FCC and IC Test report for 47 CFR part 15C; RSS-247, RSS-Gen

(Transmitter spurious emissions only)

The RvA is signatory to ILAC - MRA

Product name	: Gateway 1211
Variant	: Gateway 1231
Applicant	: Treon
FCC ID	: 2AR86GW12

Test report No. : P000319246 001 Ver 1.00

Laboratory information

Accreditation

Kiwa Nederland B.V. complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2017. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L248 and is granted by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

Kiwa Nederland B.V. is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001.

Kiwa Nederland B.V. is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.
The Industry Canada company number for Kiwa Nederland B.V. is: 4173A. The CABID is NL0001.

Kiwa Nederland B.V. is a registered Conformity Assessment body (CAB) under the Japan-EC MRA (Agreement on Mutual Recognition between Japan and the European Community). The registration number is: 201.

Documentation

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Kiwa Nederland B.V.

Testing Location

Test Site	Kiwa Nederland B.V.
Test Site location	Wilmersdorf 50 7327 AC Apeldoorn The Netherlands Tel. +31 88998 3393
Test Site FCC	NL0001
CABID	NL0001

Revision History

Version	Date	Remarks	By
v0.50	20-02-2024	First draft	PS
v1.00	11-03-2024	Final release	PS

Table of Contents

Summary of Test results

FCC	ISED	Description	Section in report	Verdict
§ 15.247(d)	RSS-247 §5.5	Radiated spurious emissions	3.1	Pass
§ 15.247(d)	RSS-247 §5.5	Authorized bandedge emissions	3.2	Pass
§ 15.207(a), (c)	RSS-Gen 8.8	AC conducted spurious emissions	3.3	Pass

1 General Description

1.1 Applicant

Client name:	Treon Oy
Address:	Visiokatu 3
Zip code:	33720, Tampere FINLAND
Telephone:	+358505507331
E-mail:	certification@treon.fi
Contact name:	Janne Julkunen

1.2 Manufacturer

Manufacturer name:	Treon Oy
Address:	Visiokatu 3
Zip code	33720, Tampere FINLAND
Telephone:	+358505507331
E-mail:	certification@treon.fi
Contact name:	Janne Julkunen

1.3 Tested Equipment Under Test (EUT)

Product name:	Treon Gateway 2 1211
Brand name:	Treon
Model or type	Model 1211, variant WP
FCC ID:	2AR86GW12
Product description:	Wireless IoT Gateway
Variant model(s):	Model 1211, Variant BT
Batch and/or serial No.	--
Software version:	V7
Hardware version:	B5.1
Date of receipt	09-10-2023
Tests started:	09-10-2023
Testing ended:	26-10-2023

1.4 Product specifications of Equipment under test

Wi-Fi	
Tx Frequency:	2.412GHz - 2.462 GHz
Rx frequency:	2.412GHz - 2.462 GHz
Antenna type:	chip antenna
Antenna gain:	1.05dBi
Type of modulation:	DSSS
Emission designator:	10M0G7D

BLE	
Tx Frequency:	2.402GHz - 2.480 GHz
Rx frequency:	2.402GHz - 2.480 GHz
Antenna type:	Inverted-F antenna on PCB
Antenna gain:	1.59dBi
Type of modulation:	GFSK
Emission designator	1M00G1D

LTE-M	
Bands 2, 4, 5, 12, 13	1850 - 1910 MHz; 1710 – 1755 MHz; 824 – 849 MHz; 699 – 716 MHz; 777 – 787 MHz
Antenna type:	Monopole antenna
Antenna gain:	2dBi
Type of modulation:	QPSK, QAM
Emission designator	20M0W7D

1.5 Environmental conditions

Test date	28-07-2023	01-08-2023	02-08-2023	09-10-2023	18-10-2023	28-11-2023
Ambient temperature	23.4°C	21.3°C	20.3°C	21°C	21.3°C	18.8°C
Humidity	68.6%	67.6%	56.6%	66.7%	67.6%	33.1%

1.6 Measurement standards

- ANSI C63.10:2013

1.7 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC part 15C, §15.207(a) and §15.247(d)
- RSS-Gen Issue 5
- RSS-247 Issue 3

1.8 Observation and remarks

The EUT contains certified modules, therefore only radiated spurious emissions are measured.
Tests are performed on a representative selection of operating frequency bands.

1.9 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.7 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.7 *"Applicable standards".*

All conducted tests are performed by:

Name : ing P.A. Suringa

Review of test methods and report by:

Name : ing R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 10-04-2024

Name : P. van Wanrooij

Function : Test Engineer

Signature :

2 Test configuration of the Equipment Under Test

2.1 Test mode

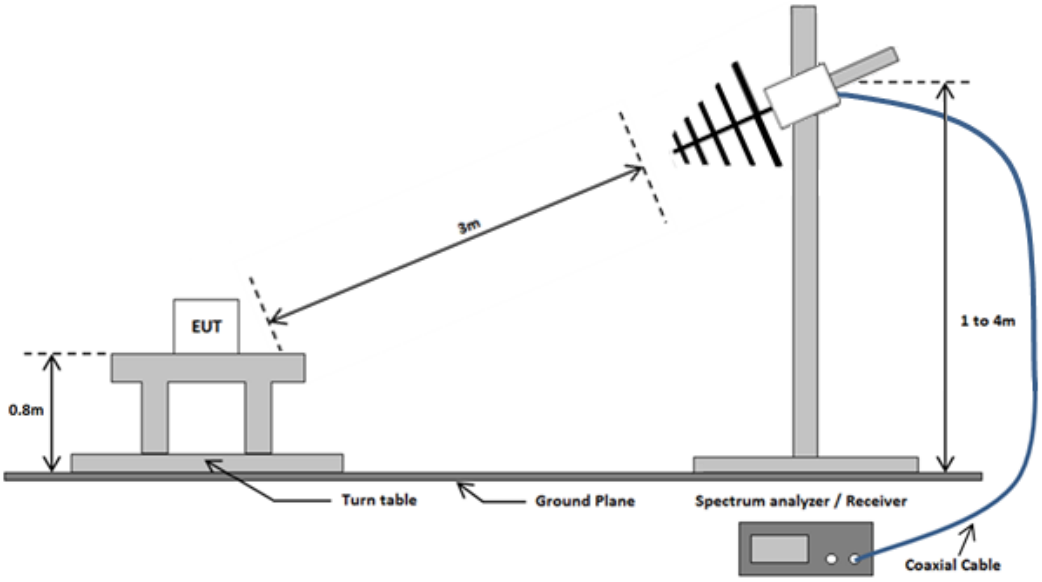
For WiFi/BLE, the manufacturer provided test mode firmware to set the EUT to transmit continuously in selectable channels

Tested channels/bands

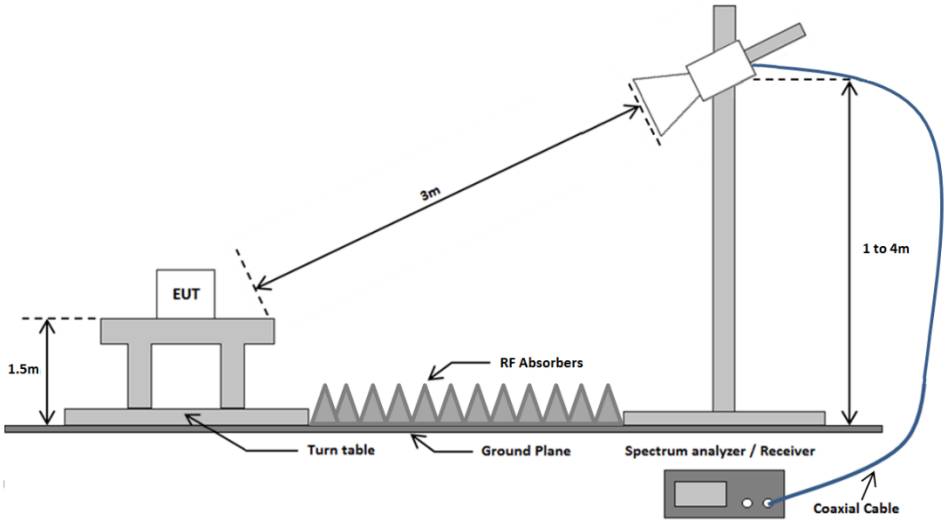
Technology	Band	Channels #	Data rate	Frequency range (MHz)
WiFi	2.4 GHz	1, 6, 11	11 Mbps	2412 – 2462
BLE	2.4 GHz	37, 17, 39	1 Mbps	2402 -2480

2.2 Test setups

Radiated emissions test setup 30 MHz - 1 GHz

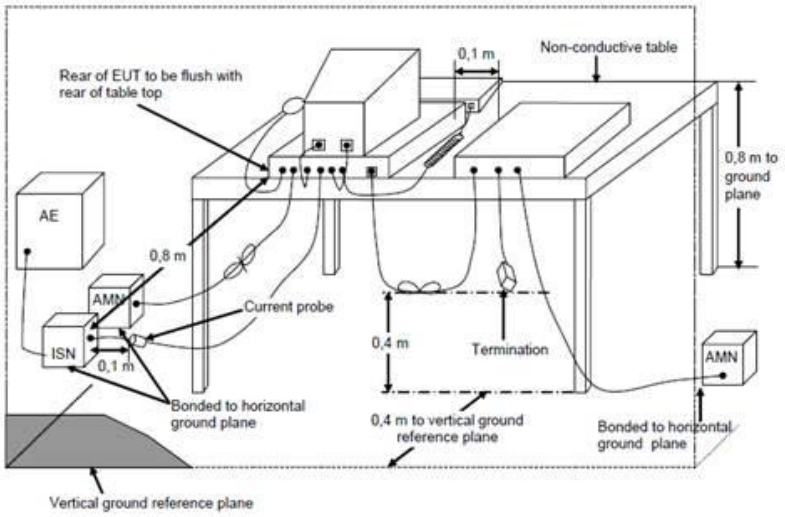


Radiated emissions test setup above 1 GHz



Conducted emissions test setup

Emissions test at AC mains



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Cal. Done date	Cal. due date	Used at Par.
EMI Receiver	Rohde & Schwarz	ESCI	114161	01-2023	01-2024	3.2
Spectrum analyzer	Rohde & Schwarz	FSP40	114792	01-2023	01-2024	3.1
Measurement receiver	Rohde & Schwarz	ESR7	114870	04-2023	04-2024	3.1
Biconical antenna (+ 6 dB atten.)	Schwarzbeck	BBA 9106 + VHA 9103	114436	11-2023	11-2024	3.1
Horn antenna	EMCO	3115	114607	01-2021	01-2024	3.1
Preamplifier	µComp	MCNA-40-001080	114771	07-2021	07-2024	3.1
Semi-Anechoic room	ETS Lindgren	SAR	114624	01-2022	01-2024	3.1
Active loop antenna	EMCO	6502	114515	01-2022	01-2024	3.1
Preamplifier	MITEQ	JS4-18004000-33-8P	TE 11131	03-2021	03-2024	3.1
Horn antenna	Flann Microwave	20240-25	114518	03-2021	03-2024	3.1
Log periodic antenna	EMCO	3147	114436	03-2021	03-2024	3.1
Test software	DARE	Radimation Version 2023.2.3	--	--	--	3.1
3.0 GHz HPF	Wainwright	WHK3.0/18G-10EF	114682	07-2021	07-2024	3.1
LISN /Two line V-network	Rohde & Schwarz	ENV 216	114379	11-2023	11-2024	3.2

2.4 Sample calculations

All formulas for data conversions and conversion factors are reported in chapter 4 of this test report.

3 Test results

3.1 Radiated spurious emissions

3.1.1 Limit

Part 15C

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance(m)
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.1.4 Test procedure

30 MHz to 26.5 GHz: According to ANSI C63.26-2015 section 5.5.2

30 MHz to 1 GHz: IRN 026 – Method 1
1 GHz to 18 GHz: IRN 026 – Method 2
18 to 26.5 GHz: IRN 026 – Method 3

3.1.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
30 – 250 MHz	Hor. & Vert.	+/- 6.29 dB
250 -1000 MHz	Hor. & Vert.	+/- 4.52 dB
1 – 18 GHz	Hor. & Vert.	+/- 5.36 dB
18 – 26.5 GHz	Hor. & Vert.	+/- 4.12 dB

3.1.6 Test results

BLE

30-250 MHz low channel (plot 1h)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi- Peak limit [dBµV/m]	Polarization
1	98.448	39.8	35.8	43.5	Vertical
2	77.209	38.9	35.8	40	Vertical
3	43.801	34.6	30.9	40	Vertical
4	53.627	19.9	9.7	40	Horizontal
5	136.397	23.5	12.1	40	Horizontal

30-250 MHz middle channel (plot 1i)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi- Peak limit [dBµV/m]	Polarization
1	67.481	17.5	6.7	40	Horizontal
2	65.704	17.4	6.4	40	Horizontal
3	98.404	37.9	34.3	43.5	Vertical
4	74.58	40	37.5	40	Vertical
5	43.803	35.8	32.3	40	Vertical

30-250 MHz high channel (plot 1j)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi- Peak limit [dBµV/m]	Polarization
1	62.803	18.1	8.4	40	Horizontal
2	95.887	20.3	9.9	43.5	Horizontal
3	31.831	28.2	16.1	40	Horizontal
4	98.418	39.3	35.4	43.5	Vertical
5	76.549	38.5	35.6	40	Vertical
6	43.808	34.5	30.9	40	Vertical
7	145.269	31.2	25.2	43.5	Vertical

250 MHz – 1 GHz low channel (plot 2g, 2h)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Peak Limit [dBµV/m]	Polarization
1	500.031	41.7	46	Horizontal
2	904.375	44.5	46	Horizontal

250 MHz – 1GHz middle channel (plot 2i, 2j)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi- Peak limit [dBµV/m]	Polarization
1	375.02	41.2	39.7	46	Vertical
2	500.022	34.6	30.1	46	Vertical
3	625.032	38.6	35.3	46	Vertical
4	724.865	30.3	19	46	Vertical
5	374.994	30.5	25.8	46	Horizontal
6	500.028	36	32.4	46	Horizontal
7	614.806	27.8	15.9	46	Horizontal
8	865.358	32.6	20.5	46	Horizontal

250 MHz – 1GHz high channel (plot 2k, 2l)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi-Peak Limit [dBµV/m]	Polarization
1	375.027	38	36.3	46	Vertical
2	500.025	35	30.6	46	Vertical
3	942.347	33.2	21.4	46	Vertical
4	613.048	28.1	16.4	46	Horizontal
5	875.055	41.3	36.9	46	Horizontal

1-18 GHz low channel (plot 3a, 3b)

Peak no.	Frequency [GHz]	Peak [dBµV/m]	Peak limit [dBµV/m	Average [dBµV/m]	Average limit [dBµV/m]	Polarization
1	9.606	57	74	47.7	54	Horizontal

1-18 GHz middle channel (plot 3c, 3d)

Peak no.	Frequency [GHz]	Peak [dBµV/m]	Peak limit [dBµV/m	Average [dBµV/m]	Average limit [dBµV/m]	Polarization
1	9.803	52.8	74	41.9	54	Horizontal

1-18 GHz high channel (plot 3e, 3f)

Peak no.	Frequency [GHz]	Peak [dBµV/m]	Peak Limit [dBµV/m]	Average [dBµV/m]	Average Limit[dBµV/m]	Polarization
1	9.713 GHz	52.7	74	42.2	54	Horizontal
2	14.695 GHz	56.9	74	55.8	54	Vertical

Remark: the average value of peak no.2 is not a signal originating from the EUT (see plot 3f1 with 100 kHz bandwidth).

WiFi

30 - 250 MHz low channel (plot 1a, 1b)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Peak Limit [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi- Peak limit [dBµV/m]	Polarization
1	33.445	38.1	40	33.1	40	Vertical
2	37	38.7	40	33.6	40	Vertical
3	170.162	44.1	43.5	40.2	43.5	Horizontal

30 -250 MHz middle channel (plot 1d, 1e)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Peak Limit [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi- Peak limit [dBµV/m]	Polarization
1	33.233	38.4	40	33.9	40	Vertical
2	36.949	39.1	40	34.6	40	Vertical
3	169.488	43.8	43.5	39.8	43.5	Horizontal

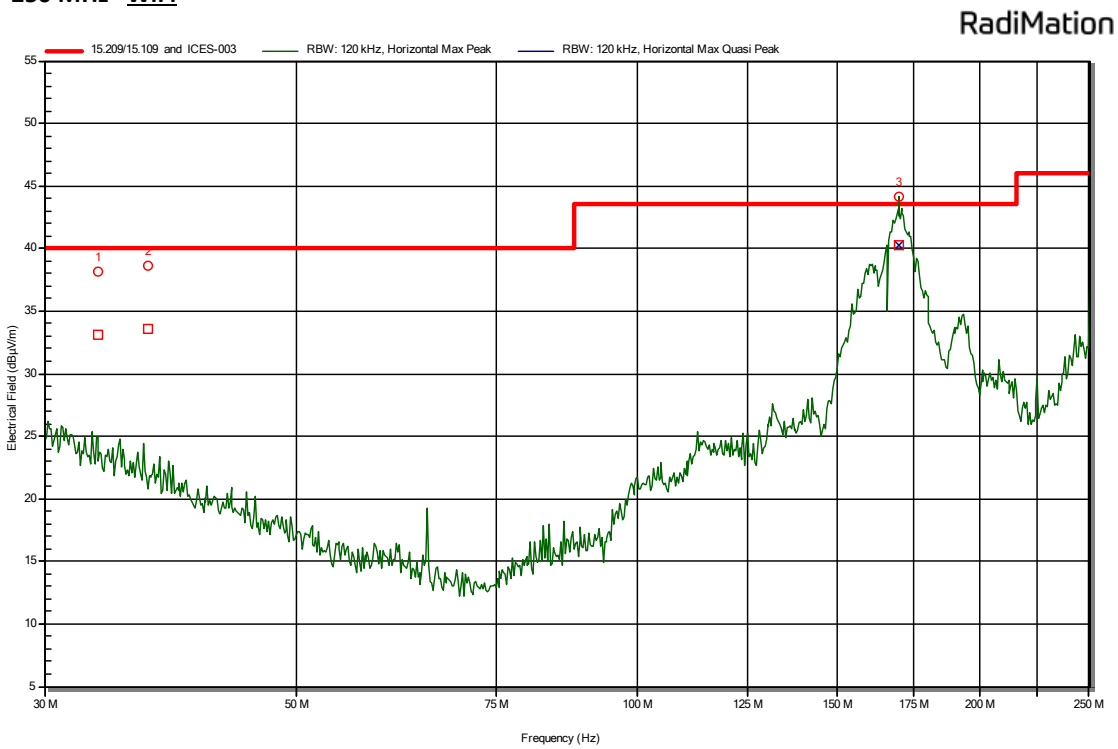
30-250 MHz high channel (plot 1f, 1g)

Peak no.	Frequency [MHz]	Peak [dBµV/m]	Peak Limit [dBµV/m]	Quasi-Peak [dBµV/m]	Quasi- Peak limit [dBµV/m]	Polarization
1	33.42	38.7	40	34.3	40	Vertical
2	36.875	39.1	40	34.7	40	Vertical
3	168.488	44.2	43.5	40.1	43.5	Horizontal

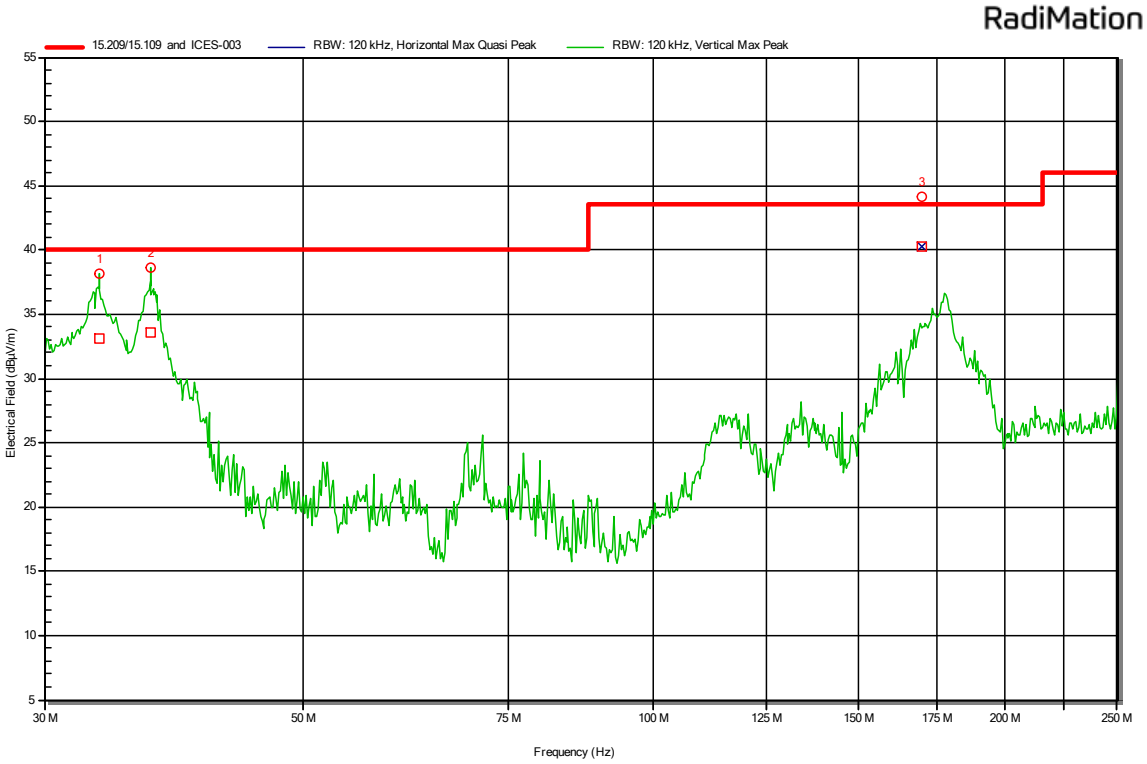
No tables in the frequency range 0.25 – 1 GHz, since the emissions are 10 dB or more below the limit (see plots 2a up to 2f).

