

# Test report – 394792-1TRFWL

Date of issue: March 4, 2021

Applicant:

**CDVI Wireless Spa**

**Via Piave, 23 – 31020 S. Pietro di Feletto (TV) – Italy**

Product:

**Remote control**

Model:

**SETR128AM2**

FCC ID:

**PWJTM128**

Specifications:

- ◆ **FCC 47 CFR Part 15 Subpart C, §15.231**  
Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.
- ◆ **RSS 210 Licence-Exempt Radio Apparatus: Category I Equipment**  
Annex A: Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

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Doc. n. TRF001; Rev. 0; Date: 2020-11-30

#### Test location

|              |  |
|--------------|--|
| Company name | Nemko Spa  |
| Address      | Via del Carroccio, 4   |
| City         | Biassono   |
| Province     | MB   |
| Postal code  | 20853  |
| Country      | Italy  |
| Telephone    | +39 039 220 12 01  |
| Facsimile    | +39 039 220 12 21  |
| Website      | <a href="http://www.nemko.com">www.nemko.com</a>   |
| Site number  | FCC ID number 481407 (10 m semi anechoic chamber)<br>ISED ID number 9109A (10 m semi anechoic chamber) |

|   |               |                   |  |
|---|---------------|-------------------|--|
| Tested by<br>(name, function and signature)   | S. Tessa      | (project handler) |   |
| Reviewed by<br>(name, function and signature) | P. Barbieri   | (verifier)        |  |
| Date  | March 4, 2021 |                   |  |

#### Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Spa's ISO/IEC 17025 accreditation.

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## Section 1. Report summary

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### 1.1 Applicant and manufacturer info

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|                 | Manufacturer:         |
|-----------------|-----------------------|
| Company name    | CDVI WIRELESS SPA     |
| Address         | Via Piave, 23         |
| City            | San Pietro di Feletto |
| Province/State  | Treviso               |
| Postal/Zip code | 31020                 |
| Country         | Italy                 |

### 1.2 Test specifications

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|  |   |
|--|---|
| FCC 47 CFR Part 15, Subpart C, Clause 15.231 | Periodic operation in the band 40.66–40.70 MHz and above 70 MHz |
| RSS 210, Annex A                             | Periodic operation in the band 40.66–40.70 MHz and above 70 MHz |

### 1.3 Test methods

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|                    |   |
|--------------------|---|
| ANSI C63.10 v 2013 | American National Standard for Procedures for Compliance Testing of Unsilenced Wireless Devices |
|--------------------|---|

### 1.4 Statement of compliance

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Testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test does not comply in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

### 1.5 Exclusions

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None

### 1.6 Test report revision history

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| Revision #    | Details of changes made to test report |
|---------------|--|
| 394792TRFWL   | Original report issued                 |
| 394792-1TRFWL | Added the FCC ID                       |

## Section 2. Summary of test results

### 2.1 FCC Part 15 Subpart C test results

| Part       | Test description   | Verdict                     |
|------------|--|-----------------------------|
| §15.207(a) | Conducted limits   | Not applicable <sup>1</sup> |
| §15.203    | Antenna requirement  | Pass <sup>2</sup>           |
| §15.231(a) | Conditions for intentional radiators to comply with periodic operation | Pass                        |
| §15.231(b) | Field strength of emissions  | Pass                        |
| §15.231(c) | Emission bandwidth   | Pass                        |
| §15.231(d) | Requirements for devices operating within 40.66–40.70 MHz band         | Not applicable              |
| §15.231(e) | Conditions for intentional radiators to comply with periodic operation | Not applicable              |

Notes: <sup>1</sup> The EUT is powered by internal battery

<sup>2</sup> The Antennas are located within the enclosure of EUT and not user accessible.

### 2.2 RSS 210 Annex A test results

| Part       | Test description   | Verdict                     |
|------------|--|-----------------------------|
| §15.207(a) | Conducted limits   | Not applicable <sup>1</sup> |
| §15.203    | Antenna requirement  | Pass <sup>2</sup>           |
| §15.231(a) | Conditions for intentional radiators to comply with periodic operation | Pass                        |
| §15.231(b) | Field strength of emissions  | Pass                        |
| §15.231(c) | Emission bandwidth   | Pass                        |
| §15.231(d) | Requirements for devices operating within 40.66–40.70 MHz band         | Not applicable              |
| §15.231(e) | Conditions for intentional radiators to comply with periodic operation | Not applicable              |

Notes: <sup>1</sup> The EUT is powered by internal battery

<sup>2</sup> The Antennas are located within the enclosure of EUT and not user accessible.

## Section 3. Equipment under test (EUT) details

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### 3.1 Sample information

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|                        |                |
|------------------------|----------------|
| Receipt date           | March 30, 2020 |
| Nemko sample ID number | 394792 1/2     |

### 3.2 EUT information

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|               |   |
|---------------|---|
| Product name  | Remote control                            |
| Model         | SETR128AM2                                |
| Serial number | 394792 1/2 (Number assigned by Nemko Spa) |

### 3.3 Technical information

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|   |   |
|---|---|
| Operating band                          | Above 70 MHz  |
| Operating frequency                     | 433.92 MHz  |
| Modulation type                         | GFSK  |
| Field strength (dBµV/m @ 3 m)           | --  |
| Measured BW (kHz) (99 %)                | 680   |
| Emission classification (F1D, G1D, D1D) | --  |
| Power requirements                      | Battery type CR2032 Lithium   |
| Antenna information                     | The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. |

### 3.4 Product description and theory of operation

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The EUT is a very high security transmitter with GFSK modulation. Manually operated four-button radio remote control powered by internal batteries.

### 3.5 EUT exercise details

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The EUT is in continuous transmission mode keeping a button pressed.

### 3.6 EUT setup diagram

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EUT is powered by internal batteries without I/O lines

### 3.7 EUT sub assemblies

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The EUT is composed by a single unit

## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

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None

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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In the laboratory, the following ambient conditions are respected for each test reported below:

|                       |                                  |
|-----------------------|----------------------------------|
| Ambient temperature:  | <u>18 ÷ 33 °C <sup>(1)</sup></u> |
| Relative Humidity:    | <u>25 ÷ 70 % <sup>(2)</sup></u>  |
| Atmospheric pressure: | <u>860 ÷ 1060 hPa</u>            |

<sup>(1)</sup> For luminaire, temperature during tests was verified to be within 18 ÷ 30 °C

<sup>(2)</sup> During ESD test, humidity was verified to be within 30 ÷ 60 %

The following instruments are used to monitor the environmental conditions:

| Equipment                      | Manufacturer | Model    | Serial N°    |
|--------------------------------|--------------|----------|--------------|
| Thermo-hygrometer data loggers | Testo        | 175-H2   | 20012380/305 |
| Thermo-hygrometer data loggers | Testo        | 175-H2   | 38203337/703 |
| Barometer                      | Castle       | GPB 3300 | 072015       |

### 5.2 Power supply range

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For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.



## Section 6. Measurement uncertainty

### 6.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002. The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

| EUT         | Type      | Test  | Range                | Measurement Uncertainty | Notes |
|-------------|-----------|---|----------------------|-------------------------|-------|
| Transmitter | Conducted | Frequency error   | 0.001 MHz ÷ 40 GHz   | 0.08 ppm                | (1)   |
|             |           | Carrier power<br>RF Output Power  | 0.009 MHz ÷ 30 MHz   | 1.1 dB                  | (1)   |
|             |           |   | 30 MHz ÷ 18 GHz      | 1.5 dB                  | (1)   |
|             |           |   | 18 MHz ÷ 40 GHz      | 3.0 dB                  | (1)   |
|             |           |   | 40 MHz ÷ 140 GHz     | 5.0 dB                  | (1)   |
|             |           | Adjacent channel power  | 1 MHz ÷ 18 GHz       | 1.4 dB                  | (1)   |
|             |           | Conducted spurious emissions  | 0.009 MHz ÷ 18 GHz   | 3.0 dB                  | (1)   |
|             |           |   | 18 GHz ÷ 40 GHz      | 4.2 dB                  | (1)   |
|             |           |   | 40 GHz ÷ 220 GHz     | 6.0 dB                  | (1)   |
|             |           | Intermodulation attenuation   | 1 MHz ÷ 18 GHz       | 2.2 dB                  | (1)   |
|             |           | Attack time – frequency behaviour   | 1 MHz ÷ 18 GHz       | 2.0 ms                  | (1)   |
|             |           | Attack time – power behaviour   | 1 MHz ÷ 18 GHz       | 2.5 ms                  | (1)   |
|             |           | Release time – frequency behaviour  | 1 MHz ÷ 18 GHz       | 2.0 ms                  | (1)   |
|             |           | Release time – power behaviour  | 1 MHz ÷ 18 GHz       | 2.5 ms                  | (1)   |
|             |           | Transient behaviour of the transmitter– Transient frequency behaviour                   | 1 MHz ÷ 18 GHz       | 0.2 kHz                 | (1)   |
|             |           | Transient behaviour of the transmitter – Power level slope                              | 1 MHz ÷ 18 GHz       | 9%                      | (1)   |
|             |           | Frequency deviation - Maximum permissible frequency deviation                           | 0.001 MHz ÷ 18 GHz   | 1.3%                    | (1)   |
|             |           | Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz | 0.001 MHz ÷ 18 GHz   | 0.5 dB                  | (1)   |
|             |           | Dwell time  | -                    | 3%                      | (1)   |
|             |           | Hopping Frequency Separation  | 0.01 MHz ÷ 18 GHz    | 1%                      | (1)   |
|             |           | Occupied Channel Bandwidth  | 0.01 MHz ÷ 18 GHz    | 2%                      | (1)   |
|             |           | Modulation Bandwidth  | 0.01 MHz ÷ 18 GHz    | 2%                      | (1)   |
|             | Radiated  | Radiated spurious emissions   | 0.009 MHz ÷ 26.5 GHz | 6.0 dB                  | (1)   |
|             |           |   | 26.5 GHz ÷ 66 GHz    | 8.0 dB                  | (1)   |
|             |           |   | 66 GHz ÷ 220 GHz     | 10 dB                   | (1)   |
|             |           | Effective radiated power transmitter  | 10 kHz ÷ 26.5 GHz    | 6.0 dB                  | (1)   |
|             |           |   | 26.5 GHz ÷ 66 GHz    | 8.0 dB                  | (1)   |
|             |           |   | 66 GHz ÷ 220 GHz     | 10 dB                   | (1)   |

