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The Netherlands
Chamber of Commerce
51565536
www.telefication.com

telefication

FCC and IC Test report for parts 15.207, 15.209, 15.247, 15.249 RSS-210, RSS-247, RSS-Gen

Product name	: Homey Bridge
Applicant	: Athom B.V.
FCC ID	: 2AVQ6HY0016
IC ID	: 25905-HY0016

Test report No. : 200200216 001 Ver 1.00

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).

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.

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	03-06-2020	First draft	PS
v1.0	10-06-2020	Initial issue	PS

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Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.249(a)	RSS-210 B.10 (a)	Field strength of fundamental emissions	3.1	Pass
15.247(d) 15.209 (a)	RSS-Gen 8.9	Radiated spurious emissions	3.2	Pass
15.205 (a)	RSS Gen 8.10	Spurious emissions in the restricted bands	3.2	Pass
15.247(d)	RSS-Gen 8.9	Antenna port conducted emissions	3.3	Pass
15.247 (a)	RSS-247 5.2(a)	6 dB bandwidth	3.4	Pass
--	RSS-Gen 6.7	99% bandwidth	3.5	Pass
15.247 (b)	RSS-247 5.4 (d)	RF output power	3.6	Pass
15.247 (e)	RSS-247 5.2 (b)	Power spectral density	3.7	Pass
15.247 (d)	RSS-247 5.5	Band edge	3.8	Pass
15.249(a) (d)	RSS-210 B.10 (a) (b)	Field strength of spurious and harmonics emissions	3.9	Pass
15.207 (c)	RSS-Gen 8.8	Conducted spurious emissions on AC mains	3.10	Pass

1 General Description

1.1 Applicant

Client name:	Athom B.V.
Address:	Rigtersbleek-Zandvoort 10-207, Enschede, the Netherlands
Zip code:	7521 BE
Telephone:	+31(0)639002706
E-mail:	Legal@athom.com
Contact name:	Mr. Stefan Witkamp

1.2 Manufacturer

Client name:	Athom B.V.
Address:	Rigtersbleek-Zandvoort 10-207, Enschede, the Netherlands
Zip code:	7521 BE
Telephone:	+31(0)639002706
E-mail:	Legal@athom.com
Contact name:	Mr. Stefan Witkamp

1.3 Tested Equipment Under Test (EUT)

Product name:	HY0016 / HOMEY-BRIDGE-EU-01
Brand name:	Homey
FCC ID:	2AVQ6HY0016
IC ID:	25905-HY0016
Product type:	Smart Home Controller
Model(s):	Matte Black Shiny Black Black Logo White
Batch and/or serial No.	--
Software version:	4.0
Hardware version:	4.0
Date of receipt:	09-03-2020
Tests started:	09-03-2020
Testing ended:	29-04-2020

1.4 Product specifications of Equipment under test

Tx Frequency:	WLAN: 2412 – 2472 MHz BLE: 2402 – 2480 MHz Zigbee: 2405 – 2475 MHz Zwave: 908.5; 916.1 MHz
Rx frequency:	WLAN: 2412 – 2472 MHz BLE: 2402 – 2480 MHz Zigbee: 2405 – 2475 MHz Zwave: 908.5; 916.1 MHz
Antenna type and gain	WLAN: PCB antenna (2.7 dBi) BLE: PCB antenna (2.7 dBi) Zigbee: Dipole PCB antenna (5 dBi) Zwave: PCB antenna (5.6 dBd)
Type of modulation:	WLAN: DSSS, OFDM BLE:GFSK Zigbee:BPSK Zwave: FSK
Emission designator	WLAN:13M4F1D BLE:1M01F1D Zigbee: 2M87G1D Channel 1 Zwave: 93K8F1D Channel 0 Zwave: 110KF1D

1.5 Environmental conditions

Test date	Ambient temperature (°C)	Relative humidity (%)
09-03-2020	21.2	37.4
10-03-2020	22.1	36.8
16-03-2020	20.3	39.2
15-04-2020	21.0	32.4
17-04-2020	20.8	34.9
28-04-2020	21.8	39.7
29-04-2020	21.9	40.3

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 §15.247
- FCC part 15 Subpart C §15.249
- RSS-Gen Issue 5
- RSS-210 Issue 10
- RSS-247 Issue 2

1.8 Observation and remarks

The EUT contains four different radios.

Power settings:
WLAN: -(8x0.25) dB
BLE: 8
Zigbee: 4.5
Zwave: 22

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 tests are performed by:

Name :ing. P.A. Suringa

Review of test methods and report by:

Name : P. van Wanrooij, BASc

The above conclusions have been verified by the following signatory:

Date : 10-06-2020

Name : P. van Wanrooij

Function : Test Engineer

Signature :

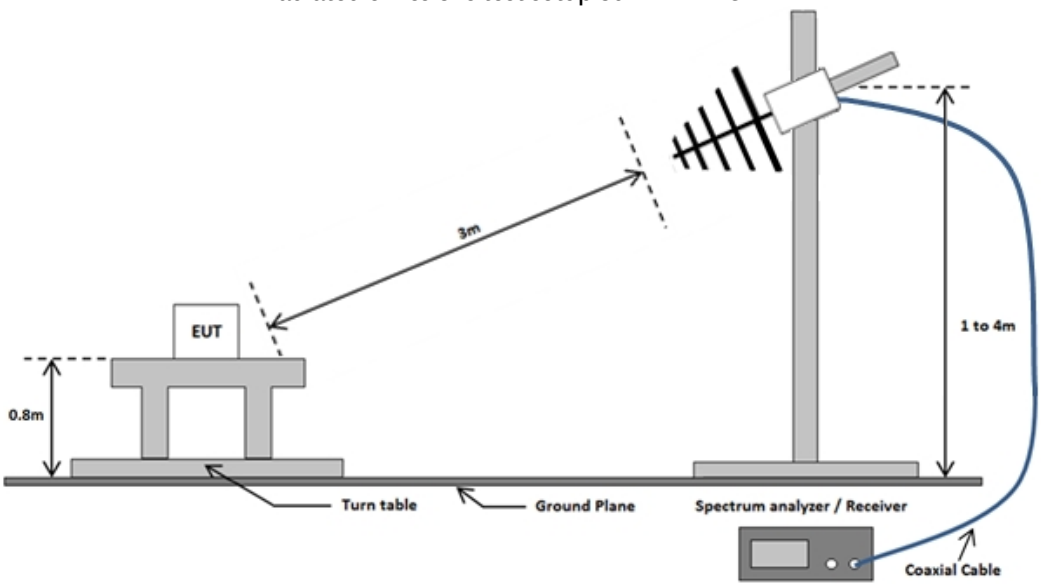
2 Test configuration of the Equipment Under Test

2.1 Test mode

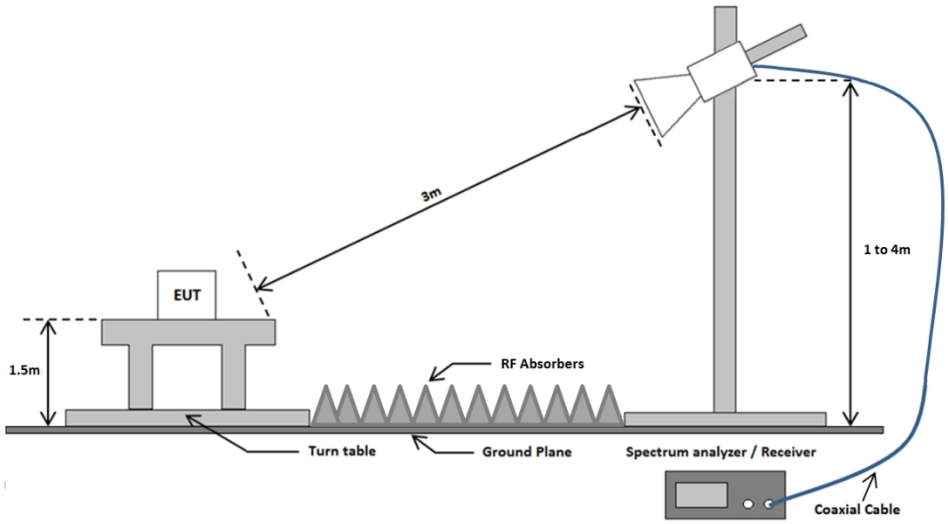
The applicant provided test mode firmware in order to set all the radios to continuous Tx mode. The Zigbee and Zwave radios required connection to an access point using WLAN in order to set them in test mode.
BLE and WLAN used Espressif firmware version 2.3
Zigbee and Zwave used Homey Playground firmware (no version)

2.2 Test setups

Radiated emissions test setup 30 MHz – 1 GHz

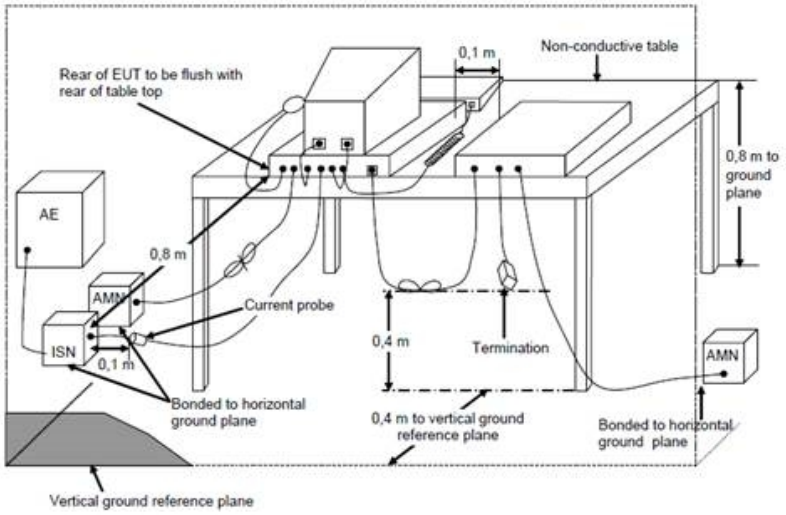


Radiated emissions test setup above 1 GHz



Conducted emissions test setup

Emissions test at AC mains



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
EMI receiver	Rohde & Schwarz	ESCI	TE11128	3.1 – 3.9
EMI receiver	Rohde & Schwarz	ESR7	TE01220	3.1; 3.2
Spectrum analyzer	Rohde & Schwarz	FSP	TE11125	3.2; 3.3; 3.4; 3.7
Spectrum analyzer	Rohde & Schwarz	FSV40	TE01269	3.1 – 3.9
High pass filter	Wainwright	WHK1.1/15G-10E	TE01139	3.9 (1-10 GHz only)

Description	Setup ID	Used at paragraph
SAR radiated emission	TS00004	3.1; 3.2
Conducted emission	TS00005	3.10

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 Field strength of fundamental emissions measurement (Zwave)

3.1.1 Limit

According to FCC 15.249(a) and RSS-210 B.10(a)

Fundamental frequency	Field strength of fundamental @3m
902 – 928 MHz	94 dBµV/m

3.1.2 Measurement instruments

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

3.1.3 Test setup

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

3.1.4 Test procedure

30 MHz to 26.5 GHz: According to ANSI C63.4-2014, section 8.3
IRN 026 – Method 1

3.1.5 Measurement Uncertainty

±3.6 dB

3.1.6 Results of the field strength of fundamental emissions measurement

Channel	Frequency (MHz)	Field strength of fundamental (dBµV/m @3m)
0	916.095	90.3
1	908.456	92.3

3.2 Cabinet radiated spurious emissions

3.2.1 Limit

According Parts 15.247(d)

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

3.2.2 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

30 MHz to 26.5 GHz: According to ANSI C63.4-2014, section 8.3
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

During measurements of cabinet emissions the antenna port(s) of the active transmitter(s) were terminated with a 50 Ohm load.

3.2.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
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

3.2.6 Results of the cabinet radiated spurious emissions

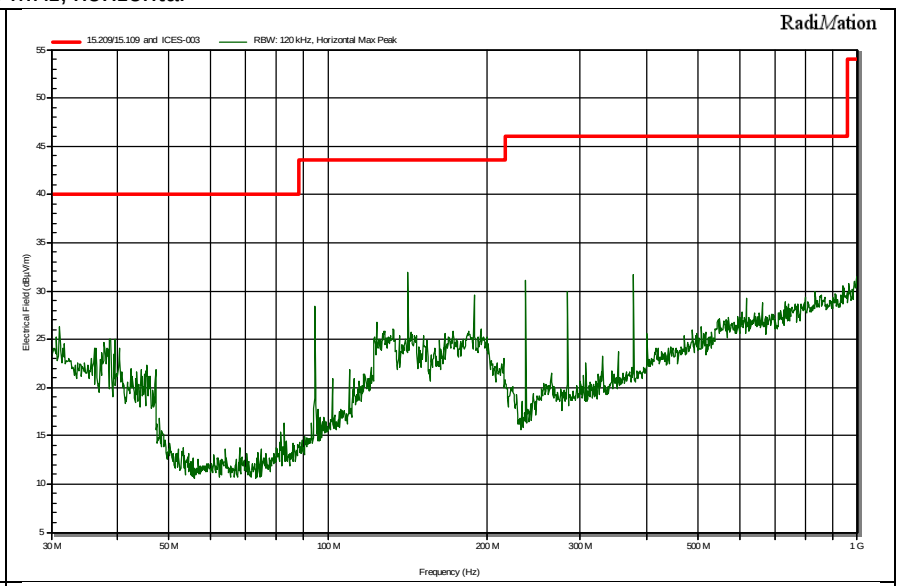
Technology and channel	Frequency	Peak	Peak Limit	Average	Average Limit	Status	Pol.
WLAN CH 6	7,303 GHz	54,9 dBµV/m	74 dBµV/m	47,2 dBµV/m	54 dBµV/m	Pass	Vertical
WLAN CH 11	7,386 GHz	57,1 dBµV/m	74 dBµV/m	49,2 dBµV/m	54 dBµV/m	Pass	Vertical
WLAN CH 11	7,385 GHz	53,6 dBµV/m	74 dBµV/m	45,8 dBµV/m	54 dBµV/m	Pass	Vertical

Technology and channel	Frequency	Peak	Peak Limit	Status	Angle	Height	Polarization
BLE CH 39	47,945 MHz	33,4 dBµV/m	40 dBµV/m	Pass	319 degrees	1 m	Vertical

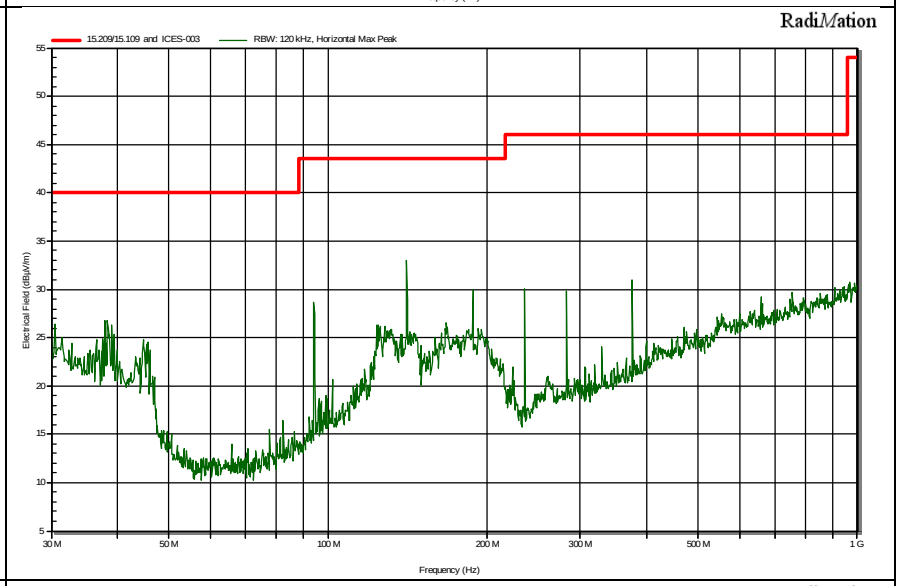
3.2.7 Plots of the BLE Radiated Spurious Emissions Measurement

30 -1000 MHz, horizontal

Ch. 37



Ch. 18



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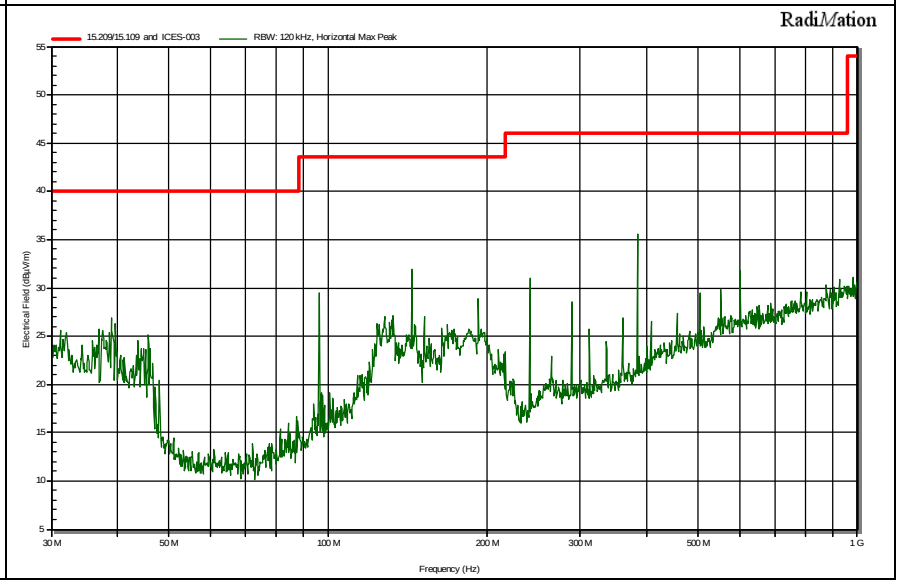
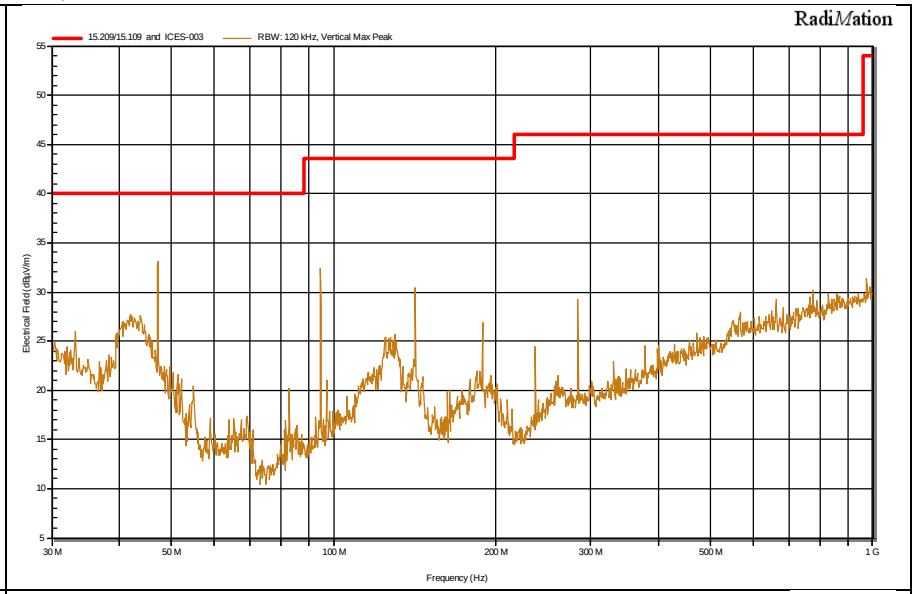


30 -1000 MHz, vertical

Ch. 37



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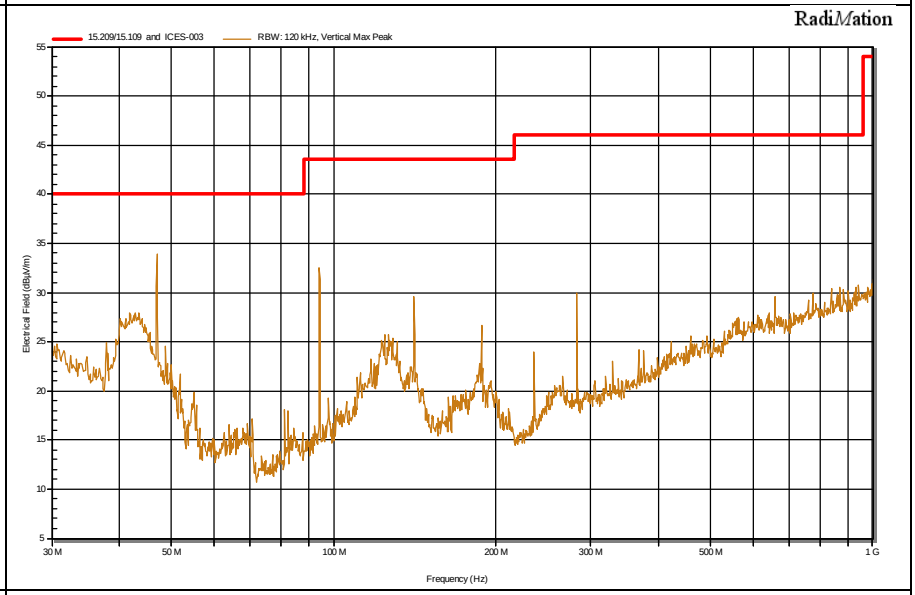

