# RADIO PERFORMANCE TEST REPORT

**Test Report No.** : **OT-237-RWD-047**

**Reception No.** : **2301000279**

**Applicant** : **LG Electronics USA, Inc.**

**Address** : **111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States**

**Manufacturer** : **LG Electronics Inc.**

**Address** : **222 LG-ro, Jinwi-Myeon, Pyeongtaek -Si, Gyeonggi-Do, 451-713, Korea**

**Type of Equipment** : **Silverbox RADIO ASM-RECEIVER**

**FCC ID.** : **BEJVCUEB-N**

**Model Name** : **VCUEB-N**

**Multiple Model Name** : **N/A**

**Serial number** : **N/A**

**Total page of Report** : **38 pages (including this page)**

**Date of Incoming** : **January 31, 2023**

**Date of issue** : **July 26, 2023**

## SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247***

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

**This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.**

| Tested by | Reviewed by | Approved by |
|---|---|---|
| Sieon Lee / Sr. Engineer | Tae-Ho, Kim / Chief Engineer | Jae-Ho Lee / Chief Engineer |
| ONETECH Corp. | ONETECH Corp. | ONETECH Corp. |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# CONTENTS

**Page**



**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

## Revision History

| Rev. No. | Issue Report No. | Issued Date | Revisions | Section Affected |
|---|---|---|---|---|
| 0 | OT-237-RWD-047 | July 26, 2023 | Initial Release | All |
| | | | | |
| | | | | |



**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA, Inc.

Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States

Contact Person : Sung Soo Kim / Director, Regulatory and Environmental Affairs

Telephone No. : +201-266-2215

FCC ID : BEJVCUEB-N

Model Name : VCUEB-N

Brand Name : -

Serial Number : N/A

Date : July 26, 2023

| | |
|---|---|
| EQUIPMENT CLASS | DSS – PART 15 SPREAD SPECTRUM TRANSMITTER |
| E.U.T. DESCRIPTION | Silverbox RADIO ASM-RECEIVER |
| THIS REPORT CONCERNS | Original Grant |
| MEASUREMENT PROCEDURES | ANSI C63.10: 2013 |
| TYPE OF EQUIPMENT TESTED | Pre-Production |
| KIND OF EQUIPMENT AUTHORIZATION REQUESTED | Certification |
| EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S) | FCC PART 15 SUBPART C Section 15.247<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |
| Modifications on the Equipment to Achieve Compliance | None |
| Final Test was Conducted On | 3 m, Semi Anechoic Chamber |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 2. TEST SUMMARY

## 2.1 Test items and results

| SECTION | TEST ITEMS | RESULTS |
|---|---|---|
| 15.247 (a) (1) | Carrier Frequency Separation | Met the Limit / PASS |
| 15.247 (a) (1) (iii) | Minimum Number of Hopping Channels | Met the Limit / PASS |
| 15.247 (a) (1) (iii) | Average Time of Occupancy | Met the Limit / PASS |
| 15.247 (b) (1) | Maximum Peak Conducted Output Power | Met the Limit / PASS |
| 15.247 (d) | 100 kHz Bandwidth Outside the Frequency Band | Met the Limit / PASS |
| 15.247 (d) | Radiated Emission which fall in the Restricted Band | Met the Limit / PASS |
| 15.209 | Radiated Emission Limits, General Requirement | Met the Limit / PASS |
| 15.207 | Conducted Limits | N/A (See Note) |
| 15.203 | Antenna Requirement | Met requirement / PASS |

Note: This test is not performed because the EUT is operated by DC Power.

## 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

## 2.3 Related Submittal(s) / Grant(s)

Original submittal only

## 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

## 2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

## 2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 3. GENERAL INFORMATION

## 3.1 Product Description

The LG Electronics USA, Inc., Model VCUEB-N (referred to as the EUT in this report) is a Silverbox RADIO ASM-RECEIVER. The product specification described herein was obtained from product data sheet or user's manual.

| | | | |
|---|---|---|---|
| DEVICE TYPE | Silverbox RADIO ASM-RECEIVER | | |
| Temperature Range | -30 °C ~ 85 °C | | |
| OPERATING FREQUENCY | Bluetooth | 2 402 MHz ~ 2 480 MHz | |
| | WLAN 2.4 GHz | 2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20)) | |
| | 5 150 MHz ~ 5 250 MHz Band | 5 180 MHz ~ 5 240 MHz (802.11a/n(HT20)/ac(VHT20)) | |
| | | 5 190 MHz ~ 5 230 MHz (802.11n(HT40)/ac(VHT40)) | |
| | | 5 210 MHz (802.11ac(VHT80)) | |
| | 5 725 MHz ~ 5 850 MHz Band | 5 745 MHz ~ 5 825 MHz (802.11a/n(HT20)/ac(VHT20)) | |
| | | 5 755 MHz ~ 5 795 MHz (802.11n(HT40)/ac(VHT40)) | |
| | | 5 775 MHz (802.11ac(VHT80)) | |
| MODULATION TYPE | Bluetooth | GFSK for 1 Mbps, π/4-DQPSK for 2 Mbps, 8-DPSK for 3 Mbps | |
| | WLAN 2.4 GHz | 802.11b:<br>DSSS Modulation(DBPSK/DQPSK/CCK)<br>802.11g/n(HT20):<br>OFDM Modulation(BPSK/QPSK/16QAM/64QAM) | |
| | WLAN 5 GHz | 802.11a/n(HT20)/n(HT40)/ac(VHT80):<br>OFDM Modulation(BPSK/QPSK/16QAM/64QAM) | |
| RF OUTPUT POWER | Bluetooth | 1 Mbps | 0.75 dBm |
| | | 2 Mbps | 2.78 dBm |
| | | 3 Mbps | 2.82 dBm |
| | WLAN 2.4 GHz | 10.04 dBm(802.11b)<br>10.49 dBm(802.11g)<br>11.34 dBm(802.11n_HT20) | |

| | | | |
|---|---|---|---|
| RF OUTPUT POWER | 5 150 MHz ~ 5 250 MHz Band (UNII I) | Internal Antenna | 14.87 dBm(802.11a)<br>15.79 dBm(802.11n_HT20)<br>15.06 dBm(802.11n_HT40)<br>11.28 dBm(802.11ac_VHT80) |
| | | External Antenna | 8.16 dBm(802.11a)<br>9.13 dBm(802.11n_HT20)<br>8.03 dBm(802.11n_HT40)<br>4.37 dBm(802.11ac_VHT80) |
| | 5 725 MHz ~ 5 850 MHz Band (UNII 3) | Internal Antenna | 15.10 dBm(802.11a)<br>16.11 dBm(802.11n_HT20)<br>14.73 dBm(802.11n_HT40)<br>10.98 dBm(802.11ac_VHT80) |
| | | External Antenna | 8.20 dBm(802.11a)<br>9.16 dBm(802.11n_HT20)<br>7.77 dBm(802.11n_HT40)<br>4.08 dBm(802.11ac_VHT80) |
| ANTENNA TYPE | Bluetooth | PCB Antenna | |
| | WLAN 2.4 GHz | PCB Antenna | |
| | WLAN 5 GHz | Internal Antenna | PCB Antenna |
| | | External Antenna | PCB Antenna |
| ANTENNA GAIN | Bluetooth | 0.89 dBi | |
| | WLAN 2.4 GHz | 2.18 dBi | |
| | 5 150 MHz ~ 5 250 MHz Band | Internal Antenna | 0.63 dBi |
| | | External Antenna | 2.37 dBi |
| | 5 725 MHz ~ 5 850 MHz Band | Internal Antenna | -1.04 dBi |
| | | External Antenna | 3.61 dBi |
| List of each Osc. or crystal Freq.(Freq. >= 1 MHz) | | 20 MHz, 24 MHz, 25 MHz, 27 MHz, 40 MHz, 55.46667 MHz | |

### 3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

## 4. EUT MODIFICATIONS

-. None

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 5. SYSTEM TEST CONFIGURATION

## 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

| DEVICE TYPE | MANUFACTURER | MODEL/PART NUMBER | FCC ID |
|---|---|---|---|
| Main Board | N/A | N/A | N/A |
| Module | N/A | N/A | N/A |
| Antenna | N/A | N/A | N/A |

## 5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

| Model | Manufacturer | Description | Connected to |
|---|---|---|---|
| VCUEB-N | LG Electronics Inc. | Silverbox RADIO ASM-RECEIVER (EUT) | - |
| TC-3000C | TESCOM | BLUETOOTH TESTER | EUT |
| GP-4303D | LG Precision Co.,Ltd | DC Power Supply (DC 30 V 3 A) | - |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 2 402 MHz, 2 441 MHz, and 2 480 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis, but the worst data was recorded in this report.

