RADIO TEST REPORT

No. 1906451STO-001, Ed. 1

RF Performance

EQUIPMENT UNDER TEST

Equipment:	Heart Monitor
Type/Model:	Coala
Manufacturer:	Coala-Life AB
Tested by request of:	Coala-Life AB

SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards:

47 CFR Part 15 Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 Subpart B: Unintentional radiators

RSS-GEN Issue 5 (2018): General requirements of compliance of radio apparatus

RSS-247 Issue 2 (2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

For details, see clause 2 – 4.

Date of issue: March 29, 2019

Tested by: Matti Virkki

Approved by: Stefan Andersson

Revision History

Edition	Date	Description	Changes
1	March 29, 2019	First release	

CONTENTS

1 CLIENT INFORMATION

The EUT has been tested by request of

Company	Coala Life AB Riddargatan 18 114 51 Stockholm Sweden
Name of contact	Johanna Tulkki

2 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment:	Heart Monitor	
Type/Model:	Coala	
Brand name:	Coala	
Manufacturer:	Coala Life AB	
Transmitter frequency range:	2402 – 2480 MHz	
Receiver frequency range:	2402 – 2480 MHz	
Frequency agile or hopping:	☒ Yes	☐ No
Antenna:	☒ Internal antenna	☐ External antenna
Antenna connector:	☒ None, internal antenna	☐ Yes
Antenna gain:	+1.67 dBi	
Rating RF output power:	-10 dBm (measured conducted)	
Type of modulation:	GFSK	
Transmitter stand by mode supported:	☒ Yes	☐ No

2.2 Additional information about the EUT

The EUT consists of the following units:

Unit	Type	Serial number
Coala Heart Monitor	Coala	00012401707005543 (FW v.286) * 00012401704000883 (FW v.286) * 00012401648002712 (FW 1eb90e8) * 00012401704002182 (FW 1eb90e8) *
Docking station	Coala Charge Station	
PSU for docking station	SAW06B-050-1000U	

*Client supplied four EUTs. It is the same product with different firm wares and with or without RF-connecter for conducted measurements.

2.3 Test signals and operation modes

Continuous signal with GFSK modulation
Normal operation mode

2.4 Modifications made to improve EMC-characteristics

No modifications were made during the testing.

3 TEST SPECIFICATIONS

3.1 Standards

Requirements:

47 CFR Part 15 Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 Subpart B: Unintentional radiators

RSS-GEN Issue 5 (2018): General requirements of compliance of radio apparatus.

RSS-247 Issue 2 (2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test methods:
ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3.2 Additions, deviations and exclusions from standards and accreditation

No additions, deviations or exclusions have been made from standards and accreditation.

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
Torshamnsgatan 43,
P.O. Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913
Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002
Intertek Semko AB is an ISED listed test facility with assigned code 2042G
Intertek Semko AB is an ISED recognized wireless testing laboratory with CAB identifier SE0003.

Measurement chambers

Measurement Chamber	Type of chamber	IC Site filing #
STORA HALLEN	Semi-anechoic 10 m and 3 m	2042G-2
Radiohallen	Fully anechoic 3m	2042G-4

4 TEST SUMMARY

The results in this report apply only to sample tested:

Requirement	Description	Result
FCC §15.203 **RSS-GEN 8.3** **FCC §15.247 (b)(4)** **RSS-247 5.4(4), 5.4(5)**	**Antenna** The EUT has integrated non detachable antenna which can't be removed without breaking the EUT. The antenna gain is less than 6 dBi	**PASS**
FCC Part 15.205 **RSS-GEN 8.10**	**Restricted bands of operations** EUT operates in un restricted 2400 – 2483.5 MHz frequency band.	**PASS**
FCC §15.207, 15.107 **RSS-GEN 8.8 table 3**	**Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port** The EUT complies with the limits. See clause 5.	**PASS**
FCC §15.247 (d), 15.209(a), 15.109 **RSS-GEN 8.9** **RSS-247 5.5**	**Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz** The EUT complies with the limits. See clause 6.	**PASS**
FCC §15.247(d), 15.209(a), 15.109 **RSS-GEN 8.9** **RSS-247 5.5**	**Radiated emission of electromagnetic fields in the frequency range above 1 GHz** The EUT complies with the limits. See clause 6.	**PASS**
FCC §15.247(a)(1) **RSS-GEN 6.6** **RSS-247 5.1.a**	**Occupied bandwidth** The EUT complies with the limits. See clause 9.	**PASS**
FCC §15.247(b) **RSS-247 5.4**	**Conducted output power** The EUT complies with the limits. See clause 8	**PASS**
FCC §15.247(a)(1) **RSS-247 5.1(b)**	**Carrier frequency separation** The EUT complies with the limits. See clause 12	**PASS**
FCC §15.247(a)(1) **RSS-247 5.1 (d)**	**Number of hopping frequencies** The EUT complies with the limits. See clause 11	**PASS**
FCC §15.247(a)(1) **RSS-247 5.1](d)**	**Time of occupancy** The EUT complies with the limits. See clause 13	**PASS**
FCC §15.247(d) **RSS-247 5.5**	**Band edge** The EUT complies with the limits. See clause 7.	**PASS**

5 CONDUCTED CONTINUOUS DISTURBANCES IN THE FREQUENCY-RANGE 0.15 TO 30 MHZ

Date of test:	March 21, 2019	**Test location:**	Bur 3
EUT Serial:	00012401707005543	**Ambient temp:**	21°C
Tested by:	Usman Ul-Haq>	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	32.1 dB

5.1 Test set-up and test procedure

The test method is in accordance with ANSI C63.10-2013 section 6.2.

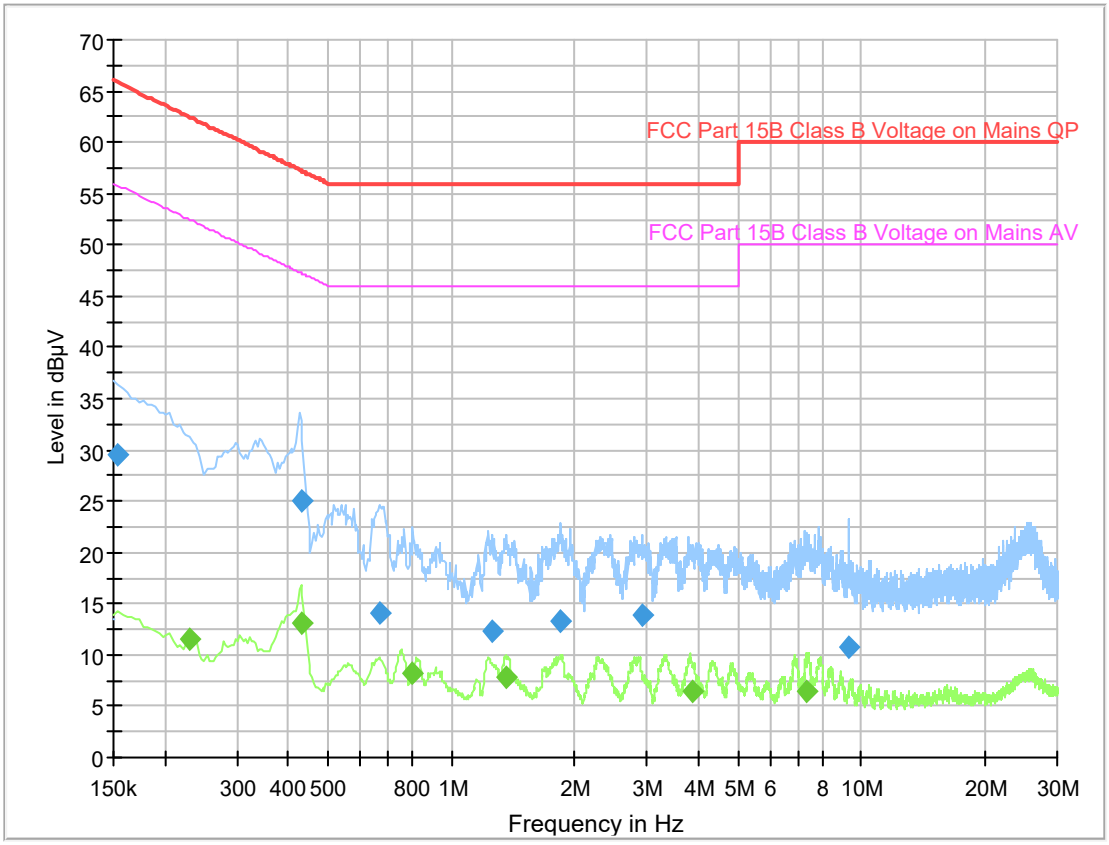
The EUT was connected to the power via Artificial Mains Networks AMN.
The EUT was placed on an insulating support 0.8 m above the floor, 0.4 m from the vertical reference ground plane (RGP) and 0.8 m from the AMN/ISN.
Overview sweeps were performed for each lead.
During the tests the EUT was operated according to the mode of operation mentioned in clause 0.

5.2 Requirement

Limits for conducted emission from AC mains
The EUT shall meet the limits for the standards.
Reference: 47 CFR §15.207, §15.107
RSS-GEN, section 8.8 table 3

Frequency range [MHz]	Limits [dBµV]	
	Quasi-Peak	Average
0.15 – 0.50	66 – 56	56 – 46
0,50 – 5.00	56	46
5.00 – 30.0	60	50

5.3 Test results



Diagram, Peak and Average overview sweep

Measurement results,

Frequency [MHz]	Level QP [dBµV]	Level Av [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.154	29.6	---	65.8	L1	36.2
0.229	---	11.5	52.5	L1	41.0
0.430	---	13.0	47.3	N	34.2
0.431	25.1	---	57.2	N	32.1
0.666	14.2	---	56.0	L1	41.8
0.799	---	8.1	46.0	N	37.9
1.254	12.3	---	56.0	N	43.7
1.357	---	7.9	46.0	L1	38.1
1.834	13.2	---	56.0	L1	42.8
2.937	13.9	---	56.0	N	42.1
3.853	---	6.5	46.0	N	39.5
7.353	---	6.4	50.0	N	43.6
9.318	10.7	---	60.0	N	49.3

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

6 RADIATED RF EMISSION IN THE FREQUENCY-RANGE 30 MHZ TO 26 GHZ

Date of test:	March 18 – 19, 2019	**Test location:**	Stora Hallen / radiohallen
EUT Serial:	00012401648002712	**Ambient temp:**	20 / 21 °C
Tested by:	Usman Ul-haq	**Relative humidity:**	20 / 29 %
Test result:	Pass	**Margin:**	14.0 dB

6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013.
The EUT was set up in order to emit maximum disturbances.
The EUT was placed on an insulating support 0.8 and 1.5 m above the turntable which is part of the reference ground plane.
Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated in the frequency-range 30 – 1000 MHz. Above 1 GHz additionally the average detector was activated.
On 30 – 1000 MHz frequency range pre-scan was made in three orthogonal EUT orientations.
Above 1 GHz frequencies the EUT was placed on a positioner which allows free rotation around X and Y axis

6.2 Test conditions

Test set-up:	**30 MHz to 1000 MHz**	
Test receiver set-up:		
Preview test:	Peak,	RBW 120 kHz. VBW 1 MHz
Final test:	Quasi-Peak,	RBW 120 kHz
EUT height above ground plane:	0.8 m	
Measuring distance:	3 m	
Measuring angle:	0 – 359°	
Antenna		
Height above ground plane:	1 – 4 m	
Polarisation:	Vertical and Horizontal	
Type:	Bilog	

Test set-up:	**1 GHz – 26.5 GHz**	
Test receiver set-up:		
Preview test:	Peak,	RBW 1 MHz. VBW 3 MHz
	Average,	RBW 1 MHz. VBW 3 MHz
Final test:	Peak,	RBW 1 MHz
	Average	Peak value + 20 x LOG (Duty cycle)
EUT height above ground plane:	1.5 m	
Measuring distance:	3 m	
Measuring angle:	0 – 359°	
Antenna		
Height above ground plane:	1,5 m	
Polarisation:	Vertical and Horizontal	
Type:	Horn	
EUT positioner:	Activated	

6.3 Requirements

Within restricted bands and receive mode:
Reference: CFR 47 §15.209, §15.109, RSS-Gen section 8.9

Field strength of emissions must comply with limits shown in table below

Frequency range [MHz]	Field strength at 3 m (dBµV/m)	Field strength at 10 m (dBµV/m)	Detector (dBµV/m)
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.0	Quasi Peak
216 – 960	46.0	35.5	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	43.5 / 63.5	Average / Peak

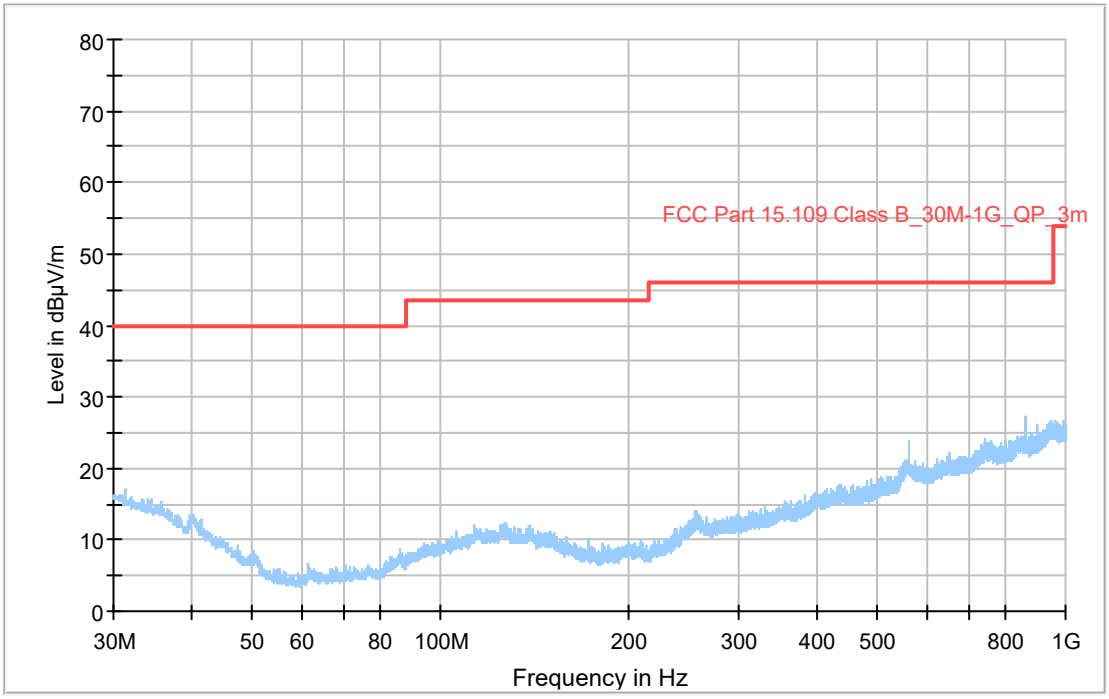
The values for 10 m measuring distance are calculated by subtracting 10.5 dB from the 3 m limit. (i.e. an extrapolation factor of 20 dB/decade according to CFR 47 §15.31(f)(1))

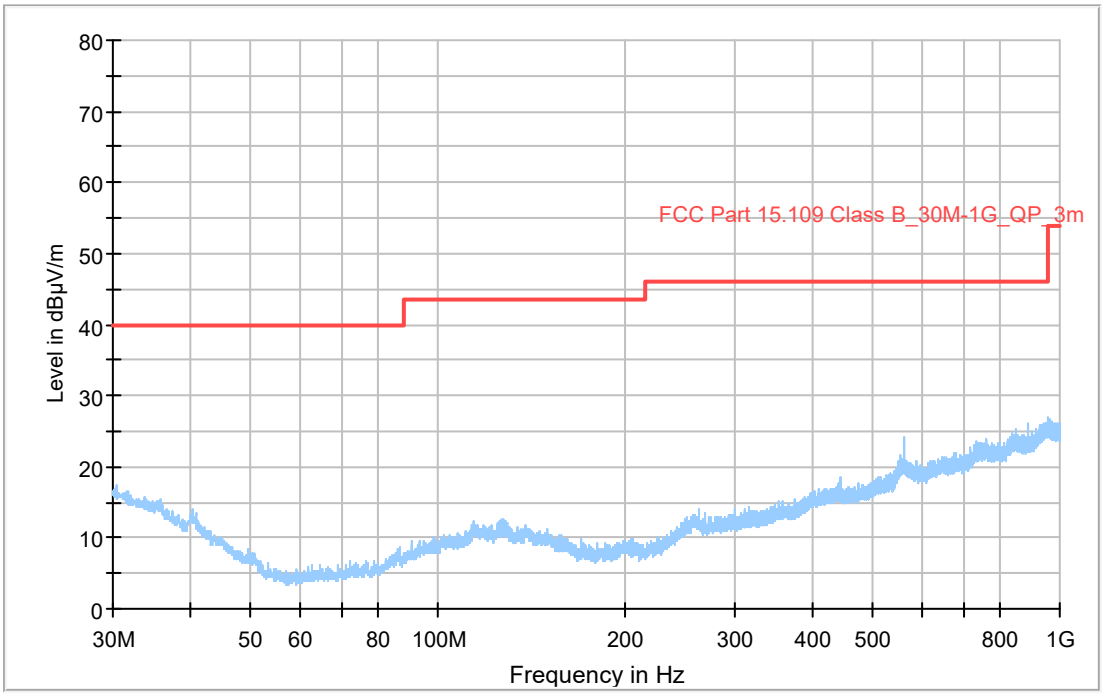
Outside the restricted bands:
Reference: CFR 47 §15.247(d), RSS-247 5.5,

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits.

