

FCC and IC Test report for parts 15.209, 15.247, RSS-247, RSS-Gen

Product name : CWS4-S8 & CWS4-S9
Applicant : CowManager B.V.
FCC ID : Y8K-CWS4
IC : 22382-CWS4

Test report No. : P000130374 001 Ver 2.00

Laboratory information

Accreditation

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Documentation

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Testing Location

Test Site	Kiwa Telefication BV
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	15-08-2022	First draft	KK
v1.00	13-09-2022	Final Version	KK
v2.00	09-12-2022	Chapter 1.4 emission designator information updated Chapter 1.6 and 3.1.4 test standard information changed Clause 1.8 Battery powered information added	KK

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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	3.2	Pass
--	RSS-Gen 6.7	99% bandwidth	3.3	Pass
15.247 (b)	RSS-247 5.4 (d)	RF output power	3.4	Pass
15.247 (e)	RSS-247 5.2 (b)	Power spectral density	3.5	Pass
15.247 (d)	RSS-247 5.5	Band edge	3.6	Pass

1 General Description

1.1 Applicant

Client name: CowManager B.V.
Address: Gerverscop 9, Harmelen The Netherlands
Zip code: 3481 LT
Telephone: +31 (0)348443840
E-mail: j.vanhusen@cowmanager.com
Contact name: Jan van Husen

1.2 Manufacturer

Manufacturer name: CowManager B.V.
Address: Gerverscop 9, Harmelen The Netherlands
Zip code: 3481 LT
Telephone: +31 (0)348443840
E-mail: j.vanhusen@cowmanager.com
Contact name: Jan van Husen

1.3 Tested Equipment Under Test (EUT)

Product name: CWS4
Brand name: CowManager B.V.
FCC ID: Y8K-CWS4
IC: 22382-CWS4
Product type: Sensor for measuring bovine behaviour.
Model(s): CWS4-S8 & CWS4-S9
Batch and/or serial No. -
Software version: 8.10
Hardware version: 4.1
Date of receipt 04-08-2022
Tests started: 05-08-2022
Testing ended: 09-08-2022

1.4 Product specifications of Equipment under test

Tx Frequency:	2405 – 2480 MHz
Rx frequency:	2405 – 2480 MHz
Occupied Channel Width:	1700 kHz
Antenna type:	Meander antenna
Antenna gain:	2.08 dBi
Type of modulation:	DSSS
Emission designator	2M38F1D

Disclaimer: The antenna gain, OCW and operating frequency bands are declared by the applicant

1.5 Environmental conditions

Test date	05-08-2022
Ambient temperature	24.9 C°
Humidity	42.9 %H

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 15 Subpart C
- RSS-Gen Issue 5
- RSS-247 Issue 2

1.8 Observation and remarks

The EUT is battery operated only, therefore conducted emissions on AC mains is not tested.

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 : Koray Korcum, MSc

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 16-01-2023

Name : P. van Wanrooij

Function : Test Engineer

Signature :

A handwritten signature in black ink, appearing to be "P. van Wanrooij".

2 Test configuration of the Equipment Under Test

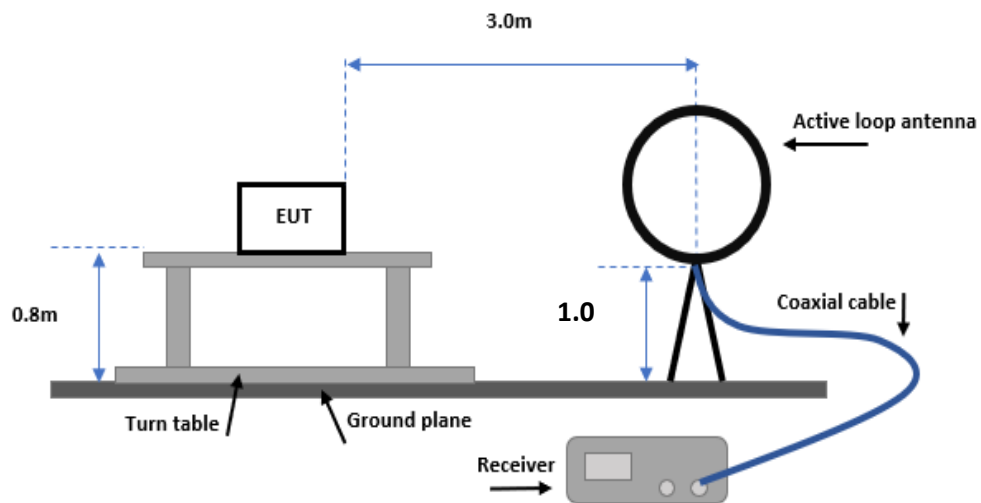
2.1 Test mode

Technology	Channels	Frequencies
ZigBee	11	2405
	18	2440
	26	2480

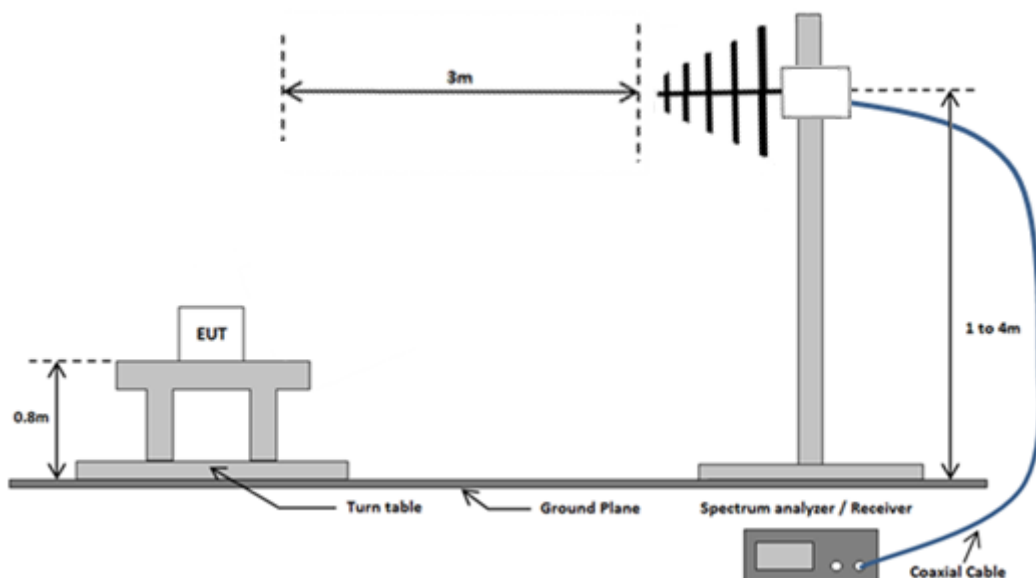
2.2 Test setups

2.2.1 Radiated test setups

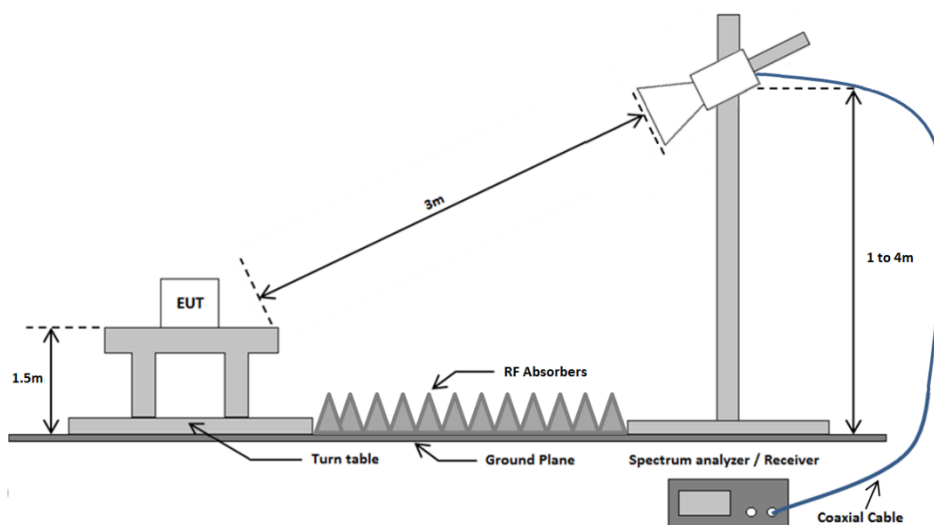
Radiated emissions test setup 9 kHz – 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.2.2 Conducted test setups

Conducted RF test setup



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	02-2022	02-2023	3.1
EMI Receiver	Rohde & Schwarz	ESR7	114534	01-2022	01-2023	3.1
Spectrum analyzer	Rohde & Schwarz	FSP40	TE11125	03-2022	03-2023	3.1
Spectrum Analyzer	Rohde & Schwarz	FSV40	114527	01-2022	01-2023	3.1 - 3.6
Active loop antenna	EMCO	6502	114515	01-2022	01-2024	3.1
Biconical antenna + 6dB attenuator	Schwarzbeck + HP	VHA9103 + 8491A	114436 + 114254	03-2021	03-2024	3.1
Logperiodic antenna	EMCO	3147	114385	03-2021	03-2024	3.1
Horn antenna	EMCO	3115	114607	01-2021	01-2024	3.1
Horn antenna	FLANN-MICROWAVE	20240-25	114518	NA*	NA*	3.1
Horn antenna	Scientific atlanta	12A-26	11487	NA*	NA*	3.1
Preamplifier 18-40 GHz	Miteq	JS4-18004000-33-8P	114693	01-2022	01-2023	3.1
Test software	Raditeq	Radimation Version 2021.1.9	TE 02008	--	--	3.1

*Note: Standard gain horn antennas do not need calibration

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

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance(m)
0.009 – 0.490	2400/F(kHz)	$20*\{\log[2400]-\log[F(\text{kHz})]\}$	300*
0.490 – 1.705	24000/F(kHz)	$20*\{\log[24000]-\log[F(\text{kHz})]\}$	30*
1.705 – 13.11 14.01 – 30.0	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 corrected to 3m measurement distance according to the method described in ANSI C63.10-2013, clause 6.4

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 2.2.1 of this report.

3.1.4 Test procedure

Prior to running the measurements, the EUT has been investigated in the X, Y and Z dimensions to determine the worst case configuration for spurious emissions.

9 kHz – 30 MHz: According to ANSI C63.10-2013, section 5.4.2 and 8.2.3

30 MHz to 26.5 GHz: According to ANSI C63.10-2013, section 8.3

9 kHz to 30 MHz: IRN 026 – Method 10

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

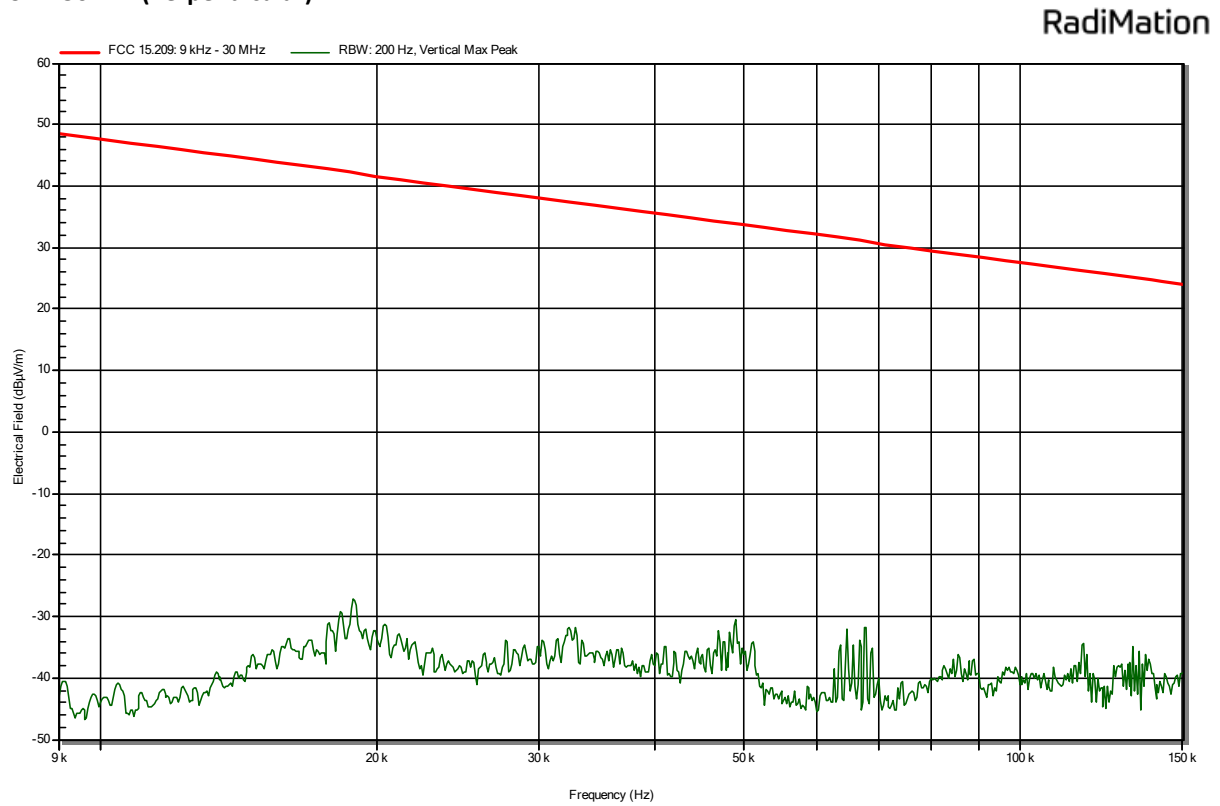
Frequency range	Polarization	Uncertainty
9 kHz – 30 MHz	--	± 1.6 dB
30 – 200 MHz	Horizontal	± 4.5 dB
	Vertical	± 5.4 dB
200 -1000 MHz	Horizontal	± 3.6 dB
	Vertical	± 4.6 dB
1 – 18 GHz	Horizontal	± 5.7 dB
	Vertical	± 5.7 dB
18 – 26.5 GHz	Horizontal	± 4.9 dB
	Vertical	± 4.9 dB

3.1.6 Peak tables of the radiated spurious emissions measurement

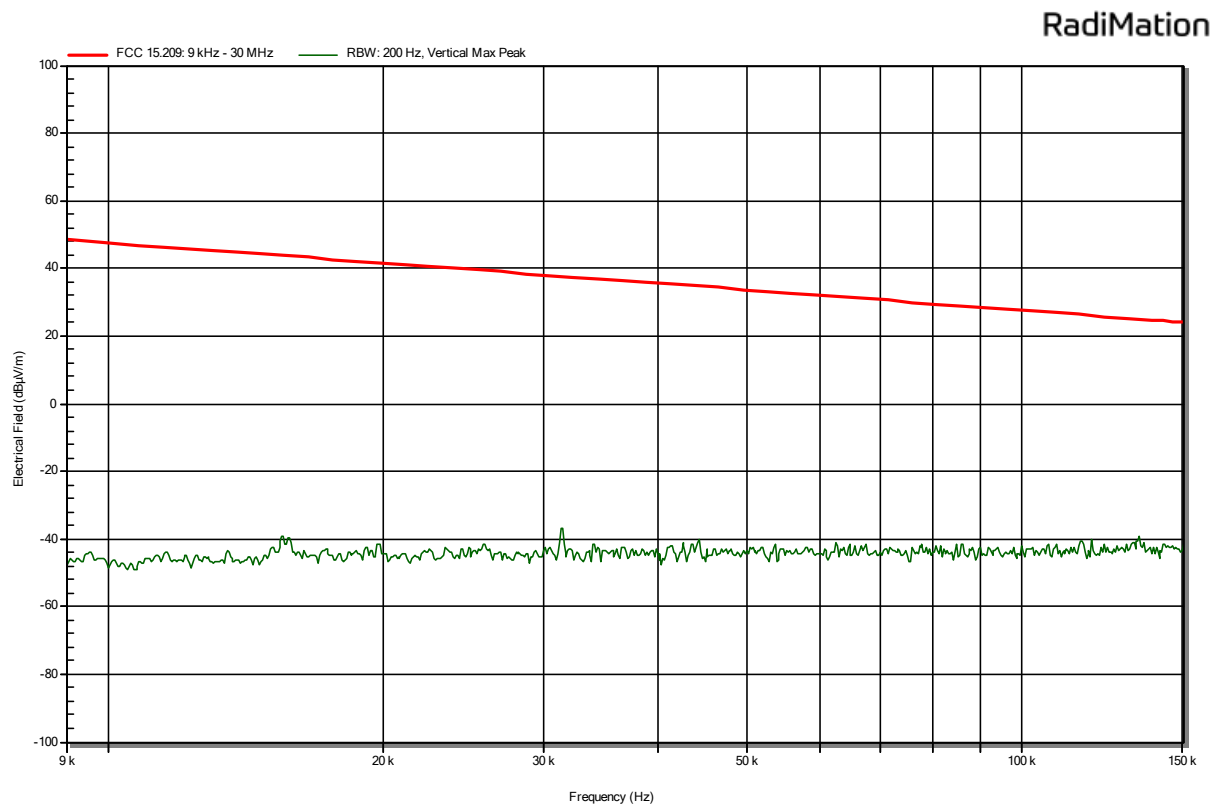
Frequency	Peak	Peak Limit	Average	Average Limit	Status	Polarization
99,575 MHz	25 dB μ V/m	40 dB μ V/m	-	-	Pass	Horizontal
84,918 MHz	20,5 dB μ V/m	46 dB μ V/m	-	-	Pass	Horizontal
7,214 GHz	49,6 dB μ V/m	74 dB μ V/m	42,6 dB μ V/m	54 dB μ V/m	Pass	Horizontal
7,321 GHz	50,1 dB μ V/m	74 dB μ V/m	44,9 dB μ V/m	54 dB μ V/m	Pass	Vertical
25,845 GHz	59,9 dB μ V/m	74 dB μ V/m	51,4 dB μ V/m	54 dB μ V/m	Pass	Vertical
25,169 GHz	58,6 dB μ V/m	74 dB μ V/m	48,5 dB μ V/m	54 dB μ V/m	Pass	Vertical

