

Test report for

47 CFR Part 15 Subpart C, § 15.247,

ISED RSS-247, RSS-Gen



Product name : Jlink Pro Plus
Applicant : JOZ B.V
FCC ID : 2BGQ2JLINK
IC : 32602-JLINK

Test report No. : P000394690 002 Ver 1.0

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).

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The Industry Canada company number for Kiwa Nederland B.V. is: 4173A. The CABID is NL0001.

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Documentation

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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	13-09-2024	First draft	TK
v1.00	18-09-2024	Initial release	TK

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Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.247(d) 15.225(d) 15.209 (a)	RSS-Gen 8.9	Radiated spurious emissions	3.1	Pass
15.205 (a)	RSS Gen 8.10	Spurious emissions in the restricted bands	3.1	Pass
15.247 (a)	RSS-247 5.2(a)	6 dB bandwidth	N.A.	Pre-certified radio module
--	RSS-Gen 6.7	99% bandwidth	N.A.	Pre-certified radio module
15.247 (b)	RSS-247 5.4 (d)	RF output power	3.2	Pass
15.247 (e)	RSS-247 5.2 (b)	Power spectral density	N.A.	Pre-certified radio module
15.247 (d)	RSS-247 5.5	Band edge	N.A.	Pre-certified radio module
15.207 (c)	RSS-Gen 8.8	AC power-line conducted emissions	3.3	Pass
15.225 (a),(b),(c)	RSS-210 B.6	Field strength of emissions	N.A.	Pre-certified radio module
15.225(e)	RSS-210 B.6	Frequency Stability	N.A.	Pre-certified radio module

Decision rule: Pass/Fail decisions are based on measurement results without taking into account measurement uncertainty.

1 General Description

1.1 Applicant

Client name:	JOZ B.V.
Address:	Industrieweg 5, Westwoud
Zip code:	1617 KK
Country:	The Netherlands
Telephone:	+31 228566500
E-mail:	barath.kumar@joz.nl

1.2 Manufacturer

Manufacturer name:	JOZ B.V.
Address:	Industrieweg 5, Westwoud
Zip code:	1617 KK
Country:	The Netherlands
Telephone:	+31 228566500
E-mail:	barath.kumar@joz.nl

1.3 Tested Equipment Under Test (EUT)

Product name:	Jlink Pro Plus
Brand name:	JOZ B.V.
FCC ID:	2BGQ2JLINK
IC:	32602-JLINK
Product type:	Access point
Model(s):	N.A.
Batch and/or serial No.	20900643
Software version:	3.7.11
Hardware version:	A
Date of receipt	17-04-2024
Tests started:	29-07-2024
Testing ended:	31-07-2024

Auxiliary items

AUX1

Product name:	Power supply for EUT
Brand name:	MEAN WELL
Product type:	AC/DC switching adapter
Model(s):	GST40A24-TI
Batch and/or serial No.	SC33430536
Remarks:	Connects to EUT

AUX2

Product name:	Notebook
Brand name:	Lenovo
Product type:	Laptop
Model(s):	Thinkbook 15 G2 ITL
Batch and/or serial No.	--
Remarks:	Connects to EUT Ethernet port, property test lab

1.4 Product specifications of Equipment under test

TX Frequencies:	802.11b/g/n (WLAN): 2412-2472 MHz 802.15.4 (Zigbee): 2405-2480 MHz
RX frequencies:	802.11b/g/n (WLAN): 2412-2472 MHz 802.15.4 (Zigbee): 2405-2480 MHz
Occupied channel width:	802.11b/g/n (WLAN): 20 MHz, 40 MHz 802.15.4 (Zigbee): 5 MHz
Antenna type:	802.11b/g/n: FPC dipole 2.4GHz Antenna 802.15.4: FPC dipole 2.4GHz Antenna
Antenna gain (dBi):	1 dBi
Type of modulation:	802.11b/g/n: CCK, OFDM, DSSS 802.15.4: DSSS, O-QPSK
Emission designator:	802.11b/g/n: 11M0F1D 802.15.4: 1M71G1D

Disclaimer: The operating frequency bands are declared by the applicant

1.5 Environmental conditions

Normal test conditions:

Temperature (*) : +15°C to +35°C

Relative humidity(*) : 20 % to 75 %

1.6 Measurement standards

- ANSI C63.10:2020
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02

1.7 Applicable standards

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

- FCC Part 15 Subpart C §15.207
- FCC Part 15 Subpart C §15.209
- FCC Part 15 Subpart C §15.247
- RSS-Gen Issue 5
- RSS-247 Issue 3

1.8 Observation and remarks

Between the 802.11b/n/g technologies only 802.11b was fully tested as this was determined to be the worst case for power and spurious emissions. An assessment was also performed to determine the worst case for power and spurious emissions between 20 MHz and 40 MHz occupied channel width, 20 MHz was determined to be the worst. So, all test in this report were performed on 20 MHz occupied channel width using 802.11b. The radio modules used in this product have been certified under the FCC and RSS-GEN directive. So, not all test as described in summary of test results were performed as they are pre-certified modules.

1.9 Modifications to the EUT (Equipment Under Test)

None

1.10 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. Kiwa Nederland B.V. 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 tests are performed by:

Name : Paul van Wanrooij, BASc

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 04-10-2024

Name : ing. R. van Barneveld

Function : Test Engineer

Signature :

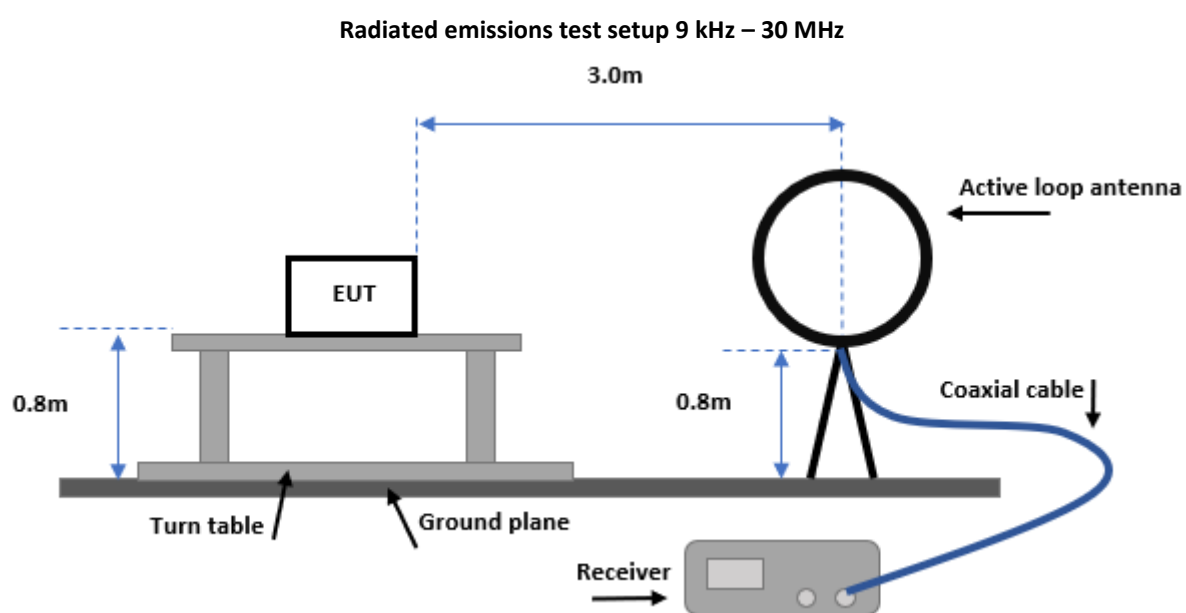
A handwritten signature in blue ink, consisting of a stylized 'R' followed by several horizontal strokes.

2 Test configuration of the Equipment Under Test

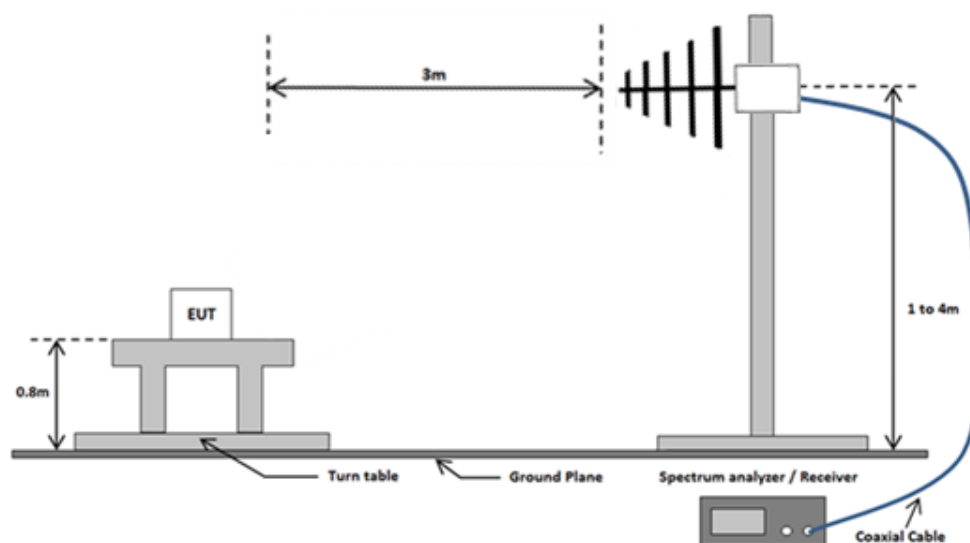
2.1 Test mode

The manufacturer provided test mode firmware to set the EUT to transmit or receive continuously on a specific channel. This software was used to set the EUT to the required channel and technology for each measurement.

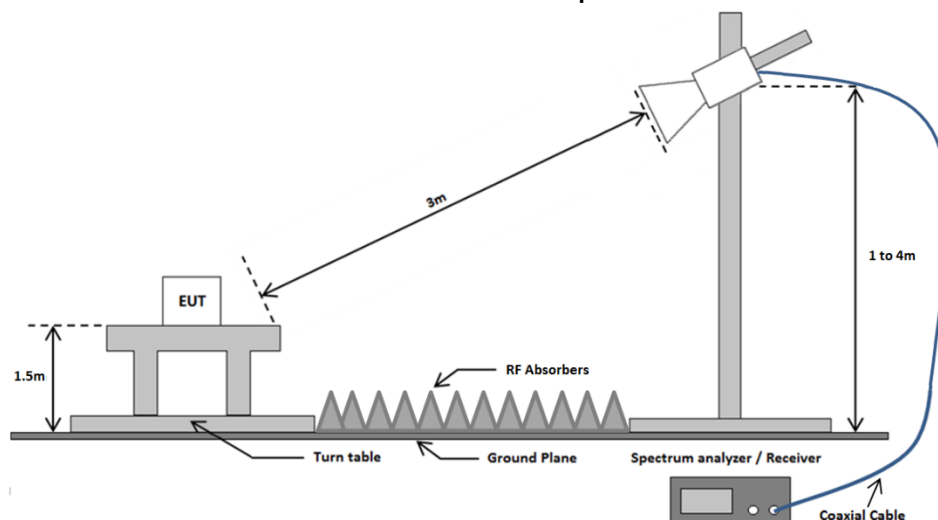
2.2 Test setups



Radiated emissions test setup 30 MHz - 1 GHz

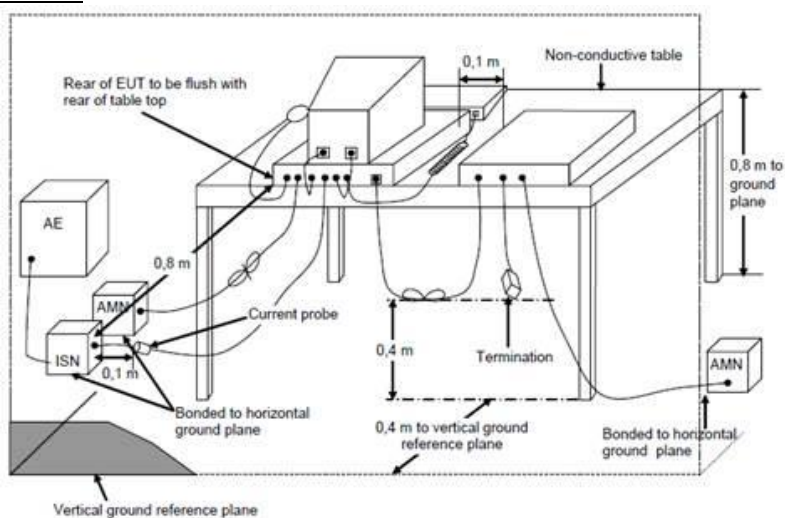


Radiated emissions test setup above 1 GHz



AC Power line conducted emissions test setup

Emissions test at AC mains



List of used cables					
Number	Function	From	To	Length	Remarks
1	AC Power	mains 120Vac 60 Hz	AUX1 & AUX2	< 3m	-
2	x Vdc power	AUX1	EUT	< 3m	-
3	Ethernet	EUT	AUX2	<3m	-

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	ESR7	114870	09-2022	09-2024	3.2
EMI Receiver	Rohde & Schwarz	ESR7	114605	07-2022	07-2024	3.1
Spectrum Analyzer	Rohde & Schwarz	FSV3044	114923	10-2023	10-2025	3.1
Spectrum Analyzer	Rohde & Schwarz	FSV3044	115043	03-2022	10-2024	3.2
3.0 GHz HPF	Wainwright	WHK3.0/18G-10EF	114682	09-2021	09-2024	3.1
Biconical antenna + 6dB attenuator	EMCO	3146	107818	06-2022	06-2025	3.1
Logperiodic antenna	EMCO	3147	114385	02-2021	02-2026	3.1
Horn antenna	EMCO	3115	114607	01-2021	07-2024	3.1
Horn antenna	FLANN-MICROWAVE	20240-25	114518	NA*	NA*	3.1
Preamplifier 1-18 GHz	µComp Nordic	MCNA-40-0010800-25-10P	114771	08-2024	08-2026	3.1
Preamplifier 18-40 GHz	Schwarzbeck	BBV-9721	115026	06-2024	06-2025	3.1
Semi-Anechoic Chamber	ETS Lindgren	SAR	114624	03-2023	03-2026	3.1
Test software	Raditeq	Radimation Version 2023.2.3	--	--	--	3.1, 3.3
LISN /Two line V-network	Rohde & Schwarz	ENV 216	114379	11-2023	11-2025	3.3

*Note: Standard gain horn antennas do not need calibration
NA= Not Applicable

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

15.209(a)

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)
0.009 – 0.490	2400/F(kHz)	$20 \cdot \{\log[2400] - \log[F(\text{kHz})]\}$	300*
0.490 – 1.705	24000/F(kHz)	$20 \cdot \{\log[24000] - \log[F(\text{kHz})]\}$	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

*Note: Measured values in the plots 9 kHz to 30 MHz are corrected to 30m or 300m limit distance according to the method described in ANSI C63.10-2020, clause 6.4.

RSS-GEN

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

Frequency (MHz)	Magnetic field strength (H-Field) (μA/m)	Magnetic field strength (H-Field) (dBμA/m)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance(m)
0.009 – 0.490	6.37/F (kHz)	$20 \cdot \{\log[6.37] - \log[F(\text{kHz})]\}$	N.A.	$20 \cdot \{\log[6.37] - \log[F(\text{kHz})]\} + 51.5$	300*
0.490 – 1.705	63.7/F (kHz)	$20 \cdot \{\log[63.7] - \log[F(\text{kHz})]\}$	N.A.	$20 \cdot \{\log[63.7] - \log[F(\text{kHz})]\} + 51.5$	30*
1.705 - 30	0.08	-21.9	N.A.	29.6	30*
30 - 88	N.A.	N.A.	100	40	3
88 - 216	N.A.	N.A.	150	43,5	3
216-960	N.A.	N.A.	200	46	3
Above 960	N.A.	N.A.	500	54	3

*Note: Measured values in the plots 9 kHz to 30 MHz are corrected to 30m or 300m limit distance according to the method described in ANSI C63.10-2020, clause 6.4.

Only the FCC 15.209 limit lines are included in the radiated plot above 30 MHz. However, RSS-GEN and FCC 15.209 limits are the same above 30 MHz, so the plots are also valid for verification to the RSS-GEN limits.

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

9 kHz – 30 MHz: According to ANSI C63.10-2020, section 6.4

30 MHz to 26.5 GHz: According to ANSI C63.10-2020, section 6.5 and 6.6

9 kHz to 30 MHz: IRN 441 – Method 10

30 MHz to 1 GHz: IRN 441 – Method 1

1 GHz to 18 GHz: IRN 441– Method 2

18 to 26.5 GHz: IRN 441– Method 3

In case of handheld and/or body-worn equipment, the EUT's orientation (X, Y, Z) was varied in order to ensure that maximum emission amplitudes were attained. In all other cases the associated cabling and the EUT orientation was varied for maximum emissions.

The spectrum was examined from 0.009 MHz to 10 times X GHz, not more than the 10th harmonic of the highest intentional generated frequency (2.475 GHz). Final radiated emission measurements were made at 3m distance.

The 6 highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit.

3.1.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
9 kHz – 30 MHz	--	±1.6 dB
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB
1 – 18 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB
18 – 26.5 GHz	Horizontal	±4.9 dB
	Vertical	±4.9 dB

3.1.6 Test results

802.11b results

Low channel (channel 1)

Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
1	39.336 MHz	33.9 dBμV/m	24.8 dBμV/m	40 dBμV/m	Pass	1 m	Vertical
2	544.488 MHz	44.3 dBμV/m	40.2 dBμV/m	46 dBμV/m	Pass	2 m	Vertical
3	555.818 MHz	37 dBμV/m	25.3 dBμV/m	46 dBμV/m	Pass	1.7 m	Horizontal

Middle channel (channel 6)

Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
1	39.335 MHz	33.3 dBμV/m	24.7 dBμV/m	40 dBμV/m	Pass	1 m	Vertical
2	89.993 MHz	29.3 dBμV/m	25.7 dBμV/m	43.5 dBμV/m	Pass	1.3 m	Vertical
3	544.475 MHz	43.7 dBμV/m	39.1 dBμV/m	46 dBμV/m	Pass	1.7 m	Horizontal
4	544.485 MHz	44.2 dBμV/m	39.9 dBμV/m	46 dBμV/m	Pass	2 m	Vertical

High channel (channel 11)

Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
1	39.081 MHz	31.6 dBμV/m	23.3 dBμV/m	40 dBμV/m	Pass	1 m	Vertical
2	90.005 MHz	29.4 dBμV/m	25.7 dBμV/m	43.5 dBμV/m	Pass	1.5 m	Vertical
3	544.488 MHz	45.5 dBμV/m	42.2 dBμV/m	46 dBμV/m	Pass	1.5 m	Horizontal
4	551.384 MHz	36.8 dBμV/m	25.2 dBμV/m	46 dBμV/m	Pass	1.8 m	Vertical

802.15.4 results

Low channel (channel 11)

Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
1	39.043 MHz	31.6 dBμV/m	22 dBμV/m	40 dBμV/m	Pass	1 m	Vertical
2	89.989 MHz	29.6 dBμV/m	25.8 dBμV/m	43.5 dBμV/m	Pass	1.5 m	Vertical
3	544.478 MHz	43.3 dBμV/m	39.2 dBμV/m	46 dBμV/m	Pass	1.5 m	Horizontal
4	544.491 MHz	42.8 dBμV/m	38.3 dBμV/m	46 dBμV/m	Pass	1.5 m	Vertical

Middle channel (channel 18)

Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
1	38.853 MHz	30.9 dB μ V/m	21 dB μ V/m	40 dB μ V/m	Pass	1 m	Vertical
2	544.478 MHz	45.2 dB μ V/m	41.7 dB μ V/m	46 dB μ V/m	Pass	1.5 m	Horizontal
3	544.488 MHz	43.8 dB μ V/m	39.9 dB μ V/m	46 dB μ V/m	Pass	1 m	Vertical

High channel (channel 26)

Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
1	39.052 MHz	31 dB μ V/m	22.2 dB μ V/m	40 dB μ V/m	Pass	1 m	Vertical
2	89.996 MHz	30.2 dB μ V/m	26.2 dB μ V/m	43.5 dB μ V/m	Pass	1.5 m	Vertical
3	152.953 MHz	28.9 dB μ V/m	18.6 dB μ V/m	43.5 dB μ V/m	Pass	1.2 m	Horizontal
4	544.466 MHz	43.1 dB μ V/m	38.5 dB μ V/m	46 dB μ V/m	Pass	1 m	Vertical
5	544.488 MHz	45.2 dB μ V/m	41.6 dB μ V/m	46 dB μ V/m	Pass	1.7 m	Horizontal

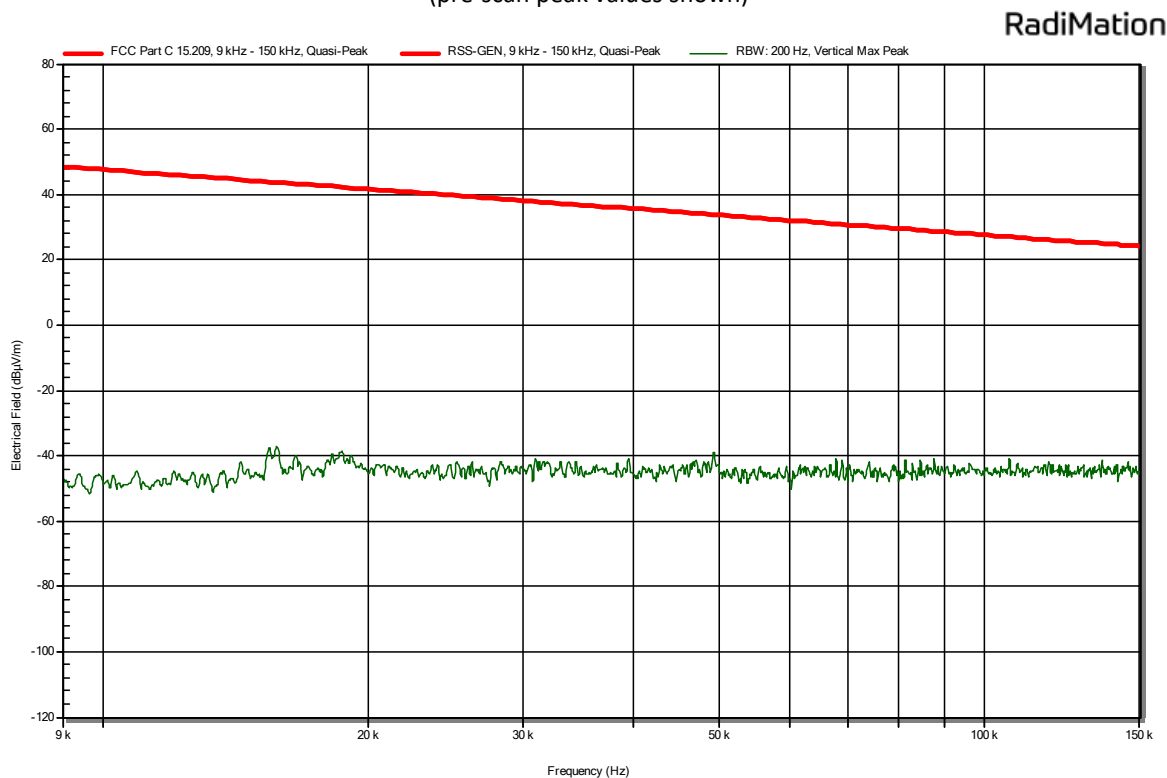
Multi radio assessment results

Radios used	Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
802.11b Ch 1 + Zigbee Ch 12	1	39.12 MHz	32.4 dB μ V/m	22.6 dB μ V/m	40 dB μ V/m	Pass	1 m	Vertical
802.11b Ch 1 + Zigbee Ch 12	2	544.469 MHz	42.3 dB μ V/m	25.1 dB μ V/m	46 dB μ V/m	Pass	1.49 m	Horizontal

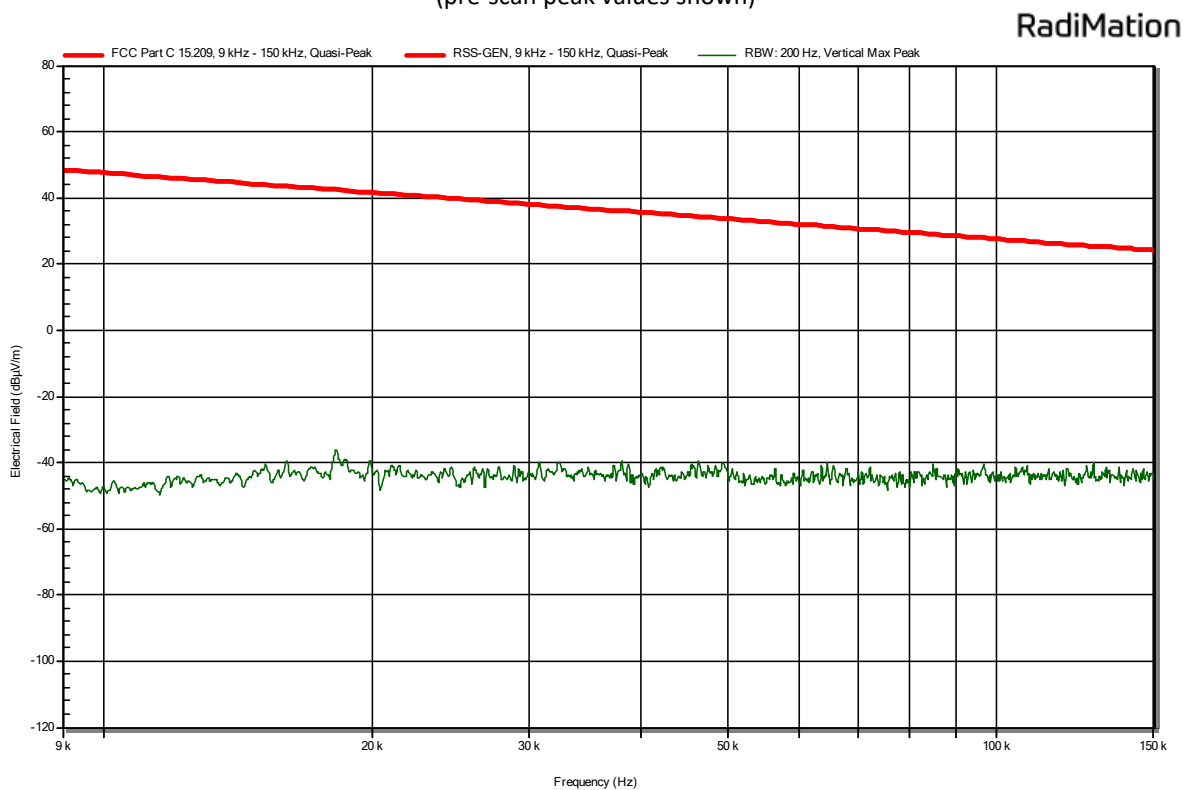
The results of the radiated emission tests are depicted in the table above. A selection of plots is provided on the next pages

3.1.7 Plots of the Radiated Spurious Emissions Measurement 802.11b

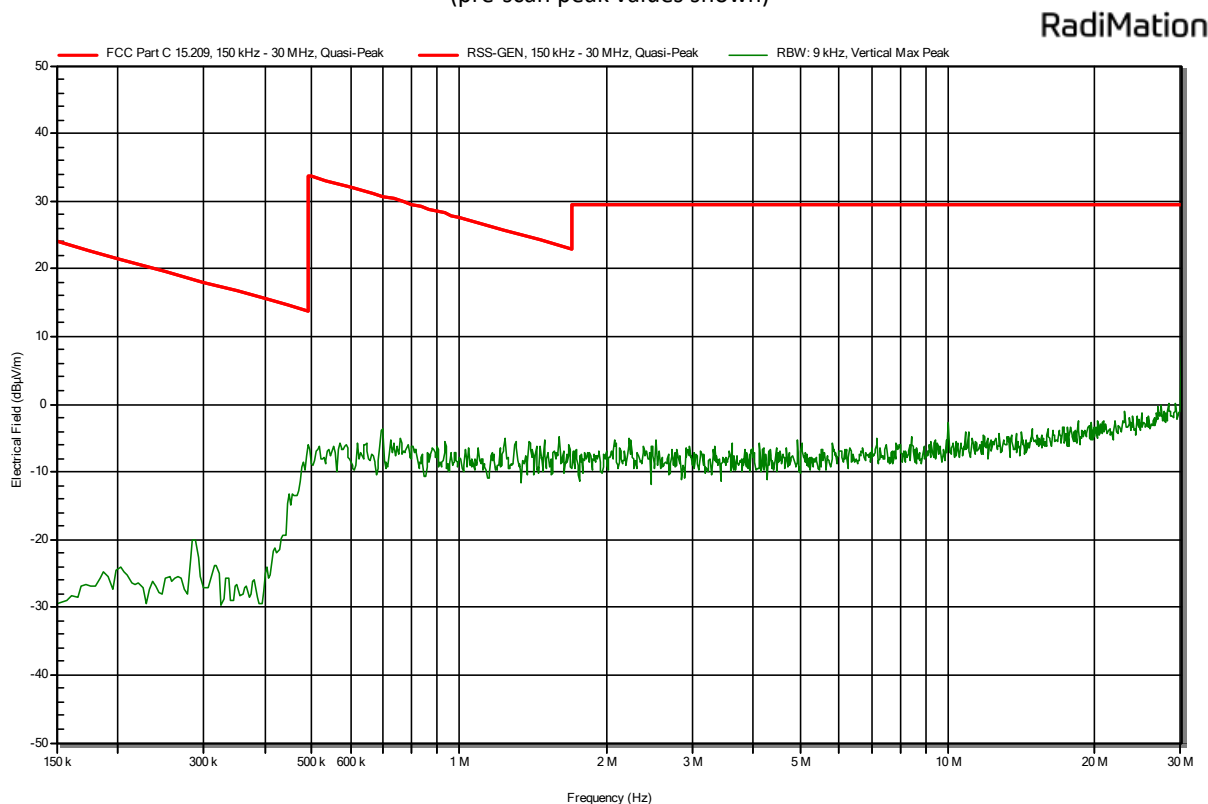
Plot 1a: radiated emissions of the EUT, Antenna perpendicular, in the range 9 – 150KHz
(pre-scan peak values shown)



