

**FCC and ISED Test Report for Parts
15.209, 15.207,
15.109, 15.107, Spurious Emissions only
and RSS Gen
Spurious Emissions and Occupied bandwidth**

Product name : Deeper Smart Sonar CHIRP+
Applicant : Deeper UAB
FCC ID : 2AHKO-PRO
ISED ID : 21307-PRO

Test report No. : 190300933 002 Ver 1.00

Laboratory information

Accreditation

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

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

Telefication is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

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

Telefication is a registered Conformity Assessment body (CAB) under the Japan-EC MRA (Agreement on Mutual Recognition between Japan and the European Community). The registration number is: 201.

Documentation

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

Testing Location

| | |
|---------------------------|---|
| Test Site | Telefication BV |
| Test Site location | Edisonstraat 12a 6902 PK Zevenaar The Netherlands Tel. +31889983600 Fax. +31316583189 |
| Test Site FCC | NL0001 |

Revision History

| Version | Date | Remarks | By |
|---------|------------|-----------------|-----|
| v0.50 | 08-10-2019 | First draft | RvB |
| v1.00 | 19-11-2019 | Release version | RvB |
| | | | |

Table of Contents

| | |
|--|-----------|
| Revision History | 2 |
| Summary of Test results | 5 |
| 1 General Description | 6 |
| 1.1 Manufacturer | 6 |
| 1.2 Tested Equipment Under Test (EUT) | 6 |
| 1.3 Product specifications of Equipment under test | 7 |
| 1.4 Modification of the Equipment Under Test (EUT) | 7 |
| 1.5 Environmental conditions | 7 |
| 1.6 Measurement standards | 7 |
| 1.7 Applicable standards | 7 |
| 1.8 Observation and remarks | 8 |
| 1.9 Conclusions | 9 |
| 2 Test configuration of the Equipment Under Test | 10 |
| 2.1 Test mode | 10 |
| 2.2 Test setups | 10 |
| 2.3 Equipment used in the test configuration | 11 |
| 3 Test results | 12 |
| 3.1 Radiated spurious emissions | 12 |
| 3.1.1 Limit | 12 |
| 3.1.2 Measurement instruments | 12 |
| 3.1.3 Test setup | 12 |
| 3.1.4 Test procedure | 12 |
| 3.1.5 Measurement Uncertainty | 12 |
| 3.1.6 Notes | 12 |
| 3.1.7 Plots of the Radiated Spurious Emissions Measurement | 13 |
| 3.2 Conducted emissions | 19 |
| 3.2.1 Limit | 19 |
| 3.2.2 Measurement instruments | 19 |
| 3.2.3 Test setup | 19 |
| 3.2.4 Test procedure | 19 |
| 3.2.5 Test results and plots of the AC mains conducted measurement | 19 |
| 3.2.6 Measurement uncertainty | 19 |
| 3.2.7 Plots of the AC mains conducted spurious measurement | 20 |
| 3.3 99% Occupied Bandwidth | 21 |
| 3.3.1 Limit | 21 |
| 3.3.2 Measurement instruments | 21 |
| 3.3.3 Test setup | 21 |

| | | |
|-------|--|----|
| 3.3.4 | Test procedure..... | 21 |
| 3.3.5 | Test results of the 99% occupied bandwidth measurement | 21 |
| 3.3.6 | Plots of the 99% Occupied Bandwidth Measurement | 22 |

Summary of Test results

| FCC | ISED | Description | Section in report | Verdict |
|------------|-------------|--|-------------------|---------|
| 15.109 (b) | RSS-Gen 8.9 | Radiated spurious emissions | 3.1 | Pass |
| 15.107 (b) | RSS-Gen 8.8 | Conducted spurious emissions on AC mains | 3.2 | Pass |
| 15.209 (a) | RSS-Gen 8.9 | Radiated spurious emissions | 3.1 | Pass |
| 15.207 (c) | RSS-Gen 8.8 | Conducted spurious emissions on AC mains | 3.2 | Pass |
| -- | RSS-Gen 6.7 | 99% Bandwidth | 3.3 | Pass |

1 General Description

Client name: Deeper UAB
Address Antakalnio str. 17, Vilnius, Lithuania
Zip code: LT-10312
Telephone: +37065657151
Contact name: J. Pileckas
E-mail: Julius.pileckas@deeper.eu

1.1 Manufacturer

Manufacturer name: Deeper UAB
Address: Antakalnio str. 17, Vilnius, Lithuania
Zip code: LT-10312
Telephone: +37065657151
Contact name: J. Pileckas
E-mail: Julius.pileckas@deeper.eu

1.2 Tested Equipment Under Test (EUT)

Product name: Deeper Smart Sonar CHIRP+
Brand name: Deeper Smart
FCC ID: 2AHKO-PRO
IC ID: 21307-PRO
Product type: Wireless Smart Sonar
Model(s): See chapter 1.8 "observations and remarks"
Software version: v1.1
Hardware version: v.3
Date of receipt 02-06-2019
Tests started: 16-08-2019
Testing ended: 19-08-2019

1.3 Product specifications of Equipment under test

| | |
|-----------------------------|-------------------------------|
| TX Frequencies: | 2412 – 2462 MHz |
| RX frequencies: | 2412 – 2462 MHz |
| Type of modulation: | According to IEEE 802.11b/g/n |
| Antenna type | Omnidirectional Antenna |
| Antenna gain | -2.3 dBi at 2.4 GHz |
| Communication Method | Duplex |
| Power source | Lithium battery |
| Emission designator | 22M0G1D |

1.4 Modification of the Equipment Under Test (EUT)

The applicant implemented some changes to the product tested in Telefication test report 160200396 300. The following changes were made:

- new MCU,
- different battery,
- battery charge IC, connector and inductor,
- boost voltage regulator IC and inductor,
- some components case changed (i.e. 0201 instead of 0402)
- PCB circuit design changed (except for RF part)

As the RF section of the PCB has not changed, only spurious emission tests are performed.

