FCC ID: 2ACT5-G

EMI – TEST REPORT

- FCC Part 15.247, RSS210 -

Test Report No. :	**T38935-00-03TK**	21. November 2014 Date of issue

Type / Model Name : One Touch Select Plus Flex

Product Description : Blood glucose meter with Bluetooth 4.0 Low Energy

Applicant : Lifescan Scotland Ltd.

Address : Beechwood Park North

INVERNESS, IV2 3ED, SCOTLAND

Manufacturer : Lifescan, Division of Cilag GmbH International

Address : Gubelstrasse 34

6300 ZUG, SWITZERLAND

Licence holder : Lifescan, Division of Cilag GmbH International

Address : Gubelstrasse 34

6300 ZUG, SWITZERLAND

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

DAkkS Deutsche Akkreditierungsstelle D-PL-12030-01-00

Contents

Attachment A as separte supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2013)

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 (September, 2013)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
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

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 2.1093	Radiofrequency radiation exposure evaluation: portable device

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

ANSI C63.4: 2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10: 2009	Testing Unlicensed Wireless Devices
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
KDB 558074 D01 v03r02	Guidance for performing compliance measurements on Digital Transmission Systems (DTS) Operating Under §15.247
KDB 447498 D01 v05r02	Mobile and Portable Devices RF Exposure Procedures and Equipment Autorization Polices

2 SUMMARY

2.1 Test result summary

WLAN device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 7.2.4.	AC power line conducted emissions	not applicable
15.247(a)(2)	RSS210, A8.2(a)	-6 dB EBW	passed
15.247(b)(3)	RSS-210, A8.4(4)	Peak power	passed
15.247(d)	RSS-210, A8.5	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 7.2.2	Emissions in restricted bands	passed
15.247(e)	RSS-210, A8.2(b)	PSD	passed
15.35(c)	RSS-Gen, 4.5	Pulsed operation	not applicable
15.247(i)	RSS 102, 2.5.2	MPE	passed
KDB 447498	RSS 102, 4	RF exposure consideration for SAR	passed
15.247(b)(4)	RSS-Gen, 7.1.2	Antenna requirement	passed
	RSS-Gen, 7.2.6	Transmitter frequency stability	not applicable
	RSS-Gen, 4.6.1	99 % Bandwidth	passed
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 Gen, Issue 3, December 2010
RSS 210, Issue 8, December 2010
RSS 102, Issue 4, March 2010

2.2 General remarks

The EUT is a Bluetooth 4.0 Low Energy system. The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band. A single PCB antenna is used within the system. The EUT must be controlled via terminal programm to select the modulation and data rate manually. A personal computer was used to control the settings of the EUT.

Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan WLAN Standard 802.15.1:

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

Note: The marked frequencies are used for testing.

Antenna

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

Number	Characteristic	Type	Plug	*f*-range (GHz)	Gain (dBi)
1	Omni	PCB antenna	none	2.4 - 2.4835	n/a

Transmit operating modes

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

- 1000 kbps (kbps = *kilobits per second)*

2.3 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 : 12 November 2014

Testing concluded on : 19 November 2014

Checked by:

Klaus Gegenfurtner
I confirm the correctness and Integrity of this documents
2014.12.10 08:36:22 +01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Tobias Kammerer
I`m the author of this document
2014.12.10 08:28:25 +01'00'

Tobias Kammerer
Radio Team

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT see attachment A

3.2 Power supply system utilised

Power supply voltage, V_{nom} : 3.0 V DC (battery powered)

3.3 Short description of the equipment under test (EUT)

The EUT is a Bluetooth 4.0 Low Energy system. The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band. A single PCB antenna is used within the system. The modulation used by the EUT is GFSK with a data rate of 1000 kbits which means worst case for testing. The EUT has a special firmware that allows enabling a permanent advertising mode with three advertising channels. The output power is set to -4 dBm by firmware and cannot be changed during tests. The EUT has only one integrated antenna, no temporary connector and no external antenna can be connected. The EUT is run with a 3.0V coin cell battery. Further there is a USB connector that allows data transmission to a PC. An active USB connection prohibits wireless transmission.

Number of tested samples:	2		
Serial number:	G2GRJ012	(Radiated)	FW: 1.1.2
Serial number:	G2GRJ049	(Conducted)	FW: 1.1.2

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- TX continuous mode, modulated

EUT configuration:

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

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

- Toshiba Laptop Model : Tecra A11-127
- N/A Model : -
- N/A Model : -
- N/A Model : -

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.

4.4 Measurement protocol for FCC and IC

4.4.1 General information

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A

In compliance with RSS 210 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.1.2 Details of test procedures

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.5 Determination of worst case measurement conditions

Measurements have been made in all three orthogonal axes and the settings of the EUT were 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.

The tests are carried out in the following frequency band:

2400 MHz – 2483.5 MHz

Preliminary tests were performed to find the worst case mode from all possible combinations between available modulations and data rates. The output power of the chipset supplies an output power range from +4 dBm to -30 dBm (P0 to P6) in 4 dB steps down to -20 dBm. The final step from P6 to P7 goes down from -20 dBm to -30dBm. The customer uses the fixed power level of -4 dBm (P2) being set within the firmware for the application. This power level is declared as worst case level and was set for the performed tests.

The firmware for the EUT provides the TX continuous mode, modulated using the advertising mode. The EUT was set with the modulation used in the application to transmit data during the tests. A duty cycle (x) of nearly x = 1.8 % from an internal packet generator was set.

Following channels and test modes has been selected for the final test as listed below:

BT 4.0 LE	Available channels	Tested channels	Power setting	Modulation	Data rate
802.15.1	00 to 39	37, 38, 39	P2 (-4 dBm)	GFSK	1000 kbps

The antenna is a PCB antenna being connected directly to the RF-output. A conducted measurement was not performed.

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: NONE

Remarks: Not applicable because the EUT does not transmit when it is connected via USB.

5.2 Emission bandwidth

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

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test setup

Note: Photo documentation of the test setup can be viewed in Attachment C

5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(2):
Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyser.