**-. Channel List (Bluetooth)**

| Channel | Frequency[MHz] | Channel | Frequency[MHz] | Channel | Frequency[MHz] |
|---|---|---|---|---|---|
| 0 | 2 402.00 | 27 | 2 429.00 | 54 | 2 456.00 |
| 1 | 2 403.00 | 28 | 2 430.00 | 55 | 2 457.00 |
| 2 | 2 404.00 | 29 | 2 431.00 | 56 | 2 458.00 |
| 3 | 2 405.00 | 30 | 2 432.00 | 57 | 2 459.00 |
| 4 | 2 406.00 | 31 | 2 433.00 | 58 | 2 460.00 |
| 5 | 2 407.00 | 32 | 2 434.00 | 59 | 2 461.00 |
| 6 | 2 408.00 | 33 | 2 435.00 | 60 | 2 462.00 |
| 7 | 2 409.00 | 34 | 2 436.00 | 61 | 2 463.00 |
| 8 | 2 410.00 | 35 | 2 437.00 | 62 | 2 464.00 |
| 9 | 2 411.00 | 36 | 2 438.00 | 63 | 2 465.00 |
| 10 | 2 412.00 | 37 | 2 439.00 | 64 | 2 466.00 |
| 11 | 2 413.00 | 38 | 2 440.00 | 65 | 2 467.00 |
| 12 | 2 414.00 | 39 | 2 441.00 | 66 | 2 468.00 |
| 13 | 2 415.00 | 40 | 2 442.00 | 67 | 2 469.00 |
| 14 | 2 416.00 | 41 | 2 443.00 | 68 | 2 470.00 |
| 15 | 2 417.00 | 42 | 2 444.00 | 69 | 2 471.00 |
| 16 | 2 418.00 | 43 | 2 445.00 | 70 | 2 472.00 |
| 17 | 2 419.00 | 44 | 2 446.00 | 71 | 2 473.00 |
| 18 | 2 420.00 | 45 | 2 447.00 | 72 | 2 474.00 |
| 19 | 2 421.00 | 46 | 2 448.00 | 73 | 2 475.00 |
| 20 | 2 422.00 | 47 | 2 449.00 | 74 | 2 476.00 |
| 21 | 2 423.00 | 48 | 2 450.00 | 75 | 2 477.00 |
| 22 | 2 424.00 | 49 | 2 451.00 | 76 | 2 478.00 |
| 23 | 2 425.00 | 50 | 2 452.00 | 77 | 2 479.00 |
| 24 | 2 426.00 | 51 | 2 453.00 | 78 | 2 480.00 |
| 25 | 2 427.00 | 52 | 2 454.00 | | |
| 26 | 2 428.00 | 53 | 2 455.00 | | |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

-. Duty Cycle

| Mode | Tx On Time [ ms ] | Tx Off Time [ ms ] | Duty Cycle [ % ] | Correction Factor [ dB ] |
|---|---|---|---|---|
| Bluetooth [ 1 Mbps ] | 2.88 | 0.87 | 76.80 | 1.15 |
| Bluetooth [ 2 Mbps ] | 2.88 | 0.87 | 76.80 | 1.15 |
| Bluetooth [ 3 Mbps ] | 2.88 | 0.87 | 76.80 | 1.15 |

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Correction Factor : 10 * Log(1 / (Duty Cycle / 100))

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 5.4 Configuration of Test System

**Line Conducted Test**: It is not need to test this requirement, because the EUT shall be operated by DC Power.

**Radiated Emission Test**: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

### 5.5 Antenna Requirement

For intentional device, according to section 15.203, 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.

**Antenna Construction:**

The PCB Antenna is located on the main board of EUT and the PCB antenna is connected to the outside of the EUT by a special connector type, so no consideration of replacement by the user.

## 6. PRELIMINARY TEST

### 6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

| Operation Mode | The Worse operating condition (Please check one only) |
|---|---|
| It is not need to test this requirement, because the power of the EUT is supplied by DC Power. | |

### 6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

| Operation Mode | The Worse operating condition (Please check one only) |
|---|---|
| Transmitting Mode | X |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 7. MINIMUM 20 dB BANDWIDTH

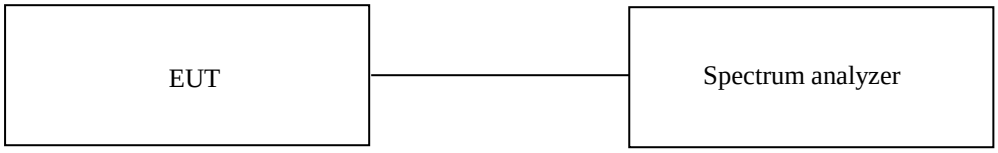
## 7.1 Operating environment

Temperature : 22 °C

Relative humidity : 48 % R.H.

## 7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 1 % to 5 % of the OBW, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.




## 7.3 Test Date

February 01, 2023 ~ March 06, 2023

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 7.4 Test data for 1 Mbps

| CHANNEL | FREQUENCY (MHz) | 20 dB Bandwidth (kHz) |
|---|---|---|
| Low | 2 402.00 | 934.10 |
| Middle | 2 441.00 | 939.10 |
| High | 2 480.00 | 944.10 |

### 7.5 Test data for 2 Mbps

| CHANNEL | FREQUENCY (MHz) | 20 dB Bandwidth (kHz) |
|---|---|---|
| Low | 2 402.00 | 1 278.70 |
| Middle | 2 441.00 | 1 318.70 |
| High | 2 480.00 | 1 323.70 |

### 7.6 Test data for 3 Mbps

| CHANNEL | FREQUENCY (MHz) | 20 dB Bandwidth (kHz) |
|---|---|---|
| Low | 2 402.00 | 1 258.70 |
| Middle | 2 441.00 | 1 288.70 |
| High | 2 480.00 | 1 288.70 |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 8. HOPPING FREQUENCY SEPARATION

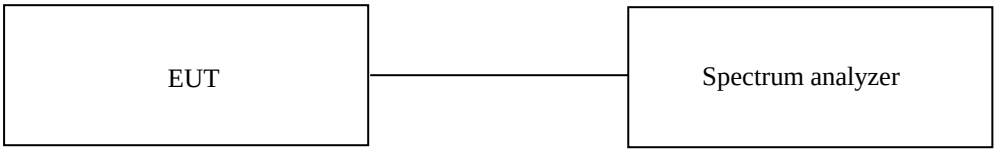
## 8.1 Operating environment

Temperature : 22 °C

Relative humidity : 48 % R.H.

## 8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 5 MHz. The analyzer is set to peak hold then a pseudo-random hopping sequence of the transmitter is captured. The mark delta function was used to measure the frequency separation between two adjacent hopping channels.