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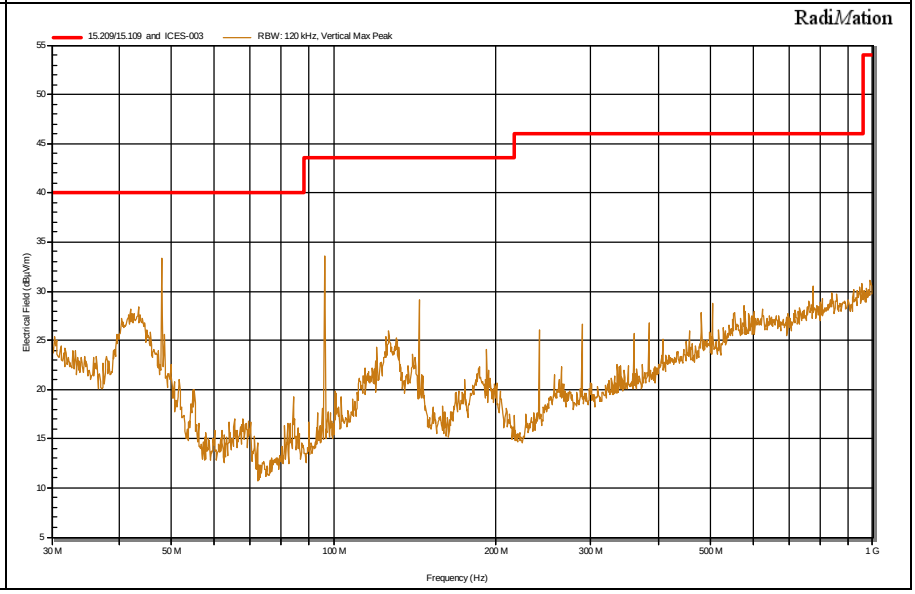
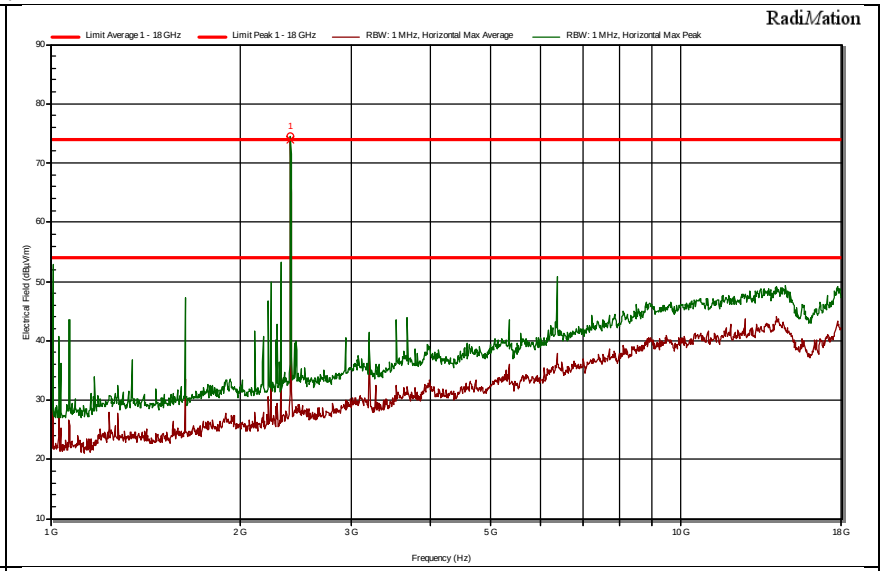


1-18 GHz, horizontal

Ch. 37



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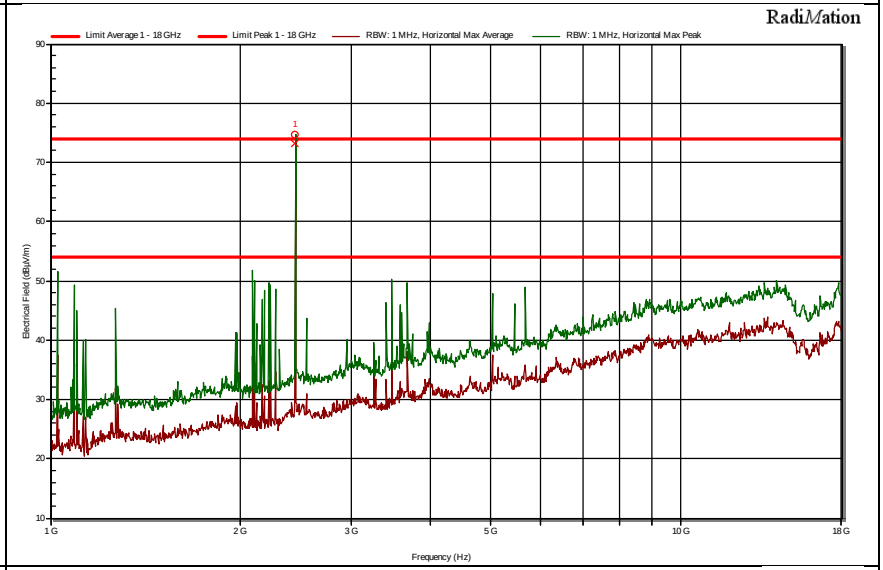

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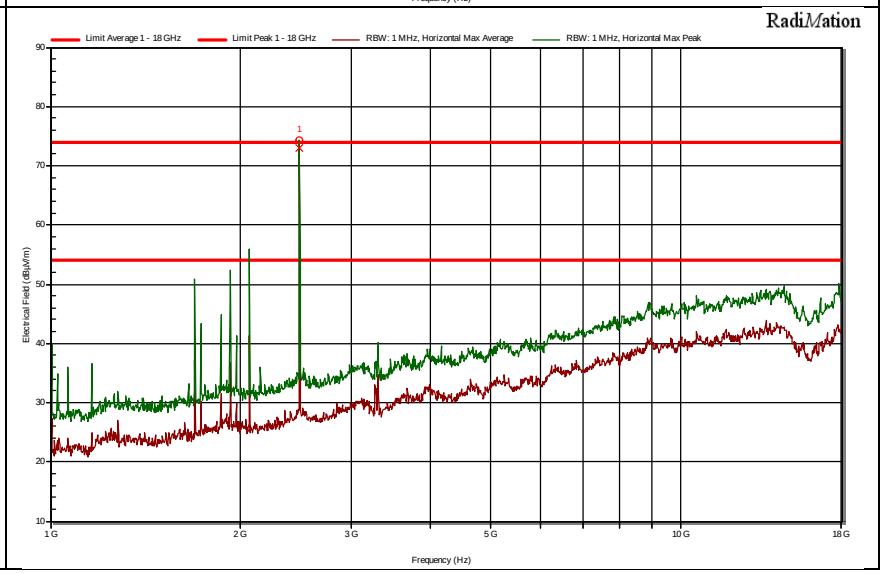
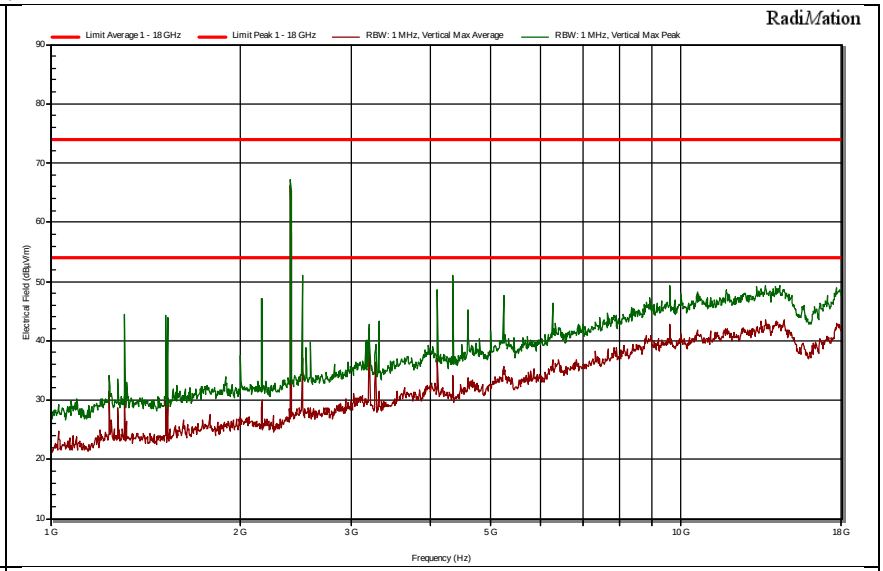


Note: The peak at 2.4 GHz is the transmission frequency and is not subject to the spurious limit.

1-18 GHz, vertical

Ch. 37



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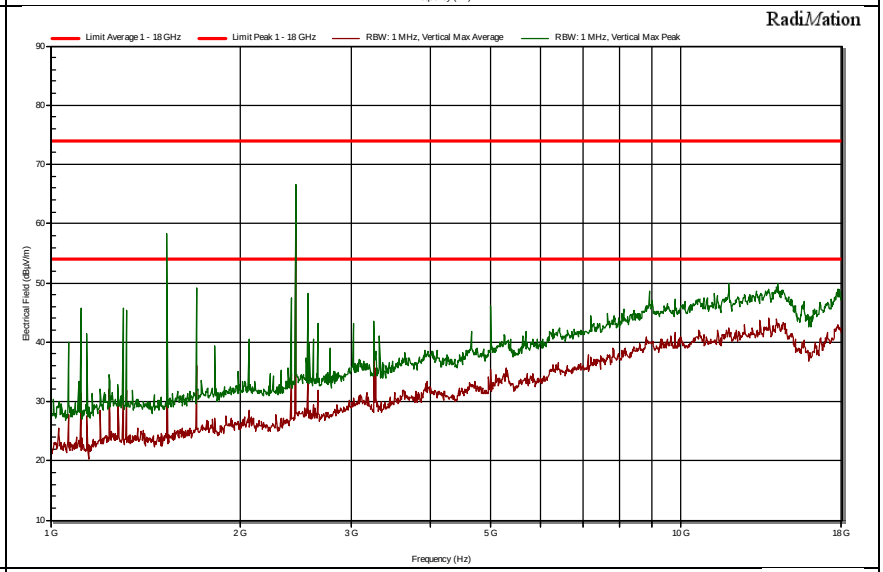

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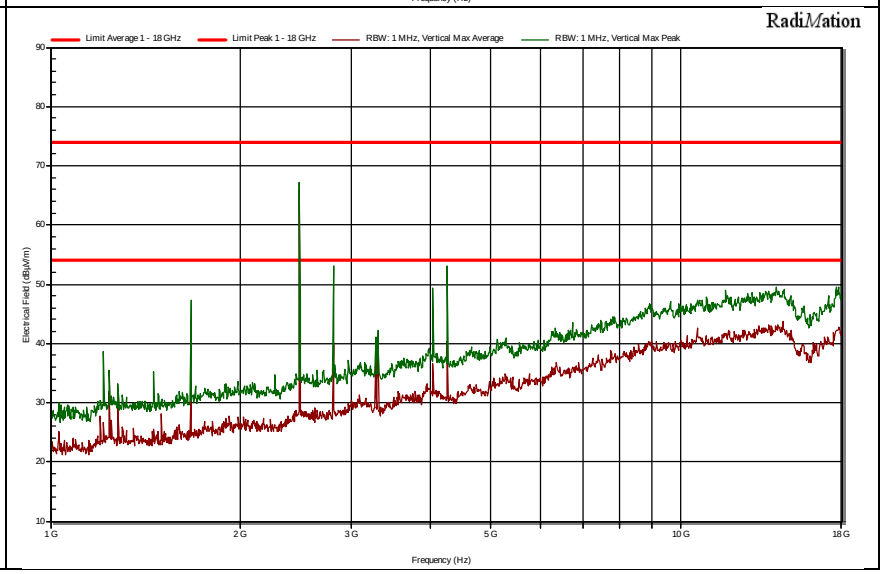
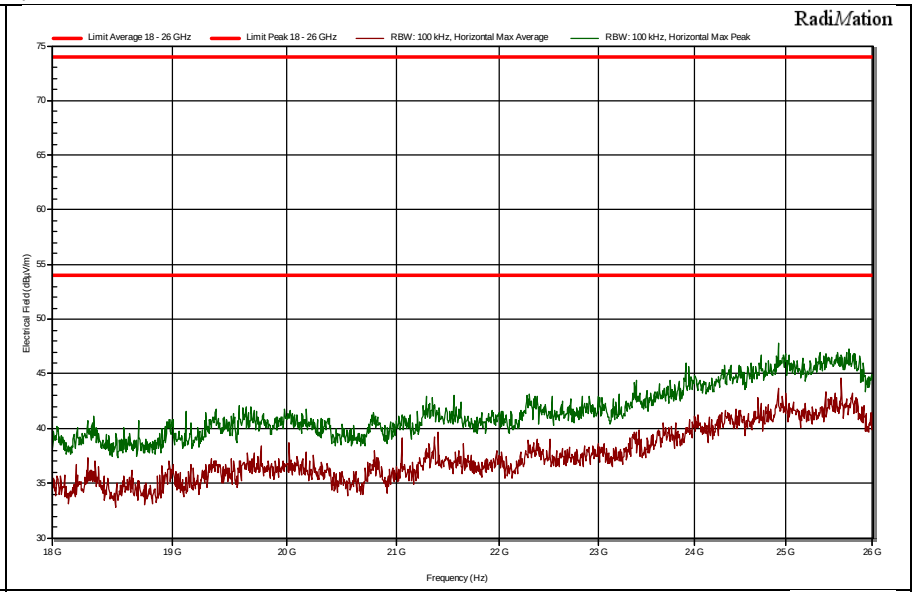


Note: The peak at 2.4 GHz is the transmission frequency and is not subject to the spurious limit.

18-26 GHz, horizontal

Ch. 37



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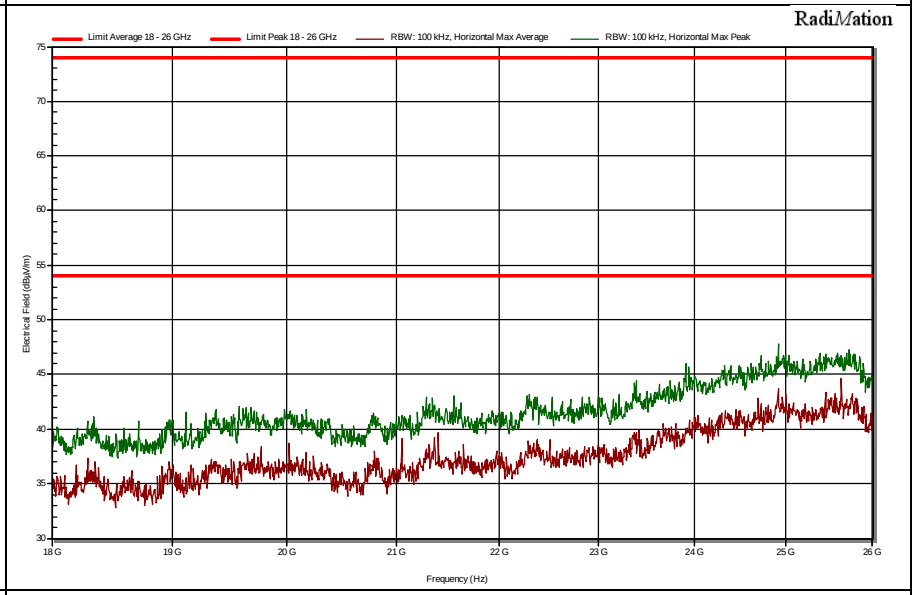

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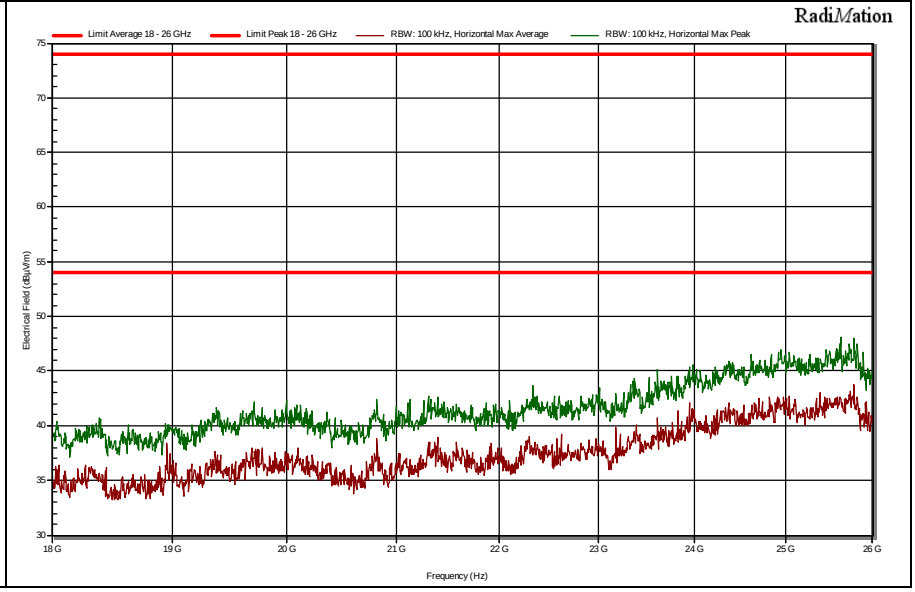
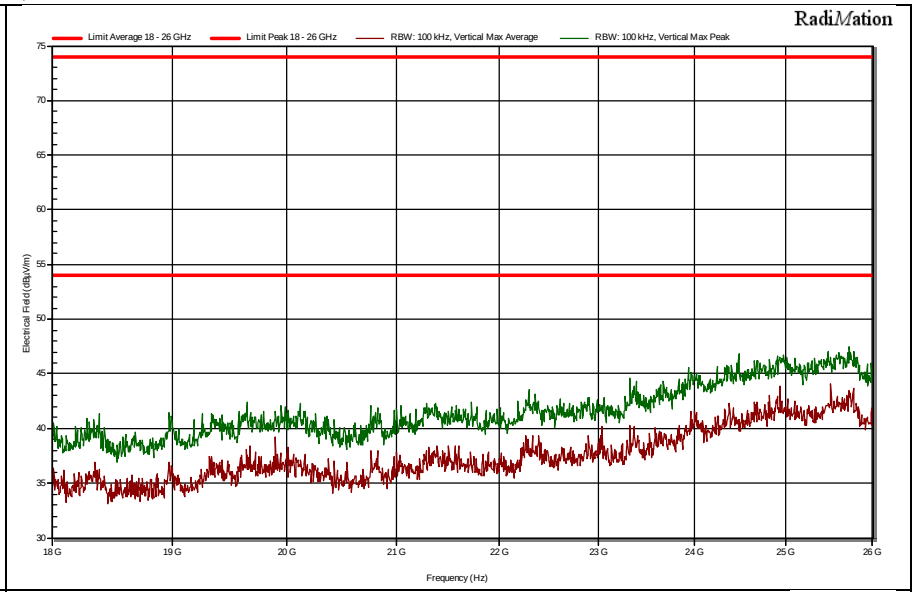


18-26 GHz, vertical

Ch. 37



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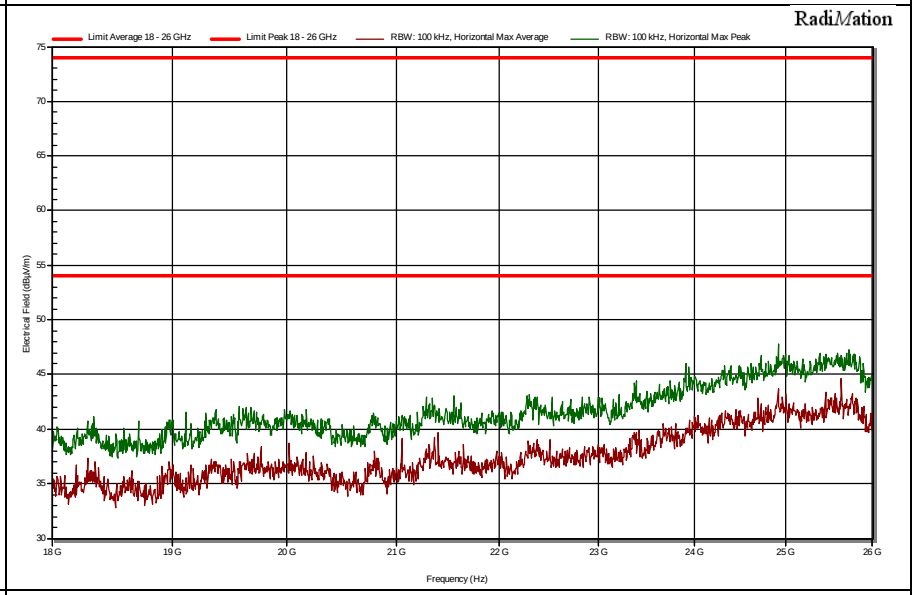

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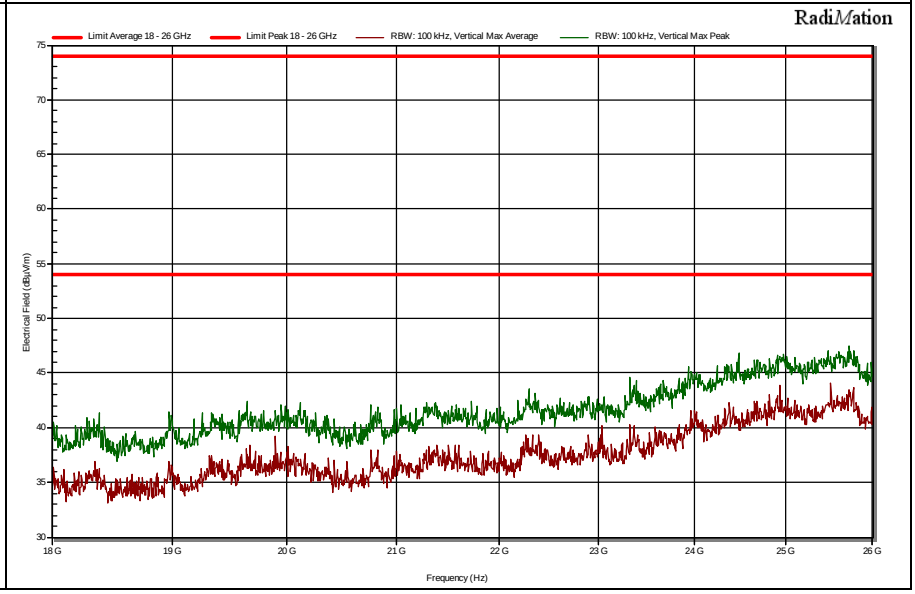
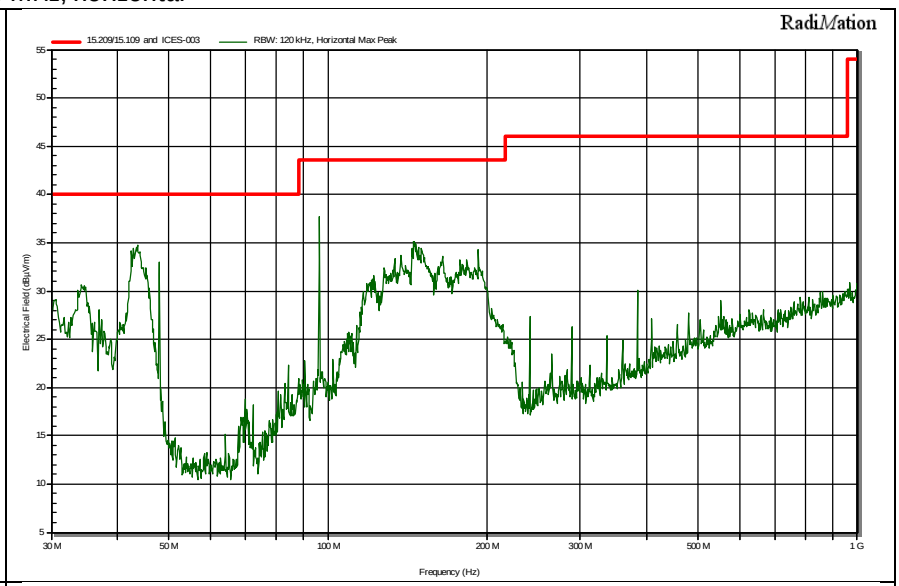