Spectrum analyser settings:
RBW: 100 kHz, VBW: 300 kHz, Detector: Peak, Sweep time: Auto sweep

The table below shows the settings according to ANSI C63.4:

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

5.2.5 Test result

Standard 802.15.1

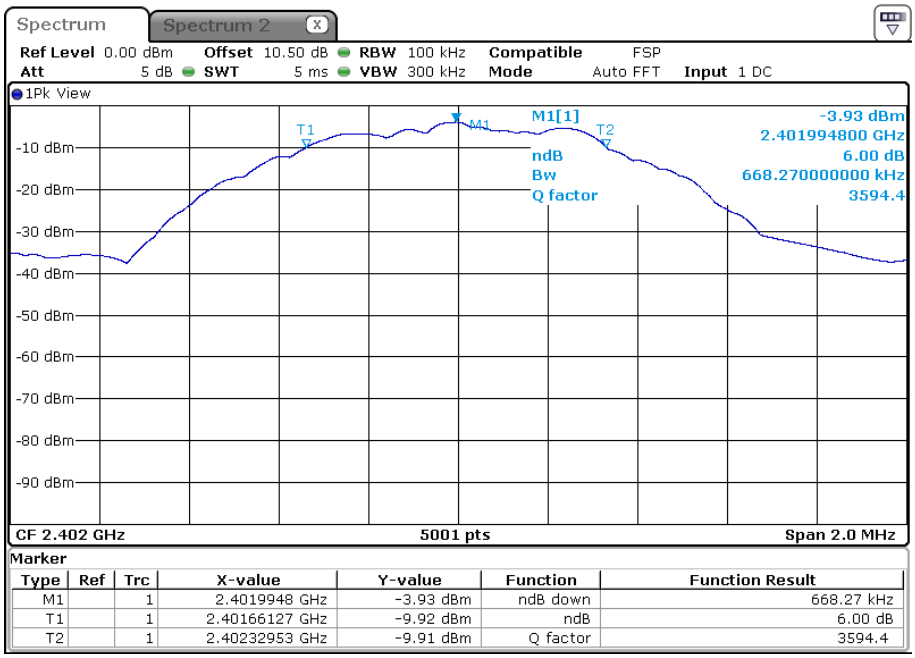
Channel	Centre frequency (MHz)	6 dB bandwidth (kHz)	Minimum limit (MHz)
37	2402	668.26	0.5
38	2426	656.27	0.5
39	2480	659.46	0.5

The requirements are **FULFILLED.**

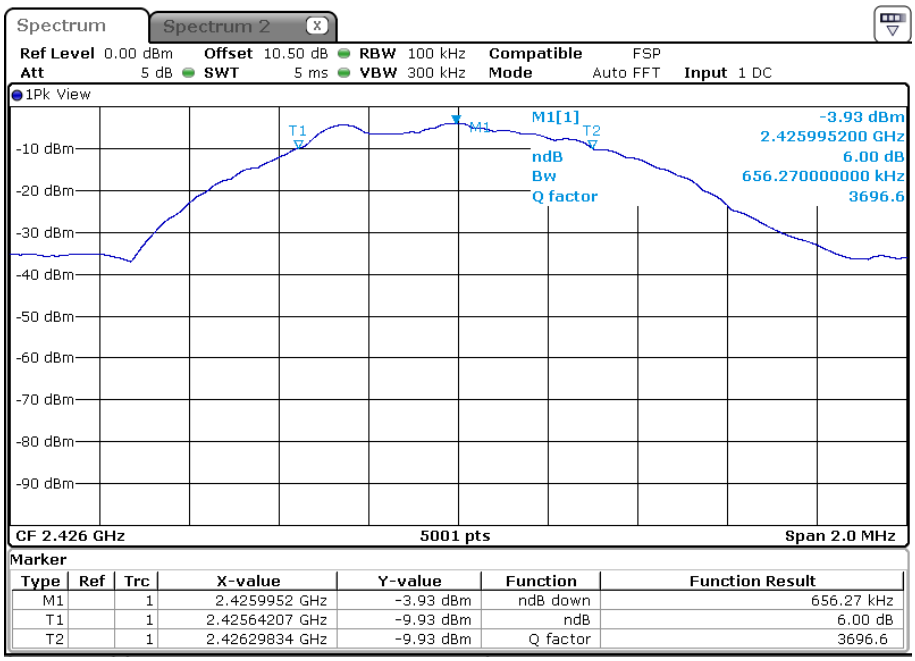
Remarks: For detailed test results please refer to following test protocols.

5.2.6 Test protocols

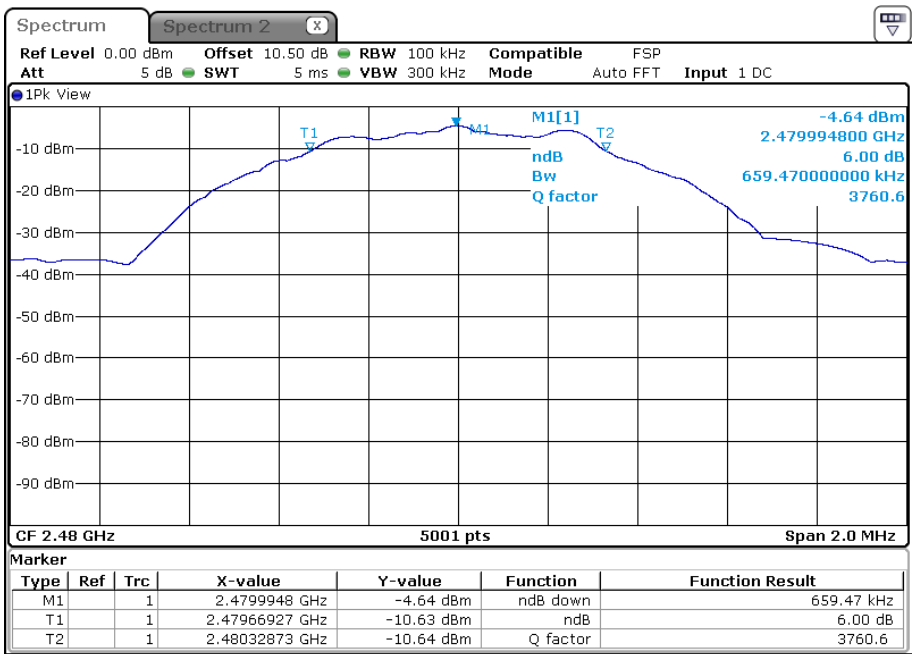
802.15.1, Channel 37 (2402 MHz)



802.15.1, Channel 38 (2426 MHz)



802.15.1, Channel 39 (2480 MHz)



5.3 Occupied bandwidth

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

5.3.1 Description of the test location

Test location: AREA4

5.3.2 Photo documentation of the test setup

Note: Photo documentation of the test setup can be viewed in Attachment C

5.3.1 Applicable standard

According to RSS-Gen, 4.6.1:
When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured.

