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The Netherlands
Chamber of Commerce
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FCC Test report for parts 15.207, 15.209, 15.223, 15.247

Product name : TR2 transponder

Applicant : MYLAPS B.V.

FCC ID : NXY-TR2

Test report No. : 190800855 001 Ver 1.0

Laboratory information

Accreditation

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).

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Telefication is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.
The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

Telefication 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 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
v0.5	31-10-2019	First draft	PvW
v1.0	18-11-2019	Final version	PvW

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Summary of Test results

FCC	Description	Section in report	Verdict
15.223	Field strength of emissions	3.1	Pass
15.247(d) 15.223 15.209 (a)	Radiated spurious emissions	3.2	Pass
15.205 (a)	Spurious emissions in the restricted bands	3.2	Pass
15.247 (a)	6 dB bandwidth	3.3	Pass
15.247 (b)	RF output power	3.4	Pass
15.247 (e)	Power spectral density	3.5	Pass
15.247 (d)	Band edge	3.6	Pass
15.207 (c)	Conducted spurious emissions on AC mains	3.7	Pass

1 General Description

1.1 Applicant

Client name:	MYLAPS B.V.
Address	Zuiderhoutlaan 4, Haarlem, the Netherlands
Zip code:	2012 PJ
Telephone:	+31 (0)237 600100
E-mail:	John.verwoerd@mylaps.com
Contact name:	John Verwoerd

1.2 Manufacturer

Manufacturer name:	MYLAPS B.V.
Address:	Zuiderhoutlaan 4, Haarlem, the Netherlands
Zip code:	2012 PJ
Telephone:	+31 (0)237 600100
E-mail:	John.verwoerd@mylaps.com
Contact name:	John Verwoerd

1.3 Tested Equipment Under Test (EUT)

Product name:	TR2 transponder
Brand name:	MYLAPS
FCC ID:	NXY-TR2
Product type:	TR2 transponder
Model(s):	Car/Bike Kart MX
Batch and/or serial No.	--
Software version:	1.0.0
Hardware version:	8
Date of receipt:	07-10-2019
Tests started:	07-10-2019
Testing ended:	07-10-2019

1.4 Product specifications of Equipment under test

Tx Frequency:	3.59 MHz BLE: 2400 – 2483.5 MHz
Rx frequency:	3.59 MHz BLE: 2400 – 2483.5 MHz
Antenna type and gain	3.59 MHz: Inductive loop antenna BLE: Ceramic chip antenna (+0.5 dBi)
Type of modulation:	3.59 MHz: BPSK BLE: GFSK
Emission designator	3.59 MHz: 346KK1D BLE: 1M05G1D

1.5 Environmental conditions

Test date	07-08-2019
Ambient temperature	20.4
Humidity	44.9%

1.6 Measurement standards

- ANSI C63.4:2014
- 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 §15.207
- FCC Part 15 Subpart C §15.209
- FCC Part 15 Subpart C §15.223
- FCC Part 15 Subpart C §15.247

1.8 Observation and remarks

The EUT contains 2 radios, a 3.59 MHz radio and a BLE radio. BLE transmits when the EUT is charging, the 3.59 MHz radio does not transmit. When the EUT is not charging, the 3.59 MHz radio starts transmitting, the BLE radio continues advertising. It is not possible to connect to the EUT using BLE when the EUT is not charging.

The EUT can be configured during production only, in three different modes, with the 3.59 MHz radio operating at a different field strength. These modes are:

- Car/bike
- Cart
- MX

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 : P. 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 : 18-11-2019

Name : ing. K.A. Roes

Function : Coordinator Wireless & EMC

Signature :

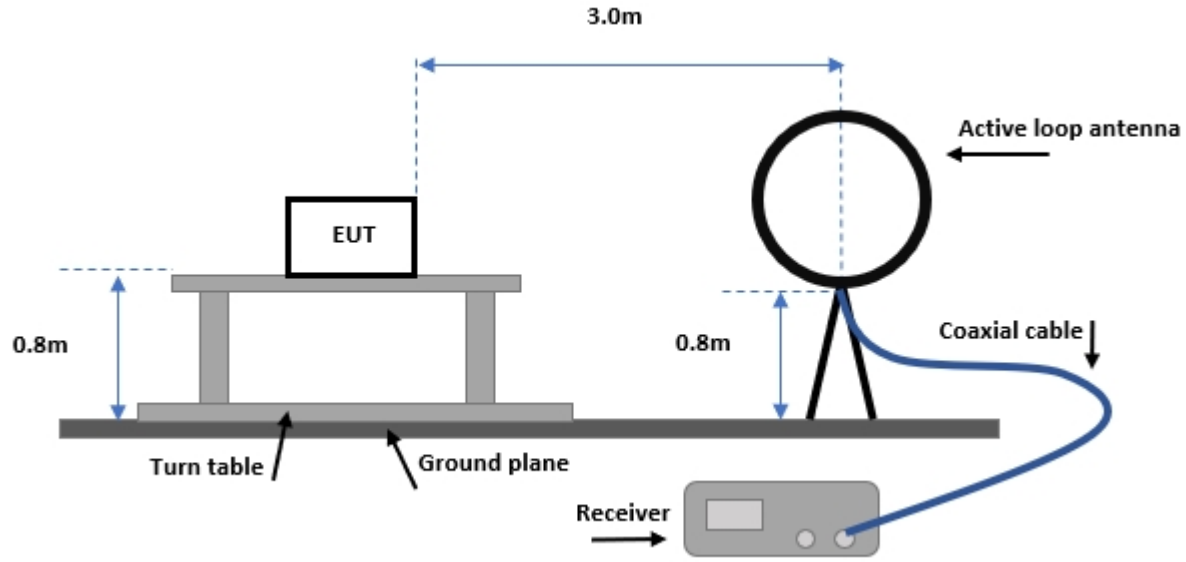
2 Test configuration of the Equipment Under Test

2.1 Test mode

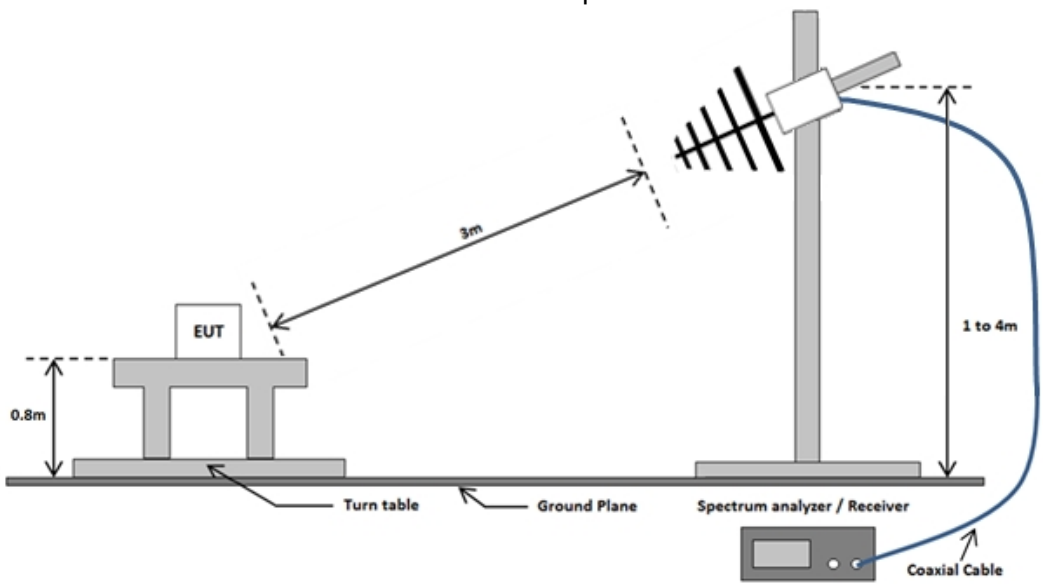
The applicant provided test mode firmware for the BLE radio, in which it was possible to configure the radio to transmit continuously. The 3.59 MHz radio has been tested in normal operation mode.