**NOTES:**

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95 %

## Section 7. Test equipment

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### 7.1 Test equipment list

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*Table 7.1-1: Equipment list*

| Equipment                  | Manufacturer | Model no.                 | Asset no. | Cal cycle | Next cal. |
|----------------------------|--------------|---------------------------|-----------|-----------|-----------|
| EMI receiver               | R&S          | ESCI                      | 100888    | 2019-10   | 2020-10   |
| EMI receiver               | R&S          | ESW44                     | 101620    | 2019-08   | 2020-08   |
| Trilog Broadband Antenna   | Schwarzbeck  | VULB 9162                 | 9162-025  | 2018-07   | 2021-07   |
| Bilog antenna (1 ÷ 18 GHz) | Schwarzbeck  | STLP 9148                 | 9148-123  | 2018-07   | 2021-07   |
| Controller                 | Maturo       | FCU3.0                    | 10041     | NCR       | NCR       |
| Tilt antenna mast          | Maturo       | TAM4.0-E                  | 10042     | NCR       | NCR       |
| Turntable                  | Maturo       | TT4.0-5T                  | 2.527     | NCR       | NCR       |
| Semi-anechoic chamber      | Nemko        | 10m semi-anechoic chamber | 530       | 2018-09   | 2021-09   |
| Shielded room              | Siemens      | 10m control room          | 1947      | NCR       | NCR       |

Note: NCR - no calibration required, VOU - verify on use

## Section 8. Testing data

### 8.1 FCC 15.31(m) Number of frequencies

#### 8.1.1 Definitions and limits

Measurements on intentional radiators or receivers shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table.

**Table 8.1-1: Frequency Range of Operation**

| Frequency range over which the device operates (in each band) | Number of test frequencies required | Location of measurement frequency inside the operating frequency range |
|---|-------------------------------------|--|
| 1 MHz or less   | 1                                   | Center (middle of the band)  |
| 1–10 MHz  | 2                                   | 1 near high end, 1 near low end  |
| Greater than 10 MHz   | 3                                   | 1 near high end, 1 near center and 1 near low end                      |

Note: “near” means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

#### 8.1.2 Test summary

|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | April 8, 2020 | Temperature       | 21 °C     |
| Test engineer | S. Tessa      | Air pressure      | 1025 mbar |
| Verdict       | Pass          | Relative humidity | 36 %      |

#### 8.1.3 Observations, settings and special notes

None

#### 8.1.4 Test data

**Table 8.1-2: Test channels selection**

| Start of Frequency range, MHz | End of Frequency range, MHz | Frequency range bandwidth, MHz | Low channel, MHz | Mid channel, MHz | High channel, MHz |
|-------------------------------|-----------------------------|--------------------------------|------------------|------------------|-------------------|
| --                            | --                          | --                             | --               | 433.95           | --                |

The EUT use only one channel

## 8.2 FCC 15.203 and RSS-Gen, section 6.8 Antenna requirement

### 8.2.1 Definitions and limits

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### 8.2.2 Test summary

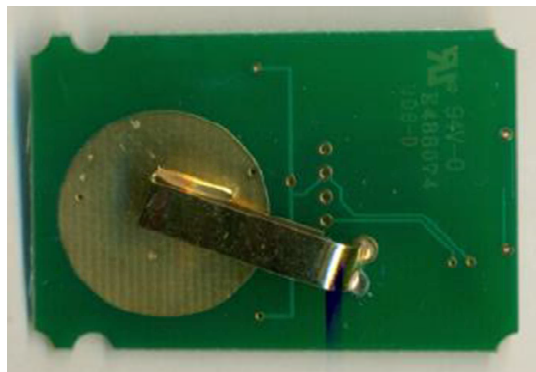
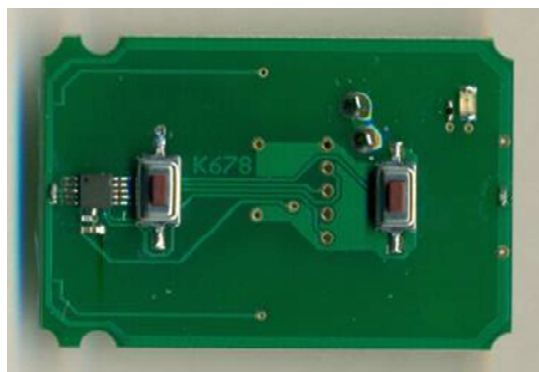
|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | April 8, 2020 | Temperature       | 21 °C     |
| Test engineer | S. Tessa      | Air pressure      | 1025 mbar |
| Verdict       | Pass          | Relative humidity | 36 %      |

### 8.2.3 Observations, settings and special notes

None

### 8.2.4 Test data

Must the EUT be professionally installed? ☐ YES ☒ NO  
 Does the EUT have detachable antenna(s)? ☐ YES ☒ NO  
 If detachable, is the antenna connector(s) non-standard? ☐ YES ☐ NO ☒ N/A



## 8.3 FCC 15.231(a) Conditions for intentional radiators to comply with periodic operation

---

### 8.3.1 Definitions and limits

---

- (a) The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:
- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
  - (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
  - (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
  - (4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.
  - (5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

### 8.3.2 Test summary

---

|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | April 8, 2020 | Temperature       | 21 °C     |
| Test engineer | S. Tessa      | Air pressure      | 1025 mbar |
| Verdict       | Pass          | Relative humidity | 36 %      |

### 8.3.3 Observations, settings and special notes

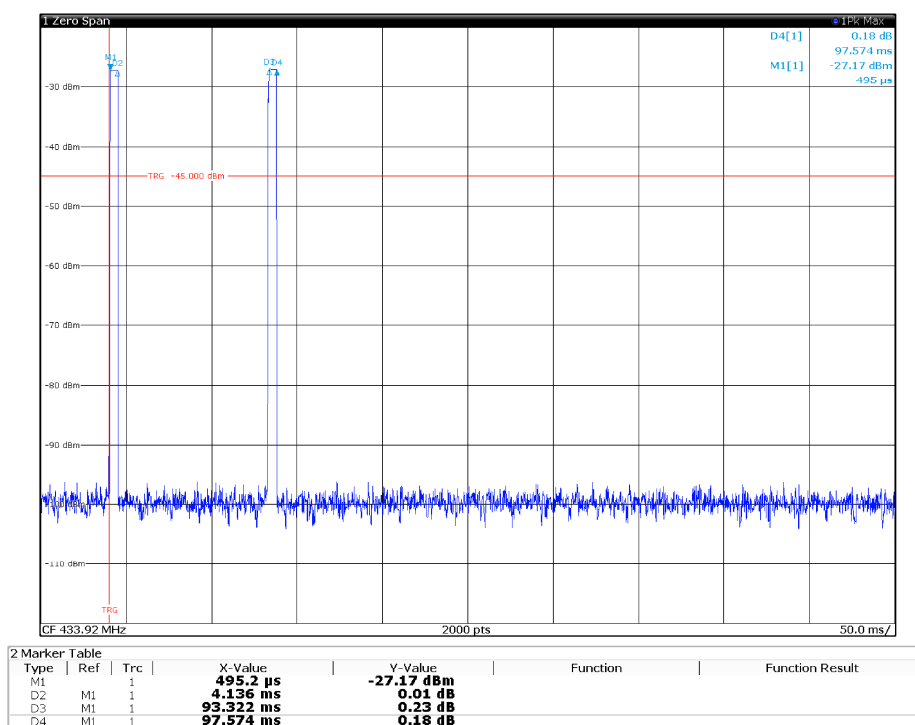
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None

### 8.3.4 Test data

- |    |   |   |  |
|----|---|---|--|
| 1) | The EUT is manually triggered?                                    | <input checked="" type="checkbox"/> YES | <input type="checkbox"/> NO            |
| 2) | The EUT is activated automatically?                               | <input type="checkbox"/> YES            | <input checked="" type="checkbox"/> NO |
| 3) | The EUT is a periodic transmitter?                                | <input type="checkbox"/> YES            | <input checked="" type="checkbox"/> NO |
| 4) | The EUT's usage is for radio control purposes during emergencies? | <input type="checkbox"/> YES            | <input checked="" type="checkbox"/> NO |
| 5) | The EUT transmits set-up information?                             | <input type="checkbox"/> YES            | <input checked="" type="checkbox"/> NO |

Once manually triggered the EUT stop to transmit after the release of the button.

