# *EVALUATION REPORT*

## *for Certification*

**Applicant : Ohsung Electronics Co.,Ltd.**

**#181 Gongdan-dong, Gumi-Si,**

**Gyeoungsangbuk-Do, South Korea**

**Attn: Mr. Hak-Ki Kim / General Manager**

**Date of Issue: Jan. 11, 2022**

**Order Number: GETEC-C1-21-415**

**Test Report Number: GETEC-E3-21-023**

**Test Site: GUMI UNIVERSITY EMC CENTER**

**CAB Designation Number: KR0033**

| | |
|---|---|
| **RESPONSIBLE PARTY** | **: Ohsung Electronics Co.,Ltd.** |
| **ADDRESS** | **: #181 Gongdan-dong, Gumi-Si, Gyeoungsangbuk-Do, South Korea** |
| **CONTACT PERSON** | **: Mr. Hak-Ki Kim / General Manager** |

| | |
|---|---|
| **Rule Part(s)** | **: FCC Part 15 Subpart C-Intentional Radiator § 15.247** |
| **Test Method** | **: ANSI C63.10 (2013)** |
| **Equipment Class** | **: Digital Transmission System(DTS)** |
| **EUT Type** | **: RF Remote Controller** |
| **Type of Authority** | **: Certification** |
| **Model Name** | **: MX-1400** |

**This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10 (2013)**

**I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.**

**Tested by,**

**Jong-Wook Park / Senior Engineer**
**GUMI UNIVERSITY EMC CENTER**

**Reviewed by,**

**Hyun Kim / Technical Manager**
**GUMI UNIVERSITY EMC CENTER**

# Version

| Test Report No. | Date | Description |
|---|---|---|
| GETEC-E3-21-023 | Jan. 11, 2022 | - First Approval Report |

# CONTENTS

***Scope:*** *Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.*

**1. General Information**

**Applicant: Ohsung Electronics Co.,Ltd.**

**Applicant Address: #181 Gongdan-dong, Gumi-Si, Gyeoungsangbuk-Do, South Korea**

**Manufacturer: Ohsung Electronics Co.,Ltd.**

**Manufacturer Address: #181 Gongdan-dong, Gumi-Si, Gyeoungsangbuk-Do, South Korea**

**Contact Person: Mr. Hak-Ki Kim/ General anager**

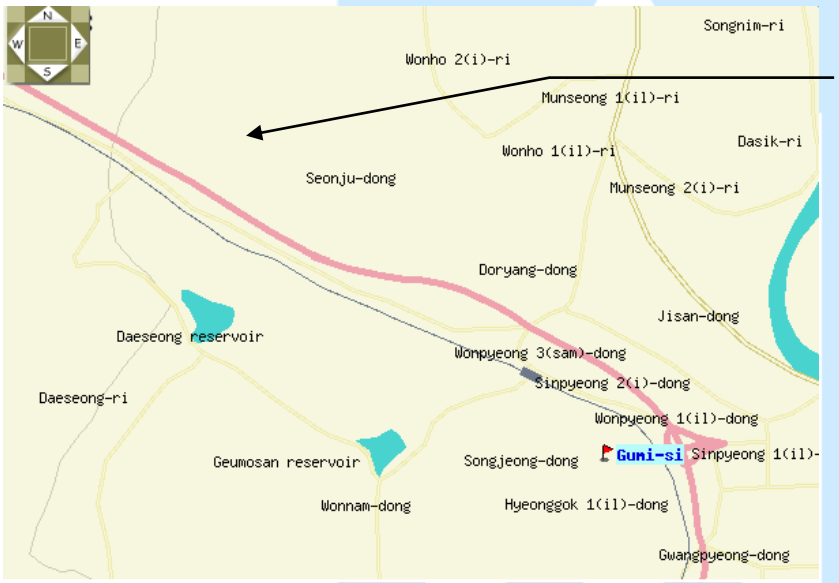
**Telephone Number: +82-54-468-7281**

- **FCC ID.** OZ5URCMX1400
- **Equipment Class** Digital Transmission System (DTS)
- **EUT Type** RF Remote Controller
- **Model Name** MX-1400
- **Rule Part(s)** FCC Part 15 Subpart C-Intentional Radiator § 15.247
- **Test Method** ANSI C63.10 (2013)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v05r02(April 2,2019)
- **Dates of Test** Jul. 28, 2021 ~ Dec. 27, 2021
- **Place of Test** **GUMI UNIVERSITY EMC CENTER** (FCC Test firm Registration No.: 269701)
  37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
- **Test Report Number** GETEC-E3-21-023
- **Dates of Issue** Jan. 11, 2022

## 2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009) was used in determining radiated and conducted emissions emanating from **Ohsung Electronics Co.,Ltd. RF Remote Controller(Model name: MX-1400).**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**.
The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
This test site is one of the highest point of GUMI UNIVERSITY at about 200 kilometers away from Seoul city and 40 kilometers away from Daege city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.10 (2013)




**GUMI UNIVERSITY EMC CENTER**
37 Yaeun-ro, Gumi-si,
Gyeongsangbuk-do, 730-711,
Republic of Korea
Tel: +82-54-440-1195
Fax: +82-54-440-1199

Fig 1. The map above shows the Gumi University in vicinity area.

# 3. Product Information

## 3.1 Description of EUT

The Equipment under Test (EUT) is the **Ohsung Electronics Co.,Ltd. RF Remote Controller (Model Name: MX-1400) FCC ID.: OZ5URCMX1400**

| | |
|---|---|
| -. Equipment | : RF Remote Controller |
| -. Model name | : MX-1400 |
| -. Serial number | : Proto type |
| -. Electrical Rating | : DC 3.7 V |
| -. Manufacturer | : Ohsung Electronics Co.,Ltd. |
| -. Frequency Range | : 2412 MHz - 2462 MHz |
| -. Modulation | : DSSS, OFDM |
| -. Antenna Specification | : Antenna type : FPCB antenna<br>Gain : 1.67 dBi |

## 3.2 Definition of models

- None.

### 3.3 Support Equipment / Cables used

3.3.1 Used Support Equipment

| Description | Manufacturer | Model Name | S/N & FCC ID. |
|---|---|---|---|
| Notebook Computer 1) | SAMSUNG | NT500R3W | S/N: 0Q2V91JJ100096T<br>FCC ID.: N/A |

Note)
1) The Support Equipment use only setting to the test mode.

3.3.2 System configuration

| Description | Manufacturer | Model Name | S/N & FCC ID. |
|---|---|---|---|
| - | - | - | - |

3.3.3 Used Cable(s)

| Cable Name | Condition | Description |
|---|---|---|
| - | - | - |

### 3.4 Modification Item(s)

-. None

## 4. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

### 4.1 Description of Antenna

The **Ohsung Electronics Co.,Ltd., RF Remote Controller.** comply with the requirement of §15.203 with a **FPCB antenna** permanently attached to the transmitter.

## 5. Description of tests

### 5.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used.

The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency: 3.7 V / DC

- Operating condition during the test(s) :
  -. Continuous RF transmitting mode with nominal maximum RF output power.
  -. Operating channel frequency and modulation technology

| Mode | Available channel | Frequency | Modulation Technology |
|---|---|---|---|
| IEEE 802.11b | 1 ~ 11 | 2412 ~ 2462 MHz | DSSS |
| IEEE 802.11g | 1 ~ 11 | 2412 ~ 2462 MHz | OFDM |
| IEEE 802.11n | 1 ~ 11 | 2412 ~ 2462 MHz | OFDM |

-. EUT set condition (Test Software)

| | |
|---|---|
| **Test Software** | WL4343WA1 |
| **Test Software version** | - |

## 6. References Standards

- FCC Part 15 (2009) Subpart C-Intentional Radiator §15.247
- ANSI C 63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices
- KDB 558074 D01 DTS meas Guidance v05r02 (April 2, 2019): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

## 7. SUMMARY OF TEST RESULTS

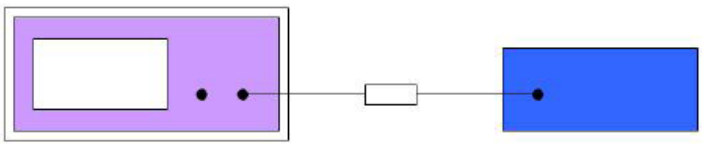
| FCC Part Section(s) | Test Description | Test Result |
|---|---|---|
| §15.247(a)(2) | 6 dB Bandwidth | Pass |
| §15.247(b)(3) | Conducted Maximum Output Power | Pass |
| §15.247(e) | Power Spectral Density | Pass |
| §15.247(d) | Conducted Out of Band Emission Emissions | Pass |
| §15.207(a) | AC Power line Conducted Emissions | Pass |
| §15.205, 15.209 | Radiated Spurious Emissions | Pass |
| §15.247(d), 15.205, 15.209 | Radiated Restricted Band Edge | Pass |

## 8. 6 dB Bandwidth Measurement

### 8.1 Operating environment

Temperature : 22.5 °C
Relative Humidity : 45.2 % R.H.