3.1.7 Plots of the Radiated Spurious Emissions Measurement

9 – 150 kHz (Perpendicular)

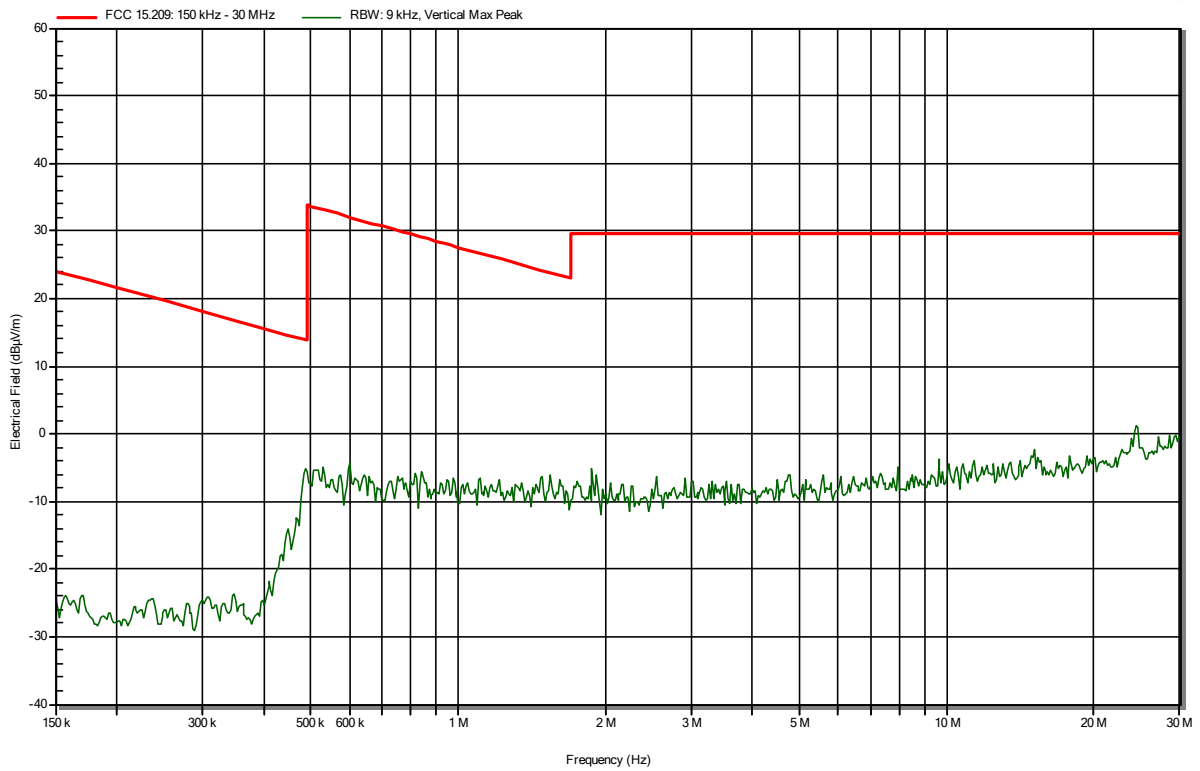


9 – 150 kHz (Parallel)



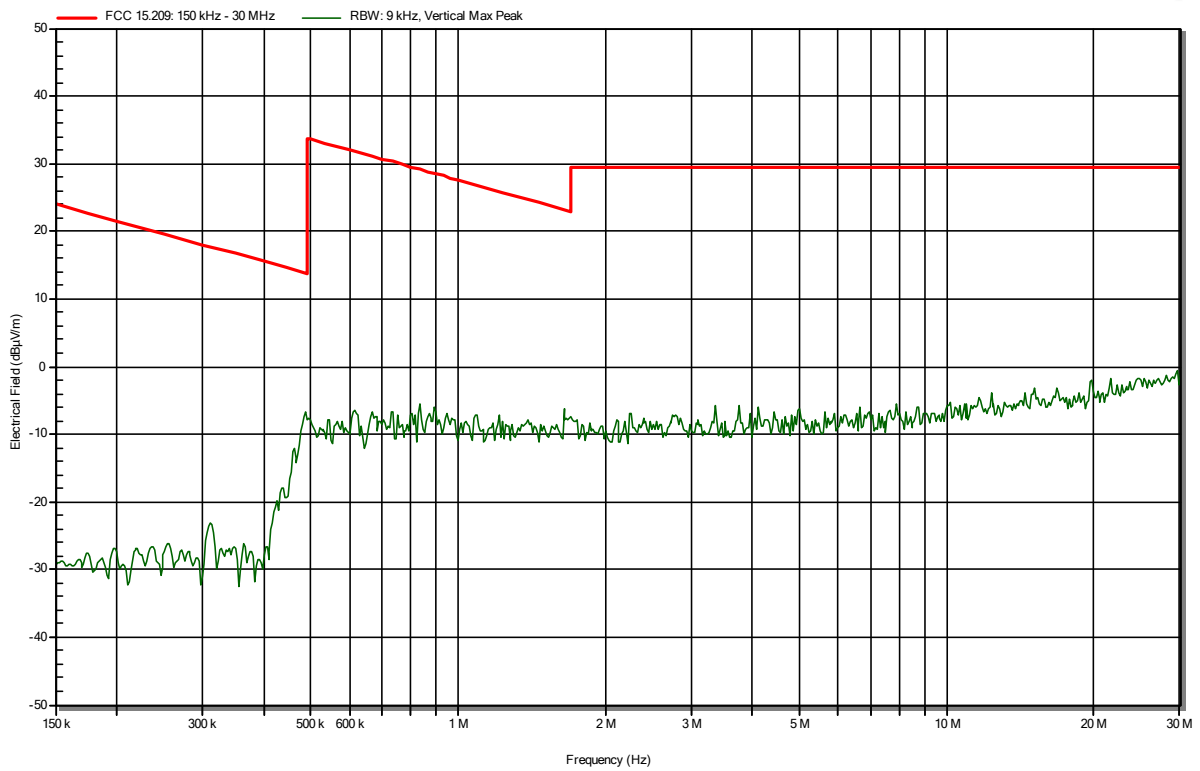
150 kHz – 30 MHz (Perpendicular)

RadiMation



150 kHz – 30 MHz (Parallel)

