

# Test report for

## 47 CFR Part 15 Subpart C

### RSS-247, RSS-Gen



The RvA is signatory to ILAC - MRA



Product name : AeroGuard  
Applicant : Plymovent Group BV  
FCC ID : 2BCUH-AG001  
IC : 31300-AG001

Test report No. : P000300707 001 V2.00

## Laboratory information

### Accreditation

Kiwa Nederland B.V. complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2017. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L248 and is granted by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

Kiwa Nederland B.V. 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.

Kiwa Nederland B.V. is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.  
The Industry Canada company number for Kiwa Nederland B.V. is: 4173A. The CABID is NL0001.

Kiwa Nederland B.V. 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 Kiwa Nederland B.V.

### Testing Location

|                           |                                                                               |
|---------------------------|-------------------------------------------------------------------------------|
| <b>Test Site</b>          | Kiwa Nederland B.V.                                                           |
| <b>Test Site location</b> | Wilmersdorf 50<br>7327 AC Apeldoorn<br>The Netherlands<br>Tel. +31 88998 3393 |
| <b>Test Site FCC</b>      | NL0001                                                                        |
| <b>CABID</b>              | NL0001                                                                        |

## Revision History

| Version | Date       | Remarks                    | By  |
|---------|------------|----------------------------|-----|
| v0.50   | 25-10-2023 | First draft                | GG  |
| v1.00   | 18-01-2024 | Initial release            | GG  |
| V2.00   | 13-02-2024 | Updates from certification | MHK |

## Table of Contents

|                                                            |           |
|------------------------------------------------------------|-----------|
| <b>Revision History</b>                                    | <b>2</b>  |
| <b>Summary of Test results</b>                             | <b>5</b>  |
| <b>1 General Description</b>                               | <b>6</b>  |
| 1.1 Applicant                                              | 6         |
| 1.2 Manufacturer                                           | 6         |
| 1.3 Tested Equipment Under Test (EUT)                      | 6         |
| 1.3.1 Auxiliary items                                      | 7         |
| 1.4 Product specifications of Equipment under test         | 8         |
| 1.5 Environmental conditions                               | 8         |
| 1.6 Measurement standards                                  | 8         |
| 1.7 Applicable standards                                   | 8         |
| 1.8 Observation and remarks                                | 8         |
| 1.9 Modifications to the EUT (Equipment Under Test)        | 8         |
| 1.10 Conclusions                                           | 9         |
| <b>2 Test configuration of the Equipment Under Test</b>    | <b>10</b> |
| 2.1 Test mode                                              | 10        |
| 2.2 Test setups                                            | 10        |
| 2.3 Equipment used in the test configuration               | 14        |
| 2.4 Sample calculations                                    | 14        |
| <b>3 Test results</b>                                      | <b>15</b> |
| 3.1 Radiated spurious emissions                            | 15        |
| 3.1.1 Limit                                                | 15        |
| 3.1.2 Measurement instruments                              | 15        |
| 3.1.3 Test setup                                           | 15        |
| 3.1.4 Test procedure                                       | 16        |
| 3.1.5 Measurement Uncertainty                              | 16        |
| 3.1.6 Test results                                         | 17        |
| 3.1.7 Plots of the Radiated Spurious Emissions Measurement | 19        |
| 3.2 6dB bandwidth Measurement                              | 44        |
| 3.2.1 Limit                                                | 44        |
| 3.2.2 Measurement instruments                              | 44        |
| 3.2.3 Test setup                                           | 44        |
| 3.2.4 Test procedure                                       | 44        |
| 3.2.5 Test Results of the 6 dB bandwidth Measurement       | 44        |
| 3.2.6 Plots of the 6 dB bandwidth                          | 45        |
| 3.3 99% Occupied Bandwidth                                 | 49        |
| 3.3.1 Limit                                                | 49        |
| 3.3.2 Measurement instruments                              | 49        |

|          |                                                                         |           |
|----------|-------------------------------------------------------------------------|-----------|
| 3.3.3    | Test setup .....                                                        | 49        |
| 3.3.4    | Test procedure.....                                                     | 49        |
| 3.3.5    | Test results of the 99% occupied bandwidth measurement .....            | 49        |
| 3.3.6    | Plots of the 99% occupied bandwidth measurement.....                    | 50        |
| 3.4      | Output Power Measurement .....                                          | 54        |
| 3.4.1    | Limit .....                                                             | 54        |
| 3.4.2    | Measurement instruments .....                                           | 54        |
| 3.4.3    | Test setup .....                                                        | 54        |
| 3.4.4    | Test procedure.....                                                     | 54        |
| 3.4.5    | Test results of Output Power Measurement .....                          | 54        |
| 3.4.6    | Plots of the Output power .....                                         | 55        |
| 3.5      | Power Spectral Density .....                                            | 59        |
| 3.5.1    | Limit .....                                                             | 59        |
| 3.5.2    | Measurement instruments .....                                           | 59        |
| 3.5.3    | Test setup .....                                                        | 59        |
| 3.5.4    | Test procedure.....                                                     | 59        |
| 3.5.5    | Test results of Power Spectral Density Measurement.....                 | 59        |
| 3.5.6    | Plots of the Power Spectral Density .....                               | 60        |
| 3.6      | Band edge Measurement.....                                              | 64        |
| 3.6.1    | Limit .....                                                             | 64        |
| 3.6.2    | Measurement instruments .....                                           | 64        |
| 3.6.3    | Test setup .....                                                        | 64        |
| 3.6.4    | Test procedure.....                                                     | 64        |
| 3.6.5    | Measurement Uncertainty .....                                           | 64        |
| 3.6.6    | Plots of the Band edge Measurements.....                                | 65        |
| 3.7      | AC Power-line conducted emissions .....                                 | 69        |
| 3.7.1    | Limit .....                                                             | 69        |
| 3.7.2    | Measurement instruments .....                                           | 69        |
| 3.7.3    | Test setup .....                                                        | 69        |
| 3.7.4    | Test procedure.....                                                     | 69        |
| 3.7.5    | Test results and plots of the AC power-line conducted measurement ..... | 69        |
| 3.7.6    | Measurement uncertainty .....                                           | 69        |
| 3.7.7    | AC Power Line Conducted emission data of the EUT, results.....          | 69        |
| 3.7.8    | Plots of the AC mains conducted measurement .....                       | 70        |
| <b>4</b> | <b>Sample calculations.....</b>                                         | <b>71</b> |

## Summary of Test results

| FCC                     | ISED            | Description                                | Section in report | Verdict |
|-------------------------|-----------------|--------------------------------------------|-------------------|---------|
| 15.247(d)<br>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    |
| 15.207 (c)              | RSS-Gen 8.8     | AC power-line conducted emissions          | 3.7               | Pass    |

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

## 1 General Description

### 1.1 Applicant

|                      |                            |
|----------------------|----------------------------|
| <b>Client name:</b>  | Plymovent Group BV         |
| <b>Address:</b>      | Koraalstraat 9             |
| <b>Zip code:</b>     | 1812 RK Alkmaar            |
| <b>Telephone:</b>    | +31(0)72 7504 600          |
| <b>E-mail:</b>       | Thomas.friso@plymovent.com |
| <b>Contact name:</b> | T. Friso                   |

### 1.2 Manufacturer

|                           |                            |
|---------------------------|----------------------------|
| <b>Manufacturer name:</b> | Plymovent Group BV         |
| <b>Address:</b>           | Koraalstraat 9             |
| <b>Zip code:</b>          | 1812 RK Alkmaar            |
| <b>Telephone:</b>         | +31(0)72 7504 600          |
| <b>E-mail:</b>            | Thomas.friso@plymovent.com |
| <b>Contact name:</b>      | T. Friso                   |

### 1.3 Tested Equipment Under Test (EUT)

|                                |                                                                                                                   |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Product name:</b>           | AeroGuard                                                                                                         |
| <b>Brand name:</b>             | Plymovent                                                                                                         |
| <b>FCC ID:</b>                 | 2BCUH-AG001                                                                                                       |
| <b>IC:</b>                     | 31300-AG001                                                                                                       |
| <b>Product description:</b>    | Air Quality monitoring device                                                                                     |
| <b>Variant model(s):</b>       | --                                                                                                                |
| <b>Batch and/or serial No.</b> | Radiated sample serial: 20869358<br>Conducted sample serial: 20869424                                             |
| <b>Software version:</b>       | Operating system: V0.5.0<br>Application: V0.4.3<br>Application-LED: V0.2.0<br>Bluetooth: V0.1.1<br>01PLYAQMTOTC9C |
| <b>Hardware version:</b>       |                                                                                                                   |
| <b>Date of receipt:</b>        | 25-09-2023                                                                                                        |
| <b>Tests started:</b>          | 28-09-2023                                                                                                        |
| <b>Testing ended:</b>          | 05-10-2023                                                                                                        |

### 1.3.1 Auxiliary items

#### AUX1

**Product name:** Laptop with mqtt broker, Influx database  
**Product type:** ERD984  
**Remarks:** Connects to Ethernet port of optical interface.

#### AUX2

**Product name:** Mk-Messtechnik optoLAN-Gb: Fiber Ethernet interface.  
**Product type:** ERT697  
**Remarks:** Connects Laptop with EUT.

#### AUX3

**Product name:** Laptop with mqtt explorer  
**Product type:** ERT761  
**Remarks:** Connects to Router to set-up and monitor wireless communications

#### AUX4

**Product name:** Teltonika RUT955 Router  
**Product type:**  
**Remarks:** Connects with antenna and ERT761 to set-up and monitor wireless communications

#### AUX5

**Product name:** Bluetooth radio (as companion radio) (Raspberry pi zero w v1.1)  
**Product type:**  
**Remarks:** Connects with antenna and ERT761 to set-up and monitor wireless communications

#### AUX6

**Product name:** Teltonika RUT 955 Router Wifi (as companion radio)  
**Product type:**  
**Remarks:** Connects with antenna and ERT 761 to set-up and monitor wireless communications

#### AUX7

**Product name:** Wifi antenna (2400-2483.5 MHz, 50, VSWR<2, gain 5 dBi, omnidirectional, RP-SMA male connector)  
**Product type:**  
**Remarks:** Connects to EUT Wifi and Bluetooth and Router to set-up and monitor wireless communications



## 1.4 Product specifications of Equipment under test

|                                |                                                    |
|--------------------------------|----------------------------------------------------|
| <b>Tx Frequency:</b>           | IEEE 802.11b/g/n: 2412-2462 MHz, BLE:2402-2480 MHz |
| <b>Rx frequency:</b>           | IEEE 802.11b/g/n: 2412-2462 MHz, BLE:2402-2480 MHz |
| <b>Occupied channel width:</b> | IEEE 802.11b/g/n: 20 MHz, BLE: 1 MHz               |
| <b>Antenna type:</b>           | Internal antenna, FPC 2.4G Antenna                 |
| <b>Antenna gain:</b>           | 2 dBi                                              |
| <b>Type of modulation:</b>     | CCK, OFDM, BPSK, QPSK, 16-QAM, 64-QAM              |
| <b>Emission designator</b>     | 12M5F1D 16M4F1D 17M5F1D 1M06F1D                    |

Disclaimer: The operating frequency bands are declared by the applicant

## 1.5 Environmental conditions

Normal test conditions:

Temperature (\*) : +15°C to +35°C  
Relative humidity(\*) : 20 % to 75 %

## 1.6 Measurement standards

- ANSI C63.10:2013
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02

## 1.7 Applicable standards

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

- FCC Title 47 Part 15 Subpart C §15.207
- FCC Title 47 Part 15 Subpart C §15.209
- FCC Title 47 Part 15 Subpart C §15.247
- RSS-Gen Issue 5
- RSS-247 Issue 3

## 1.8 Observation and remarks

During the tests the EUT was set in to maximum transmitting mode on specific frequencies.

## 1.9 Modifications to the EUT (Equipment Under Test)

None.

## 1.10 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.7 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Kiwa Nederland B.V. accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.7 "*Applicable standards*".

All tests are performed by:

Name : ing. M.H. Khan

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 01-03-2024

Name : ing. R. van Barneveld

Function : Test Engineer

Signature :

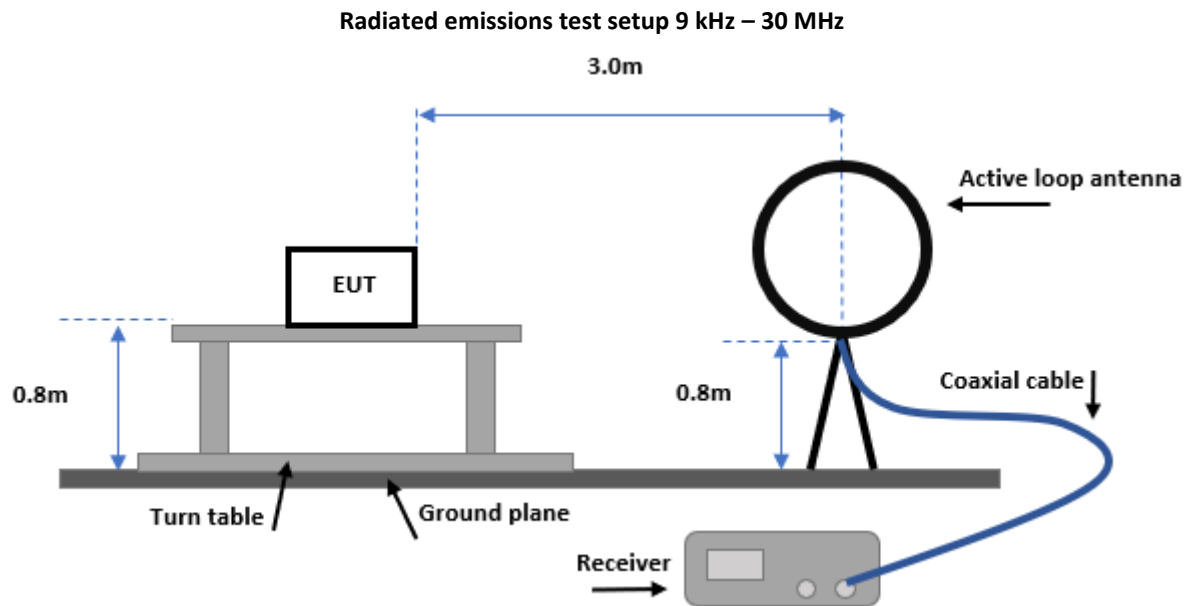
A handwritten signature in blue ink, consisting of a stylized 'R' followed by several horizontal strokes.

## 2 Test configuration of the Equipment Under Test

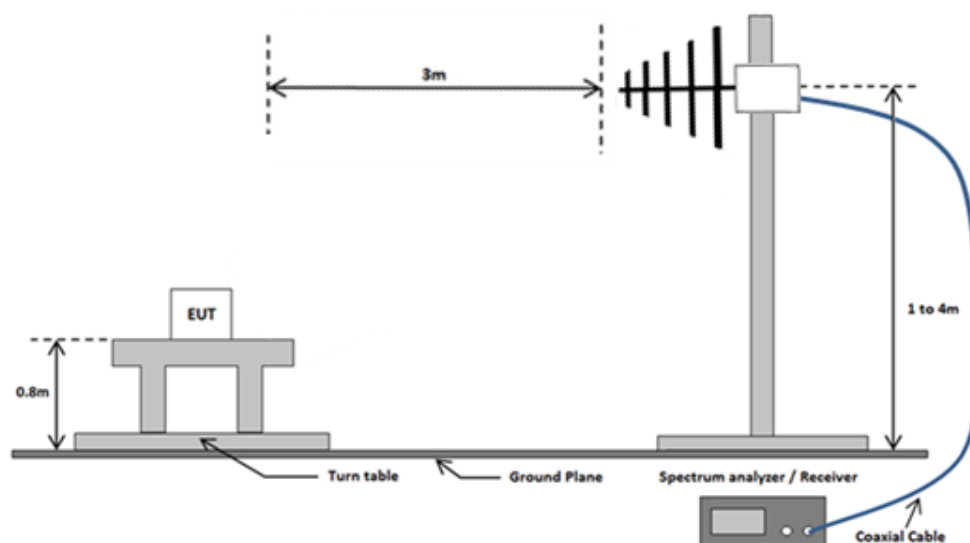
### 2.1 Test mode

The applicant provided test mode firmware with which it was possible to configure the radio to transmit continuously.

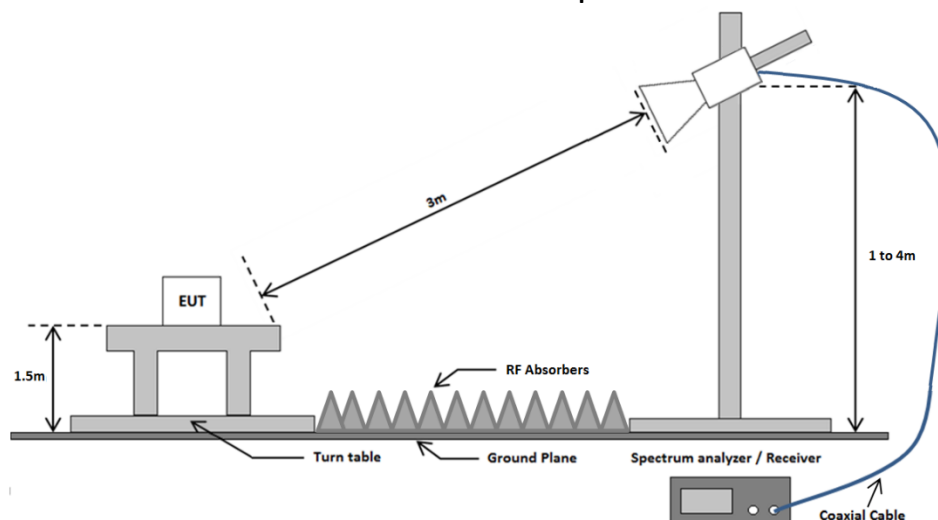
### 2.2 Test setups



### Radiated emissions test setup 30 MHz - 1 GHz

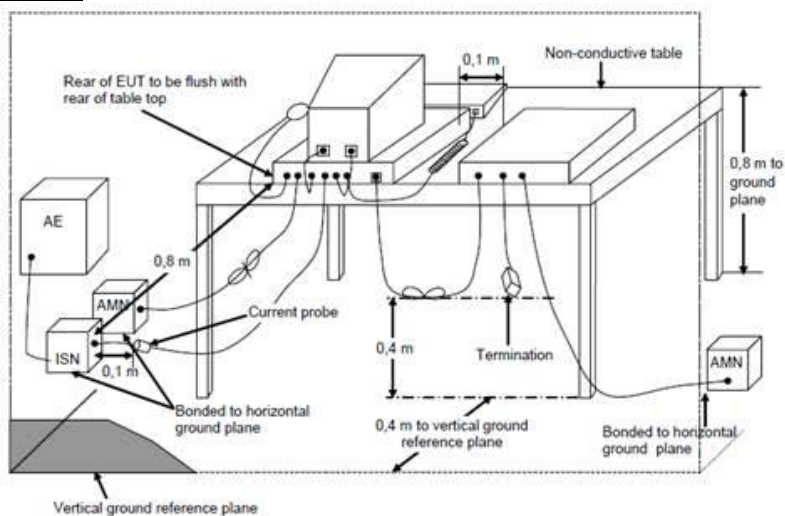


### Radiated emissions test setup above 1 GHz



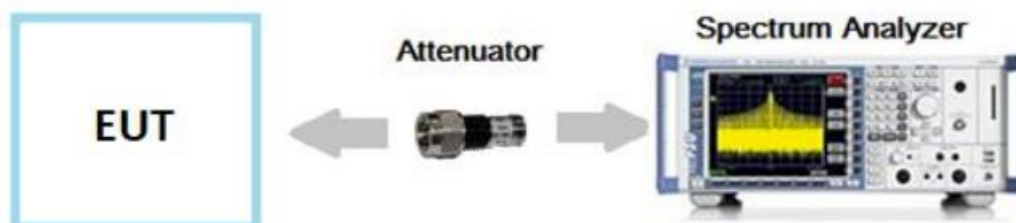
## AC Power line conducted emissions test setup

### Emissions test at AC mains



### Antenna port conducted tests

#### Conducted test setup



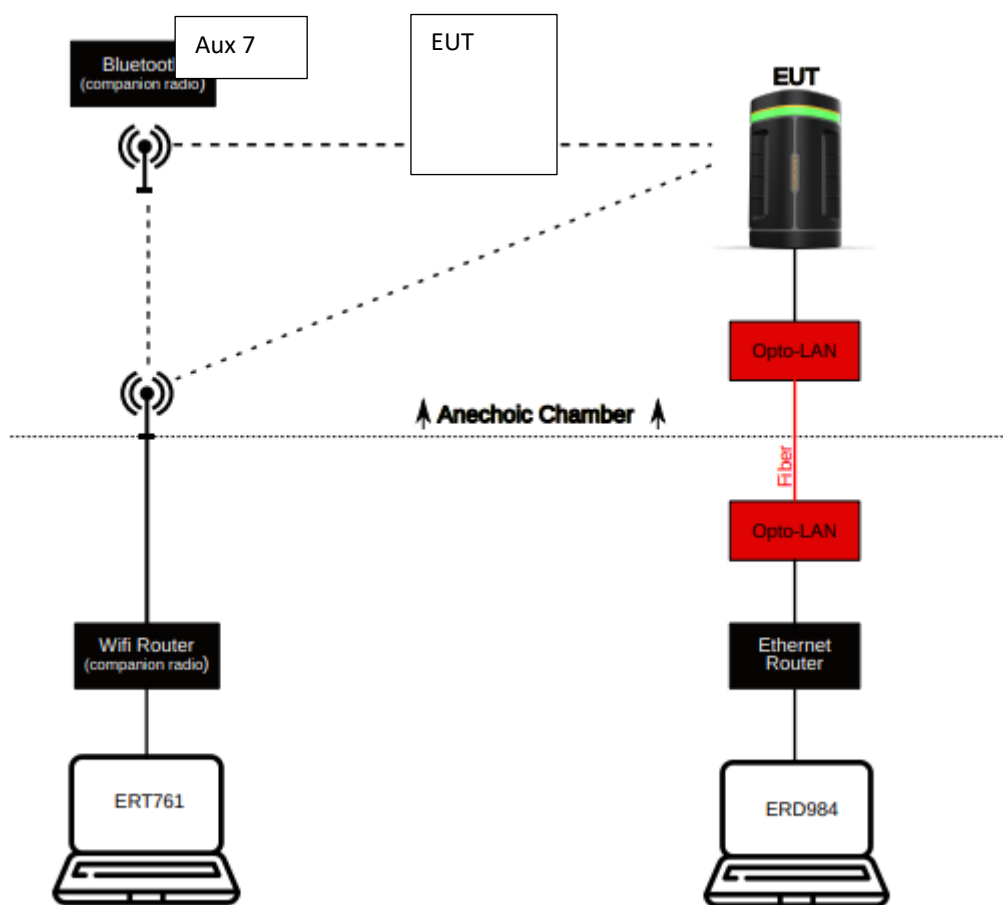


Figure 2: Picture EUT

Figure 1. EUT and auxiliary setup

| List of used cables |          |                       |      |        |         |
|---------------------|----------|-----------------------|------|--------|---------|
| Number              | Function | From                  | To   | Length | Remarks |
| 1                   | AC Power | mains<br>120Vac 60 Hz | EUT  | < 3m   | -       |
| 2                   | Ethernet | EUT                   | AUX2 | <3m    | -       |
| 3                   | Relay    | EUT                   | EUT  | <3m    | -       |

## 2.3 Equipment used in the test configuration

| Description                        | Manufacturer       | Model              | ID              | Cal. Done date | Cal. due date | Used at Par. |
|------------------------------------|--------------------|--------------------|-----------------|----------------|---------------|--------------|
| EMI Receiver                       | Rohde & Schwarz    | ESCI               | 114161          | 01-2023        | 01-2024       | 3.1          |
| EMI Receiver                       | Rohde & Schwarz    | ESR7               | 114534          | 04-2023        | 04-2024       | 3.1          |
| Spectrum Analyzer                  | Rohde & Schwarz    | FSV3040            | 114530          | 03-2022        | 10-2023       | 3.1, 3.2-3.6 |
| 1.1 GHz HPF                        | Wainwright         | WHK1.1/15G-10EF    | TE01139         | 01-2022        | 01-2024       | 3.1          |
| 3.0 GHz HPF                        | Wainwright         | WHK3.0/18G-10EF    | 114682          | 07-2021        | 07-2024       | 3.1          |
| 7.0 GHz HPF                        | Wainwright         | WHKX7.0/18G-8SS    | 114678          | 01-2022        | 01-2024       | 3.1          |
| 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 1-18 GHz              | Schwarzbeck        | BBV 9718D          | 114874          | 01-2023        | 01-2024       | 3.1          |
| Preamplifier 18-40 GHz             | Miteq              | JS4-18004000-33-8P | 114693          | 01-2023        | 01-2024       | 3.1          |
| LISN /Two line V-network           | Rohde & Schwarz    | ENV 216            | 114379          | 07-2023        | 07-2025       | 3.7          |

\*Note: Standard gain horn antennas do not need calibration

NA= Not Applicable

## 2.4 Sample calculations

All formulas for data conversions and conversion factors are reported in chapter 4 of this test report.

### 3 Test results

#### 3.1 Radiated spurious emissions

##### 3.1.1 Limit

###### 15.209(a)

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

| Frequency (MHz)               | Field strength (μV/m) | Field strength (dBμV/m)                          | Measurement distance(m) |
|-------------------------------|-----------------------|--------------------------------------------------|-------------------------|
| 0.009 – 0.490                 | 2400/F(kHz)           | $20 \cdot \{\log[2400] - \log[F(\text{kHz})]\}$  | 300*                    |
| 0.490 – 1.705                 | 24000/F(kHz)          | $20 \cdot \{\log[24000] - \log[F(\text{kHz})]\}$ | 30*                     |
| 1.705 – 13.11<br>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 30m or 300m limit 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 of this report.



### 3.1.4 Test procedure

9 kHz – 30 MHz: According to ANSI C63.10-2013, section 6.4

30 MHz to 26.5 GHz: According to ANSI C63.10-2013, section 6.5 and 6.6

9 kHz to 30 MHz: IRN 441 – Method 9

30 MHz to 1 GHz: IRN 441 – Method 1

1 GHz to 18 GHz: IRN 441– Method 2

18 to 26 GHz: IRN 441– Method 3

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

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

### 3.1.5 Measurement Uncertainty

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

### 3.1.6 Test results

Only worst case results are reported.

the range 9 – 150KHz perpendicular ) IEEE 802.11 n low channel

| Peak number | Frequency [kHz] | Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|-----------------|------------|--------------|--------------|
| 1           | 18.729          | -38.2         | 279             | 1          | 3            | Vertical     |
| 2           | 49.185          | -46.8         | 66              | 1          | 3            | Vertical     |

the range 9 – 150KHz orthogonal IEEE 802.11b high channel

| Peak number | Frequency [kHz] | Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|-----------------|------------|--------------|--------------|
| 1           | 18.623          | -30.6         | 258             | 1          | 3            | Vertical     |
| 2           | 64.607          | -47.8         | 4               | 1          | 3            | Vertical     |

the range 150KHz – 30 MHz perpendicular BLE low channel

| Peak number | Frequency [kHz] | Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|-----------------|------------|--------------|--------------|
| 1           | 205.969         | -23.1         | 157             | 1          | 3            | Horizontal   |
| 2           | 657.45          | -5.1          | 176             | 1          | 3            | Horizontal   |
| 3           | 23127           | 15            | 298             | 1          | 3            | Horizontal   |

the range 150KHz – 30 MHz orthogonal BLE mid channel

| Peak number | Frequency [kHz] | Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|-----------------|------------|--------------|--------------|
| 1           | 224.625         | -22.6         | 300             | 1          | 3            | Horizontal   |
| 2           | 523.125         | -3            | 341             | 1          | 3            | Horizontal   |
| 3           | 16351           | 1.6           | 0               | 1          | 3            | Horizontal   |

The range 30-250 MHz Vertical IEEE 802.11b low/ IEEE 802.11 g high

| Peak number | Frequency [MHz] | Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|-----------------|------------|--------------|--------------|
| 1           | 31.43           | 30.8          | 172             | 1          | 3            | Vertical     |
| 2           | 43.503          | 29.3          | 103             | 1          | 3            | Vertical     |
| 3           | 64.183          | 28.4          | 223             | 1.5        | 3            | Vertical     |
| 4           | 66.658          | 30            | 22              | 1          | 3            | Vertical     |
| 5           | 98.42           | 24.7          | 359             | 1          | 3            | Vertical     |
| 6           | 177.978         | 29            | 345             | 1.5        | 3            | Vertical     |
| 7           | 234.765         | 29.8          | 84              | 1          | 3            | Vertical     |
| 1           | 42.925          | 31.7          | 65              | 1          | 3            | Vertical     |

The range 30-250 MHz Horizontal IEEE 802.11b low

| Peak number | Frequency [MHz] | Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|-----------------|------------|--------------|--------------|
| 1           | 62.23           | 26            | 128             | 3          | 3            | Horizontal   |

## The range 250 MHz -1 GHz Vertical BLE low/IEEE 802.11 b high

| Peak number | Frequency [MHz] | Peak [dBμV/m] | Quasi-Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|---------------------|-----------------|------------|--------------|--------------|
| 1           | 936.25          | 43.5          | --                  | 264             | 4          | 3            | Vertical     |
| 1           | 893.131         | 41.9          | 30.3                | 183             | 1.9        | 3            | Vertical     |
| 2           | 905.24          | 42.3          | 30.5                | 183             | 1.7        | 3            | Vertical     |

## The range 250 MHz – 1 GHz Horizontal BLE low

| Peak number | Frequency [MHz] | Peak [dBμV/m] | Quasi-Peak [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|---------------------|-----------------|------------|--------------|--------------|
| 1           | 719.211         | 47.7          | 31.8                | 121             | 2.2        | 3            | Horizontal   |
| 2           | 720.078         | 49.3          | 37.1                | 0               | 1.2        | 3            | Horizontal   |
| 3           | 733.647         | 38.4          | 27                  | 16              | 3          | 3            | Horizontal   |
| 4           | 712.089         | 39            | 27.3                | 4               | 1.2        | 3            | Horizontal   |
| 5           | 719.489         | 39            | 27.5                | 121             | 2.2        | 3            | Horizontal   |

## The range 1 - 18 GHz Vertical IEEE 802.11 n high

| Peak number | Frequency [GHz] | Peak [dBμV/m] | Average [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|------------------|-----------------|------------|--------------|--------------|
| 1           | 17.634*         | 59.3          | 54.7             | 284             | 1          | 3            | Vertical     |

## The range 1 - 18 GHz Horizontal IEEE 802.11 n high

| Peak number | Frequency [GHz] | Peak [dBμV/m] | Average [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|------------------|-----------------|------------|--------------|--------------|
| 1           | 17.712*         | 59            | 50.5             | 80              | 4          | 3            | Horizontal   |

(\*) in the 1-18GHz range the noise floor of the equipment exceeds the limit, verification was performed and the EUT is compliant

## The range 18 – 26.5 GHz Vertical IEEE 802.11 n high

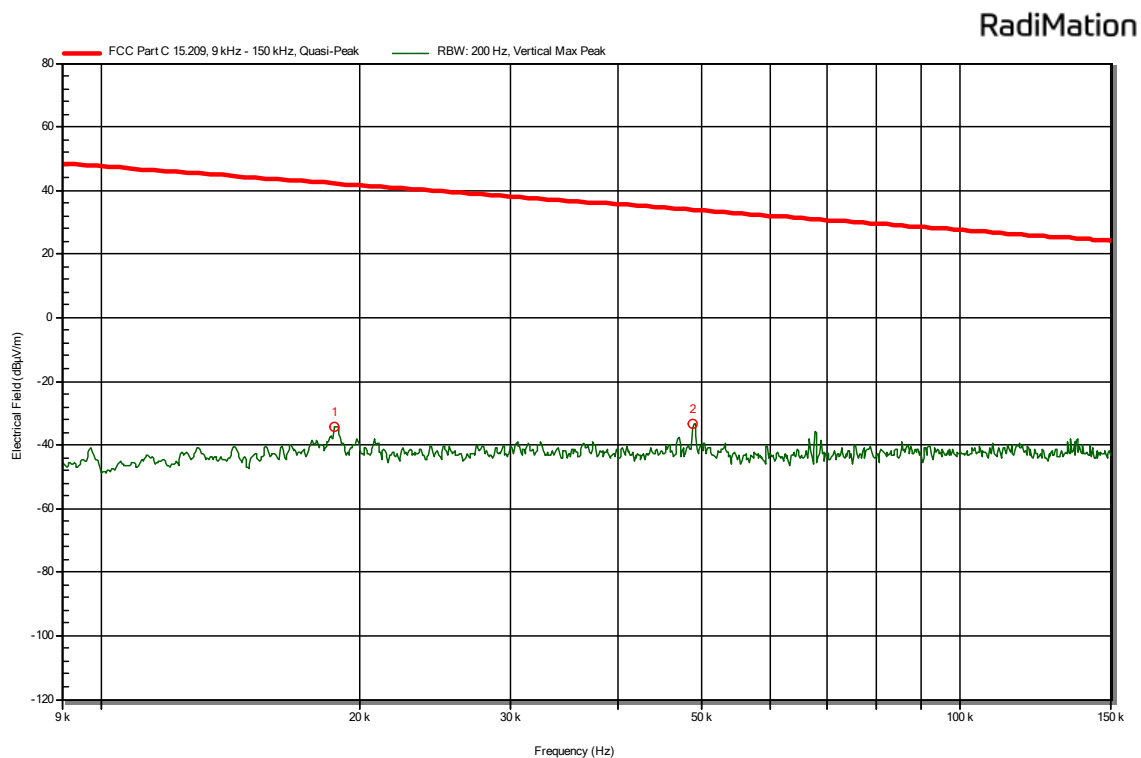
| Peak number | Frequency [GHz] | Peak [dBμV/m] | Average [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|------------------|-----------------|------------|--------------|--------------|
| 1           | 25.67           | 49.2          | 42.3             | 296             | 1          | 3            | Vertical     |