## 8.3 Test Date

February 01, 2023 ~ March 06, 2023

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 8.4 Test data for 1 Mbps

-. Test Result : Pass

| MEASURED VALUE (kHz) | Two-third of 20 dB Bandwidth (kHz) | LIMIT |
|---|---|---|
| 1 004.00 | 626.07 | Separated by a minimum of 626.07 kHz |

### 8.5 Test data for 2 Mbps

-. Test Result : Pass

| MEASURED VALUE (kHz) | Two-third of 20 dB Bandwidth (kHz) | LIMIT |
|---|---|---|
| 1 004.00 | 879.13 | Separated by a minimum of 879.13 kHz |

### 8.6 Test data for 3 Mbps

-. Test Result : Pass

| MEASURED VALUE (kHz) | Two-third of 20 dB Bandwidth (kHz) | LIMIT |
|---|---|---|
| 1 004.00 | 859.13 | Separated by a minimum of 859.13 kHz |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 9. NUMBER OF HOPPING CHANNELS

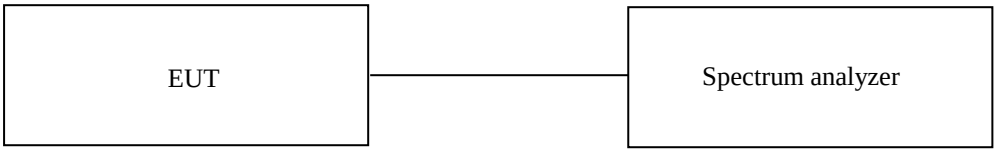
## 9.1 Operating environment

Temperature : 22 °C

Relative humidity : 48 % R.H.

## 9.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 100 kHz and the resolution bandwidth is set to 300 kHz. The analyzer is set to peak hold and then complete pseudo-random hopping sequence of the transmitter is captured.




## 9.3 Test Date

February 01, 2023 ~ March 06, 2023

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 9.4 Test data for 1 Mbps

-. Test Result : Pass

| Data Transfer Rate | Measured value (Number) | Limit (Number) | Margin (Number) |
|---|---|---|---|
| 1 Mbps | 79 | Minimum of 15 | 64 |

### 9.5 Test data for 2 Mbps

-. Test Result : Pass

| Data Transfer Rate | Measured value (Number) | Limit (Number) | Margin (Number) |
|---|---|---|---|
| 2 Mbps | 79 | Minimum of 15 | 64 |

### 9.6 Test data for 3 Mbps

-. Test Result : Pass

| Data Transfer Rate | Measured value (Number) | Limit (Number) | Margin (Number) |
|---|---|---|---|
| 3 Mbps | 79 | Minimum of 15 | 64 |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 10. TIME OF OCCUPANCY

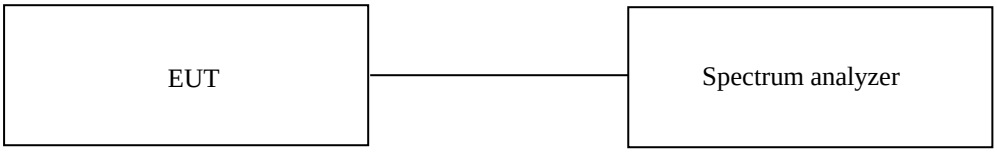
## 10.1 Operating environment

Temperature : 22 °C

Relative humidity : 48 % R.H.

## 10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The transmitter is set to operate in its normal frequency hopping mode. The center frequency of the spectrum analyzer is set to one of hopping channels near the center of the operating band and span is set to zero Hz. The sweep time is set to display one complete pulse. The mark delta function is used to measure the duration of the pulses.




## 10.3 Test Date

February 01, 2023 ~ March 06, 2023

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 10.4 Test data for 1 Mbps

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625 μs with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second (= 1 600/2/79) for DH1, and 5.06 times (= 1 600/4/79) for DH3, and 3.38 times (= 1 600/6/79) for DH5.

| Packet Type | Pulse Time (ms) | Hops per second with channels | Period Time (ms) | Total Dwell Time (ms) | Limit (ms) | Test Result |
|---|---|---|---|---|---|---|
| DH1 | 0.39 | 10.13 | 31.60 | 124.84 | 400.00 | PASS |
| DH3 | 1.64 | 5.06 | 31.60 | 262.23 | 400.00 | |
| DH5 | 2.88 | 3.38 | 31.60 | 307.61 | 400.00 | |

Total dwell time is calculated as following.

Total Dwell Time = Pulse time * Hops per second with channels * period time

Remark: See next page for an overview sweep performed with peak detector.

### 10.5 Test data for 2 Mbps

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625 μs with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second (= 1 600/2/79) for DH1, and 5.06 times (= 1 600/4/79) for DH3, and 3.38 times (= 1 600/6/79) for DH5.

| Packet Type | Pulse Time (ms) | Hops per second with channels | Period Time (ms) | Total Dwell Time (ms) | Limit (ms) | Test Result |
|---|---|---|---|---|---|---|
| DH1 | 0.39 | 10.13 | 31.60 | 124.84 | 400.00 | PASS |
| DH3 | 1.64 | 5.06 | 31.60 | 262.23 | 400.00 | |
| DH5 | 2.88 | 3.38 | 31.60 | 307.61 | 400.00 | |

Total dwell time is calculated as following.

Total Dwell Time = Pulse time * Hops per second with channels * period time

Remark: See next page for an overview sweep performed with peak detector.

### 10.6 Test data for 3 Mbps

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625 μs with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second (= 1 600/2/79) for DH1, and 5.06 times (= 1 600/4/79) for DH3, and 3.38 times (= 1 600/6/79) for DH5.

| Packet Type | Pulse Time (ms) | Hops per second with channels | Period Time (ms) | Total Dwell Time (ms) | Limit (ms) | Test Result |
|---|---|---|---|---|---|---|
| DH1 | 0.39 | 10.13 | 31.60 | 124.84 | 400.00 | PASS |
| DH3 | 1.64 | 5.06 | 31.60 | 262.23 | 400.00 | |
| DH5 | 2.88 | 3.38 | 31.60 | 307.61 | 400.00 | |

Total dwell time is calculated as following.

Total Dwell Time = Pulse time * Hops per second with channels * period time

Remark: See next page for an overview sweep performed with peak detector.

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 11. MAXIMUM PEAK OUTPUT POWER (Radiated output power (E.I.R.P))

## 11.1 Operating environment

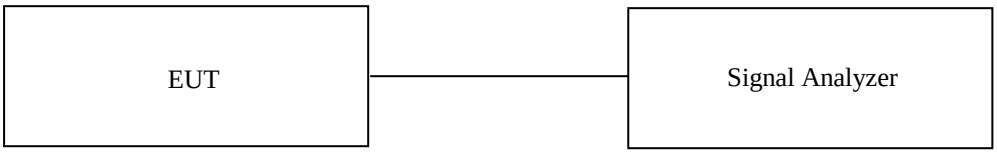
Temperature : 22 °C

Relative humidity : 48 % R.H.