5.3.2 Description of Measurement

The bandwidth was measured with the function “bandwidth measurement” of the spectrum analyser. The EUT is connected via suitable attenuator at the spectrum analyser. The measurement is repeated for every different modulation standard of the EUT and recorded.

Spectrum analyser settings:
RBW: 30 kHz, VBW: 100 kHz, Detector: Peak detector, Sweep time: auto

5.3.3 Test result

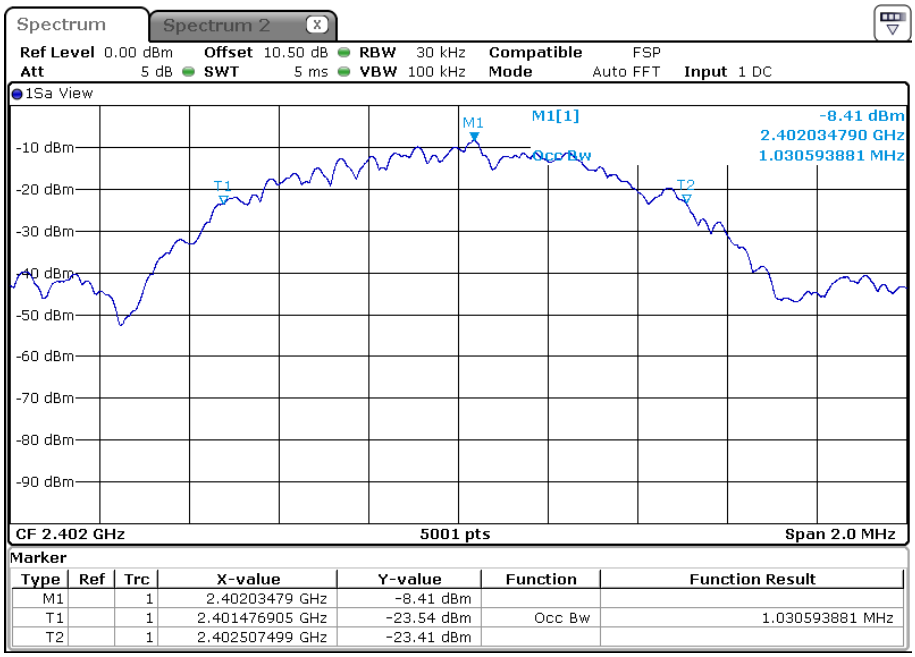
Standard 802.15.1

Channel	Centre frequency (MHz)	99 % bandwidth (kHz)
37	2402	1030.59
38	2426	1011.80
39	2480	1019.80

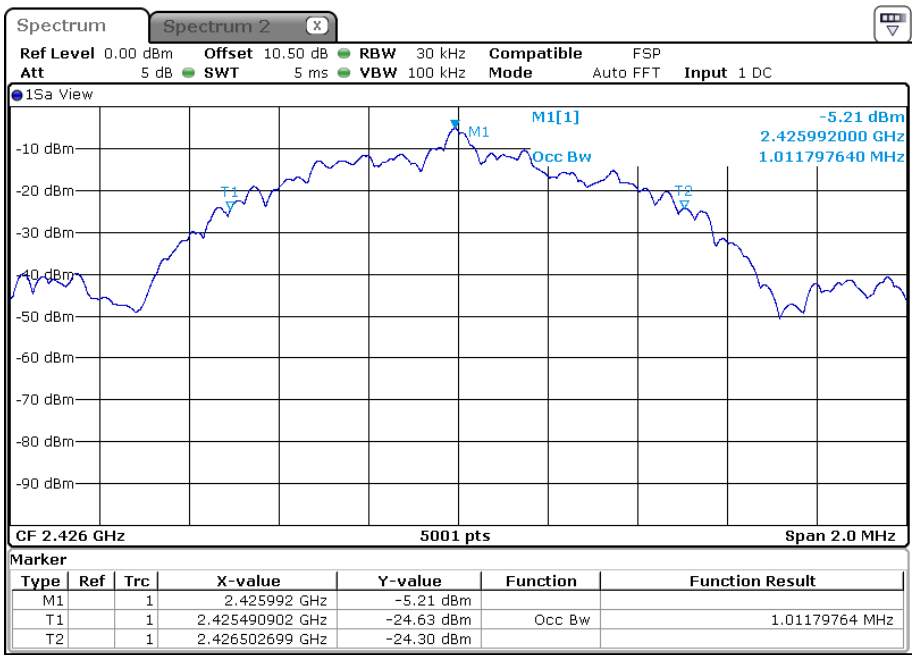
Remarks: For detailed test result please refer to following test protocols. The RSS Gen defines no limit for the occupied bandwidth!

5.3.4 Test protocols

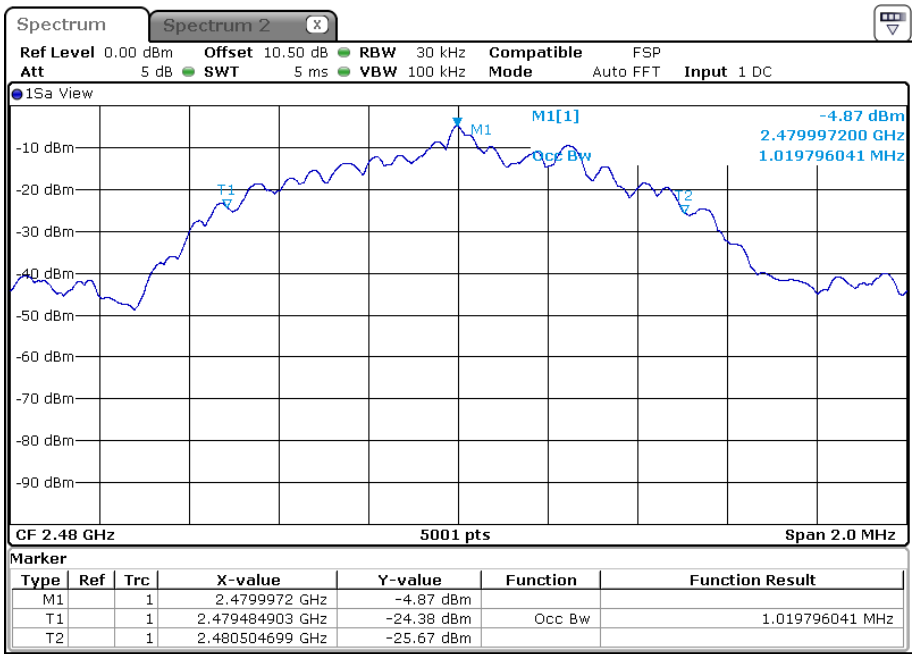
802.15.1, Channel 37 (2402 MHz)