2.2 Test setups

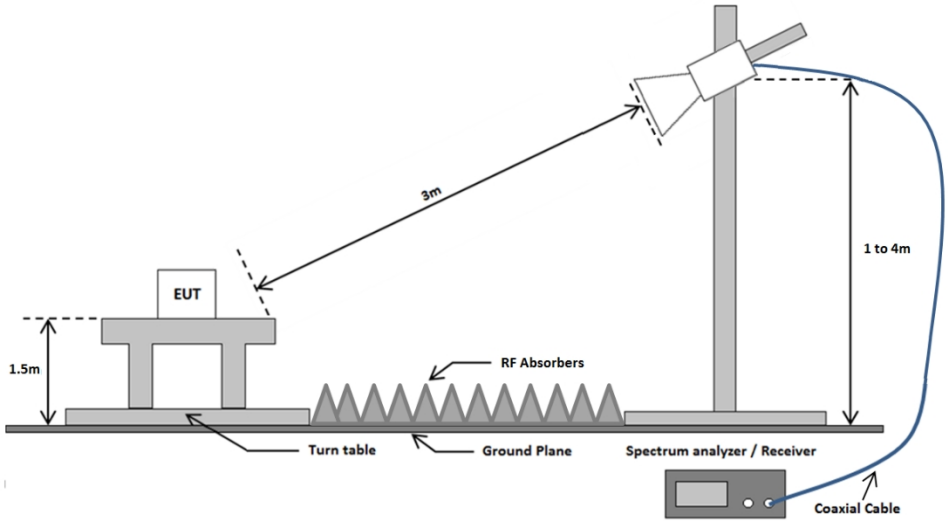
Radiated emissions test setup 9 kHz – 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz

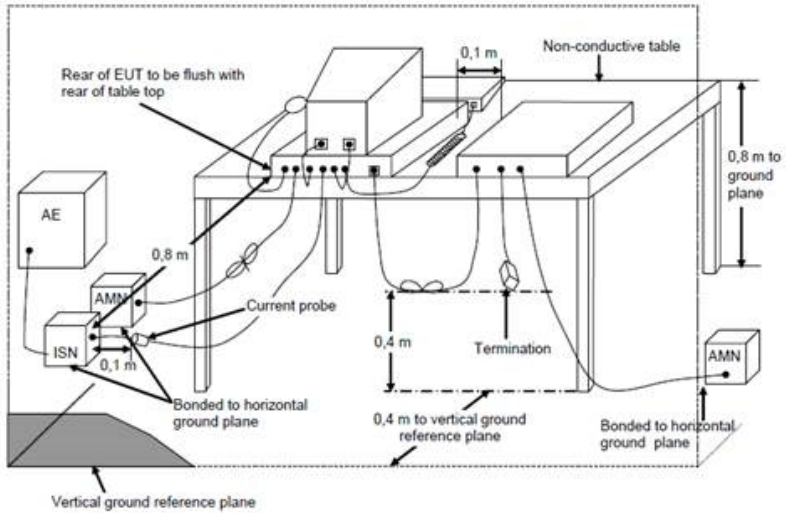


Radiated emissions test setup above 1 GHz



Conducted emissions test setup

Emissions test at AC mains



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Spectrum analyzer	Rohde & Schwarz	FSV40	TE01269	3.1, 3.3 – 3.6
Spectrum analyzer	Rohde & Schwarz	ESR7	TE01220	3.2, 3.7

Test site	Site ID	Used at paragraphs
Semi-Anechoic Chamber	TS 00004	3.2
Conducted emission measurement system	TS 00005	3.7

Measurement software	DARE!! RadiMation® Ver. 2019.1.8	3.2
	DARE!! RadiMation® Ver. 2019.1.5	3.7

2.4 Sample calculations

Field Strength Measurement example(see chapter 3.2):

Frequency (MHz)	Polarization	Height(m)	Quasi-Peak (dBµV/m)
135,6	Horizontal	1	40,4

The following relation applies:

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

Where:

E = Electric field strength
U = Measuring reveiver voltage
AF = Antenna factor
CL = Cable loss

(40.4 = 27.23 + 11.8 + 1.37)

3 Test results

3.1 Field strength of emissions

3.1.1 Limit

Frequency (MHz)	µV/m at 30 meter	dBµV/m at 30 meter
1.705-10	100	40

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

According to ANSI C63.10-2013, section 6.4.4.2.
IRN 026 – Method 10.

3.1.5 Test results of Field strength of emissions

Mode	Frequency (MHz)	Max Field strength at 30m (dBµV/m)
Car/Bike	3.59	30.67
Cart	3.59	22.13
MX	3.59	30.88
	Uncertainty	+3.0 / -2.5 dB

3.2 Radiated spurious emissions

3.2.1 Limit

15.223(d)
The field strength of any emissions appearing outside of the 1.705 - 10 MHz band shall not exceed the general radiated emission limits in part 15.209.

15.209

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance(m)
0.009 – 0.490	2400/F(kHz)	20*{log[2400]-log[F(kHz)]}	300*
0.490 – 1.705	24000/F(kHz)	20*{log[24000]-log[F(kHz)]}	30*
1.705 – 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: Limit lines in the plots corrected to 3m measurement distance according to the method described in ANSI C63.10-2013, clause 6.4

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

9 kHz – 30 MHz: According to ANSI C63.4-2014, section 5.4.2 and 8.2.3.
30 MHz to 26.5 GHz: According to ANSI C63.4-2014, 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.

3.2.5 Test results of the radiated spurious emissions measurement

Measured peaks Horizontal 1 – 18 GHz Low channel

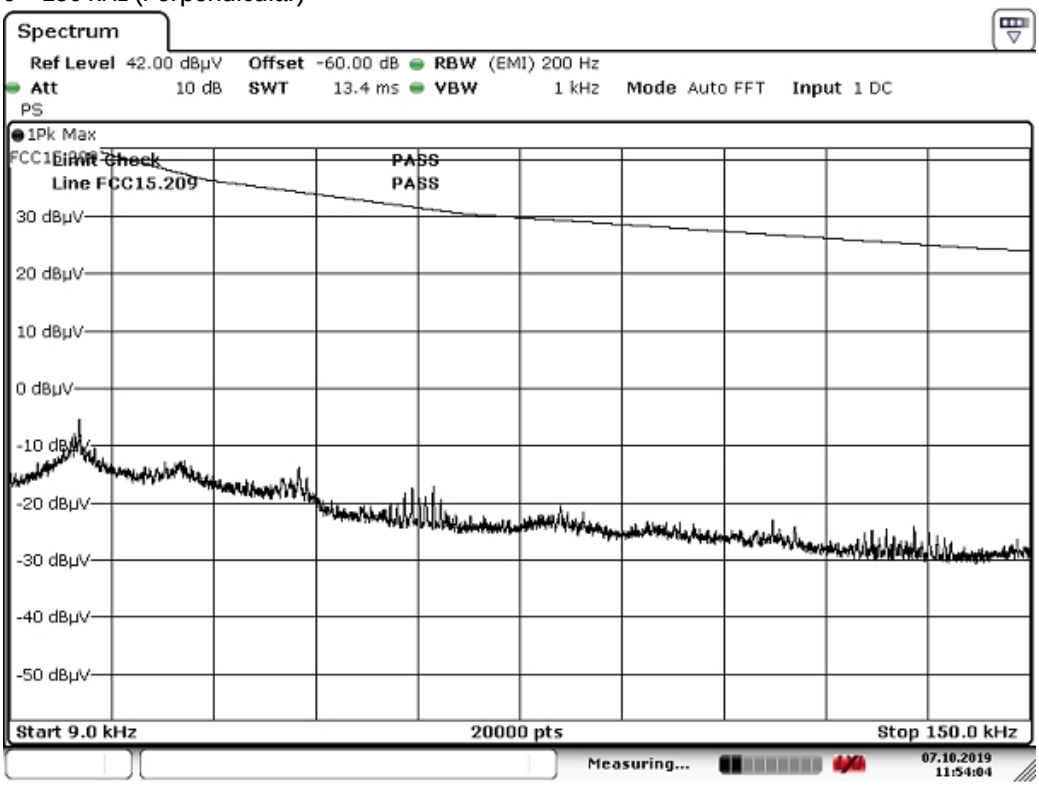
Frequency	Polarization	Height	Peak	Average	Peak Limit	Average Limit	Peak Difference	Average Difference
4,804 GHz	Horizontal	2,5 m	45,8 dBµV/m	38,5 dBµV/m	74 dBµV/m	54 dBµV/m	-28,2 dB	-15,5 dB

