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FCC Test Report for Parts 15.247, 15.209 (DTS)

Product name : Communication Hub

Applicant : Neways Electronics International NV

FCC ID : 2AK2ZHUB1

Test report No. : 161000613 05 Ver2.00

Laboratory information

Accreditation

Telefication 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

The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

Documentation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. 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 L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

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 Telefication Netherlands

Testing Location

Test Site	Telefication BV
Test Site location	Edisonstraat 12a 6902 PK Zevenaar The Netherlands Tel. +31316583180 Fax. +31316583189
Test Site FCC	NL0001

Revision History

Version	Date	Remarks	By
v0.50	22-11-2016	First draft	RvB
v1.00	02-02-2017	Release version	RvB
v2.00	23-02-2017	In section 1.3 changed FCC ID and product name	RvB

Table of Contents

Summary of Test results

FCC	Description	Section in report	Verdict
15.247(a)	6 dB bandwidth	3.1	Pass
15.247(b)(c)	RF output power	3.2	Pass
15.247(e)	Power spectral density	3.3	Pass
--	20 dB Bandwidth	3.4	Pass
15.209 (a)	Radiated Spurious emissions	3.5	Pass
15.205 (a)	Spurious emissions in the restricted bands	3.5	Pass

1 General Description

1.1 Applicant

Client name:	Neways Electronics International NV
Address	Science Park Eindhoven 5010
Zip code:	5692 EA
E-mail:	Tim.van.der.Loo@newayselectronics.com
Contact name:	T. van der Loo

1.2 Manufacturer

Manufacturer name:	SC Industries
Address:	24151 Telegraph Road, Suite 100, Southfield, USA
E-mail:	sdc@lifeear.com
Contact name:	Sreenivas Cherukuri

1.3 Tested Equipment Under Test (EUT)

Product name:	Communication Hub
Brand name:	LifeEar
Product type:	Communication Hub between hearing aid and Smartphone
FCC ID:	2AK2ZHUB1
Model(s):	HUB-1
Software version:	V1.0
Hardware version:	V4
Date of receipt	04-11-2016
Tests started:	04-11-2016
Testing ended:	22-11-2016

1.4 Product specifications of Equipment under test

Tx Frequency range (MHz):	Bluetooth BR/EDR/LE: 2402 - 2480 NFMI: 10.579
Rx frequency range (MHz):	Bluetooth BR/EDR/LE: 2402 - 2480 NFMI: 10.579
Maximum output power to antenna:	Bluetooth BR/EDR/LE: -- NFMI: 7.37 mV
Antenna type :	Bluetooth BR/EDR/LE: Ceramic antenna NFMI: Loop antenna
Antenna gain(dBi):	Bluetooth BR/EDR/LE: 0 dBi NFMI:--
Type of modulation:	Bluetooth BR/EDR: GFSK, π/4-DQPSK, 8-DPSK Bluetooth LE: GFSK NFMI:CP-FSK
Channel Spacing (MHz):	Bluetooth BR/EDR:1 Bluetooth LE: 2
Emission designator Bluetooth BR :	998KG7D
Emission designator Bluetooth EDR:	1M12G7D
Emission designator Bluetooth BLE:	700kG1D
Emission designator NFMI:	570KX1X

1.5 Modification of the Equipment Under Test (EUT)

None.

1.6 Observations and remarks

The EUT Contains 2 radios, 1 Bluetooth radio with FCC ID: SSSBC127-X . and a NFMI radio operating at 10.579 MHz. During testing both radios were active.

The EUT has a USB port which used for charging the lithium-ion battery only, the data lines are not connected.

The Bluetooth test results can be found in test report 161000613 03.

1.7 Environmental conditions

Test date	04-11-2016	21-11-2016	22-11-016
Ambient temperature	23.8°C	26.7°C	22.7°C
Humidity	43.5%	48.1%	38.3%

1.8 Measurement Standards

- FCC KDB Publication No. 558074 D01DTS Meas. Guidance V03r05
- ANSI C63.10:2013

1.9 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 §15.247, §15.209

1.10 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.9 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 1.9 *"Applicable standards".*

All tests are performed by:

Name : ing R. van Barneveld

Review of test methods and report by:

Name : ing P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 02-03-2017

Name : ing K.A. Roes

Function : Coordinator Radio laboratory

Signature :

2 Test configuration of the Equipment Under Test

2.1 Test mode

The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT into different test channels.

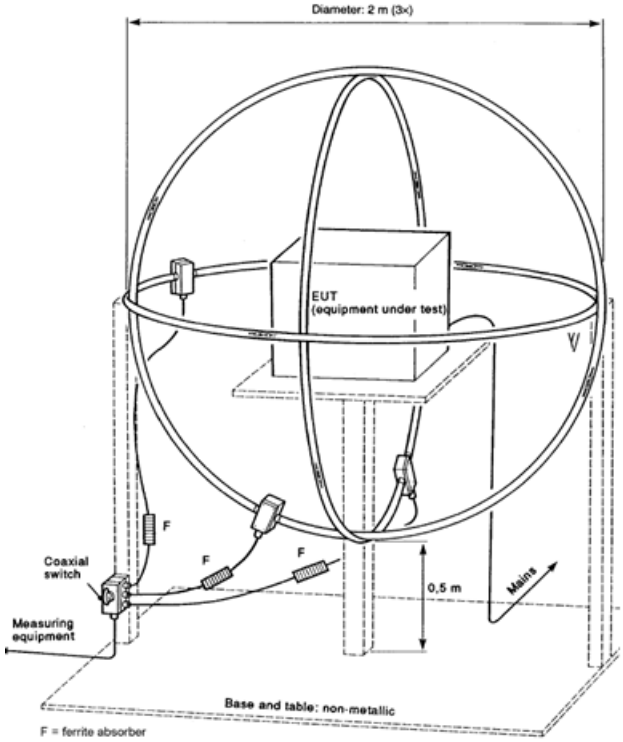
The USB data line were connected to program the different setting in the EUT.

2.2 Tested channels and Data rates

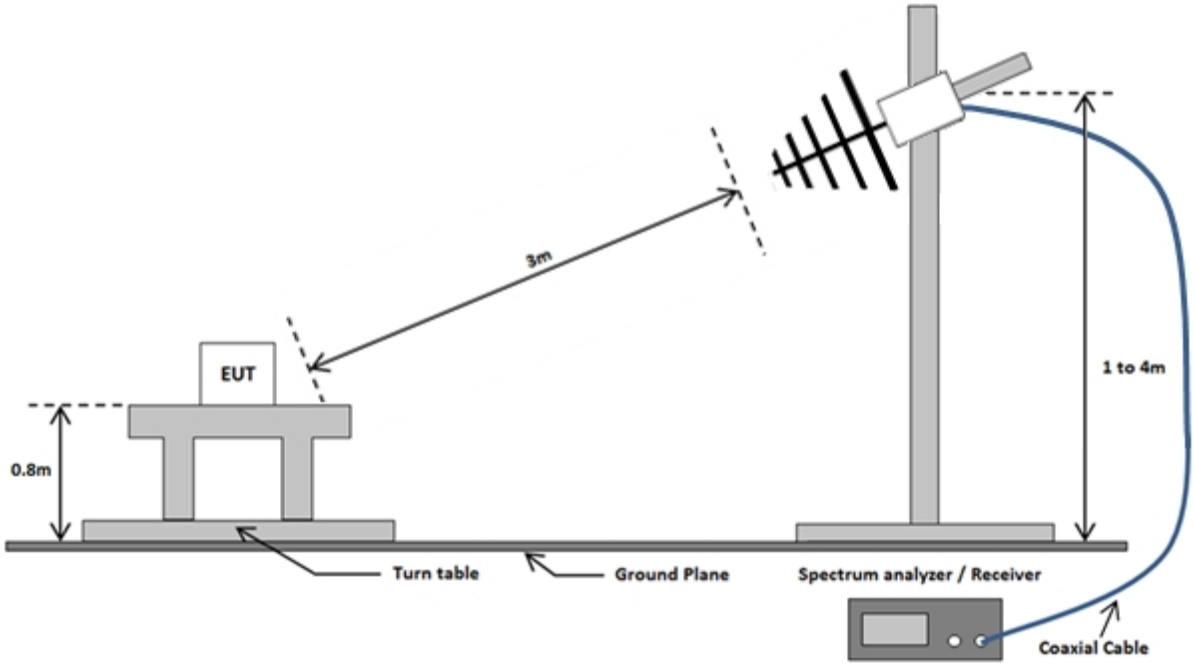
Technology	Channels	Packet type	Data rate	Frequency (MHz)
Bluetooth Low Energy	37	--	1 Mbps	2402
	17	--	1 Mbps	2440
	39	--	1 Mbps	2480
NFMI	--	--	259 kB/s	10.579