802.15.1, Channel 38 (2426 MHz)



802.15.1, Channel 39 (2480 MHz)



5.4 Maximum peak radiated output power

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

5.4.1 Description of the test location

Test location: Anechoic chamber 1

5.4.2 Photo documentation of the test setup

Note: Photo documentation of the test setup can be viewed in Attachment C

5.4.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):
For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

5.4.4 Description of Measurement

The maximum peak radiated output power is measured using a spectrum analyser following the procedure set out in KDB 558074, item 9.1.1. The EUT is set in TX continuous advertising mode while measuring. The radiated measurement was performed in a fieldstrength measurement. Therefore the formula set out in KDB 558074, item 12.2.2 e) is changed into the following term:

$$E = EIRP - (20*\log_{10} 3) + 104.8$$

5.4.5 Test result

802.15.1, 1000 kbps, TX		Test results radiated			
		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
Lowest frequency: CH37					
T_{nom}	V_{nom}	92.3	-3.0	36.0	-39.0
Middle frequency: CH38					
T_{nom}	V_{nom}	91.6	-3.7	36.0	-39.7
Highest frequency: CH39					
T_{nom}	V_{nom}	91.5	-3.8	36.0	-39.8

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	36	4.0
2400-2483.5	**36**	**4.0**
5725-5850	36	4.0

The requirements are **FULFILLED.**

Remarks: N/A

5.5 Power spectral density

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

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test setup

Note: Photo documentation of the test setup can be viewed in Attachment C

5.5.3 Applicable standard

According to FCC Part 15, Section 15.247(e):
For digitally modulated systems, the power spectral density radiated from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the radiated output power shall be used to determine the power spectral density.

5.5.4 Description of Measurement

The measurement is performed using the procedure 10.2 set out in KDB-558074. Therefore the PKPSD is measured conducted. The max peak was located and measured with the spectrum analyser and the marker set to peak. An offset of 10.5 dB was set to compensate the matching and cable attenuation. The maximum antenna gain being computed in paragraph 5.9 of this test report is used to calculate the maximum peak power spectral density.

Spectrum analyser settings:
RBW: 3 kHz, VBW: 10 kHz, Detector: Peak, Sweep time: Auto

5.5.5 Test result

Standard 802.15.1

802.15.1, 1000 kbps, 1 TX		Test results conducted				
		PD [Pmax] (dBm/3kHz)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm/3kHz)	Margin (dB)
Lowest frequency: 2402 MHz						
T_{nom}	V_{nom}	-19.2	-0.4	-19.6	14.0	-33.6
Middle frequency: 2426 MHz						
T_{nom}	V_{nom}	-20.0	-0.4	-20.4	14.0	-34.4
Highest frequency: 2480 MHz						
T_{nom}	V_{nom}	-21.1	-0.4	-21.5	14.0	-35.5

Power spectral density limit according to FCC Part 15, Section 15.247(e):

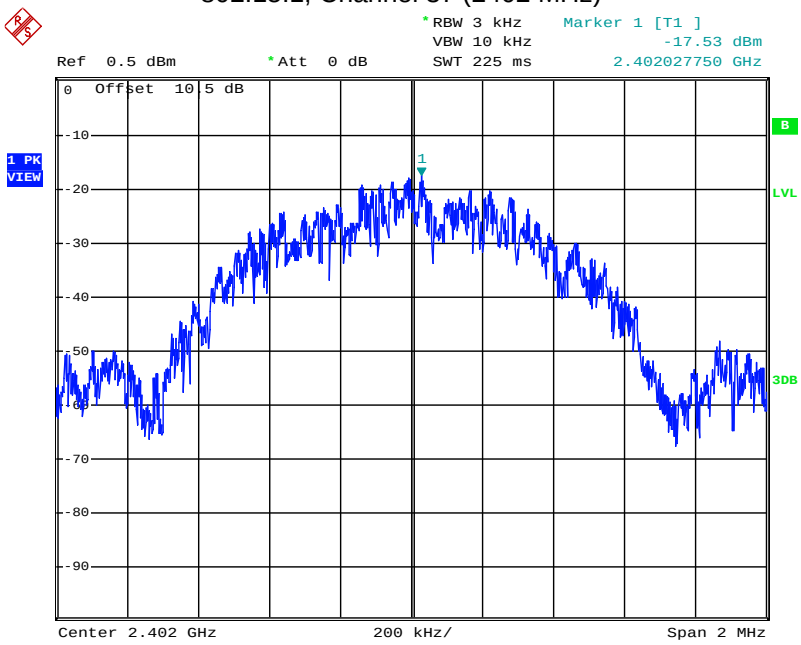
Frequency (MHz)	Power spectral density limit (EIRP) (dBm/3 kHz)
2400 - 2483.5	14

The requirements are **FULFILLED.**

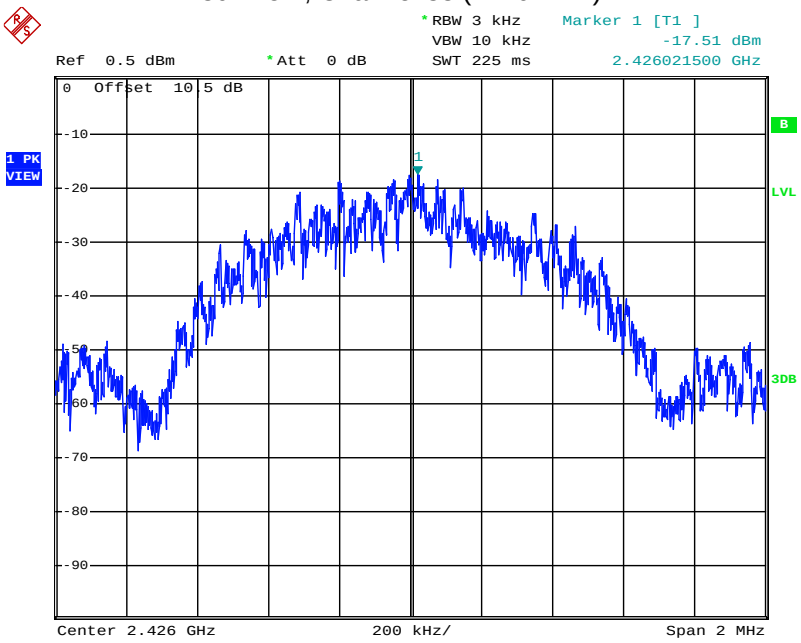
Remarks: For detailed test results please refer to following test protocols.