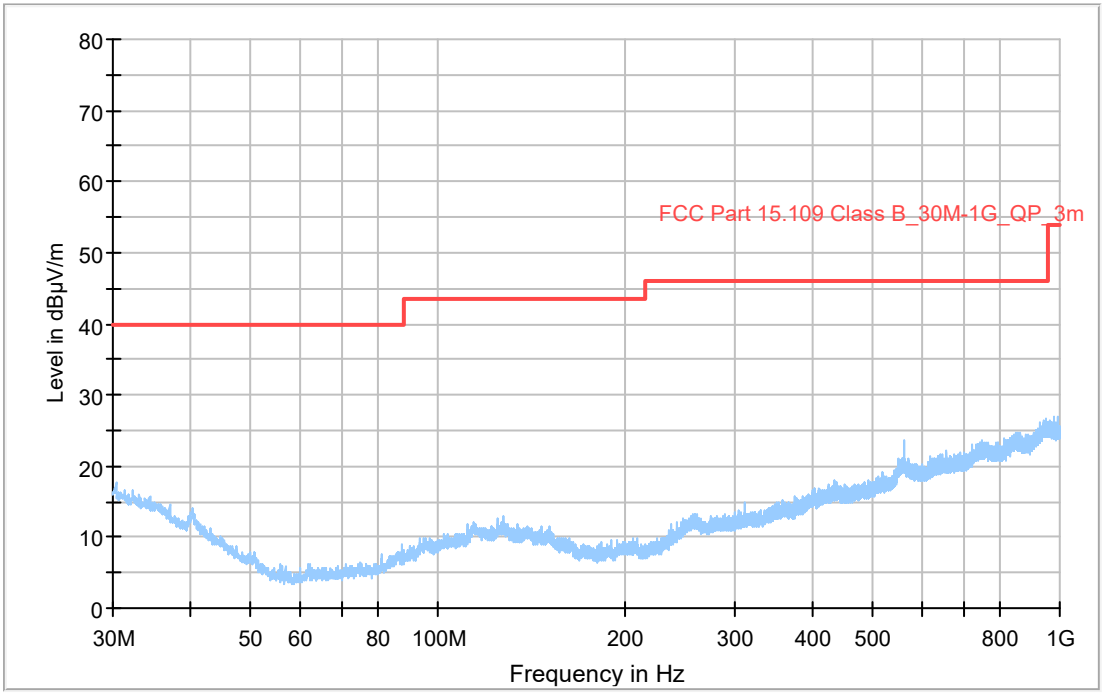
6.4 Test results 30 MHz – 1000 MHz, TX

Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX low channel, EUT orientation x.





Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX midle channel, EUT orientation Y.

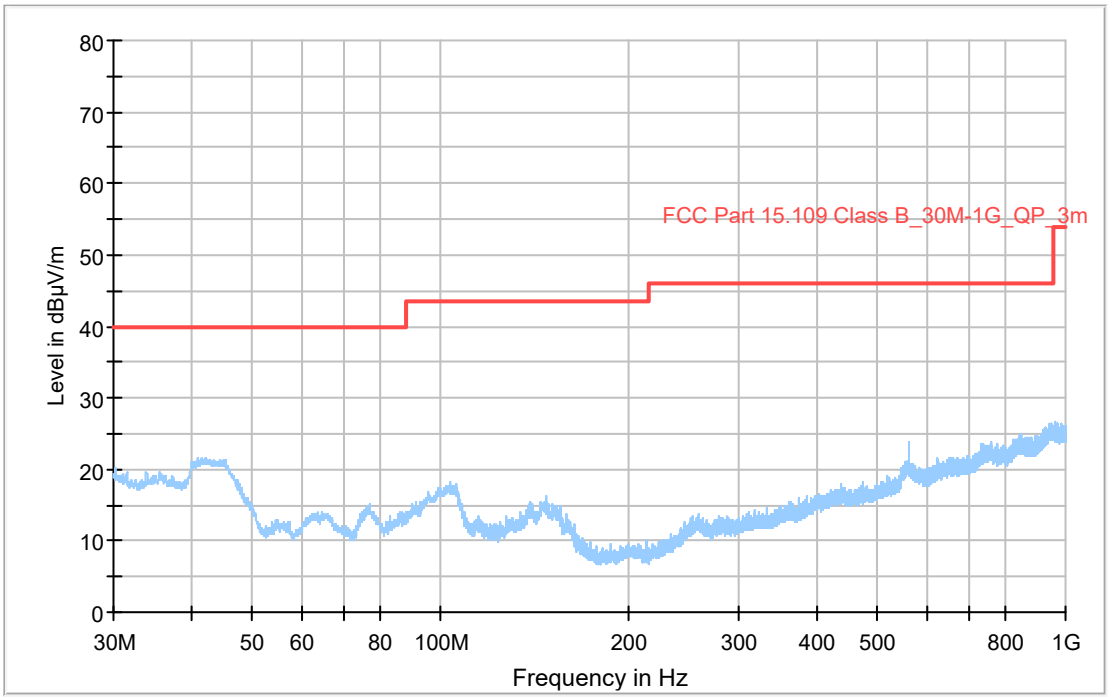


Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX high channel, EUT orientation Z.

Measurement results, Quasi Peak

No emissions are found above noise floor or closer than 20 dB from limit.

6.5 Test results 30 MHz – 1000 MHz, RX

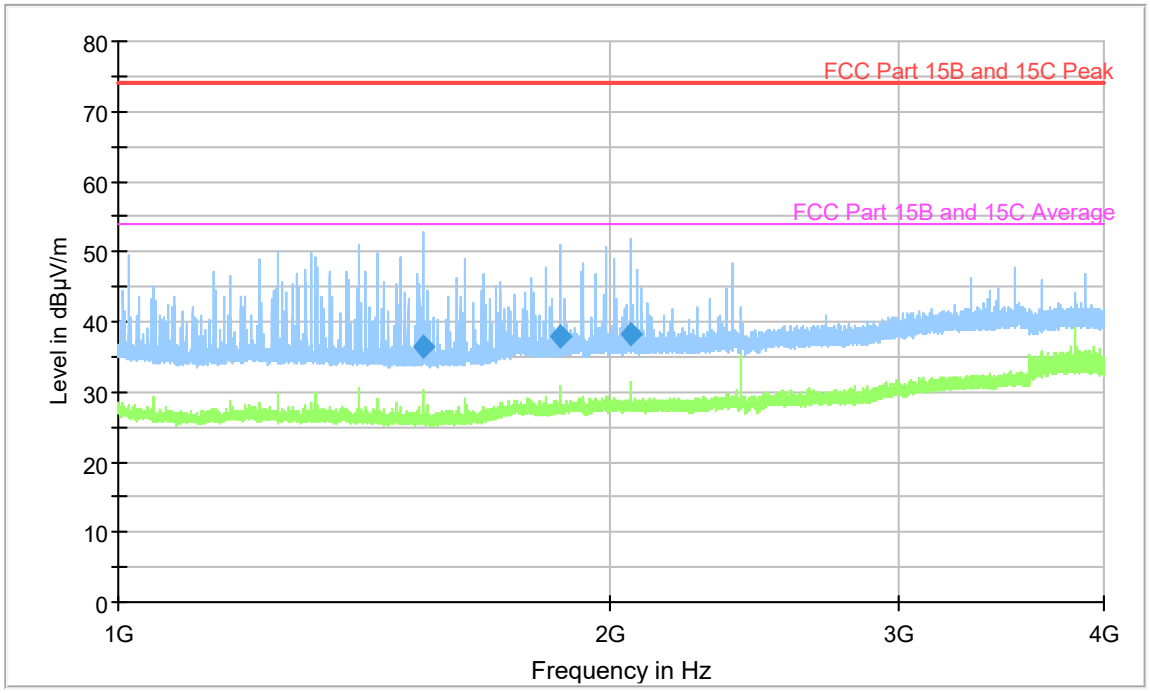


Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. EUT sitting in a charger

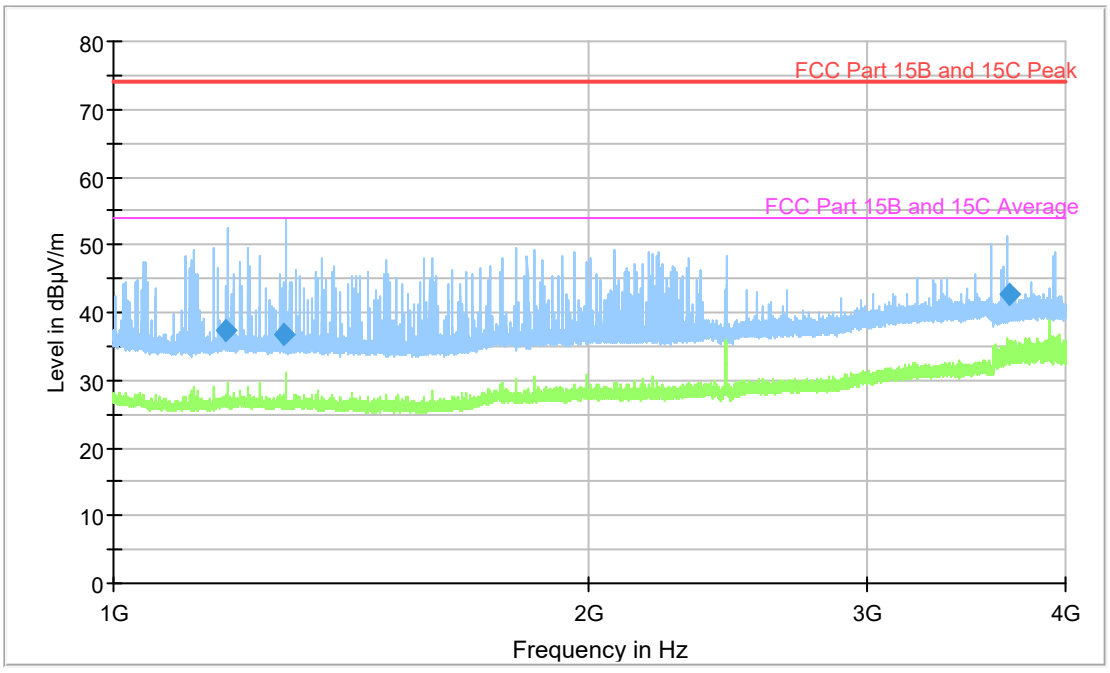
Measurement results, Quasi Peak

No emissions are found within 20 dB from limit.

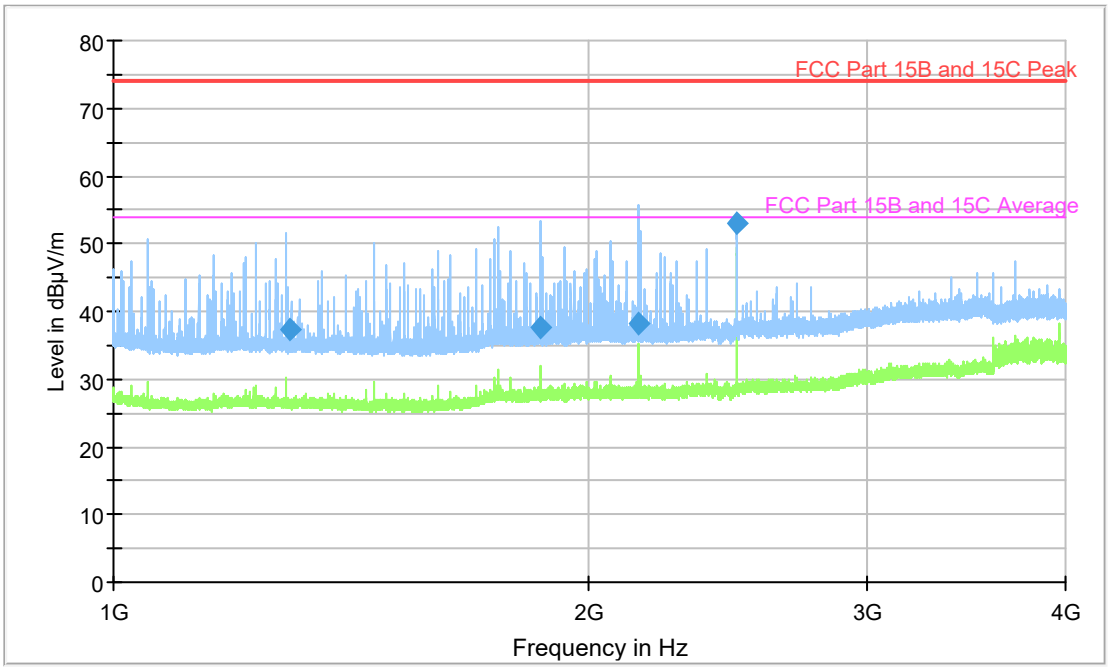
6.6 Test results 1 GHz – 26 GHz, TX



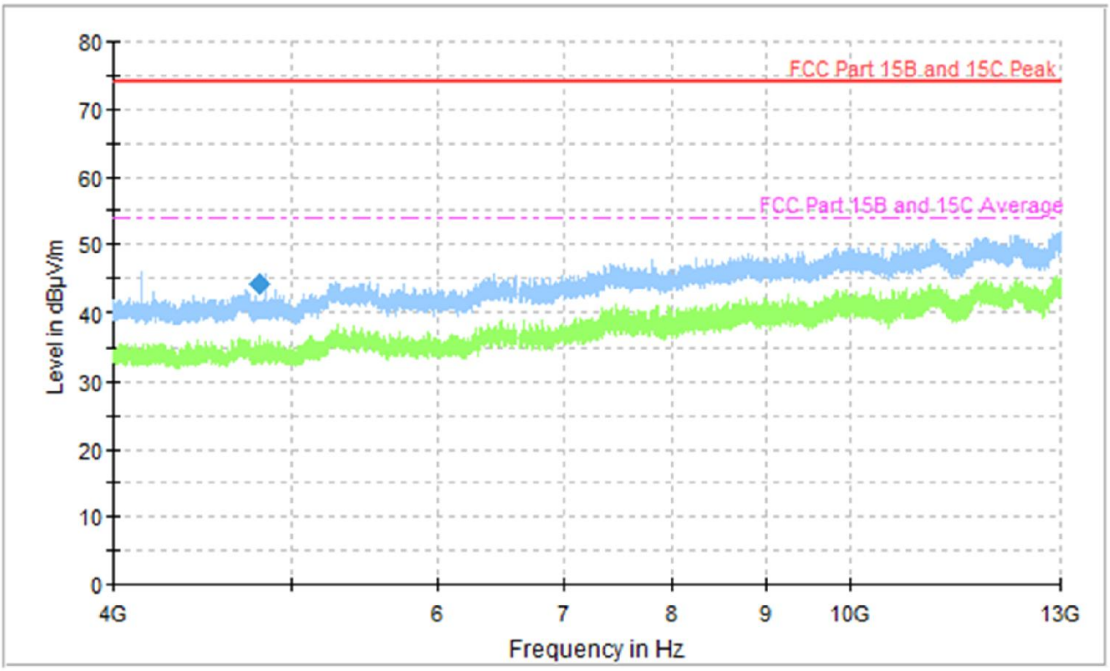
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX low channel, Carrier is attenuated by band rejection filter.