### 8.2 Test Set-up (Layout)




### 8.3 Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

### 8.4 Test Equipment used

| | Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | FSV | Rohde & Schwarz | Spectrum Analyzer | 101552 | Apr. 09, 2022 |
| ■ - | J12J102248-00-4 | JUNFLON | RF Test Cable | SEP-10-14-084 | N/A |
| ■ - | J12J102248-00-2 | JUNFLON | RF Test Cable | SEP-10-14-046 | N/A |
| ■ - | MODEL 2 | Rohde & Schwarz | 10 dB attenuator | SEP-10-14-046 | Apr. 07, 2022 |
| ■ - | OSP120 | Rohde & Schwarz | Open Switch and control platform | 101329 | Apr. 09. 2022 |
| ■ - | WMS 32 | Rohde & Schwarz | Testing Software | VER10.40.10 | N/A |

### 8.5 Test Test Procedure

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**8.6 Test result**

-. Test Date : Jul. 28, 2021
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(2)
-. Test Procedure(s) : ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v05r02(April 2,2019)
-. Operating Condition : RF transmitting mode (1 ch: 2 412 MHz, 6 ch: 2 437 MHz, 11 ch: 2 462 MHz)
-. Power Source : DC 3.7 V

IEEE 802.11b

| Frequency (MHz) | 6 dB Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Min. Limit (MHz) | Result |
|---|---|---|---|---|---|
| 2 412 | 8.70 | 2407.65 | 2416.35 | 0.50 | Complies |
| 2 437 | 8.90 | 2432.55 | 2441.45 | 0.50 | Complies |
| 2 462 | 9.00 | 2457.35 | 2466.35 | 0.50 | Complies |

IEEE 802.11g

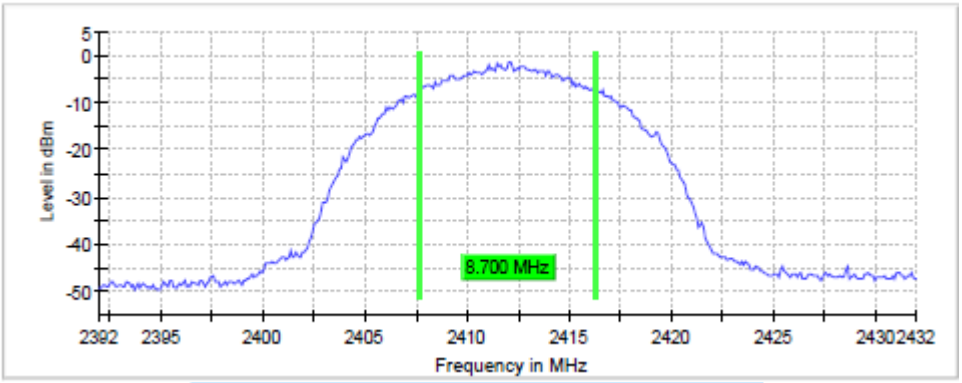
| Frequency (MHz) | 6 dB Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Min. Limit (MHz) | Result |
|---|---|---|---|---|---|
| 2 412 | 16.20 | 2403.75 | 2419.95 | 0.50 | Complies |
| 2 437 | 16.30 | 2428.95 | 2445.25 | 0.50 | Complies |
| 2 462 | 15.90 | 2454.35 | 2470.25 | 0.50 | Complies |

IEEE 802.11n

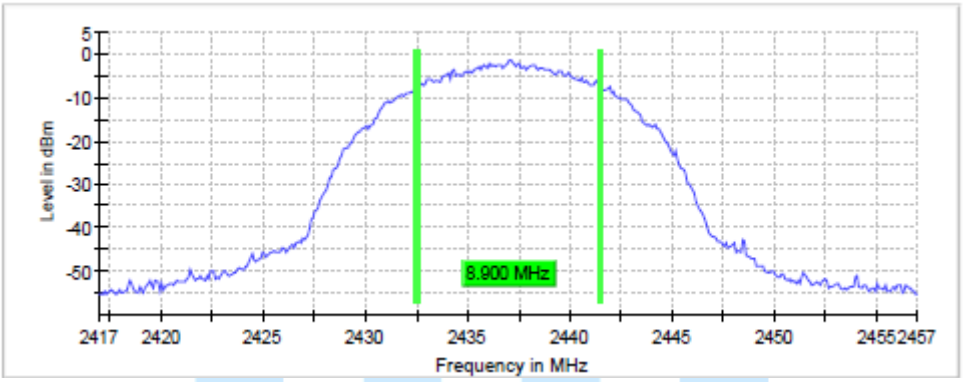
| Frequency (MHz) | 6 dB Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Min. Limit (MHz) | Result |
|---|---|---|---|---|---|
| 2 412 | 15.30 | 2402.35 | 2419.65 | 0.50 | Complies |
| 2 437 | 15.30 | 2429.35 | 2444.65 | 0.50 | Complies |
| 2 462 | 15.30 | 2454.35 | 2469.65 | 0.50 | Complies |

**IEEE 802.11b**

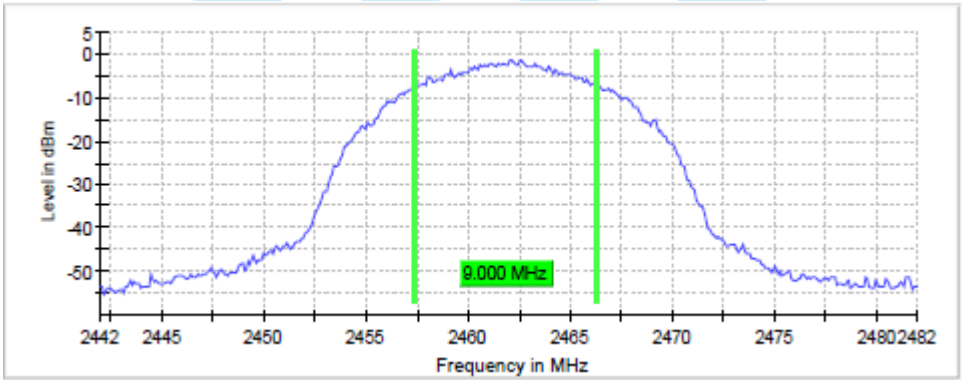
**6 dB Bandwidth Plot on Configuration : 1 ch**