3.2.6 Measurement Uncertainty

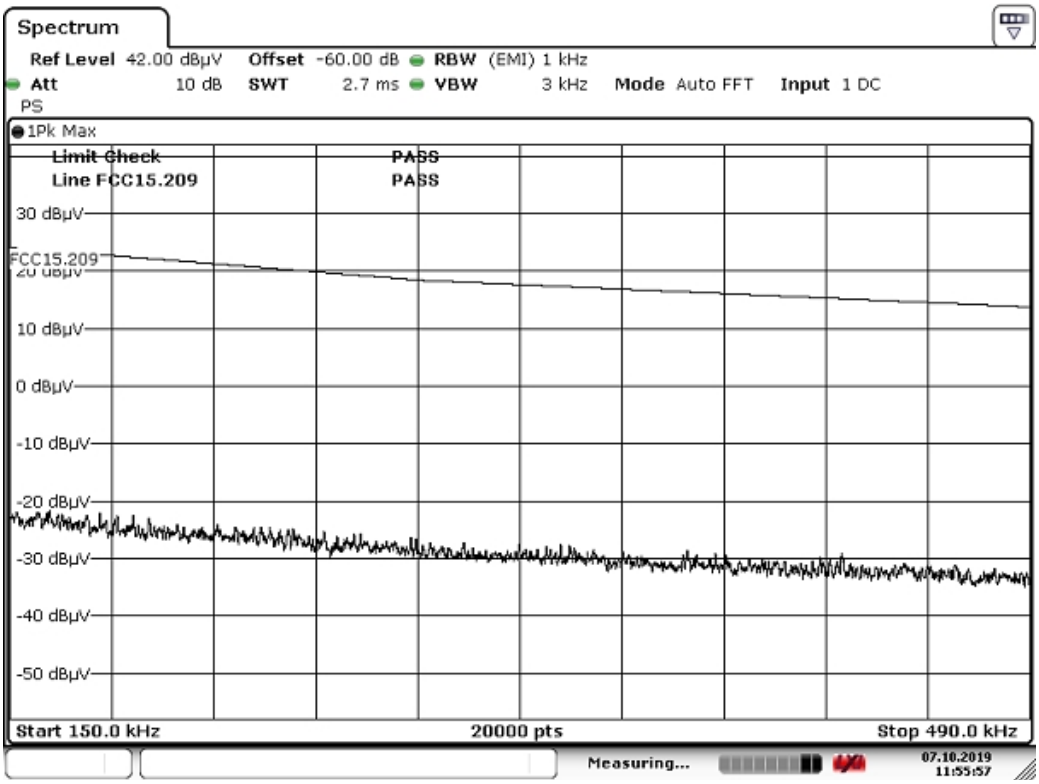
Frequency range	Polarization	Uncertainty
9 kHz – 30 MHz	--	±1.6 dB
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB
1 – 18 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB
18 – 26.5 GHz	Horizontal	±4.9 dB
	Vertical	±4.9 dB

3.2.7 Plots of the Radiated Spurious Emissions Measurement

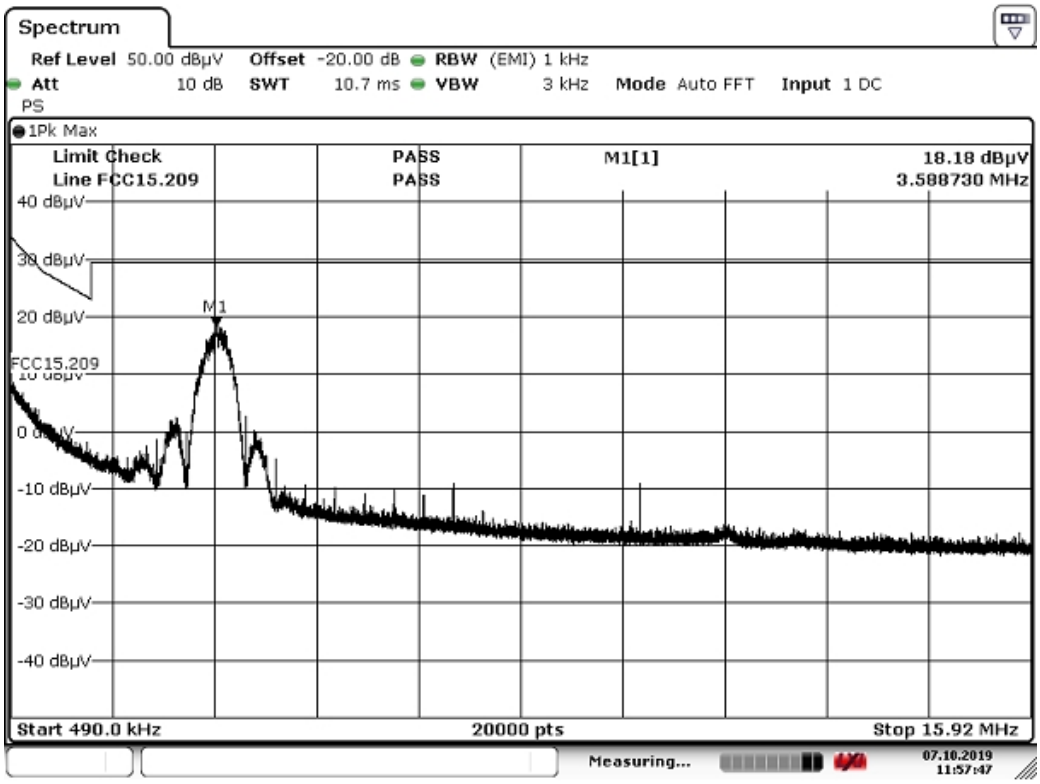
9 – 150 kHz (Perpendicular)