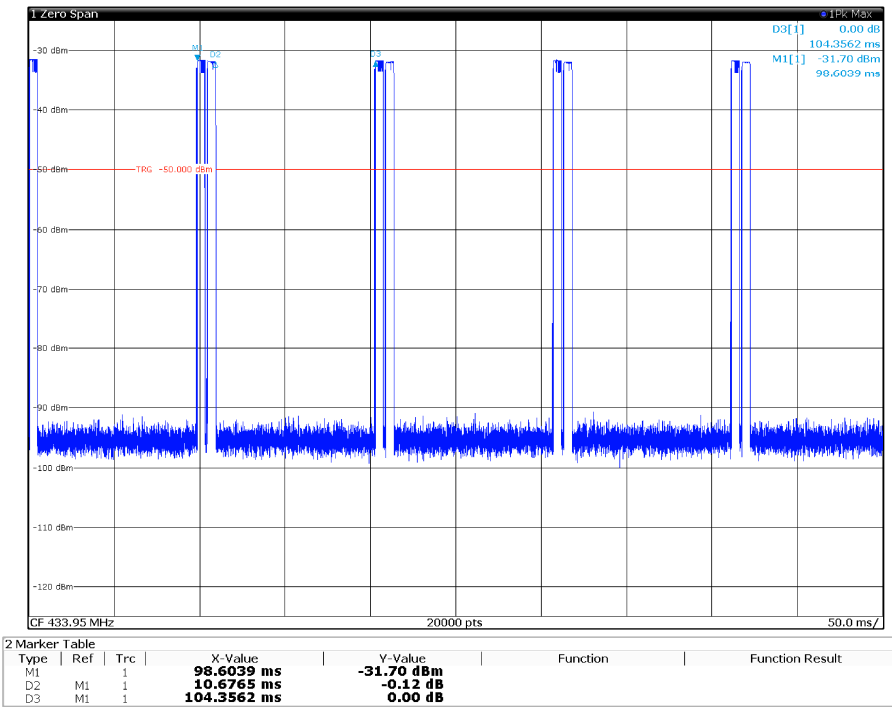
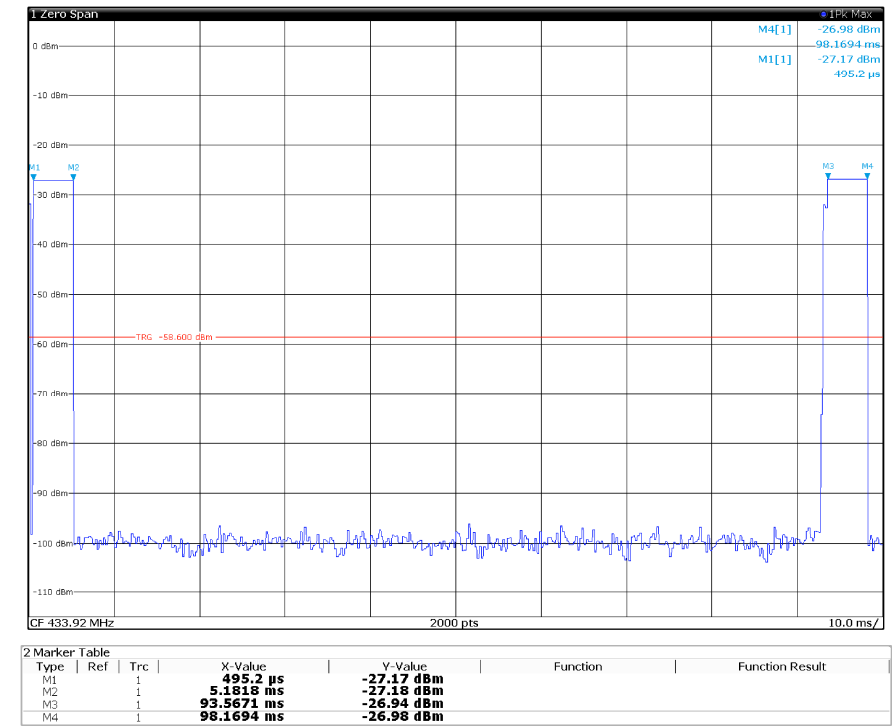




Detailed timing information:

The EUT repeat the following pattern:

1 pulse of 5 ms followed by a pause of 88 ms



|                      |  |
|----------------------|--|
| <b>Section 8</b>     | Testing data   |
| <b>Test name</b>     | FCC 15.231(a) Conditions for intentional radiators to comply with periodic operation |
| <b>Specification</b> | FCC Part 15 Subpart C  |

The duty cycle calculated, with the following equation, is 5 %.

$$\delta(\text{dB}) = 20 \log \left[ \sum (nt_1 + mt_2 + \dots + \xi t_x) / T \right]$$



## 8.4 FCC 15.231(b) Field strength of emissions

### 8.4.1 Definitions and limits

- (b) In addition to the provisions of §15.205 the field strength of emissions from intentional radiators operated under this section shall not exceed the following table.
- 1) The field strength limits in the table are specified at a distance of 3 meters. The tighter limits apply at the band edges.
  - 2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.
  - 3) The limits on the field strength of the spurious emissions in the table below are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

**Table 8.4-1: Field strength limits**

| Fundamental frequency<br>(MHz) | Field strength of fundamental |                       | Field strength of spurious emissions |                       |
|--------------------------------|-------------------------------|-----------------------|--------------------------------------|-----------------------|
|                                | ( $\mu\text{V/m}$ )           | (dB $\mu\text{V/m}$ ) | ( $\mu\text{V/m}$ )                  | (dB $\mu\text{V/m}$ ) |
| 40.66–40.70                    | 2,250                         | 67                    | 225                                  | 47                    |
| 70–130                         | 1,250                         | 61.9                  | 125                                  | 41.9                  |
| 130–174                        | 1,250 to 3,750*               | 61.9 to 71.5*         | 125 to 375*                          | 41.9 to 51.5*         |
| 174–260                        | 3,750                         | 71.5                  | 375                                  | 51.5                  |
| 260–470                        | 3,750 to 12,500*              | 71.5 to 81.9*         | 375 to 1,250*                        | 51.5 to 61.9*         |
| Above 470                      | 12,500                        | 81.9                  | 1,250                                | 61.9                  |

\* Linear interpolations

Note:

\* Linear interpolation with frequency F in MHz

**Table 8.4-2: FCC §15.209– Radiated emission limits**

| Frequency,<br>MHz | Field strength of emissions |                                 | Measurement distance, m |
|-------------------|-----------------------------|---------------------------------|-------------------------|
|                   | $\mu\text{V/m}$             | dB $\mu\text{V/m}$              |                         |
| 0.009–0.490       | 2400/F                      | $67.6 - 20 \times \log_{10}(F)$ | 300                     |
| 0.490–1.705       | 24000/F                     | $87.6 - 20 \times \log_{10}(F)$ | 30                      |
| 1.705–30.0        | 30                          | 29.5                            | 30                      |
| 30–88             | 100                         | 40.0                            | 3                       |
| 88–216            | 150                         | 43.5                            | 3                       |
| 216–960           | 200                         | 46.0                            | 3                       |
| above 960         | 500                         | 54.0                            | 3                       |

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

**Table 8.4-3:** FCC restricted frequency bands

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090–0.110       | 16.42–16.423        | 399.9–410     | 4.5–5.15    |
| 0.495–0.505       | 16.69475–16.69525   | 608–614       | 5.35–5.46   |
| 2.1735–2.1905     | 16.80425–16.80475   | 960–1240      | 7.25–7.75   |
| 4.125–4.128       | 25.5–25.67          | 1300–1427     | 8.025–8.5   |
| 4.17725–4.17775   | 37.5–38.25          | 1435–1626.5   | 9.0–9.2     |
| 4.20725–4.20775   | 73–74.6             | 1645.5–1646.5 | 9.3–9.5     |
| 6.215–6.218       | 74.8–75.2           | 1660–1710     | 10.6–12.7   |
| 6.26775–6.26825   | 108–121.94          | 1718.8–1722.2 | 13.25–13.4  |
| 6.31175–6.31225   | 123–138             | 2200–2300     | 14.47–14.5  |
| 8.291–8.294       | 149.9–150.05        | 2310–2390     | 15.35–16.2  |
| 8.362–8.366       | 156.52475–156.52525 | 2483.5–2500   | 17.7–21.4   |
| 8.37625–8.38675   | 156.7–156.9         | 2690–2900     | 22.01–23.12 |
| 8.41425–8.41475   | 162.0125–167.17     | 3260–3267     | 23.6–24.0   |
| 12.29–12.293      | 167.72–173.2        | 3332–3339     | 31.2–31.8   |
| 12.51975–12.52025 | 240–285             | 3345.8–3358   | 36.43–36.5  |
| 12.57675–12.57725 | 322–335.4           | 3600–4400     | Above 38.6  |
| 13.36–13.41       |                     |               |             |

#### 8.4.2 Test summary

|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | April 9, 2020 | Temperature       | 21 °C     |
| Test engineer | S. Tessa      | Air pressure      | 1025 mbar |
| Verdict       | Pass          | Relative humidity | 36 %      |

#### 8.4.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 5 GHz.  
Radiated measurements were performed at a distance of 3 m.  
EUTs that can be operated in multiple orientations (such as handheld, portable, or modular devices) shall be tested in three orientations.  
Average radiated emissions were obtained by subtracting duty cycle / correction factor from the peak measurement results.

Spectrum analyser settings for radiated measurements below 1 GHz:

|                      |          |
|----------------------|----------|
| Resolution bandwidth | 100 kHz  |
| Video bandwidth      | 300 kHz  |
| Detector mode        | Peak     |
| Trace mode           | Max Hold |

Spectrum analyser settings for radiated measurements above 1 GHz:

|                      |          |
|----------------------|----------|
| Resolution bandwidth | 1 MHz    |
| Video bandwidth      | 3 MHz    |
| Detector mode        | Peak     |
| Trace mode           | Max Hold |