2.3 Radiated Test setup

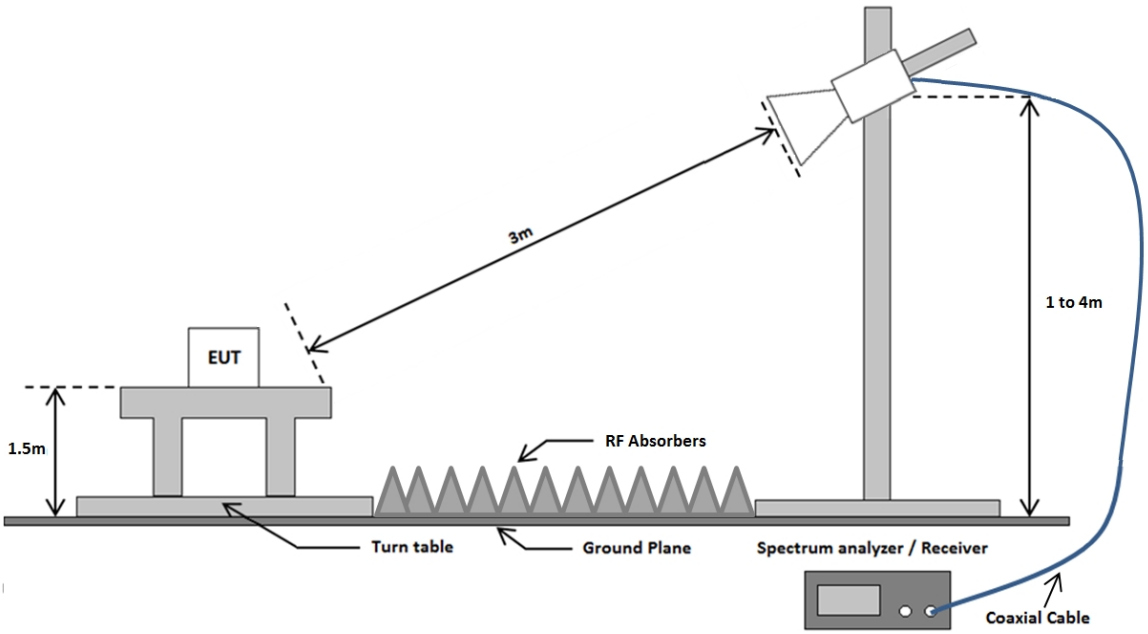
Radiated emissions test setup 9 kHz - 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.4 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Signal Generator	Hewlett Packard	83650B	TE00487	3.1, 3.4
Spectrum Analyzer	Rohde & Schwarz	FSV	TE01269	3.1, 3.4
Spectrum Analyzer	Rohde & Schwarz	FSP40	TE11125	3.5
Spectrum Analyzer	Rohde & Schwarz	ESR7	TE01220	3.5
10 MHz distribution Amplifier	Stanford Research Systems	FS735/1	TE01278	3.1, 3.4
USB to GPIB adapter	National Instruments	GPIB-USB-HS+	TE01283	3.1, 3.4
Biconilog Antenna	Chase	CBL6112A	TE00967	3.5
Horn Antenna	EMCO The Electro – Mechanics Co	3115	TE00531	3.2,3.3,3.5
SAC Chamber	Comtest Engineering BV	-	TE00861	3.2,3.3,3.5
High pass filter	Wainwright instruments	WHK3.0/18G-10EF	TE01140	3.5
Pre-amplifier	Miteq	JF4-18004000-30-8P-A1	TE11131	3.2,3.3,3.5

2.5 Sample calculations

Field Strength Calculation using example values:

Frequency (GHz)	Polarization	Height(m)	Peak (dBµV/m)
4.959	Vertical	3	51.8

The following relation applies:

E (dBµV/m) = U(dBµV) + AF (dB/m) – G (dB) + CL (dB)

Where:

E = Electric field strength
U = Measuring reveiver voltage
AF = Antenna factor
G = Gain of the pre-amplifier
CL = Cable loss

(51.8 = 52.49 + 33.1 - 38.19 + 4.4)

3 Test results

3.1 6dB bandwidth Measurement

3.1.1 Limit

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

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.4 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.1.4 Test procedure

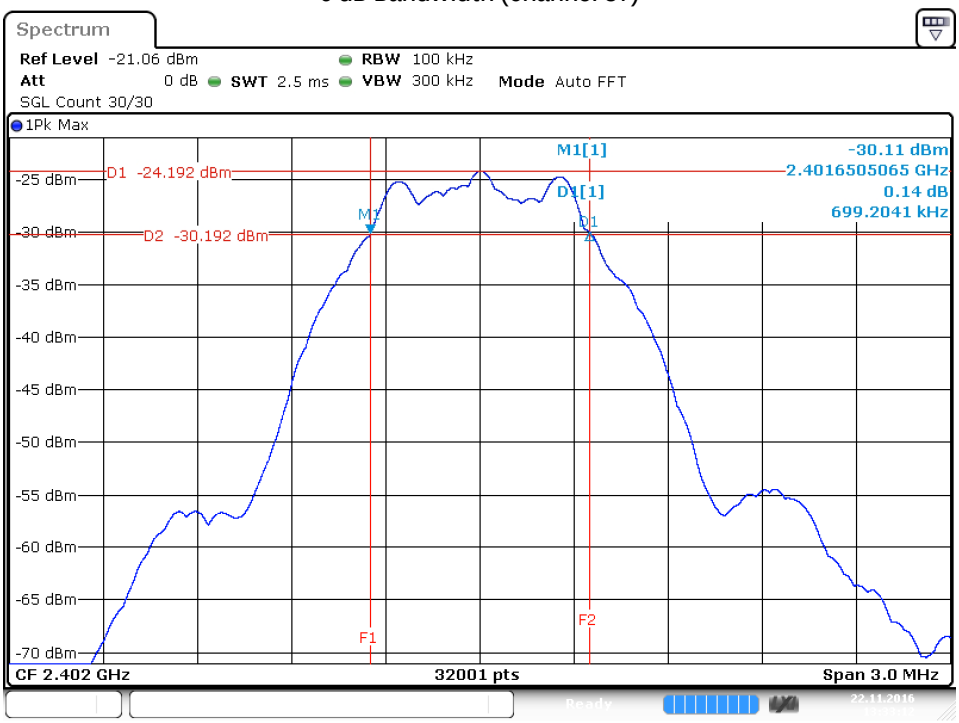
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

3.1.5 Test Results of the 6 dB bandwidth Measurement

Technology Std.	Channel	Frequency (MHz)	Data rate	6dB bandwidth (kHz)
Bluetooth Low Energy	37	2402	--	699.20
	17	2440	--	700.94
	39	2480	--	691.39
Uncertainty	±707 kHz			

3.1.6 Plots of the 6 dB bandwidth Measurement

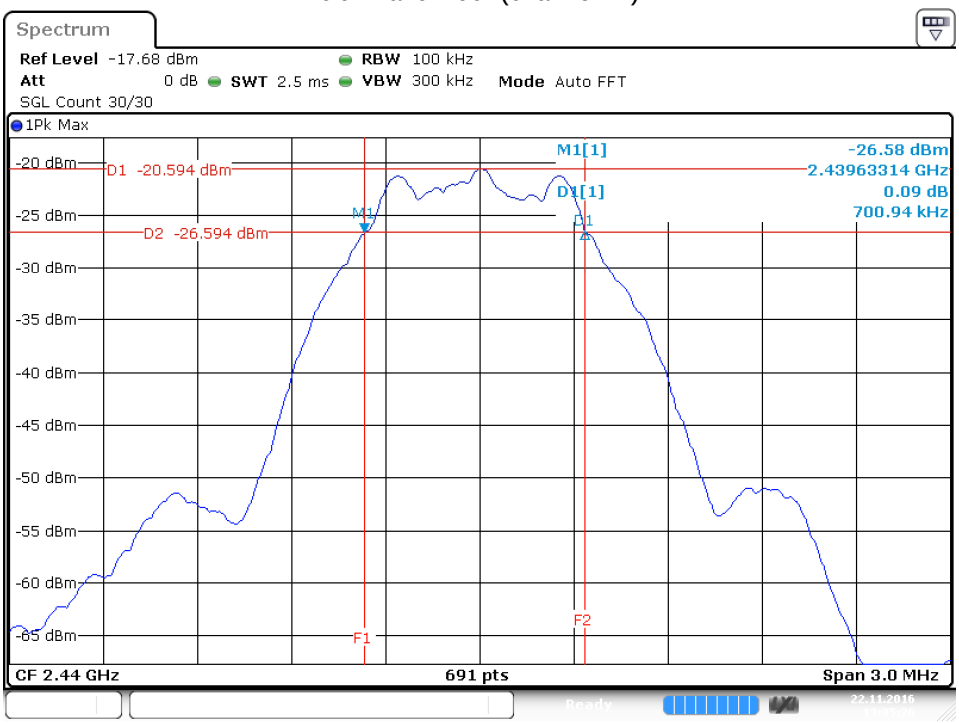
6 dB Bandwidth (Channel 37)



