

## FCC Test Report for Parts 15.247, 15.209 (DTS)

Product name : Communication Hub  
Applicant : Neways Electronics International NV  
FCC ID : 2AK2ZHUB1

Test report No. : 161000613 05 Ver2.00

## Laboratory information

### Accreditation

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001

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

### Documentation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Telefication Netherlands

### Testing Location

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

## Revision History

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

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## Summary of Test results

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

## 1 General Description

### 1.1 Applicant

|               |                                                                                                  |
|---------------|--------------------------------------------------------------------------------------------------|
| Client name:  | Neways Electronics International NV                                                              |
| Address       | Science Park Eindhoven 5010                                                                      |
| Zip code:     | 5692 EA                                                                                          |
| E-mail:       | <a href="mailto:Tim.van.der.Loo@newayselectronics.com">Tim.van.der.Loo@newayselectronics.com</a> |
| Contact name: | T. van der Loo                                                                                   |

### 1.2 Manufacturer

|                    |                                                        |
|--------------------|--------------------------------------------------------|
| Manufacturer name: | SC Industries                                          |
| Address:           | 24151 Telegraph Road, Suite 100, Southfield, USA       |
| E-mail:            | <a href="mailto:sdcc@lifeear.com">sdcc@lifeear.com</a> |
| Contact name:      | Sreenivas Cherukuri                                    |

### 1.3 Tested Equipment Under Test (EUT)

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

## 1.4 Product specifications of Equipment under test

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

## 1.5 Modification of the Equipment Under Test (EUT)

None.

## 1.6 Observations and remarks

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

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

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

## 1.7 Environmental conditions

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

## 1.8 Measurement Standards

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

## 1.9 Applicable Standards

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

- FCC Part 15 Subpart C §15.247, §15.209

## 1.10 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.9 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.9 "*Applicable standards*".

All tests are performed by:

Name : ing R. van Barneveld

Review of test methods and report by:

Name : ing P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 02-03-2017

Name : ing K.A. Roes

Function : Coordinator Radio laboratory

Signature :



## 2 Test configuration of the Equipment Under Test

### 2.1 Test mode

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

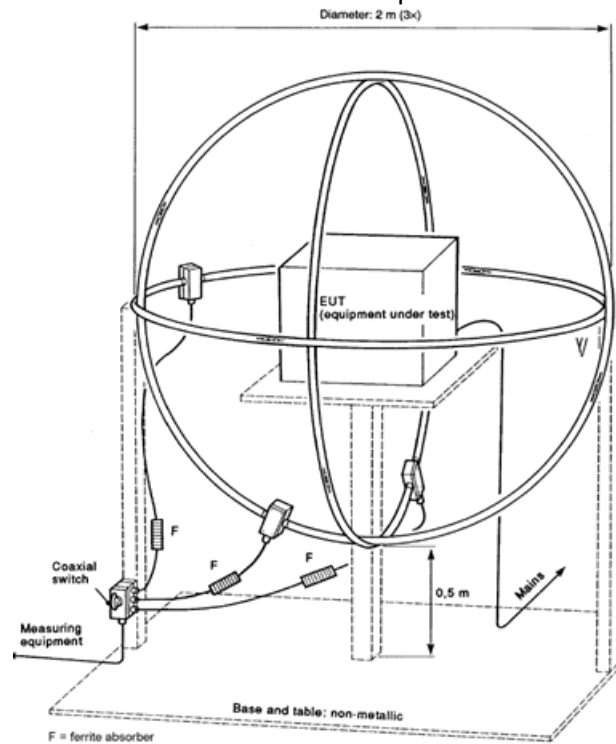
The USB data line were connected to program the different setting in the EUT.

### 2.2 Tested channels and Data rates

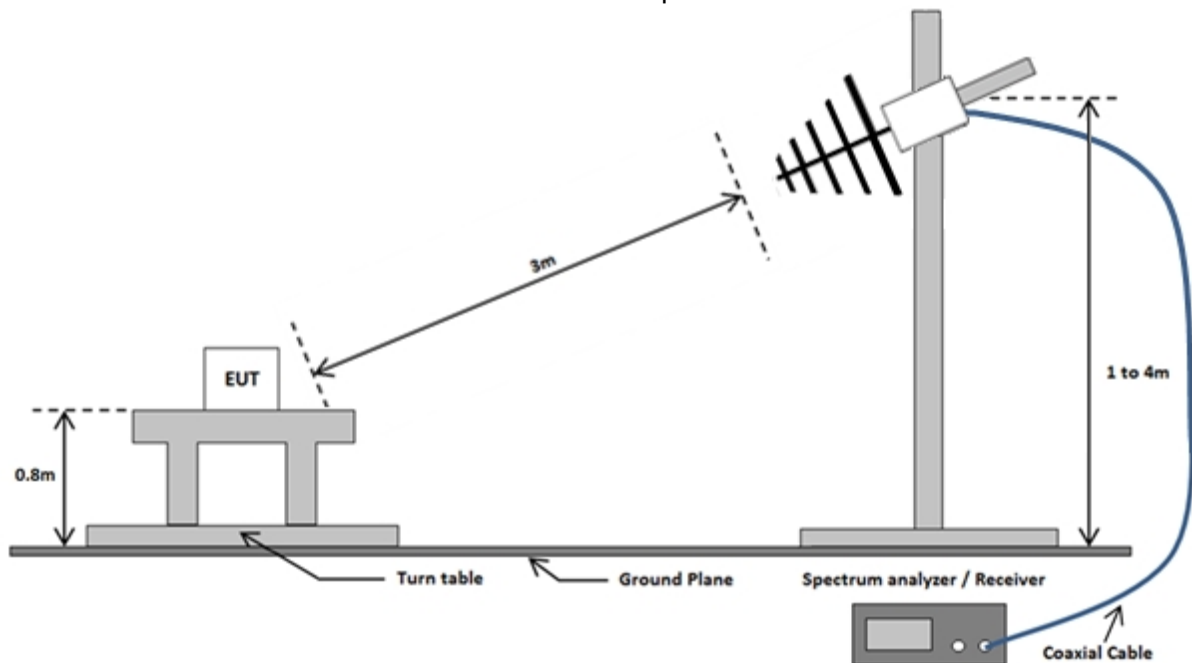
| Technology           | Channels | Packet type | Data rate | Frequency (MHz) |
|----------------------|----------|-------------|-----------|-----------------|
| Bluetooth Low Energy | 37       | --          | 1 Mbps    | 2402            |
|                      | 17       | --          | 1 Mbps    |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

## 2.3 Radiated Test setup

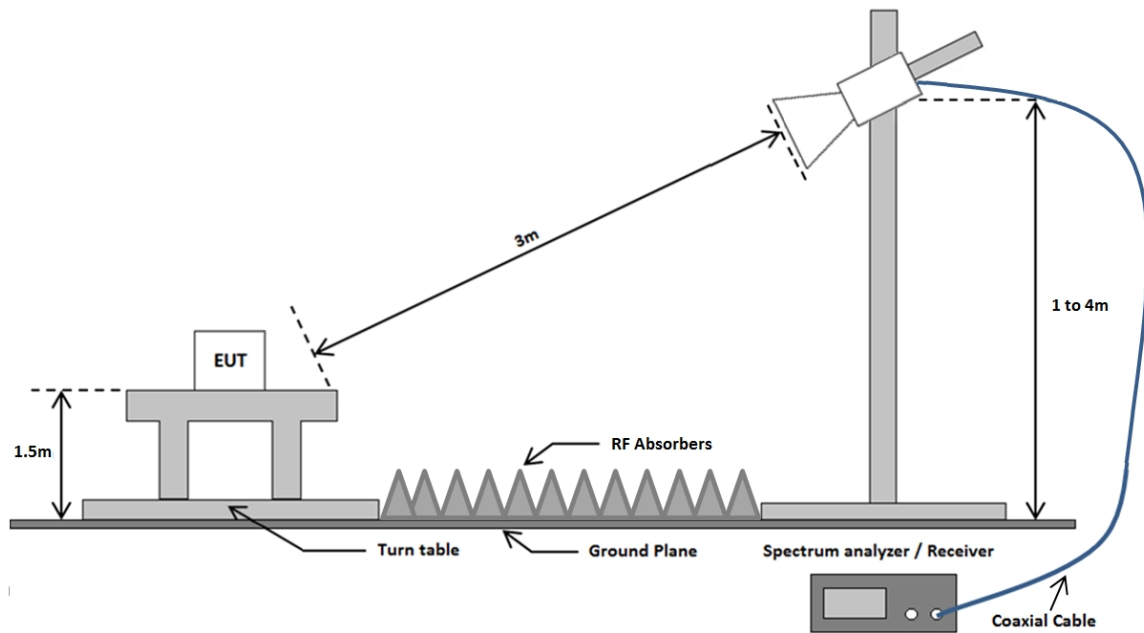
Radiated emissions test setup 9 kHz - 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