150 kHz – 490 kHz

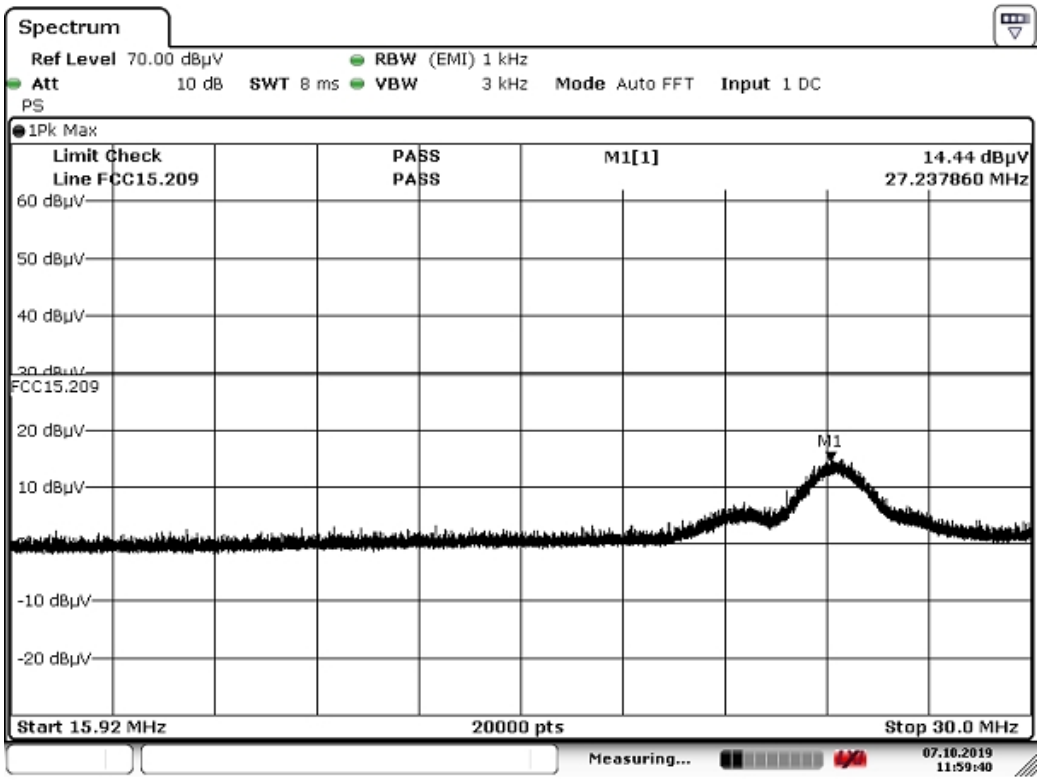


490 kHz – 15.92 MHz



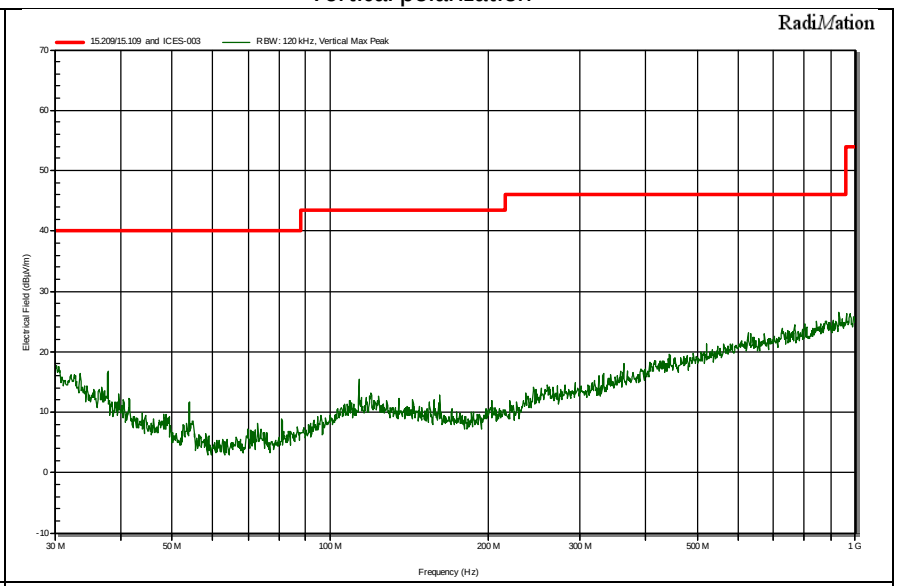
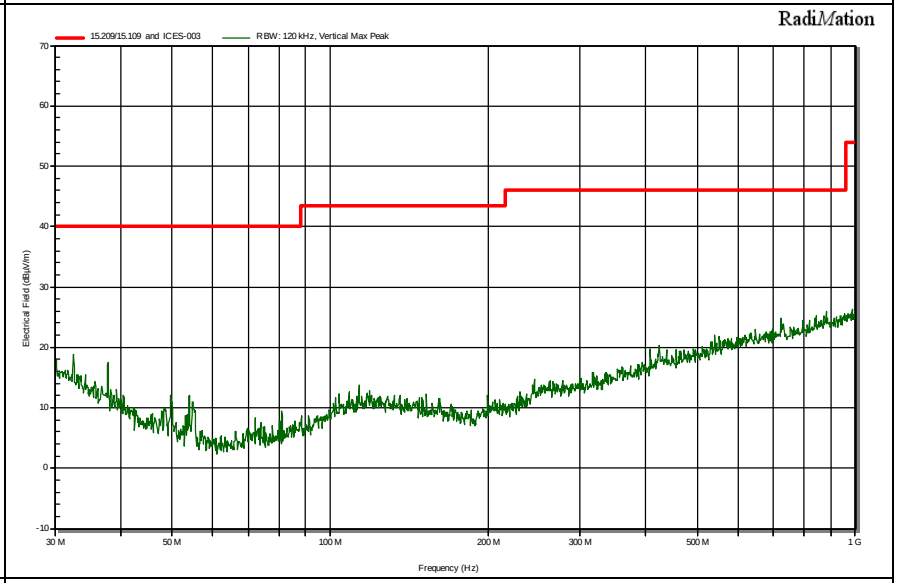
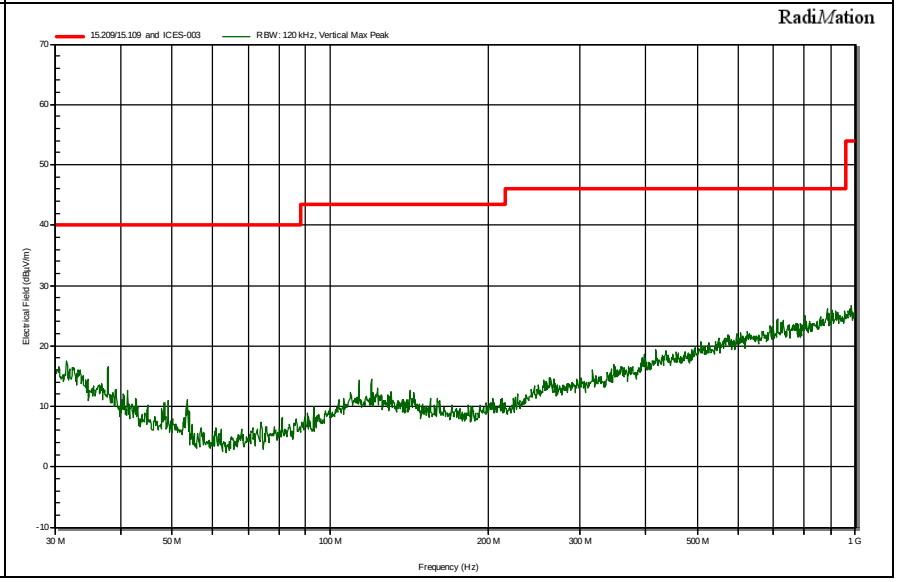
Note: the peak at 3.59 MHz is the carrier frequency and is not subject to the spurious limit.

15.92 – 30 MHz



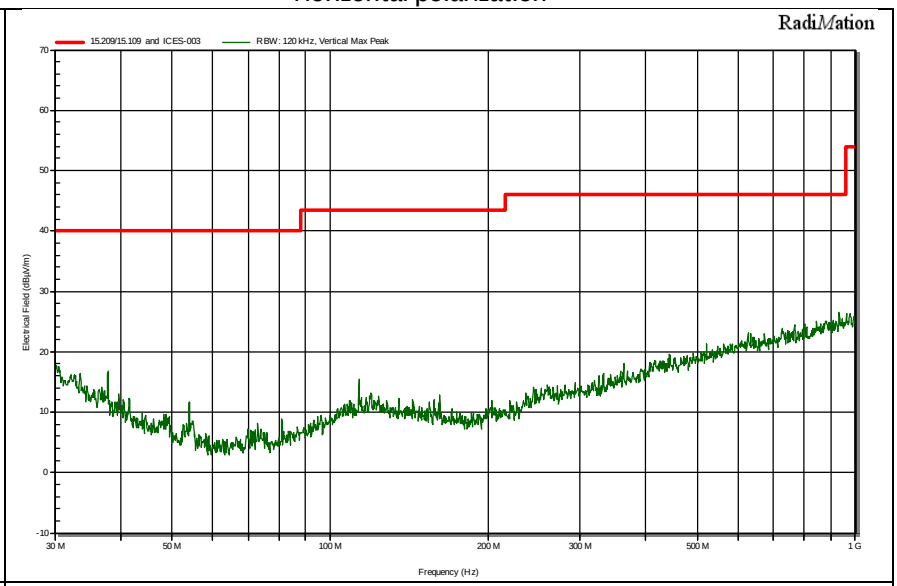
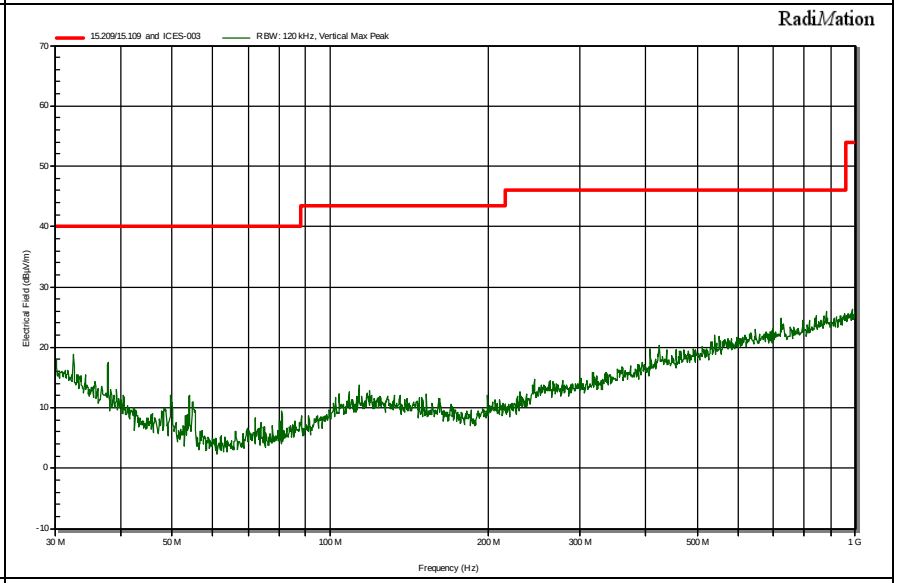
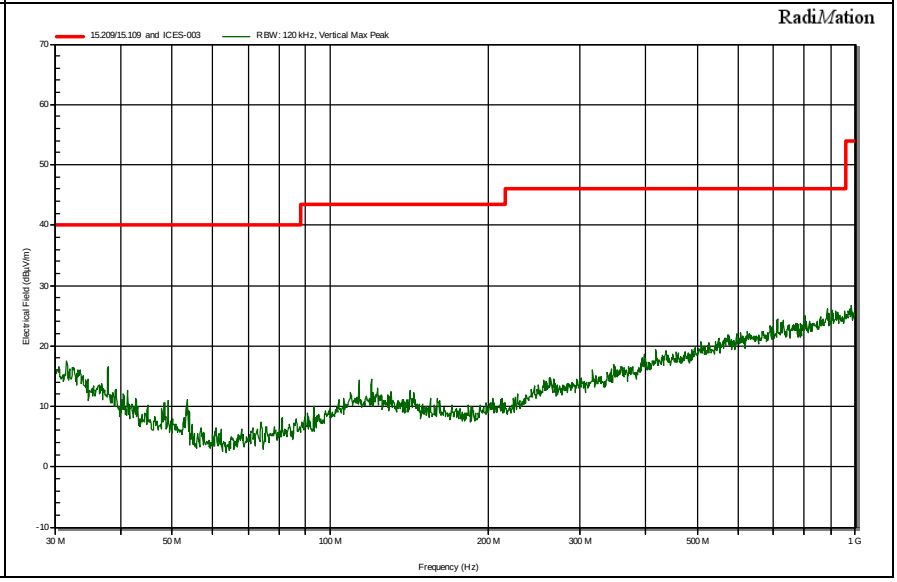
30 MHz to 1 GHz