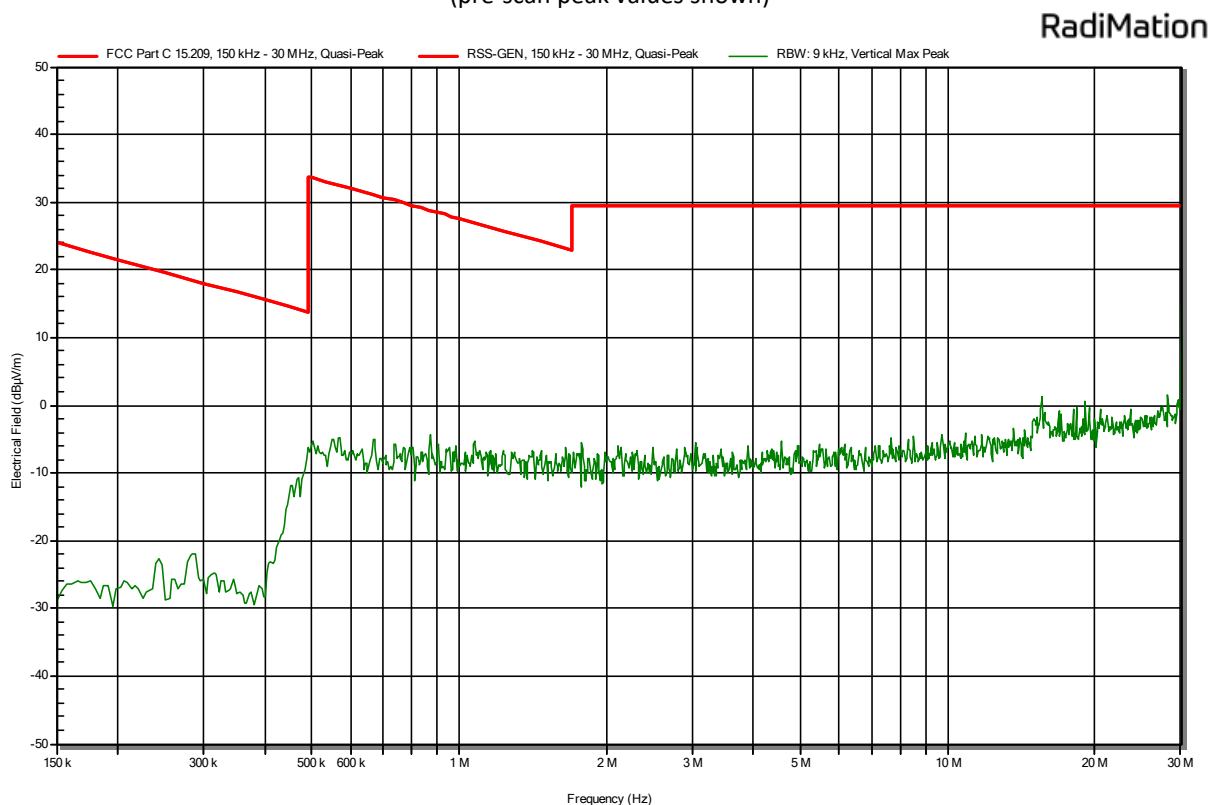
Plot 1b: radiated emissions of the EUT, Antenna parallel, in the range 9 – 150KHz
(pre-scan peak values shown)



Plot 2a: radiated emissions of the EUT, Antenna perpendicular, in the range 150KHz-30 MHz
(pre-scan peak values shown)



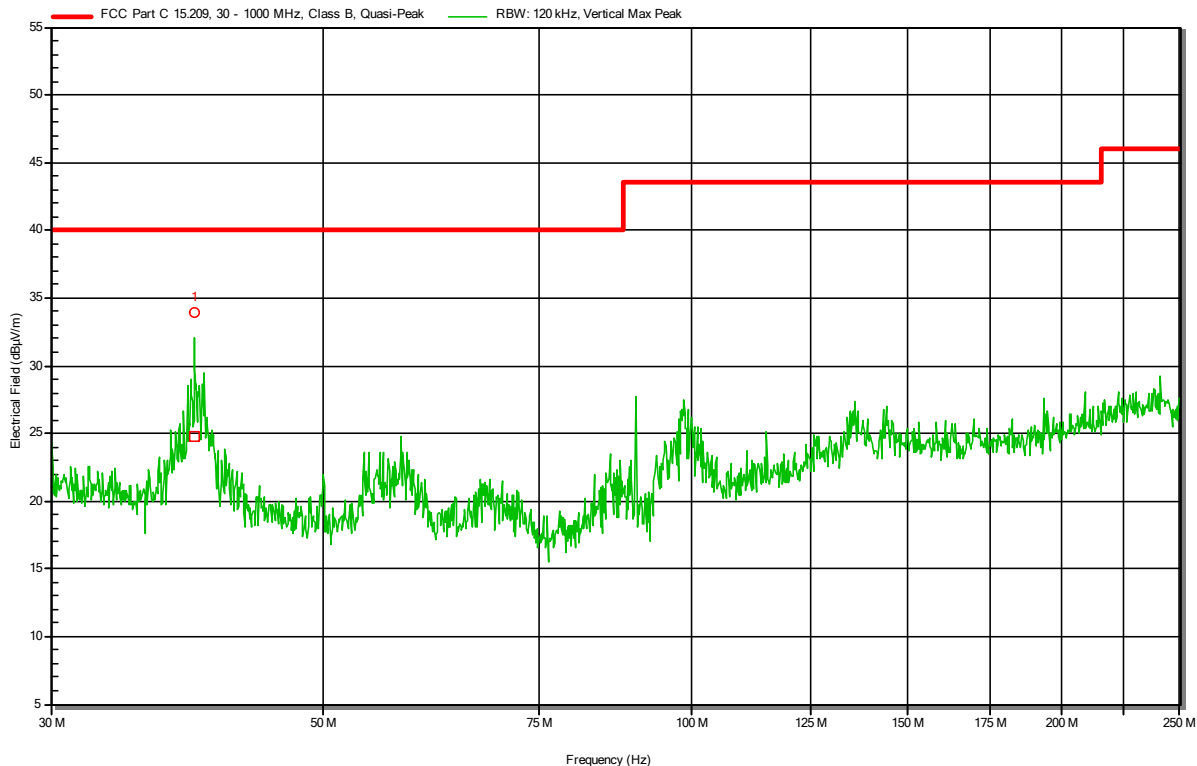
Plot 2b: radiated emissions of the EUT, Antenna parallel, in the range 150KHz-30 MHz
(pre-scan peak values shown)



Plot 3a: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)

Low channel

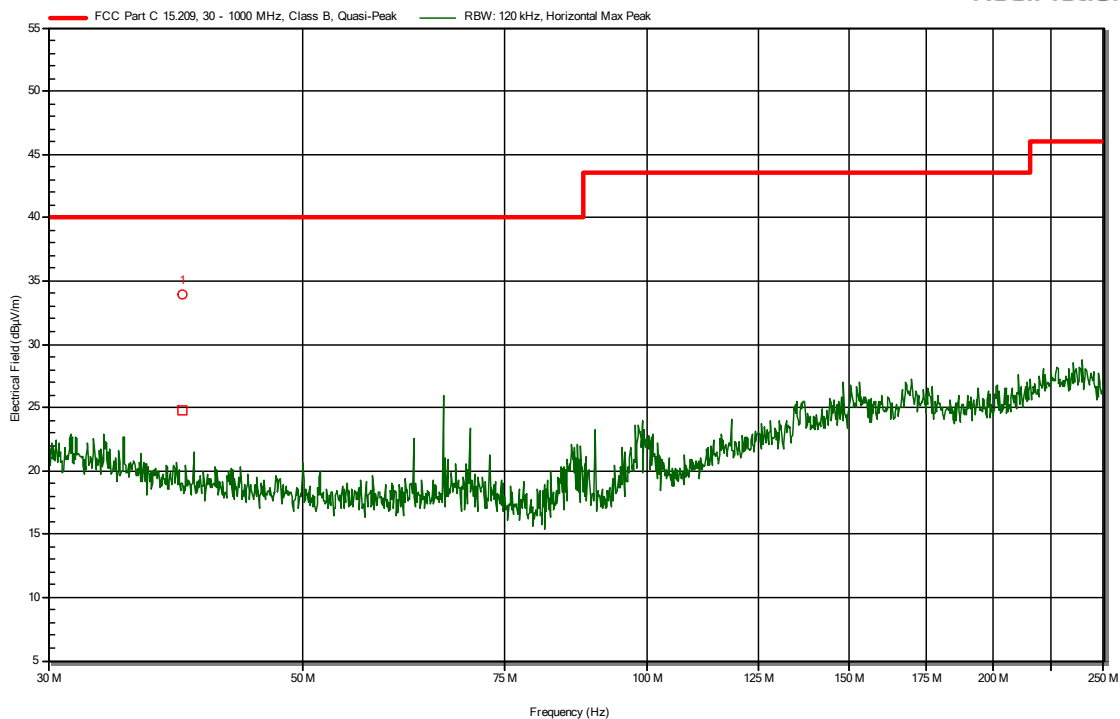
RadiMation



Plot 3b: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)

Low channel

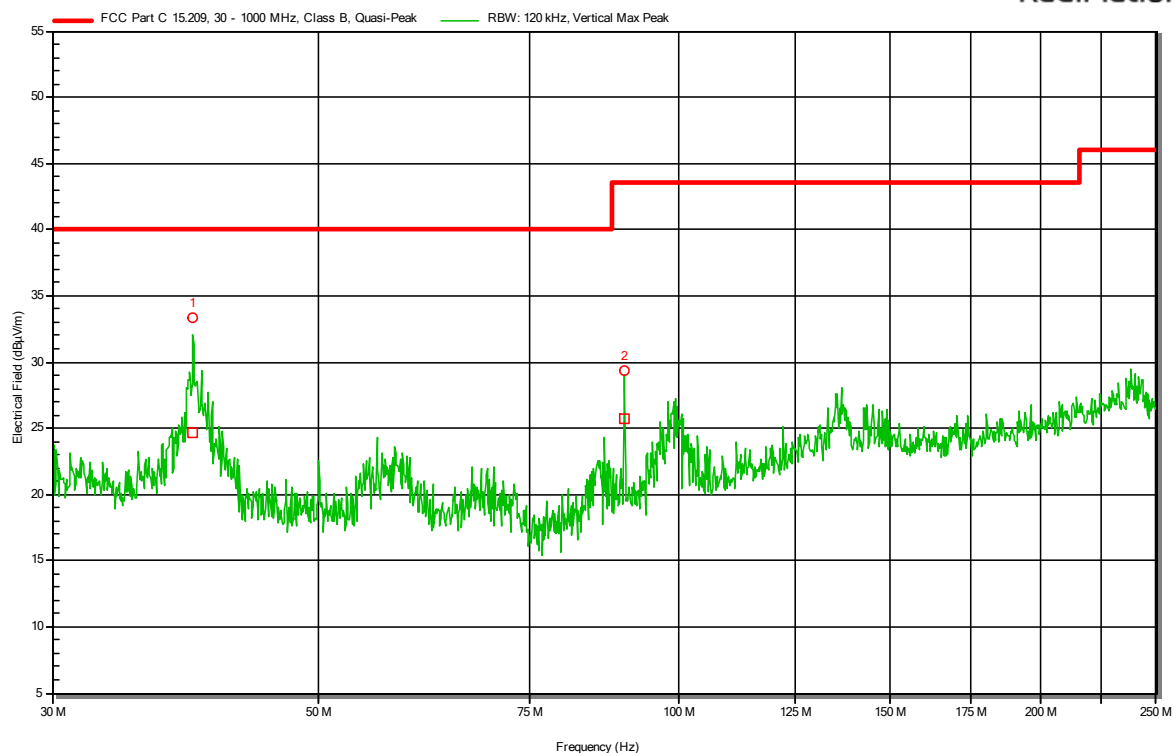
RadiMation



Plot 3c: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)

Middle channel

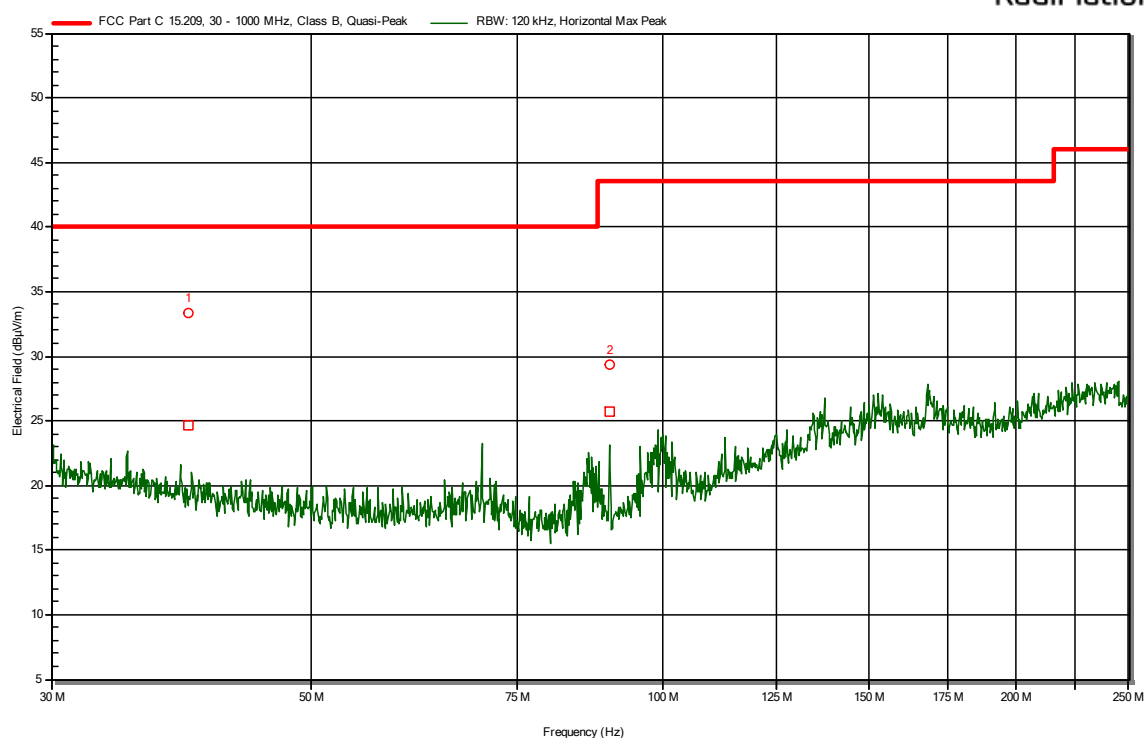
RadiMation



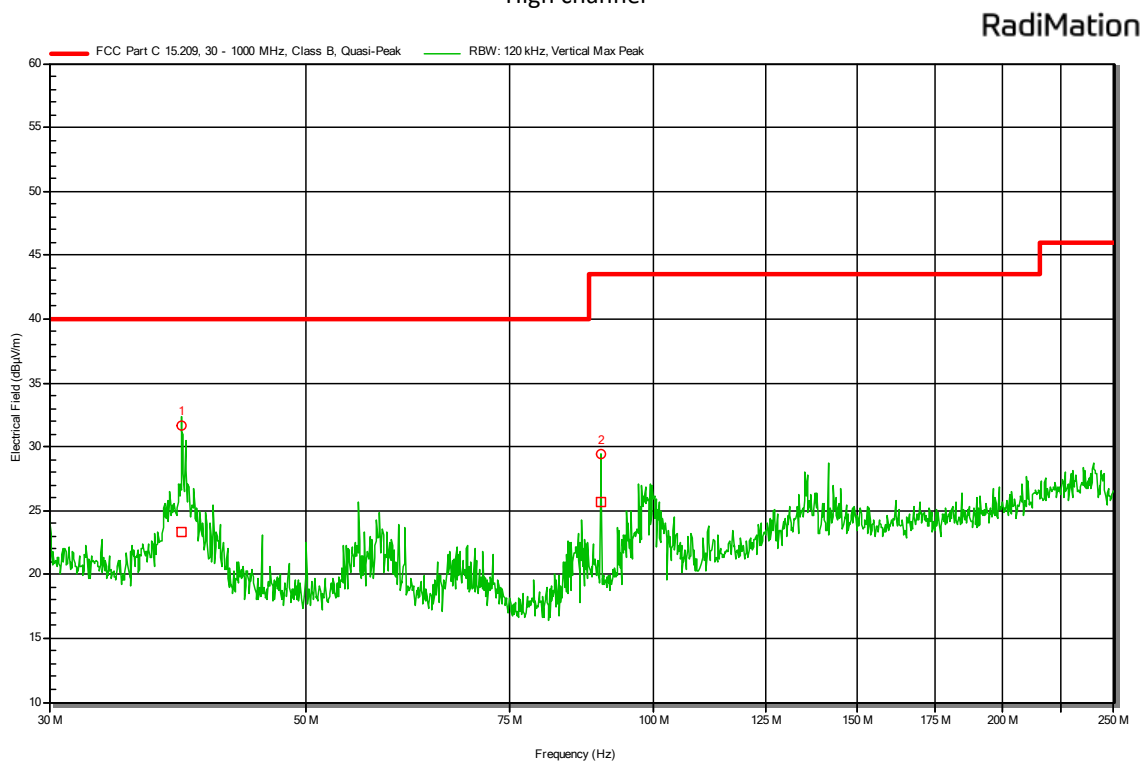
Plot 3d: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)

Middle channel

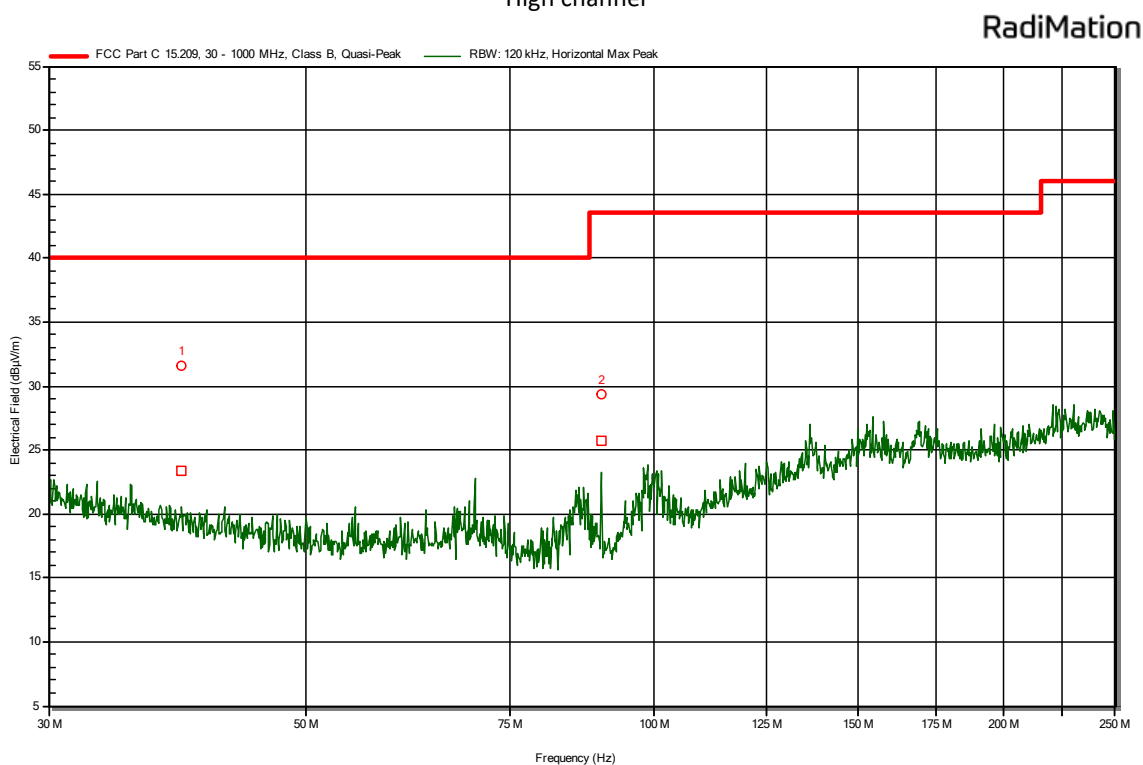
RadiMation



Plot 3e: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel

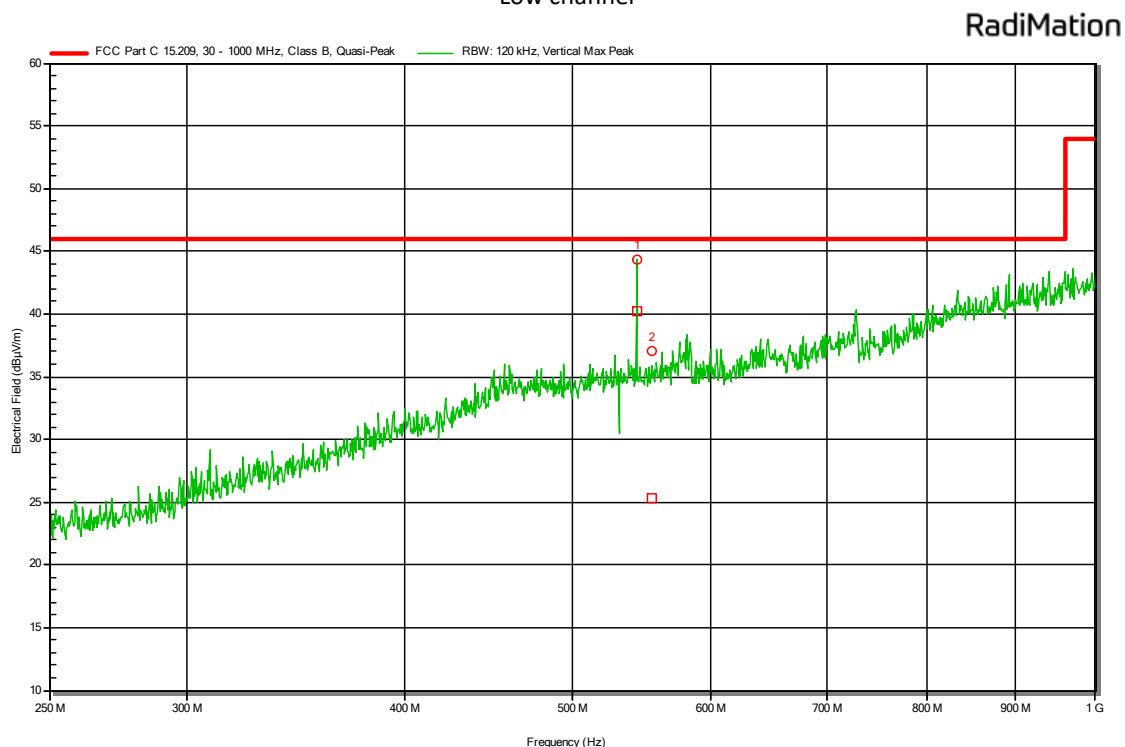


Plot 3f: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel



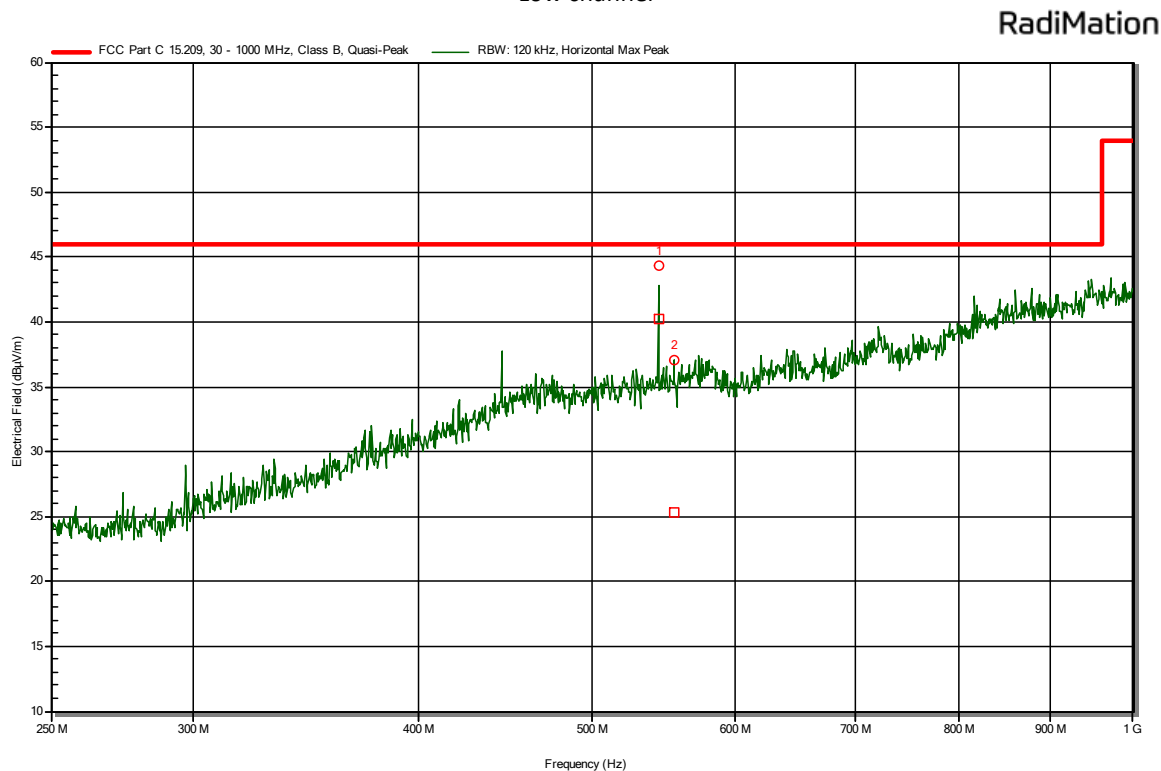
Plot 4a: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)

Low channel



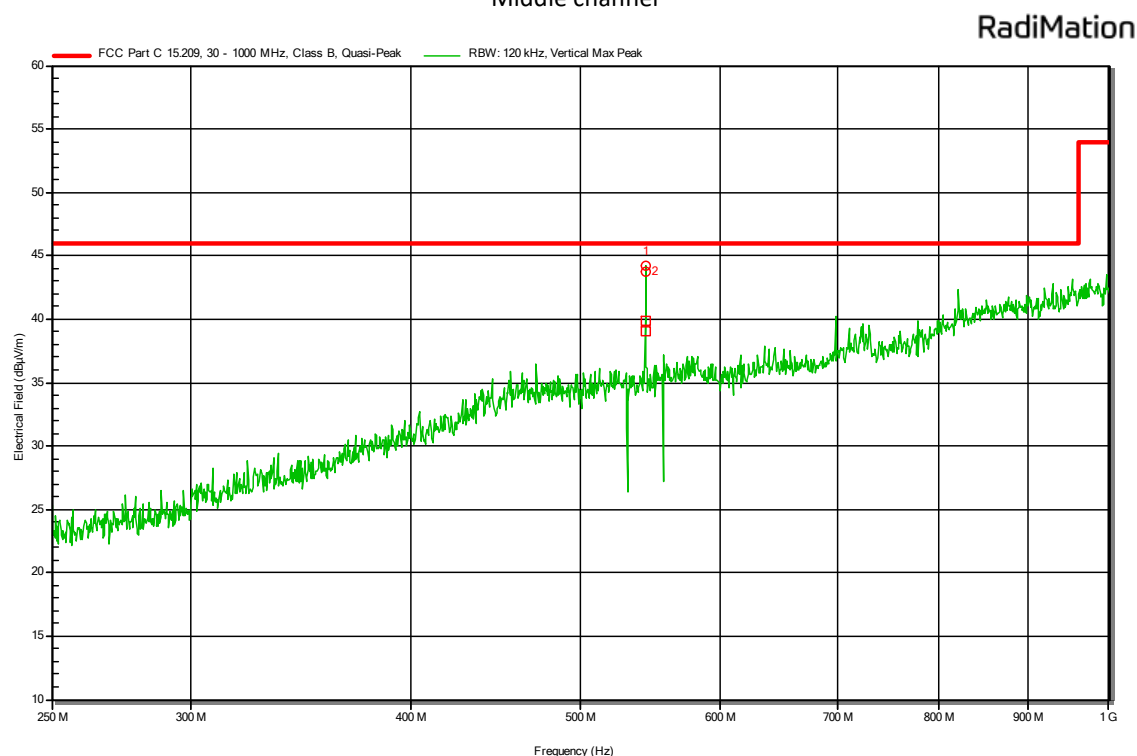
Plot 4b: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)