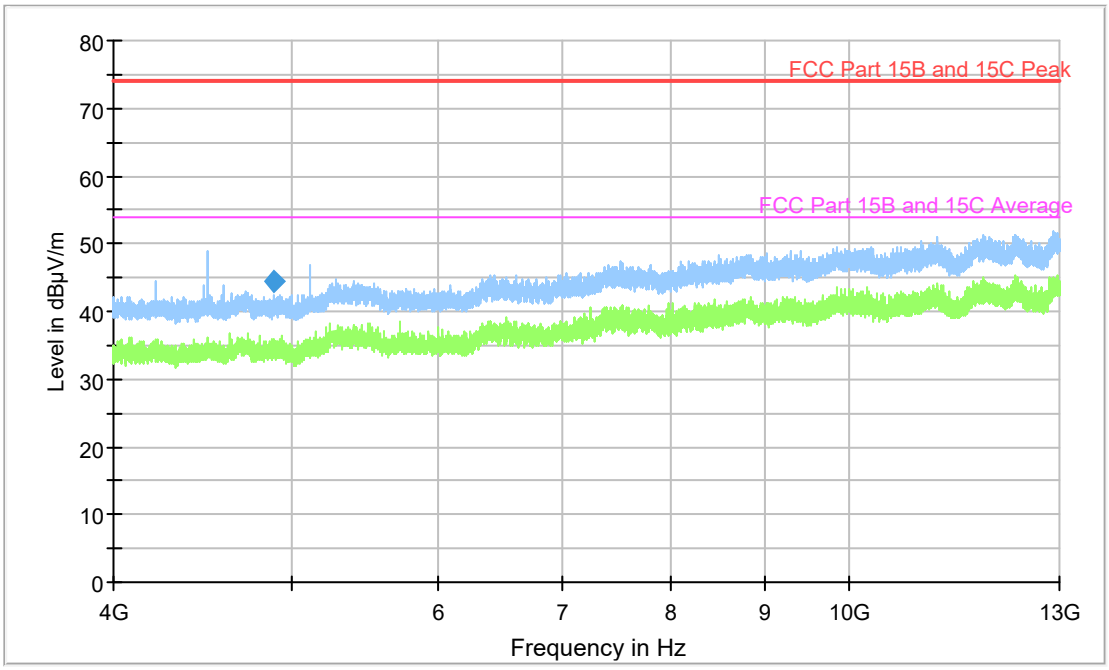
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX middle channel, Carrier is attenuated by band rejection filter.



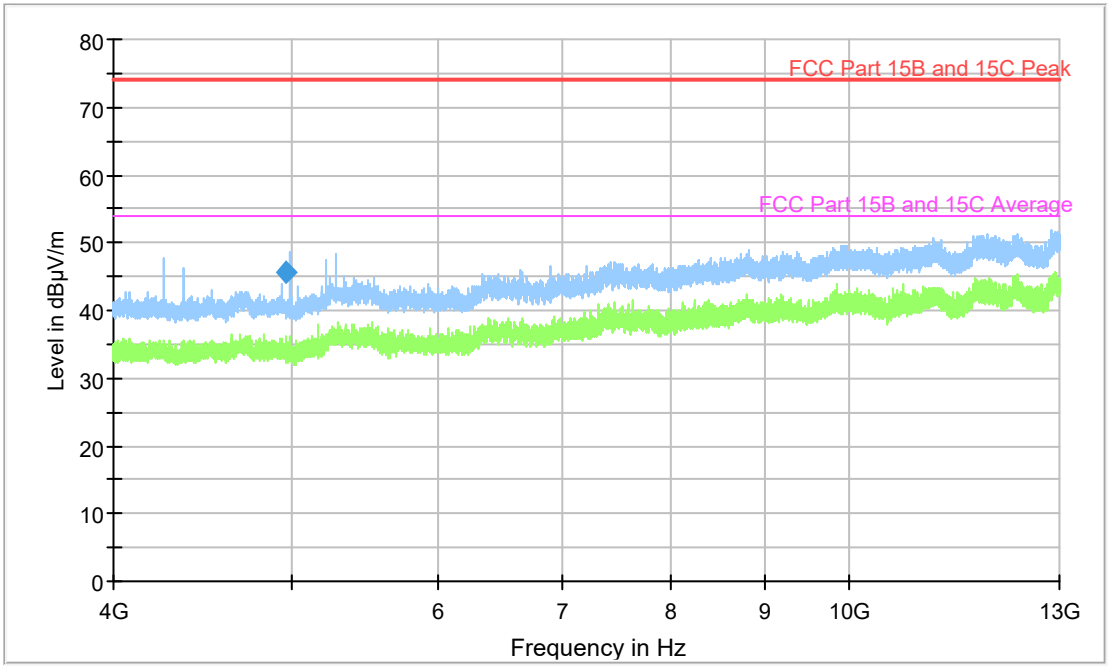
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX high channel, Carrier is attenuated by band rejection filter.



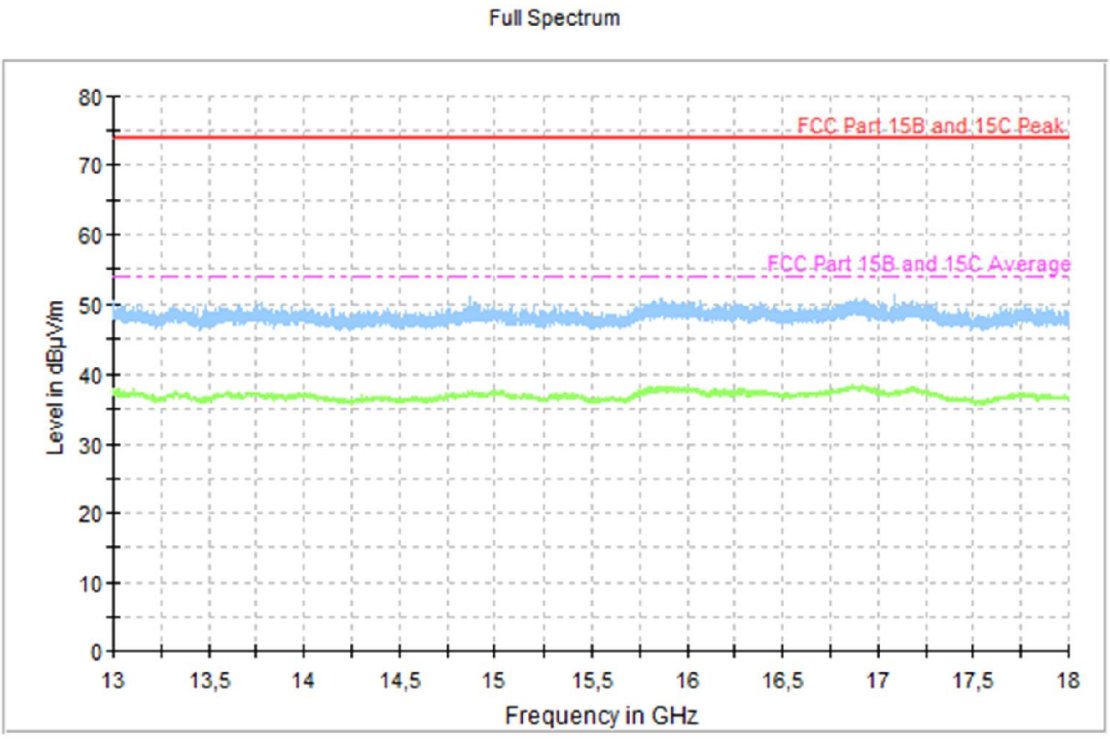
Diagram, Peak overview sweep, 4– 13 GHz at 3 m distance. TX low channel. Emissions below 4000 MHz are attenuated by high-pass filter.



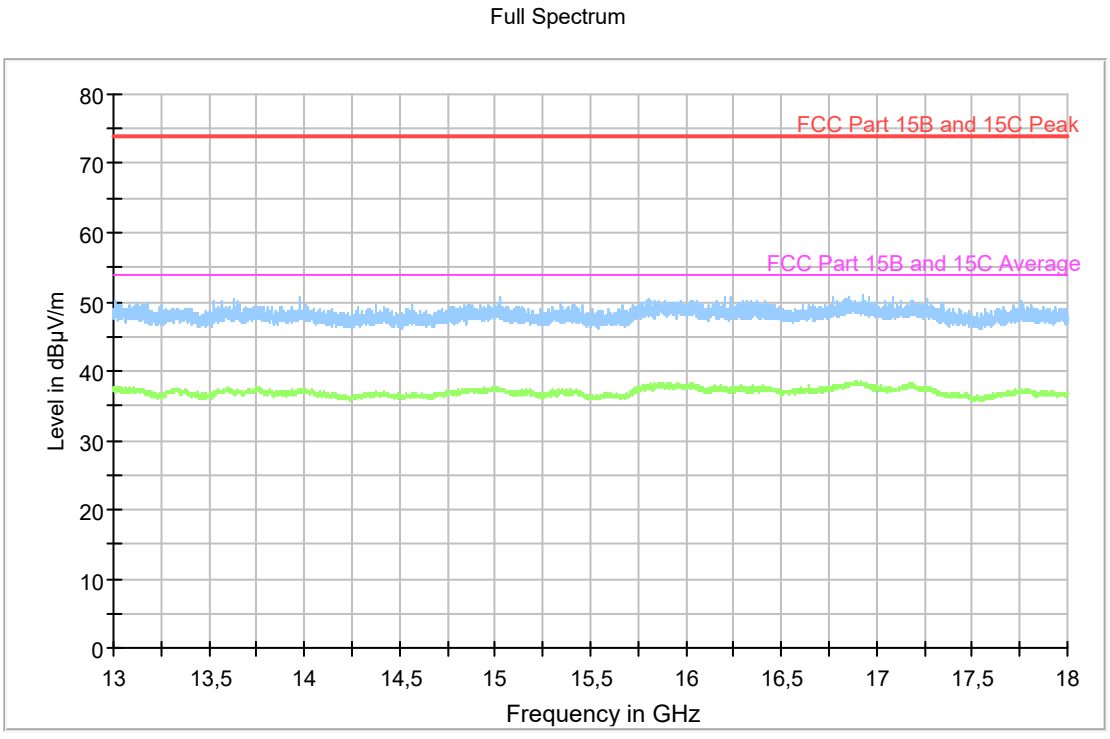
Diagram, Peak overview sweep, 4– 13 GHz at 3 m distance. TX middle channel. Emissions below 4000 MHz are attenuated by high-pass filter.



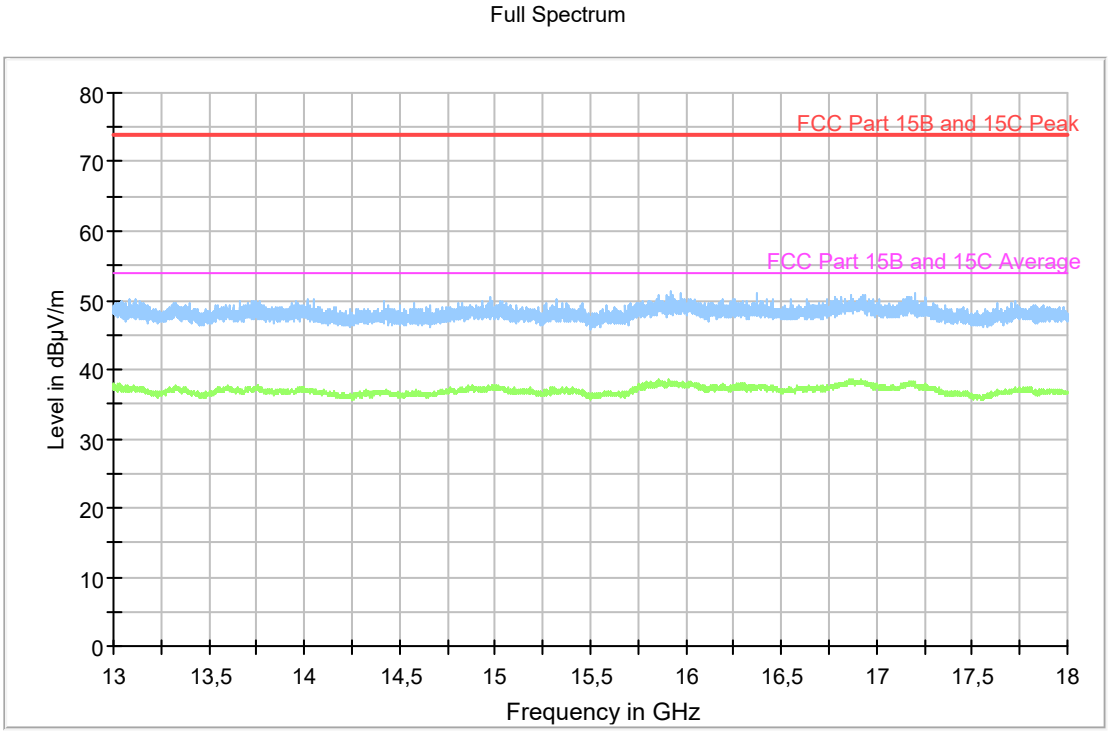
Diagram, Peak overview sweep, 4– 13 GHz at 3 m distance. TX high channel. Emissions below 4000 MHz are attenuated by high-pass filter.



