# TEST REPORT

| | | |
|---|---|---|
| **Product** | : | Multi Mouse Trap |
| **Trade mark** | : | Rentokil Initial |
| **Model/Type reference** | : | 5000009R |
| **Serial Number** | : | N/A |
| **Report Number** | : | EED32O81365001 |
| **FCC ID** | : | 2AK3P-5000009R |
| **Date of Issue** | : | Feb. 01, 2023 |
| **Test Standards** | : | 47 CFR Part 15 Subpart C |
| **Test result** | : | PASS |

Prepared for:

**Rentokil Initial 1927 plc**
**Compass House, Manor Royal, Crawley, West Sussex, RH10 9PY, United Kingdom**

Prepared by:

**Centre Testing International Group Co., Ltd.**
**Hongwei Industrial Zone, Bao'an 70 District, Shenzhen, Guangdong, China**
**TEL: +86-755-3368 3668**
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Approved by: Aaron Ma — Aaron Ma

Date of issue: Feb. 01, 2023

Check No.:1845310822

# 1 Contents

# 2 Version

| Version No. | Date | Description |
|---|---|---|
| 00 | Feb. 01, 2023 | Original |
| | | |
| | | |

# 3 Test Summary

| Test Item | Test Requirement | Result |
|---|---|---|
| **Antenna Requirement** | 47 CFR Part 15, Subpart C Section 15.203/15.247 (c) | PASS |
| **AC Power Line Conducted Emission** | 47 CFR Part 15, Subpart C Section 15.207 | N/A |
| **Maximum Conducted Output Power** | 47 CFR Part 15, Subpart C Section 15.247 (b)(1) | PASS |
| **20dB Emission Bandwidth** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | PASS |
| **Carrier Frequency Separation** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | PASS |
| **Number of Hopping Channels** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | PASS |
| **Time of Occupancy** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | PASS |
| **Pseudorandom Frequency Hopping Sequence** | 47 CFR Part 15, Subpart C Section 15.247(b)(4) | PASS |
| **Band Edge Measurements** | 47 CFR Part 15, Subpart C Section 15.247(d) | PASS |
| **Conducted Spurious Emissions** | 47 CFR Part 15, Subpart C Section 15.247(d) | PASS |
| **Radiated Spurious emissions** | 47 CFR Part 15, Subpart C Section 15.205/15.209 | PASS |
| **Restricted bands around fundamental frequency** | 47 CFR Part 15, Subpart C Section 15.205/15.209 | PASS |

Remark:
N/A：The product is power by battery.
Company Name and Address shown on Report, the sample(s) and sample Information were provided by the applicant who should be responsible for the authenticity which CTI hasn't verified.

# 4 General Information

## 4.1 Client Information

| | |
|---|---|
| Applicant: | Rentokil Initial 1927 plc |
| Address of Applicant: | Compass House, Manor Royal, Crawley, West Sussex, RH10 9PY, United Kingdom |
| Manufacturer: | Rentokil Initial 1927 plc |
| Address of Manufacturer: | Compass House, Manor Royal, Crawley, West Sussex, RH10 9PY, United Kingdom |
| Factory: | Exzone Precision Engineering Sdn Bhd |
| Address of Factory: | Lot 50, Jalan 7, Bakar Arang Industrial Estate, 08000 Sungai Petani, Kedah, Malaysia |

## 4.2 General Description of EUT

| | |
|---|---|
| Product Name: | Multi Mouse Trap |
| Model No.: | 5000009R |
| Trade Mark: | Rentokil Initial |
| Product Type: | Fix Location |
| Operation Frequency: | 915.25MHz~927.50MHz |
| Modulation Technique: | Frequency Hopping Spread Spectrum(FHSS) |
| Modulation Type: | LoRa Chirp Spread Spectrum |
| Number of Channel: | 50 |
| Hopping Channel Type: | Adaptive Frequency Hopping systems |
| Antenna Type: | Internal antenna |
| Antenna Gain: | -1.0dBi |
| Power Supply: | Battery:DC 4.5V |
| Test Voltage: | DC 4.5V |
| Sample Received Date: | Sep. 01, 2022 |
| Sample tested Date: | Jan. 11, 2023 to Jan.31, 2023 |

| Operation Frequency each of channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency(MHz) | Channel | Frequency (MHz) |
| 1 | 915.25 | 14 | 918.50 | 27 | 921.75 | 40 | 925.00 |
| 2 | 915.50 | 15 | 918.75 | 28 | 922.00 | 41 | 925.25 |
| 3 | 915.75 | 16 | 919.00 | 29 | 922.25 | 42 | 925.50 |
| 4 | 916.00 | 17 | 919.25 | 30 | 922.50 | 43 | 925.75 |
| 5 | 916.25 | 18 | 919.50 | 31 | 922.75 | 44 | 926.00 |
| 6 | 916.50 | 19 | 919.75 | 32 | 923.00 | 45 | 926.25 |
| 7 | 916.75 | 20 | 920.00 | 33 | 923.25 | 46 | 926.50 |
| 8 | 917.00 | 21 | 920.25 | 34 | 923.50 | 47 | 926.75 |
| 9 | 917.25 | 22 | 920.50 | 35 | 923.75 | 48 | 927.00 |
| 10 | 917.50 | 23 | 920.75 | 36 | 924.00 | 49 | 927.25 |
| 11 | 917.75 | 24 | 921.00 | 37 | 924.25 | 50 | 927.50 |
| 12 | 918.00 | 25 | 921.25 | 38 | 924.50 | | |
| 13 | 918.25 | 26 | 921.50 | 39 | 924.75 | | |

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Channel | Frequency(MHz) |
|---|---|
| The Lowest channel | 915.25 |
| The Middle channel | 921.25 |
| The Highest channel | 927.50 |

## 4.3 Test Configuration

| **EUT Test Software Settings:** | | |
|---|---|---|
| Software: | Putty.exe | |
| EUT Power Grade: | Default(Power level is built-in set parameters and cannot be changed and selected) | |
| Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT. | | |
| Mode | Channel | Frequency(MHz) |
| BW125KHz | CH1 | 915.25 |
| | CH25 | 921.25 |
| | CH50 | 927.50 |

