telefication bv
The Netherlands
Chamber of Commerce
51565536
www.telefication.com

# FCC Test Report for Part 15.247

# (DTS)

Product name : SmartTAG Bluetooth Low Energy

Applicant : Wistiki SAS Company

FCC ID : 2AEBR-WISTIKI-V4

Test report No. : 170901627 09 Ver 2.00

# 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. +31889983600<br>Fax. +31316583189 |
| Test Site FCC | NL0001 |

## Revision History

| Version | Date | Remarks | By |
|---|---|---|---|
| v0.50 | 31-05-2018 | First draft | PS |
| v1.00 | 02-08-2018 | Initial release | PS |
| v2.00 | 29-10-2018 | Added sample calculation and corrected FCC ID. | PS |
| | | | |

# Table of Contents

## Summary of Test results

| FCC | Description | Section in report | Verdict |
|---|---|---|---|
| 15.247(a) | 6dB Bandwidth | 3.1 | Pass |
| 15.247(b) | Peak output power | 3.2 | Pass |
| 15.247(e) | Power spectral density | 3.3 | Pass |
| 15.247(d) | Band edge emissions | -- | NA Note |
| 15.247(d) | Conducted spurious emissions | 3.4 | Pass |
| 15.209 (a) | Radiated Spurious emissions (incl. restricted bands) (cabinet radiation) | 3.5 | Pass |

Note; Not applicable, since the DTS bandwidth edges do not fall within 2 MHz of the authorized band edges.

# 1 General Description

## 1.1 Applicant

| | |
|---|---|
| Client name: | Wistiki SaS Company |
| Address | rue du Faubourg Pioissonnière, Paris, France |
| Zip code: | 75010 |
| Telephone: | +33 650102272 |
| Contact name: | H. Lussato |
| E-mail: | hugo.lussato@wistiki.com |

## 1.2 Manufacturer

| | |
|---|---|
| Manufacturer name: | Robert Bosch France SAS |
| Address: | 15, rue Charles de Coulomb, Mondeville, France |
| Zip code: | 14125 |
| Contact name:: | J. Poux |
| E-mail: | Joel.Poux@fr.bosch.com |

## 1.3 Tested Equipment Under Test (EUT)

| | |
|---|---|
| Product name: | SmartTAG Bluetooth Low Energy |
| Brand name: | WISTIKI |
| Product type: | 2.4 GHz data transmission equipment |
| FCC ID: | 2AEBR-WISTIKI-V4 |
| Model(s): | HOPLA |
| Software version: | 1.1.2 |
| Hardware version: | BSX0604-1 BU136v3 |
| Date of receipt | 19-03-2018 |
| Tests started: | 24-05-2018 |
| Testing ended: | 01-06-2018 |

## 1.4 Product specifications of Equipment under test

| | |
|---|---|
| Tx Frequency range (MHz): | 2402 – 2480 |
| Rx frequency range (MHz): | 2402 – 2480 |
| Maximum output power to antenna (dBm): | 0 |
| Antenna type : | PCB printed (meander) |
| Antenna gain (dBi): | 2 |
| Type of modulation: | GFSK |

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

None.

## 1.6 Observations and remarks

The tested sample was modified to include a temporary antenna connector.

## 1.7 Environmental conditions

| | | |
|---|---|---|
| Test date | 24-05-2018 | 01-06-2018 |
| Ambient temperature | 25.0 °C | 27.5 °C |
| Humidity | 44.6 % RH | 51.5 % RH |

## 1.8 Measurement Standards

- FCC KDB Publication No. 558074 D01DTS Meas. Guidance V04
- 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 standard(s):

- FCC Part 15 Subpart C §15.247

## 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. P.A. Suringa

Review of test methods and report by:

Name : ing R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 29-10-2018

Name : ing. K.A. Roes

Function : Coordinator Radio Laboratory

Signature :

# 2 Test configuration of the Equipment Under Test

## 2.1 Test mode

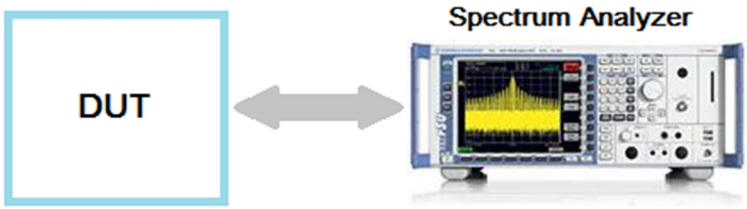
The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT into different test channels.