RadiMation

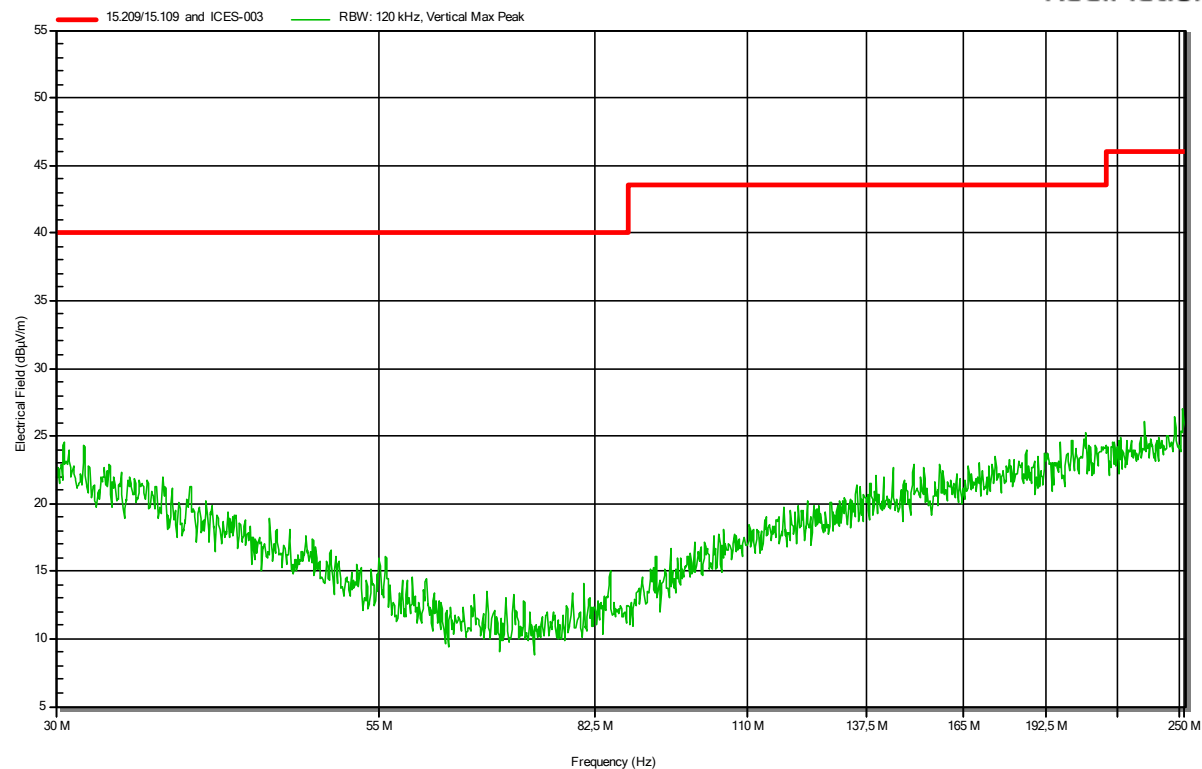


30 -250 MHz

Vertical polarization

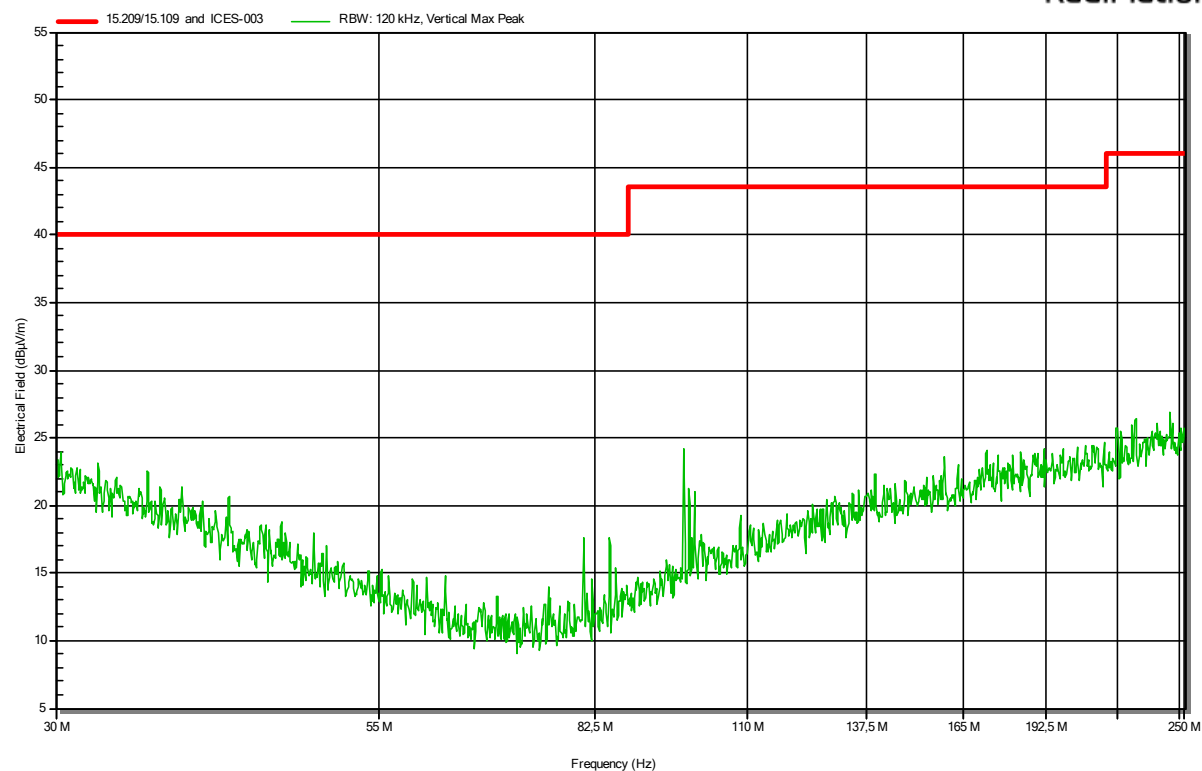
Low channel

RadiMation



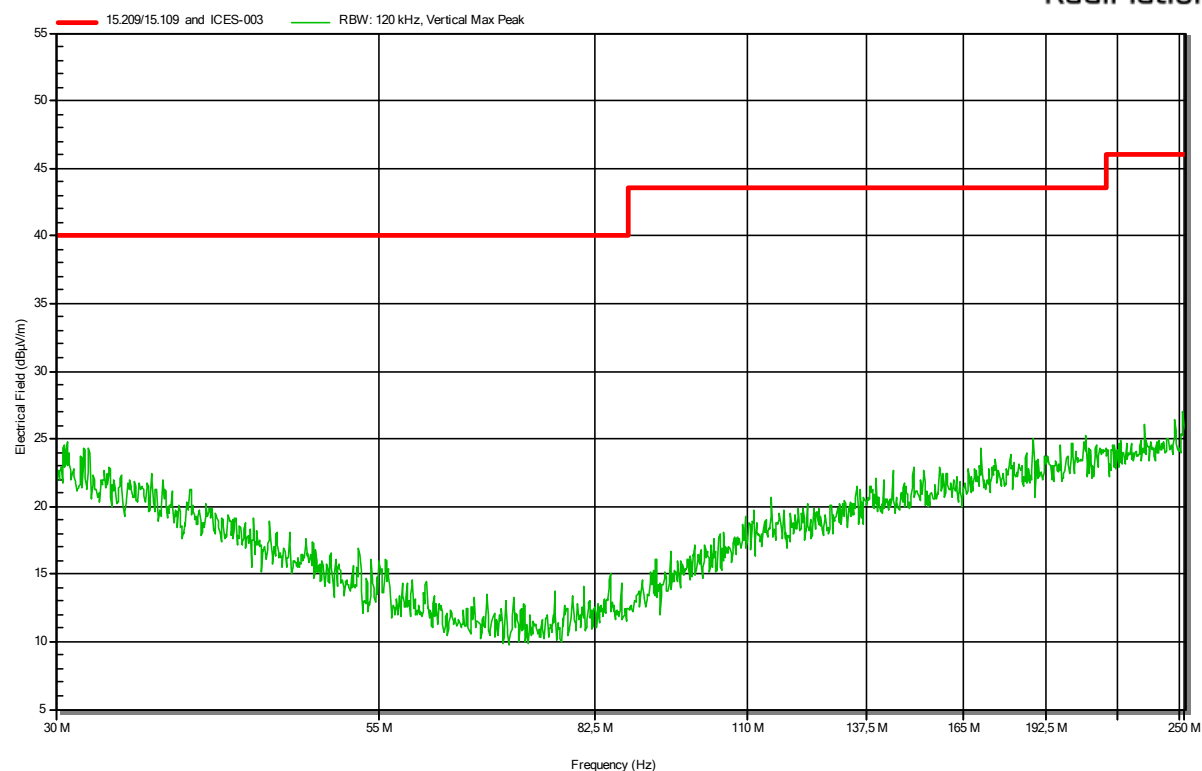
Mid channel

RadiMation



High channel

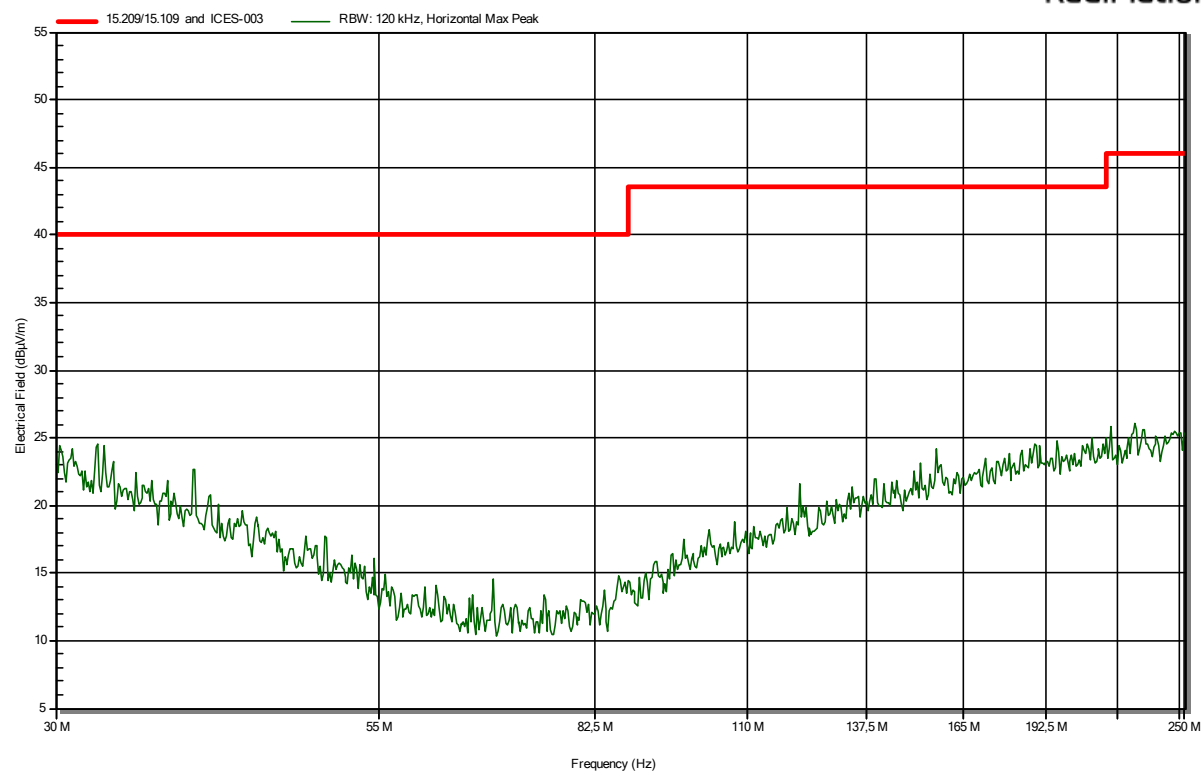
RadiMation



Horizontal polarization

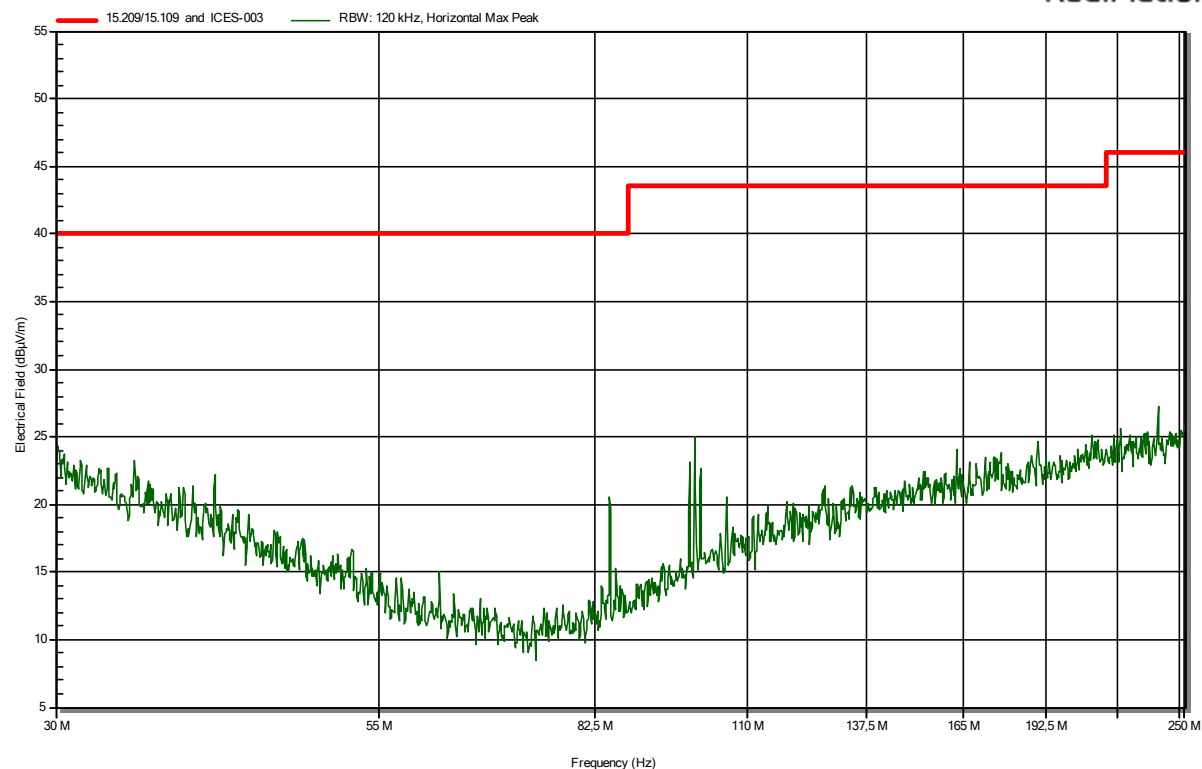
Low channel

RadiMation



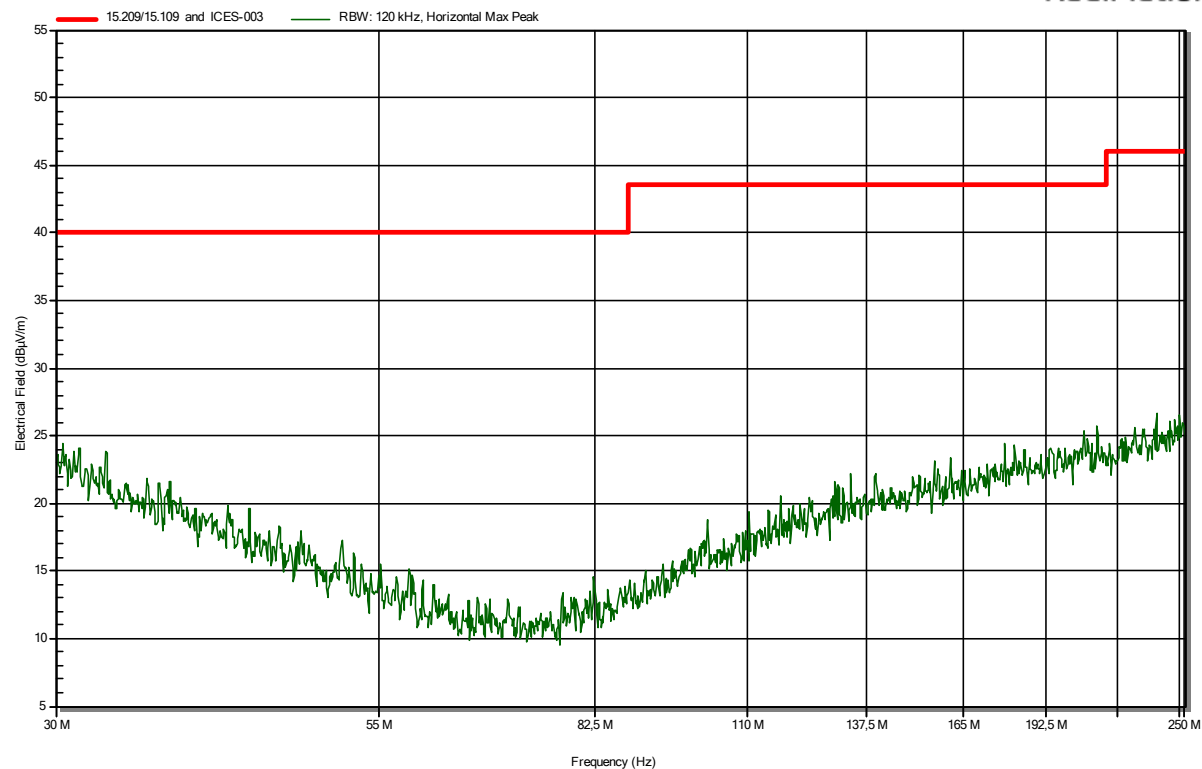
Mid channel

RadiMation



High channel

RadiMation

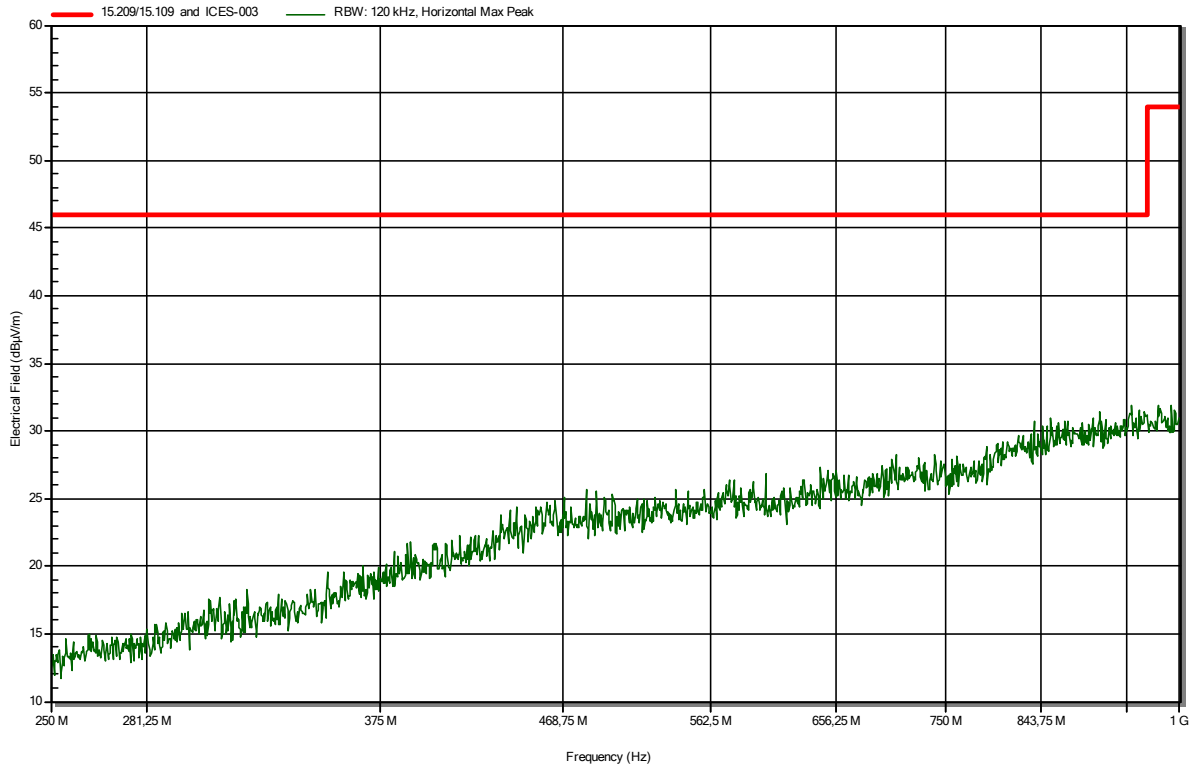


250 – 1000 MHz