Low channel



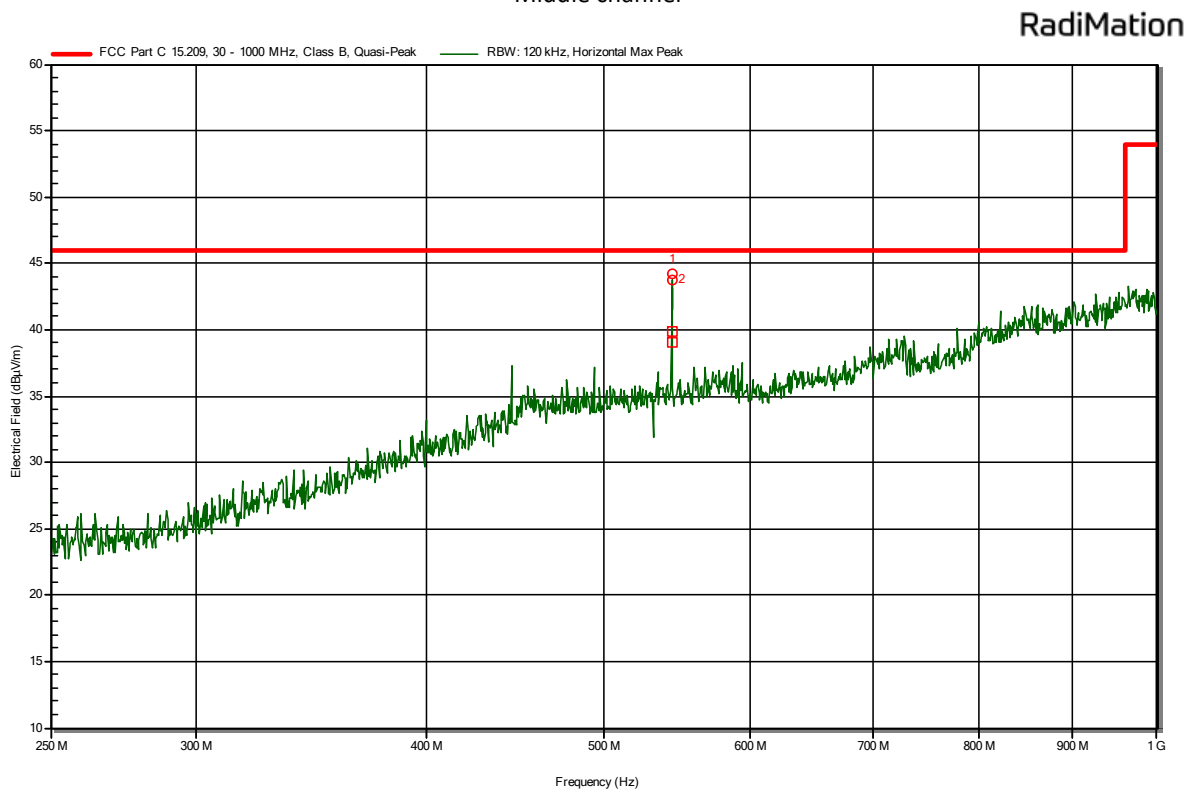
Plot 4c: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)

Middle channel

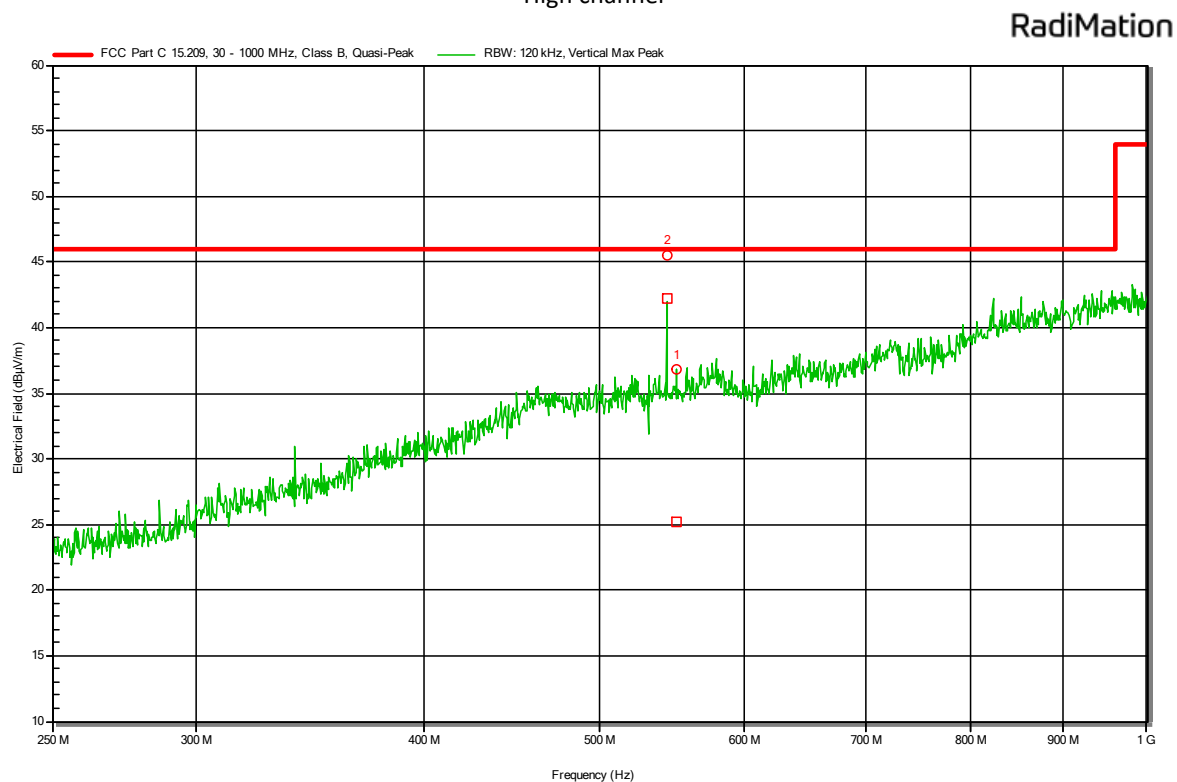


Plot 4d: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)

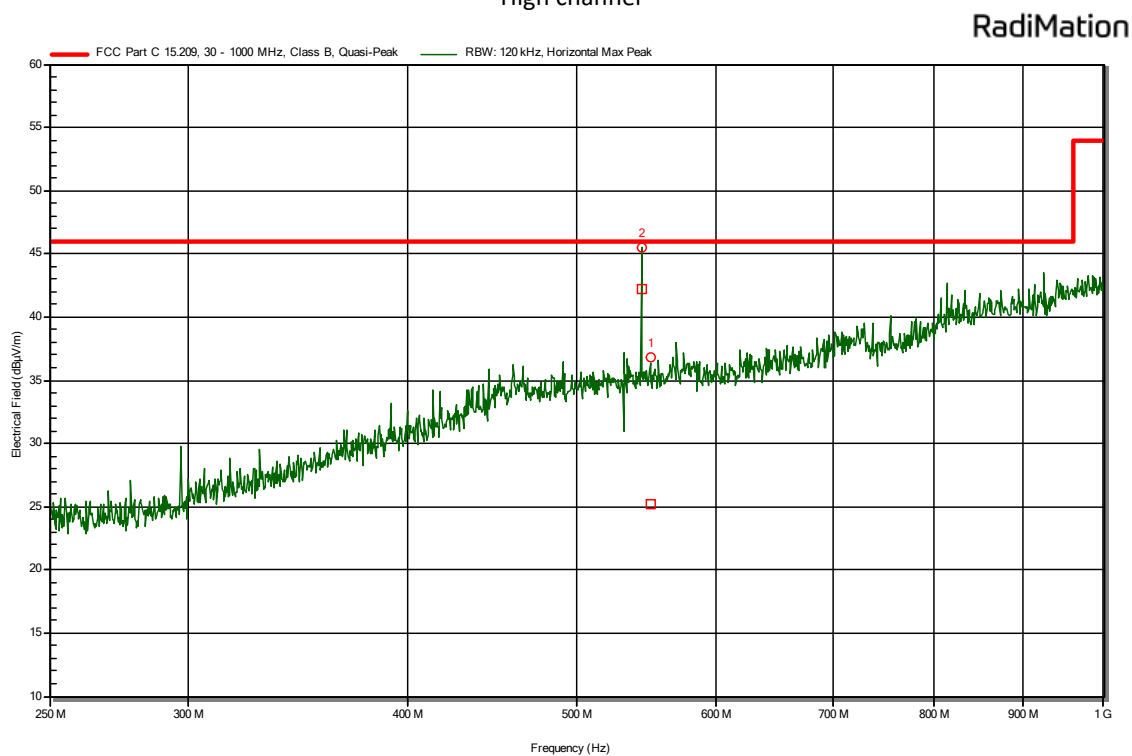
Middle channel



Plot 4e: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)
High channel

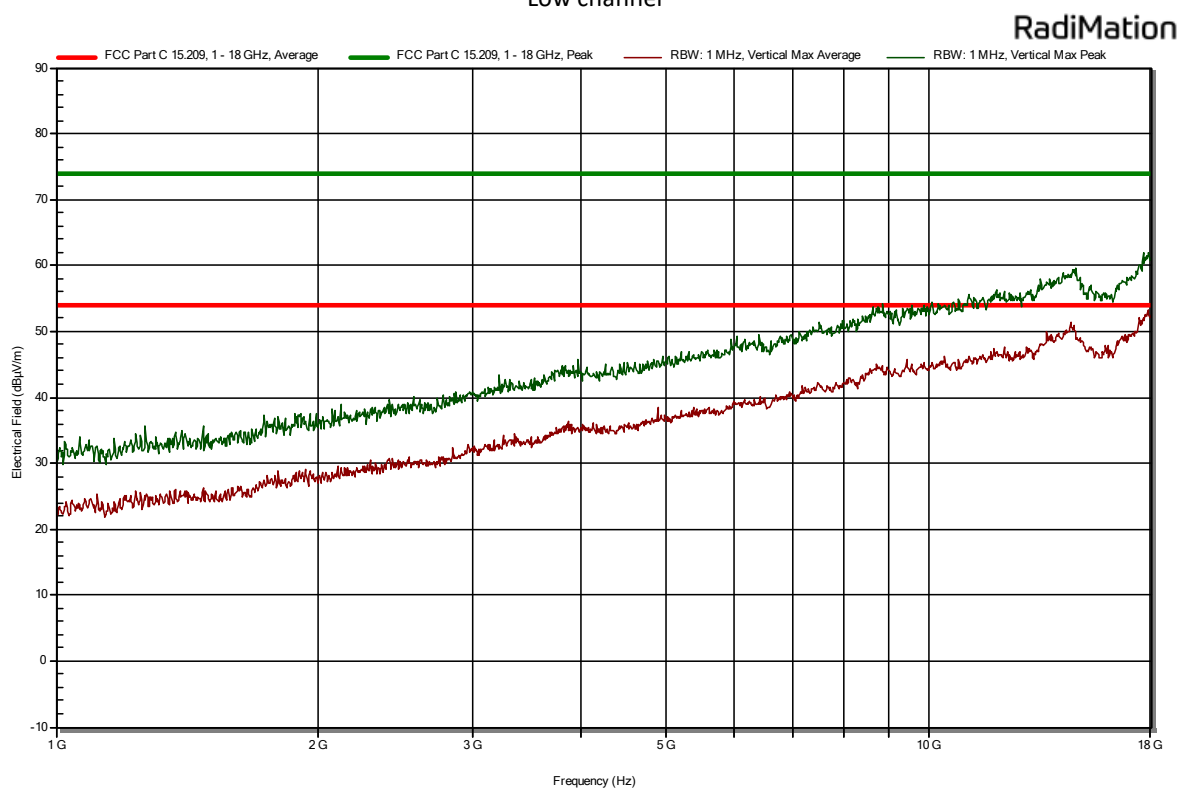


Plot 4f: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)
High channel



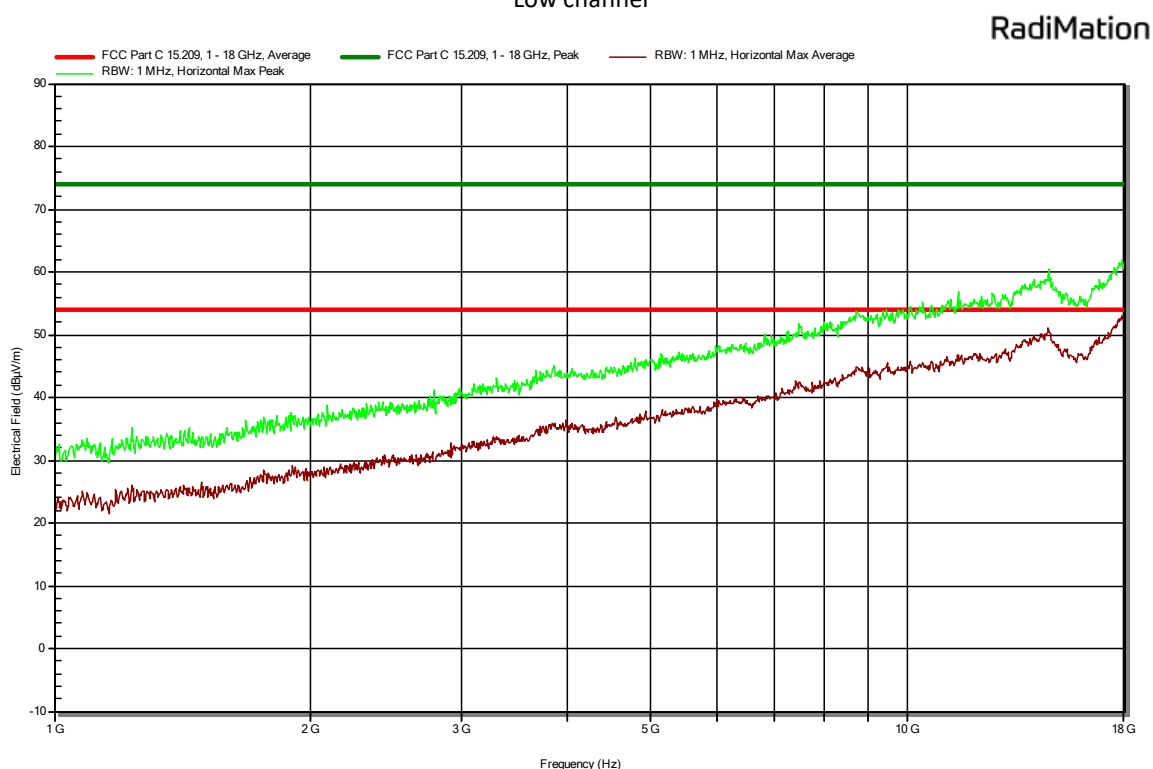
Plot 5a: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)

Low channel

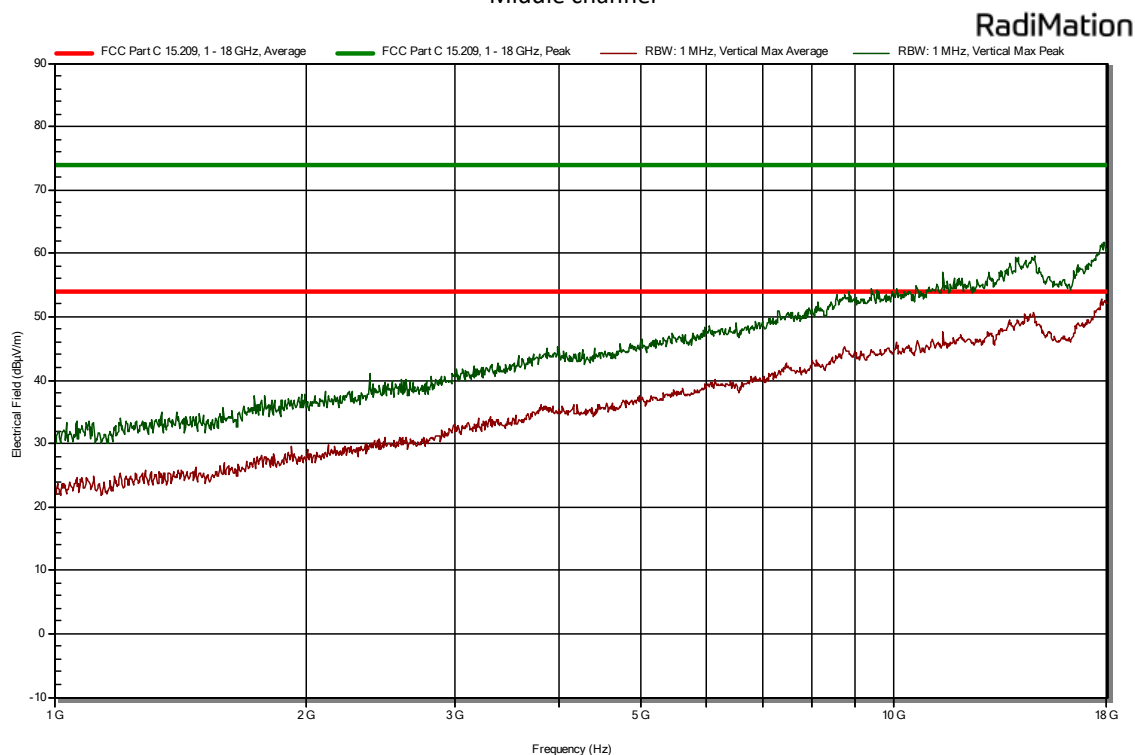


Plot 5b: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)

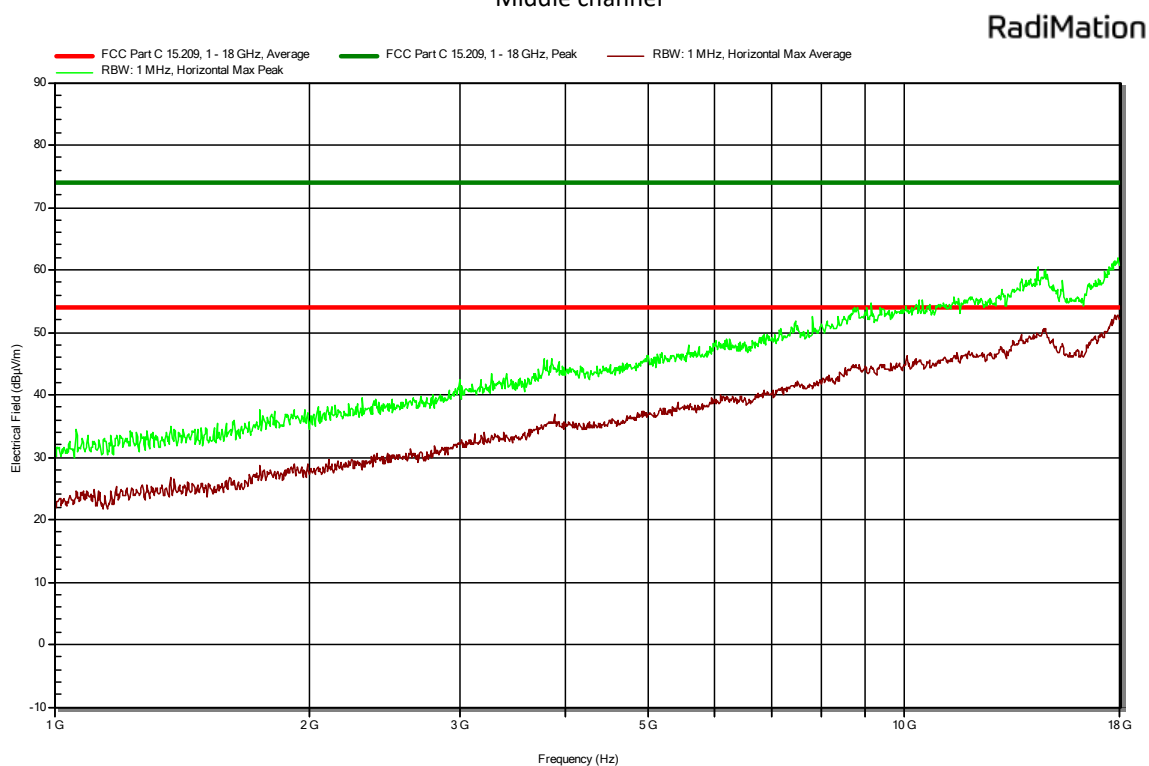
Low channel



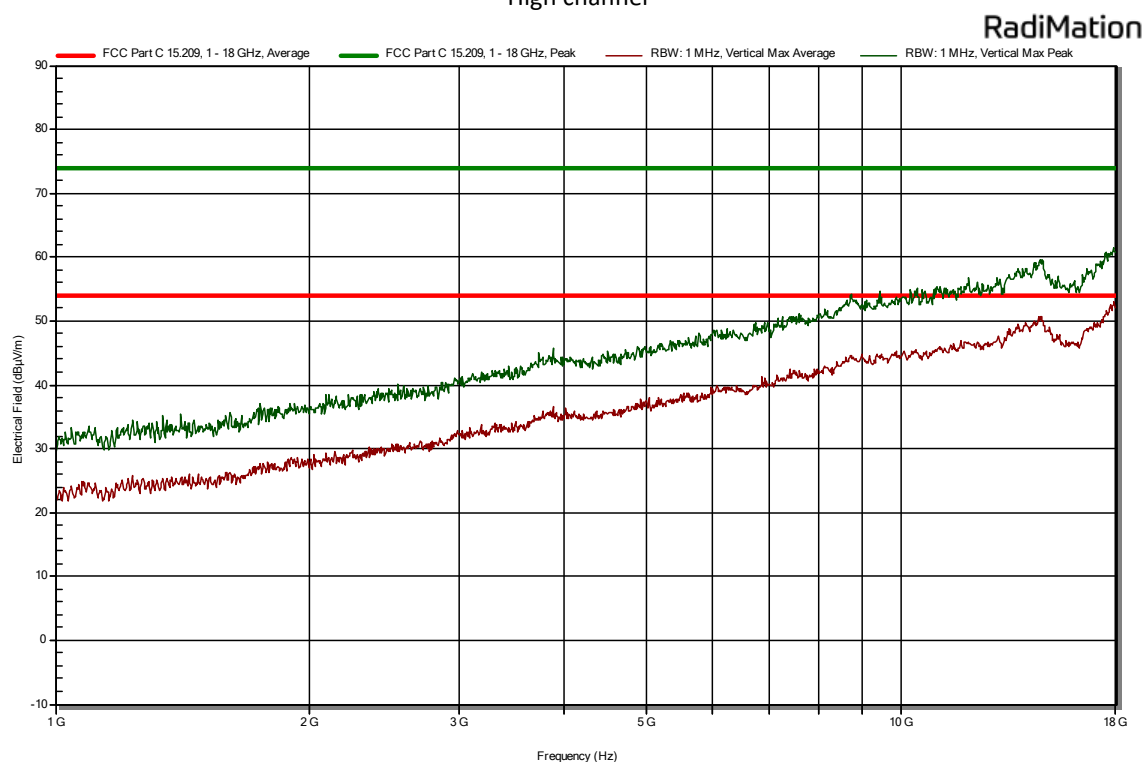
Plot 5c: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
Middle channel



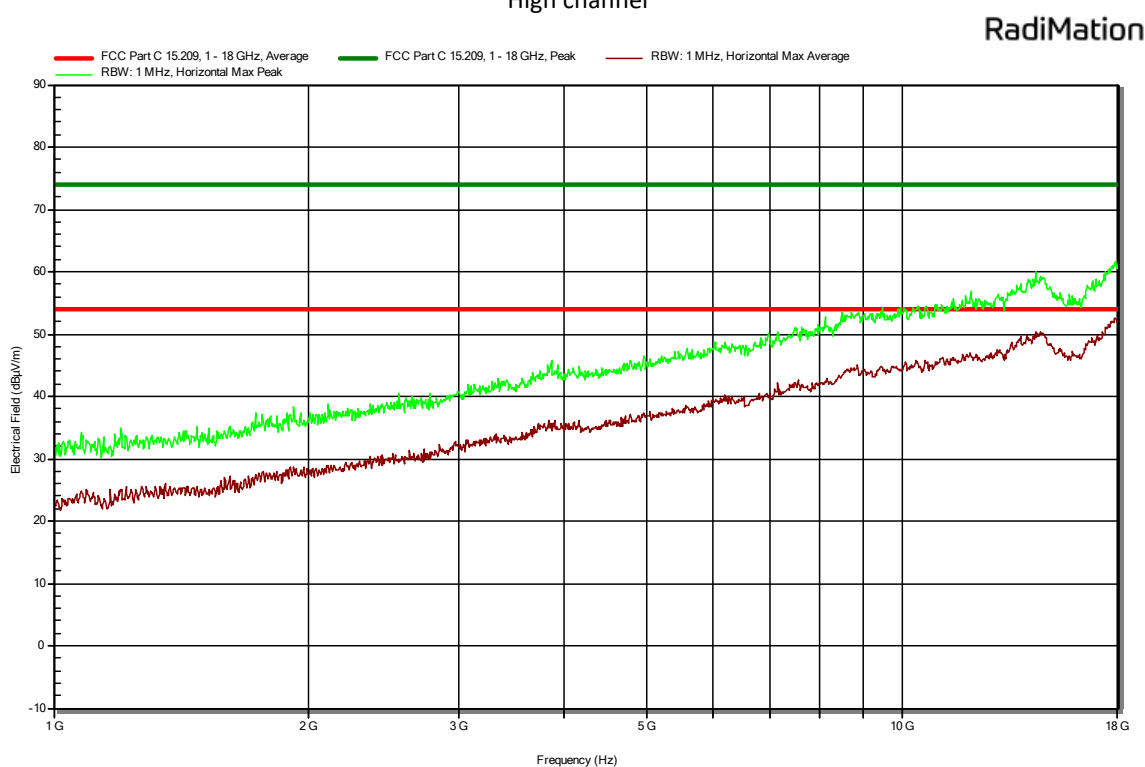
Plot 5d: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)
Middle channel



Plot 5e: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
High channel



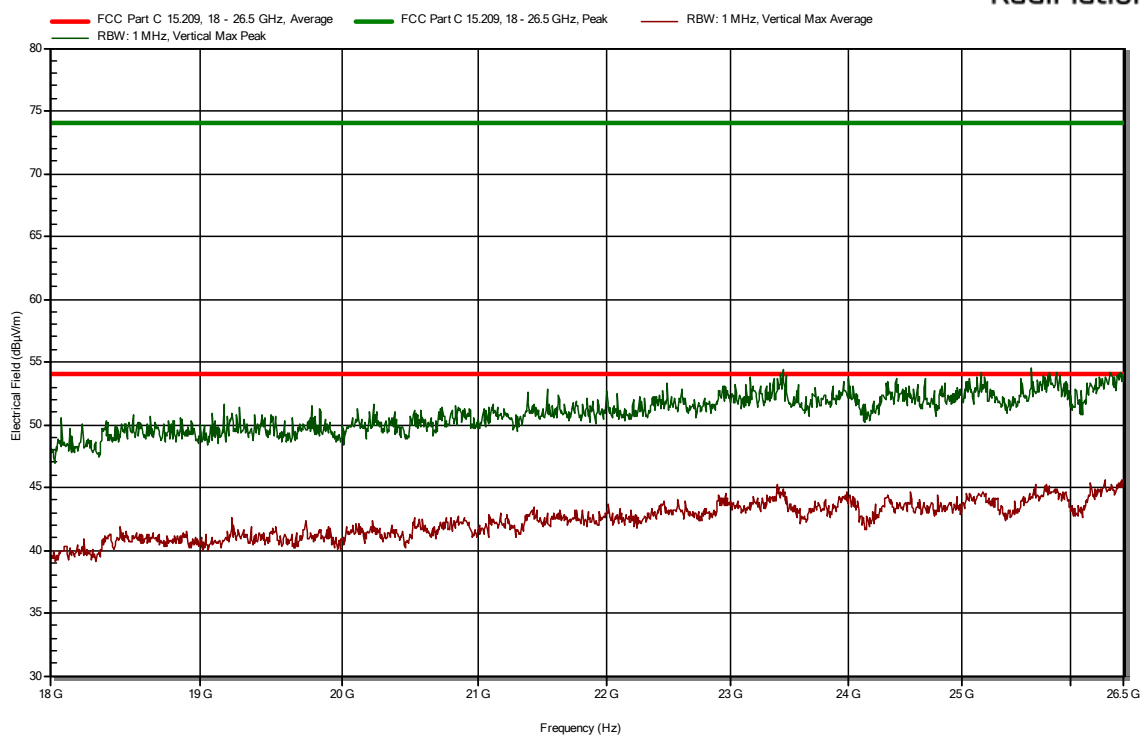
Plot 5f: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)
High channel