## 2.2 Tested channels and Data rates

| Technology | Channels | Frequency (MHz) | Data rate |
|---|---|---|---|
| Bluetooth Low Energy | 37 | 2402 | 1 Mbps |
| | 17 | 2440 | 1 Mbps |
| | 39 | 2480 | 1 Mbps |

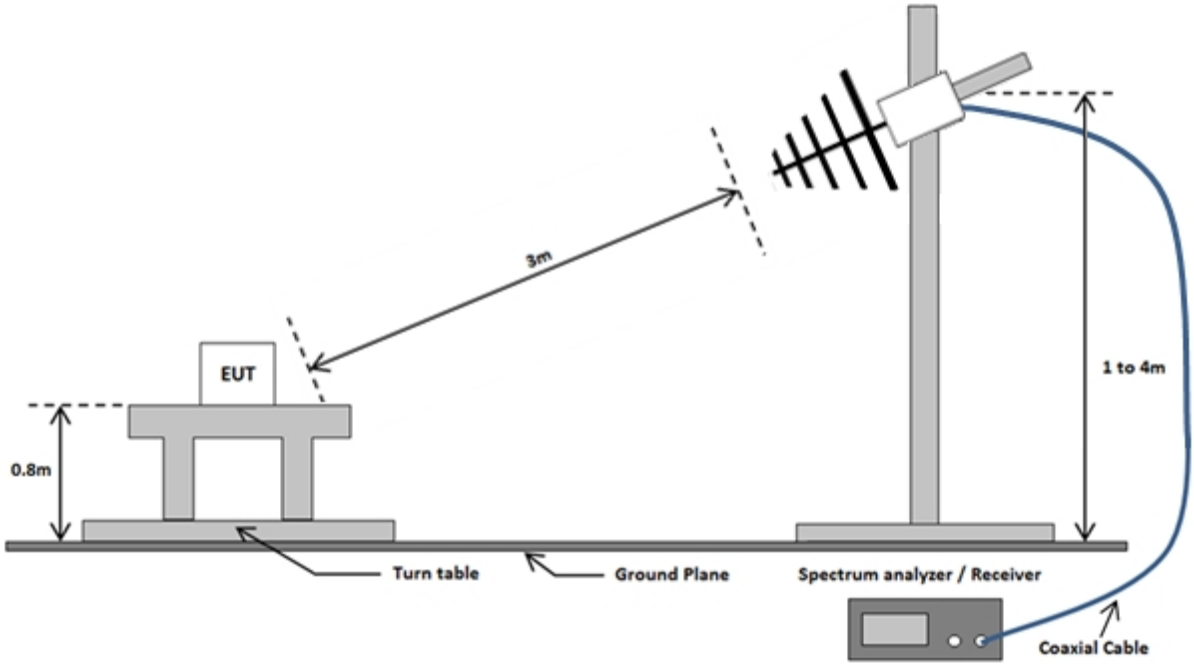
## 2.3 Conducted Test setup

*RF tests at antenna connector*

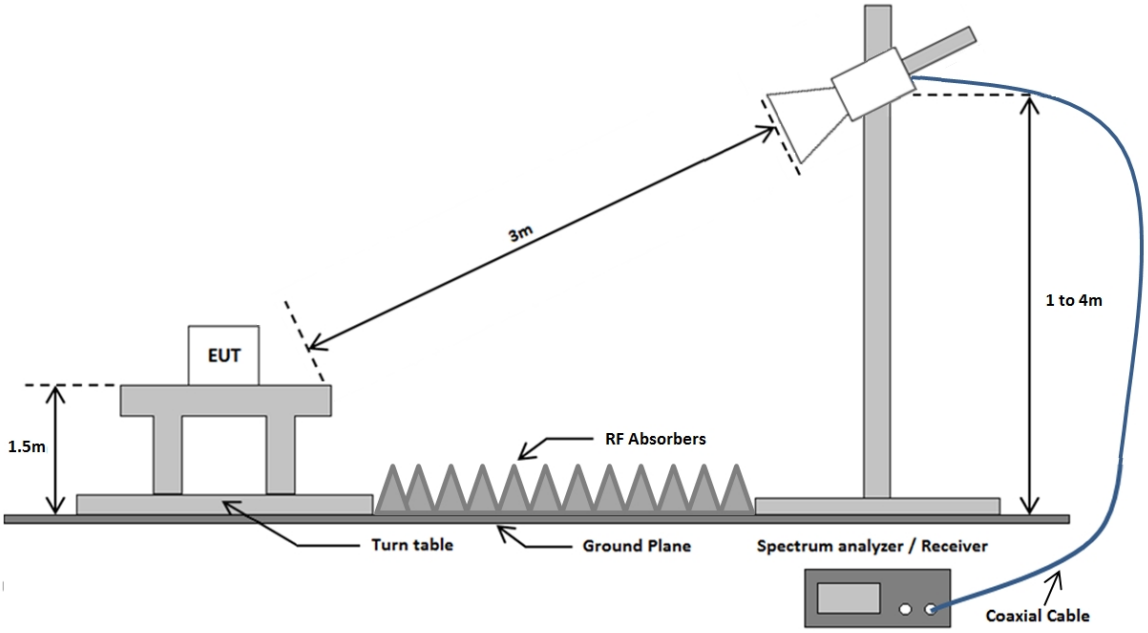


## 2.4 Radiated Test setup

Radiated emissions test setup 30 MHz - 1 GHz




Radiated emissions test setup above 1 GHz



## 2.5 Equipment used in the test configuration

| Description | Manufacturer | Model | ID | Used at Par. |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | TE11125 | 3.1, 3.4, 3.5 |
| Spectrum Analyzer | Rohde & Schwarz | ESCI | TE11128 | 3.2 |
| Biconilog Antenna | Chase | CBL6112A | TE00967 | 3.5 |
| Horn Antenna | EMCO The Electro – Mechanics Co | 3115 | TE00531 | 3.5 |
| SAC Chamber | Comtest Engineering BV | - | TE00861 | 3.5 |
| Measurement software | Dare | Radimation | Version 2016.2.8 | 3.5 |
| Pre-amplifier | Miteq | AFS42-041001800-28-10P-42 | TE11132 | 3.5 |