1.5 Environmental conditions

| | | |
|----------------------------|------------|------------|
| Test date | 16-08-2019 | 19-08-2019 |
| Ambient temperature | 24.9 °C | 23.8 °C |
| Humidity | 49.6 % | 49.8 % |

1.6 Measurement standards

- ANSI C63.4:2014
- ANSI C63.10:2013
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05

1.7 Applicable standards

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

- FCC Part 15 Subpart B §15.109 ,15.107
- FCC Part 15 Subpart C §15.209, 15.207
- RSS-Gen Issue 5

1.8 Observation and remarks

Model info:

| Main/Variant | Type designation | Trademark | Description | Hardware version | Software version |
|-----------------|------------------|-----------|-------------|------------------|------------------|
| Main | DP1H10S10 | Deeper | Pro+ | H12 | v.1.0 |
| Variant(tested) | DP3H10S10 | Deeper | CHIRP+ | v.3 | v.1.1 |
| Variant | DP3H20S10 | Deeper | CHIRP+ | v.3 | v.1.1 |
| Variant | DP3H30S10 | Deeper | CHIRP | v.3 | v.1.1 |
| Variant | DP3H40S10 | Deeper | CHIRP | v.3 | v.1.1 |

1.9 Conclusions

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

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

All conducted tests are performed by:

Name : ing. R. van Barneveld

Review of test methods and report by:

Name : P. van Wanrooij, BASc

The above conclusions have been verified by the following signatory:

Date : 22-11-2019

Name : ing K.A. Roes

Function : Coordinator Wireless & EMC

Signature :

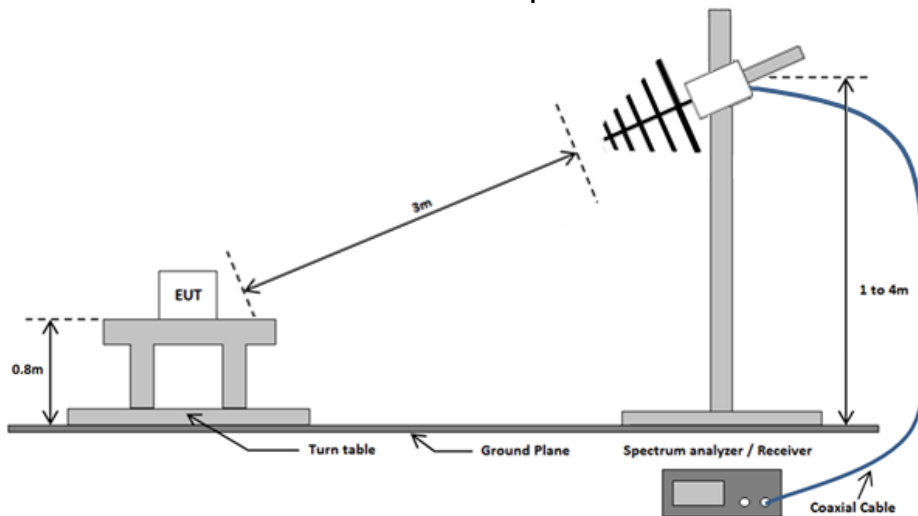
2 Test configuration of the Equipment Under Test

2.1 Test mode

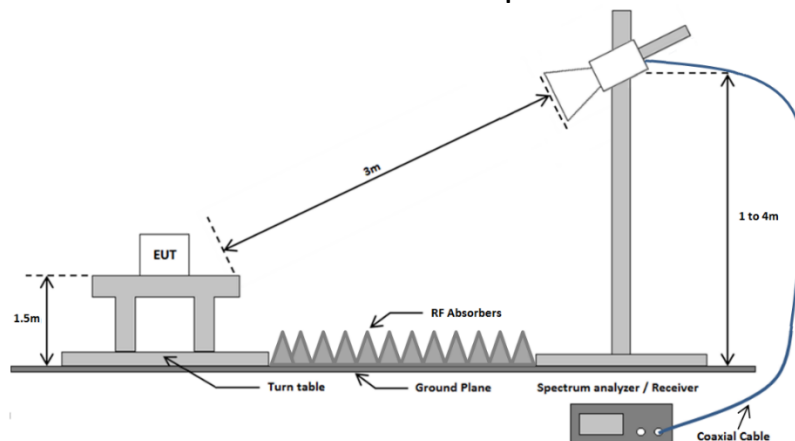
The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT into different test channels.