**6 dB Bandwidth Plot on Configuration : 6 ch**

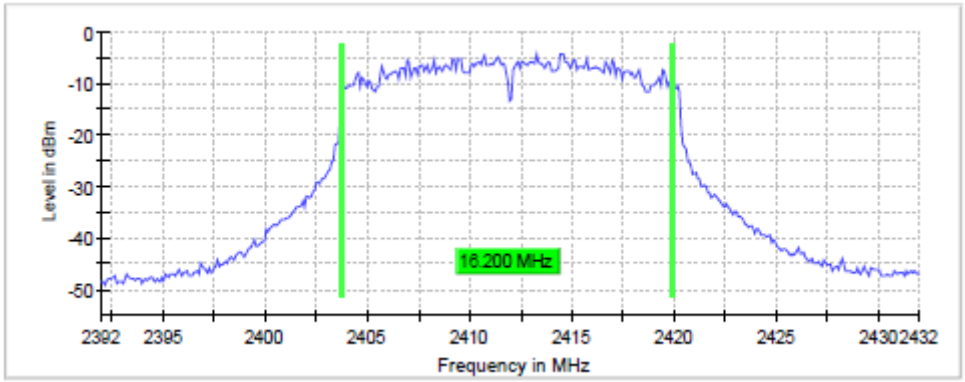



**6 dB Bandwidth Plot on Configuration : 11 ch**

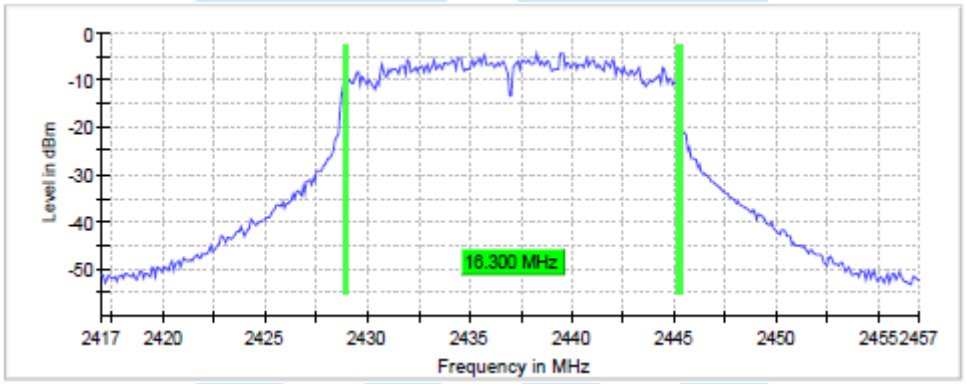


**IEEE 802.11g**

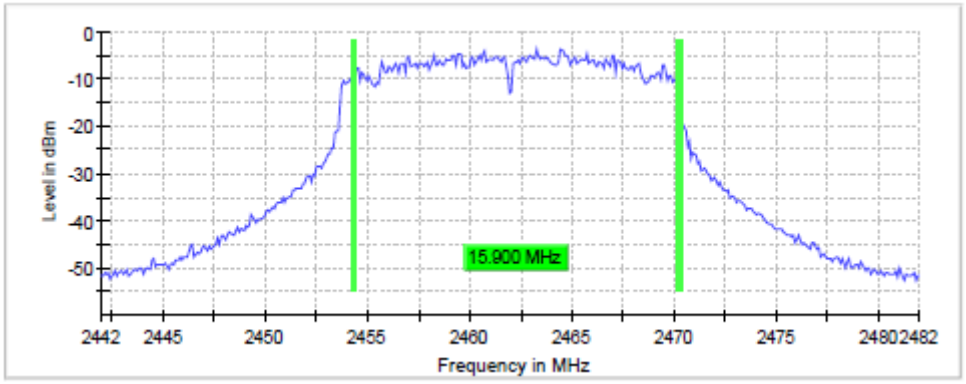
**6 dB Bandwidth Plot on Configuration : 1 ch**




**6 dB Bandwidth Plot on Configuration : 6 ch**

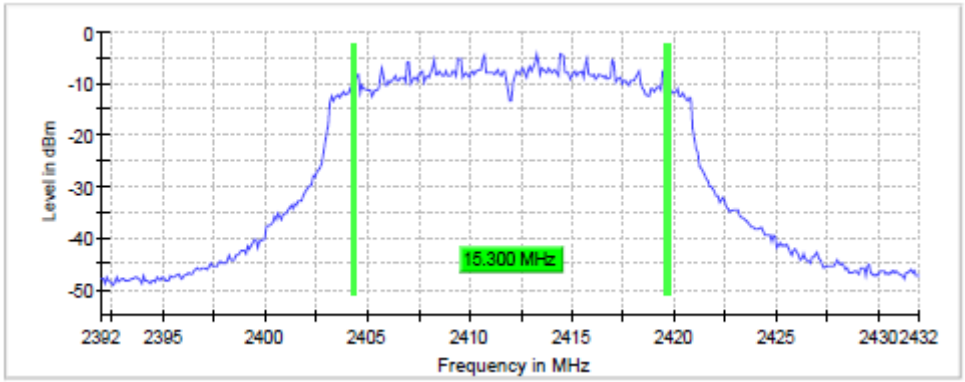



**6 dB Bandwidth Plot on Configuration : 11 ch**

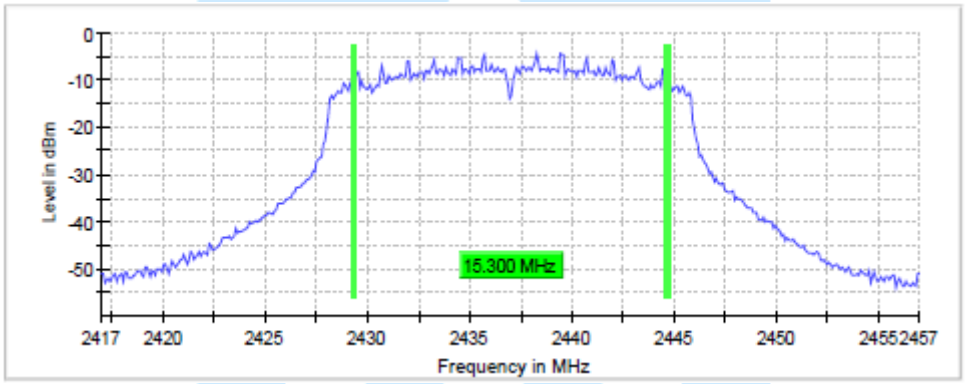


**IEEE 802.11n**

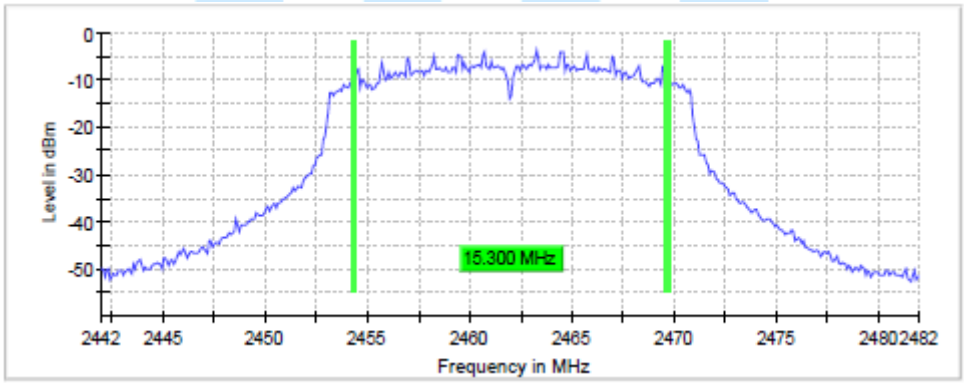
**6 dB Bandwidth Plot on Configuration : 1 ch**




**6 dB Bandwidth Plot on Configuration : 6 ch**




**6 dB Bandwidth Plot on Configuration : 11 ch**

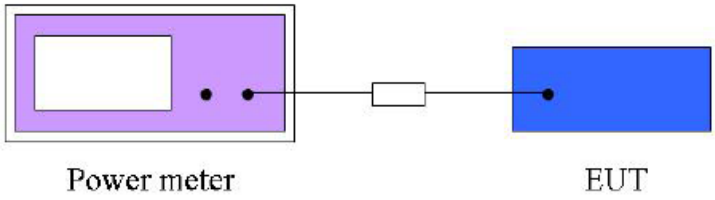


## 9. Conducted Maximum Output Power Measurement

### 9.1 Operating environment

Temperature : 22.5 °C
Relative Humidity : 45.2 % R.H.