Horizontal polarization

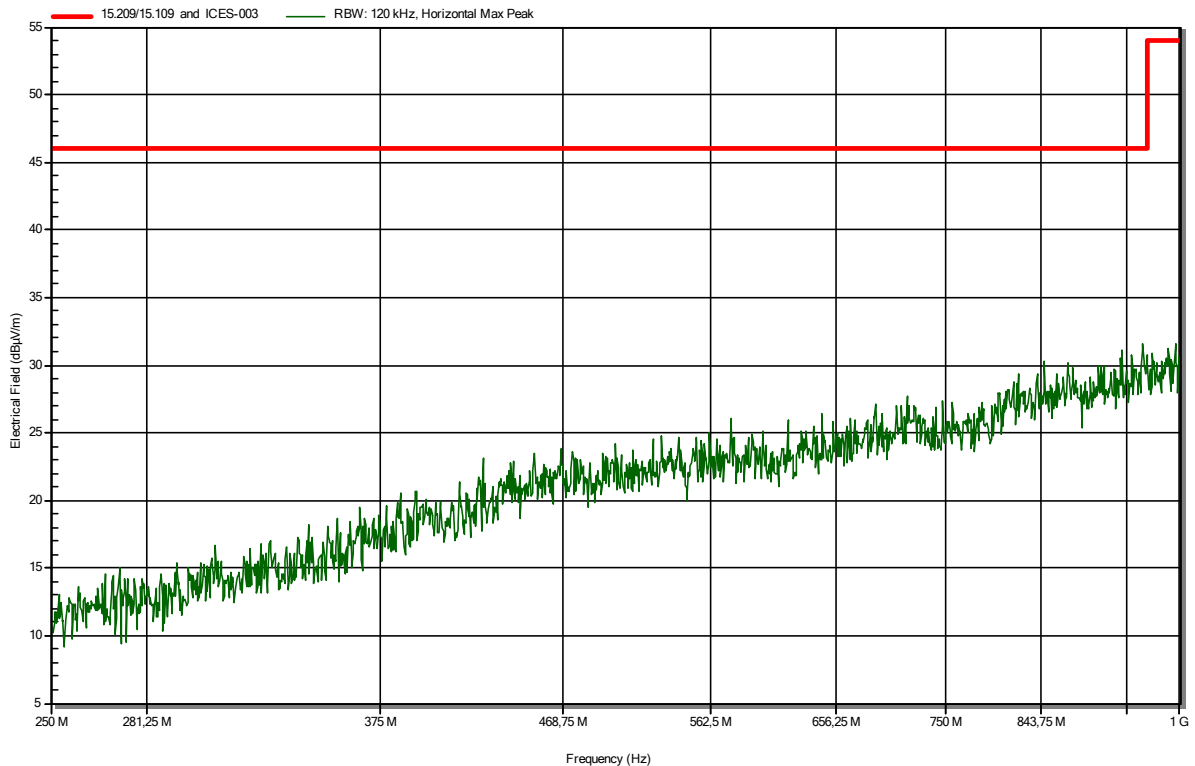
Low channel

RadiMation



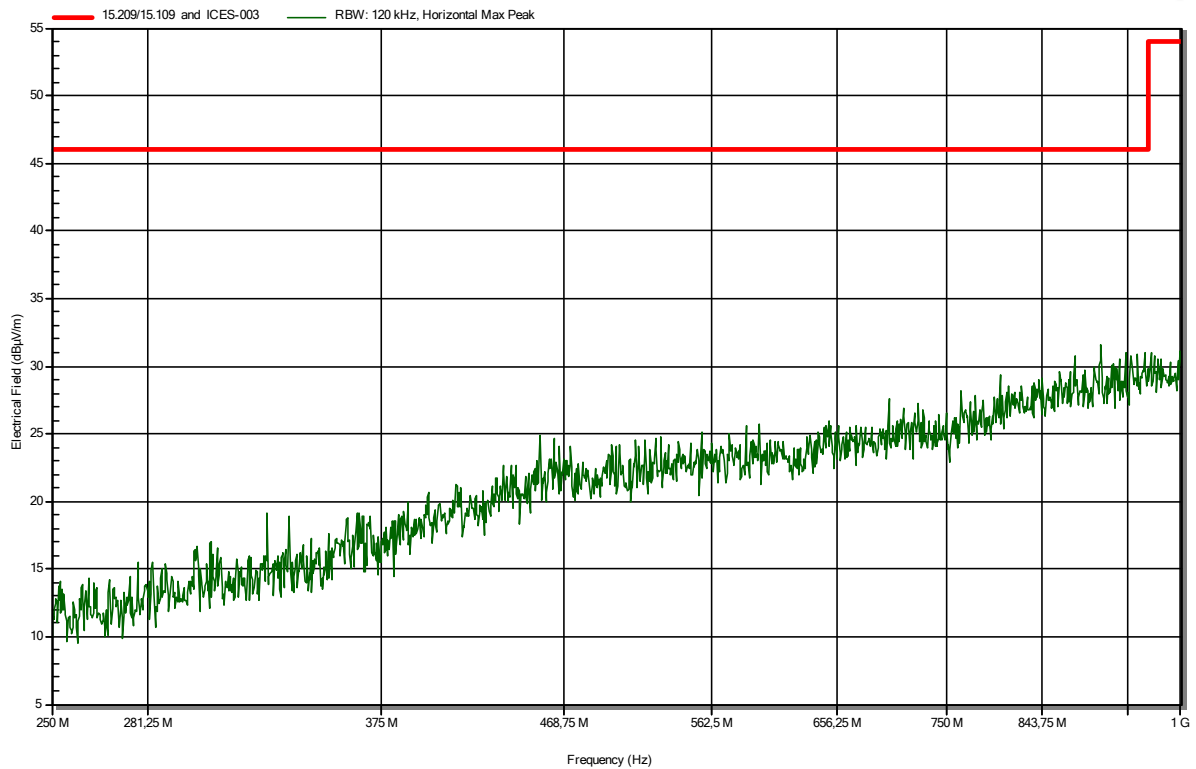
Mid channel

RadiMation



High channel

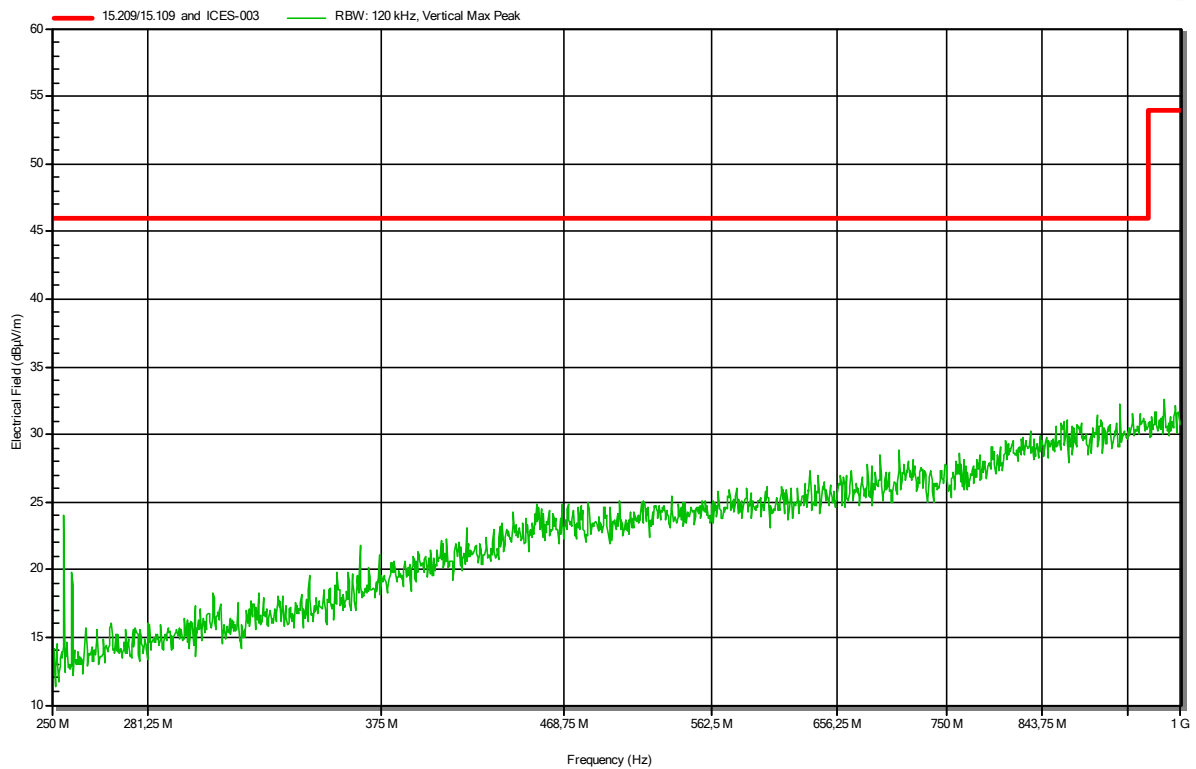
RadiMation



Vertical polarization

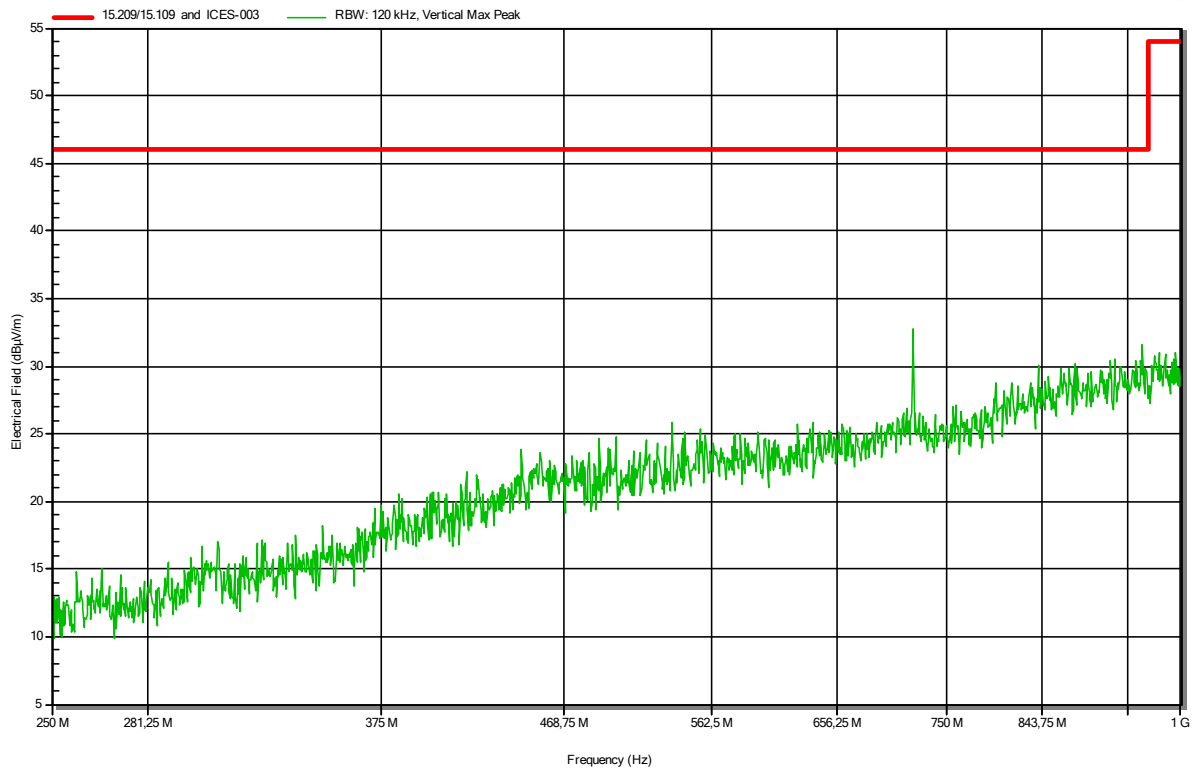
Low channel

RadiMation



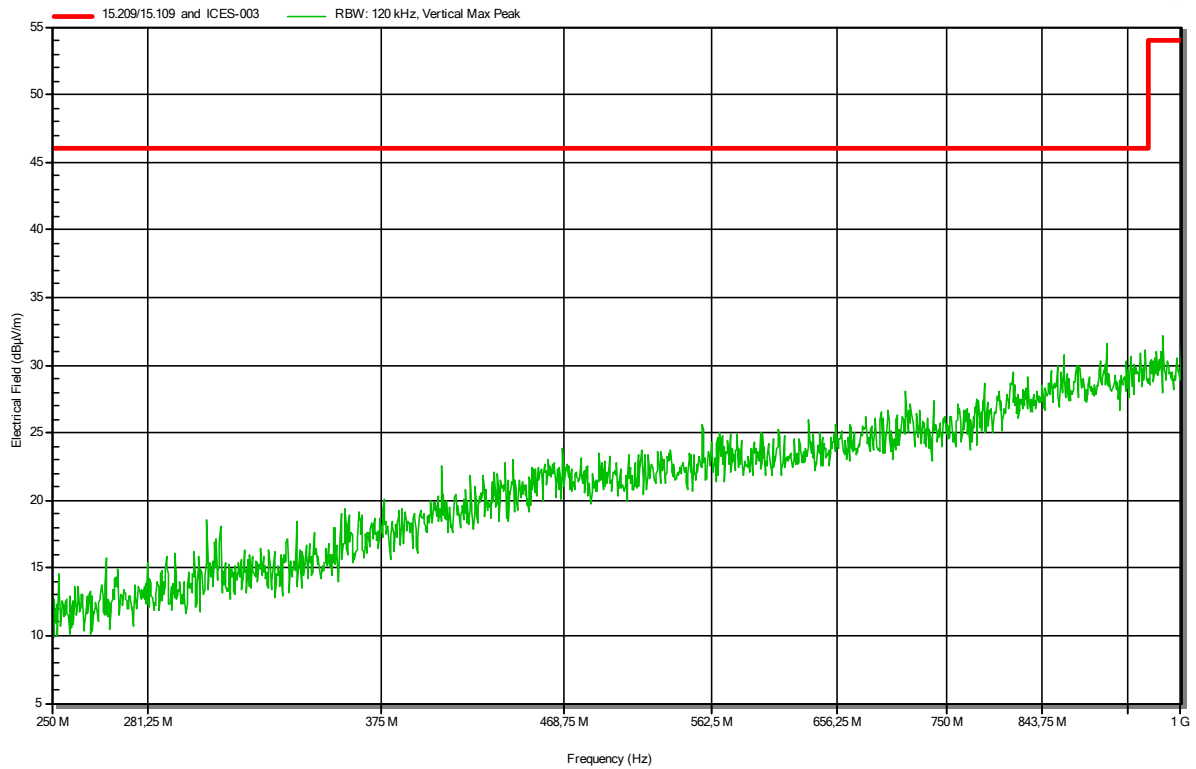
Mid channel

RadiMation



High channel

RadiMation

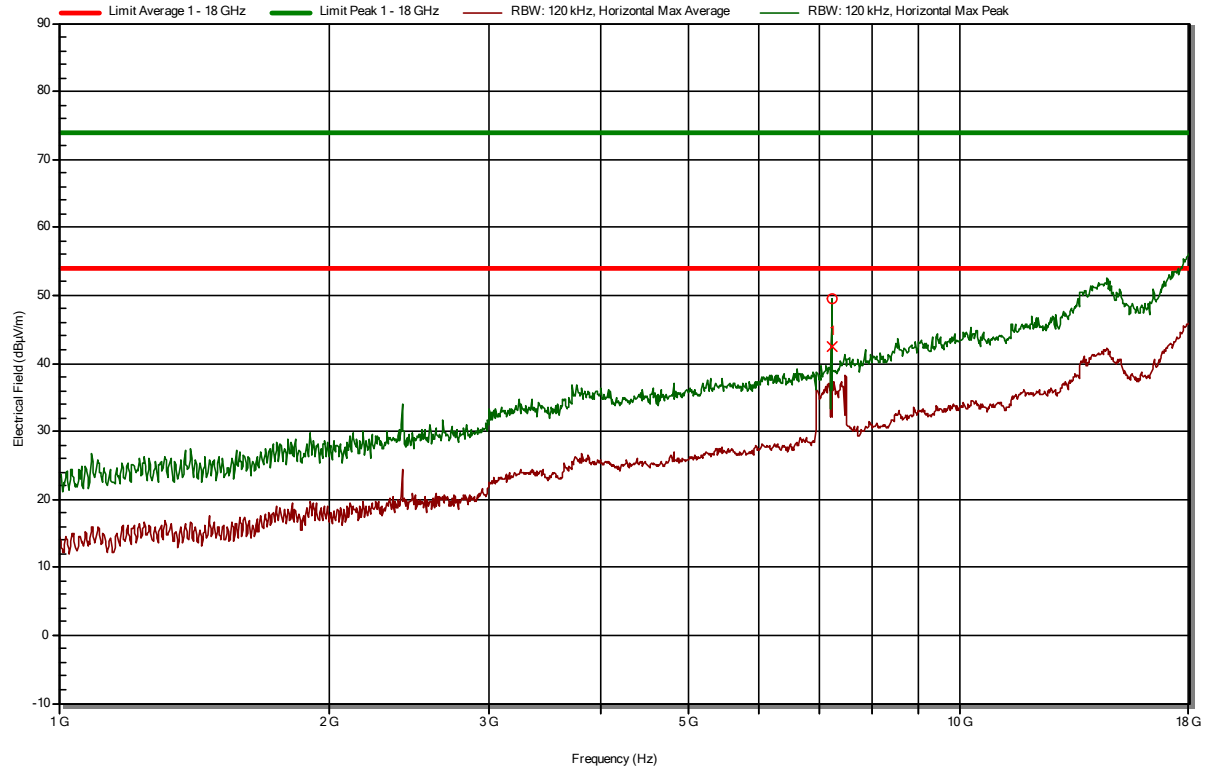


1 – 18 GHz

Horizontal polarization

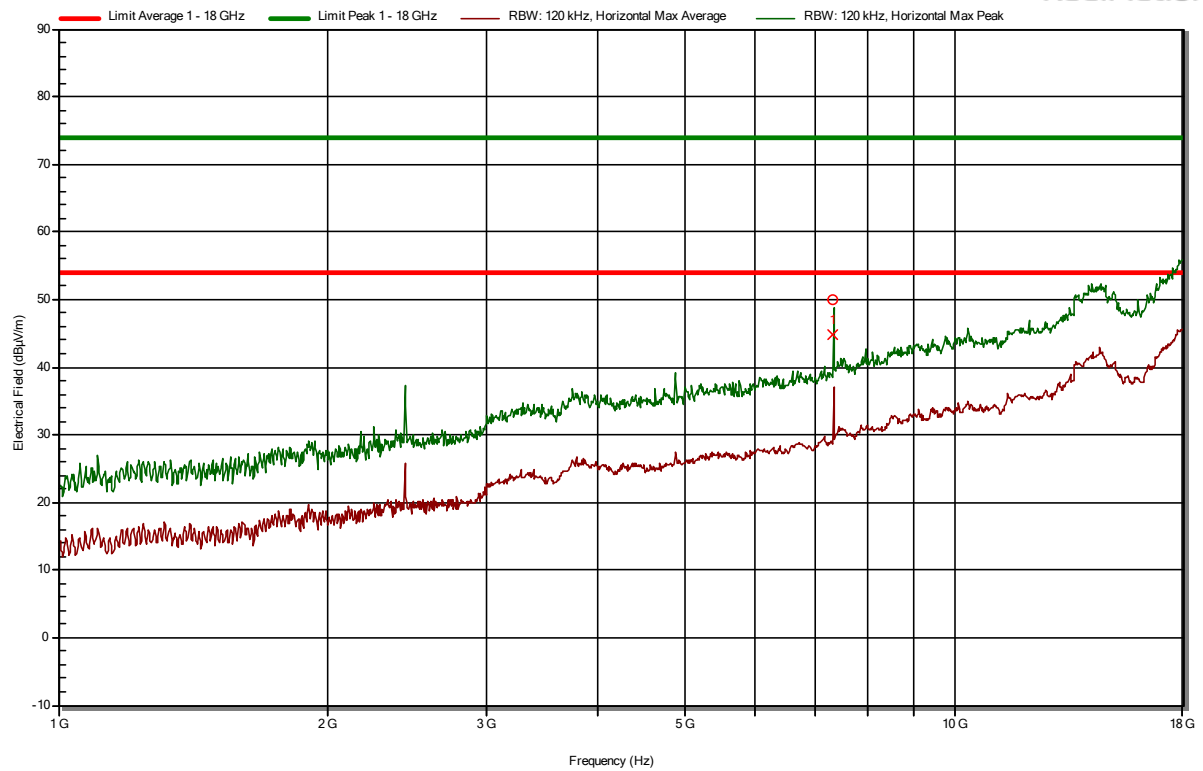
