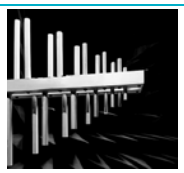
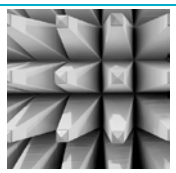

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

# TEST REPORT

**Test report no.: 1-6411/18-02-02-A**

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

## Testing laboratory


**CTC advanced GmbH**
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**Accredited Testing Laboratory:**
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-04 and D-PL-12076-01-05.

## Applicant


**RSI Video Technologies SA**
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67200 Strasbourg / FRANCE
Phone: +33 3 90 20 66 96
Contact: Geoffroy Eude
e-mail: geoffroy.eude@rsivideotech.com
Phone: +33 3 90 20 66 39


## Manufacturer


**RSI Video Technologies SA**
25 rue Jacobi-Netter
67200 Strasbourg / FRANCE


## Test standard/s

| | |
|---|---|
| FCC - Title 47 CFR Part 15 | FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |
| RSS - 247 Issue 2 | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices |

For further applied test standards please refer to section 3 of this test report.

## Test Item

| | |
|---|---|
| **Kind of test item:** | **Alarm panel** |
| **Model name:** | **XT640** |
| **FCC ID:** | X46XT08 |
| **IC:** | 8816A-XT08 |
| Frequency: | ISM band 902 MHz to 928 MHz |
| Technology tested: | Proprietary |
| Antenna: | Integrated wire antenna |
| Power supply: | 4.2 V to 14.4 V DC by battery |
| Temperature range: | -10°C to +55°C |

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

**Test report authorized:**

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Sumit Kumar

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2019.09.11 08:56:36 +02'00'

Sumit Kumar
Testing Manager
Radio Communications & EMC

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# 2 General information

## 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.
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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

**This test report replaces the test report with the number 1-6411/18-02-02 and dated 2019-07-05.**

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2018-05-28 |
| Date of receipt of test item: | 2019-04-04 |
| Start of test: | 2019-04-05 |
| End of test: | 2019-06-19 |
| Person(s) present during the test: | -/- |

## 2.3 Test laboratories sub-contracted

None

# 3 Test standard/s and references

| Test standard | Date | Description |
|---|---|---|
| FCC - Title 47 CFR Part 15 | -/- | FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |
| RSS - 247 Issue 2 | February 2017 | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices |
| RSS – Gen Issue 5 | April 2018 | Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements for Compliance of Radio Apparatus |

| Guidance | Version | Description |
|---|---|---|
| DTS: KDB 558074 D01 | v05 | GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES |
| ANSI C63.4-2014 | -/- | American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz |
| ANSI C63.10-2013 | -/- | American national standard of procedures for compliance testing of unlicensed wireless devices |

# 4 Test environment

| | | | |
|---|---|---|---|
| Temperature | : | $T_{nom}$<br>$T_{max}$<br>$T_{min}$ | +23 °C during room temperature tests<br>+55 °C during high temperature tests<br>-10 °C during low temperature tests |
| Relative humidity content | : | | 55 % |
| Barometric pressure | : | | 1021 hpa |
| Power supply | : | $V_{nom}$<br>$V_{max}$<br>$V_{min}$ | 12.0 V DC by battery<br>14.4 V<br>4.2 V |

# 5 Test item

## 5.1 General description

| | | |
|---|---|---|
| Kind of test item | : | Alarm panel |
| Type identification | : | XT640 |
| HMN | : | -/- |
| PMN | : | XT640 |
| HVIN | : | XT640 |
| FVIN | : | -/- |
| S/N serial number | : | F5C01219EF0A0006 |
| Hardware status | : | 5CA1299D-0A2 (Motherboard)<br>5CA0775A-0b (Input/Output board) |
| Software status | : | V.04.04.8T.028D |
| Firmware status | : | -/- |
| Frequency band | : | ISM band 902 MHz to 928 MHz |
| Type of radio transmission<br>Use of frequency spectrum | :<br>: | FHSS |
| Type of modulation | : | GFSK |
| Number of channels | : | 25 |
| Antenna | : | Integrated wire antenna |
| Power supply | : | 4.2 V to 14.4 V DC by battery |
| Temperature range | : | -10°C to +55°C |

## 5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report: 1-6411/18-02-01_AnnexA
1-6411/18-02-01_AnnexB
1-6411/18-02-01_AnnexD

# 6 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

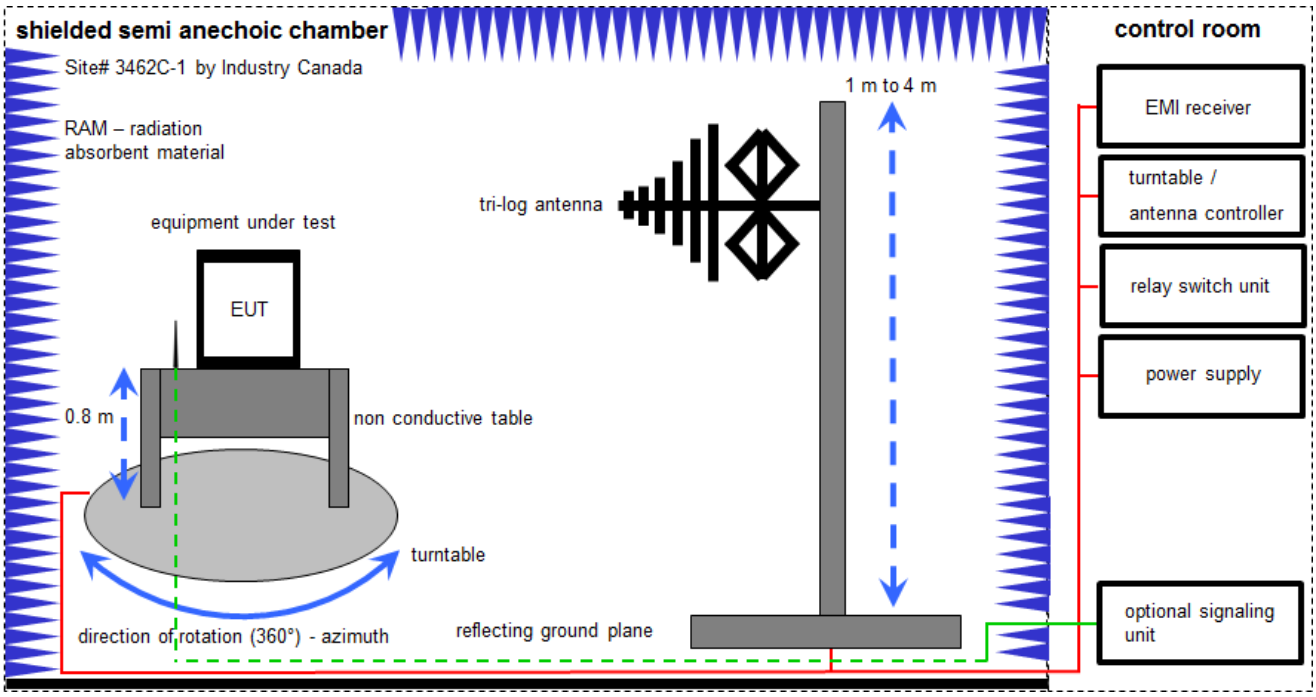
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

**Agenda:** Kind of Calibration

| | | | |
|---|---|---|---|
| k | calibration / calibrated | EK | limited calibration |
| ne | not required (k, ev, izw, zw not required) | zw | cyclical maintenance (external cyclical maintenance) |
| ev | periodic self verification | izw | internal cyclical maintenance |
| Ve | long-term stability recognized | g | blocked for accredited testing |
| vlkl! | Attention: extended calibration interval | | |
| NK! | Attention: not calibrated | *) | next calibration ordered / currently in progress |