## 2.4 Equipment used in the test configuration

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

## 2.5 Sample calculations

Field Strength Calculation using example values:

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

The following relation applies:

$$E \text{ (dB}\mu\text{V/m)} = U \text{ (dB}\mu\text{V)} + AF \text{ (dB/m)} - G \text{ (dB)} + CL \text{ (dB)}$$

Where:

E = Electric field strength

U = Measuring receiver voltage

AF = Antenna factor

G = Gain of the pre-amplifier

CL = Cable loss

$$(51.8 = 52.49 + 33.1 - 38.19 + 4.4)$$

### 3 Test results

#### 3.1 6dB bandwidth Measurement

##### 3.1.1 Limit

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

##### 3.1.2 Measurement instruments

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

##### 3.1.3 Test setup

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

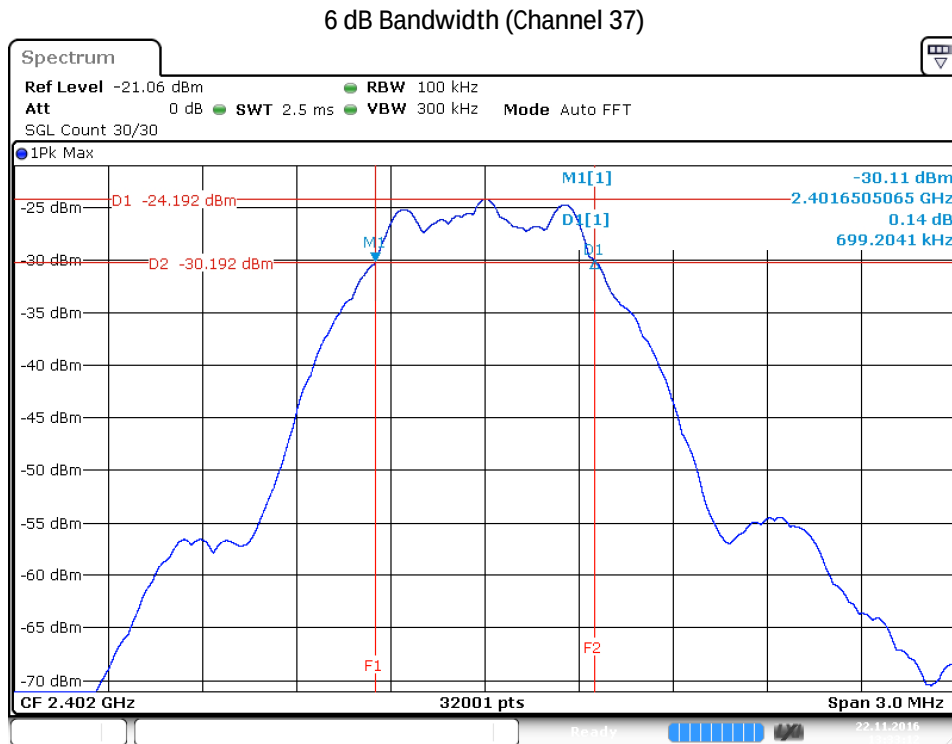
##### 3.1.4 Test procedure

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

##### 3.1.5 Test Results of the 6 dB bandwidth Measurement

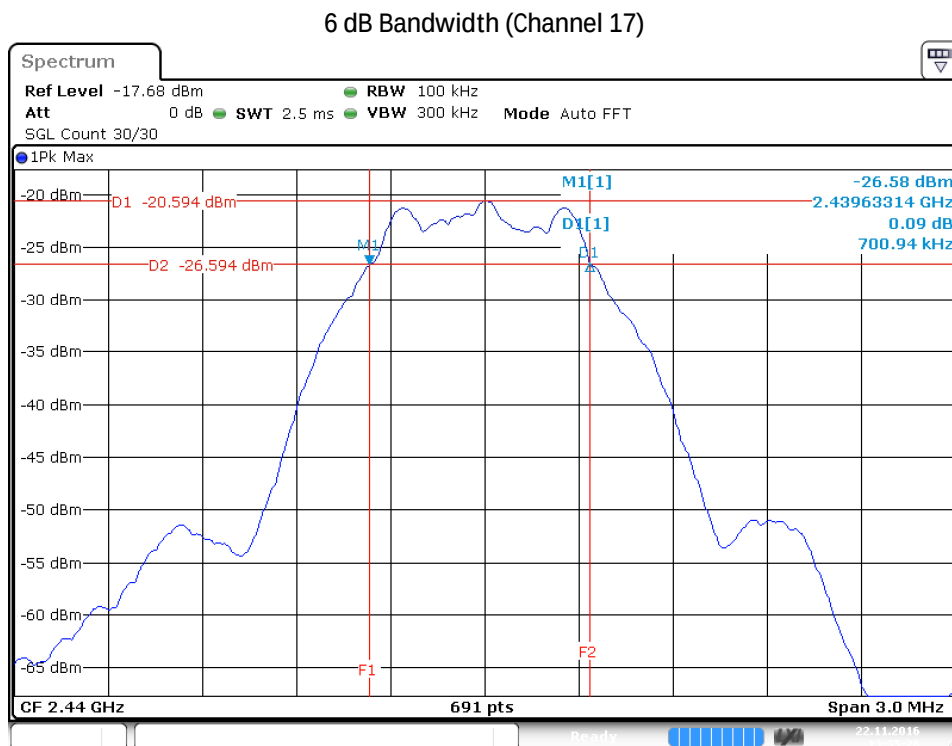
| Technology Std.      | Channel       | Frequency (MHz) | Data rate | 6dB bandwidth (kHz) |
|----------------------|---------------|-----------------|-----------|---------------------|
| Bluetooth Low Energy | 37            | 2402            | --        | 699.20              |
|                    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