## 2.6 Sample calculation

Maximum Field Strength Measurement value:

| Frequency (GHz) | Polarization | Height(m) | Peak (dBµV/m) |
|---|---|---|---|
| 1.895 | Vertical | 2 | 45.7 |

The following relation applies:

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

Where:

E = Electric field strength
U = Measuring receiver voltage
AF = Antenna factor
G = Gain of the pre-amplifier
CL = Cable loss

(45.7 = 36.6 + 27.8 – 39.6 + 2.7)

# 3 Test results

## 3.1 DTS 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 2.5 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

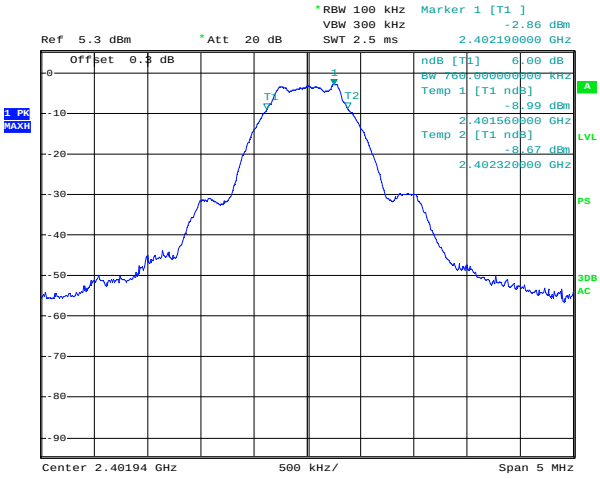
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
IRN 017_10 Occupied bandwidth (Hz) – Method 4.

### 3.1.5 Test Results of the DTS bandwidth measurement

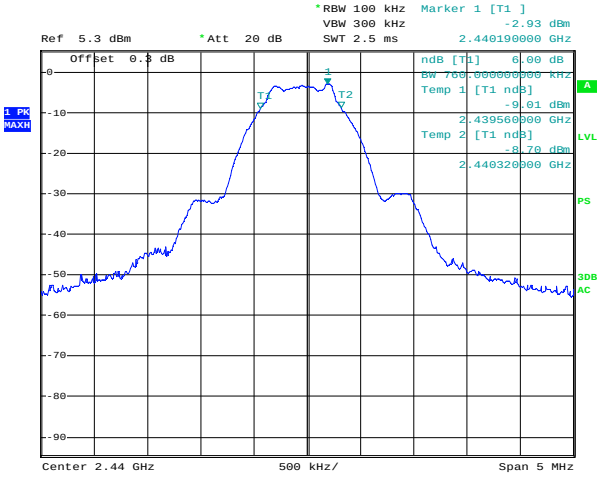
| Technology Std. | Channel | Frequency (MHz) | Data rate | DTS bandwidth (kHz) |
|---|---|---|---|---|
| Bluetooth Low Energy | 37 | 2402 | 1 Mbps | 760 |
| | 17 | 2440 | 1 Mbps | 760 |
| | 39 | 2480 | 1 Mbps | 760 |
| Uncertainty | ± 81 kHz | | | |

## 3.1.6 Plots of the DTS bandwidth Measurement

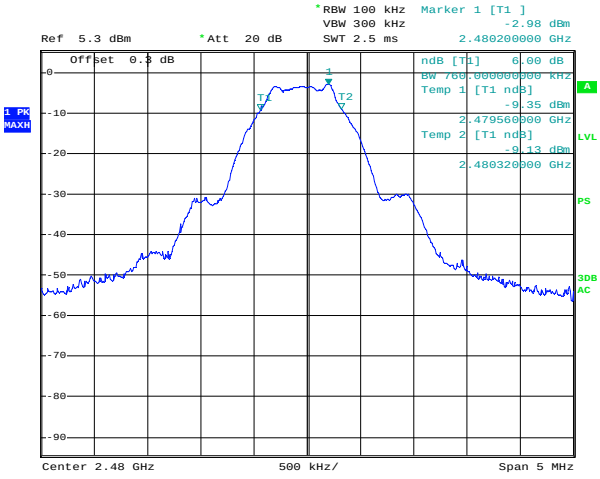
(Channel 37)




(Channel 17)




(Channel 39)



## 3.2 Peak 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 2.5 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 v04.
IRN 014_14 RF Power (W) – method 9.