## 6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.




Measurement distance: tri-log antenna 10 meter
EMC32 software version: 10.30.0

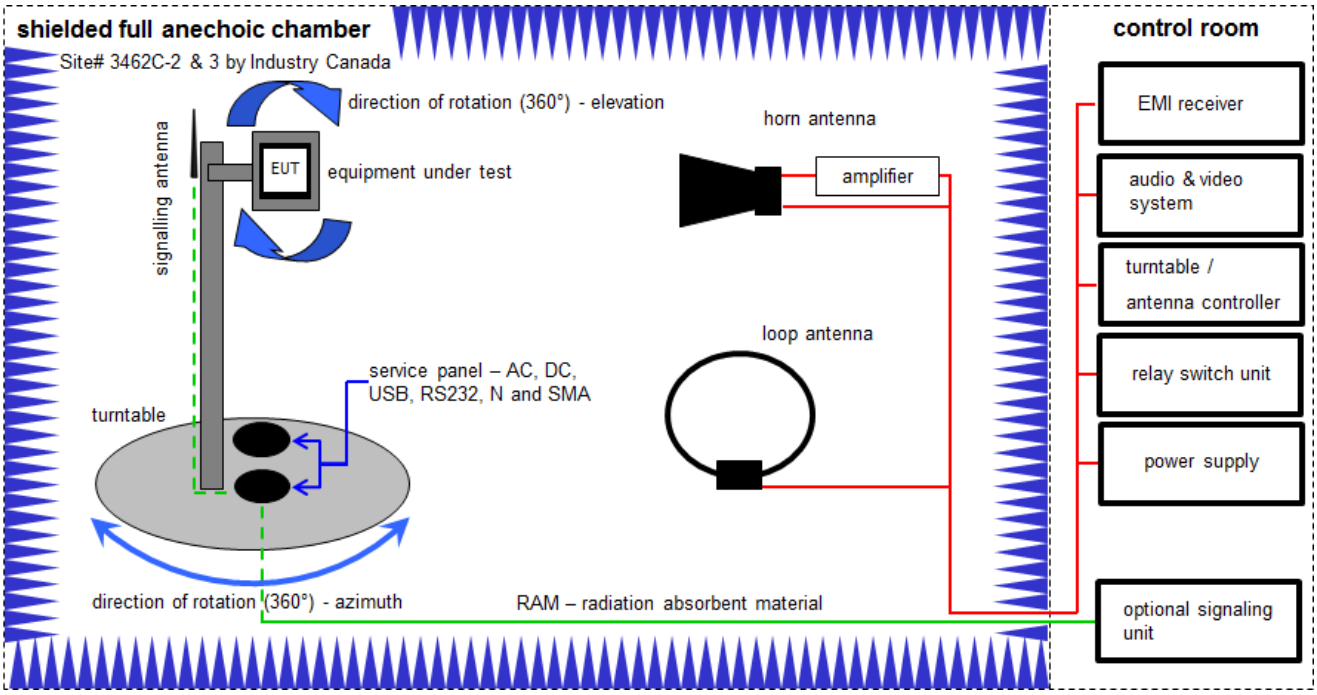
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

*Example calculation:*
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Switch-Unit | 3488A | HP | 2719A14505 | 300000368 | ev | -/- | -/- |
| 2 | A | Meßkabine 1 | HF-Absorberhalle | MWB AG 300023 | | 300000551 | ne | -/- | -/- |
| 3 | A | EMI Test Receiver | ESCI 3 | R&S | 100083 | 300003312 | k | 12.12.2018 | 11.12.2019 |
| 4 | A | Analyzer-Reference-System (Harmonics and Flicker) | ARS 16/1 | SPS | A3509 07/0 0205 | 300003314 | vlKl! | 15.01.2018 | 14.01.2020 |
| 5 | A | Positioning Controller | Model 2090 | ETS-Lindgren | 64672 | 300003746 | izw | -/- | -/- |
| 6 | A | Turntable Interface-Box | Model 105637 | ETS-Lindgren | 44583 | 300003747 | izw | -/- | -/- |
| 7 | A | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck Mess - Elektronik | 371 | 300003854 | vlKl! | 24.11.2017 | 23.11.2020 |

## 6.2 Shielded fully anechoic chamber




Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter / 1 meter

FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

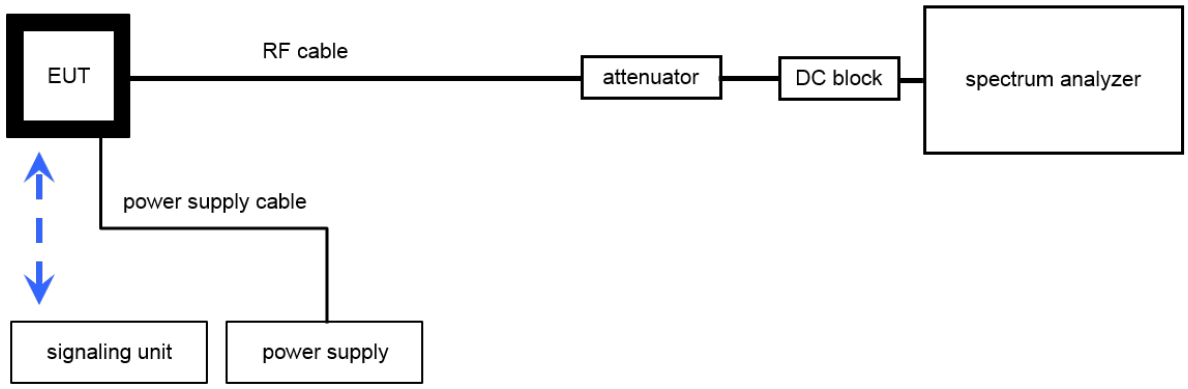
*Example calculation:*
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A,B | Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 | ev | -/- | -/- |
| 2 | A,B | Switch / Control Unit | 3488A | HP | * | 300000199 | ne | -/- | -/- |
| 3 | B | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 8812-3089 | 300000307 | vlKl! | 07.07.2017 | 06.07.2019 |
| 4 | A,B | EMI Test Receiver 20Hz- 26,5GHz | ESU26 | R&S | 100037 | 300003555 | k | 14.09.2018 | 13.12.2019 |
| 5 | A,B | 4U RF Switch Platform | L4491A | Agilent Technologies | MY50000037 | 300004509 | ne | -/- | -/- |
| 6 | A,B | NEXIO EMV-Software | BAT EMC V3.16.0.49 | EMCO | | 300004682 | ne | -/- | -/- |
| 7 | A, B | PC | ExOne | F+W | | 300004703 | ne | -/- | -/- |
| 9 | A | Active Loop Antenna 9 kHz to 30 MHz | 6502 | EMCO | 2210 | 300001015 | vlKl! | 07.07.2017 | 06.07.2019 |

## 6.3 Conducted measurements

**Conducted measurements normal conditions**




OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

*Example calculation:*
OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Signal- and Spectrum Analyzer | FSW26 | R&S | 101455 | 300004528 | k | 19.12.2018 | 18.12.2019 |
| 2 | A | RF-Cable SRD021 No. 8 | Enviroflex 316 D | Huber & Suhner | -/- | 400001318 | ev | -/- | -/- |
| 3 | A. | Climatic Box | VT 4011 | Voetsch Industrietechnik | 5856623060001 0 | 300005363 | ev | 07.05.2018 | 06.05.2020 |

# 7 Sequence of testing

## 7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement***

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

**Final measurement**

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

## 7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement**

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

**Final measurement**

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

## 7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement**

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

**Final measurement**

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

# 8 Measurement uncertainty

| Measurement uncertainty | |
|---|---|
| **Test case** | **Uncertainty** |
| Antenna gain | ± 3 dB |
| Carrier frequency separation | ± 21.5 kHz |
| Number of hopping channels | -/- |
| Spectrum bandwidth | ± 21.5 kHz absolute; ± 15.0 kHz relative |
| Maximum output power | ± 1 dB |
| Detailed conducted spurious emissions @ the band edge | ± 1 dB |
| Band edge compliance radiated | ± 3 dB |
| Spurious emissions conducted | ± 3 dB |
| Spurious emissions radiated below 30 MHz | ± 3 dB |
| Spurious emissions radiated 30 MHz to 1 GHz | ± 3 dB |
| Spurious emissions radiated 1 GHz to 12.75 GHz | ± 3.7 dB |
| Spurious emissions radiated above 12.75 GHz | ± 4.5 dB |

# 9 Summary of measurement results

| | |
|---|---|
| ☒ | No deviations from the technical specifications were ascertained |
| ☐ | There were deviations from the technical specifications ascertained |
| ☐ | This test report is only a partial test report. The content and verdict of the performed test cases are listed below. |

| TC Identifier | Description | Verdict | Date | Remark |
|---|---|---|---|---|
| RF-Testing | CFR Part 15<br>RSS - 247, Issue 2 | Passed | 2019-09-11 | -/- |

| Test specification clause | Test case | Temperature conditions | Power source voltages | Mode | C | NC | NA | NP | Remark |
|---|---|---|---|---|---|---|---|---|---|
| §15.247(b)(4)<br>RSS - 247 / 5.4 (b) | Antenna gain | Nominal | Nominal | CW modulated | ☐ | ☐ | ☐ | ☒ | -/- |
| §15.247(a)(1)<br>RSS - 247 / 5.1 (b) | Carrier frequency separation | Nominal | Nominal | TX hopping | ☐ | ☐ | ☐ | ☒ | -/- |
| §15.247(a)(1)<br>RSS - 247 / 5.1 (d) | Number of hopping channels | Nominal | Nominal | TX hopping | ☐ | ☐ | ☐ | ☒ | -/- |
| §15.247(a)(1) (iii)<br>RSS - 247 / 5.1 (d) | Time of occupancy (dwell time) | Nominal | Nominal | TX hopping | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(a)(1)<br>RSS - 247 / 5.1 (a) | Spectrum bandwidth of a FHSS system bandwidth | Nominal | Nominal | CW modulated | ☐ | ☐ | ☐ | ☒ | -/- |
| §15.247(b)(1)<br>RSS - 247 / 5.4 (b) | Maximum output power | Nominal | Nominal | CW modulated | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(d)<br>RSS - 247 / 5.5 | Detailed spurious emissions @ the band edge - conducted | Nominal | Nominal | TX hopping | ☐ | ☐ | ☒ | ☐ | -/- |
| §15.205<br>RSS - 247 /<br>5.5 RSS - Gen | Band edge compliance radiated | Nominal | Nominal | -/- | ☐ | ☐ | ☒ | ☐ | No restricted band nearby |
| §15.247(d)<br>RSS - 247 / 5.5 | Spurious emissions conducted | Nominal | Nominal | CW modulated | ☐ | ☐ | ☐ | ☒ | -/- |
| §15.209(a)<br>RSS - Gen | Spurious emissions radiated below 30 MHz | Nominal | Nominal | CW modulated | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(d)<br>RSS - 247 / 5.5<br>§15.109<br>RSS - Gen | Spurious emissions radiated 30 MHz to 1 GHz | Nominal | Nominal | CW modulated / RX mode | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(d)<br>RSS - 247 / 5.5<br>§15.109<br>RSS - Gen | Spurious emissions radiated above 1 GHz | Nominal | Nominal | CW modulated / RX mode | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.107(a)<br>§15.207 | Conducted emissions below 30 MHz (AC conducted) | Nominal | Nominal | -/- | ☐ | ☐ | ☒ | ☐ | Battery powered only |

**Note:** C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

# 10 RF measurements

## 10.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode: ☒ Special software is used.
EUT is transmitting pseudo random data by itself

# 11 Measurement results

## 11.1 Average Time of Occupancy (dwell time)

**Measurement:**

The measurement is performed in zero span mode to show that none of the 25 used channels is allocated more than 0.4 seconds within a 10 seconds interval.