## 11.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to ≥ DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.




## 11.3 Test set-up for radiated measurement

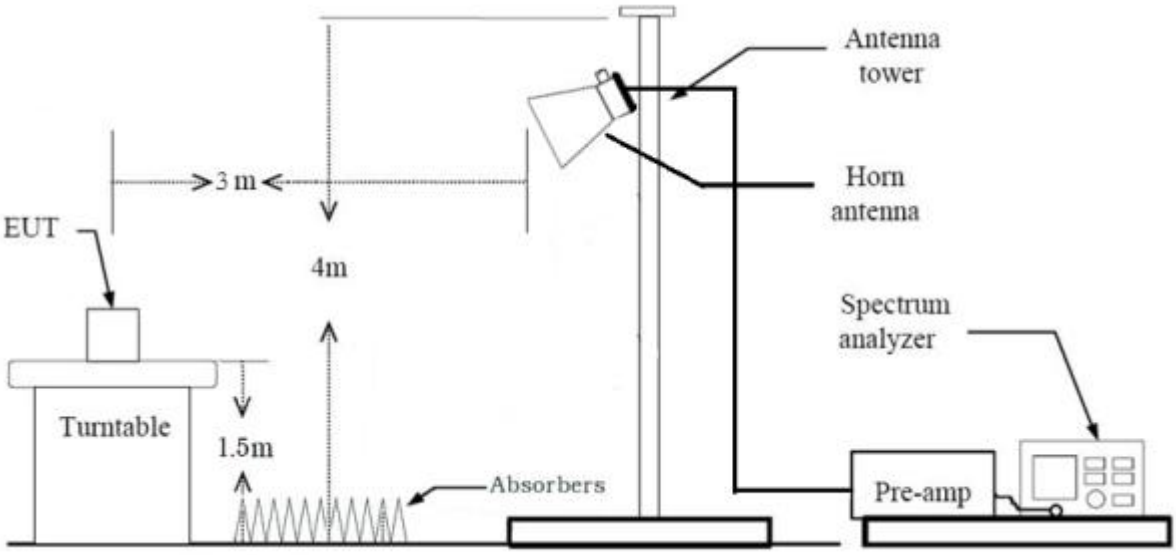
The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded.

The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna

**- Test Configuration**

Above 1 GHz



### 11.4 Test Date

June 19, 2023 ~ July 05, 2023

### 11.5 Test data for BDR(1 Mbps)

| Frequency (MHz) | Ant. Pol. (H/V) | Ant. Height (m) | Angle ( ° ) | OBW (MHz) | Measured (dBuV) | C.F (dB) | Result (dBuV/m) | E.I.R.P (dBm) | Ant Gain (dBi) | Conducted Power (dBm) | Limit (dBm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 402.00 | H | 2.0 | 175 | 0.88 | 63.84 | 31.88 | 95.72 | 0.46 | 0.89 | -0.43 | 21.00 |
| 2 441.00 | H | 2.0 | 175 | 0.88 | 64.19 | 32.07 | 96.26 | 1.00 | 0.89 | 0.11 | 21.00 |
| 2 480.00 | H | 2.0 | 175 | 0.88 | 64.85 | 32.05 | 96.90 | 1.64 | 0.89 | 0.75 | 21.00 |

### 11.6 Test data for EDR(2 Mbps)

| Frequency (MHz) | Ant. Pol. (H/V) | Ant. Height (m) | Angle ( ° ) | OBW (MHz) | Measured (dBuV) | C.F (dB) | Result (dBuV/m) | E.I.R.P (dBm) | Ant Gain (dBi) | Conducted Power (dBm) | Limit (dBm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 402.00 | H | 2.0 | 175 | 1.17 | 65.67 | 31.88 | 97.55 | 2.29 | 0.89 | 1.40 | 21.00 |
| 2 441.00 | H | 2.0 | 175 | 1.17 | 66.19 | 32.07 | 98.26 | 3.00 | 0.89 | 2.11 | 21.00 |
| 2 480.00 | H | 2.0 | 175 | 1.17 | 66.88 | 32.05 | 98.93 | 3.67 | 0.89 | 2.78 | 21.00 |

### 11.7 Test data for EDR(3 Mbps)

| Frequency (MHz) | Ant. Pol. (H/V) | Ant. Height (m) | Angle ( ° ) | OBW (MHz) | Measured (dBuV) | C.F (dB) | Result (dBuV/m) | E.I.R.P (dBm) | Ant Gain (dBi) | Conducted Power (dBm) | Limit (dBm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 402.00 | H | 2.0 | 175 | 1.19 | 65.97 | 31.88 | 97.85 | 2.59 | 0.89 | 1.70 | 21.00 |
| 2 441.00 | H | 2.0 | 175 | 1.19 | 66.43 | 32.07 | 98.50 | 3.24 | 0.89 | 2.35 | 21.00 |
| 2 480.00 | H | 2.0 | 175 | 1.19 | 66.92 | 32.05 | 98.97 | 3.71 | 0.89 | 2.82 | 21.00 |

# 12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

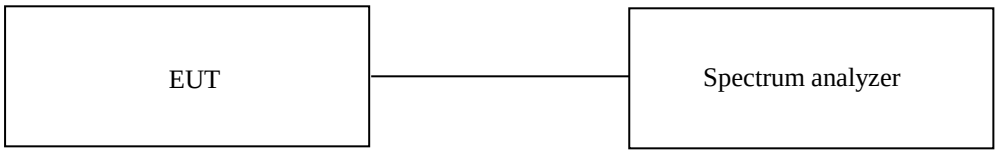
## 12.1 Operating environment

Temperature : 22 °C

Relative humidity : 48 % R.H.

## 12.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz and video bandwidth is set to 300 kHz, and peak detection was used.




## 12.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

## 12.4 Test Date

February 01, 2023 ~ March 06, 2023

## 12.5 Test data for conducted emission

For Test data for conducted emission, Please refer to the annex.

## 12.6 Test data for Transmitting mode radiated emission

### 12.6.1 Radiated Emission which fall in the Restricted Band

#### 12.6.1.1 Test data for 1 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 76.80 %

-. Result : PASSED

| Frequency (MHz) | Reading (dBµV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | AMP Gain | ATT (dB) | Duty Factor (dB) | Total (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | | | | |
| 2 352.14 | 53.31 | Peak | H | 27.31 | 6.72 | 44.96 | 5.77 | 0.00 | 48.15 | 74.00 | 25.85 |
| 2 389.55 | 41.33 | Average | H | 27.54 | 6.93 | 44.94 | 5.77 | 1.15 | 37.78 | 54.00 | 16.22 |
| 2 318.78 | 53.29 | Peak | V | 27.74 | 6.62 | 44.97 | 5.77 | 0.00 | 48.45 | 74.00 | 25.55 |
| 2 353.79 | 41.29 | Average | V | 27.32 | 6.72 | 44.96 | 5.77 | 1.15 | 37.29 | 54.00 | 16.71 |
| **Test Data for High Channel** | | | | | | | | | | | |
| 2 492.10 | 53.34 | Peak | H | 27.53 | 6.92 | 44.90 | 5.77 | 0.00 | 48.66 | 74.00 | 25.34 |
| 2 487.02 | 41.68 | Average | H | 27.55 | 6.90 | 44.91 | 5.77 | 1.15 | 38.14 | 54.00 | 15.86 |
| 2 490.30 | 53.45 | Peak | V | 27.54 | 6.92 | 44.90 | 5.77 | 0.00 | 48.78 | 74.00 | 25.22 |
| 2 490.60 | 41.58 | Average | V | 27.54 | 6.92 | 44.90 | 5.77 | 1.15 | 38.06 | 54.00 | 15.94 |