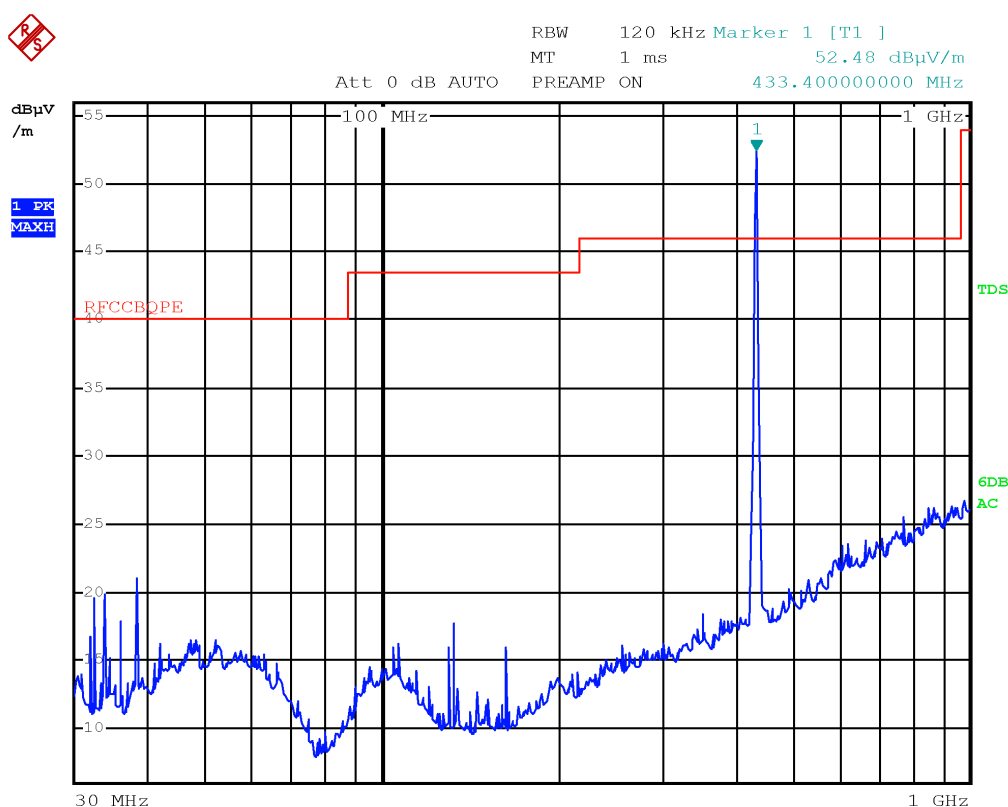
## 8.4.4 Test data

### Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed; the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

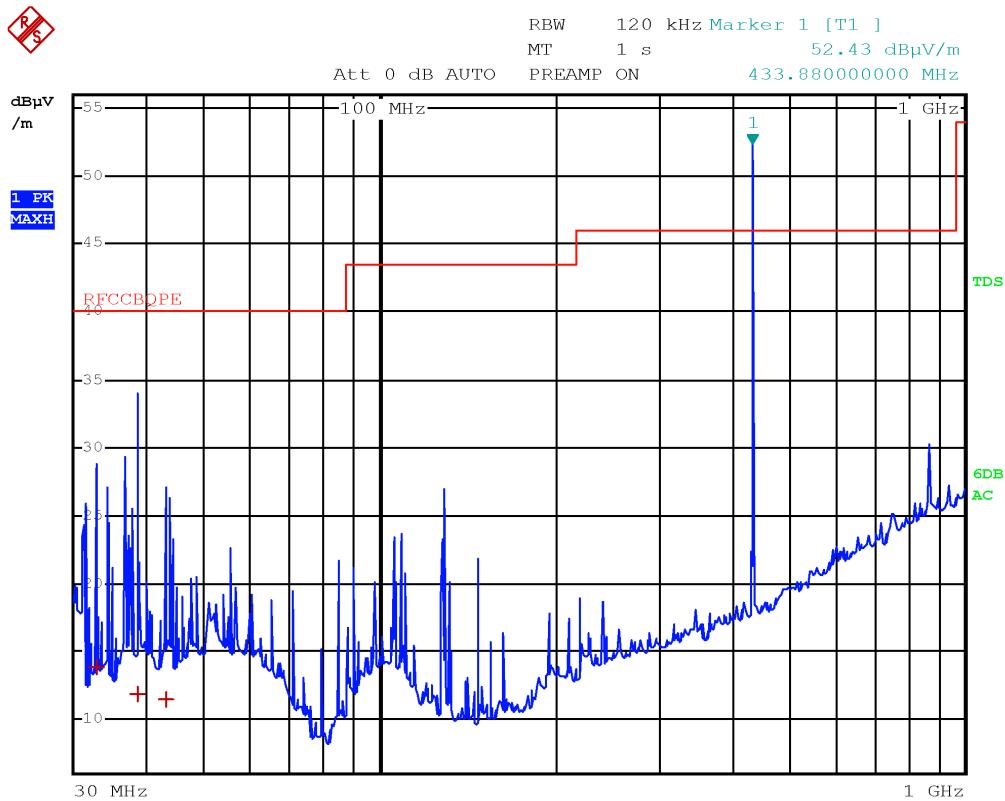
$$\text{Duty cycle or average factor} = 20 \times \log_{10} \left( \frac{T_{x_{100ms}}}{100ms} \right)$$

$$\text{Duty cycle correction factor for 46.4 ms pulse duration} = 20 \times \log_{10} (10 / 100) = -20 \text{ dB}$$



Radiated emission in the frequency range 30 to 1000 MHz with EUT in horizontal position and the antenna in horizontal polarization

| Frequency, MHz | Peak field strength, dBµV/m | Peak limit, dBµV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBµV/m | Average limit, dBµV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 433.40         | 52.5                        | --                 | --         | -20.0                 | 32.5                           | 80.1                  | -47.6      |

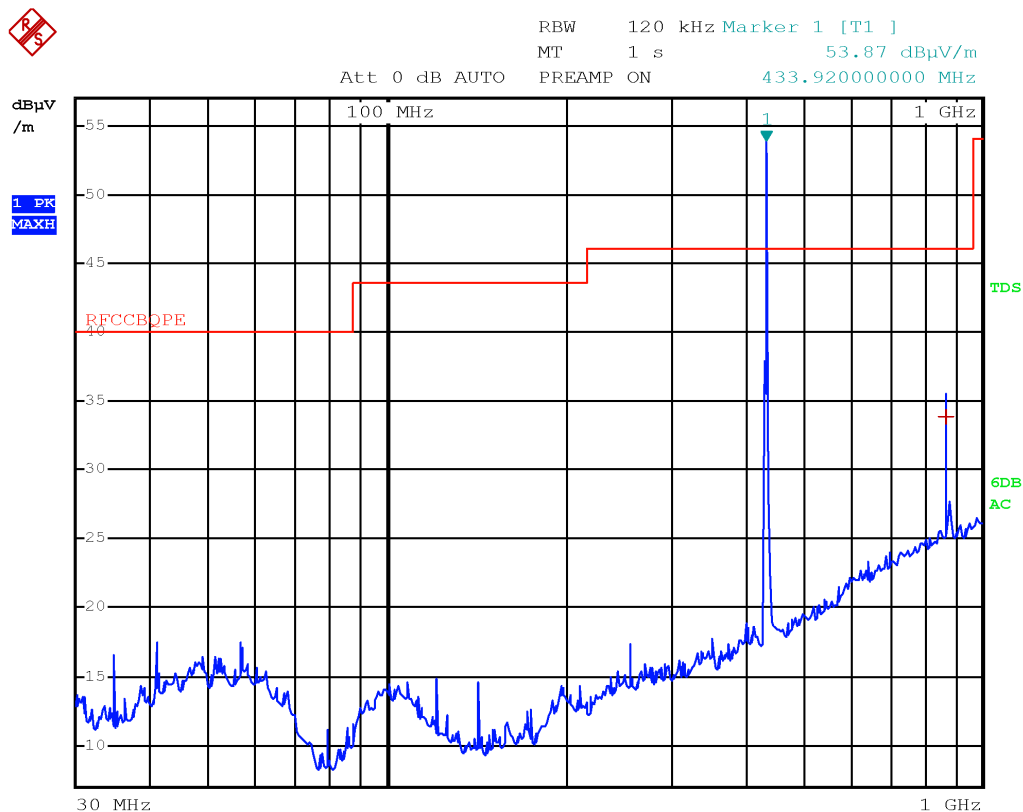


Radiated emission in the frequency range 30 to 1000 MHz with EUT in horizontal position and the antenna in vertical polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 433.88         | 52.4                        | --                 | --         | -20.0                 | 32.4                           | 80.1                  | -47.7      |

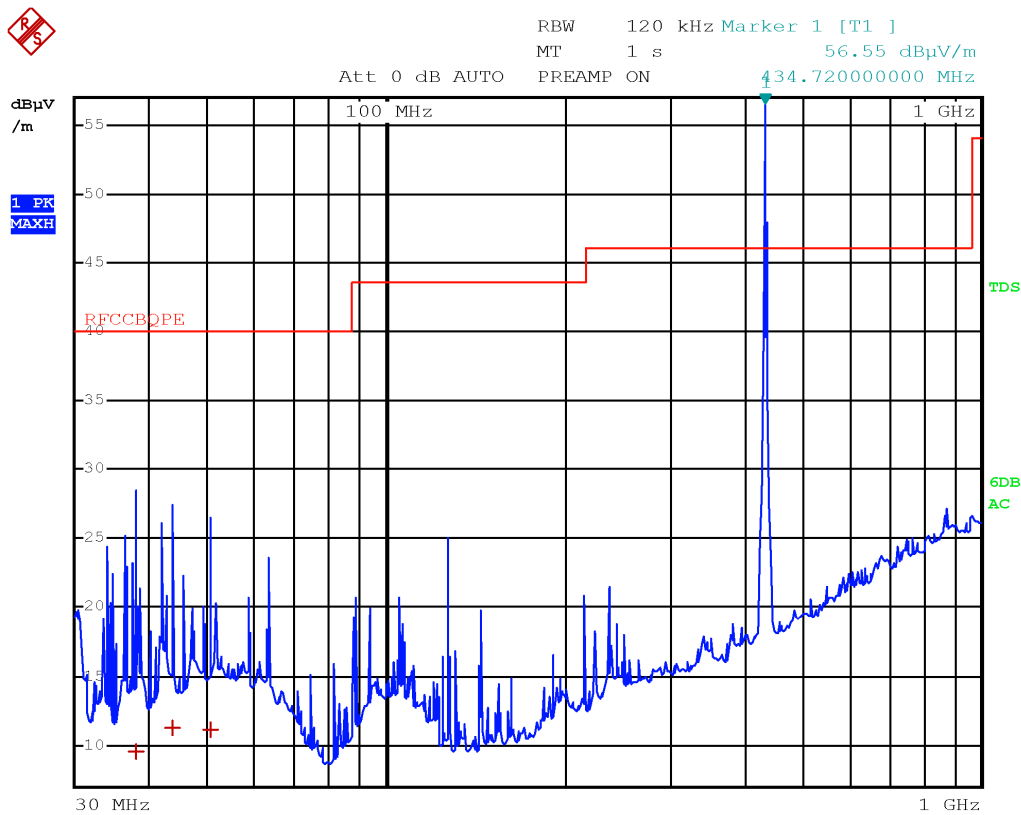
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Specification