2.2 Test setups

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz

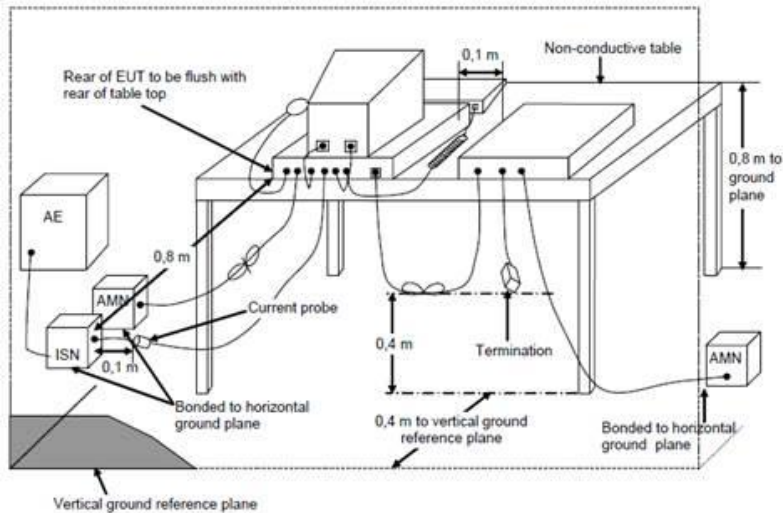


Conducted test setup



Conducted emissions test setup

Emissions test at AC mains



2.3 Equipment used in the test configuration

| Description | Manufacturer | Model | ID | Used at Par. |
|--------------------------------|---------------------------------|------------|----------|--------------|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | TE11125 | 3.1 |
| Spectrum Analyzer | Rohde & Schwarz | ESR7 | TE01220 | 3.1 – 3.2 |
| Software | D.A.R.E Instruments | Radimation | 2019.1.8 | 3.1 |
| Biconilog Antenna | Chase | CBL6112A | TE00967 | 3.1 |
| Horn Antenna | EMCO The Electro – Mechanics Co | 3115 | TE00531 | 3.1 |
| SAC Chamber | Comtest Engineering BV | - | TE00861 | 3.2 |
| Artificial Mains Network (AMN) | Rohde & Schwarz | ESH3-Z5 | TE00208 | 3.2 |
| Pulse limiter | Rohde & Schwarz | ESH3-Z2 | TE00756 | 3.2 |
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | TE01269 | 3.3 |

3 Test results

3.1 Radiated spurious emissions

3.1.1 Limit

15.209 (b) and 15.109

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

3.1.2 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

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 V05.

IRN 026 - Radiated electrical disturbance (V per m) Method 1 – 30 MHz – 1 GHz in SAR.

IRN 026 - Radiated electrical disturbance (V per m) Method 2 – 1 - 18 GHz in SAR.

IRN 026 - Radiated electrical disturbance (V per m) Method 3 – 18 - 26.5 GHz in SAR.

IRN 027 - Radiated magnetic disturbance Method 1 – Loop antenna.

3.1.5 Measurement Uncertainty

| Frequency range | Polarization | Uncertainty |
|-----------------|--------------|-------------------|
| 9 kHz – 30 MHz | -- | +1.5 dB, - 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 |