5.5.6 Test protocols

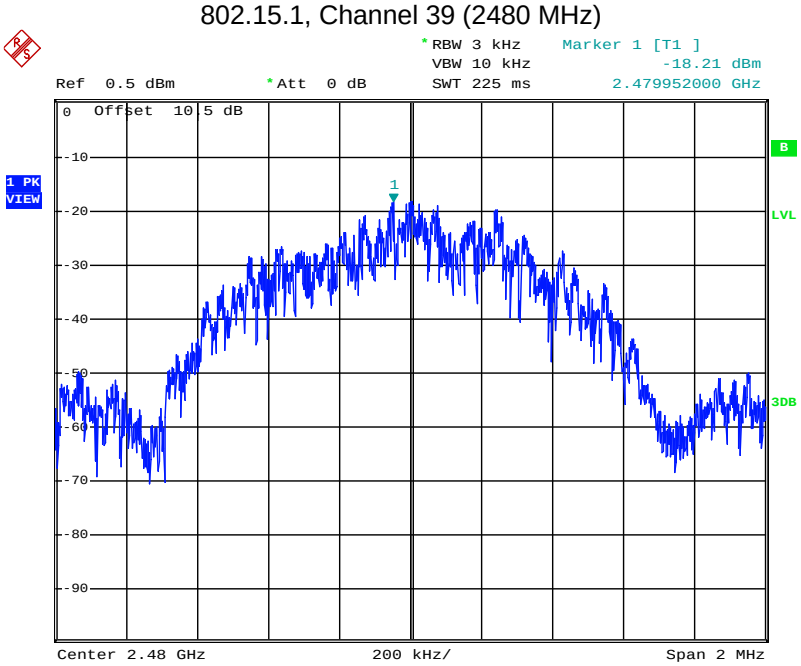
802.15.1, Channel 37 (2402 MHz)



802.15.1, Channel 38 (2426 MHz)



802.15.1, Channel 39 (2480 MHz)



5.6 Radiated emissions in restricted bands

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

5.6.1 Description of the test location

Test location: OATS 1
Test location: Anechoic Chamber 1

Test distance: 3 m

5.6.2 Photo documentation of the test setup

Note: Photo documentation of the test setup can be viewed in Attachment C

According to FCC Part 15, Section 15.205(a):
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

5.6.3 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. To show compliance the FCC Part 15, section 15.35(c) was used. The correction factor being calculated in section 5.9 .

Test receiver settings for SER2:
RBW: 120 MHz, Detector: Quasi peak, Meas. Time: 1 s,

Spectrum analyser settings for SER3:
RBW: 1 MHz, VBW: 3 MHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

Spectrum analyser settings for SER3 re-measurements:
RBW: 1 MHz, VBW: 3 MHz, Detector: RMS, Trace: Max. hold, Sweep: Auto

5.6.1 Test result

Standard 802.15.1

Emissions 30 MHz – 1000 MHz, SER2

Advertising mode with CH37, CH38, CH39							
Test conditions: TX, P2, 1000 kbps							
			Test results				
Start *f*	Stop *f*	RBW	Maximum emission		Limit	Margin	Detector
(MHz)	(MHz)	(kHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
30	1000	120	250.00	19.6	46.0	-26.5	QP
30	1000	120	265.73	14.4	46.0	-31.6	QP
30	1000	120	320.00	19.7	46.0	-26.3	QP
30	1000	120	399.90	17.0	46.0	-29.0	QP
30	1000	120	500.00	20.3	46.0	-25.7	QP
30	1000	120	597.36	22.5	46.0	-23.5	QP
Measurement uncertainty				±6 dB			

Emissions 1 GHz – 25 GHz

Advertising mode with CH37, CH38, CH39							
Test conditions: TX, P2, 1000 kbps							
Peak pre-scan			Test results				
Start *f*	Stop *f*	RBW	Maximum emission		AVLimit	Margin	Detector
(MHz)	(MHz)	(kHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
1000	2400	1000	2323.30	50.9	54.0	-3.1	Pk
2483.5	4000	1000	2491.84	53.6	54.0	-0.5	Pk
4000	5000	1000	4803.40	50.3	54.0	-3.7	Pk
5000	8000	1000	7922.50	46.1	54.0	-7.9	Pk
8000	12000	1000	11935.00	49.0	54.0	-5.0	Pk
12000	18000	1000	16473.00	52.3	54.0	-1.7	Pk
18000	25000	1000	24864.38	55.0	54.0	1.0	Pk
Measurement uncertainty				±6 dB			

Re-measrement for wideband emissions

Advertising mode with CH37, CH38, CH39							
Test conditions: TX, P2, 1000 kbps							
AV re-measurement			Test results				
Start *f*	Stop *f*	RBW	Maximum emission		AVLimit	Margin	Detector
(MHz)	(MHz)	(kHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
18000	25000	1000	24900.25	46.5	54.0	-7.5	RMS
Measurement uncertainty				±6 dB			

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

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

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

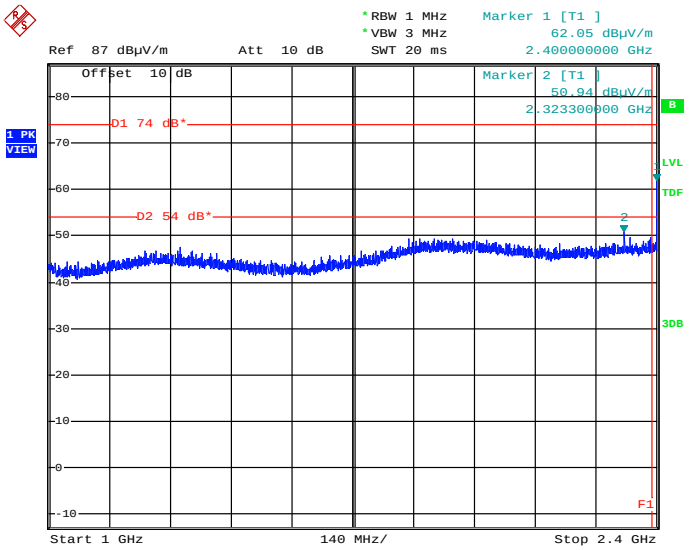
The requirements are **FULFILLED.**

Remarks: The measurement was performed up to the 10th harmonic. All emissions not reported in this test report are more than 20 dB below the specified limit. For detailed test results please see the Following test protocols.