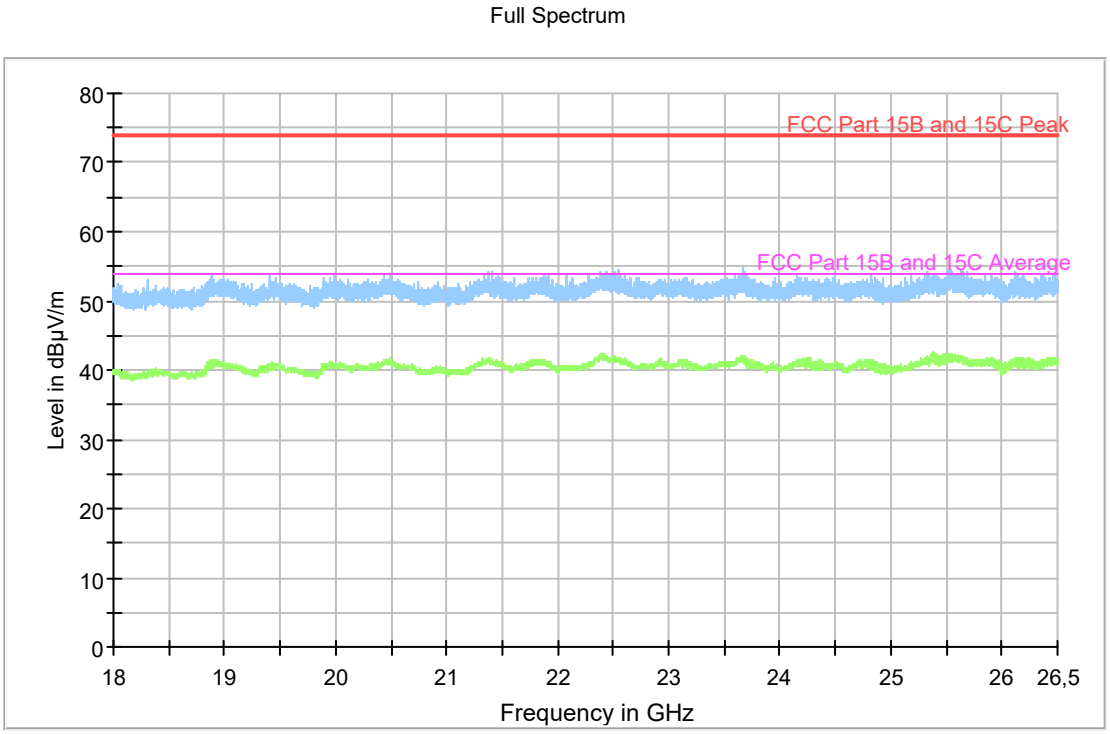
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX low channel



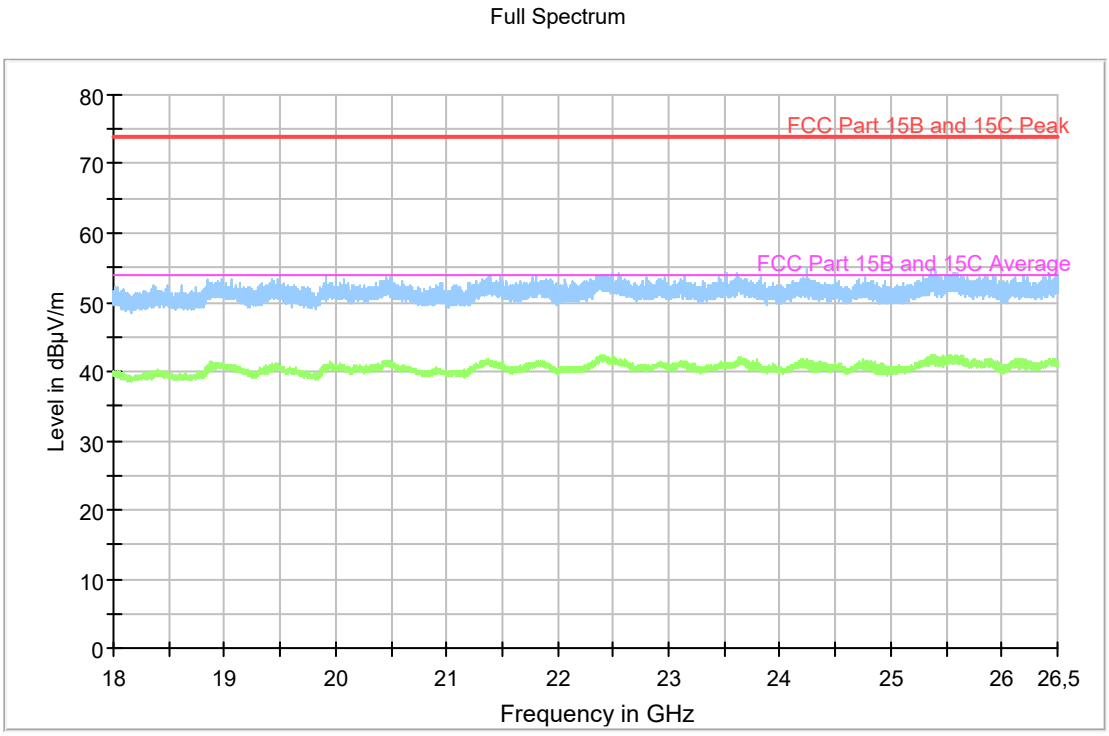
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX middle channel.



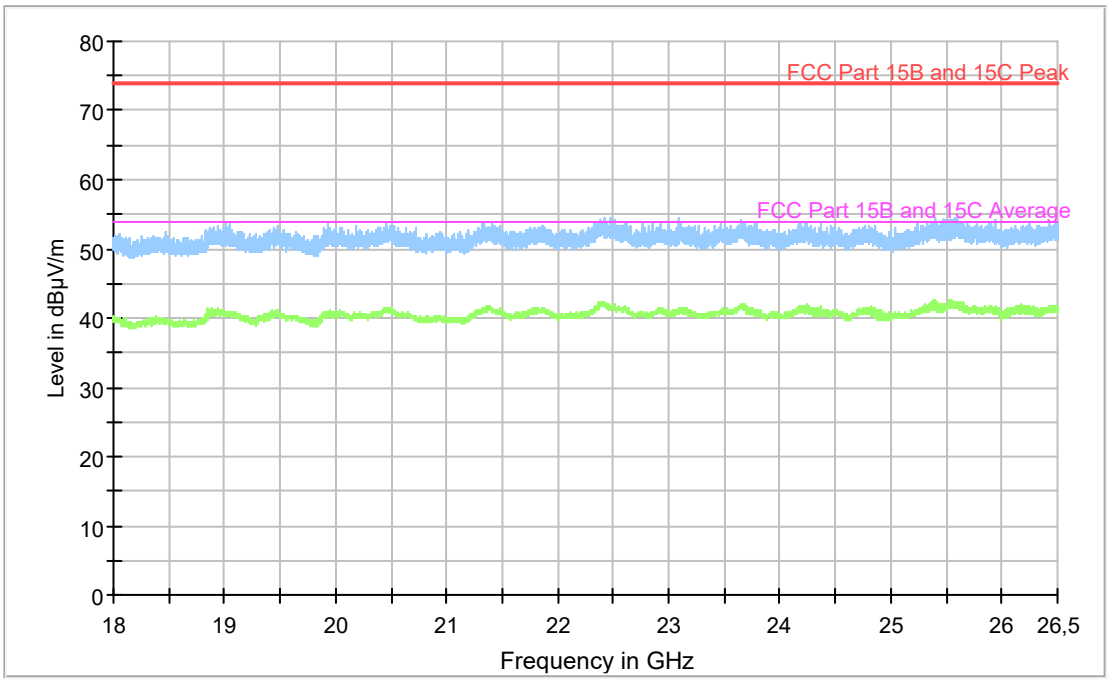
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX high channel



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX low channel



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX middle channel



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX high channel

Measurement results, Peak, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	EUT Orientation (deg)	Polarization H/V	Margin [dB]
1534.3	36.4	74	120.0	V	37.6
1860.7	37.9	74	110.0	V	36.1
2054.2	38.2	74	-13.0	V	35.8
4804.0	44.0	74	-24.0	H	30.0

Measurement results, Average, TX low channel

Not measured. All measured peak values are under average the limit

Measurement results, Peak, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	EUT Orientation (deg)	Polarization H/V	Margin [dB]
1178.5	37.2	74	120.0	V	36.8
1283.4	36.7	74	110.0	V	37.3
3683.7	42.5	74	-13.0	H	31.5
4884.3	44.4	74	80.0	H	29.7

Measurement results, Average, TX average channel

Not measured. All measured peak values are under average the limit

Measurement results, Peak, TX high channel

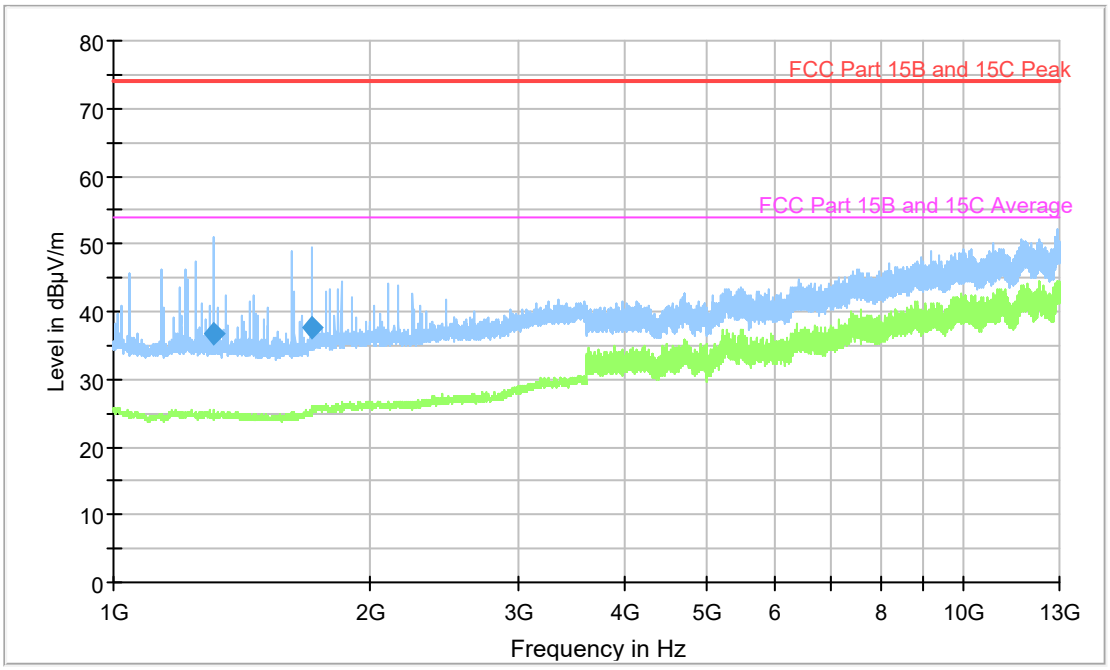
Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	EUT Orientation (deg)	Polarization H/V	Margin [dB]
1291.3	37.3	74.0	30.0	V	36.7
1860.8	37.7	74.0	34.0	V	36.3
2146.3	38.3	74.0	9.0	H	35.7
2480.4	53.2	74.0	14.0	H	20.8
2484.0	60.0	74.0	14.0	H	14.0
4960.9	45.7	74.0	44.0	V	28.3

Measurement results, Average, TX high channel

Not measured. All measured peak values are under average the limit

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

6.7 Test results 1 GHz – 13 GHz, RX



Diagram, Peak overview sweep, 1 - 13 GHz at 3 m distance. RX

Measurement results, Peak, RX

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	EUT orientation	Polarization H/V	Margin [dB]
1309.0	36.8	74	23.0	H	37.2
1712.8	37.5	74	-24.0	V	36.5

All other measured disturbances have a margin of more than 20 dB to the limits.

Measurement results, Avcerage, RX low channel

No emissions are found within 20 dB from limit

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

7 CONDUCTED BAND EDGE MEASUREMENT

Date of test:	March 19 / 27, 2019	**Test location:**	Wireless center
EUT Serial:	00012401704000883 00012401704002182	**Ambient temp:**	21°C
Tested by:	Usman Ul-haq / Matti Virkki	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	29.7 dB

7.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 6.10.4.

The EUT was connected to spectrum analyser via rf-cable and attenuator

The EUT was set up in order to emit maximum disturbances. Measurements are made with EUT on single channel and with EUT in hopping mode.

7.2 Test conditions

Detector: Peak,
RBW: 100 kHz
VBW: 300 kHz
Span: 10 MHz

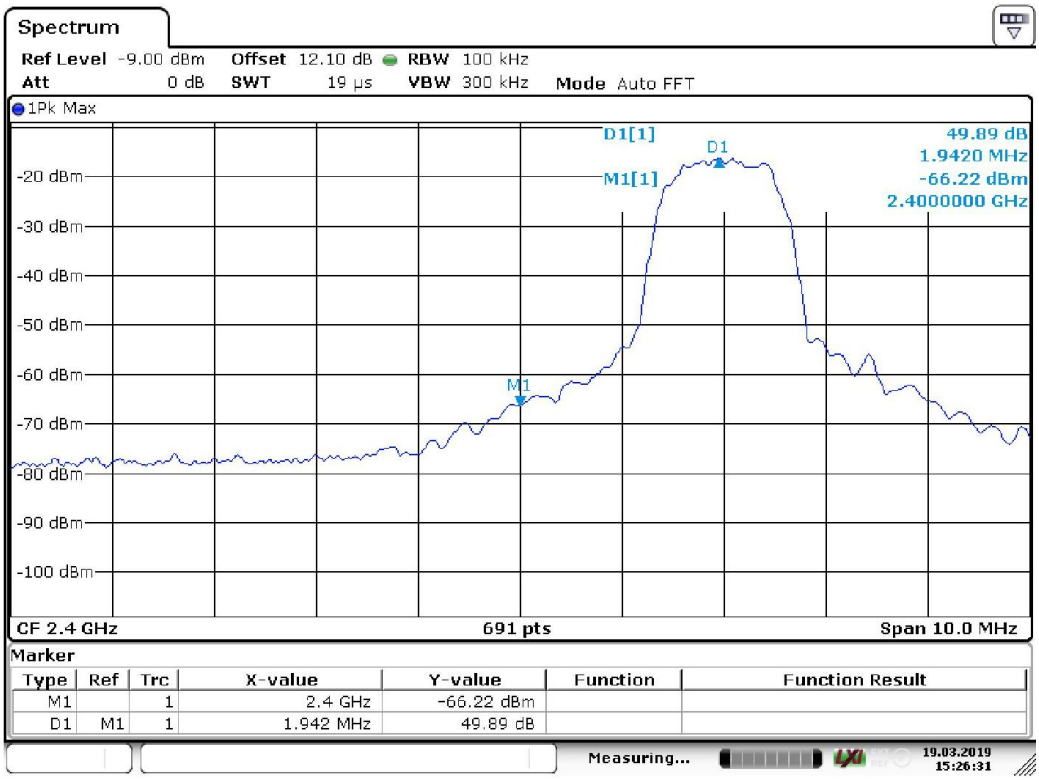
7.3 Requirement

Reference: CFR 47 §15.247(d), RSS-247 5.5,

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits.