### 9.2 Test Set-up (Layout)




### 9.3 Limit

For systems using digital modulation in the (2 400~2 483.5) MHz, the limit for peak output power is 30 dBm The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

### 9.4 Test Equipment used

| | Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | NRVD | Rohde & Schwarz | Dual Channel Power Meter | 837794/048 | Apr. 15, 2022 |
| ■ - | NRV-Z32 | Rohde & Schwarz | Peak power sensor | 100049 | Apr. 08, 2022 |
| ■ - | NRP-Z51 | Rohde & Schwarz | Power sensor | 1138.0005.02 | Apr. 08, 2022 |

### 9.5 Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

### 9.6 Test Result

-. Test Date : Jul. 28, 2021
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(b)(3)
-. Test Procedure(s) : ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v05r02(April 2,2019)
-. Operating Condition : RF transmitting mode (1 ch: 2 412 MHz, 6 ch: 2 437 MHz, 11 ch: 2 462 MHz)
-. Power Source : DC 3.7 V

IEEE 802.11b

| Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power[1)] (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 2 412 | 7.6 | 4.8 | 30.00 | Complies |
| 2 437 | 7.5 | 4.8 | 30.00 | Complies |
| 2 462 | 7.8 | 5.3 | 30.00 | Complies |

Note: 1) The Average output power is reference data for RF Exposure.

IEEE 802.11g

| Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power[1)] (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 2 412 | 15.9 | 5.4 | 30.00 | Complies |
| 2 437 | 15.8 | 5.2 | 30.00 | Complies |
| 2 462 | 16.3 | 5.7 | 30.00 | Complies |

Note: 1) The Average output power is reference data for RF Exposure.

IEEE 802.11n

| Frequency (MHz) | Peak Conducted Power (dBm) | Average Conducted Power[1)] (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 2 412 | 16.9 | 5.2 | 30.00 | Complies |
| 2 437 | 16.8 | 5.1 | 30.00 | Complies |
| 2 462 | 17.4 | 5.6 | 30.00 | Complies |

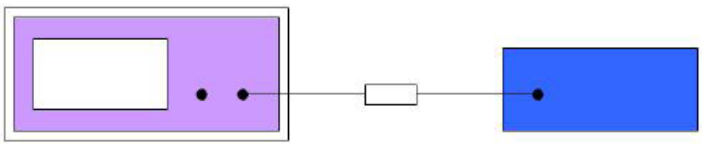
Note: 1) The Average output power is reference data for RF Exposure.

## 10. Power Spectral Density Measurement

### 10.1 Operating Environment

Temperature : 22.5 °C
Relative Humidity : 45.2 % R.H.

### 10.2 Test Set-up (Layout)




### 10.3 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

### 10.4 Test Equipment used

| | Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | FSV | Rohde & Schwarz | Spectrum Analyzer | 101552 | Apr. 09, 2022 |
| ■ - | J12J102248-00-4 | JUNFLON | RF Test Cable | SEP-10-14-084 | N/A |
| ■ - | J12J102248-00-2 | JUNFLON | RF Test Cable | SEP-10-14-046 | N/A |
| ■ - | MODEL 2 | Rohde & Schwarz | 10 dB attenuator | SEP-10-14-046 | Apr. 07, 2022 |
| ■ - | OSP120 | Rohde & Schwarz | Open Switch and control platform | 101329 | Apr. 09. 2022 |
| ■ - | WMS 32 | Rohde & Schwarz | Testing Software | VER10.40.10 | N/A |

### 10.5 Test Procedure

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz
d) Set the VBW to 10 kHz
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.

**10.6 Test Result**

-. Test Date : Jul. 28, 2021
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(e)
-. Test Procedure(s) : ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v05r02(April 2,2019)
-. Operating Condition : RF transmitting mode (1 ch: 2 412 MHz, 6 ch: 2 437 MHz, 11 ch: 2 462 MHz)
-. Power Source : DC 3.7 V

IEEE 802.11b

| Frequency (MHz) | PSD (dBm/3kHz) | Max. Limit (dBm/3kHz) | Result |
|---|---|---|---|
| 2 412 | -3.38 | 8.00 | Complies |
| 2 437 | -3.06 | 8.00 | Complies |
| 2 462 | -2.87 | 8.00 | Complies |

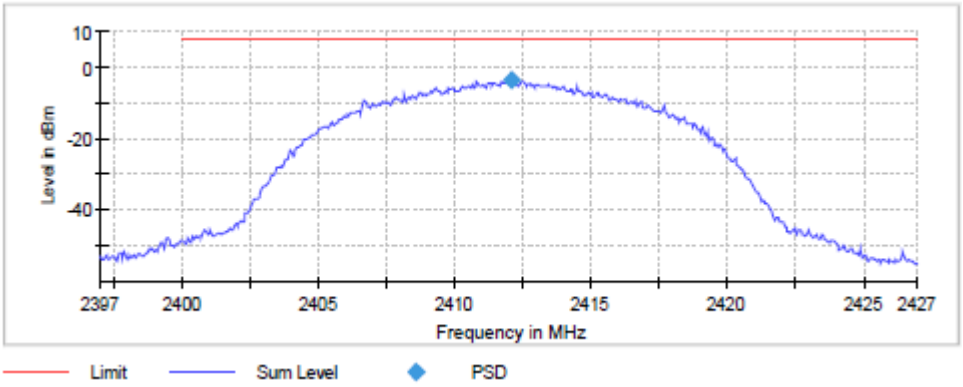
IEEE 802.11g

| Frequency (MHz) | PSD (dBm/3kHz) | Max. Limit (dBm/3kHz) | Result |
|---|---|---|---|
| 2 412 | -6.18 | 8.00 | Complies |
| 2 437 | -6.21 | 8.00 | Complies |
| 2 462 | -5.68 | 8.00 | Complies |

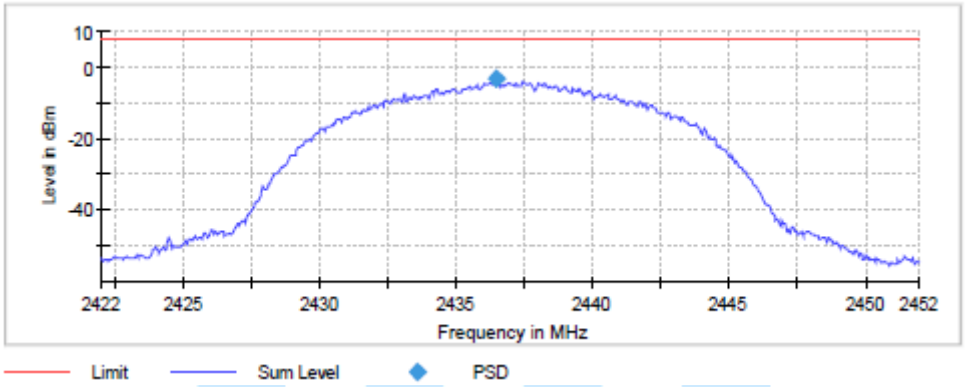
IEEE 802.11n

| Frequency (MHz) | PSD (dBm/3kHz) | Max. Limit (dBm/3kHz) | Result |
|---|---|---|---|
| 2 412 | -6.27 | 8.00 | Complies |
| 2 437 | -6.28 | 8.00 | Complies |
| 2 462 | -5.74 | 8.00 | Complies |

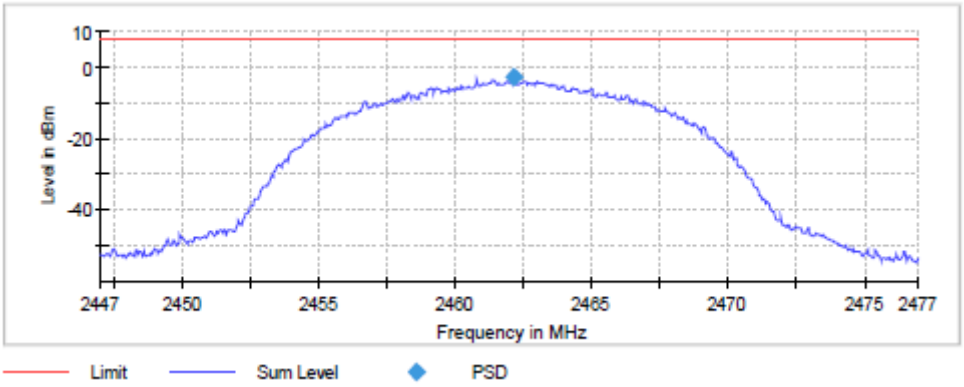
**Power Density Plot on configuration : IEEE 802.11b 1 ch**