**Limits:**

| FCC | IC |
|---|---|
| **Average time of occupancy** | |
| For frequency hopping systems operating in the 902-928 MHz band: If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within 10 second period. | |

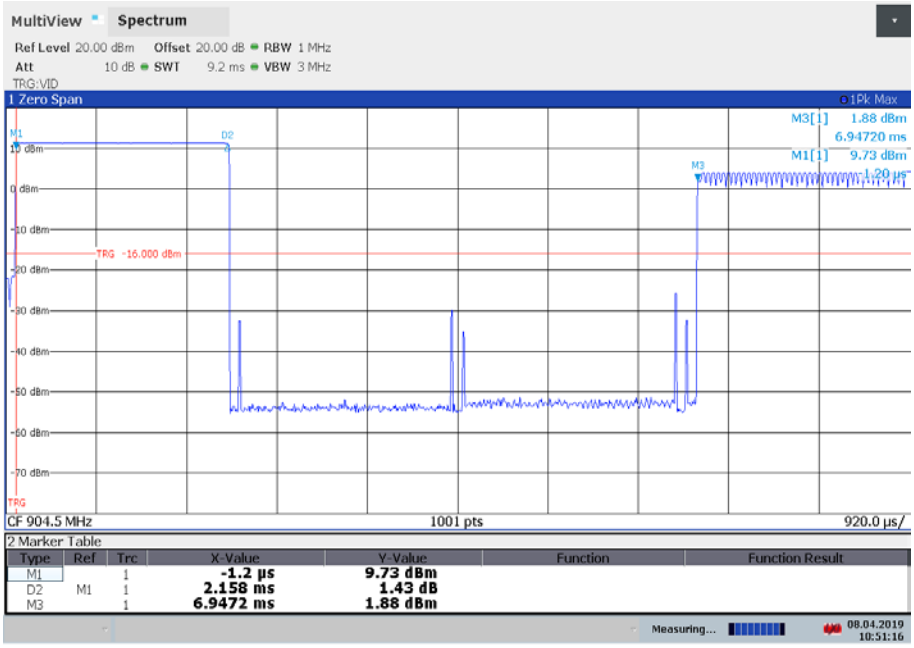
**Result:** The time slot length is = 2.158 ms
Number of hops / channel @ 1s = 18

Within 10 s period, the average time of occupancy = 10s* 18*2.158 ms

→ The average time of occupancy = 388.44 ms

**Plots:**

Plot 1: Time slot length = 2.158 ms

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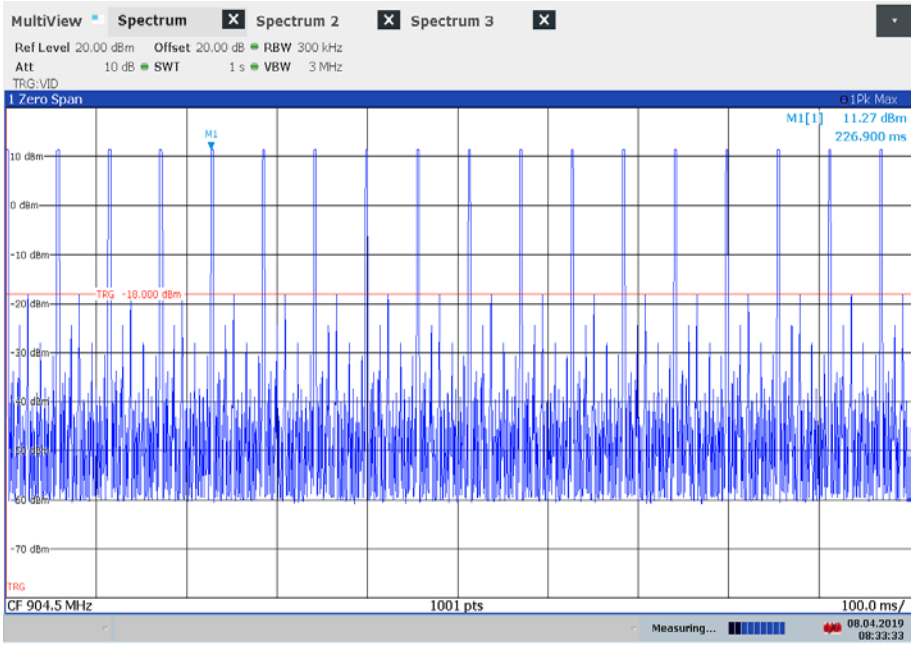
Plot 2: Number of hopping channels in 1s = 18

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## 11.2 Maximum Output Power

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 MHz |
| Video bandwidth: | 3 MHz |
| Span: | 5 MHz |
| Trace-Mode: | Max Hold |
| Used equipment: | See chapter 6.2 A |
| Measurement uncertainty: | See chapter 8 |

**Limits:**

| FCC | IC |
|---|---|
| Maximum Output Power Conducted | |
| For frequency hopping systems operating in the 902–928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section. | |

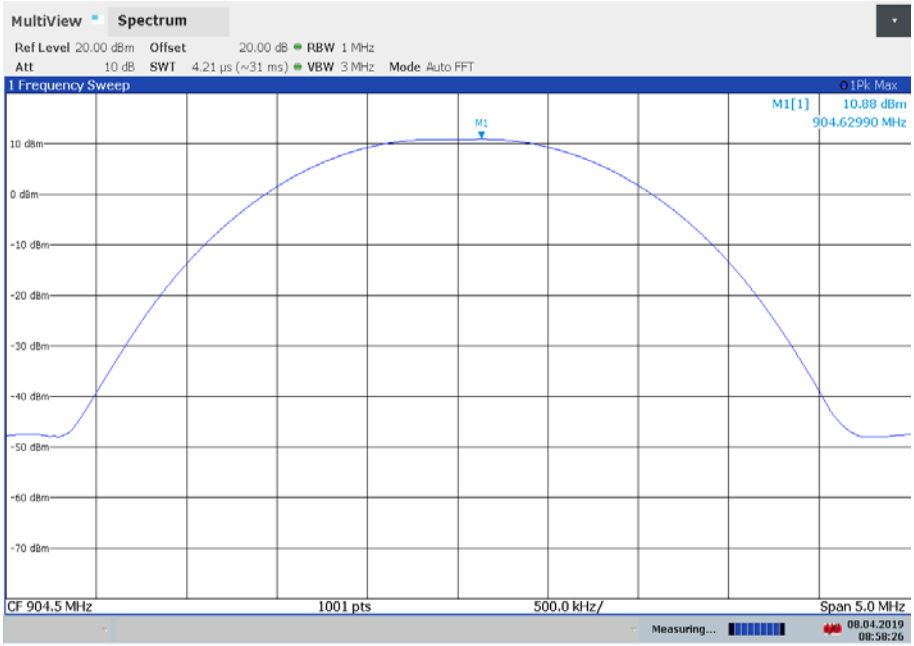
**Result:**

| Test Conditions | | Maximum Output Power Conducted | | |
|---|---|---|---|---|
| | | Low channel | Middle channel | High channel |
| $T_{nom}$ | $V_{nom}$ | 10.88 dBm | 10.88 dBm | 11.02 dBm |

| Test Conditions | | ERP | | |
|---|---|---|---|---|
| | | Low channel | Middle channel | High channel |
| $T_{nom}$ | $V_{nom}$ | 21.09 dBm | 20.50 dBm | 20.33 dBm |

**Plots:**

Plot 1: Low Channel BSP!