### 3.1.6 Plots of the 6 dB bandwidth Measurement



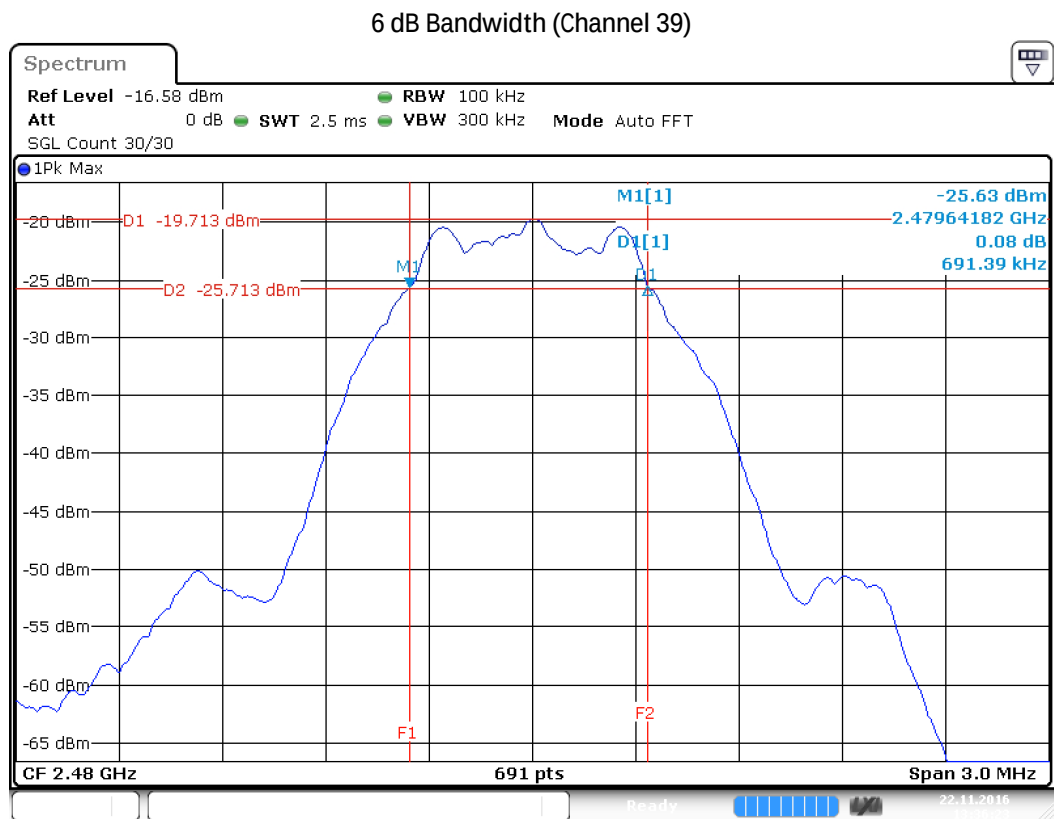
Ble, channel: 0 : 6 dB BW Measurement

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



Ble, channel: 19 : 6 dB BW Measurement

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



Ble, channel: 39 : 6 dB BW Measurement

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

## 3.2 Output Power Measurement

### 3.2.1 Limit

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

### 3.2.2 Measurement instruments

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

### 3.2.3 Test setup

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

### 3.2.4 Test procedure

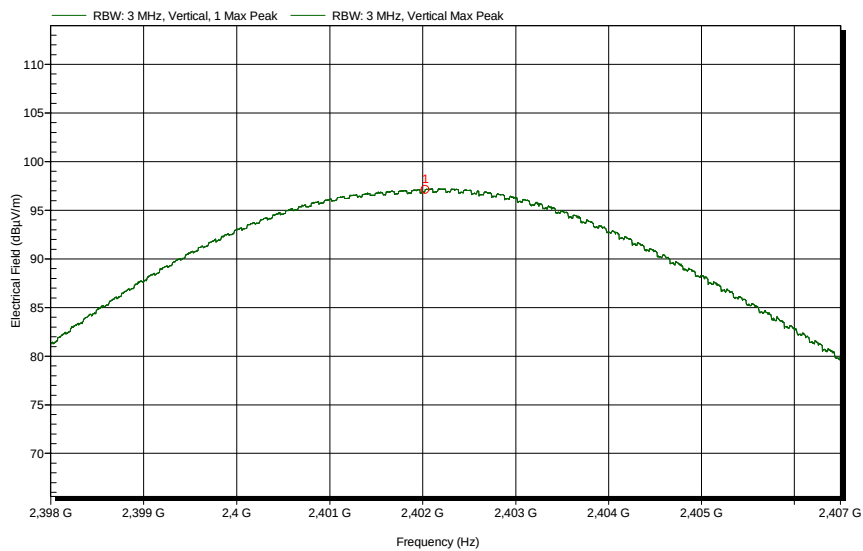
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

### 3.2.5 Test results of Output Power Measurement

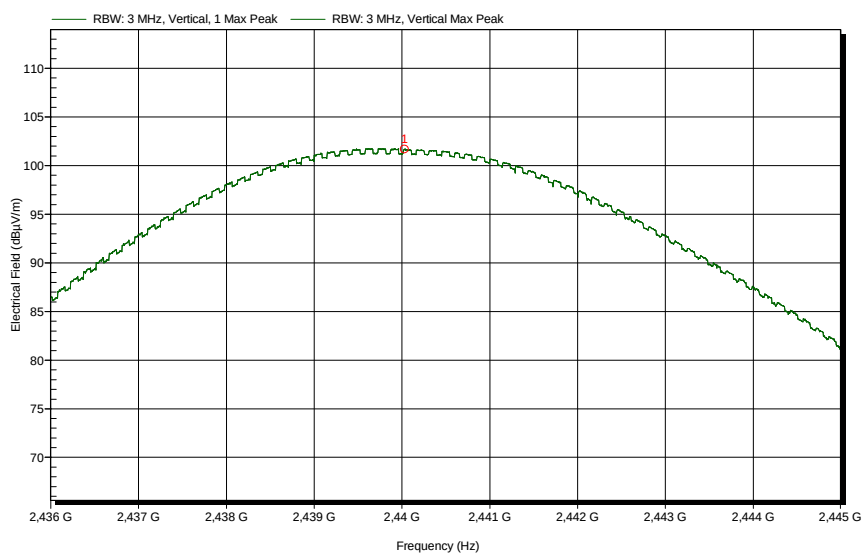
| Peak method          |               |                 |           |                         |
|----------------------|---------------|-----------------|-----------|-------------------------|
| Technology Std.      | Channels      | Frequency (MHz) | Data rate | Peak output power (dBm) |
| Bluetooth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

### 3.2.6 Plots of Peak Output Power Measurement

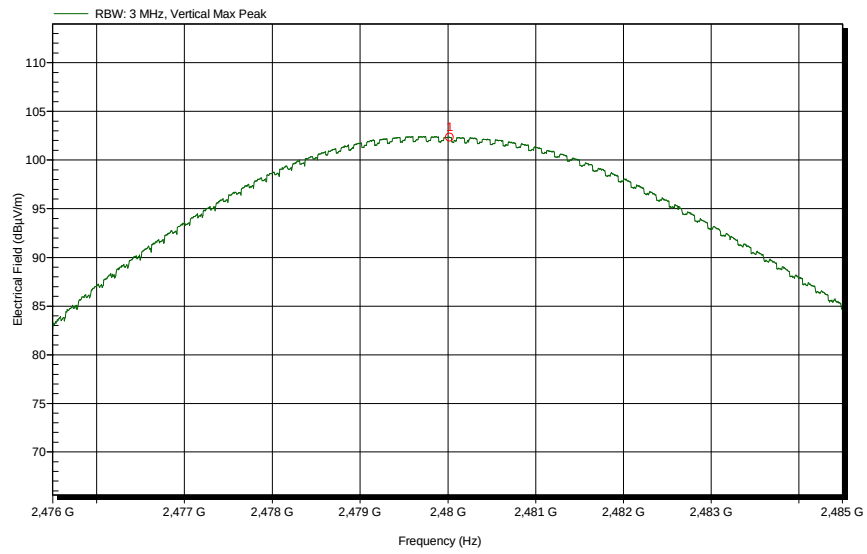
Peak Output Power (Channel 37)



Peak Output Power (Channel 17)



### Peak Output Power (Channel 39)



### 3.3 Power Spectral Density

#### 3.3.1 Limit

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

#### 3.3.2 Measurement instruments

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

#### 3.3.3 Test setup

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

#### 3.3.4 Test procedure

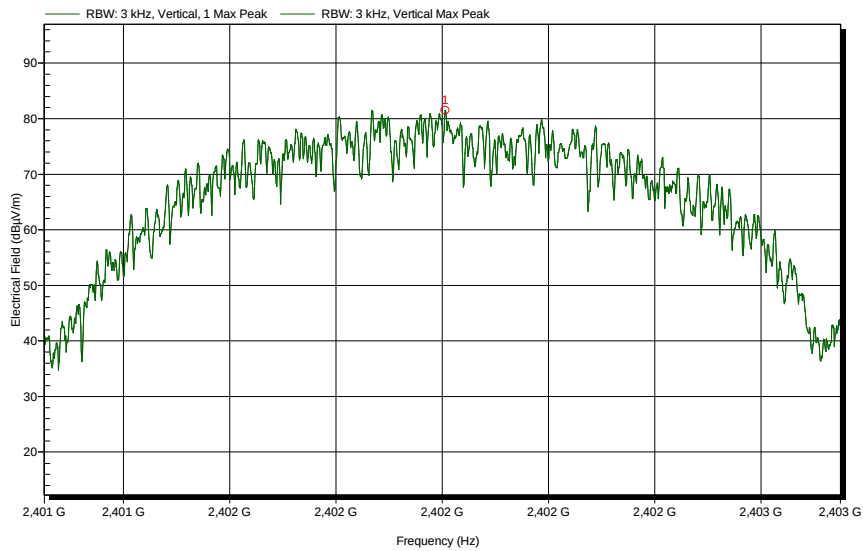
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