Low channel

RadiMation



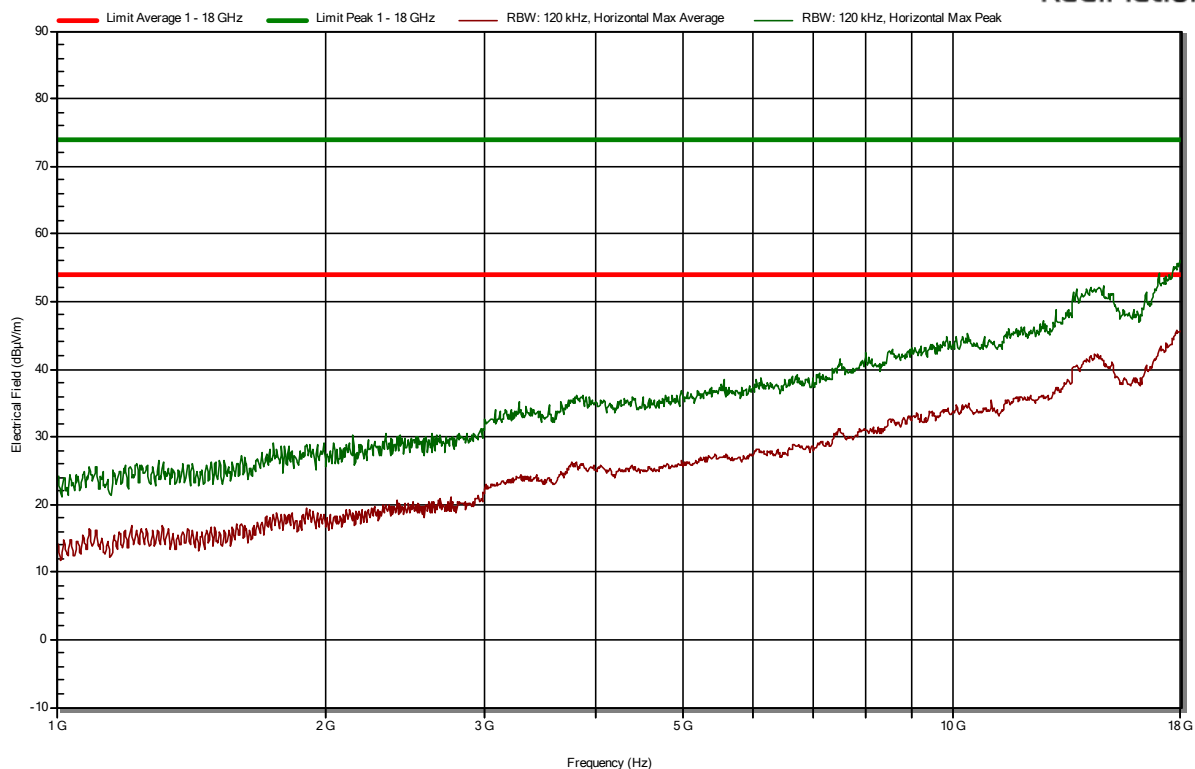
Mid channel

RadiMation



High channel

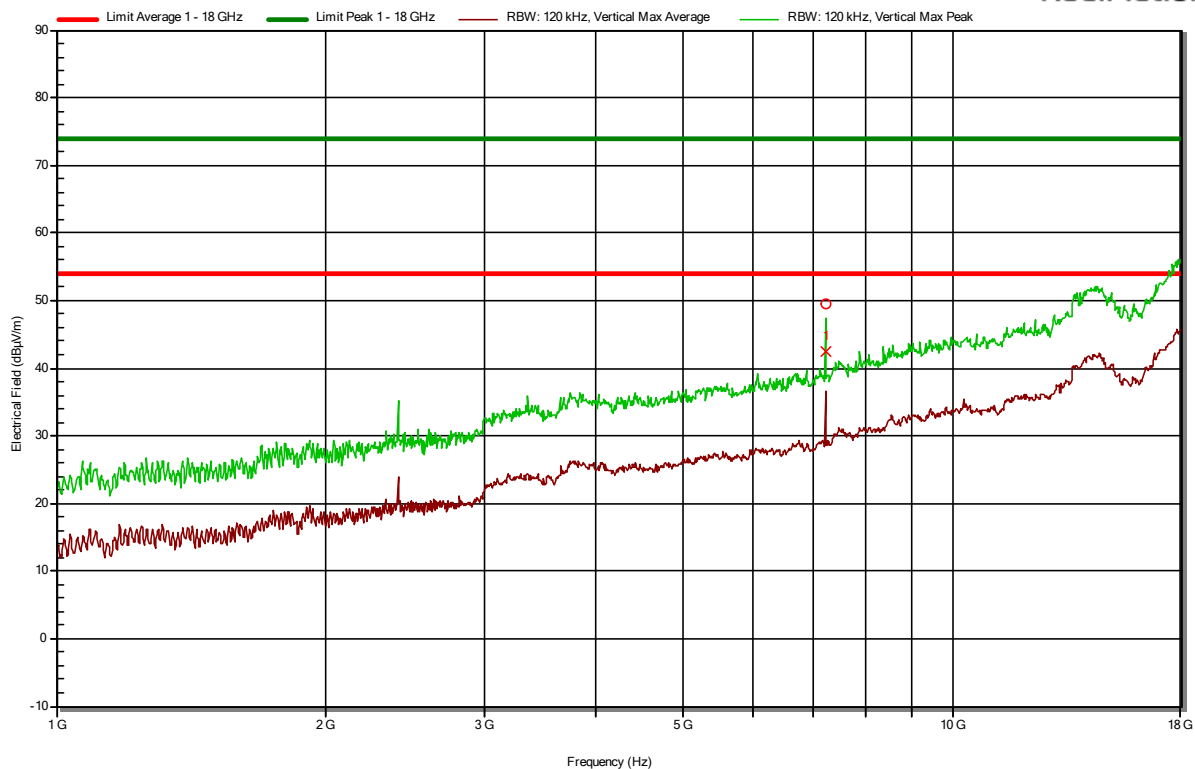
RadiMation



Vertical polarization

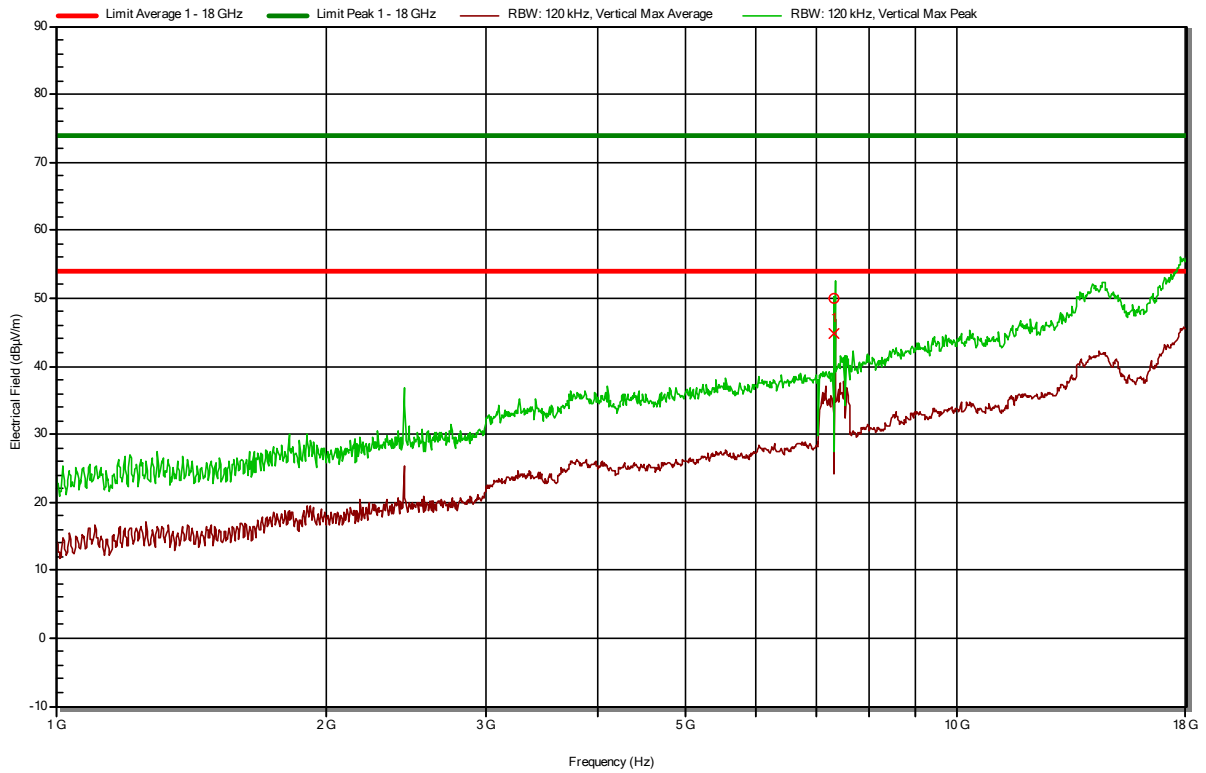
Low channel

RadiMation



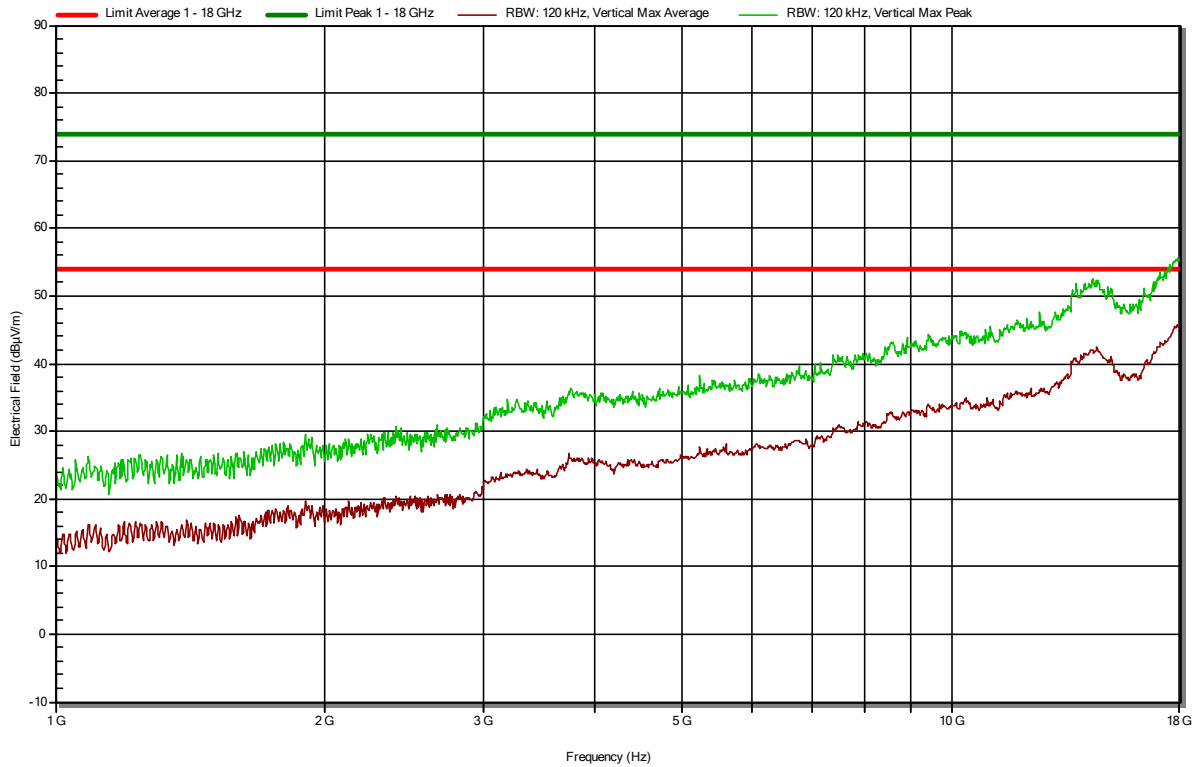
Mid channel

RadiMation



High channel

RadiMation

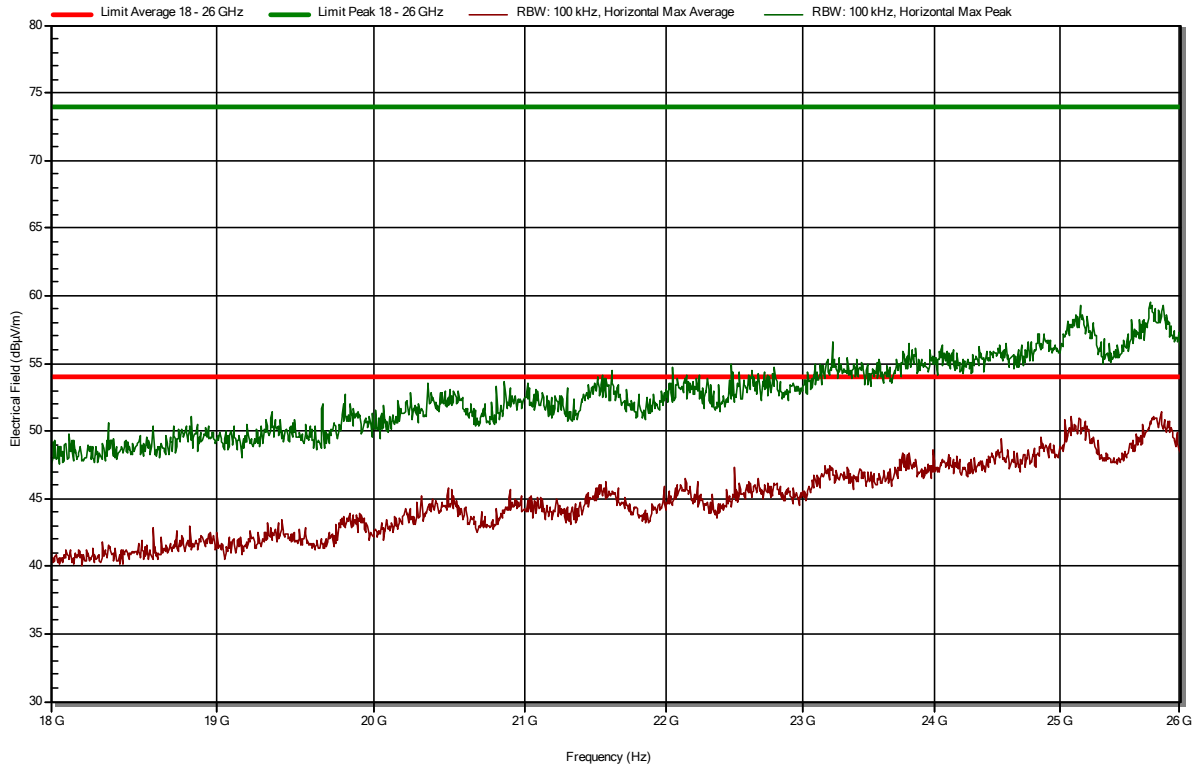


18 – 26 GHz

Horizontal polarization

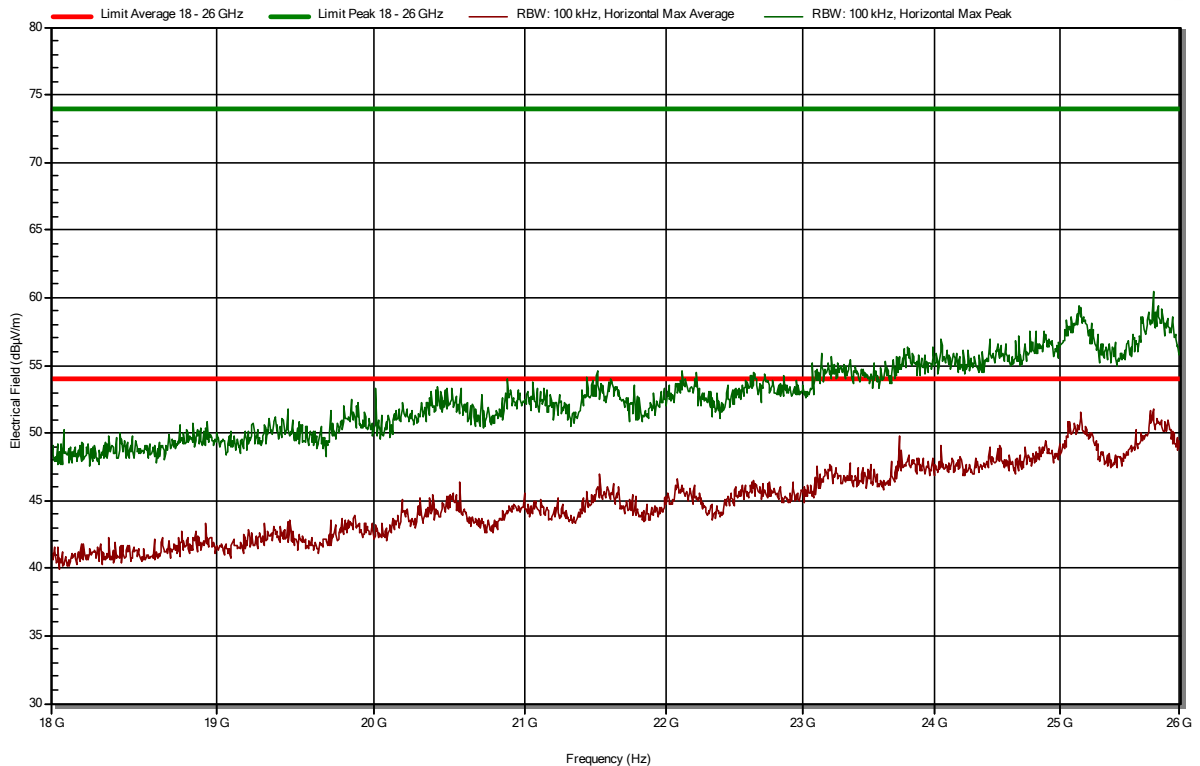
Low channel

RadiMation



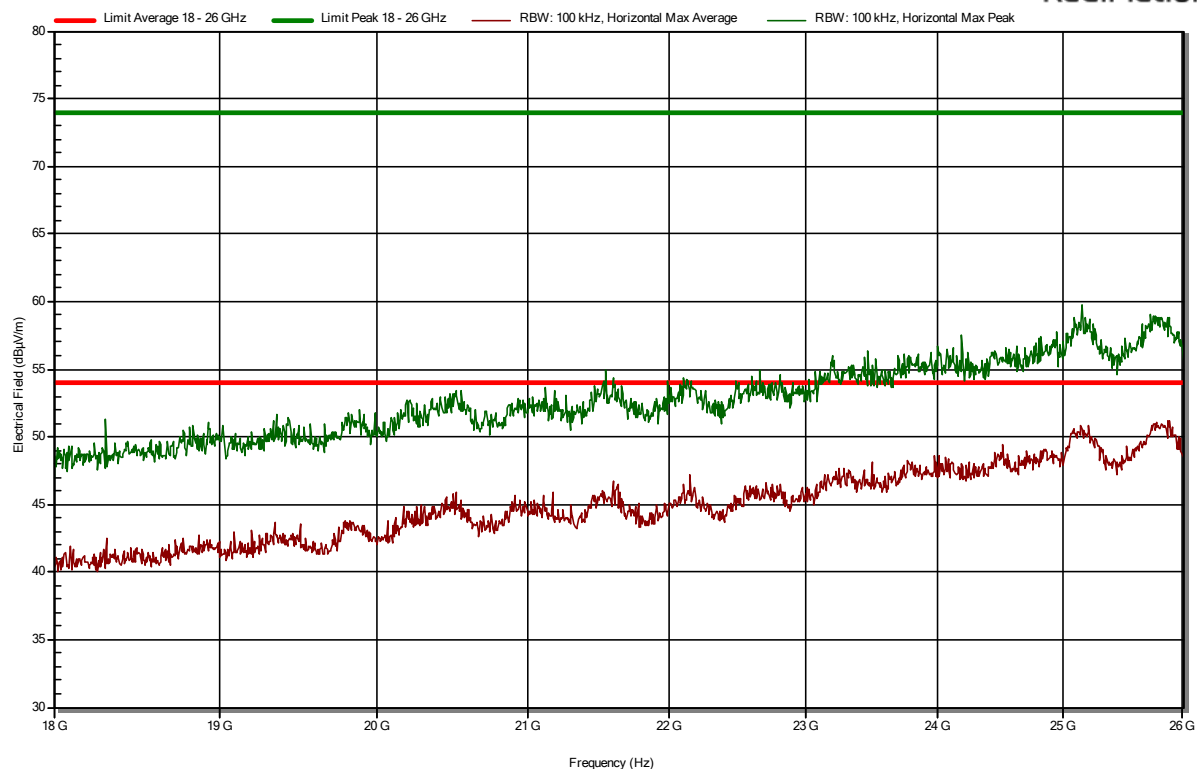
Mid channel