## 4.4 Test Environment

| | |
|---|---|
| **Operating Environment:** | |
| **Radiated Spurious Emissions:** | |
| Temperature: | 22~25.0 °C |
| Humidity: | 50~55 % RH |
| Atmospheric Pressure: | 1010mbar |
| **RF Conducted:** | |
| Temperature: | 22~25.0 °C |
| Humidity: | 50~55 % RH |
| Atmospheric Pressure: | 1010mbar |

## 4.5 Description of Support Units

The EUT has been tested with associated equipment below.

support equipment

| Description | Manufacturer | Model No. | Certification | Supplied by |
|---|---|---|---|---|
| Netbook | DELL | Latitude 3490 | FCC&CE | CTI |

## 4.6 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd
Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China
Telephone: +86 (0) 755 33683668 Fax:+86 (0) 755 33683385
No tests were sub-contracted.
FCC Designation No.: CN1164

## 4.7 Measurement Uncertainty (95% confidence levels, k=2)

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Radio Frequency | $7.9 \times 10^{-8}$ |
| 2 | RF power, conducted | 0.46dB (30MHz-1GHz) |
| | | 0.55dB (1GHz-40GHz) |
| 3 | Radiated Spurious emission test | 3.3dB (9kHz-30MHz) |
| | | 4.3dB (30MHz-1GHz) |
| | | 4.5dB (1GHz-18GHz) |
| | | 3.4dB (18GHz-40GHz) |
| 4 | Conduction emission | 3.5dB (9kHz to 150kHz) |
| | | 3.1dB (150kHz to 30MHz) |
| 5 | Temperature test | 0.64°C |
| 6 | Humidity test | 3.8% |
| 7 | DC power voltages | 0.026% |

## 4.8 Equipment List

| RF test system | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Mode No.** | **Serial Number** | **Cal. Date (mm-dd-yyyy)** | **Cal. Due date (mm-dd-yyyy)** |
| Communication test set | R&S | CMW500 | 107929 | 07-06-2022 | 07-05-2023 |
| Signal Generator | R&S | SMBV100A | 1407.6004K02-262149-CV | 09-09-2022 | 09-08-2023 |
| Spectrum Analyzer | R&S | FSV40 | 101200 | 07-29-2022 | 07-28-2023 |
| RF control unit(power unit) | MWRF-test | MW100-RFCB | MW220620CTI-42 | 07-06-2022 | 07-05-2023 |
| high-low temperature test chamber | Dong Guang Qin Zhuo | LK-80GA | QZ20150611879 | 12-19-2022 | 12-18-2023 |
| Temperature/ Humidity Indicator | biaozhi | HM10 | 1804186 | 06-16-2022 | 06-15-2023 |
| BT&WI-FI Automatic test software | MWRF-test | MTS 8310 | 2.0.0.0 | --- | --- |

| 3M Semi-anechoic Chamber (2)- Radiated disturbance Test | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial No.** | **Cal. Date** | **Due Date** |
| 3M Chamber & Accessory Equipment | TDK | SAC-3 | --- | 05/22/2022 | 05/21/2025 |
| Receiver | R&S | ESCI7 | 100938-003 | 09/28/2022 | 09/27/2023 |
| TRILOG Broadband Antenna | schwarzbeck | VULB 9163 | 9163-618 | 05/22/2022 | 05/21/2023 |
| Loop Antenna | Schwarzbeck | FMZB 1519B | 1519B-076 | 04-15-2021 | 04-14-2024 |
| Multi device Controller | maturo | NCD/070/10711112 | --- | --- | --- |
| Horn Antenna | ETS-LINGREN | BBHA 9120D | 9120D-1869 | 04/15/2021 | 04/14/2024 |
| Microwave Preamplifier | Agilent | 8449B | 3008A02425 | 06/20/2022 | 06/19/2023 |

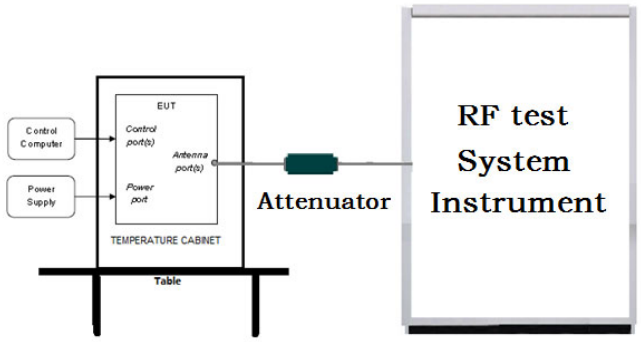
| 3M full-anechoic Chamber | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial Number** | **Cal. Date (mm-dd-yyyy)** | **Cal. Due date (mm-dd-yyyy)** |
| RSE Automatic test software | JS Tonscend | JS36-RSE | 10166 | --- | --- |
| Receiver | Keysight | N9038A | MY57290136 | 03-01-2022 | 03-28-2023 |
| Spectrum Analyzer | Keysight | N9020B | MY57111112 | 02-23-2022 | 02-22-2023 |
| Spectrum Analyzer | Keysight | N9030B | MY57140871 | 02-23-2022 | 02-22-2023 |
| TRILOG Broadband Antenna | Schwarzbeck | VULB 9163 | 9163-1148 | 04-30-2021 | 04-29-2024 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | 9170-832 | 04-17-2021 | 04-16-2024 |
| Communication Antenna | Schwarzbeck | CLSA 0110L | 1014 | --- | --- |
| Horn Antenna | ETS-LINDGREN | 3117 | 57407 | 07-04-2021 | 07-03-2024 |
| Preamplifier | EMCI | EMC184055SE | 980596 | 04-20-2022 | 04-19-2023 |
| Communication test set | R&S | CMW500 | 102898 | 12-23-2022 | 12-22-2023 |
| Preamplifier | EMCI | EMC001330 | 980563 | 04-01-2022 | 03-31-2023 |
| Preamplifier | JS Tonscend | 980380 | EMC051845SE | 12-23-2022 | 12-22-2023 |
| Temperature/ Humidity Indicator | biaozhi | GM1360 | EE1186631 | 04-11-2022 | 04-10-2023 |
| Fully Anechoic Chamber | TDK | FAC-3 | --- | 01-16-2021 | 01-15-2024 |
| Signal Generator | KEYSIGHT | E8257D | MY53401106 | 12-19-2022 | 12-18-2023 |
| Cable line | Times | SFT205-NMSM-2.50M | 394812-0001 | --- | --- |
| Cable line | Times | SFT205-NMSM-2.50M | 394812-0002 | --- | --- |
| Cable line | Times | SFT205-NMSM-2.50M | 394812-0003 | --- | --- |
| Cable line | Times | SFT205-NMSM-2.50M | 393495-0001 | --- | --- |
| Cable line | Times | EMC104-NMNM-1000 | SN160710 | --- | --- |
| Cable line | Times | SFT205-NMSM-3.00M | 394813-0001 | --- | --- |
| Cable line | Times | SFT205-NMNM-1.50M | 381964-0001 | --- | --- |
| Cable line | Times | SFT205-NMSM-7.00M | 394815-0001 | --- | --- |
| Cable line | Times | HF160-KMKM-3.00M | 393493-0001 | --- | --- |