Ble, channel: 0 : 6 dB BW Measurement

Date: 22.NOV.2016 13:33:12

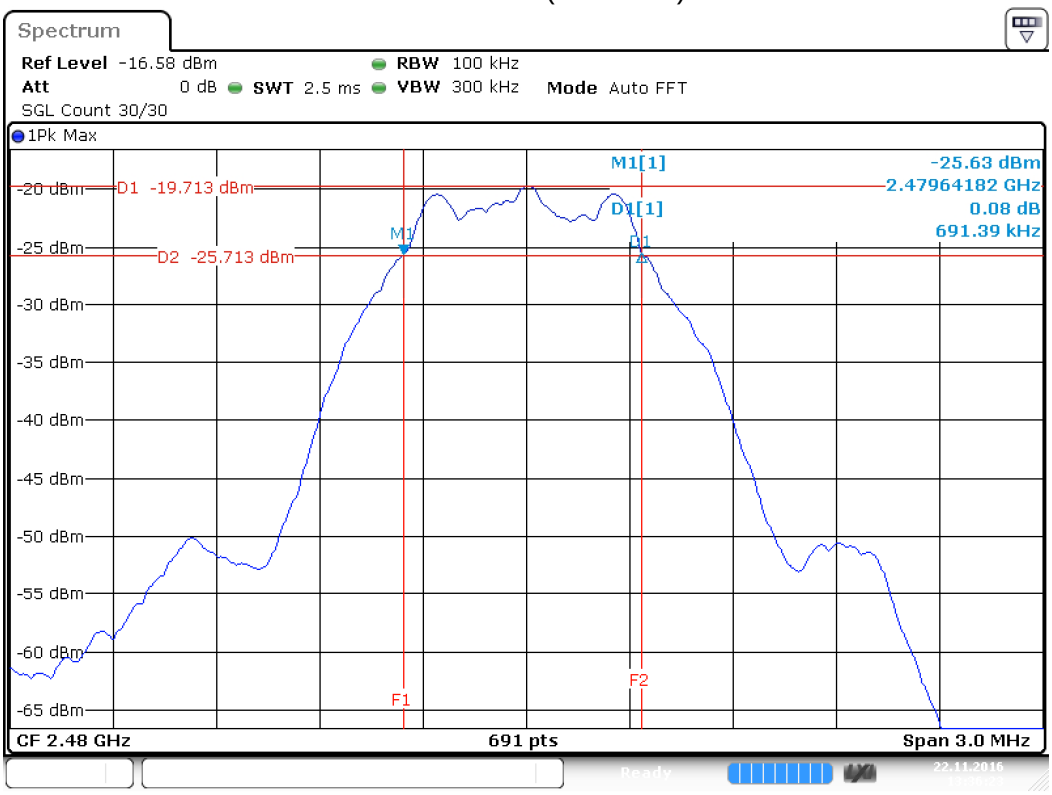
6 dB Bandwidth (Channel 17)



Ble, channel: 19 : 6 dB BW Measurement

Date: 22.NOV.2016 13:35:26

6 dB Bandwidth (Channel 39)



Ble, channel: 39 : 6 dB BW Measurement

Date: 22.NOV.2016 13:36:23

3.2 Output Power Measurement

3.2.1 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.

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.4 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.2.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

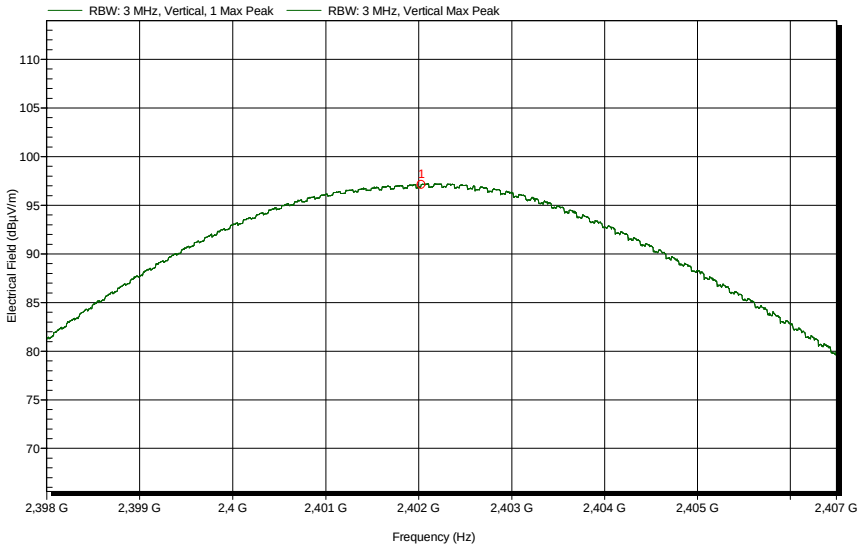
3.2.5 Test results of Output Power Measurement

Peak method

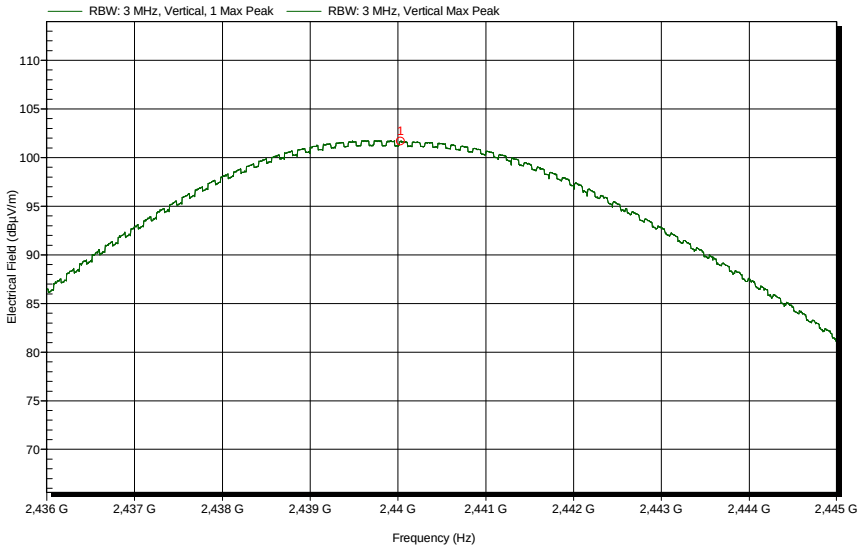
Technology Std.	Channels	Frequency (MHz)	Data rate	Peak output power (dBm)
Bluetooth Low Energy	37	2402	--	1.9
	17	2440	--	6.5
	39	2480	--	7.1
Uncertainty	±1.78 dB			

3.2.6 Plots of Peak Output Power Measurement

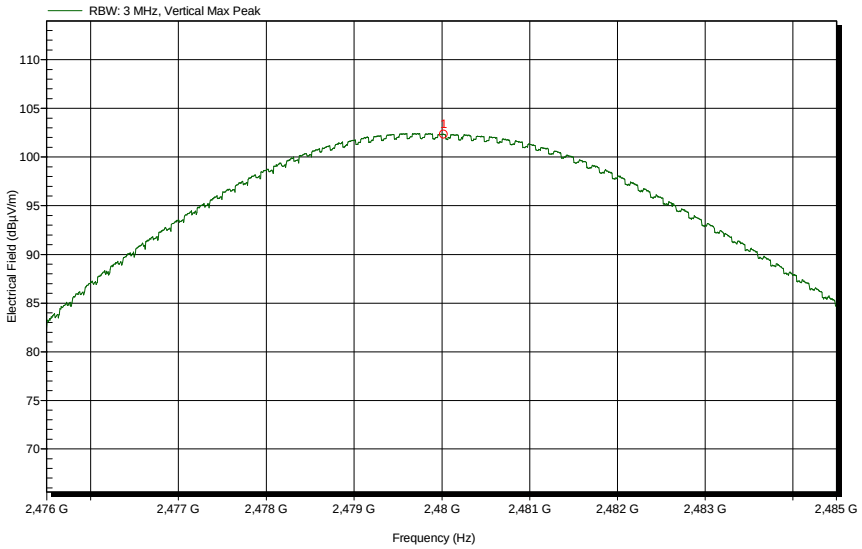
Peak Output Power (Channel 37)



Peak Output Power (Channel 17)



Peak Output Power (Channel 39)



3.3 Power Spectral Density

3.3.1 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.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.4 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.3.4 Test procedure