3.1.7 Plots of the Radiated Spurious Emissions Measurement

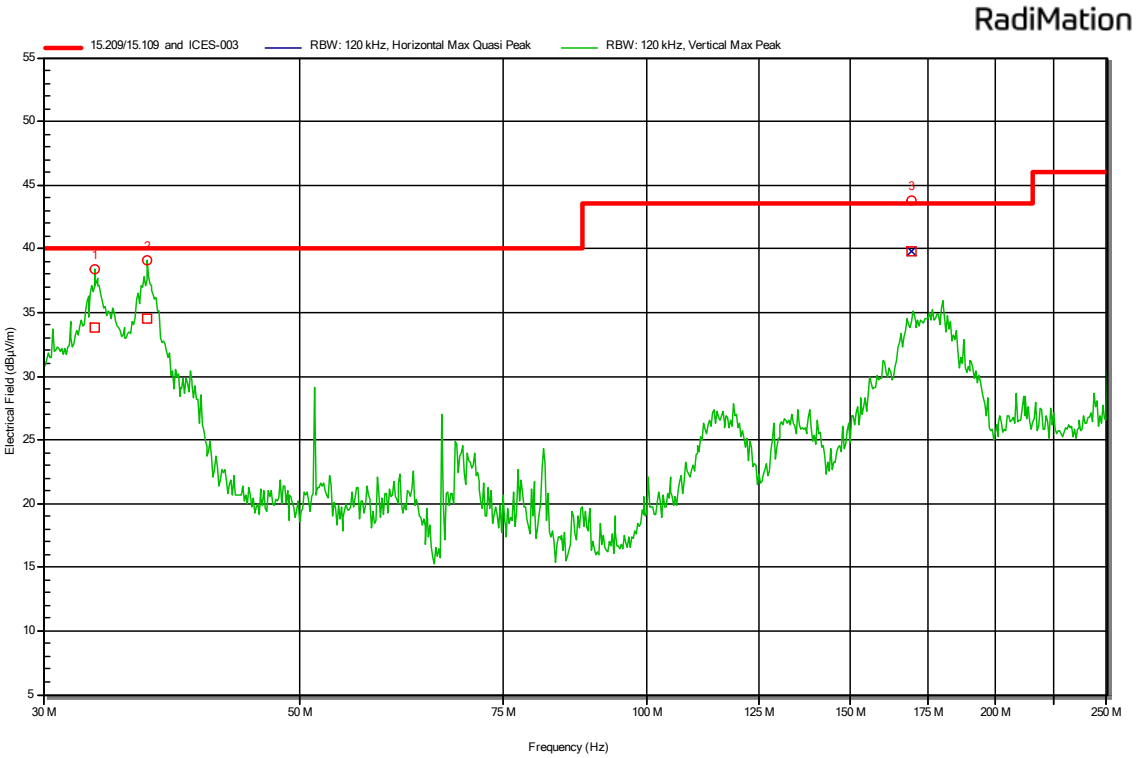
30 – 250 MHz WiFi



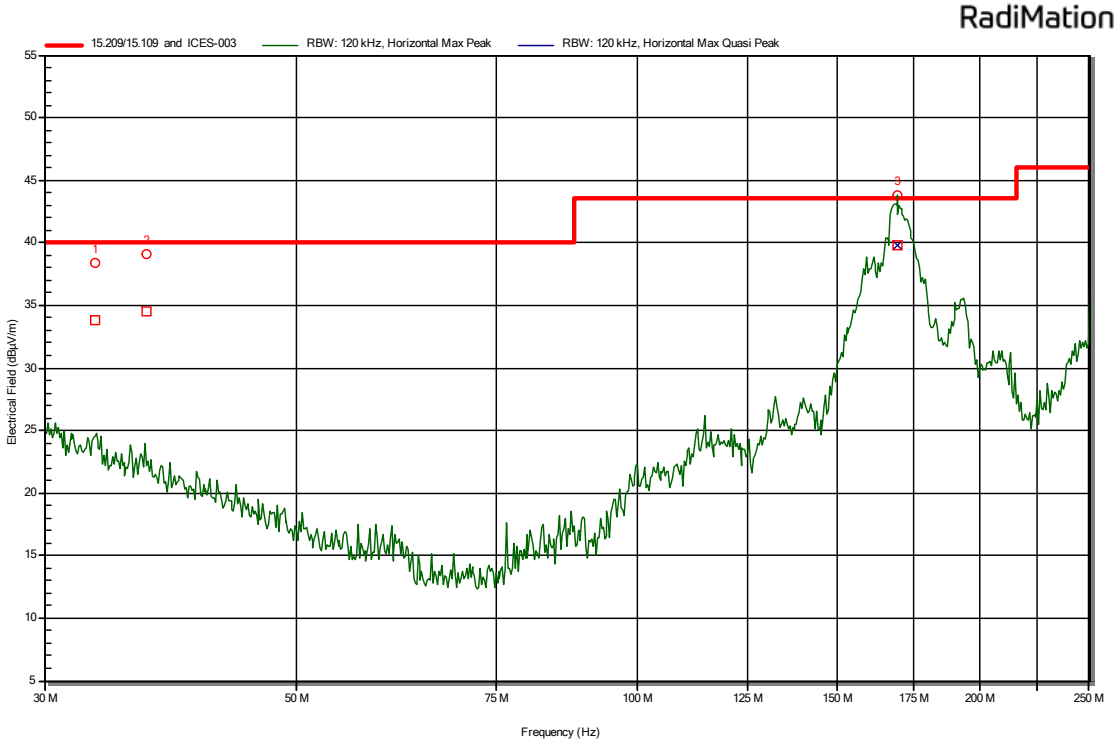
Plot 1a: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
Low channel



Plot 1b: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown) Low channel

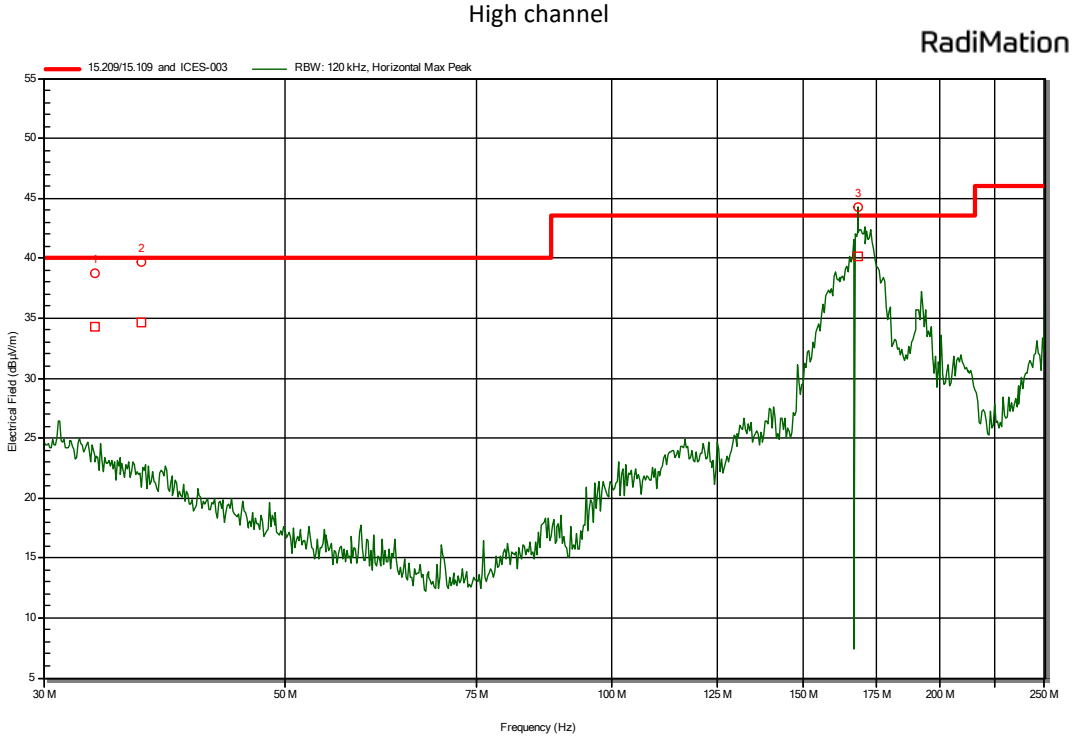


Plot 1d: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
Middle channel



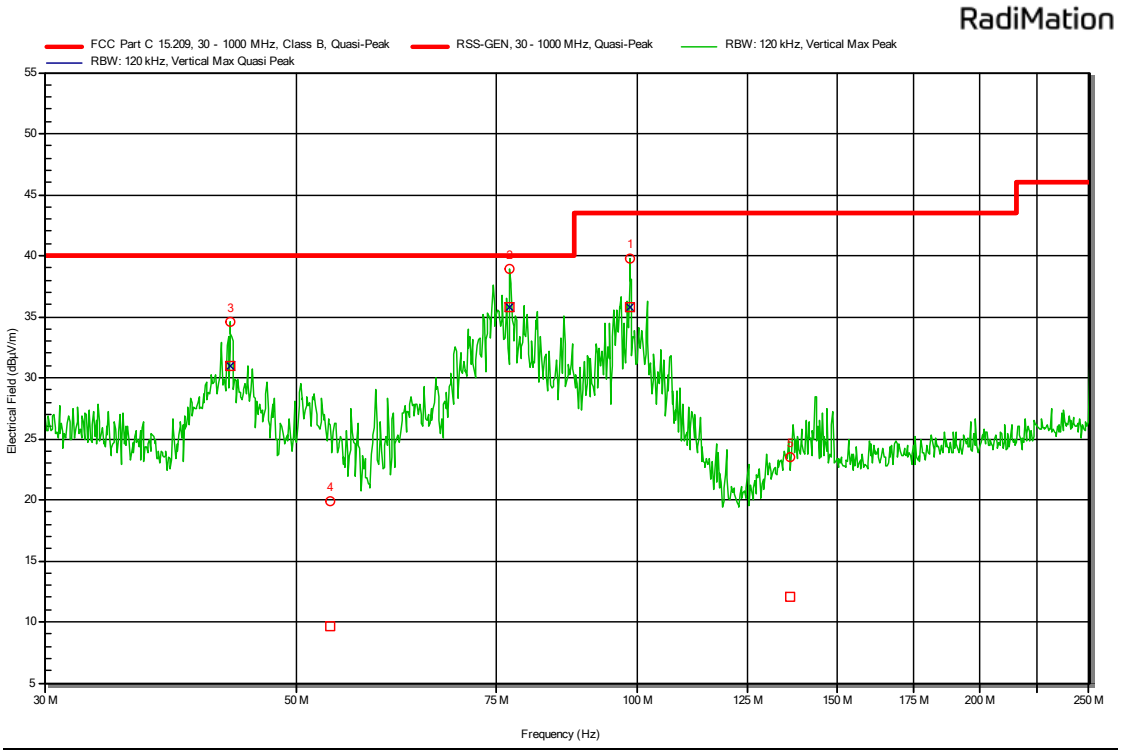
Plot 1e: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
Middle channel

Plot 1f: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel

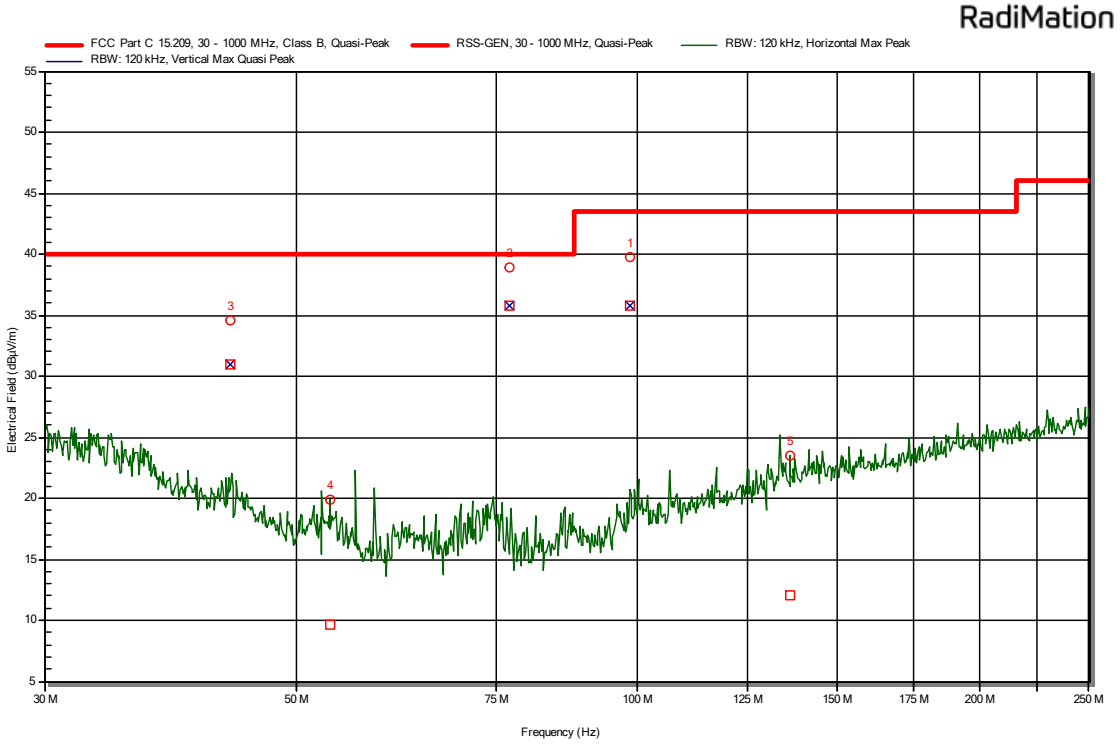


Plot 1g: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel

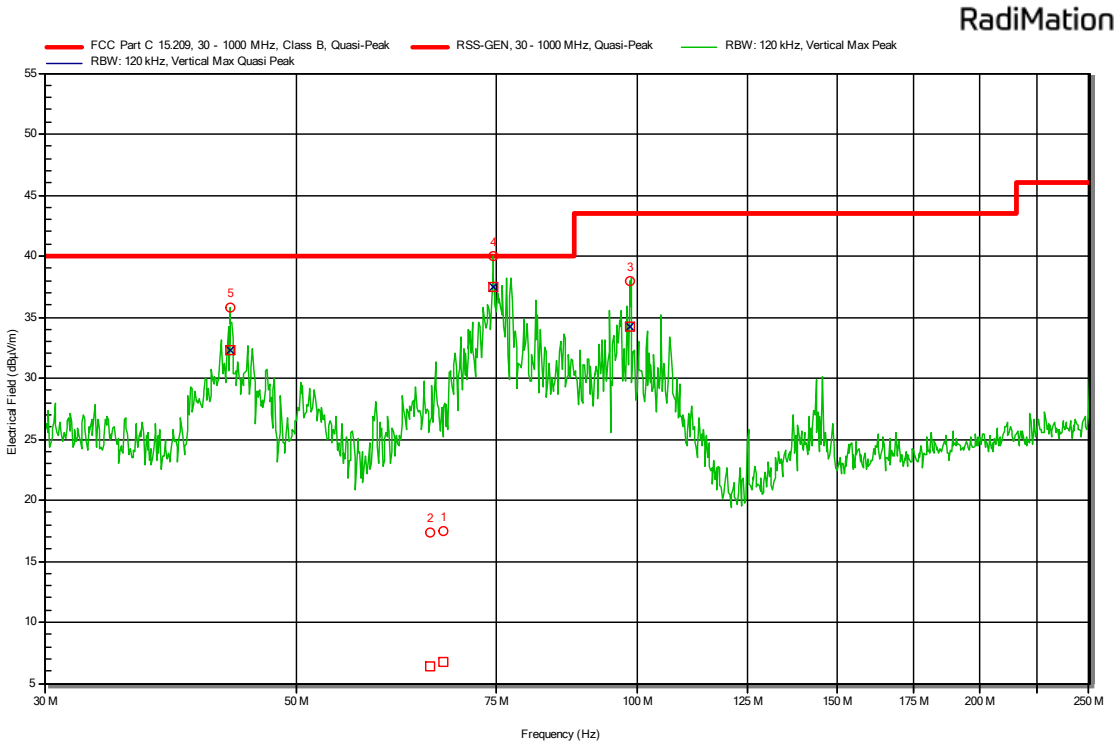
BLE



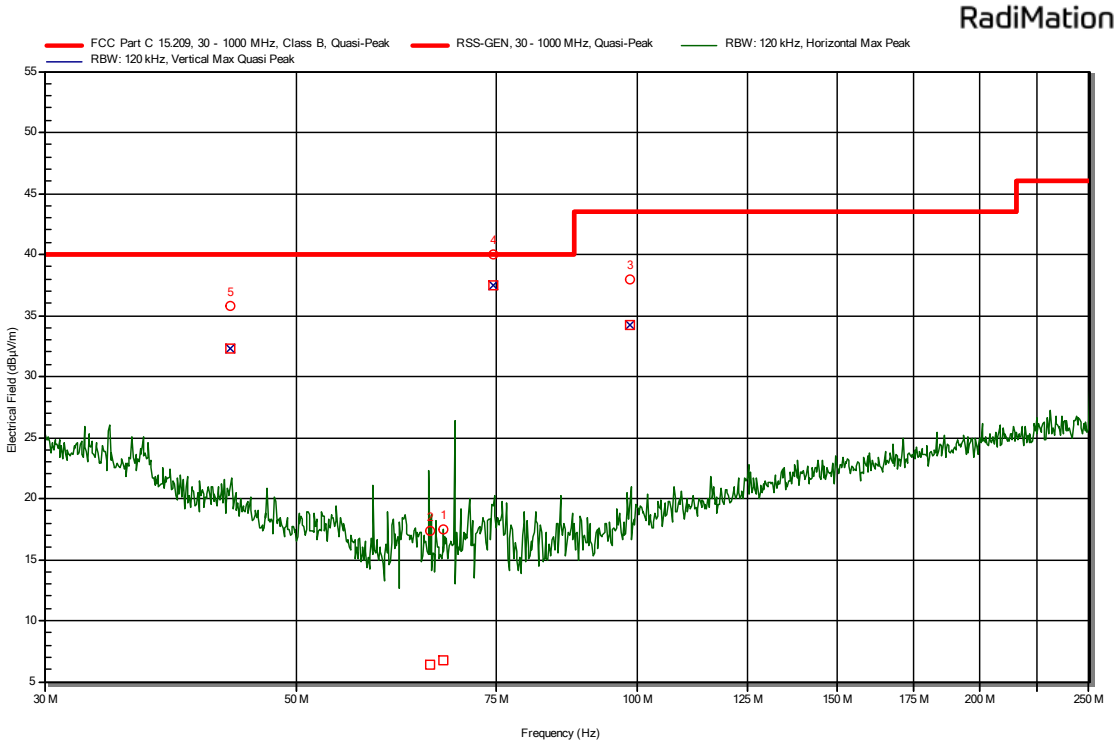
Plot 1h: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
Low channel