Vertical polarization

Low ch	
Mid ch	
High ch	

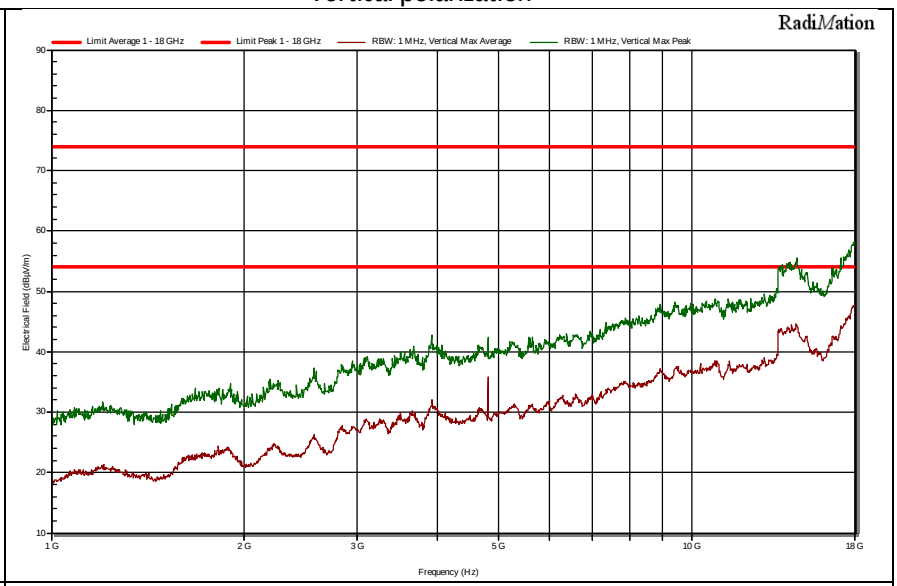
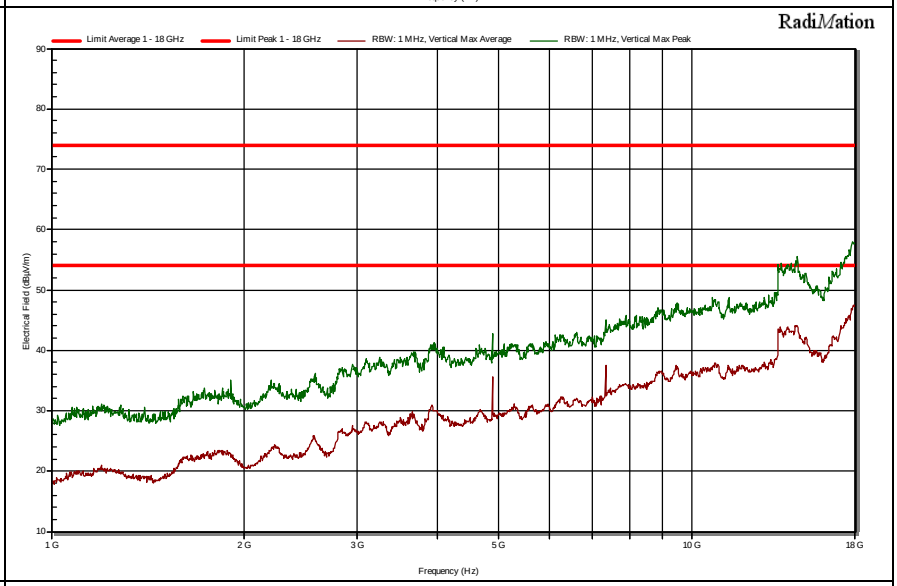
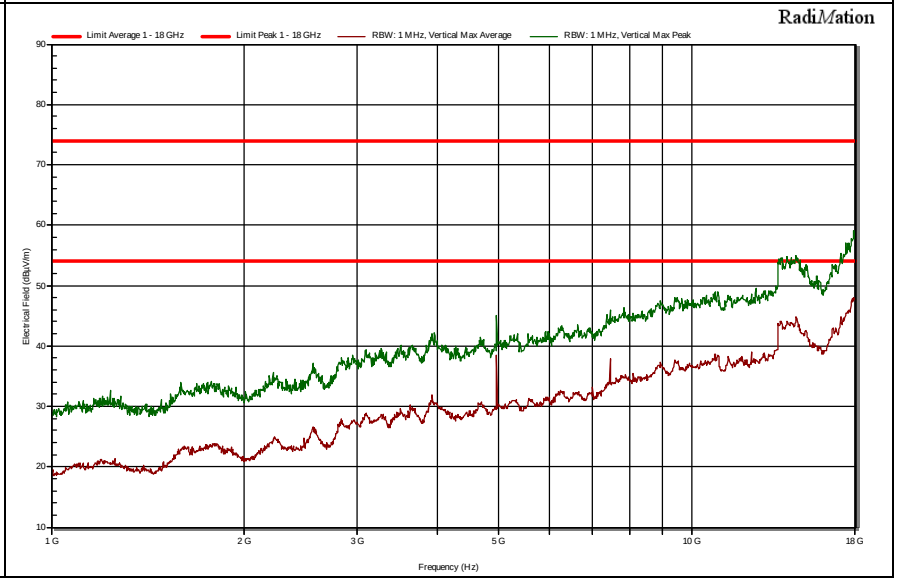
30 MHz to 1 GHz