## The range 18 – 26.5 GHz Horizontal IEEE 802.11 n high

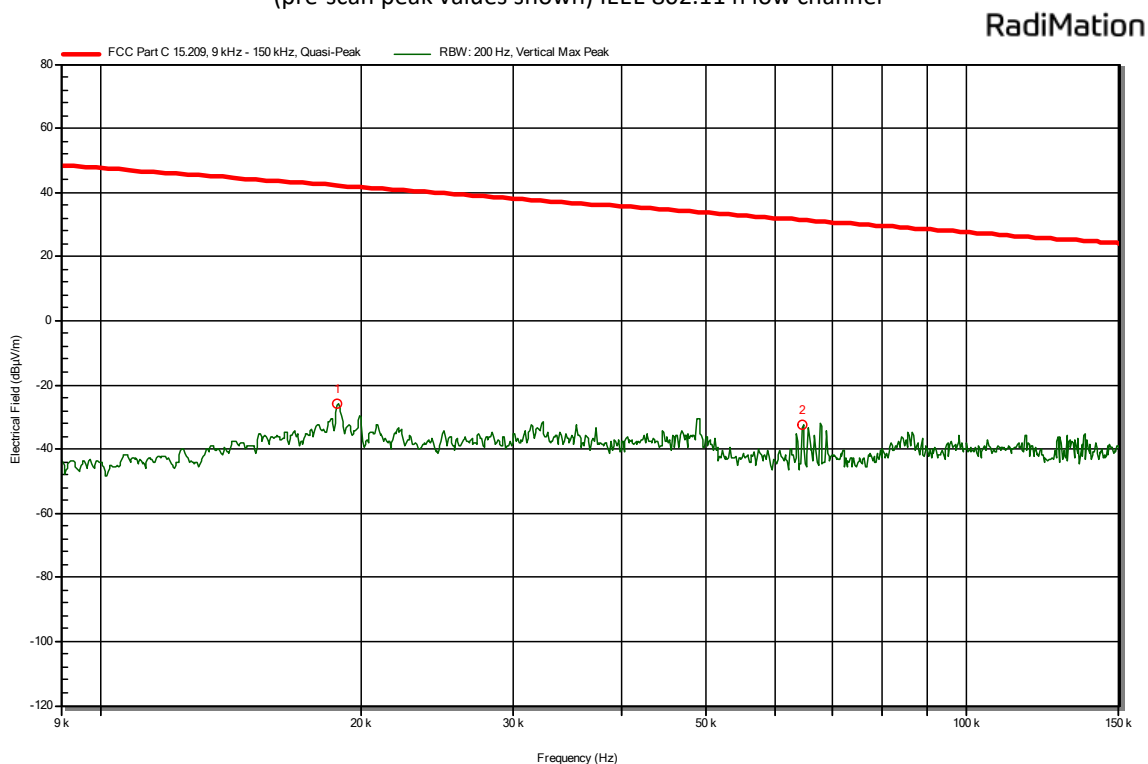
| Peak number | Frequency [GHz] | Peak [dBμV/m] | Average [dBμV/m] | Angle [degrees] | Height [m] | Distance [m] | Polarization |
|-------------|-----------------|---------------|------------------|-----------------|------------|--------------|--------------|
| 1           | 25.741          | 49            | 45.3             | 317             | 1          | 3            | Horizontal   |

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

### 3.1.7 Plots of the Radiated Spurious Emissions Measurement

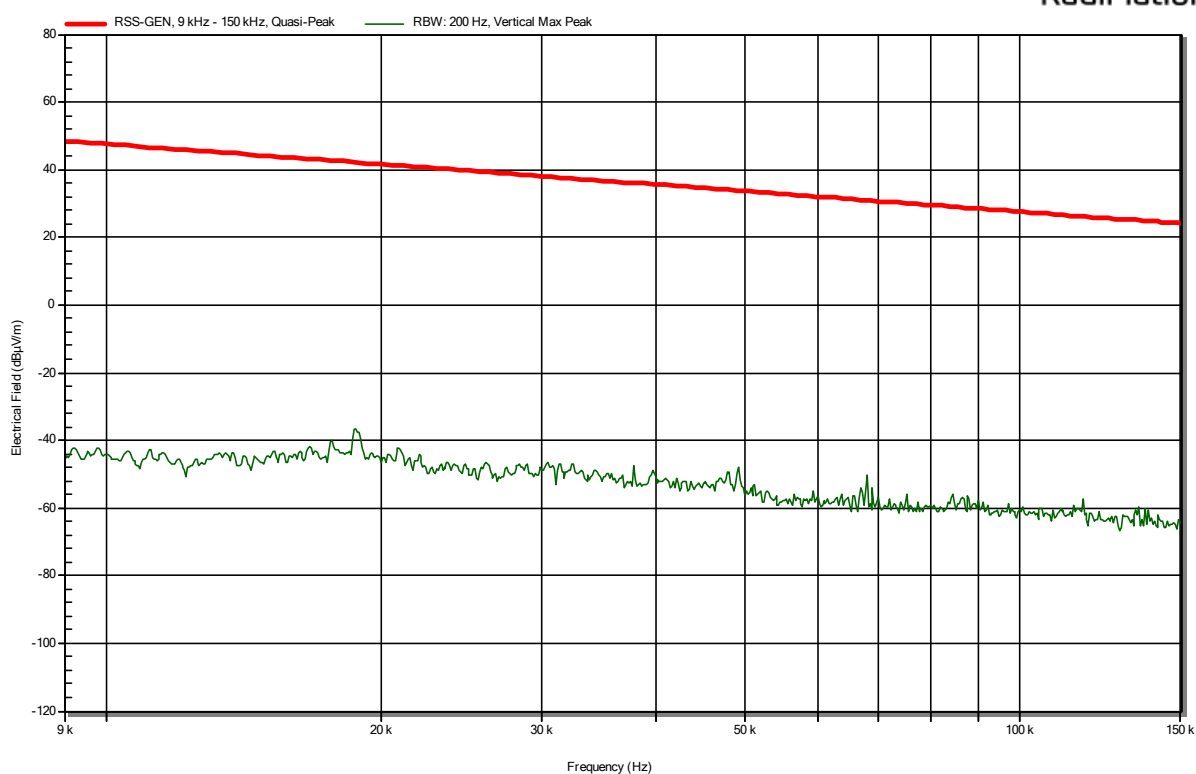


Plot 1a: radiated emissions of the EUT, Antenna perpendicular, in the range 9 – 150KHz  
(pre-scan peak values shown) IEEE 802.11 n low channel



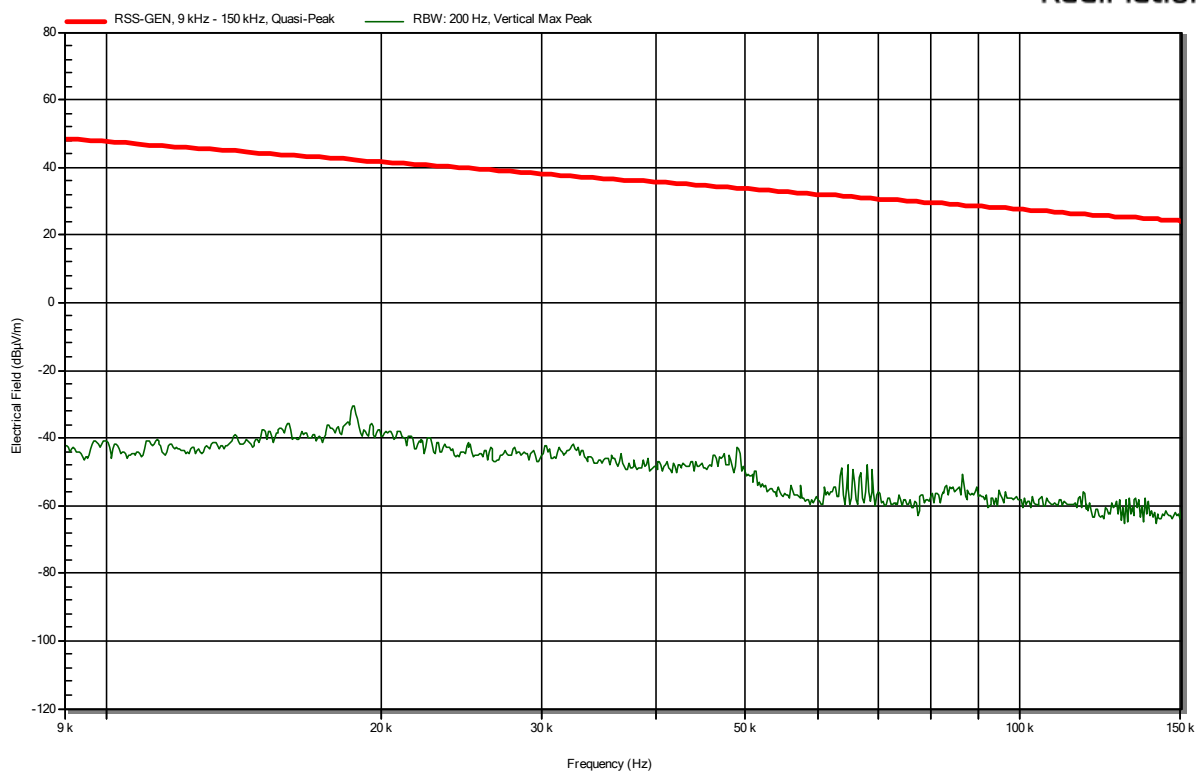
Plot 1b: radiated emissions of the EUT, Antenna parallel, in the range 9 – 150KHz  
(pre-scan peak values shown) IEEE 802.11b high channel

## RadiMation

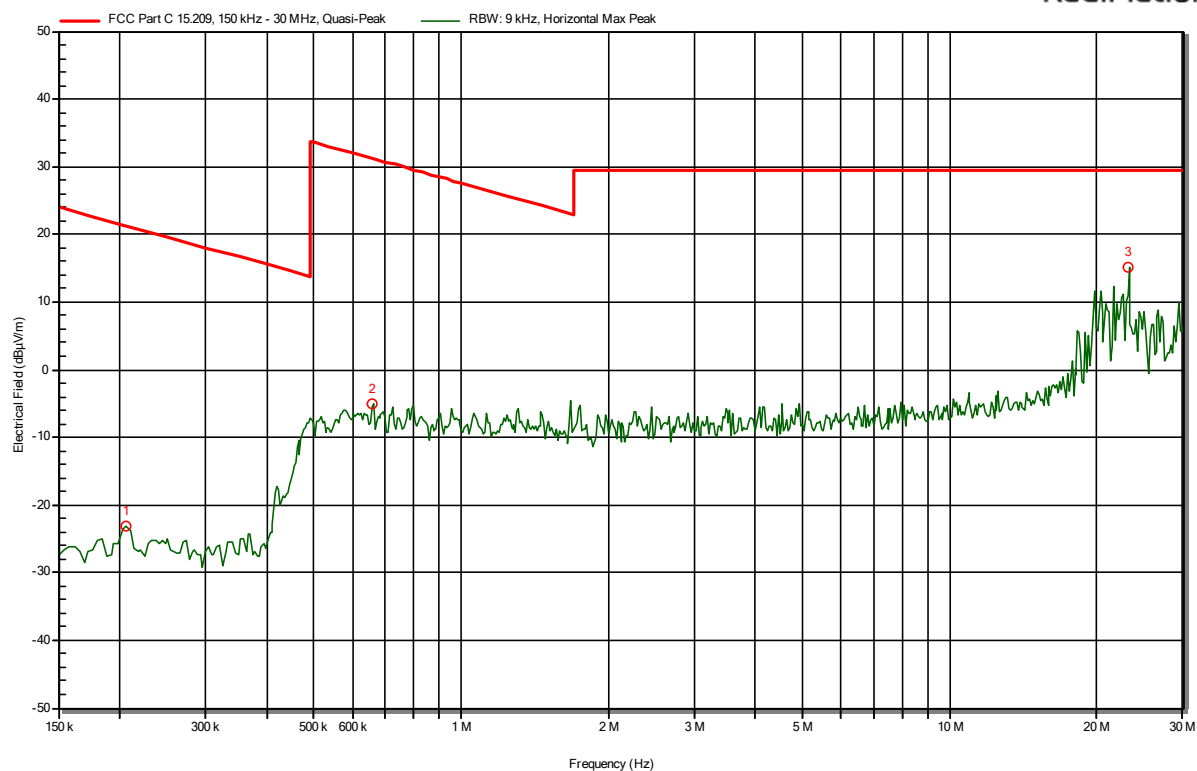


Plot 1c: radiated emissions of the EUT, Antenna perpendicular, in the range 9 – 150KHz  
(pre-scan peak values shown) BLE high channel

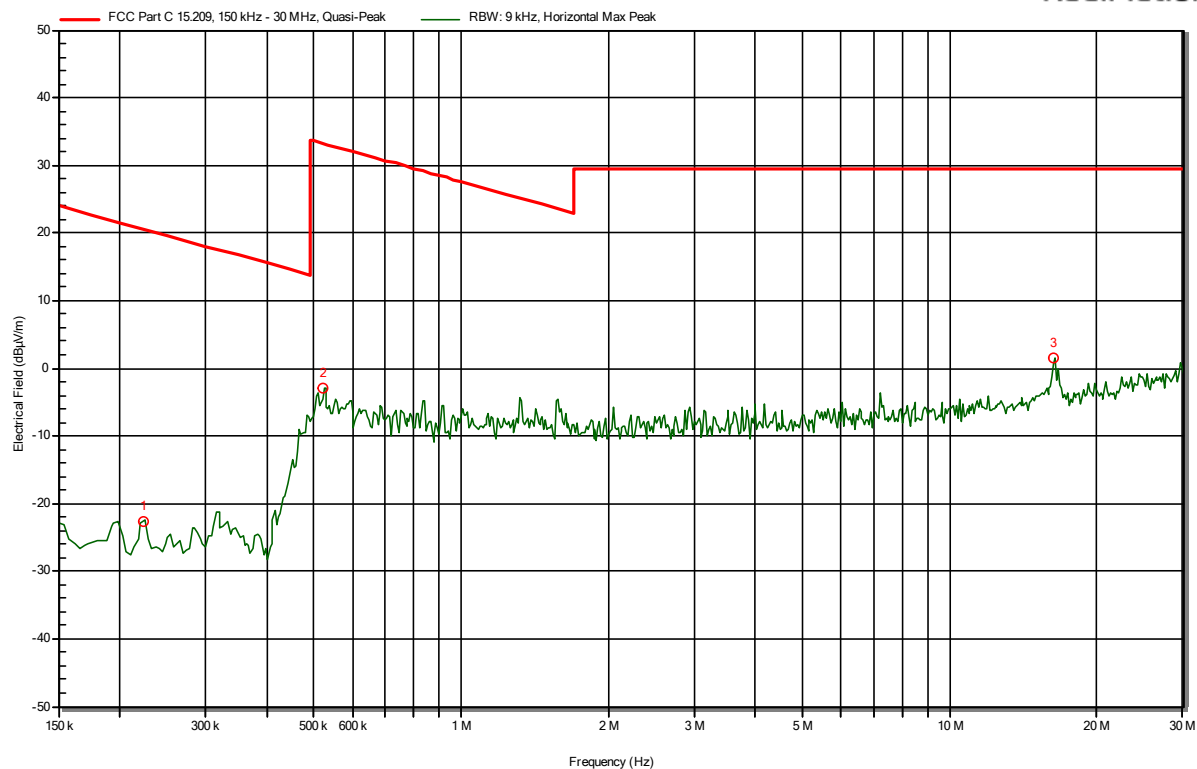
## RadiMation



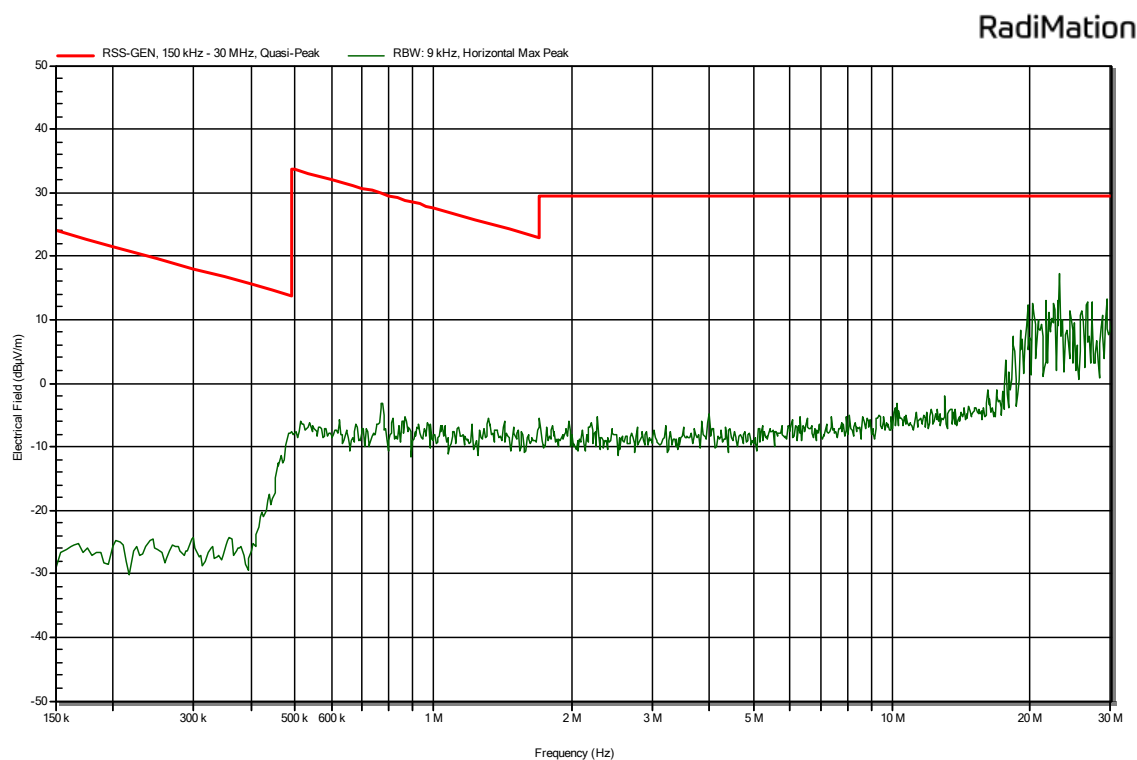
Plot 1d: radiated emissions of the EUT, Antenna parallel, in the range 9 – 150KHz  
(pre-scan peak values shown) BLE low channel



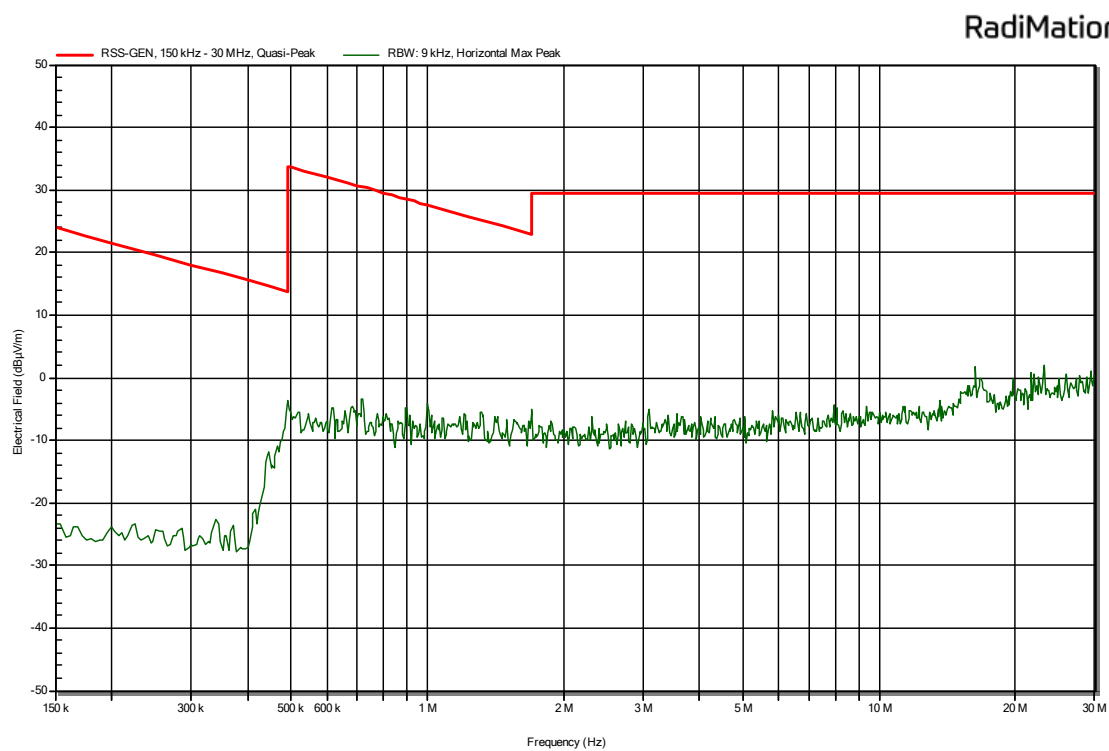
Plot 2a: radiated emissions of the EUT, Antenna perpendicular, in the range 150KHz-30 MHz  
(pre-scan peak values shown) BLE low channel



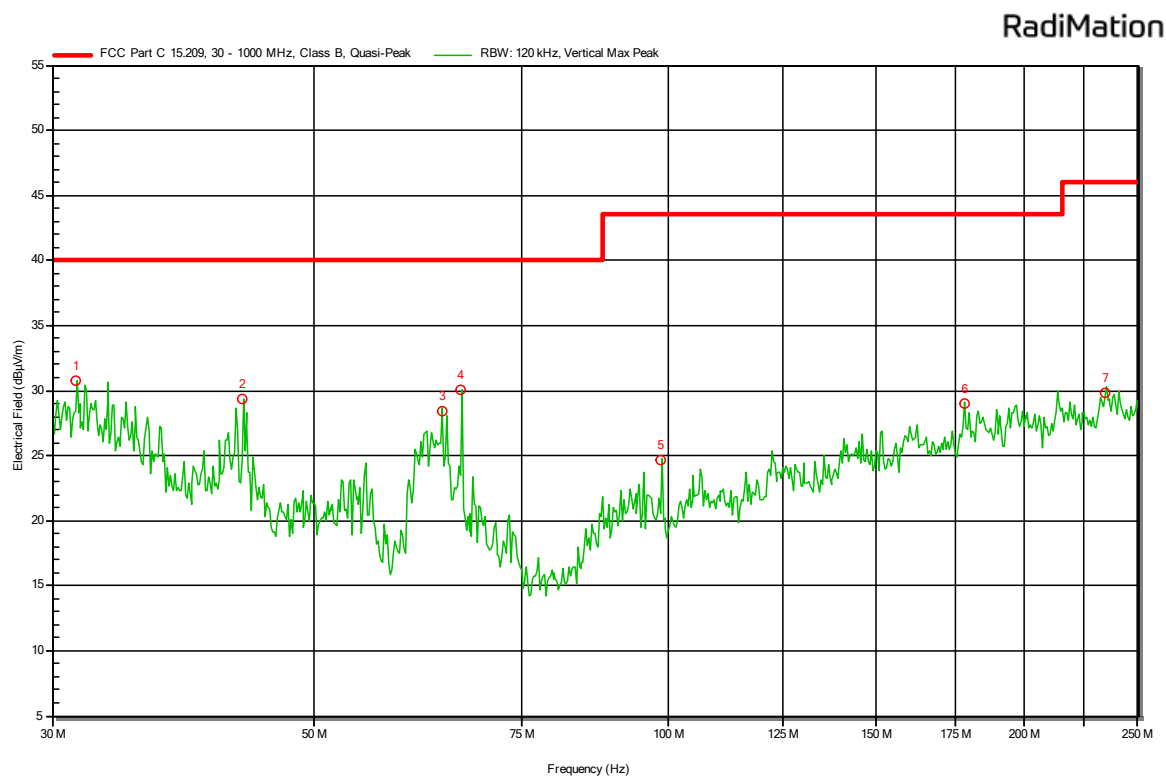
Plot 2b: radiated emissions of the EUT, Antenna parallel, in the range 150KHz-30 MHz  
(pre-scan peak values shown) BLE Mid Channel



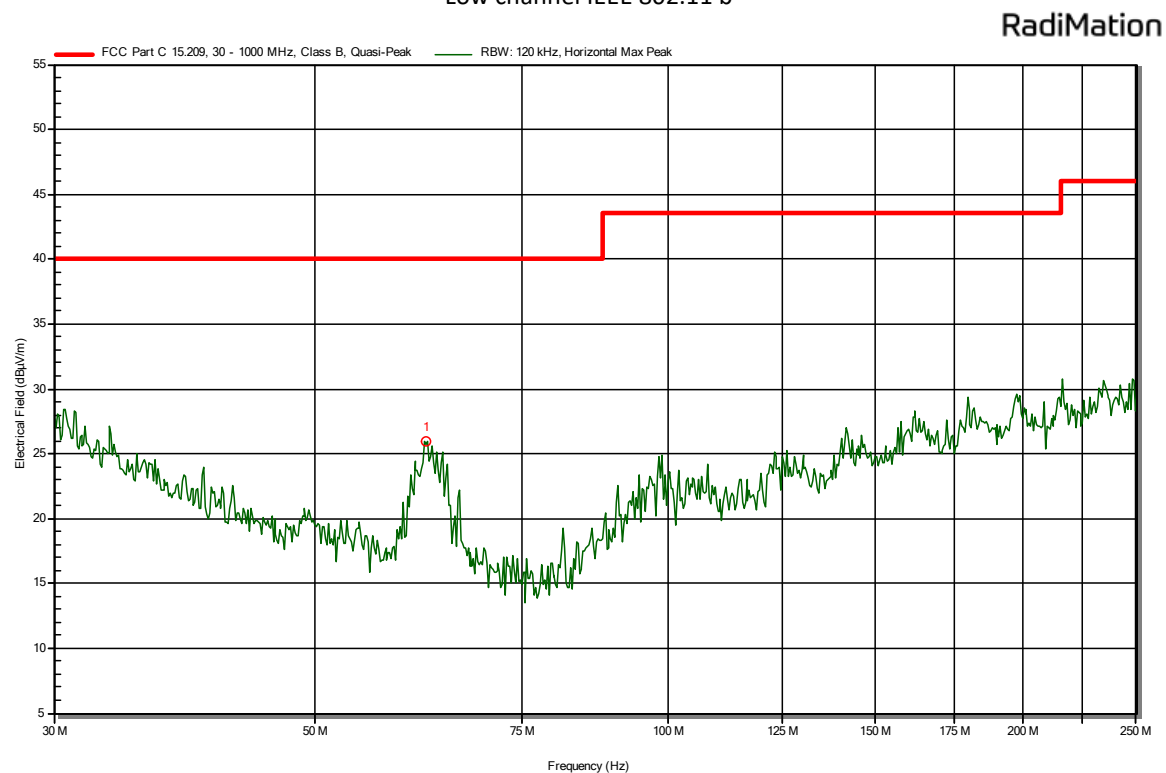
Plot 2c: radiated emissions of the EUT, Antenna perpendicular, in the range 150KHz-30 MHz  
(pre-scan peak values shown) BLE low channel



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



Plot 3a: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Low channel IEEE 802.11 b



Plot 3b: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Low channel IEEE 802.11 b

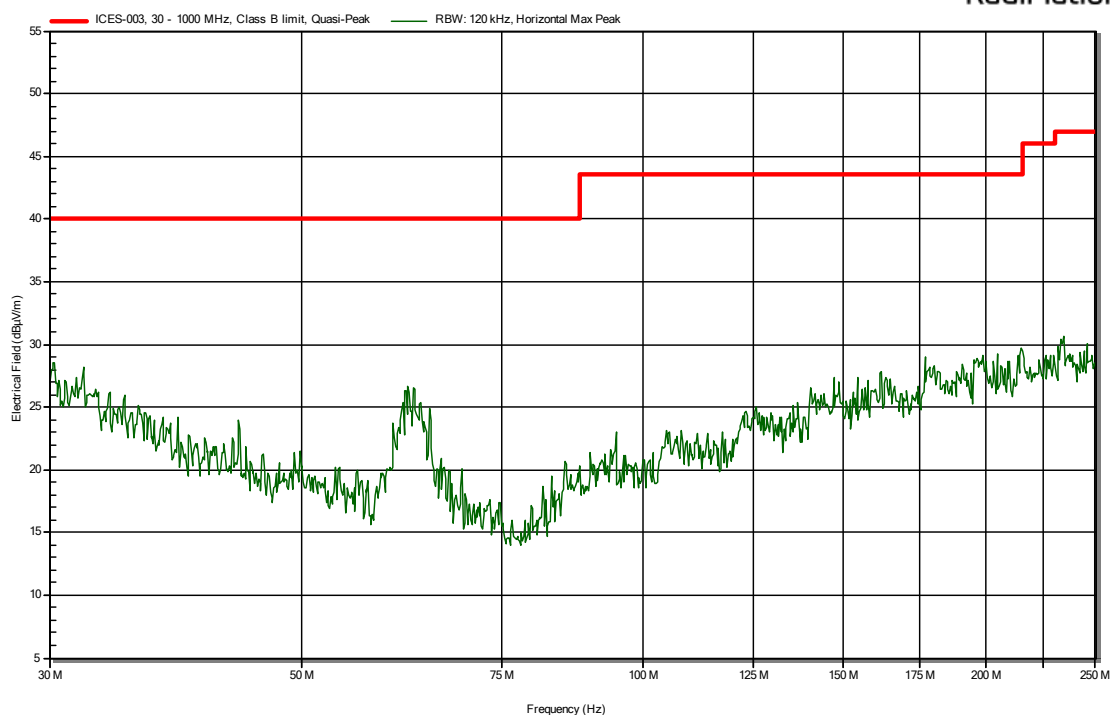


## RadiMation

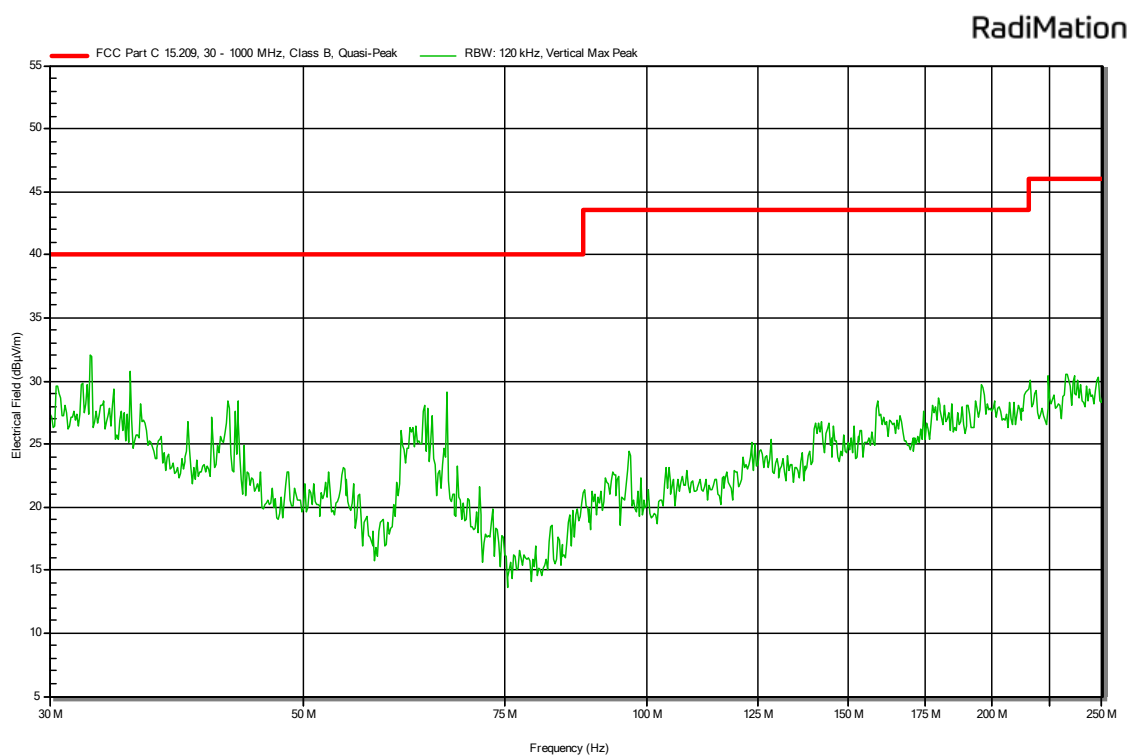


Plot 3c: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Low channel IEEE 802.11 b