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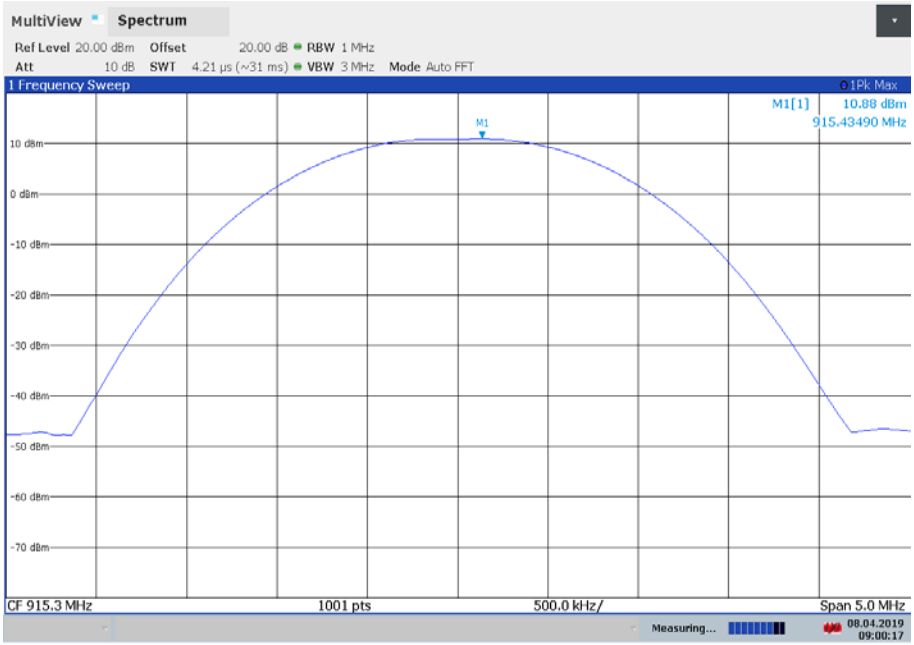
Plot 2: Middle Channel

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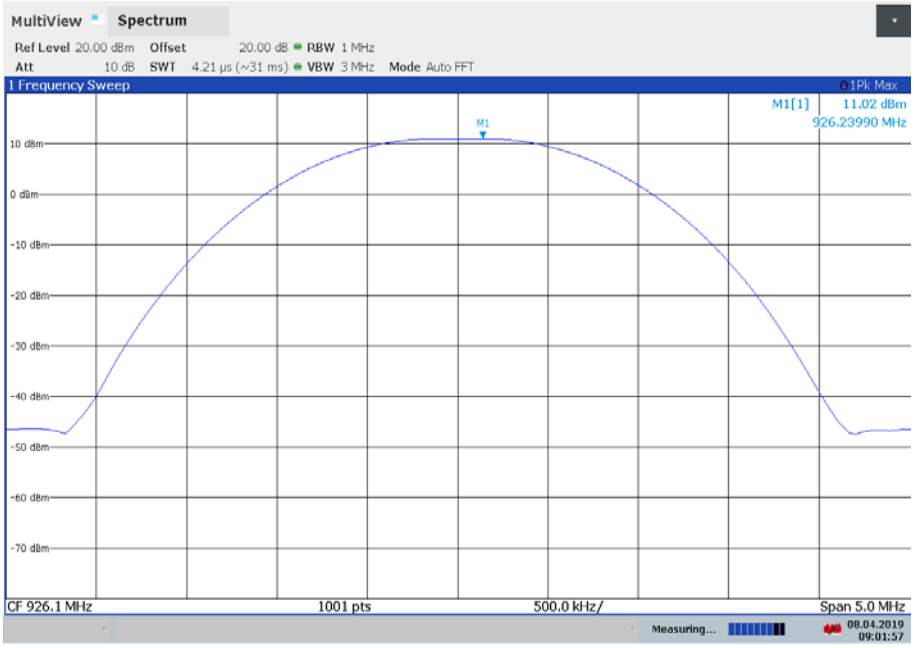
Plot 3: Highest Channel

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## 11.3 Spurious Emissions Radiated < 30 MHz

**Description:**

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channels are 00; 39 and 78. The measurement is performed in the mode with the highest output power. The limits are recalculated to a measurement distance of 3 m according the ANSI C63.10.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak / Quasi Peak |
| Sweep time: | Auto |
| Video bandwidth: | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz |
| Resolution bandwidth: | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span: | 9 kHz to 30 MHz |
| Trace-Mode: | Max Hold |
| Used equipment: | See chapter 6.2 B |
| Measurement uncertainty: | See chapter 8 |

**Limits:**

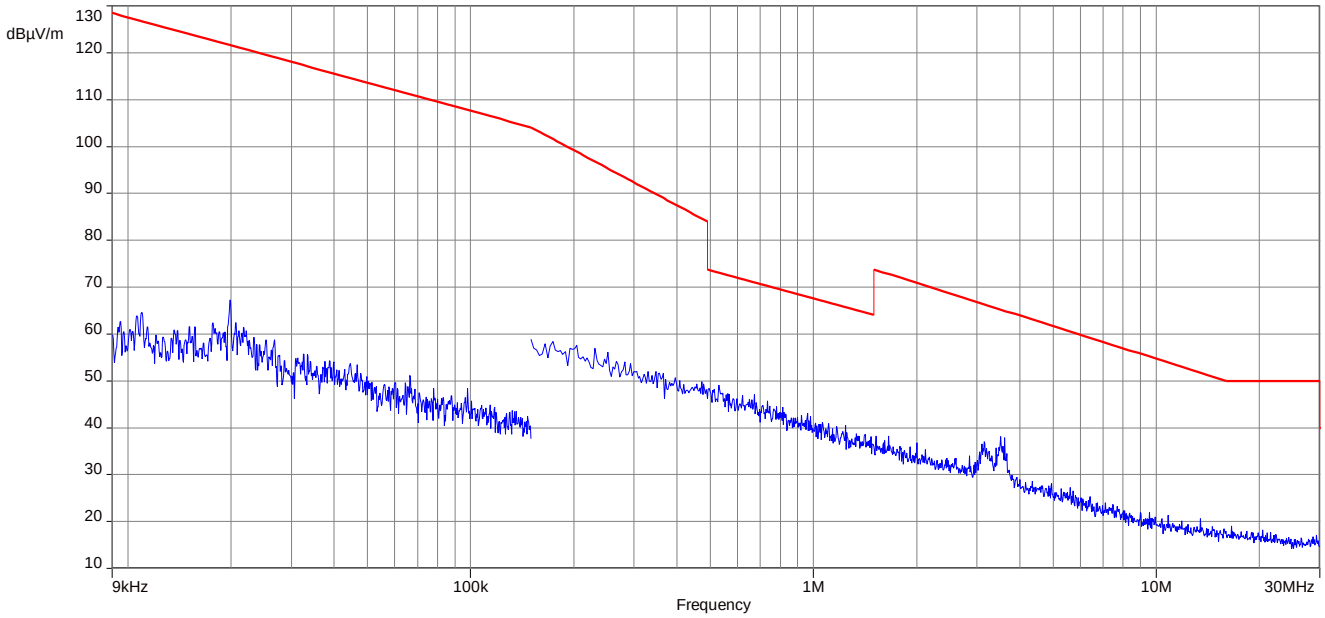
| FCC | | IC |
|---|---|---|
| TX spurious emissions radiated < 30 MHz | | |
| Frequency (MHz) | Field strength (dBµV/m) | Measurement distance |
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |

**Result:**

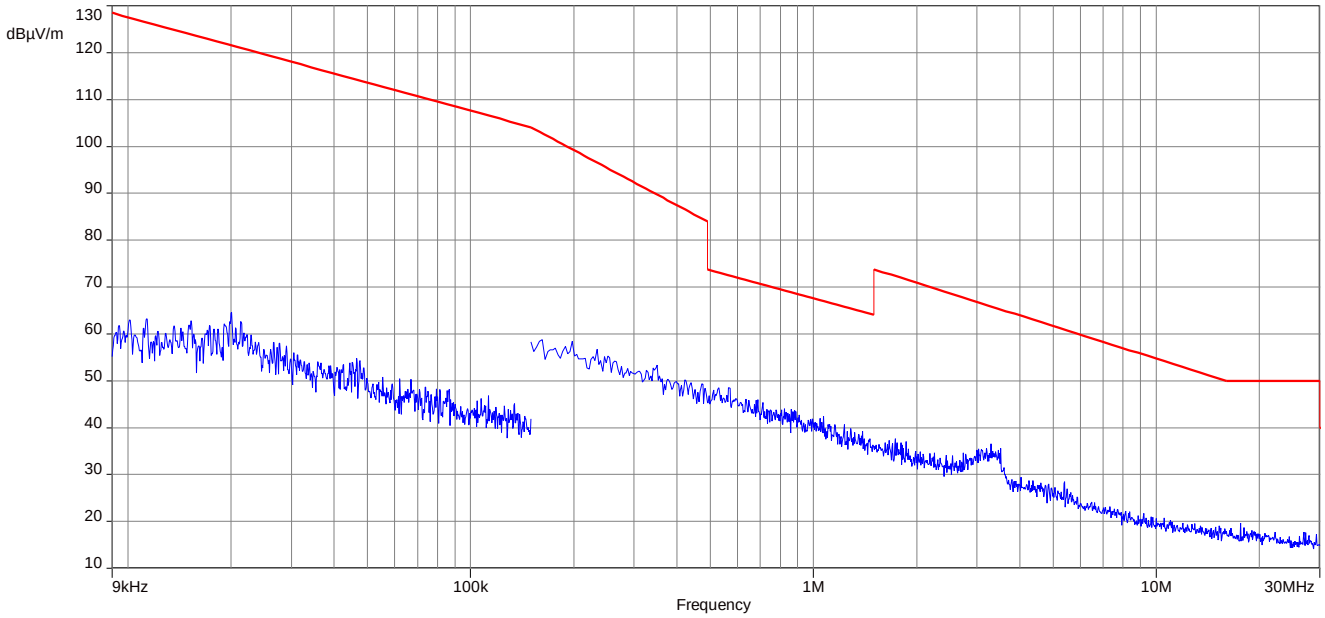
| SPURIOUS EMISSIONS LEVEL | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lowest channel | | | Middle channel | | | Highest channel | | |
| Frequency [MHz] | Detector | Level [dBµV/m] | Frequency [MHz] | Detector | Level [dBµV/m] | Frequency [MHz] | Detector | Level [dBµV/m] |
| All emissions were more than 10 dB below the limit. | | | | | | | | |