Horizontal polarization

Low ch	
Mid ch	
High ch	

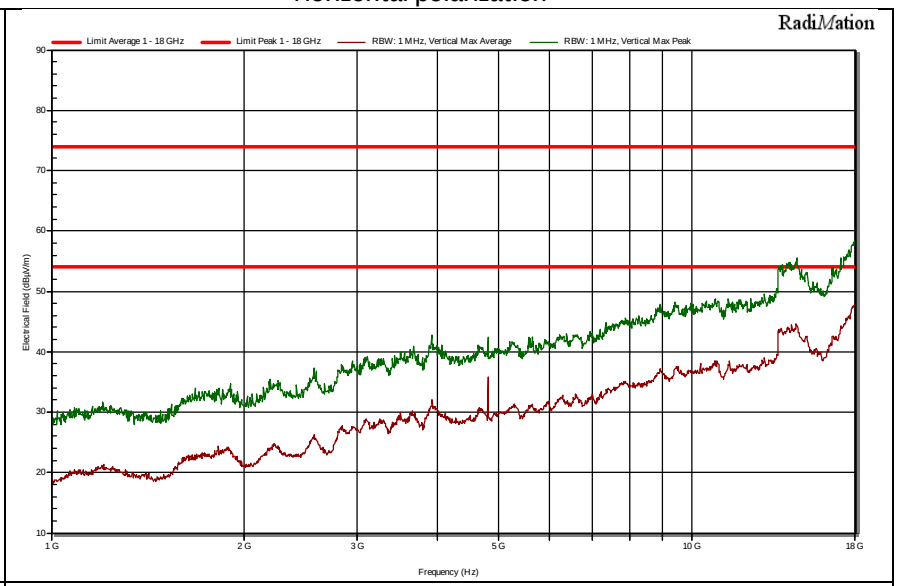
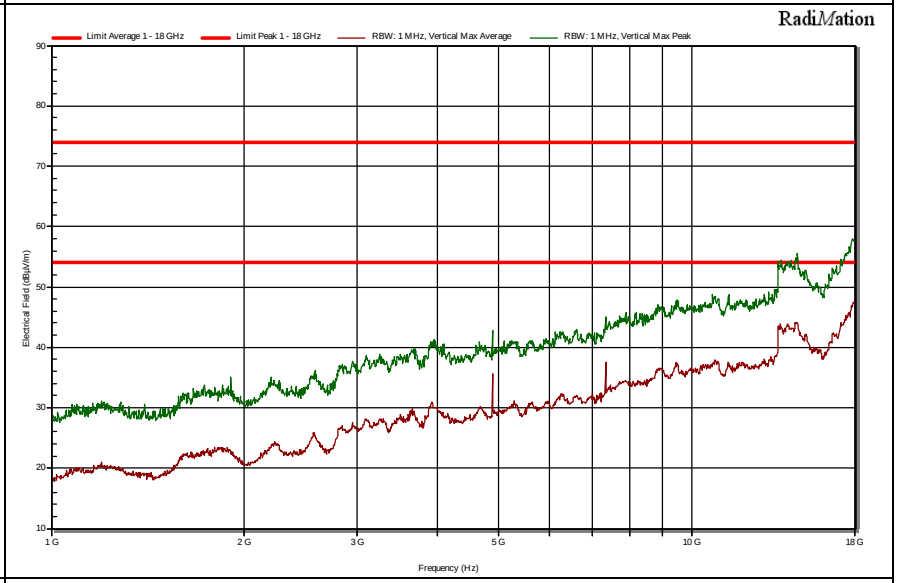
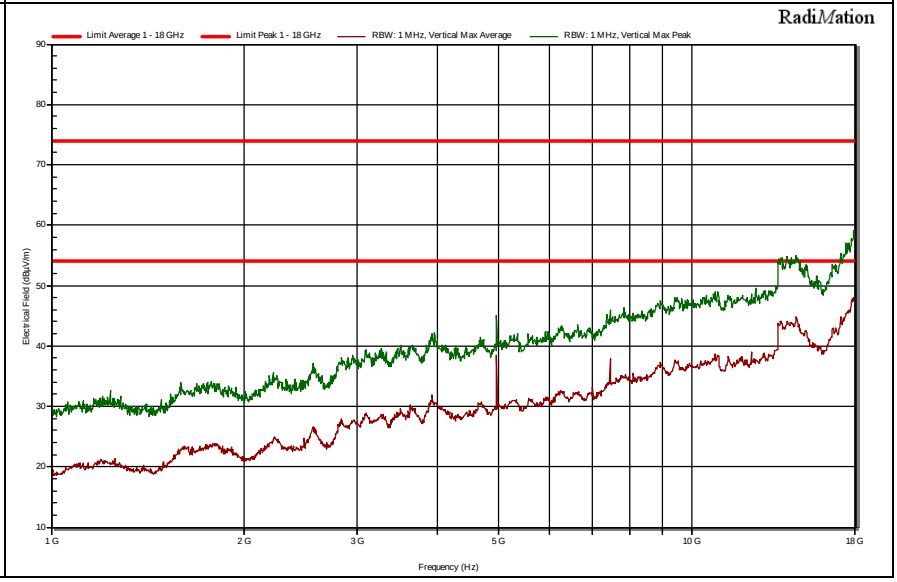
1 GHz to 18 GHz

Vertical polarization

Low ch	
Mid ch	
High ch	

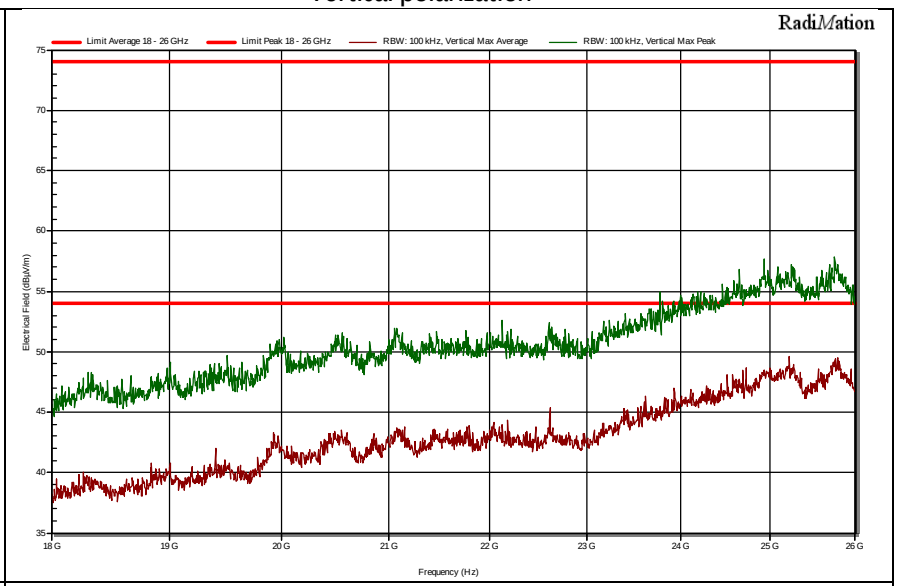
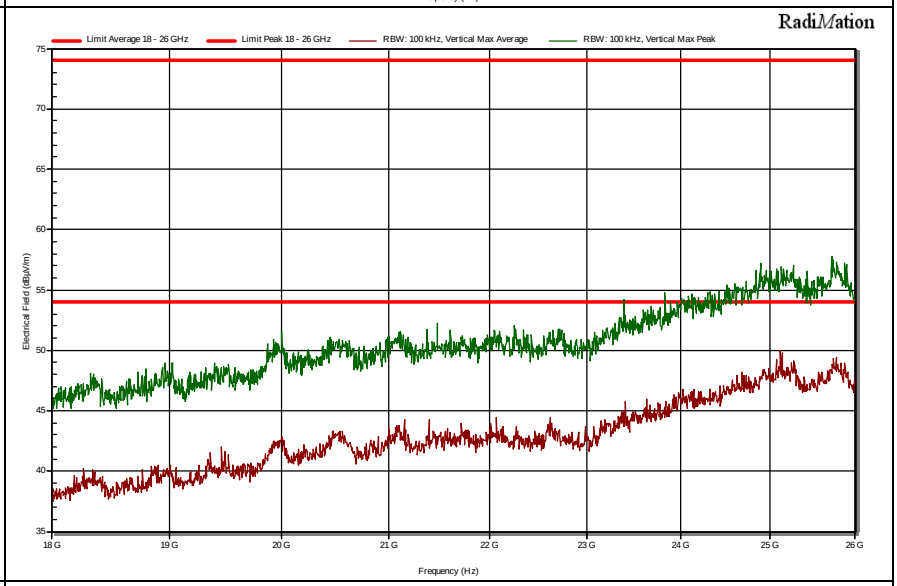
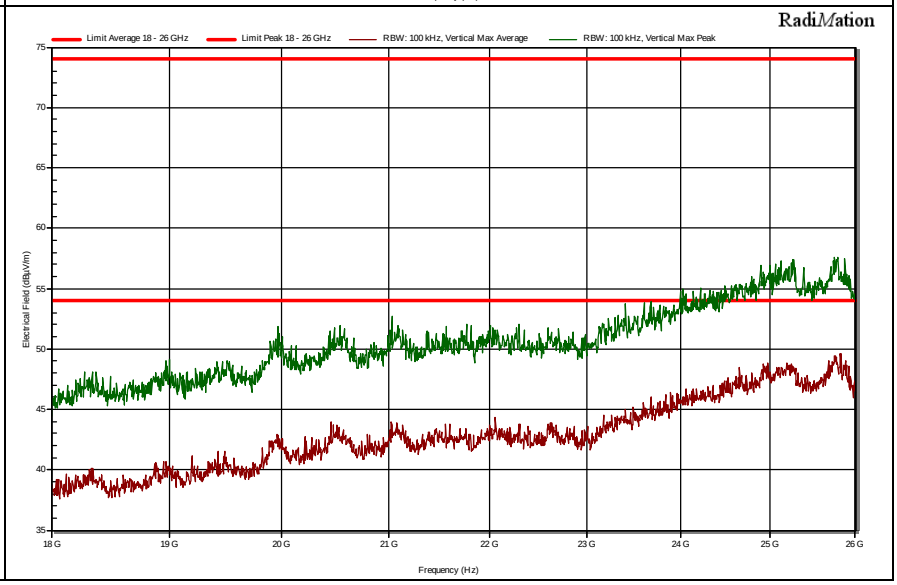
1 GHz to 18 GHz