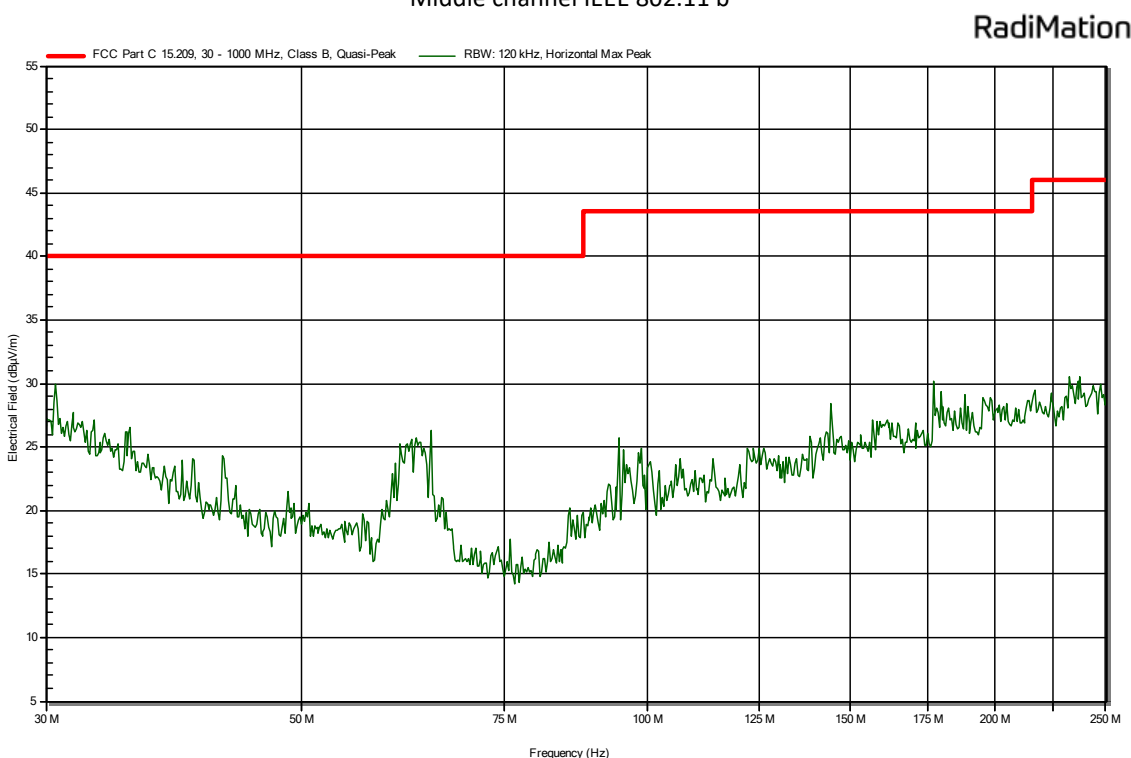
## RadiMation



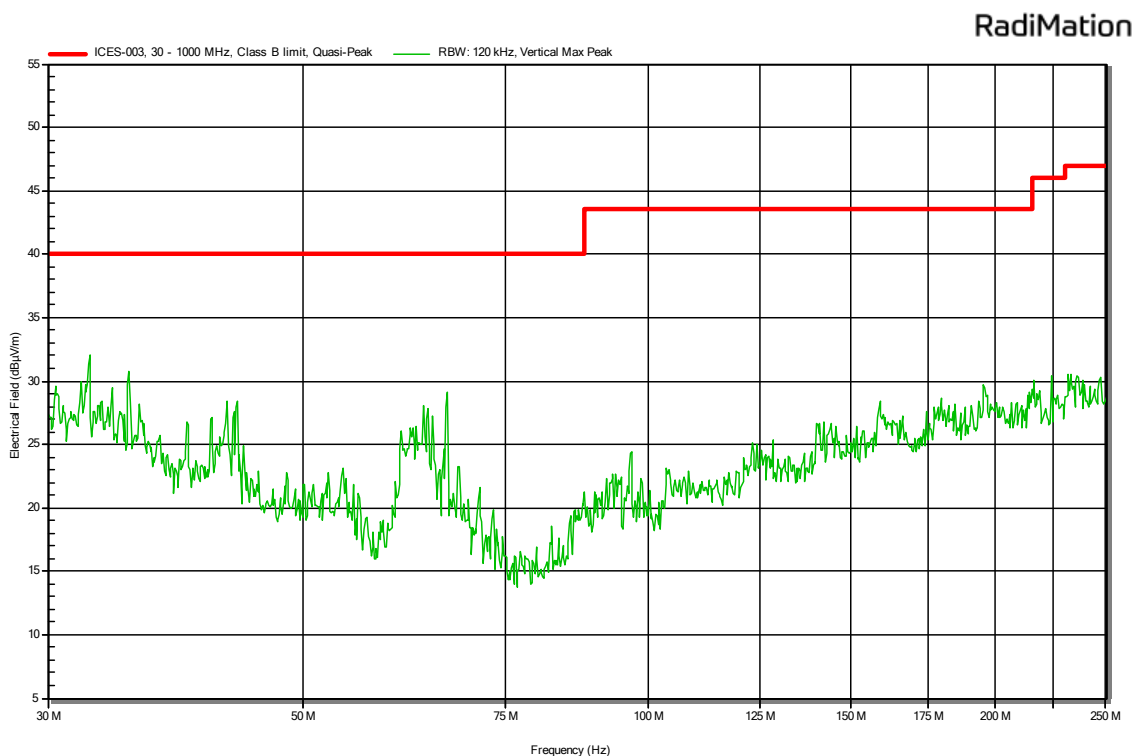
Plot 3d: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Low channel IEEE 802.11 b



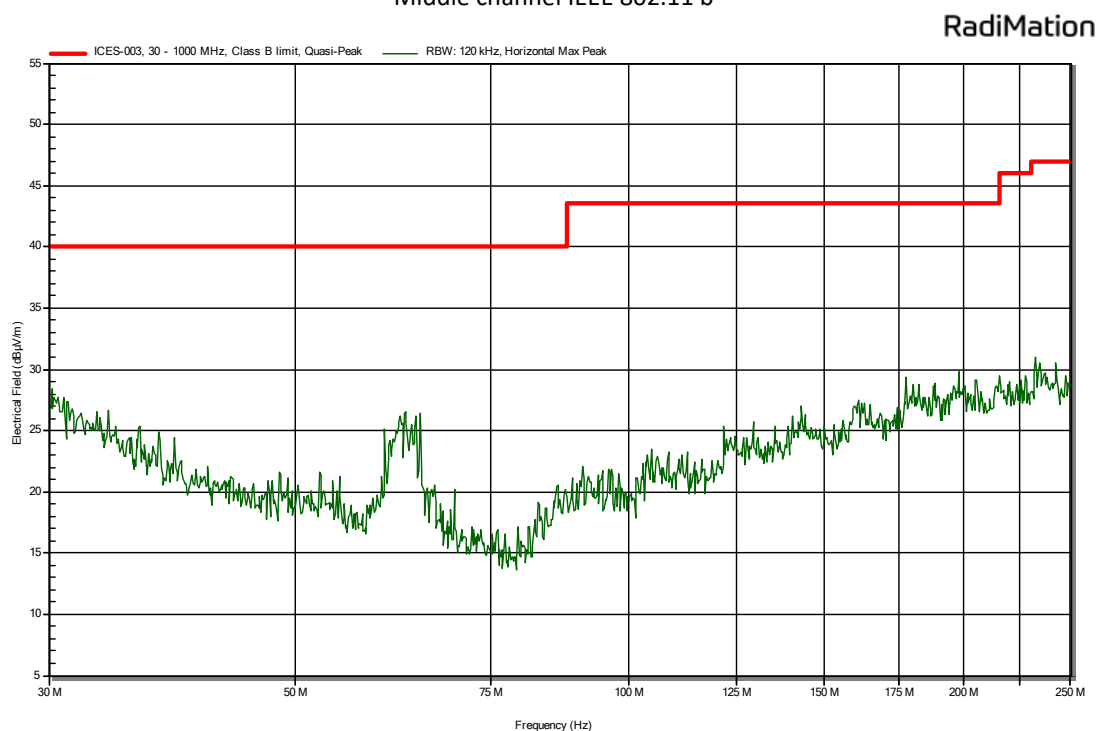
Plot 3e: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Middle channel IEEE 802.11 b



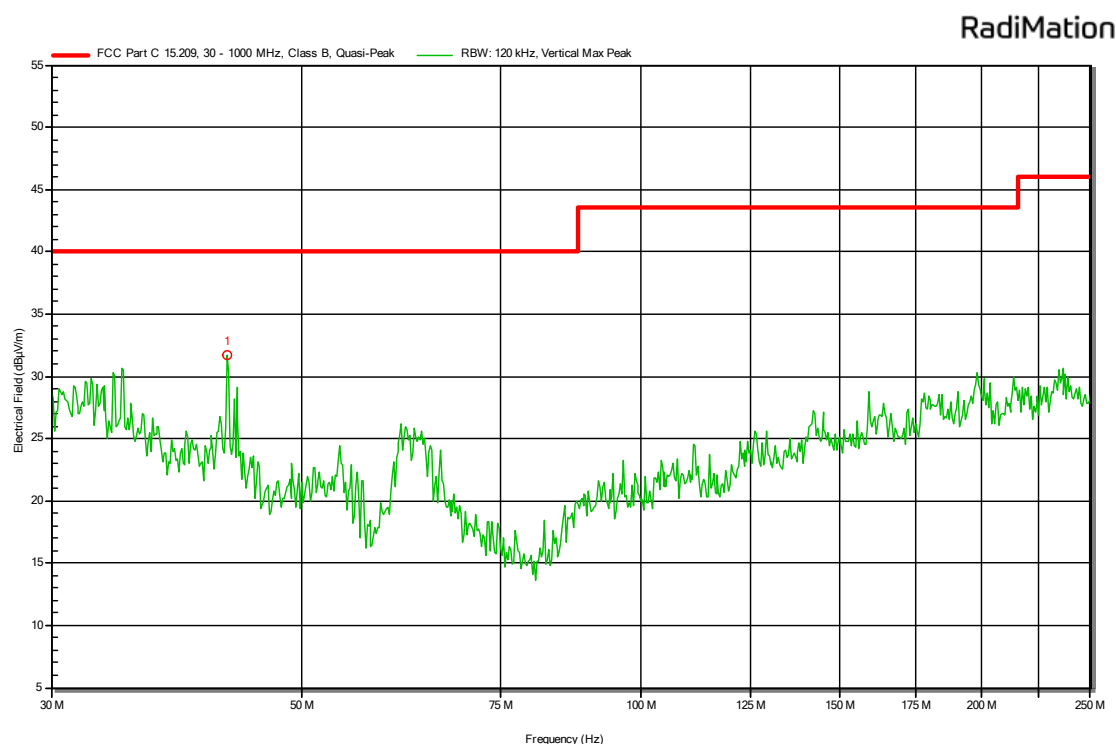
Plot 3f: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Middle channel IEEE 802.11 b



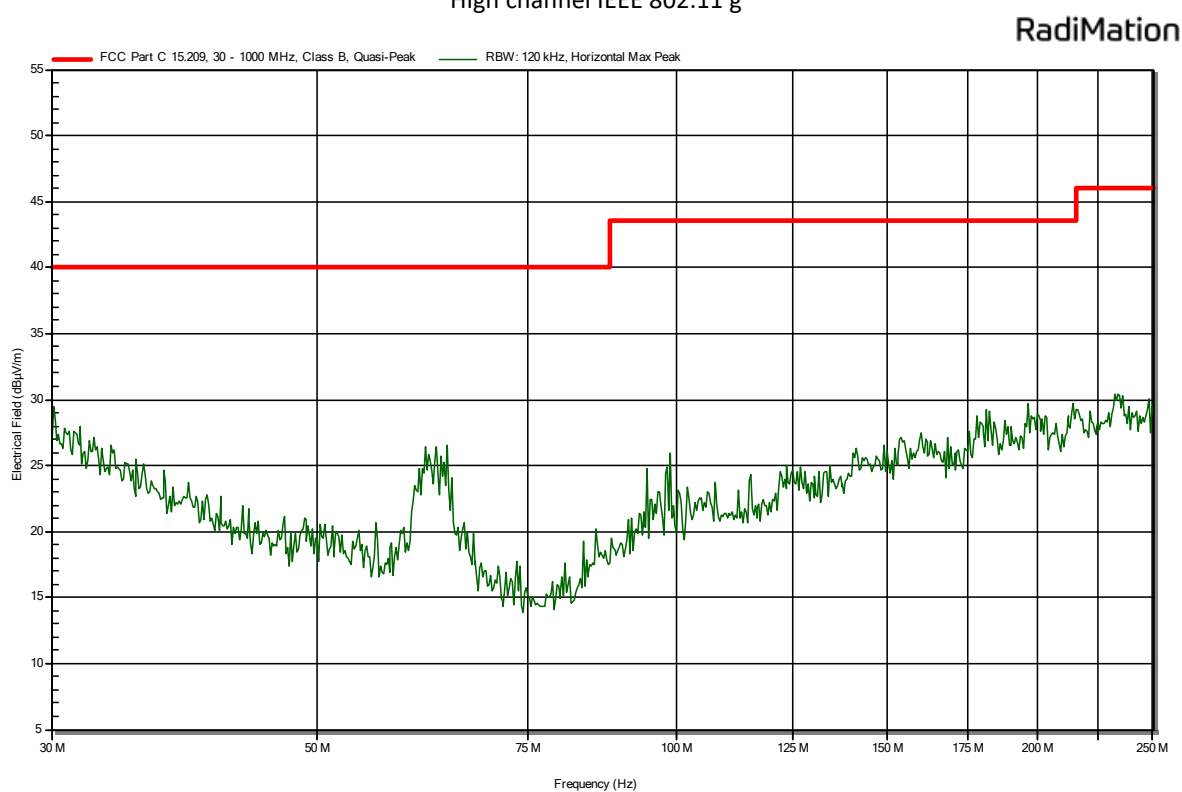
Plot 3g: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Middle channel IEEE 802.11 b



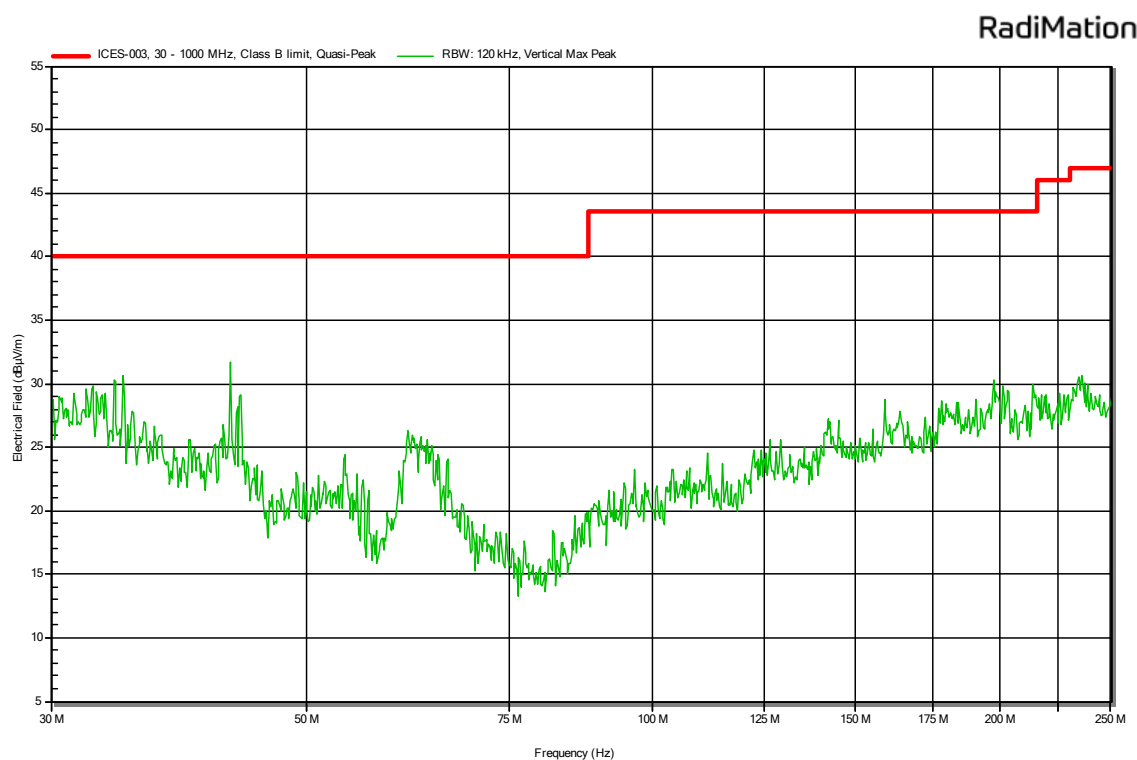
Plot 3h: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
Middle channel IEEE 802.11 b



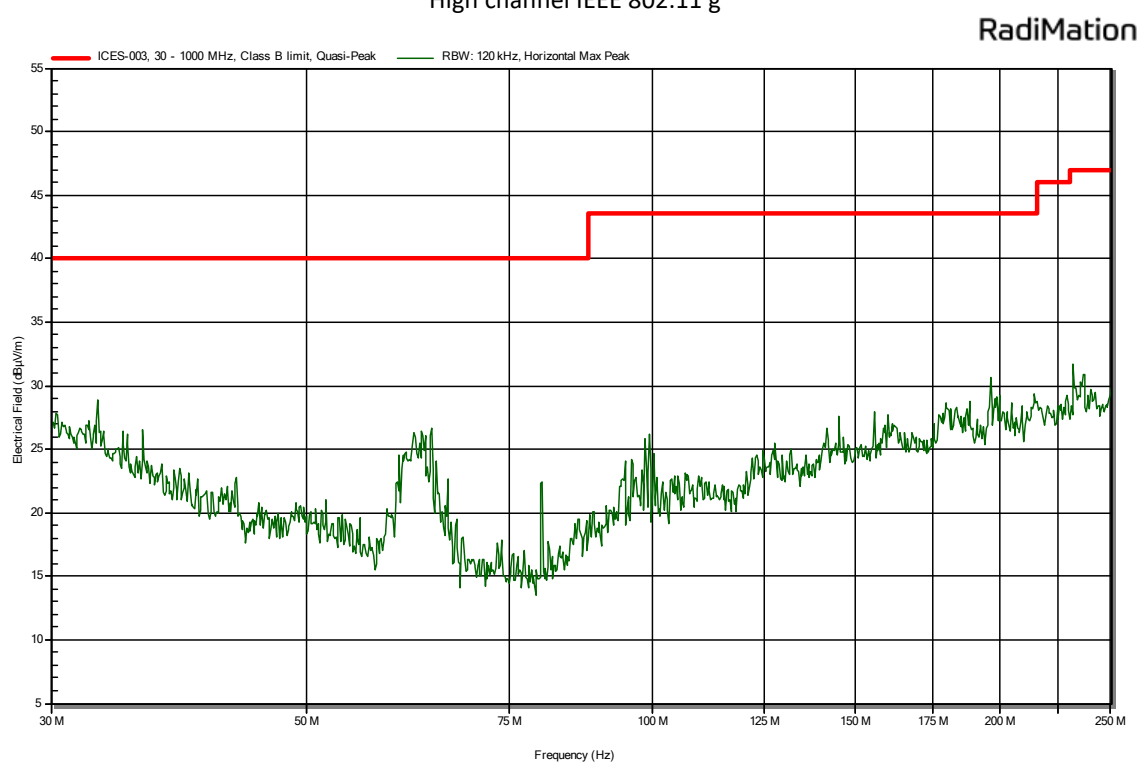
Plot 3i: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 g



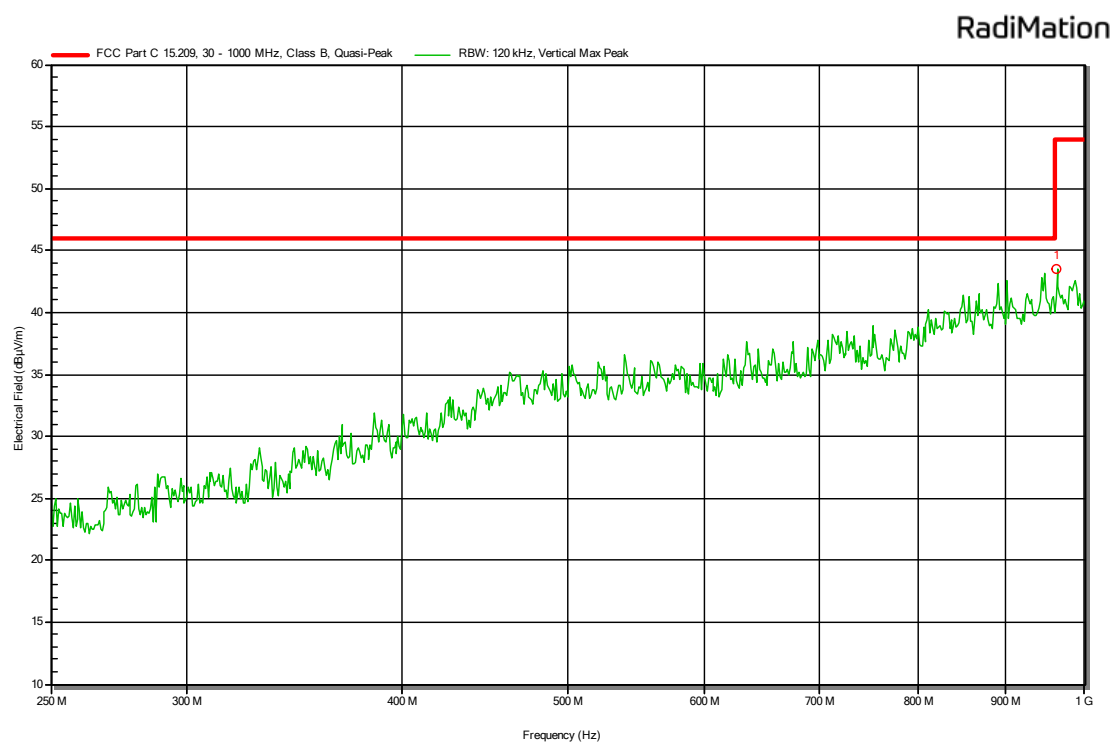
Plot 3j: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 g



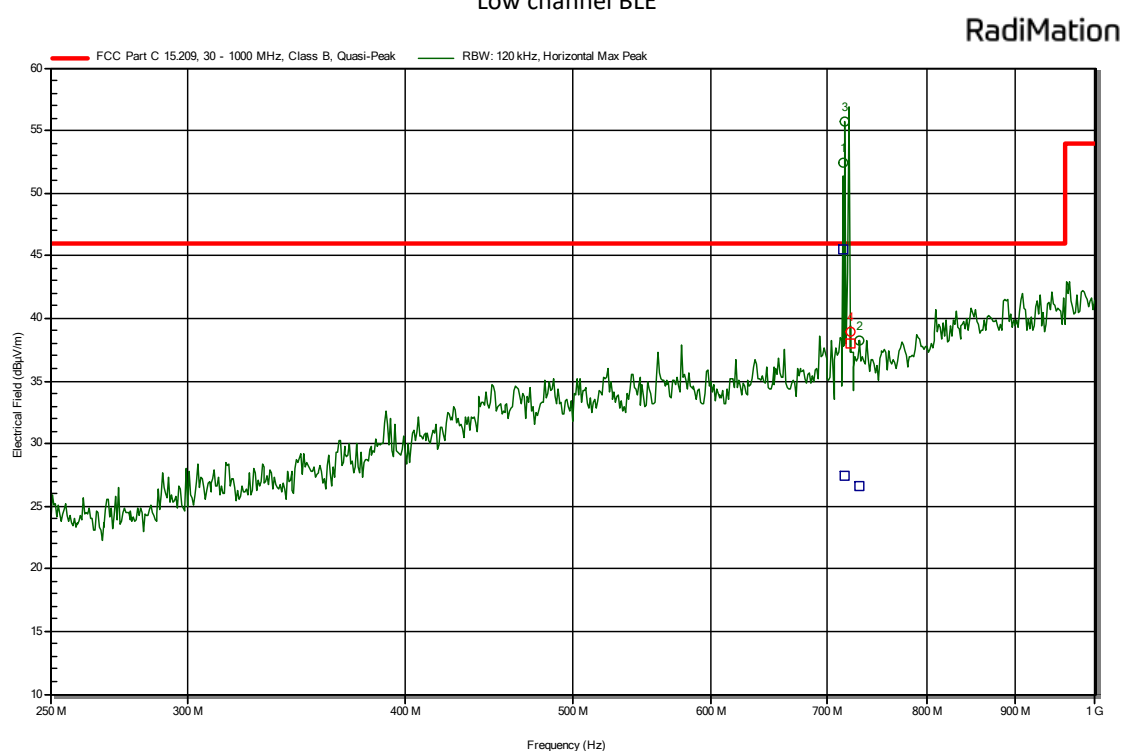
Plot 3k: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 g



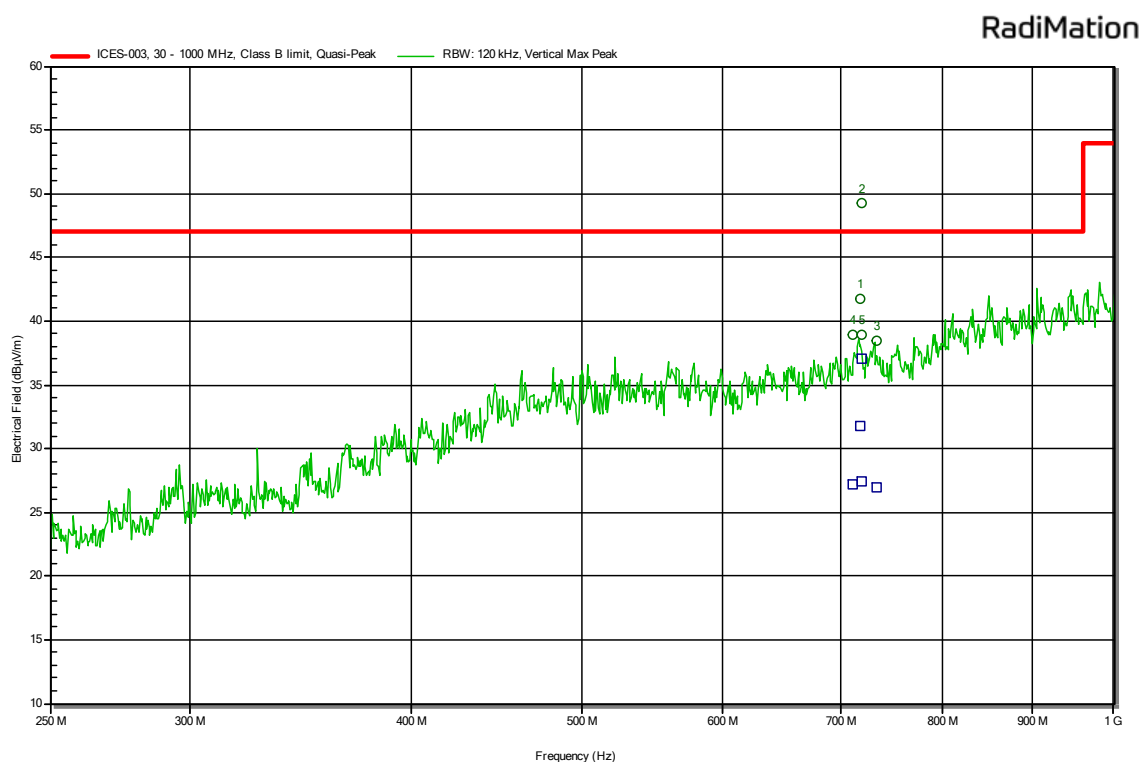
Plot 3l: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 g



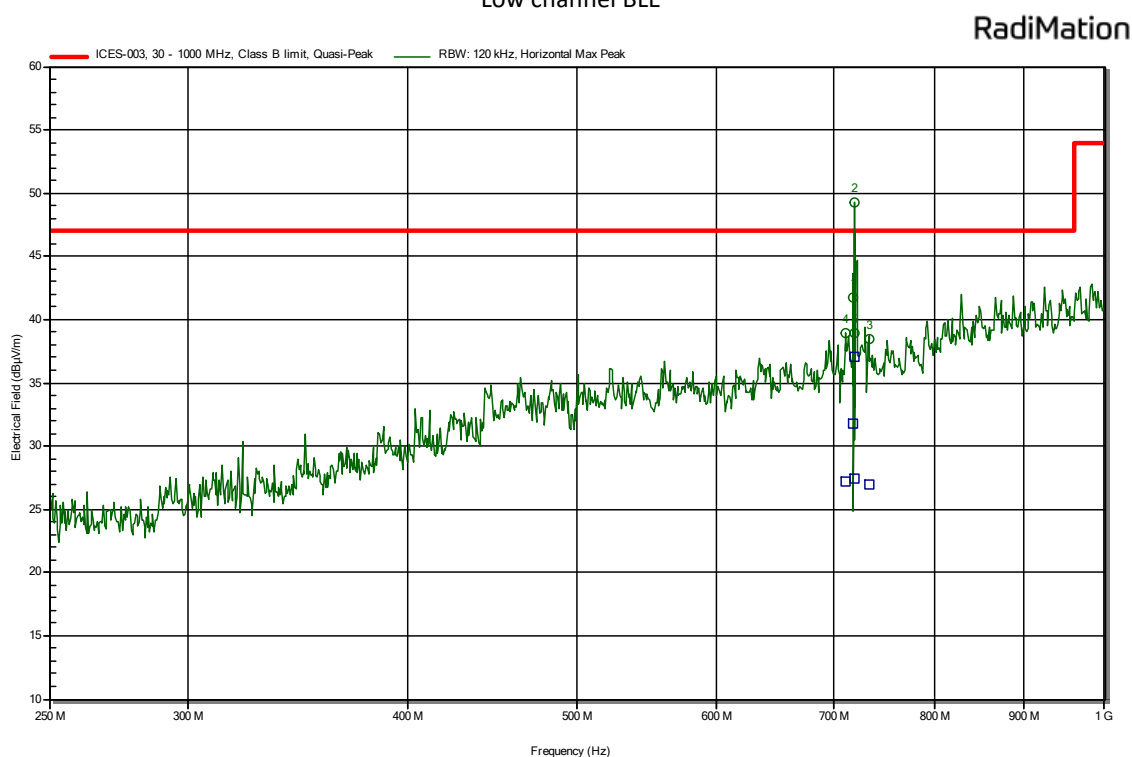
Plot 4a: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz  
(pre-scan peak values shown)  
Low channel BLE



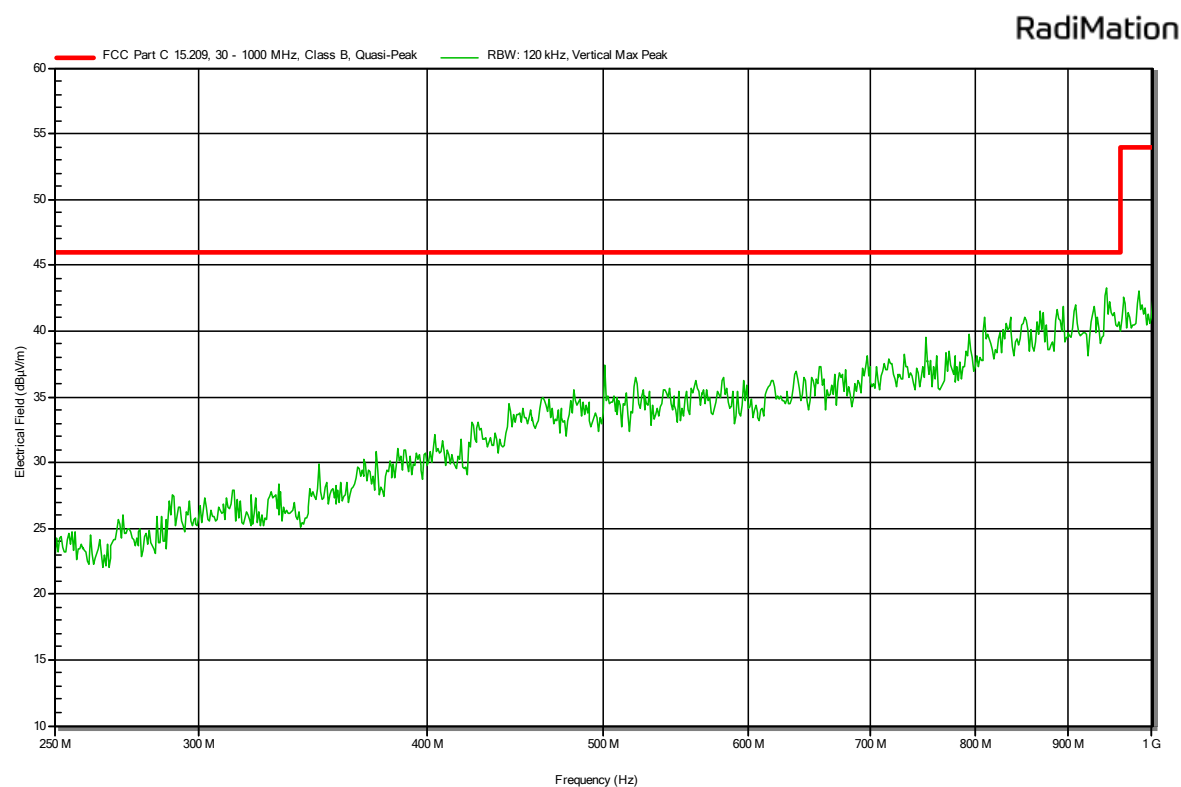
Plot 4b: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz  
(pre-scan peak values shown)  
Low channel BLE