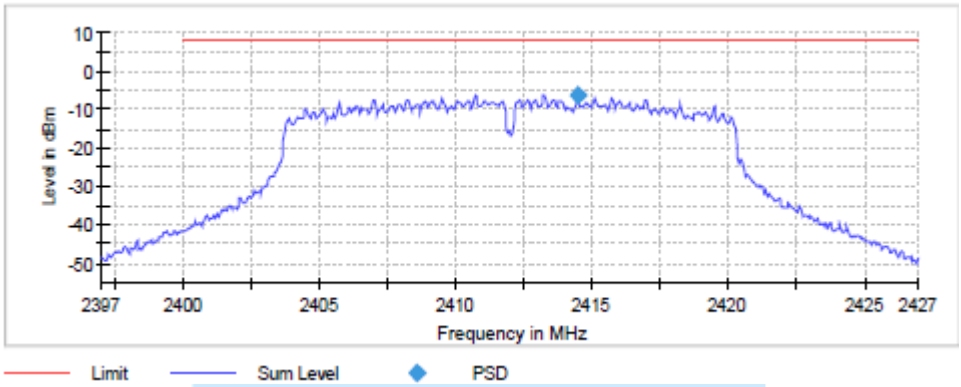

**Power Density Plot on configuration : IEEE 802.11b 6 ch**



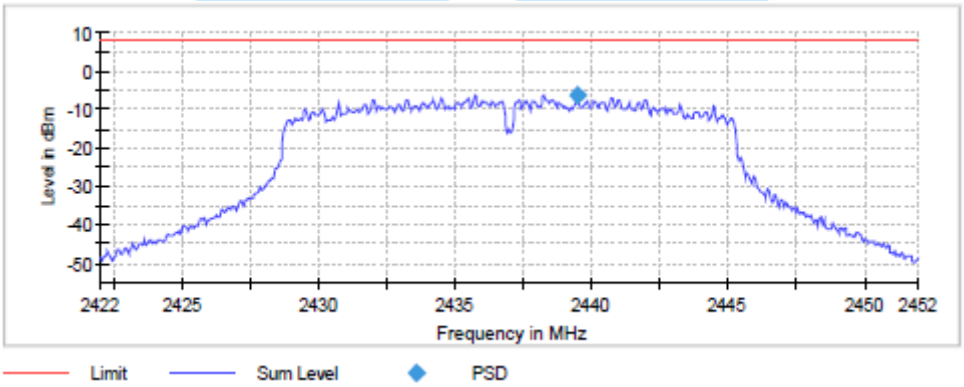

**Power Density Plot on configuration : IEEE 802.11b 11 ch**



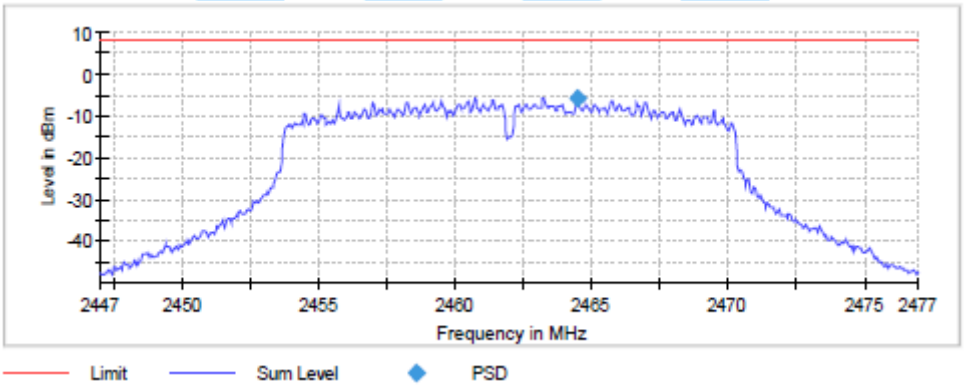
**Power Density Plot on configuration : IEEE 802.11g 1 ch**



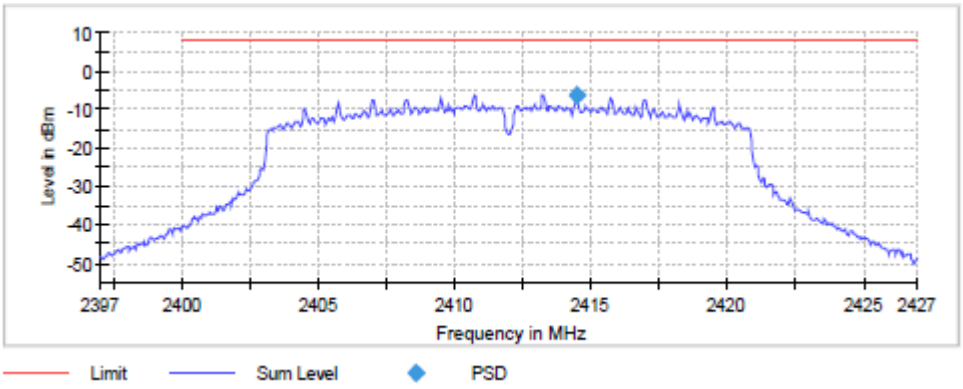

**Power Density Plot on configuration : IEEE 802.11g 6 ch**



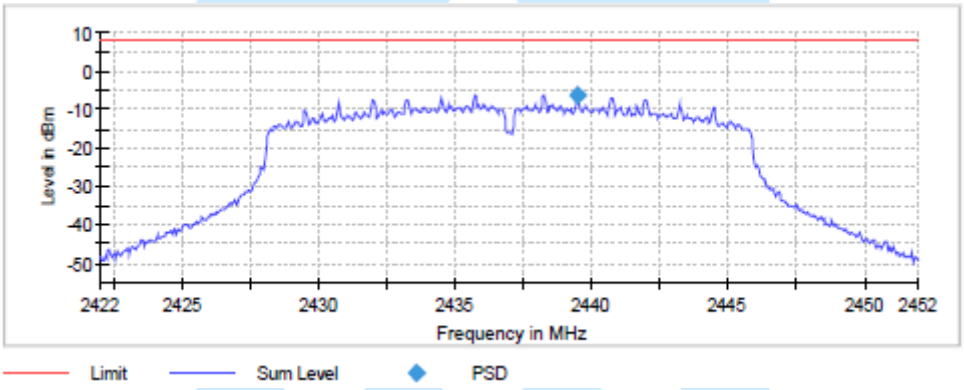

**Power Density Plot on configuration : IEEE 802.11g 11 ch**



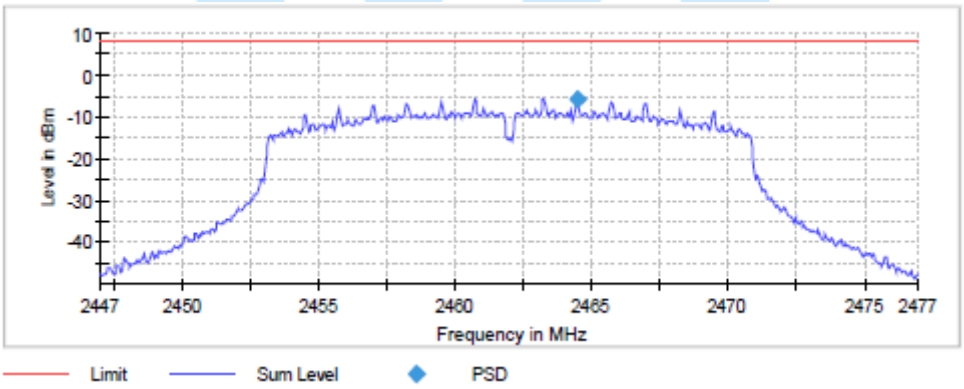
**Power Density Plot on configuration : IEEE 802.11n 1 ch**




**Power Density Plot on configuration : IEEE 802.11n 6 ch**




**Power Density Plot on configuration : IEEE 802.11n 11 ch**

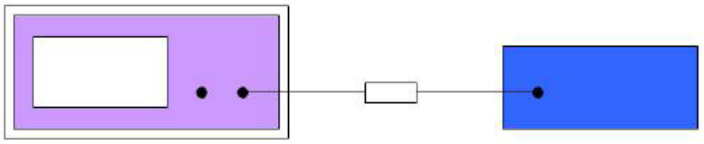


## 11. Conducted Spurious Emission & Out of Band Emission

### 11.1 Operating environment

Temperature : 22.5 °C
Relative Humidity : 45.2 % R.H.