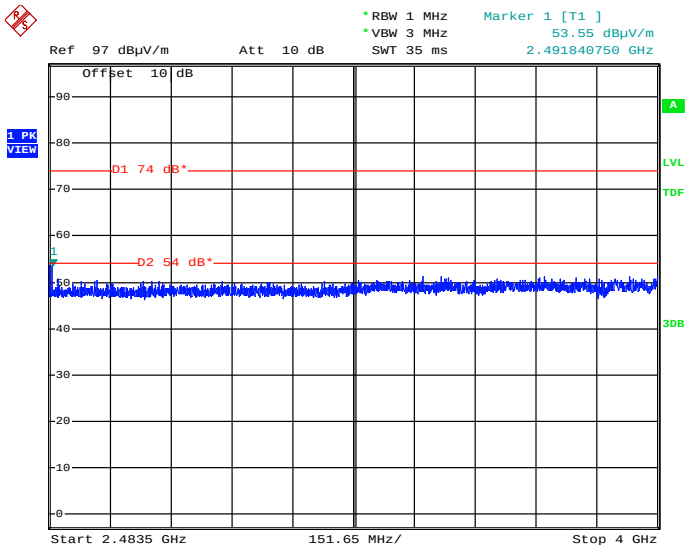
5.6.2 Test protocols radiated emissions SER3

802.15.1, Channel 37, 38, 39 (Advertising mode)