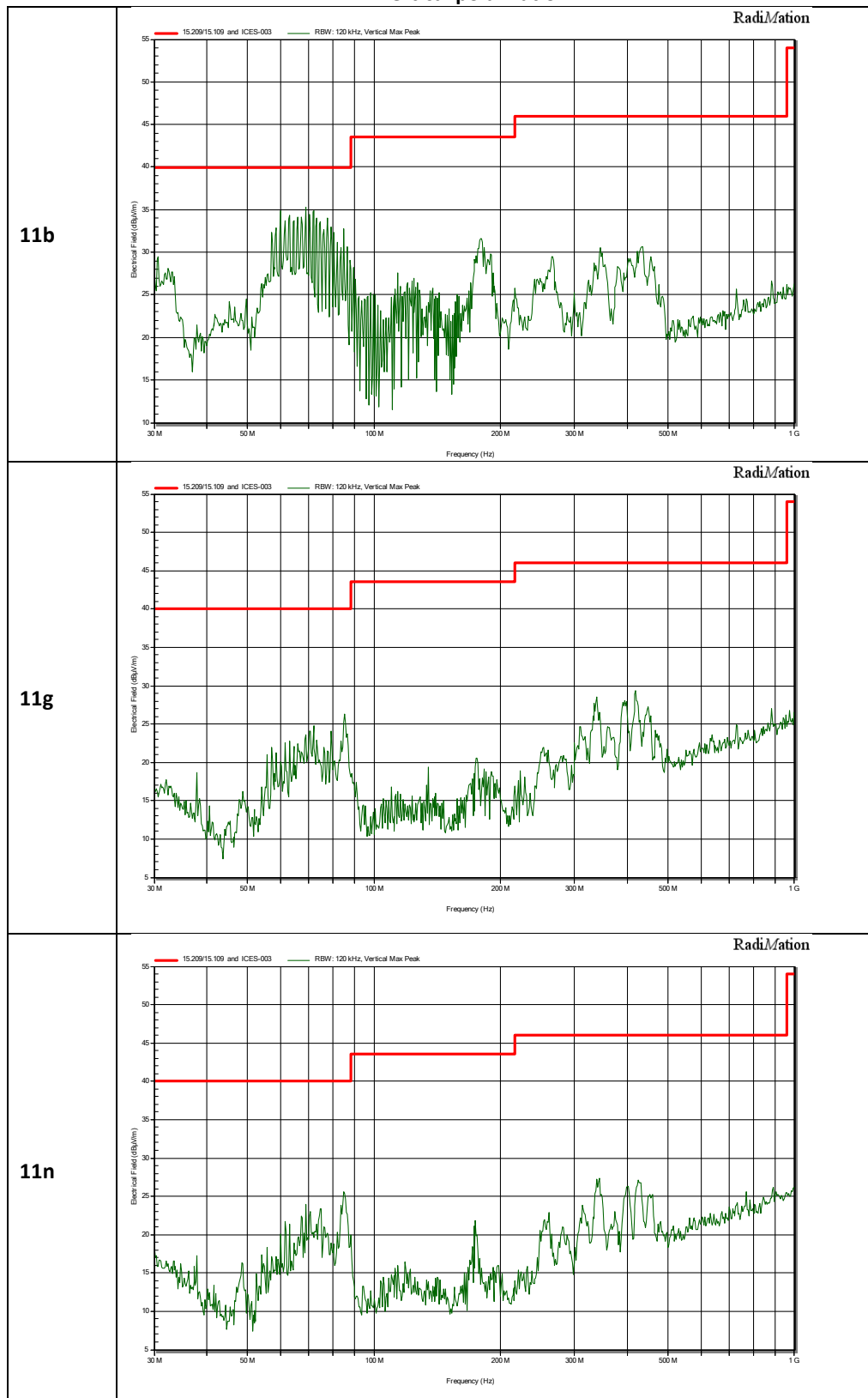
3.1.6 Notes

- In the frequency range of 1 – 26 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.
- in the frequency range of 9 kHz to 30 MHz all emissions are 20 dB below the limit and are therefore not reported.
- Tested only on the middle channel.

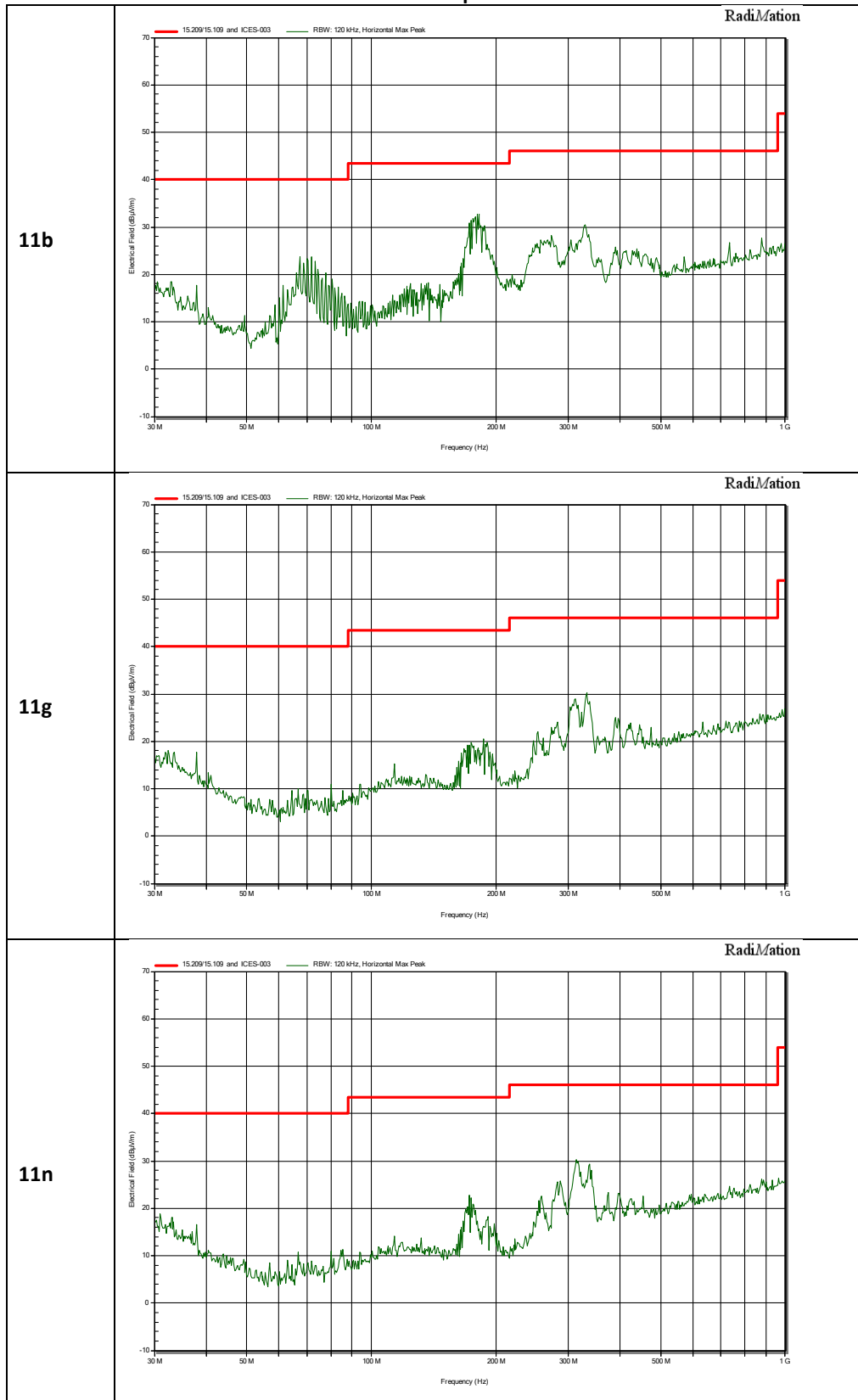
3.1.7 Plots of the Radiated Spurious Emissions Measurement