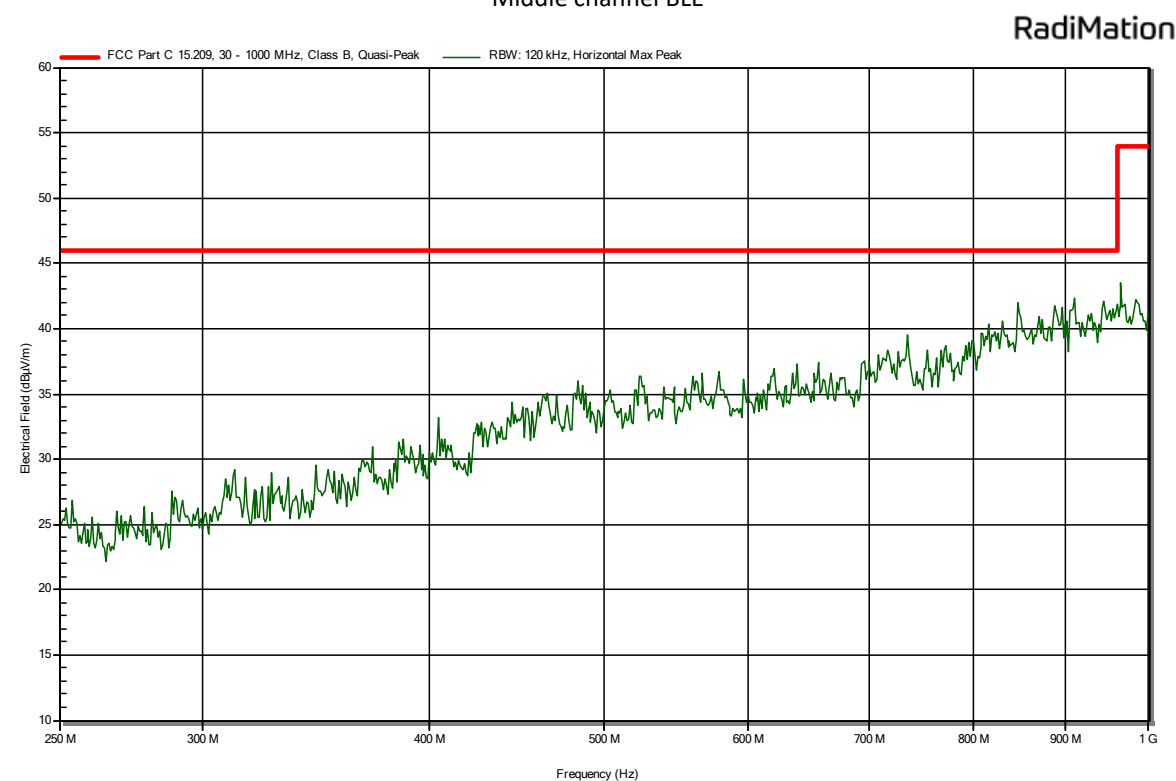
Plot 4c radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz  
(pre-scan peak values shown)  
Low channel BLE



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

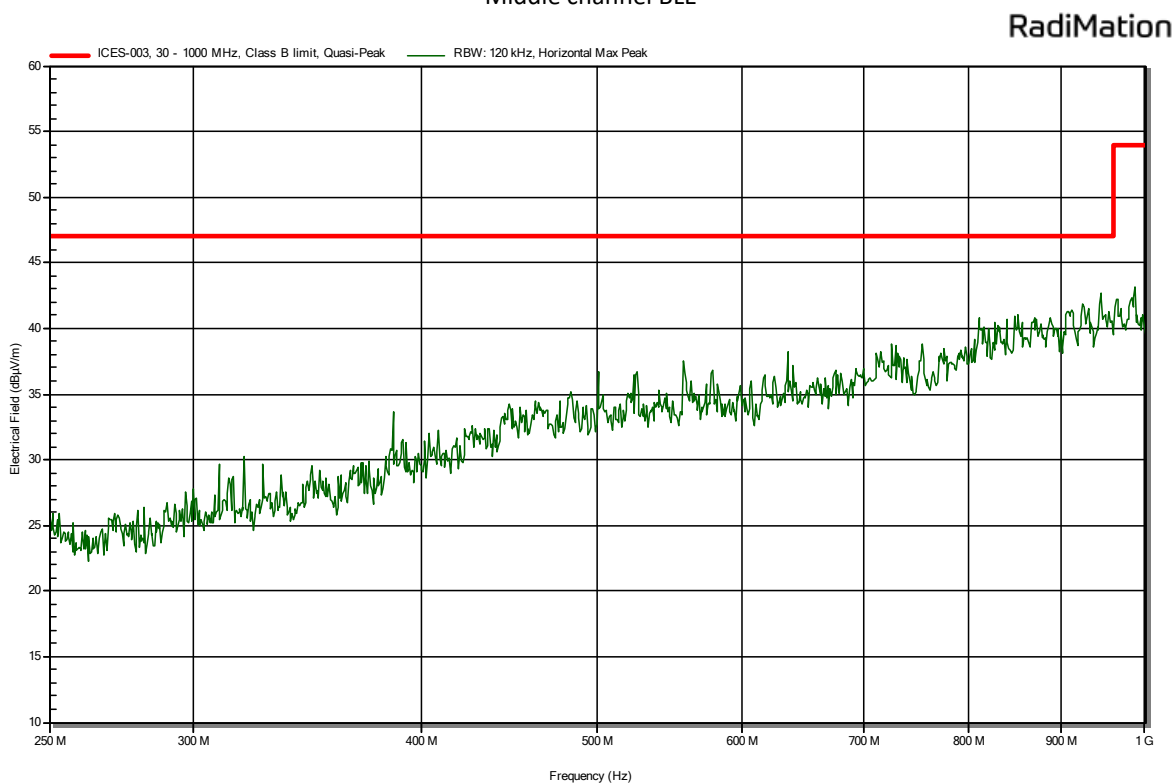
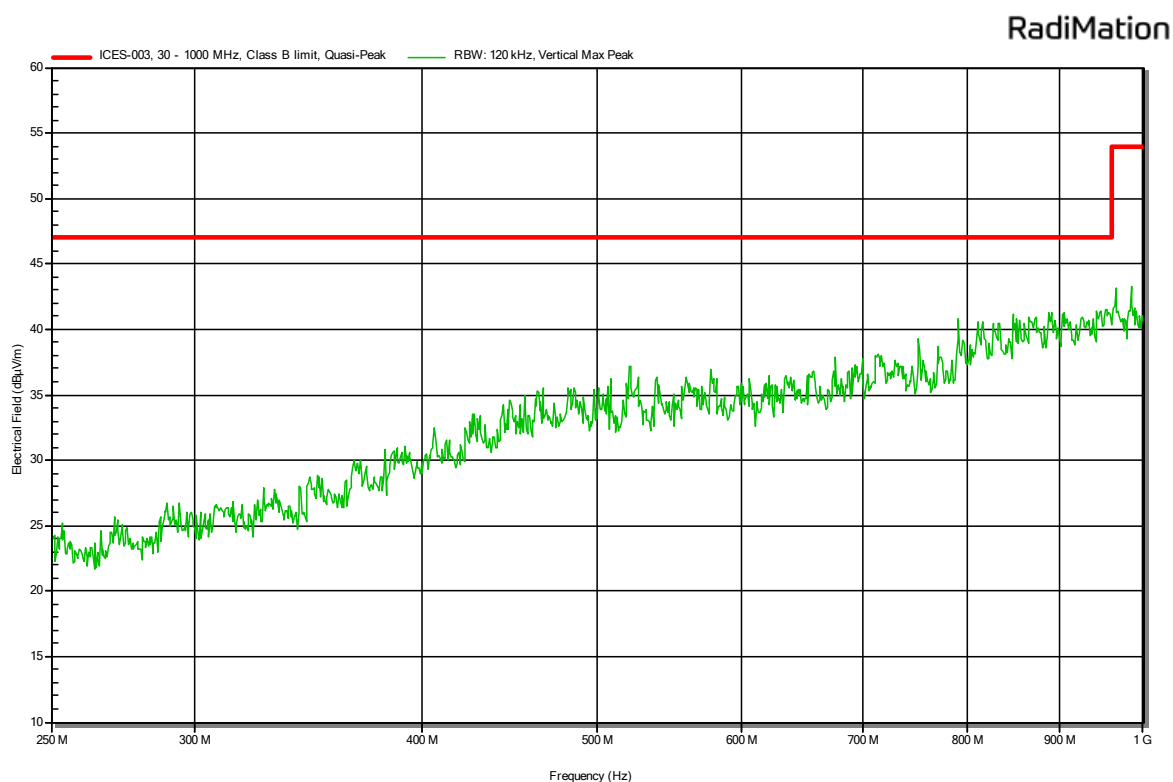


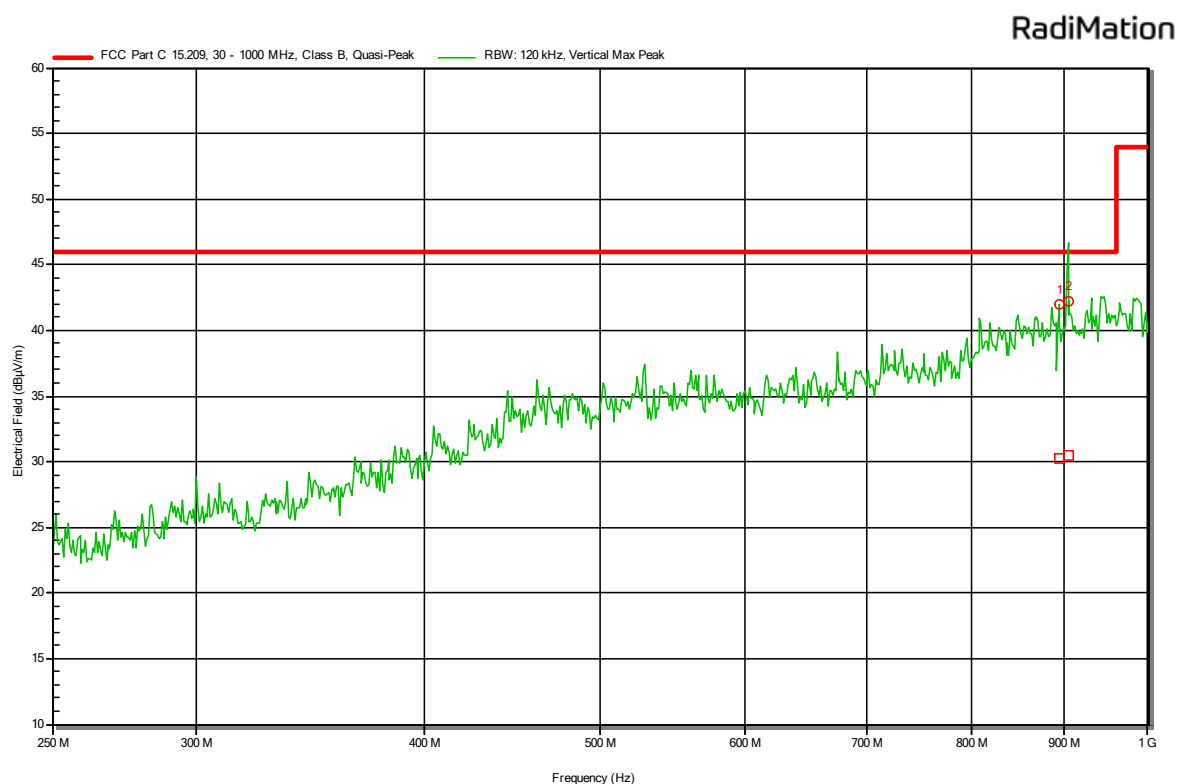
Plot 4e: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz  
(pre-scan peak values shown)  
Middle channel BLE



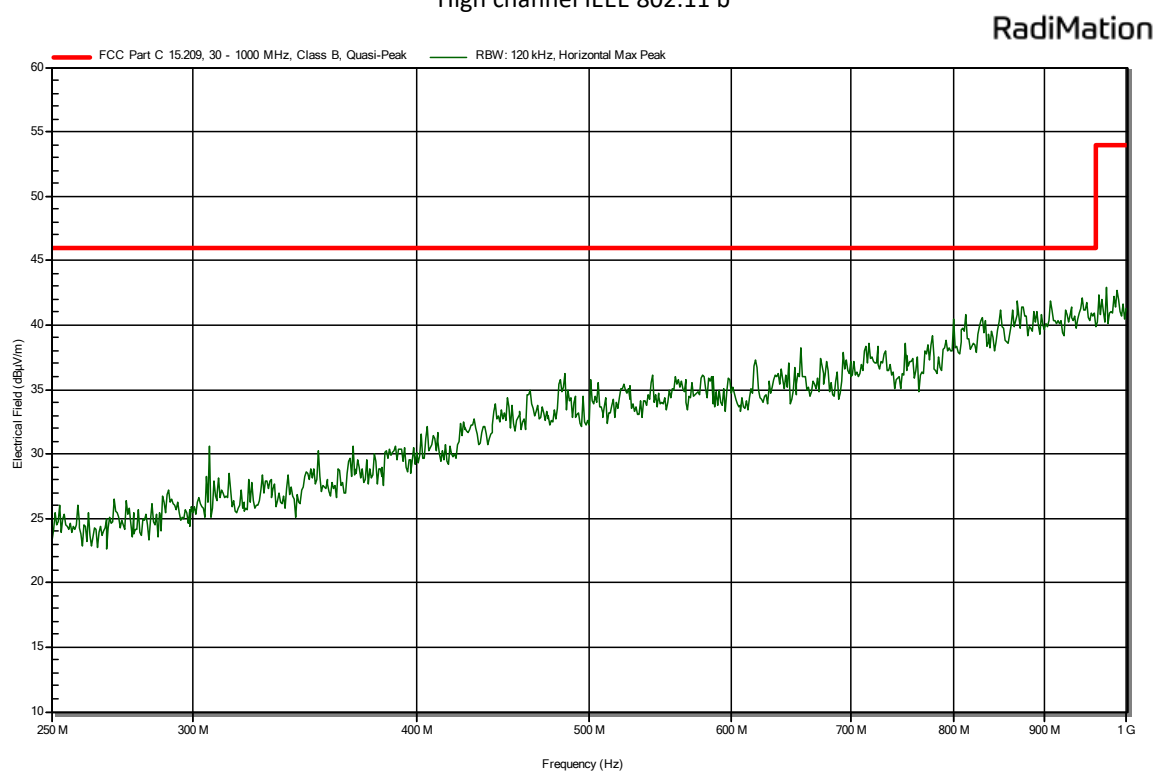
Plot 4f: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz  
(pre-scan peak values shown)  
Middle channel BLE



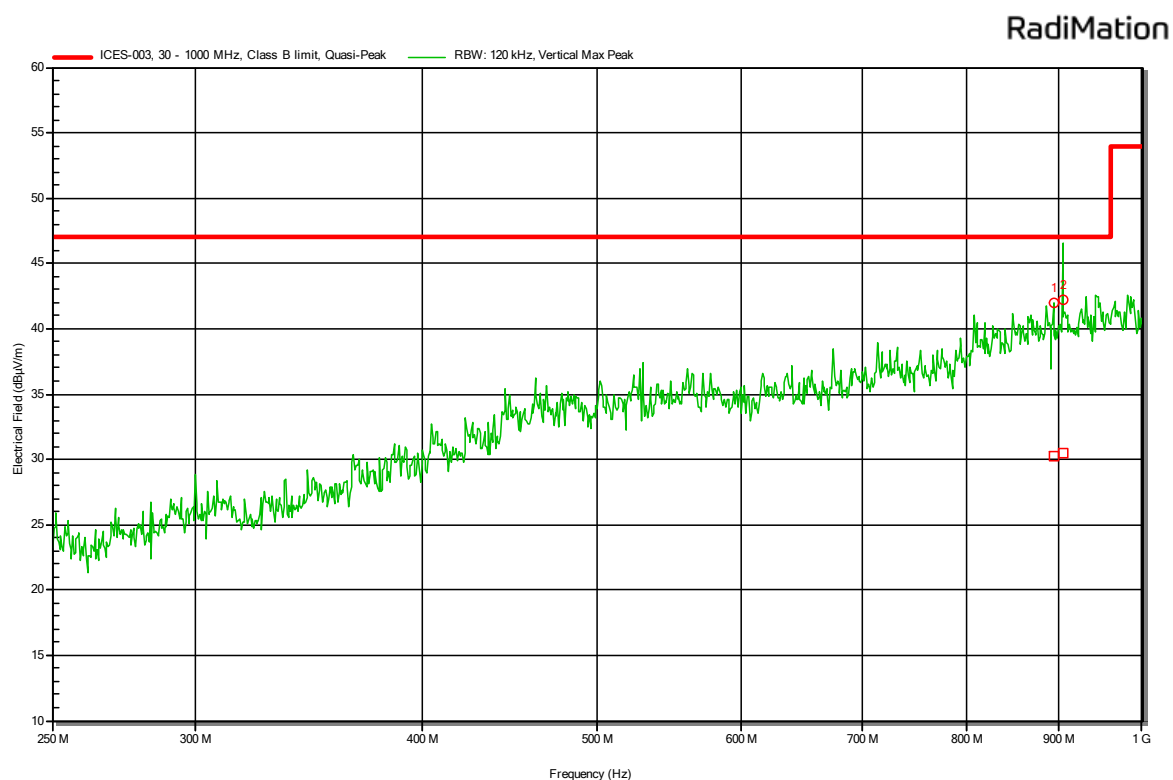




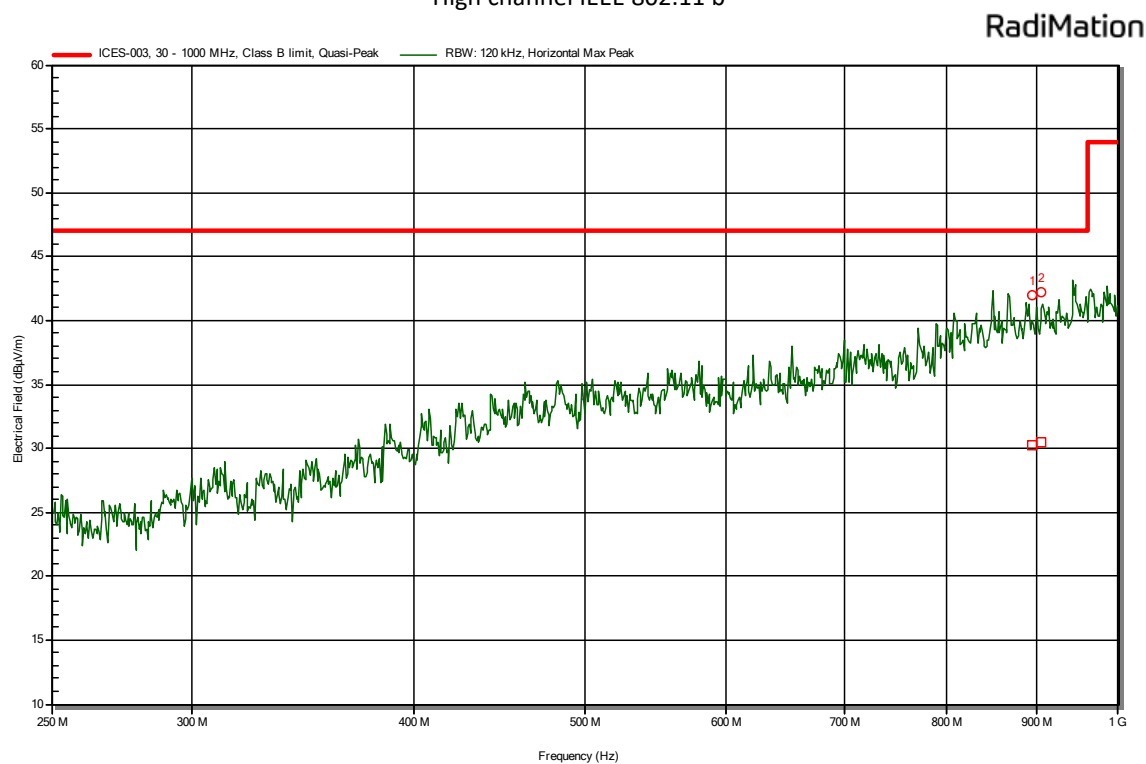
Plot 4g: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 b



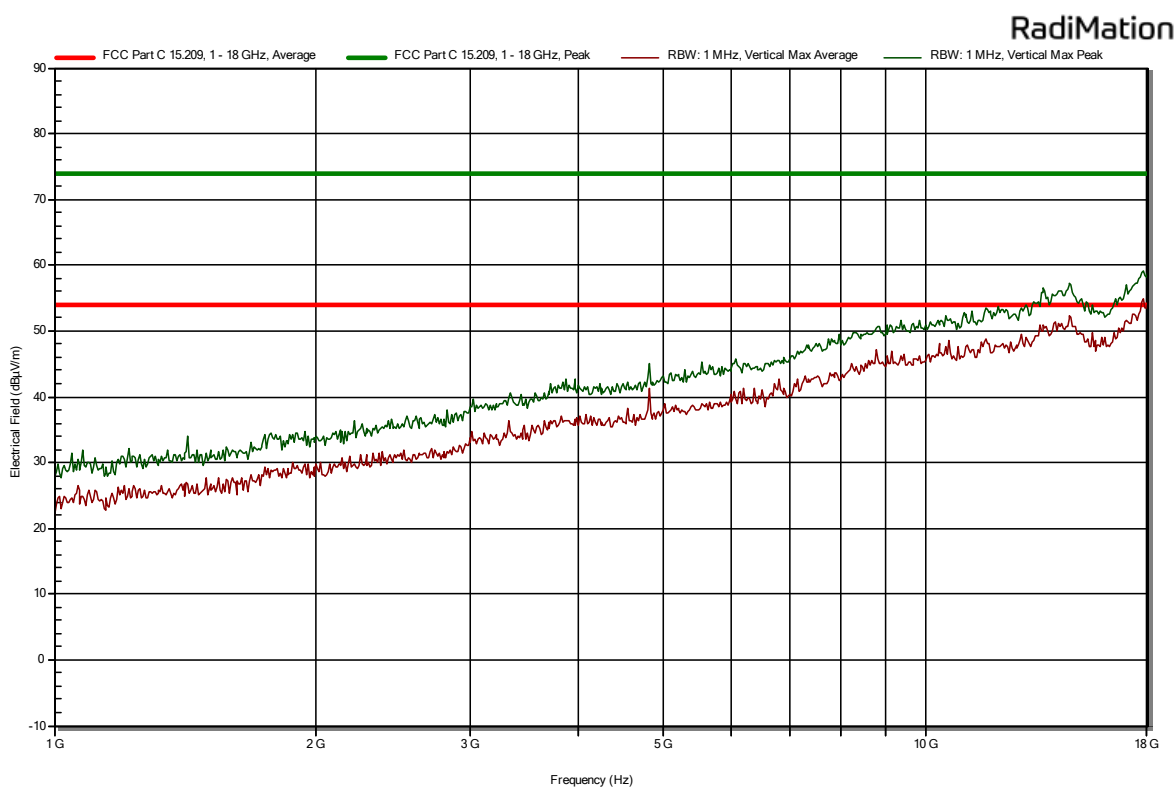
Plot 4h: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 b



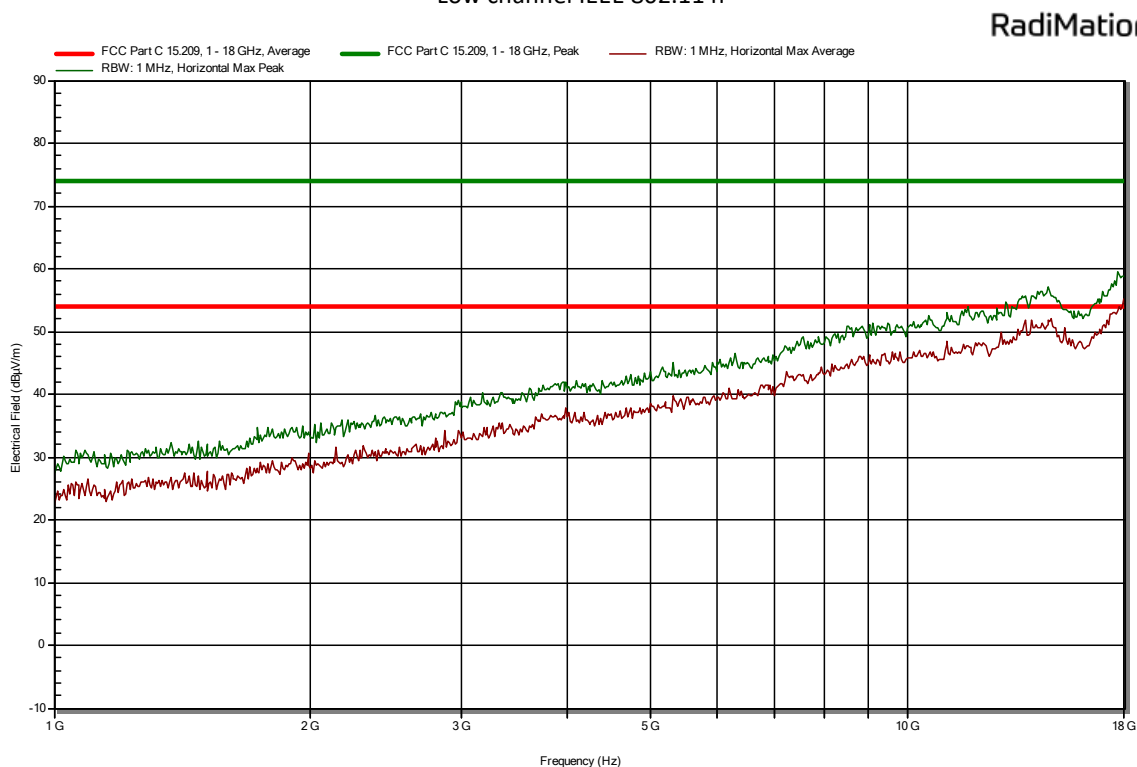
Plot 4i: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 b



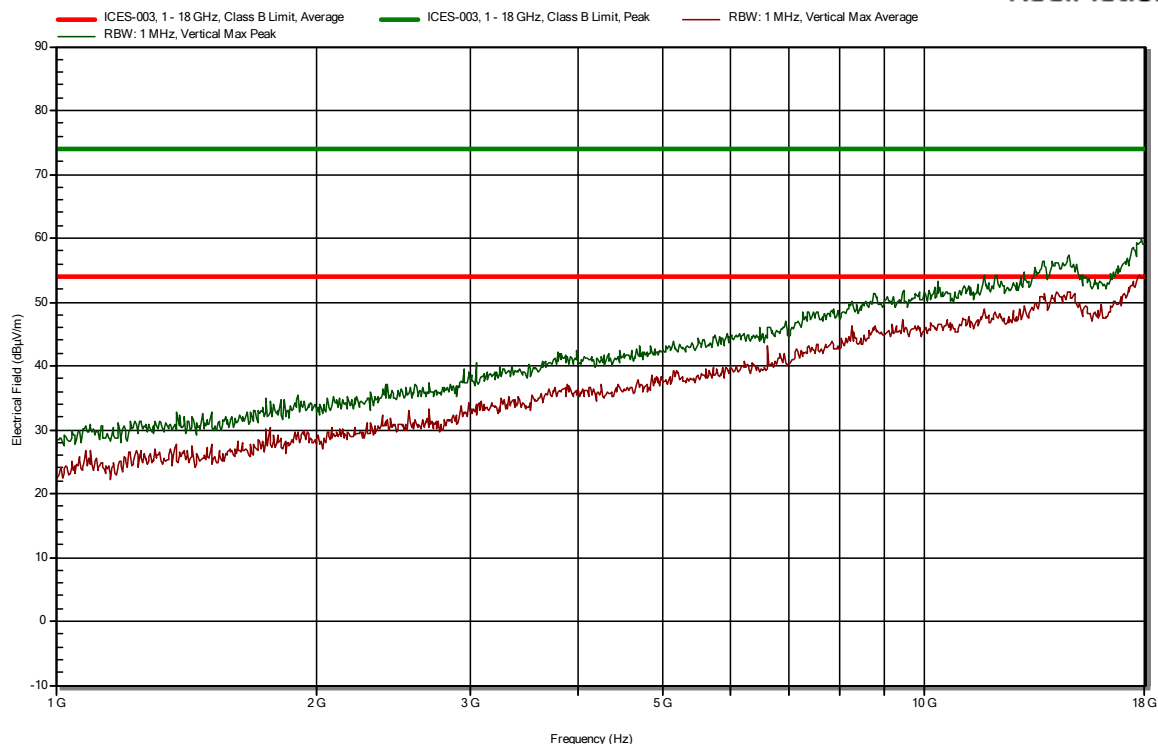
Plot 4j: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz  
(pre-scan peak values shown)  
High channel IEEE 802.11 b



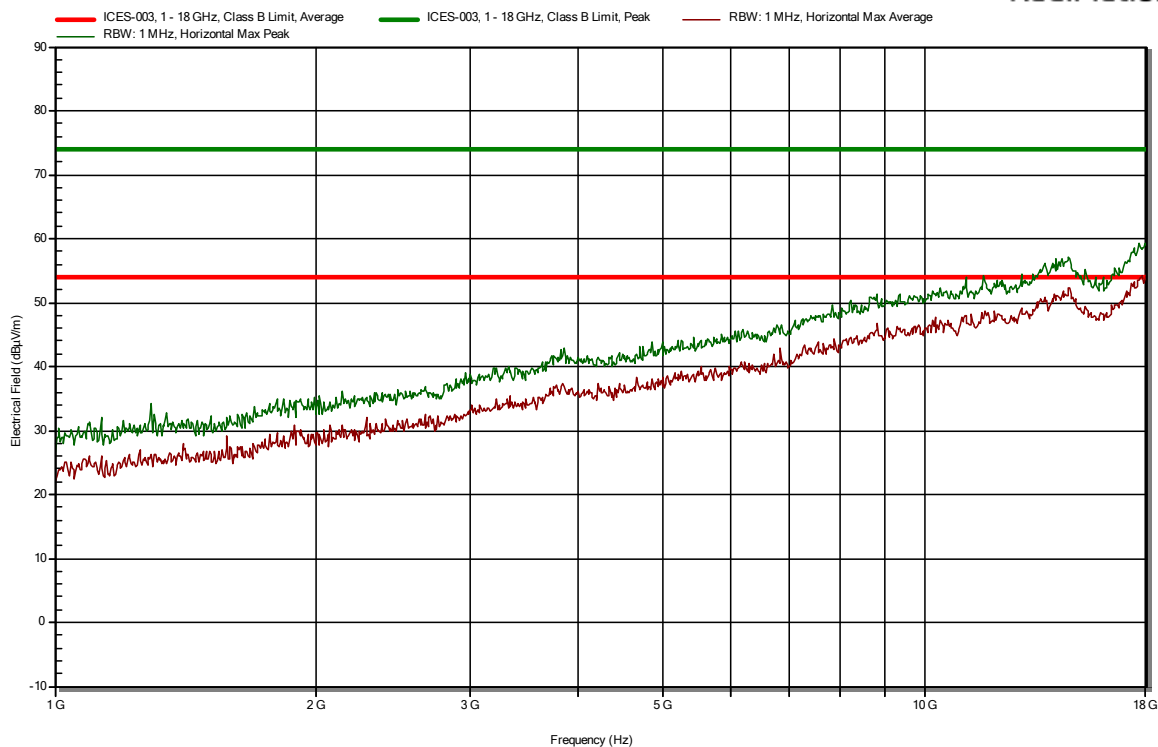
Plot 5a: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz  
(peak and average values shown)  
Low channel IEEE 802.11 n