#### 3.3.5 Test results of Power Spectral Density Measurement

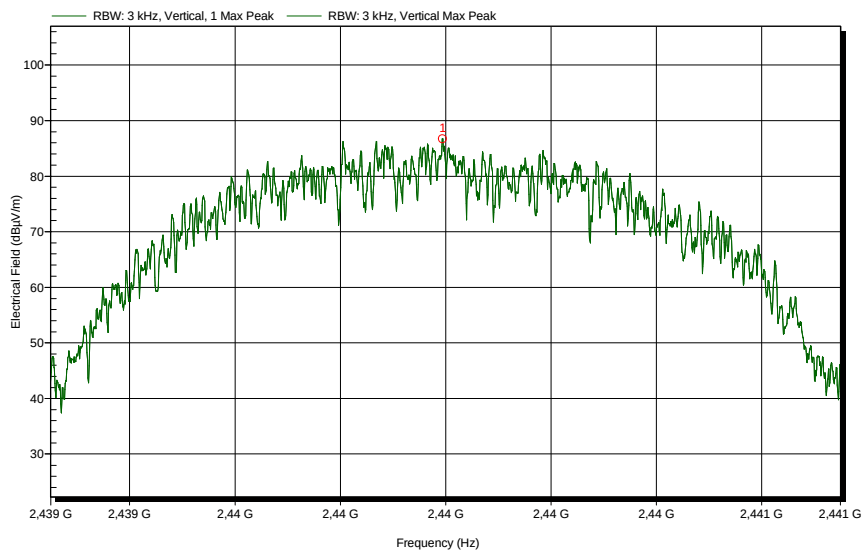
| Technology Std.      | Channels      | Frequency (MHz) | Data rate | PSD/3 kHz (dBm) |
|----------------------|---------------|-----------------|-----------|-----------------|
| Bluetooth Low Energy | 37            | 2402            | --        | -13.7           |
|                      | 17      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

### 3.3.6 Plots of the Power Spectral Density Measurements

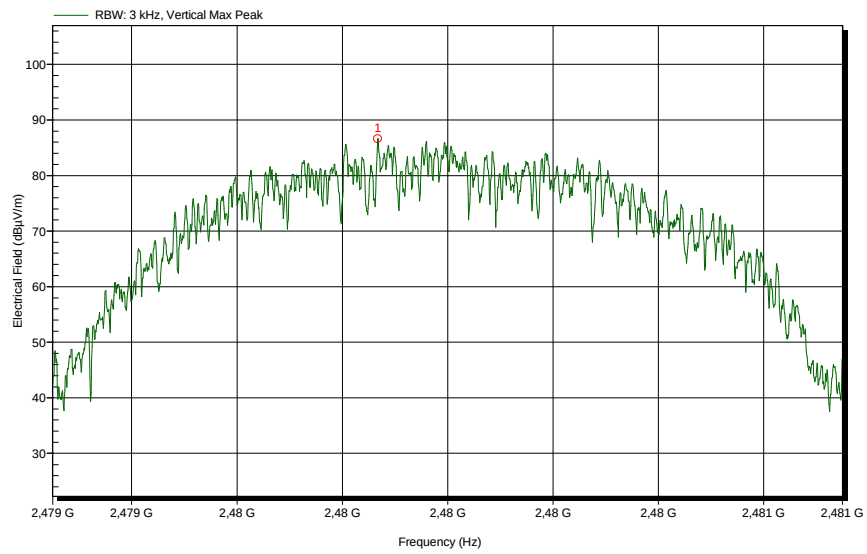
Power Spectral Density 3 kHz (channel 37)



Power Spectral Density 3 kHz (channel 17)



Power Spectral Density 3 kHz (channel 39)



### 3.4 20 dB bandwidth Measurement

#### 3.4.1 Limit

Reporting only

#### 3.4.2 Measurement instruments

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

#### 3.4.3 Test setup

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

#### 3.4.4 Test procedure

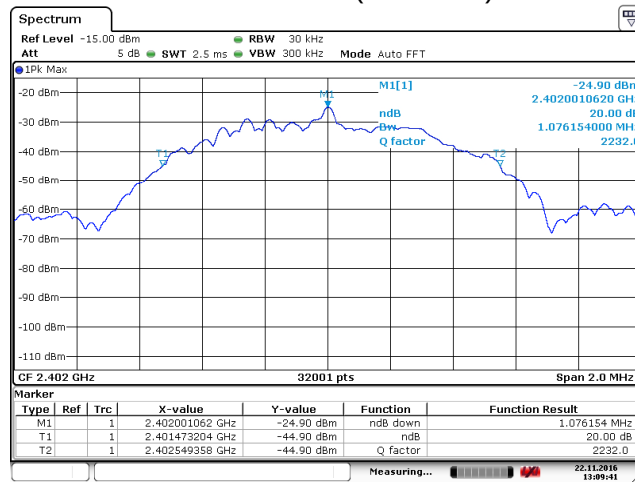
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

#### 3.4.5 Test Results of the 20 dB bandwidth Measurement

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

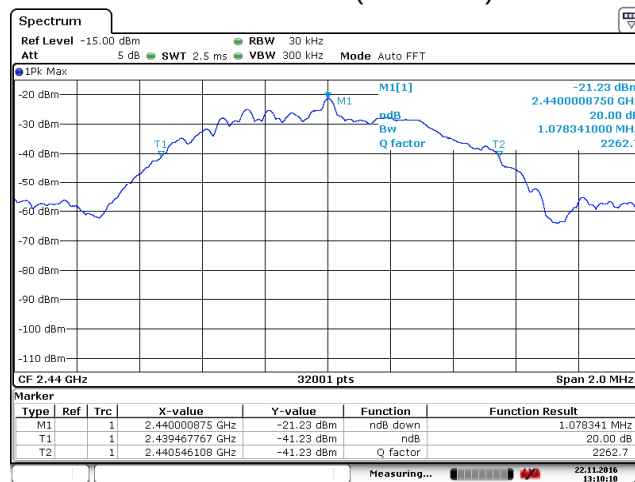
### 3.4.6 Plots of the 20 dB bandwidth Measurement

20 dB Bandwidth (Channel 37)



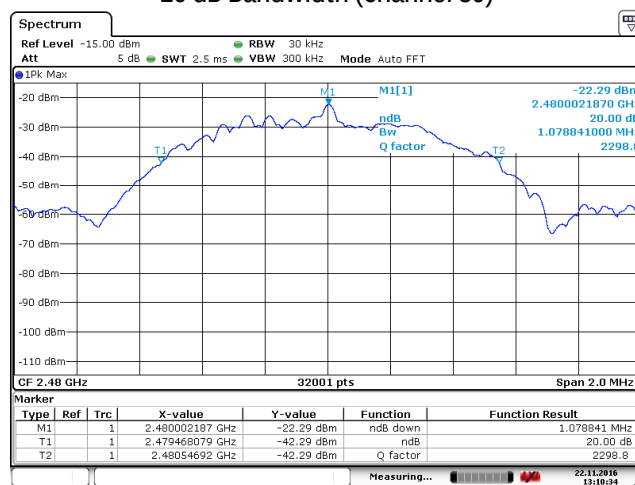
Band edge  
 Date: 22.NOV.2016 13:09:40

20 dB Bandwidth (Channel 17)



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

20 dB Bandwidth (Channel 39)



Band edge  
 Date: 22.NOV.2016 13:10:34

### 3.5 Radiated Spurious Emissions Measurement

#### 3.5.1 Limit

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

15.209

| Frequency (MHz) | Field strength ( $\mu\text{V/m}$ ) | Measurement distance(m) |
|-----------------|------------------------------------|-------------------------|
| 0.009 – 0.490   | $2400/F(\text{kHz})$               | 300                     |
| 0.490 – 1.705   | $24000/F(\text{kHz})$              | 30                      |
| 1.705 - 30      | 30                                 | 30                      |
| 30 -88          | 100                                | 3                       |
| 88 - 216        | 150                                | 3                       |
| 216-960         | 200                                | 3                       |
| Above 960       | 500                                | 3                       |