Horizontal polarization

Low ch	
Mid ch	
High ch	

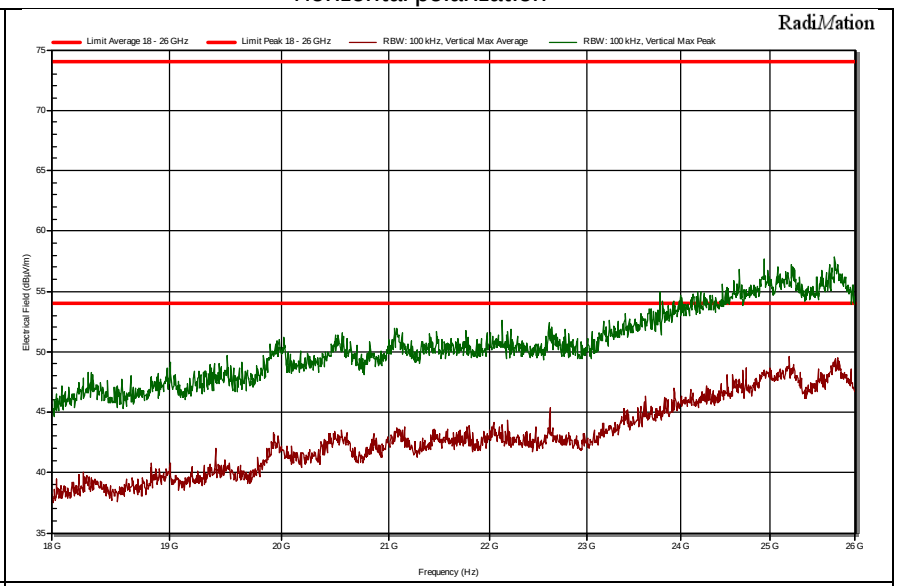
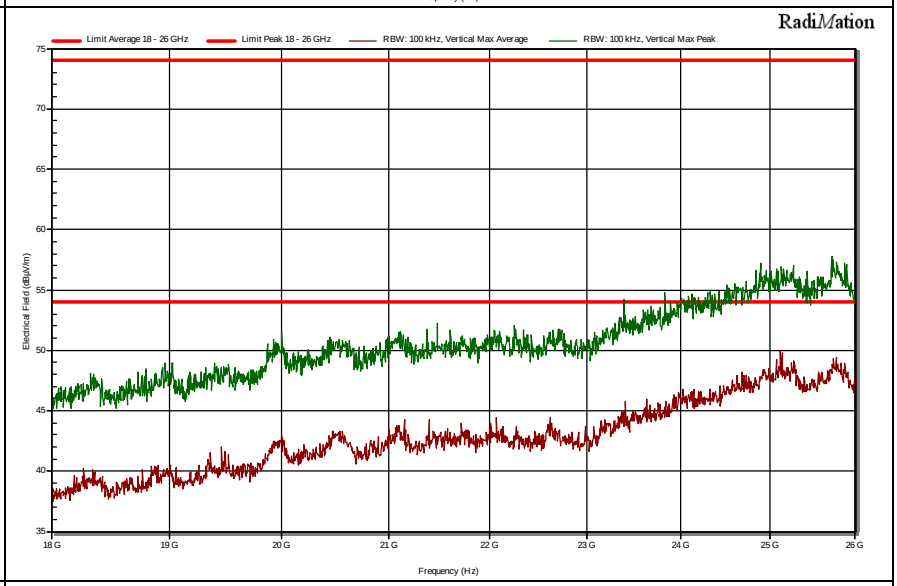
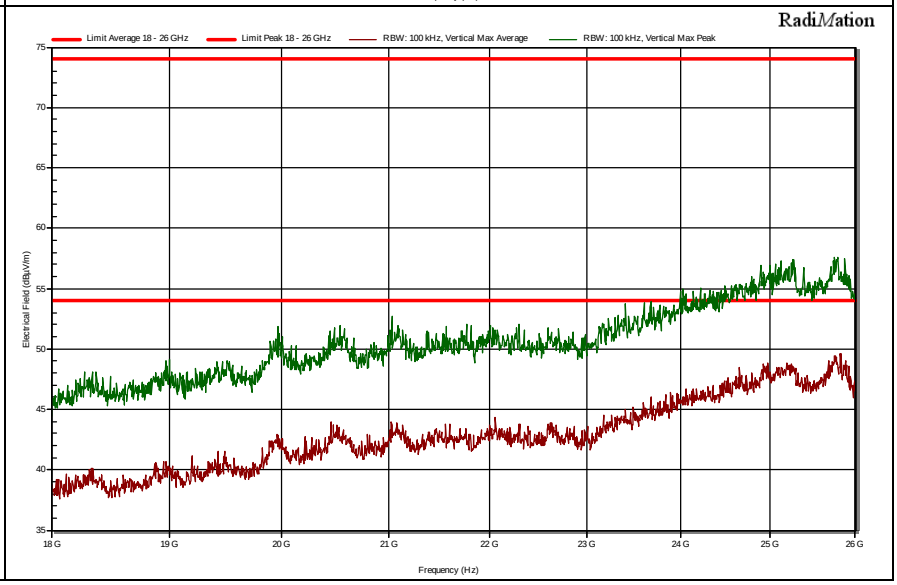
18 GHz to 26 GHz

Vertical polarization

Low ch	
Mid ch	
High ch	

18 GHz to 26 GHz

Horizontal polarization

Low ch	
Mid ch	
High ch	

3.3 6dB bandwidth Measurement

3.3.1 Limit

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

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

Tests according to ANSI C63.10.
IRN 017 - Method 4.

3.3.5 Test Results of the 6 dB bandwidth Measurement

Technology Std.	Channel	Frequency (MHz)	Data rate	6dB bandwidth (kHz)
Bluetooth Low energy	1	2402	1 Mbps	681.6
	38	2426	1 Mbps	659.9
	39	2480	1 Mbps	668.6
3.59 MHz radio	1	3.59	--	346.2
Uncertainty	± 36.2 kHz			

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 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 1 – AVGSA (DTS) according to ANSI C63.10.

3.4.5 Test results of Output Power Measurement

Peak method

Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power (dBm)
Bluetooth Low Energy	1	2402	1 Mbps	-2.27
	18	2440	1 Mbps	-2.10
	39	2480	1 Mbps	-2.76
Uncertainty	±0.71 dB			

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 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)
Bluetooth Low Energy	1	2402	1 Mbps	-17
	38	2426	1 Mbps	-17
	39	2480	1 Mbps	-17
Uncertainty	±2 dB			

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 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.

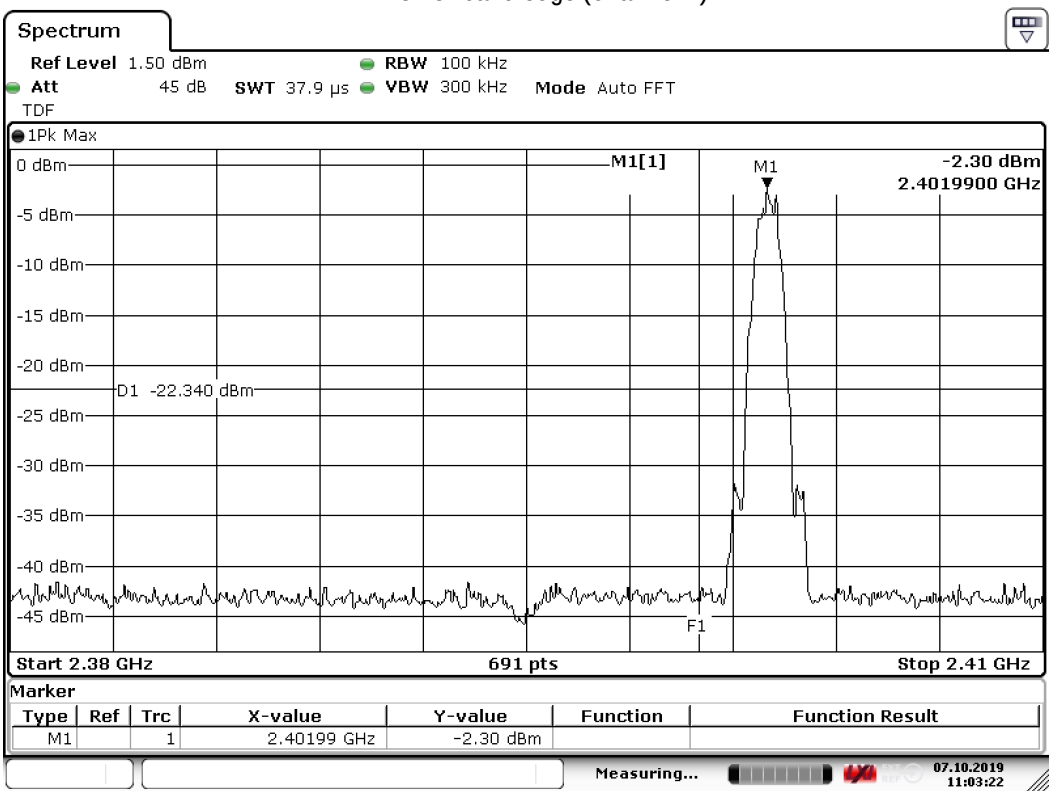
3.6.5 Measurement Uncertainty

± 5.7 dB.