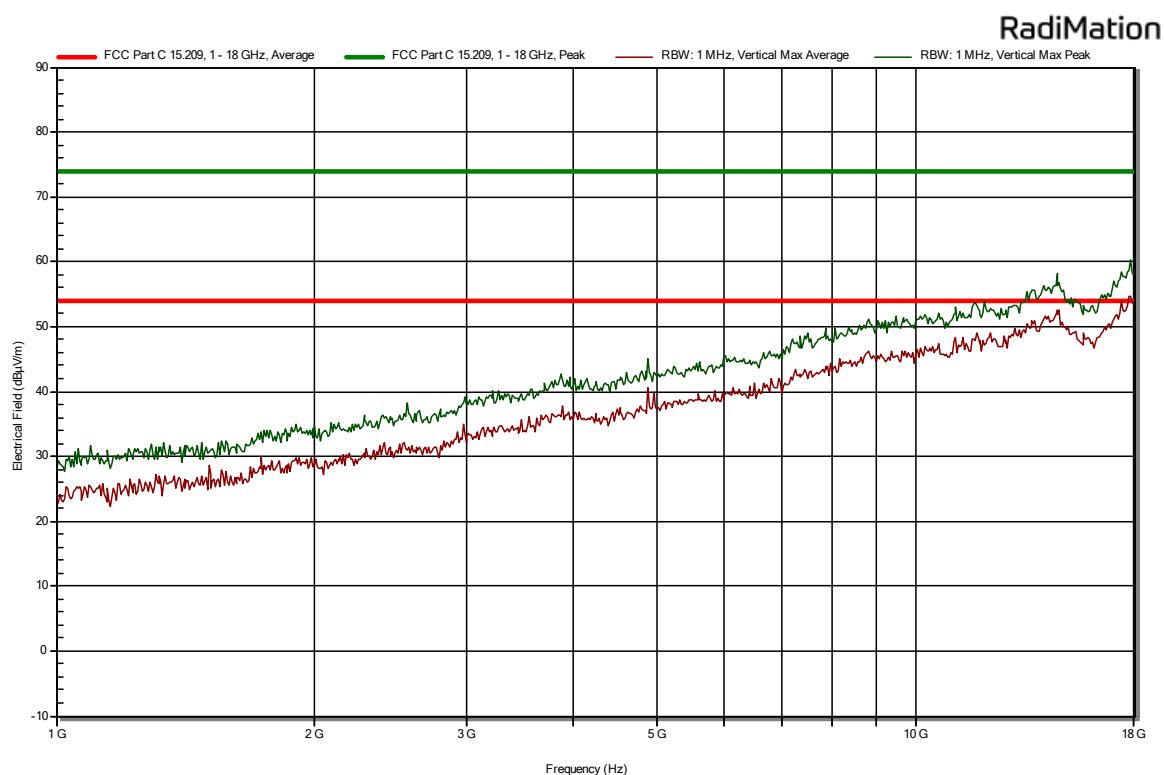
Plot 5b: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz  
(peak and average values shown)  
Low channel 802.11 n



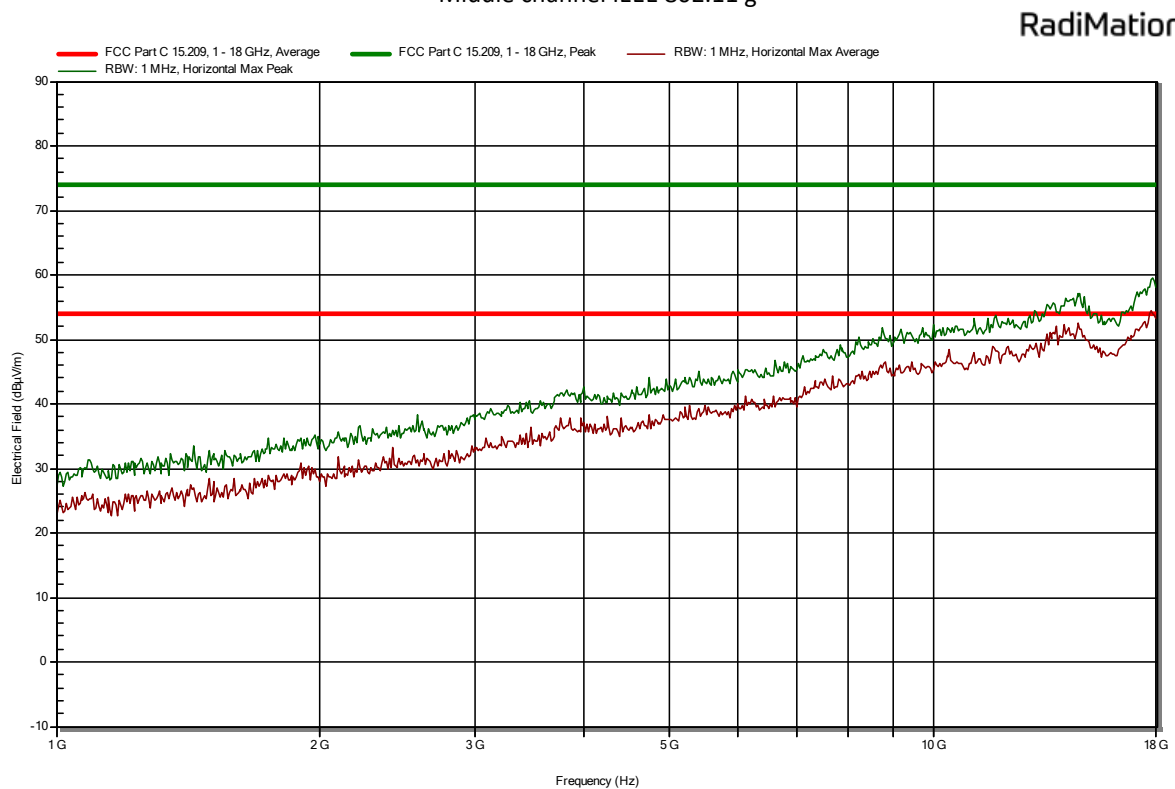
Plot 5c: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz  
(peak and average values shown)  
Low channel IEEE 802.11 n



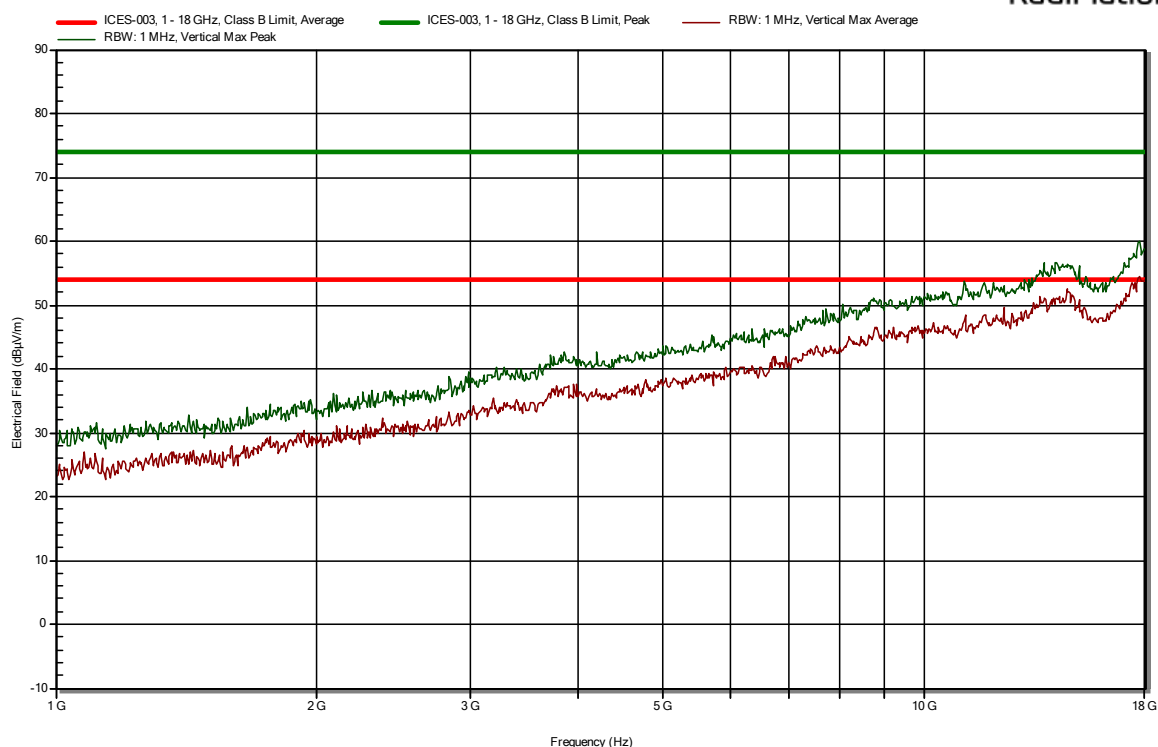
Plot 5d: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz  
(peak and average values shown)  
Low channel IEEE 802.11 n



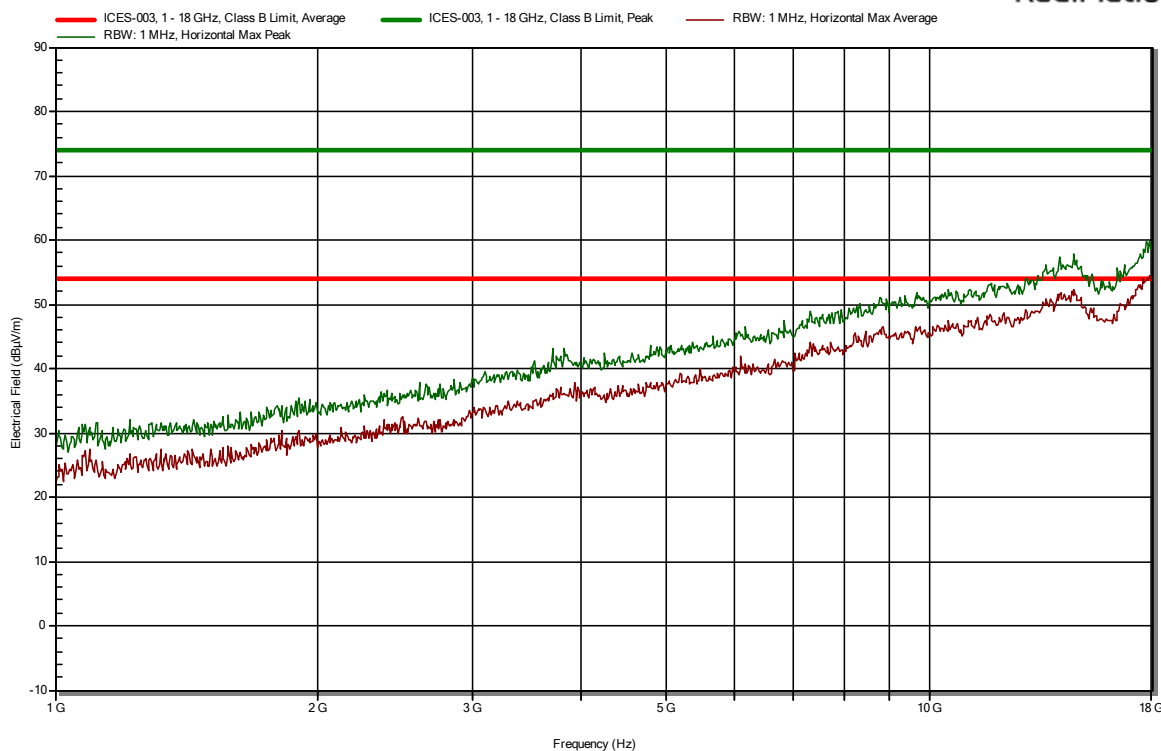
Plot 5e: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz  
(peak and average values shown)  
Middle channel IEEE 802.11 g



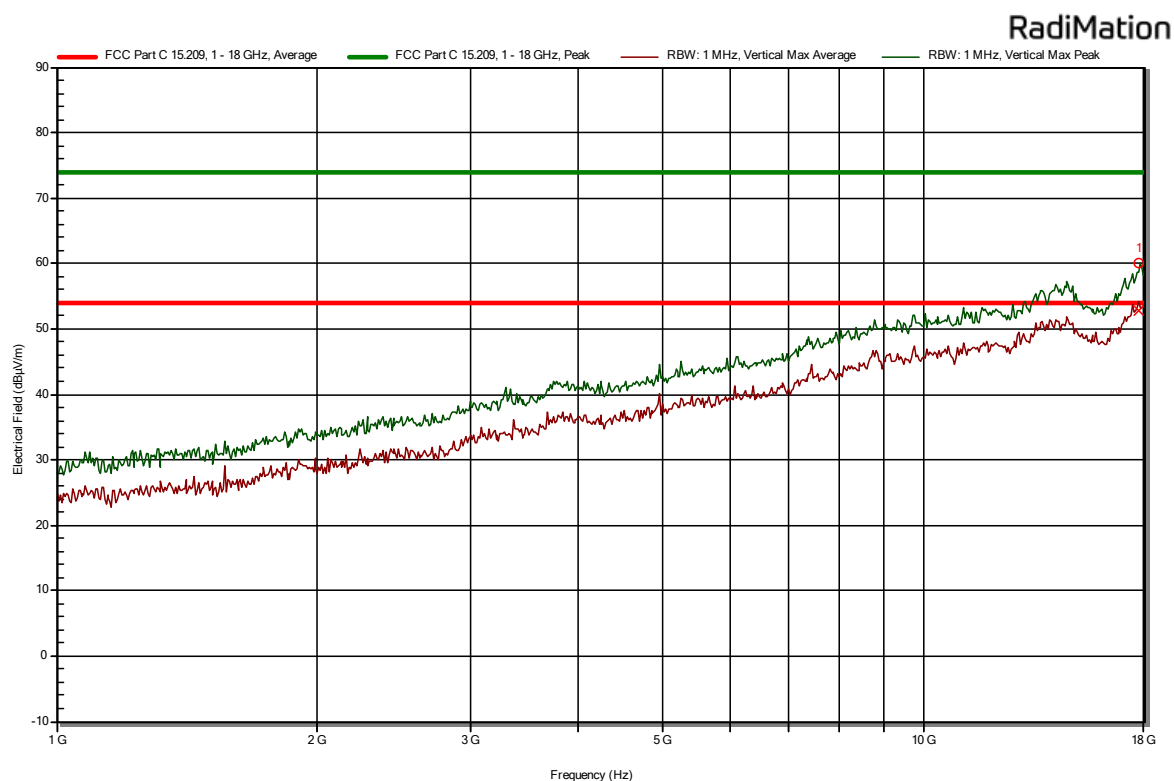
Plot 5f: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz  
(peak and average values shown)  
Middle channel IEEE 802.11 g



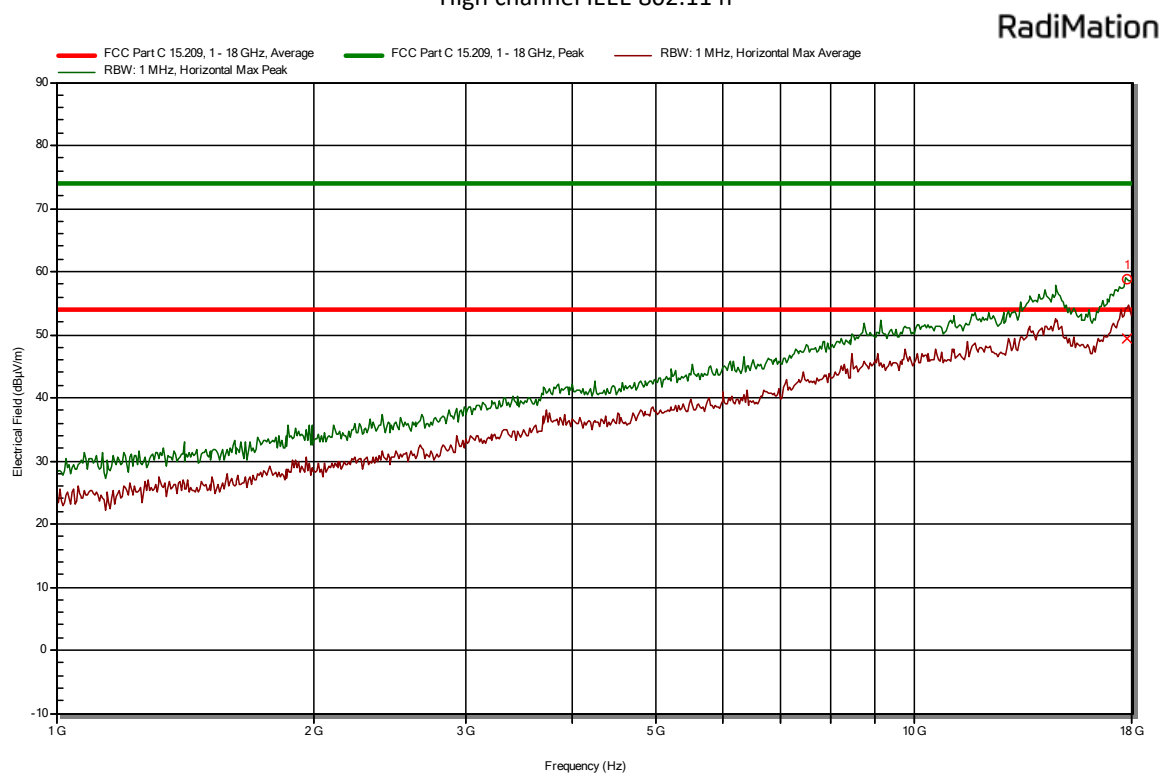
Plot 5g: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz  
(peak and average values shown)  
Middle channel IEEE 802.11 g



Plot 5h: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz  
(peak and average values shown)  
Middle channel IEEE 802.11 g



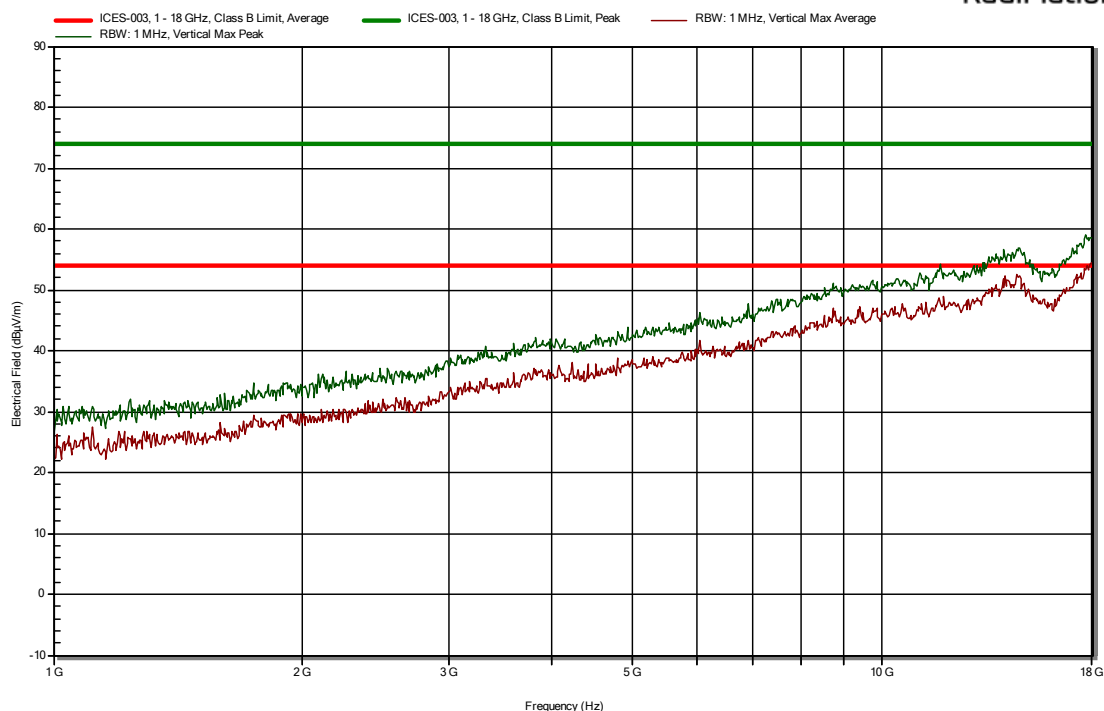
Plot 5i: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz  
(peak and average values shown)  
High channel IEEE 802.11 n



Plot 5j: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz  
(peak and average values shown)  
High channel IEEE 802.11 n

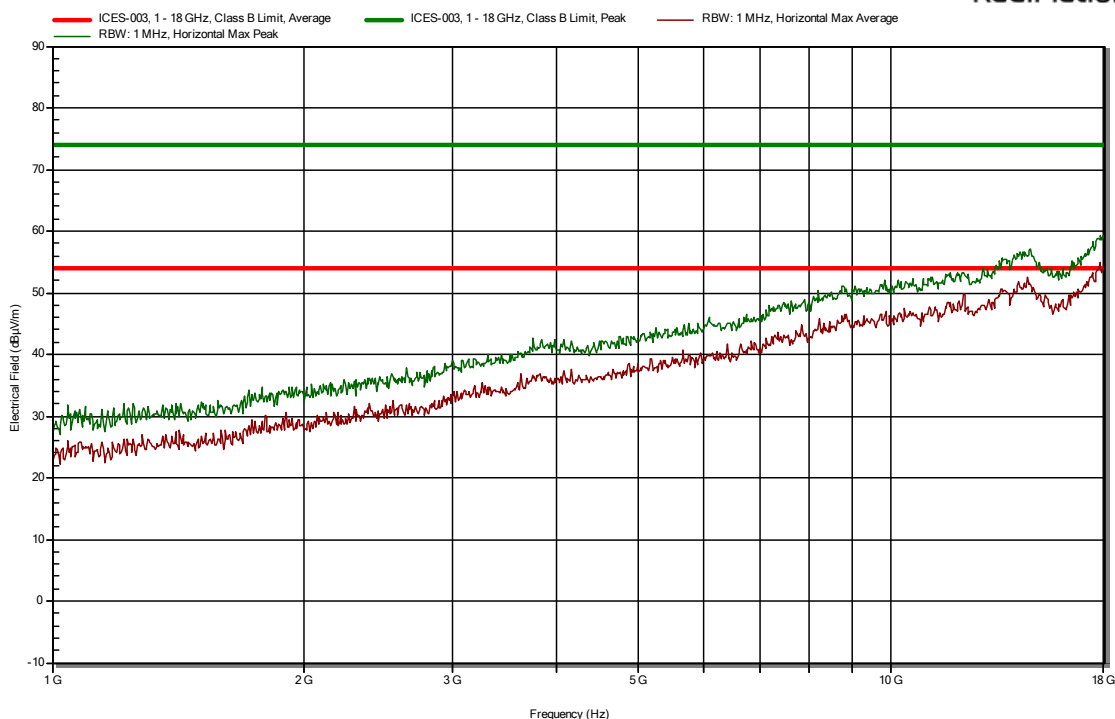


## RadiMation

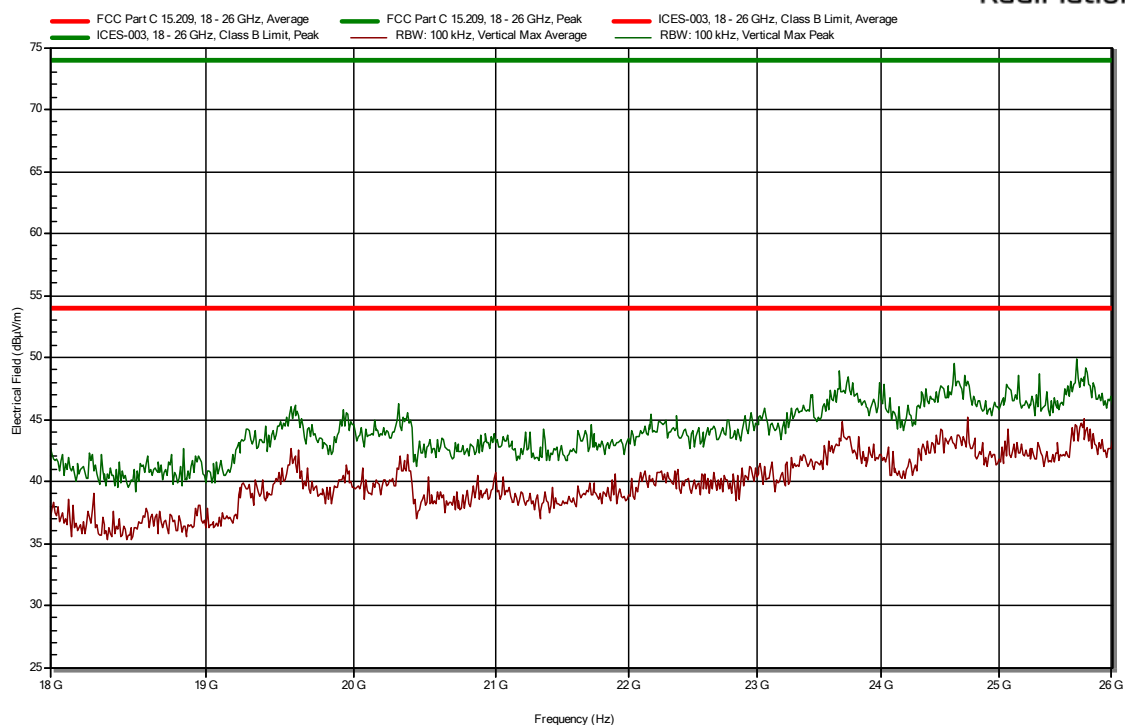


Plot 5k: radiated emissions of the EUT, Antenna vertical, in the range 1 – 18 GHz  
(peak and average values shown)  
High channel IEEE 802.11 n

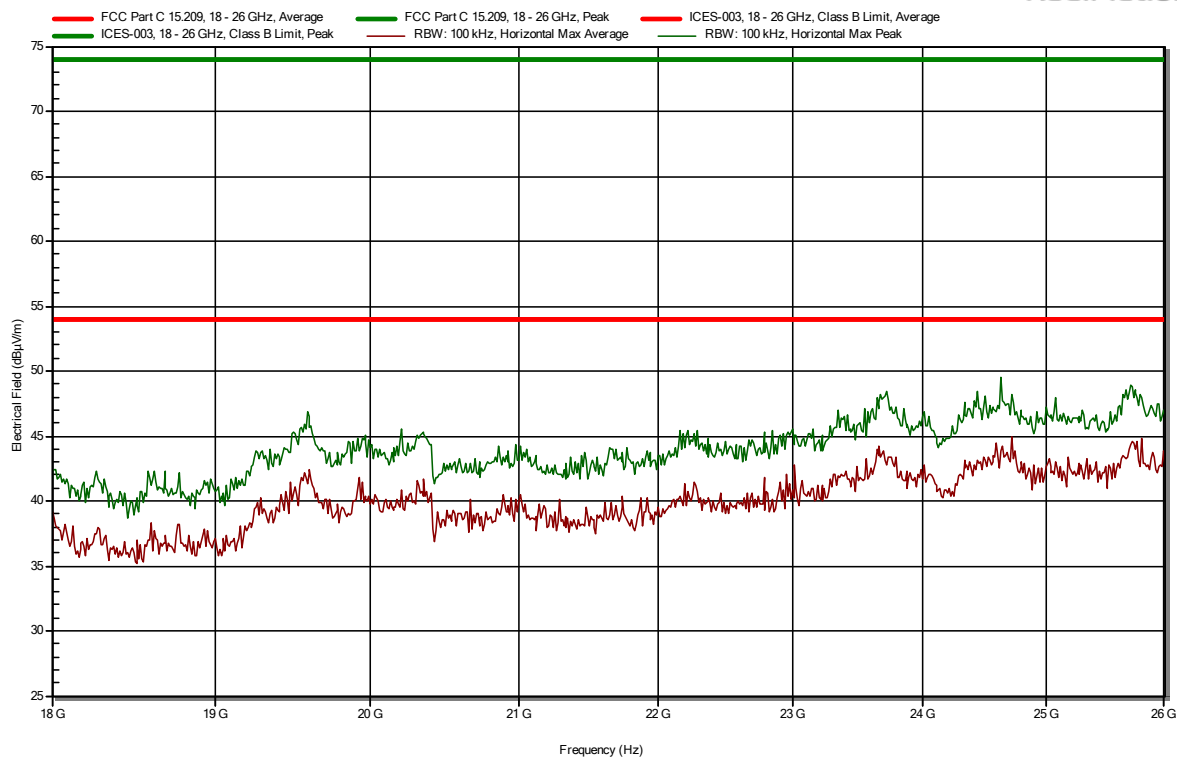
## RadiMation



Plot 5l: radiated emissions of the EUT, Antenna horizontal, in the range 1 – 18 GHz  
(peak and average values shown)  
High channel IEEE 802.11 n

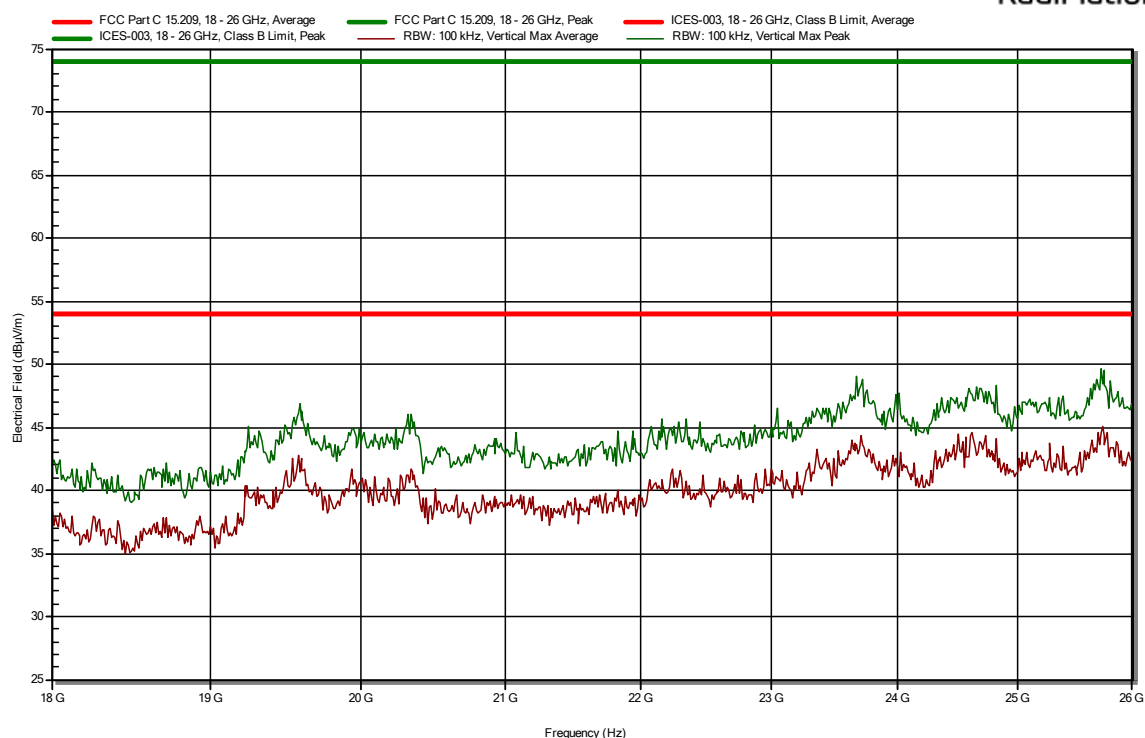


Plot 6a: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26 GHz  
(peak and average values shown)  
Low channel BLE



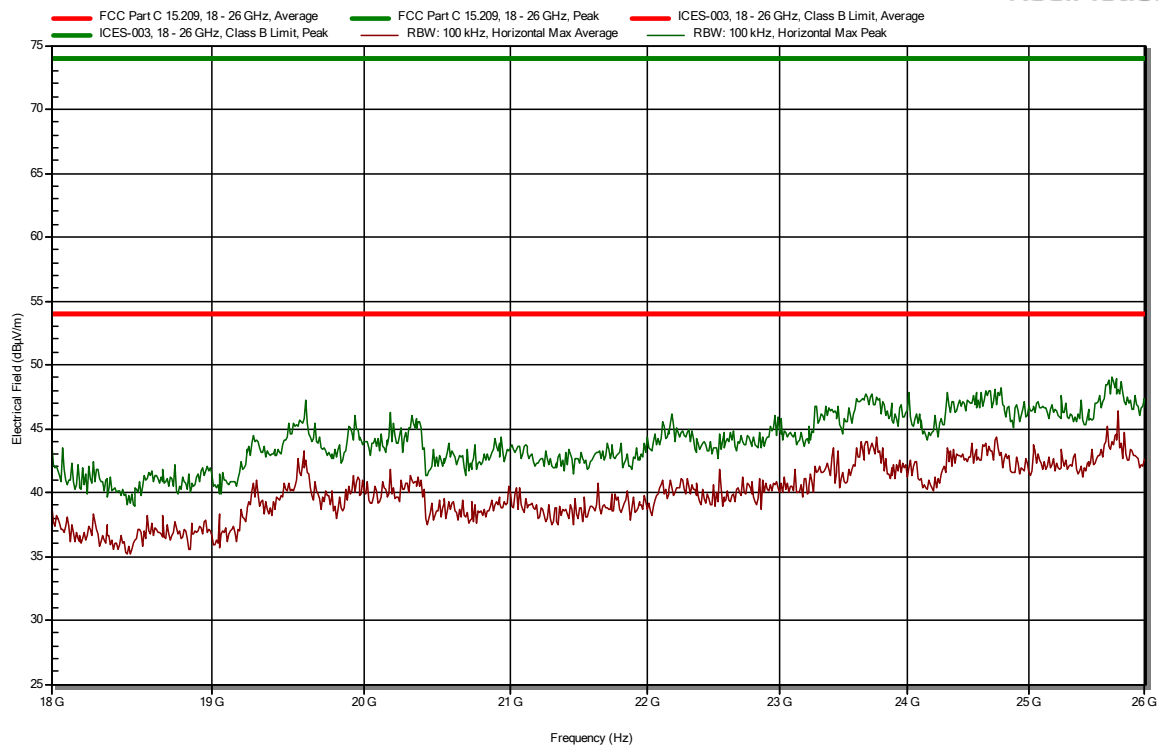
Plot 6b: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26GHz  
(peak and average values shown)  
Low channel BLE