RadiMation



High channel

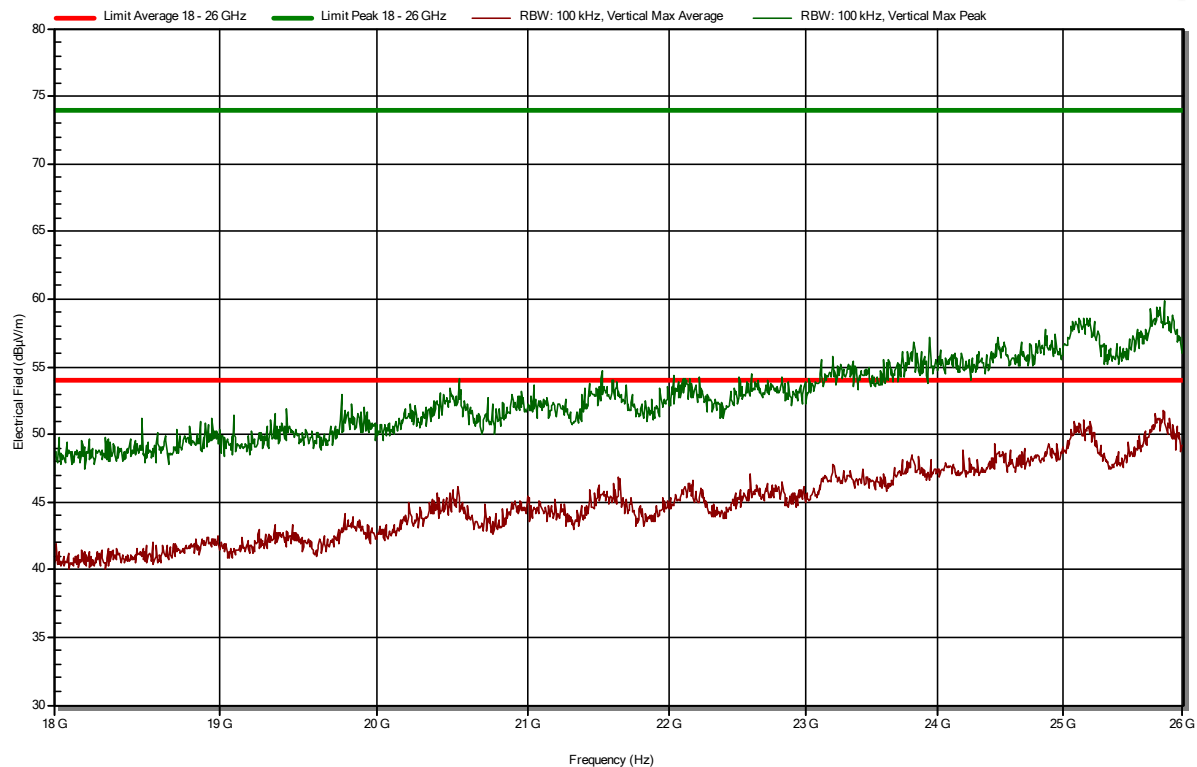
RadiMation



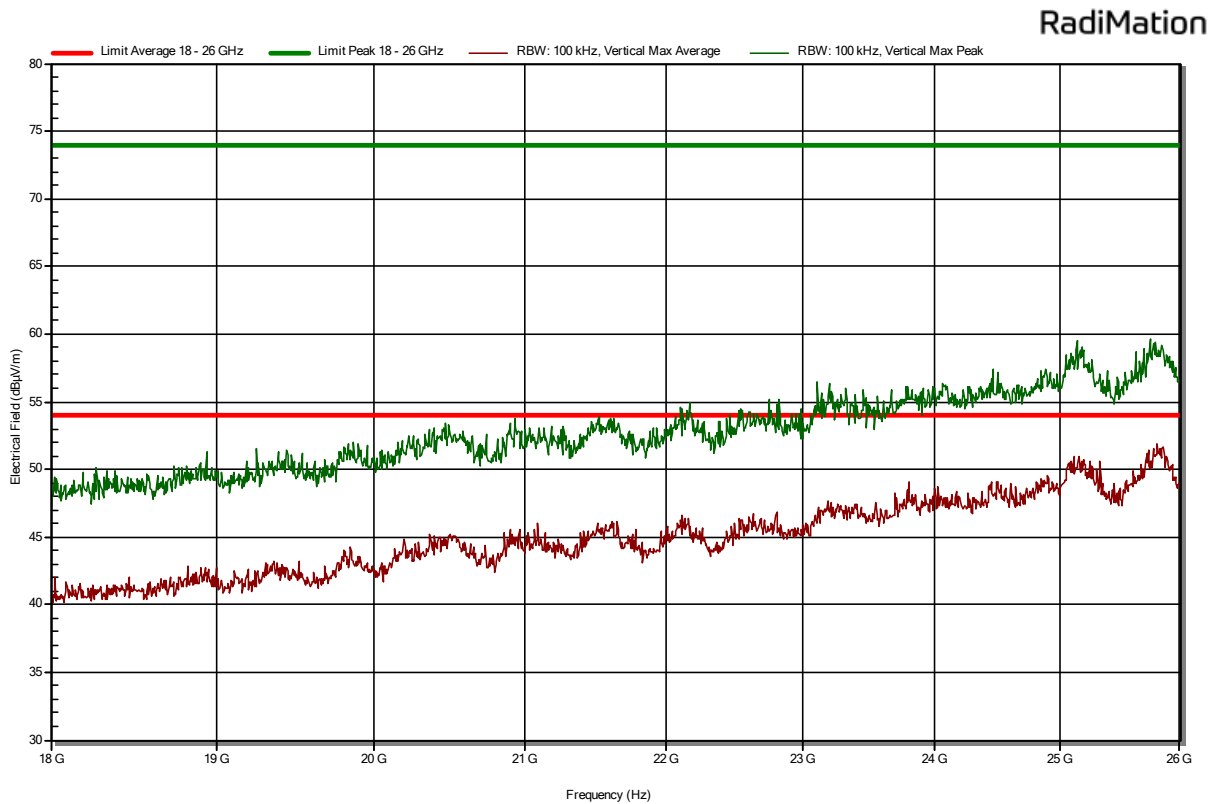
Vertical polarization

Low channel

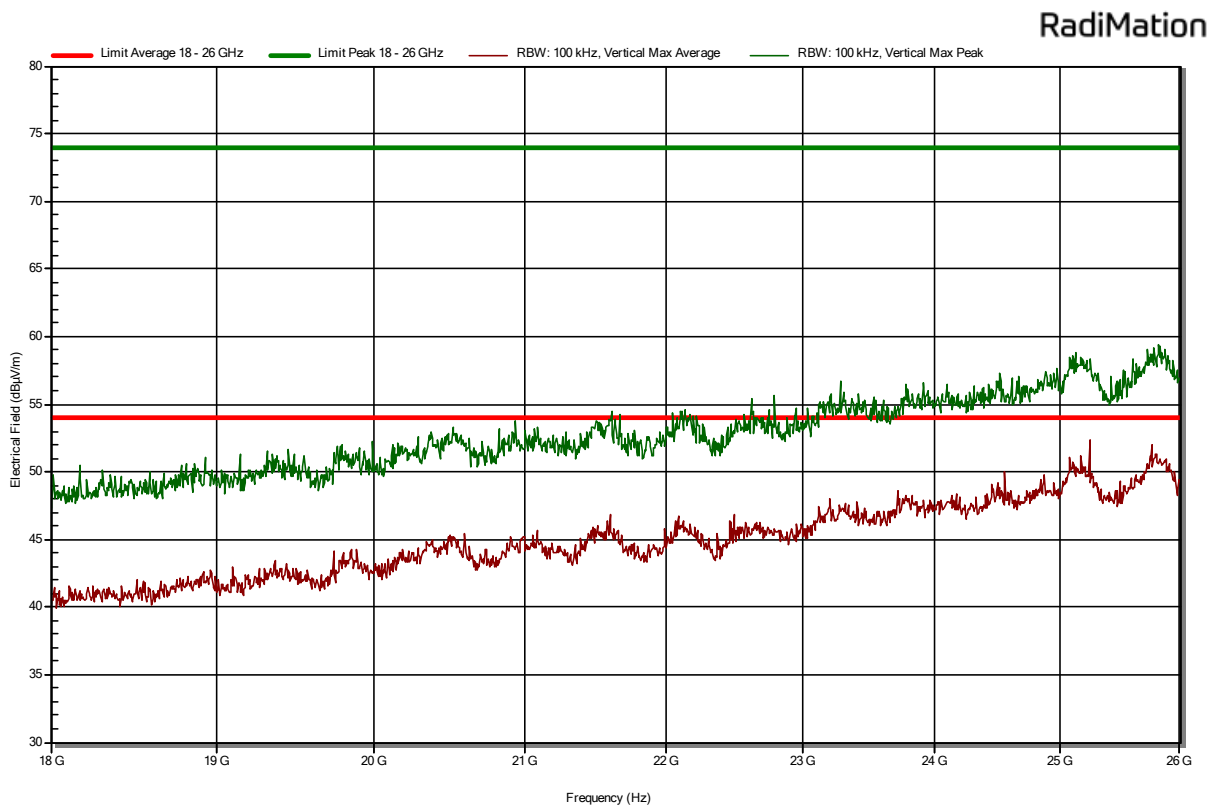
RadiMation



Mid channel



High channel



3.2 6dB bandwidth Measurement

3.2.1 Limit

The minimum 6 dB Bandwidth shall be at least 500 kHz.

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 2.2.2 of this report.

3.2.4 Test procedure

Tests according to ANSI C63.10

IRN 017 - Occupied bandwidth (Hz) Method 4 – DTS Bandwidth.