#### 3.5.2 Measurement instruments

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

#### 3.5.3 Test setup

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

#### 3.5.4 Test procedure

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

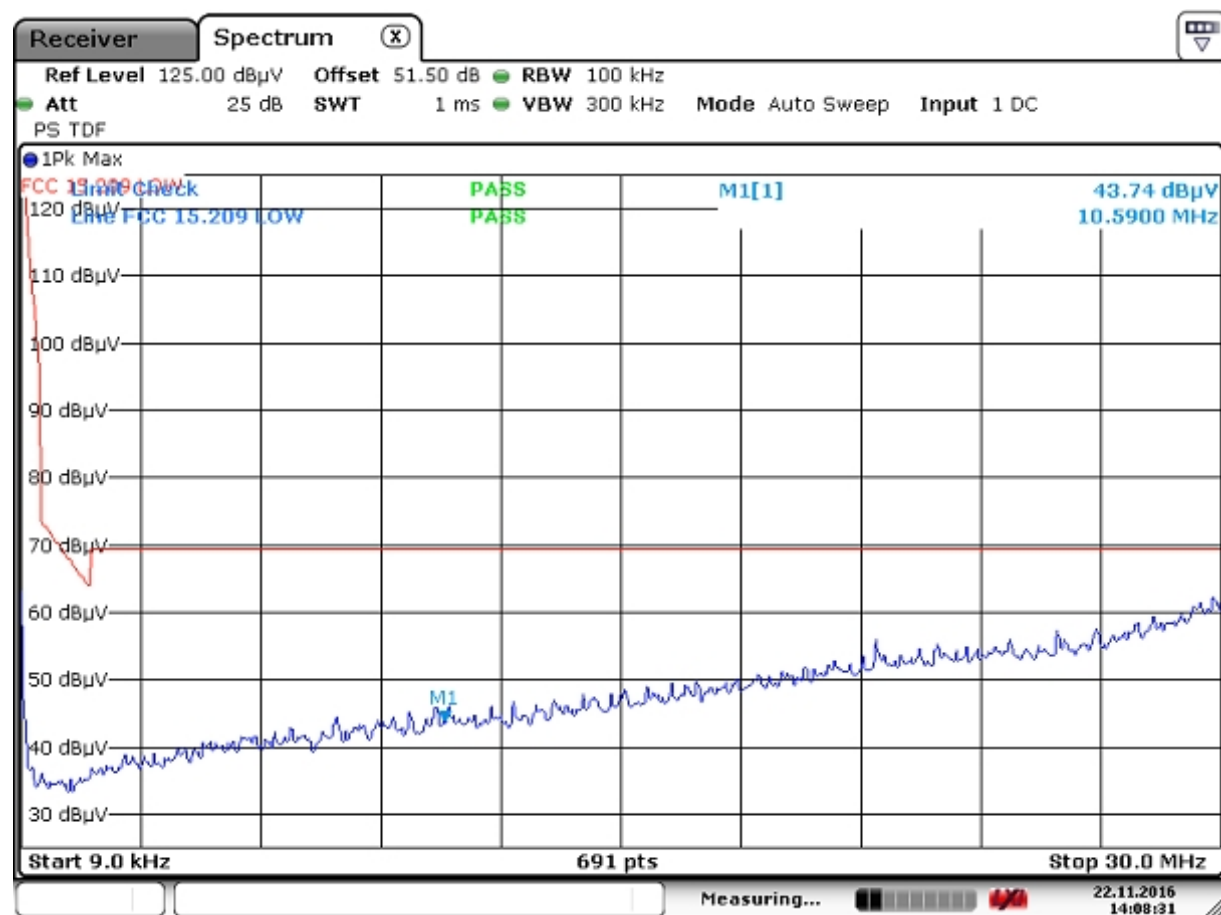
Other details are according to KDB Publication 558074 V02r05, sections 11.3 and 12.1

#### 3.5.5 Notes

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

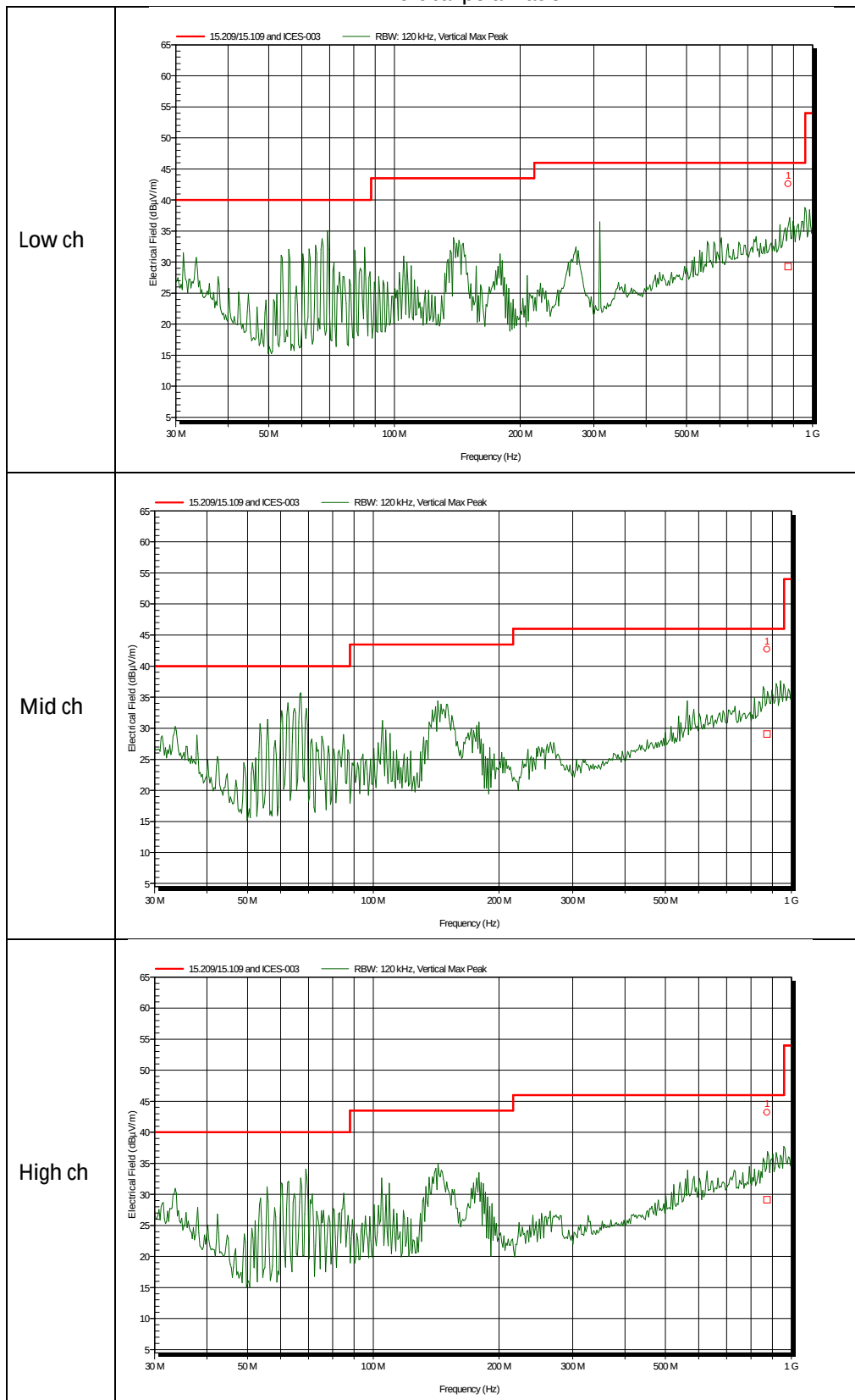
### 3.5.6 Plots of the Radiated Spurious Emissions Measurement