## RadiMation

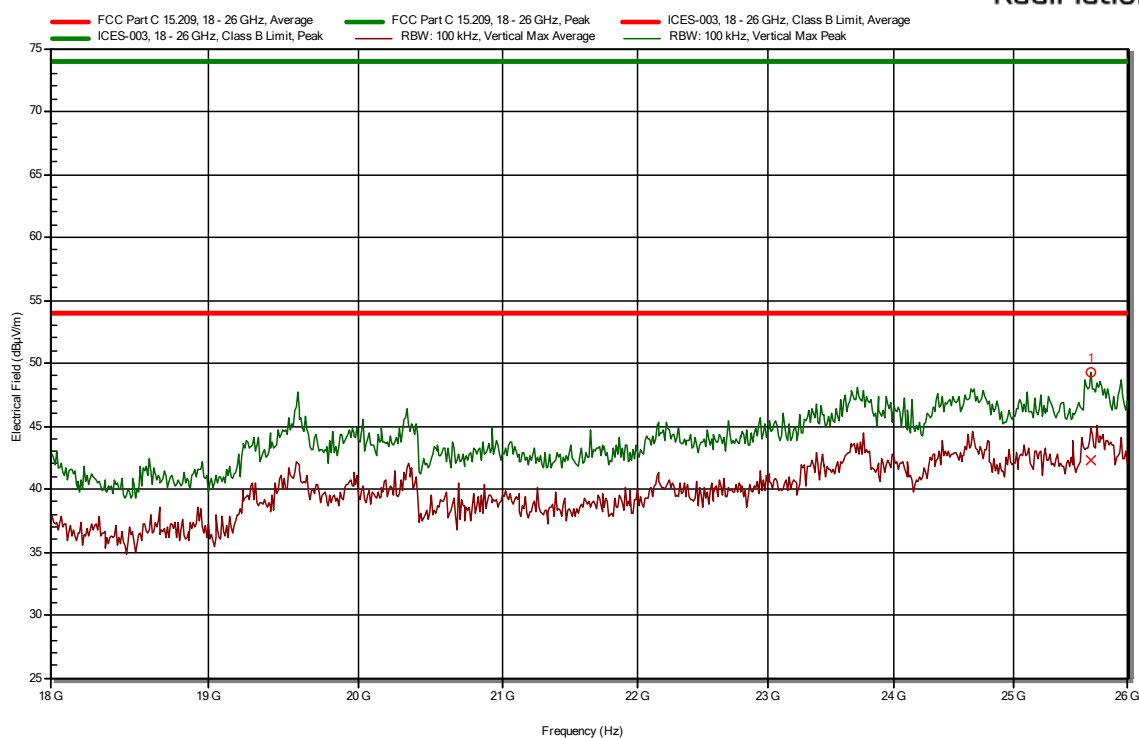


Plot 6c: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26GHz  
(peak and average values shown)  
Middle channel IEEE 802.11 g

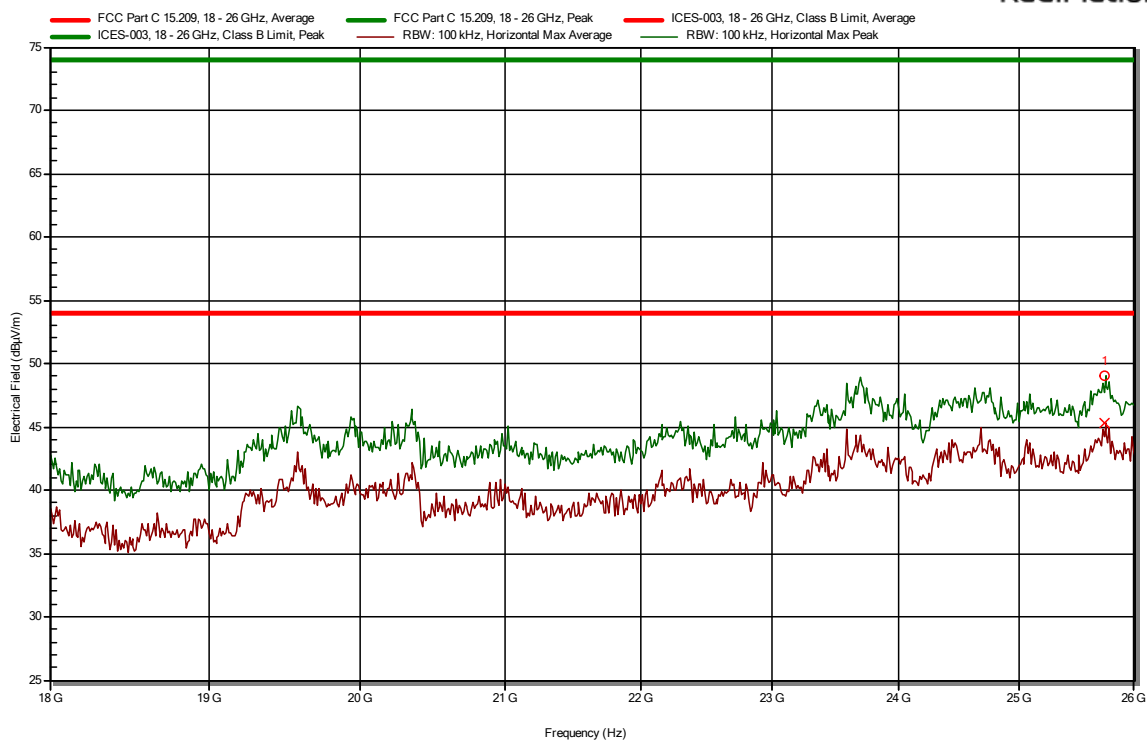
## RadiMation



Plot 6d: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26GHz  
(peak and average values shown)  
Middle channel IEEE 802.11 g



Plot 6e: radiated emissions of the EUT, Antenna vertical, in the range 18 – 26GHz  
(peak and average values shown)  
High channel IEEE 802.11 n



Plot 6f: radiated emissions of the EUT, Antenna horizontal, in the range 18 – 26 GHz  
(peak and average values shown)  
High channel IEEE 802.11 n

## 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 of this report.

### 3.2.4 Test procedure

According to ANSI C63.10, section 6.9

IRN 404 - 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 (MHz) |
|-----------------|----------------|-----------------|-----------|---------------------|
| IEEE 802.11b    | 1              | 2412            | 11 Mbps   | 6.350               |
|                 | 6              | 2437            | 11 Mbps   | 6.350               |
|                 | 11             | 2462            | 11 Mbps   | 6.300               |
| Uncertainty     | $\pm 0.50$ MHz |                 |           |                     |

| Technology Std. | Channel        | Frequency (MHz) | Data rate | 6dB bandwidth (MHz) |
|-----------------|----------------|-----------------|-----------|---------------------|
| IEEE 802.11g    | 1              | 2412            | 54 Mbps   | 16.10               |
|                 | 6              | 2437            | 54 Mbps   | 16.15               |
|                 | 11             | 2462            | 54 Mbps   | 16.15               |
| Uncertainty     | $\pm 0.50$ MHz |                 |           |                     |

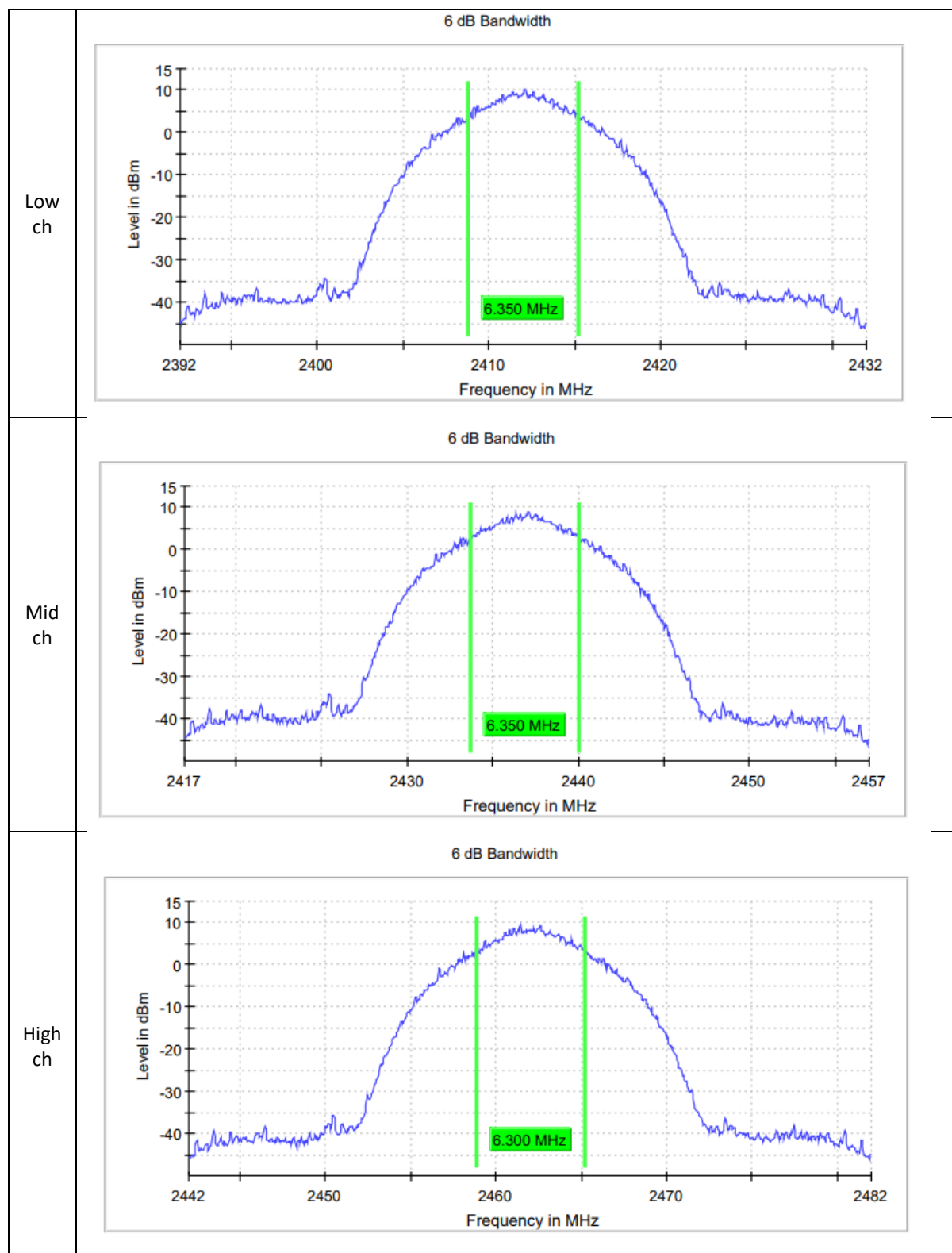
| Technology Std. | Channel        | Frequency (MHz) | Data rate | 6dB bandwidth (MHz) |
|-----------------|----------------|-----------------|-----------|---------------------|
| IEEE 802.11n    | 1              | 2412            | 54 Mbps   | 16.40               |
|                 | 6              | 2437            | 54 Mbps   | 16.45               |
|                 | 11             | 2462            | 54 Mbps   | 16.30               |
| Uncertainty     | $\pm 0.50$ MHz |                 |           |                     |

| Technology Std.      | Channel        | Frequency (MHz) | Data rate | 6dB bandwidth (kHz) |
|----------------------|----------------|-----------------|-----------|---------------------|
| Bluetooth Low energy | 37             | 2402            | 1 Mbps    | 772,3               |
|                      | 18             | 2440            | 1 Mbps    | 752.5               |
|                      | 39             | 2480            | 1 Mbps    | 752.5               |
| Uncertainty          | $\pm 36.2$ kHz |                 |           |                     |

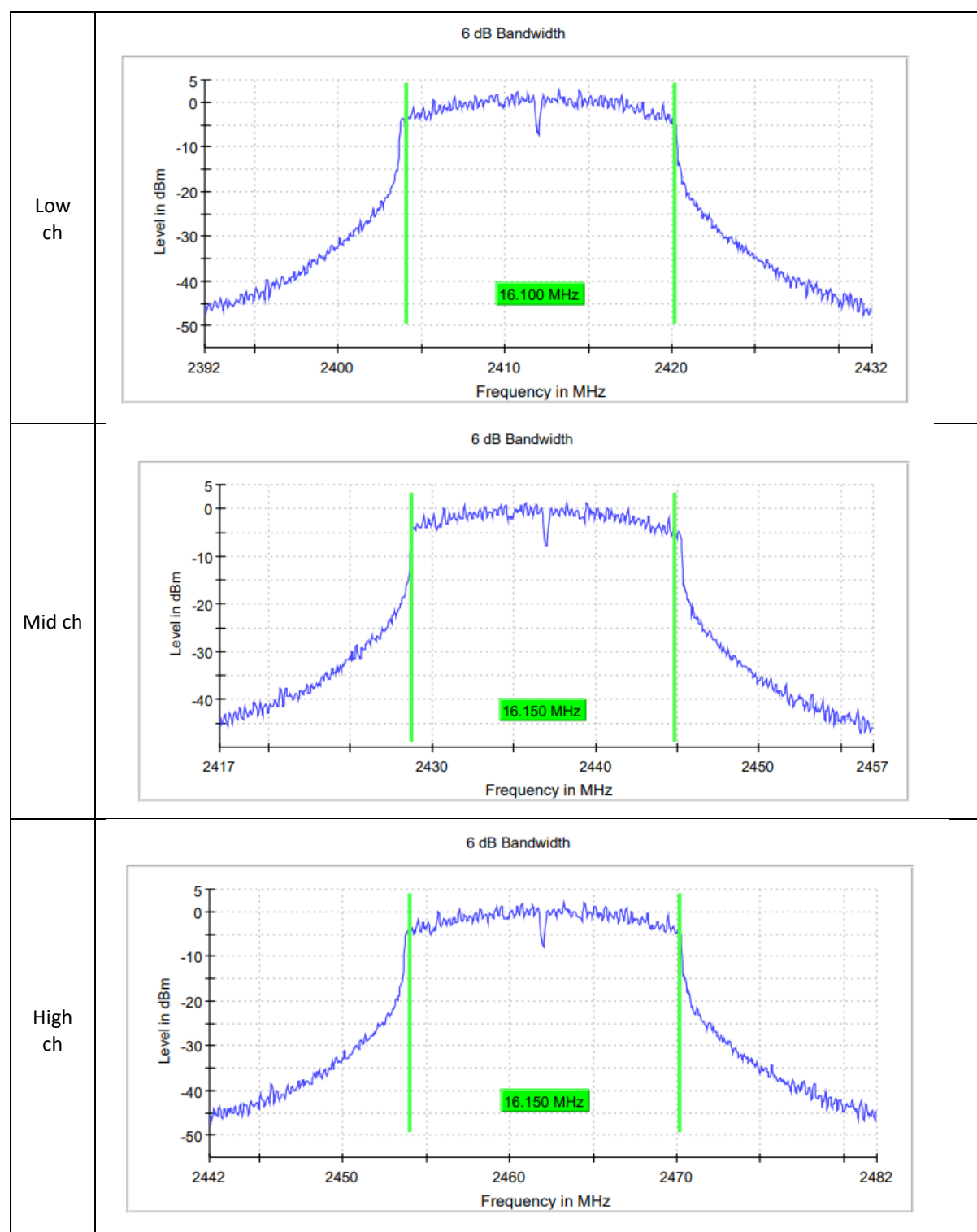
Note: plots are provided on the next page.

### 3.2.6 Plots of the 6 dB bandwidth

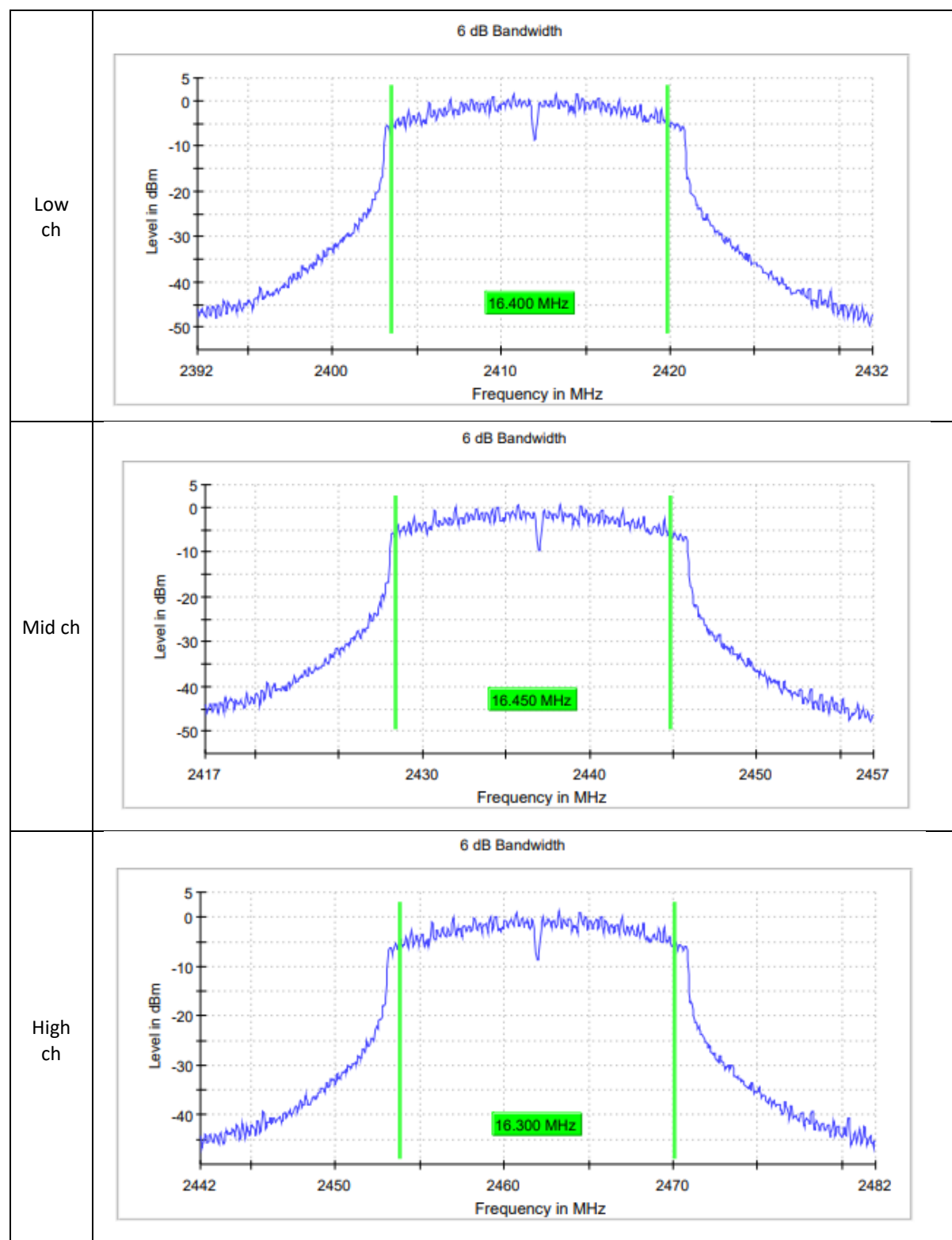
IEEE 802.11b:



IEEE 802.11g:

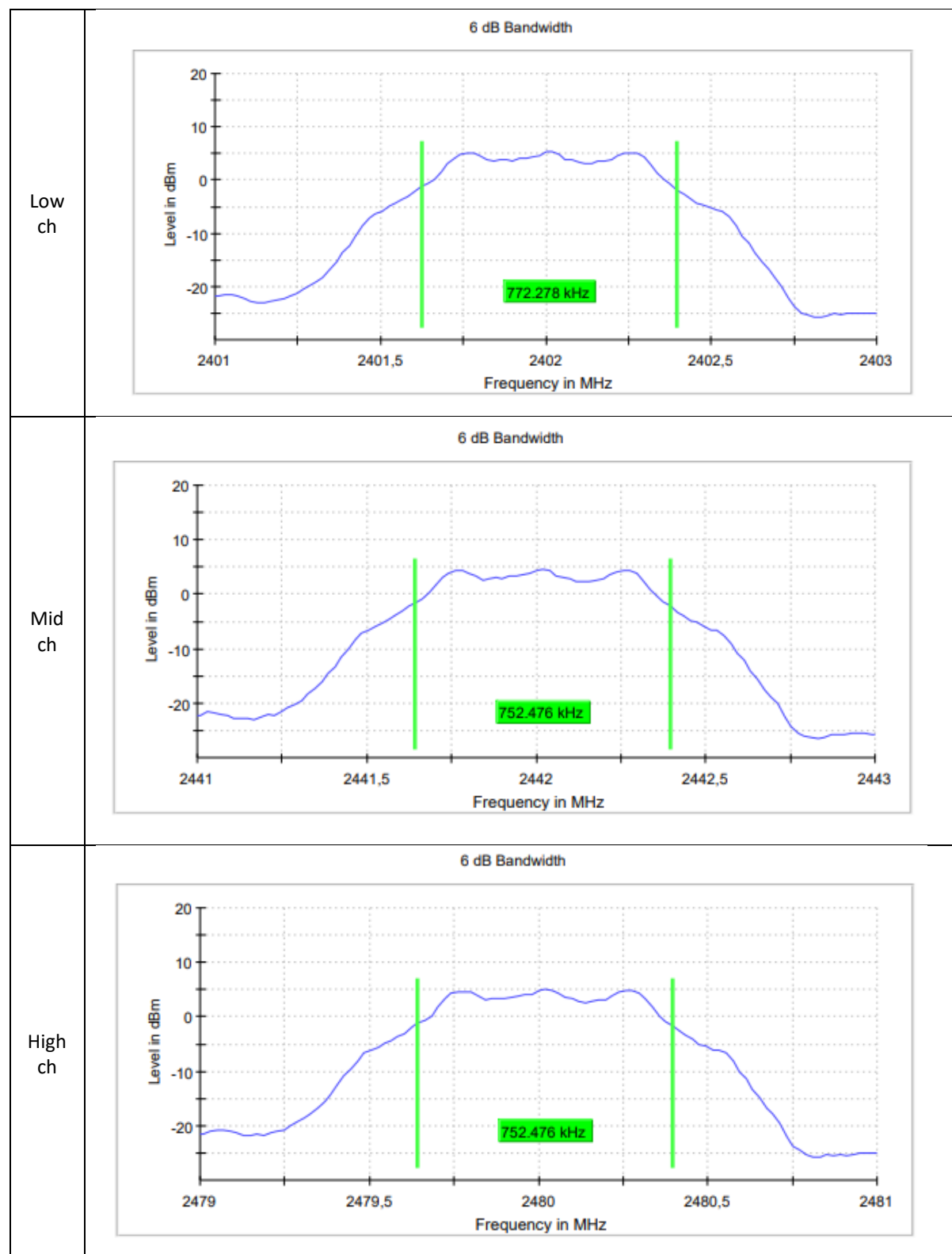


IEEE 802.11n:





BLE:



### 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 of this report.

#### 3.3.4 Test procedure

According to ANSI C63.10, section 6.9

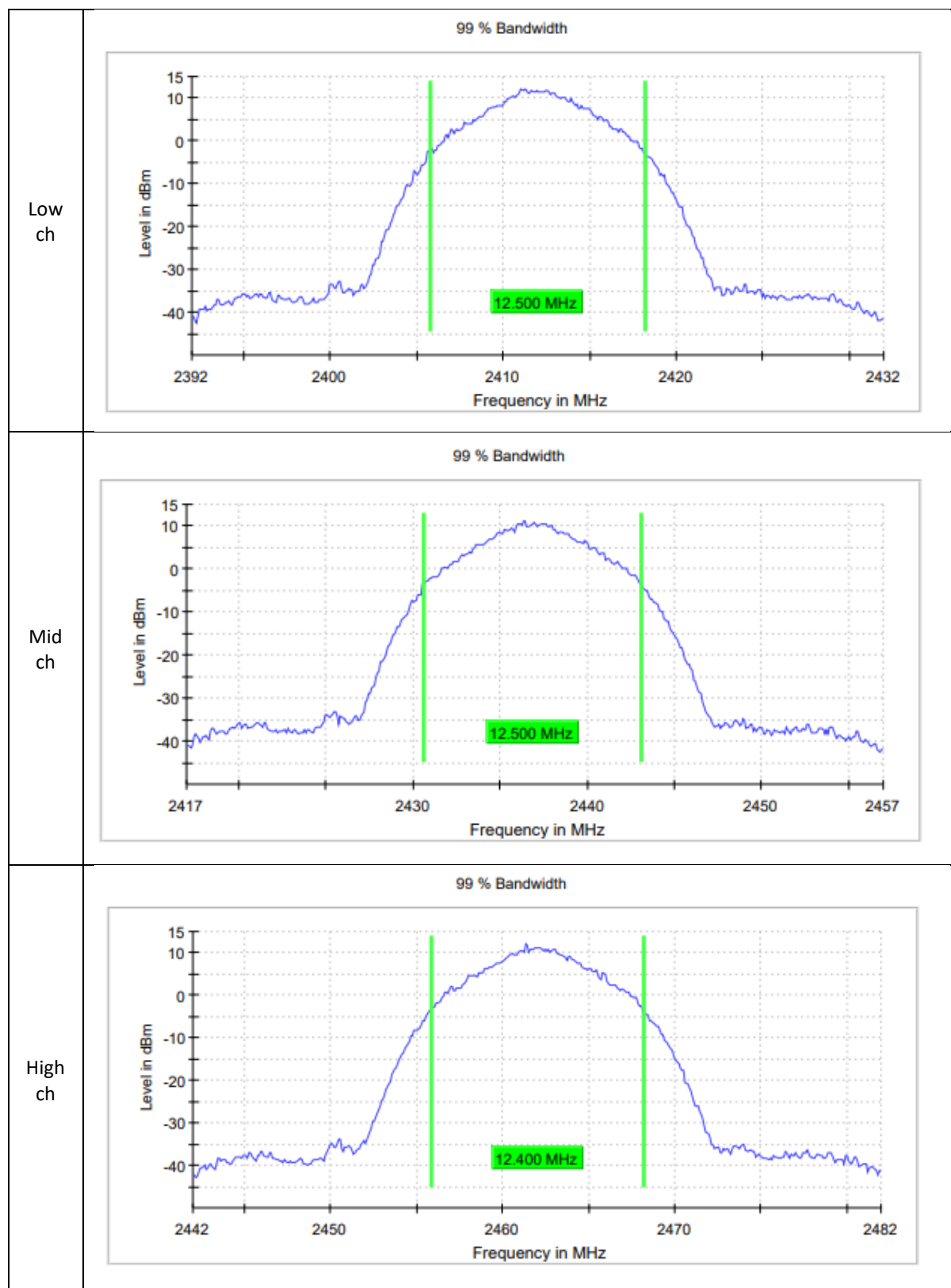
IRN 404 - Occupied bandwidth (Hz) Method 1 – XX % power bandwidth.

#### 3.3.5 Test results of the 99% occupied bandwidth measurement

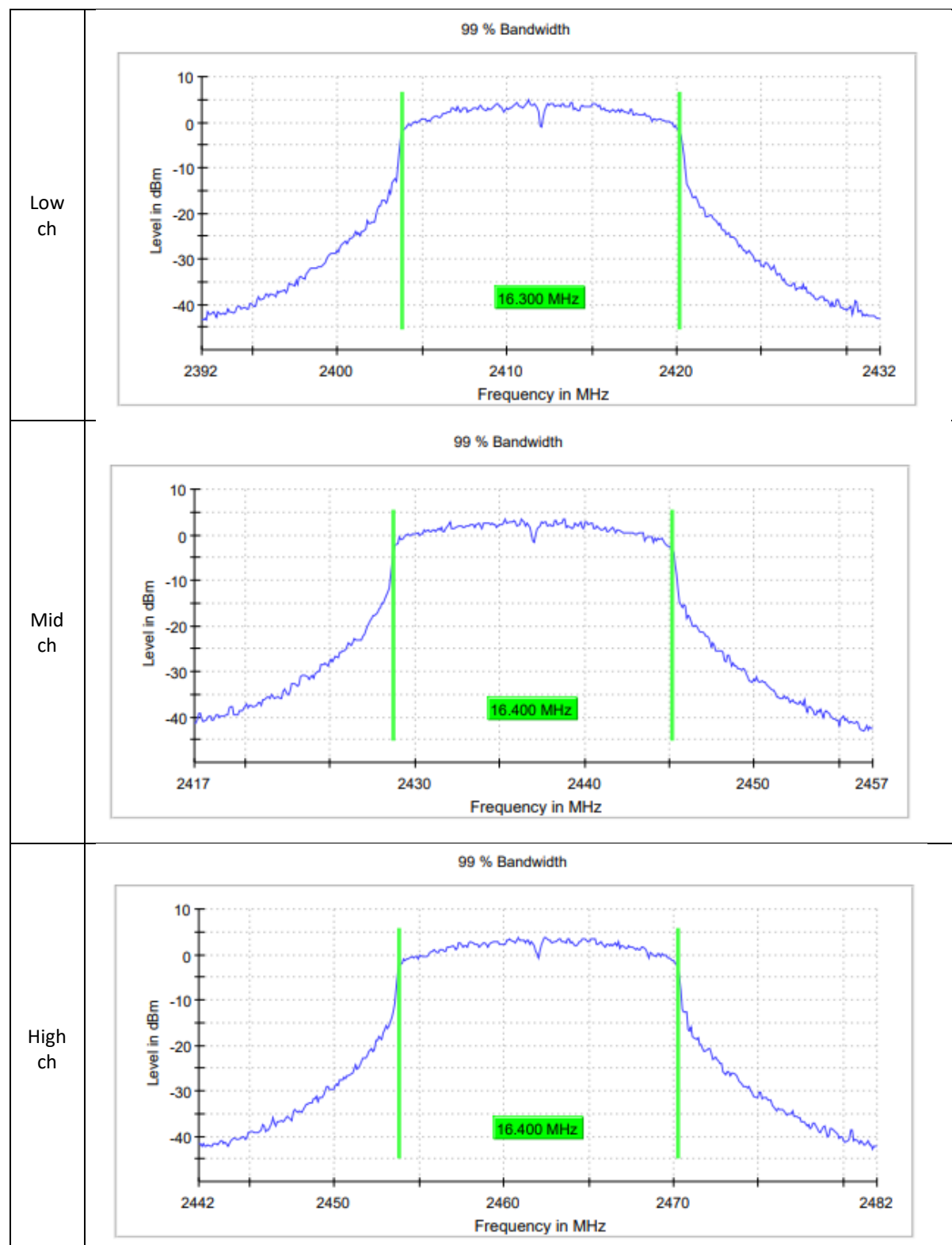
| Technology Std.      | Channel      | Frequency (MHz) | Data rate | 99% bandwidth (MHz) |
|----------------------|--------------|-----------------|-----------|---------------------|
| IEEE 802.11b         | 1            | 2412            | 11 Mbps   | 12.50               |
|                      | 6            | 2437            | 11 Mbps   | 12.50               |
|                      | 11           | 2462            | 11 Mbps   | 12.40               |
| IEEE 802.11g         | 1            | 2412            | 54 Mbps   | 16.30               |
|                      | 6            | 2437            | 54 Mbps   | 16.40               |
|                      | 11           | 2462            | 54 Mbps   | 16.40               |
| IEEE 802.11n         | 1            | 2412            | 54 Mbps   | 17.50               |
|                      | 6            | 2437            | 54 Mbps   | 17.50               |
|                      | 11           | 2462            | 54 Mbps   | 17.50               |
| Bluetooth Low energy | 1            | 2402            | 1 Mbps    | 1.060               |
|                      | 18           | 2440            | 1 Mbps    | 1.060               |
|                      | 39           | 2480            | 1 Mbps    | 1.060               |
| Uncertainty          | $\pm 12$ kHz |                 |           |                     |