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + ATT + Duty Factor

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

**12.6.1.2 Test data for 2 Mbps**

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 76.80 %

-. Result : PASSED

| Frequency (MHz) | Reading (dBμV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | AMP Gain | ATT (dB) | Duty Factor (dB) | Total (dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | | | | |
| 2 348.19 | 53.66 | Peak | H | 27.33 | 6.72 | 44.96 | 5.77 | 0.00 | 48.52 | 74.00 | 25.48 |
| 2 312.71 | 41.24 | Average | H | 27.82 | 6.62 | 44.97 | 5.77 | 1.15 | 37.63 | 54.00 | 16.37 |
| 2 330.63 | 53.35 | Peak | V | 27.57 | 6.72 | 44.97 | 5.77 | 0.00 | 48.44 | 74.00 | 25.56 |
| 2 362.71 | 41.18 | Average | V | 27.38 | 6.72 | 44.95 | 5.77 | 1.15 | 37.25 | 54.00 | 16.75 |
| **Test Data for High Channel** | | | | | | | | | | | |
| 2 483.53 | 55.90 | Peak | H | 27.57 | 6.90 | 44.91 | 5.77 | 0.00 | 51.23 | 74.00 | 22.77 |
| 2 491.72 | 41.70 | Average | H | 27.53 | 6.92 | 44.90 | 5.77 | 1.15 | 38.17 | 54.00 | 15.83 |
| 2 483.55 | 55.42 | Peak | V | 27.57 | 6.90 | 44.91 | 5.77 | 0.00 | 50.75 | 74.00 | 23.25 |
| 2 497.57 | 41.65 | Average | V | 27.51 | 6.92 | 44.90 | 5.77 | 1.15 | 38.10 | 54.00 | 15.90 |

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + ATT + Duty Factor

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

**12.6.1.3 Test data for 3 Mbps**

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 76.80 %

-. Result : PASSED

| Frequency (MHz) | Reading (dBµV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | AMP Gain | ATT (dB) | Duty Factor (dB) | Total (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | | | | |
| 2 389.18 | 53.26 | Peak | H | 27.54 | 6.93 | 44.94 | 5.77 | 0.00 | 48.56 | 74.00 | 25.44 |
| 2 344.05 | 41.28 | Average | H | 27.38 | 6.72 | 44.96 | 5.77 | 1.15 | 37.34 | 54.00 | 16.66 |
| 2 339.18 | 53.77 | Peak | V | 27.45 | 6.72 | 44.96 | 5.77 | 0.00 | 48.75 | 74.00 | 25.25 |
| 2 350.12 | 41.16 | Average | V | 27.30 | 6.72 | 44.96 | 5.77 | 1.15 | 37.14 | 54.00 | 16.86 |
| **Test Data for High Channel** | | | | | | | | | | | |
| 2 483.57 | 56.54 | Peak | H | 27.57 | 6.90 | 44.91 | 5.77 | 0.00 | 51.87 | 74.00 | 22.13 |
| 2 483.63 | 41.75 | Average | H | 27.57 | 6.90 | 44.91 | 5.77 | 1.15 | 38.23 | 54.00 | 15.77 |
| 2 483.83 | 57.76 | Peak | V | 27.57 | 6.90 | 44.91 | 5.77 | 0.00 | 53.09 | 74.00 | 20.91 |
| 2 498.97 | 41.50 | Average | V | 27.50 | 6.92 | 44.90 | 5.77 | 1.15 | 37.94 | 54.00 | 16.06 |

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + ATT + Duty Factor

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

## 12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz

### 12.6.2.1 Test data for 1 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 76.80 %

-. Result : PASSED

| Frequency (MHz) | Reading (dBµV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | AMP Gain | Duty Factor (dB) | Total (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | | | |
| 4 803.83 | 50.32 | Peak | H | 31.30 | 10.62 | 44.66 | 0.00 | 47.58 | 74.00 | 26.42 |
| 4 805.45 | 38.00 | Average | H | 31.30 | 10.62 | 44.66 | 1.15 | 36.41 | 54.00 | 17.59 |
| 4 803.48 | 50.34 | Peak | V | 31.30 | 10.62 | 44.66 | 0.00 | 47.60 | 74.00 | 26.40 |
| 4 805.53 | 38.00 | Average | V | 31.30 | 10.62 | 44.66 | 1.15 | 36.41 | 54.00 | 17.59 |
| **Test Data for Middle Channel** | | | | | | | | | | |
| 4 881.07 | 50.34 | Peak | H | 31.30 | 10.62 | 44.68 | 0.00 | 47.58 | 74.00 | 26.42 |
| 4 882.91 | 38.07 | Average | H | 31.30 | 10.62 | 44.68 | 1.15 | 36.46 | 54.00 | 17.54 |
| 4 880.15 | 50.09 | Peak | V | 31.30 | 10.62 | 44.68 | 0.00 | 47.33 | 74.00 | 26.67 |
| 4 880.42 | 38.21 | Average | V | 31.30 | 10.62 | 44.68 | 1.15 | 36.60 | 54.00 | 17.40 |
| **Test Data for High Channel** | | | | | | | | | | |
| 4 962.38 | 50.58 | Peak | H | 31.35 | 10.62 | 44.69 | 0.00 | 47.86 | 74.00 | 26.14 |
| 4 957.53 | 38.07 | Average | H | 31.35 | 10.62 | 44.69 | 1.15 | 36.50 | 54.00 | 17.50 |
| 4 957.86 | 49.99 | Peak | V | 31.35 | 10.62 | 44.69 | 0.00 | 47.27 | 74.00 | 26.73 |
| 4 957.57 | 38.14 | Average | V | 31.35 | 10.62 | 44.69 | 1.15 | 36.57 | 54.00 | 17.43 |

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Duty Factor

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

**12.6.2.2 Test data for 2 Mbps**

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 76.80 %

-. Result : PASSED

| Frequency (MHz) | Reading (dBµV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | AMP Gain | Duty Factor (dB) | Total (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | | | |
| 4 804.73 | 49.61 | Peak | H | 31.30 | 10.62 | 44.66 | 0.00 | 46.87 | 74.00 | 27.13 |
| 4 806.41 | 37.97 | Average | H | 31.30 | 10.62 | 44.66 | 1.15 | 36.38 | 54.00 | 17.62 |
| 4 802.56 | 50.31 | Peak | V | 31.30 | 10.62 | 44.66 | 0.00 | 47.57 | 74.00 | 26.43 |
| 4 801.67 | 37.92 | Average | V | 31.30 | 10.62 | 44.66 | 1.15 | 36.33 | 54.00 | 17.67 |
| **Test Data for Middle Channel** | | | | | | | | | | |
| 4 883.01 | 50.25 | Peak | H | 31.30 | 10.62 | 44.68 | 0.00 | 47.49 | 74.00 | 26.51 |
| 4 882.46 | 38.17 | Average | H | 31.30 | 10.62 | 44.68 | 1.15 | 36.56 | 54.00 | 17.44 |
| 4 884.36 | 50.11 | Peak | V | 31.30 | 10.62 | 44.68 | 0.00 | 47.35 | 74.00 | 26.65 |
| 4 883.44 | 38.09 | Average | V | 31.30 | 10.62 | 44.68 | 1.15 | 36.48 | 54.00 | 17.52 |
| **Test Data for High Channel** | | | | | | | | | | |
| 4 958.72 | 50.26 | Peak | H | 31.35 | 10.62 | 44.69 | 0.00 | 47.54 | 74.00 | 26.46 |
| 4 957.73 | 38.12 | Average | H | 31.35 | 10.62 | 44.69 | 1.15 | 36.55 | 54.00 | 17.45 |
| 4 961.74 | 49.53 | Peak | V | 31.35 | 10.62 | 44.69 | 0.00 | 46.81 | 74.00 | 27.19 |
| 4 959.71 | 37.91 | Average | V | 31.35 | 10.62 | 44.69 | 1.15 | 36.34 | 54.00 | 17.66 |