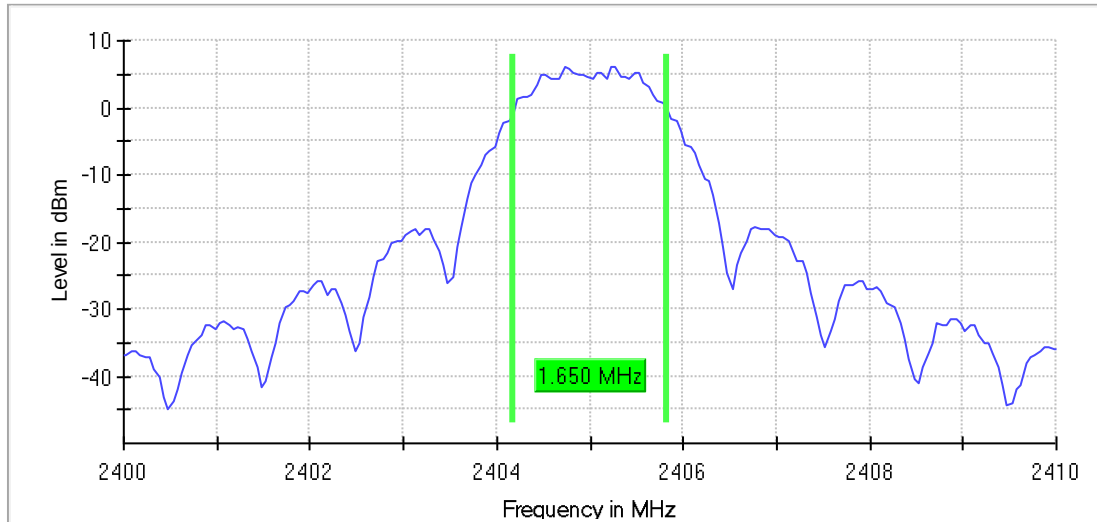
3.2.5 Test Results of the 6 dB bandwidth Measurement

Technology Std.	Channel	Frequency (MHz)	Data rate	6dB bandwidth (kHz)
ZigBee	11	2405	250 kbps	1650
	18	2440	250 kbps	1700
	26	2480	250 kbps	1650
Uncertainty	± 36.2 kHz			

3.2.6 Plots of the 6dB bandwidth measurement

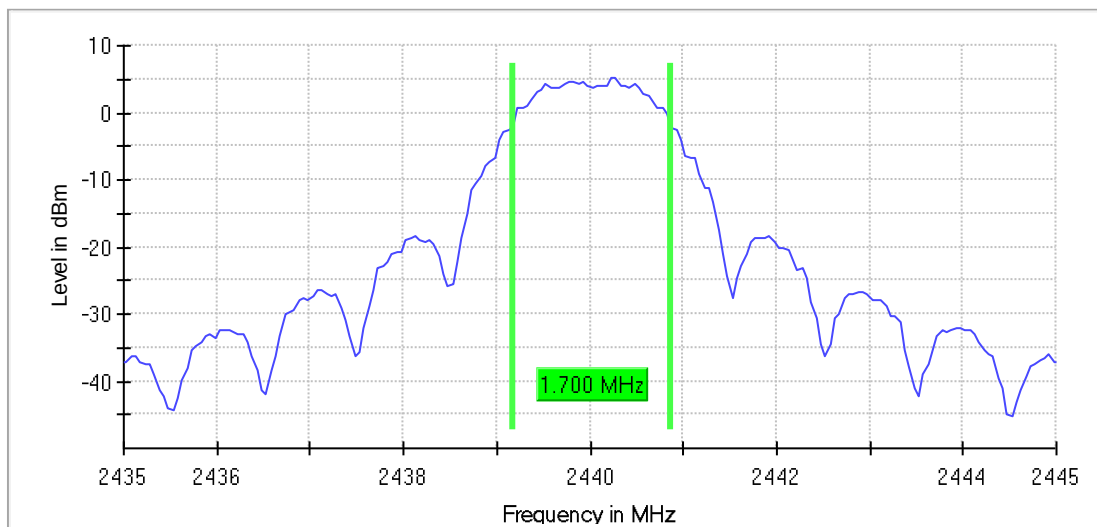
Channel 11

6 dB Bandwidth



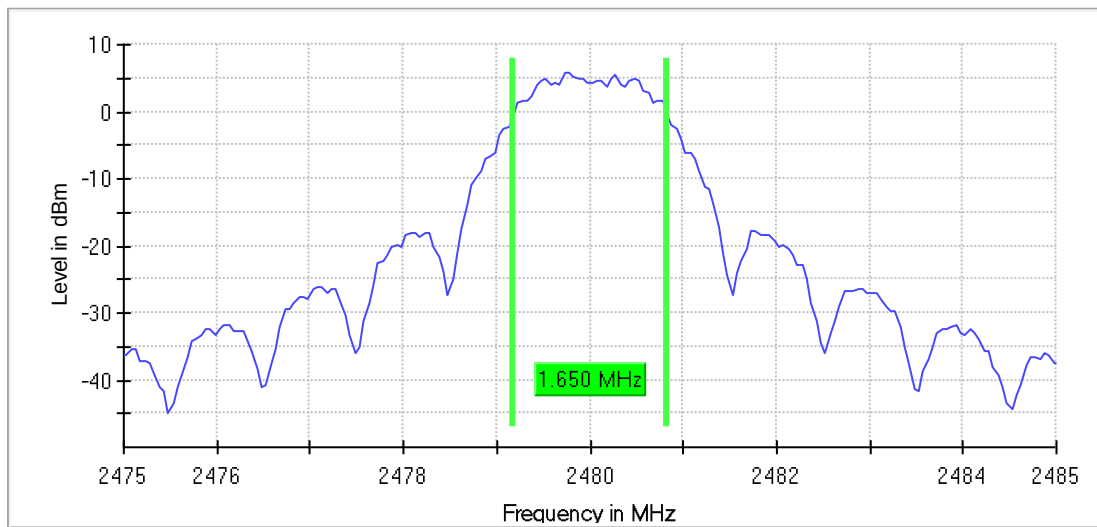
Channel 18

6 dB Bandwidth



Channel 26

6 dB Bandwidth



3.3 99% Occupied Bandwidth

3.3.1 Limit

According to RSS-Gen 6.7

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 2.2.2 of this report.

3.3.4 Test procedure

IRN 017 - Occupied bandwidth (Hz) Method 1 – XX % power bandwidth.

1. Set the centre frequency to the nominal EUT channel centre frequency
2. Set span = 1.5 times to 0.5 times the Occupied Bandwidth
3. Set VBW $\geq 3 \times$ RBW
4. Video averaging is not permitted. Where practical, detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

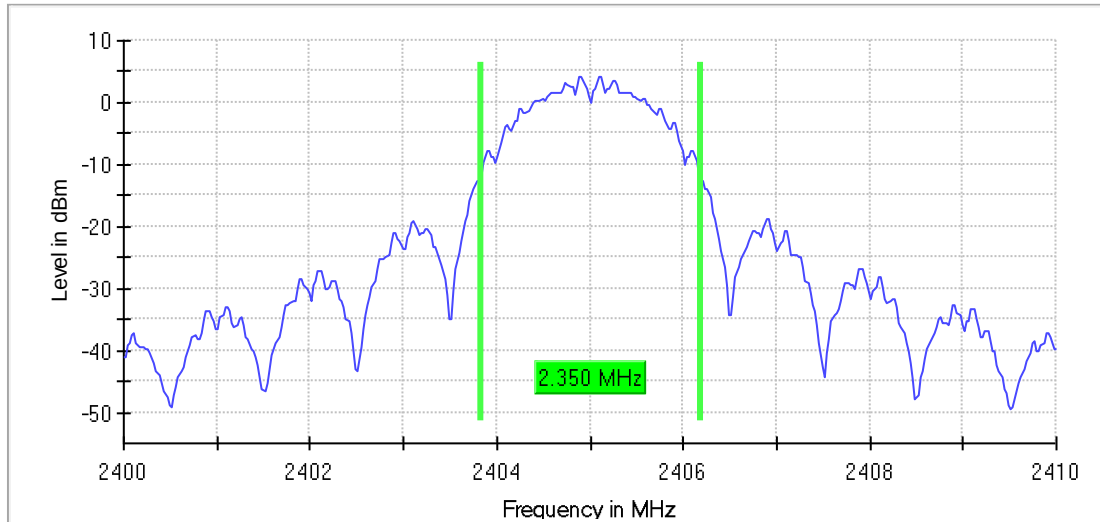
3.3.5 Test results of the 99% occupied bandwidth measurement

Technology Std.	Channel	Frequency (MHz)	Data rate	99% bandwidth (kHz)
ZigBee	11	2405	250 kbps	2350
	18	2440	250 kbps	2375
	26	2480	250 kbps	2375
Uncertainty	± 12 kHz			

3.3.6 Plots of the 99% occupied bandwidth measurement

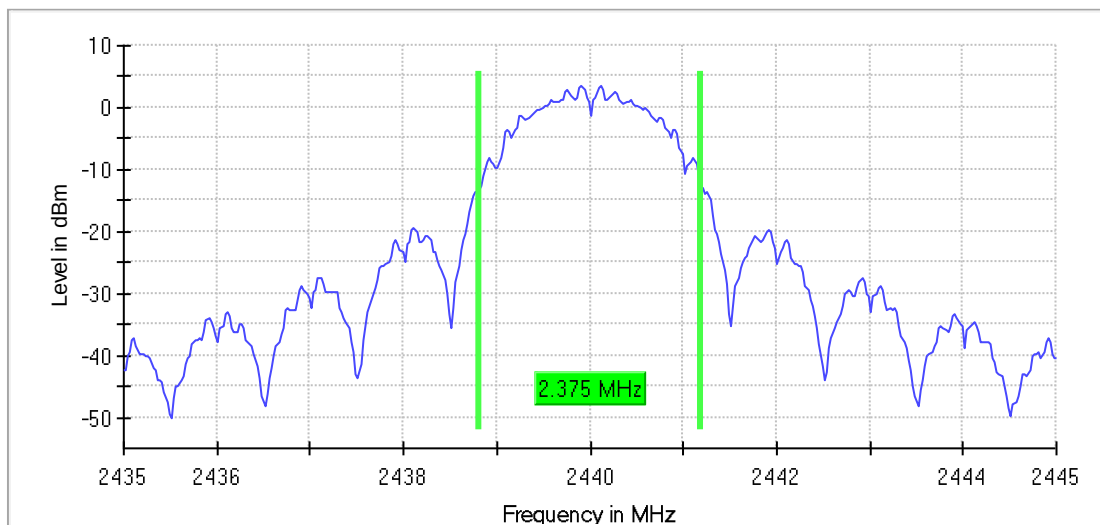
Channel 11

99 % Bandwidth



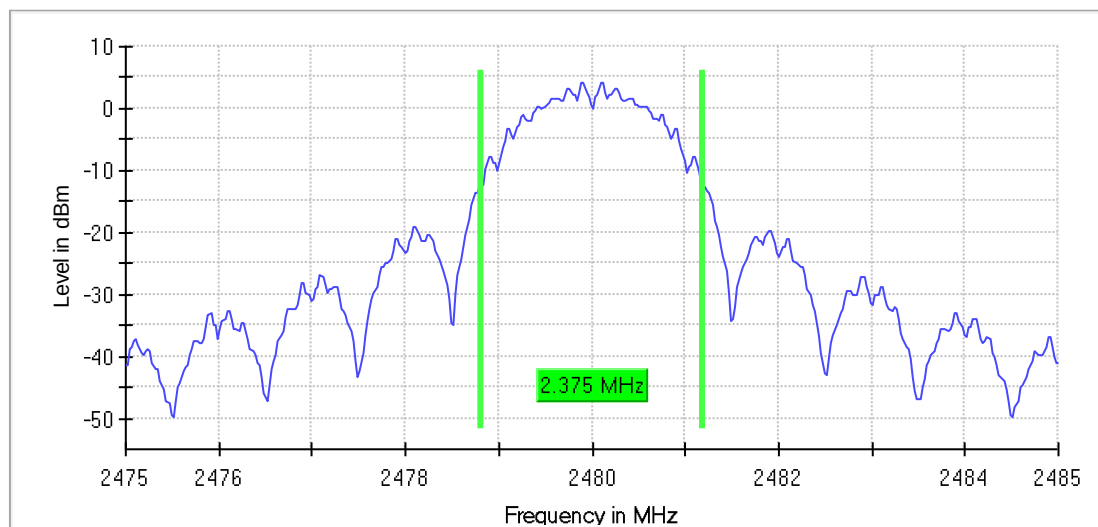
Channel 18

99 % Bandwidth



Channel 26

99 % Bandwidth



3.4 Output Power Measurement

3.4.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 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.

3.4.2 Measurement instruments

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

3.4.3 Test setup

The test setup is as shown in chapter 2.2.2 of this report.

3.4.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.

IRN 014 - RF power (W) - Method 6

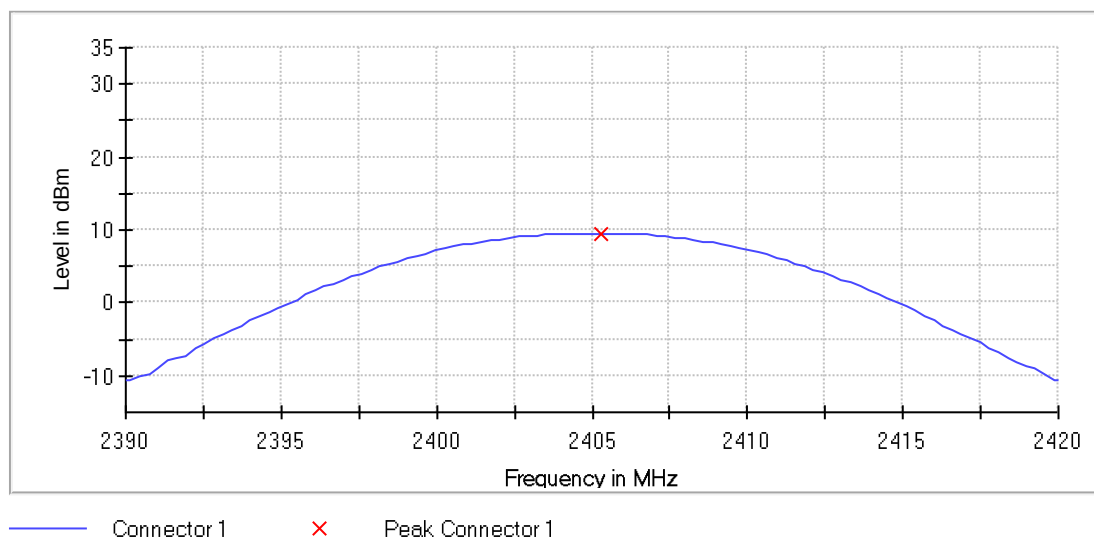
3.4.5 Test results of Output Power Measurement

Peak method				
Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power (dBm)
ZigBee	11	2405	250 kbps	9.5
	18	2440	250 kbps	8.7
	26	2480	250 kbps	9.0
Uncertainty	±0.71 dB			