# 5 Test results and Measurement Data

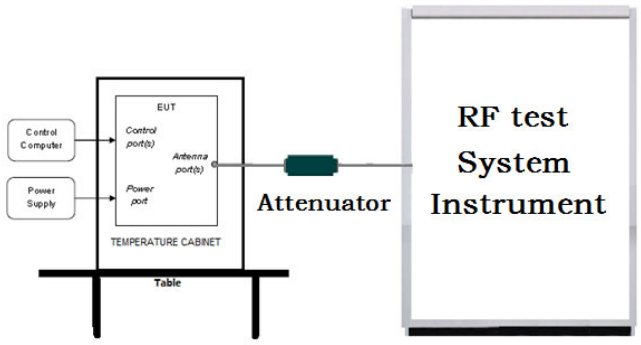
## 5.1 Antenna Requirement

| | |
|---|---|
| **Standard requirement:** | 47 CFR Part 15C Section 15.203 /247(c) |
| 15.203 requirement:<br>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, 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.<br>15.247(b) (4) requirement:<br>The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. | |
| **EUT Antenna:** | Please see Internal photos |
| The antenna is Spring antenna. The best case gain of the antenna is -1.0dBi. | |

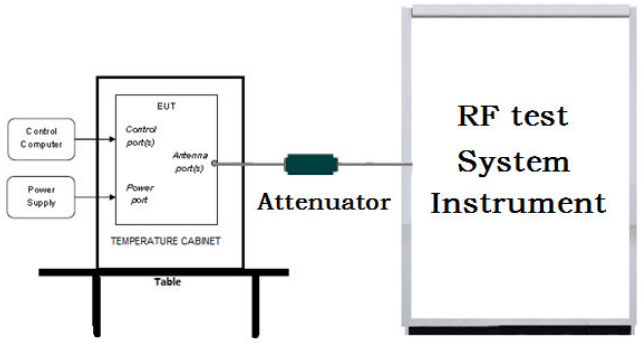
## 5.2 Maximum Conducted Output Power

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (b)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark: Offset=Cable loss+ attenuation factor. |
| Test Procedure: | Use the following spectrum analyzer settings:<br>Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel<br>RBW > the 20 dB bandwidth of the emission being measured VBW ≥ RBW<br>Sweep = auto<br>Detector function = peak<br>Trace = max hold<br>Allow the trace to stabilize.<br>Use the marker-to-peak function to set the marker to the peak of the emission. |
| Limit: | 21dBm |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Test Results: | Refer to Appendix A |

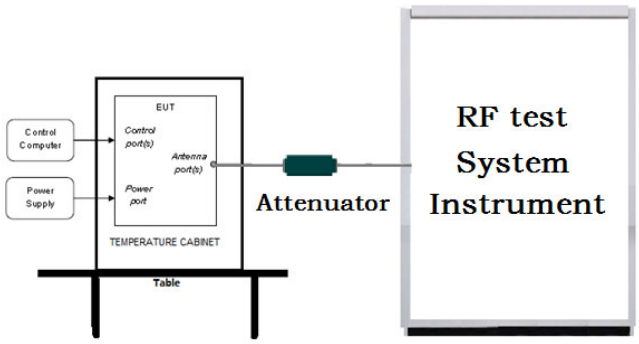
## 5.3 20dB Emission Bandwidth

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark: Offset=Cable loss+ attenuation factor. |
| Test Procedure: | 1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.<br>2. Set to the maximum power setting and enable the EUT transmit continuously.<br>3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.<br>Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel; 1%≤RBW ≤5% of the 20 dB bandwidth; VBW≥3RBW; Sweep = auto; Detector function = peak; Trace = max hold.<br>4. Measure and record the results in the test report. |
| Limit: | NA |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Test Results: | Refer to Appendix A |

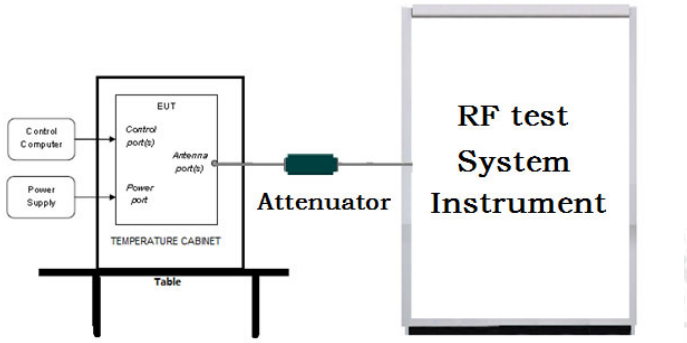
## 5.4 Carrier Frequency Separation

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark: Offset=Cable loss+ attenuation factor. |
| Test Procedure: | 1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.<br>2. Set to the maximum power setting and enable the EUT transmit continuously.<br>3. Enable the EUT hopping function.<br>4. Use the following spectrum analyzer settings:<br>Span = wide enough to capture the peaks of two adjacent channels; RBW is set to approximately 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel;<br>VBW≥RBW; Sweep = auto;<br>Detector function = peak; Trace = max hold.<br>5. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.<br>Record the value in report. |
| Limit: | Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater. |
| Exploratory Test Mode: | Hopping transmitting with all kind of modulation and all kind of data type |
| Test Results: | Refer to Appendix A |