7.4 Test results

Band edge	EUT mode of operation	Delta [dBc]	Limit [dBc]	Margin [dB]
Lower	Single channel	49.9	20.0	29.9
Lower	Hopping	53.2	20.0	33.2
Upper	Single channel	49.7	20.0	29.7
Upper	Hopping	55.1	20.0	35.1

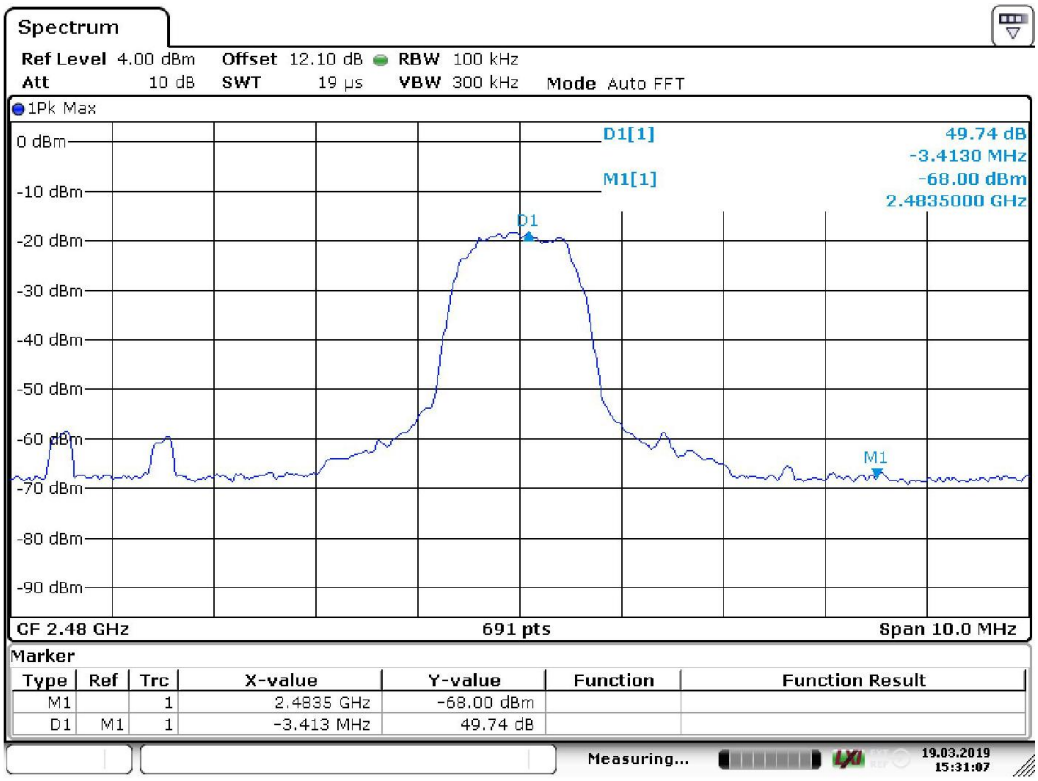


Date: 19.MAR.2019 15:26:31

Screenshot: Lower band edge sweep, single channel

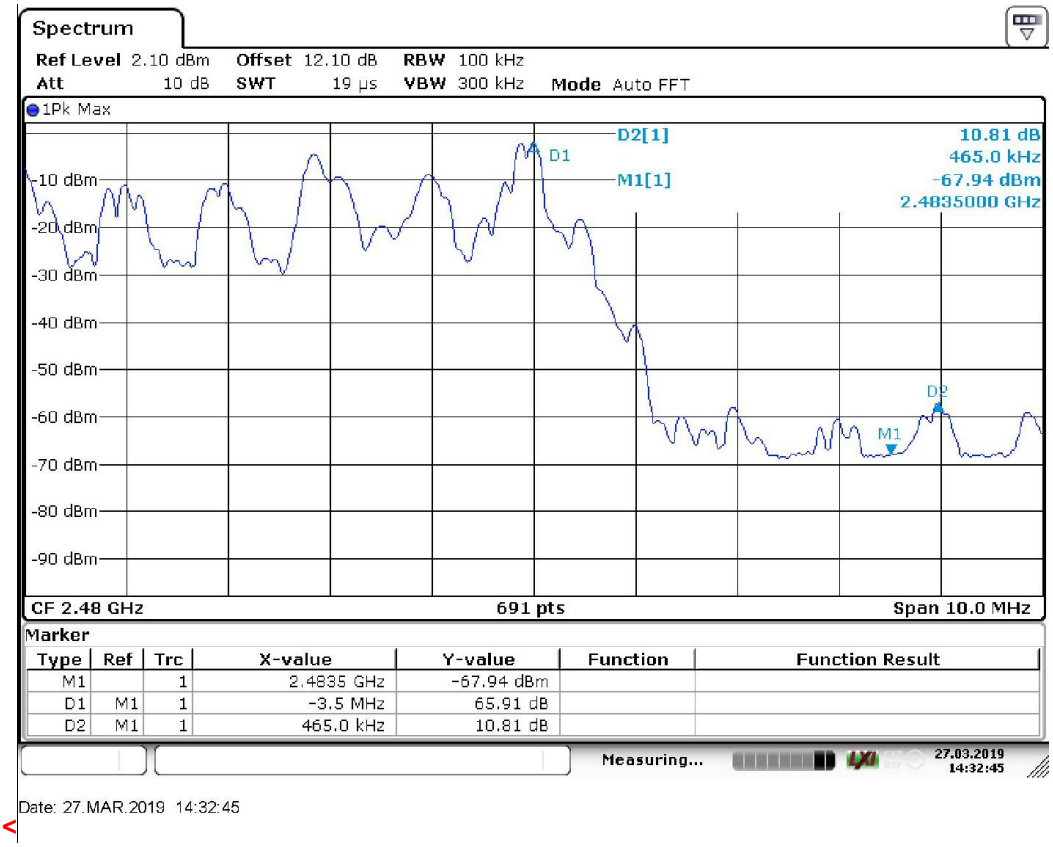
Date: 27.MAR.2019 14:30:11

Screenshot: Lower band edge sweep, hopping mode



Date: 19.MAR.2019 15:31:07

Screenshot: Upper band edge sweep, single channel



Date: 27.MAR.2019 14:32:45

Screenshot: Upperband edge sweep, hopping mode

8 PEAK CONDUCTED OUTPUT POWER

Date of test:	March 19, 2019	**Test location:**	Wireless Center
EUT Serial:	00012401704002182	**Ambient temp:**	21°C
Tested by:	Usman Ul-haq / Matti Virkki	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	40.6 dB

8.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 7.8.5.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

8.2 Test conditions

Detector: Peak,
RBW: >20 dB BW
VBW: 3 x RBW
Span: 5 x 20 dB BW

The EUT was set up in order to emit maximum disturbances.

8.3 Requirement

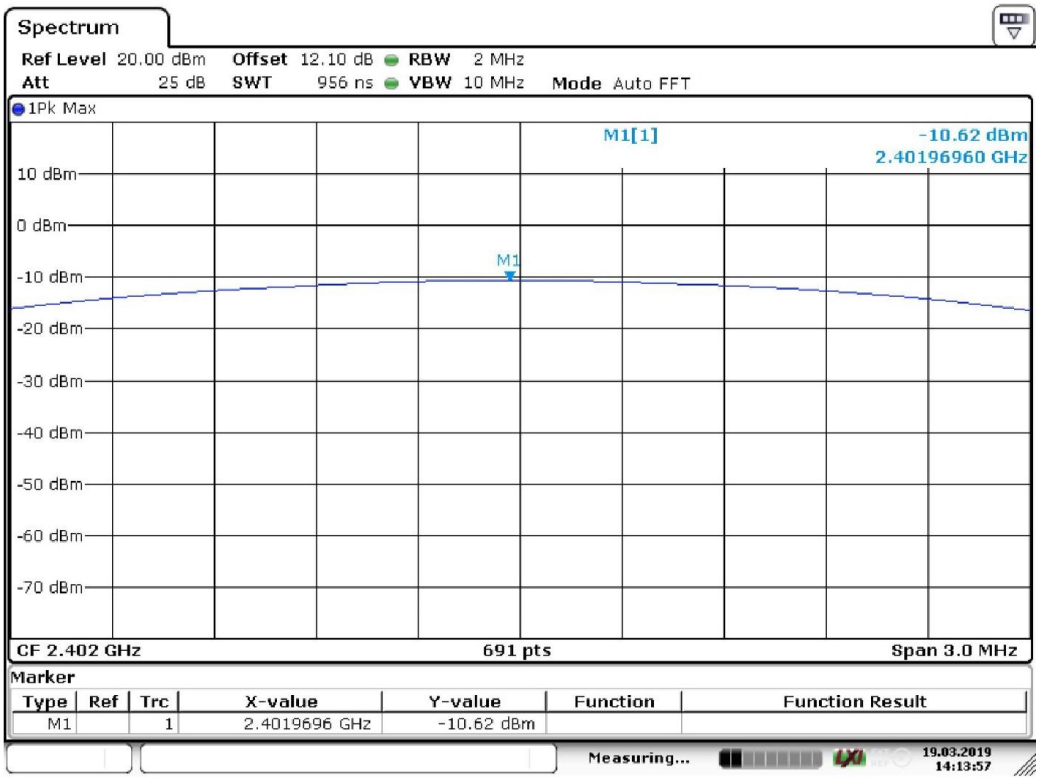
Reference: CFR 47 §15.247(b)(1), RSS-247 5.4

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
The e.i.r.p. shall not exceed 4 W.

8.4 Test results

Test result

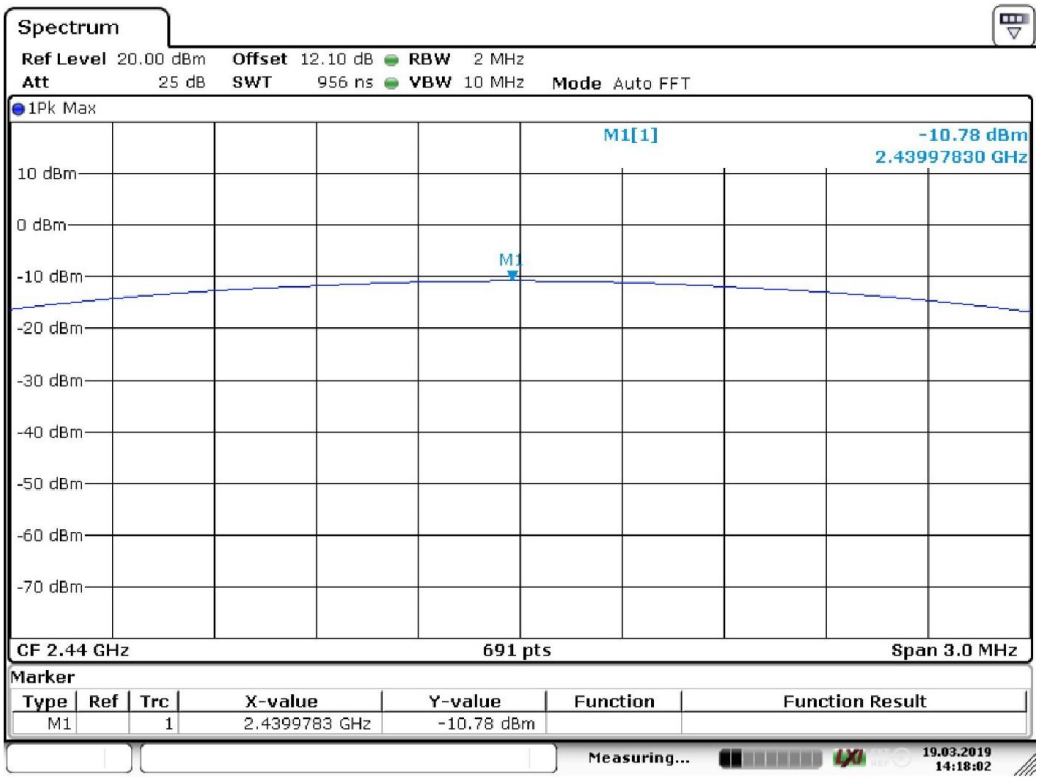
Channel [MHz]	Output power [dBm]	Limit [dBm]	Margin [dB]
2405	-10.6	+30	40.6
2445	-10.8	+30	40.9
2480	-13.8	+30	43.8



Date: 19.MAR.2019 14:13:57

Screenshot:

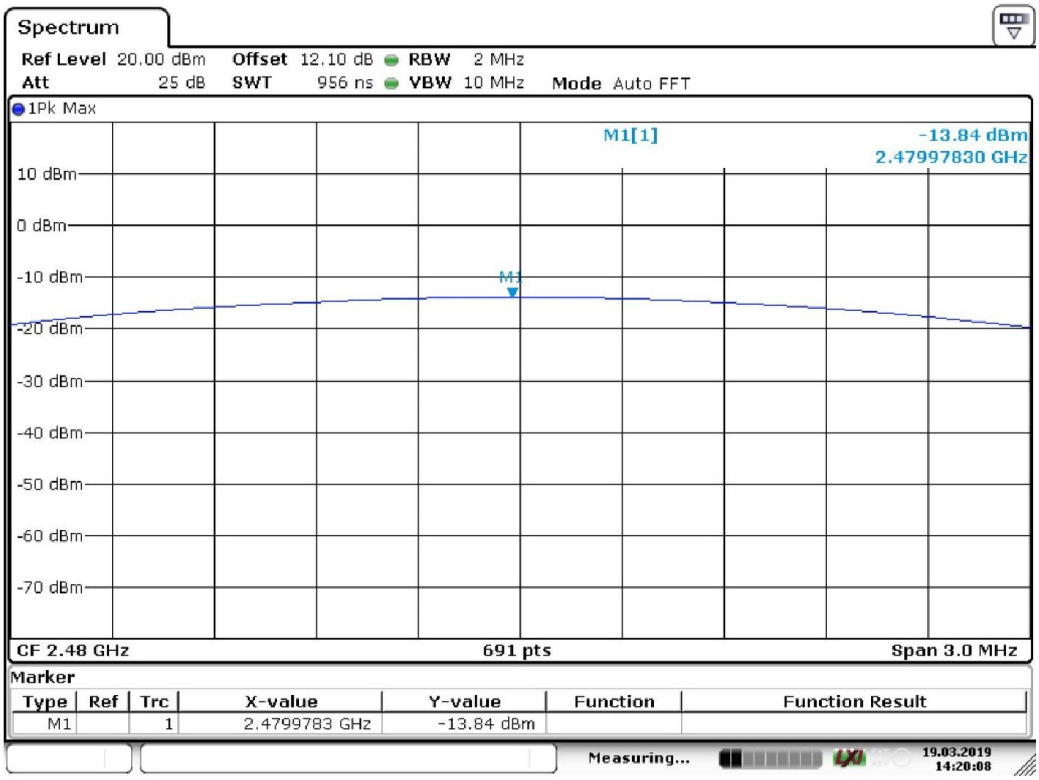
Output power, low channel



Date: 19.MAR.2019 14:18:02

Screenshot:

Output power, middle channel



Date: 19.MAR.2019 14:20:08

Screenshot: Output power, high channel

9 OCCUPIED 20 DB BANDWIDTH

Date of test:	March 19, 2019	**Test location:**	Wireless Center
EUT Serial:	00012401704002182	**Ambient temp:**	21°C
Tested by:	Usman Ul-haq / Matti Virkki	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	N/A

9.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 6.9.2.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

9.2 Test conditions

Detector: Peak,
RBW: 1 – 5 % of OBW
VBW: 3 x RBW
Span: >1,5 x OBW

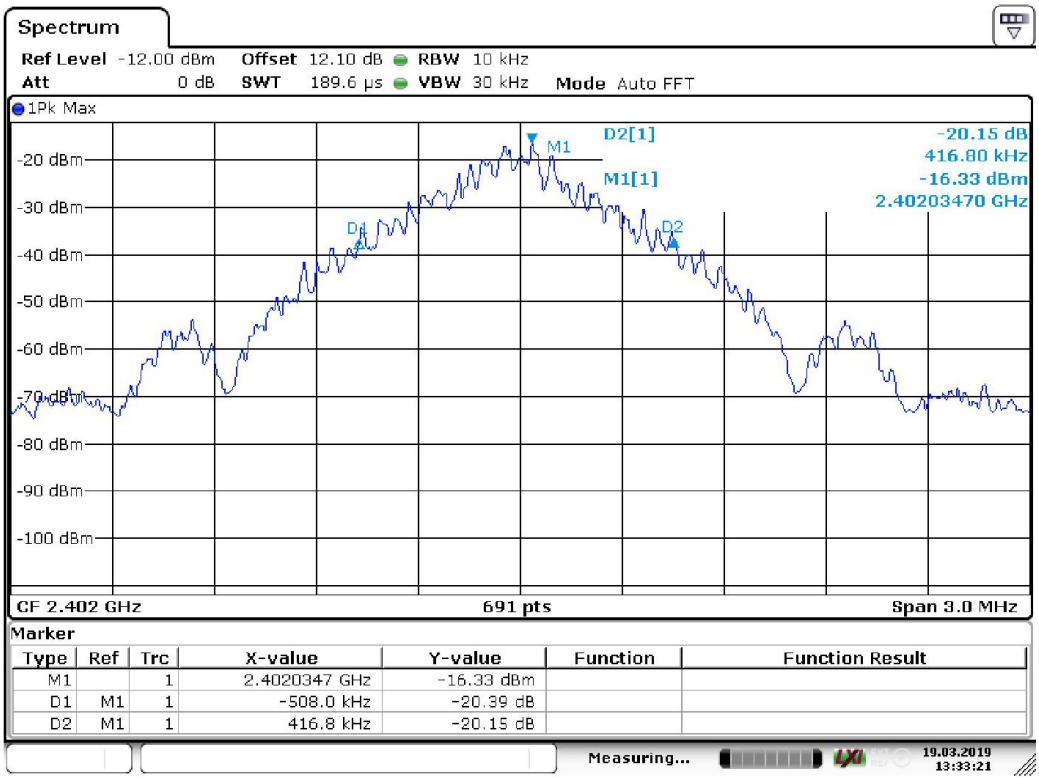
The EUT was set up in order to emit maximum disturbances.