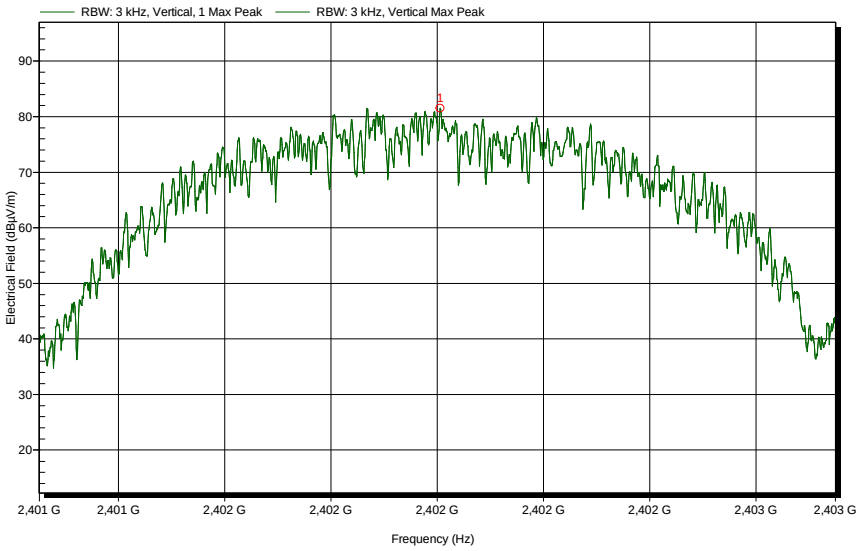
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

3.3.5 Test results of Power Spectral Density Measurement

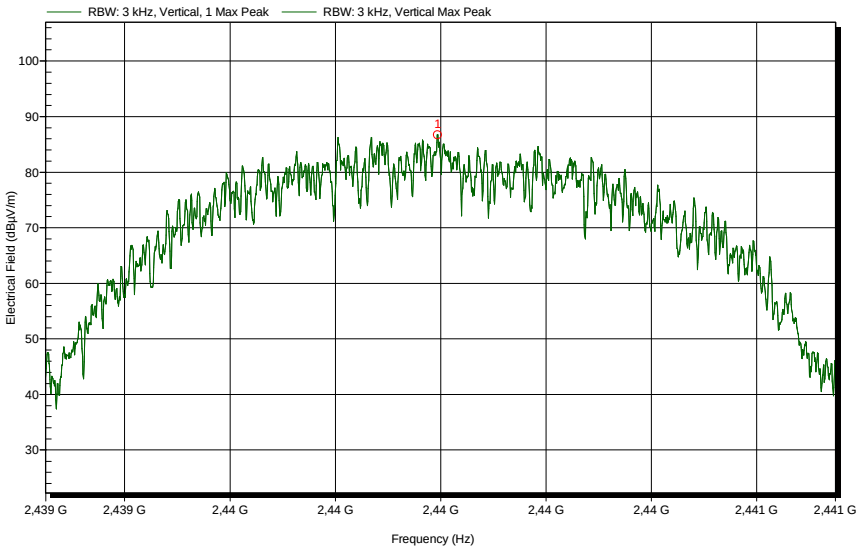
Technology Std.	Channels	Frequency (MHz)	Data rate	PSD/3 kHz (dBm)
Bluetooth Low Energy	37	2402	--	-13.7
	17	2440	--	-8.5
	39	2480	--	-8.6
Uncertainty	±0.63 dB			

3.3.6 Plots of the Power Spectral Density Measurements

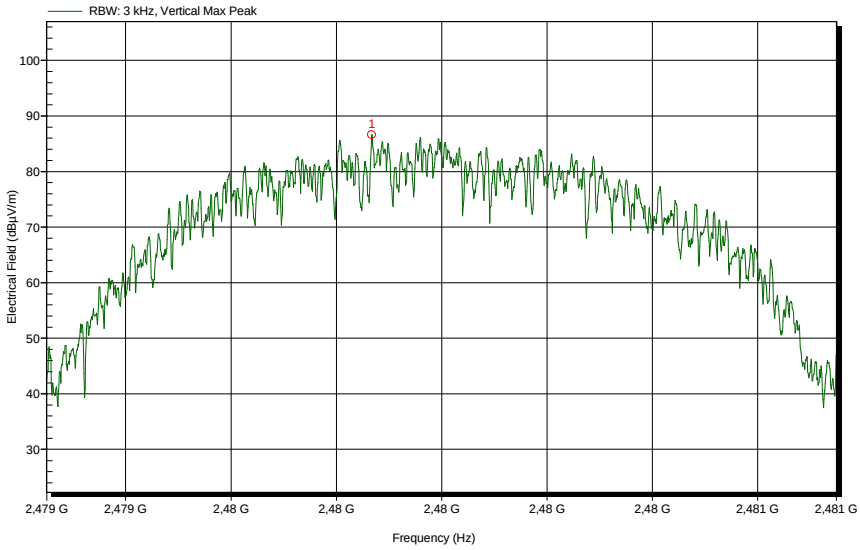
Power Spectral Density 3 kHz (channel 37)



Power Spectral Density 3 kHz (channel 17)



Power Spectral Density 3 kHz (channel 39)



3.4 20 dB bandwidth Measurement

3.4.1 Limit

Reporting only

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.4 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.4.4 Test procedure

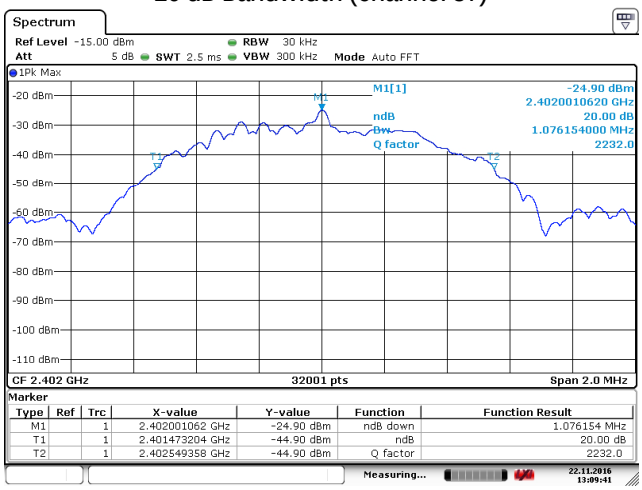
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

3.4.5 Test Results of the 20 dB bandwidth Measurement

Technology Std.	Channel	Frequency (MHz)	Data rate	20 dB bandwidth (MHz)
Bluetooth Low Energy	37	2402	--	1.076
	17	2440	--	1.078
	39	2480	--	1.078
Uncertainty	±707 kHz			

3.4.6 Plots of the 20 dB bandwidth Measurement

20 dB Bandwidth (Channel 37)



Band edge

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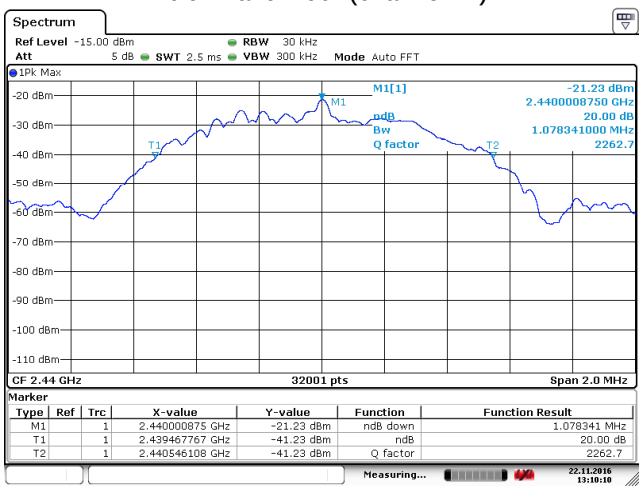
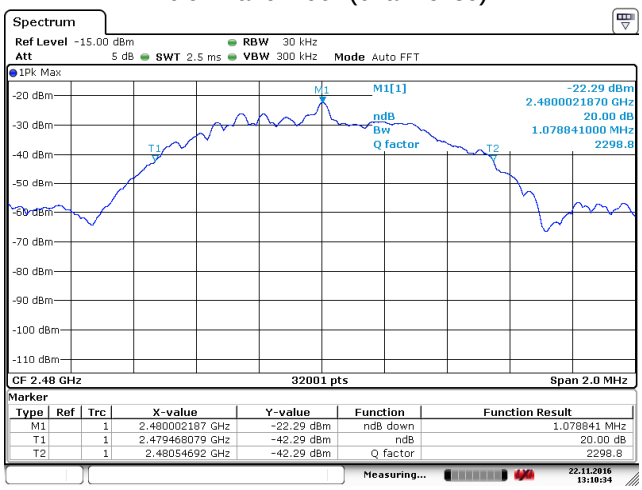
20 dB Bandwidth (Channel 17)



Band edge

Date: 22.NOV.2016 13:10:10

20 dB Bandwidth (Channel 39)



Band edge

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3.5 Radiated Spurious Emissions Measurement

3.5.1 Limit

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

15.209

Frequency (MHz)	Field strength (µV/m)	Measurement distance(m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 - 30	30	30
30 -88	100	3
88 - 216	150	3
216-960	200	3
Above 960	500	3

3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.4 of this report.

3.5.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.5.4 Test procedure

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz.
Radiated emission limits in these three bands are based on measurements employing an average detector.