### 11.2 Test set-up (Lay-out)




### 11.3 Limit

Below -20 dB of the highest emission level of operating band (in 100 kHz resolution band width)

### 11.4 Test equipment used

| | Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | FSV | Rohde & Schwarz | Spectrum Analyzer | 101552 | Apr. 09, 2022 |
| ■ - | J12J102248-00-5 | JUNFLON | RF Test Cable | JUL-06-14-106 | N/A |
| ■ - | 56-10 | Weinschel | Attenuator | 53184 | Apr. 09, 2022 |

### 11.5 Test Procedure

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz
d) Set the VBW to 10 kHz
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.

**11.6 Test Result**

-. Test Date : Jul. 28, 2021
-. Reference standard : Part 15 Subpart C, Sec. 15.247(d)
-. Test Procedure(s) : ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v05r02(April 2,2019)
-. Operating condition : RF transmitting mode (1 ch: 2 412 MHz, 6 ch: 2 437 MHz, 11 ch: 2 462 MHz)
-. Power Source : DC 3.7 V

**Conducted Spurious Emission**

IEEE 802.11b

| Operating Frequency (MHz) | Fundamental Level (dBm) | Spurious Level (dBm) | Deviation (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| 2 412 | -1.20 | -41.31 | -40.11 | -20.00 | Complies |
| 2 437 | -1.37 | -40.62 | -39.25 | | Complies |
| 2 462 | -1.28 | -40.85 | -39.57 | | Complies |

IEEE 802.11g

| Operating Frequency (MHz) | Fundamental Level (dBm) | Spurious Level (dBm) | Deviation (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| 2 412 | -3.64 | -40.47 | -36.83 | -20.00 | Complies |
| 2 437 | -3.30 | -40.87 | -37.57 | | Complies |
| 2 462 | -3.21 | -40.95 | -37.74 | | Complies |

IEEE 802.11n

| Operating Frequency (MHz) | Fundamental Level (dBm) | Spurious Level (dBm) | Deviation (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| 2 412 | -3.61 | -40.72 | -37.11 | -20.00 | Complies |
| 2 437 | -3.43 | -39.98 | -36.55 | | Complies |
| 2 462 | -3.00 | -40.31 | -37.31 | | Complies |

**Conducted Out of Band(Band Edge) Emission**

IEEE 802.11b

| Operating Frequency (MHz) | Fundamental Level (dBm) | Bandedge Level (dBm) | Deviation (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| 2 412 | -1.20 | -45.27 | -44.07 | -20.00 | Complies |
| 2 462 | -1.28 | -47.90 | -46.62 | | Complies |

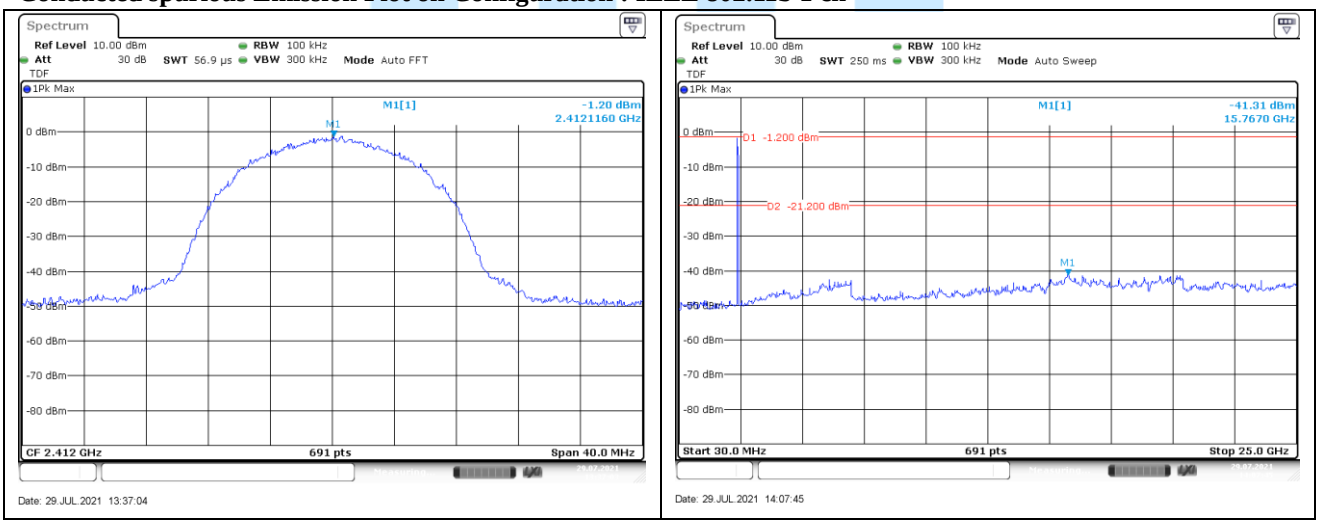
IEEE 802.11g

| Operating Frequency (MHz) | Fundamental Level (dBm) | Bandedge Level (dBm) | Deviation (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| 2 412 | -3.64 | -38.85 | -35.21 | -20.00 | Complies |
| 2 462 | -3.21 | -47.02 | -43.81 | | Complies |

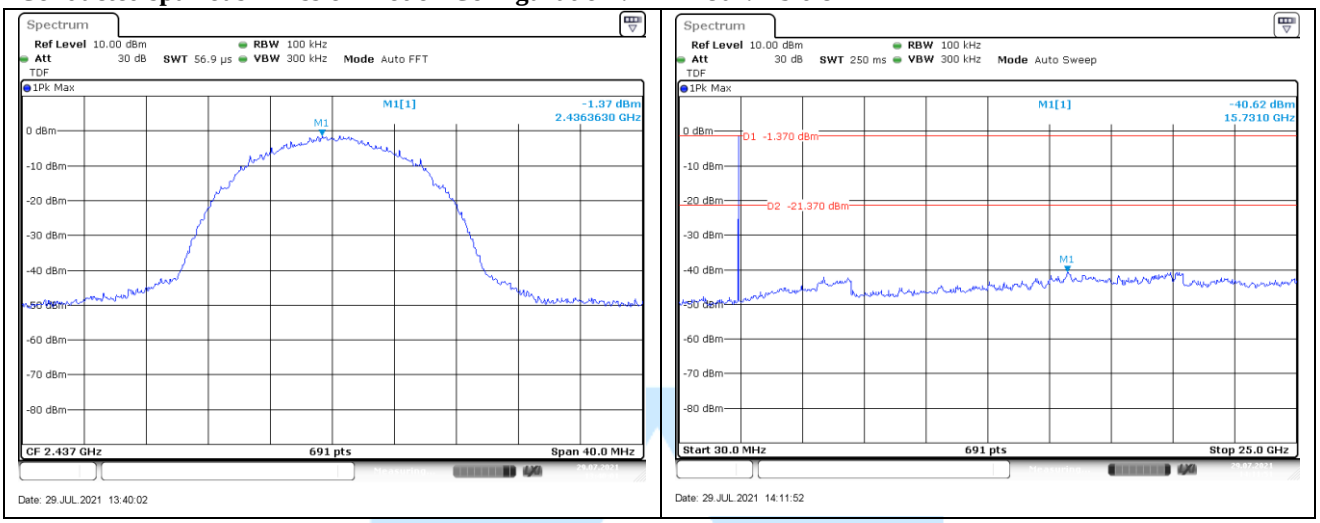
IEEE 802.11n

| Operating Frequency (MHz) | Fundamental Level (dBm) | Bandedge Level (dBm) | Deviation (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| 2 412 | -3.61 | -38.32 | -34.71 | -20.00 | Complies |
| 2 462 | -3.00 | -47.24 | -44.24 | | Complies |