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Duty Factor

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

**12.6.2.3 Test data for 3 Mbps**

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 76.80 %

-. Result : PASSED

| Frequency (MHz) | Reading (dBµV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | AMP Gain | Duty Factor (dB) | Total (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | | | |
| 4 802.17 | 49.93 | Peak | H | 31.30 | 10.62 | 44.66 | 0.00 | 47.19 | 74.00 | 26.81 |
| 4 805.55 | 37.91 | Average | H | 31.30 | 10.62 | 44.66 | 1.15 | 36.32 | 54.00 | 17.68 |
| 4 801.97 | 49.52 | Peak | V | 31.30 | 10.62 | 44.66 | 0.00 | 46.78 | 74.00 | 27.22 |
| 4 806.00 | 37.86 | Average | V | 31.30 | 10.62 | 44.66 | 1.15 | 36.27 | 54.00 | 17.73 |
| **Test Data for Middle Channel** | | | | | | | | | | |
| 4 880.49 | 50.36 | Peak | H | 31.30 | 10.62 | 44.68 | 0.00 | 47.60 | 74.00 | 26.40 |
| 4 879.60 | 38.04 | Average | H | 31.30 | 10.62 | 44.68 | 1.15 | 36.43 | 54.00 | 17.57 |
| 4 880.70 | 50.00 | Peak | V | 31.30 | 10.62 | 44.68 | 0.00 | 47.24 | 74.00 | 26.76 |
| 4 881.28 | 37.95 | Average | V | 31.30 | 10.62 | 44.68 | 1.15 | 36.34 | 54.00 | 17.66 |
| **Test Data for High Channel** | | | | | | | | | | |
| 4 957.74 | 50.01 | Peak | H | 31.35 | 10.62 | 44.69 | 0.00 | 47.29 | 74.00 | 26.71 |
| 4 958.28 | 37.93 | Average | H | 31.35 | 10.62 | 44.69 | 1.15 | 36.36 | 54.00 | 17.64 |
| 4 960.22 | 50.00 | Peak | V | 31.35 | 10.62 | 44.69 | 0.00 | 47.28 | 74.00 | 26.72 |
| 4 958.75 | 37.98 | Average | V | 31.35 | 10.62 | 44.69 | 1.15 | 36.41 | 54.00 | 17.59 |

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Duty Factor

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

# 13. RADIATED EMISSION TEST

## 13.1 Operating environment

Temperature : 22 °C

Relative humidity : 48 % R.H.

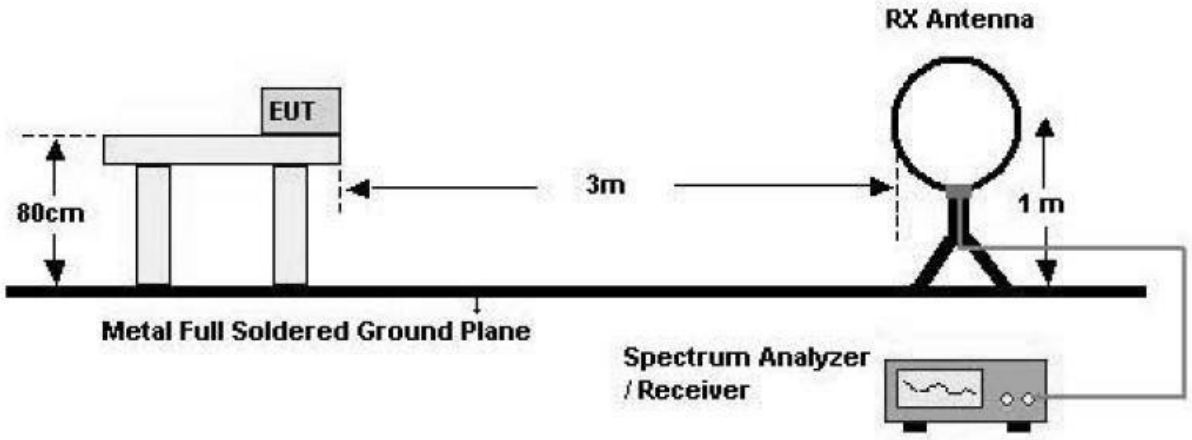
## 13.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

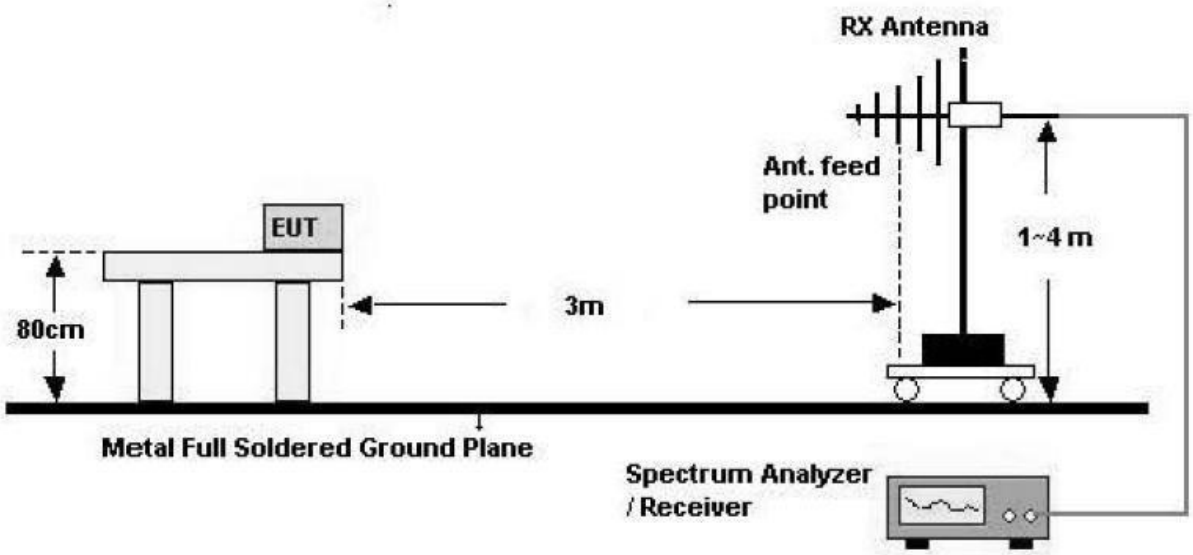
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