Plot 6a: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26 GHz
(peak and average values shown)

Low channel

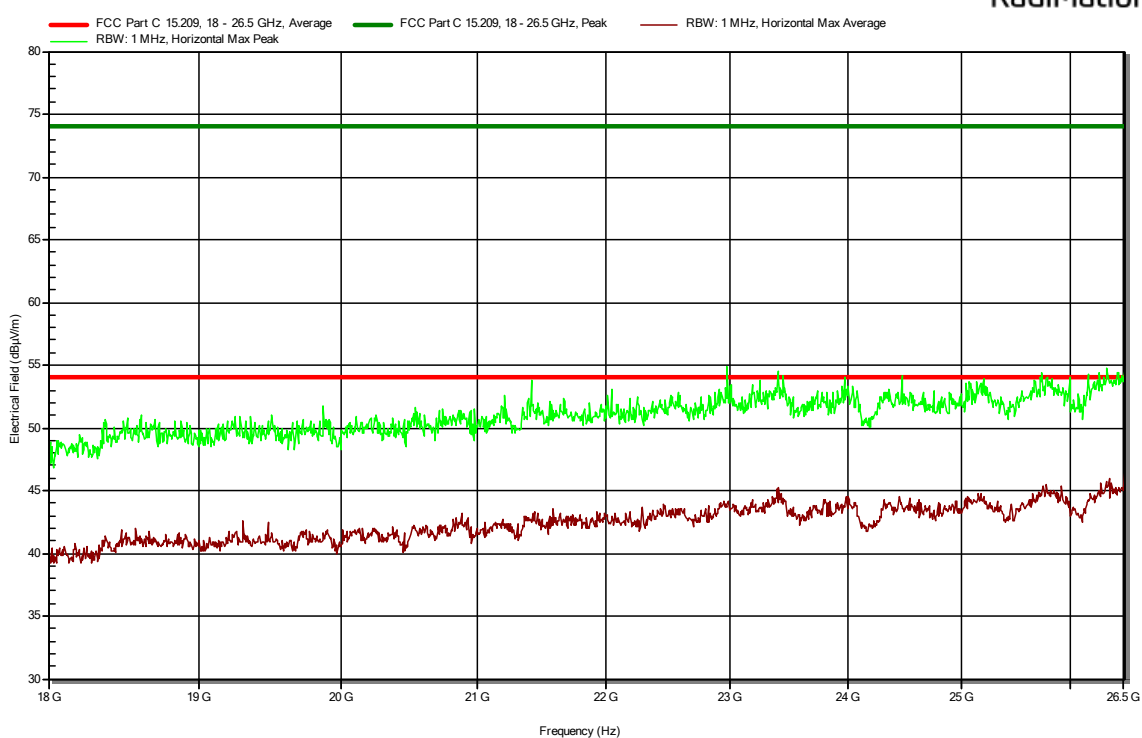
RadiMation



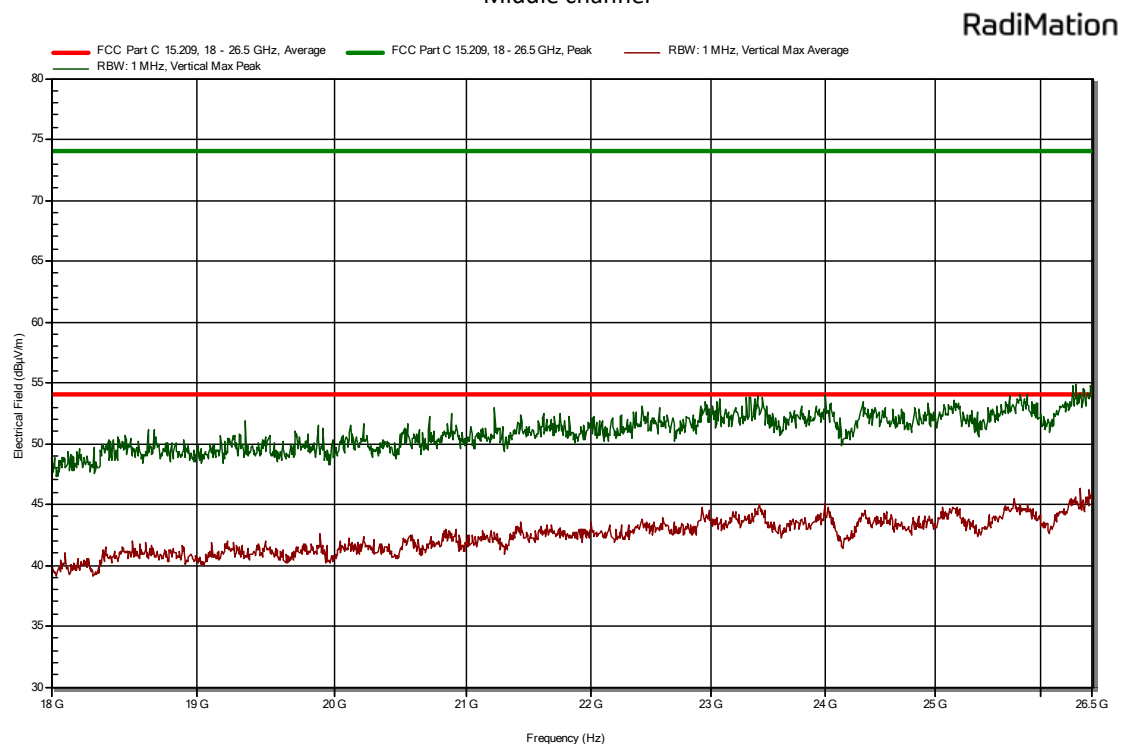
Plot 6b: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26GHz
(peak and average values shown)

Low channel

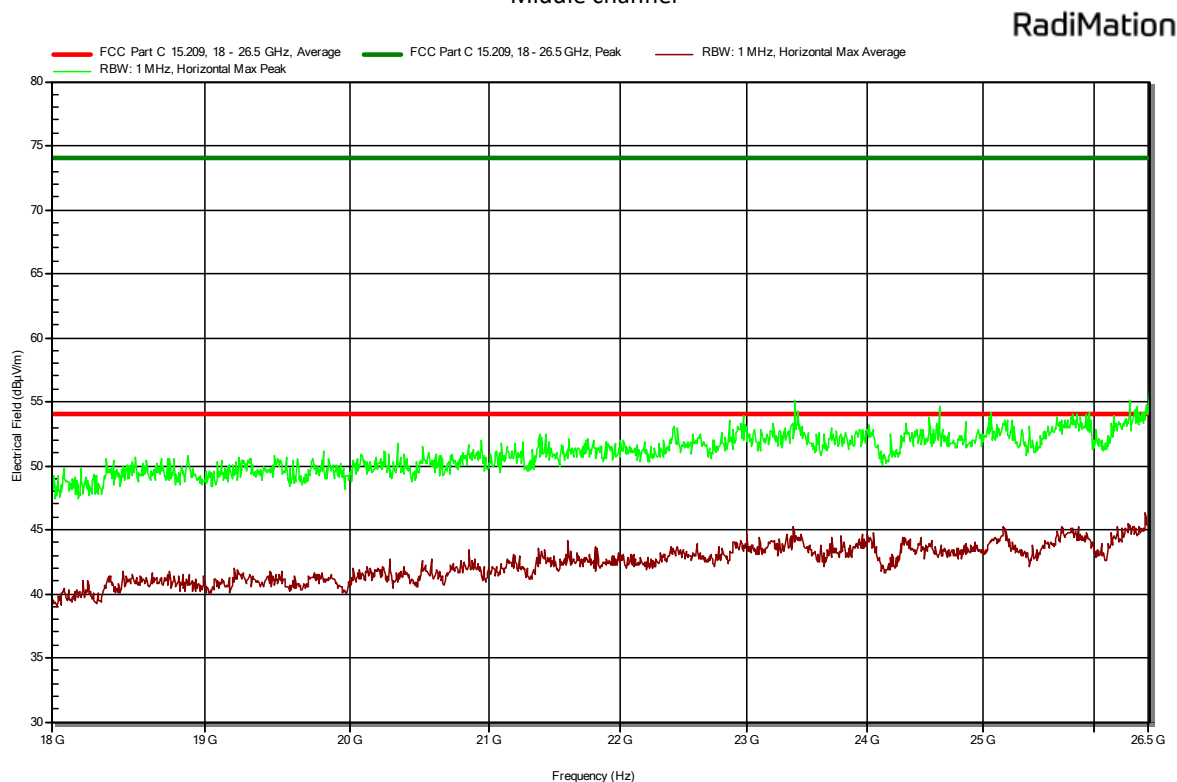
RadiMation



Plot 6c: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26GHz
(peak and average values shown)
Middle channel



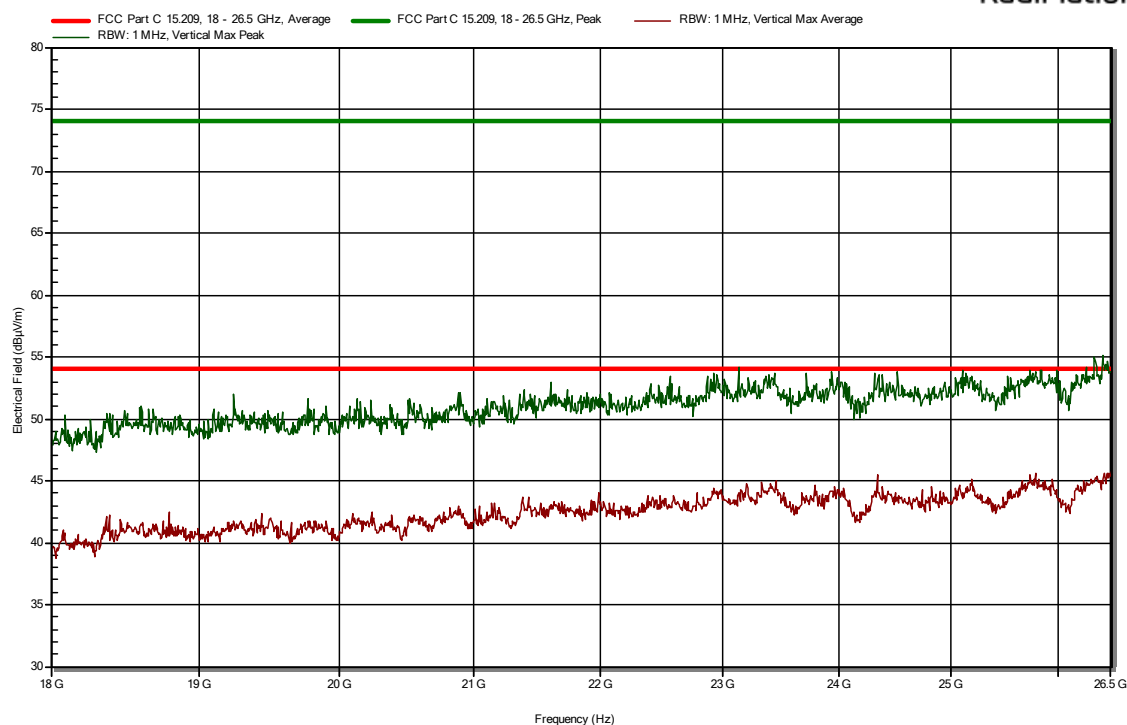
Plot 6d: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26GHz
(peak and average values shown)
Middle channel



Plot 6e: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26GHz
(peak and average values shown)

High channel

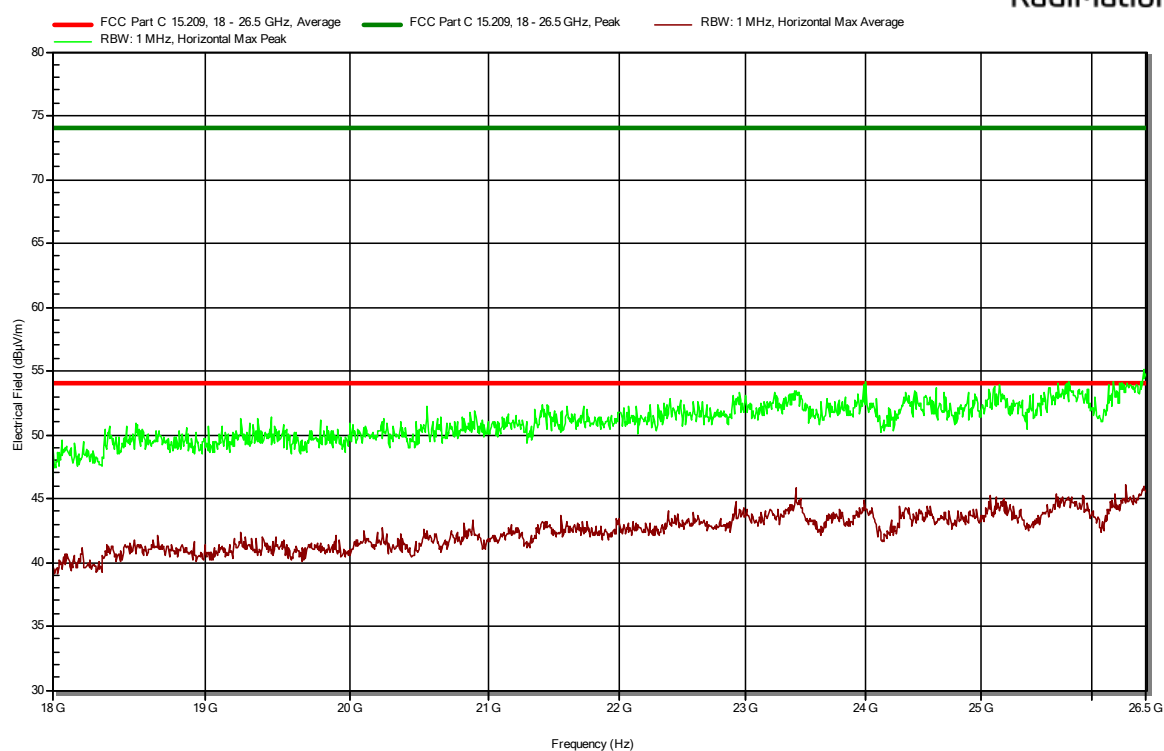
RadiMation



Plot 6f: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26 GHz
(peak and average values shown)

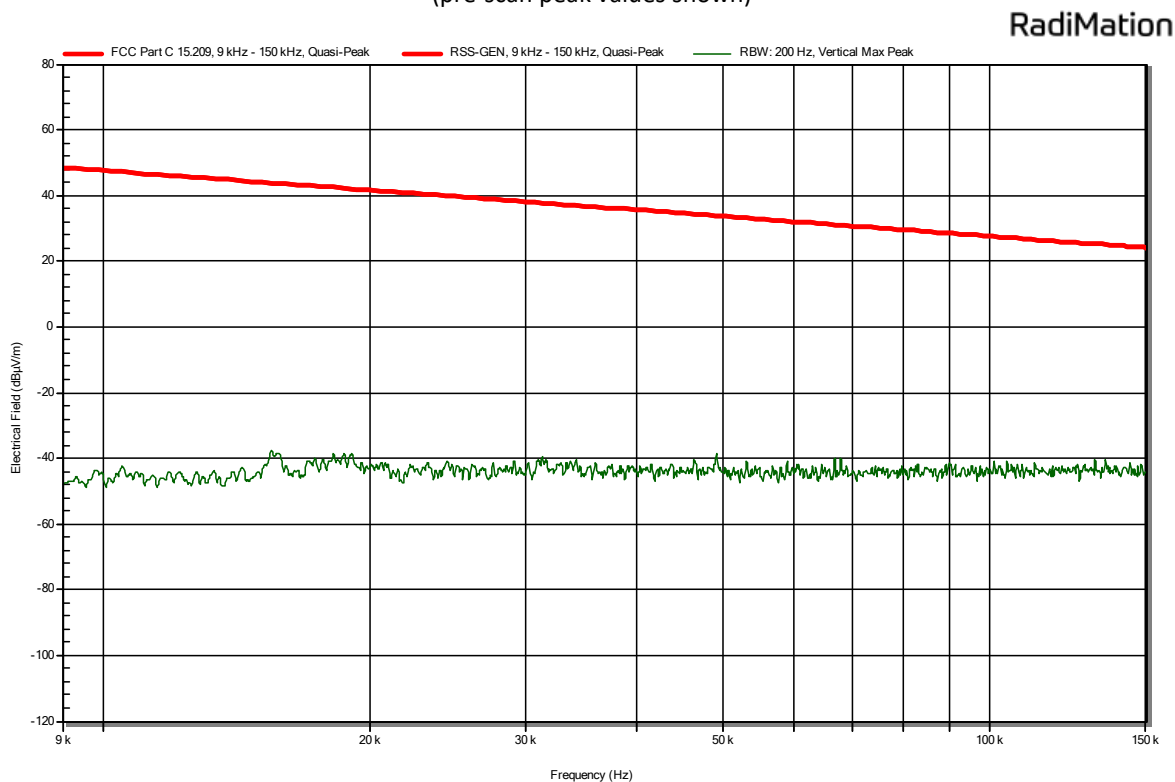
High channel

RadiMation

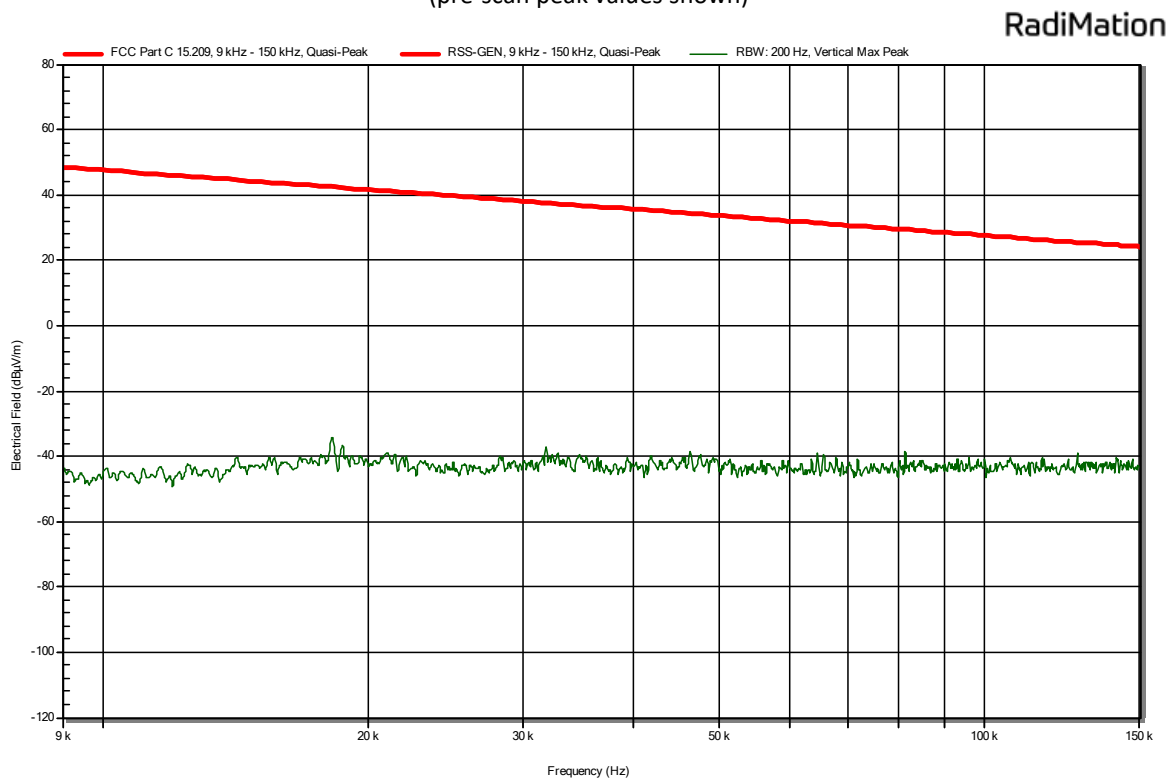


3.1.8 Plots of the Radiated Spurious Emissions Measurement 802.15.4

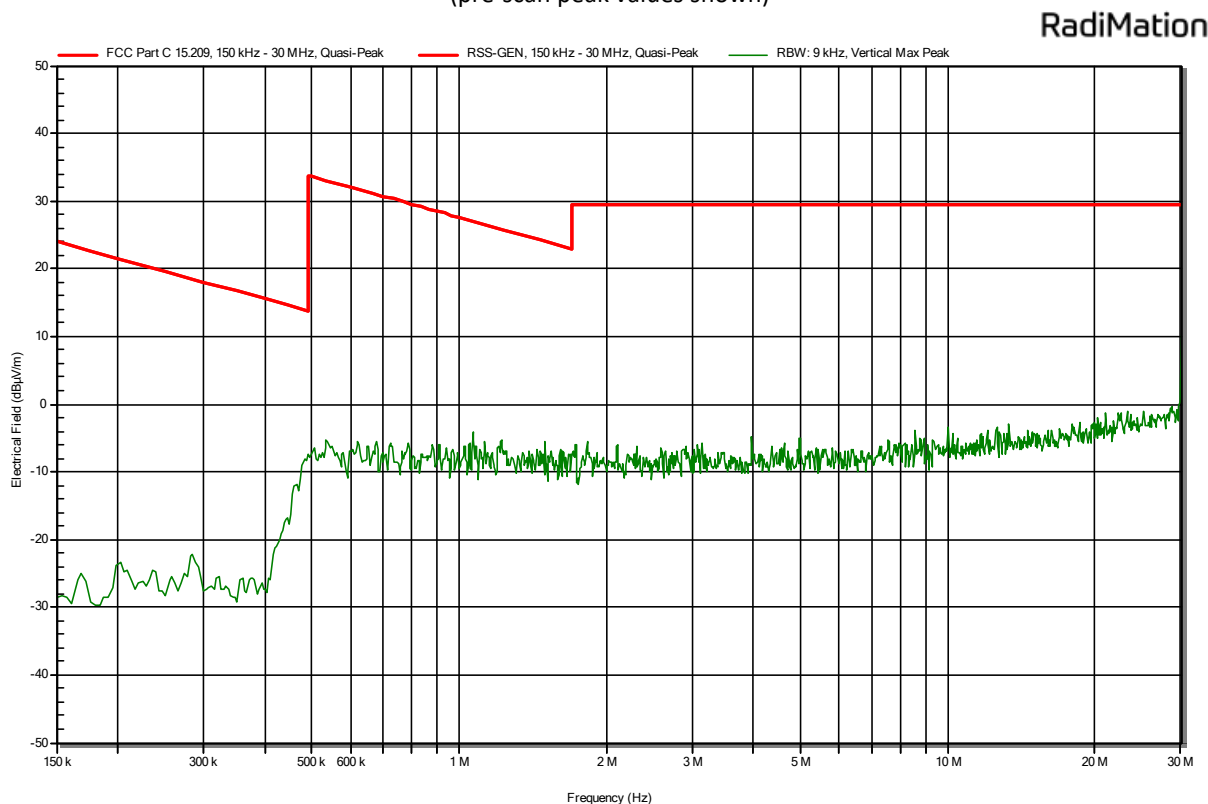
Plot 1a: radiated emissions of the EUT, Antenna perpendicular, in the range 9 – 150KHz
(pre-scan peak values shown)



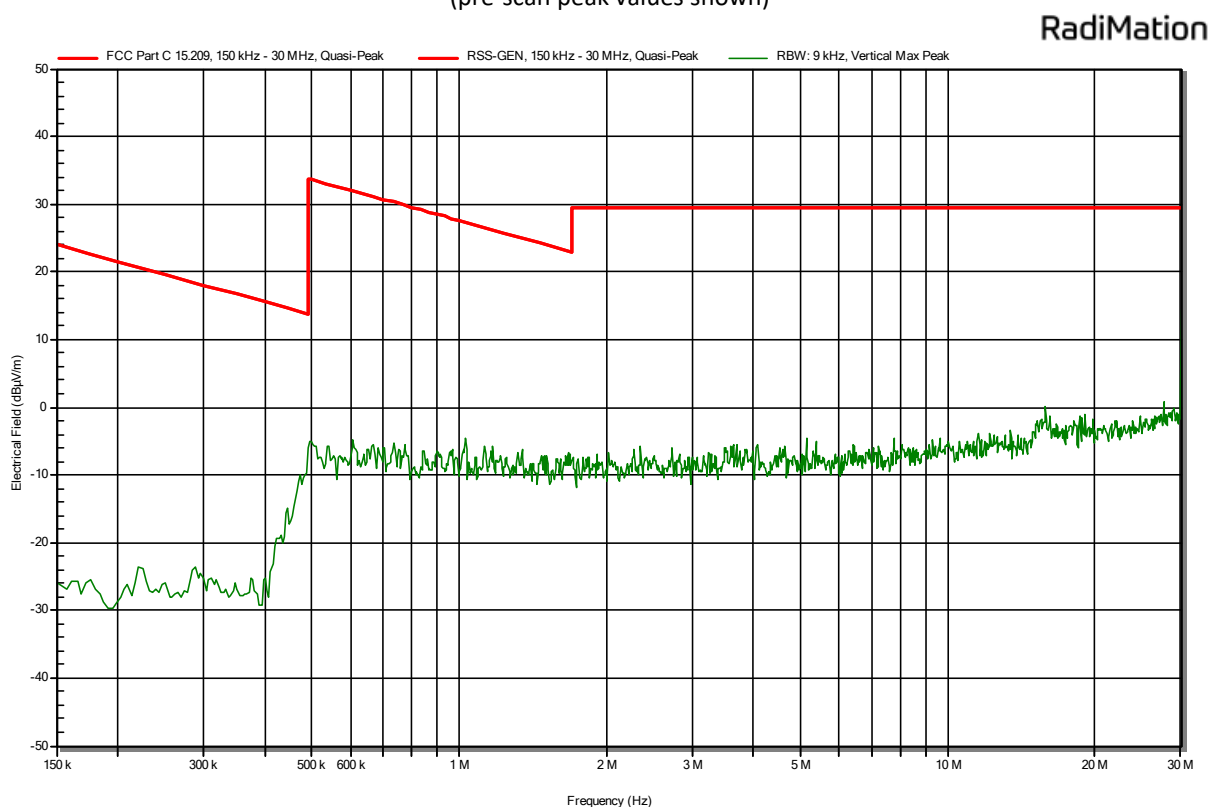
Plot 1b: radiated emissions of the EUT, Antenna parallel, in the range 9 – 150KHz
(pre-scan peak values shown)



Plot 2a: radiated emissions of the EUT, Antenna perpendicular, in the range 150KHz-30 MHz
(pre-scan peak values shown)