9 kHz – 30 MHz



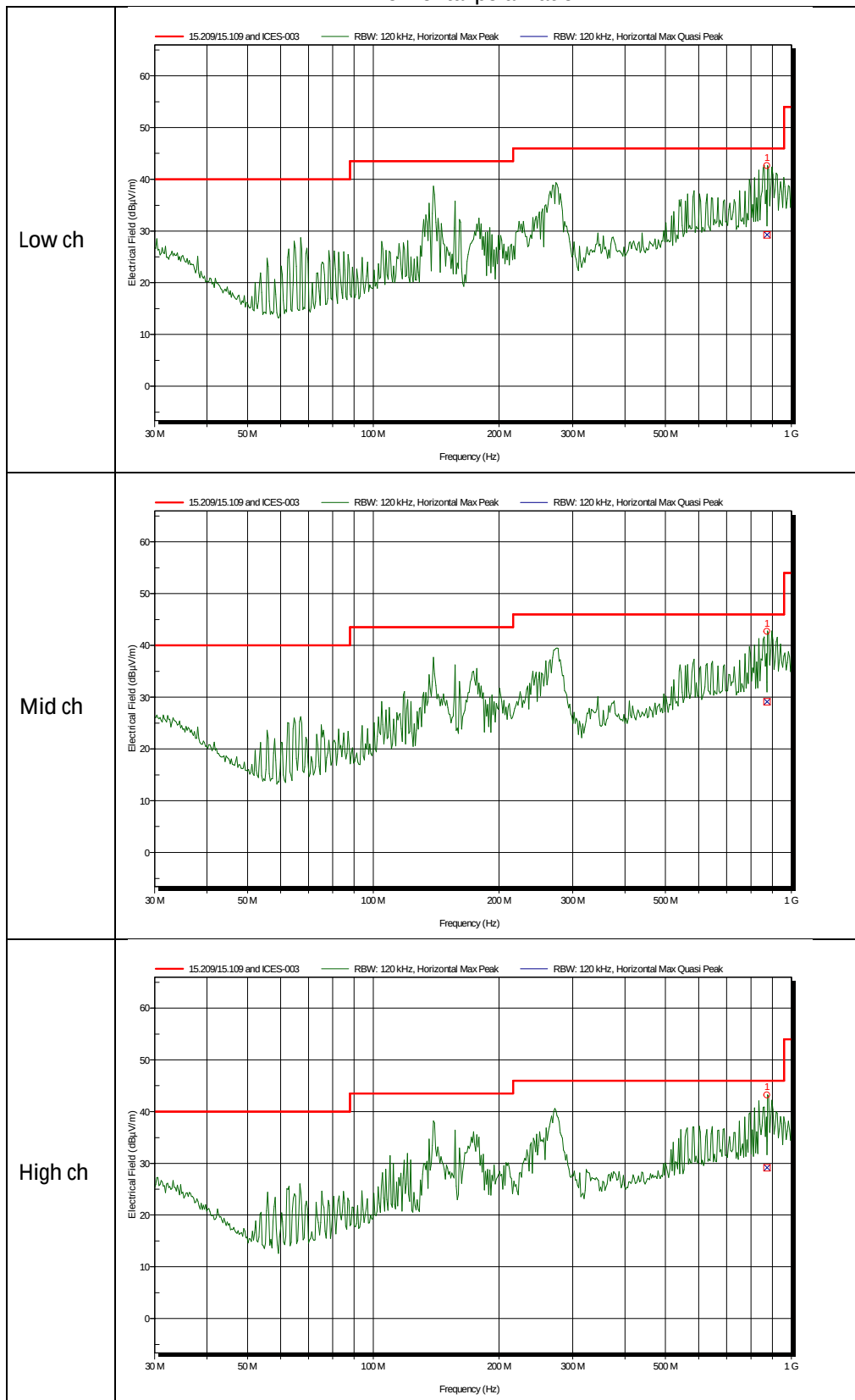
30 – 1000 MHz

Vertical polarization



30 MHz to 1 GHz

Horizontal polarization



**Measured peaks 30 – 1000 MHz Low channel**

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

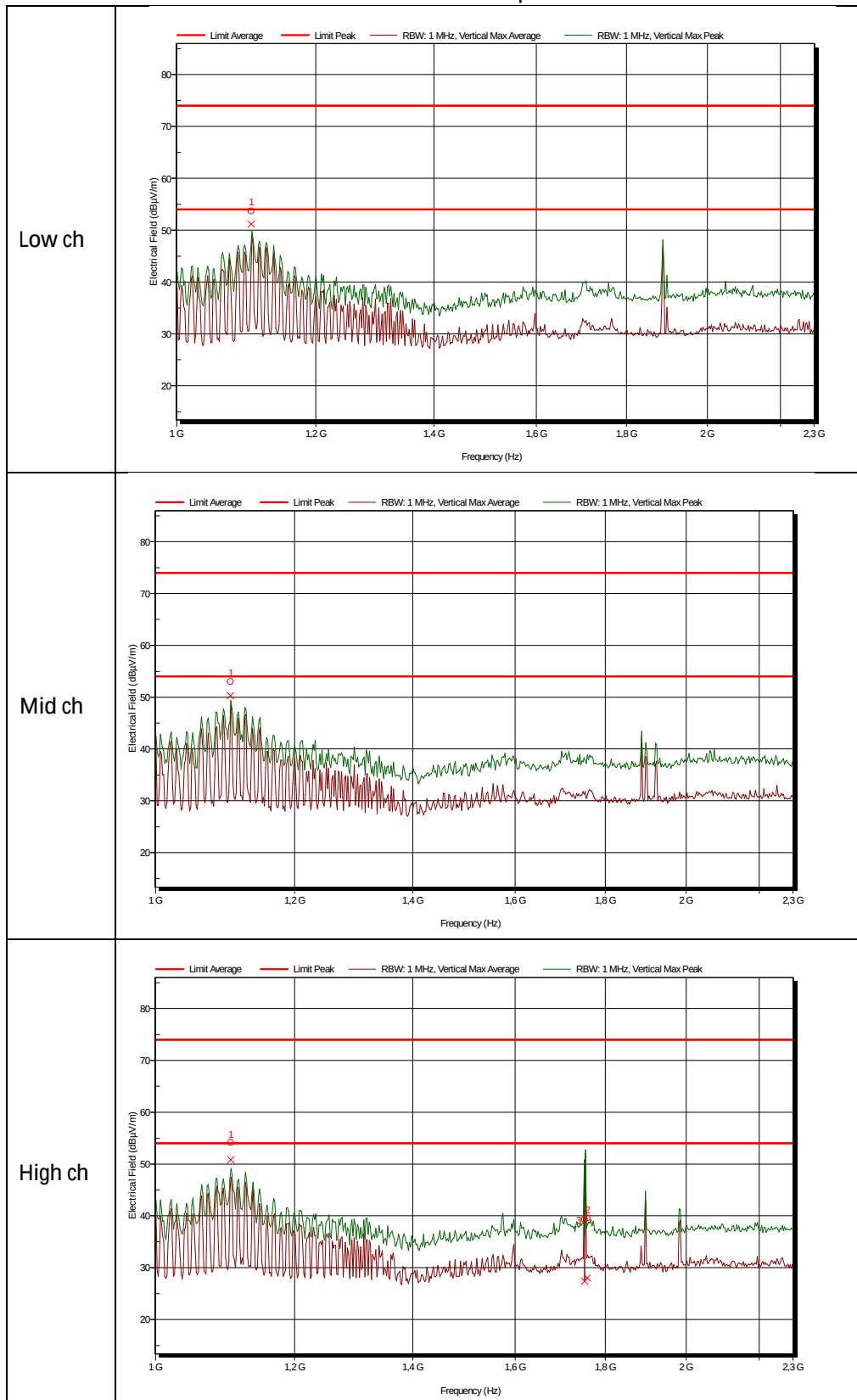
**Measured peaks 30 – 1000 MHz Middle channel**

| Frequency (MHz) | Polarization | Height (m) | Quasi-Peak (dB $\mu$ V/m) | Quasi-Peak Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------|------------|---------------------------|---------------------------------|-------------|
| 874,74          | Horizontal   | 1          | 29,1                      | 46                              | -16,9       |