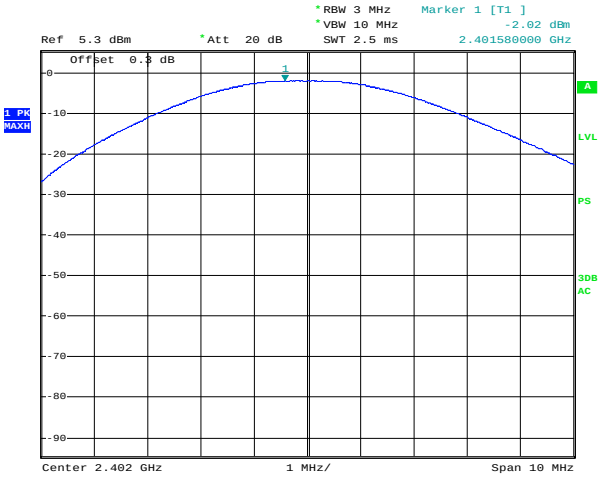
### 3.2.5 Test results of Peak Output Power Measurement

Peak method

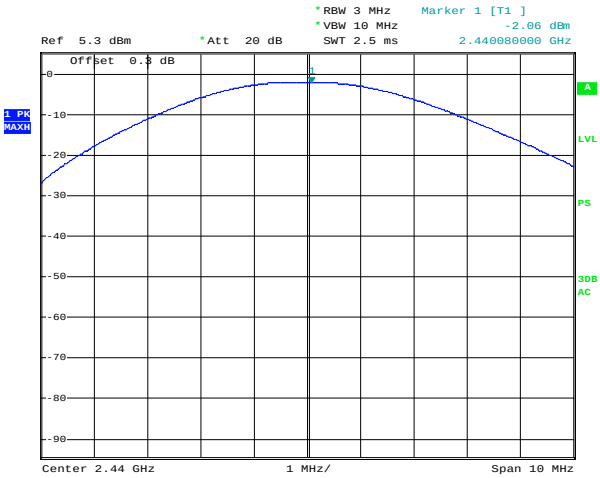
| Technology Std. | Channel | Frequency (MHz) | Data rate | Peak output power (dBm eirp) |
|---|---|---|---|---|
| Bluetooth Low Energy | 37 | 2402 | 1 Mbps | -2.02 + 2 = -0.02 |
| | 17 | 2440 | 1 Mbps | -2.06 + 2 = -0.06 |
| | 39 | 2480 | 1 Mbps | -2.09 + 2 = -0.09 |
| Uncertainty | ±0.71 dB | | | |

## 3.2.6 Plots of Output Power Measurement

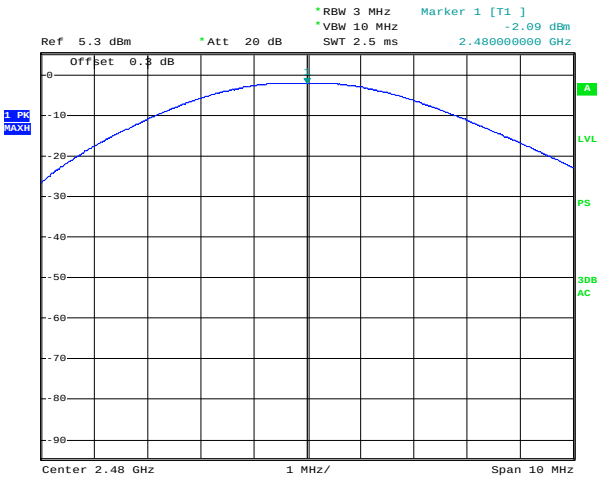
Peak Output Power (Channel 37)




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

Not applicable.

### 3.3.3 Test setup

Not applicable.

### 3.3.4 Test procedure

Not applicable.

### 3.3.5 Test results of Power Spectral Density Measurement

Since the peak output power values are below 0 dBm, the power spectral density limit is considered to be met.

## 3.4 Conducted spurious emissions at the antenna connector

### 3.4.1 Limits

In any 100 kHz bandwidth outside the operating frequency band, the RF power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either a RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.
Attenuation below the general limits specified in §15.209 (a) is not required.

### 3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 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

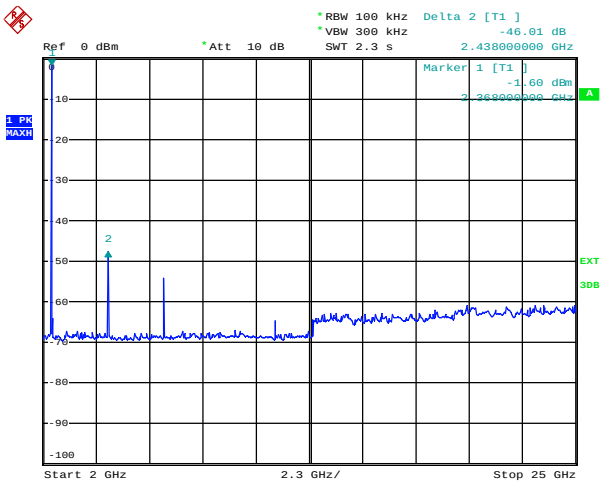
According to KDB Publication 558074 v04, section 11.0.
IRN 016_10 Spurious emission (W) – method 1.