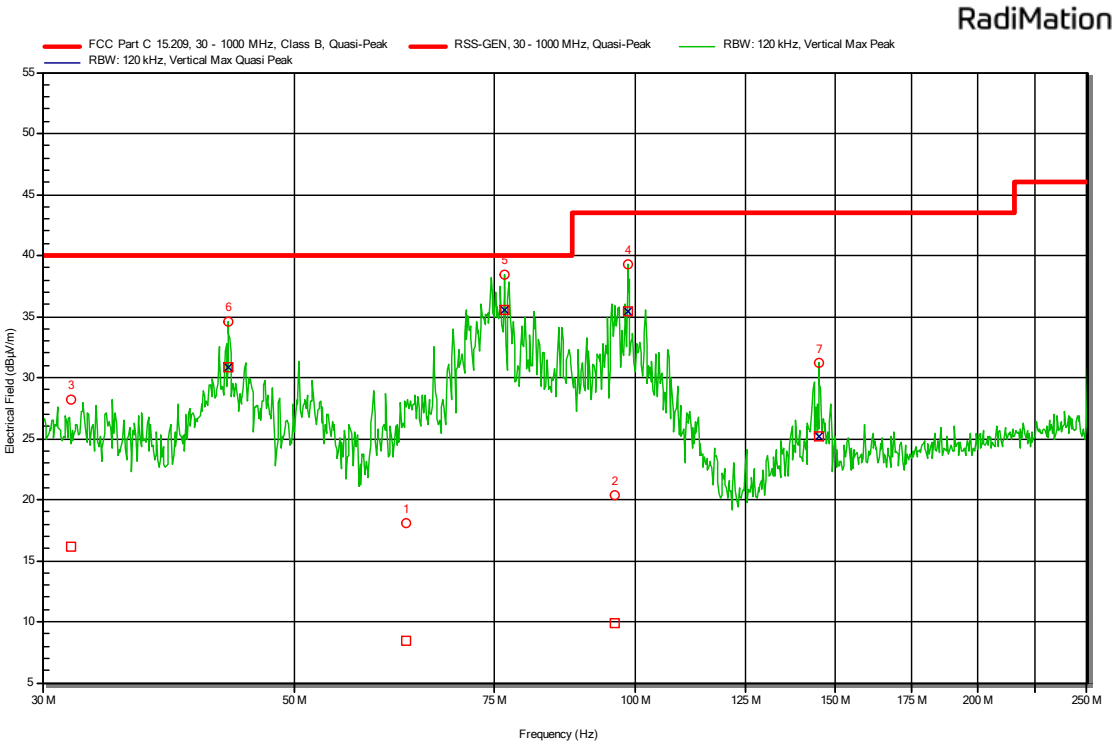
Plot 1i: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
Low channel



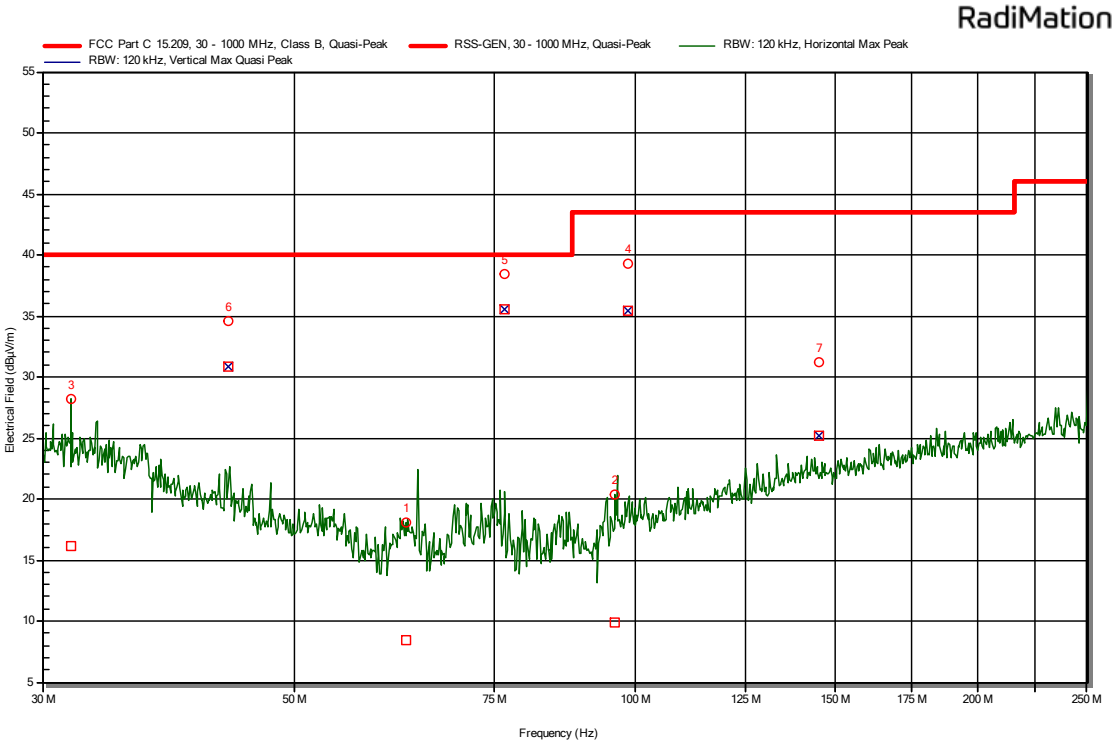
Plot 1j: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
Middle channel



Plot 1k: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
Middle channel



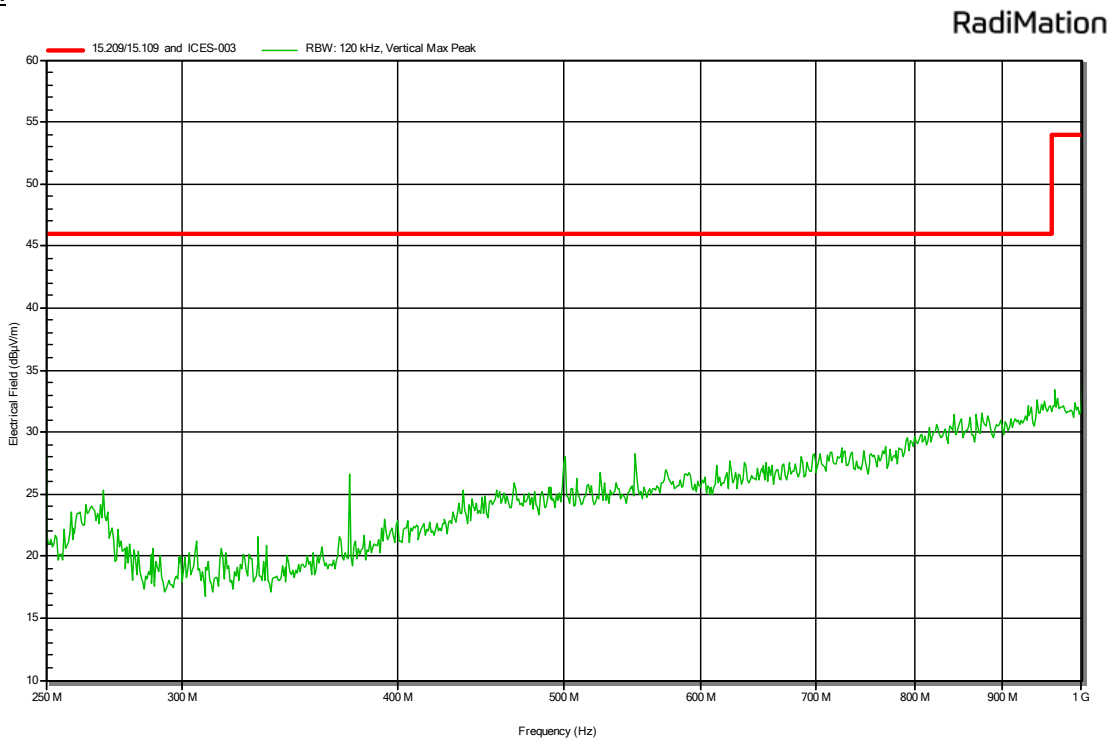
Plot 1l: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel



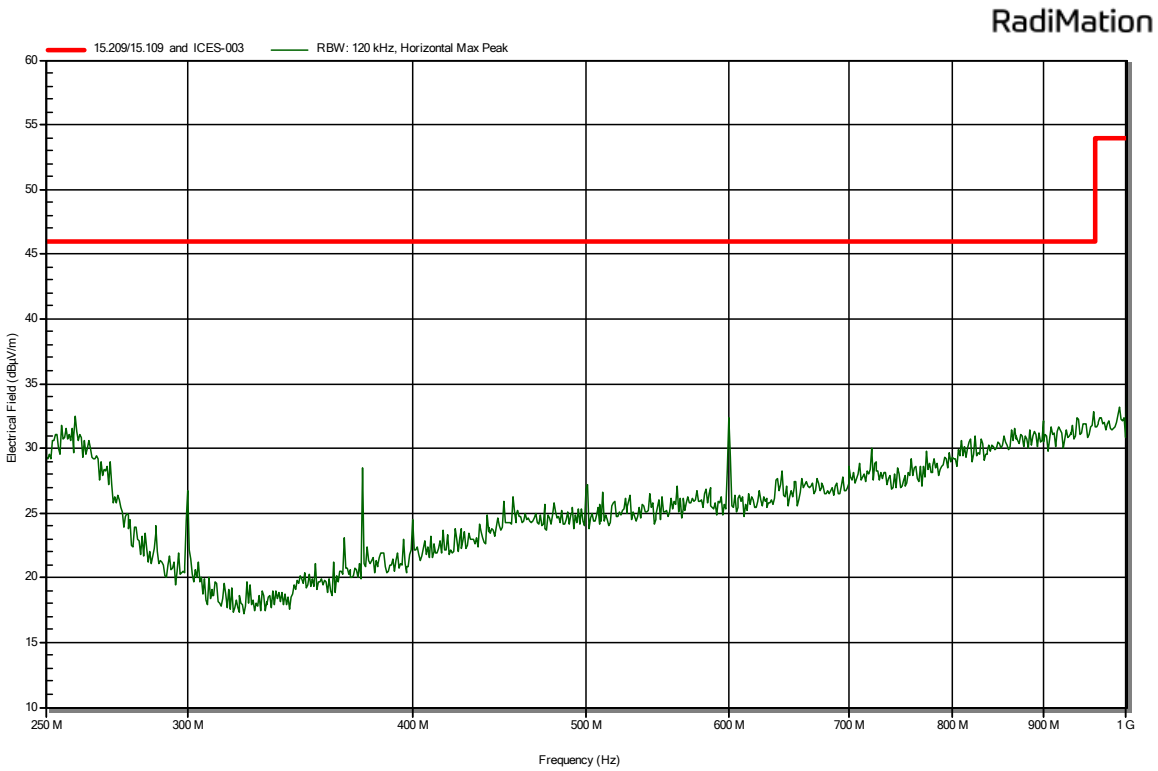
Plot 1m: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel

0.25 – 1 GHz

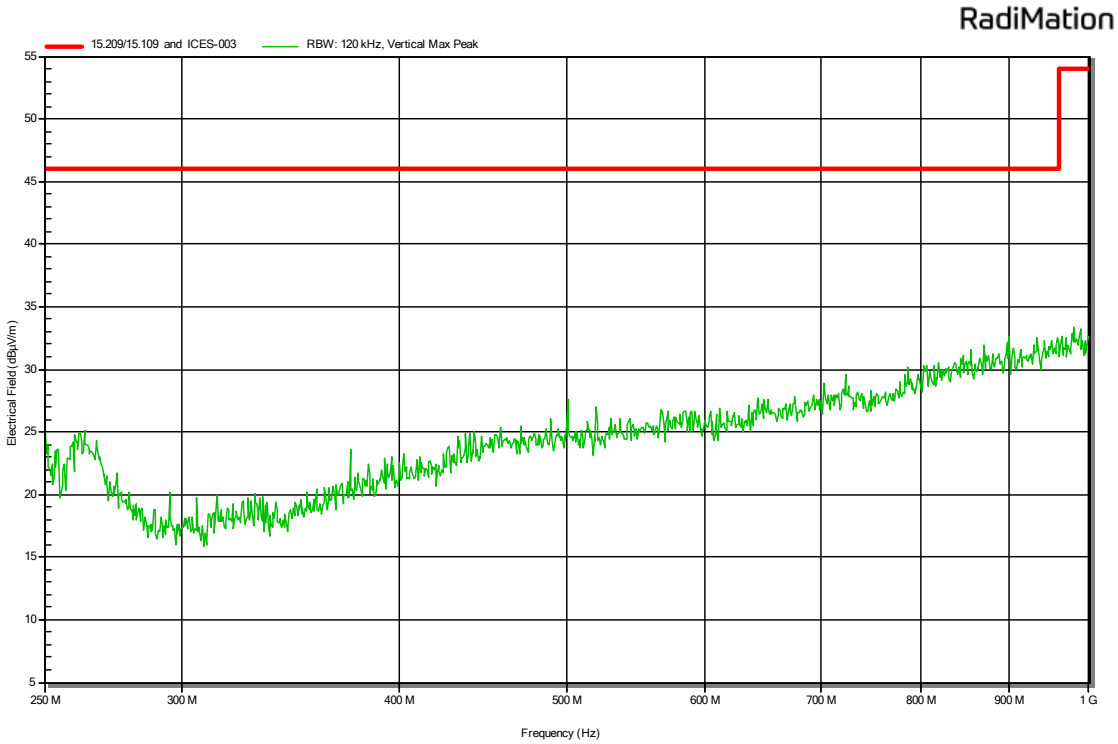
WiFi



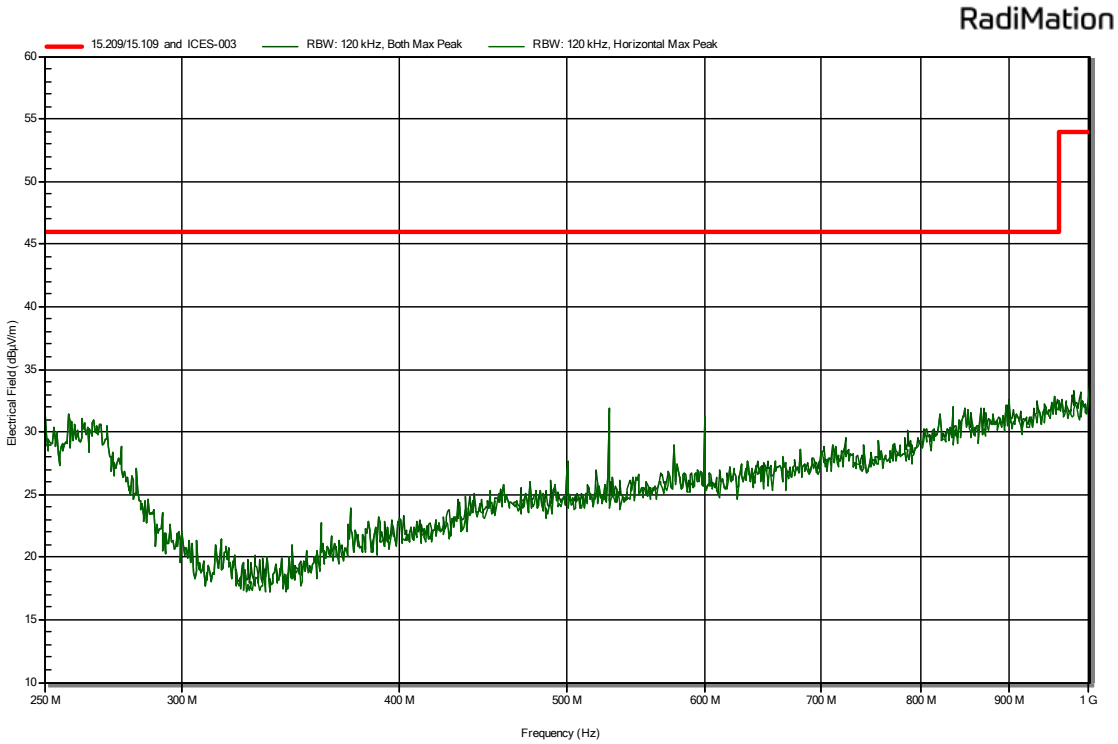
Plot 2a: radiated emissions of the EUT, Antenna vertical , in the range 250-1000 MHz (pre-scan peak values shown) Low channel