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FCC 15.231(b) Field strength of emissions  
FCC Part 15 Subpart C



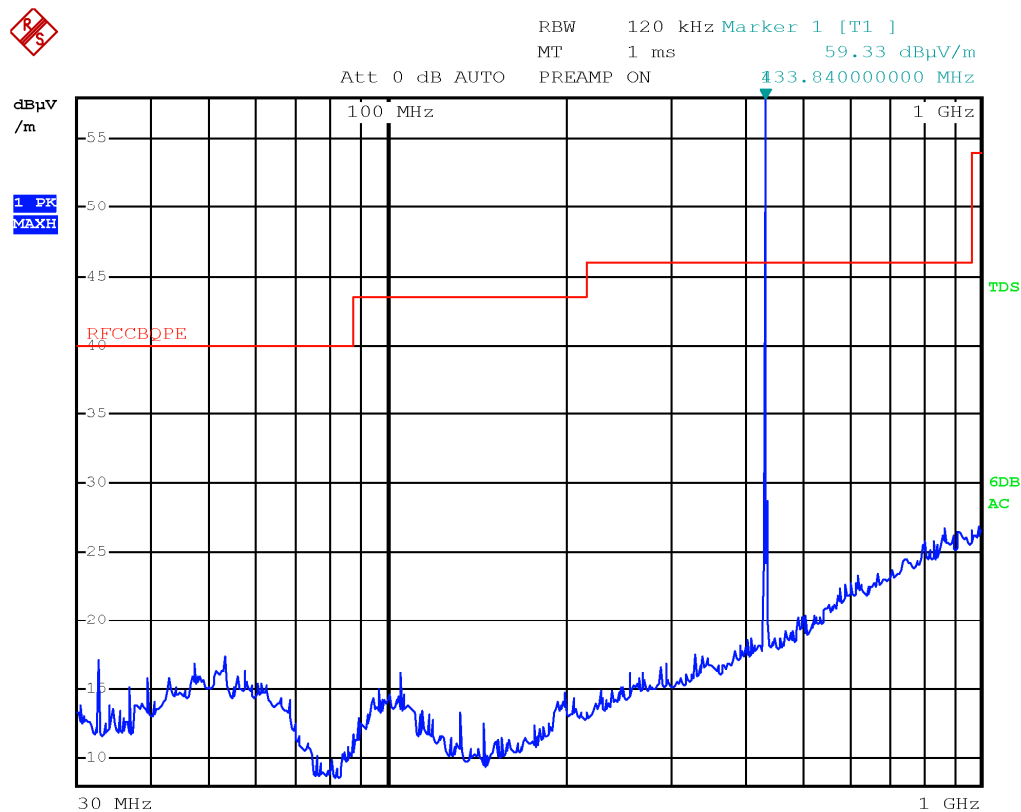
Radiated emission in the frequency range 30 to 1000 MHz with EUT in lateral position and the antenna in horizontal polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 433.92         | 53.9                        | --                 | --         | -20.0                 | 33.9                           | 80.1                  | -46.2      |
| 867.76         | 33.8                        | --                 | --         | -20.0                 | 13.8                           | 60.1                  | -46.3      |



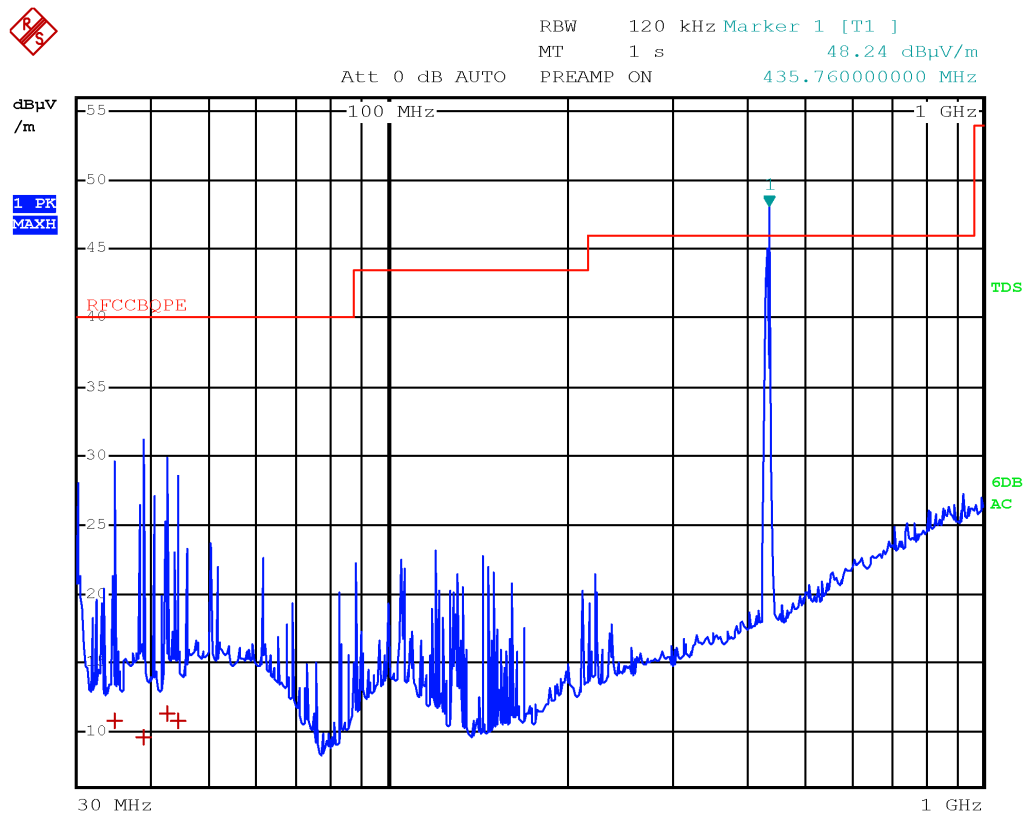
Radiated emission in the frequency range 30 to 1000 MHz with EUT in lateral position and the antenna in vertical polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 434.72         | 56.6                        | --                 | --         | -20.0                 | 36.6                           | 80.1                  | -43.5      |



Radiated emission in the frequency range 30 to 1000 MHz with EUT in vertical position and the antenna in horizontal polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 433.84         | 59.3                        | --                 | --         | -20.0                 | 39.3                           | 80.1                  | -40.8      |



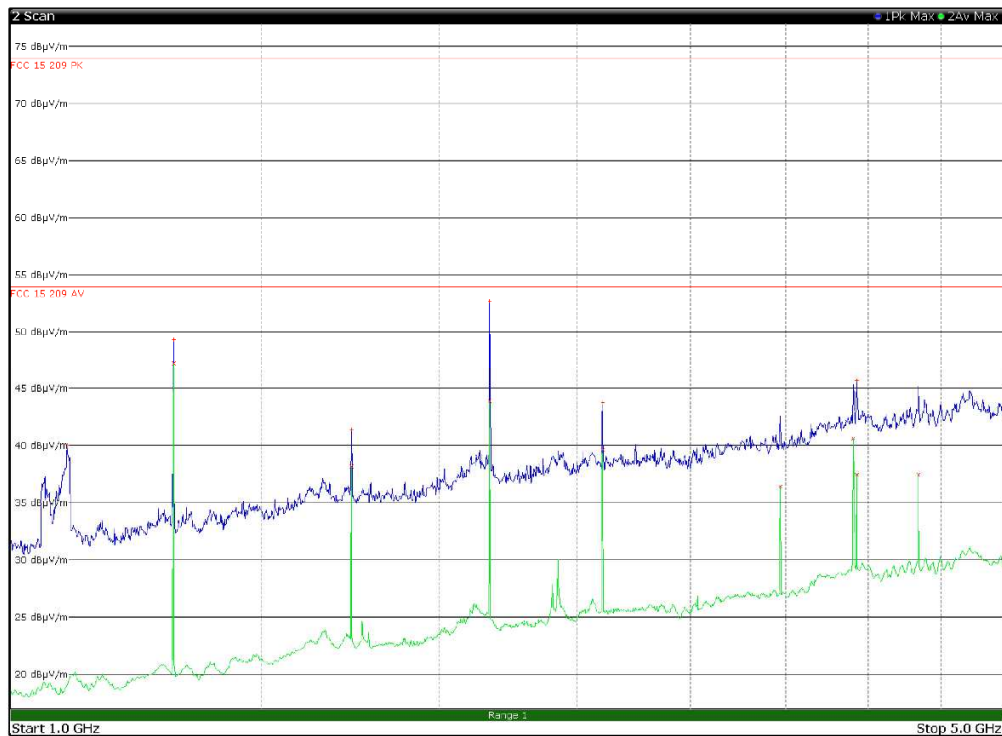
Radiated emission in the frequency range 30 to 1000 MHz with EUT in vertical position and the antenna in vertical polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 435.76         | 48.2                        | --                 | --         | -20.0                 | 46.2                           | 80.1                  | -33.9      |