### 3.4.5 Measurement Uncertainty

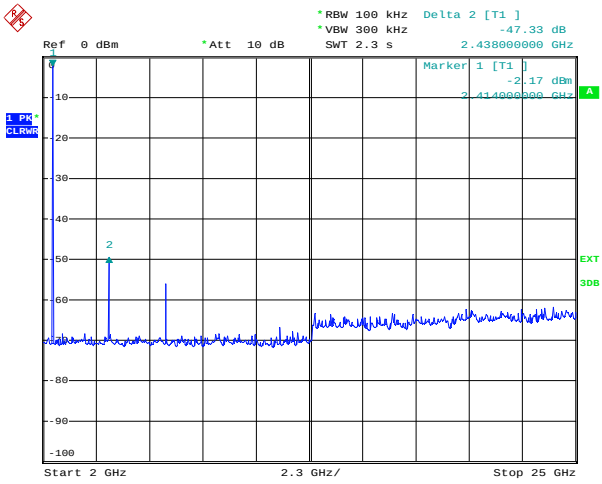
+ 1.1/ - 1.1 dB.

### 3.4.6 Plots of the conducted spurious emissions at the antenna connector

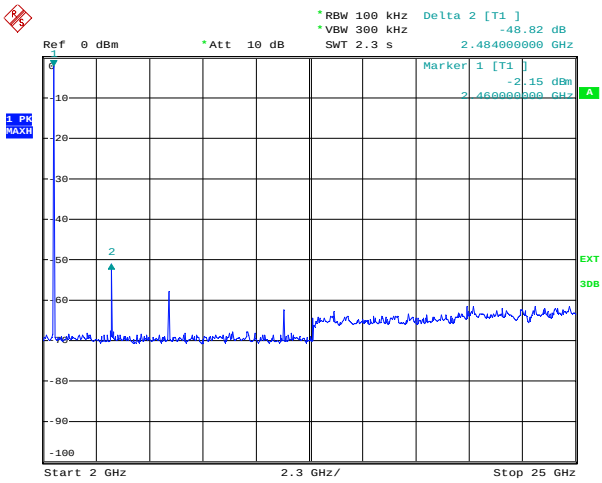
(Channel 37)




(Channel 17)




(Channel 39)



## 3.5 Radiated spurious emissions measurement (cabinet radiation) (incl. restricted band spurious emissions)

### 3.5.1 Limits

Radiated emissions must comply with the limits specified in §15.209(a) (see below).

| Frequency (MHz) | Field strength (µV/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 |

### 3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.5.3 Test setup

The test setup is as shown in chapter 2.4 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 V03r05, sections 11.3 and 12.1.
IRN 016_10 Spurious emission (W) – method 1.

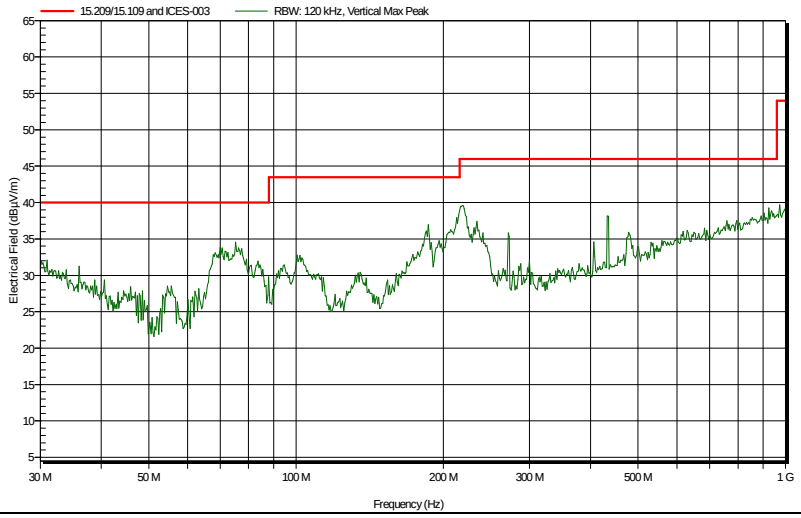
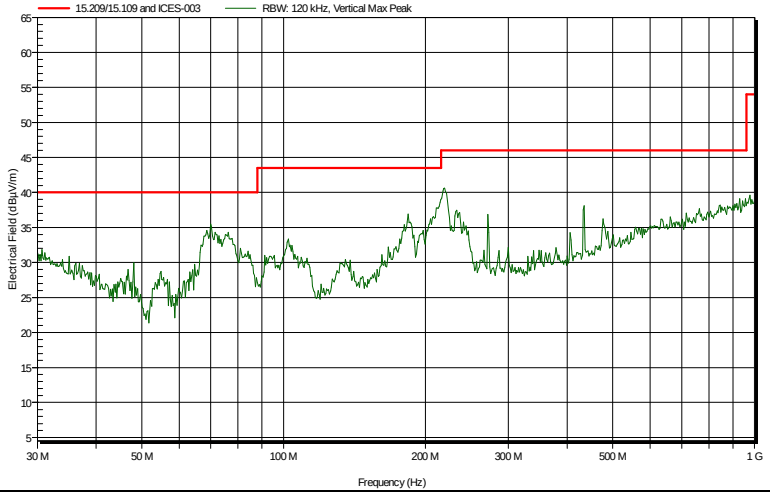
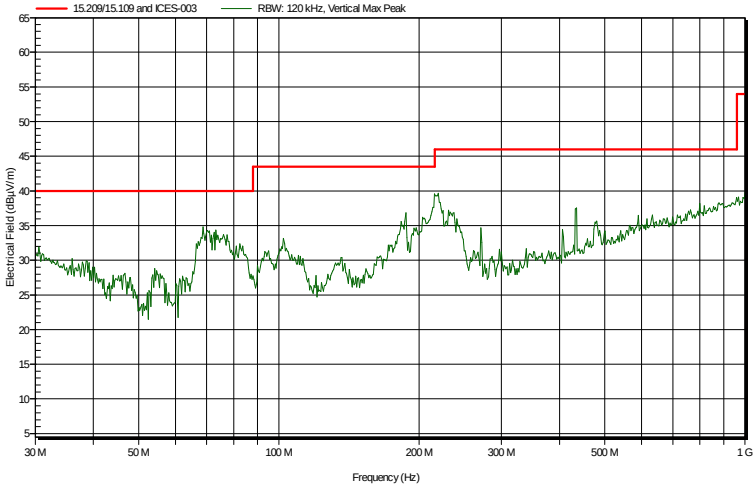
### 3.5.5 Note