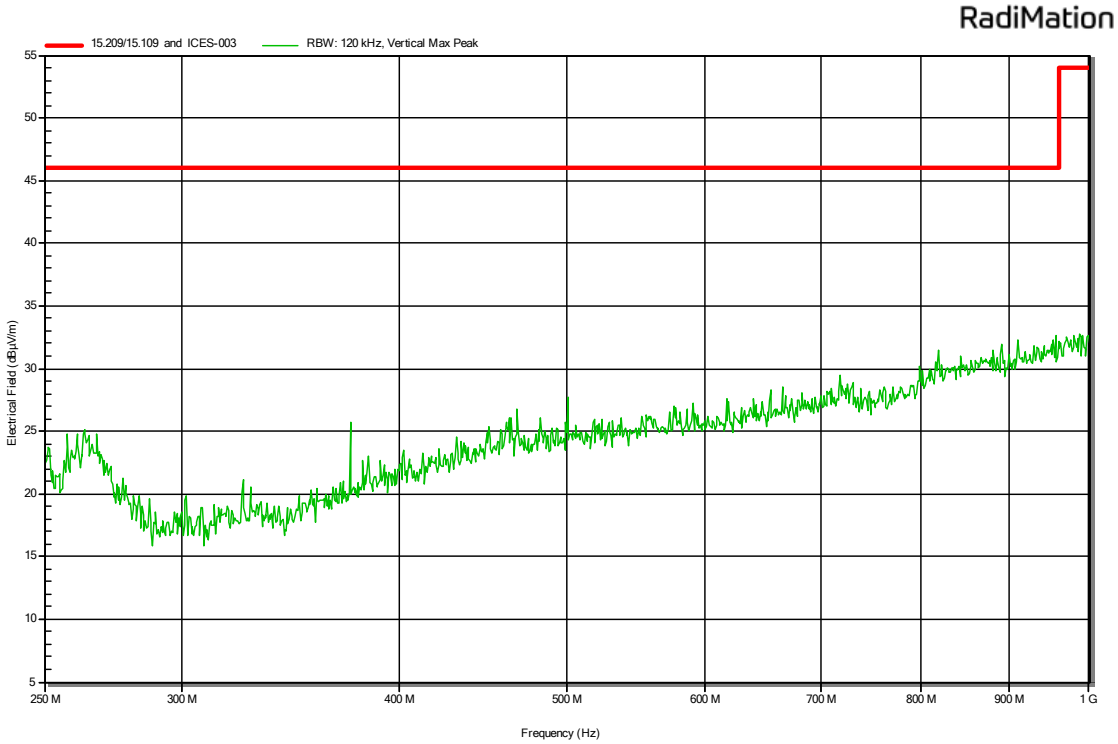
Plot 2b: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)
Low channel



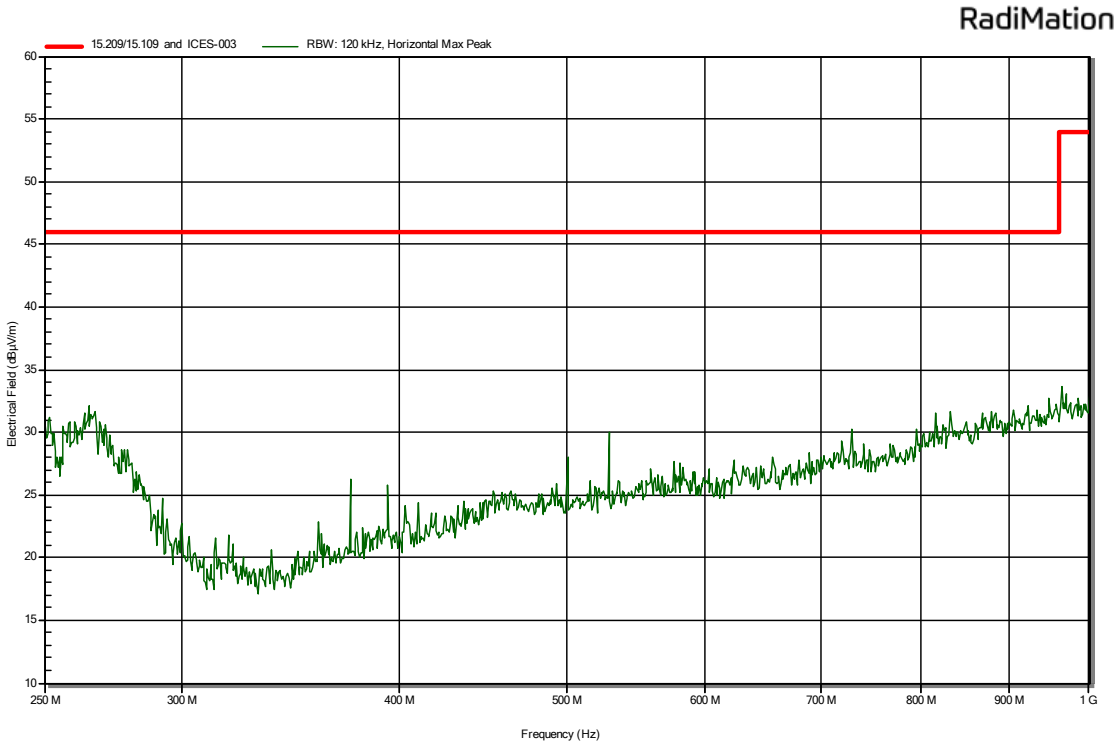
Plot 2c: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)Mid channel



Plot 2d: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)
Mid channel

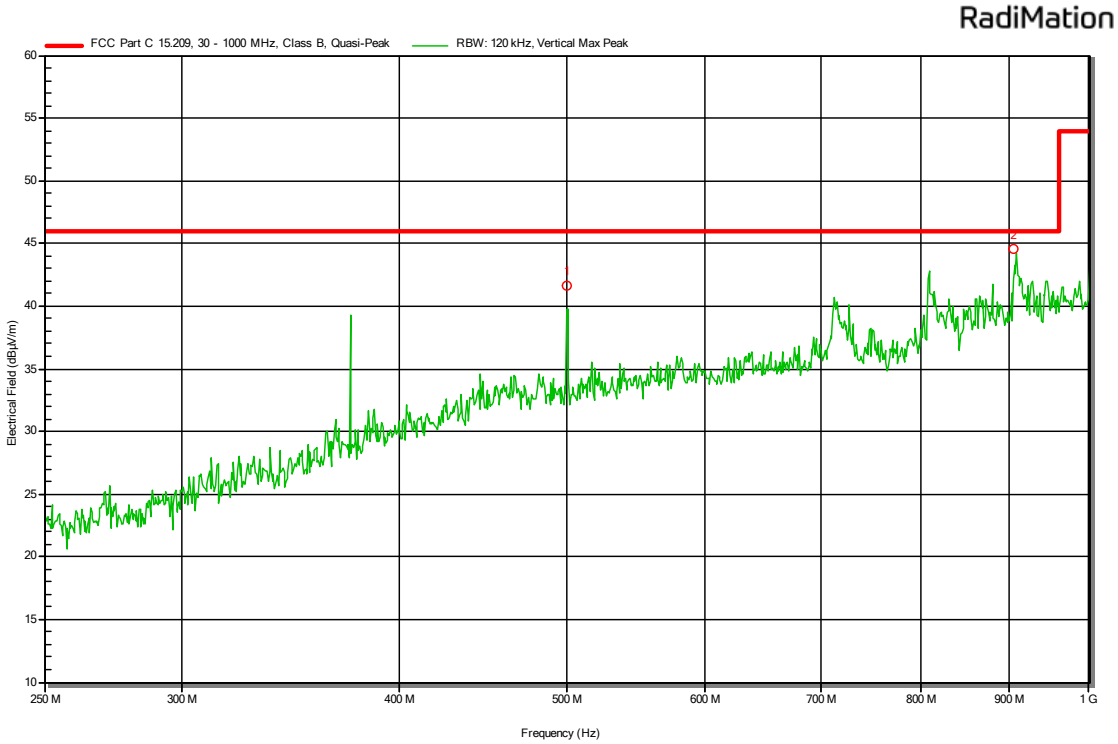


Plot 2e: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)High channel

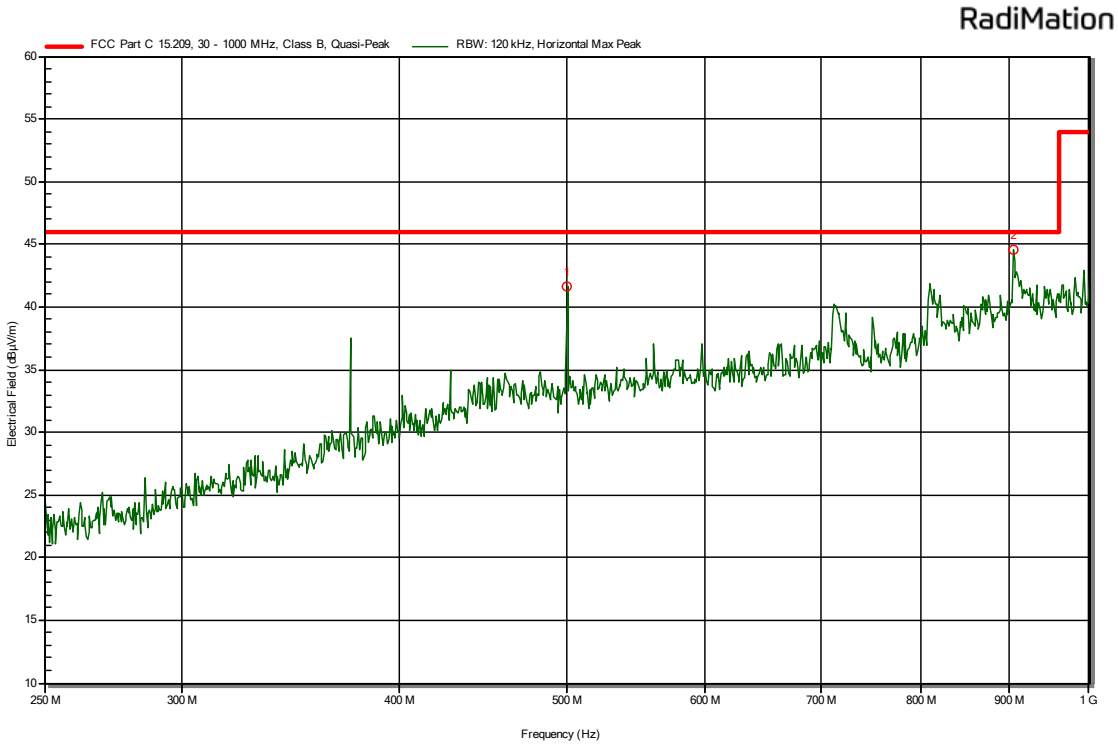


Plot 2f: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz (pre-scan peak values shown)High channel

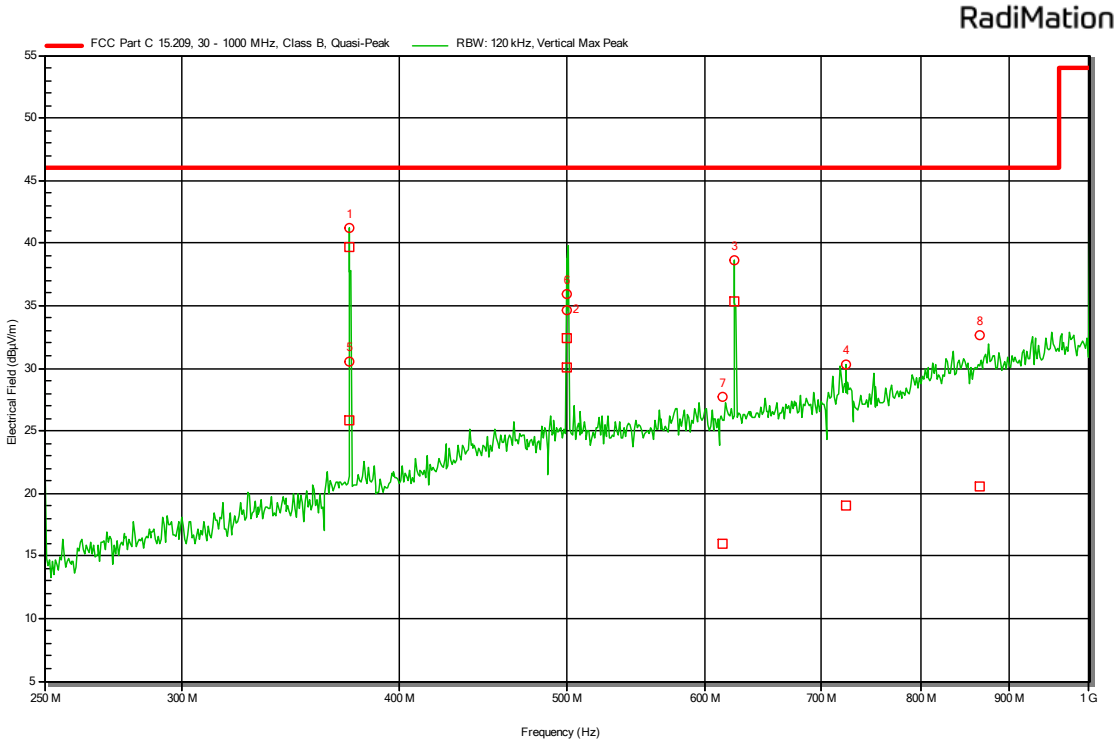
BLE



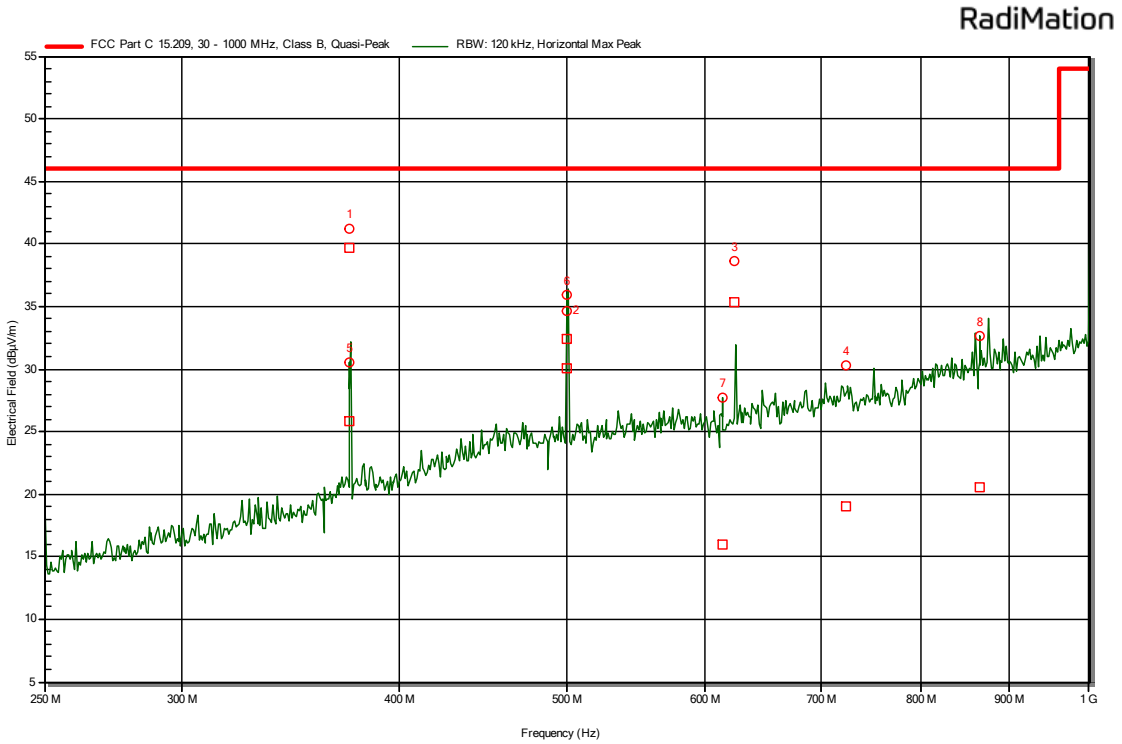
Plot 2g: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz (pre-scan peak values shown) Low channel



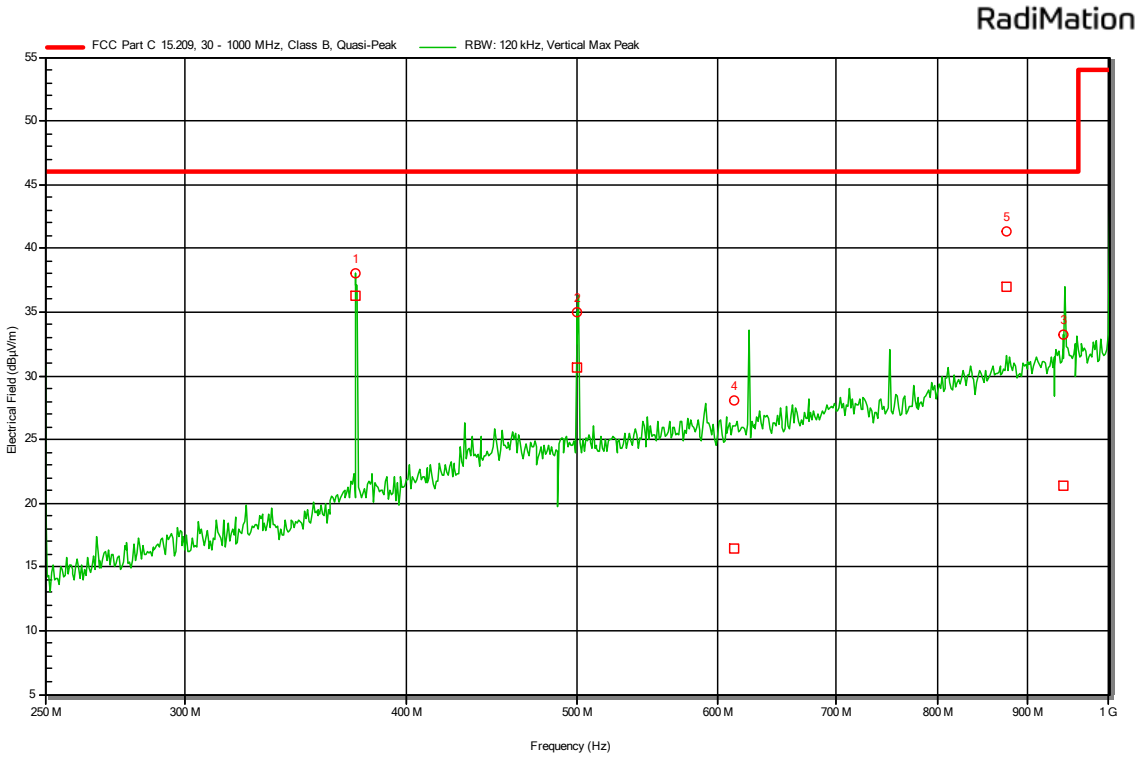
Plot 2h: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz (pre-scan peak values shown) Low channel