**- Test Configuration**

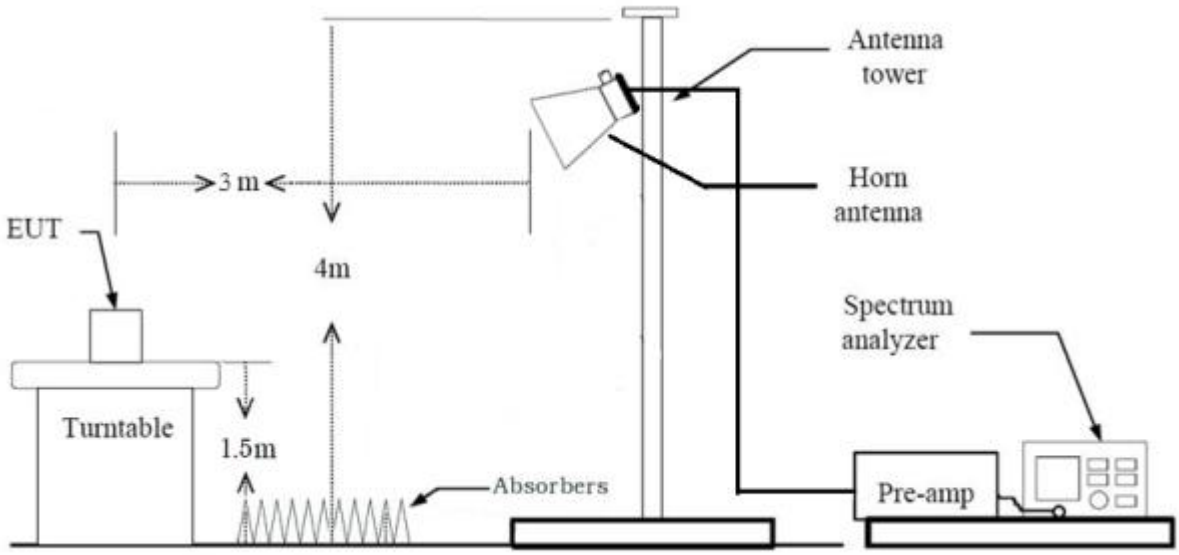
1. Below 30 MHz



2. 30 MHz - 1 GHz




3. Above 1 GHz




### 13.3 Test Date

February 01, 2023 ~ March 06, 2023

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

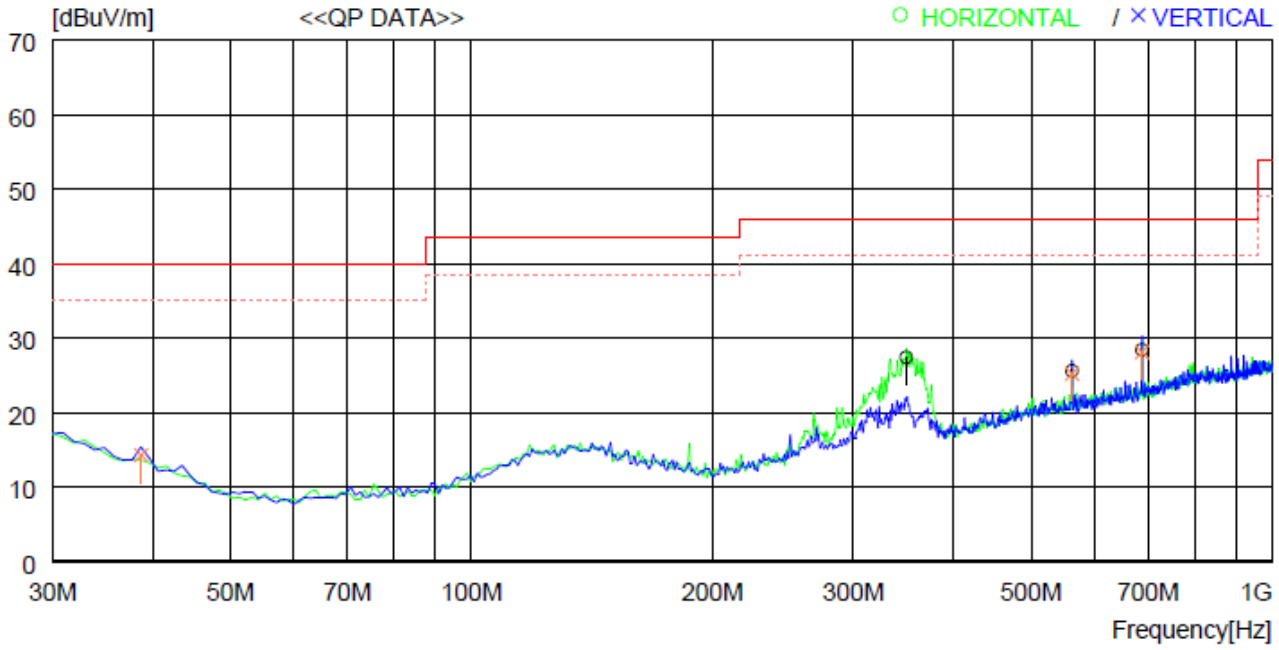
## 13.4 Test data for 30 MHz ~ 1 000 MHz

### 13.4.1 Test data for Bluetooth Mode_Internal Antenna

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m




| No. | FREQ [MHz] | READING QP [dBuV] | ANT FACTOR [dB] | LOSS [dB] | GAIN [dB] | RESULT [dBuV/m] | LIMIT [dBuV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- Horizontal ------ | | | | | | | | | | |
| 1 | 349.130 | 37.1 | 19.9 | 2.4 | 32.0 | 27.4 | 46.0 | 18.6 | 100 | 359 |
| 2 | 562.529 | 31.0 | 23.7 | 3.1 | 32.2 | 25.6 | 46.0 | 20.4 | 400 | 0 |
| 3 | 687.655 | 32.1 | 25.2 | 3.4 | 32.3 | 28.4 | 46.0 | 17.6 | 400 | 0 |
| ----- Vertical ------ | | | | | | | | | | |
| 4 | 38.730 | 28.0 | 17.6 | 0.8 | 32.1 | 14.3 | 40.0 | 25.7 | 100 | 0 |
| 5 | 562.529 | 30.6 | 23.7 | 3.1 | 32.2 | 25.2 | 46.0 | 20.8 | 400 | 33 |
| 6 | 687.655 | 31.8 | 25.2 | 3.4 | 32.3 | 28.1 | 46.0 | 17.9 | 100 | 200 |

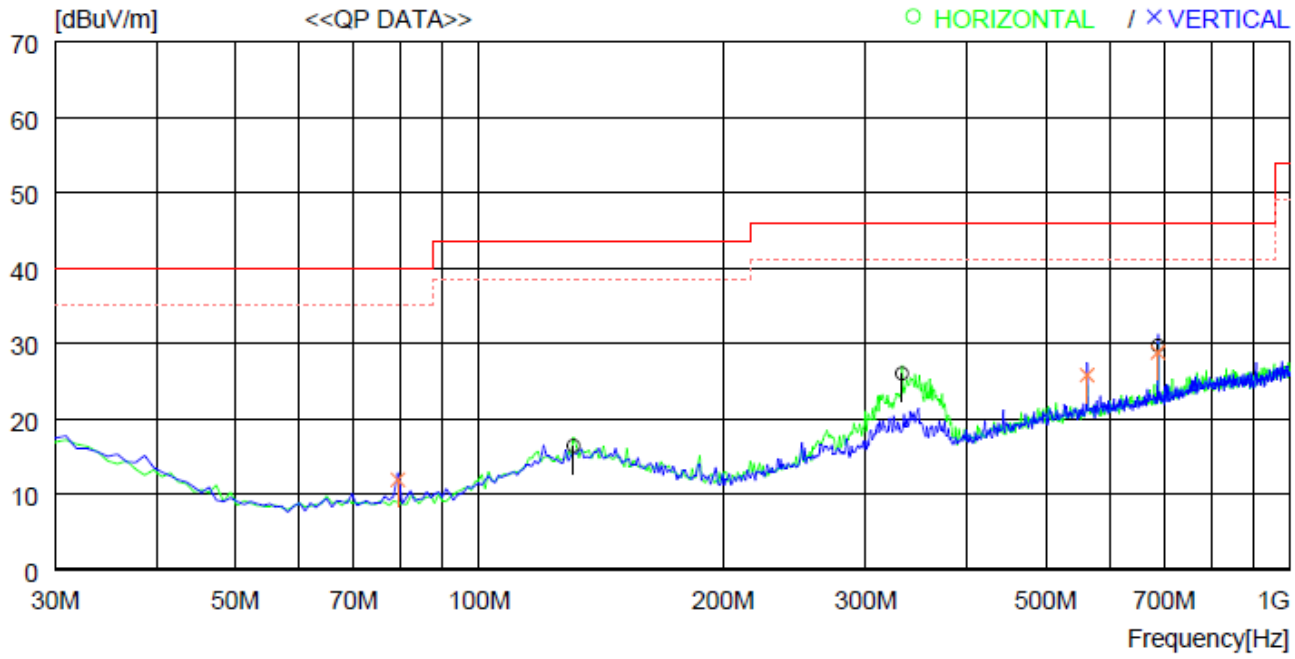
**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 13.4.2 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz)