**Measured peaks 30 – 1000 MHz High channel**

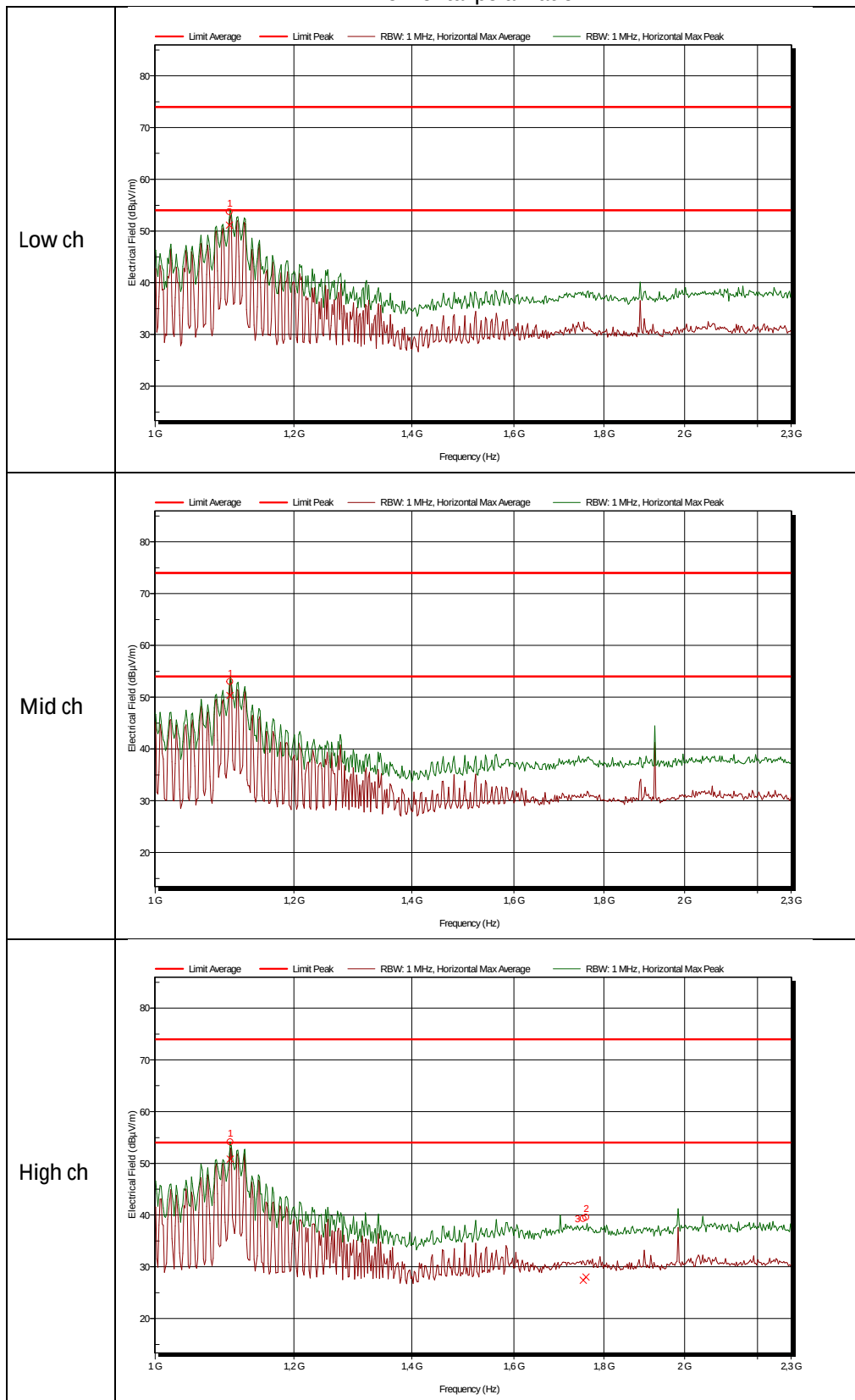
| Frequency (MHz) | Polarization | Height (m) | Quasi-Peak (dB $\mu$ V/m) | Quasi-Peak Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------|------------|---------------------------|---------------------------------|-------------|
| 874,92          | Horizontal   | 1          | 29,1                      | 46                              | -16,9       |

### 1 – 2.3 GHz Vertical polarization



1 GHz to 2,3 GHz

## Horizontal polarization



**Measured peaks 1 – 2.3 GHz Low channel**

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

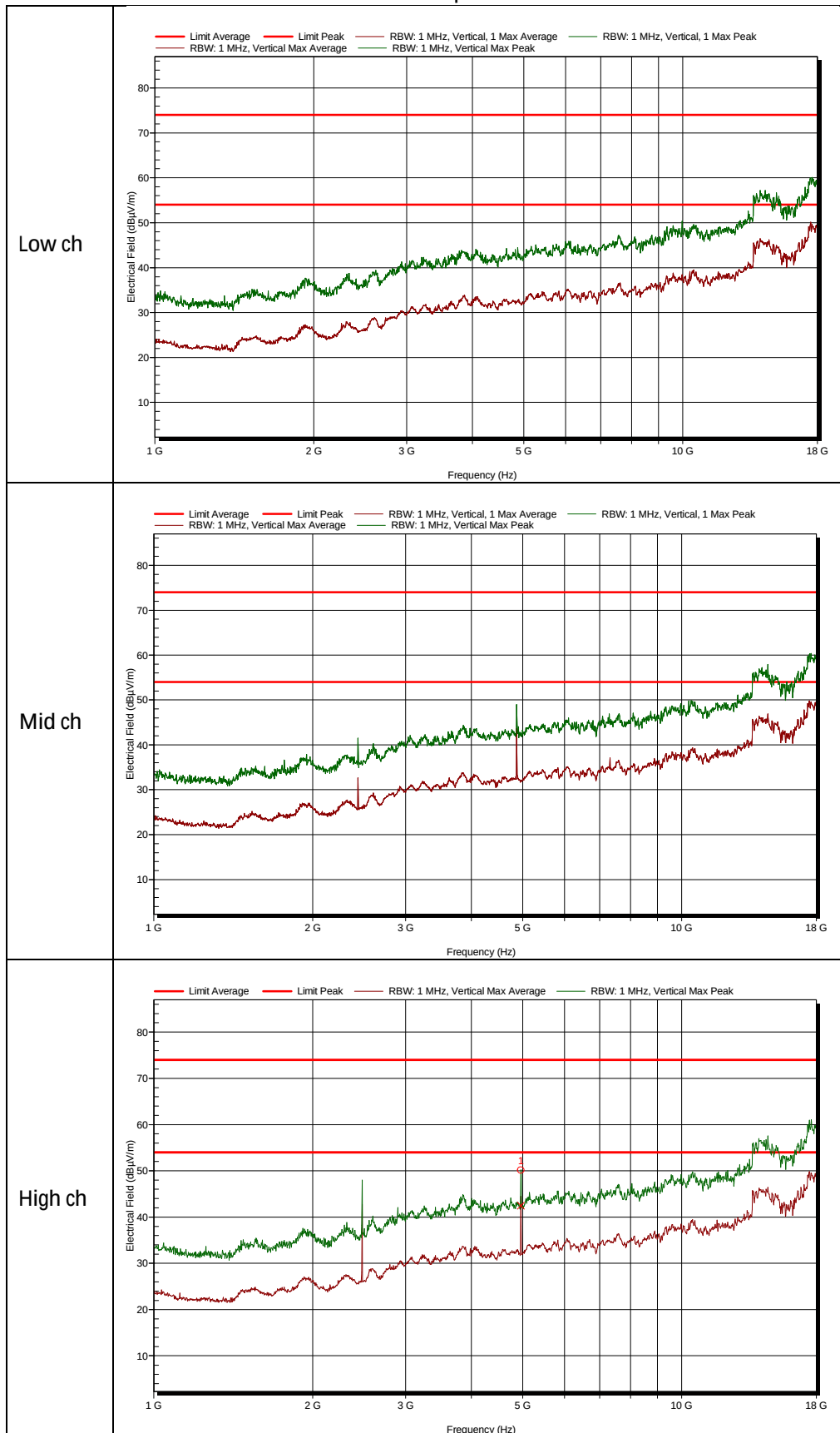
**Measured peaks 1 – 2.3 GHz Middle channel**