- In the frequency range of 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.

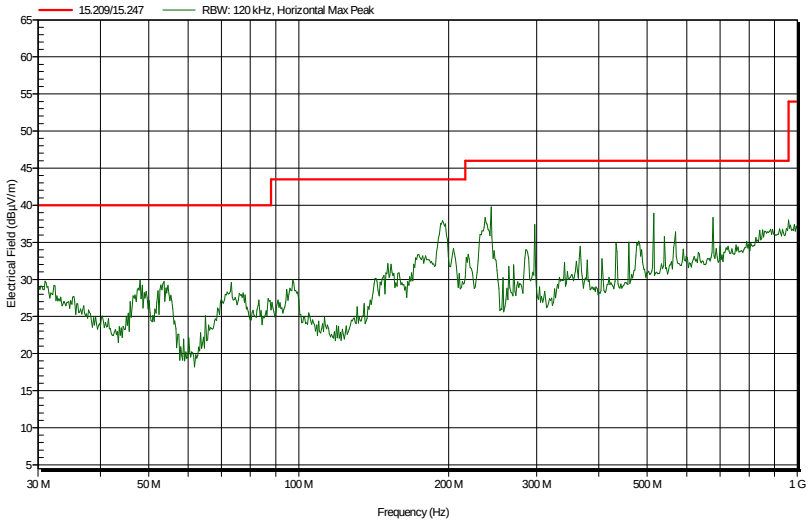
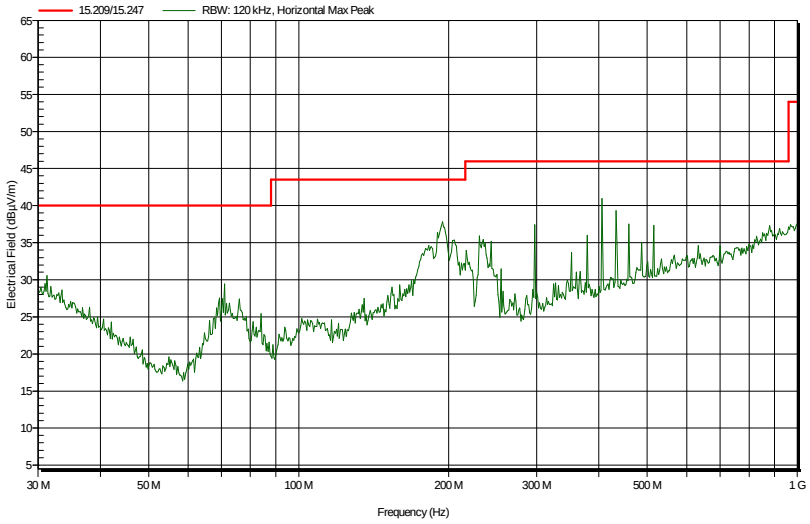
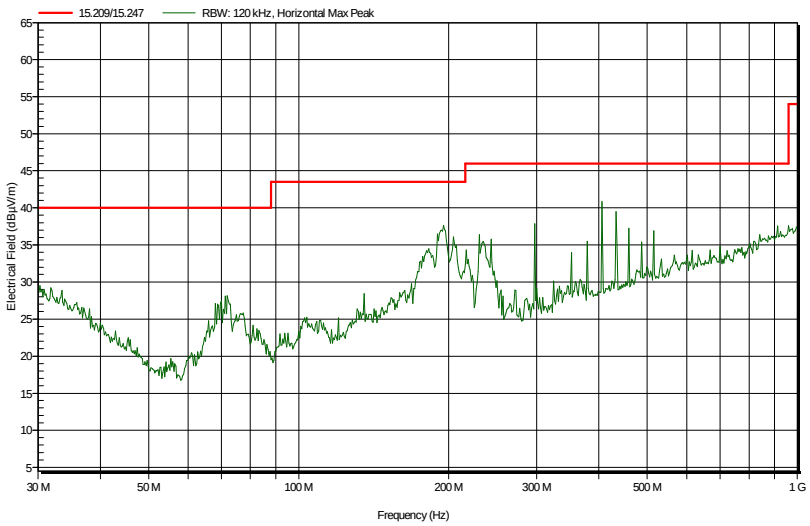
## 3.5.6 Plots of the Radiated Spurious Emissions Measurement