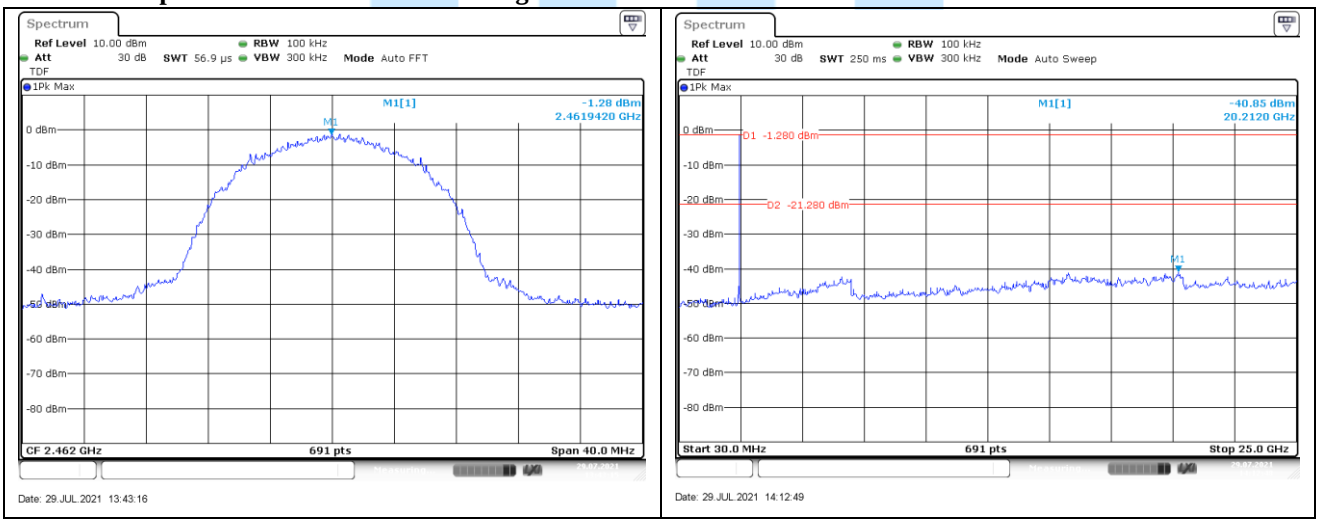
**Conducted spurious Emission Plot on Configuration : IEEE 802.11b 1 ch**



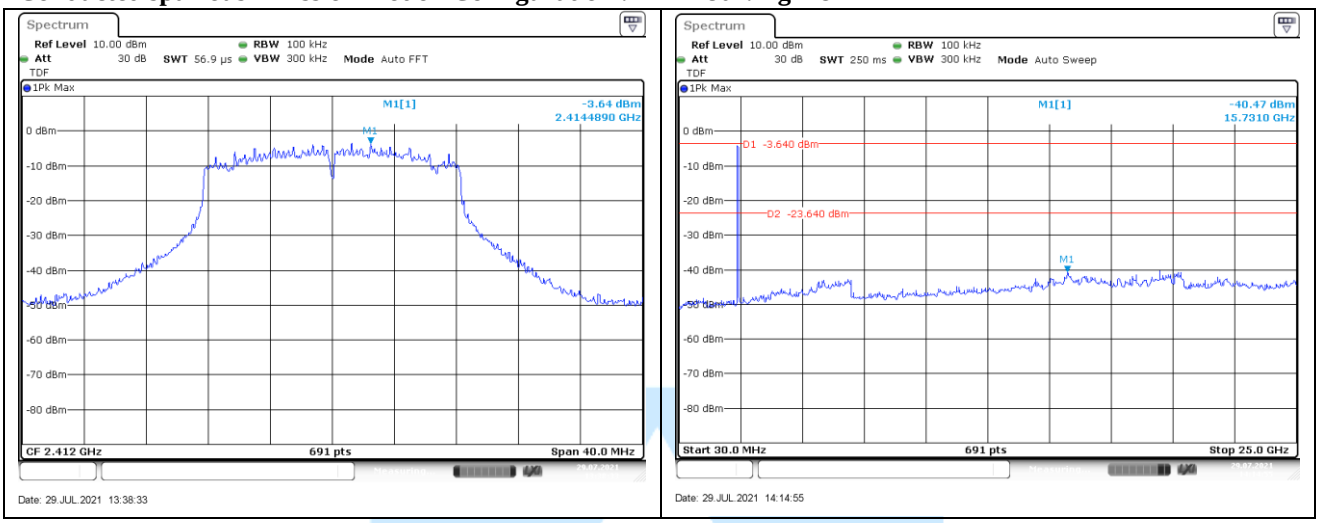
**Conducted spurious Emission Plot on Configuration : IEEE 802.11b 6 ch**



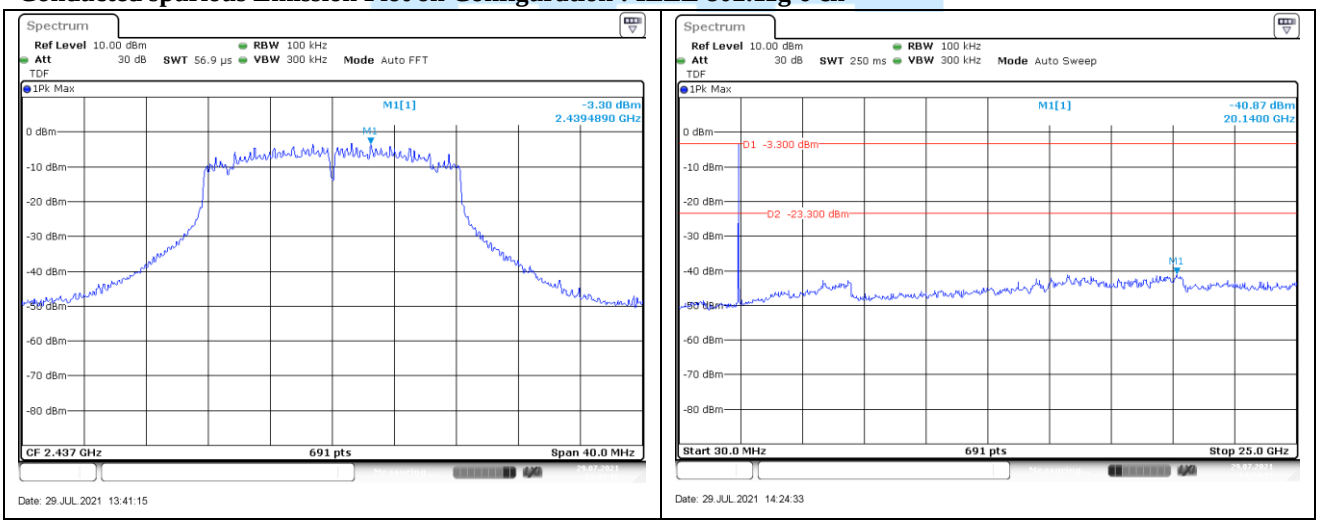

**Conducted spurious Emission Plot on Configuration : IEEE 802.11b 11 ch**



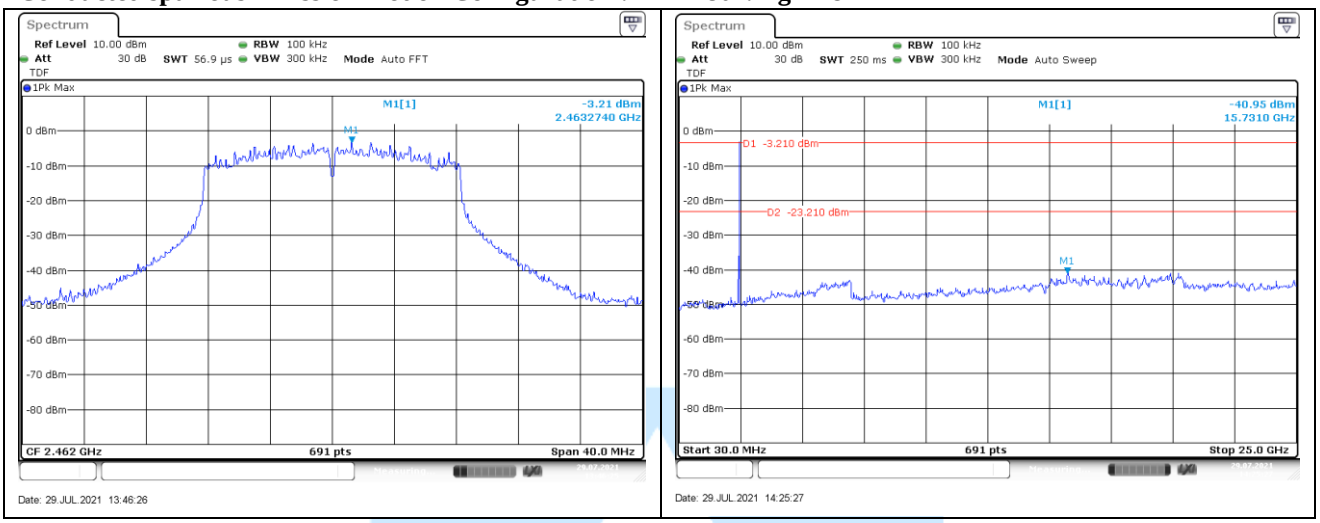
**Conducted spurious Emission Plot on Configuration : IEEE 802.11g 1 ch**