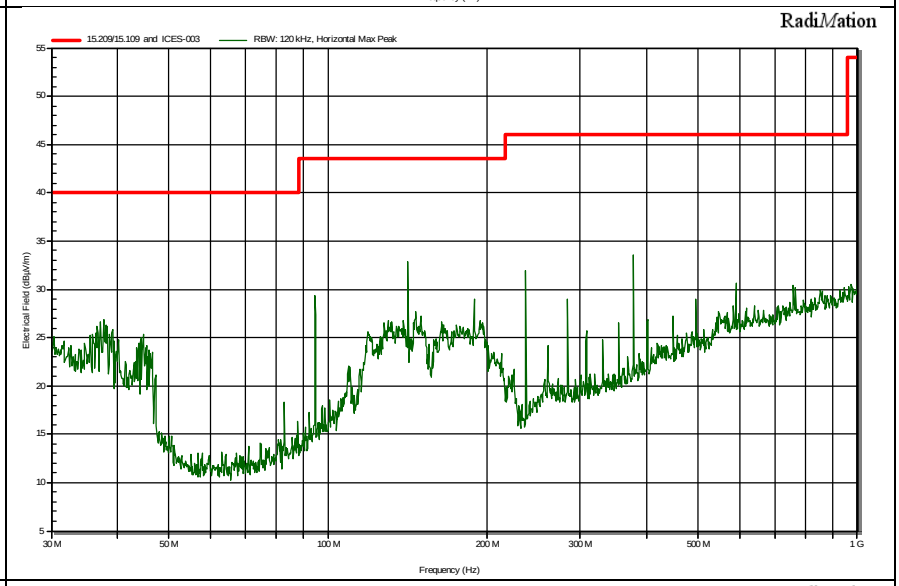
3.2.8 Plots of the 802.11b Radiated Spurious Emissions Measurement

30 -1000 MHz, horizontal

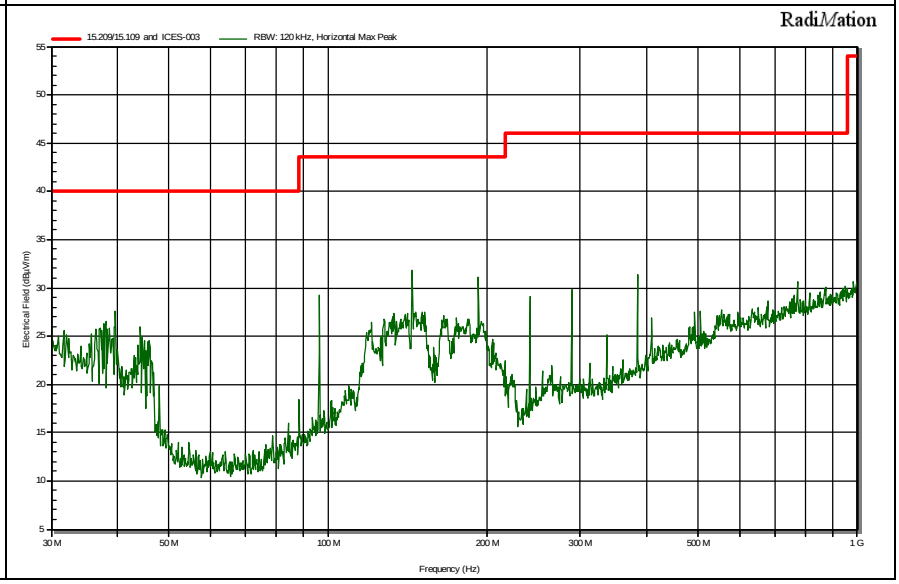
Ch. 1



Ch. 6

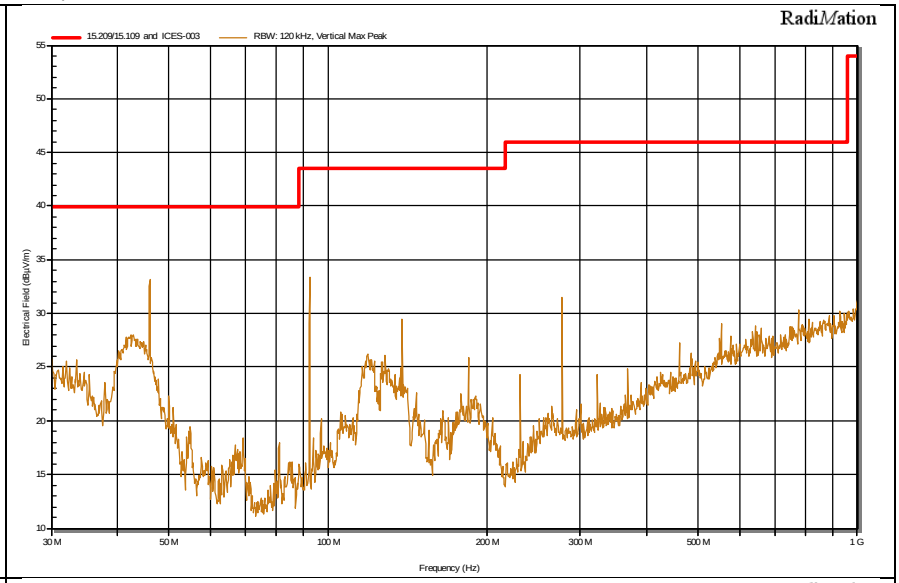


Ch. 11

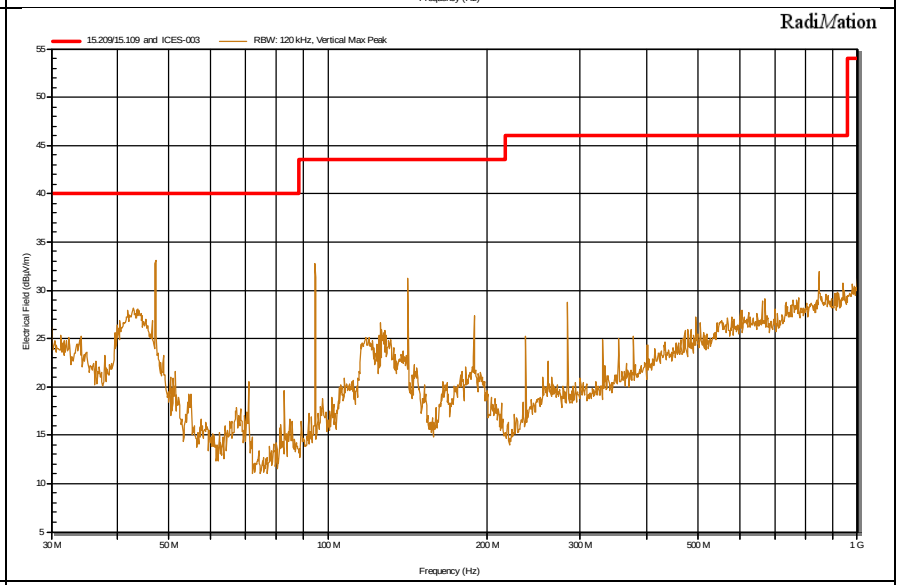


30 -1000 MHz, vertical

Ch. 1



Ch. 6



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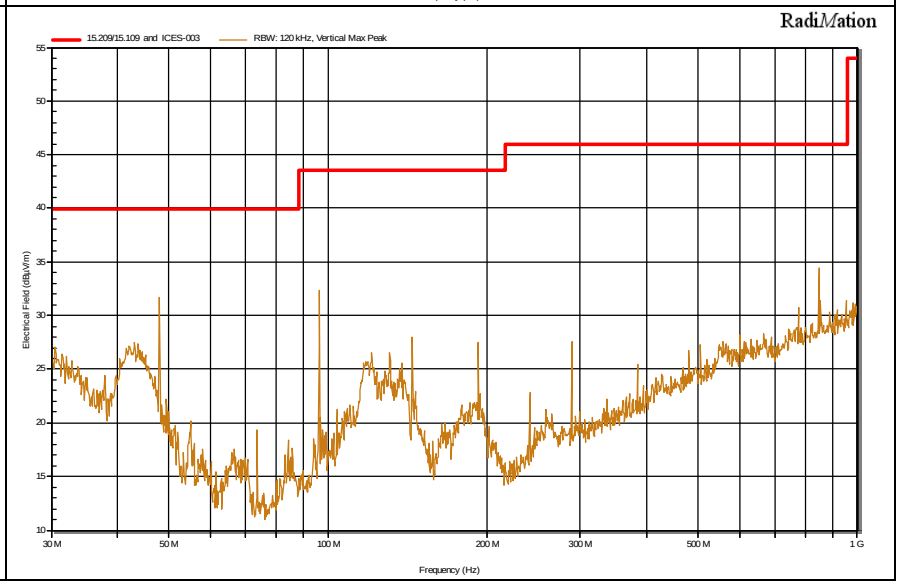
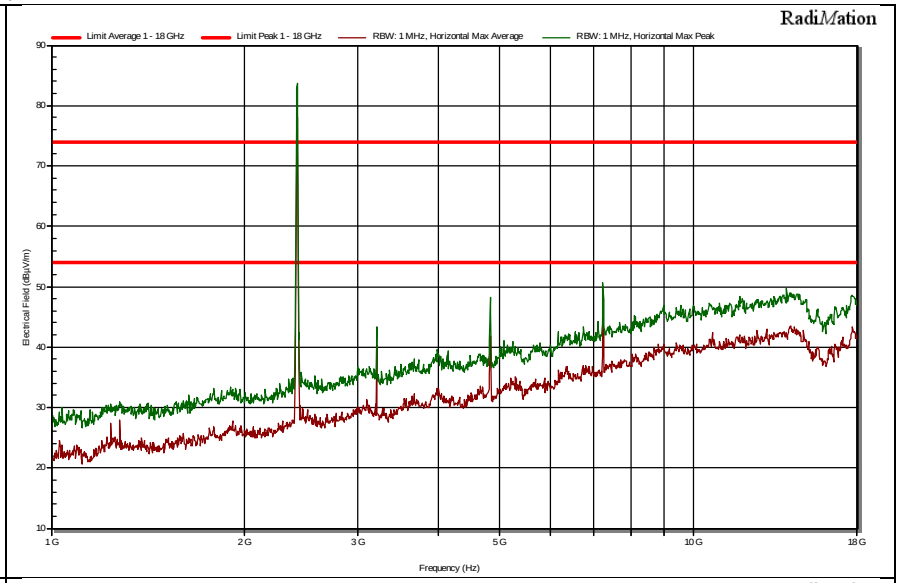


1-18 GHz, horizontal

Ch. 1



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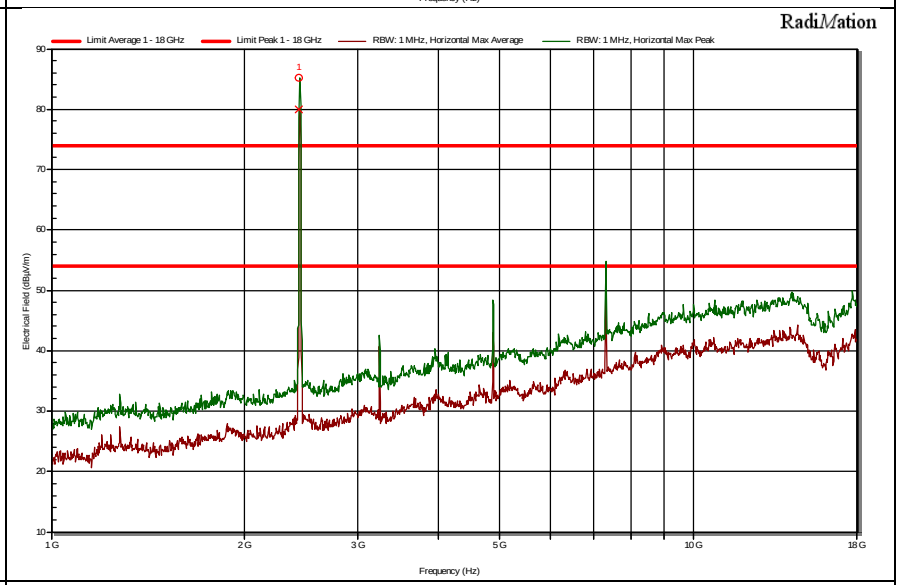

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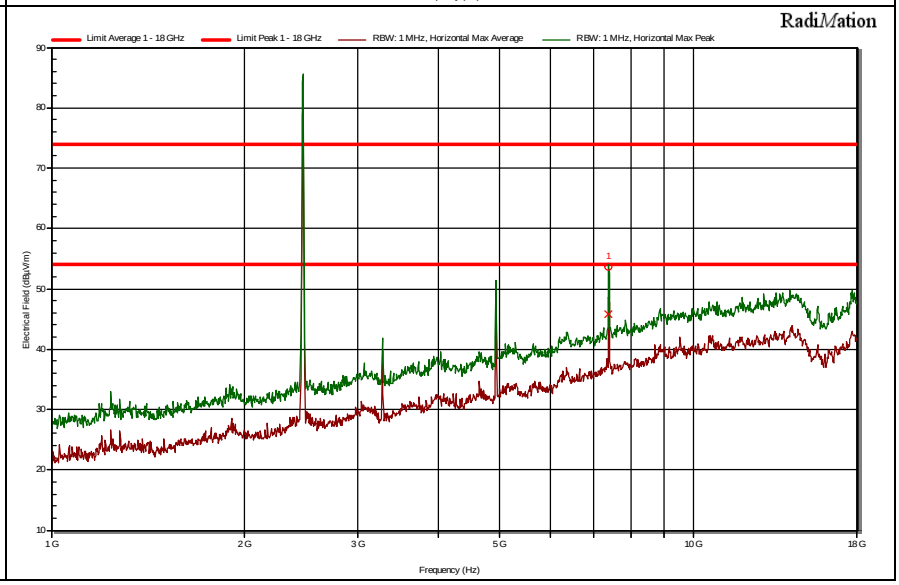
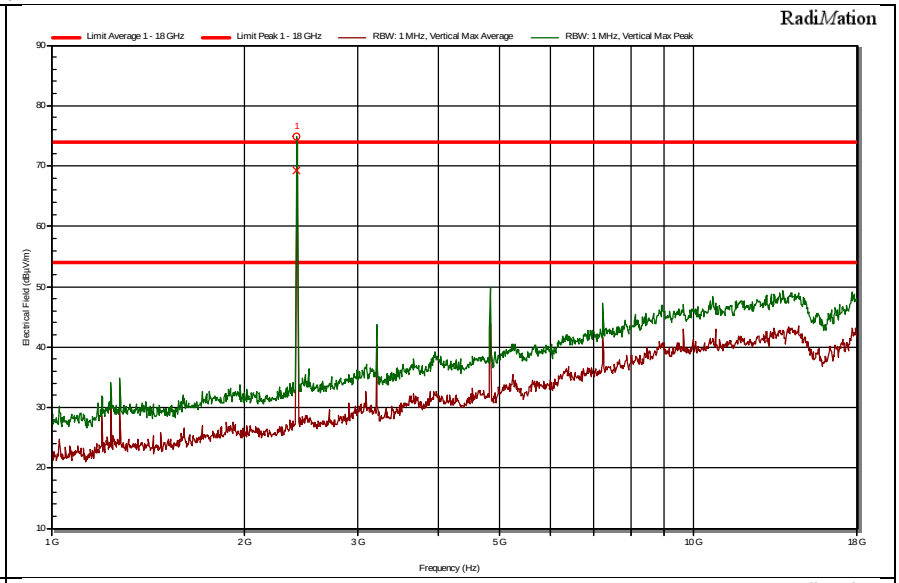


Note: The peak at 2.4 GHz is the transmission frequency and is not subject to the spurious limit.

1-18 GHz, vertical

Ch. 1



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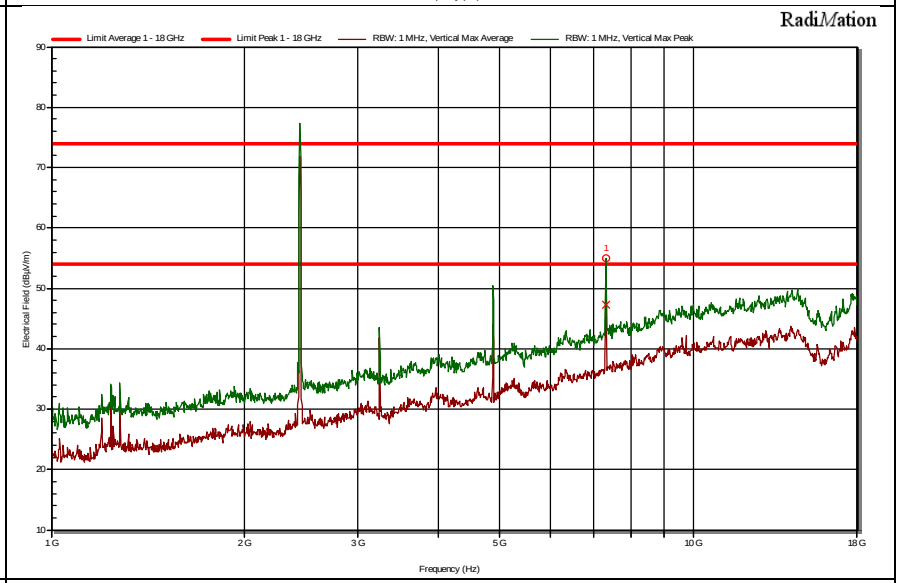

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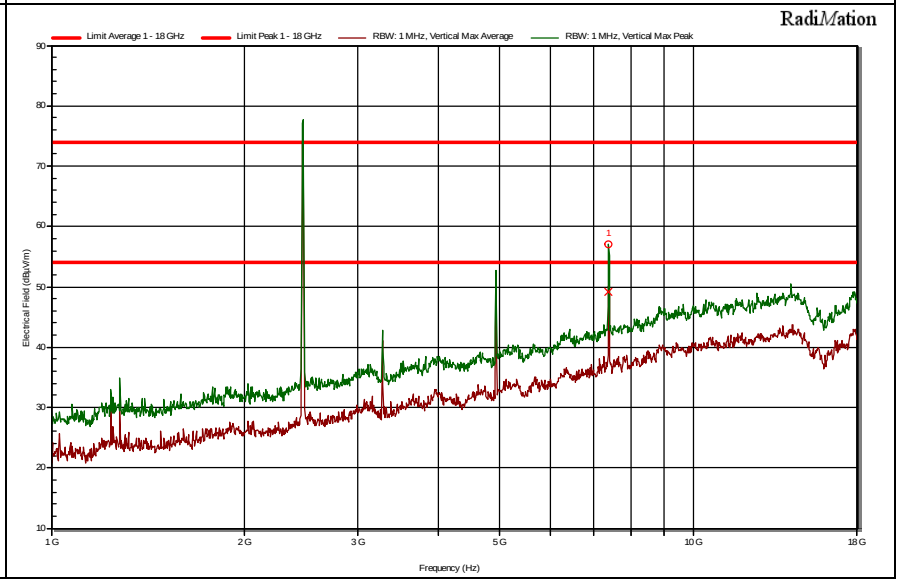
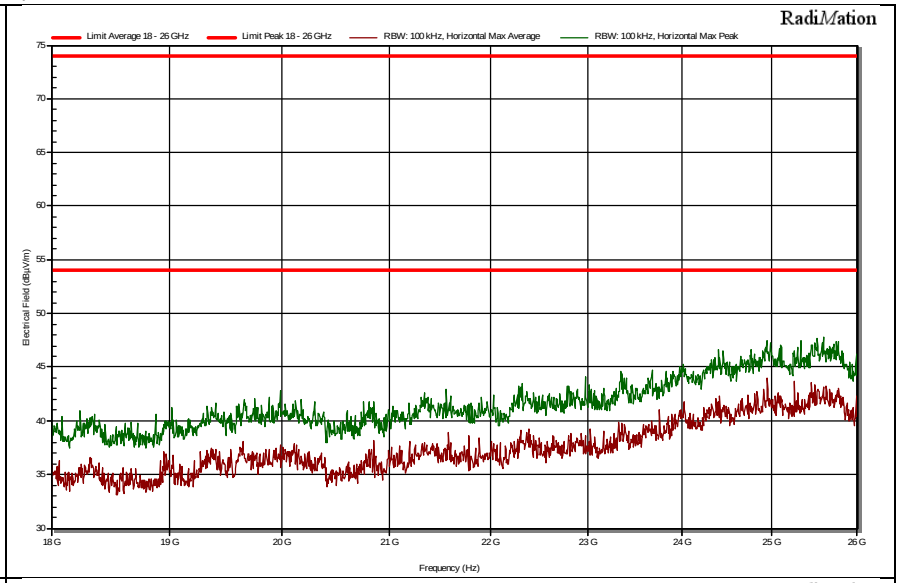


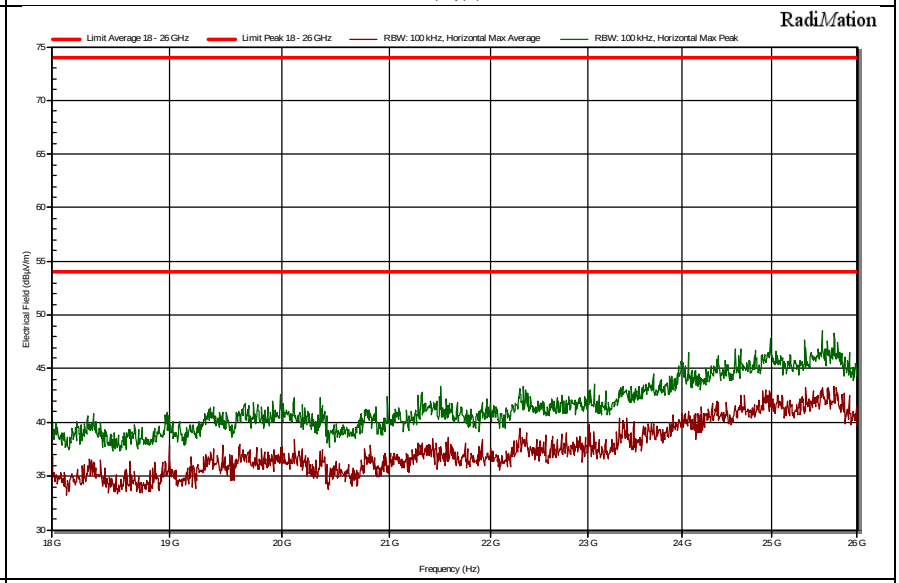
Note: The peak at 2.4 GHz is the transmission frequency and is not subject to the spurious limit.