30 – 1000 MHz

Vertical polarization

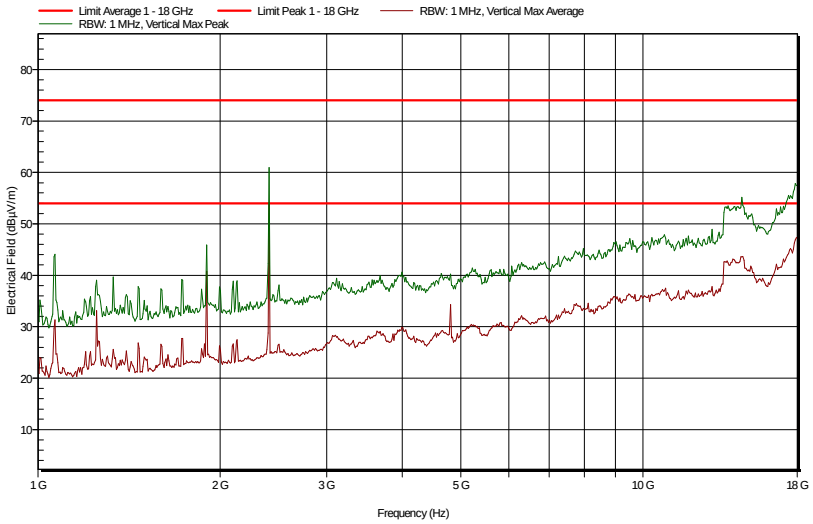
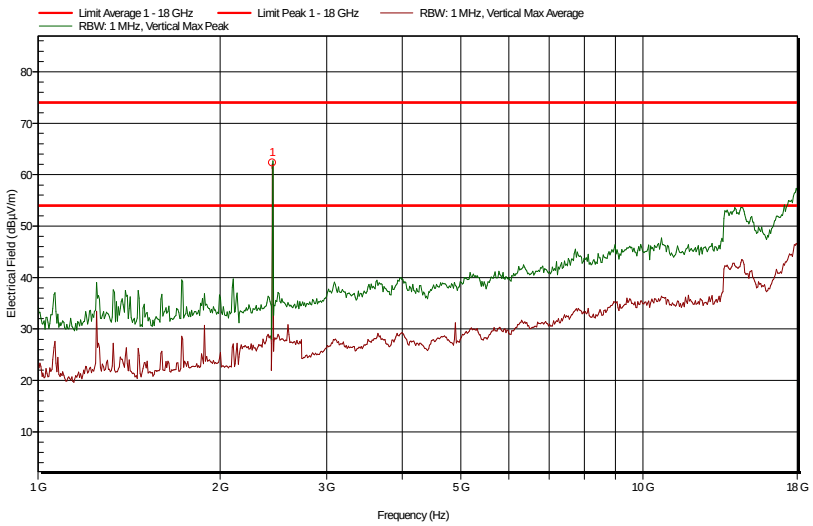
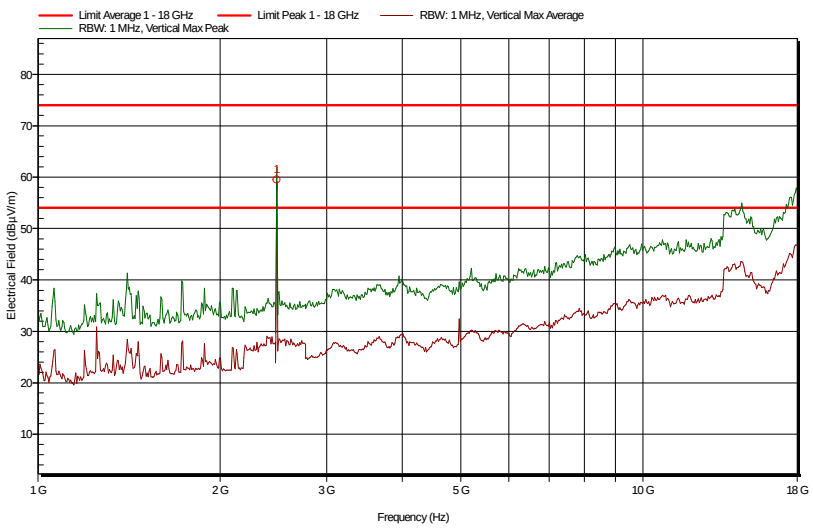
| | |
|---|---|
| Low ch |  |
| Mid ch |  |
| High ch |  |