9.3 Requirements

Reference: CFR 47 §15.247(a)(1), RSS-247 5.1

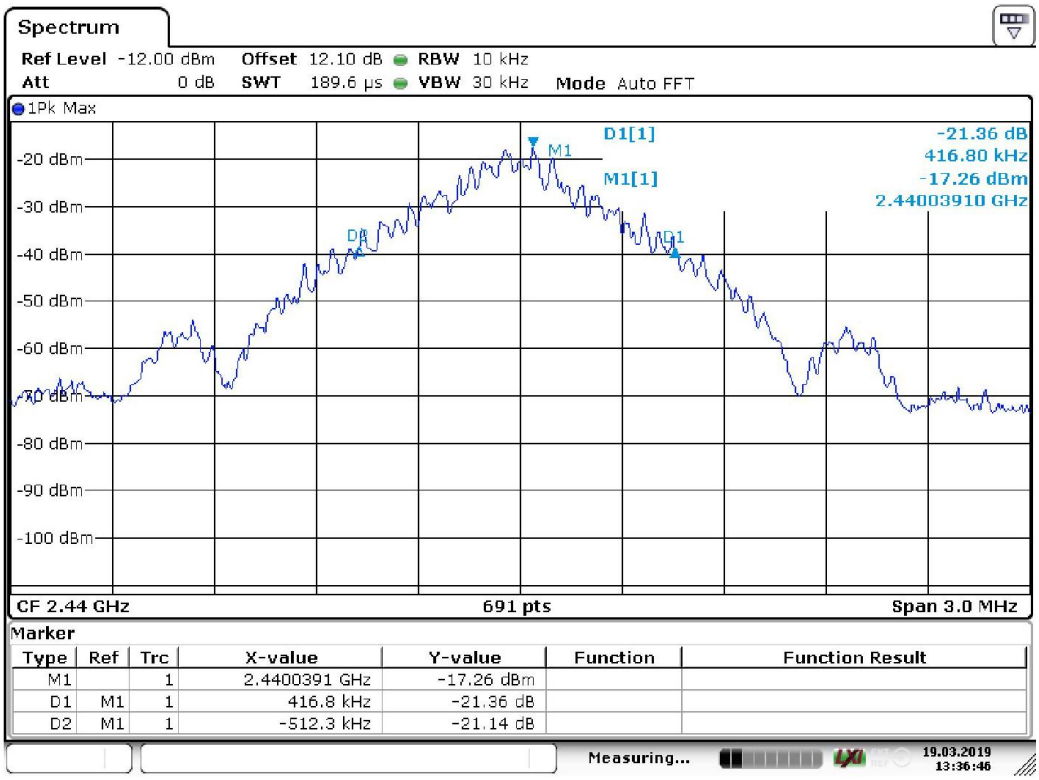
9.4 Test results

Channel [MHz]	20 dB BW [kHz]
2402	924
2440	929
2480	929



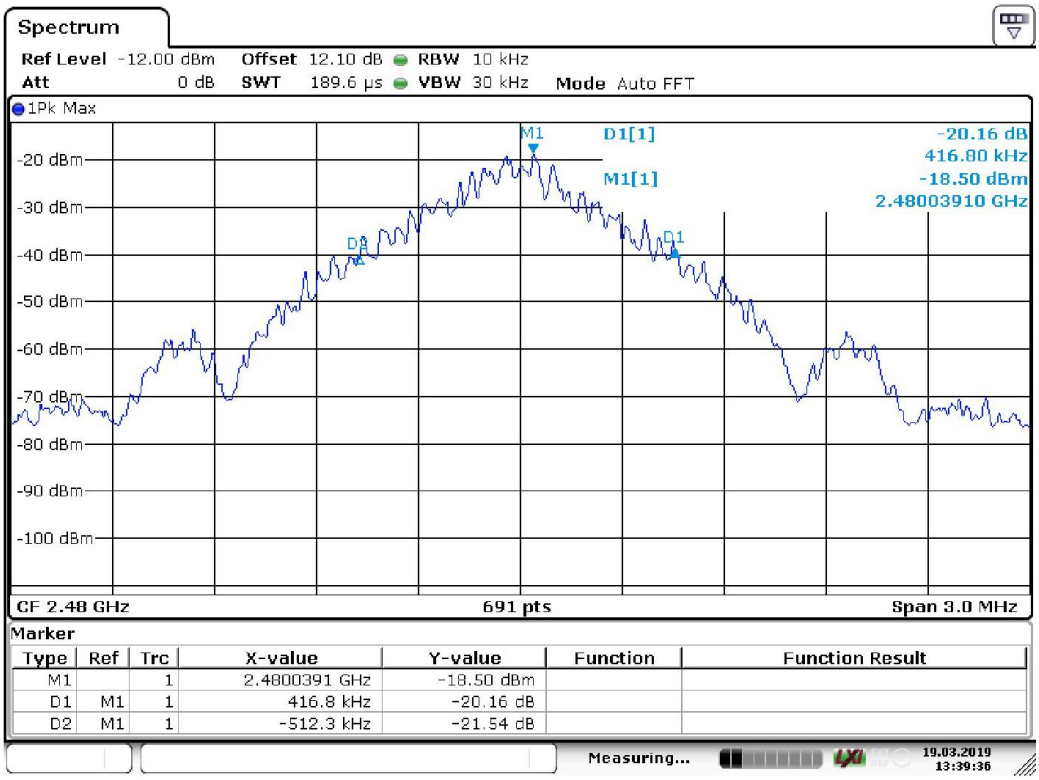
Date: 19.MAR.2019 13:33:21

Screenshot: Occupied bandwidth Measurement, low channel



Date: 19.MAR.2019 13:36:46

Screenshot: Occupied bandwidth Measurement, middle channel



Date: 19.MAR.2019 13:39:36

Screenshot: Occupied bandwidth Measurement, high channel

10 99 % BANDWIDTH

Date of test:	March 19, 2019	**Test location:**	Wireless Center
EUT Serial:	00012401704002182	**Ambient temp:**	21°C
Tested by:	Usman Ul-haq / Matti Virkki	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	N/A

10.1 Test set-up and test procedure.

The test method is in accordance with RSS-GEN section 6.7.

Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth. The EUT was connected to spectrum analyser via rf-cable and attenuator.

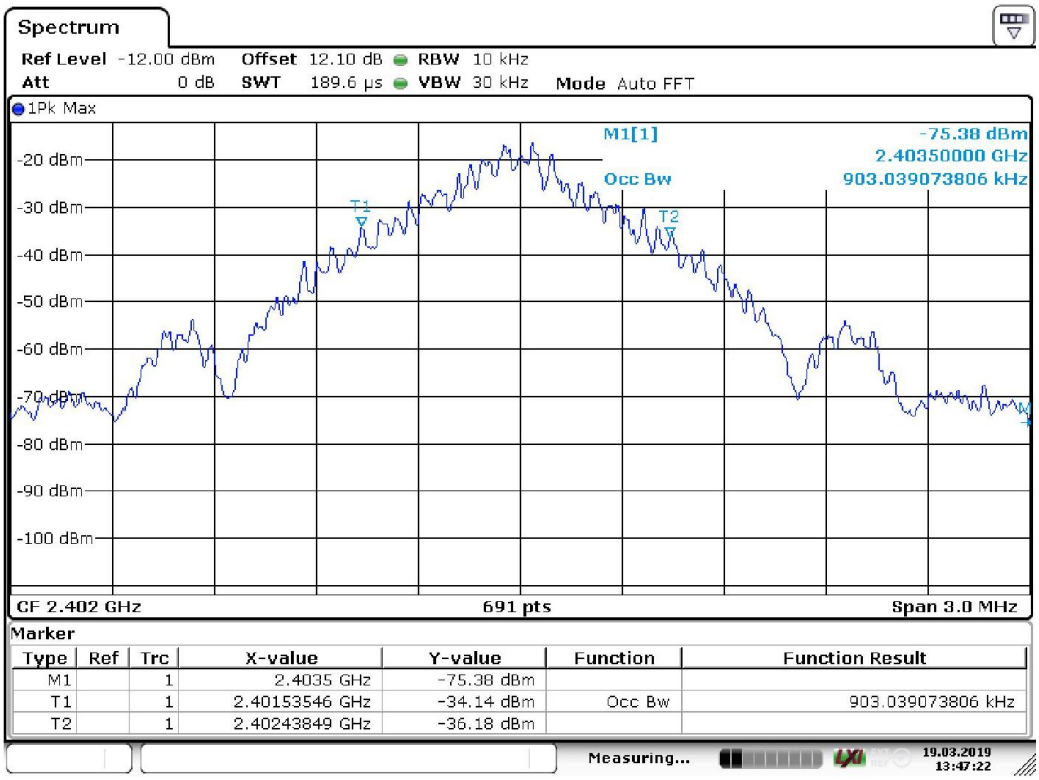
10.2 Test conditions

Detector: Peak,
RBW: 1 – 5 % of OBW
VBW: 3 x RBW

The EUT was set up in order to emit maximum disturbances.

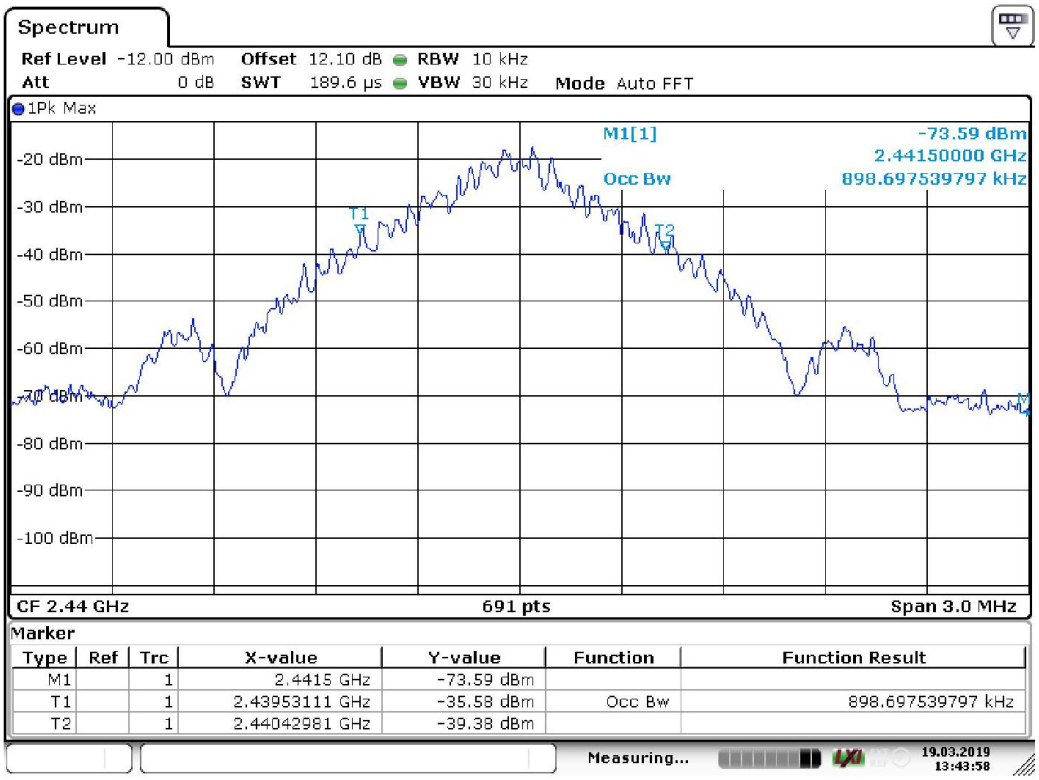
10.3 Test results

Channel [MHz]	99 % BW [kHz]
2402	903.0
2440	898.7
2480	898.7



Date: 19.MAR.2019 13:47:22

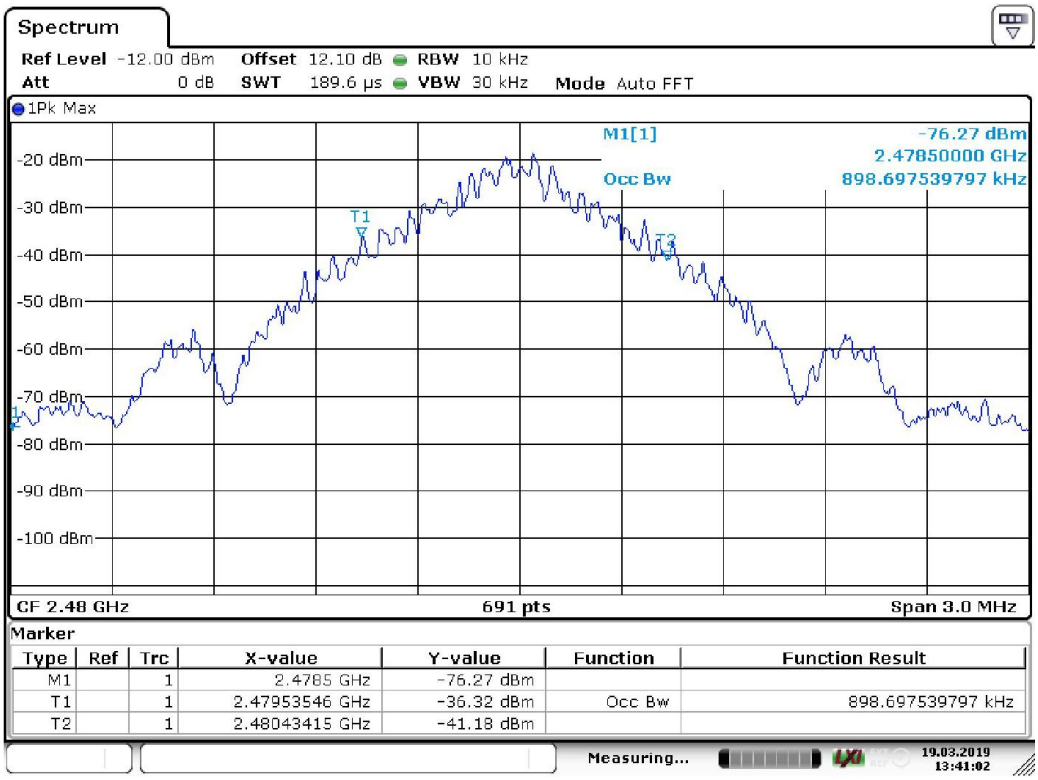
Screenshot: Occupied bandwidth Measurement, low channel



Date: 19.MAR.2019 13:43:58

Screenshot: Occupied bandwidth Measurement, middle channel

<



Date: 19.MAR.2019 13:41:03

Screenshot: Occupied bandwidth Measurement, high channel

11 NUMBER OF HOPPING FREQUENCIES

Date of test:	March 19, 2019	**Test location:**	Wireless Center
EUT number:	00012401704000883	**Ambient temp:**	21°C
Tested by:	Usman Ul-haq / Matti Virkki	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	≥64

11.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 7.8.3.