18-26 GHz, horizontal

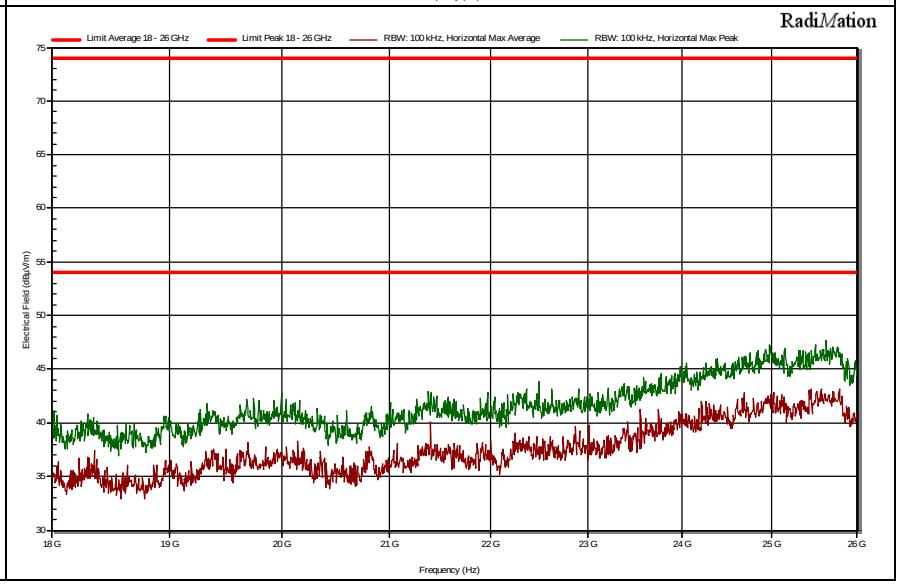
Ch. 1



Ch. 6

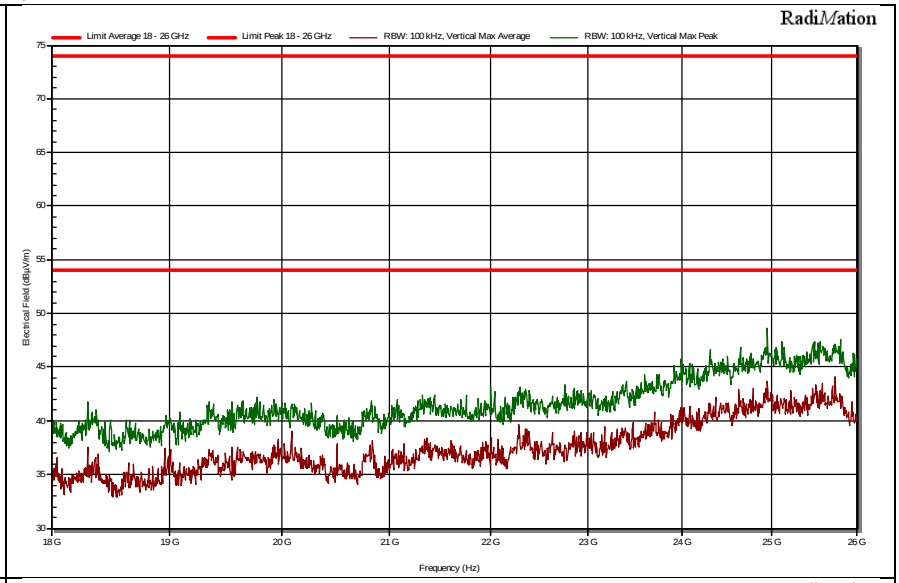


Ch. 11

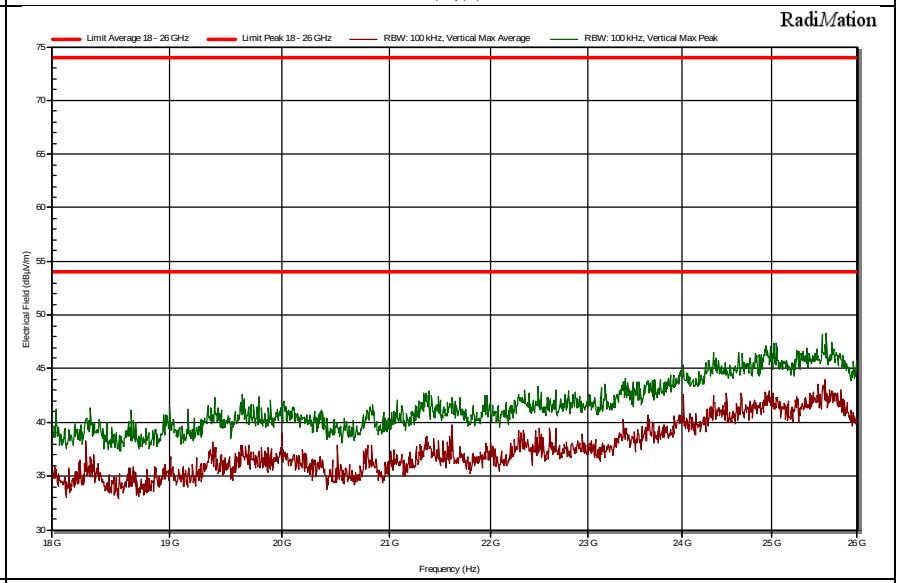


18-26 GHz, vertical

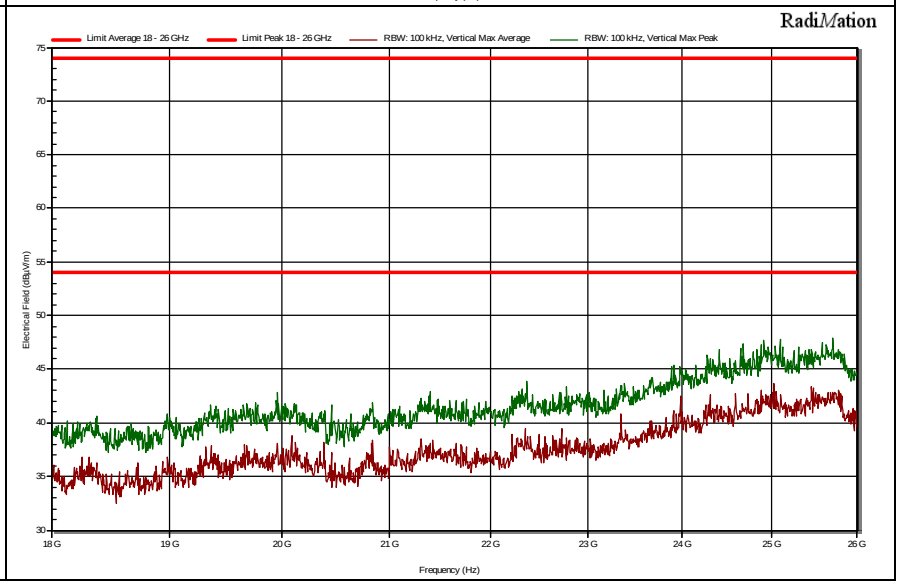
Ch. 1



Ch. 6

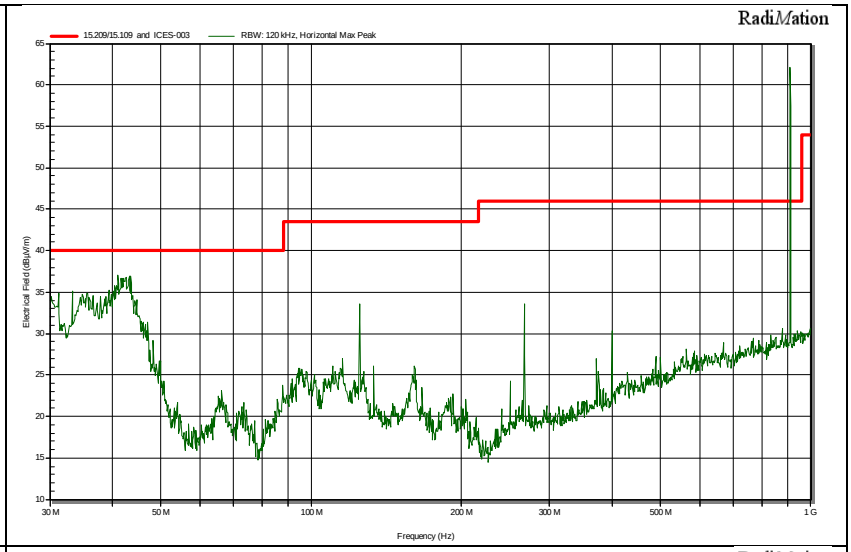
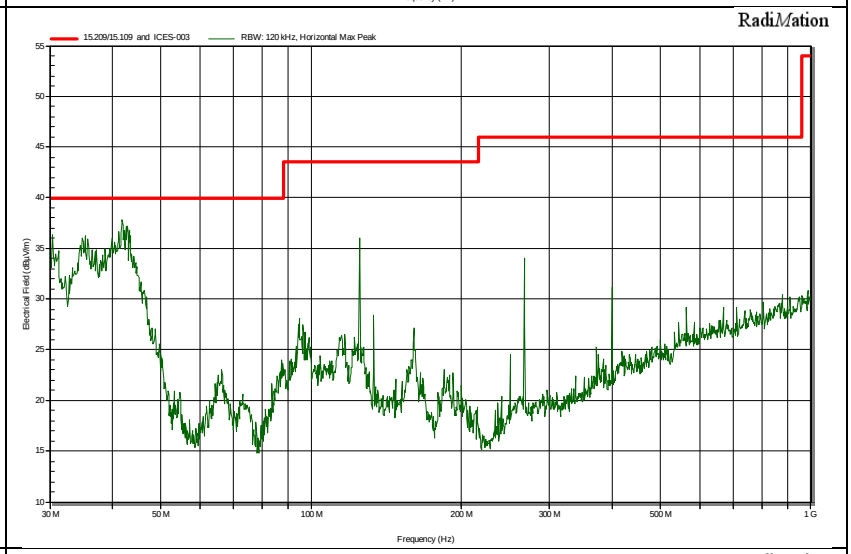
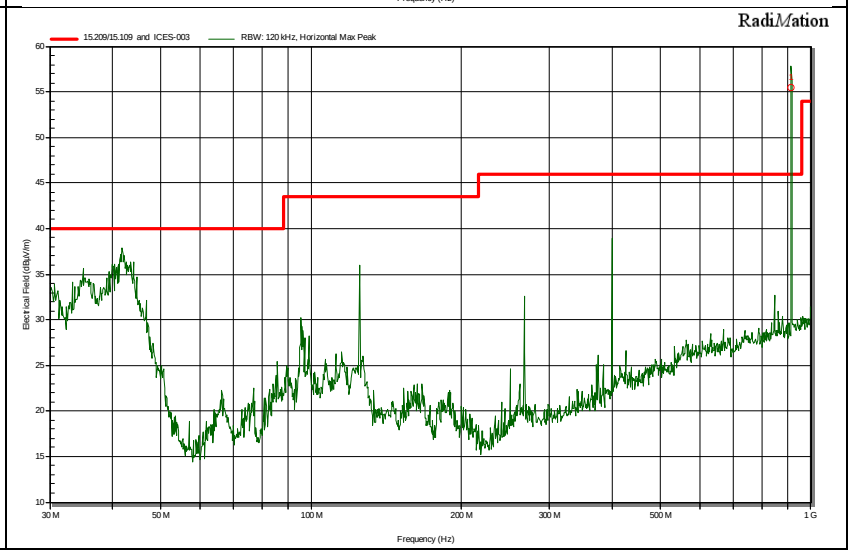


Ch. 11



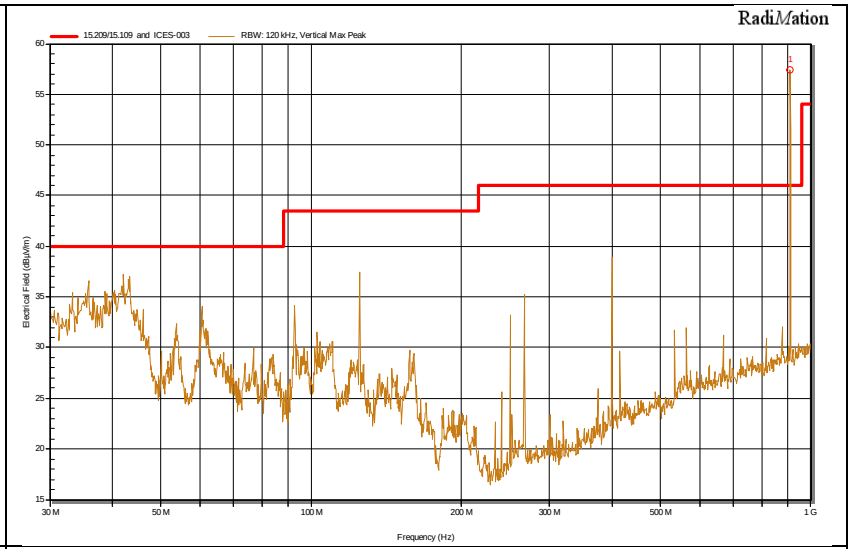
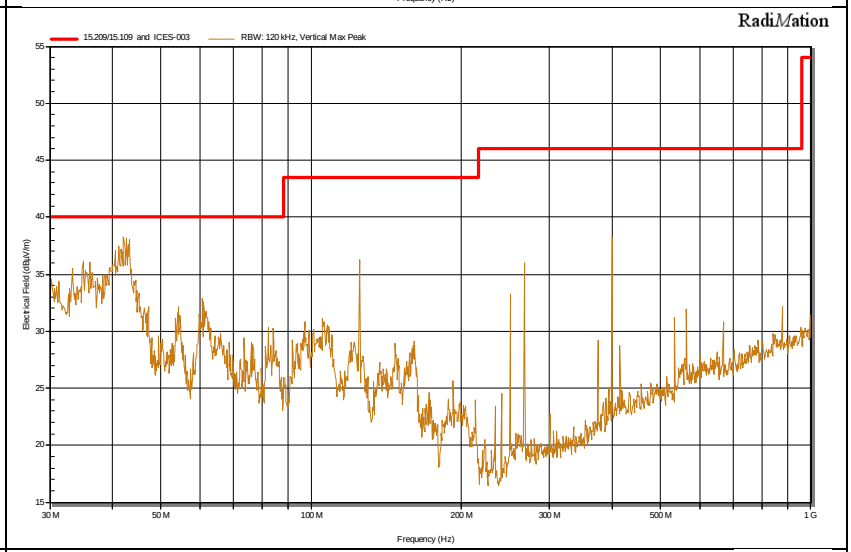
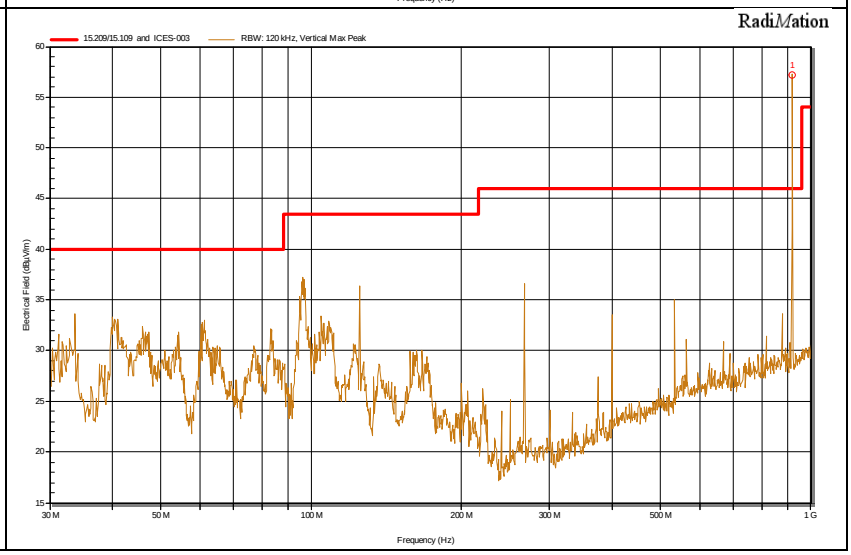
3.2.9 Plots of the Zwave and ZigBee Radiated Spurious Emissions Measurement (simultaneous transmission)

30 -1000 MHz, horizontal

Zwave: Ch1 Zigbee: Ch11	
Zigbee: Ch 18 Zwave: Off	
Zwave: Ch0 Zigbee: Ch26	

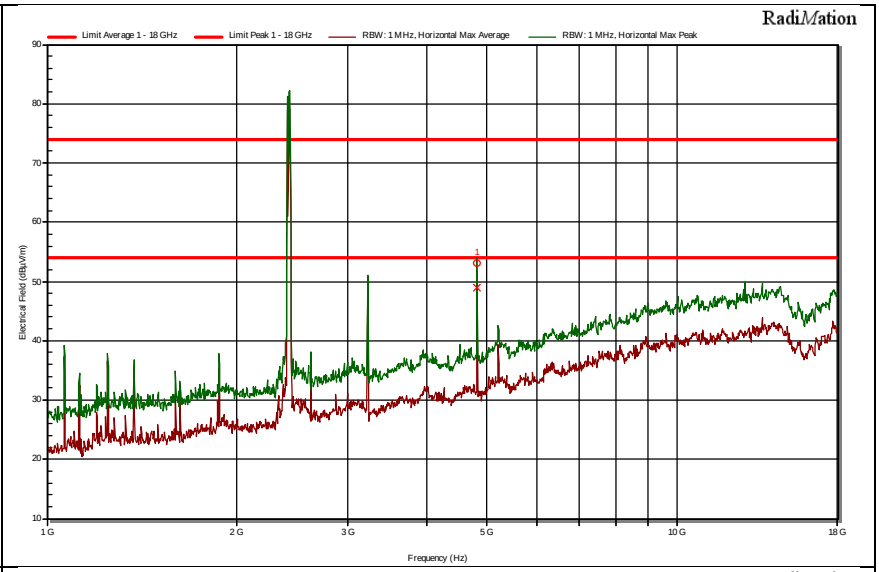
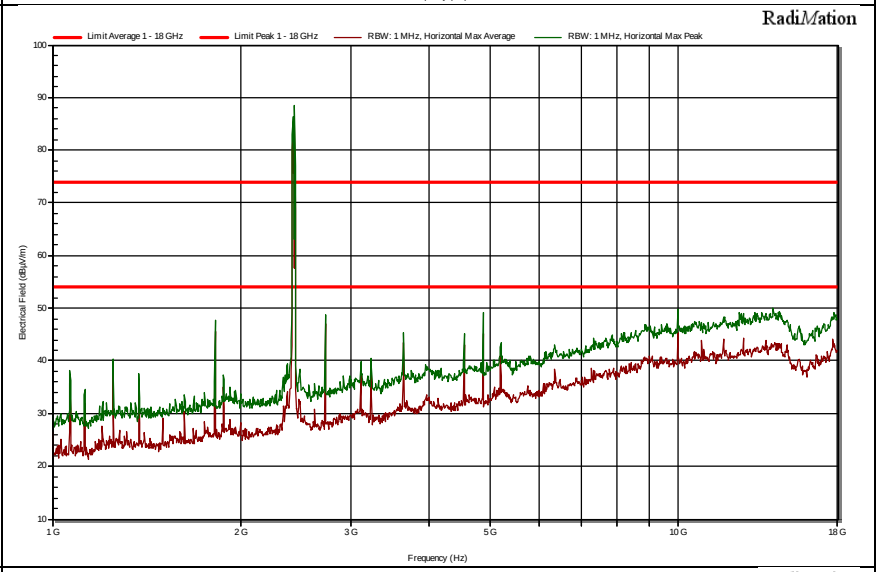
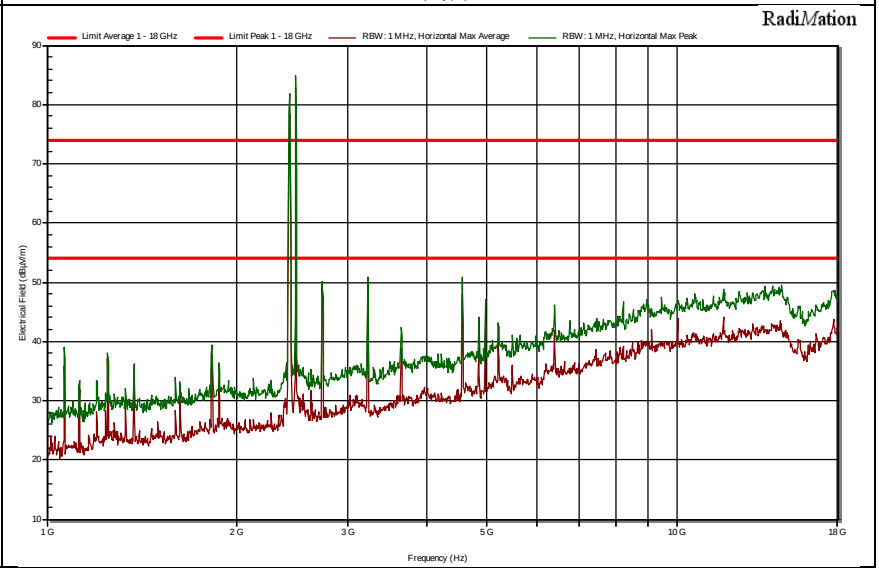
Note: the peaks at 908-916 MHz are the transmission frequencies and are not subject to the limit