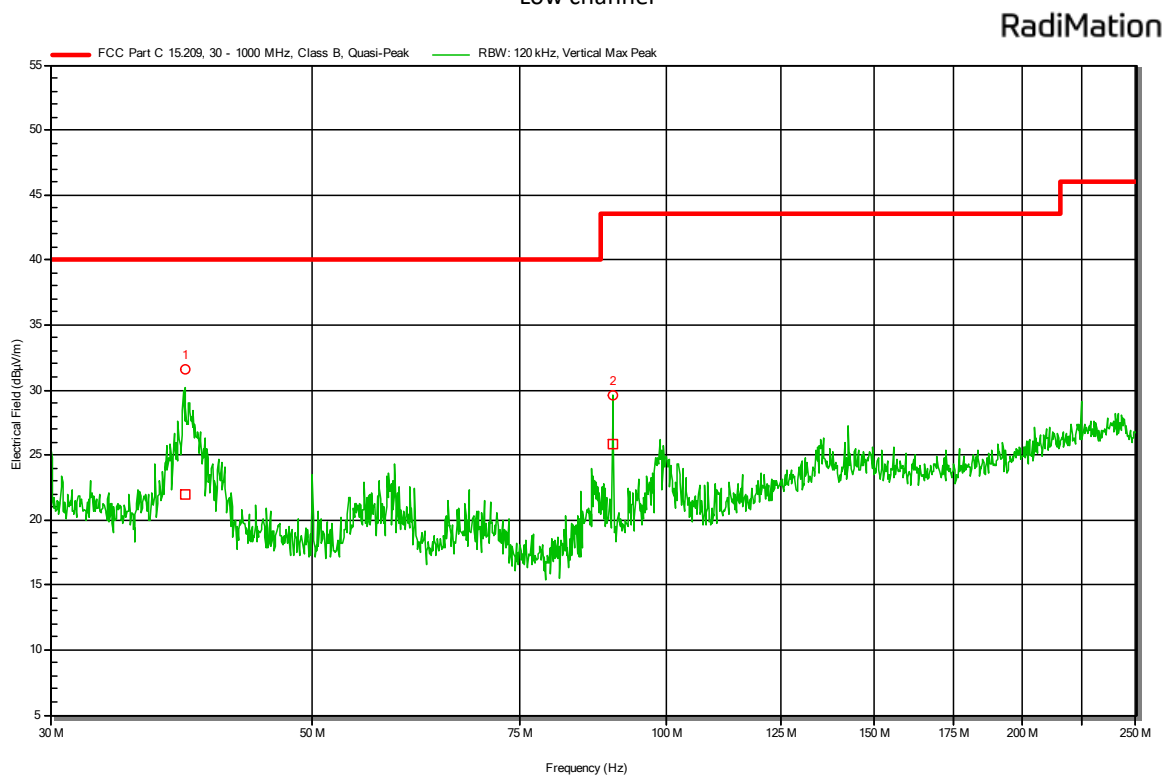


Plot 2b: radiated emissions of the EUT, Antenna parallel, in the range 150KHz-30 MHz
(pre-scan peak values shown)



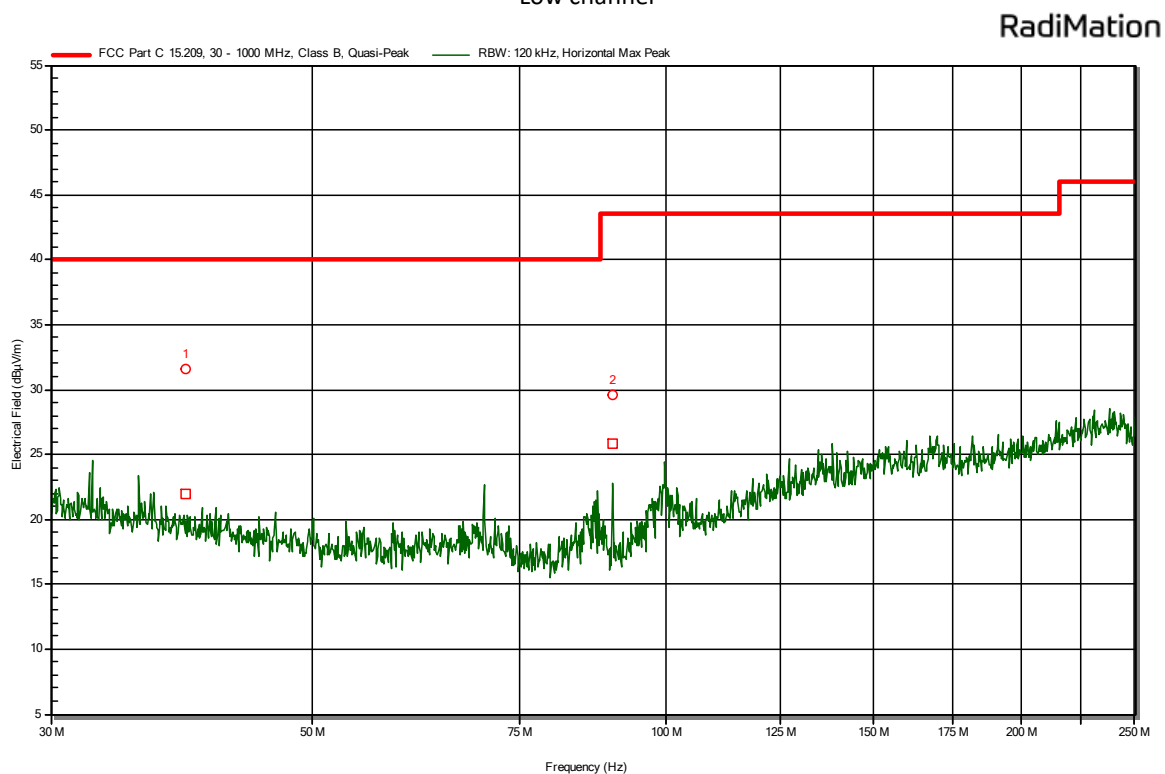
Plot 3a: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)

Low channel



Plot 3b: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)

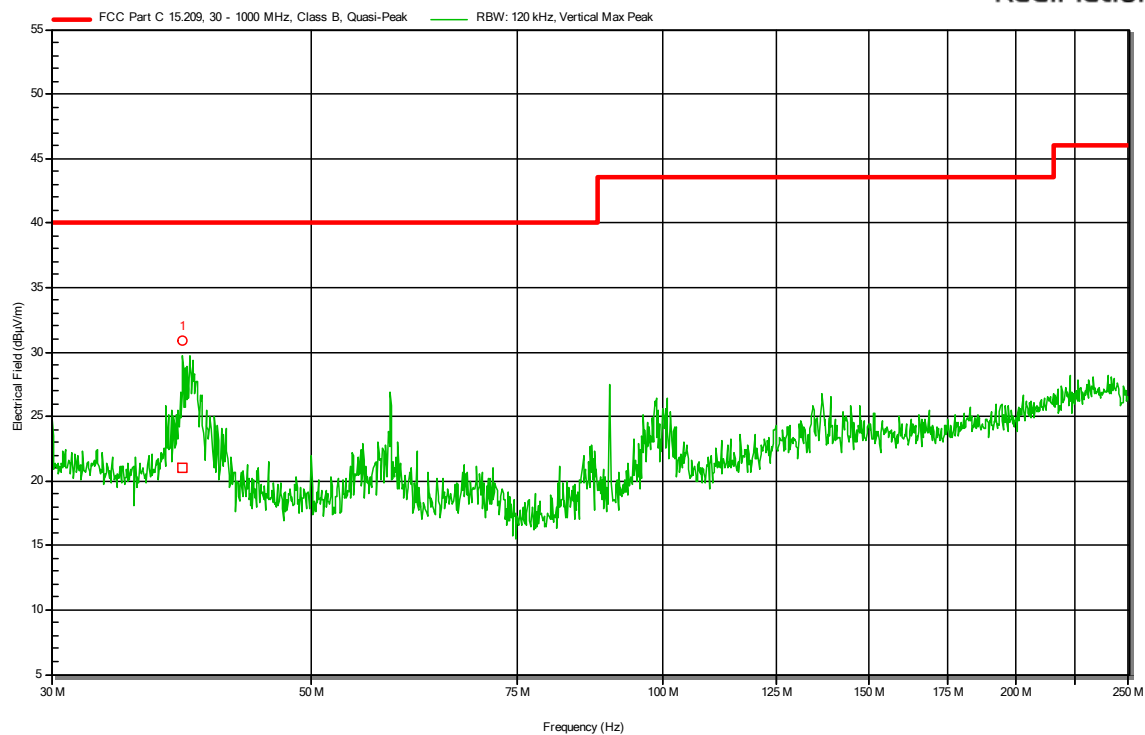
Low channel



Plot 3c: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)

Middle channel

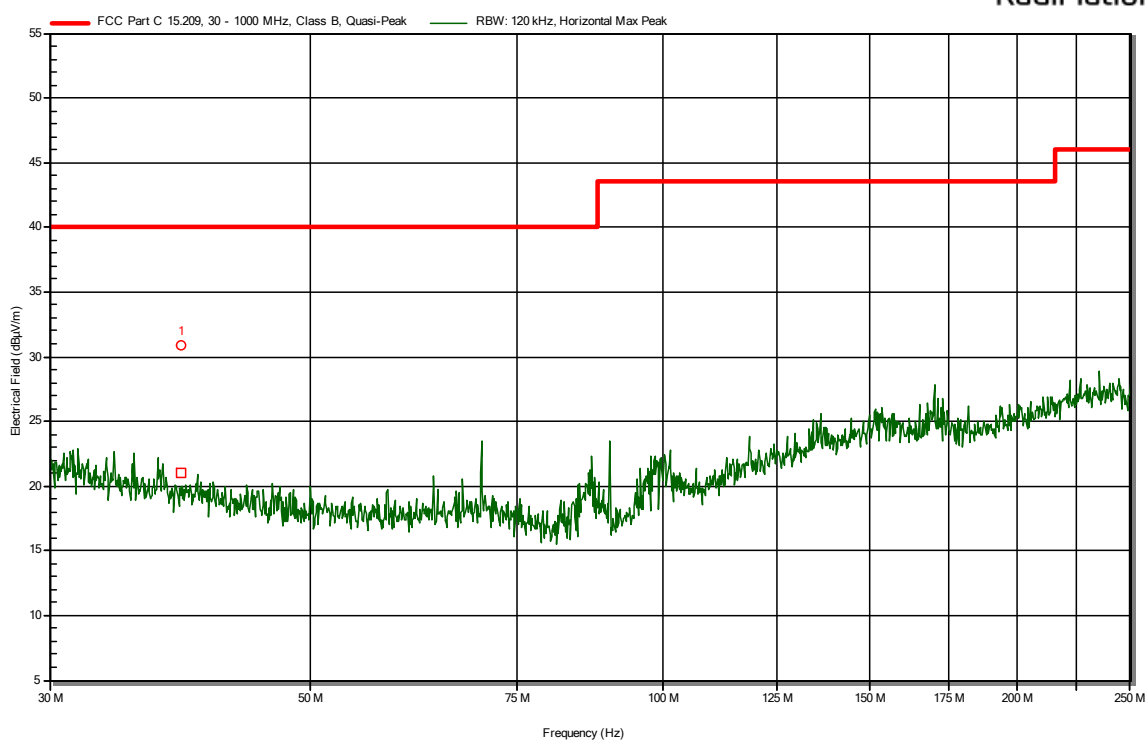
RadiMation



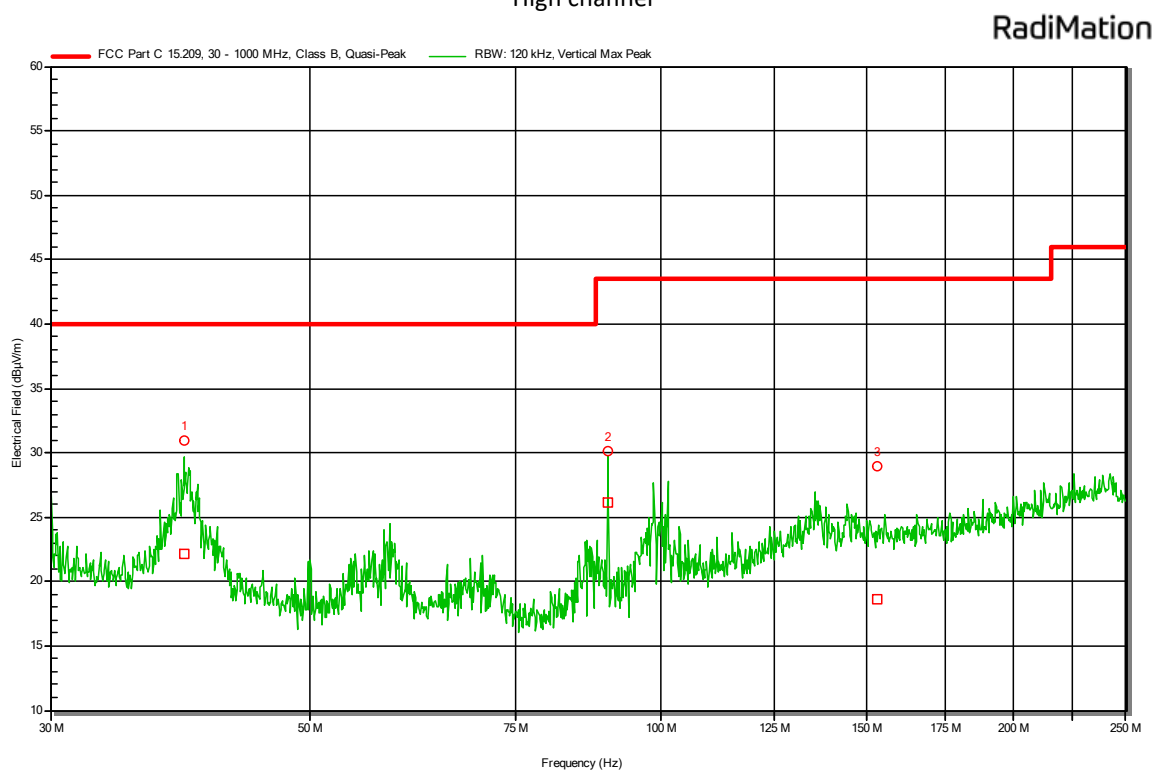
Plot 3d: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)

Middle channel

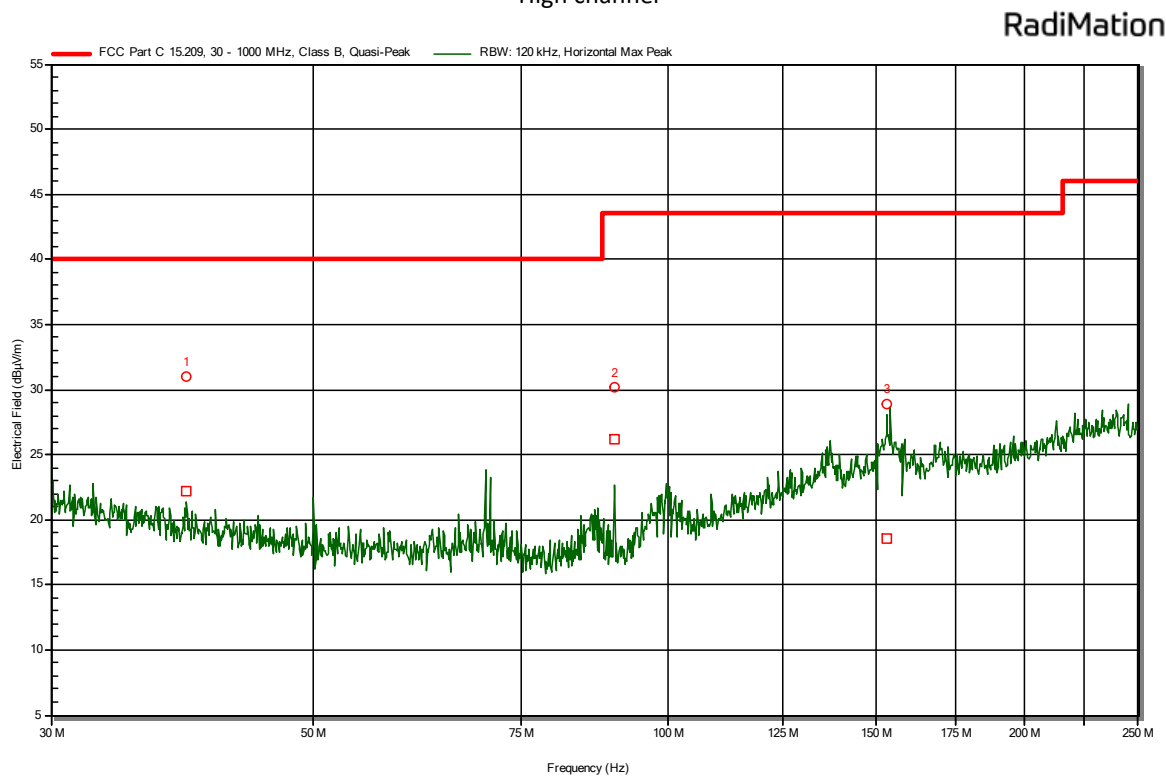
RadiMation



Plot 3e: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel

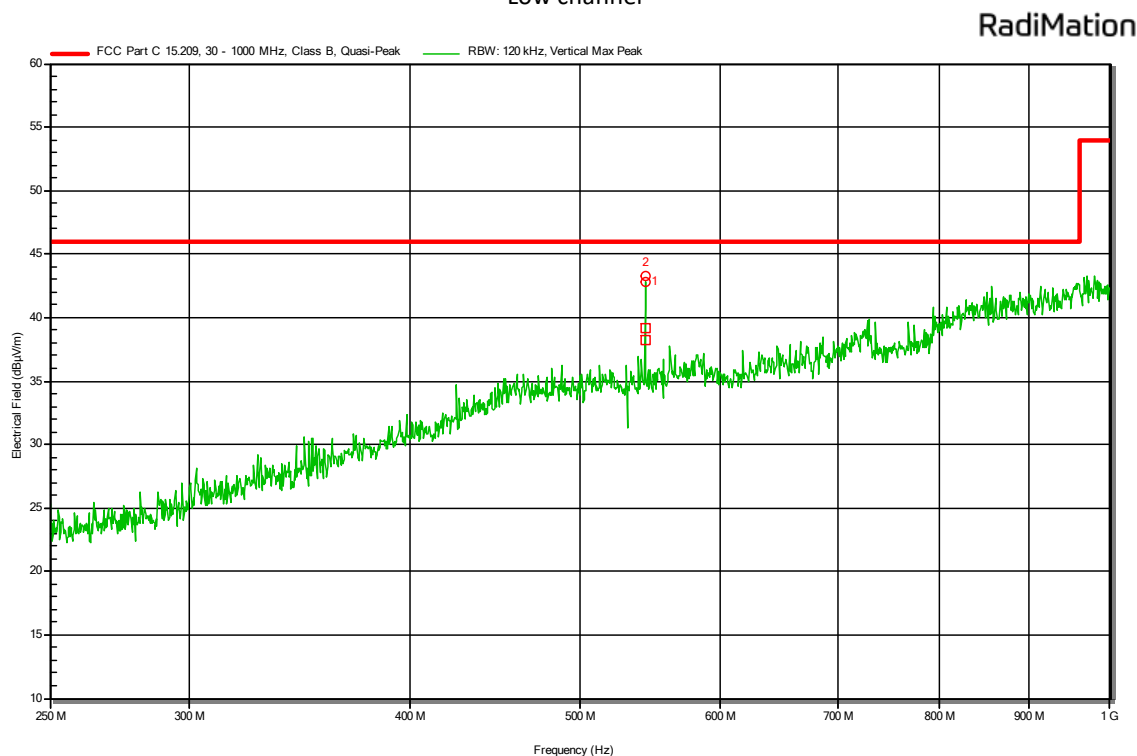


Plot 3f: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
High channel



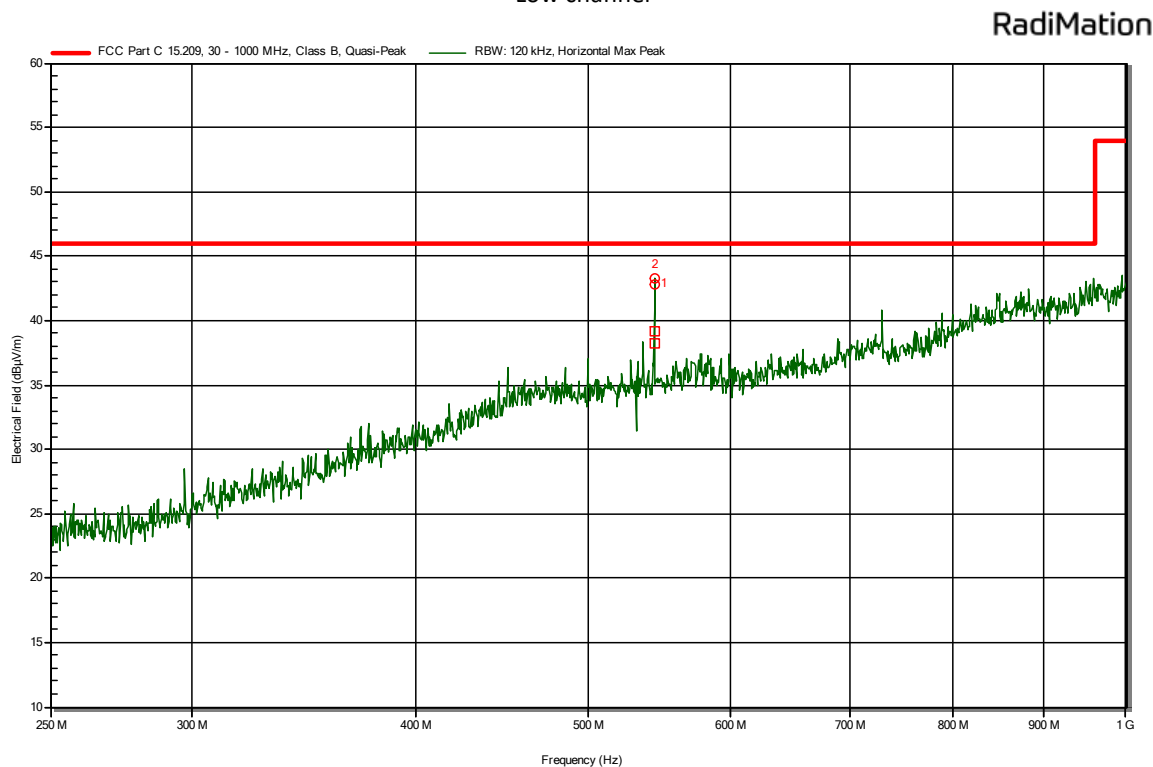
Plot 4a: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)

Low channel



Plot 4b: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)

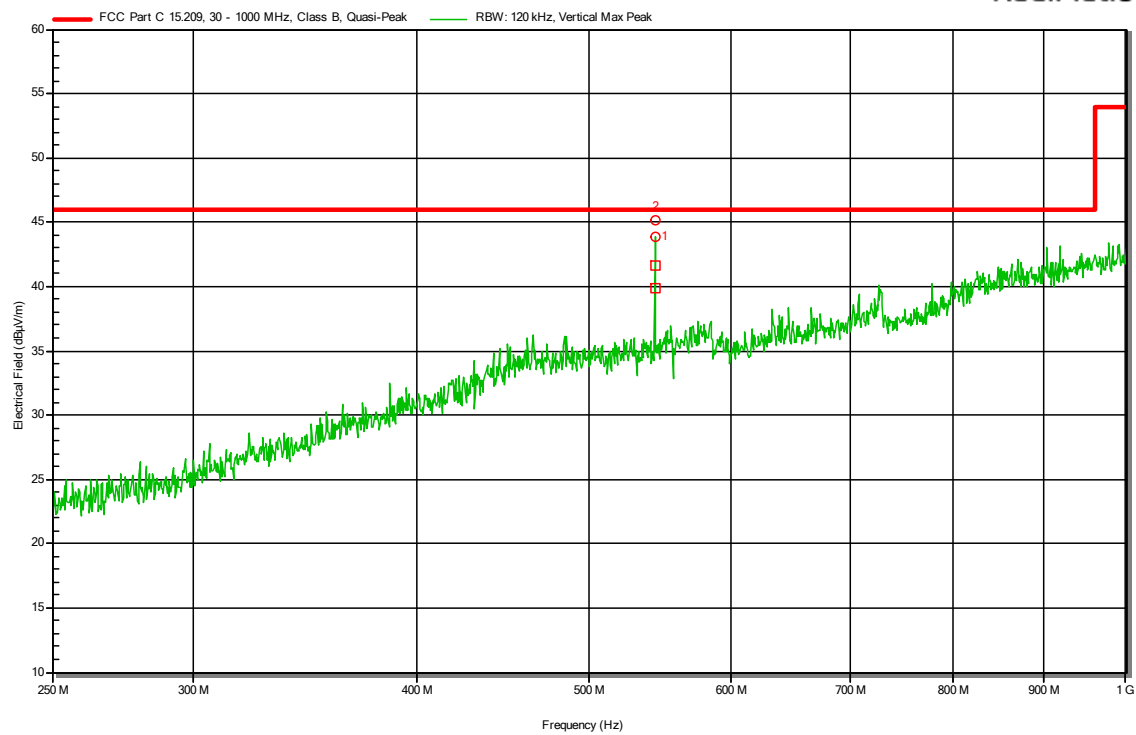
Low channel



Plot 4c: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)

Middle channel

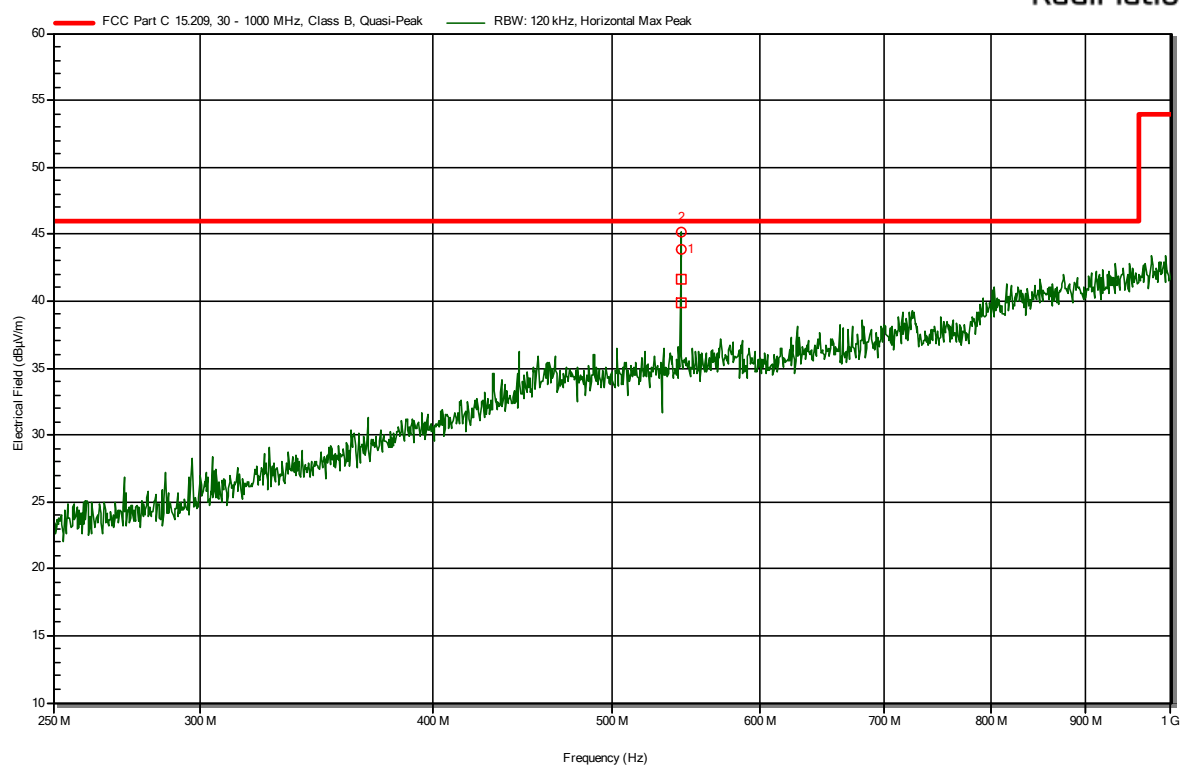
RadiMation



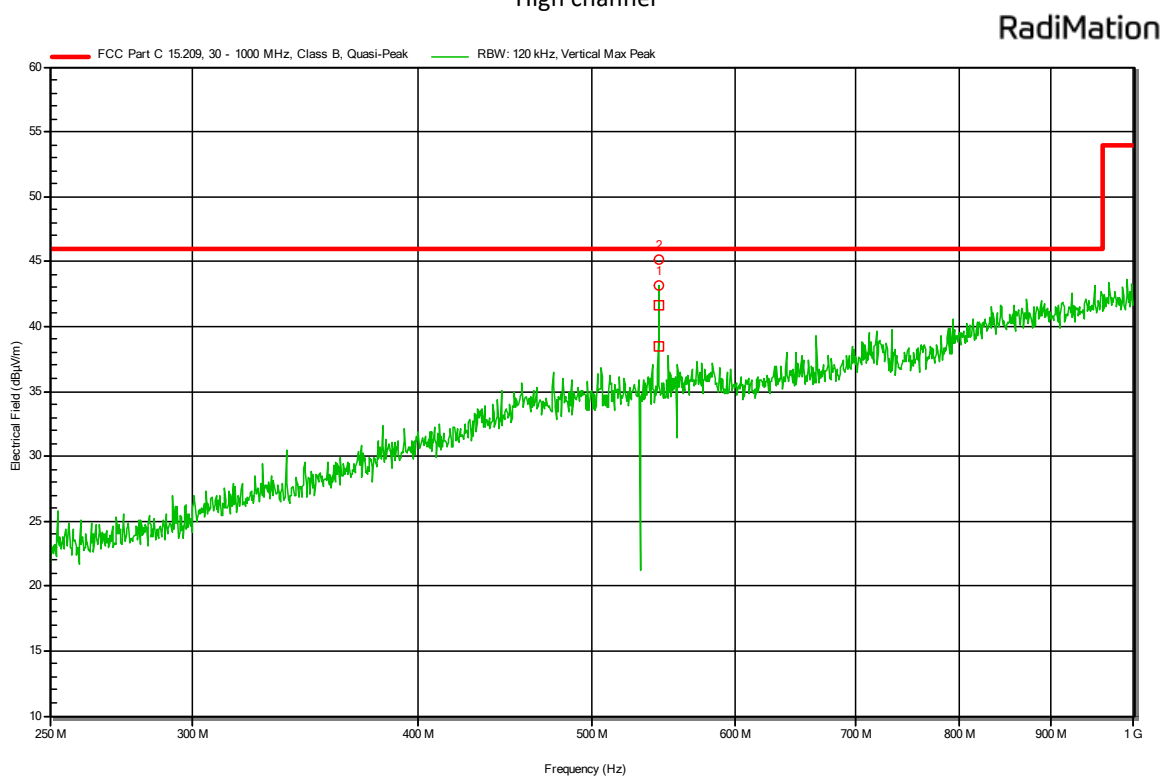
Plot 4d: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)