The EUT was connected to spectrum analyser via rf-cable and attenuator

11.2 Test conditions

Detector: Peak
Trace Max hold
RBW 30 kHz
VBW 3 x RBW
Span 100 MHz
Sweep Auto

11.3 Requirements

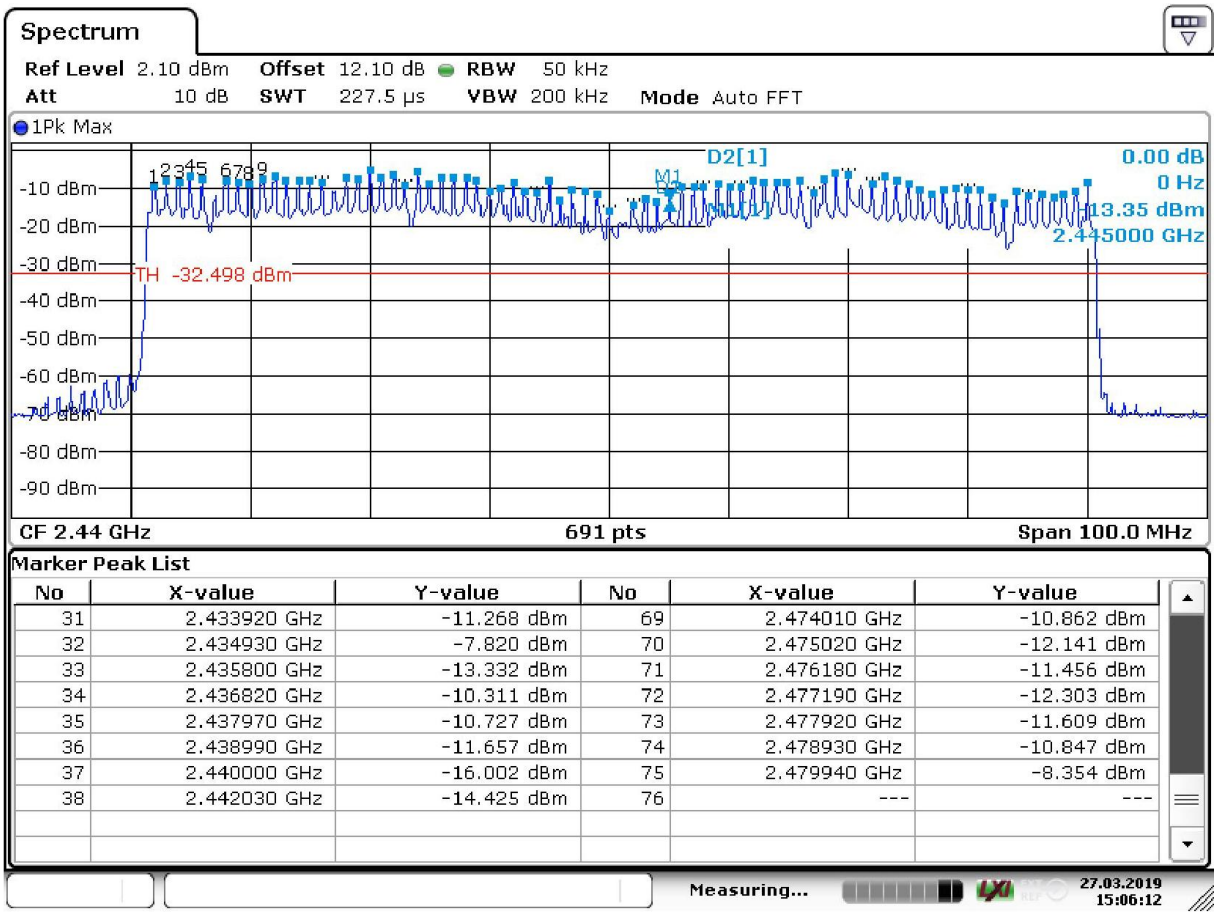
Reference: CFR 47§15.247(a)(1), RSS-247 5.1

Frequency hopping systems operating in the band 2400–2483.5 MHz shall use at least 15 hopping channels.

11.4 Test results

number of hopping frequencies	Limit	Margin
79	≥15	≥64

Signal analyser peak search result is 75. 4 peaks were not counted but they are visible on screenshot making total number of channels 79



Date: 27.MAR.2019 15:06:12

Screenshot: Number of hopping frequencies

12 CARRIER FREQUENCY SEPARATION

Date of test:	March 19, 2019	**Test location:**	Wireless Center
EUT number:	00012401704000883	**Ambient temp:**	21°C
Tested by:	Usman Ul-haq / Matti Virkki	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	85 kHz

12.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 7.8.2.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

12.2 Test conditions

Detector: Peak
Trace Max hold
RBW 30 kHz
VBW 3 x RBW
Span 5 x 20 dB bw
Sweep Auto

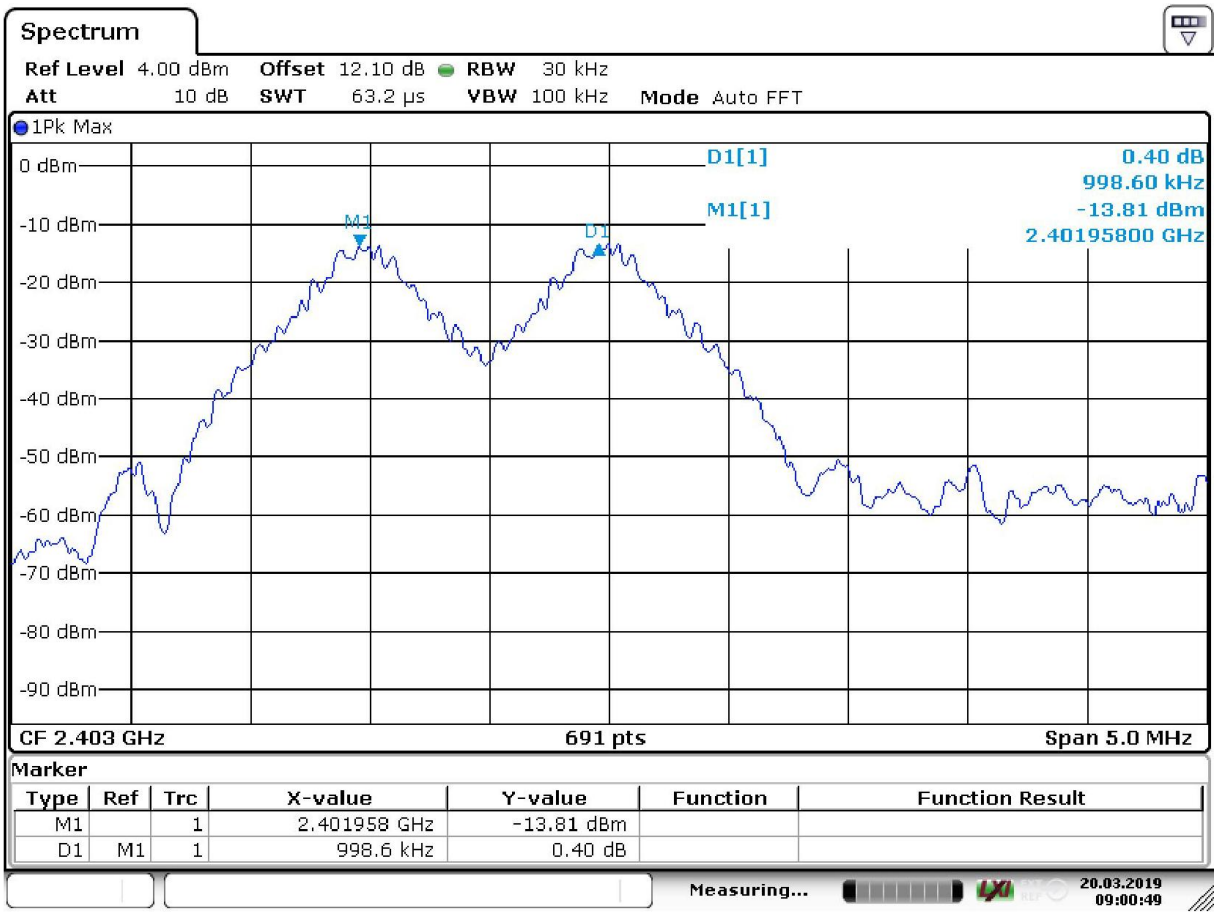
12.3 Requirements

Reference: CFR 47§15.247(a)(1), RSS-247 5.(b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400–2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

12.4 Test results

Carrier frequency separation [kHz]	Limit [kHz]	Margin [kHz]
999	616	383



Date: 20.MAR.2019 09:00:49

Screenshot: Carrier frequency separation. EUT hopping between 2 channels

13 TRANSMITTER TIME OF OCCUPANCY

Date of test:	March 19, 2019	**Test location:**	Wireless Center
EUT number:	00012401704000883	**Ambient temp:**	21°C
Tested by:	Usman Ul-haq / Matti Virkki	**Relative humidity:**	22%
Test result:	Pass	**Margin:**	395 ms

13.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 7.8.4.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

13.2 Test conditions

Detector: Peak
RBW 500 kHz
VBW 3 x RBW
Span 0 Hz
Sweep time 32 s (0.4s * 79 channels)

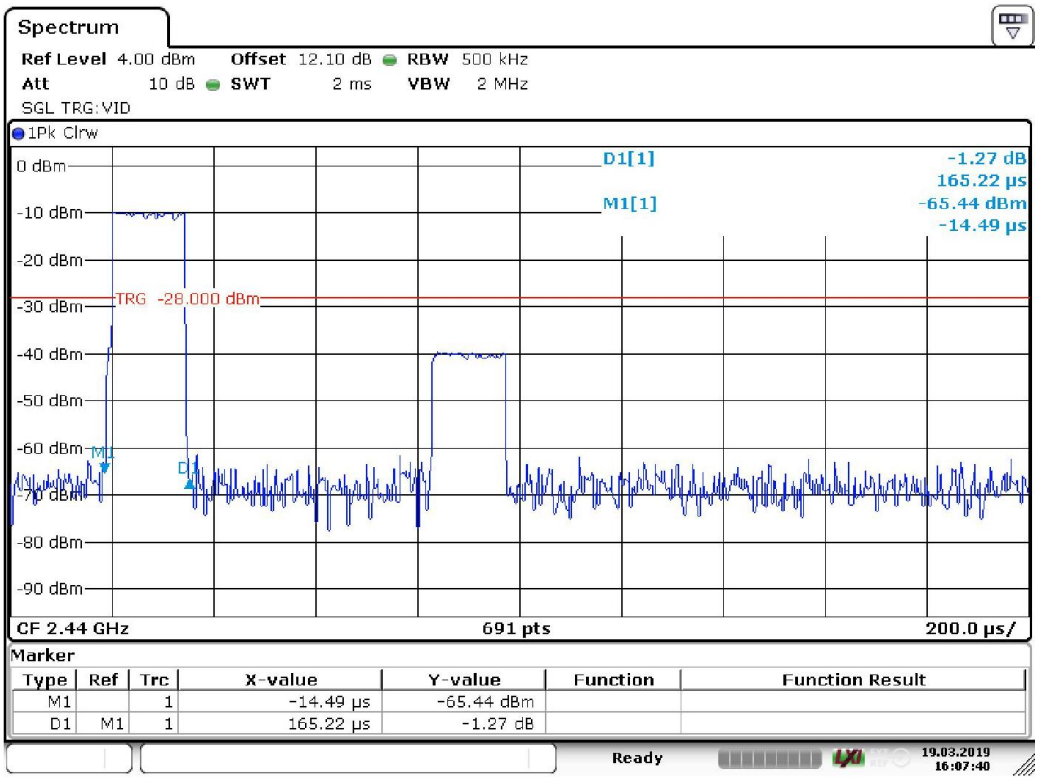
13.3 Requirement

Reference: CFR 47 §15.247(a)(1), RSS-247 5.1

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

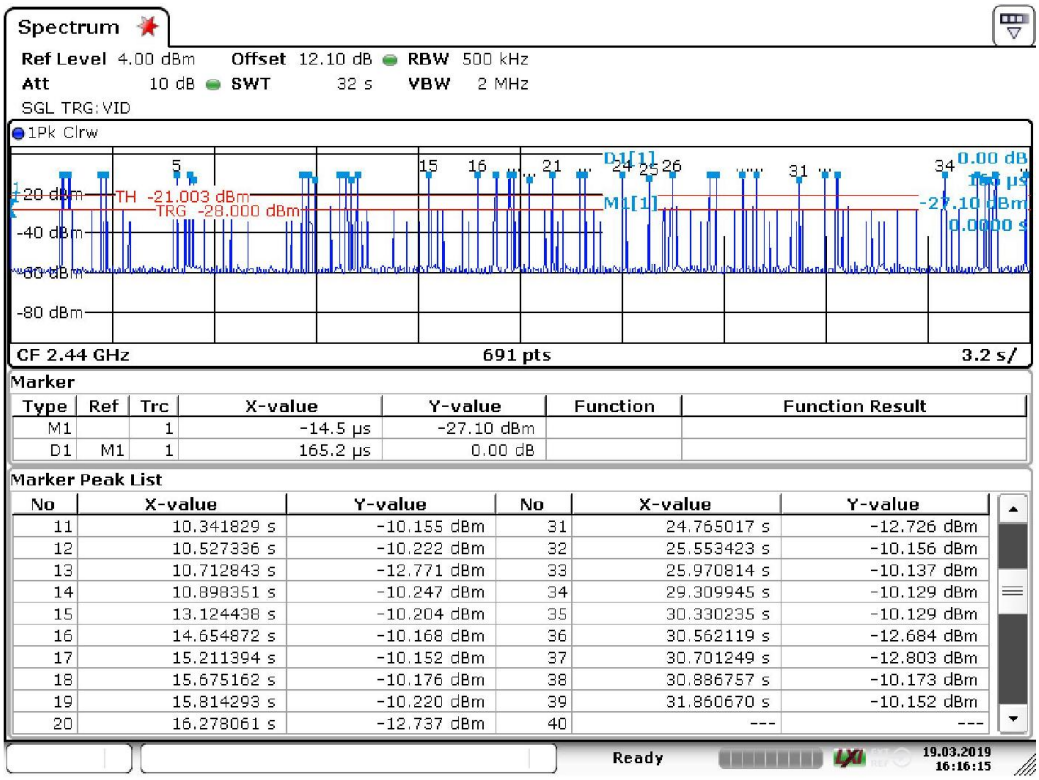
13.4 Test results

Number of transmissions	Transmission time [ms]	Time of occupancy /32 s [ms]	Limit [ms]	Margin [ms]
39	0.165	6.44	400	395.56



Date: 19.MAR.2019 16:07:40

Screenshot: time of one transmission



Date: 19.MAR.2019 16:16:15

Screenshot: time of occupancy / 0.4 x number of hopping frequencies s.