30 -1000 MHz, vertical

Zwave: Ch1 Zigbee: Ch11	
Zigbee: Ch 18 Zwave: Off	
Zwave: Ch0 Zigbee: Ch26	

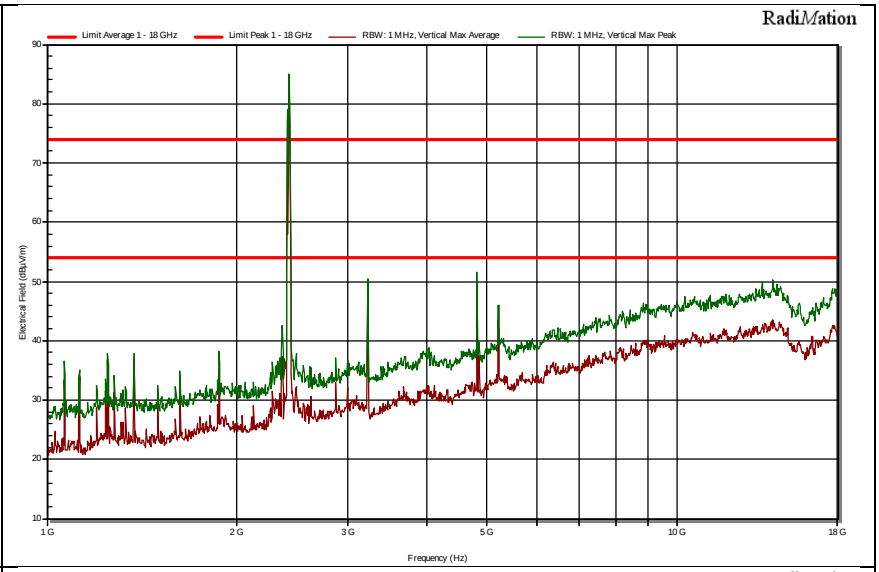
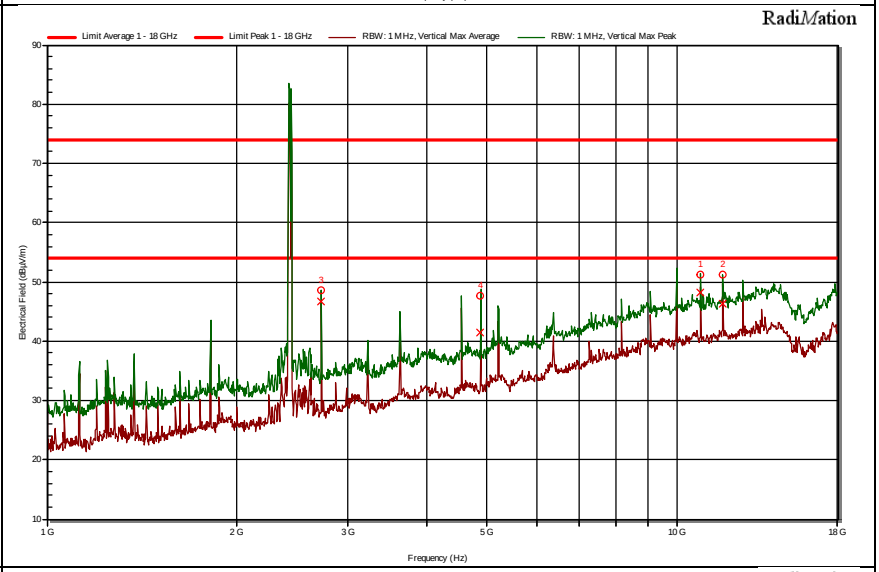
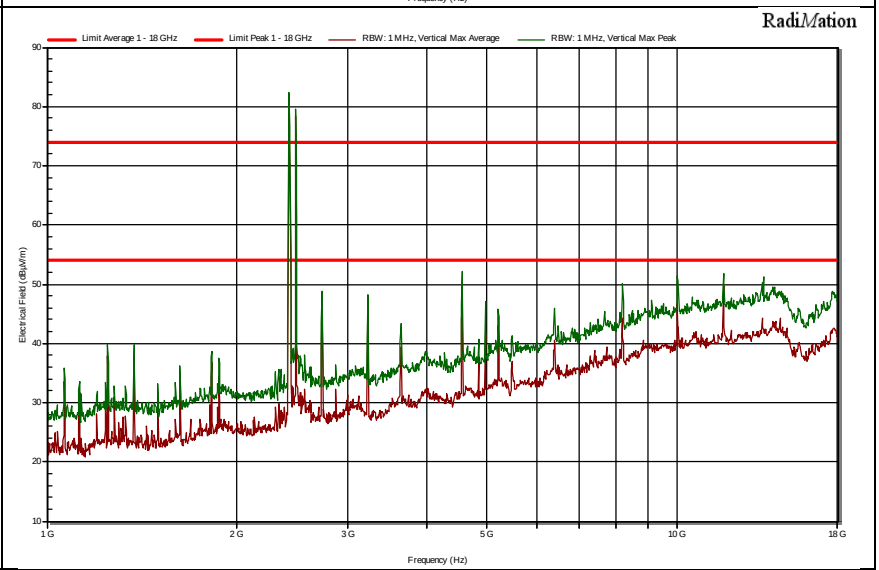
Note: the peaks at 908-916 MHz are the transmission frequencies and are not subject to the limit

1-18 GHz, horizontal

Zwave: off Zigbee: Ch11	
Zigbee: Ch 18 Zwave: Ch 1	
Zwave: Ch0 Zigbee: Ch26	

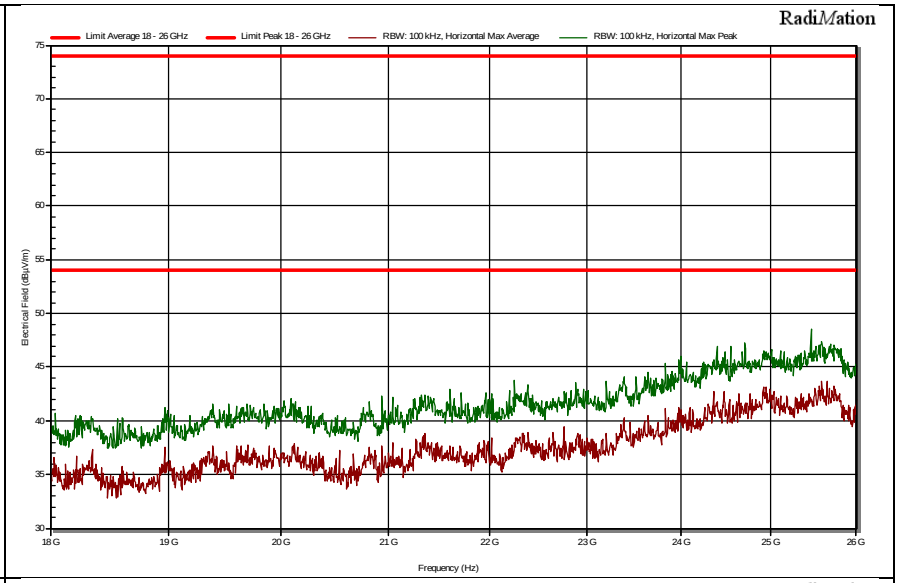
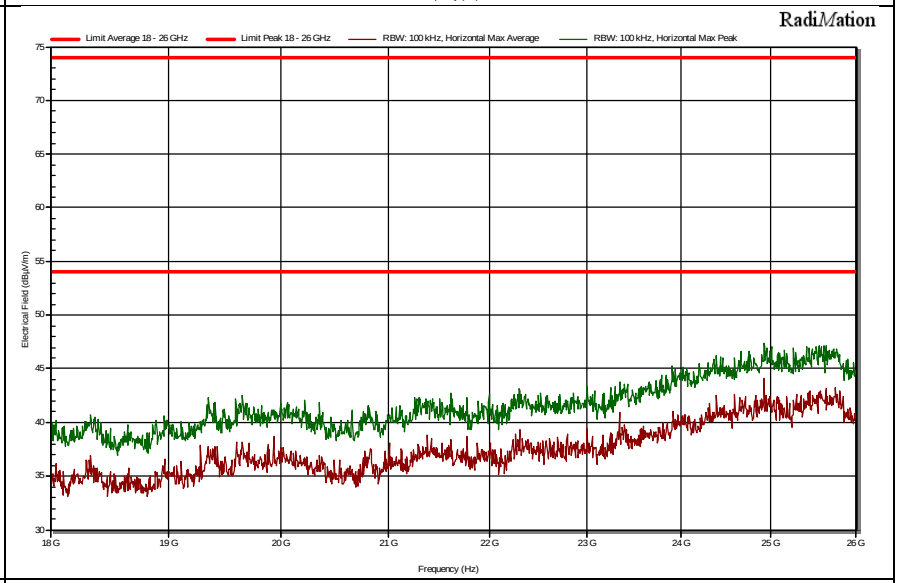
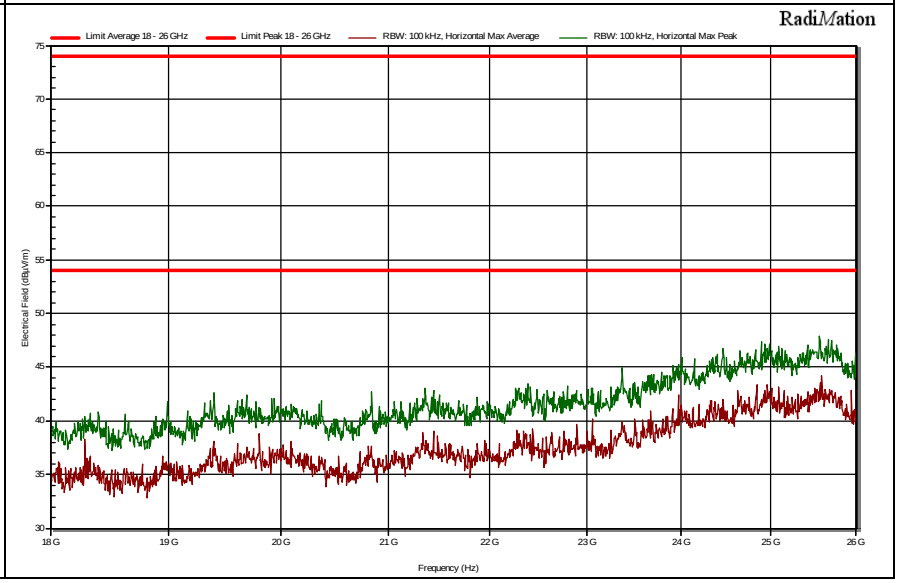
Note: the peaks at 2.4 GHz are the transmission frequencies of Zigbee and WLAN. WLAN connected to the access point needed to control the test mode. These peaks are not subject to the spurious emissions limit.

1-18 GHz, vertical

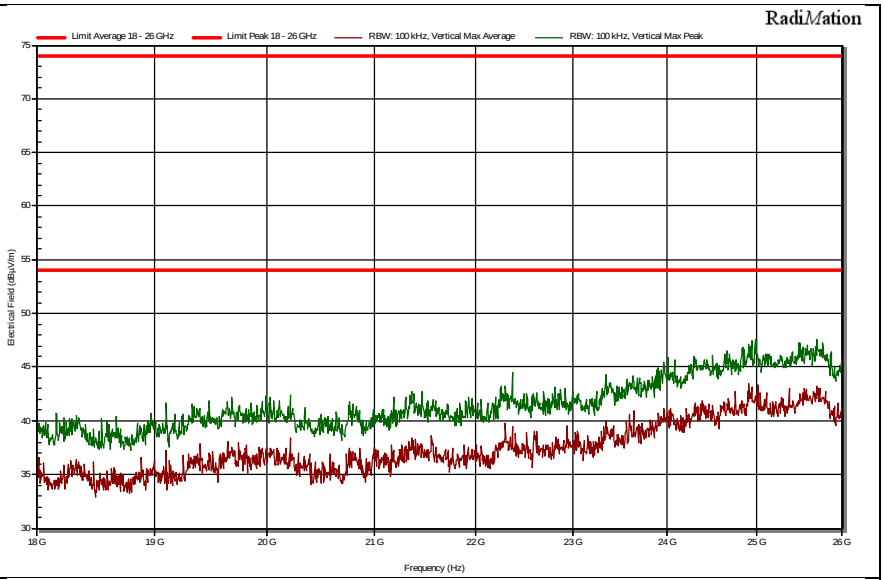
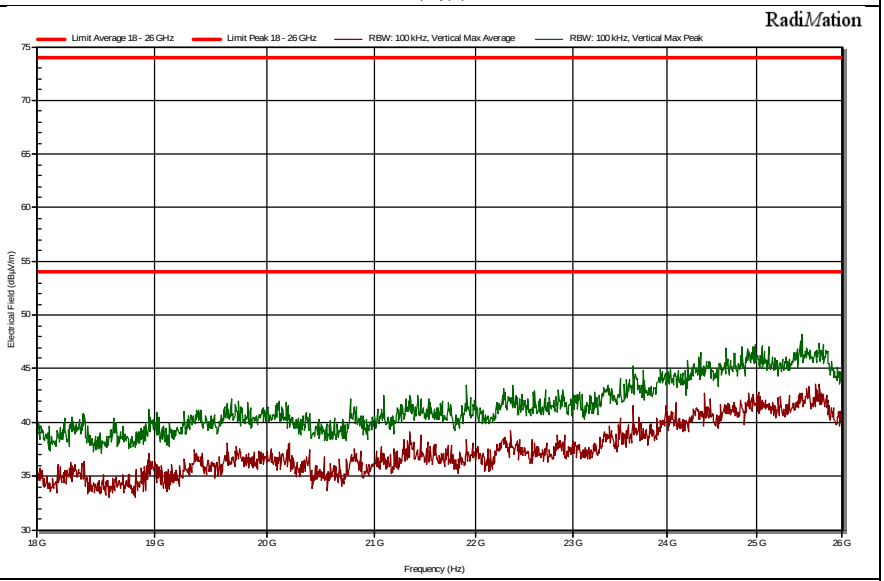
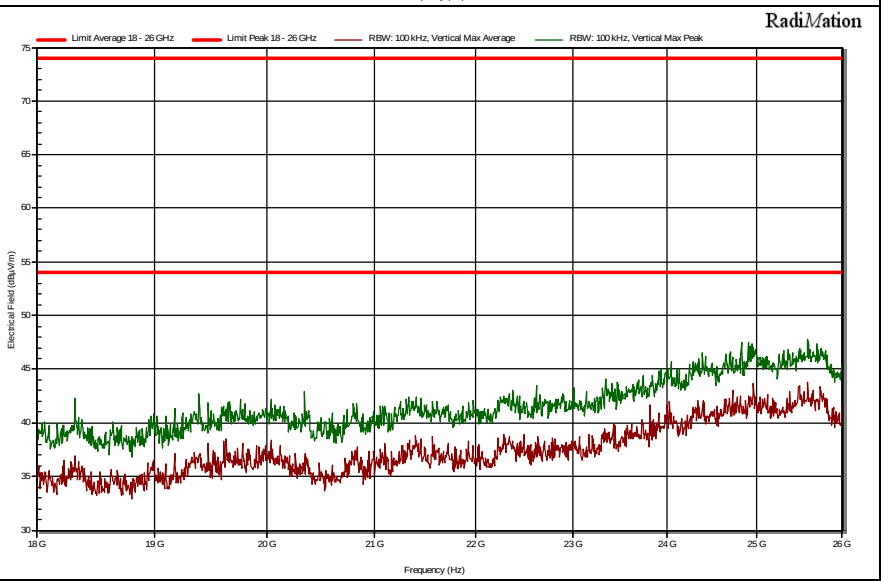
Zwave: off Zigbee: Ch11	
Zigbee: Ch 18 Zwave: Ch 1	
Zwave: Ch0 Zigbee: Ch26	

Note: the peaks at 2.4 GHz are the transmission frequencies of Zigbee and WLAN. WLAN connected to the access point needed to control the test mode. These peaks are not subject to the spurious emissions limit.

18-26 GHz, horizontal

Zwave: Ch1 Zigbee: Ch11	
Zigbee: Ch 18 Zwave: Off	
Zwave: Ch0 Zigbee: Ch26	

18-26 GHz, vertical

Zwave: Ch1 Zigbee: Ch11	
Zigbee: Ch 18 Zwave: Off	
Zwave: Ch0 Zigbee: Ch26	

3.3 Antenna port conducted spurious emissions

3.3.1 Limit

All emissions shall be attenuated by at least 20 dB relative to the maximum in-band power.

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

30 MHz to 26.5 GHz: According to ANSI C63.4-2014, section 8.3
IRN 016 – Method 12

3.3.5 Measurement Uncertainty

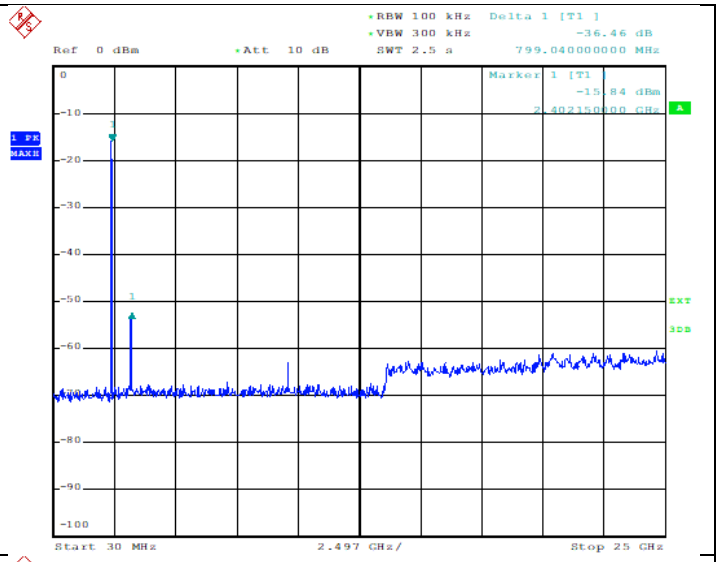
Uncertainty: ±1.1 dB

3.3.6 Plots of the conducted spurious emissions measurement

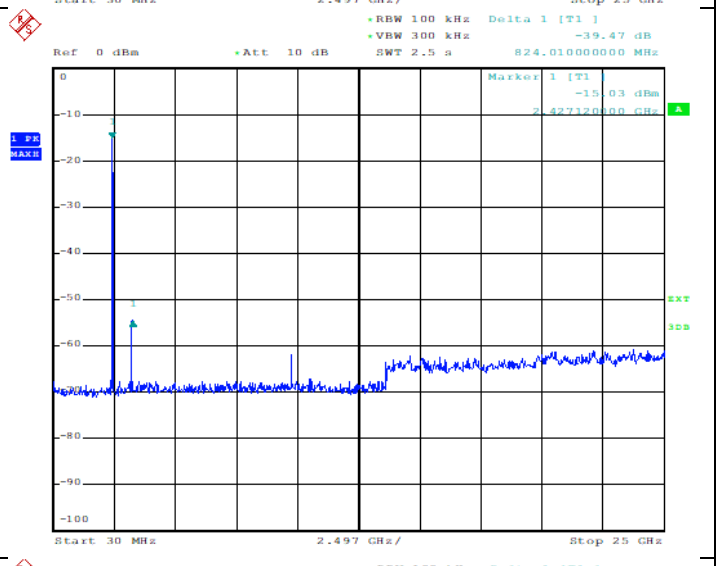
See next page.