**Plots:**

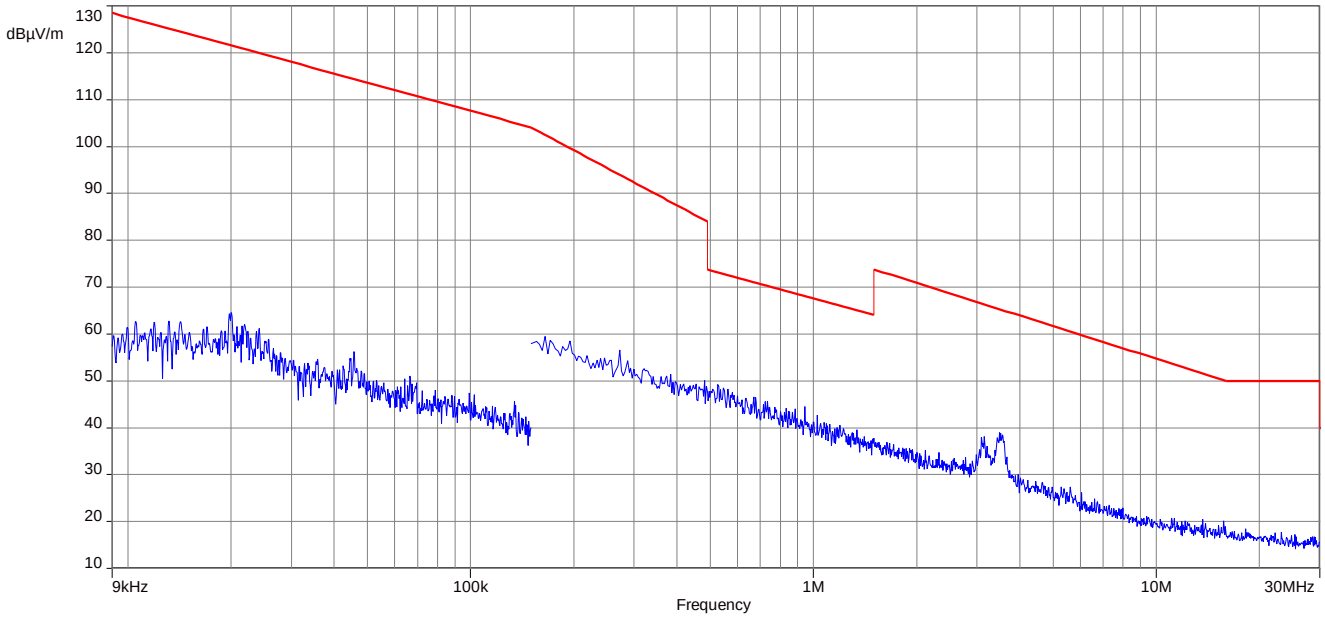
Plot 1: TX-Mode low channel




Plot 2: TX-Mode mid channel



Plot 3: TX-Mode high channel



## 11.4 Spurious Emissions Radiated > 30 MHz

### 11.4.1 Spurious emissions radiated 30 MHz to 1 GHz

**Description:**

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at channel low, mid and high.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector | Peak / Quasi Peak |
| Sweep time | Auto |
| Resolution bandwidth | 3 x VBW |
| Video bandwidth | 120 kHz |
| Span | 30 MHz to 1 GHz |
| Trace mode | Max hold |
| Measured modulation | DBPSK |
| Test setup | See sub clause 6.1 A |
| Measurement uncertainty | See sub clause 8 |

**Limits:**

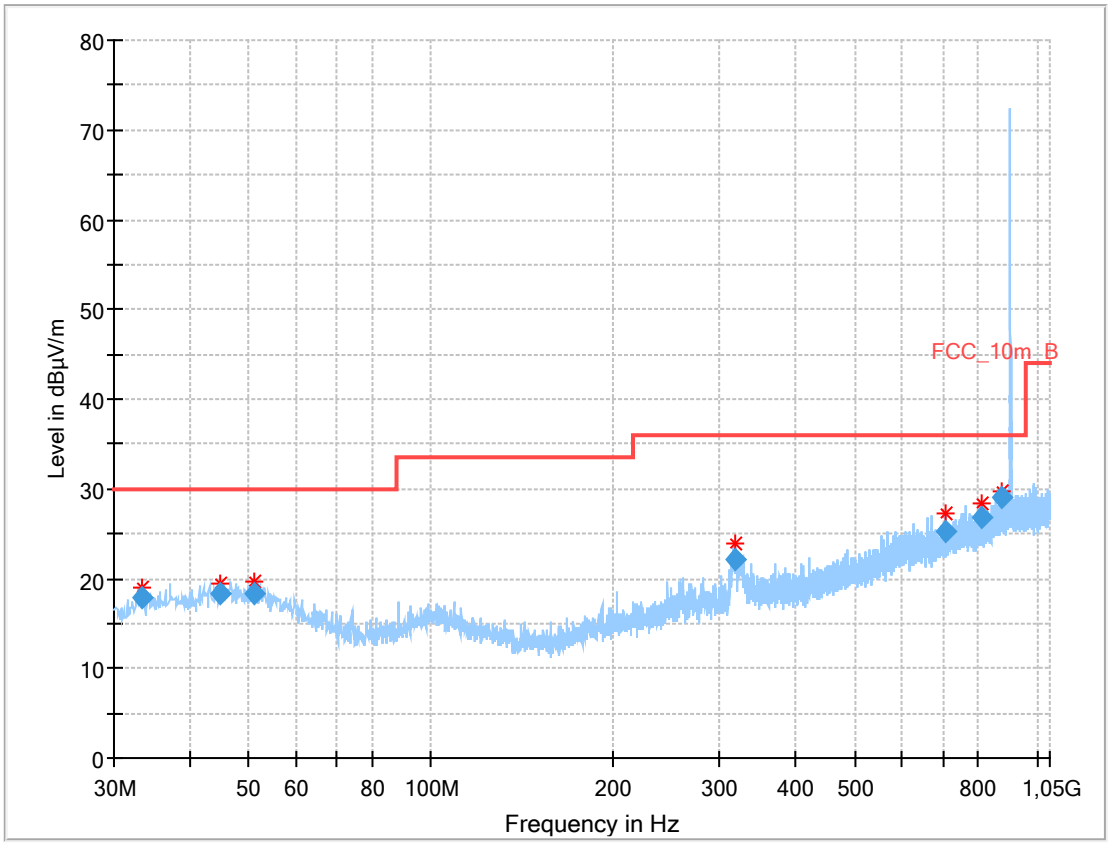
| FCC | | IC |
|---|---|---|
| Band-edge Compliance of conducted and radiated emissions | | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). | | |
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| 30 - 88 | 30.0 | 10 |
| 88 – 216 | 33.5 | 10 |
| 216 – 960 | 36.0 | 10 |
| Above 960 | 54.0 | 3 |

**Result:**

See result table below the plots.

**Plots:**

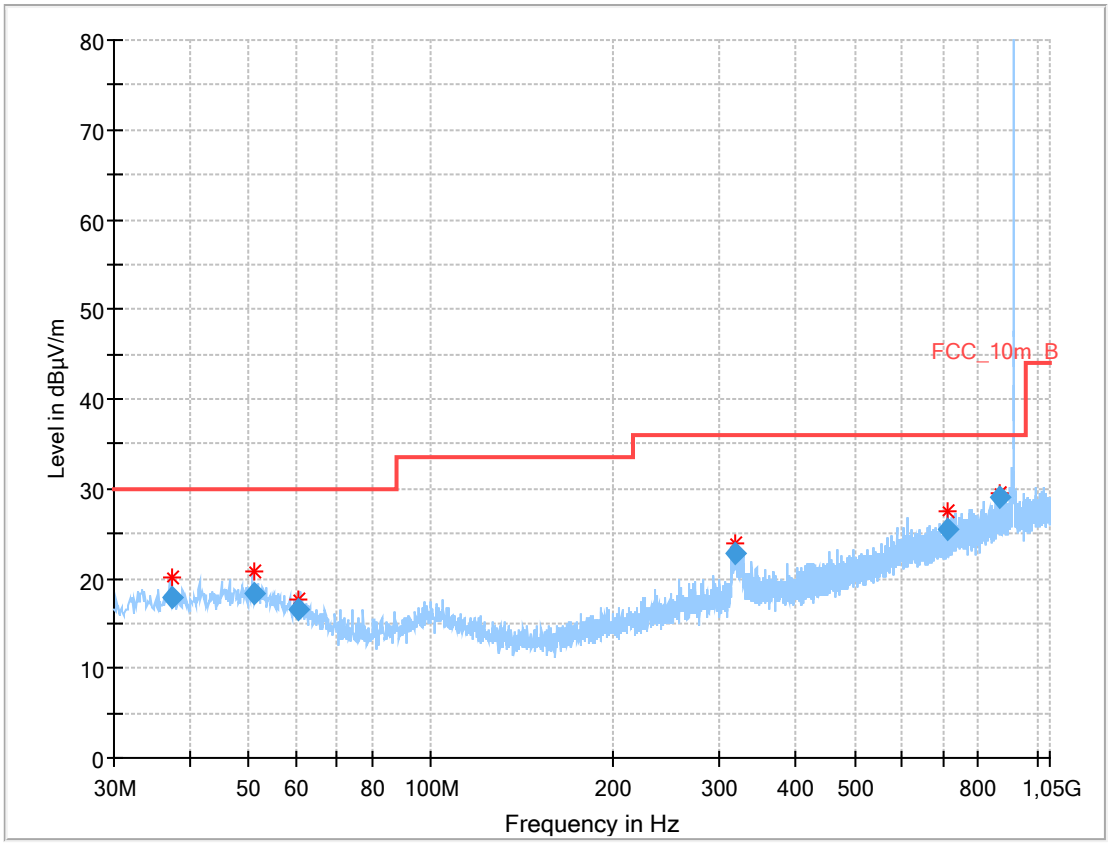
Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarisation (lowest channel)




## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 33.276 | 17.78 | 30.0 | 12.22 | 1000 | 120 | 170.0 | V | 292.0 | 14 |
| 44.895 | 18.31 | 30.0 | 11.69 | 1000 | 120 | 101.0 | V | 279.0 | 15 |
| 51.272 | 18.43 | 30.0 | 11.57 | 1000 | 120 | 145.0 | V | 161.0 | 15 |
| 317.253 | 22.18 | 36.0 | 13.82 | 1000 | 120 | 98.0 | V | 100.0 | 15 |
| 706.856 | 25.25 | 36.0 | 10.75 | 1000 | 120 | 170.0 | H | 157.0 | 21 |
| 809.860 | 26.92 | 36.0 | 9.08 | 1000 | 120 | 170.0 | H | 112.0 | 23 |
| 874.068 | 29.10 | 36.0 | 6.90 | 1000 | 120 | 101.0 | H | 22.0 | 24 |

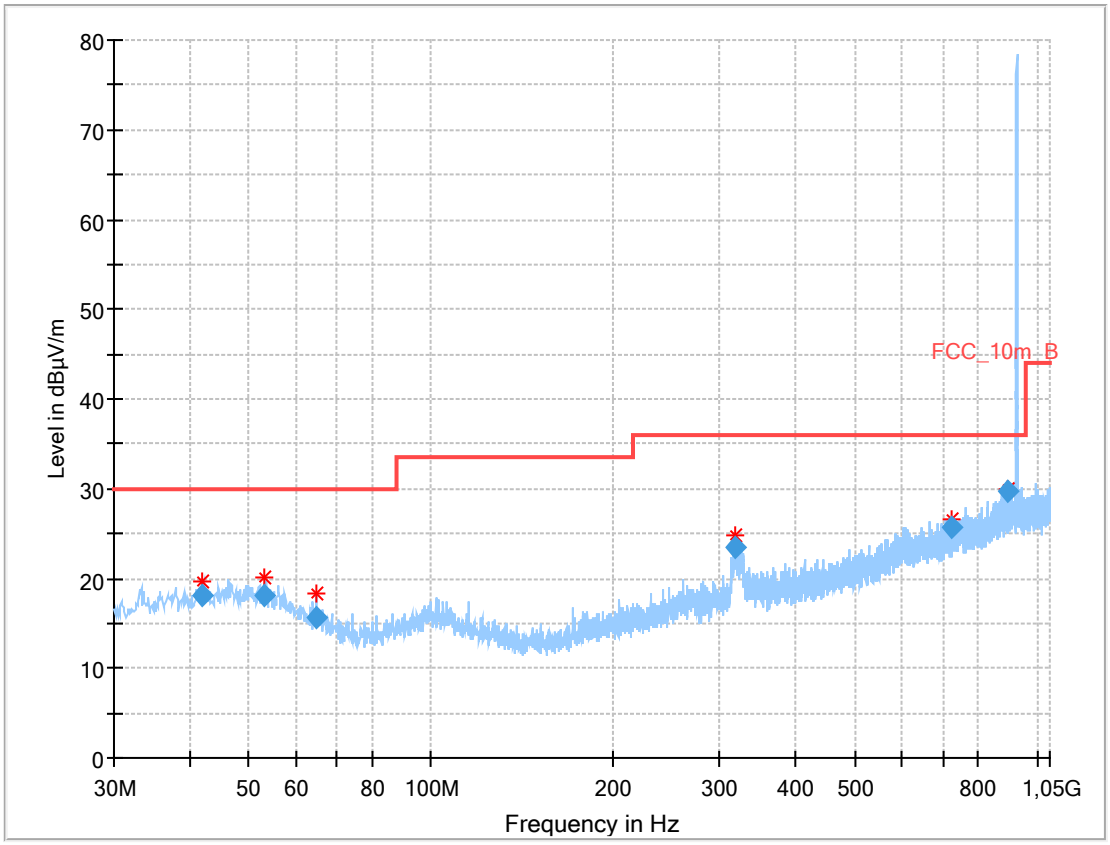
Plot 2: 30 MHz – 1 GHz, horizontal & vertical polarisation (middle channel)




## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 37.361 | 17.85 | 30.0 | 12.15 | 1000 | 120 | 170.0 | H | -10.0 | 14 |
| 50.924 | 18.42 | 30.0 | 11.58 | 1000 | 120 | 144.0 | V | 169.0 | 15 |
| 60.638 | 16.64 | 30.0 | 13.36 | 1000 | 120 | 143.0 | H | 248.0 | 13 |
| 316.852 | 22.70 | 36.0 | 13.30 | 1000 | 120 | 98.0 | V | 248.0 | 15 |
| 711.057 | 25.40 | 36.0 | 10.60 | 1000 | 120 | 170.0 | V | 71.0 | 21 |
| 869.233 | 28.98 | 36.0 | 7.02 | 1000 | 120 | 98.0 | H | 22.0 | 23 |

Plot 3: 30 MHz – 1 GHz, horizontal & vertical polarisation (highest channel)




## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 41.906 | 18.21 | 30.0 | 11.79 | 1000 | 120 | 100.0 | V | 10.0 | 15 |
| 53.230 | 18.12 | 30.0 | 11.88 | 1000 | 120 | 170.0 | H | 268.0 | 14 |
| 64.539 | 15.74 | 30.0 | 14.26 | 1000 | 120 | 101.0 | H | 202.0 | 12 |
| 317.173 | 23.38 | 36.0 | 12.62 | 1000 | 120 | 170.0 | H | -10.0 | 15 |
| 725.420 | 25.70 | 36.0 | 10.30 | 1000 | 120 | 170.0 | V | -22.0 | 22 |
| 895.148 | 29.63 | 36.0 | 6.37 | 1000 | 120 | 101.0 | H | 202.0 | 24 |

## 11.4.2 Spurious emissions radiated above 1 GHz

**Description:**

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed in the mode with the highest output power.

| Measurement parameters | |
|---|---|
| Detector | Peak / RMS |
| Sweep time | Auto |
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 3 x RBW |
| Span | 1 GHz to 26 GHz |
| Trace mode | Max hold |
| Measured modulation | DBPSK |
| Test setup | See sub clause 6.2 C (1 GHz – 12.75 GHz) |
| Measurement uncertainty | See sub clause 8 |

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

**Limits:**

| ANSI C63.10 |
|---|
| The average emission shall be determined by using RMS detector. If the dwell time of the hopping signal is less than 100 ms (per channel), the RMS reading may be adjusted by a factor:<br>F = 20log (dwell time/100 ms) |

| FCC | | IC |
|---|---|---|
| TX spurious emissions radiated | | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). | | |
| §15.209 | | |
| Frequency (MHz) | Field strength (dBµV/m) | Measurement distance |
| Above 960 | 54.0 (average)<br>74.0 (peak) | 3 |

**Result:**

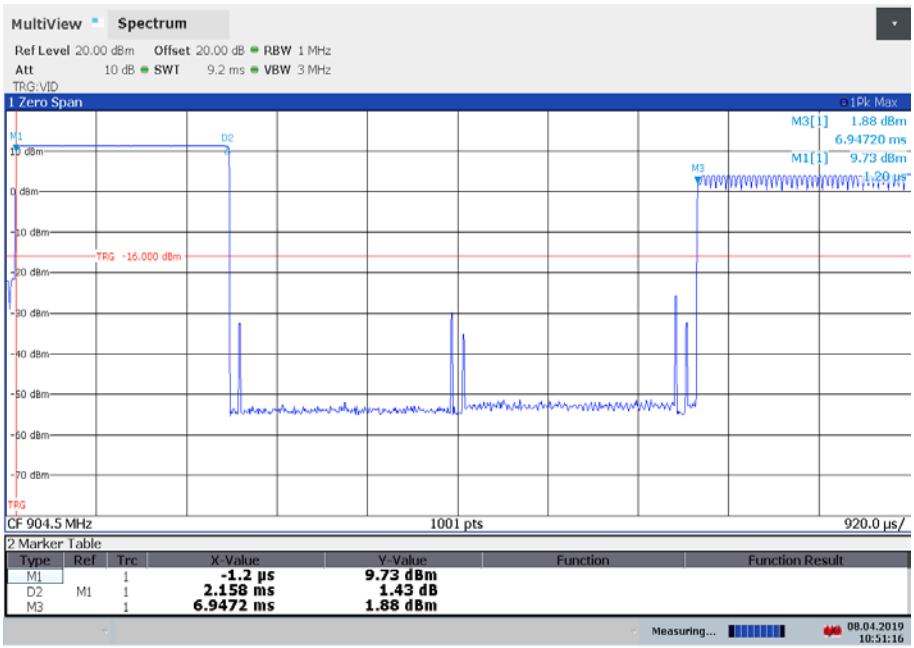
For radiated spurious emission the limits of 15.209 applies for all frequencies mentioned in 15.205. According to FCC Public Notice DA 00-705 (ANSI C63.10) the average emission shall be determined by using Video averaging (VBW = 10 Hz). If the dwell time of the hopping signal is less than 100 ms (per channel), the VBW=10 Hz reading may be adjusted by a factor:

**F = 20*log (dwell time/100 ms)**

In a period of 100 ms, we have a maximum of 2 transmissions and that gives the correction factor for spurious measurement.