Horizontal polarization

| | |
|---|---|
| Low ch |  |
| Mid ch |  |
| High ch |  |

1 – 18 GHz

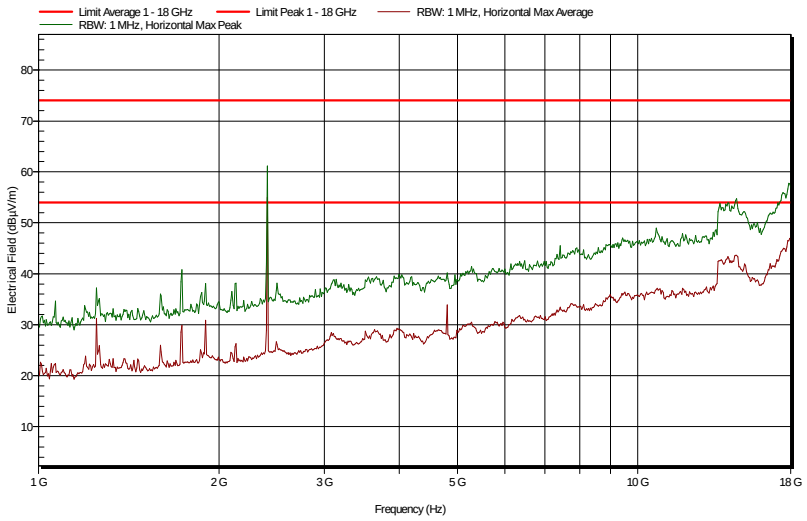
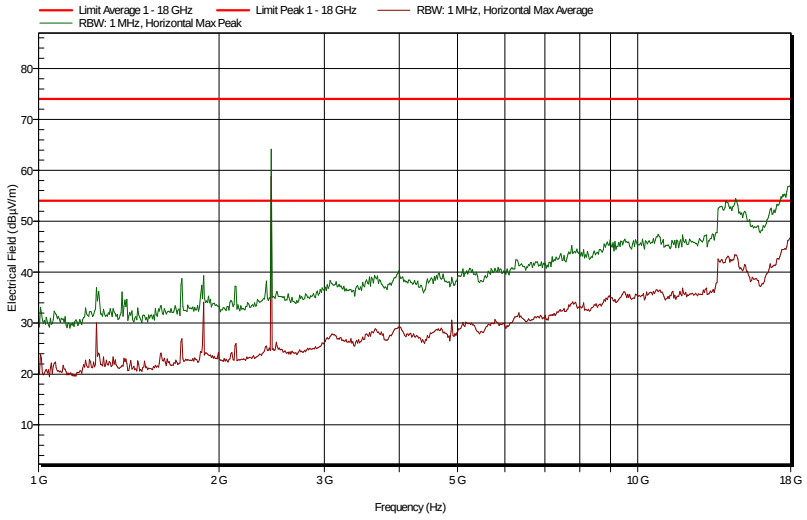
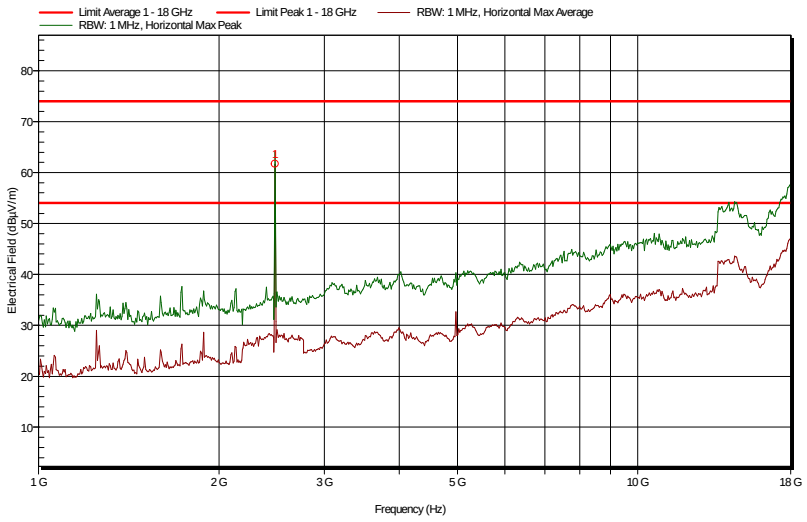
Vertical polarization

| | |
|---|---|
| Low ch |  |
| Mid ch |  |
| High ch |  |



Note: emission peaks in the 2.4 GHz band are not subject to the limit.

Horizontal polarization

| | |
|---|---|
| Low ch |  |
| Mid ch |  |
| High ch |  |



Note: emission peaks in the 2.4 GHz band are not subject to the limit.

18 GHz to 26.5 GHz

Measurements in this frequency range are already performed on the temporary antenna connector, see section3.4. As no spurious emissions above the test system noise floor are observed, the radiated measurements are omitted.

### 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 dB |