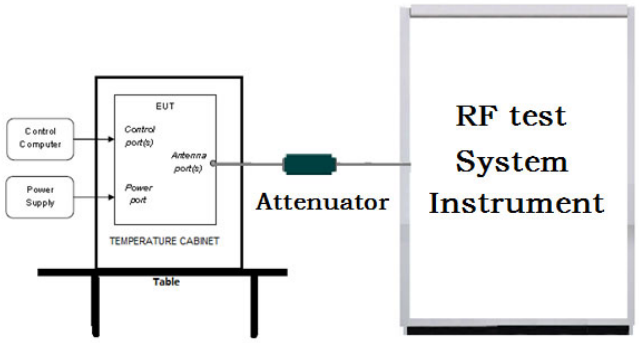
## 5.5 Number of Hopping Channel

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark: Offset=Cable loss+ attenuation factor. |
| Test Procedure: | 1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.<br>2. Set to the maximum power setting and enable the EUT transmit continuously.<br>3. Enable the EUT hopping function.<br>4. Use the following spectrum analyzer settings: Span = the frequency band of operation; set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller; VBW≥RBW; Sweep= auto; Detector function = peak; Trace = max hold.<br>5. The number of hopping frequency used is defined as the number of total channel.<br>6. Record the measurement data in report. |
| Limit: | Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. |
| Test Mode: | Hopping transmitting with all kind of modulation |
| Test Results: | Refer to Appendix A |

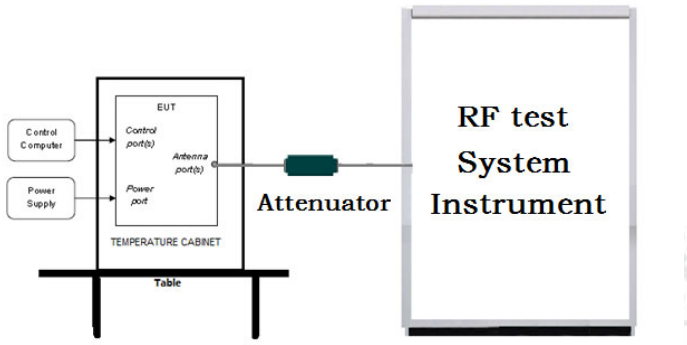
## 5.6 Time of Occupancy

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark: Offset=Cable loss+ attenuation factor. |
| Test Procedure: | 1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.<br>2. Set to the maximum power setting and enable the EUT transmit continuously.<br>3. Enable the EUT hopping function.<br>4. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected<br>dwell time per channel; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.<br>5. Measure and record the results in the test report. |
| Limit: | The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. |
| Test Mode: | Hopping transmitting with all kind of modulation and all kind of data type. |
| Test Results: | Refer to Appendix A |

## 5.7 Band edge Measurements

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark: Offset=Cable loss+ attenuation factor. |
| Test Procedure: | 1. Set to the maximum power setting and enable the EUT transmit continuously.<br>2. Set RBW = 100 kHz, VBW = 300 kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.<br>3. Enable hopping function of the EUT and then repeat step 2 and 3.<br>4. Measure and record the results in the test report. |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. |
| Exploratory Test Mode: | Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type |
| Test Results: | Refer to Appendix A |

## 5.8 Conducted Spurious Emissions

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark: Offset=Cable loss+ attenuation factor. |
| Test Procedure: | 1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.<br>2. Set to the maximum power setting and enable the EUT transmit continuously.<br>3. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW.<br>4. Measure and record the results in the test report.<br>5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band. |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Test Results: | Refer to Appendix A |

## 5.9 Radiated Spurious Emission & Restricted bands

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.209 and 15.205 |
| Test Method: | ANSI C63.10: 2013 |
| Test Site: | Measurement Distance: 3m (Semi-Anechoic Chamber) |

Receiver Setup:

| Frequency | Detector | RBW | VBW | Remark |
|---|---|---|---|---|
| 0.009MHz-0.090MHz | Peak | 10kHz | 30kHz | Peak |
| 0.009MHz-0.090MHz | Average | 10kHz | 30kHz | Average |
| 0.090MHz-0.110MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| 0.110MHz-0.490MHz | Peak | 10kHz | 30kHz | Peak |
| 0.110MHz-0.490MHz | Average | 10kHz | 30kHz | Average |
| 0.490MHz -30MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| 30MHz-1GHz | Peak | 100 kHz | 300kHz | Peak |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | Peak | 1MHz | 10kHz | Average |

Limit:

| Frequency | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark | Measurement distance (m) |
|---|---|---|---|---|
| 0.009MHz-0.490MHz | 2400/F(kHz) | - | - | 300 |
| 0.490MHz-1.705MHz | 24000/F(kHz) | - | - | 30 |
| 1.705MHz-30MHz | 30 | - | - | 30 |
| 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| Above 1GHz | 500 | 54.0 | Average | 3 |