Middle channel

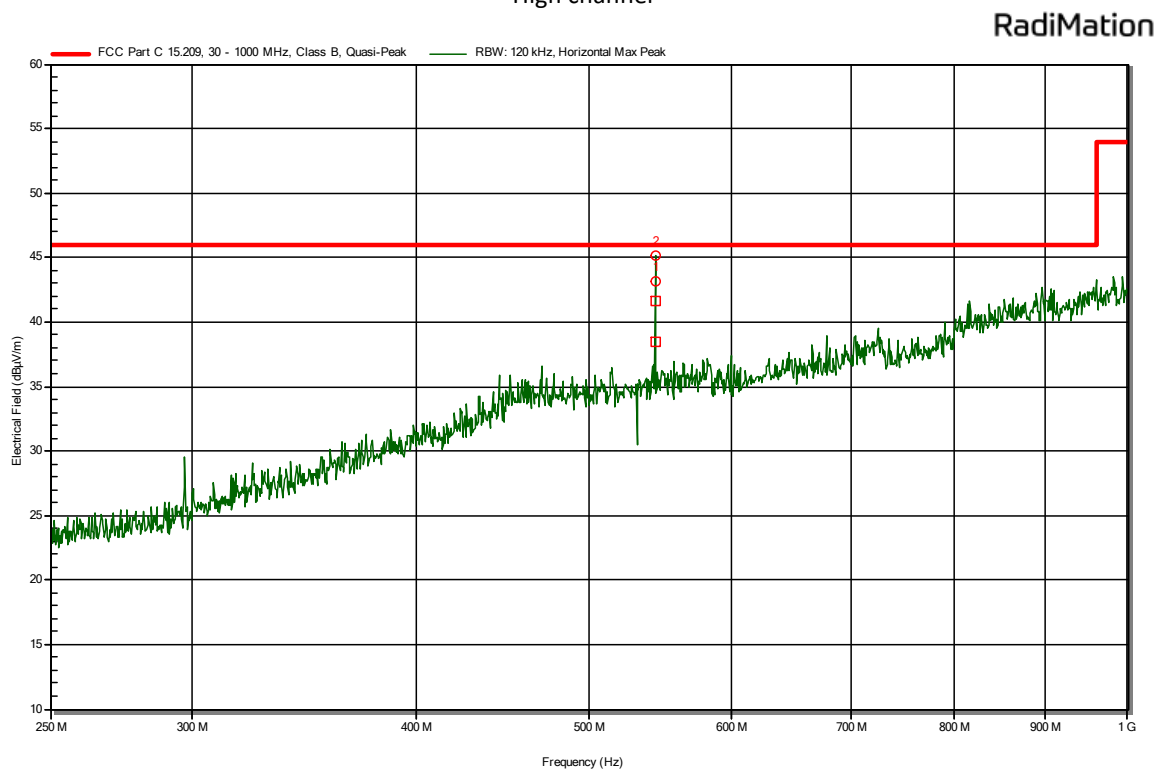
RadiMation



Plot 4e: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)
High channel

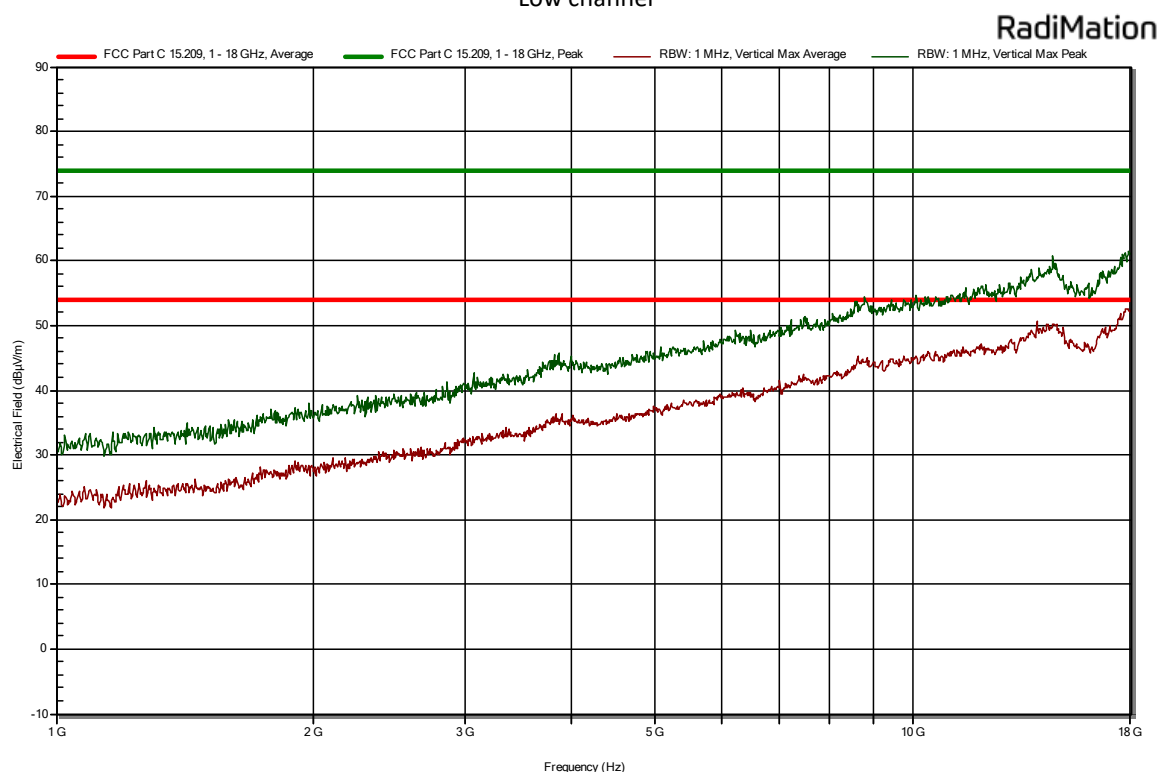


Plot 4f: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)
High channel



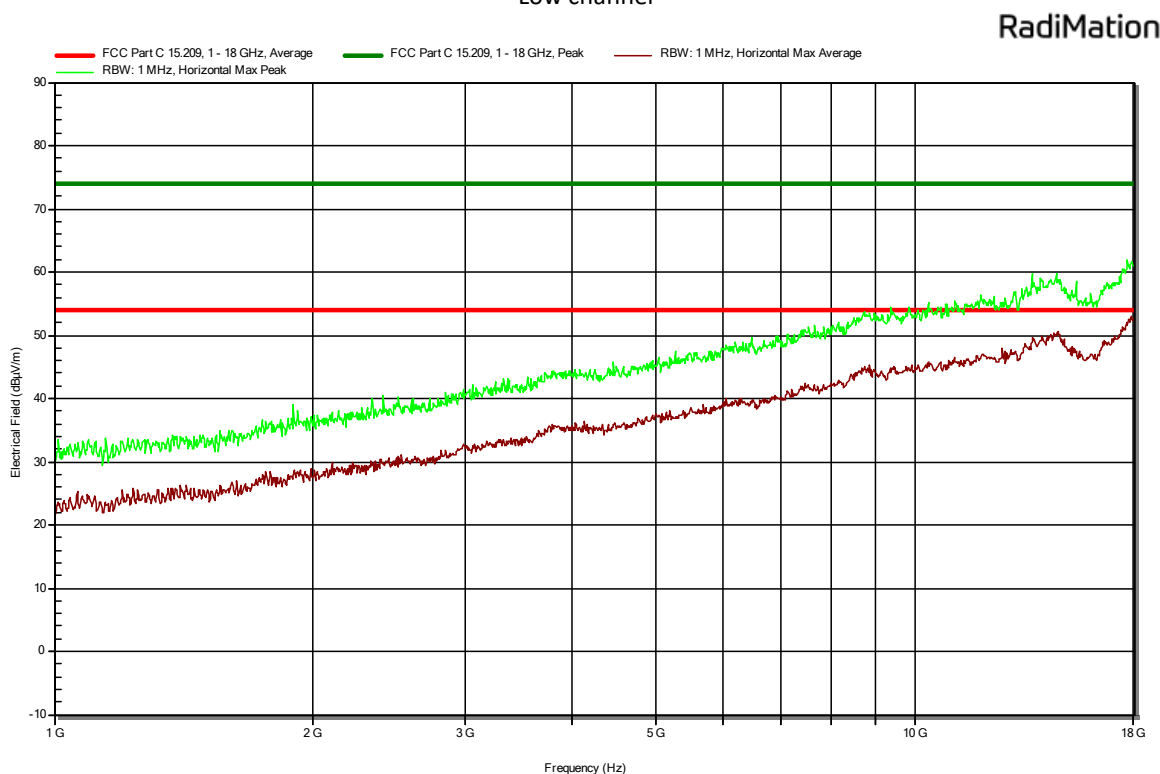
Plot 5a: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)

Low channel



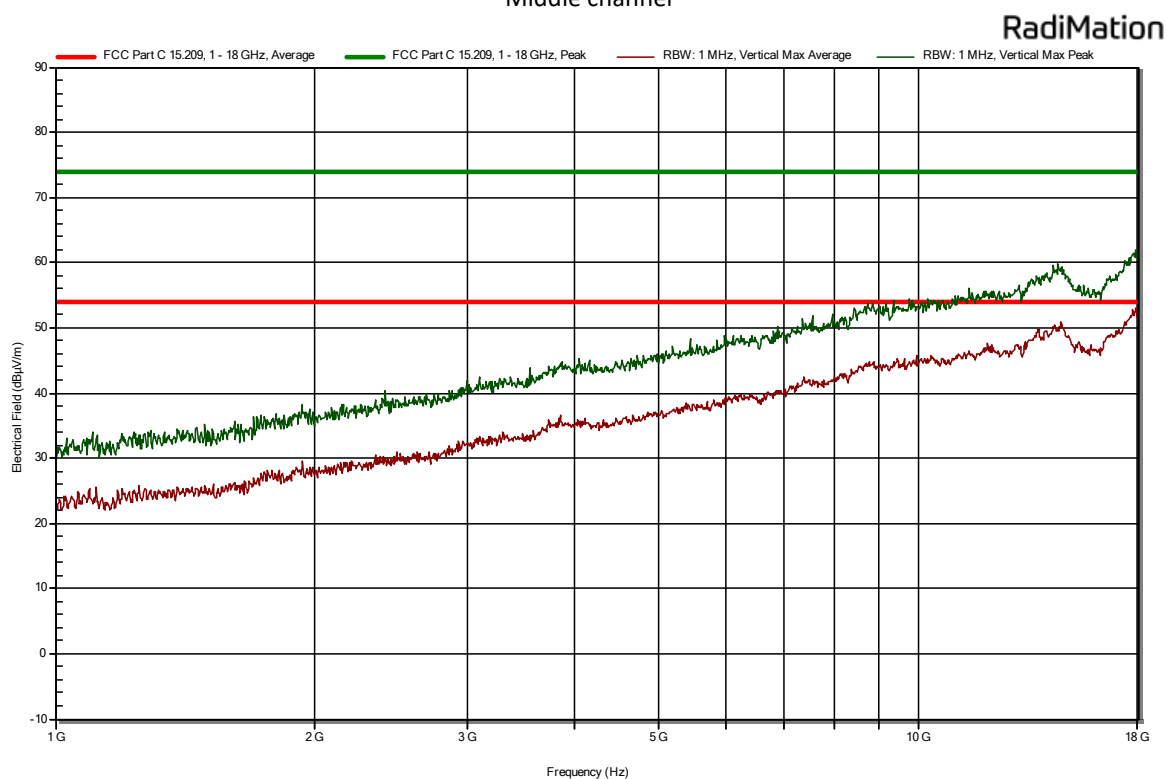
Plot 5b: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)

Low channel



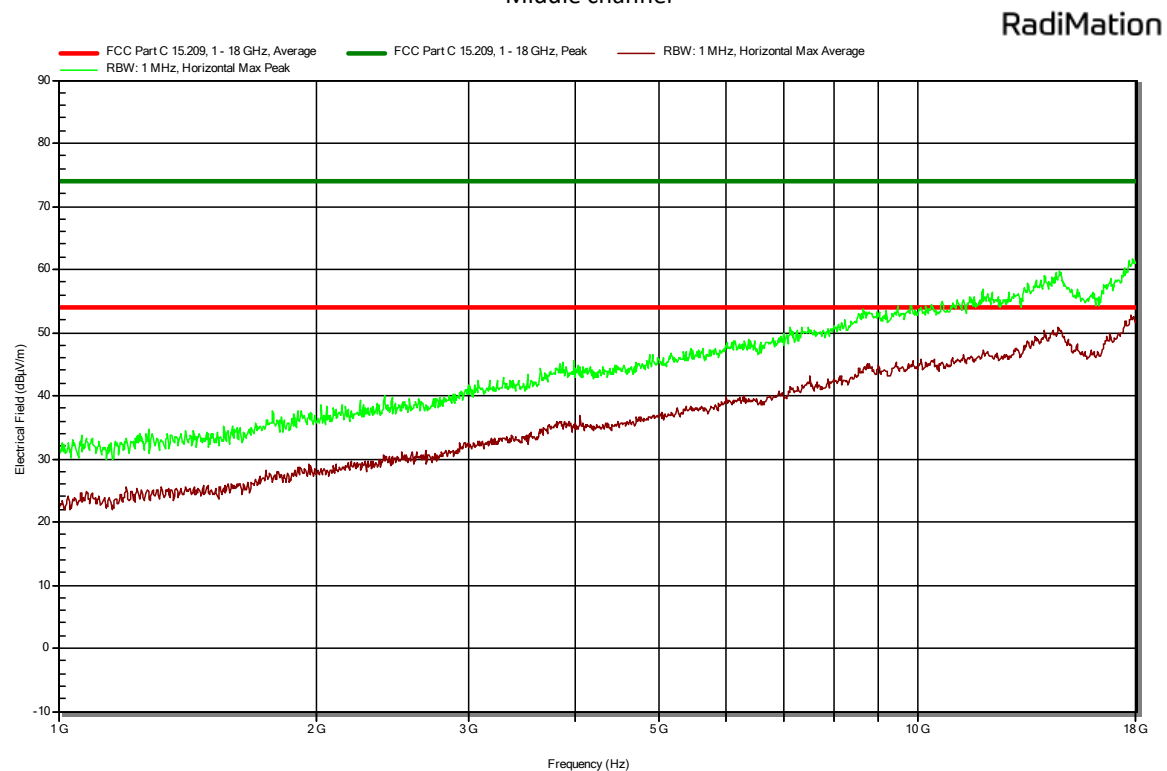
Plot 5c: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)

Middle channel



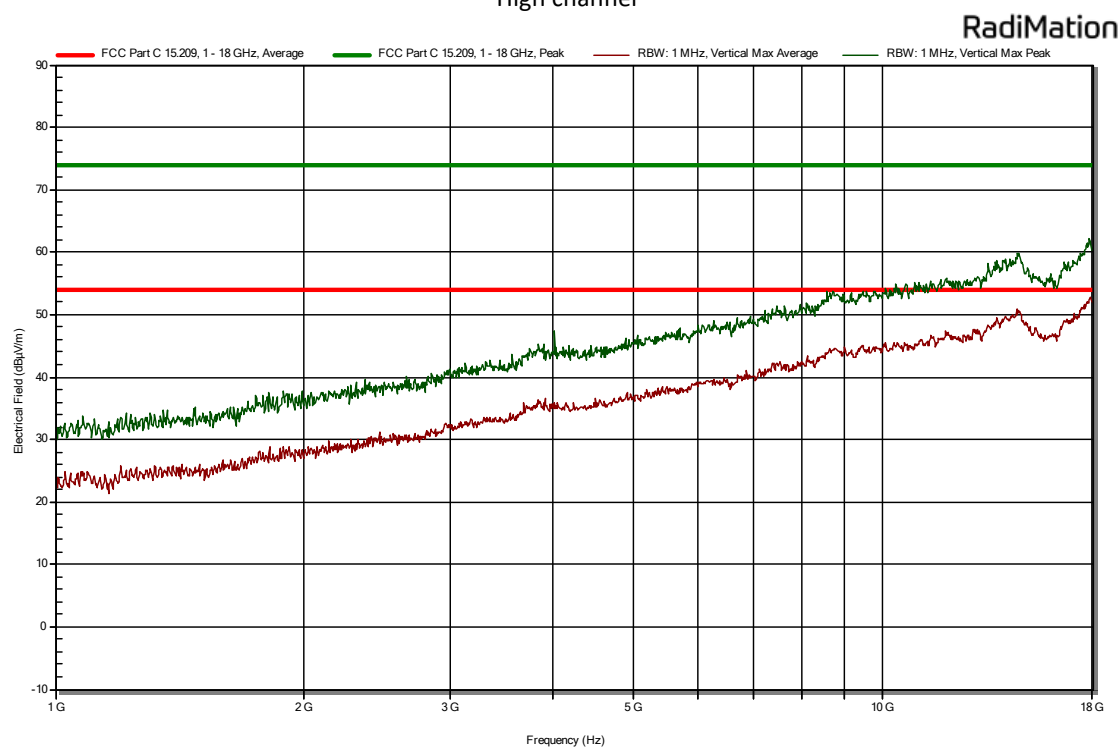
Plot 5d: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)

Middle channel



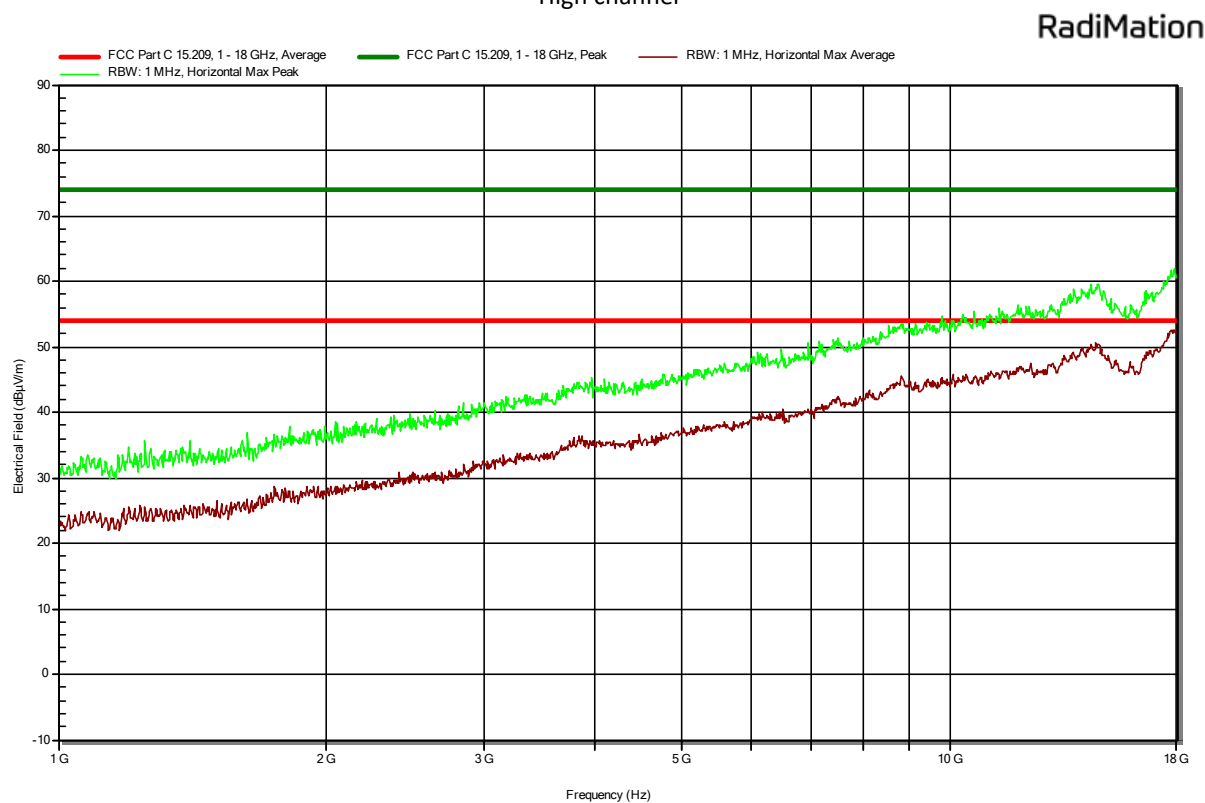
Plot 5e: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)

High channel



Plot 5f: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)

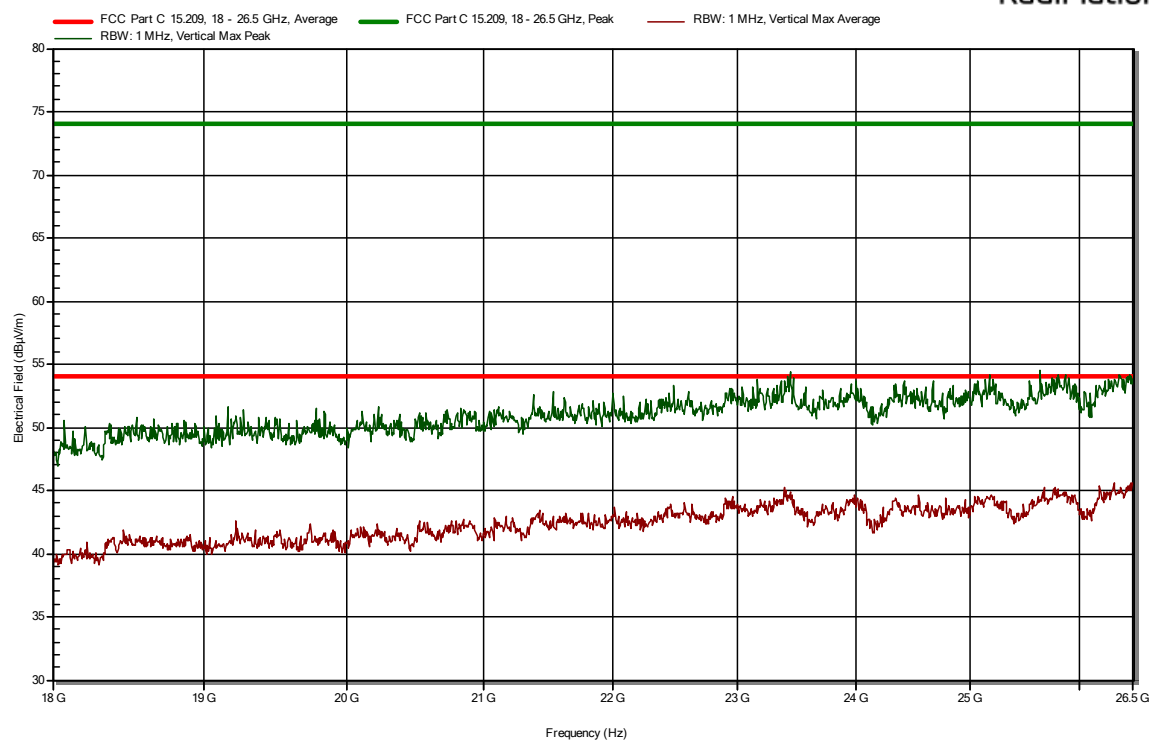
High channel



Plot 6a: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26 GHz
(peak and average values shown)

Low channel

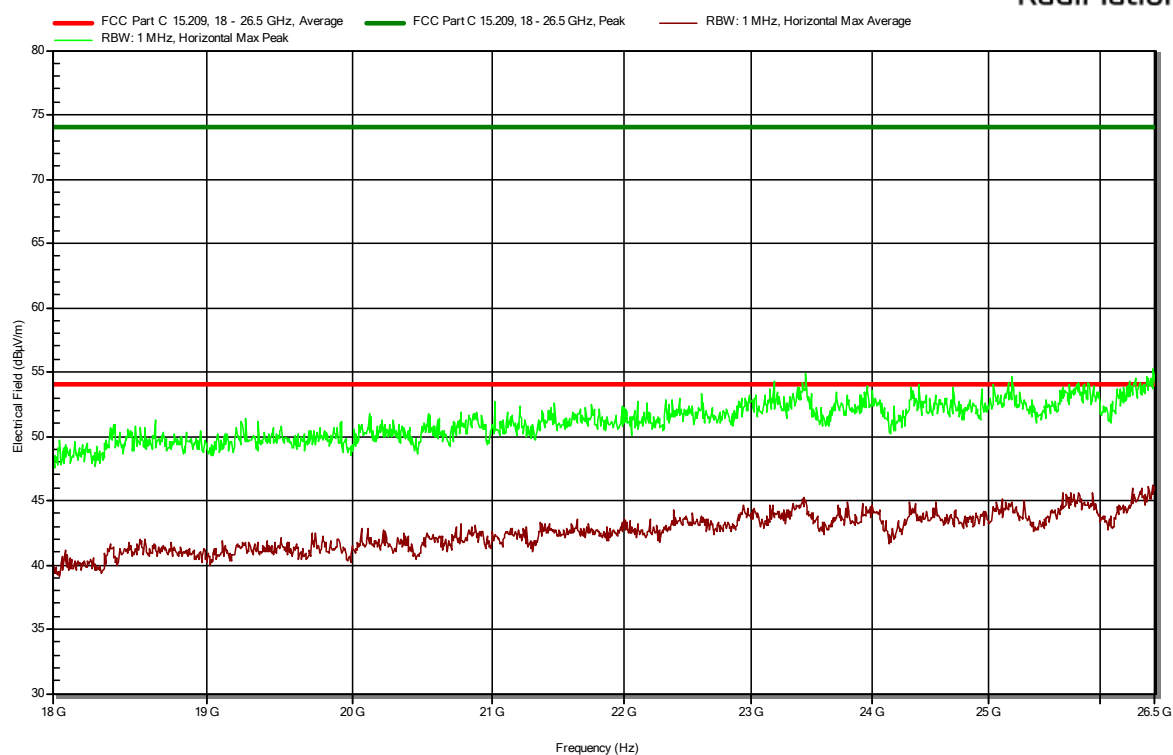
RadiMation



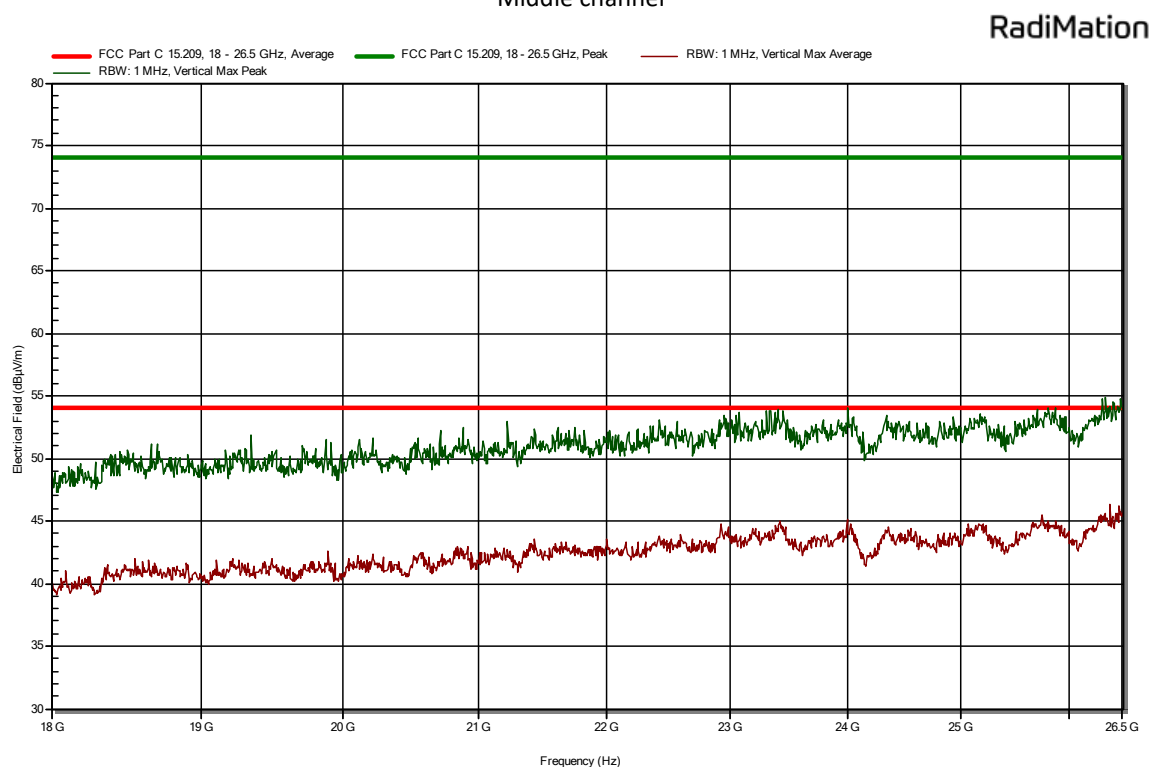
Plot 6b: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26GHz
(peak and average values shown)