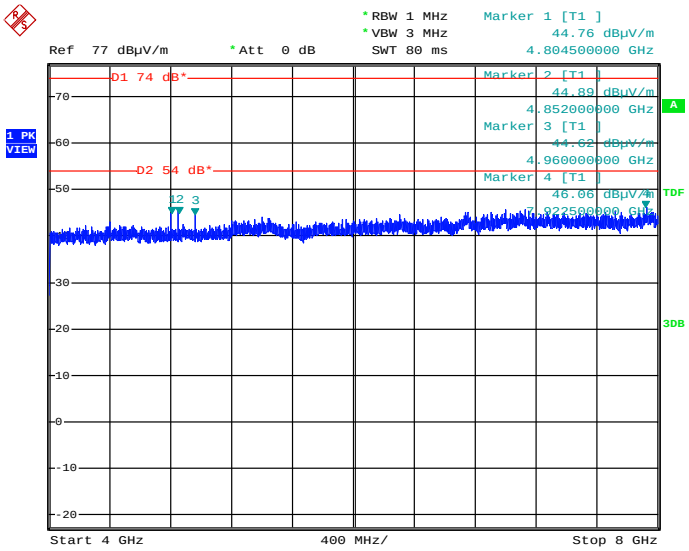
1 GHz – 2.4 GHz



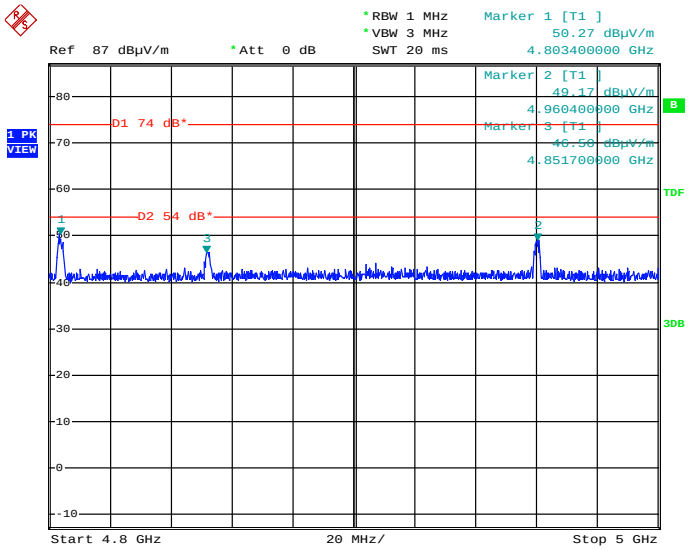
2.4835 GHz - 4 GHz



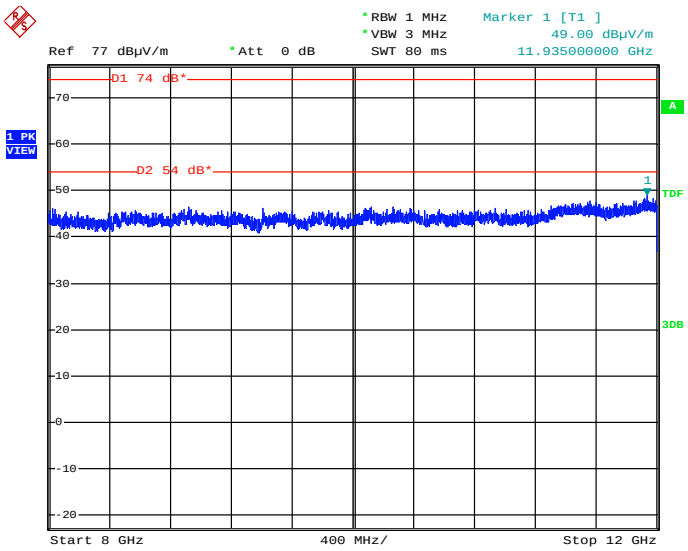
4 GHz – 8 GHz



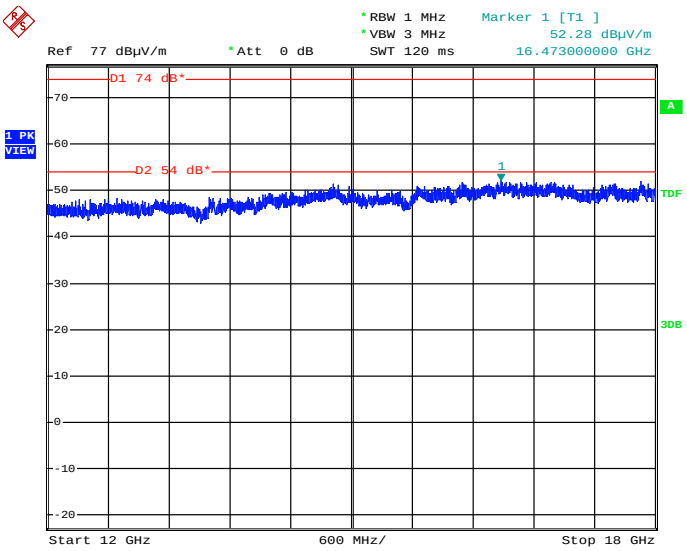
4.8 GHz – 5.0 GHz



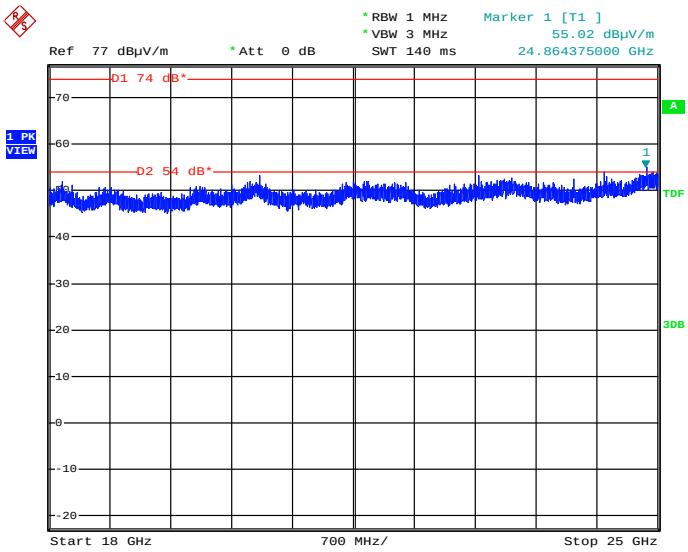
8 GHz – 12 GHz



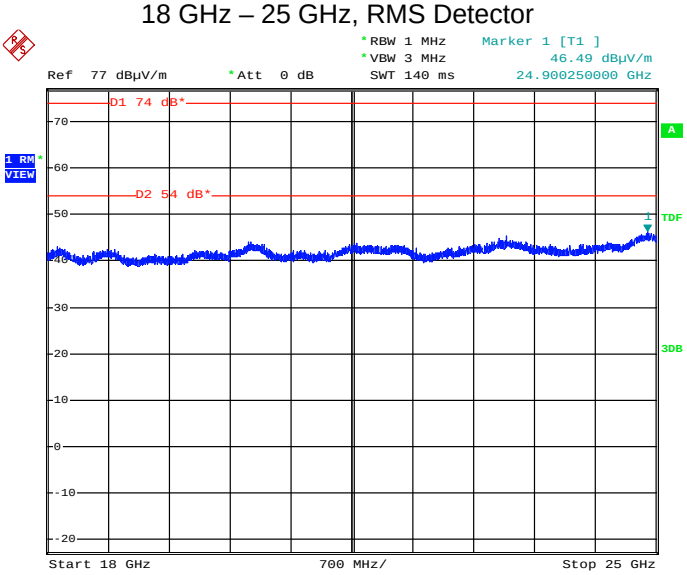
12 GHz – 18 GHz



18 GHz – 25 GHz



18 GHz – 25 GHz, RMS Detector



5.7 Spurious emissions radiated

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

5.7.1 Description of the test location

Test location: NONE

Test distance: -

Note: Photo documentation of the test setup can be viewed in Attachment C

5.7.2 Applicable standard

According to FCC Part 15, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated 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 an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.7.3 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. 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.

Test receiver settings for SER2:
RBW: 120 MHz, Detector: Quasi peak, Mes. Time: 1 s,

Spectrum analyser settings for SER3:
RBW: 100 kHz, VBW: 300 kHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

5.7.4 Test result

Note:
Measurements were performed in the frequency range from 1 GHz up to 25 GHz with the analyser settings for restricted band measurements to show compliance for emissions falling into restricted bands, else the band edge compliance is fulfilled. In the frequency ranges from 9 kHz up to 30 MHz and from 18 GHz up to 25 GHz no emission can be detected.
According to FCC Part 15, Section 15.205(a):
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

Limit according to FCC Part 15, Section 15.247(d) for emissions falling not in restricted bands:
In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated 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 an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

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

The requirements are **FULFILLED.**

Remarks: N/A

5.8 RF exposure consideration for SAR test exclusion

According to KDB 447498 D01 General RF Exposure Guidance v05r02 chapter 4.3.1 the 1-g SAR number is calculated for a distance of **1** mm using the following formula.

$$\left(\frac{max.\ Pchannel\ (mW)}{Distance\ (mm)}\right) * \sqrt{f(GHz)} \leq 3$$

Where:

Max. Pchannel = EIRP (mW)
Distance = 5 mm
f (GHz) = Channel frequency (MHz) divided by thousand

5.8.1 Test result

Standard 802.15.1

Channel frequency (MHz)	EIRP (dBm)	EIRP (mW)	1-g SAR (1)	Limit 1-g SAR (1)
2402	-3.0	0.50	0.78	3.0
2426	-3.7	0.43	0.67	3.0
2480	-3.8	0.42	0.66	3.0

The limits for SAR test exclusion threshold are given in KDB 447498 D01 General RF Exposure Guidance Appendix A.

The requirements are **FULFILLED.**

Remarks: N/A

5.9 Correction for pulse operation (duty cycle)

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

5.9.1 Description of the test location

Test location: AREA4

5.9.2 Photo documentation of the test setup

Note: Photo documentation of the test setup can be viewed in Attachment C

5.9.3 Applicable standard

According to FCC Part 15A, Section 15.35(c):
When the radiated emission limits are expressed in terms of average value and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete puls train, including blanking intervals, as long as the pulse train does not exceed 0.1s. In cases where the puls train exceeds 0.1s, the measured field strength shall be determined from the average absolute voltage during a 0.1s interval during which the field strength is at its maximum. The exact method of calculating the average field strength shall be submitted.

5.9.4 Description of Measurement

The duty cycle factor (dB) is calculated applying the following formula:

$$K_E = 20 \log \frac{(t_{iW}/T_B) * t_{iB}}{T_W}$$

Where:

K_E = pulse operation correction factor
t_{iw} = pulse duration for one complete pulse track
t_{iB} = pulse duration for one pulse
T_w = a period of the pulse track
T_B = a period of one pulse

5.9.5 Test result

CH	t_{iw} (ms)	T_w (ms)	t_{iB} (ms)	T_B (ms)	K_E (dB)
37	100	100	1.84	100	-34.7

Remarks: The duty cycle has been calculated by averaging the sum of the pulse widths over 100 ms width with the highest average value.