30 -1000 MHz

Vertical polarization

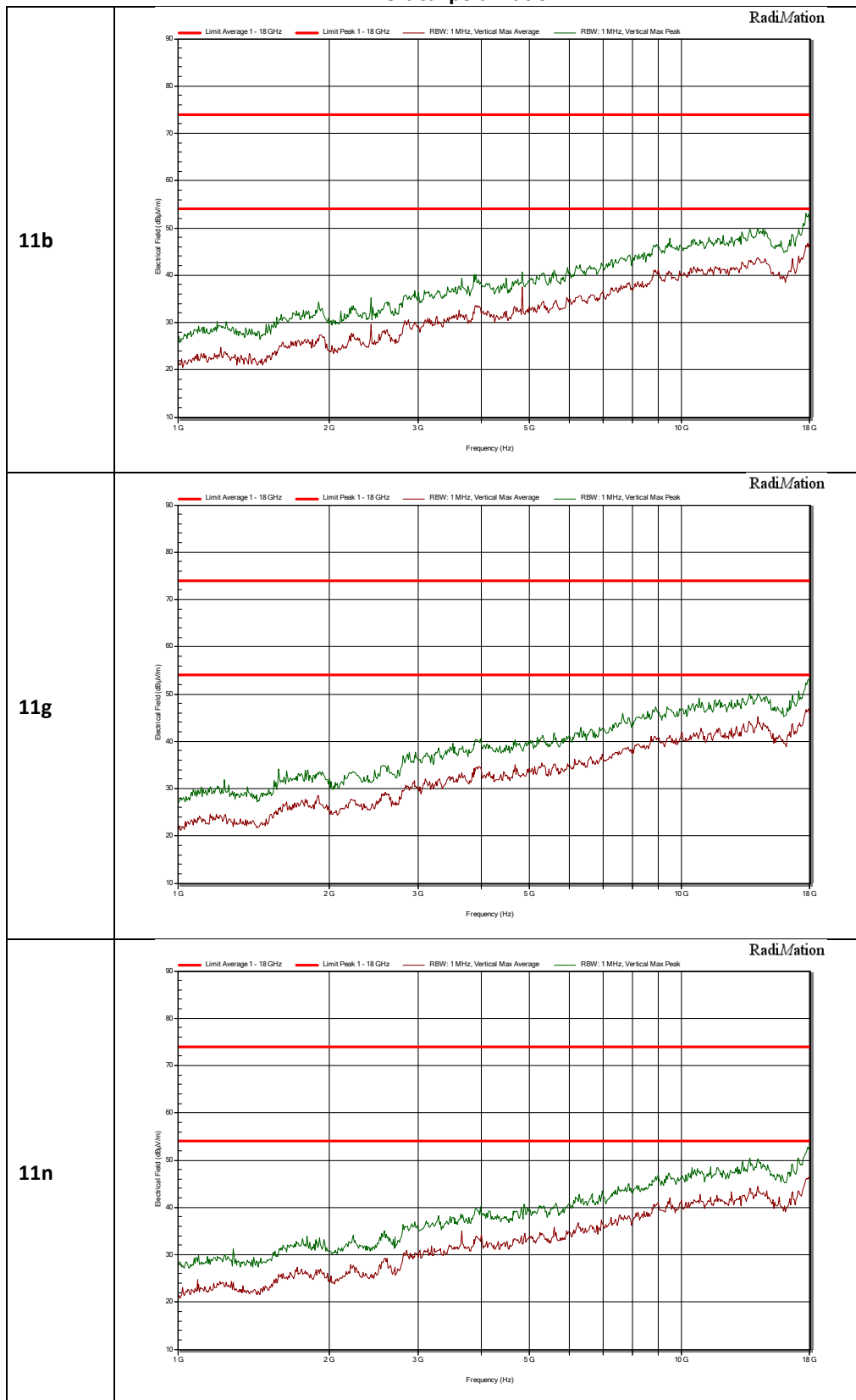


Horizontal polarization

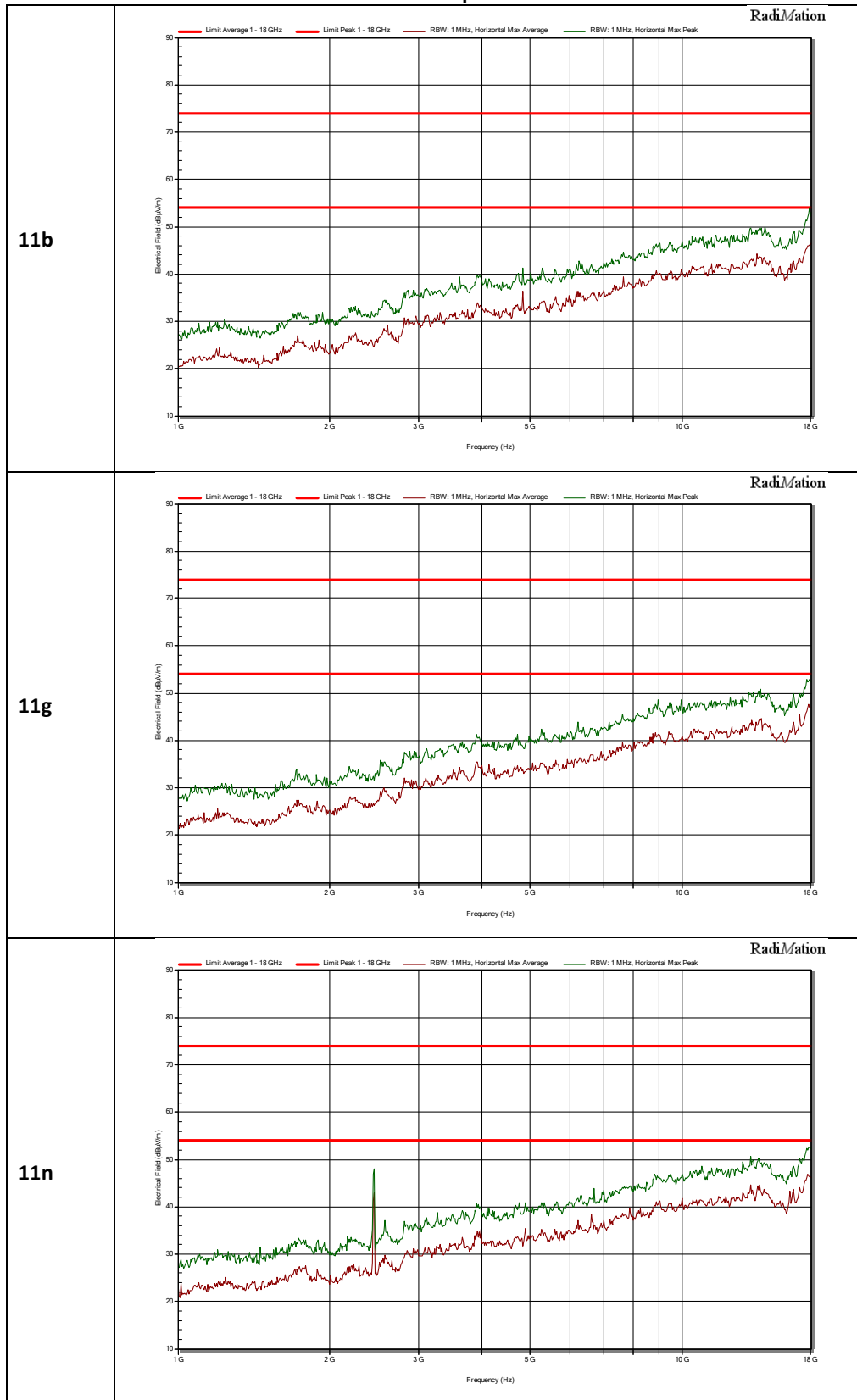


1 – 18 GHz

Vertical polarization

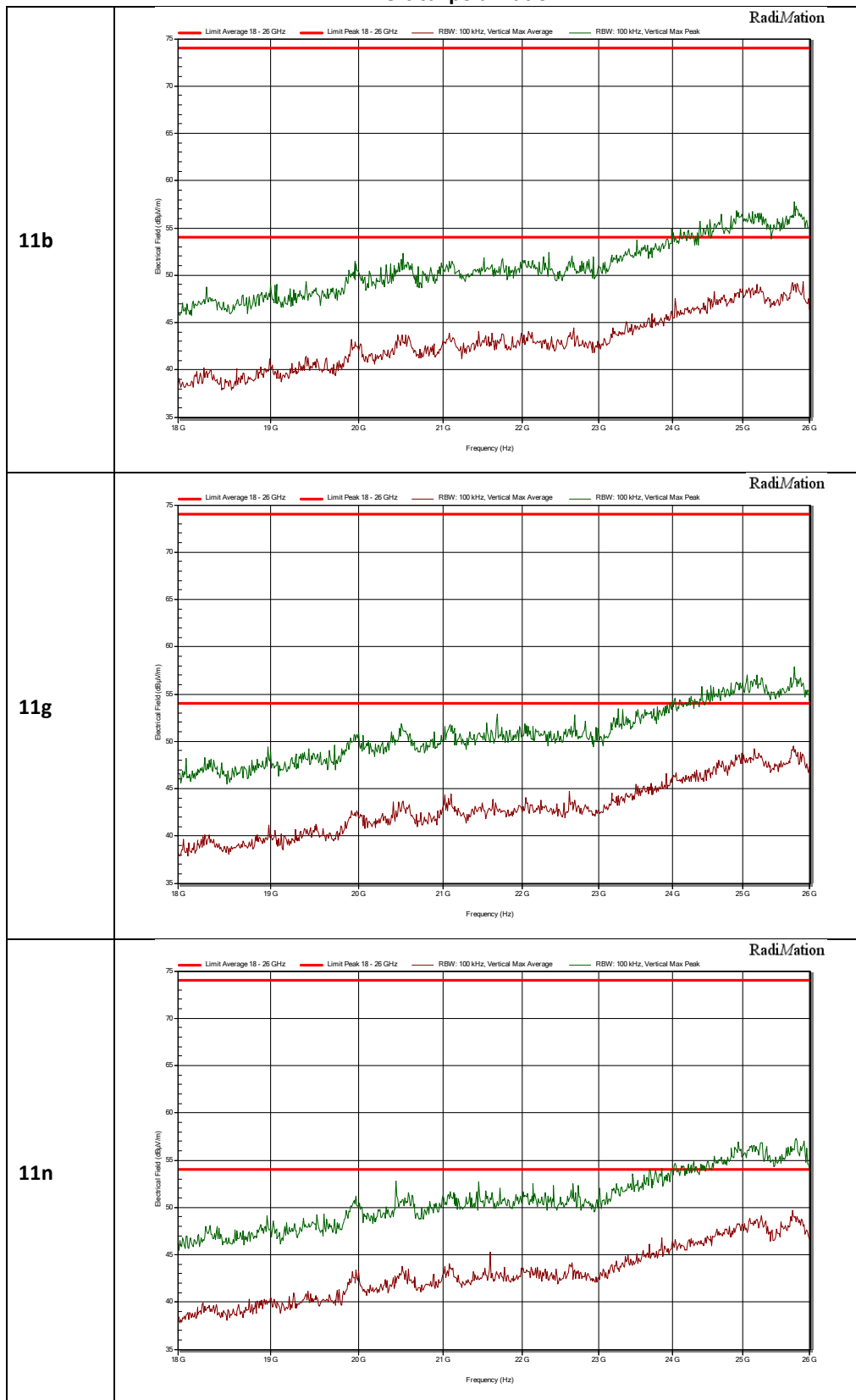


Horizontal polarization

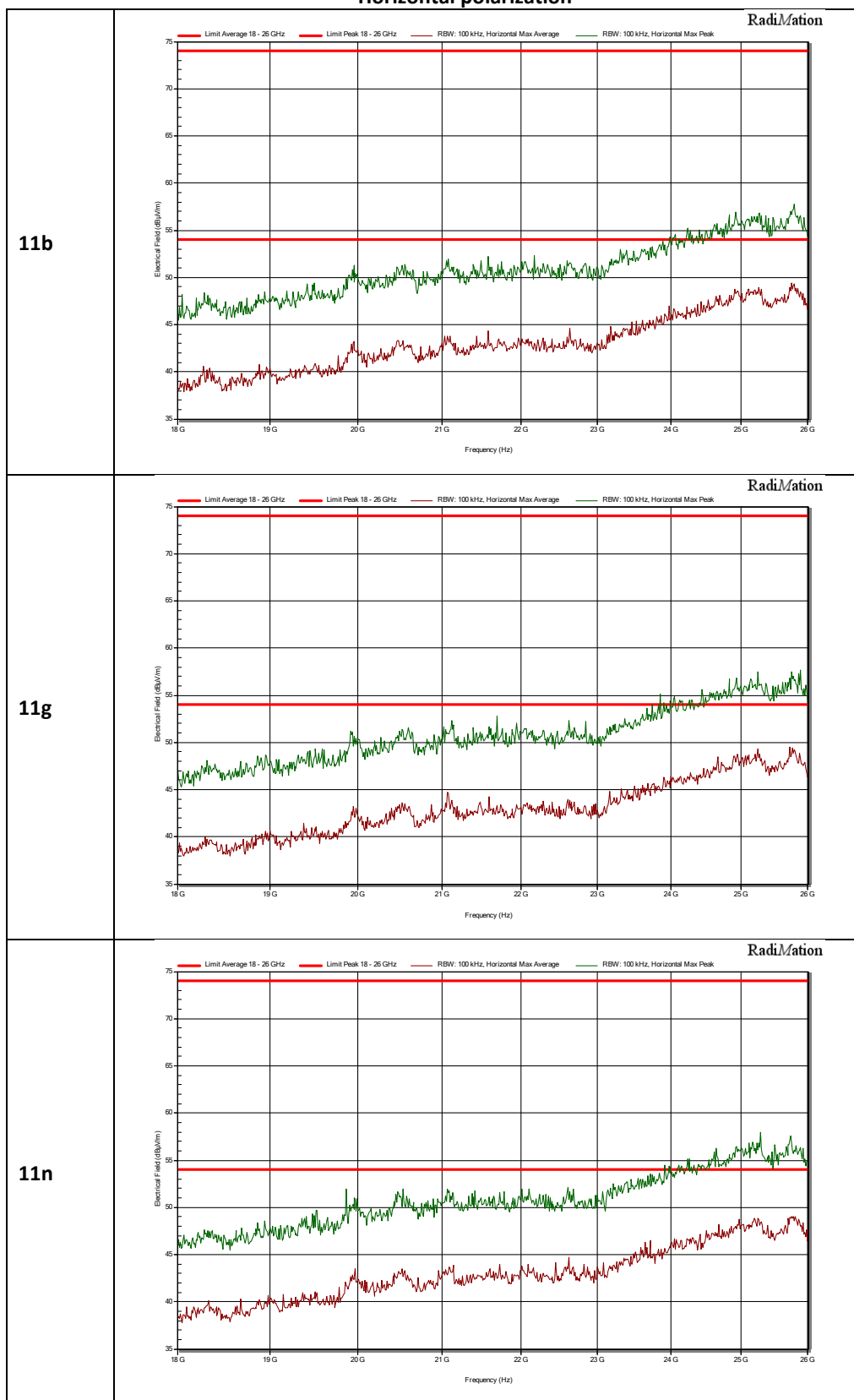