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

| Test Setup: | |
|---|---|

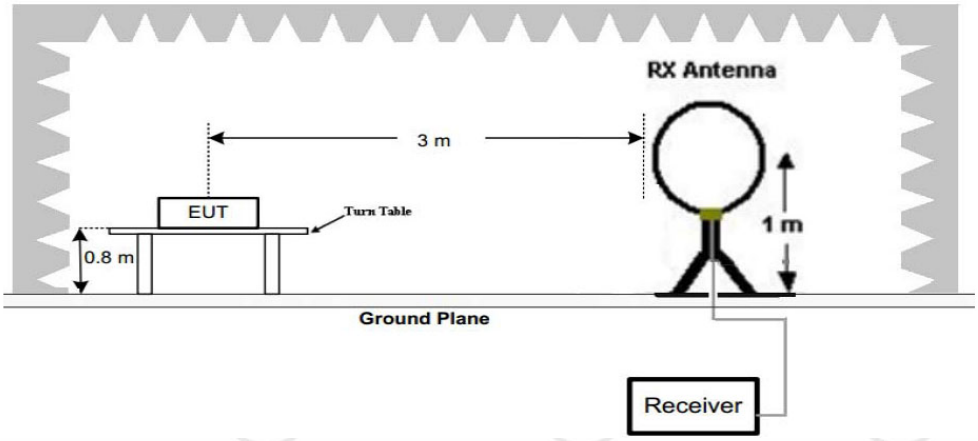



Figure 1. Below 30MHz

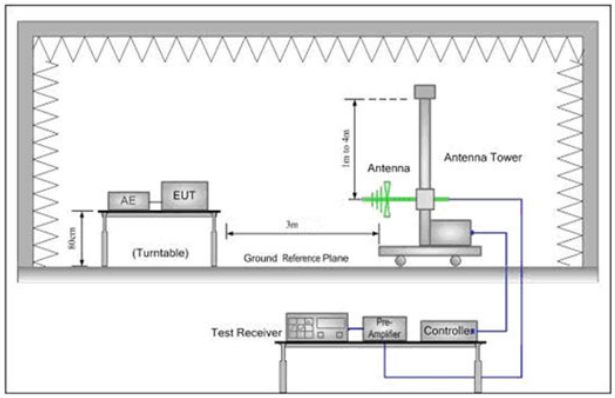



Figure 2. 30MHz to 1GHz

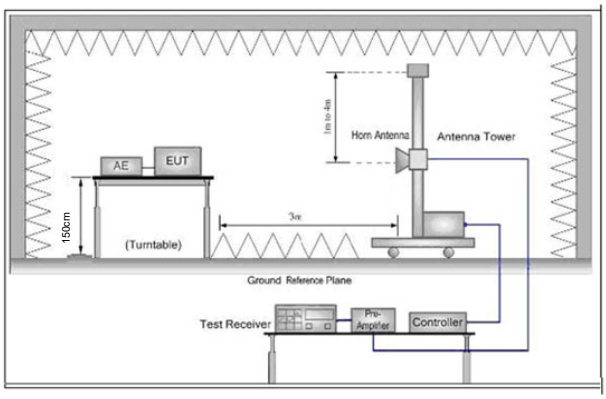



Figure 3. Above 1 GHz

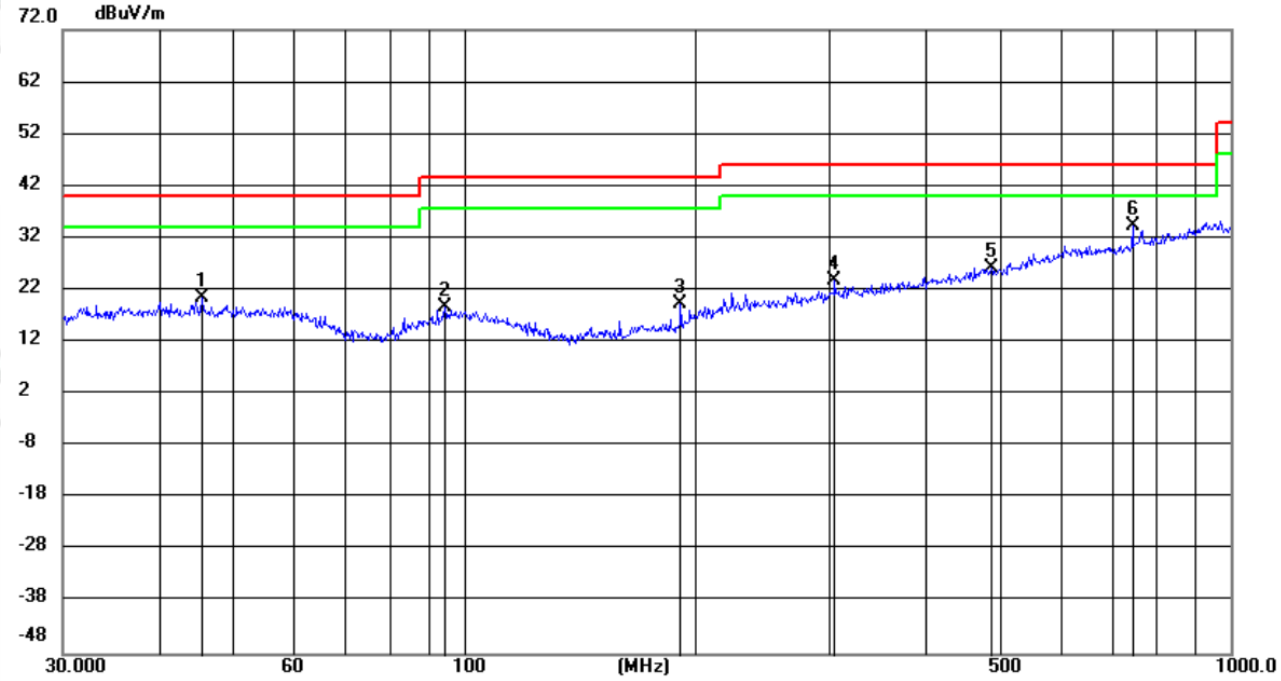
| | |
|---|---|
| Test Procedure: | a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>Note: For the radiated emission test above 1GHz:<br>Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.<br>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.<br>d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.<br>g. Test the EUT in the lowest channel (2402MHz),the middle channel (2441MHz),the Highest channel (2480MHz)<br>h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.<br>i. Repeat above procedures until all frequencies measured was complete. |
| Exploratory Test Mode: | Non-hopping transmitting mode with all kind of modulation and all kind of data type |
| Test Results: | Pass |

## Radiated Spurious Emission below 1GHz:

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes, only the worst case lowest channel of LORA was recorded in the report.

Horizontal:

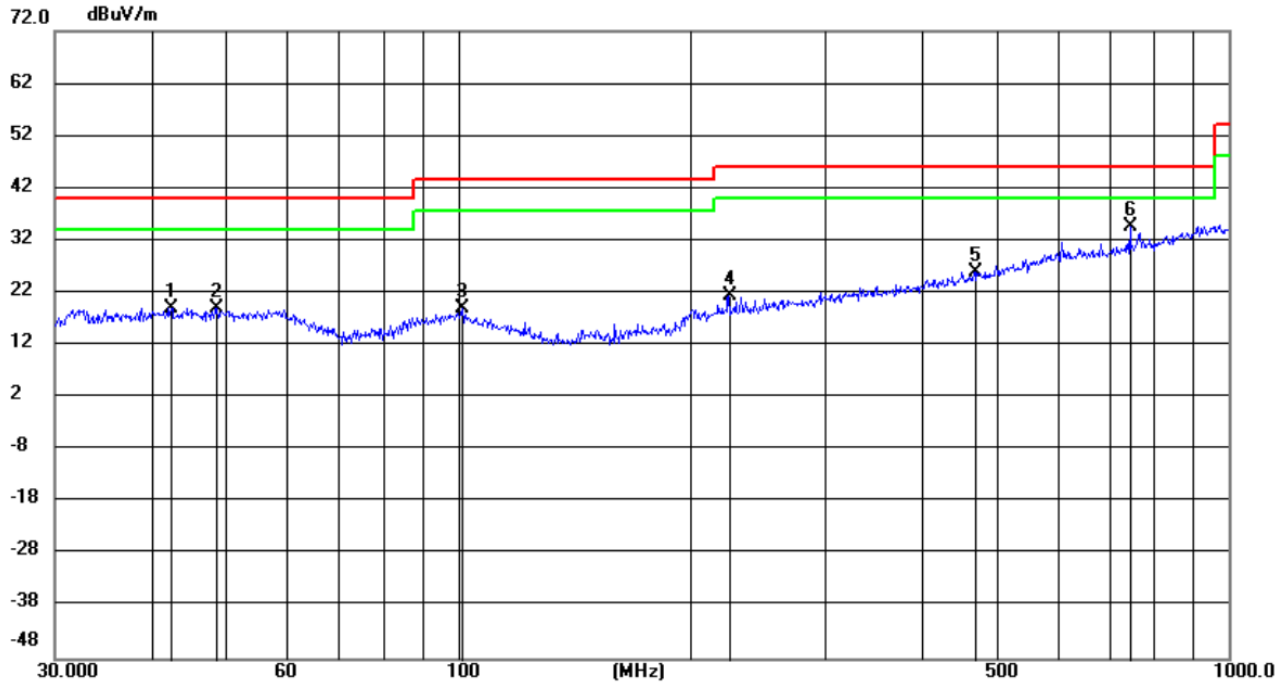
**Test Graph**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | Antenna Height | Table Degree | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | cm | degree | Comment |
| 1 | | 45.5348 | 6.19 | 14.39 | 20.58 | 40.00 | -19.42 | QP | 100 | 219 | |
| 2 | | 94.4283 | 5.47 | 13.29 | 18.76 | 43.50 | -24.74 | QP | 200 | 4 | |
| 3 | | 191.7450 | 7.13 | 12.10 | 19.23 | 43.50 | -24.27 | QP | 100 | 259 | |
| 4 | | 304.6099 | 6.60 | 17.35 | 23.95 | 46.00 | -22.05 | QP | 200 | 4 | |
| 5 | | 487.3150 | 4.93 | 21.27 | 26.20 | 46.00 | -19.80 | QP | 200 | 19 | |
| 6 | * | 744.8660 | 8.76 | 25.48 | 34.24 | 46.00 | -11.76 | QP | 200 | 10 | |

Note:
1. Margin=Measurement-Limit.
2. Measurement=Reading_Level+Correct Factor.
3. Correct Factor=Ant Factor+Cable loss.

Vertical：




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | Antenna Height | Table Degree | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | cm | degree | Comment |
| 1 | | 42.4508 | 4.67 | 14.46 | 19.13 | 40.00 | -20.87 | QP | 100 | 360 | |
| 2 | | 48.6719 | 4.68 | 14.30 | 18.98 | 40.00 | -21.02 | QP | 200 | 356 | |
| 3 | | 101.2885 | 5.09 | 13.87 | 18.96 | 43.50 | -24.54 | QP | 100 | 50 | |
| 4 | | 224.5193 | 6.96 | 14.63 | 21.59 | 46.00 | -24.41 | QP | 100 | 123 | |
| 5 | | 468.8762 | 5.11 | 20.87 | 25.98 | 46.00 | -20.02 | QP | 100 | 19 | |
| 6 | * | 744.8661 | 9.03 | 25.48 | 34.51 | 46.00 | -11.49 | QP | 100 | 4 | |

Note:
1. Margin=Measurement-Limit.
2. Measurement=Reading_Level+Correct Factor.
3. Correct Factor=Ant Factor+Cable loss.

## Radiated Spurious Emission above 1GHz:

| Mode: | | | LORA Transmitting | | | Channel: | | 915.25MHz | |
|---|---|---|---|---|---|---|---|---|---|
| NO | Freq. [MHz] | Factor [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1 | 2745.4497 | -22.09 | 68.32 | 46.23 | 74.00 | 27.77 | Pass | H | PK |
| 2 | 3661.1107 | -20.33 | 64.05 | 43.72 | 74.00 | 30.28 | Pass | H | PK |
| 3 | 4576.7718 | -16.86 | 61.34 | 44.48 | 74.00 | 29.52 | Pass | H | PK |
| 4 | 5491.4994 | -14.37 | 68.33 | 53.96 | 74.00 | 20.04 | Pass | H | PK |
| 5 | 8236.6158 | -11.06 | 62.44 | 51.38 | 74.00 | 22.62 | Pass | H | PK |
| 6 | 9152.2768 | -8.13 | 56.48 | 48.35 | 74.00 | 25.65 | Pass | H | PK |
| 7 | 1830.722 | -24.54 | 66.86 | 42.32 | 74.00 | 31.68 | Pass | V | PK |
| 8 | 2745.4497 | -22.09 | 65.78 | 43.69 | 74.00 | 30.31 | Pass | V | PK |
| 9 | 3661.1107 | -20.33 | 67.69 | 47.36 | 74.00 | 26.64 | Pass | V | PK |
| 10 | 5491.4994 | -14.37 | 68.31 | 53.94 | 74.00 | 20.06 | Pass | V | PK |
| 11 | 8237.5492 | -11.05 | 61.82 | 50.77 | 74.00 | 23.23 | Pass | V | PK |
| 12 | 9153.2102 | -8.12 | 58.04 | 49.92 | 74.00 | 24.08 | Pass | V | PK |