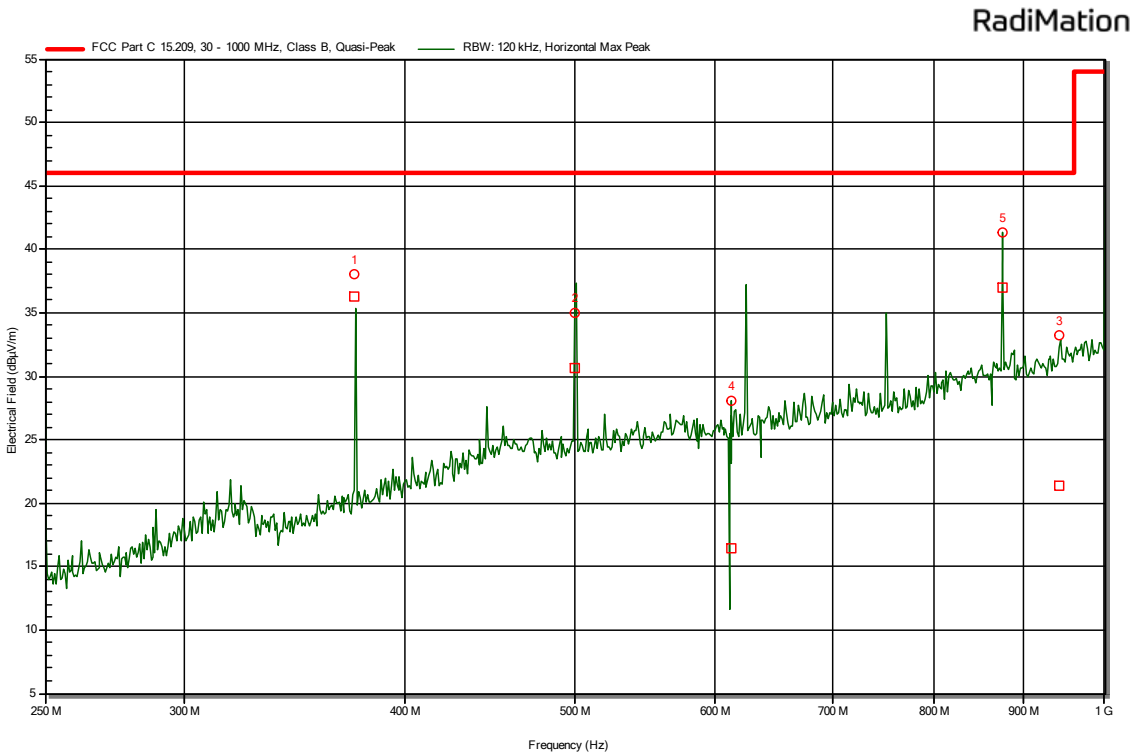
Plot 2i: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz (pre-scan peak values shown)
Middle channel



Plot 2j: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)
Middle channel



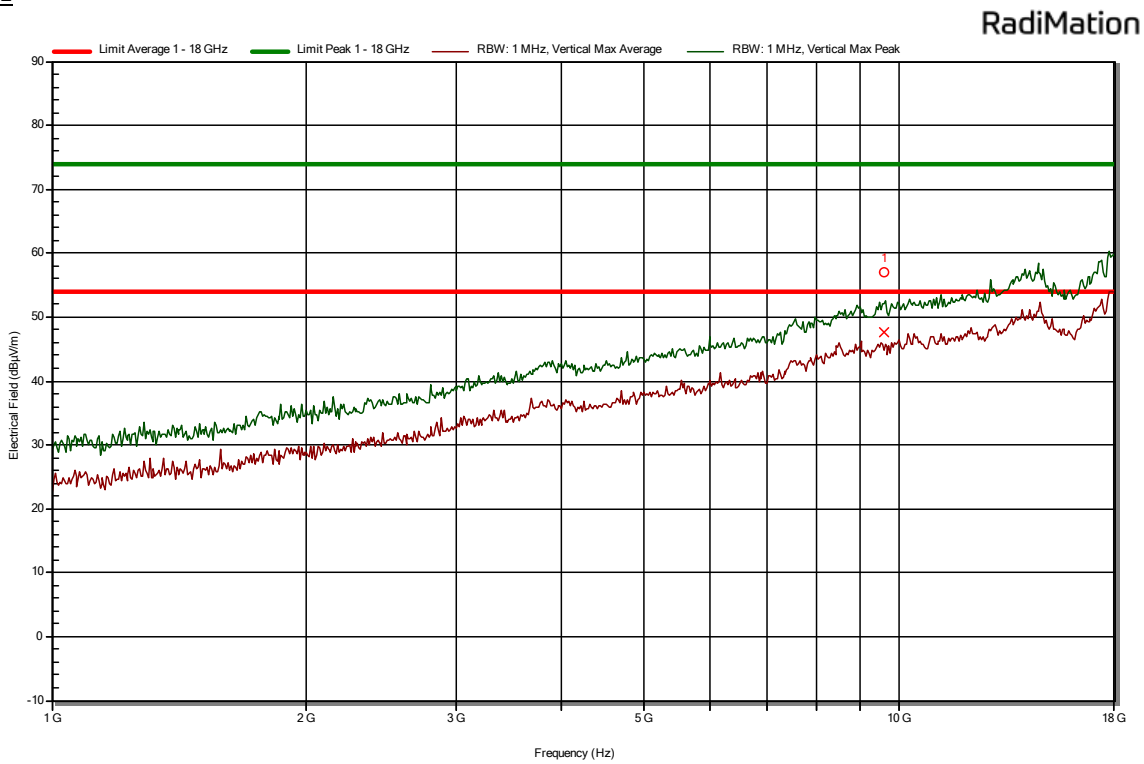
Plot 2k: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)
High channel



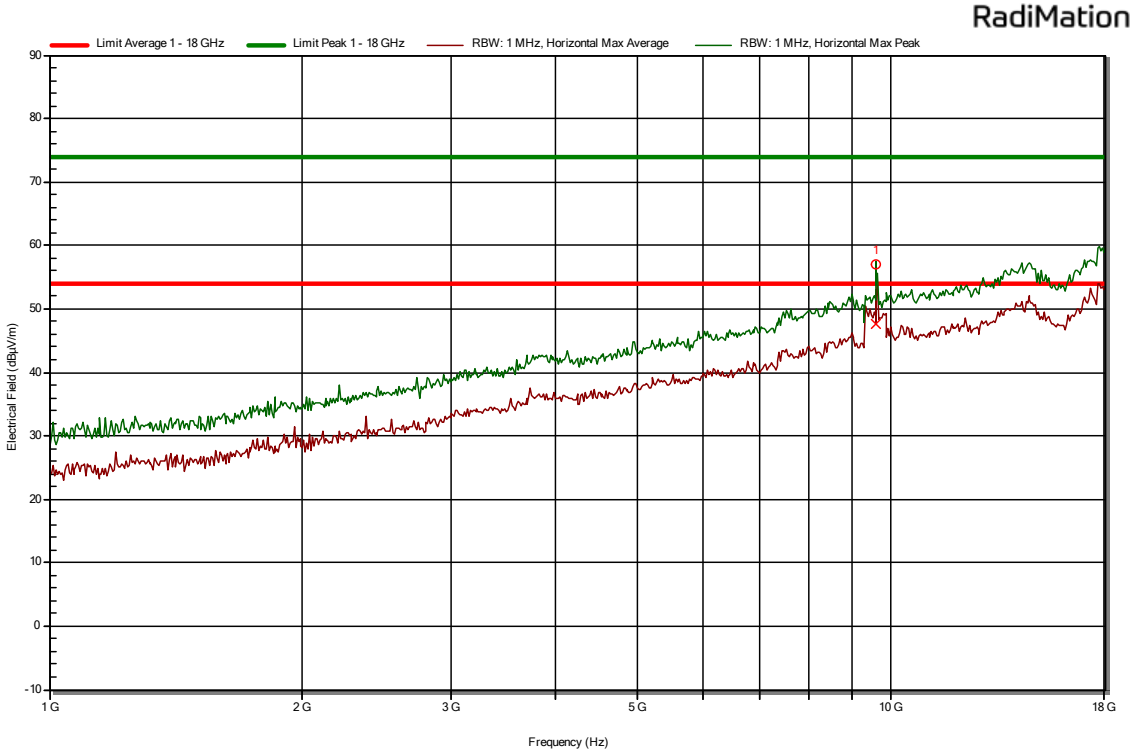
Plot 2l: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)
High channel

1 – 18 GHz

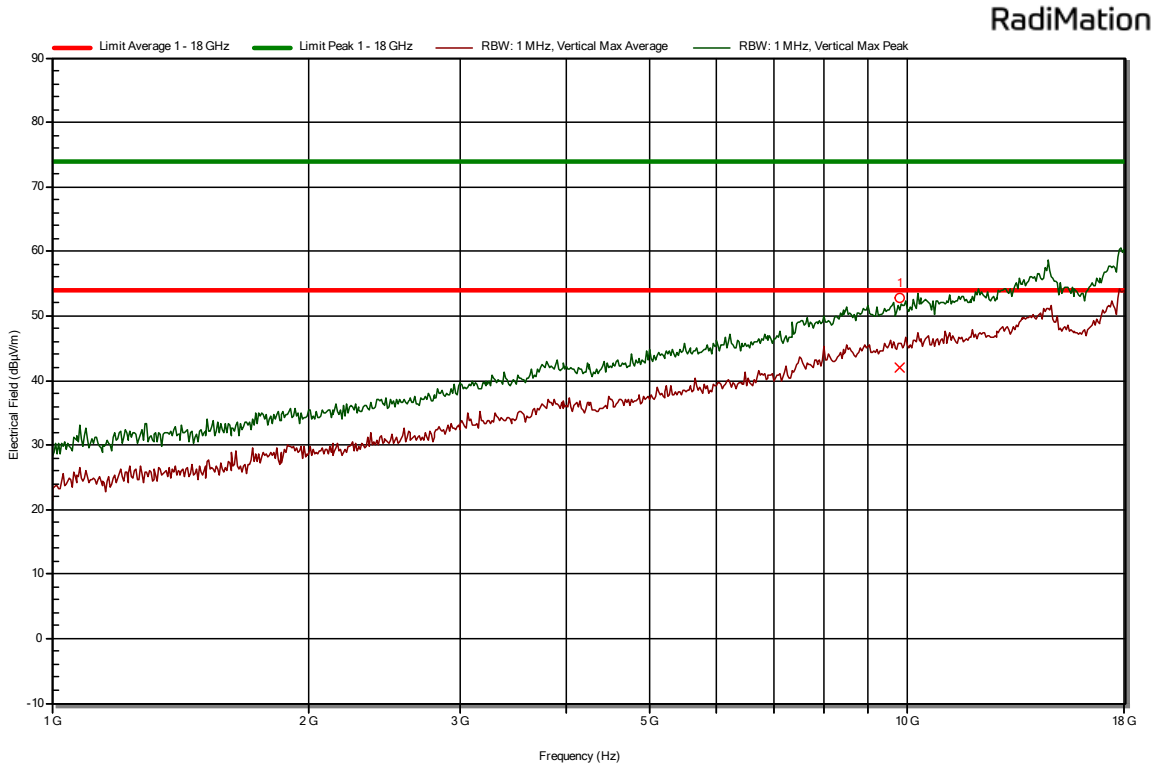
BLE



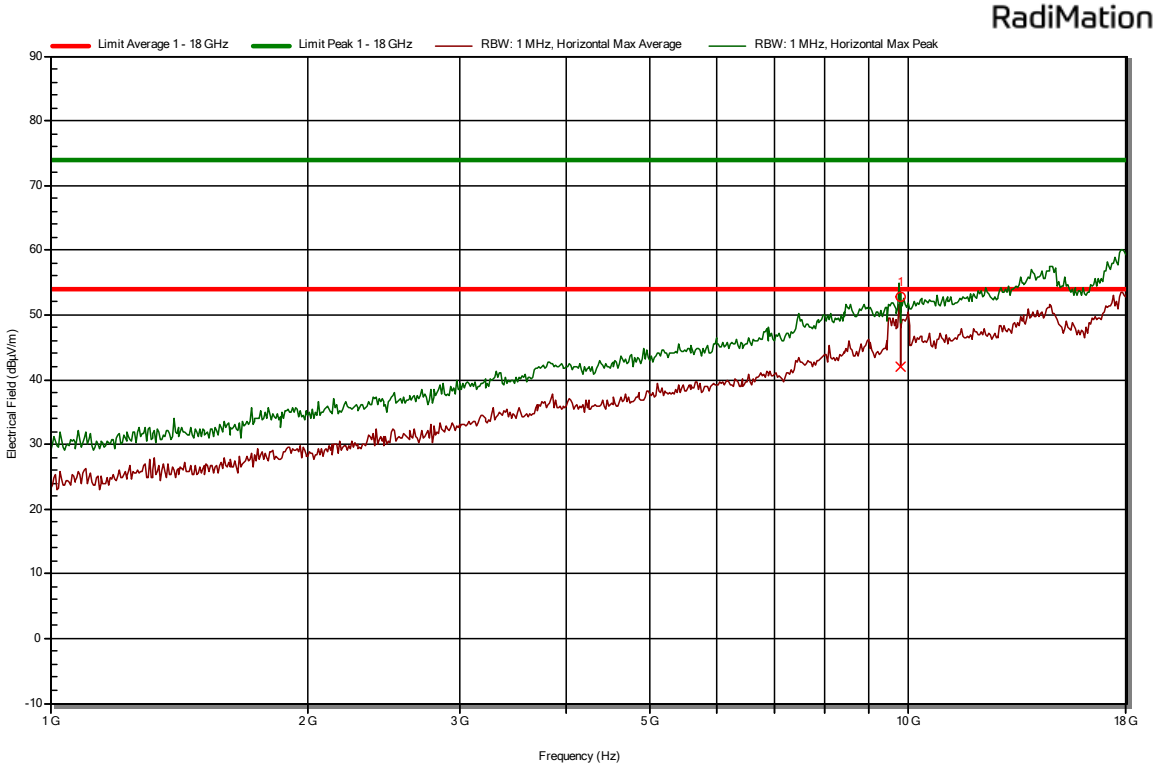
Plot 3a: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
Low channel



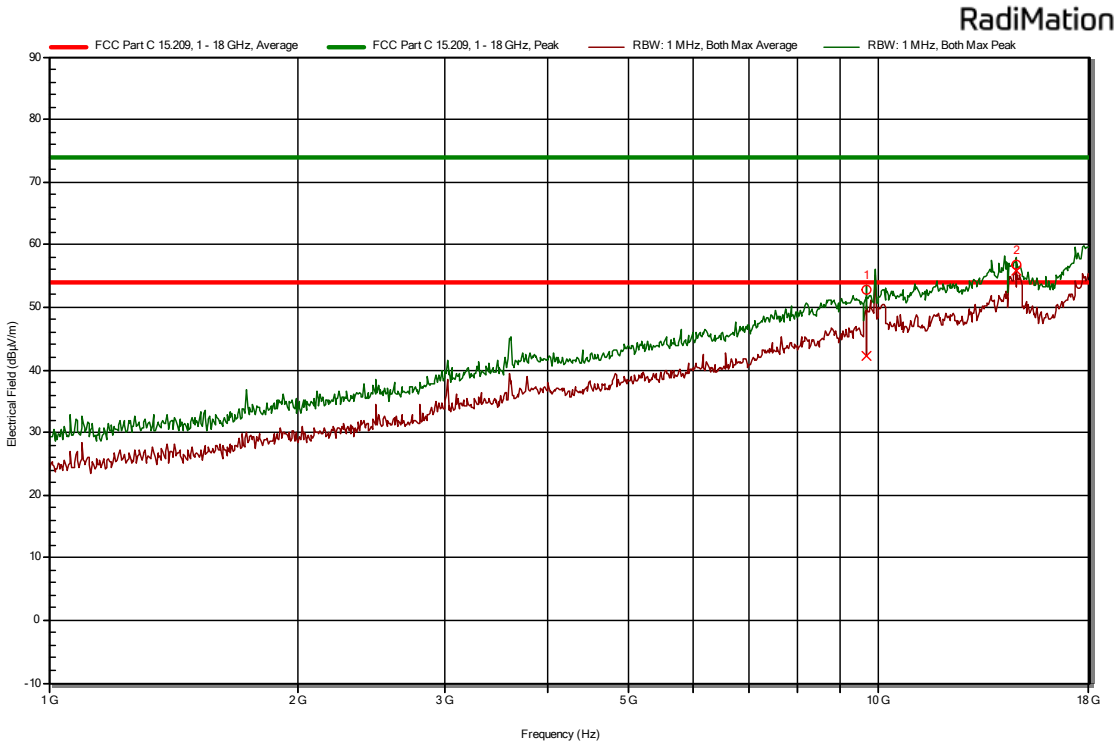
Plot 3b: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)
Low channel



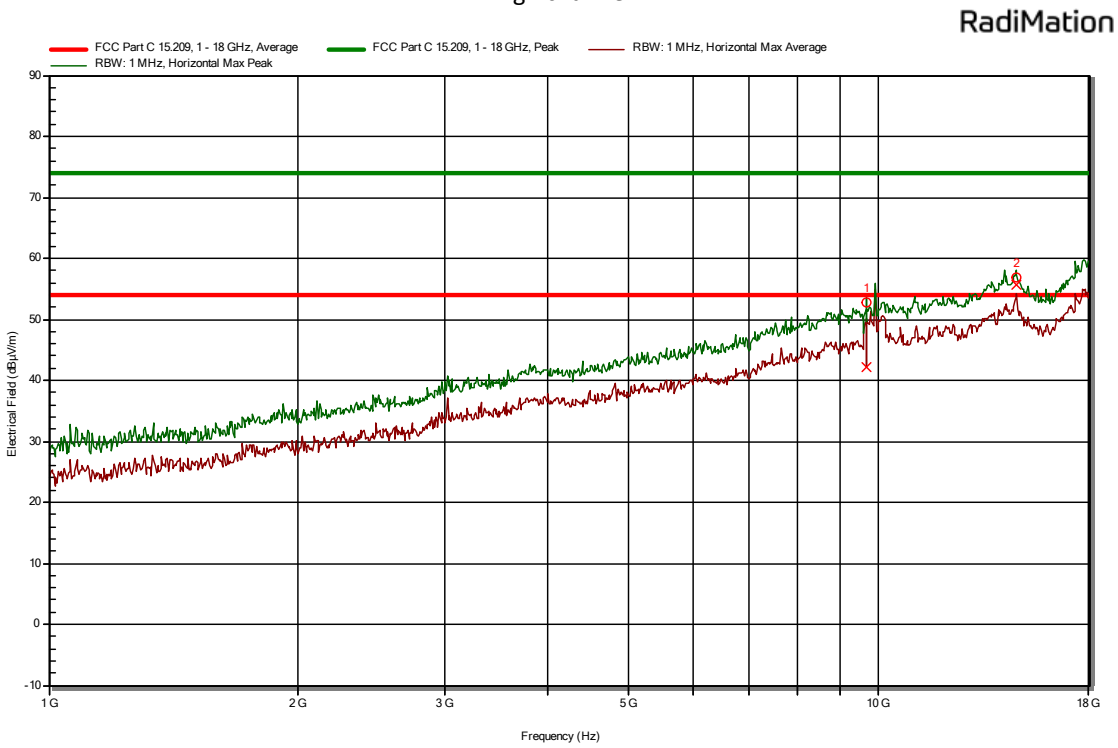
Plot 3c: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
Middle channel