18 – 26.5 GHz

Vertical polarization



Horizontal polarization



3.2 Conducted emissions

3.2.1 Limit

According to 15.207 (c) and 15.107.

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.

| Frequency of emission (MHz) | Conducted limit (dB μ 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.

3.2.2 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 C63.4: 2014, section 13.3.
IRN 029 – Method 1.

3.2.5 Test results and plots of the AC mains conducted measurement

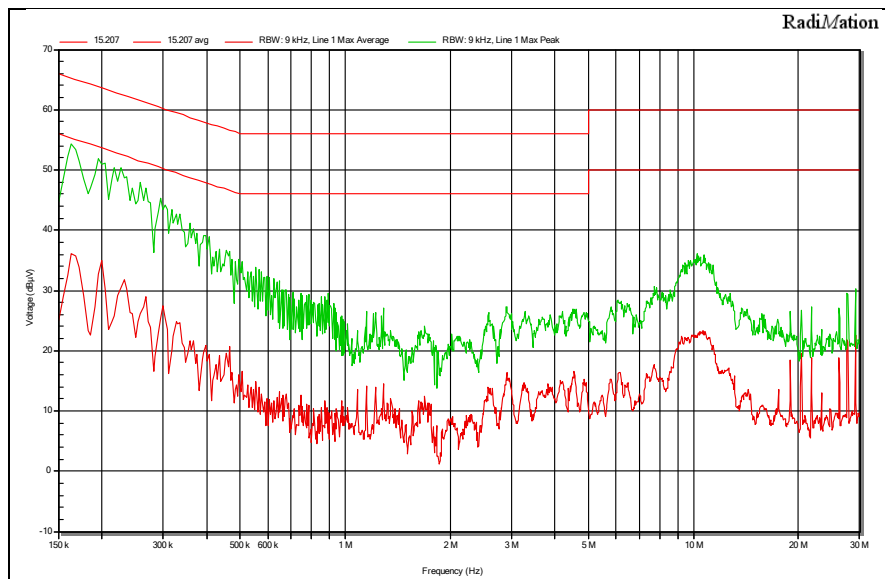
See next page.