BLE

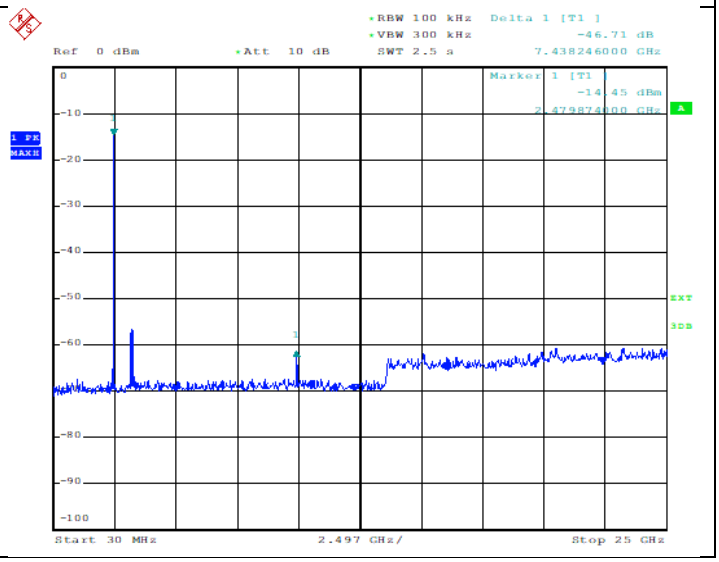
Ch. 37



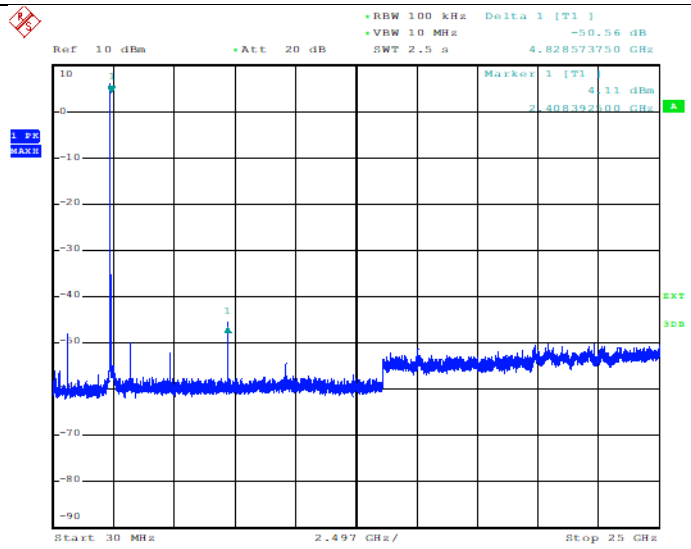
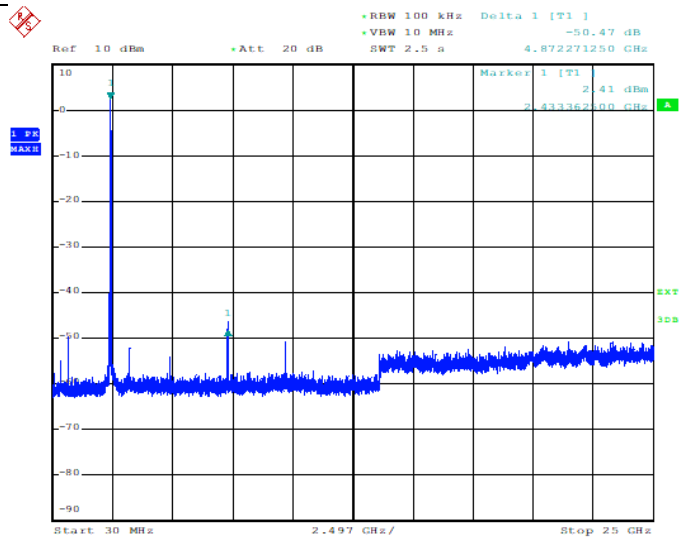
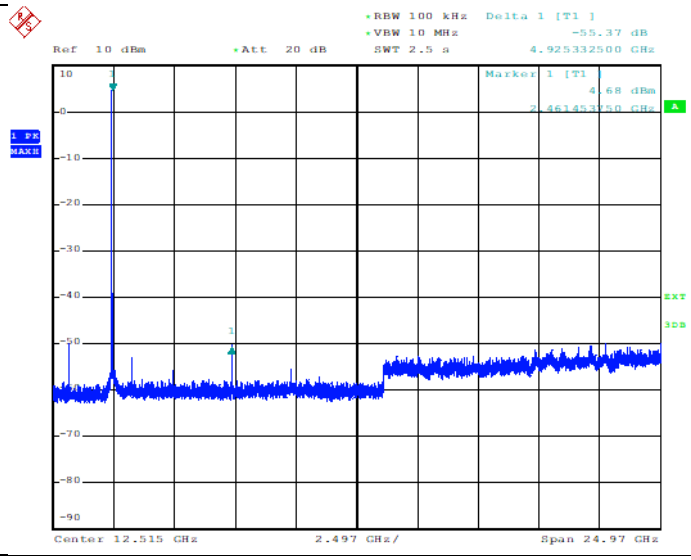
Ch. 18



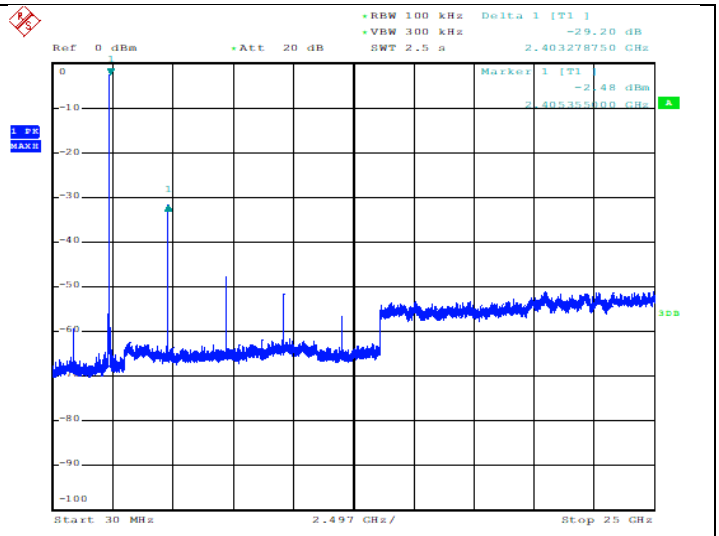
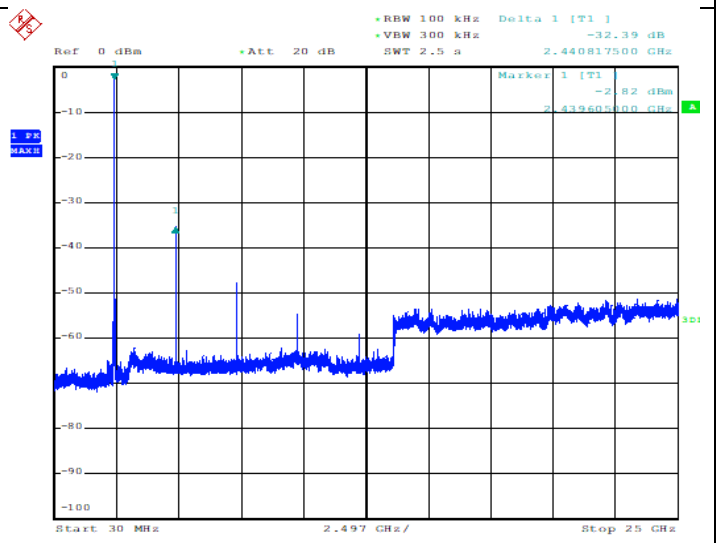
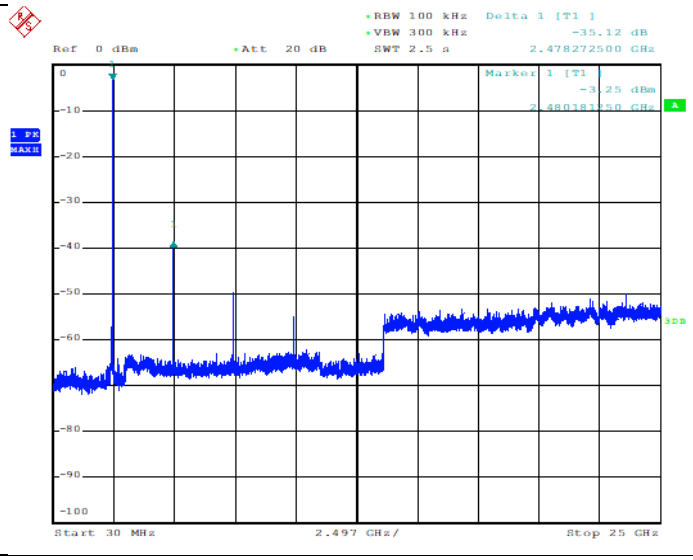
Ch. 39



802.11b

Ch. 1	
Ch. 6	
Ch. 11	

Zigbee

Ch. 11	
Ch. 18	
Ch. 26	

3.4 6dB bandwidth Measurement

3.4.1 Limit

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

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

Tests according to ANSI C63.10
IRN 017 - Occupied bandwidth (Hz) Method 4 – DTS Bandwidth.

3.4.5 Test Results of the 6 dB bandwidth Measurement

Requirement only applicable to BLE, WLAN and Zigbee transmitters

Technology Std.	Channel	Frequency (MHz)	Data rate	6dB bandwidth (kHz)
Bluetooth Low energy	37	2402	1 Mbps	620
	18	2440	1 Mbps	615
	39	2480	1 Mbps	620
WLAN 802.11b	1	2412	11 Mbps	9000
	6	2437	11 Mbps	7700
	11	2462	11 Mbps	7650
Zigbee	11	2405	250 kbps	1620
	18	2440	250 kbps	1620
	26	2475	250 kbps	1610
Uncertainty	± 36 kHz			

3.5 99% Occupied Bandwidth

3.5.1 Limit

According to RSS-Gen 6.7

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

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 ≥ 3x 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.

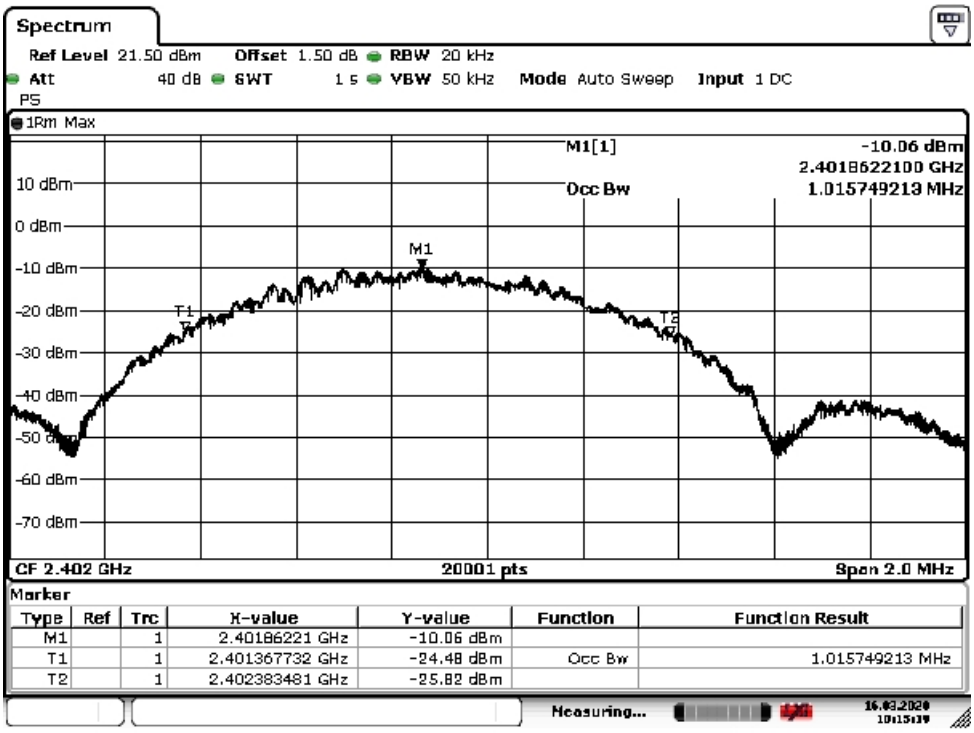
3.5.5 Test results of the 99% occupied bandwidth measurement

Technology Std.	Channel	Frequency (MHz)	Data rate	99% bandwidth (kHz)	Uncertainty (kHz)
Bluetooth Low energy	37	2402	1 Mbps	1015.7	±12.8
	18	2440	1 Mbps	1015.3	±12.8
	39	2480	1 Mbps	1015.4	±12.8
WLAN 802.11b	1	2412	11 Mbps	13404	±86
	6	2437	11 Mbps	13356	±86
	11	2462	11 Mbps	13386	±86
Zigbee	11	2405	250 kbps	2827.7	±44.5
	18	2440	250 kbps	2878.3	±44.5
	26	2475	250 kbps	2860.5	±44.5
Zwave	1	908.4	40 kbps	93.8	±2.2
	0	916.0	100 kbps	110	±2.2

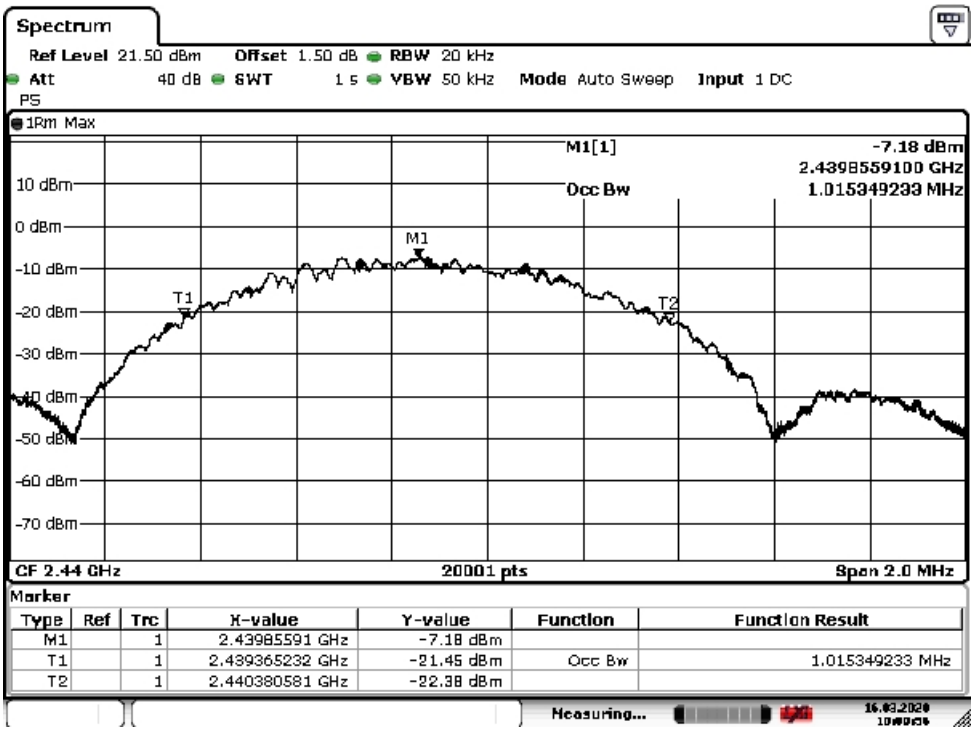
3.5.6 Plots of the 99% occupied bandwidth measurement