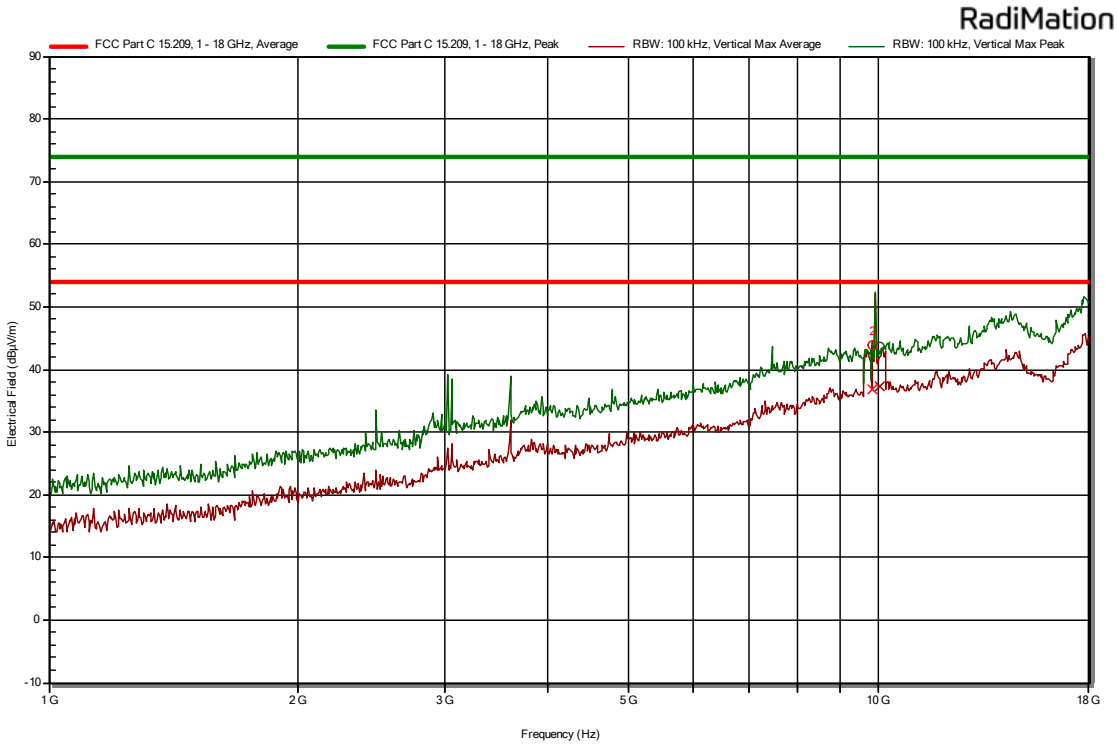
Plot 3d: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown) Middle channel



Plot 3e: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
High channel

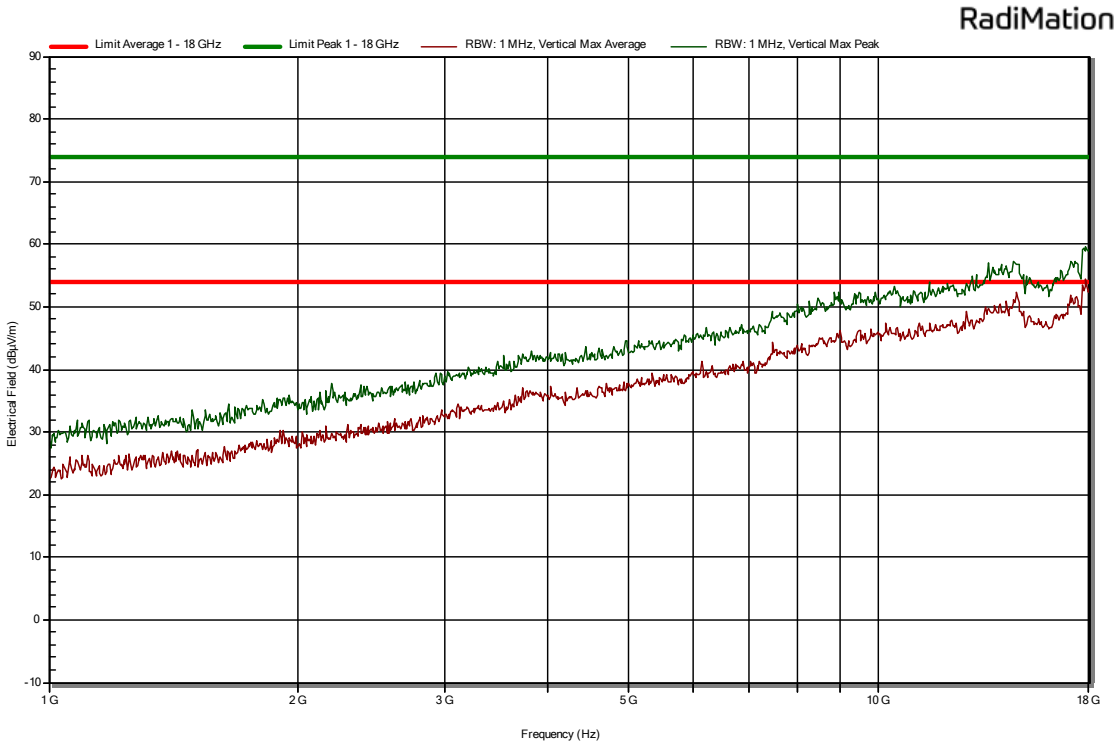


Plot 3f: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown) High channel

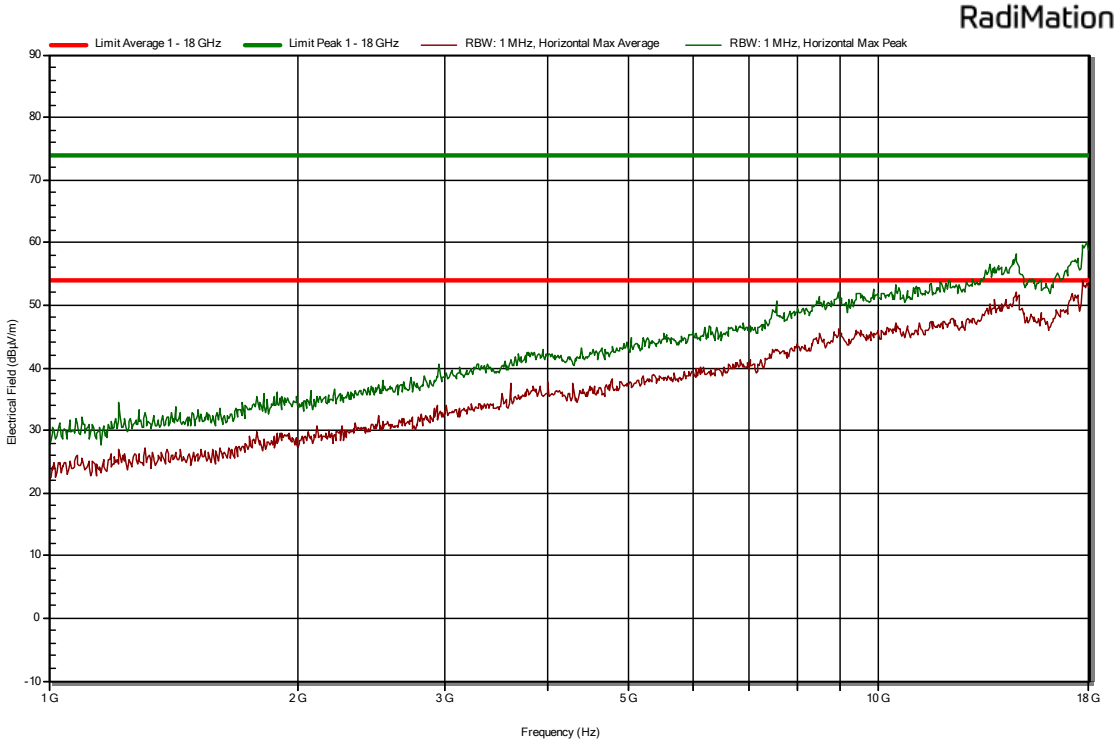


Plot 3f1: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
High channel

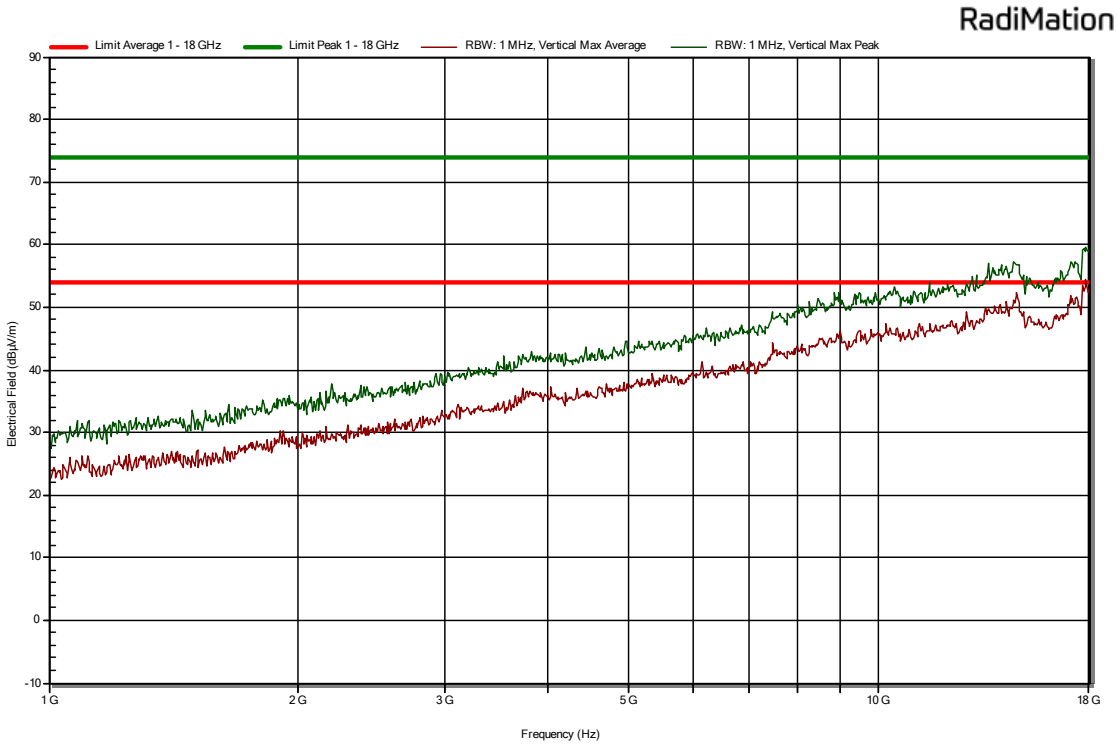
WiFi



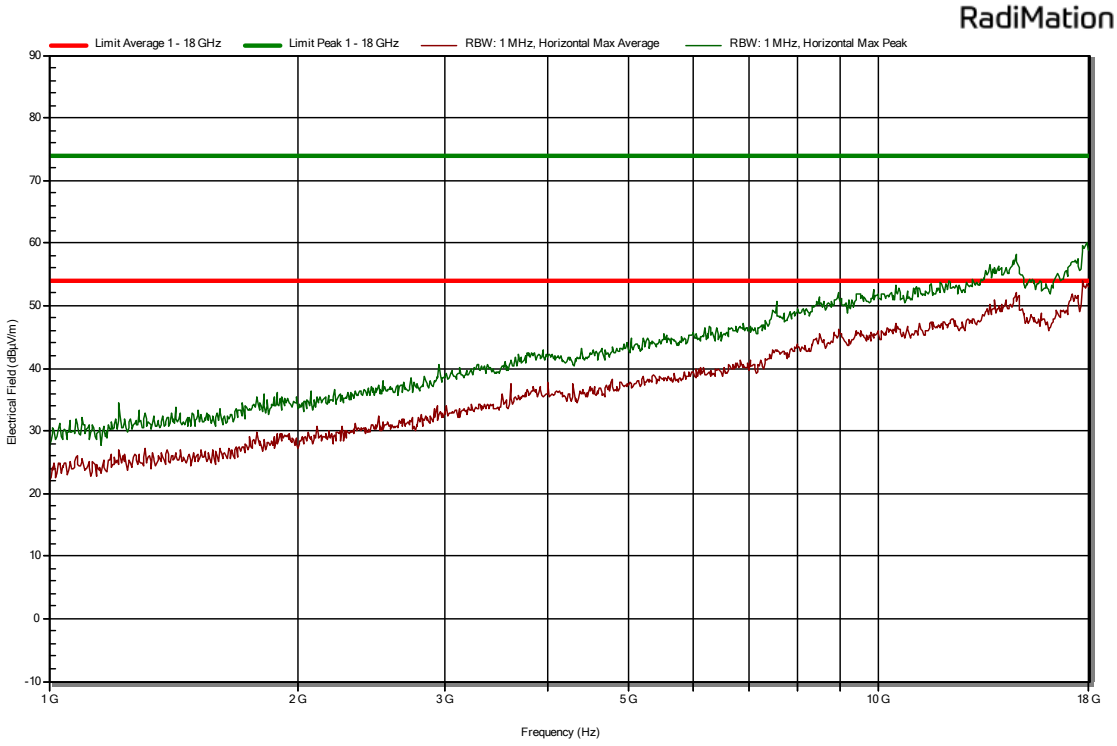
Plot 3g: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
Low channel



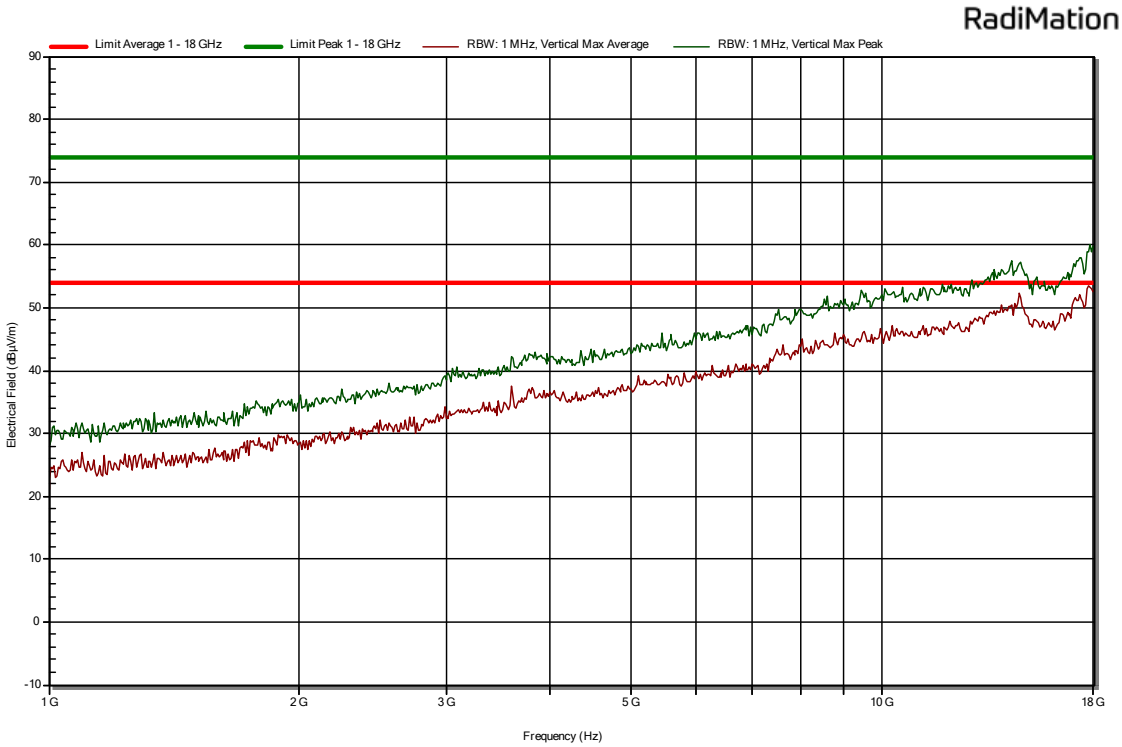
Plot 3h: radiated emissions of the EUT, Antenna horizontal in the range 1 – 18 GHz
(peak and average values shown)
Low channel



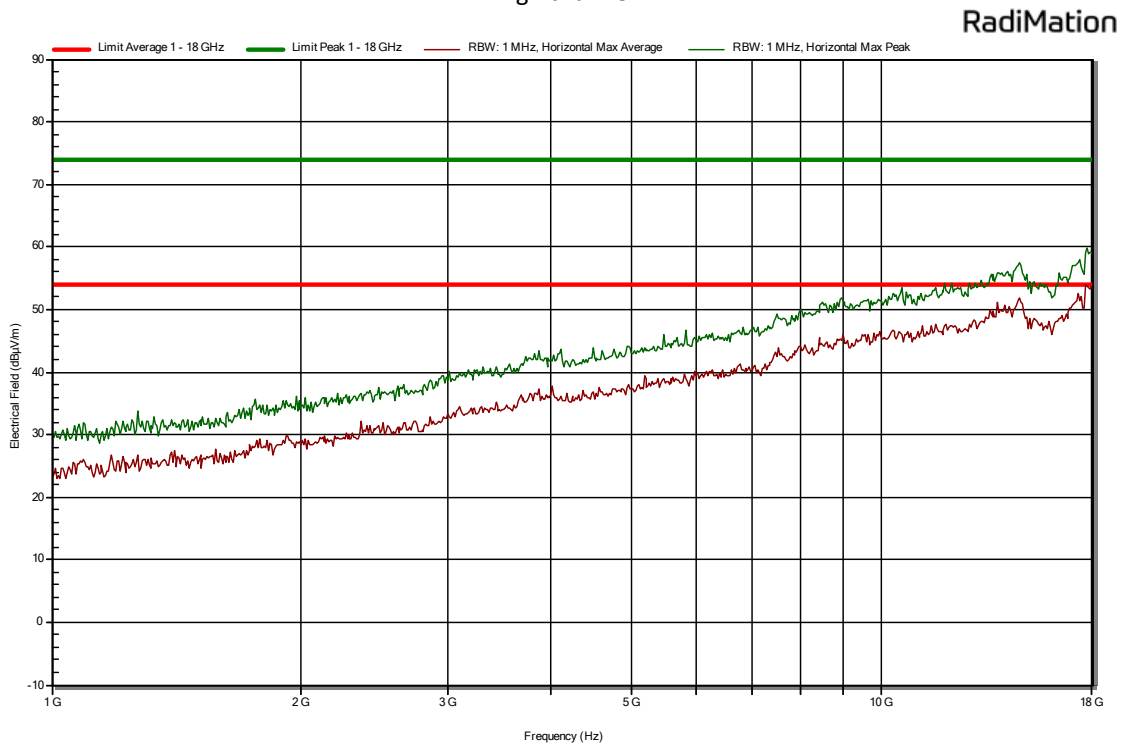
Plot 3i: radiated emissions of the EUT, Antenna vertical in the range 1 – 18 GHz
(peak and average values shown)
Mid channel



Plot 3j: radiated emissions of the EUT, Antenna horizontal in the range 1 – 18 GHz
(peak and average values shown)
Mid channel