### 3.3.6 Plots of the 99% occupied bandwidth measurement

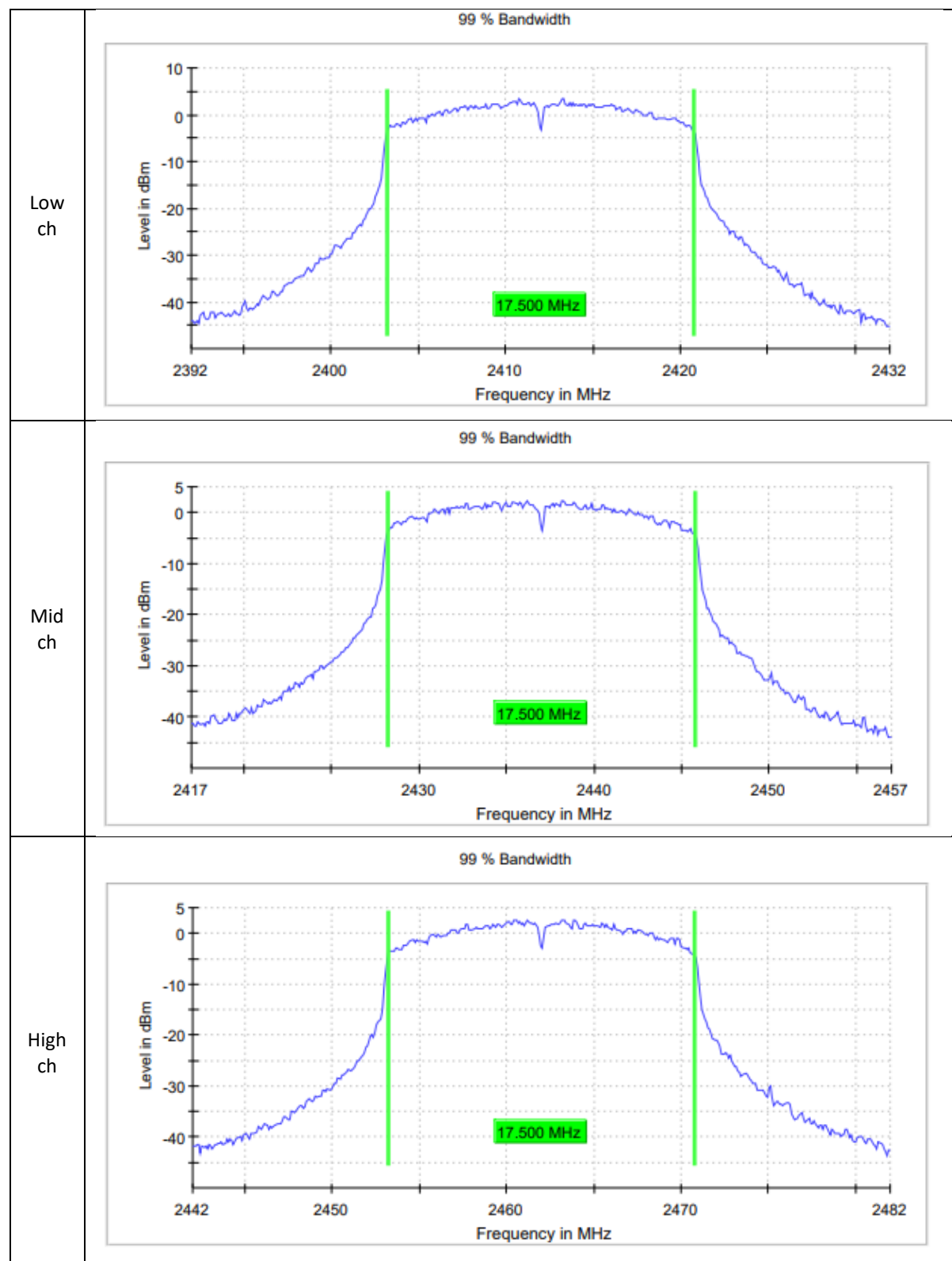
IEEE 802.11b:



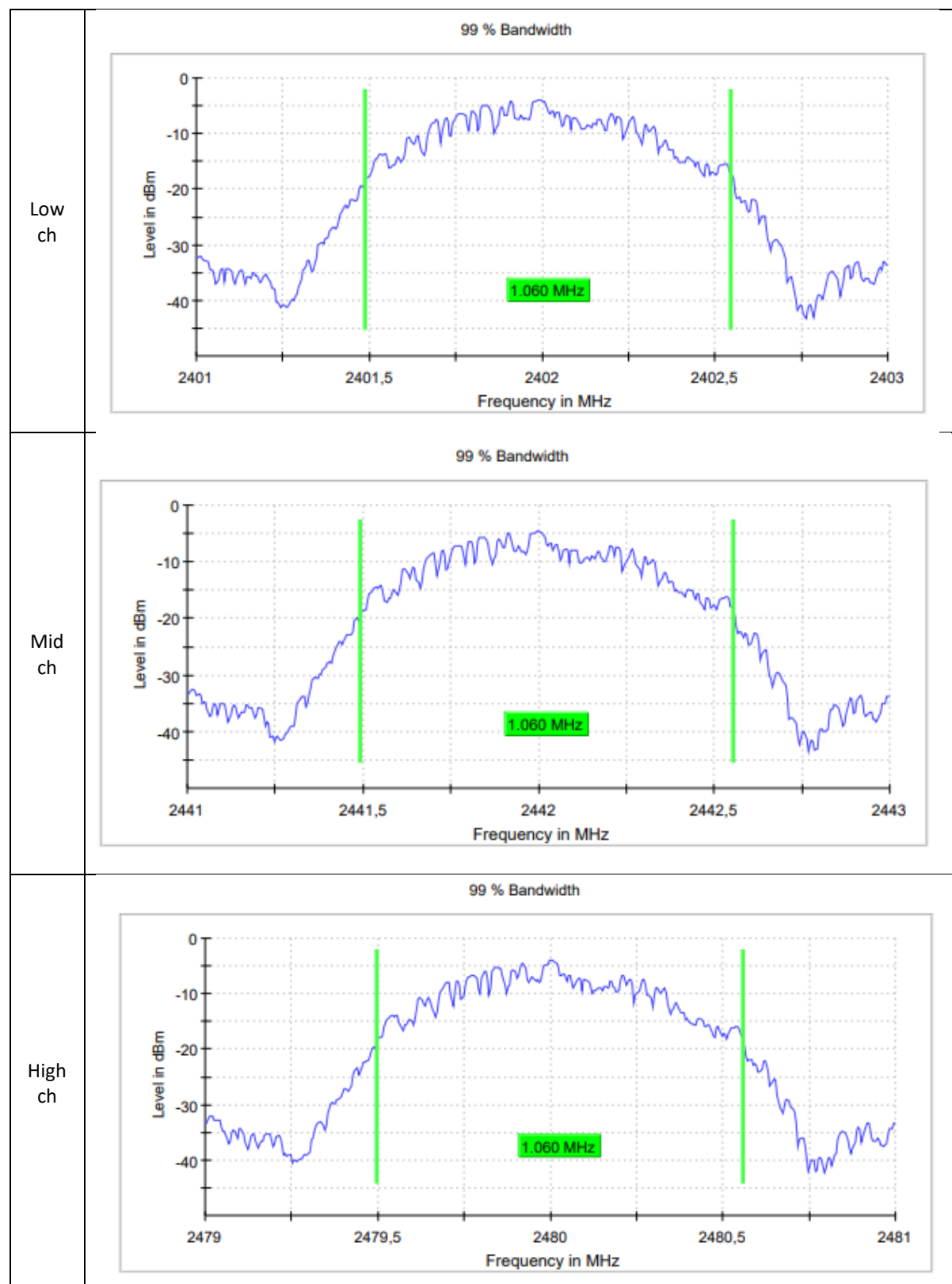
IEEE 802.11g:



IEEE 802.11n:



BLE:



### 3.4 Output Power Measurement

#### 3.4.1 Limit

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

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

#### 3.4.2 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 v05r02.

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

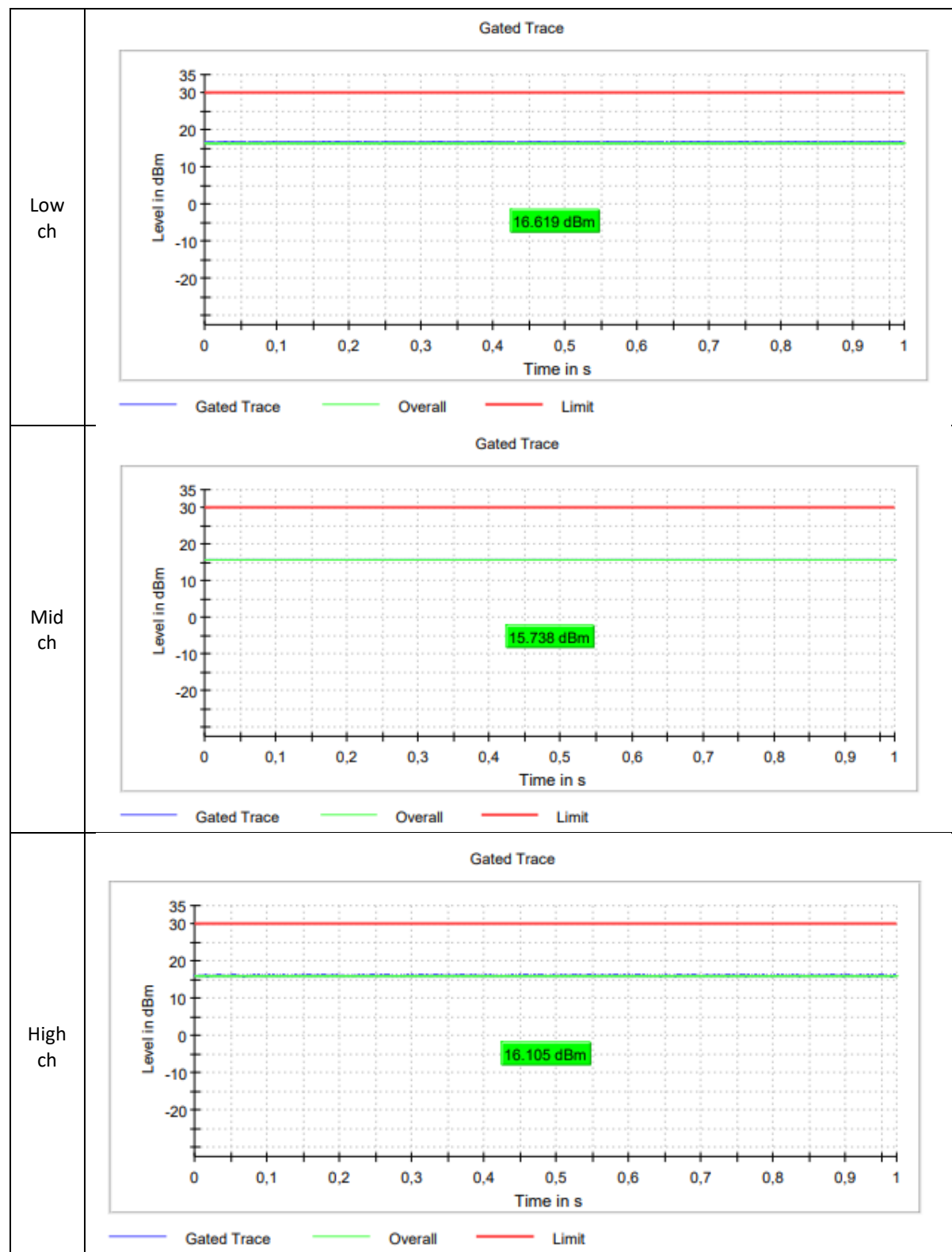
#### 3.4.5 Test results of Output Power Measurement

| Peak method          |         |                 |           |                                   |                                  |                             |
|----------------------|---------|-----------------|-----------|-----------------------------------|----------------------------------|-----------------------------|
| Technology Std.      | Channel | Frequency (MHz) | Data rate | Peak output power conducted (dBm) | Peak output power conducted (W)  | Peak output power EIRP (W)  |
| IEEE 802.11b         | 1       | 2412            | 11 Mbps   | 16.62                             | 0.04592                          | 0,07278                     |
|                      | 6       | 2437            | 11 Mbps   | 15.74                             | 0.03750                          | 0.05943                     |
|                      | 11      | 2462            | 11 Mbps   | 16.11                             | 0,04083                          | 0.06471                     |
| IEEE 802.11g         | 1       | 2412            | 54 Mbps   | 13.24                             | 0.02109                          | 0,03342                     |
|                      | 6       | 2437            | 54 Mbps   | 12.37                             | 0,01726                          | 0,02735                     |
|                      | 11      | 2462            | 54 Mbps   | 12.60                             | 0.01820                          | 0.02884                     |
| IEEE 802.11n         | 1       | 2412            | 54 Mbps   | 12.22                             | 0.01667                          | 0.02642                     |
|                      | 6       | 2437            | 54 Mbps   | 11.40                             | 0.01380                          | 0.02188                     |
|                      | 11      | 2462            | 54 Mbps   | 11.67                             | 0.01469                          | 0.02328                     |
| Technology Std.      | Channel | Frequency (MHz) | Data rate | Peak output power conducted (dBm) | Peak output power conducted (mW) | Peak output power EIRP (mW) |
| Bluetooth Low Energy | 1       | 2402            | 1 Mbps    | 4.850                             | 3.055                            | 4.842                       |
|                      | 18      | 2440            | 1 Mbps    | 5.137                             | 3.264                            | 5.172                       |
|                      | 39      | 2480            | 1 Mbps    | 5.564                             | 3.601                            | 5.707                       |
| Uncertainty          |         |                 |           | ±0.71 dB                          |                                  |                             |

Note: plots are provided on the next page

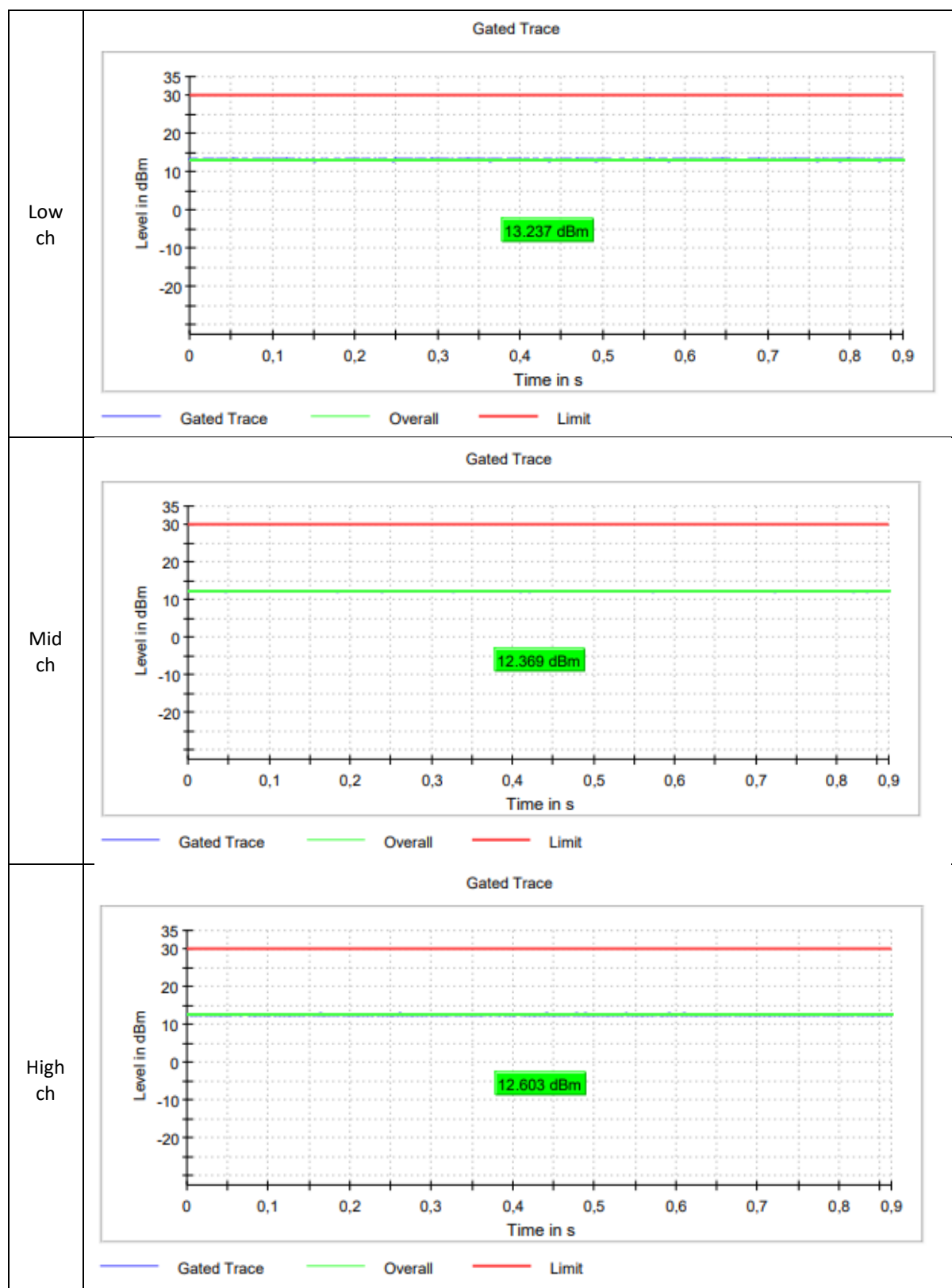
### 3.4.6 Plots of the Output power

IEEE 802.11b:

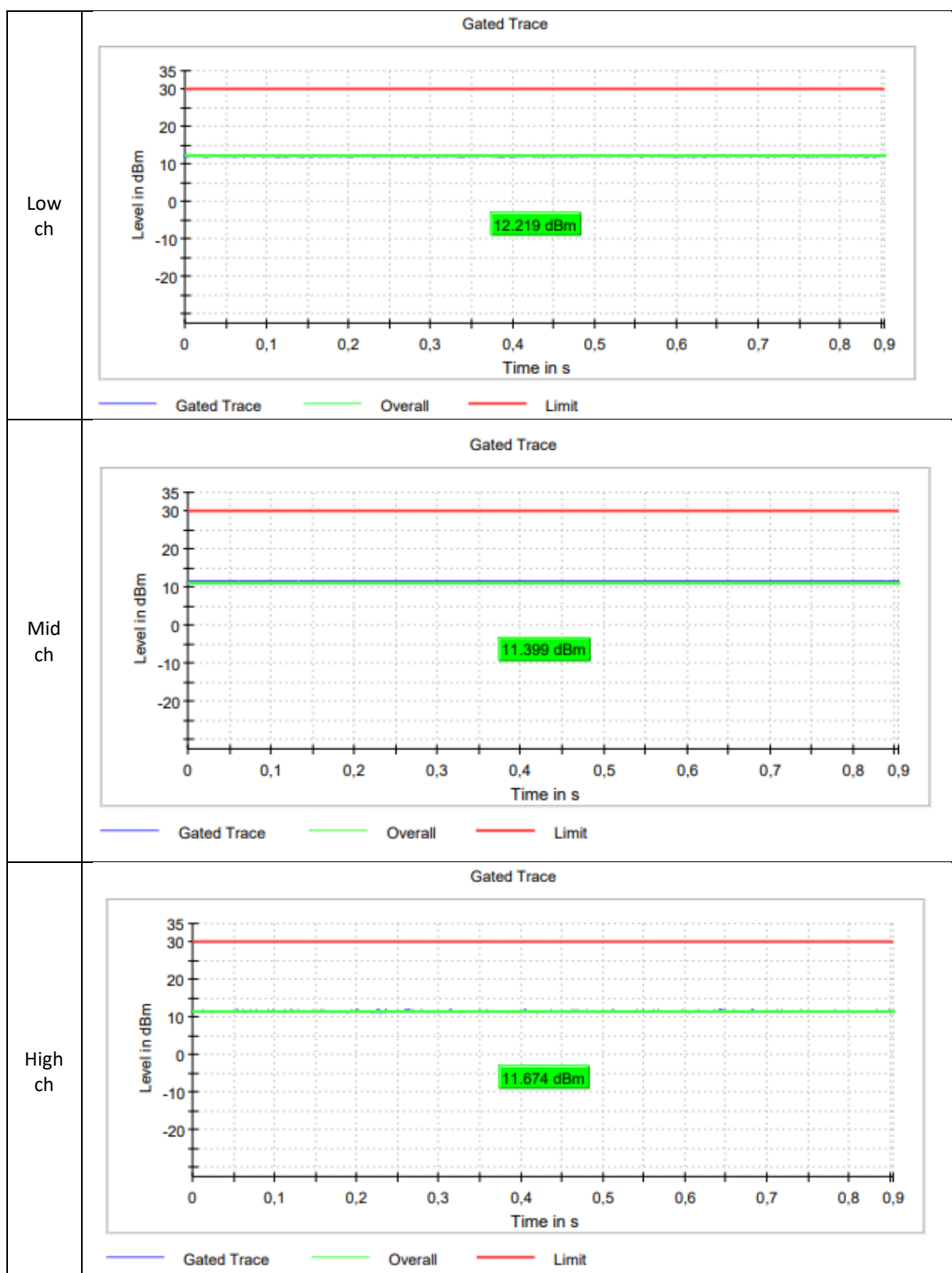




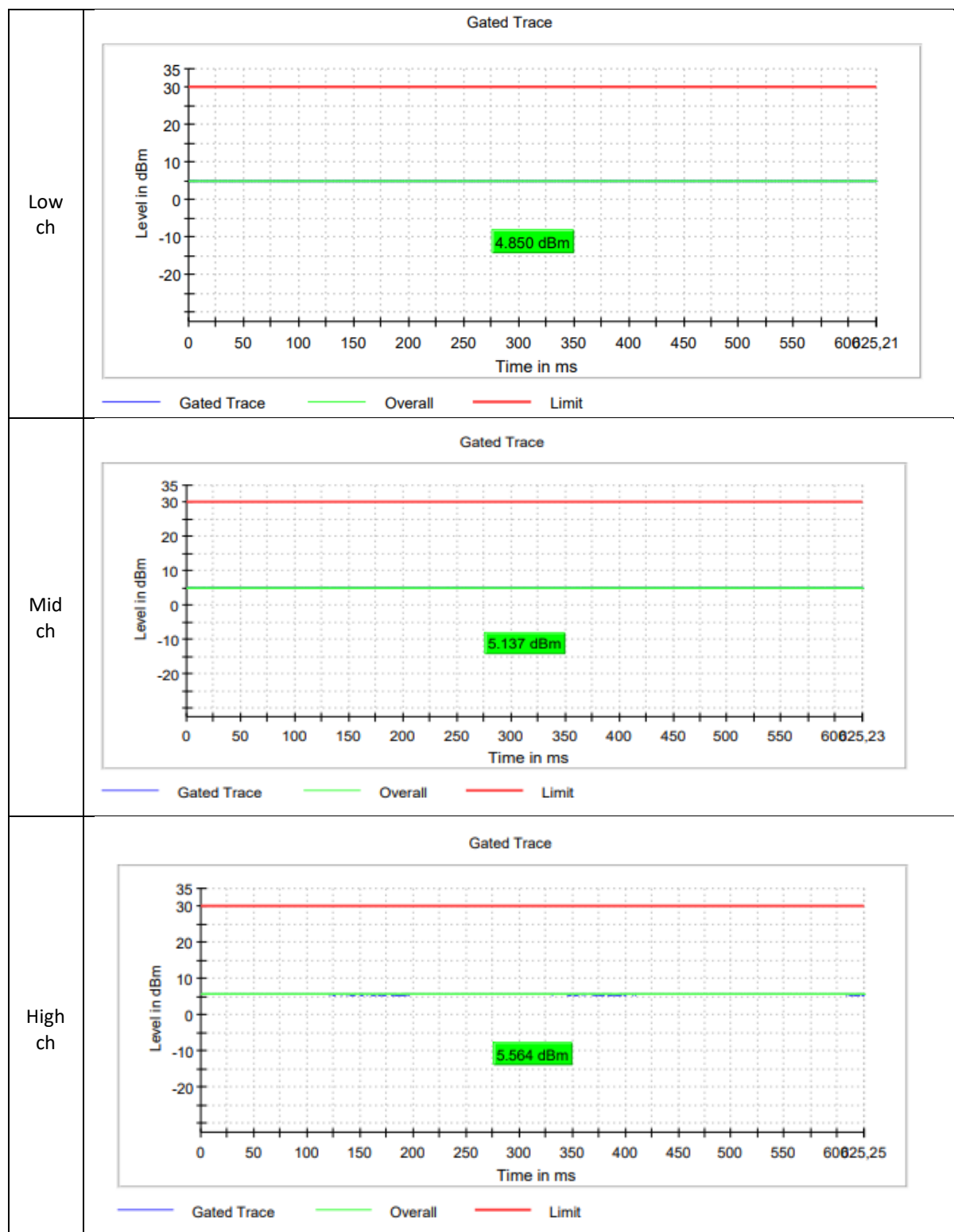
IEEE 802.11g:



IEEE 802.11n:



BLE:



### 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 v05r02.

IRN 412 - 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

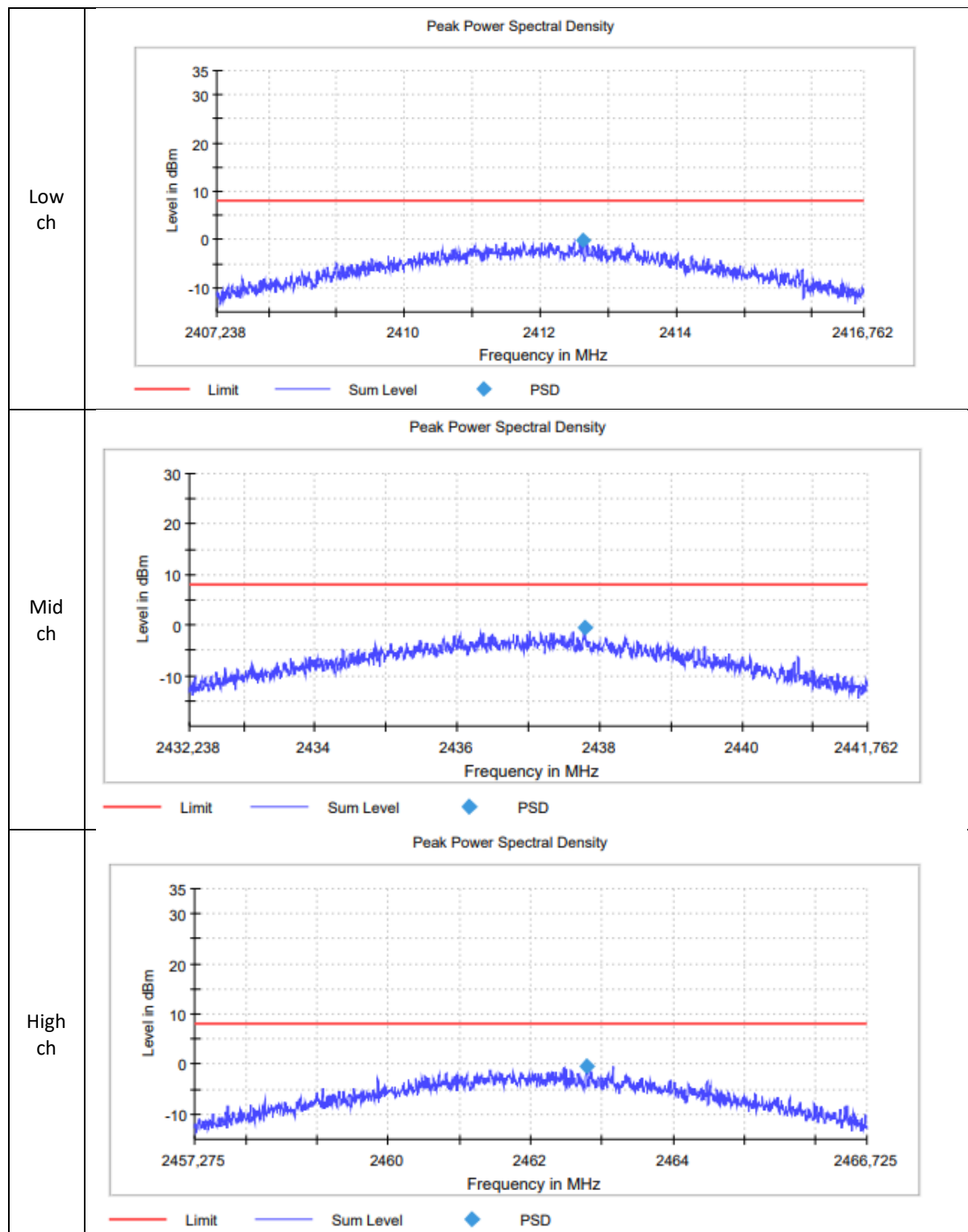
| Technology Std.      | Channel | Frequency (MHz) | Data rate | PSD conducted* (dBm/3 kHz) | Limit (conducted) (dBm/3kHz) |
|----------------------|---------|-----------------|-----------|----------------------------|------------------------------|
| IEEE 802.11b         | 1       | 2412            | 11 Mbps   | -0.229                     | 8                            |
|                      | 6       | 2437            | 11 Mbps   | -0.596                     | 8                            |
|                      | 11      | 2462            | 11 Mbps   | -0.328                     | 8                            |
| IEEE 802.11g         | 1       | 2412            | 54 Mbps   | 2.527                      | 8                            |
|                      | 6       | 2437            | 54 Mbps   | 1.486                      | 8                            |
|                      | 11      | 2462            | 54 Mbps   | 1.986                      | 8                            |
| IEEE 802.11n         | 1       | 2412            | 54 Mbps   | 1.532                      | 8                            |
|                      | 6       | 2437            | 54 Mbps   | 0.550                      | 8                            |
|                      | 11      | 2462            | 54 Mbps   | 1.033                      | 8                            |
| Bluetooth Low Energy | 1       | 2402            | 1 Mbps    | -3.802                     | 8                            |
|                      | 18      | 2440            | 1 Mbps    | -4.582                     | 8                            |
|                      | 39      | 2480            | 1 Mbps    | -4.086                     | 8                            |
| Uncertainty          | ±2 dB   |                 |           |                            |                              |

\* strikethrough which one is not applicable

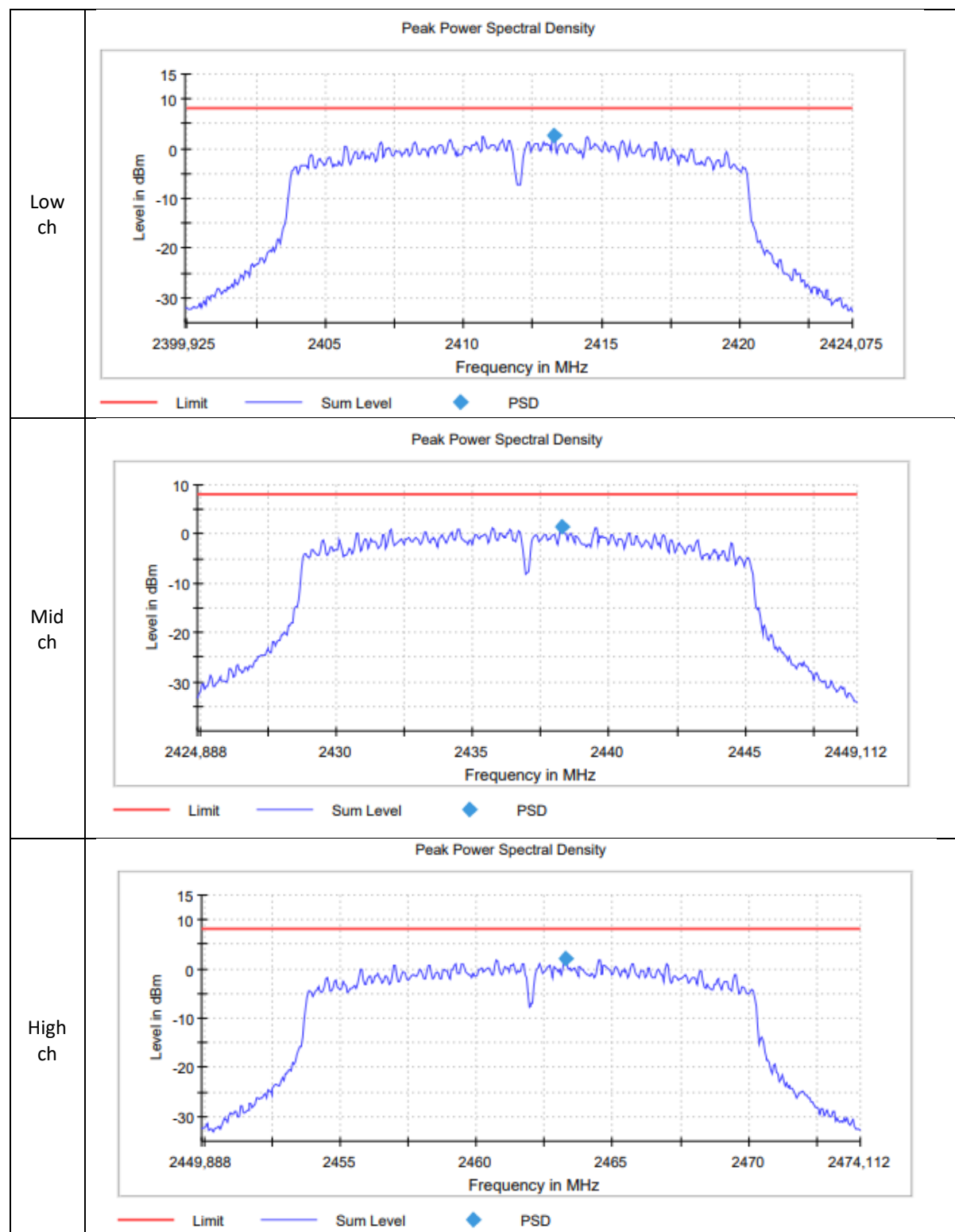
Note: plots are provided on the next page