BLE

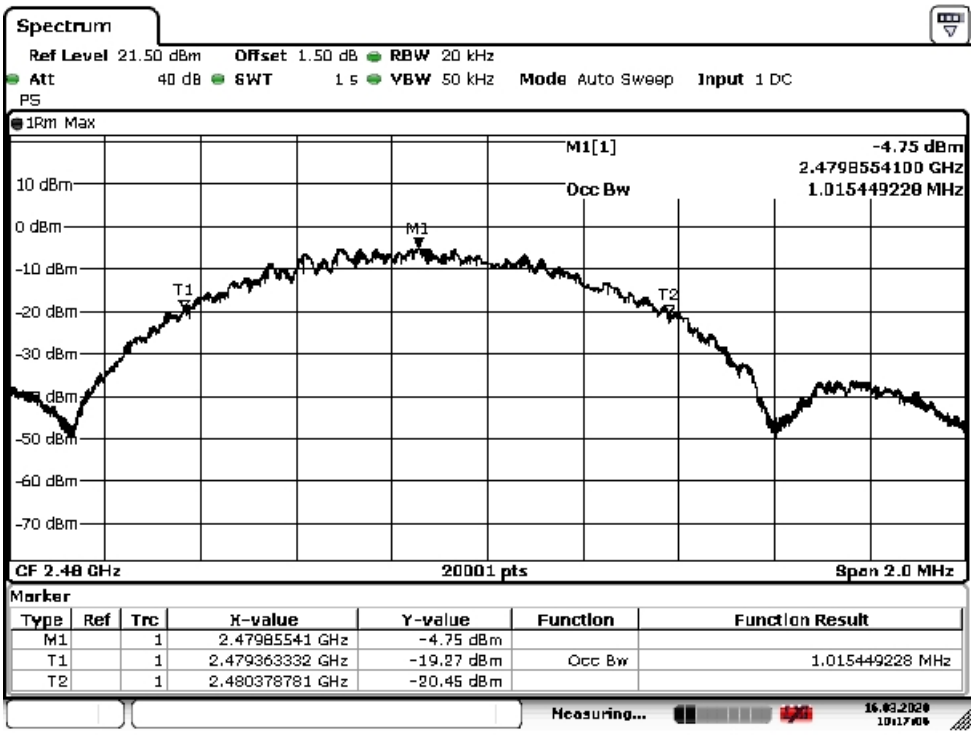
Channel 37



Channel 18

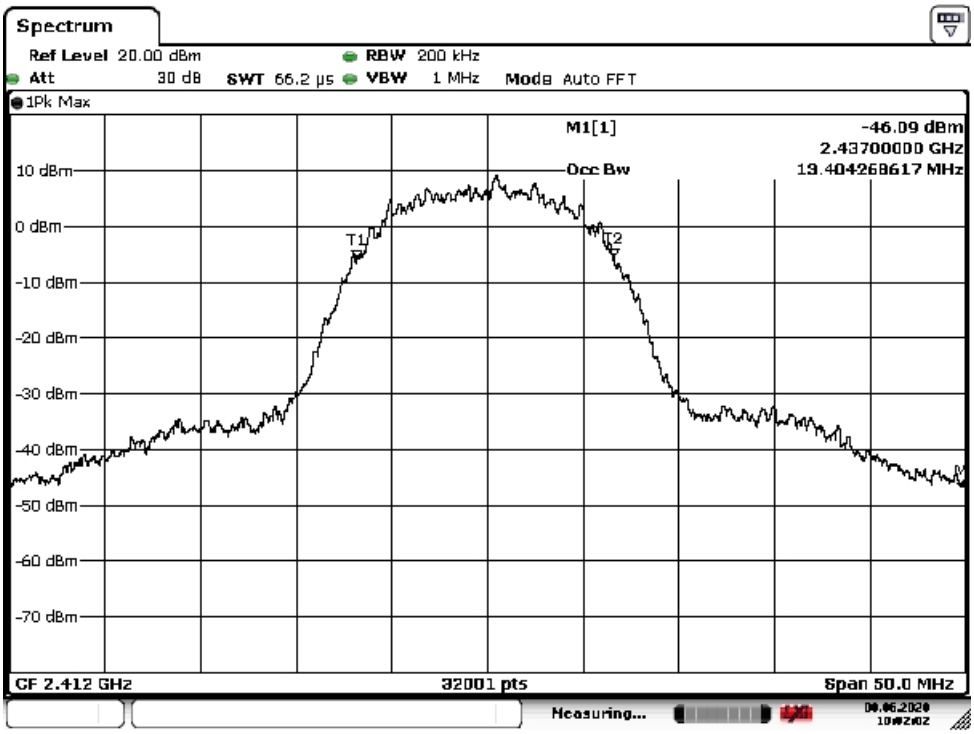


Channel 39

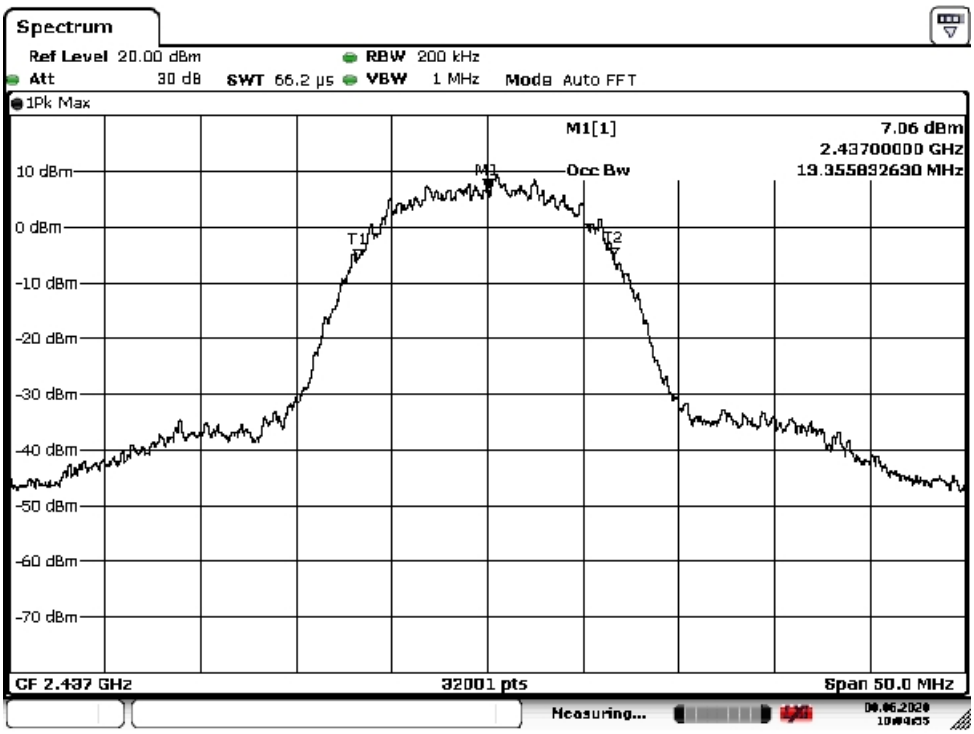


802.11b

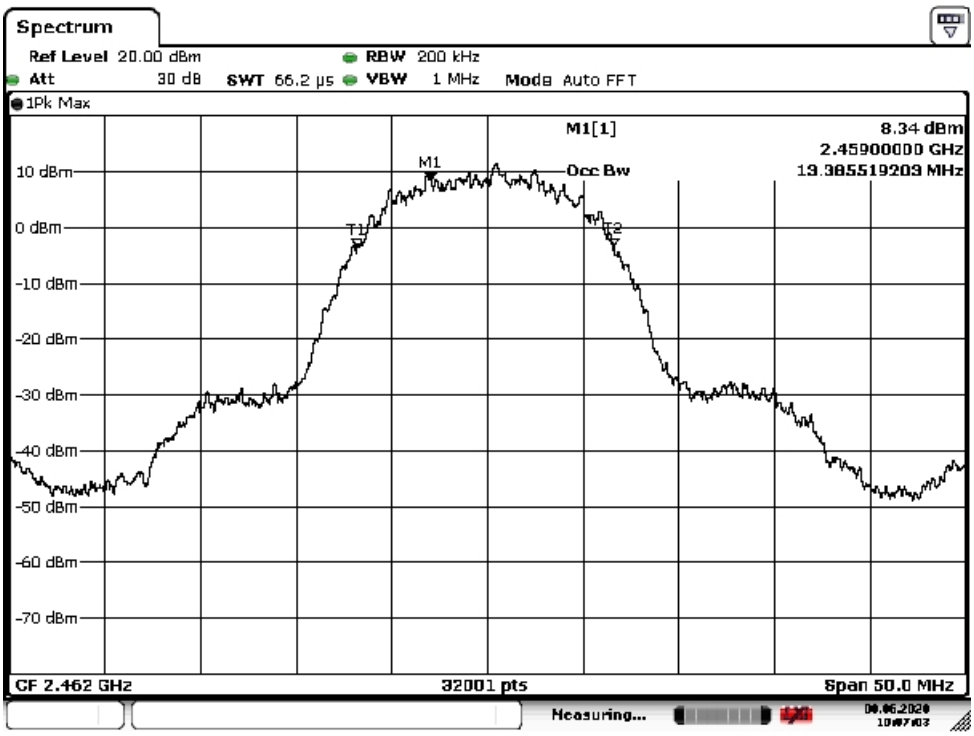
Channel 1



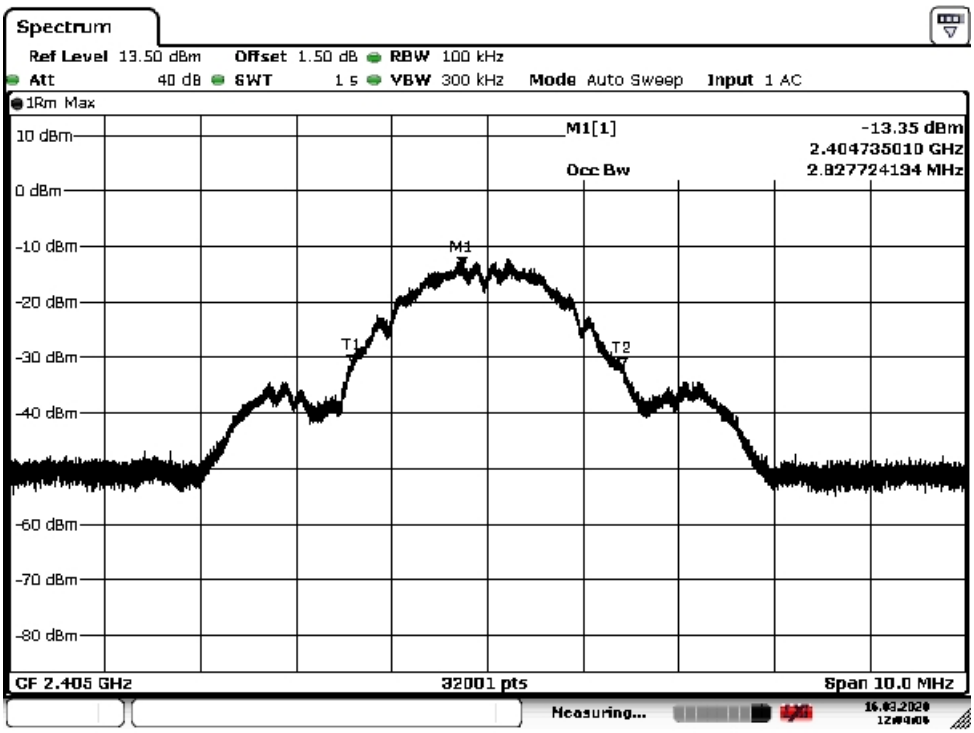
802.11b
Channel 6



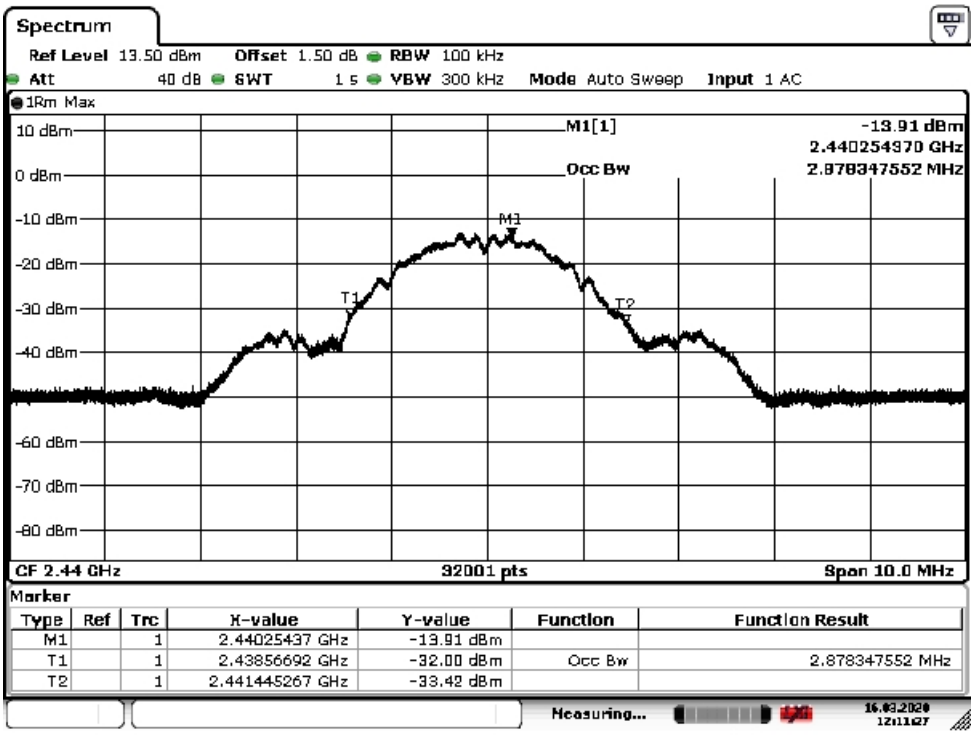
Channel 11



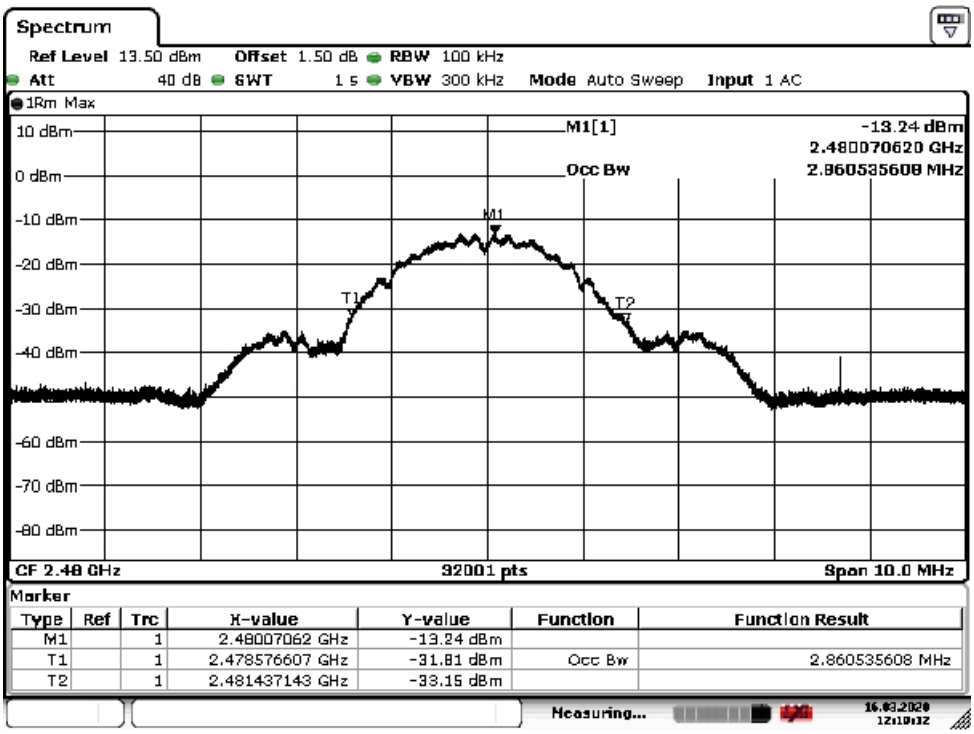
Zigbee
Channel 11



Channel 18



Zigbee
Channel 26



3.6 Output Power Measurement

3.6.1 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.

3.6.2 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.
IRN 014 - RF power (W) - Method 1 – AVGSA (DTS) according to ANSI C63.10.

3.6.5 Test results of Output Power Measurement

Requirement only applicable to BLE, WLAN and Zigbee.

Peak method

Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power (dBm)
Bluetooth Low energy	37	2402	1 Mbps	8.2
	18	2440	1 Mbps	7.4
	39	2480	1 Mbps	9.3
WLAN 802.11b	1	2412	2 Mbps	17.4
	6	2437	2 Mbps	16.1
	11	2462	2 Mbps	16.8
Zigbee	11	2405	250 kbps	7.0
	18	2440	250 kbps	7.6
	26	2475	250 kbps	8.5
Uncertainty	±0.71 dB			

Note: For each technology only the worst case configuration of data rate and occupied bandwidth for output power is reported

3.7 Power Spectral Density

3.7.1 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.

3.7.2 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

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)

3.7.5 Test results of Power Spectral Density Measurement

Measurement applicable to BLE, WLAN and Zigbee

Peak Power spectral density

Technology Std.	Channel	Frequency (MHz)	Data rate	Peak power spectral density (dBm/3kHz)
Bluetooth Low energy	37	2402	1 Mbps	-0.44
	18	2440	1 Mbps	-3.69
	39	2480	1 Mbps	-5.05
WLAN 802.11b	1	2412	11 Mbps	-9.50
	6	2437	11 Mbps	-9.29
	11	2462	11 Mbps	-10.32
Zigbee	11	2405	250 kbps	-3.42
	18	2435	250 kbps	-3.67
	26	2475	250 kbps	-4.04
Uncertainty	±2 dB			

3.8 Band edge Measurement

3.8.1 Limit

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

3.8.2 Measurement instruments

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

3.8.3 Test setup

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

3.8.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05, sections 11.3 and 12.1.
IRN 016 – Method 12

3.8.5 Measurement Uncertainty

± 2.53 dB.

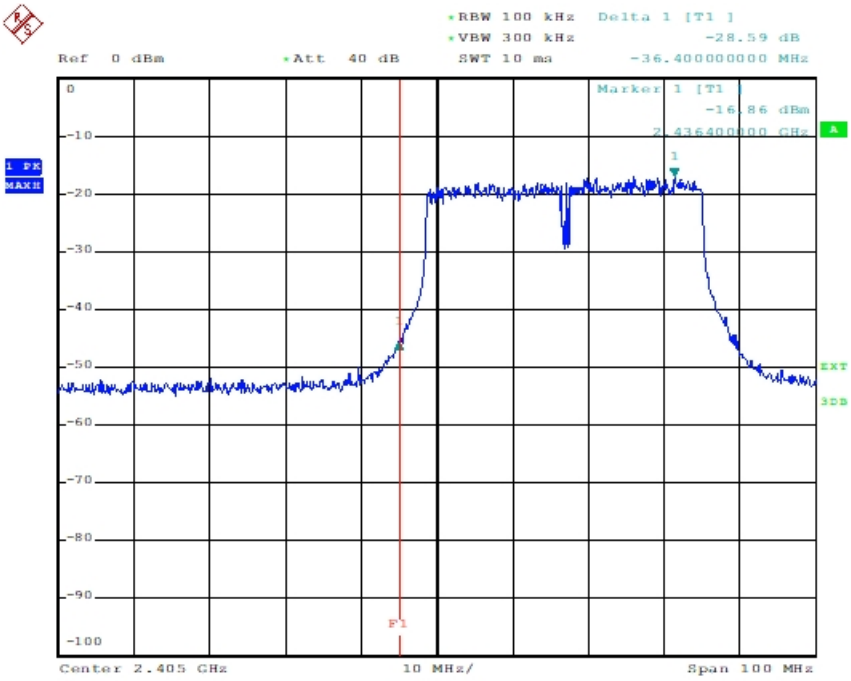
3.8.6 Plots of the Band edge Measurements

See next page

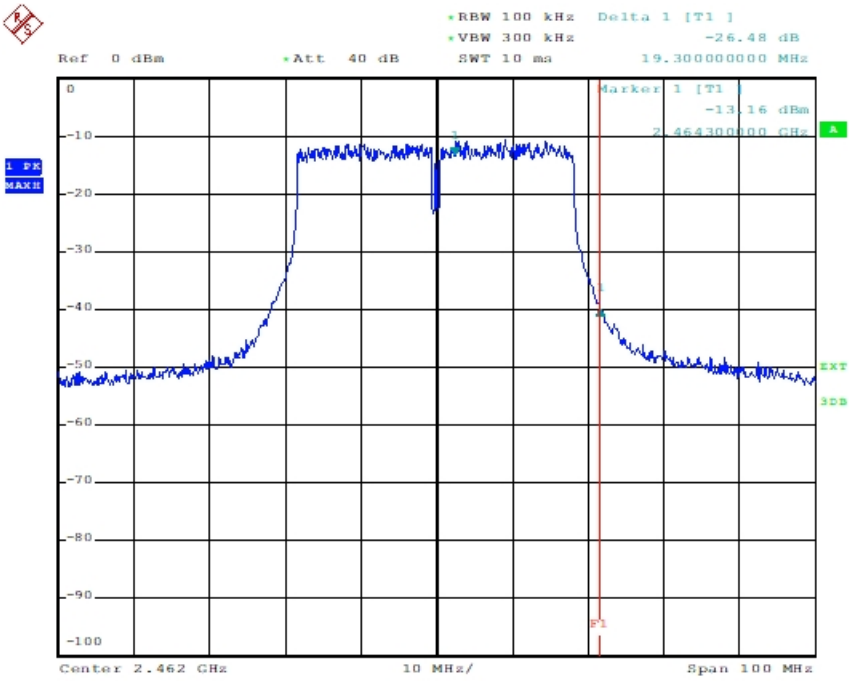
Tests applicable to WLAN, BLE and Zigbee.

Only the worst case configuration for band edge is reported, which is WLAN 802.11n HT40.

802.11n40 lower band edge (channel 3)



802.11n40 upper band edge (channel 11)



3.9 Radiated spurious and harmonics emissions (Zwave)

3.9.1 Limit

According to FCC 15.249(a) and (d)

Fundamental frequency	Field strength of harmonics @3m	Field strength of spurious @ 3m
902 – 928 MHz	54 dBµV/m	≥ 50 dB below fundamental or the limits of § 15.209 whichever is the lesser attenuation

3.9.2 Measurement instruments

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

3.9.3 Test setup

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

3.9.4 Test procedure

30 MHz to 10 GHz: According to ANSI C63.4-2014, section 8.3
IRN 026 – Method 1, 2

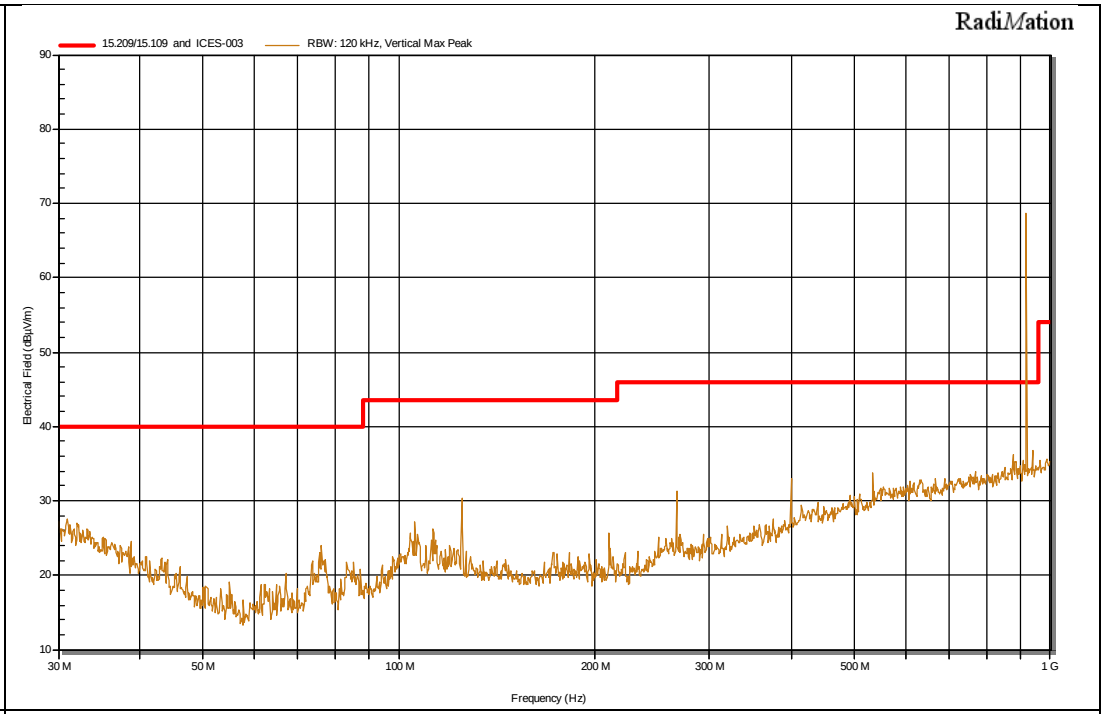
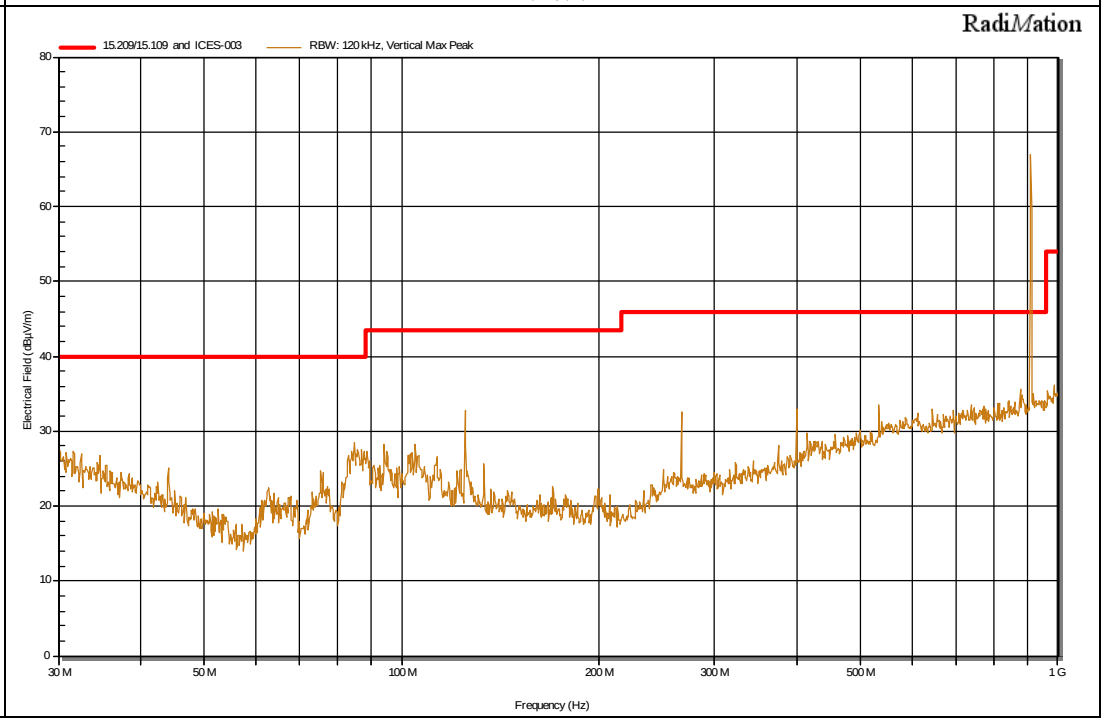
3.9.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB
1 – 10 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB

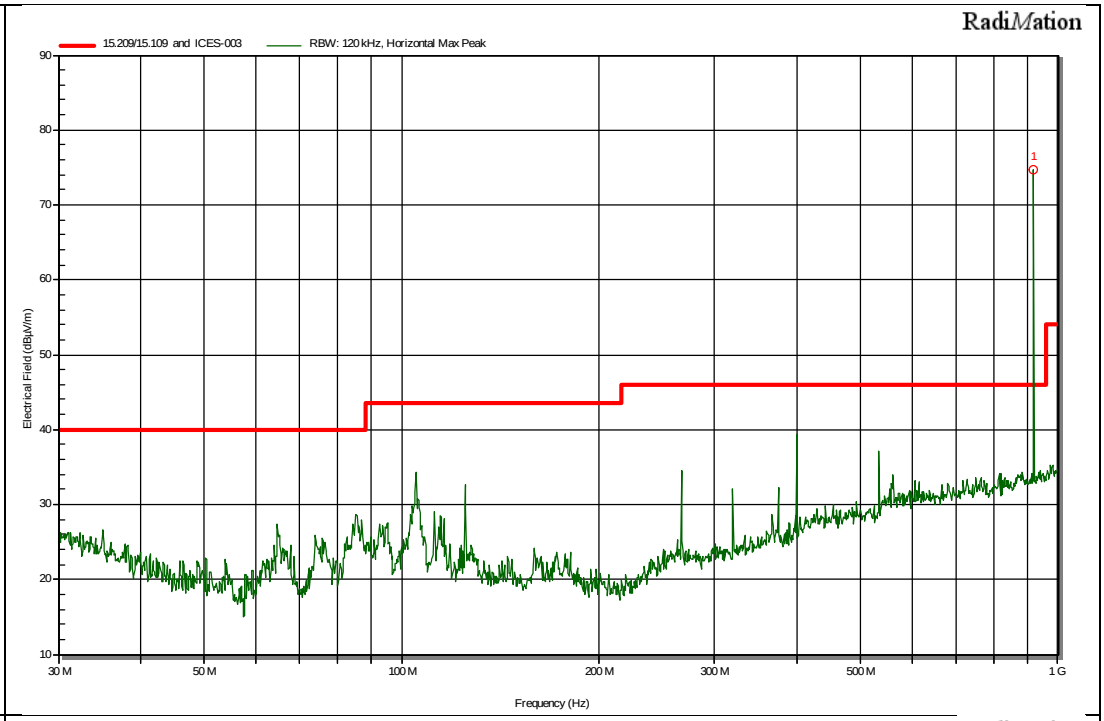
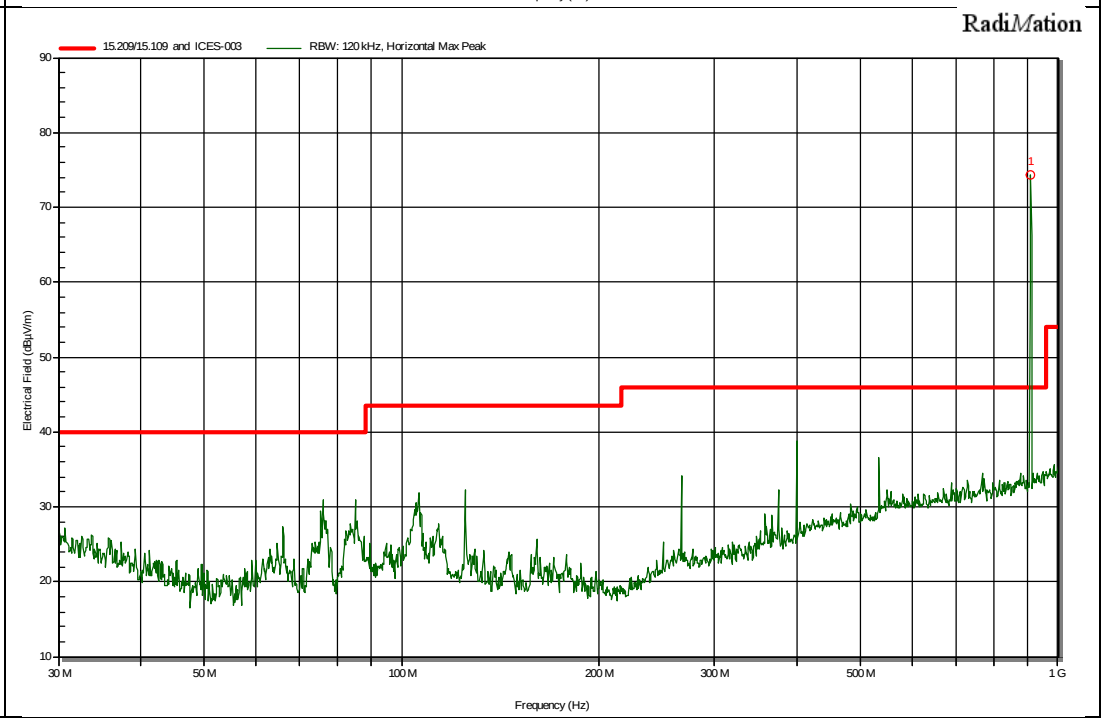
3.9.6 Results of the harmonics and spurious emissions measurement

See next pages.