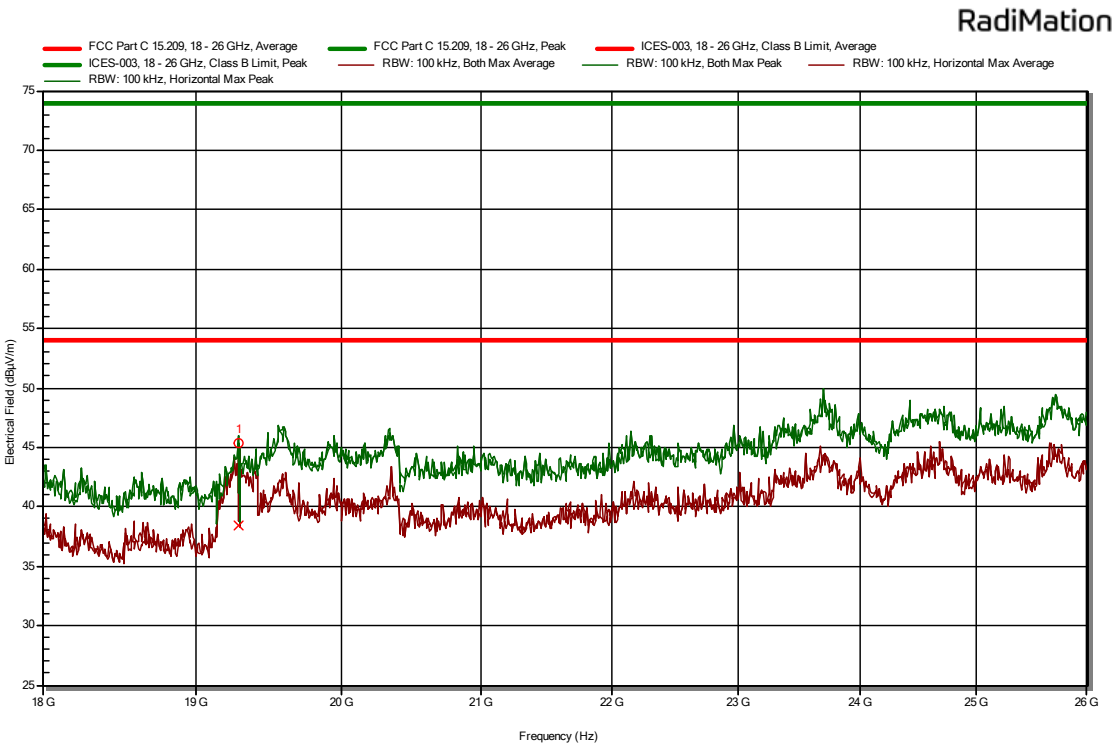
Plot 3k: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz (peak and average values shown)
High channel



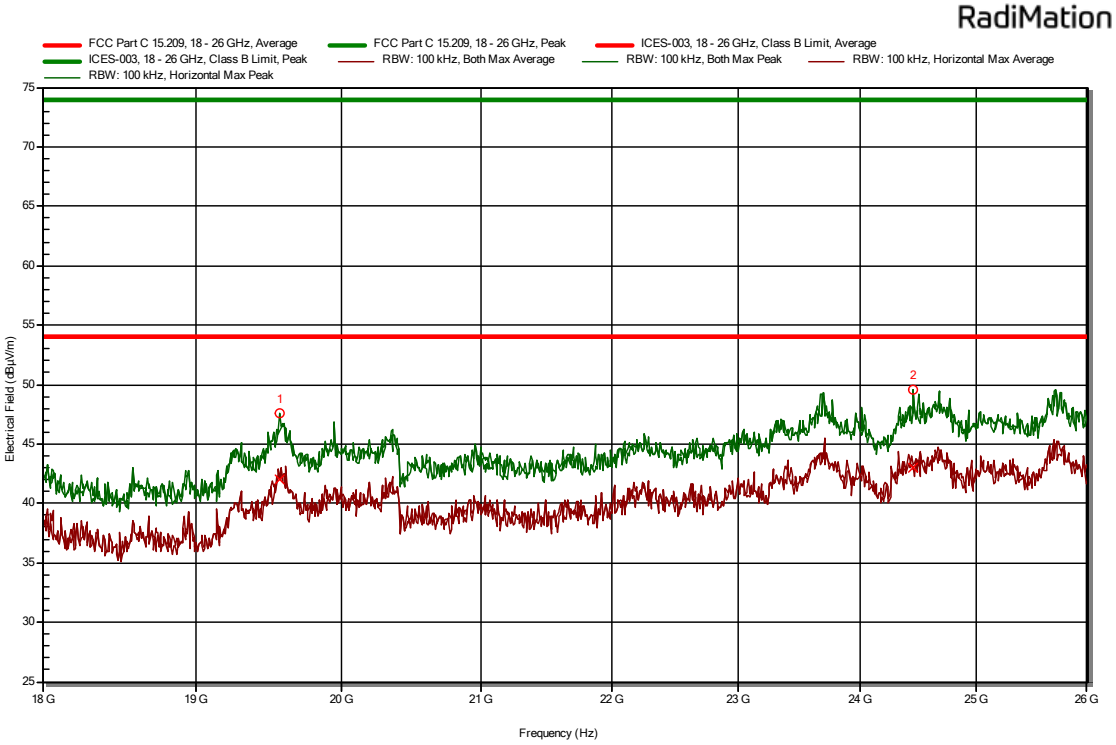
Plot 3l: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz (peak and average values shown) High channel

18 – 26.5 GHz

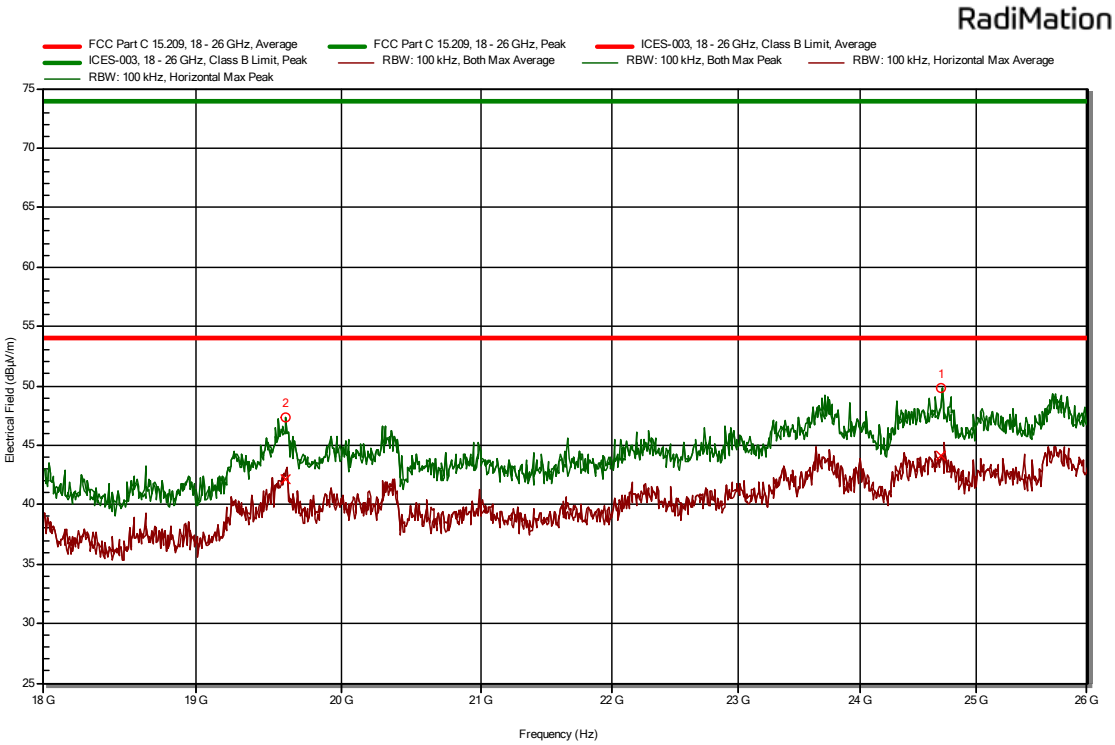
BLE



Plot 4a: radiated emissions of the EUT, Antenna horizontal and vertical in the range 18 – 26.5 GHz (peak and average values shown) Low channel

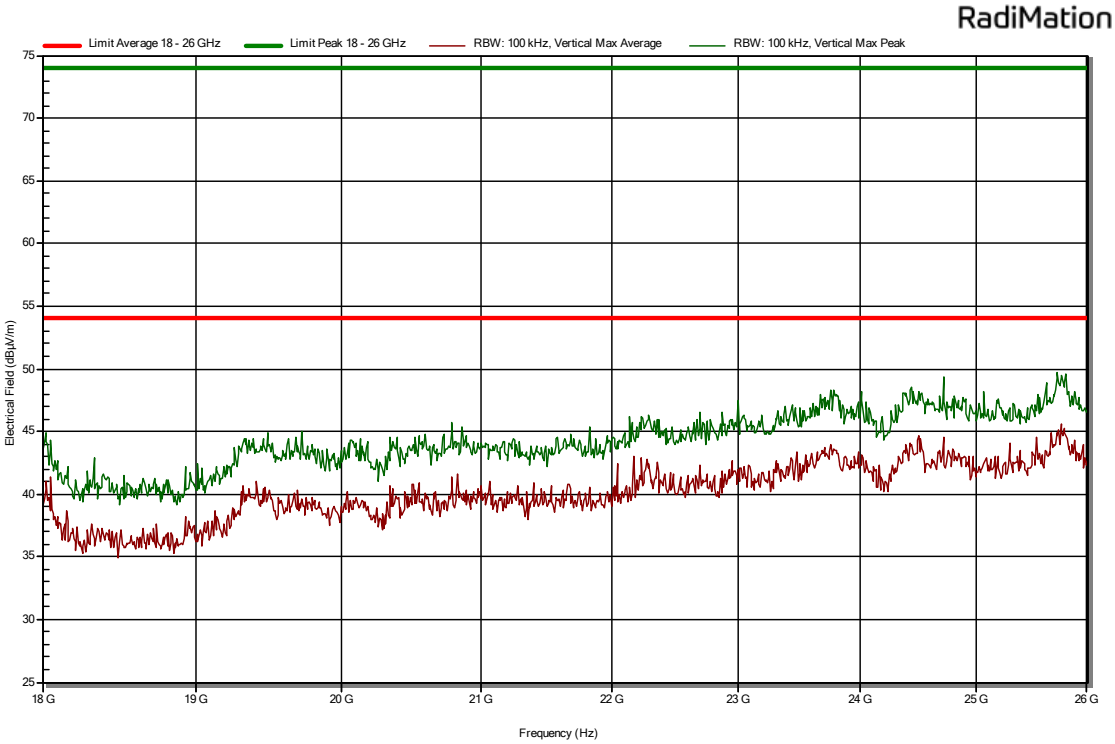


Plot 4b: radiated emissions of the EUT, Antenna horizontal and vertical in the range 18 – 26.5 GHz (peak and average values shown) Mid channel

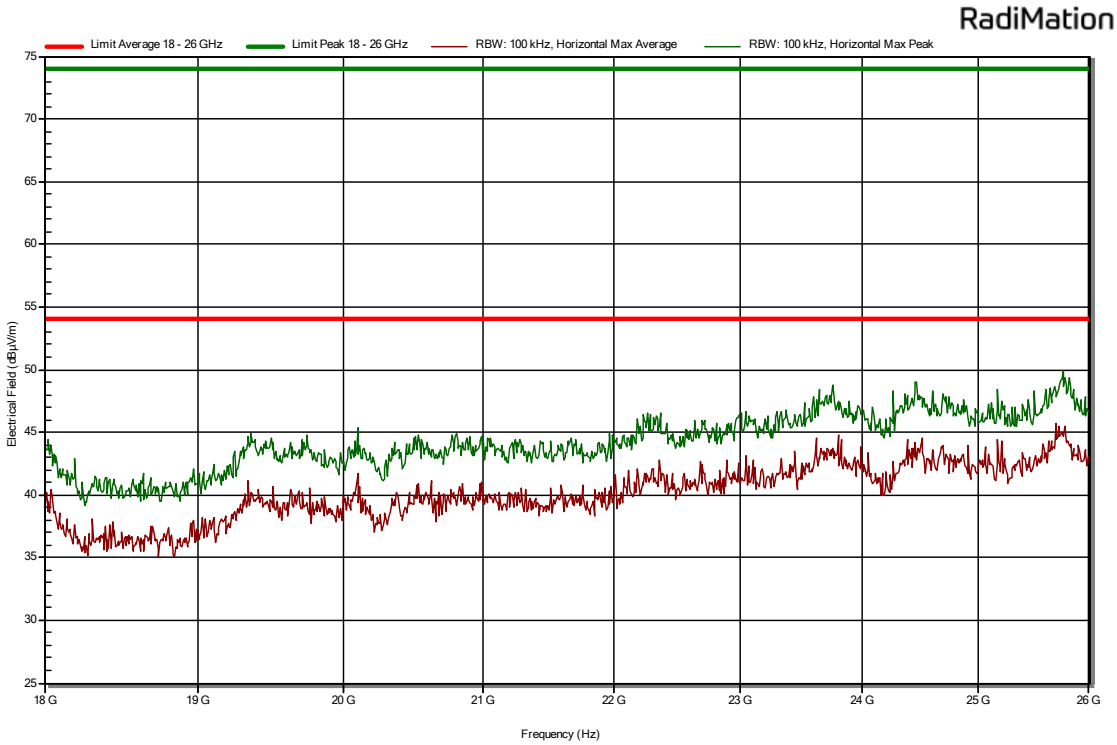


Plot 4c: radiated emissions of the EUT, Antenna horizontal and vertical in the range 18 – 26.5 GHz (peak and average values shown) High channel

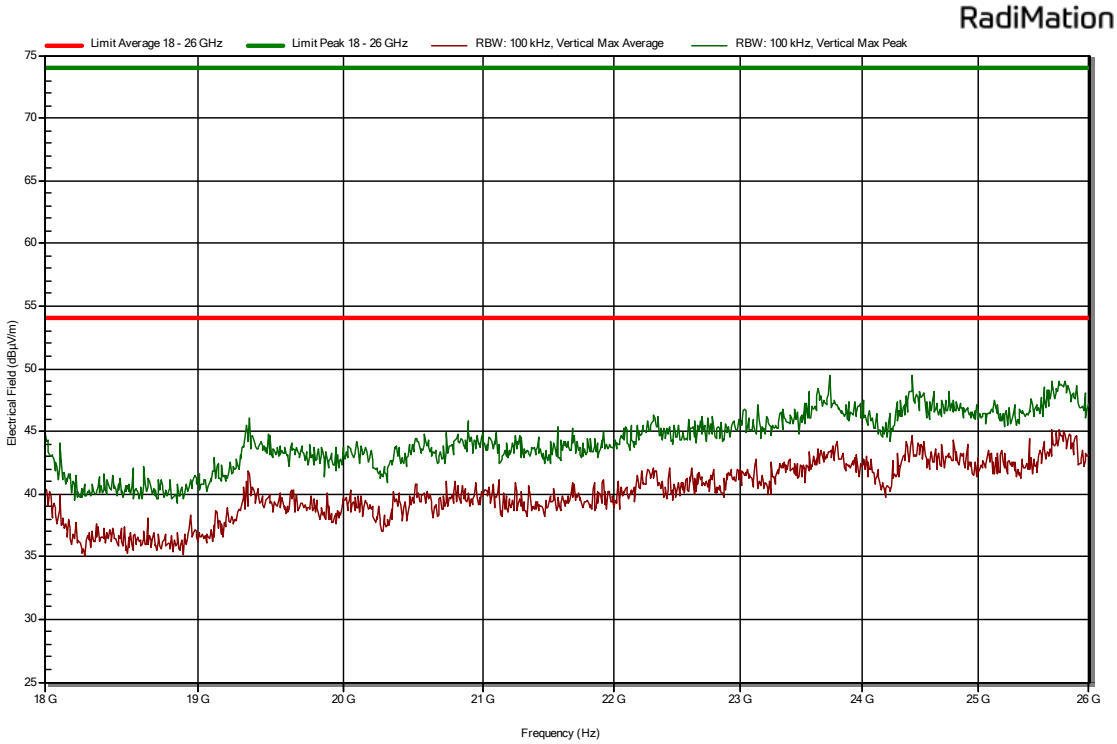
WiFi



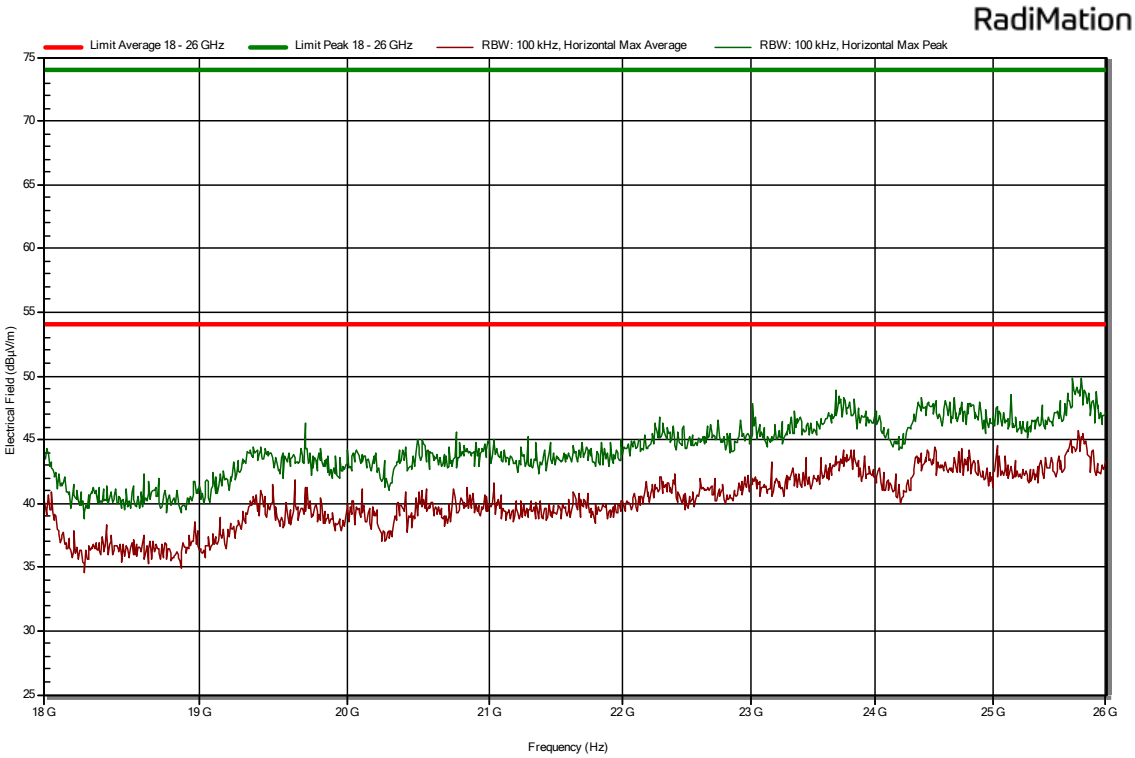
Plot 4d: radiated emissions of the EUT, Antenna vertical in the range 18 – 26.5 GHz (peak and average values shown) Low channel