3.2.6 Measurement uncertainty

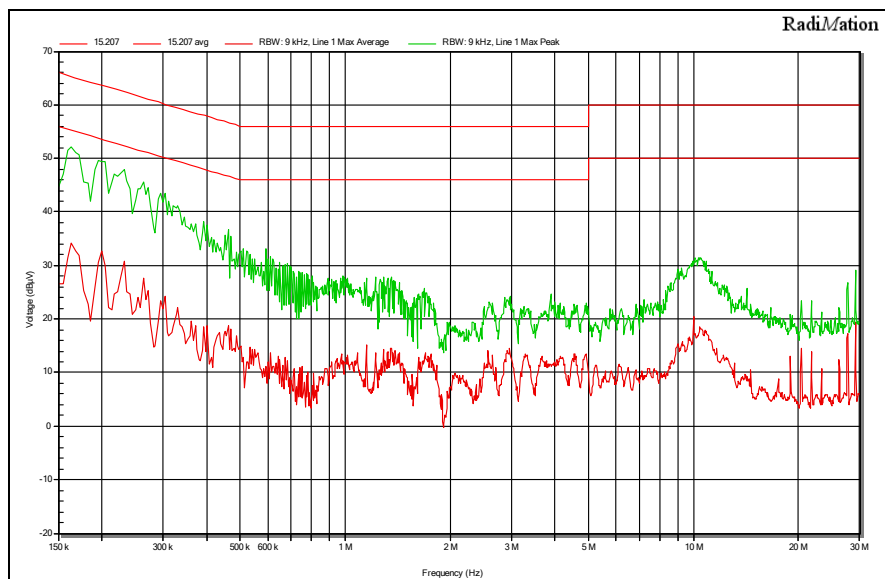
+/- 3.6 dB.

3.2.7 Plots of the AC mains conducted spurious measurement

Phase



Neutral



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 2.4 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

IRN 017 - Occupied bandwidth (Hz) Method 1 – XX % power bandwidth.

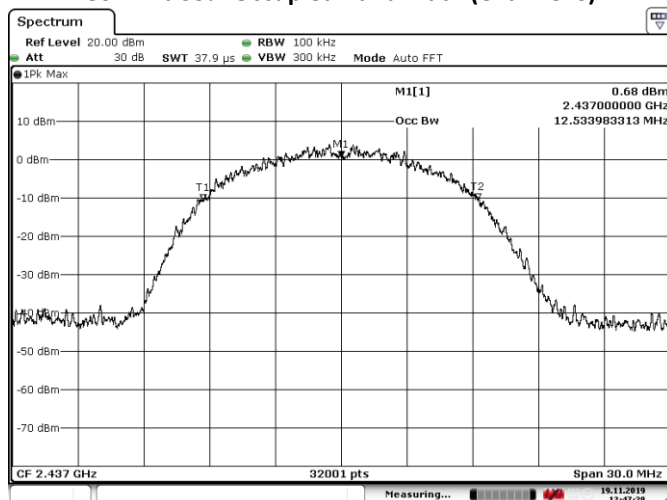
1. Set the centre frequency to the nominal EUT channel centre frequency
2. Set span = 1.5 times to 0.5 times the Occupied Bandwidth
3. Set VBW $\geq 3 \times$ RBW
4. Video averaging is not permitted. Where practical, detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

3.3.5 Test results of the 99% occupied bandwidth measurement

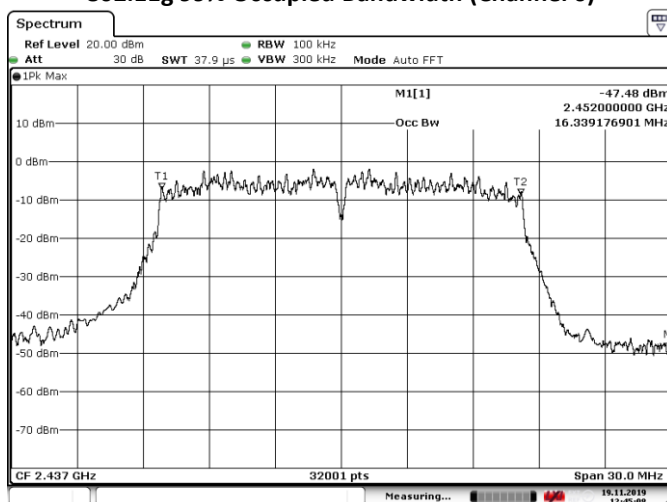
| Technology Std. | Channel | Frequency (MHz) | Data rate | 99% bandwidth (MHz) |
|-----------------|--------------|-----------------|-----------|---------------------|
| IEEE 802.11b | 6(Mid) | 2437 | 11 Mbps | 12.55 |
| IEEE 802.11g | 6(Mid) | 2437 | 54 Mbps | 16.34 |
| IEEE 802.11n | 6(Mid) | 2437 | MCS7 | 17.49 |
| Uncertainty | ± 39 kHz | | | |

3.3.6 Plots of the 99% Occupied Bandwidth Measurement

802.11b 99% Occupied Bandwidth (Channel 6)



802.11g 99% Occupied Bandwidth (Channel 6)



802.11n 99% Occupied Bandwidth (Channel 6)