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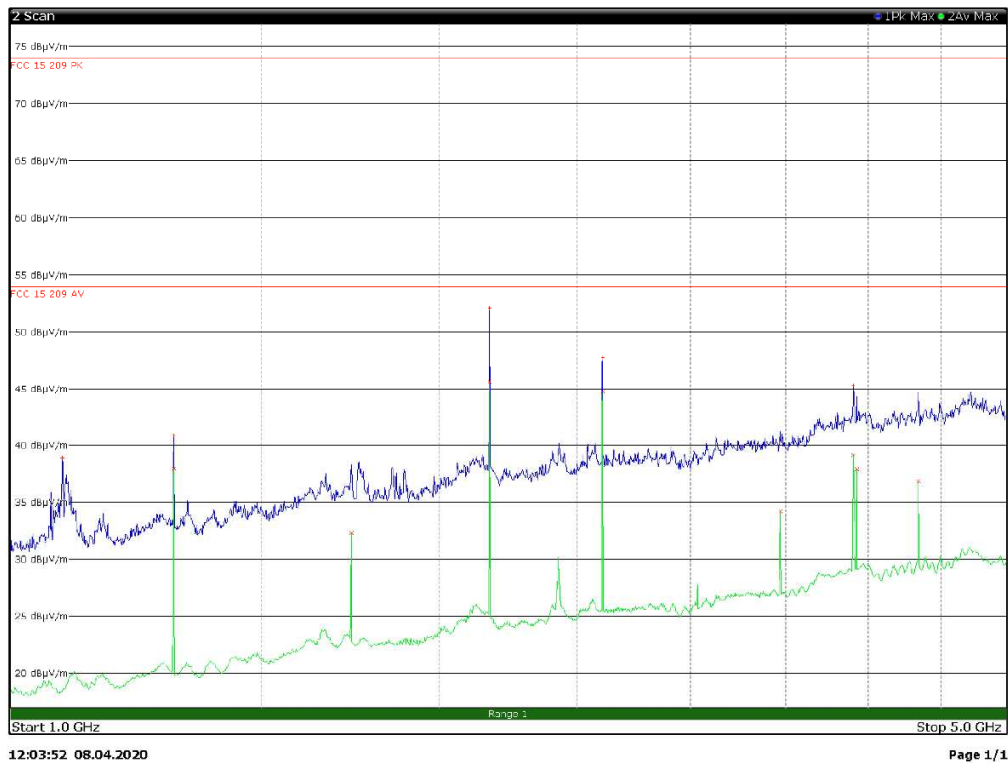


Radiated emission in the frequency range 1 to 5 GHz with EUT in horizontal position and the antenna in horizontal polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 1096.0000      | 40.1                        | 74.0               | -33.9      | -20.0                 | 20.1                           | 54.0                  | -33.9      |
| 1301.7500      | 49.4                        | 74.0               | -24.6      | -20.0                 | 29.4                           | 54.0                  | -24.6      |
| 1735.7500      | 41.5                        | --                 | --         | -20.0                 | 21.5                           | 60.1                  | -38.6      |
| 2169.5000      | 52.8                        | --                 | --         | -20.0                 | 32.8                           | 60.1                  | -27.3      |
| 2603.5000      | 43.8                        | --                 | --         | -20.0                 | 23.8                           | 60.1                  | -36.3      |
| 3928.5000      | 45.7                        | 74.0               | -28.3      | -20.0                 | 25.7                           | 54.0                  | -28.3      |

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Testing data  
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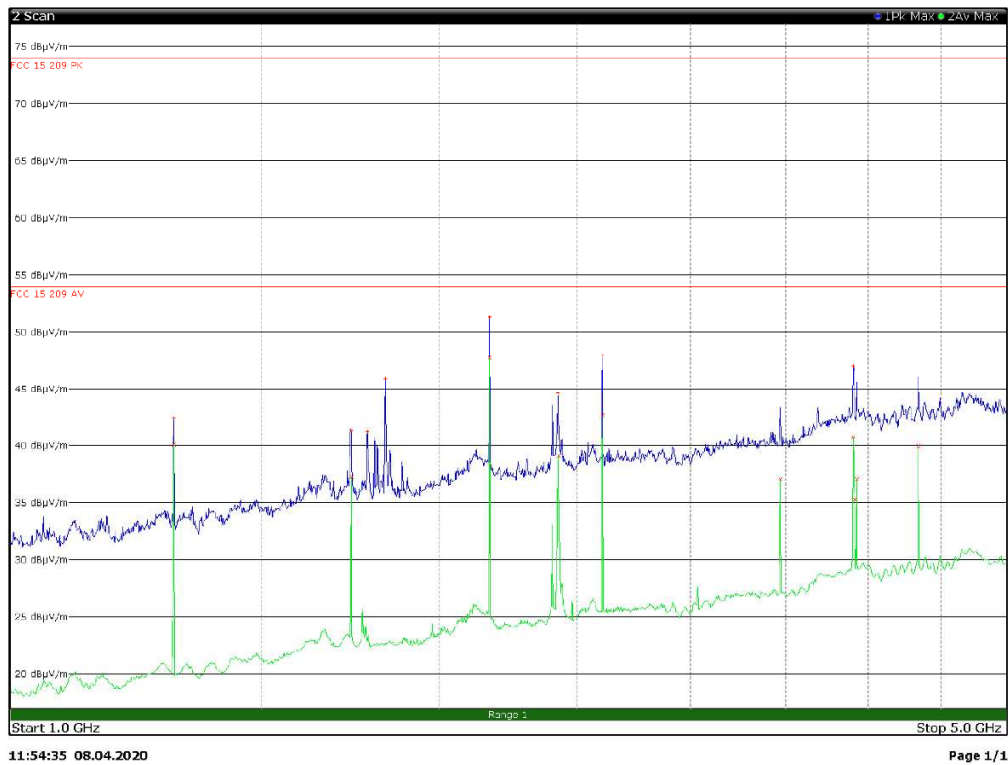


Radiated emission in the frequency range 1 to 5 GHz with EUT in horizontal position and the antenna in vertical polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 1087.7500      | 39.0                        | 74.0               | -35.0      | -20.0                 | 19.0                           | 54.0                  | -35.0      |
| 1301.7500      | 40.9                        | 74.0               | -33.1      | -20.0                 | 20.9                           | 54.0                  | -33.1      |
| 2169.5000      | 52.2                        | --                 | --         | -20.0                 | 32.2                           | 60.1                  | -27.9      |
| 2603.5000      | 47.9                        | --                 | --         | -20.0                 | 27.9                           | 60.1                  | -32.2      |
| 3905.2500      | 45.4                        | 74.0               | -28.6      | -20.0                 | 25.4                           | 54.0                  | -28.6      |

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Testing data  
FCC 15.231(b) Field strength of emissions  
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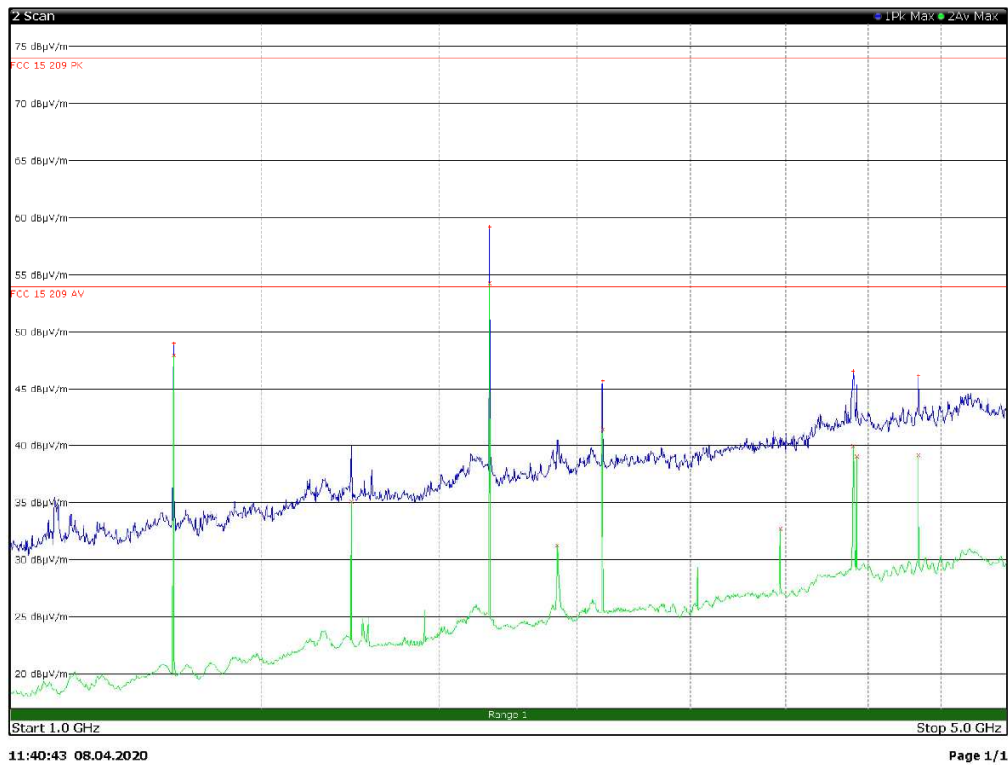


Radiated emission in the frequency range 1 to 5 GHz with EUT in lateral position and the antenna in horizontal polarization

| Frequency,<br>MHz | Peak field<br>strength,<br>dBμV/m | Peak limit,<br>dBμV/m | Margin, dB | Duty cycle<br>factor, dB | Average field<br>strength,<br>dBμV/m | Average limit,<br>dBμV/m | Margin, dB |
|-------------------|-----------------------------------|-----------------------|------------|--------------------------|--------------------------------------|--------------------------|------------|
| 1301.7500         | 43.7                              | 74.0                  | -30.3      | -20.0                    | 23.7                                 | 54.0                     | -30.3      |
| 1732.7500         | 41.4                              | --                    | --         | -20.0                    | 21.4                                 | 60.1                     | -38.7      |
| 2169.7500         | 51.4                              | --                    | --         | -20.0                    | 31.4                                 | 60.1                     | -28.7      |
| 2603.7500         | 48.0                              | --                    | --         | -20.0                    | 28.0                                 | 60.1                     | -32.1      |
| 3905.7500         | 47.1                              | 74.0                  | -26.9      | -20.0                    | 27.1                                 | 54.0                     | -26.9      |