Low channel

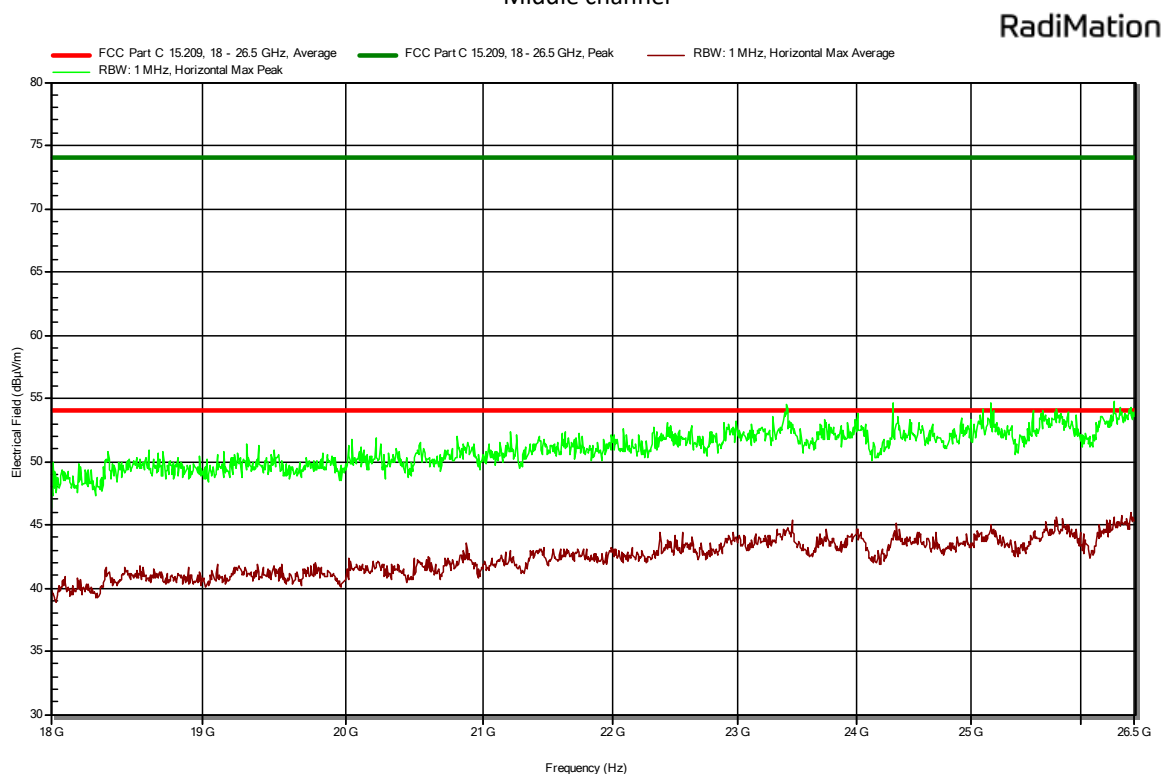
RadiMation



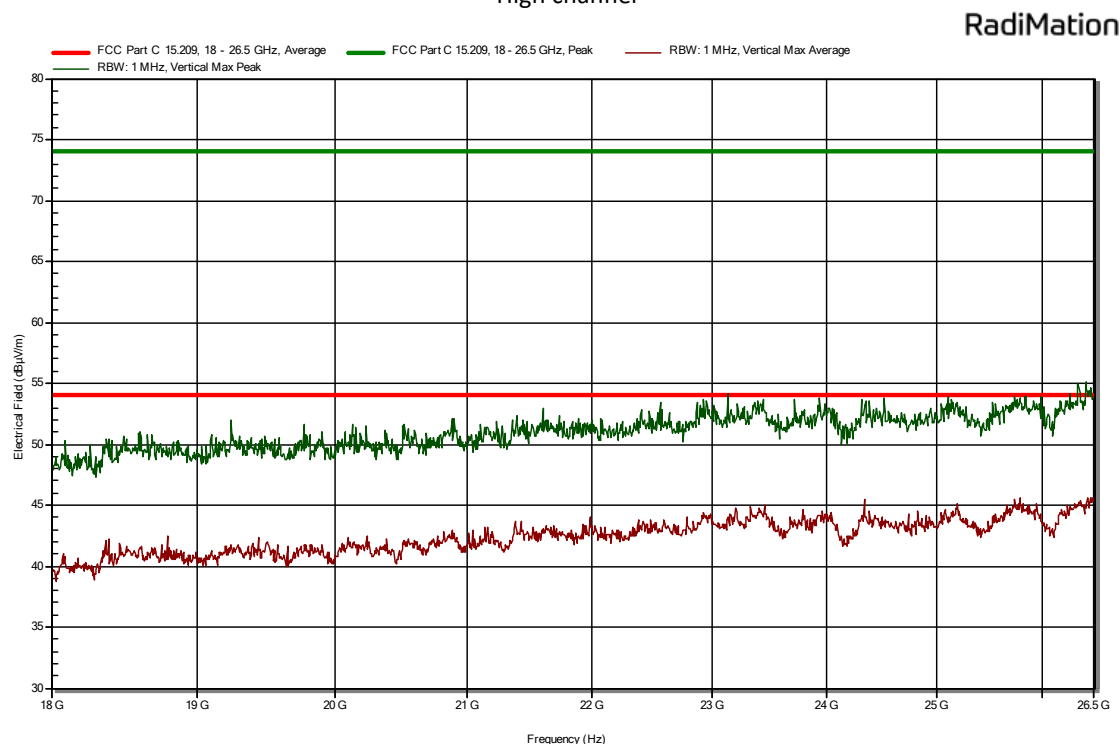
Plot 6c: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26GHz
(peak and average values shown)
Middle channel



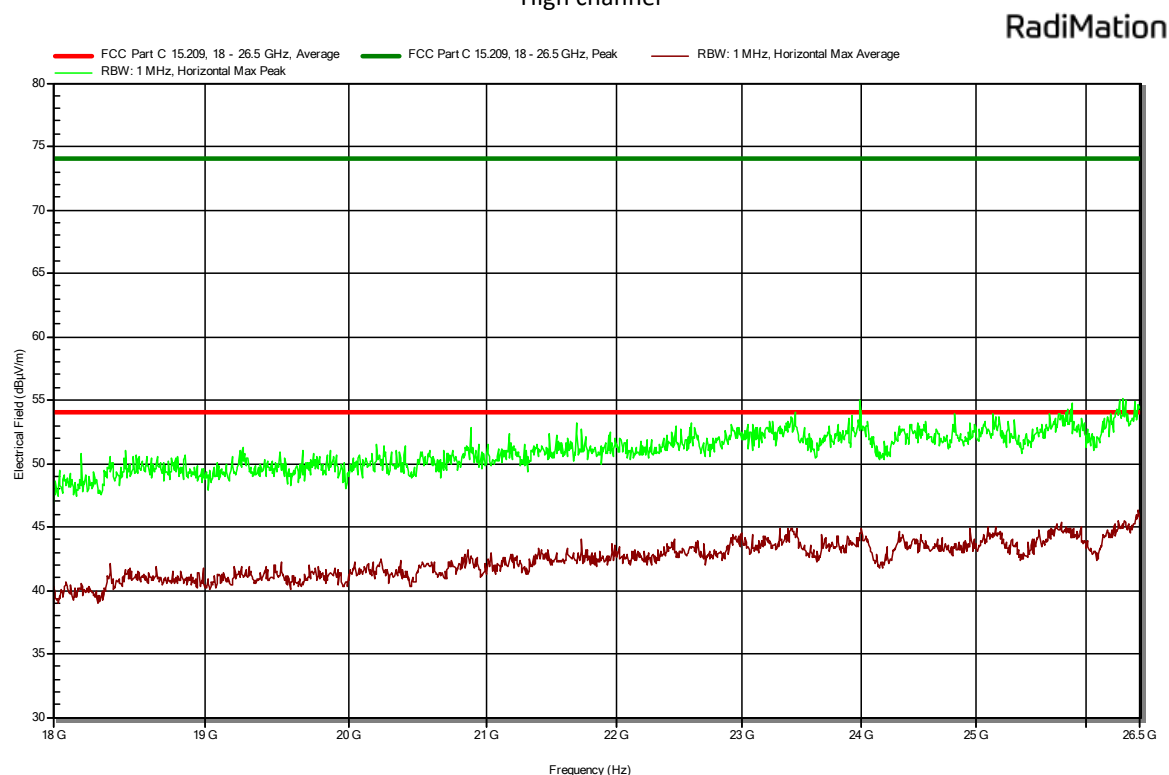
Plot 6d: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26GHz
(peak and average values shown)
Middle channel



Plot 6e: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26GHz
(peak and average values shown)
High channel

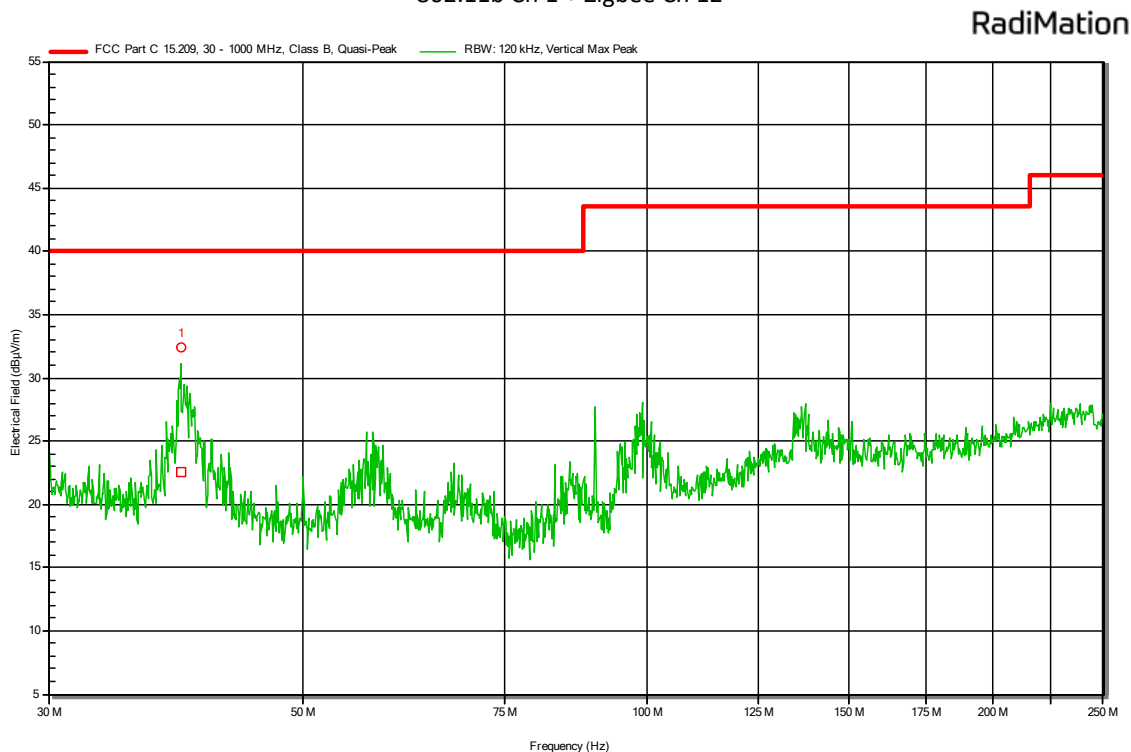


Plot 6f: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26 GHz
(peak and average values shown)
High channel

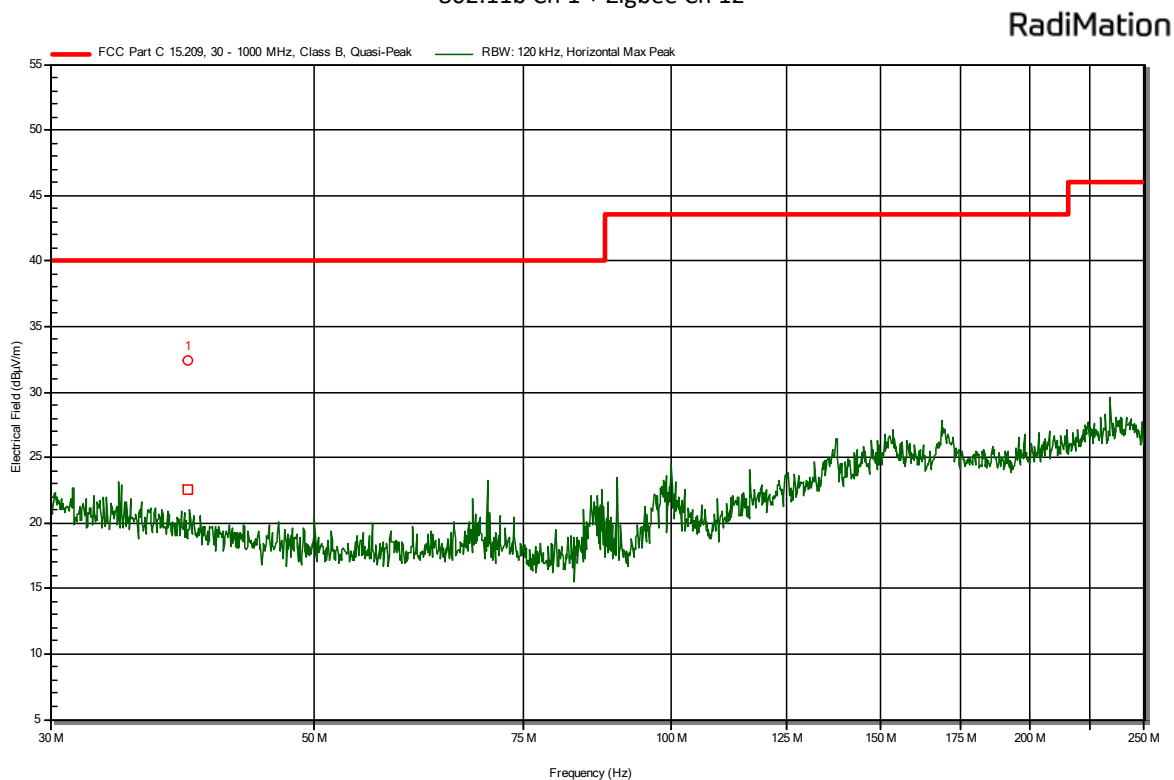


3.1.9 Plots of the Radiated Spurious Emissions Measurement multi radio assessment

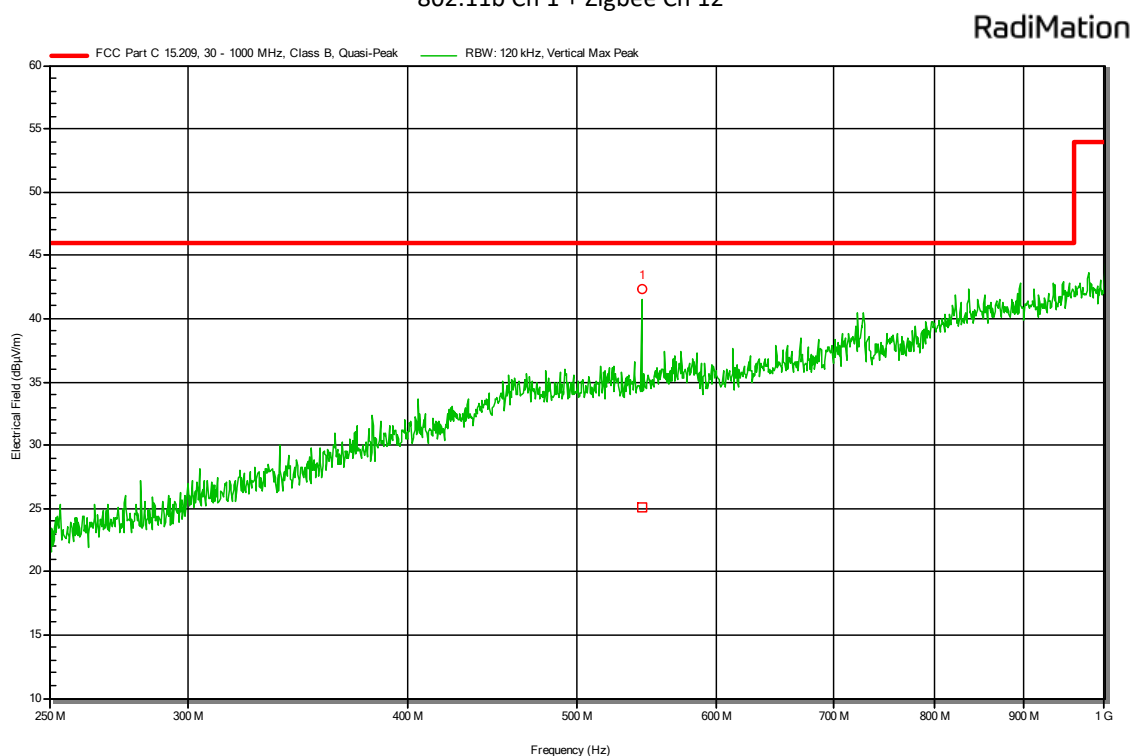
Plot 3a: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)
802.11b Ch 1 + Zigbee Ch 12



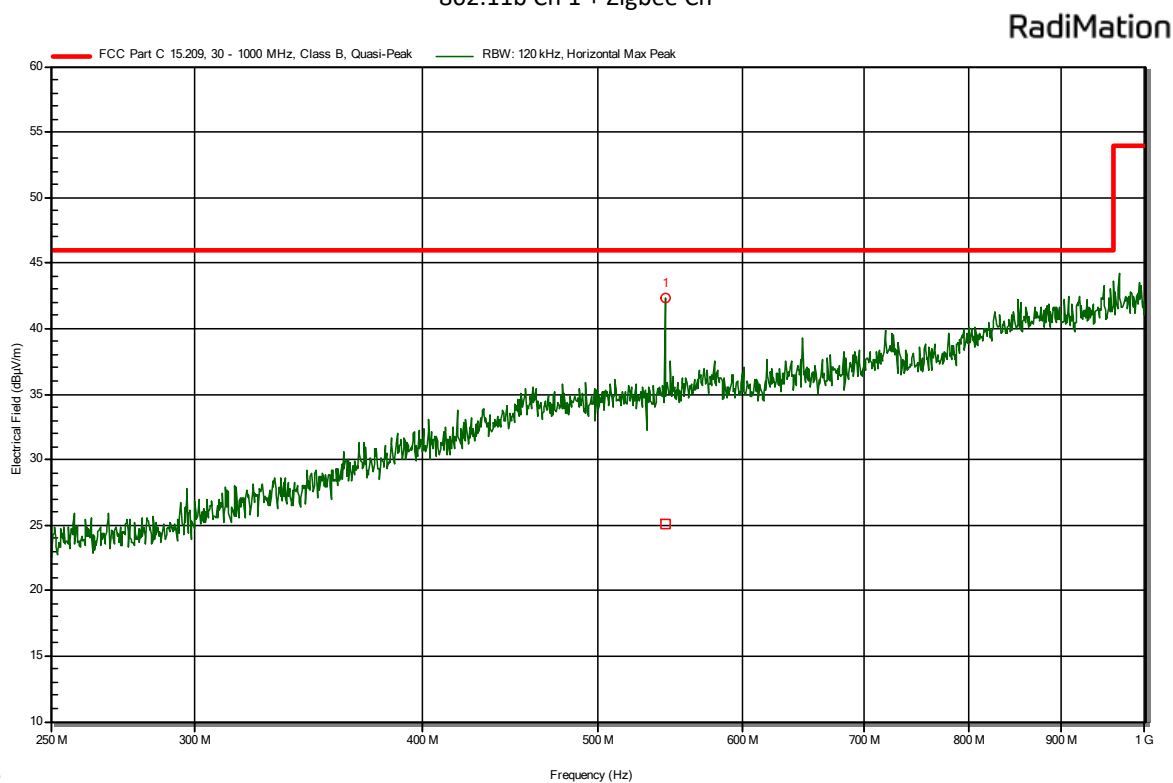
Plot 3b: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)
802.11b Ch 1 + Zigbee Ch 12



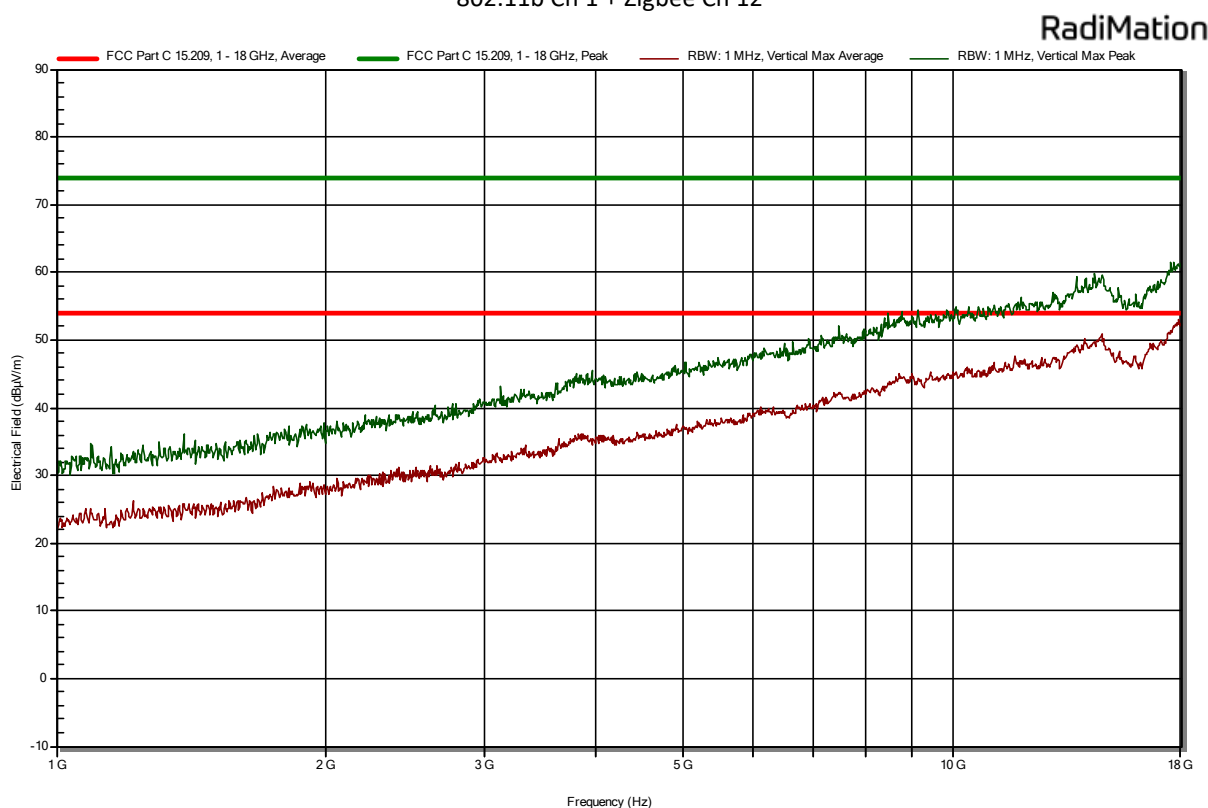
Plot 4a: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)
802.11b Ch 1 + Zigbee Ch 12



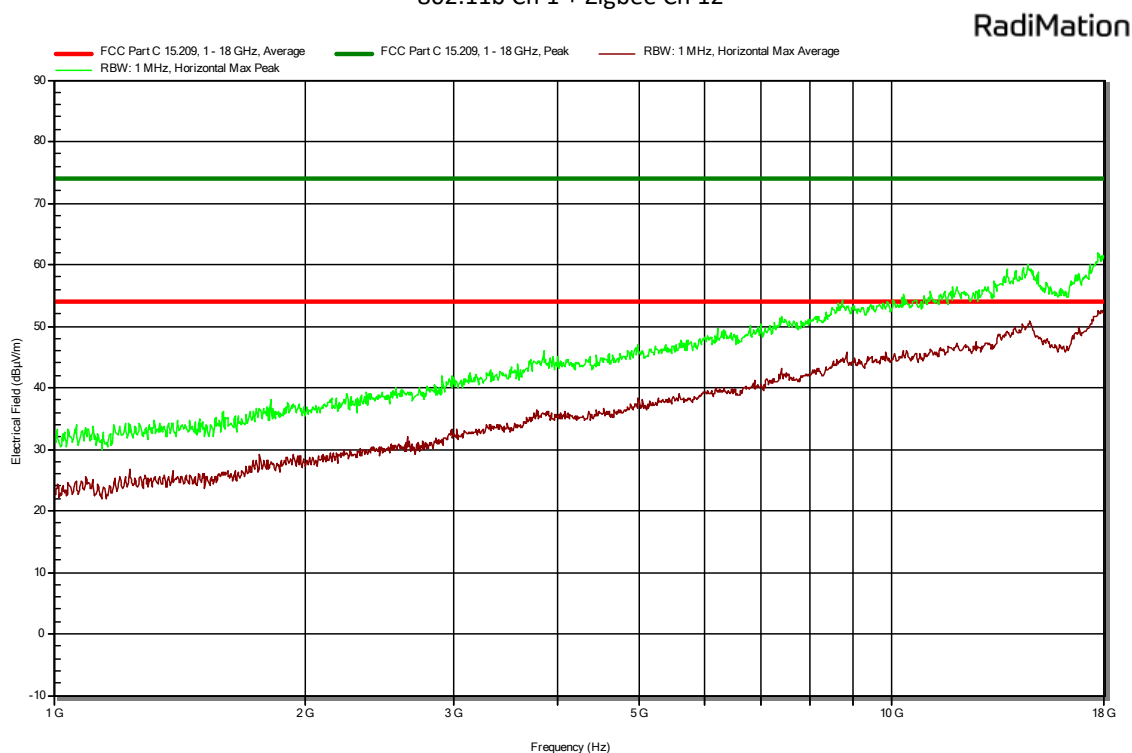
Plot 4b: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)
802.11b Ch 1 + Zigbee Ch