### 3.5.6 Plots of the Power Spectral Density

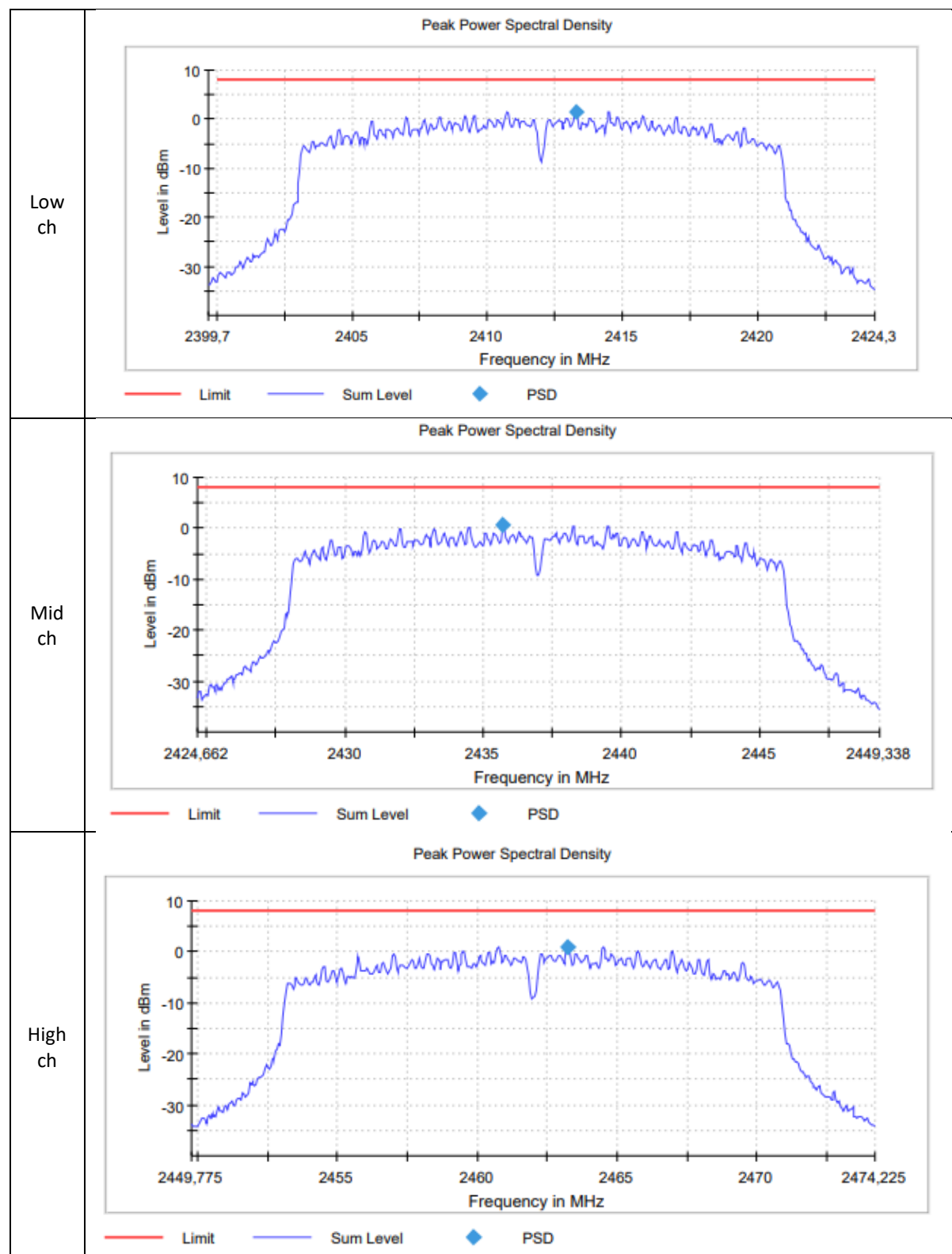
IEEE 802.11b:



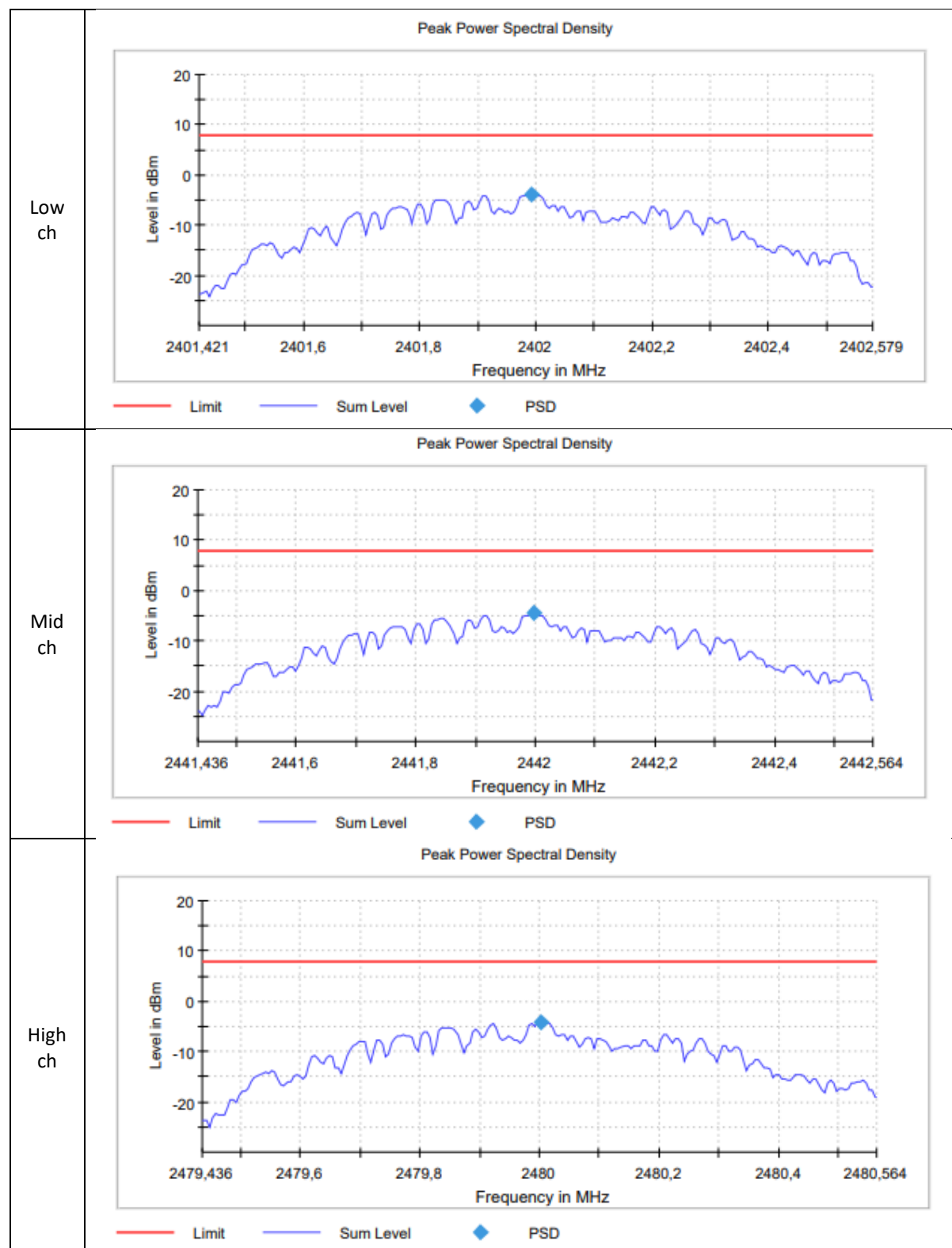
IEEE 802.11g:



IEEE 802.11n:



BLE:





### **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. Antenna port conducted.

#### **3.6.4 Test procedure**

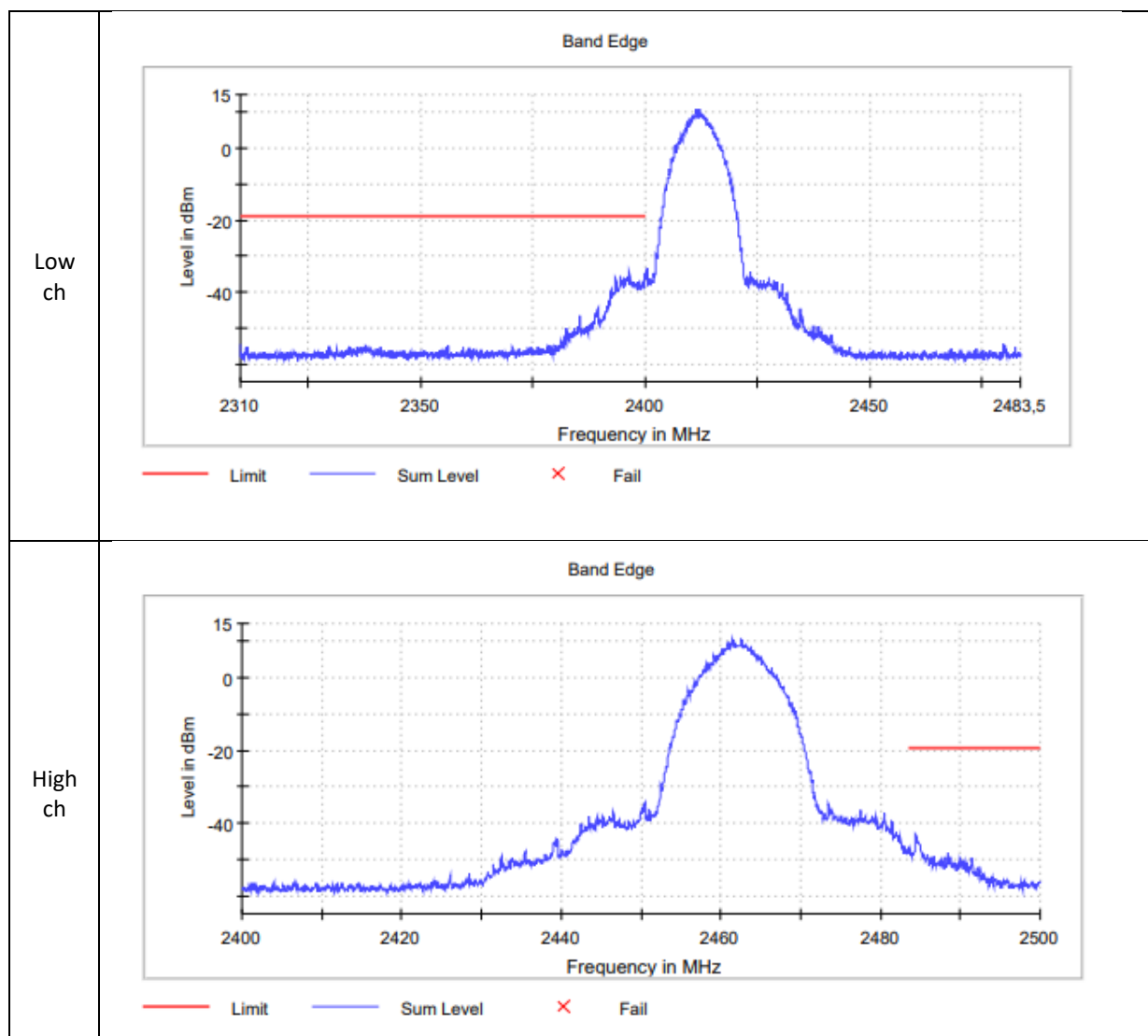
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02, section 8.7.  
IRN 441 - Radiated electrical disturbance (V per m) Method 6 – Radiated electrical disturbance at the Authorized band edge.

#### **3.6.5 Measurement Uncertainty**

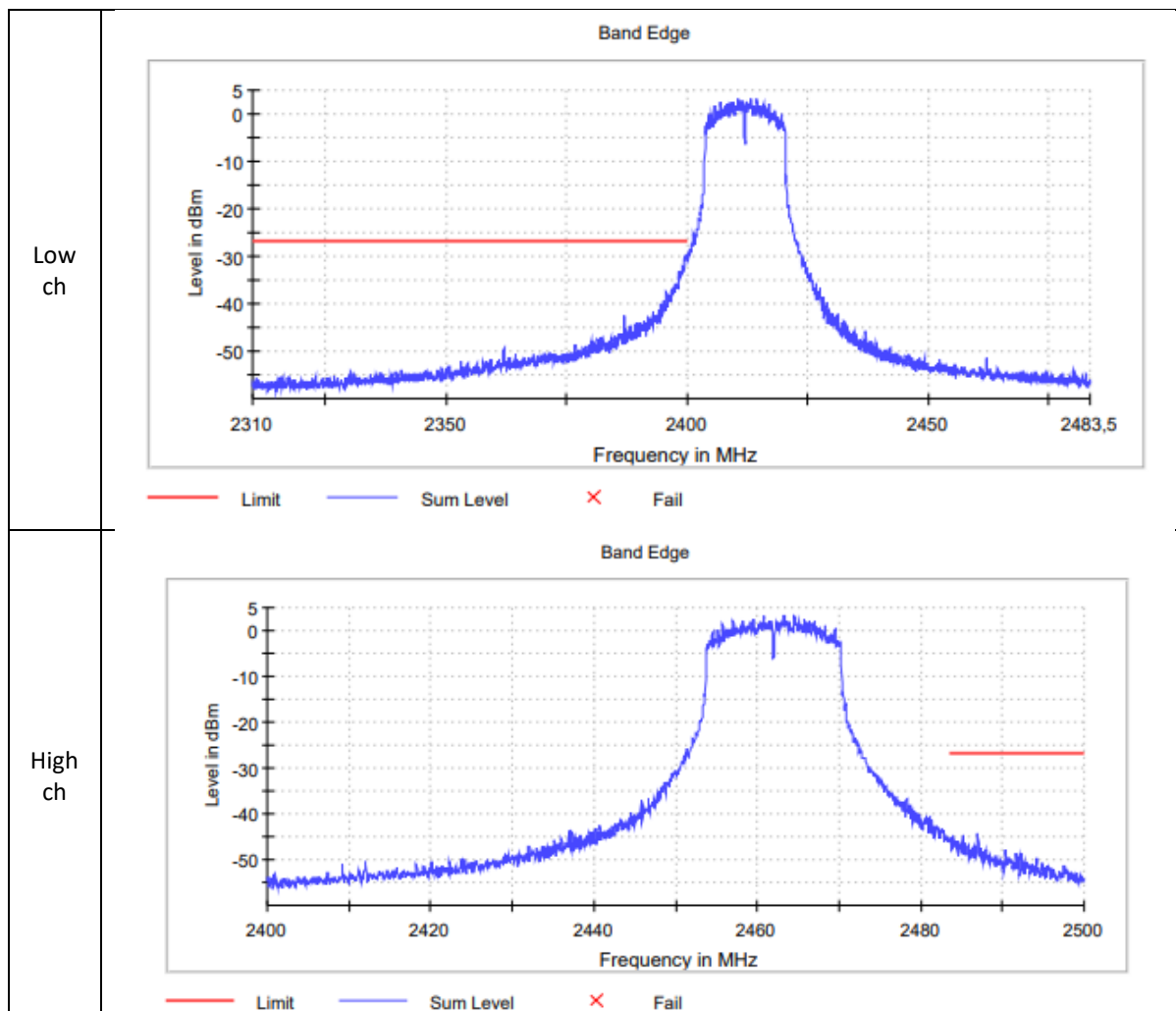
$\pm 5.7$  dB.(radiated)

### 3.6.6 Plots of the Band edge Measurements

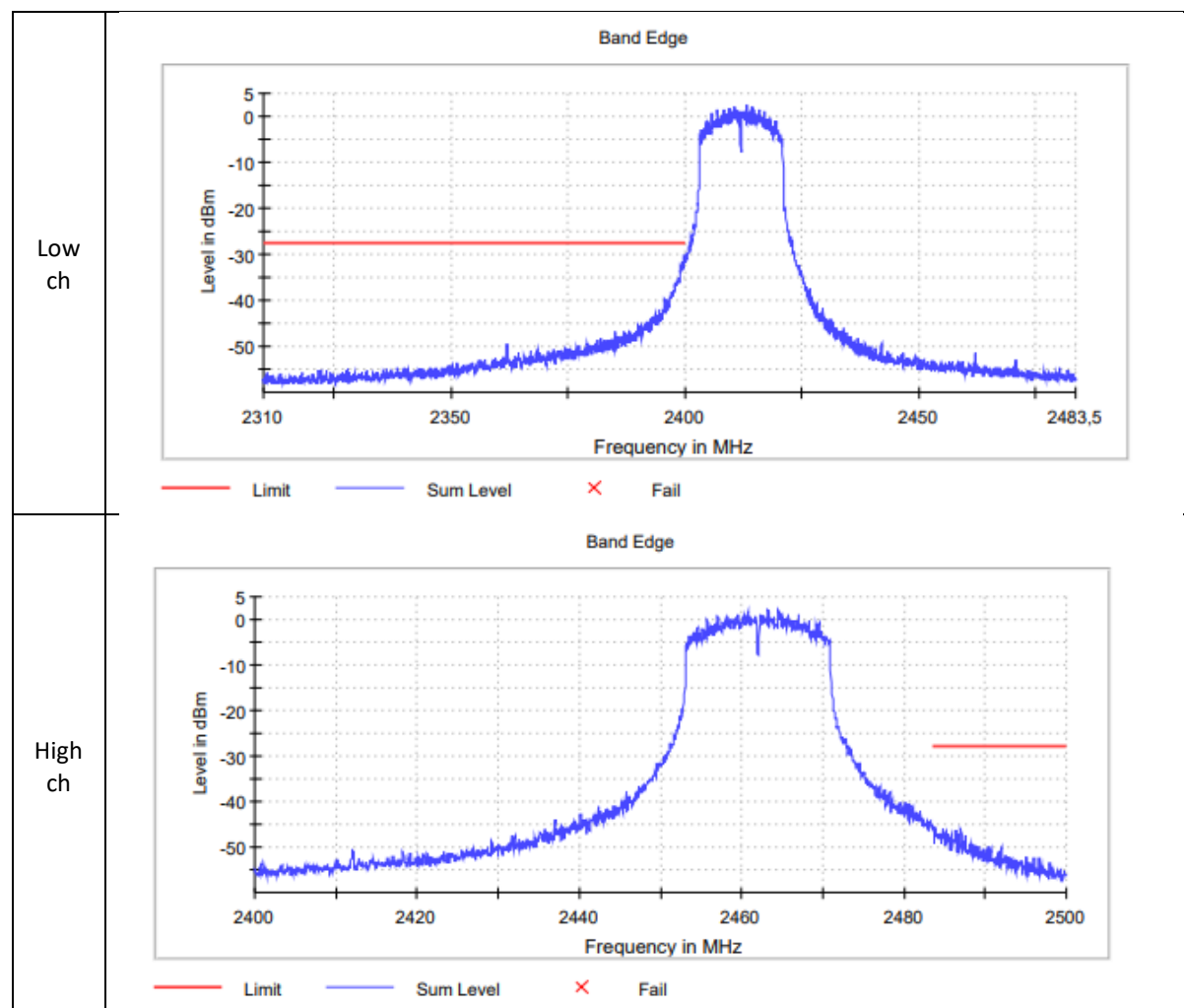
IEEE 802.11b:



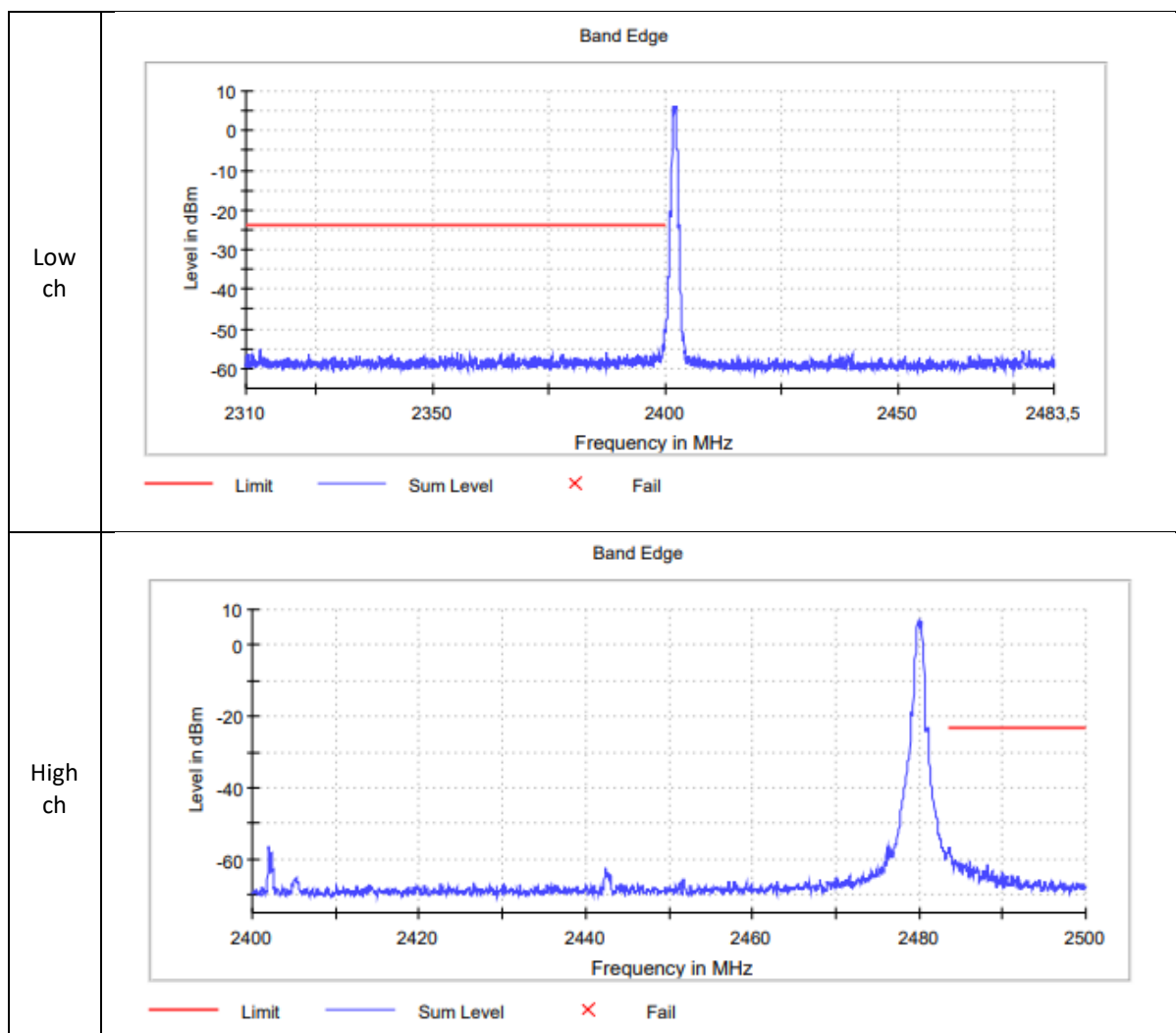
IEEE 802.11g:



IEEE 802.11n:



BLE:



### 3.7 AC Power-line conducted emissions

#### 3.7.1 Limit

According to 15.207 (a), (c)

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

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

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | 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 C63.10-2020 Section 6.2  
IRN 439 – Method 1

#### 3.7.5 Test results and plots of the AC power-line conducted measurement

See next page.

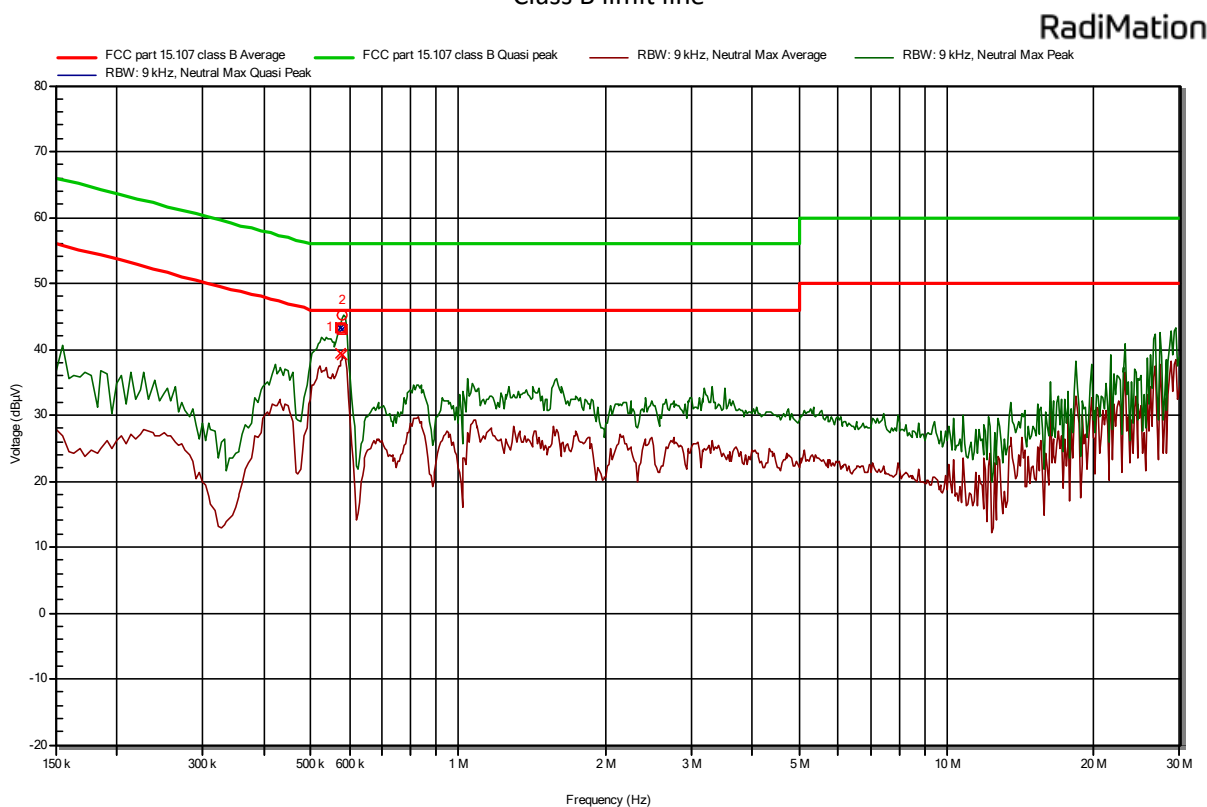
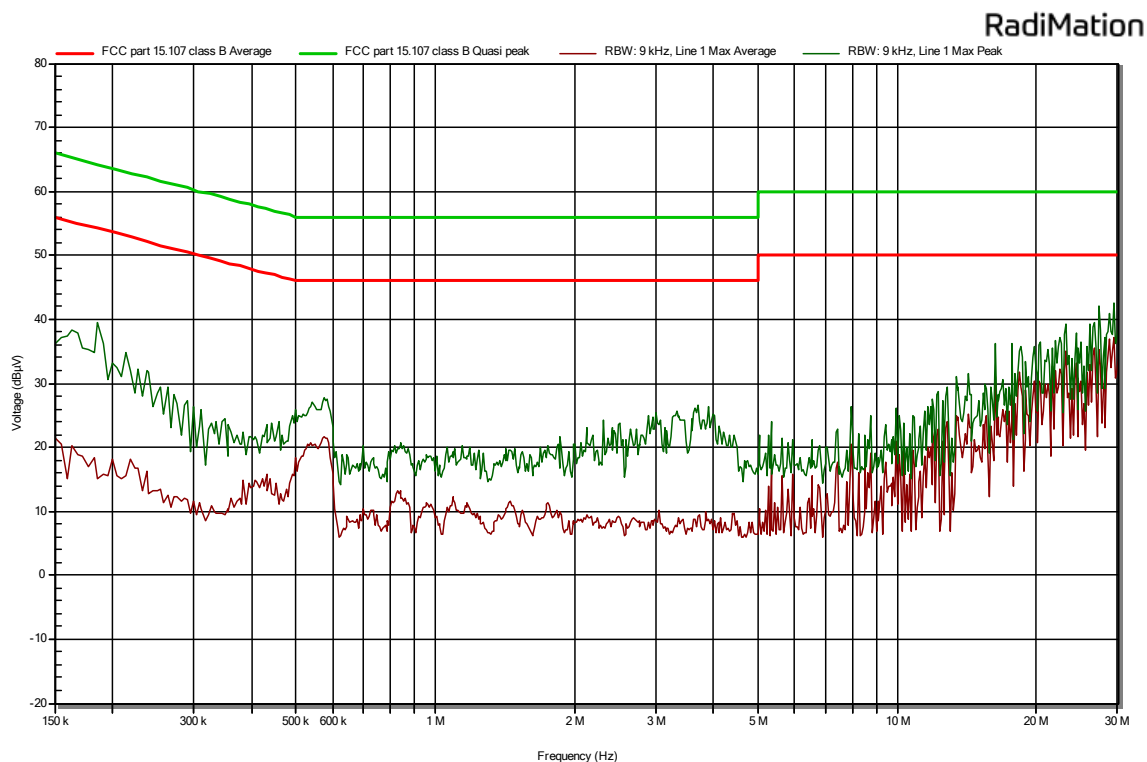
#### 3.7.6 Measurement uncertainty

+/- 3.6 dB

#### 3.7.7 AC Power Line Conducted emission data of the EUT, results

| Peak Number | Frequency  | Average         | Average Limit | Quasi-Peak      | Quasi-Peak Limit | Status | LISN    |
|-------------|------------|-----------------|---------------|-----------------|------------------|--------|---------|
| 1           | 573 kHz    | 39.3 dB $\mu$ V | 46 dB $\mu$ V | 43.3 dB $\mu$ V | 56 dB $\mu$ V    | Pass   | Neutral |
| 2           | 581.1 kHz  | 39.1 dB $\mu$ V | 46 dB $\mu$ V | 42.9 dB $\mu$ V | 56 dB $\mu$ V    | Pass   | Neutral |
| 3           | 1.576 MHz  | 26 dB $\mu$ V   | 46 dB $\mu$ V | --              | --               | Pass   | Neutral |
| 4           | 573 kHz    | 21.6 dB $\mu$ V | 46 dB $\mu$ V | --              | --               | Pass   | Line 1  |
| 5           | 3.701 MHz  | 9.2 dB $\mu$ V  | 46 dB $\mu$ V | --              | --               | Pass   | Line 1  |
| 6           | 16.229 MHz | 31 dB $\mu$ V   | 50 dB $\mu$ V | --              | --               | Pass   | Line 1  |

### 3.7.8 Plots of the AC mains conducted measurement



## 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)                                   | Insertion Loss<br>Pulse limiter (dB)                       | Cable loss (dB) | Corr. (dB) |
|-----------------|--------------------------------------------------------------|------------------------------------------------------------|-----------------|------------|
|                 | Kiwa ID: 114159<br>SN: 892785/004<br>Rohde & Schwarz ESH3-Z5 | Kiwa ID: 114160<br>SN: 5SM03153<br>Rohde & Schwarz ESH3-Z2 | -               |            |
| 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      |



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<sub>c</sub> is the cable loss

AF<sup>H</sup> is the magnetic antenna factor

| Frequency (MHz) | AF (dB/Ωm)                                   | CL (dB)   | Corr. (dB) |
|-----------------|----------------------------------------------|-----------|------------|
|                 | Kiwa ID 114515<br>EMCO 6505<br>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     |

# Field Strength Measurement:

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

Where:

E = Electric field strength

U = Measuring receiver voltage

AF = Antenna factor

CL = Cable loss

Corr. = sum of single correction factors of used cable and amplifier (if applicable).

Linear interpolation will be used for frequencies in between the values in the table.

Tables shows an extract of the values.

| Frequency (Mhz) | AF (dB/m)                                     | Cable loss (dB)       | Corr. (dB) |
|-----------------|-----------------------------------------------|-----------------------|------------|
|                 | Kiwa ID: 109683<br>Chase CBL6112B<br>SN: 2408 | Kiwa ID:<br>SAR cable |            |
| 30              | 25,4                                          | 0,68                  | 26,1       |
| 100             | 16,8                                          | 1,15                  | 18,0       |
| 150             | 16,8                                          | 1,41                  | 18,2       |
| 200             | 15,3                                          | 1,63                  | 16,9       |
| 250             | 19,3                                          | 1,93                  | 21,2       |
| 300             | 13,3                                          | 2,12                  | 15,4       |
| 350             | 14,6                                          | 2,20                  | 16,8       |
| 400             | 22,0                                          | 2,29                  | 24,3       |
| 450             | 23,0                                          | 2,53                  | 25,5       |
| 500             | 23,8                                          | 2,67                  | 26,5       |
| 550             | 25,4                                          | 2,90                  | 28,3       |
| 600             | 24,8                                          | 3,02                  | 27,8       |
| 650             | 25,2                                          | 3,09                  | 28,3       |
| 700             | 25,0                                          | 3,22                  | 28,2       |
| 750             | 25,8                                          | 3,56                  | 29,4       |
| 800             | 25,8                                          | 3,69                  | 29,5       |
| 900             | 26,5                                          | 3,81                  | 30,3       |
| 950             | 27,0                                          | 3,91                  | 30,9       |
| 1000            | 27,4                                          | 4,30                  | 31,7       |

| Frequency (MHz) | AF (dB/m)                                     | Gain (dB)                                        | Cable loss (dB) | Corr. (dB) |
|-----------------|-----------------------------------------------|--------------------------------------------------|-----------------|------------|
|                 | Kiwa ID: 114607<br>Emco 3115<br>SN: 9412-4377 | Kiwa ID:114693<br>Miteq<br>JS4-18004000-30-8P-A1 |                 |            |
| 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)                                       | Gain (dB)                                        | Cable loss (dB) | Corr. (dB) |
|-----------------|-------------------------------------------------|--------------------------------------------------|-----------------|------------|
|                 | Kiwa ID: 114518<br>Flann 20240-25<br>SN: 163703 | Kiwa ID:114693<br>Miteq<br>JS4-18004000-30-8P-A1 |                 |            |
| 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       |

&lt;&lt; END OF REPORT&gt;&gt;