**F = 20*log (2*2.158/100 ms) =-27.29 dB**

Plot 1: Time slot length = 2.158 ms

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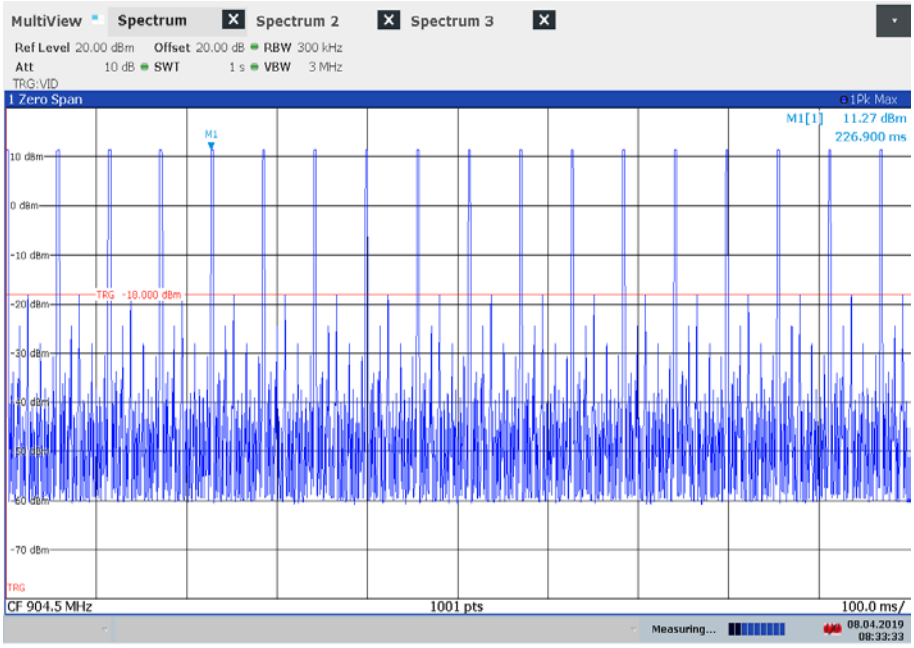
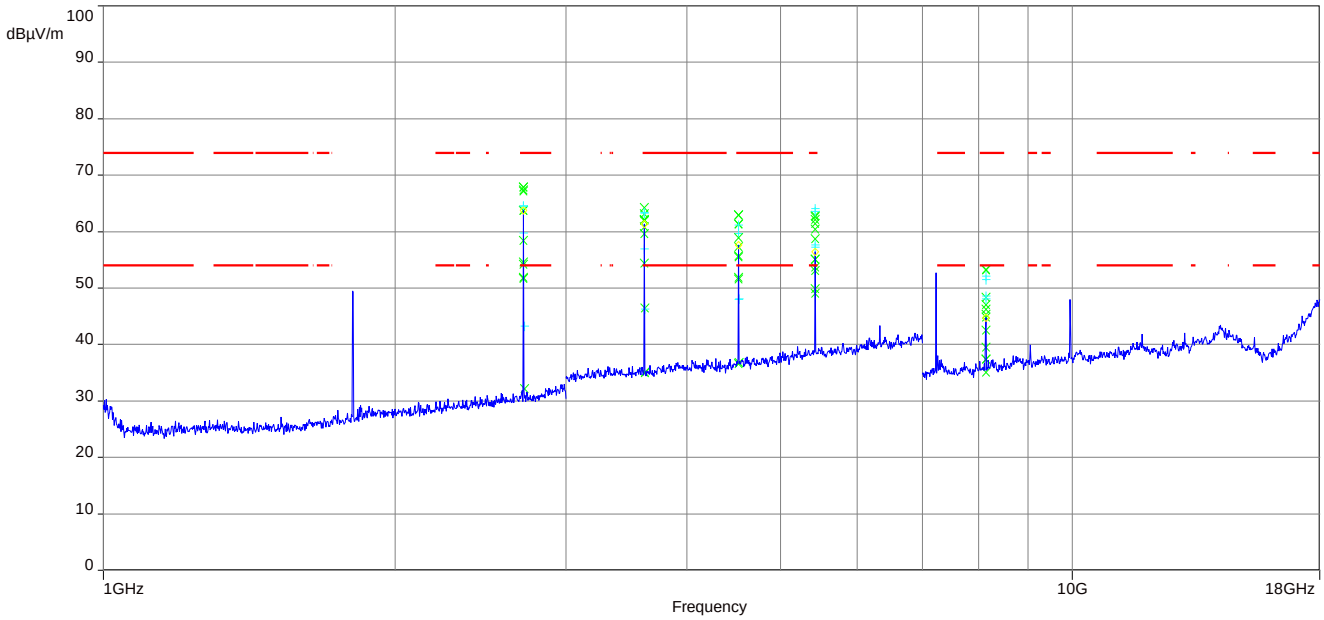
Plot 2: Number of hopping channels in 1s = 18



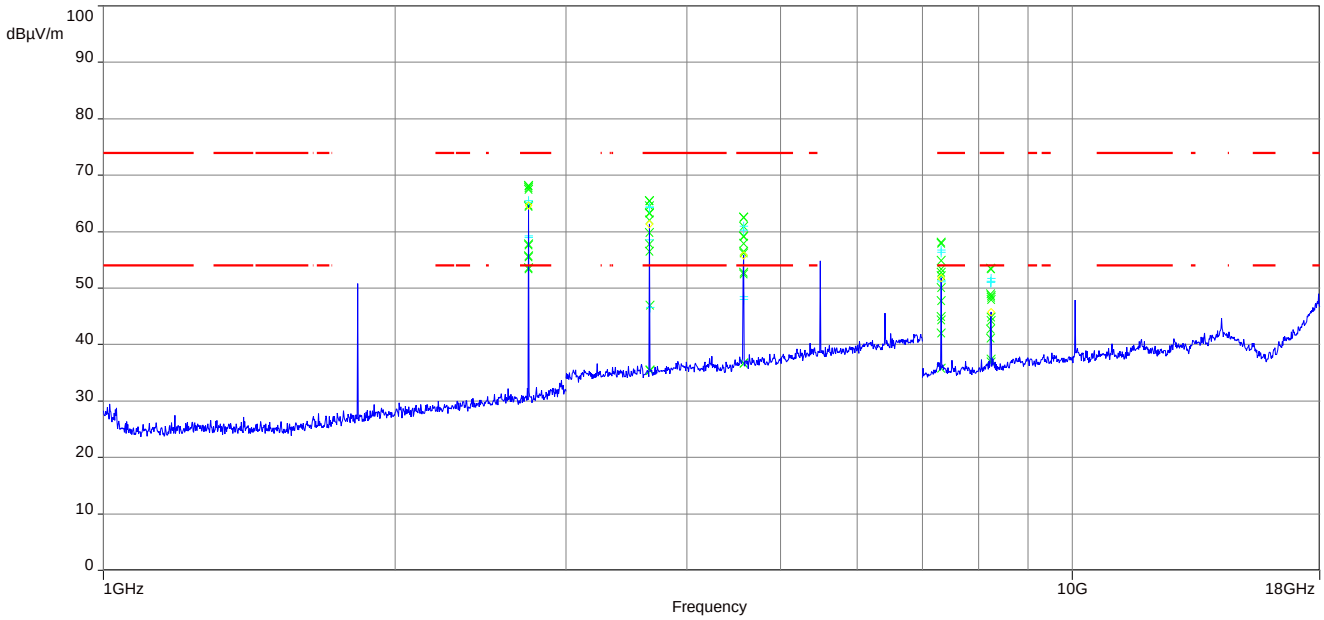

| TX spurious emissions radiated | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| 2714 | Peak | 67.93 | 2746.4 | Peak | 68.26 | 2778 | Peak | 66.53 |
| | AVG | 40.64 | | AVG | 40.97 | | AVG | 39.24 |
| 3618.4 | Peak | 64.26 | 3661.6 | Peak | 65.54 | 3704.8 | Peak | 65.32 |
| | AVG | 36.97 | | AVG | 38.25 | | AVG | 38.03 |
| 4522 | Peak | 63.03 | 4576 | Peak | 62.63 | 4630 | Peak | 61.21 |
| | AVG | 35.74 | | AVG | 35.34 | | AVG | 33.92 |
| 5428 | Peak | 64.06 | 7321.2 | Peak | 58.16 | 7409.2 | Peak | 55.48 |
| | AVG | 36.77 | | AVG | 30.87 | | AVG | 28.19 |
| 8140.7 | Peak | 53.33 | 8238.6 | Peak | 53.49 | -/- | Peak | -/- |
| | AVG | 26.04 | | AVG | 26.20 | | AVG | -/- |