| Mode: | | | LORA Transmitting | | | Channel: | | 921.25MHz | |
|---|---|---|---|---|---|---|---|---|---|
| NO | Freq. [MHz] | Factor [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1 | 1841.9228 | -24.48 | 71.75 | 47.27 | 74.00 | 26.73 | Pass | H | PK |
| 2 | 2763.1842 | -22.01 | 66.50 | 44.49 | 74.00 | 29.51 | Pass | H | PK |
| 3 | 3684.4456 | -20.23 | 66.86 | 46.63 | 74.00 | 27.37 | Pass | H | PK |
| 4 | 5525.1017 | -14.29 | 66.48 | 52.19 | 74.00 | 21.81 | Pass | H | PK |
| 5 | 6965.331 | -12.15 | 54.27 | 42.12 | 74.00 | 31.88 | Pass | H | PK |
| 6 | 9210.1473 | -7.68 | 54.45 | 46.77 | 74.00 | 27.23 | Pass | H | PK |
| 7 | 1841.9228 | -24.48 | 71.93 | 47.45 | 74.00 | 26.55 | Pass | V | PK |
| 8 | 2763.1842 | -22.01 | 66.76 | 44.75 | 74.00 | 29.25 | Pass | V | PK |
| 9 | 3683.5122 | -20.23 | 67.94 | 47.71 | 74.00 | 26.29 | Pass | V | PK |
| 10 | 5526.0351 | -14.29 | 67.46 | 53.17 | 74.00 | 20.83 | Pass | V | PK |
| 11 | 8289.8193 | -11.14 | 55.78 | 44.64 | 74.00 | 29.36 | Pass | V | PK |
| 12 | 9210.1473 | -7.68 | 56.22 | 48.54 | 74.00 | 25.46 | Pass | V | PK |

| Mode: | | | LORA Transmitting | | | Channel: | | 927.5 MHz | |
|---|---|---|---|---|---|---|---|---|---|
| NO | Freq. [MHz] | Factor [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1 | 1854.9903 | -24.42 | 73.63 | 49.21 | 74.00 | 24.79 | Pass | H | PK |
| 2 | 2782.7855 | -21.93 | 66.80 | 44.87 | 74.00 | 29.13 | Pass | H | PK |
| 3 | 3709.6473 | -20.09 | 67.93 | 47.84 | 74.00 | 26.16 | Pass | H | PK |
| 4 | 4637.4425 | -16.76 | 61.10 | 44.34 | 74.00 | 29.66 | Pass | H | PK |
| 5 | 5565.2377 | -14.17 | 69.02 | 54.85 | 74.00 | 19.15 | Pass | H | PK |
| 6 | 8347.6898 | -11.09 | 55.66 | 44.57 | 74.00 | 29.43 | Pass | H | PK |
| 7 | 5566.1711 | -14.16 | 64.11 | 49.95 | 54.00 | 4.05 | Pass | V | AV |
| 8 | 1854.9903 | -24.42 | 73.82 | 49.40 | 74.00 | 24.60 | Pass | V | PK |
| 9 | 2782.7855 | -21.93 | 66.97 | 45.04 | 74.00 | 28.96 | Pass | V | PK |
| 10 | 3710.5807 | -20.09 | 69.04 | 48.95 | 74.00 | 25.05 | Pass | V | PK |
| 11 | 4637.4425 | -16.76 | 60.54 | 43.78 | 74.00 | 30.22 | Pass | V | PK |
| 12 | 5565.2377 | -14.17 | 69.84 | 55.67 | 74.00 | 18.33 | Pass | V | PK |
| 13 | 8346.7565 | -11.09 | 59.95 | 48.86 | 74.00 | 25.14 | Pass | V | PK |
| 14 | 5566.1711 | -14.16 | 63.87 | 49.71 | 54.00 | 4.29 | Pass | V | AV |

Remark:

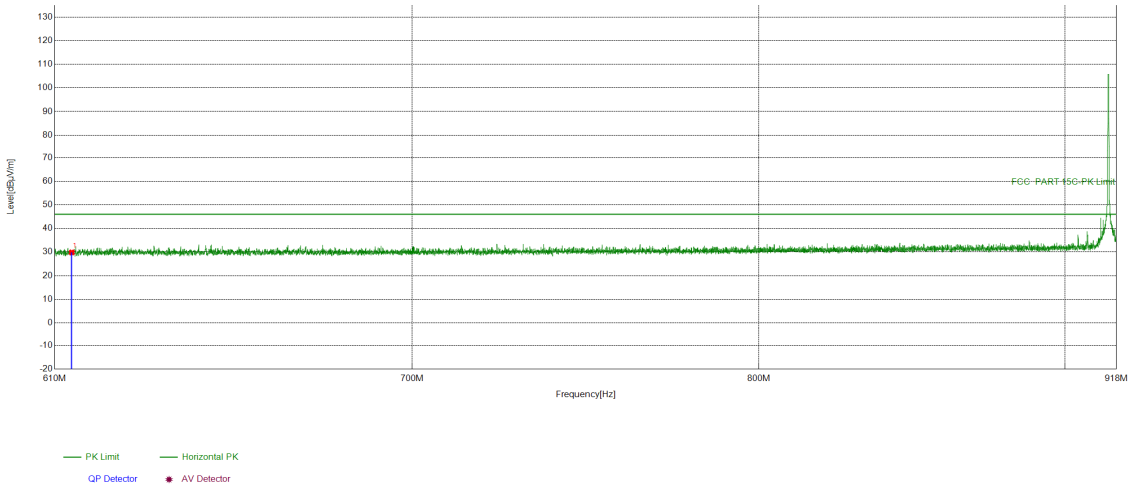
1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
   Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
2) Scan from 9kHz to 25GHz, the disturbance above 10GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

## Restricted bands:

**Test plot as follows:**

| Mode: | LORA Transmitting | Channel: | 915.25MHz |
|---|---|---|---|
| Remark: | BW125KHz | | |