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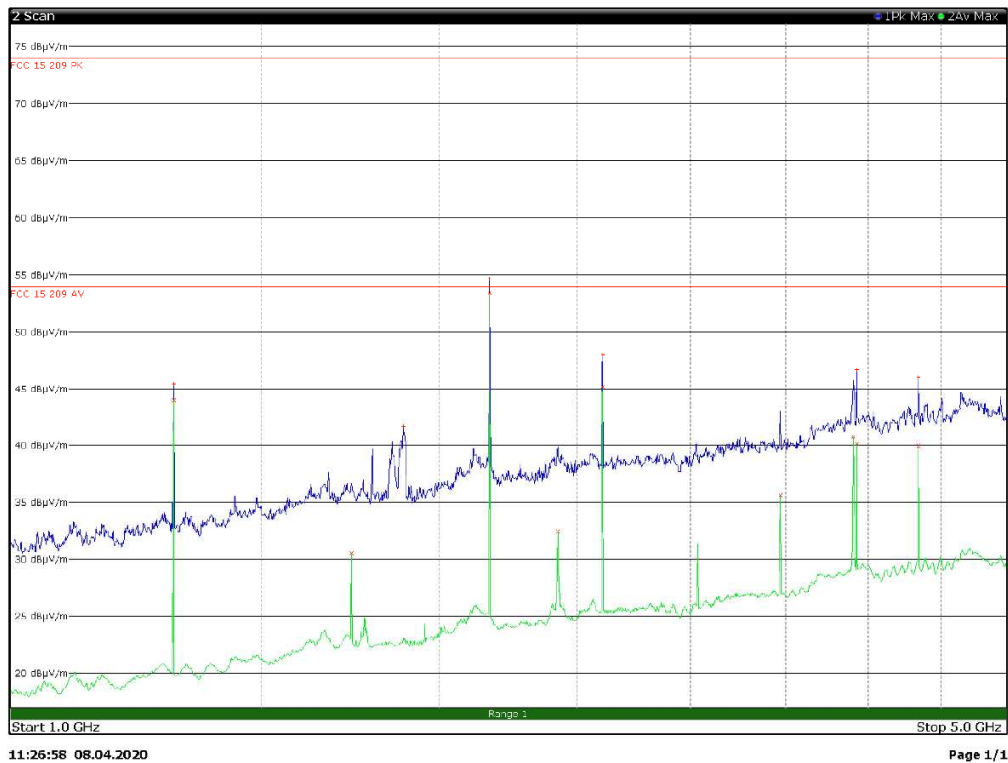


Radiated emission in the frequency range 1 to 5 GHz with EUT in lateral position and the antenna in vertical polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 1301.7500      | 49.1                        | 74.0               | -24.9      | -20.0                 | 29.1                           | 54.0                  | -24.9      |
| 2169.7500      | 59.3                        | --                 | --         | -20.0                 | 39.3                           | 60.1                  | -20.8      |
| 2603.5000      | 45.8                        | --                 | --         | -20.0                 | 25.8                           | 60.1                  | -34.3      |
| 3905.2500      | 46.6                        | 74.0               | -27.4      | -20.0                 | 26.6                           | 54.0                  | -27.4      |
| 4339.2500      | 46.2                        | 74.0               | -27.8      | -20.0                 | 26.2                           | 54.0                  | -27.8      |

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Testing data  
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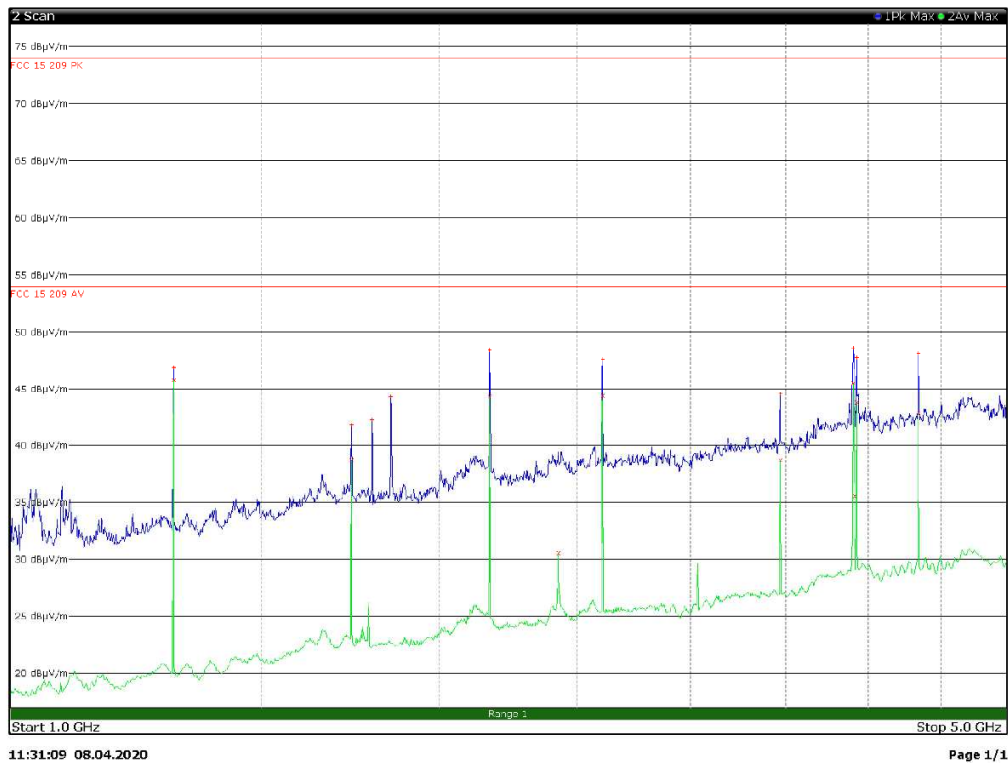


Radiated emission in the frequency range 1 to 5 GHz with EUT in vertical position and the antenna in horizontal polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 1302.0000      | 45.5                        | 74.0               | -28.5      | -20.0                 | 25.5                           | 54.0                  | -28.5      |
| 1887.2500      | 41.7                        | --                 | --         | -20.0                 | 21.7                           | 60.1                  | -38.4      |
| 2169.5000      | 54.7                        | --                 | --         | -20.0                 | 34.7                           | 60.1                  | -25.4      |
| 2603.7500      | 48.1                        | --                 | --         | -20.0                 | 28.1                           | 60.1                  | -32.0      |
| 3928.7500      | 46.8                        | 74.0               | -27.2      | -20.0                 | 26.8                           | 54.0                  | -27.2      |
| 4339.7500      | 46.1                        | 74.0               | -27.9      | -20.0                 | 26.1                           | 54.0                  | -27.9      |

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Testing data  
FCC 15.231(b) Field strength of emissions  
FCC Part 15 Subpart C



Radiated emission in the frequency range 1 to 5 GHz with EUT in vertical position and the antenna in vertical polarization

| Frequency, MHz | Peak field strength, dBμV/m | Peak limit, dBμV/m | Margin, dB | Duty cycle factor, dB | Average field strength, dBμV/m | Average limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|--------------------|------------|-----------------------|--------------------------------|-----------------------|------------|
| 1301.7500      | 47.0                        | 74.0               | -27.0      | -20.0                 | 27.0                           | 54.0                  | -27.0      |
| 1736.0000      | 41.9                        | --                 | --         | -20.0                 | 21.9                           | 60.1                  | -38.2      |
| 1794.2500      | 42.3                        | --                 | --         | -20.0                 | 22.3                           | 60.1                  | -37.8      |
| 1849.5000      | 44.4                        | --                 | --         | -20.0                 | 24.4                           | 60.1                  | -35.7      |
| 2169.5000      | 48.5                        | --                 | --         | -20.0                 | 28.5                           | 60.1                  | -31.6      |
| 2603.7500      | 47.7                        | --                 | --         | -20.0                 | 27.7                           | 60.1                  | -32.4      |
| 3471.2500      | 44.6                        | --                 | --         | -20.0                 | 24.6                           | 60.1                  | -35.5      |
| 3905.7500      | 48.7                        | 74.0               | -25.3      | -20.0                 | 28.7                           | 54.0                  | -25.3      |
| 3928.5000      | 47.9                        | 74.0               | -26.1      | -20.0                 | 27.9                           | 54.0                  | -26.1      |
| 4339.5000      | 48.2                        | 74.0               | -25.8      | -20.0                 | 28.2                           | 54.0                  | -25.8      |

## 8.5 FCC 15.231(c) Emission bandwidth of momentary signals

### 8.5.1 Definitions and limits

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### 8.5.2 Test summary

|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | April 9, 2020 | Temperature       | 21 °C     |
| Test engineer | S. Tessa      | Air pressure      | 1025 mbar |
| Verdict       | Pass          | Relative humidity | 36 %      |

### 8.5.3 Observations, settings and special notes

Limit: 0.25 % of 433.92 MHz is 1.08 MHz  
Spectrum analyser settings:

|                      |                               |
|----------------------|-------------------------------|
| Resolution bandwidth | ≥ 1 % of emission bandwidth   |
| Video bandwidth      | ≥ 3 × RBW                     |
| Frequency span       | Wider than emission bandwidth |
| Detector mode        | Peak                          |

### 8.5.4 Test data

**Table 8.5-1: Occupied bandwidth measurement result**

| Occupied bandwidth per frequency, KHz | Limit, MHz | Margin, kHz |
|---------------------------------------|------------|-------------|
| 680.0                                 | 1.08       | - 400.0     |