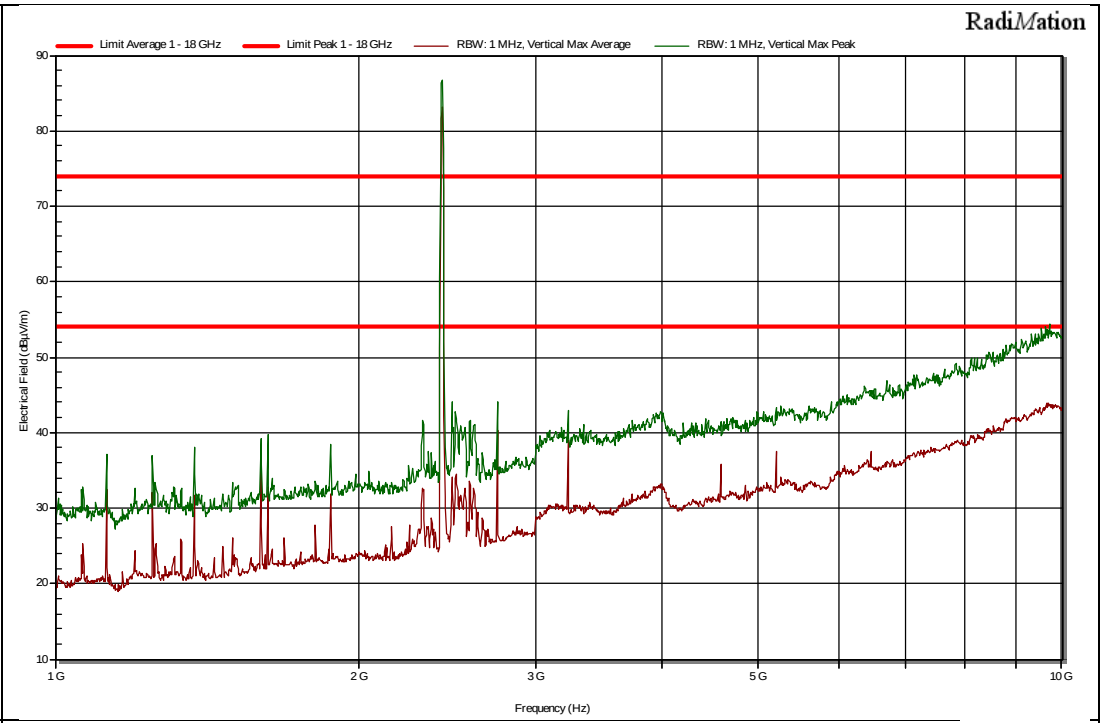
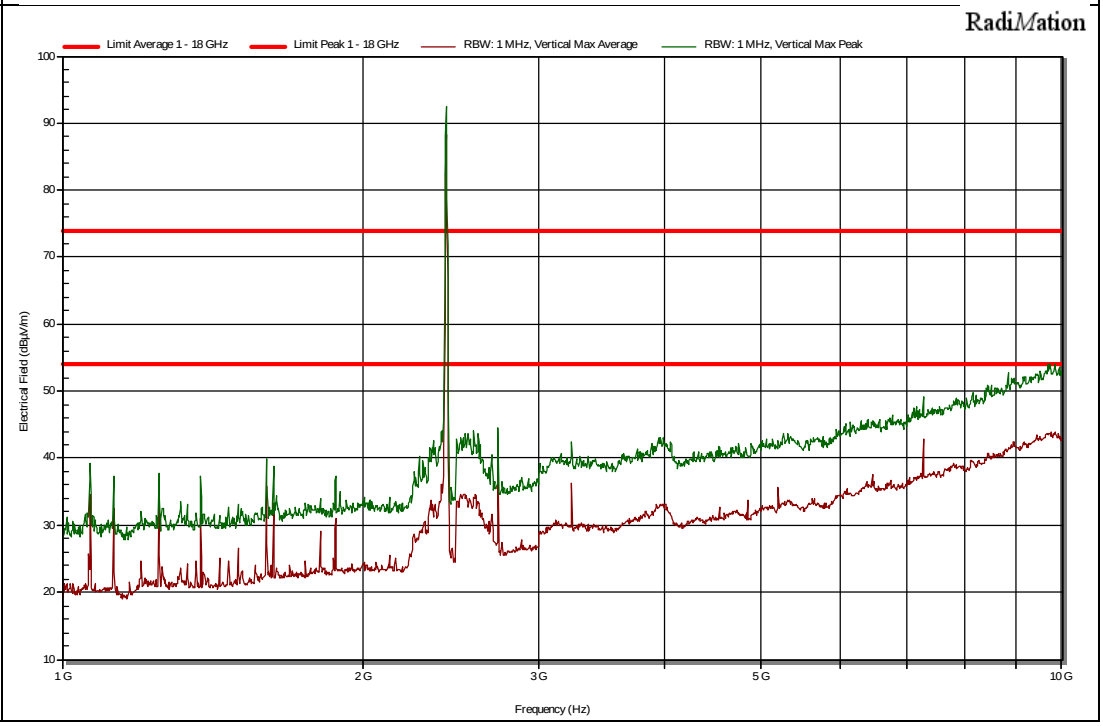
30 – 1000 MHz vertical polarization

Zwave: Ch0	
Zwave Ch 1	

30 – 1000 MHz horizontal polarization

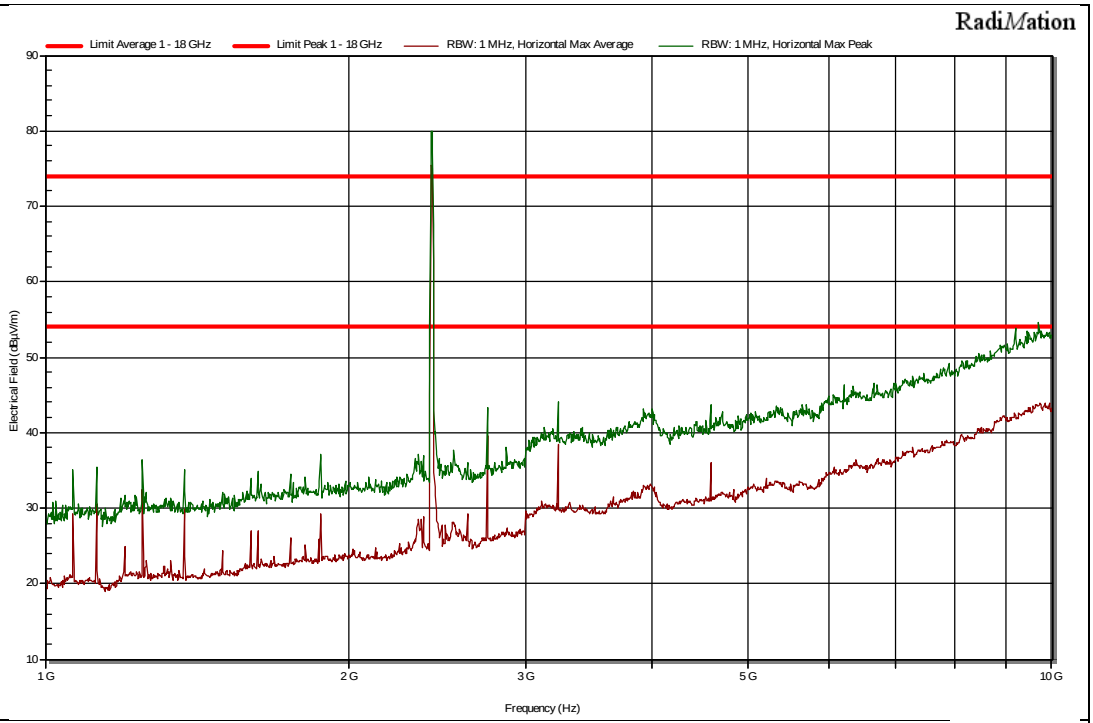
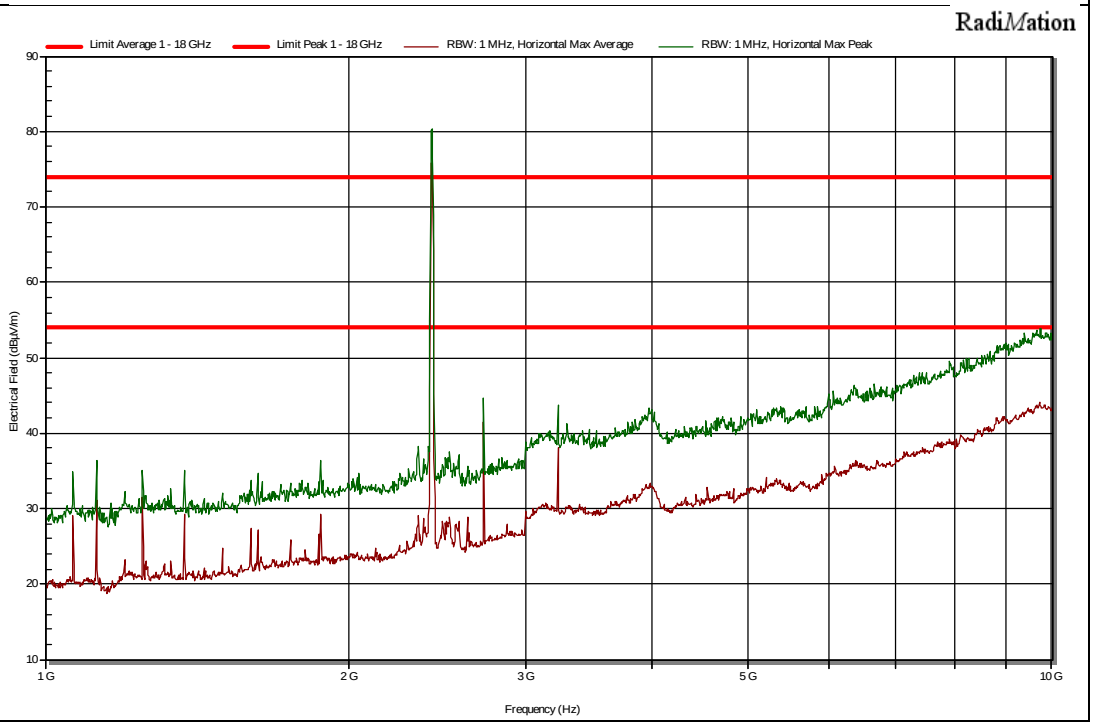
Zwave: Ch0	
Zwave Ch 1	

1 -10 GHz vertical polarization

Zwave : Ch0	
Zwave Ch 1	

Note: the peak at 2.4 GHz is the transmission frequency of WLAN. WLAN connected to the access point needed to control the test mode. This peak is not subject to the spurious emissions limit.

1 -10 GHz horizontal polarization

Zwave : Ch0	
Zwave Ch 1	

Note: the peak at 2.4 GHz is the transmission frequency of WLAN. WLAN connected to the access point needed to control the test mode. This peak is not subject to the spurious emissions limit.

3.10 Conducted emissions

3.10.1 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.

3.10.2 Measurement instruments

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

3.10.3 Test setup

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

3.10.4 Test procedure

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

3.10.5 Test results and plots of the AC mains conducted measurement

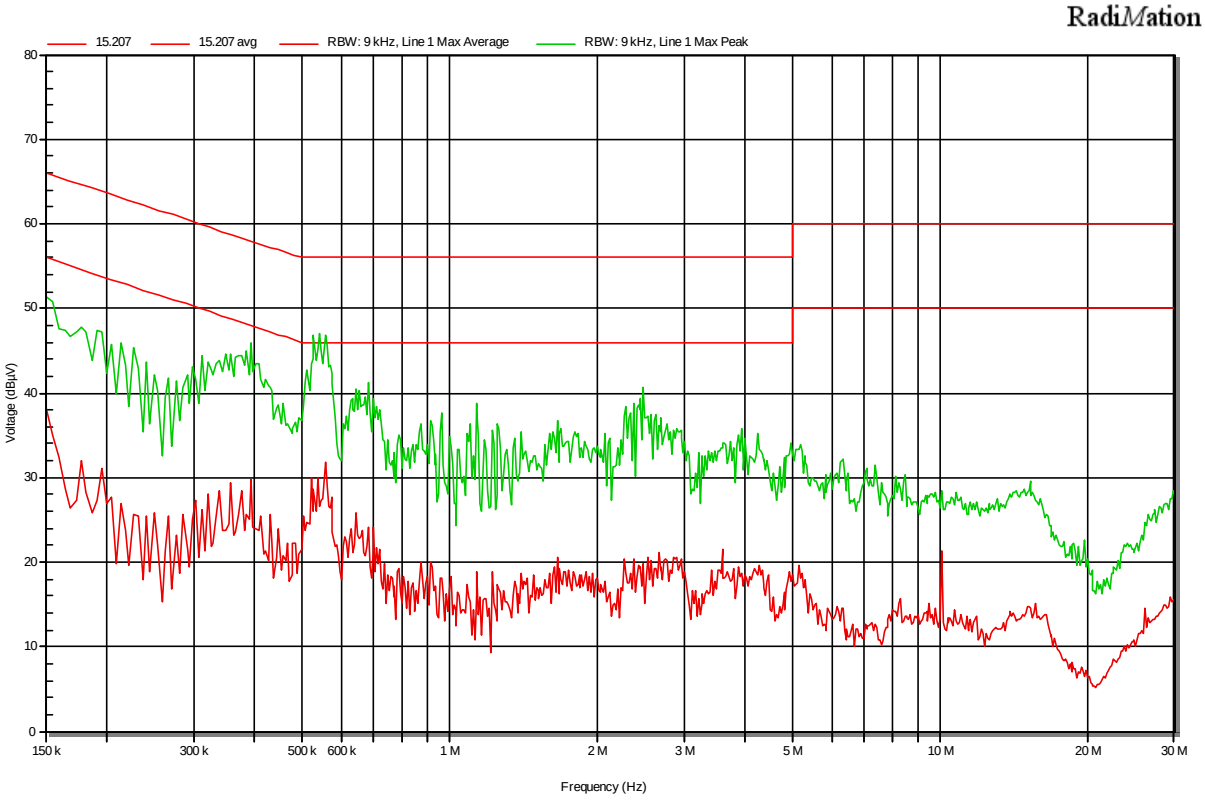
See next page.

3.10.6 Measurement uncertainty

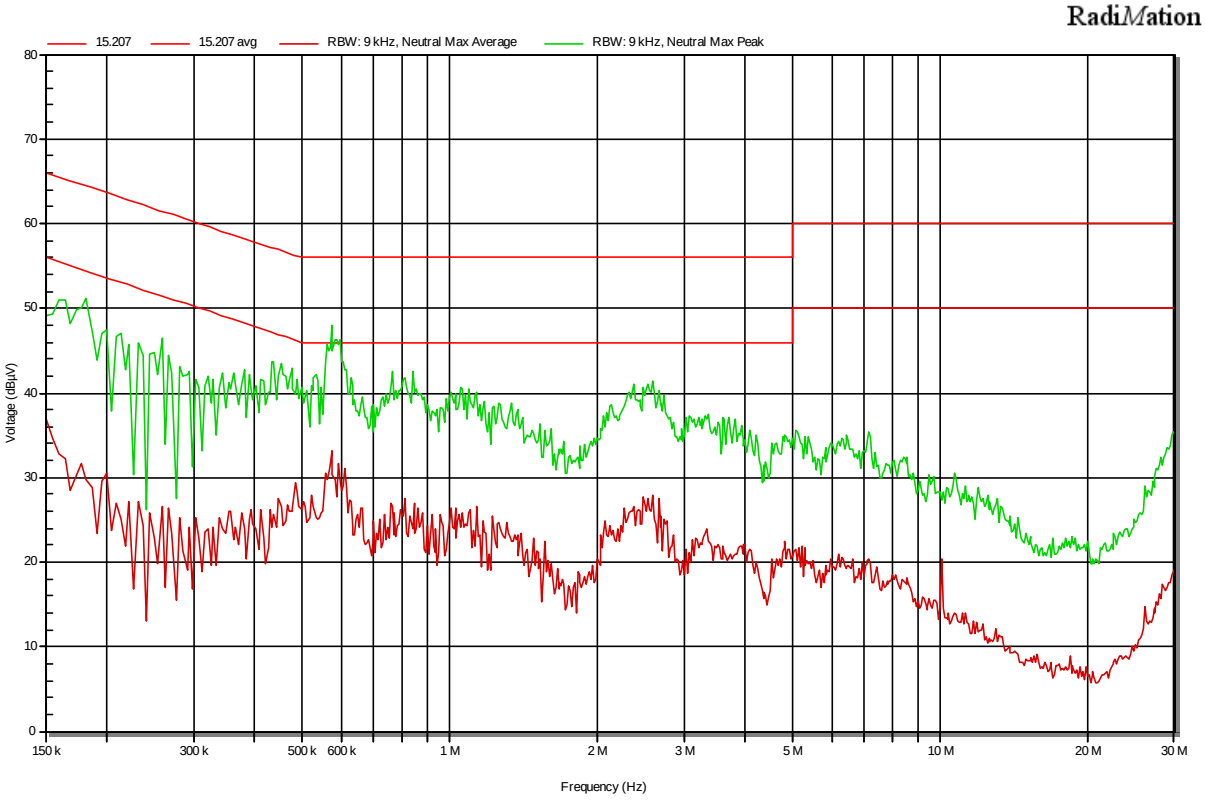
+/- 3.6 dB

3.10.7 Plots of the AC mains conducted spurious measurement

Phase



Neutral



4 Sample calculations

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

Conducted emission Measurement (see chapter 3.10):

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

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

Frequency (Mhz)	Voltage division LISN (db)	Insertion Loss Pulse limiter (dB)	Cable loss (dB)	Corr. (dB)
	TE 00208 SN: 892785/004 Rohde & Schwarz ESH3-Z5	TE 00756 SN: 5SM03153 Rohde & Schwarz ESH3-Z2	TE 11134	
0,15	0,09	9,87	0,02	9,98
0,2	0,1	9,87	0,03	10
0,3	0,1	9,87	0,03	10
0,5	0,1	9,87	0,08	10,05
0,7	0,12	9,87	0,25	10,24
0,8	0,12	9,87	0,25	10,24
1	0,13	9,87	0,11	10,11
2	0,16	9,87	0,15	10,18
3	0,19	9,87	0,21	10,27
5	0,26	9,88	0,21	10,35
7	0,36	9,89	0,25	10,5
8	0,39	9,89	0,25	10,53
10	0,46	9,91	0,29	10,66
15	0,77	9,93	0,34	11,04
20	0,95	9,96	0,37	11,28
25	1,12	9,99	0,43	11,54
30	1,1	10,04	0,45	11,59

Field Strength Measurement (see chapter 3.2):

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

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

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

Frequency (Mhz)	AF (dB/m) TE 00967 Chase CBL6112A SN: 2308	Cable loss (dB) Id: SAR cable	Corr. (dB)
30	18,6	0,68	19,28
100	10,7	1,15	11,85
150	10,6	1,41	12,01
200	9,3	1,63	10,93
250	12,6	1,93	14,53
300	13,3	2,12	15,42
350	14,6	2,2	16,8
400	15,5	2,29	17,79
450	16,9	2,53	19,43
500	17,5	2,67	20,17
550	18,4	2,9	21,3
600	18,8	3,02	21,82
650	19,2	3,09	22,29
700	19	3,22	22,22
750	19,8	3,56	23,36
800	19,7	3,69	23,39
900	20,4	3,81	24,21
950	20,8	3,91	24,71
1000	21,2	4,3	25,5

Frequency (Mhz)	AF (dB/m) TE 00531 Emco 3115 SN: 9412-4377	Gain (dB) TE 11132 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
1000	23,6	40,4	2,0	66
1500	25,1	40,5	2,4	68
2000	27,1	40,5	2,7	70,3
2500	28,6	40,7	3,2	72,5
3000	30,5	40,7	3,2	74,4
3500	31,2	40,7	3,4	75,3
4000	32,7	40,9	4,9	78,5
4500	32,4	40,9	4,4	77,7
5000	33,2	40,7	4,6	78,5
5500	34,0	40,5	4,5	79
6000	34,6	40,0	5,2	79,8
6500	34,3	39,4	5,9	79,6
7000	35,2	38,6	5,7	79,5
7500	36,4	39,2	5,9	81,5
8000	37,0	38,9	6,3	82,2
8500	37,5	38,4	6,4	82,3
9000	38,1	37,4	6,5	82
9500	37,8	37,0	7,1	81,9
10000	38,2	36,5	7,3	82
10500	38,1	36,7	7,6	82,4
11000	38,3	36,9	8,3	83,5
11500	38,5	37,6	8,1	84,2
12000	39,1	38,3	8,4	85,8
12500	38,7	38,5	8,3	85,5
13000	39,2	38,9	9,2	87,3
13500	40,5	40,2	8,3	89
14000	41,1	40,0	8,2	89,3
14500	41,4	40,1	8,2	89,7
15000	40,2	41,4	8,3	89,9
15500	37,9	41,4	8,6	87,9
16000	37,5	42,8	9,2	89,5
16500	38,6	42,3	8,8	89,7
17000	41,1	43,1	9,4	93,6
17500	42,7	43,2	9,4	95,3
18000	44,0	44,2	9,8	98

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