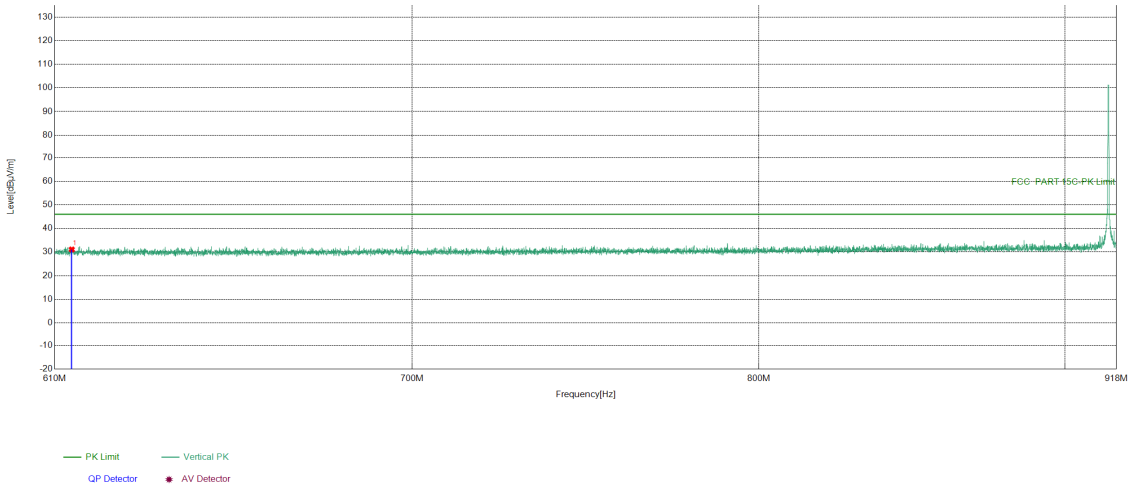
**Test Graph**




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO | Freq. [MHz] | Factor [dB] | Reading [dBµV] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Result | Polarity | Remark |
| 1 | 614 | -8.49 | 38.34 | 29.85 | 46.00 | 16.15 | PASS | Horizontal | PK |

| Mode: | LORA Transmitting | Channel: | 915.25MHz |
|---|---|---|---|
| Remark: | BW125KHz | | |

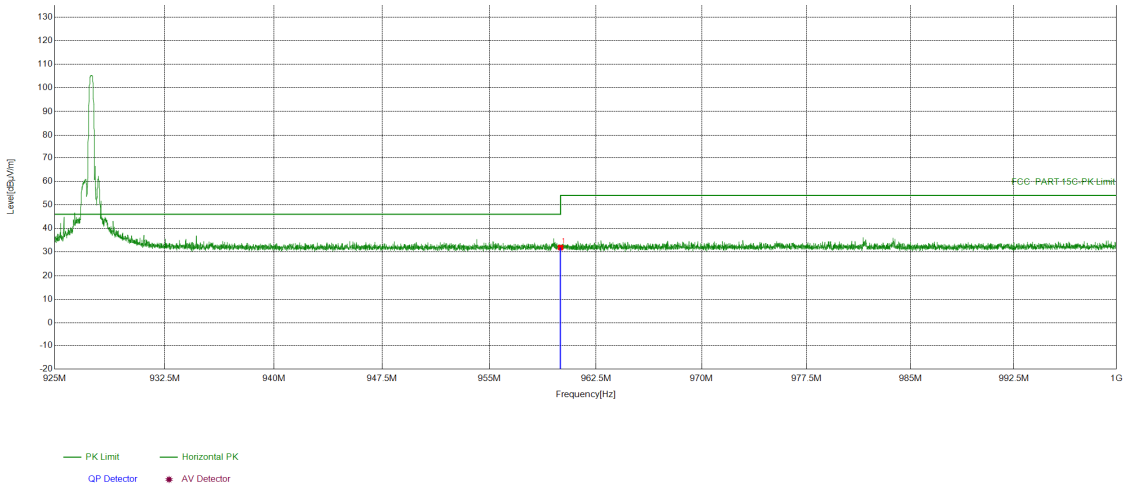
**Test Graph**




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO | Freq. [MHz] | Factor [dB] | Reading [dBµV] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Result | Polarity | Remark |
| 1 | 614 | -8.49 | 39.58 | 31.09 | 46.00 | 14.91 | PASS | Vertical | PK |

| Mode: | LORA Transmitting | Channel: | 927.5MHz |
|---|---|---|---|
| Remark: | BW125KHz | | |

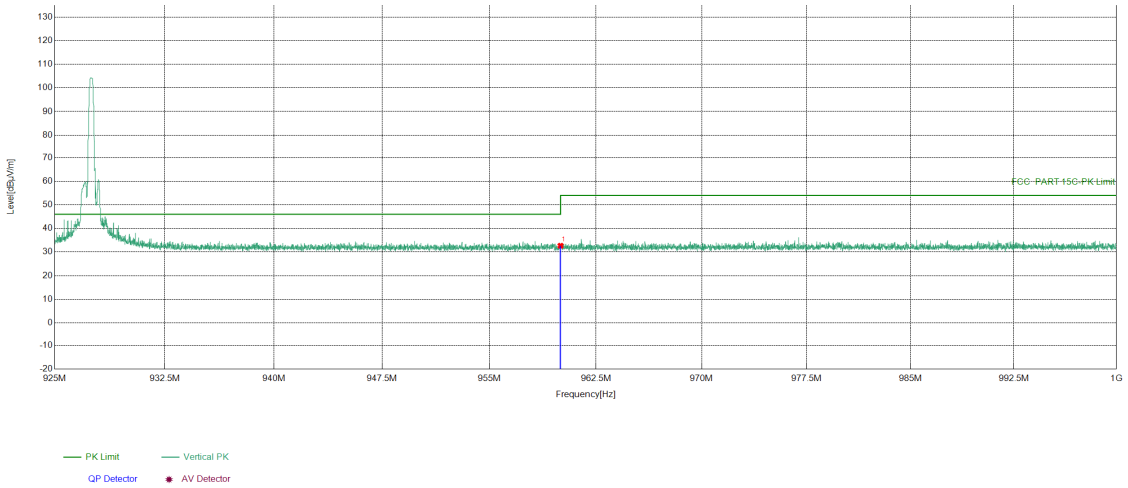
**Test Graph**




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO | Freq. [MHz] | Factor [dB] | Reading [dBµV] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Result | Polarity | Remark |
| 1 | 960 | -4.37 | 36.29 | 31.92 | 54.00 | 22.08 | PASS | Horizontal | PK |

| Mode: | LORA Transmitting | Channel: | 927.5MHz |
|---|---|---|---|
| Remark: | BW125KHz | | |

**Test Graph**




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO | Freq. [MHz] | Factor [dB] | Reading [dBµV] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Result | Polarity | Remark |
| 1 | 960 | -4.37 | 37.04 | 32.67 | 54.00 | 21.33 | PASS | Vertical | PK |

Note:
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading - Correct Factor
Correct Factor = Preamplifier Factor– Antenna Factor–Cable Factor

# 6 Appendix A

Refer to Appendix: Lora FHSS of EED32O81365001