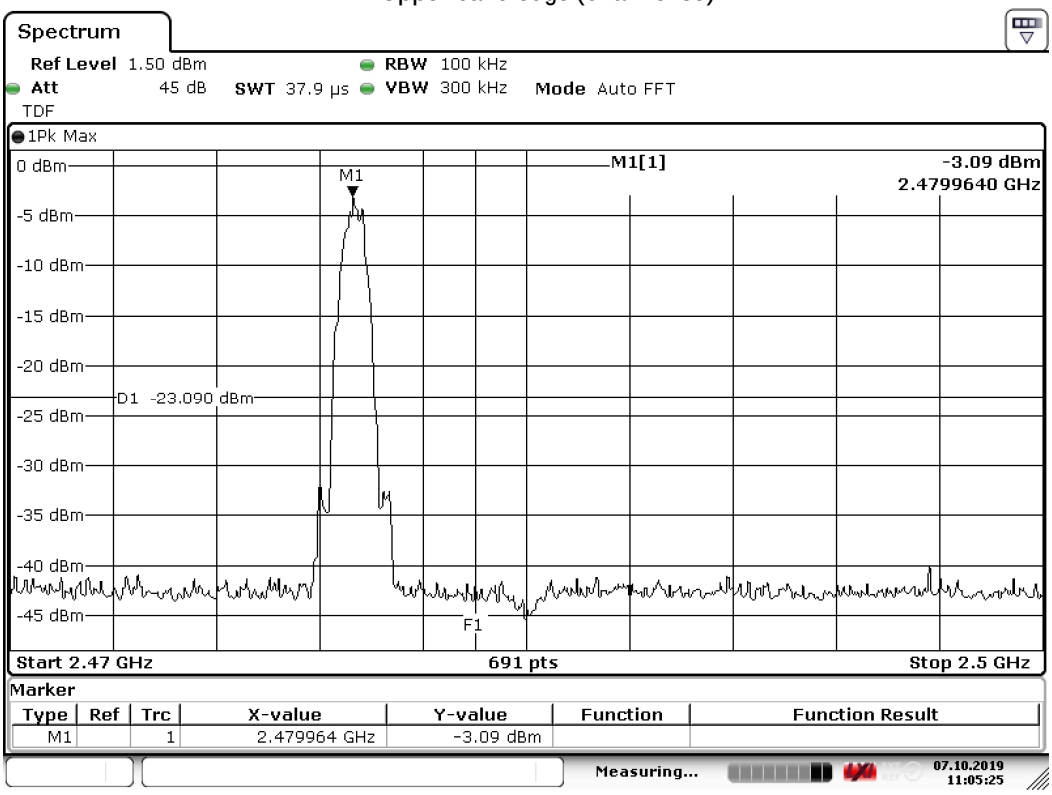
3.6.6 Plots of the Band edge Measurements

See next page.

BLE Lower band edge (Channel 1)



BLE Upper band edge (Channel 39)



3.7 Conducted emissions

3.7.1 Limit

According to 15.207 (c)

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.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

3.7.2 Measurement instruments

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

3.7.3 Test setup

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

3.7.4 Test procedure

According to ANSI C63.4: 2014, section 13.3.
IRN 029 – Method 1.

3.7.5 Test results and plots of the AC mains conducted measurement

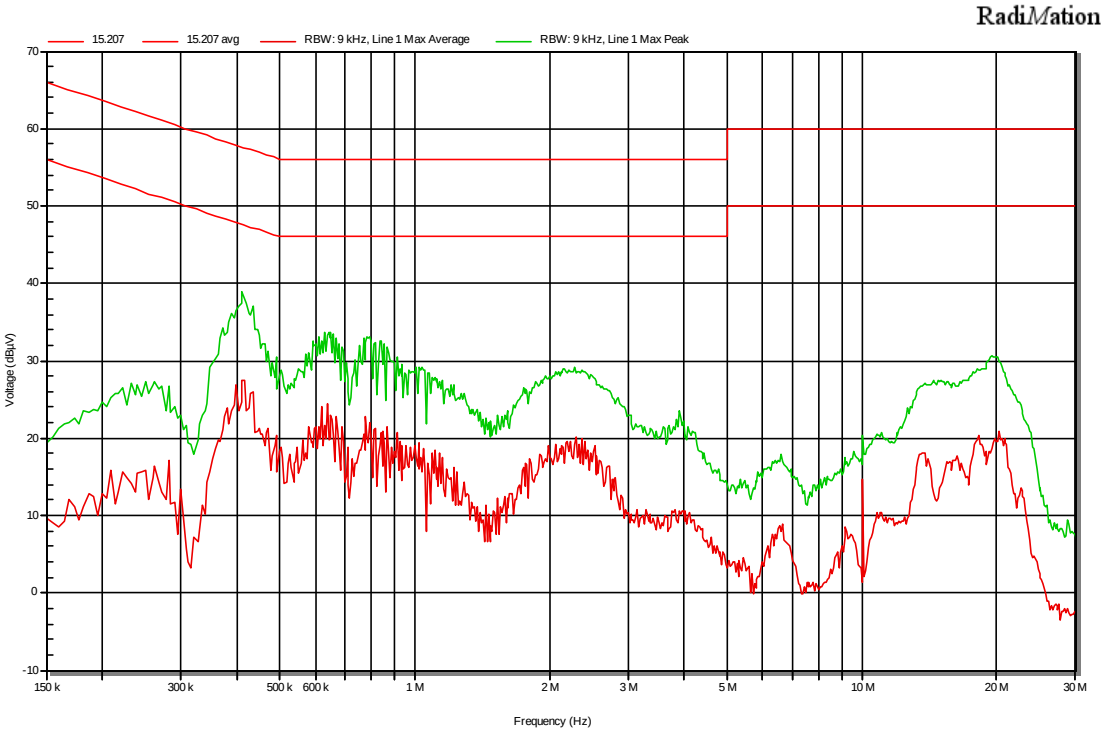
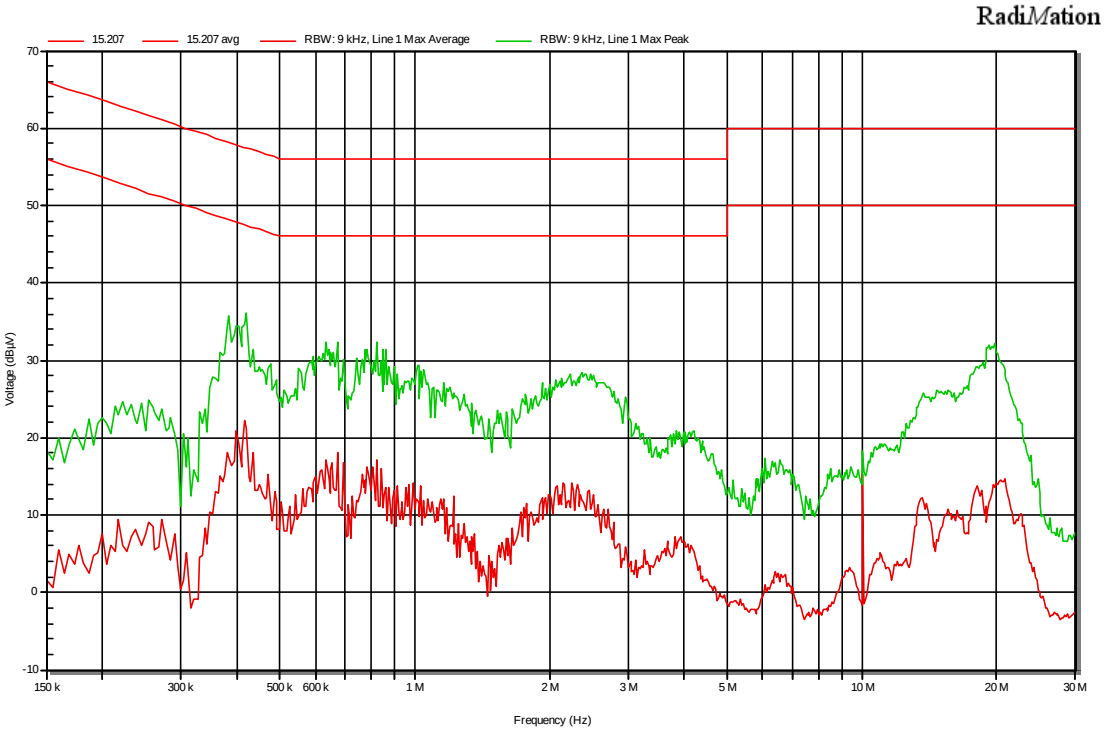
See next page.

3.7.6 Measurement uncertainty

+/- 3.6 dB.

3.7.7 Plots of the AC mains conducted spurious measurement

Phase



Neutral