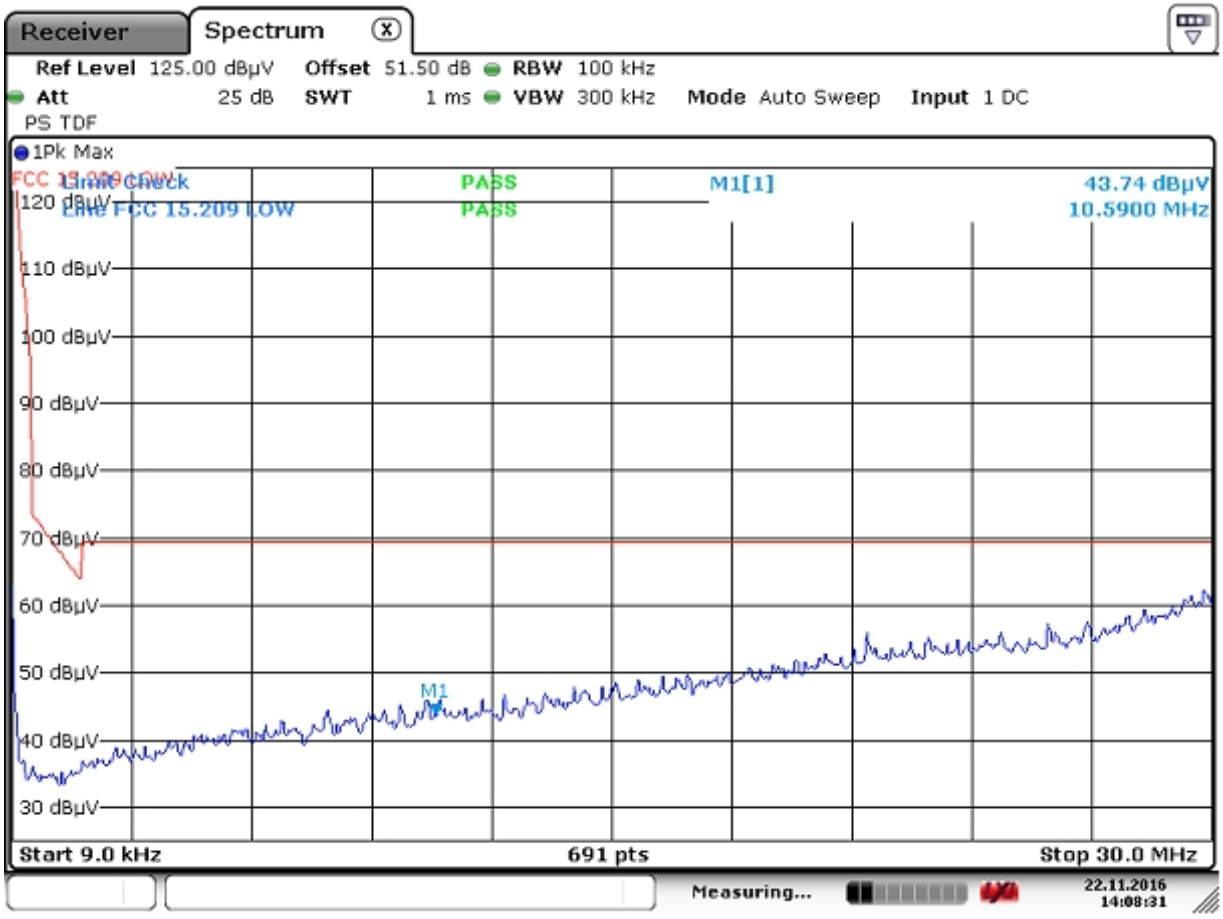
Other details are according to KDB Publication 558074 V02r05, sections 11.3 and 12.1

3.5.5 Notes

- In the frequency range of 1 - 2.3 GHz and 1 – 18 GHz the green trace is measured using a peak detector and the red trace is measured using an average detector. The top limit line represent the peak limit and the bottom limit represents the average limit

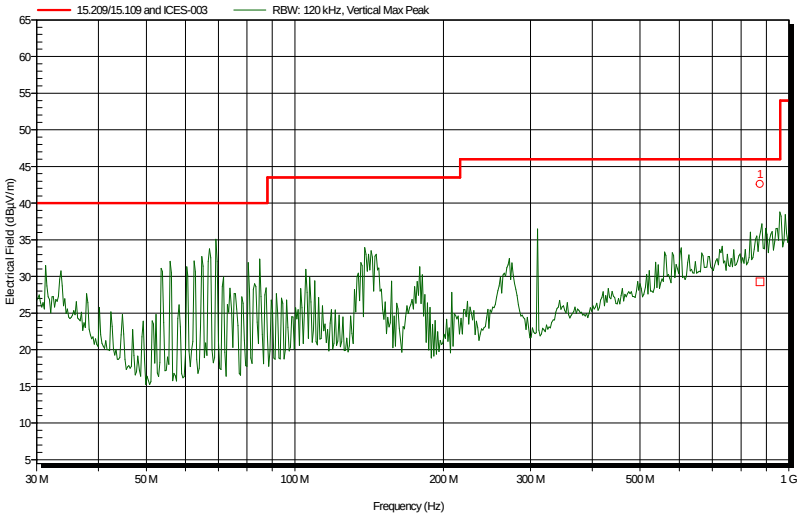
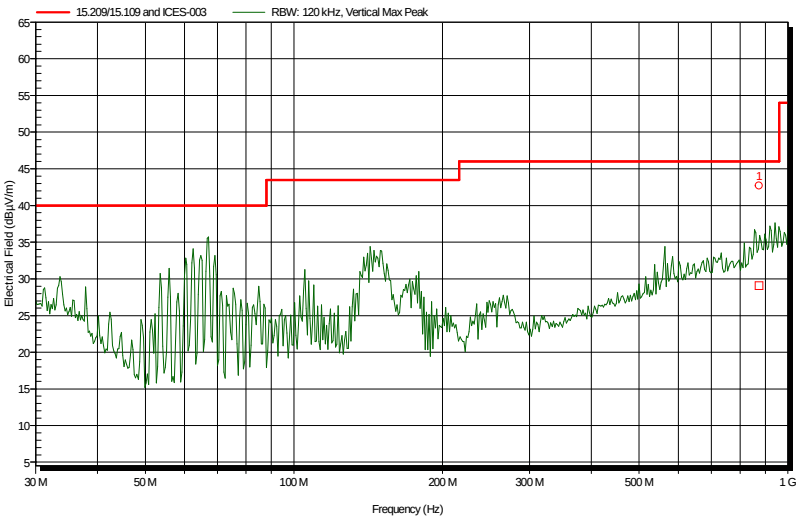
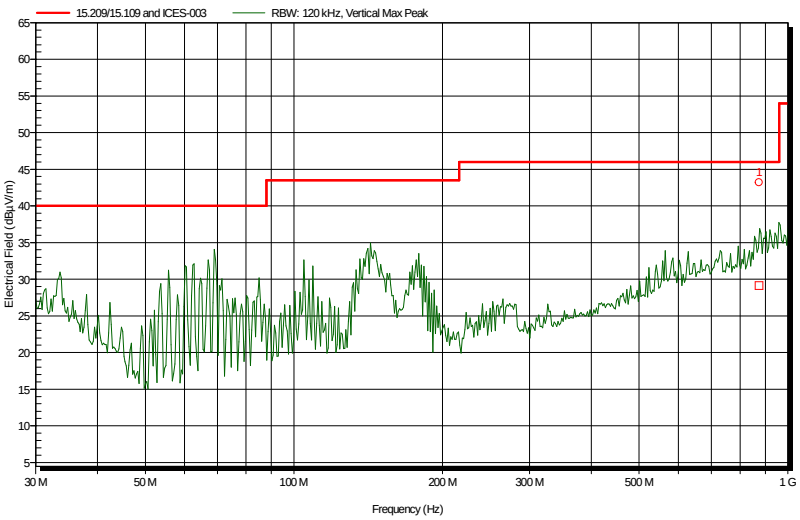
3.5.6 Plots of the Radiated Spurious Emissions Measurement