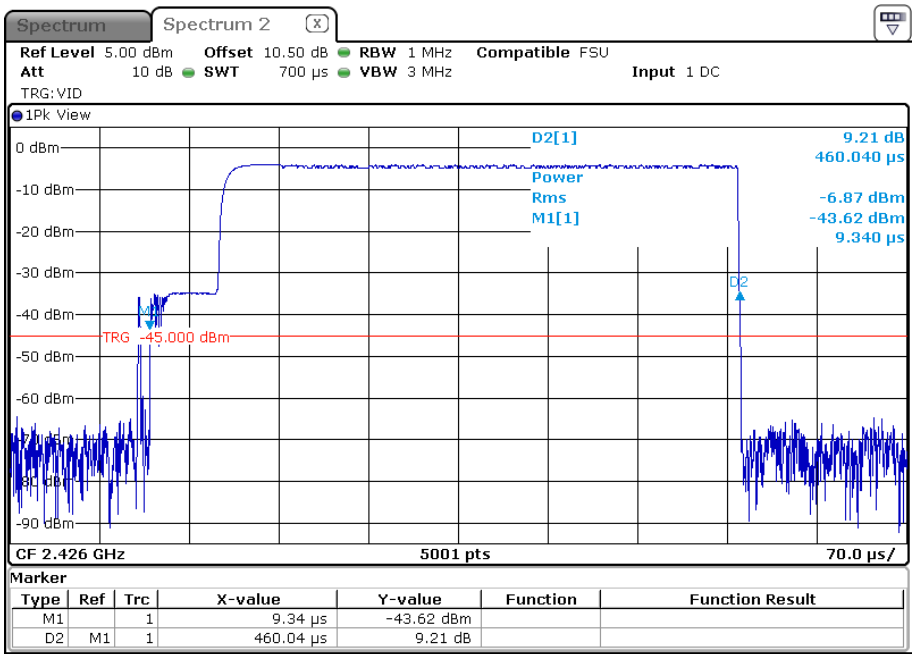
For detailed results, please see the test protocol below.

5.9.6 Test protocol

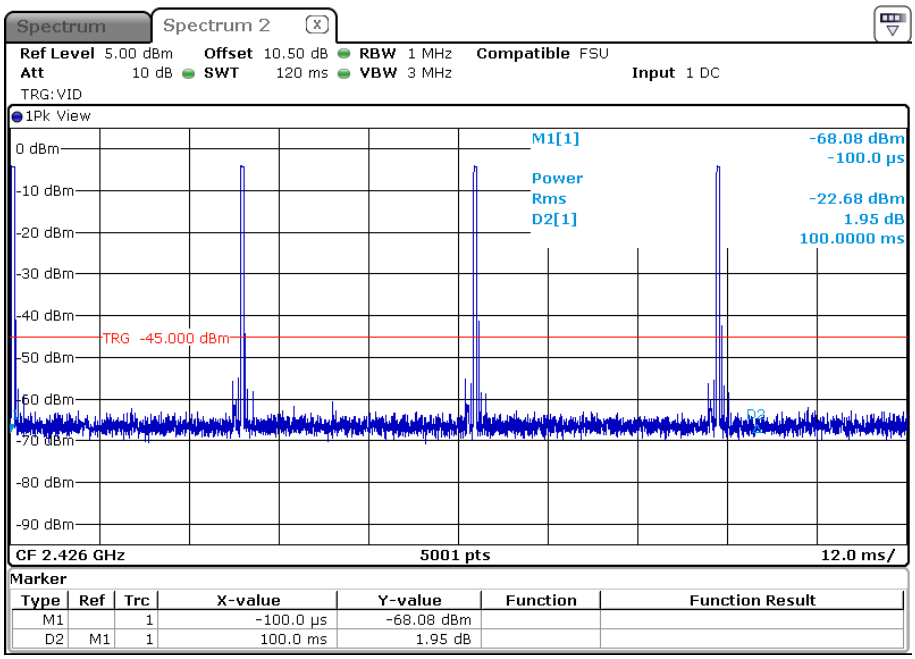
Correction for Pulse Operation (Duty Cycle)

FCC Part 15A, Section 15.35(c)

Pulse duration for one pulse



Pulses within a pulse train of 100 ms



5.10 Antenna application

For test instruments and accessories used see section 6 Part **CPC3** .

5.10.1 Description of the test location

Test location: AREA4

5.10.2 Photo documentation of the test setup

Note: Photo documentation of the test setup can be viewed in Attachment A

5.10.3 Applicable standard

According to FCC Part 15C, Section 15.203:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has an integrated antenna. No other antenna can be used with the device. Additional to that a conducted output power measurement was performed. According to the following formula the maximum gain of the antenna was calculated.

$$EIRP = P + G$$

Where:

EIRP = Equivalent isotropic radiated power
P = Conducted output power
G = Calculated gain of the antenna

Result:

802.15.1, 1000 kbps, TX		Test results conducted		
		EIRP (dBm)	P (dBm)	Antenna Gain (dBi)
Lowest frequency: CH37				
T_{nom}	V_{nom}	-3.0	-3.9	0.9
Middle frequency: CH38				
T_{nom}	V_{nom}	-3.7	-3.9	0.3
Highest frequency: CH39				
T_{nom}	V_{nom}	-3.8	-4.6	0.8

Th supplied antenna meets the requirements of part 15.203 and 15.204.

5.10.4 Antenna requirements

According to FCC Part 15C, Section 15.247(b)(4):
The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The output power has not to be reduced.

5.10.5 Photo documentation of the used antenna

Note: Photo documentation of the test setup can be viewed in Attachment A

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.
CPC 3	ESR 7	02-02/03-13-001	03/06/2015	03/06/2014		
	NSP 3630	02-02/50-14-015				
CPR 3	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
DC	ESR 7	02-02/03-13-001	03/06/2015	03/06/2014		
	NSP 3630	02-02/50-14-015				
MB	ESR 7	02-02/03-13-001	03/06/2015	03/06/2014		
	NSP 3630	02-02/50-14-015				
SER 2	ESVS 30	02-02/03-05-006	03/07/2015	03/07/2014		
	VULB 9168	02-02/24-05-005	08/04/2015	08/04/2014	04/03/2015	04/09/2014
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 3	FSP 40	02-02/11-11-001	02/10/2015	02/10/2014		
	JS4-18004000-30-5A	02-02/17-05-017				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	BBHA 9170	02-02/24-05-013	15/05/2017	15/05/2014	15/05/2015	15/05/2014
	Sucoflex N-2000-SMA	02-02/50-05-075				
	KMS102-0.2 m	02-02/50-11-020				
	SF104/11N/11N/1500MM	02-02/50-13-015				