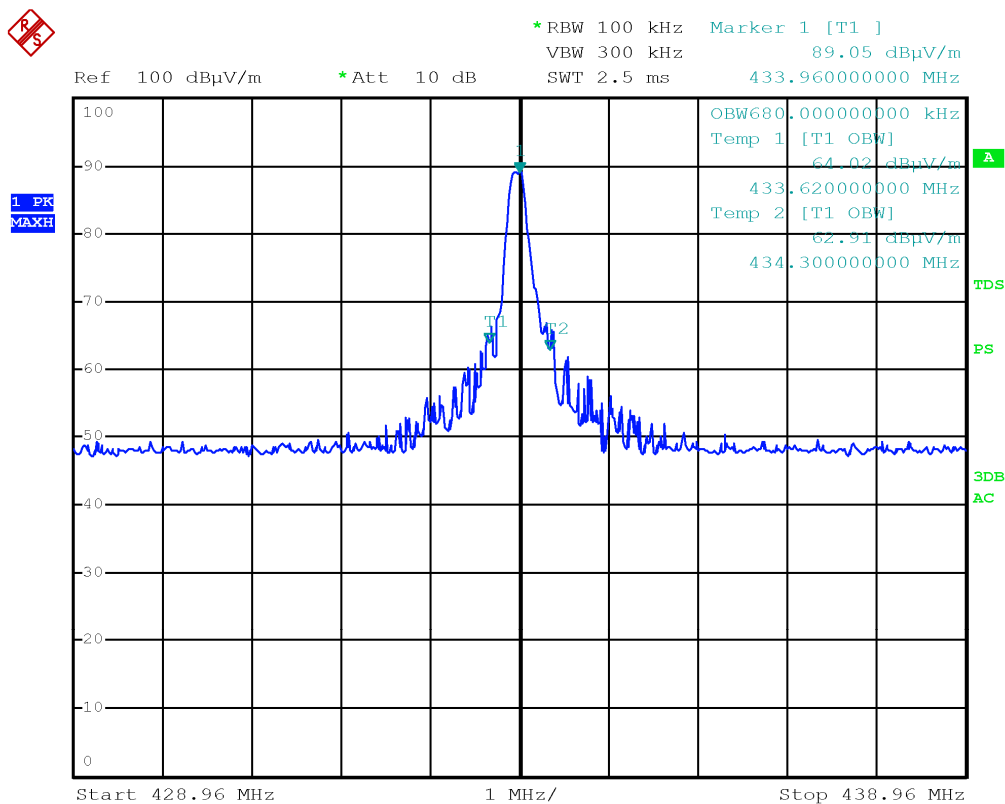
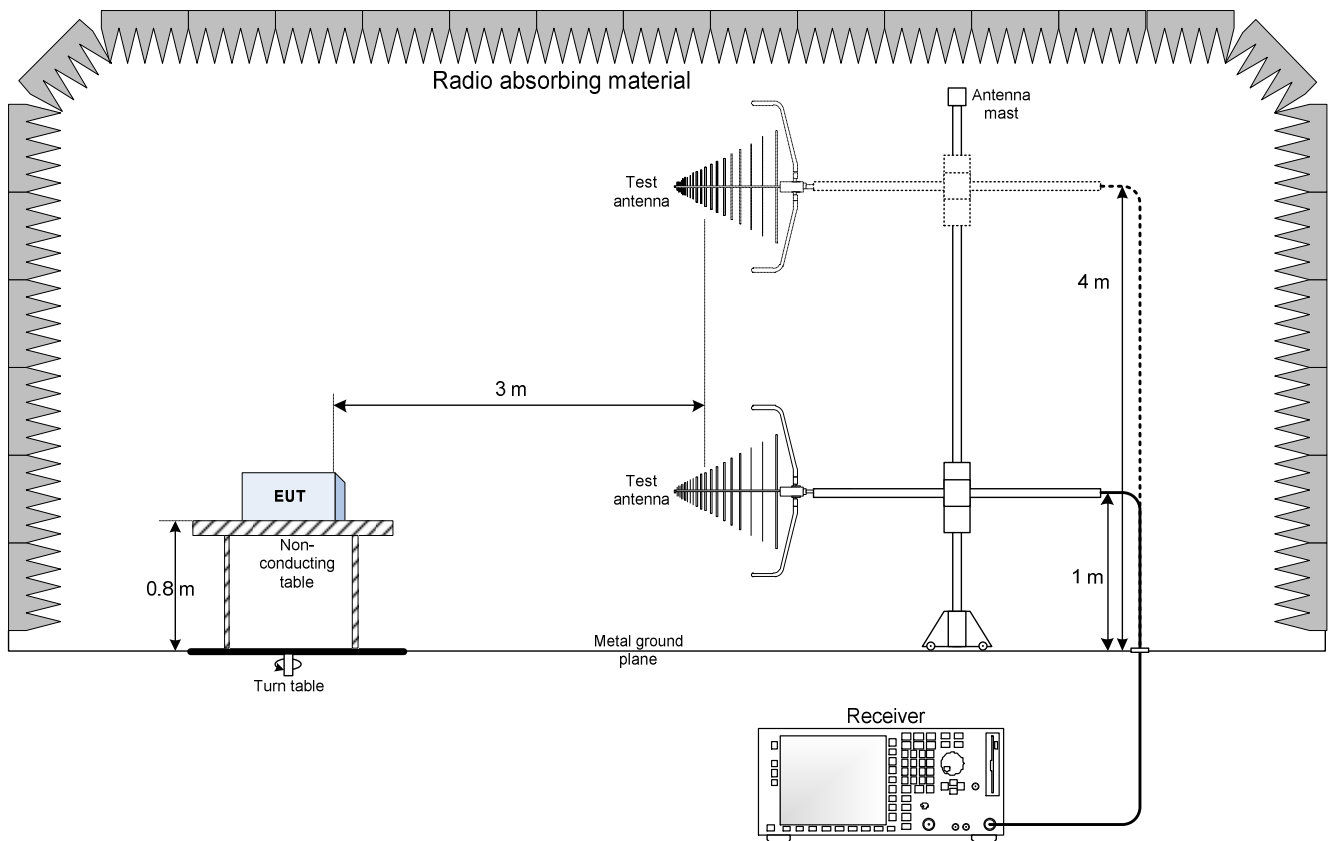


Figure 8.5-1: Occupied bandwidth measurement

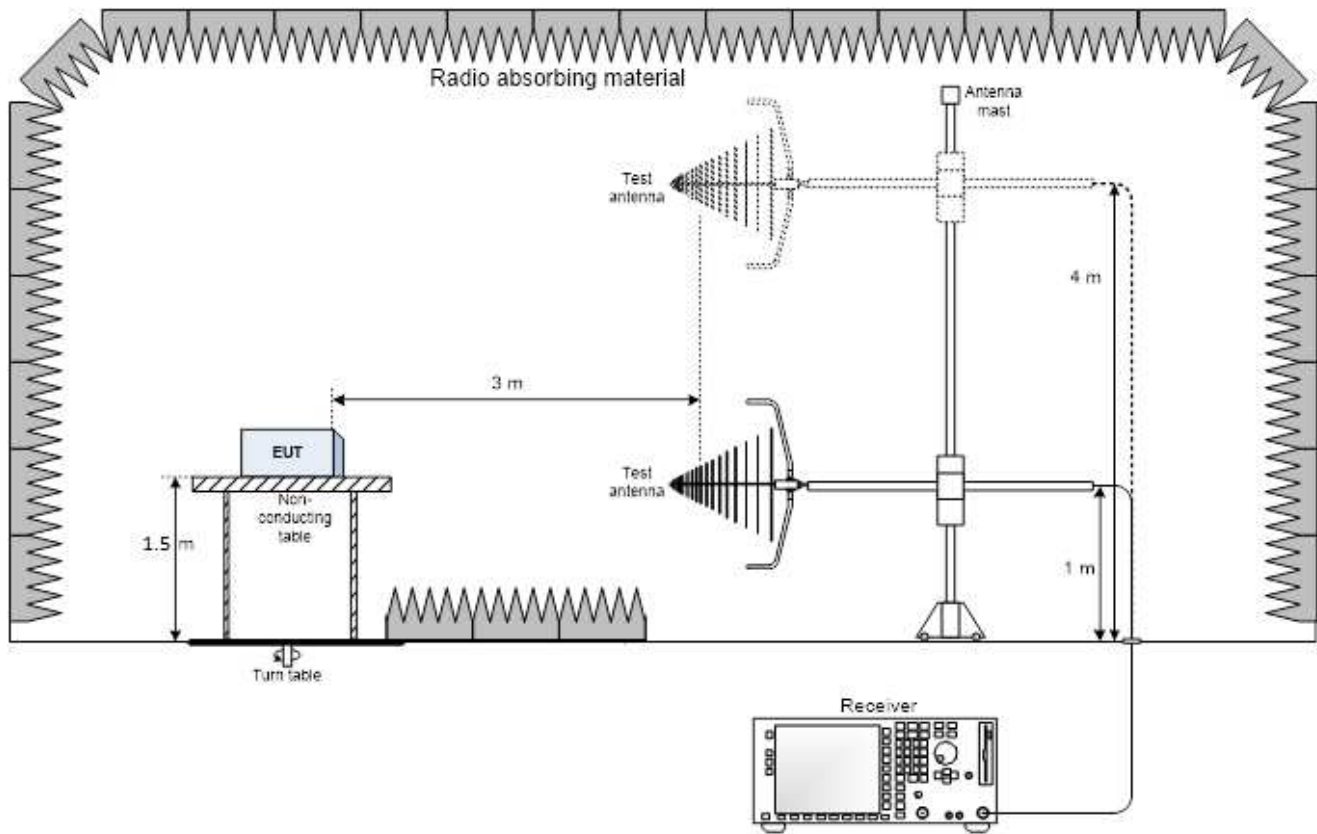


## Section 9. Block diagrams of test set-ups

### 9.1 Radiated emissions set-up for frequencies below 1 GHz



## 9.2 Radiated emissions set-up for frequencies above 1 GHz



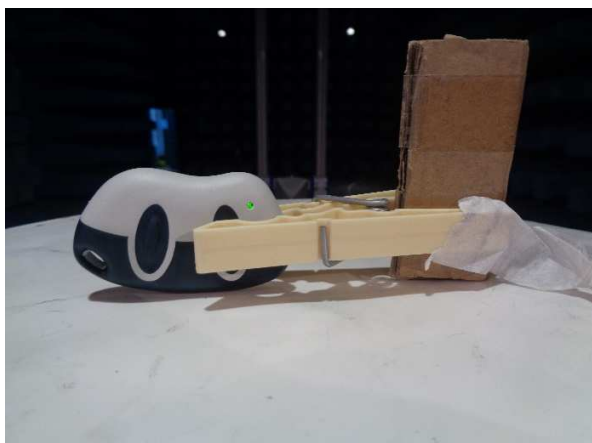
## Section 10. Photos

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### 10.1 Photos of the test set-up

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## 10.2 Photos of the EUT

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End of report