9 kHz – 30 MHz



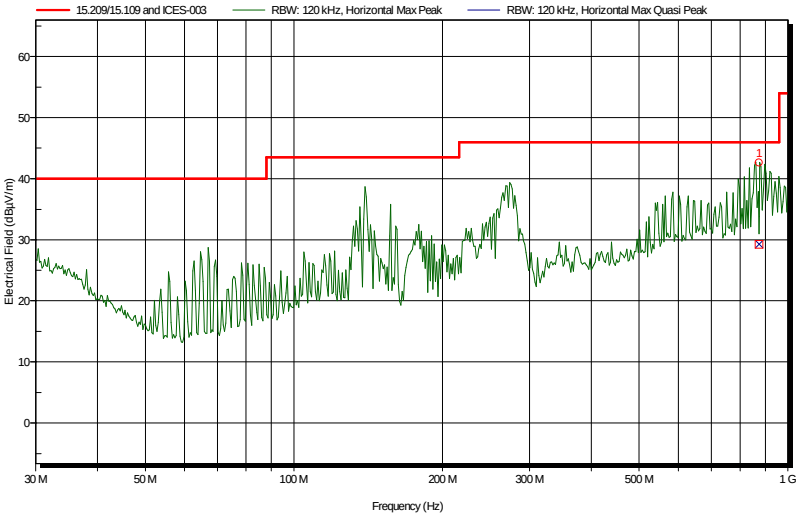
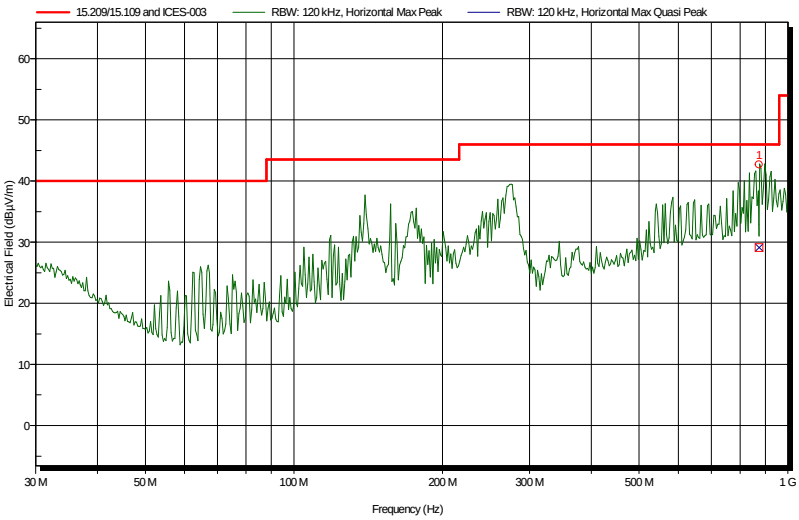
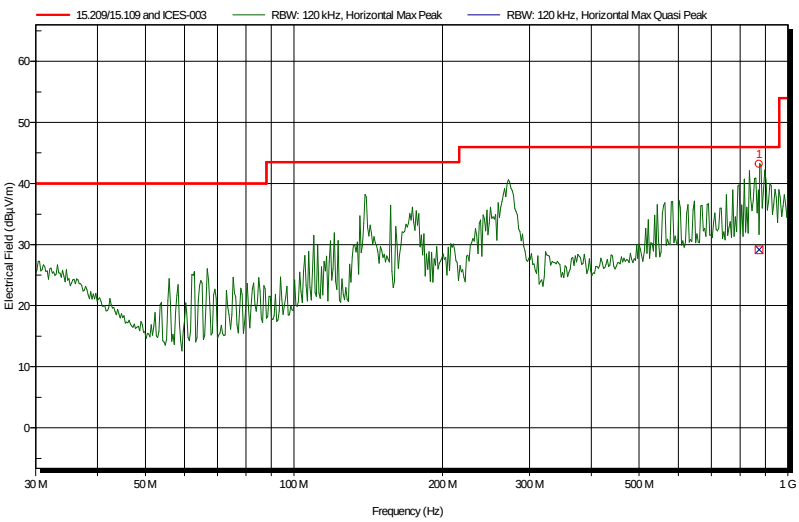
30 – 1000 MHz

Vertical polarization

Low ch	
Mid ch	
High ch	

30 MHz to 1 GHz

Horizontal polarization

Low ch	
Mid ch	
High ch	

Measured peaks 30 – 1000 MHz Low channel

Frequency (MHz)	Polarization	Height (m)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)
874,92	Horizontal	1	29,3	46	-16,7

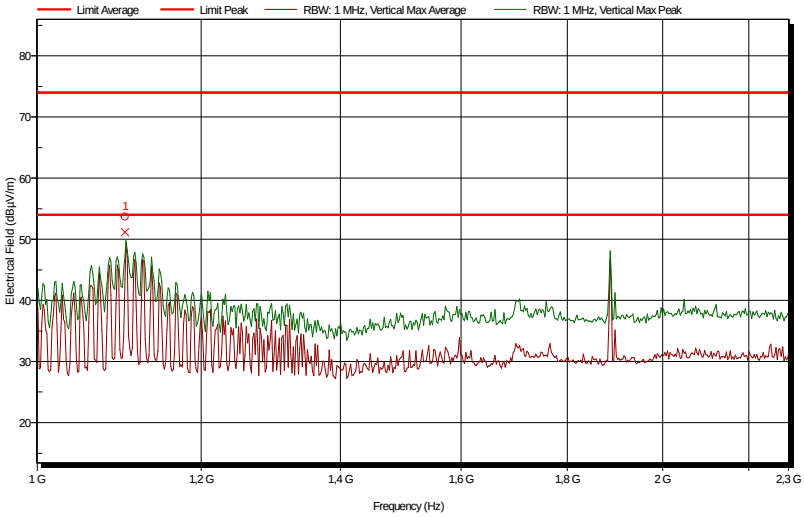
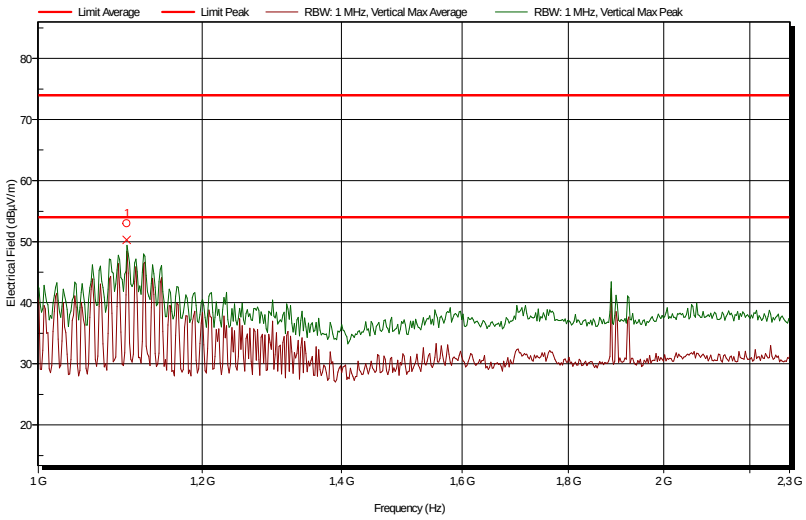
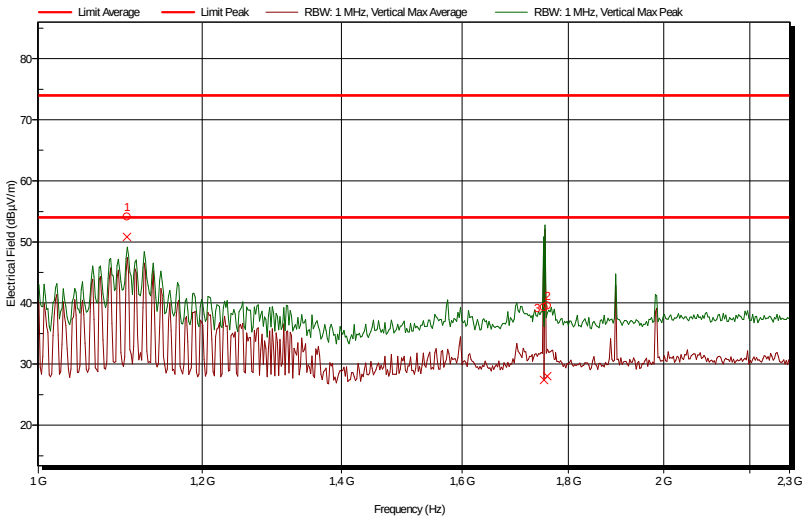
Measured peaks 30 – 1000 MHz Middle channel

Frequency (MHz)	Polarization	Height (m)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)
874,74	Horizontal	1	29,1	46	-16,9