3.4.6 Plots of the output power measurement

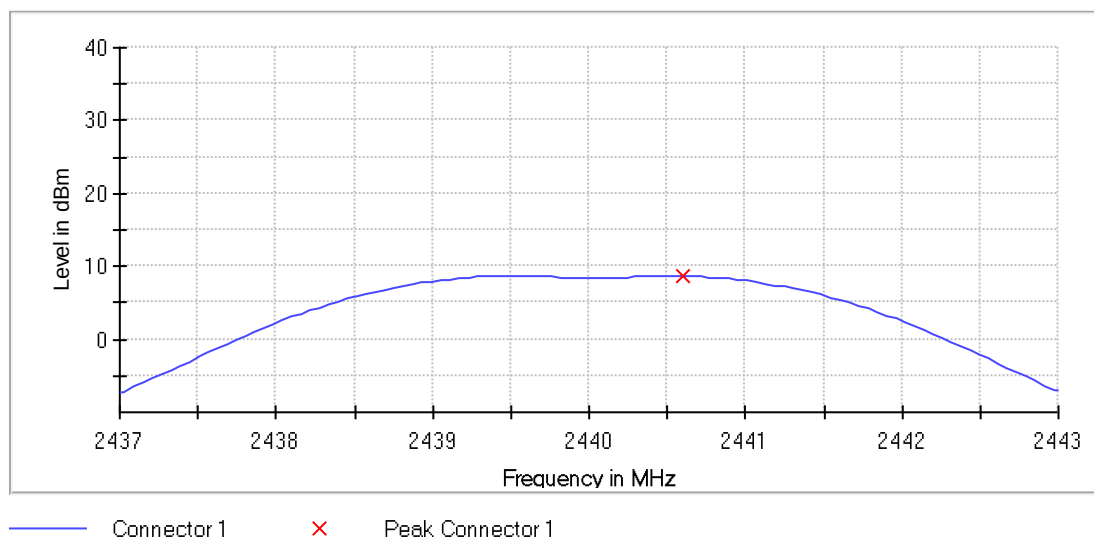
Channel 11

Peak Power



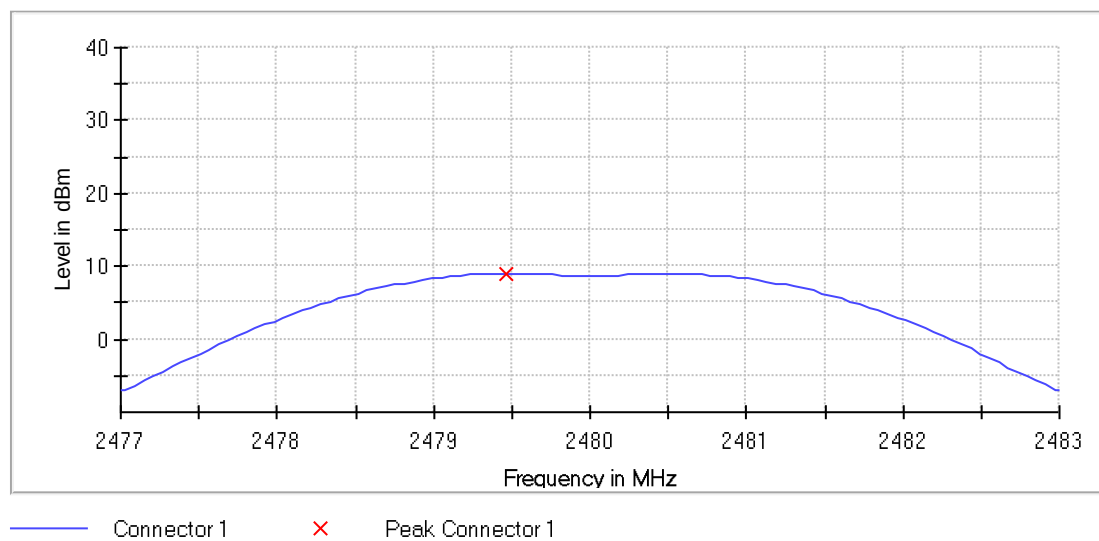
Channel 18

Peak Power



Channel 26

Peak Power



3.5 Power Spectral Density

3.5.1 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.5.2 Measurement instruments

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

3.5.3 Test setup

The test setup is as shown in chapter 2.2.2 of this report.

3.5.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.

IRN 030 - Spectral power density (W per n.Hz) - Method 5 – Peak method PKPSD (PSD in 3 kHz band)

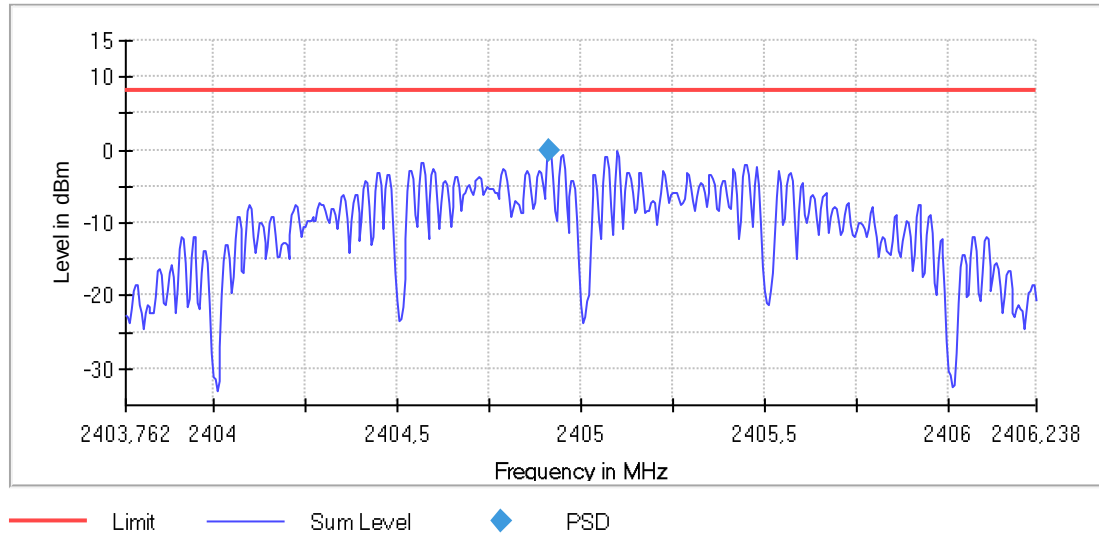
3.5.5 Test results of Power Spectral Density Measurement

Peak Power spectral density				
Technology Std.	Channel	Frequency (MHz)	Data rate	PSD (dBm/3 kHz)
ZigBee	11	2405	250 kbps	0.019
	18	2440	250 kbps	-0.578
	26	2480	250 kbps	-0.187
Uncertainty	±2 dB			

3.5.6 Plots of the power spectral density measurement

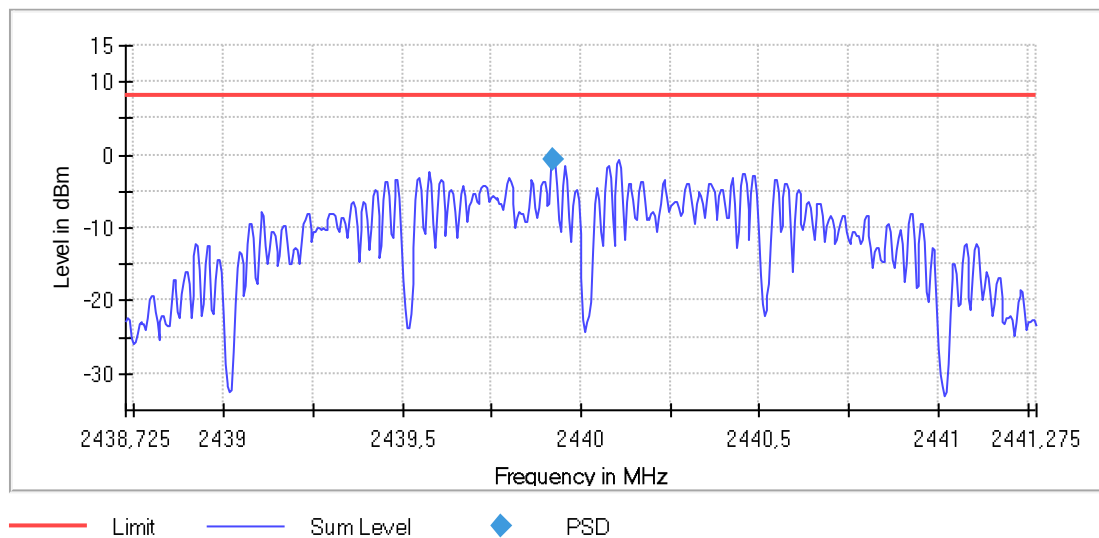
Channel 11

Peak Power Spectral Density



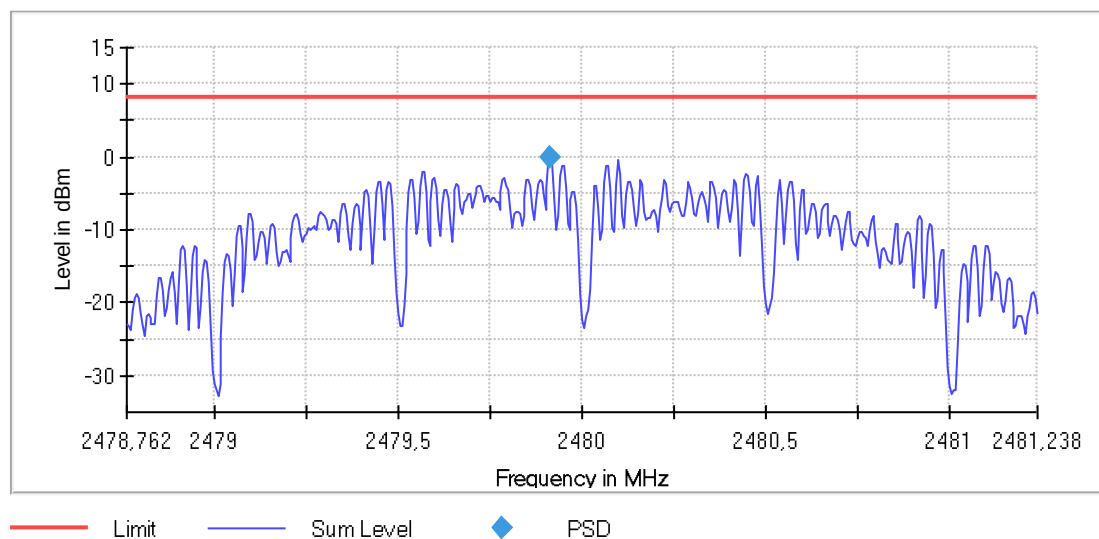
Channel 18

Peak Power Spectral Density



Channel 26

Peak Power Spectral Density



3.6 Band edge Measurement

3.6.1 Limit

Band edge:

At the edge of the authorized band the RF power shall be at least 20 dB down.

3.6.2 Measurement instruments

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

3.6.3 Test setup

The test setup is as shown in chapter 2.2.2 of this report.

3.6.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05, sections 11.3 and 12.1.
IRN 026 - Radiated electrical disturbance (V per m) Method 6 – Radiated electrical disturbance at the Authorized band edge.

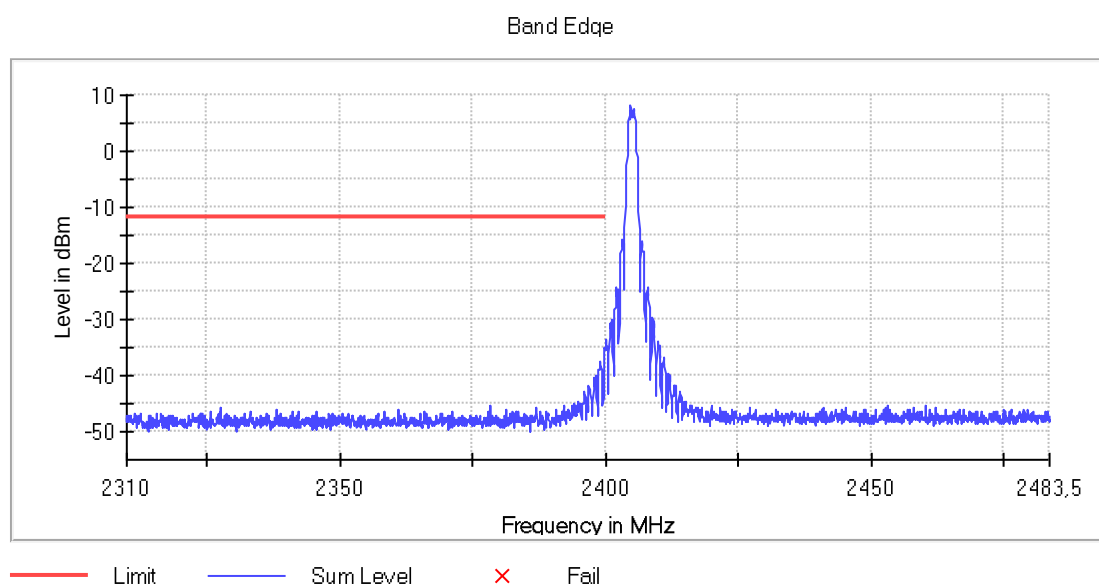
3.6.5 Measurement Uncertainty

± 5.7 dB.

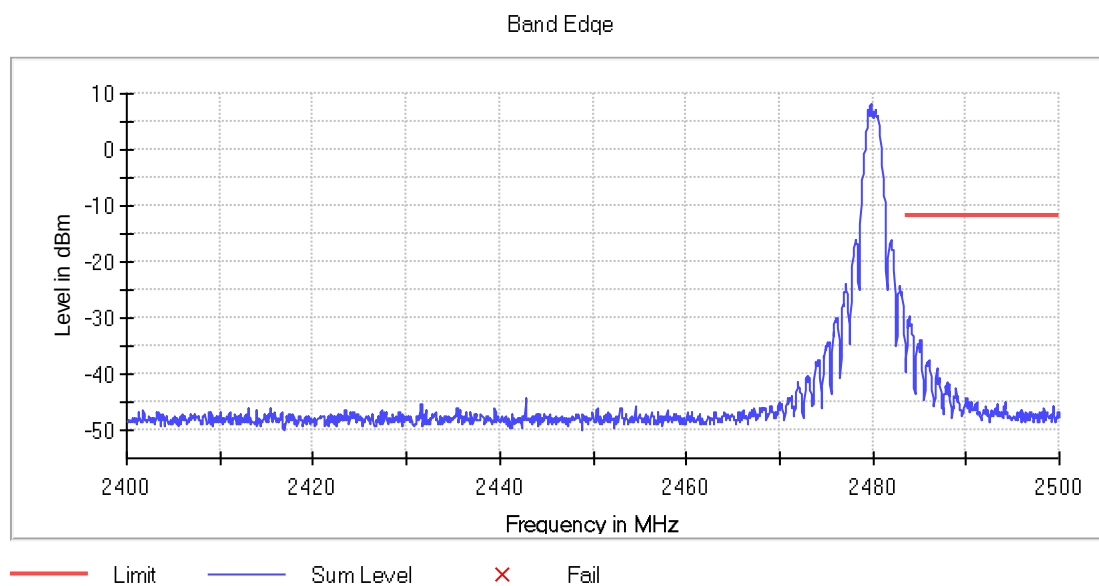
3.6.6 Plots of the Band edge Measurements

See next page

ZigBee Lower band edge (Channel 1)



ZigBee Upper band edge (Channel 39)



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 Rohde & Schwarz ENV216	TE 11134	
0,15	9.6	0,02	9.62
0,3	9.6	0,03	9.63
0,5	9.6	0,08	9.68
0,7	9.7	0,25	9.95
1	9.6	0,11	9.71
3	9.6	0,21	9.81
5	9.6	0,21	9.81
7	9.7	0,25	9.95
10	9.7	0,29	9.99
15	9.7	0,34	10.04
20	9.8	0,37	10.17
22	9.6	0,39	9.99
24	9.6	0,43	10.03
30	9.6	0,45	10.05

Magnetic field strength measurement:

$$H \left[dB \left(\mu \frac{A}{m} \right) \right] = V[dB(\mu V)] + L_c[dB] + AF^H \left[\frac{dB}{\Omega m} \right]$$

Where:

H is the magnetic field strength (to be compared to the limit)

V is the voltage level measured by the receiver or spectrum analyzer

L_c is the cable loss

AF^H is the magnetic antenna factor

Frequency (MHz)	AF (dB/Ωm)	CL (dB)	Corr. (dB)
	114515 EMCO 6505 S/N:9112-2710	SAR cable	
0,009	-32,35	0,7	-31,65
0,01	-33,16	0,05	-33,11
0,02	-37,56	0,07	-37,49
0,03	-39,29	0,1	-39,19
0,04	-40,11	0,1	-40,01
0,1	-41,27	0,1	-41,17
0,2	-41,48	0,1	-41,38
0,5	-41,58	0,1	-41,48
1	-41,62	0,2	-41,42
3	-41,6	0,2	-41,4
5	-41,65	0,3	-41,35
10	-42,11	0,6	-41,51
15	-42,88	0,9	-41,98
20	-43,78	1	-42,78
25	-44,85	0,7	-44,15
27	-45,36	1,2	-44,16
30	-46,25	1	-45,25

< End of Report >