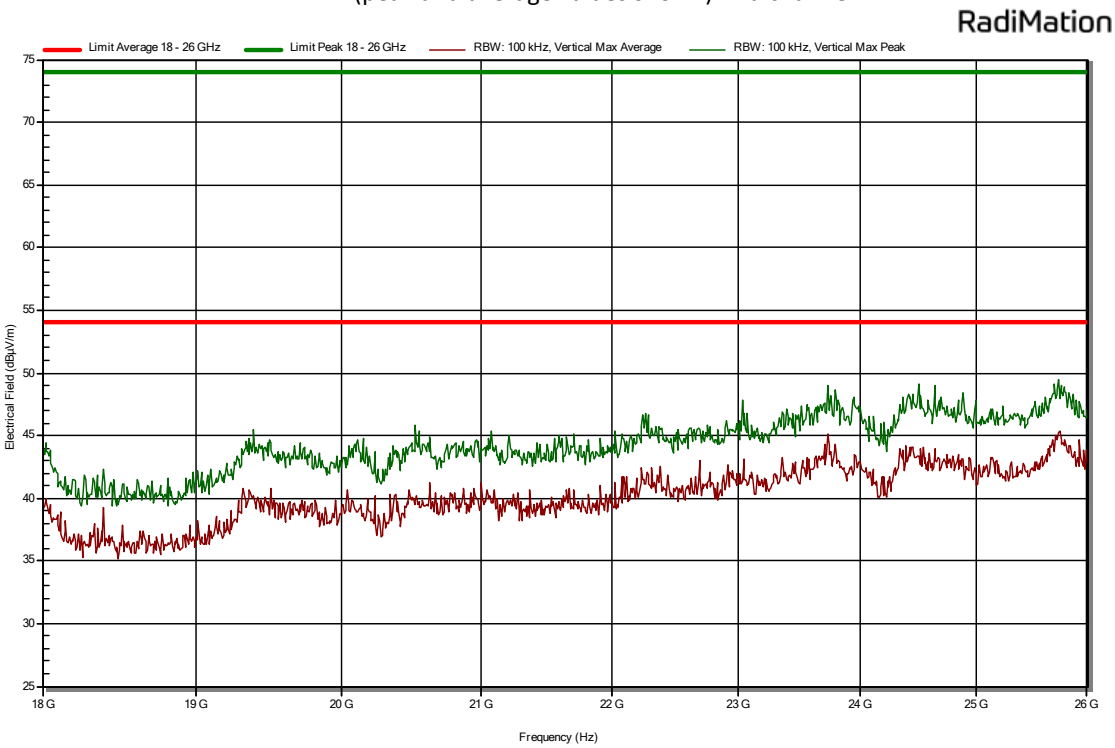
Plot 4e: radiated emissions of the EUT, Antenna horizontal in the range 18 – 26.5 GHz (peak and average values shown) Low channel



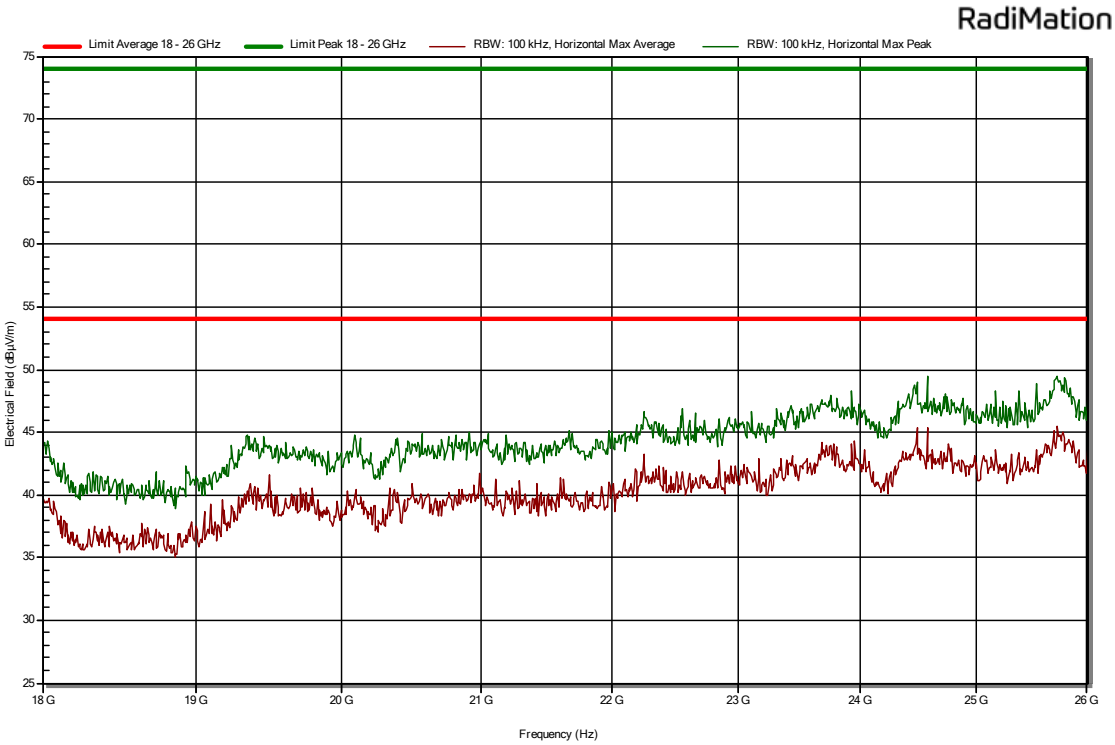
Plot 4f: radiated emissions of the EUT, Antenna vertical in the range 18 – 26.5 GHz (peak and average values shown) Mid channel



Plot 4g: radiated emissions of the EUT, Antenna horizontal in the range 18 – 26.5 GHz (peak and average values shown) Mid channel



Plot 4h: radiated emissions of the EUT, Antenna vertical in the range 18 – 26.5 GHz (peak and average values shown) High channel



Plot 4j: radiated emissions of the EUT, Antenna horizontal in the range 18 – 26.5 GHz (peak and average values shown) High channel

3.2 Authorized band-edge measurements

3.2.1 Limit

At least 20 dB below fundamental fieldstrength

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

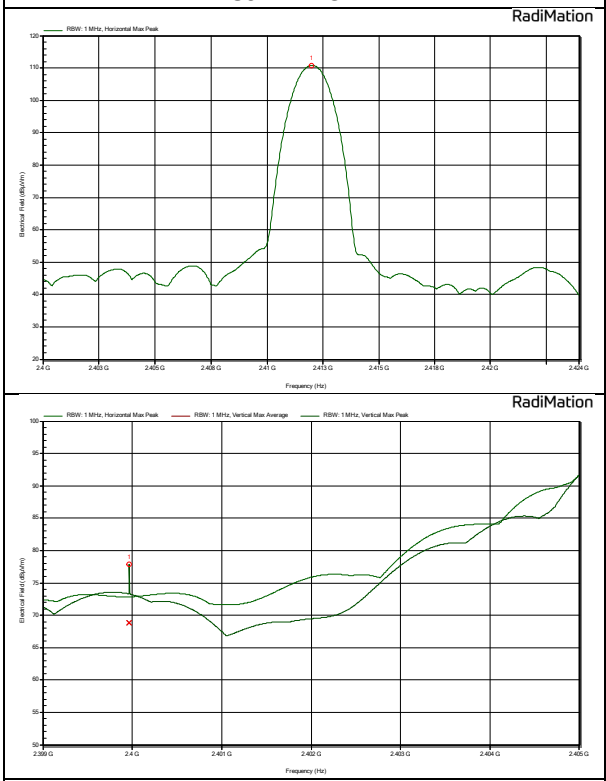
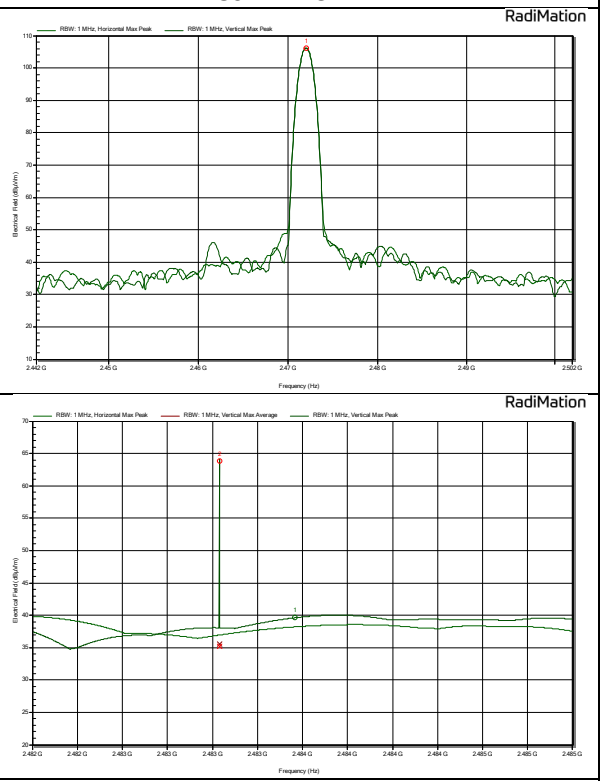
3.2.4 Test procedure

According to ANSI C63.10-2013 section 6.10.6.2
IRN 441 – Method 6

3.2.5 Measurement Uncertainty

+/- 5.4 dB

3.2.6 Plots of the authorized band-edge measurement

802.11B CH 1	802.11B CH 11
	
Delta at 2400 MHz: 110.8 – 77.9 = 32.9 dB	Delta at 2483.5 MHz: 106.0 – 63.8 = 42.2 dB

3.3 AC Power-line conducted emissions

3.3.1 Limit

§ 15.107 (a), (c)
Except for Class A digital devices, for equipment 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 limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

Where the product under test is powered through an external device (for example, through an external power supply, or by means of a device providing power over Ethernet to the product under test), the conducted emission limits apply at the AC mains power terminals of the external device, while this is powering the product under test: see ICES-Gen.

Frequency of Emission (MHz)	Conducted Limit (dBµV) Quasi-Peak	Conducted Limit (dBµV) Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 - 30	46	50

*Decreases with the logarithm of the frequency.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.2.3 of this report.

3.3.4 Test procedure

According to ANSI C63.10-2013 Section 6.2
IRN 439 – Method 1

3.3.5 Test results and plots of the AC power-line conducted measurement

See next page.

3.3.6 Measurement uncertainty

+/- 3.6 dB

3.3.7 AC Power Line Conducted emission data of the EUT, results

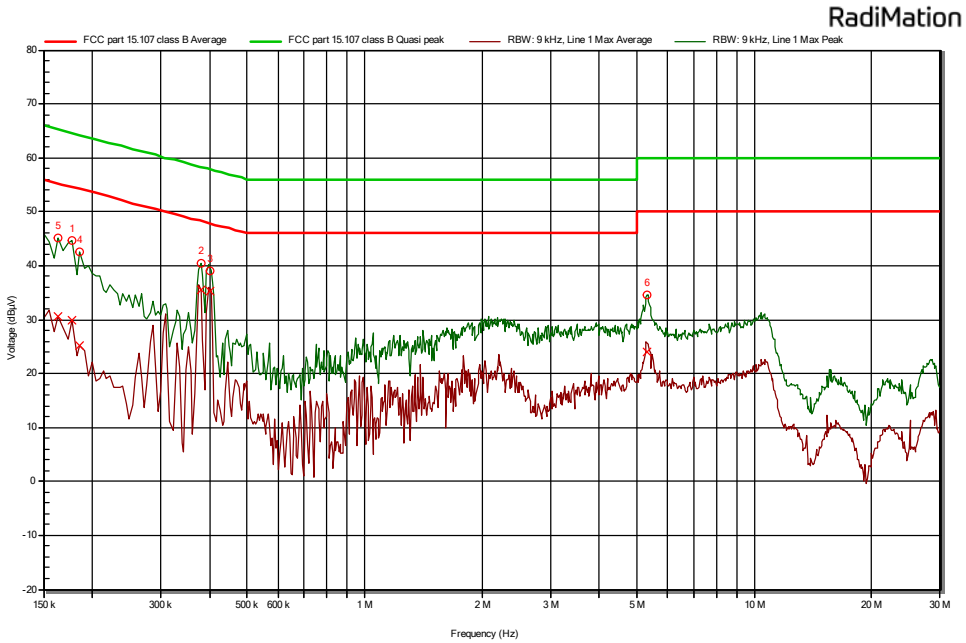
Phase

Peak Number	Frequency	Peak	Average	Average Limit	Status
1	177 kHz	44.6 dBµV	29.8 dBµV	54.6 dBµV	Pass
2	379.5 kHz	40.4 dBµV	35.4 dBµV	48.3 dBµV	Pass
3	402 kHz	39.1 dBµV	35.3 dBµV	47.8 dBµV	Pass
4	186 kHz	42.7 dBµV	25.1 dBµV	54.2 dBµV	Pass
5	163.5 kHz	45.1 dBµV	30.7 dBµV	55.3 dBµV	Pass
6	5.298 MHz	34.7 dBµV	23.9 dBµV	50 dBµV	Pass

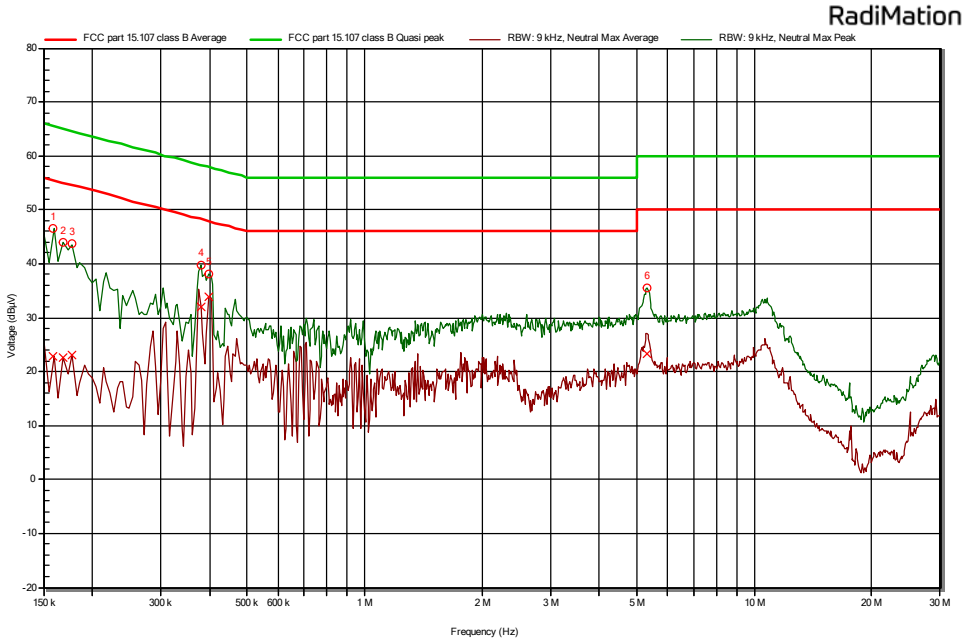
Neutral

Peak Number	Frequency	Peak	Average	Average Limit	Status
1	159 kHz	46.5 dBµV	22.7 dBµV	55.5 dBµV	Pass
2	168 kHz	43.9 dBµV	22.6 dBµV	55.1 dBµV	Pass
3	177 kHz	3.6 dBµV	23.1 dBµV	54.6 dBµV	Pass
4	379.5 kHz	39.7 dBµV	31.9 dBµV	48.3 dBµV	Pass
5	397.5 kHz	38.1 dBµV	34 dBµV	47.9 dBµV	Pass
6	5.289 MHz	35.6 dBµV	23.3 dBµV	50 dBµV	Pass

3.3.8 Plots of the AC mains conducted spurious measurement



Pre-scan plot with peak detector of the AC Power-line Conducted emissions on **Phase**



Pre-scan plot with peak detector of the AC Power-line Conducted emissions on **Neutral**

4 Sample calculations

All formulas for data conversions and conversion factors are reported in this chapter.

Conducted emission Measurement:

U_{lisn} (dBµV) = U (dBµV) + Corr. (dB)

Where:
U = Measuring receiver voltage
LISN insertion loss = Voltage division factor of LISN
Corr. = sum of single correction factors of used LISN, cables and pulse limiter.
Linear interpolation will be used for frequencies in between the values in the table.

Frequency (MHz)	**Voltage division LISN (db)**	**Cable loss (dB)**	**Corr. (dB)**
	114379 SN: 230000813 Rohde & Schwarz ENV 216	**TE 11134**	
0,15	9.7	0.02	9.72
0,2	9.68	0.03	9.71
0,3	9.68	0.03	9.71
0,5	9.69	0.08	9.77
0,7	9.69	0.25	9.94
0,8	9.69	0.25	9.94
1	9.68	0.11	9.79
2	9.7	0.15	9.85
3	9.71	0.21	9.92
5	9.72	0.21	9.93
7	9.76	0.25	10.01
8	9.77	0.25	10.02
10	9.77	0.29	10.06
15	9.84	0.34	10.18
20	9.88	0.37	10.25
25	9.97	0.43	10.4
30	10.08	0.45	10.53

Field Strength Measurement:

E (dBµV/m) = U(dBµV) + AF (dB/m) + Corr. (dB)

Where:
E = Electric field strength
U = Measuring receiver voltage
AF = Antenna factor
CL = Cable loss

Corr. = sum of single correction factors of used cable and amplifier (if applicable).
Linear interpolation will be used for frequencies in between the values in the table.
Tables shows an extract of the values.

Frequency (MHz)	**AF (dB/m)** **ID: 114436** **VHA 9103 + BBA 9106** **SN: 9856**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
30	18.6	0.68	19.28
100	10.4	1.15	11.55
150	14.8	1.41	16.21
200	16.0	1.63	17.63
250	16.9	1.93	18.83

Frequency (MHz)	**Gain (dBi)** **ID: 114385** **EMCO LPDA** **SN: 9856**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
250	11.8	1.93	13.73
300	13	2.12	15.12
350	15.6	2.2	17.8
400	17.1	2.29	19.39
450	17.3	2.53	19.83
500	17.7	2.67	20.37
550	18.4	2.9	21.3
600	19.2	3.02	22.22
650	19.7	3.09	22.79
700	20.3	3.22	23.52
750	21.4	3.56	24.96
800	22	3.69	25.69
900	22.1	3.81	25.91
950	22.6	3.91	26.51
1000	22.5	4.3	26.8

Frequency (Mhz)	AF (dB/m) Kiwa ID: 114607 Emco 3115 SN: 9412-4377	Gain (dB) Kiwa ID: 114771 µComp MCNA-40-001080	Cable loss (dB) TE 01315	Corr. (dB)
1000	23,6	40,4	2,0	66
1500	25,1	40,5	2,4	68
2000	27,1	40,5	2,7	70,3
2500	28,6	40,7	3,2	72,5
3000	30,5	40,7	3,2	74,4
3500	31,2	40,7	3,4	75,3
4000	32,7	40,9	4,9	78,5
4500	32,4	40,9	4,4	77,7
5000	33,2	40,7	4,6	78,5
5500	34,0	40,5	4,5	79
6000	34,6	40,0	5,2	79,8
6500	34,3	39,4	5,9	79,6
7000	35,2	38,6	5,7	79,5
7500	36,4	39,2	5,9	81,5
8000	37,0	38,9	6,3	82,2
8500	37,5	38,4	6,4	82,3
9000	38,1	37,4	6,5	82
9500	37,8	37,0	7,1	81,9
10000	38,2	36,5	7,3	82
10500	38,1	36,7	7,6	82,4
11000	38,3	36,9	8,3	83,5
11500	38,5	37,6	8,1	84,2
12000	39,1	38,3	8,4	85,8
12500	38,7	38,5	8,3	85,5
13000	39,2	38,9	9,2	87,3
13500	40,5	40,2	8,3	89
14000	41,1	40,0	8,2	89,3
14500	41,4	40,1	8,2	89,7
15000	40,2	41,4	8,3	89,9
15500	37,9	41,4	8,6	87,9
16000	37,5	42,8	9,2	89,5
16500	38,6	42,3	8,8	89,7
17000	41,1	43,1	9,4	93,6
17500	42,7	43,2	9,4	95,3
18000	44,0	44,2	9,8	98

Frequency (Mhz)	AF (dB/m) TE 00531 Emco 3115 SN: 9412-4377	Gain (dB) TE 11132 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
18000	31,3	26,2	9,8	67,3
19000	31,5	26,1	9,6	67,2
20000	31,7	25,9	11	68,6
21000	31,9	24,3	10,7	66,9
22000	32,1	18,3	10,5	60,9
23000	32,2	18,9	10,8	61,9
24000	32,3	23,6	11,4	67,3
25000	32,4	24,5	11,6	68,5
26000	32,5	25,3	11,7	69,5

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