**Plots:**

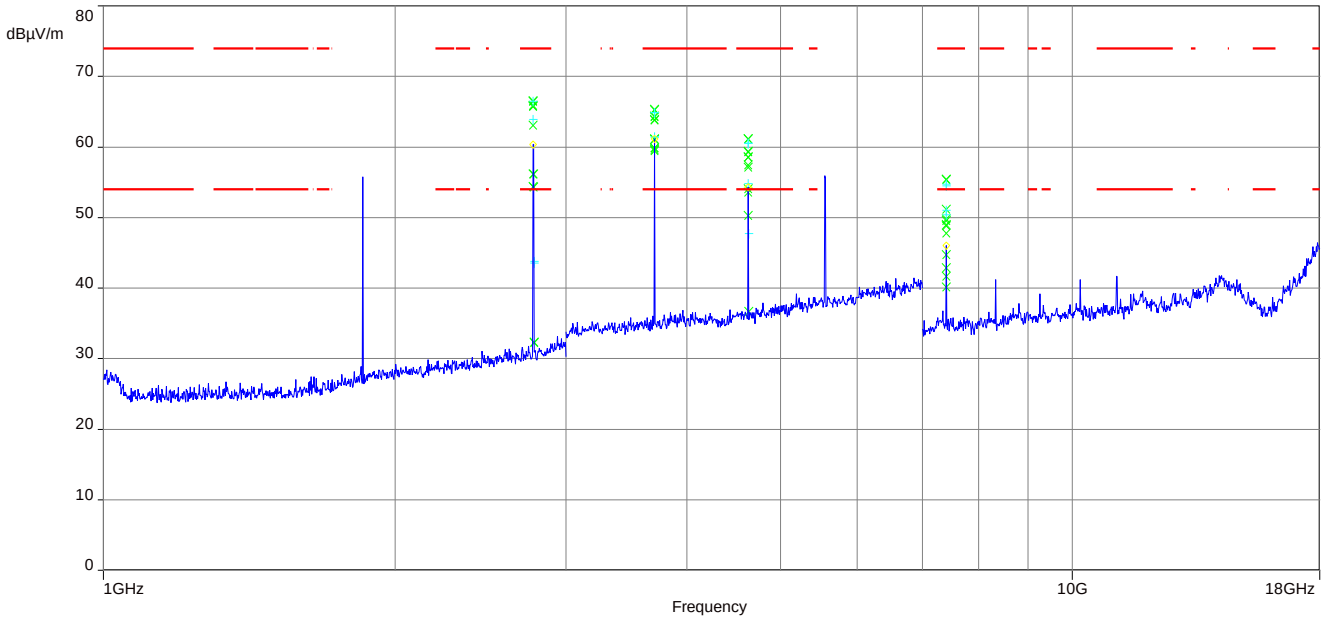
Plot 1: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (lowest channel)



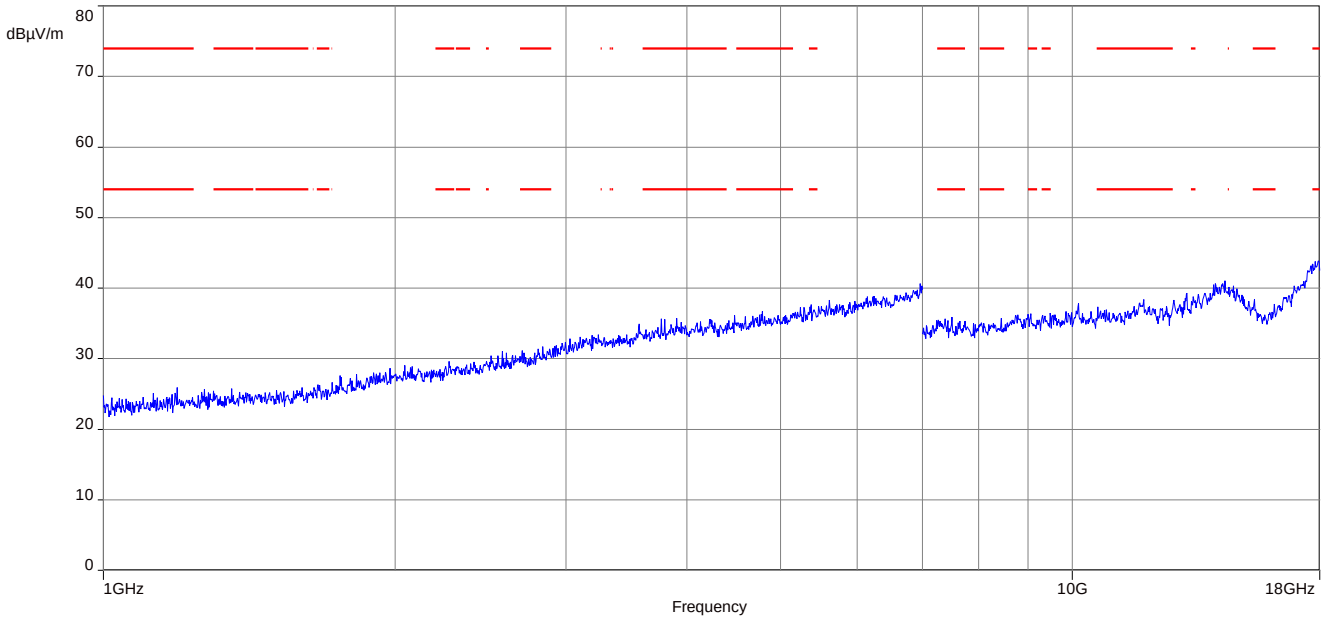

Plot 2: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (middle channel)



Plot 3: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (highest channel)




Plot 4: 1GHz – 12.75 GHz, RX-Mode, horizontal & vertical polarisation



## 12 Observations

No observations except those reported with the single test cases have been made.

## Annex A Glossary

| | |
|---|---|
| **EUT** | Equipment under test |
| **DUT** | Device under test |
| **UUT** | Unit under test |
| **GUE** | GNSS User Equipment |
| **ETSI** | European Telecommunications Standards Institute |
| **EN** | European Standard |
| **FCC** | Federal Communications Commission |
| **FCC ID** | Company Identifier at FCC |
| **IC** | Industry Canada |
| **PMN** | Product marketing name |
| **HMN** | Host marketing name |
| **HVIN** | Hardware version identification number |
| **FVIN** | Firmware version identification number |
| **EMC** | Electromagnetic Compatibility |
| **HW** | Hardware |
| **SW** | Software |
| **Inv. No.** | Inventory number |
| **S/N or SN** | Serial number |
| **C** | Compliant |
| **NC** | Not compliant |
| **NA** | Not applicable |
| **NP** | Not performed |
| **PP** | Positive peak |
| **QP** | Quasi peak |
| **AVG** | Average |
| **OC** | Operating channel |
| **OCW** | Operating channel bandwidth |
| **OBW** | Occupied bandwidth |
| **OOB** | Out of band |
| **DFS** | Dynamic frequency selection |
| **CAC** | Channel availability check |
| **OP** | Occupancy period |
| **NOP** | Non occupancy period |
| **DC** | Duty cycle |
| **PER** | Packet error rate |
| **CW** | Clean wave |
| **MC** | Modulated carrier |
| **WLAN** | Wireless local area network |
| **RLAN** | Radio local area network |
| **DSSS** | Dynamic sequence spread spectrum |
| **OFDM** | Orthogonal frequency division multiplexing |
| **FHSS** | Frequency hopping spread spectrum |
| **GNSS** | Global Navigation Satellite System |
| **$C/N_0$** | Carrier to noise-density ratio, expressed in dB-Hz |

## Annex B Document history

| Version | Applied changes | Date of release |
|---|---|---|
| -/- | Initial release | 2019-07-05 |
| A | Editorial changes (FCC-ID and IC number was mixed up) | 2019-09-11 |

## Annex C Accreditation Certificate – D-PL-12076-01-05

| first page | last page |
|---|---|
| | |

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

**Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV**
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

**Accreditation**

The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

**CTC advanced GmbH**
**Untertürkheimer Straße 6-10, 66117 Saarbrücken**

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

**Telecommunication (FCC Requirements)**

The accreditation certificate shall only apply in connection with the notice of accreditation of 11.01.2019 with the accreditation number D-PL-12076-01 and is valid until 21.04.2021. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 5 pages.

Registration number of the certificate: **D-PL-12076-01-05**

Frankfurt am Main, 11.01.2019

Dipl.-Ing. Uwe Zimmermann
Head of Division

See notes overleaf

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https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf

################################### END OF TEST REPORT ###################################