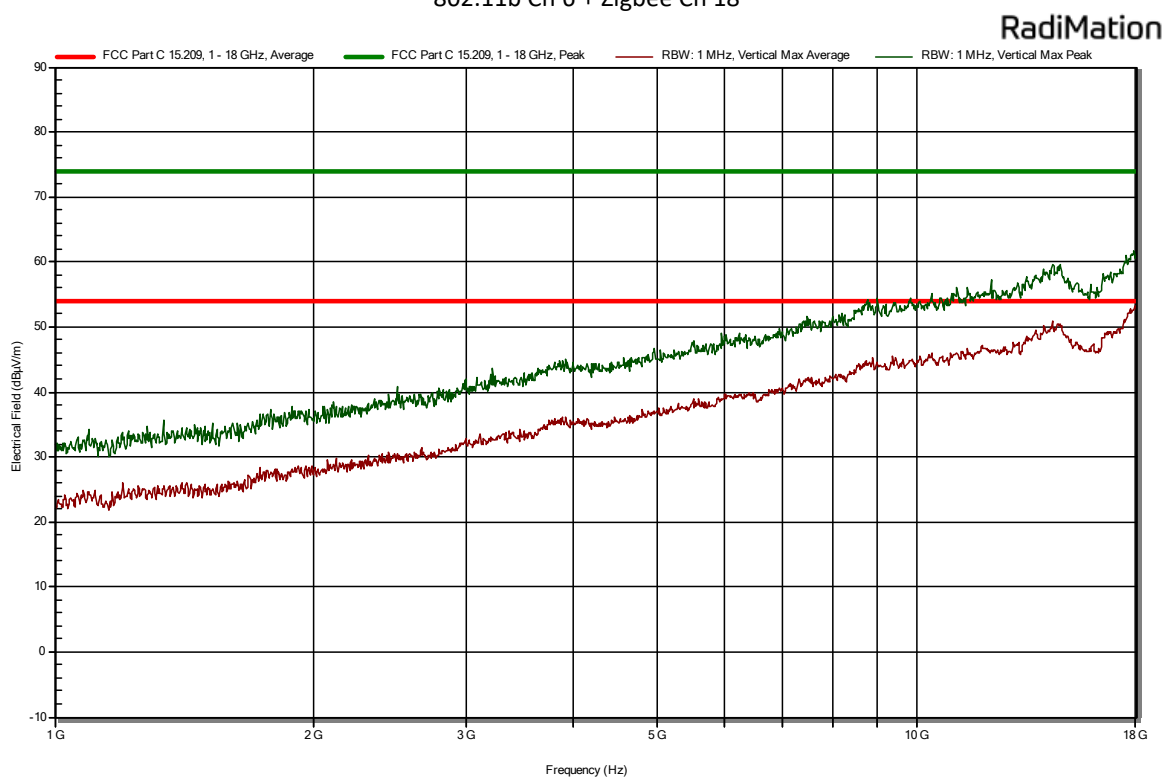
Plot 5a: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
802.11b Ch 1 + Zigbee Ch 12



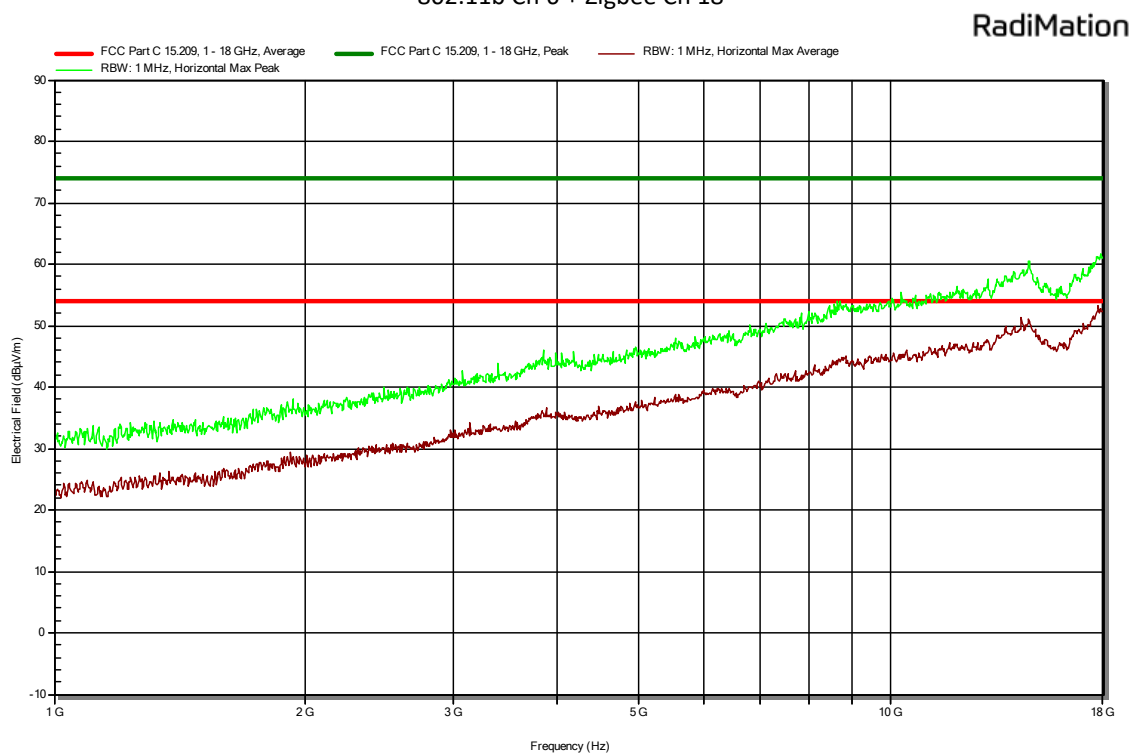
Plot 5b: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)
802.11b Ch 1 + Zigbee Ch 12



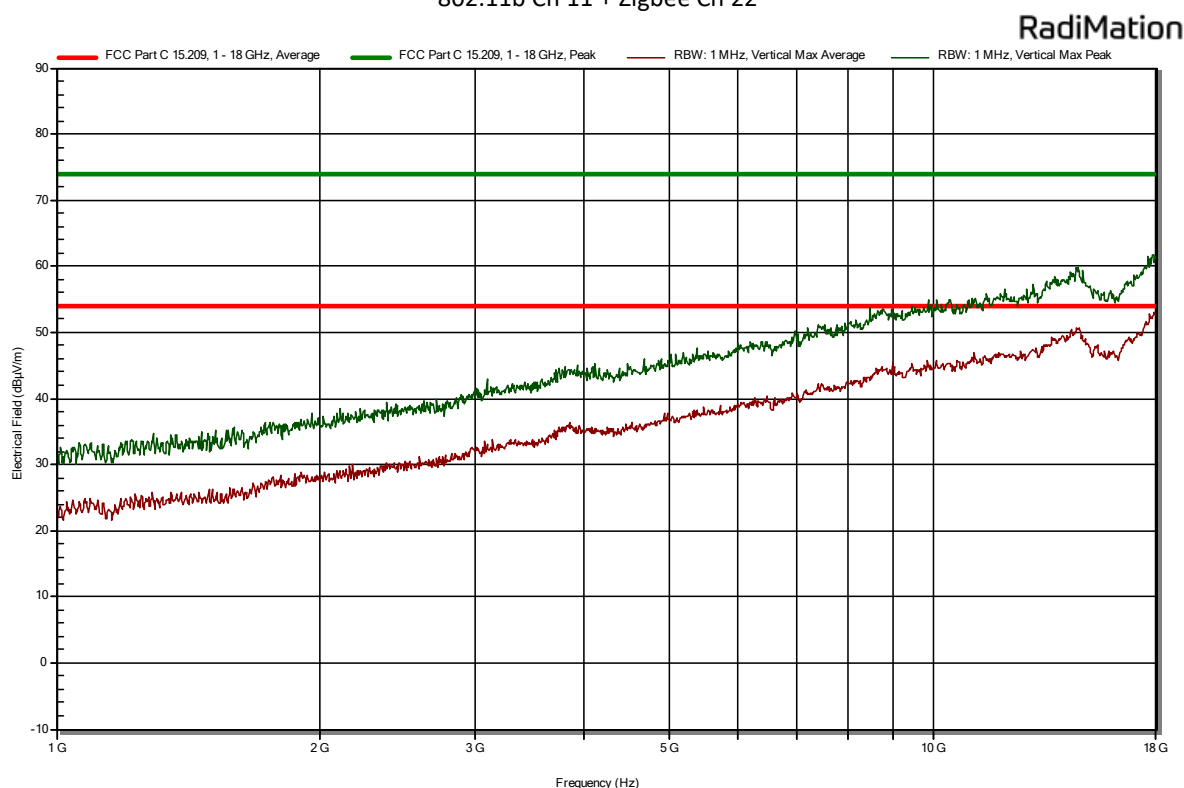
Plot 5c: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
802.11b Ch 6 + Zigbee Ch 18



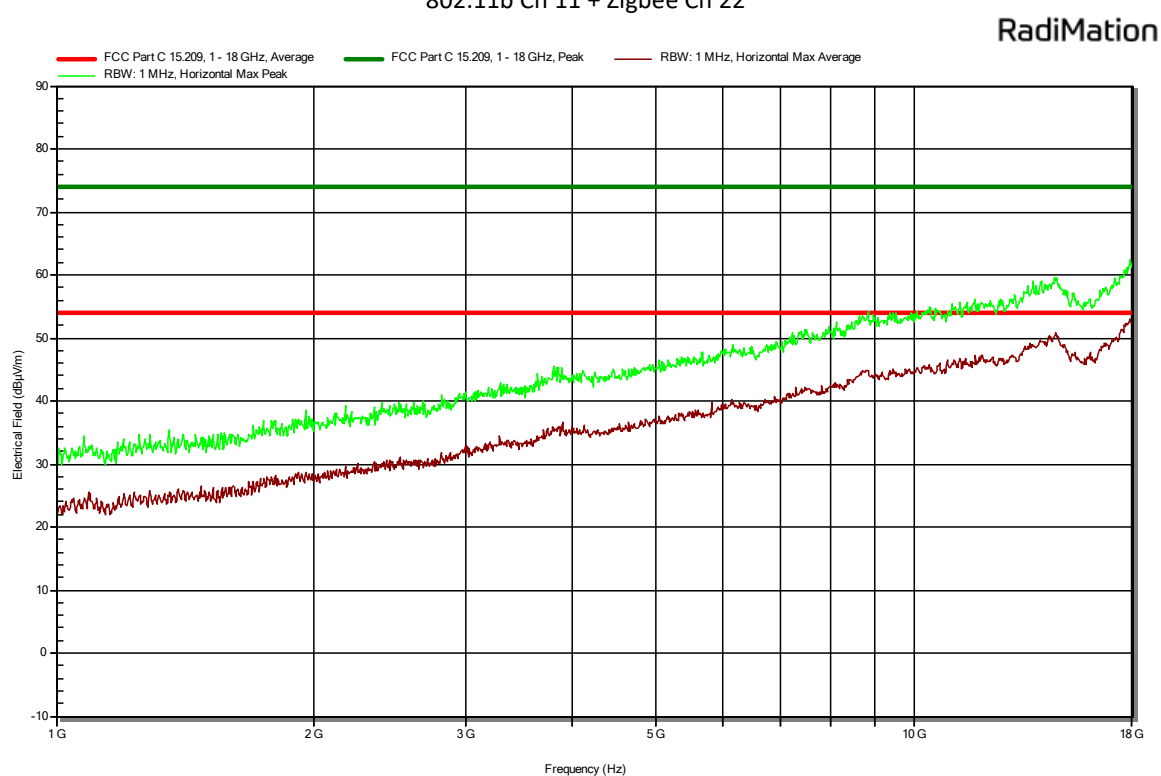
Plot 5d: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)
802.11b Ch 6 + Zigbee Ch 18



Plot 5e: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz
(peak and average values shown)
802.11b Ch 11 + Zigbee Ch 22

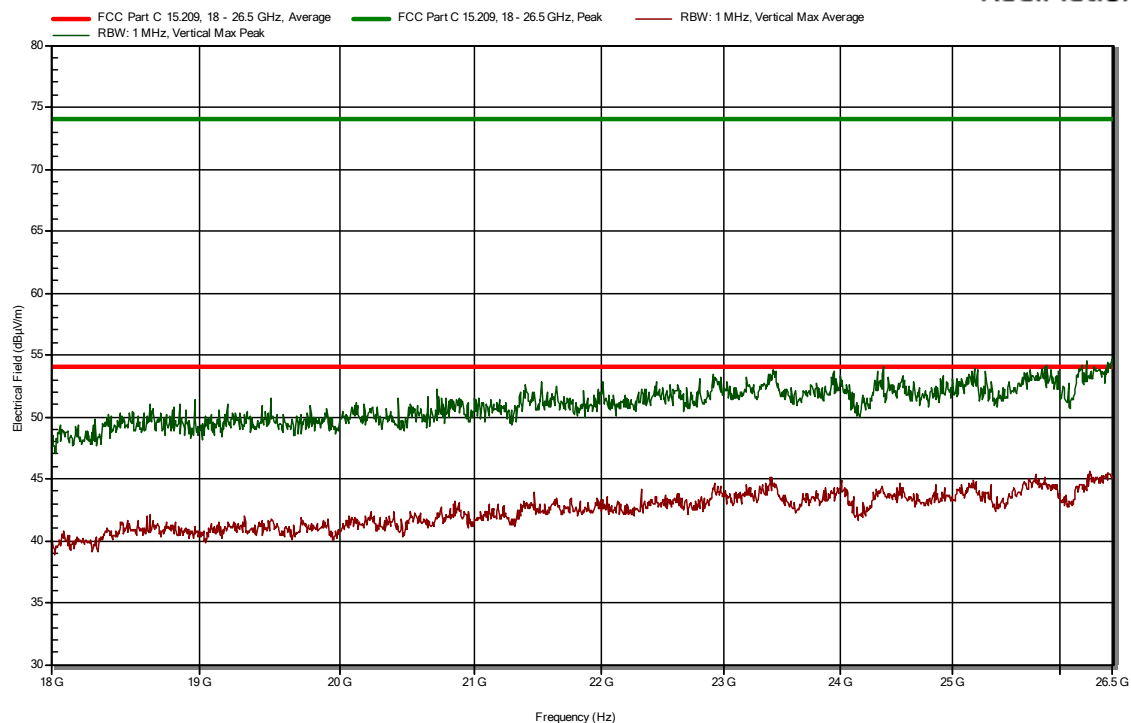


Plot 5f: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz
(peak and average values shown)
802.11b Ch 11 + Zigbee Ch 22



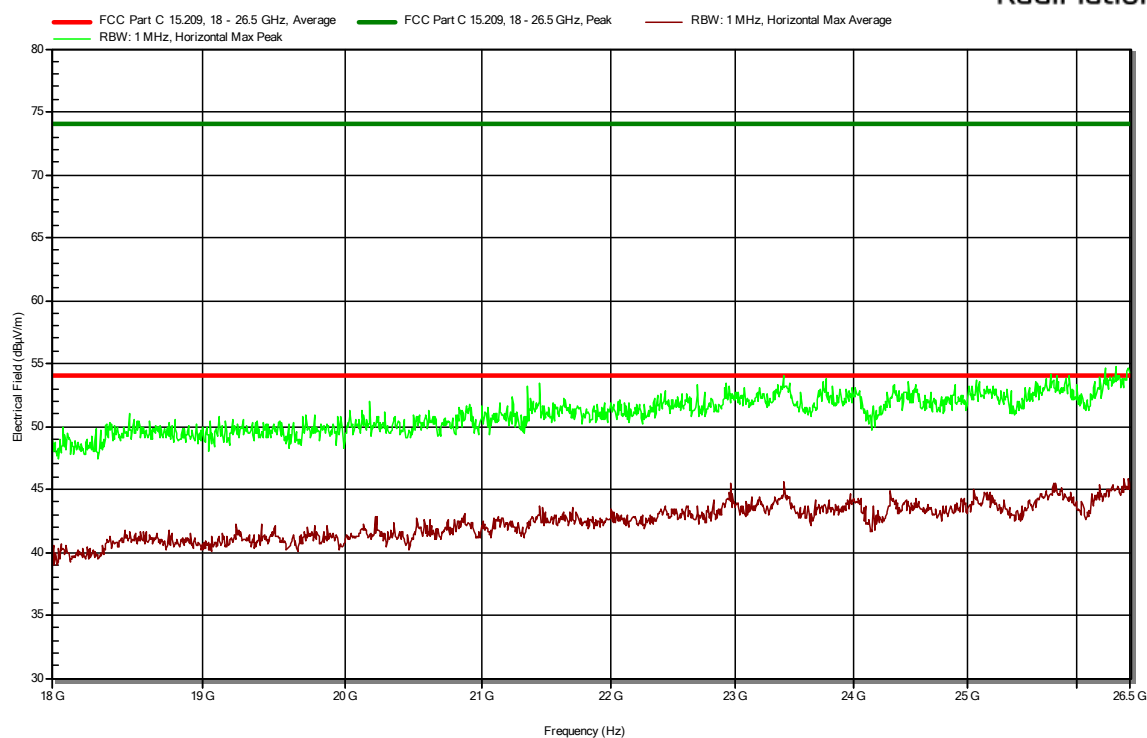
Plot 6a: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26 GHz
(peak and average values shown)
802.11b Ch 1 + Zigbee Ch 12

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Plot 6b: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26GHz
(peak and average values shown)
802.11b Ch 1 + Zigbee Ch 12

RadiMation



3.2 Output Power Measurement

3.2.1 Limit

FCC: For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 1W (30 dBm). If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

RSS: For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4W

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

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02.

IRN 402 - RF power (W) - Method 1 – AVGSA (DTS) according to ANSI C63.10.

3.2.5 Test results of Output Power Measurement

Peak method						
Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power conducted (dBm)	Peak output power conducted (mW)	Peak output power EIRP (W)
802.11b	1	2412	1 Mbps	15.9	0.03890	0.04898
	18	2437	1 Mbps	15.9	0.03890	0.04898
	39	2462	1 Mbps	15.1	0.03236	0.04074
Uncertainty				±0.71 dB		

Note: plots are provided on the next page

Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power conducted (dBm)	Peak output power conducted (mW)	Peak output power EIRP (W)
802.11g	1	2412	1 Mbps	12.2	0.01660	0.02089
	18	2437	1 Mbps	12.2	0.01660	0.02089
	39	2462	1 Mbps	11.2	0.01318	0.0166
Uncertainty				±0.71 dB		

Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power conducted (dBm)	Peak output power conducted (W)	Peak output power EIRP (W)
802.11n	1	2412	1 Mbps	11.1	0.01288	0.01622
	18	2437	1 Mbps	11.1	0.01288	0.01622
	39	2462	1 Mbps	10.1	0.01023	0.01288
Uncertainty				±0.71 dB		

Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power conducted (dBm)	Peak output power conducted (W)	Peak output power EIRP (W)
802.15.4	1	2405	1 Mbps	3.8	0.00240	0.00302
	18	2440	1 Mbps	3.5	0.00224	0.00282
	39	2480	1 Mbps	4.1	0.00257	0.00324
Uncertainty				±0.71 dB		

3.3 AC Power-line conducted emissions

3.3.1 Limit

According to 15.207 (a), (c) and RSS-GEN

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

Since the RSS-GEN limits are exactly the same, only the FCC limit lines are included in the plots.

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 ¹	56 to 46 ¹
0.5 – 5	56	46
5 – 30	60	50

Note 1: The level decreases linearly with the logarithm of the frequency.

3.3.2 Measurement instruments

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

3.3.3 Test setup

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

3.3.4 Test procedure

According to ANSI C63.10-2020 Section 6.2
IRN 439 – Method 1

3.3.5 Measurement uncertainty

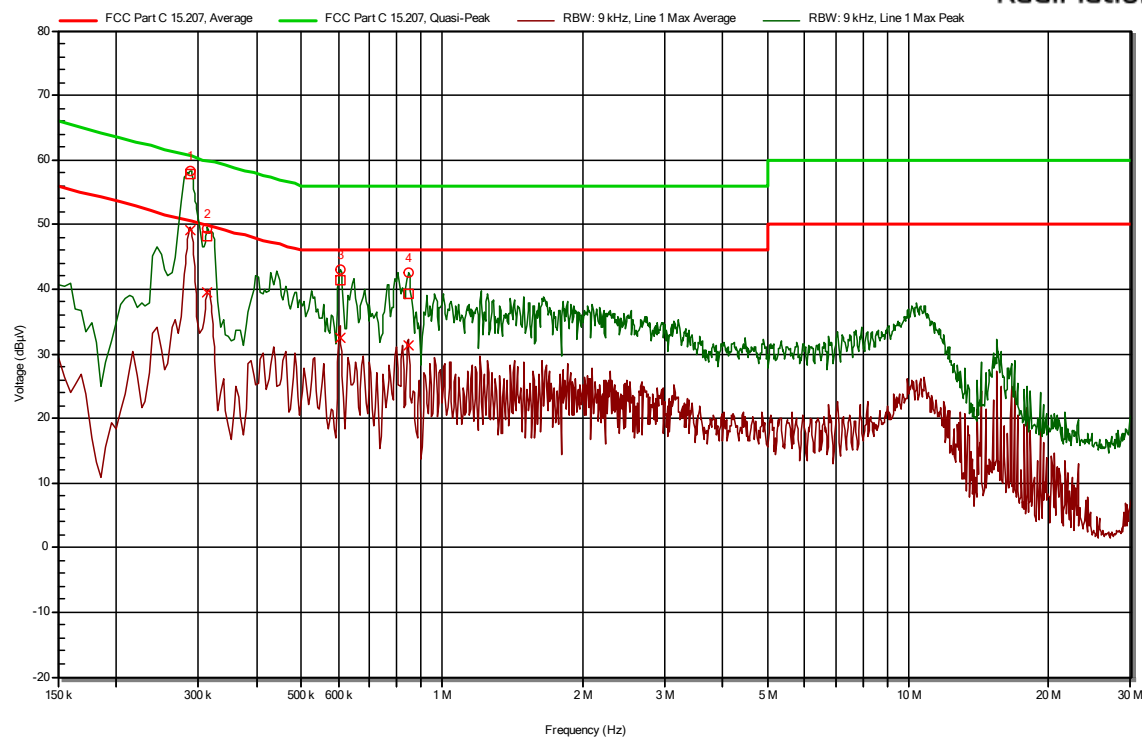
+/- 3.6 dB

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

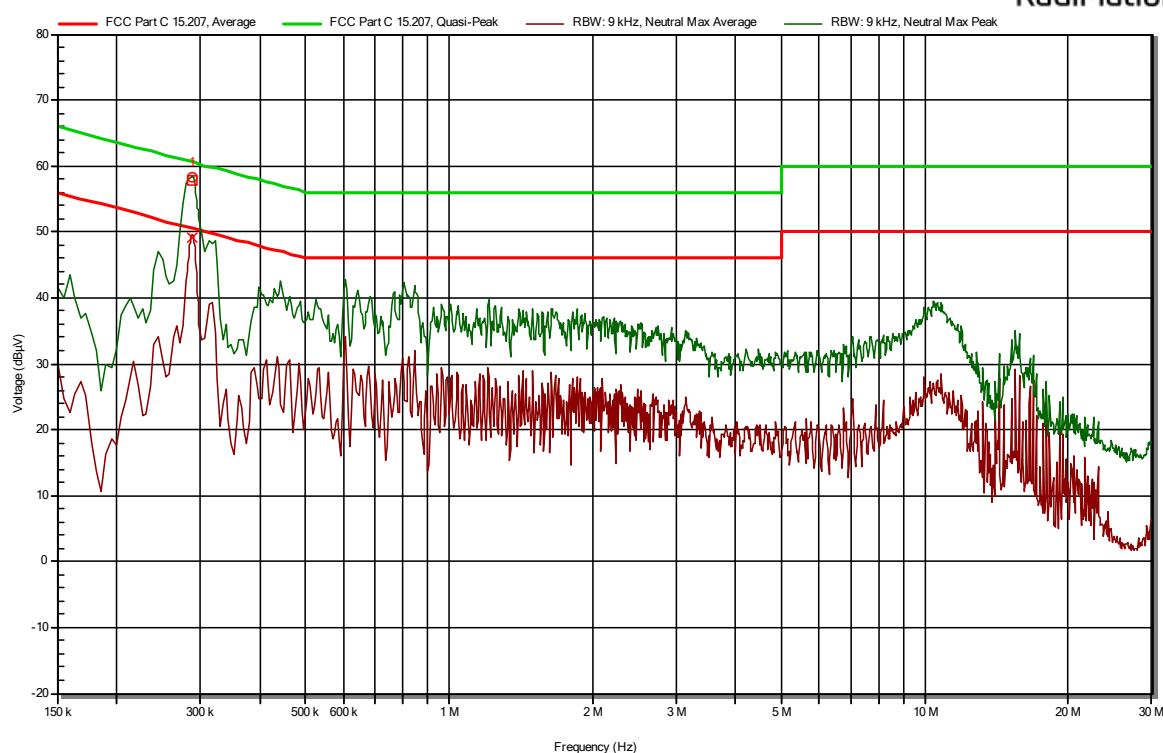
Peak Number	Frequency	Peak	Average	Average Limit	Quasi-Peak	Quasi-Peak Limit	Status	LISN
1	289.05 kHz	58.2 dBμV	49.1 dBμV	50.6 dBμV	57.7 dBμV	60.6 dBμV	Pass	Line 1
2	313.35 kHz	49.4 dBμV	39.4 dBμV	49.9 dBμV	48.3 dBμV	59.9 dBμV	Pass	Line 1
3	605.85 kHz	43 dBμV	32.4 dBμV	46 dBμV	41.3 dBμV	56 dBμV	Pass	Line 1
4	845.7 kHz	42.6 dBμV	31.2 dBμV	46 dBμV	39.2 dBμV	56 dBμV	Pass	Line 1
5	289.05 kHz	58.3 dBμV	49.2 dBμV	50.6 dBμV	57.8 dBμV	60.6 dBμV	Pass	Neutral

3.3.7 Plots of the AC mains conducted spurious measurement

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



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



4 Sample calculations

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

Conducted emission Measurement:

$$U_{\text{lisn}} (\text{dB}\mu\text{V}) = U (\text{dB}\mu\text{V}) + \text{Corr. (dB)}$$

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:

$$E \text{ (dB}\mu\text{V/m)} = U \text{ (dB}\mu\text{V)} + AF \text{ (dB/m)} + \text{Corr. (dB)}$$

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	300m to 3m and 30m to 3m correction	CL (dB)	Corr. (dB)
	114515 EMCO 6505 S/N:9112-2710		SAR cable	
0.009	18.49	104.956	0.7	-85.8
0.01	17.64	104.041	0.05	-86.4
0.02	13.23	98.02	0.07	-84.7
0.03	11.65	94.498	0.1	-82.7
0.04	10.97	91.999	0.1	-80.9
0.1	10.14	84.041	0.1	-73.8
0.2	10.01	78.02	0.1	-67.9
0.5	9.95	50.061	0.1	-40
1	9.91	44.041	0.2	-33.9
3	9.93	34.498	0.2	-24.4
5	9.93	30.061	0.3	-19.8
10	9.75	24.041	0.6	-13.7
15	9.29	20.519	0.9	-10.3
20	8.57	18.02	1	-8.5
25	7.55	16.082	0.7	-7.8
27	7.01	15.413	1.2	-7.2
30	6.03	14.498	1	-7.5

Frequency (MHz)	AF (dB/m)	Cable loss (dB)	Attenuator	Corr. (dB)
	ID: 107818 EMCO 3109	Id: 114928	ID:114525 Hewlett Packet	
30	13.5	1.8	6	21.3
100	9.2	2.7	6	17.9
150	12.6	3.2	6	21.8
200	13.6	3.6	6	23.2
250	15.2	4.3	6	25.5

Frequency (MHz)	AF (dB/m)	Cable loss (dB)	Corr. (dB)
	ID: 114385 EMCO LPDA	Id: 114928	
250	11.8	4.3	16.1
300	13	5.1	18.1
350	14.2	5.8	20
400	15.6	7.3	22.9
450	17.1	7.9	25
500	17.3	8	25.3
550	17.7	8	25.7
600	18.4	7.7	26.1
650	19.2	7.5	26.7
700	19.7	7.7	27.4
750	20.3	7.9	28.2
800	21.4	8.2	29.6
850	22.0	8.7	30.7
900	22.1	8.9	31
950	22.6	9.2	31.8
1000	22.5	9.6	32.1

Frequency (MHz)	AF (dB/m)	Gain (dB)	Cable loss (dB)	Corr. (dB)
	114607 Emco 3115 SN: 9412-4377	114690 µComp Nordic MCNA-40-0010800-25-10P	114691	
1000	23.6	45.1	2.1	-19.4
2000	27.1	44.7	3.3	-14.3
3000	30.5	44.2	4.2	-9.5
4000	32.7	43.5	4.9	-5.9
5000	33.2	43.1	5.6	-4.3
6000	34.6	43	6.3	-2.1
7000	35.2	42.9	6.4	-1.3
8000	37.0	43.3	7.2	0.9
9000	38.1	43.3	7.9	2.7
10000	38.2	43	8.2	3.4
11000	38.3	42.9	8.7	4.1
12000	39.1	42.6	9	5.5
13000	39.2	43.6	9.8	5.4
14000	41.1	44.3	9.7	6.5
15000	40.2	44.4	10.4	6.2
16000	37.5	44.3	10.8	4
17000	41.1	44.5	11.4	8
18000	44.0	44.9	11.4	10.5

Frequency (MHz)	AF (dB/m)	Gain (dB)	Cable loss (dB)	Corr. (dB)
	Kiwa ID: 114518 Flann 20240-25 SN: 163703	Kiwa ID: Schwarzbeck BBV 9721	114691	
18000	31.3	34.5	11.4	8.2
19000	31.5	34.9	11.2	7.8
20000	31.7	34.1	11.6	9.2
21000	31.9	33.6	12.1	10.4
22000	32.1	33.6	12.4	10.9
23000	32.2	33.3	13.6	12.5
24000	32.3	32.3	13.5	13.5
25000	32.4	33.0	13.4	12.8
26000	32.5	32.9	13.7	13.3

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