Measured peaks 30 – 1000 MHz High channel

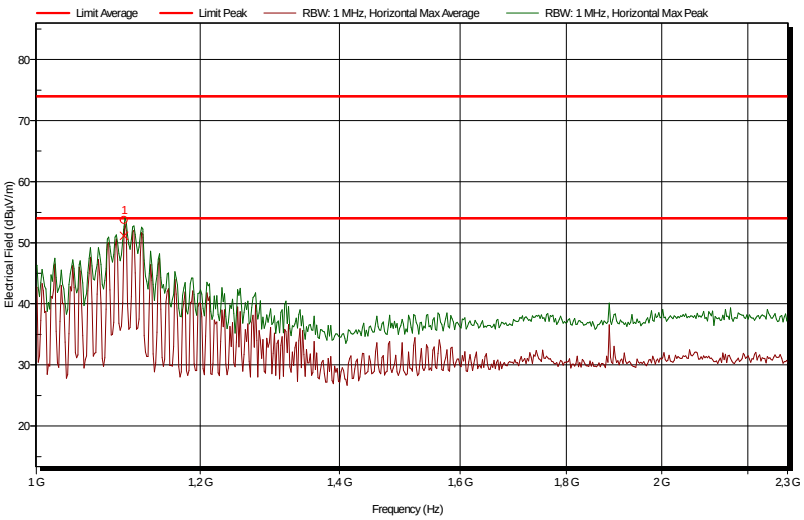
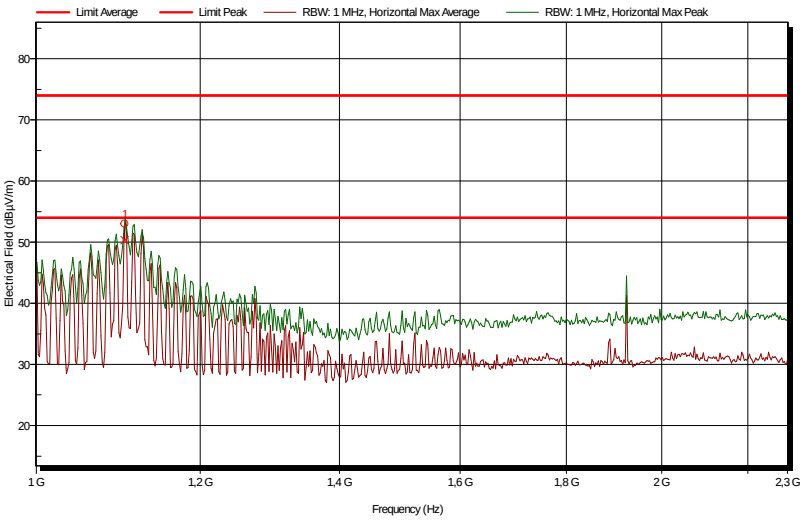
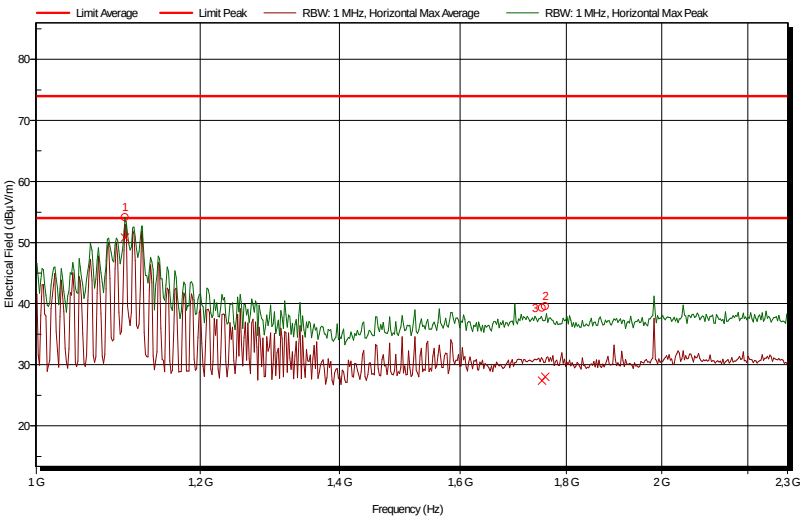
Frequency (MHz)	Polarization	Height (m)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)
874,92	Horizontal	1	29,1	46	-16,9

1 – 2.3 GHz Vertical polarization

Low ch	
Mid ch	
High ch	

1 GHz to 2,3 GHz

Horizontal polarization

Low ch	
Mid ch	
High ch	

Measured peaks 1 – 2.3 GHz Low channel

Frequency (GHz)	Polarization	Height (m)	Peak (dBµV/m)	Average (dBµV/m)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Margin (dB)	Average Margin (dB)
1,103	Horizontal	1,5	53,7	51,2	74	54	-20,3	-2,8

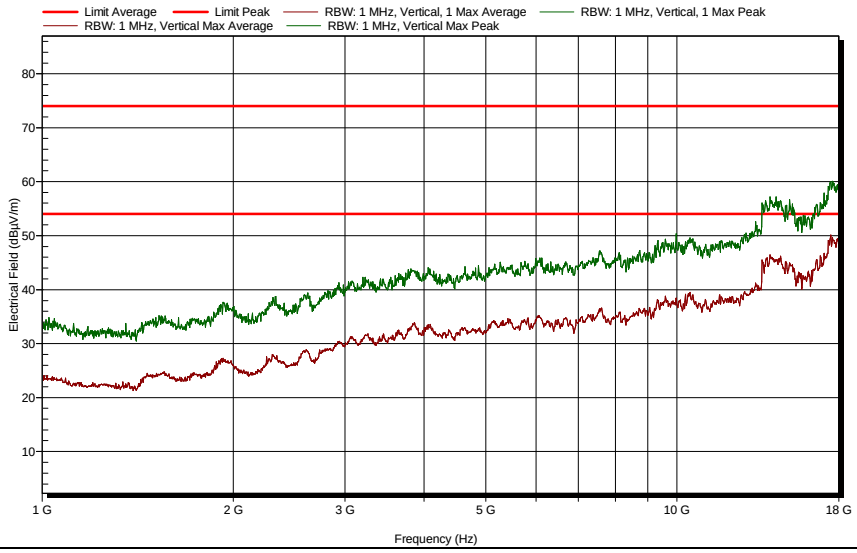
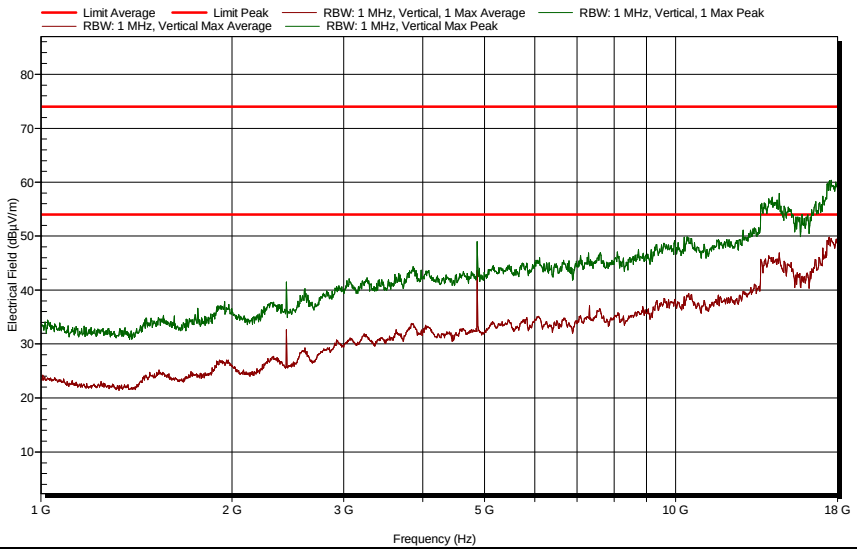
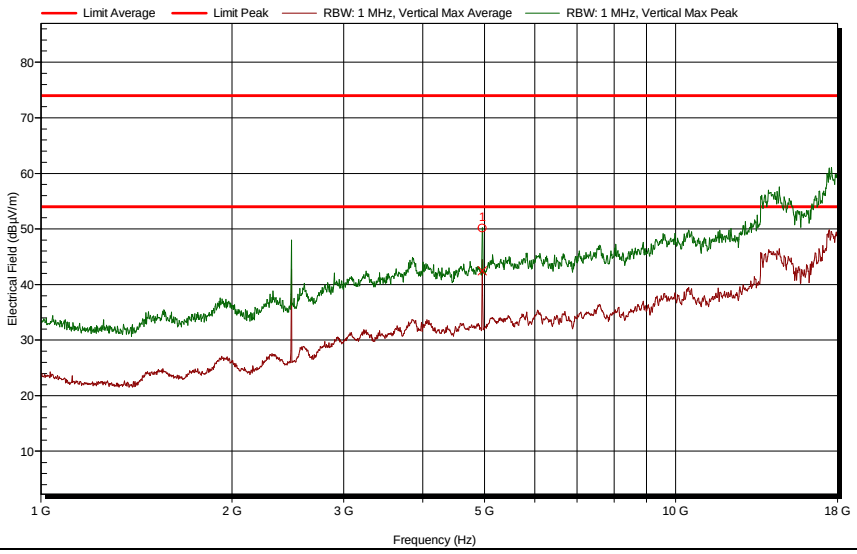
Measured peaks 1 – 2.3 GHz Middle channel

Frequency (GHz)	Polarization	Height (m)	Peak (dBµV/m)	Average (dBµV/m)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Margin (dB)	Average Margin (dB)
1,104	Horizontal	1,5	53	50,3	74	54	-21,0	-3,7