14 TEST EQUIPMENT

Wireless Center and 3m FAC

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 10.50	--	--	--
Measurement receiver	Rohde & Schwarz	ESU40	12793	7-2018	1 year
Measurement cable	Huber + Suhner	Sucoflex 104 PE	39119	7-2018	1 year
Measurement cable	Huber + Suhner	Sucoflex 104 PE	39079	7-2018	1 year
Measurement cable	Huber + Suhner	Sucoflex 104	5191	7-2018	1 year
Measurement cable	Huber + Suhne	Sucoflex 102	39131	7-2018	1 year
Measurement cable	Huber + Suhne	Sucoflex 102	39138	7-2018	1 year
Horn antenna	EMCO	3115	4936	7-2017	3 years
Pre amplifier	Sangus	00101400-23-10P -6-S ; AFS44-12002400-32-10P -44	12335	7-2018	1 year
Horn antenna	EMCO	3160-08	30099	7-2016	3 years
Horn antenna	EMCO	3160-09	30101	10-2016	3 years
Signal analyzer:	Rohde & Schwarz	FSV	32594	7-2018	1 year
2,4 GHz band reject filter:	Wainwright Instruments	WrCGV10-2381-2401-2479-2499-40-SMA	33839	10-2018	1 year
4 GHz high pass filter	K&L MICROWAVE INC	4410-X4500/18000-0/0	5133	8-2018	1 year
10 dB Attenuator:	Huber+Suhner	5910_N-50-010	32696	4-2018	1 year

Conducted emission test site BUR 3

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - V10.50	--	--	--
Receiver	Rohde & Schwarz	ESCI	31686	7-2018	1 year
AMN / LISN	Rohde & Schwarz	ESH3-Z5	2727	7-2018	1 year

Stora Hallen

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - V10.50	--	--	--
Receiver	Rohde & Schwarz	ESW 44	33890	7-2018	1 year
BiLog antenna	Chase	CBL6110A	971	9-2017	3 years
Preamplifier	Semko	AM1331	303661	4-2018	1 year
Measurement cable	Huber + Suhner	Sucoflex 106	39122	4-2018	1 year
Measurement cable	Rosenberger	LA5-S003-10000	39163	10-2018	1 year
Measurement cable	Rosenberger	LA5-S003-7000	39162	10-2018	1 year

15 MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz ± 3.7 dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 5.1 dB
Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	± 4.7 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 4.8 dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	± 5.7 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.
The measurement uncertainty is given with a confidence of 95 %.

16 TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1906451STO-001 Annex 1.
Test set up photos are in separate document 1906451STO-001 Annex 2.

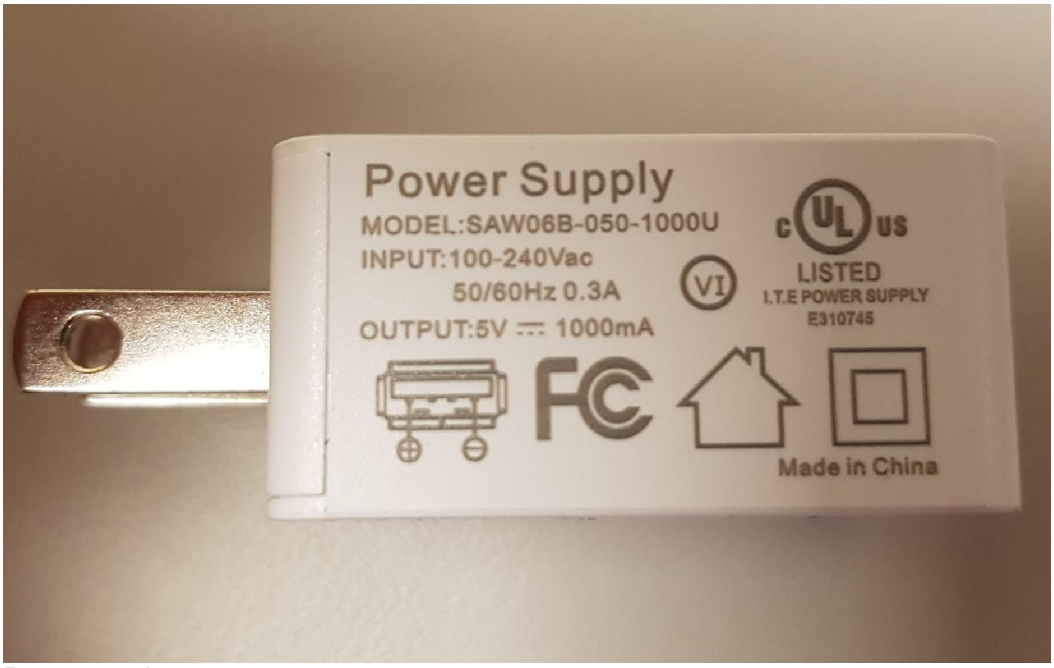
Photos of EUT

Heart Monitor top

Heart Monitor bottom

Charging station

Charging station



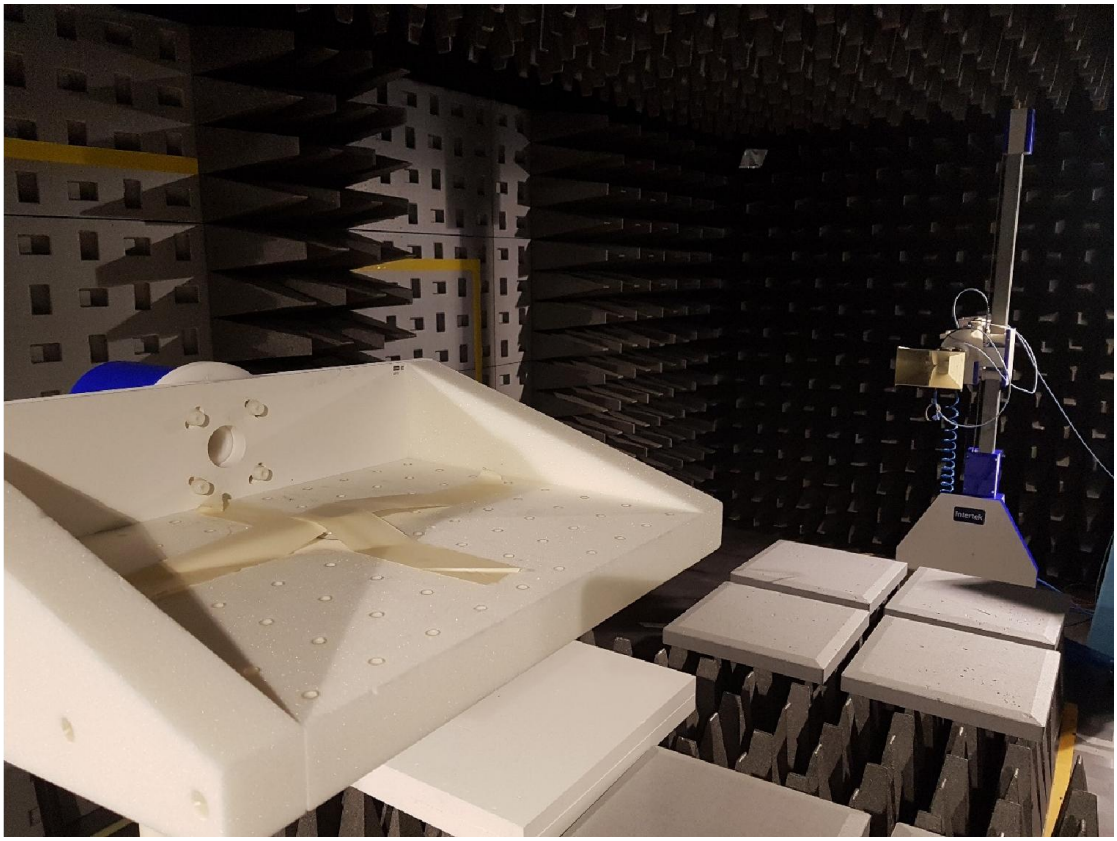
Power supply

Photos of test setup.

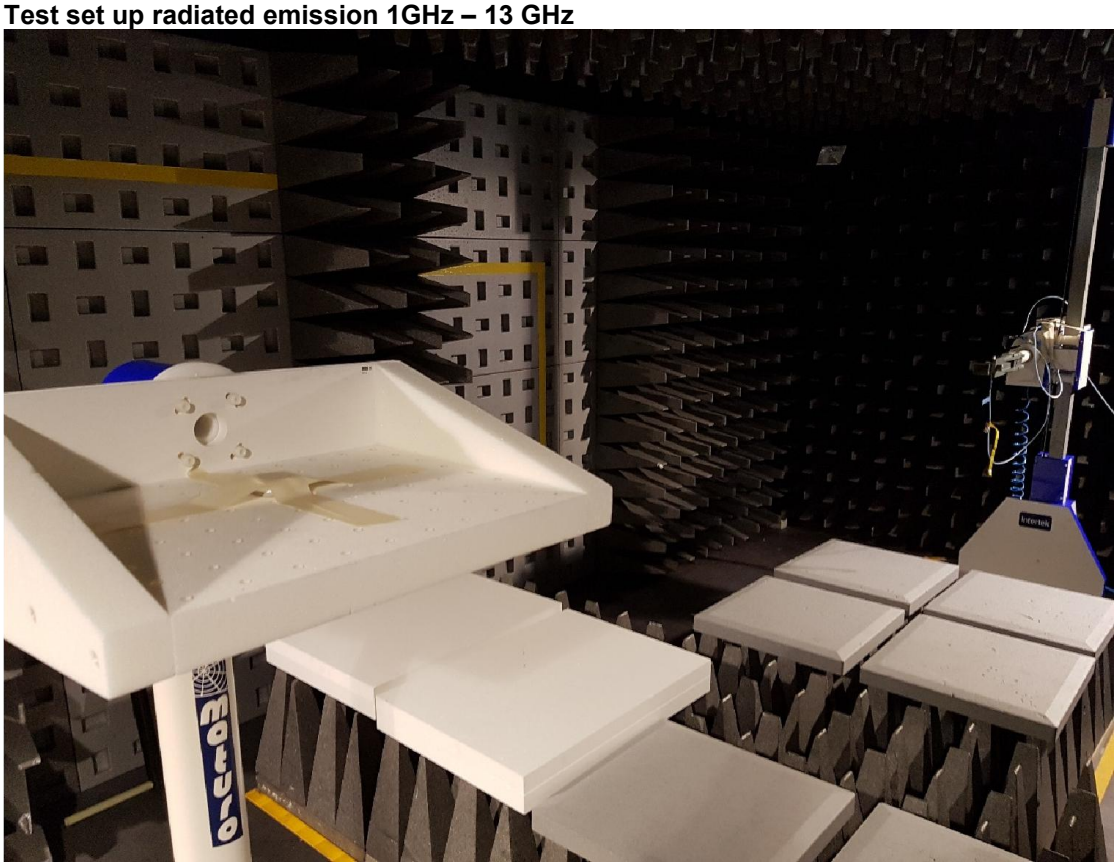
Test set up radiated emission 30 MHz – 1GHz

Test set up radiated emission 30 MHz – 1GHz

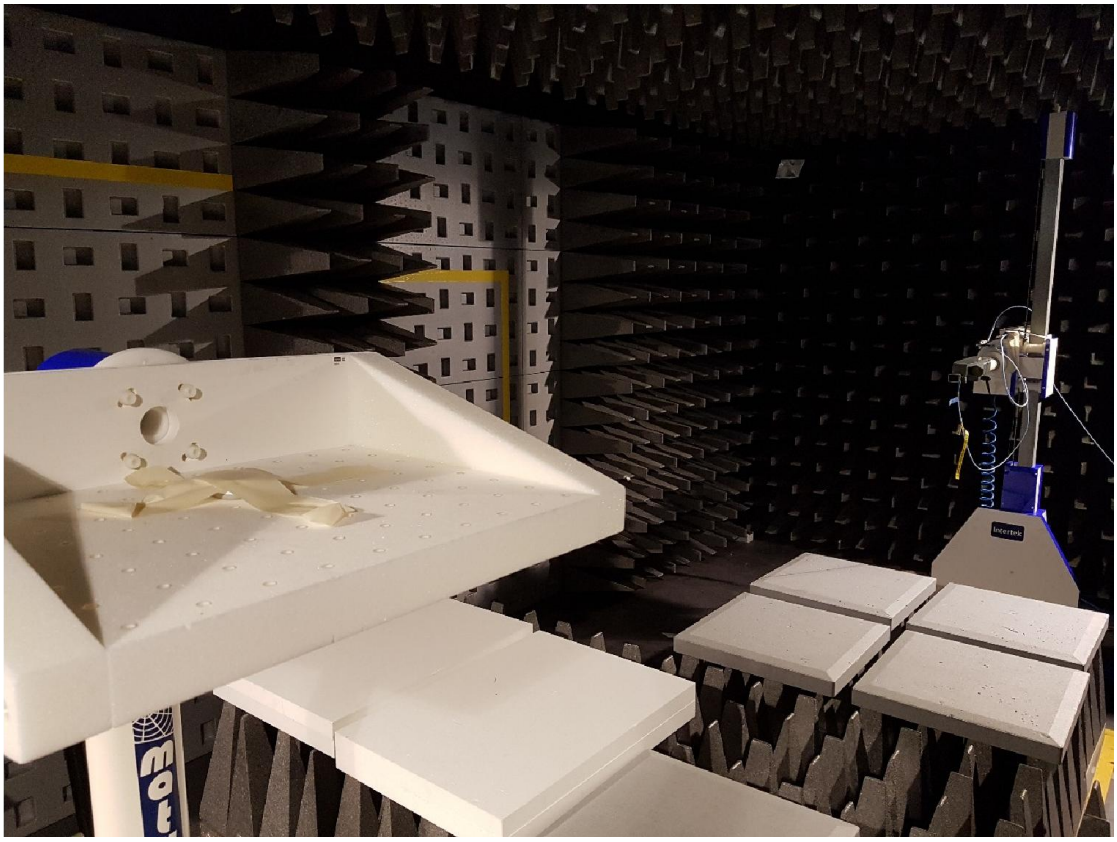
Test set up radiated emission 30 MHz – 1GHz Heart Monitor in a charging station



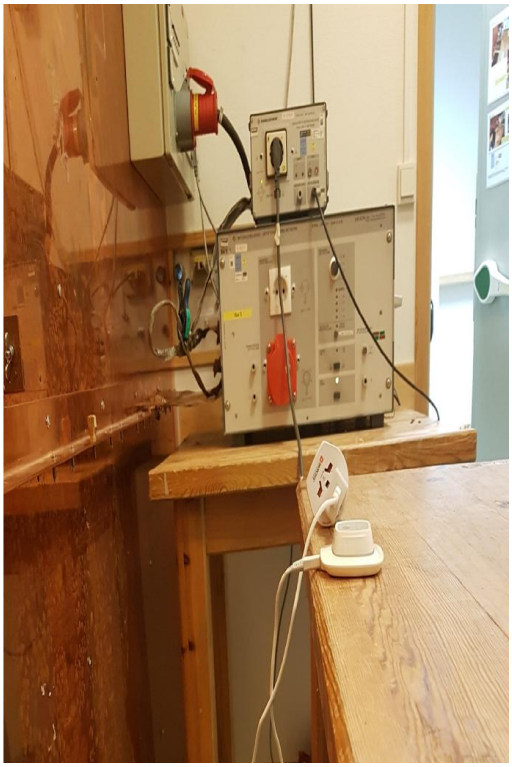
Test set up radiated emission 1GHz – 13 GHz



Test set up radiated emission 13GHz – 18 GHz



Test set up radiated emission 18 GHz – 26.5 GHz



Test set up conducted emission 150 kHz – 30 MHz