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m




| No. | FREQ [MHz] | READING QP [dBuV] | ANT FACTOR [dB] | LOSS [dB] | GAIN [dB] | RESULT [dBuV/m] | LIMIT [dBuV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- Horizontal ------ | | | | | | | | | | |
| 1 | 130.880 | 28.0 | 18.9 | 1.5 | 32.0 | 16.4 | 43.5 | 27.1 | 200 | 0 |
| 2 | 332.640 | 36.0 | 19.7 | 2.3 | 32.0 | 26.0 | 46.0 | 20.0 | 100 | 359 |
| 3 | 687.655 | 33.4 | 25.2 | 3.4 | 32.3 | 29.7 | 46.0 | 16.3 | 400 | 29 |
| ----- Vertical ------ | | | | | | | | | | |
| 4 | 79.470 | 29.6 | 13.2 | 1.1 | 32.0 | 11.9 | 40.0 | 28.1 | 400 | 359 |
| 5 | 562.529 | 31.2 | 23.7 | 3.1 | 32.2 | 25.8 | 46.0 | 20.2 | 400 | 2 |
| 6 | 687.655 | 32.5 | 25.2 | 3.4 | 32.3 | 28.8 | 46.0 | 17.2 | 100 | 0 |

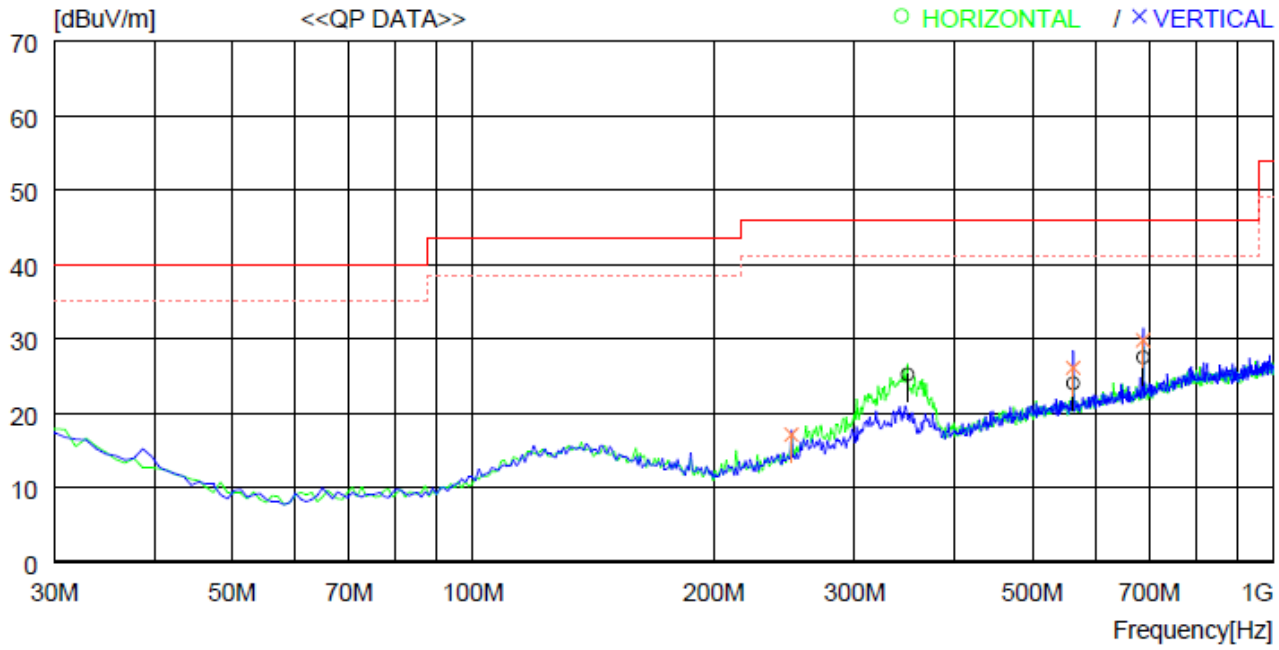
**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 13.4.3 Test data for Intermodulation Mode(Bluetooth + WLAN 5 GHz)

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m




| No. | FREQ [MHz] | READING QP [dBuV] | ANT FACTOR [dB] | LOSS [dB] | GAIN [dB] | RESULT [dBuV/m] | LIMIT [dBuV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- Horizontal ------ | | | | | | | | | | |
| 1 | 349.130 | 34.9 | 19.9 | 2.4 | 32.0 | 25.2 | 46.0 | 20.8 | 100 | 137 |
| 2 | 562.529 | 29.4 | 23.7 | 3.1 | 32.2 | 24.0 | 46.0 | 22.0 | 400 | 0 |
| 3 | 687.655 | 31.2 | 25.2 | 3.4 | 32.3 | 27.5 | 46.0 | 18.5 | 400 | 165 |
| ----- Vertical ------ | | | | | | | | | | |
| 4 | 250.190 | 29.5 | 17.6 | 2.0 | 32.0 | 17.1 | 46.0 | 28.9 | 200 | 32 |
| 5 | 562.529 | 31.5 | 23.7 | 3.1 | 32.2 | 26.1 | 46.0 | 19.9 | 100 | 254 |
| 6 | 687.655 | 33.5 | 25.2 | 3.4 | 32.3 | 29.8 | 46.0 | 16.2 | 100 | 0 |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

### 13.4 Test data for Below 30 MHz

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

| Frequency (MHz) | Reading (dBµV) | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss | Amp Gain | Emission Level(dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Emission from the EUT more than 20 dB below the limit in each frequency range. | | | | | | | | |

### 13.5 Test data for above 1 GHz

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode

1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

| Frequency (MHz) | Reading (dBµV) | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss | Amp Gain | Emission Level(dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Emission from the EUT more than 20 dB below the limit in each frequency range. | | | | | | | | |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

## 14. LIST OF TEST EQUIPMENT

| Model Number | Manufacturer | Description | Serial Number | Last Cal.(Interval) |
|---|---|---|---|---|
| FSVA40 | Rohde & Schwarz | Signal Analyzer | 101598 | Apr. 03, 2023 (1Y) |
| ESU | Rohde & Schwarz | EMI Test Receiver | 100261 | Mar. 06, 2023 (1Y) |
| GP-4303D | LG Precision Co.,Ltd | DC POWER SUPPLY | 5071069 | Jan. 04, 2023 (1Y) |
| WT-A3882-R10 | Microwave | Cavity Band Rejection Filter | WT22040502-1 | Apr. 03, 2023 (1Y) |
| 310N | Sonoma Instrument | Pre-Amplifier | 392756 | Oct. 13, 2022 (1Y) |
| SCU18 | Rohde & Schwarz | Pre-Amplifer | 102266 | Jul. 14, 2023 (1Y) |
| SCU40A | Rohde & Schwarz | Signal Conditioning unit | 100436 | Jan. 18, 2023 (1Y) |
| QFA1802-26-6-S | Qualwave | 6dB Attenuator | 225340 | Apr. 04, 2023 (1Y) |
| 152610 | KRYTAR | Directional Coupler | 214012 | Apr. 03, 2023 (1Y) |
| TC-3000C | TESCOM | BLUETOOTH TESTER | 3000C000634 | Jan. 16, 2023 (1Y) |
| DT2000-2t | Innco System | Turn Table | N/A | N/A |
| CO3000 | Innco System | Controller | 1026/40960617/P | N/A |
| MA-4640-XPET | Innco System | Antenna Master | MA4640/652/43100318/P | N/A |
| HLP-2008 | TDK | Hybrid Antenna | 131316 | Mar. 07, 2022 (2Y) |
| BBHA9120D | Schwarzbeck | Horn Antenna | 9120D-1366 | Jun. 22, 2023 (1Y) |
| BBHA9170 | Schwarzbeck | Horn Antenna | BBHA9170178 | Jan. 04, 2023 (1Y) |
| FMZB 1513 | Schwarzbeck | Loop Antenna | 1513-235 | Mar. 24, 2022 (2Y) |

**ONETECH Corp.**: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)