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

**Measured peaks 1 – 2.3 GHz High channel**

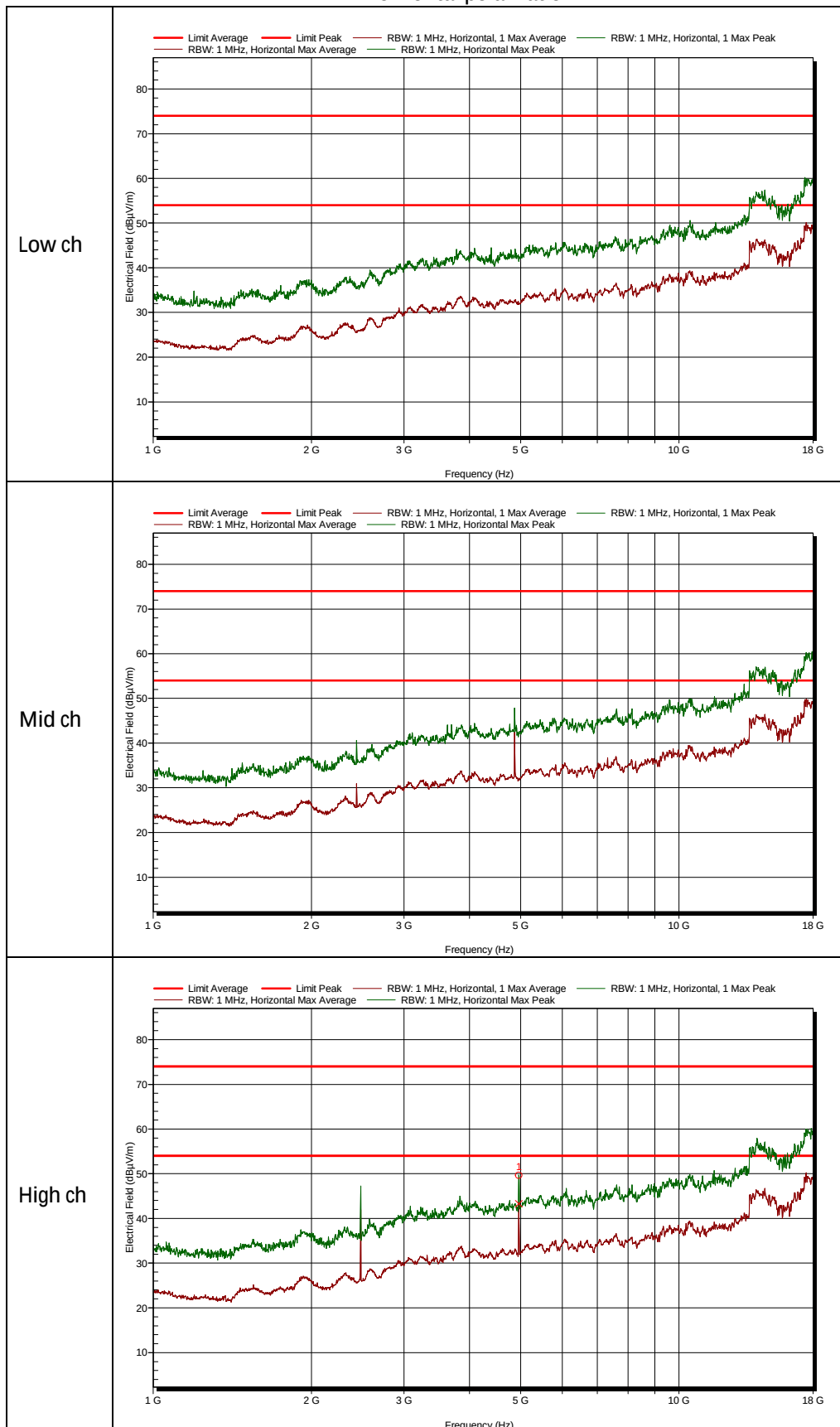
| Frequency (GHz) | Polarization | Height (m) | Peak (dB $\mu$ V/m) | Average (dB $\mu$ V/m) | Peak Limit (dB $\mu$ V/m) | Average Limit (dB $\mu$ V/m) | Peak Margin (dB) | Average Margin (dB) |
|-----------------|--------------|------------|---------------------|------------------------|---------------------------|------------------------------|----------------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

### Vertical polarization



1 GHz to 18 GHz

## Horizontal polarization



Measured peaks Horizontal 1 – 18 GHz High channel

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

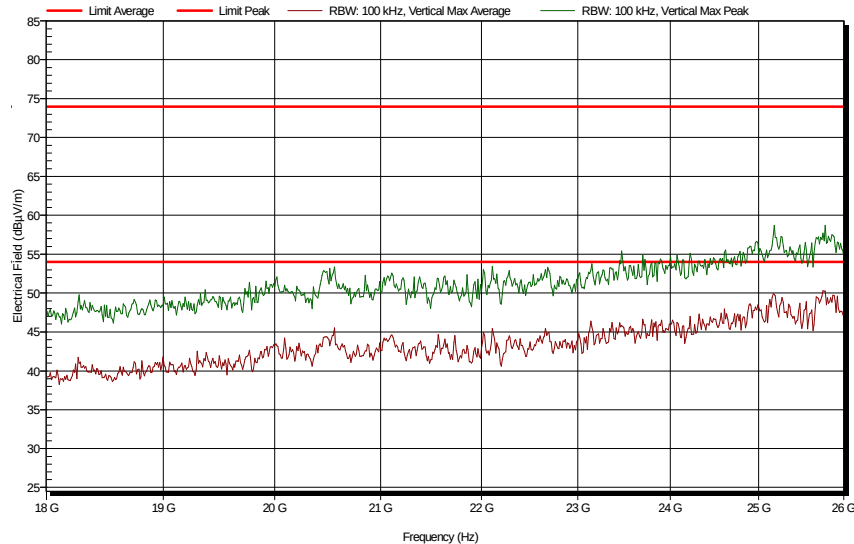
Measured peaks Vertical 1 – 18 GHz High channel

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

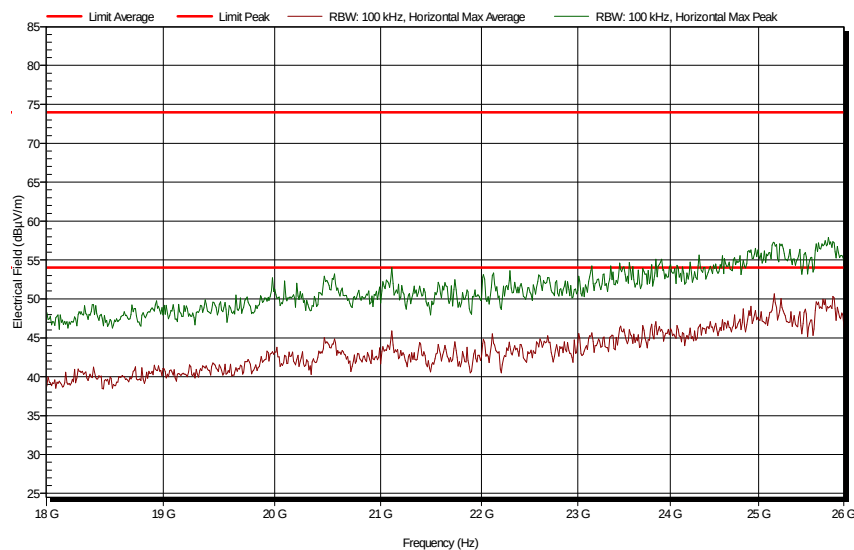
18 GHz to 26.5 GHz

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

#### Vertical polarization, Bluetooth EDR, 3-DH5



#### Horizontal polarization, Bluetooth EDR, 3-DH5



### 3.5.7 Measurement Uncertainty

#### Measurement uncertainty Radiated emissions below 1 GHz

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

#### Measurement uncertainty Radiated emissions above 1 GHz

|                 |               |
|-----------------|---------------|
| 1000- 18000 MHz | + 5.7/- 5.7dB |
|-----------------|---------------|