75.2	2310 - 2390	17.7 - 21.4
6.26775 - 6.26825	108 - 138	2483.5 - 2500	22.01 - 23.12
6.31175 - 6.31225	149.9 - 150.05	2655 - 2900	23.6 - 24.0
8.291 - 8.294	156.52475 - 156.52525	3260 - 3267	31.2 - 31.8
8.362 - 8.366	156.7 - 156.9	3332 - 3339	36.43 - 36.5
8.37625 - 8.38675	162.0125 - 167.17	3345.8 - 3358	Above 38.6
8.41425 - 8.41475	167.72 - 173.2	3500 - 4400	
12.29 - 12.293	240 - 285	4500 - 5150	
12.51975 - 12.52025	322 - 335.4	5350 - 5460	

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic. Only the worst-case plots are listed.

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.
A 4	BAT-EMC 2022.0.32.0	01-02/68-13-001				
	ESCI	02-02/03-15-001	03/07/2024	03/07/2023		
	ESH 2 - Z 5	02-02/20-05-004	13/10/2025	13/10/2022	17/04/2024	17/04/2023
	N-4000-BNC	02-02/50-05-138				
	ESH 3 - Z 2	02-02/50-05-155	09/11/2025	09/11/2022	25/01/2024	25/07/2023
	SP 103 /3.5-60	02-02/50-05-182				
	HM 8143	02-02/50-10-016				
SER 1	ESW26	02-02/03-17-002	08/03/2024	08/03/2023		
	HFH 2 - Z 2	02-02/24-05-020	01/06/2025	01/06/2022	05/09/2024	05/09/2023
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	EA-PS2012-10	02-02/50-15-035				
SER 2	ESVS 30	02-02/03-05-006	27/07/2024	27/07/2023		
	VULB 9168	02-02/24-05-005	20/04/2024	20/04/2023	03/05/2024	03/05/2023
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	EA-PS2012-10	02-02/50-15-035				
	50F-003 N 3 dB	02-02/50-21-010				
SER 3	FSW43	02-02/11-21-001	22/05/2024	22/05/2023		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	LNA-40-18004000-33-5P	02-02/17-20-002				
	3117	02-02/24-05-009	12/07/2024	12/07/2023		
	BBHA 9170	02-02/24-05-013	21/03/2026	21/03/2023	21/03/2024	21/03/2023
	VLP-1602 PRO	02-02/50-10-015				
	EA-PS2012-10	02-02/50-15-035				
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	KMS116-GL140SE-KMS116-	02-02/50-20-026				
	BAT-EMC 2022.0.32.0	02-02/68-13-001				