Measured peaks 1 – 2.3 GHz High channel

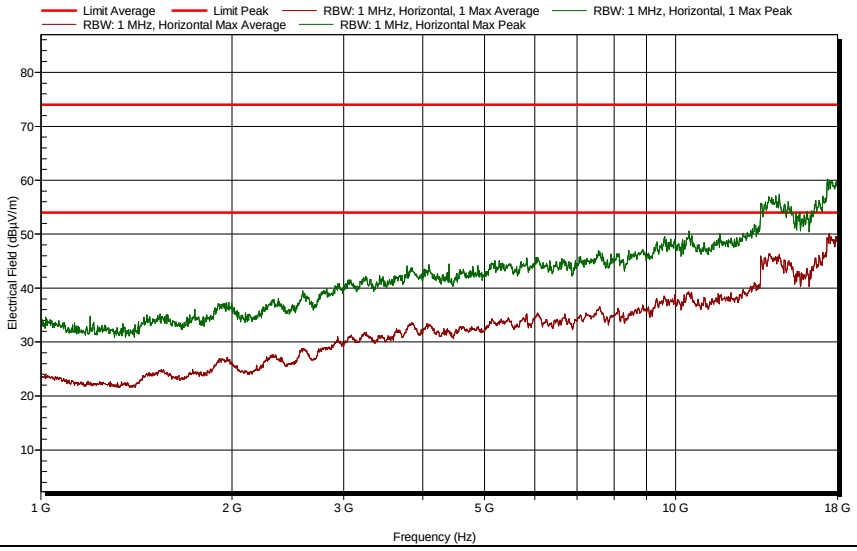
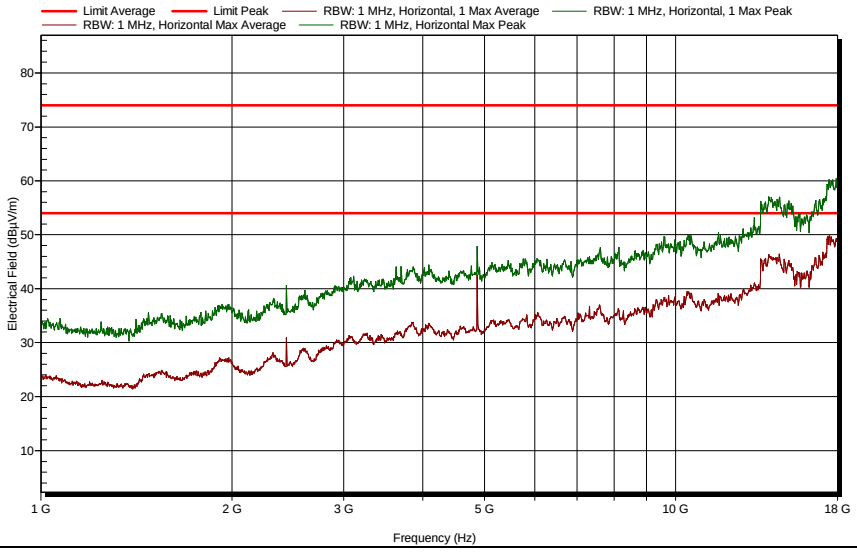
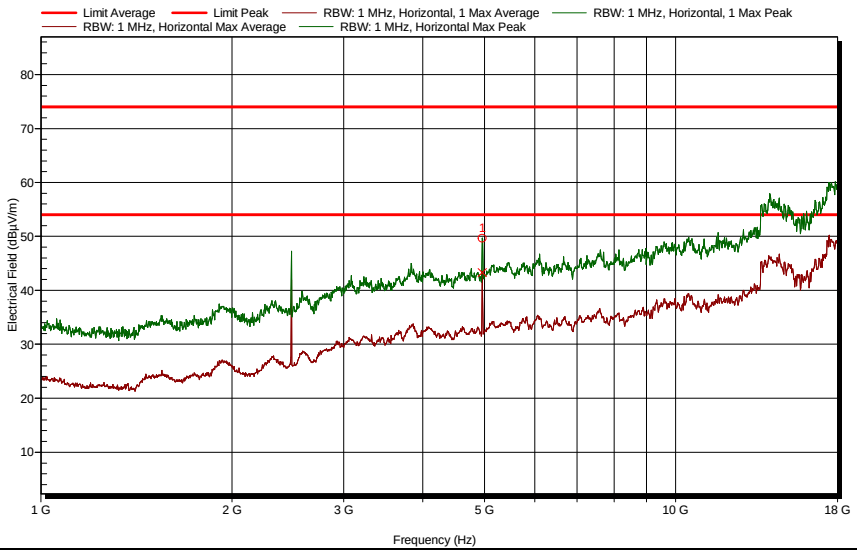
Frequency (GHz)	Polarization	Height (m)	Peak (dBµV/m)	Average (dBµV/m)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Margin (dB)	Average Margin (dB)
1,104z	Horizontal	1,5	54,1	50,8	74	54	-19,9	-3,2
1,758	Vertical	1	39,6	28	74	54	-34,4	-26,0
1,752	Vertical	1	39,3	27,4	74	54	-34,7	-26,6

Vertical polarization

Low ch	
Mid ch	
High ch	

1 GHz to 18 GHz

Horizontal polarization

Low ch	
Mid ch	
High ch	

Measured peaks Horizontal 1 – 18 GHz High channel

Frequency (MHz)	Polarization	Height (m)	Peak (dBµV/m)	Average (dBµV/m)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Margin (dB)	Average Margin (dB)
4,959	Horizontal	4	49,7	43,3	74	54	-24,3	-10,7

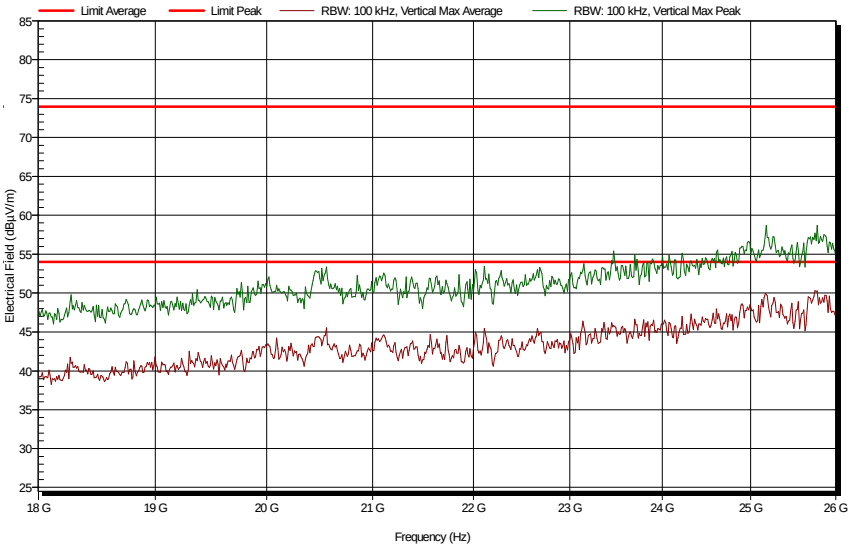
Measured peaks Vertical 1 – 18 GHz High channel

Frequency (MHz)	Polarization	Height (m)	Peak (dBµV/m)	Average (dBµV/m)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Margin (dB)	Average Margin (dB)
4,959	Vertical	4	50,2	42,5	74	54	-23,8	-11,5

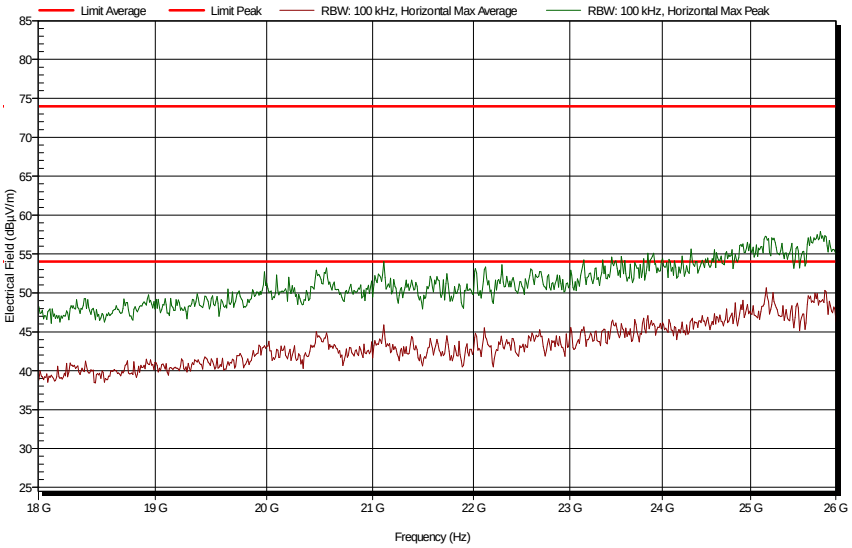
18 GHz to 26.5 GHz

A Radiated pre-scan was performed to see if any emission are found in the frequency range from 18 to 26.5 GHz.

Vertical polarization, Bluetooth EDR, 3-DH5



Horizontal polarization, Bluetooth EDR, 3-DH5



3.5.7 Measurement Uncertainty

Measurement uncertainty Radiated emissions below 1 GHz

Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

Measurement uncertainty Radiated emissions above 1 GHz

1000- 18000 MHZ	+ 5.7/- 5.7dB