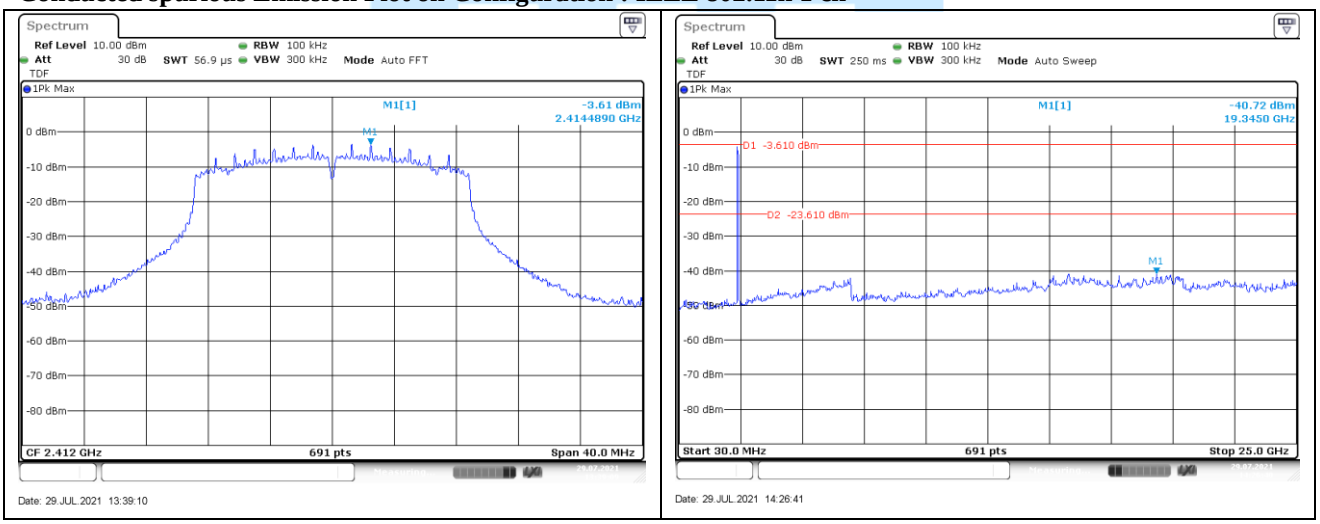

**Conducted spurious Emission Plot on Configuration : IEEE 802.11g 6 ch**



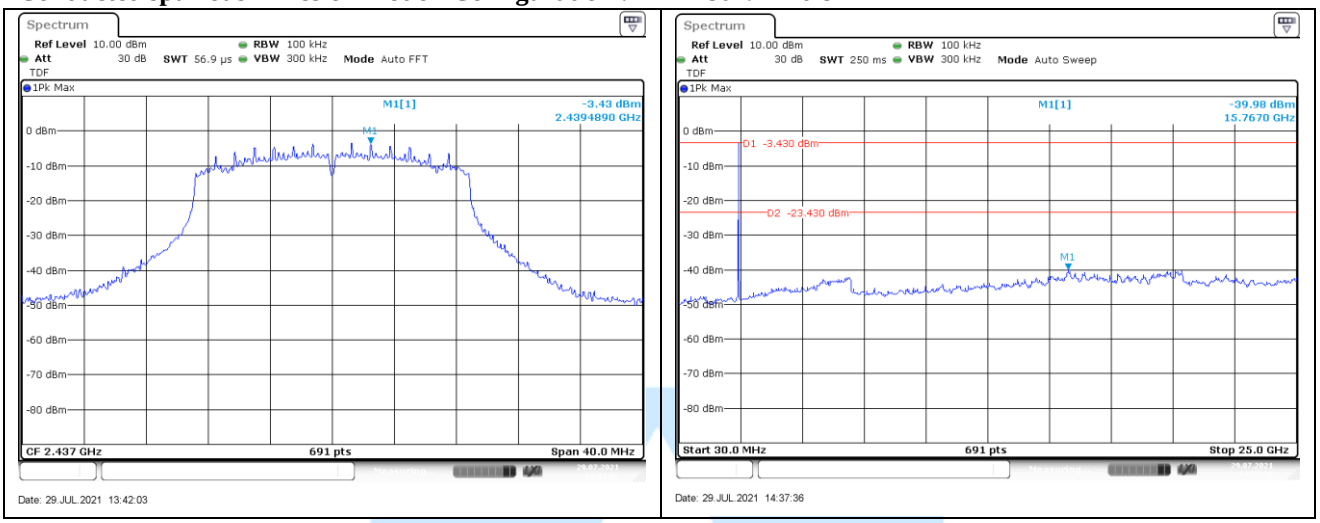
**Conducted spurious Emission Plot on Configuration : IEEE 802.11g 11 ch**



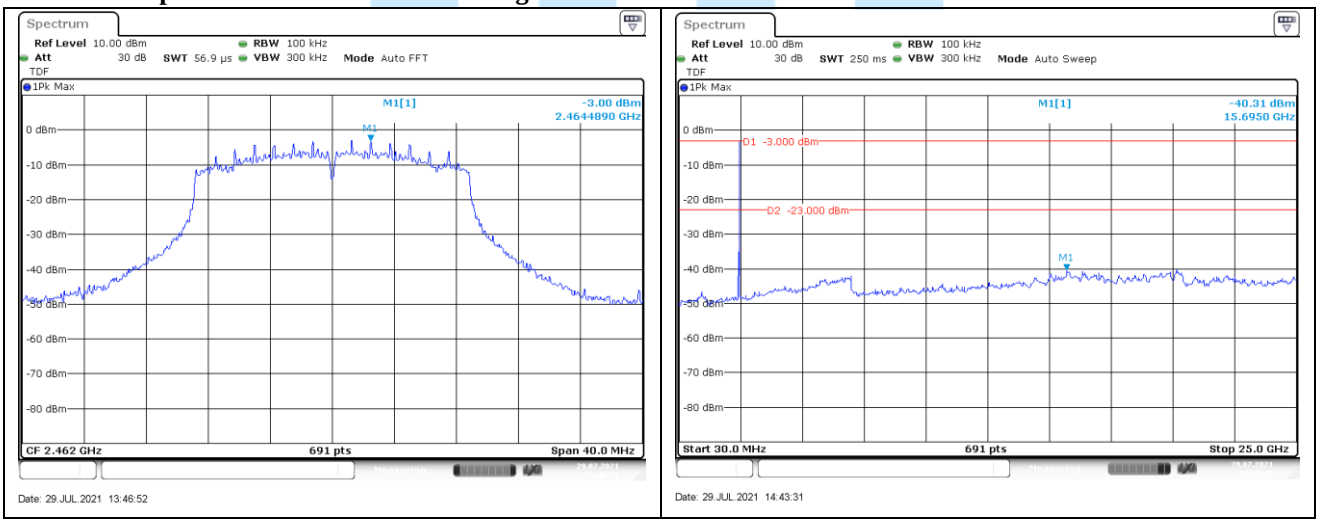

**Conducted spurious Emission Plot on Configuration : IEEE 802.11n 1 ch**



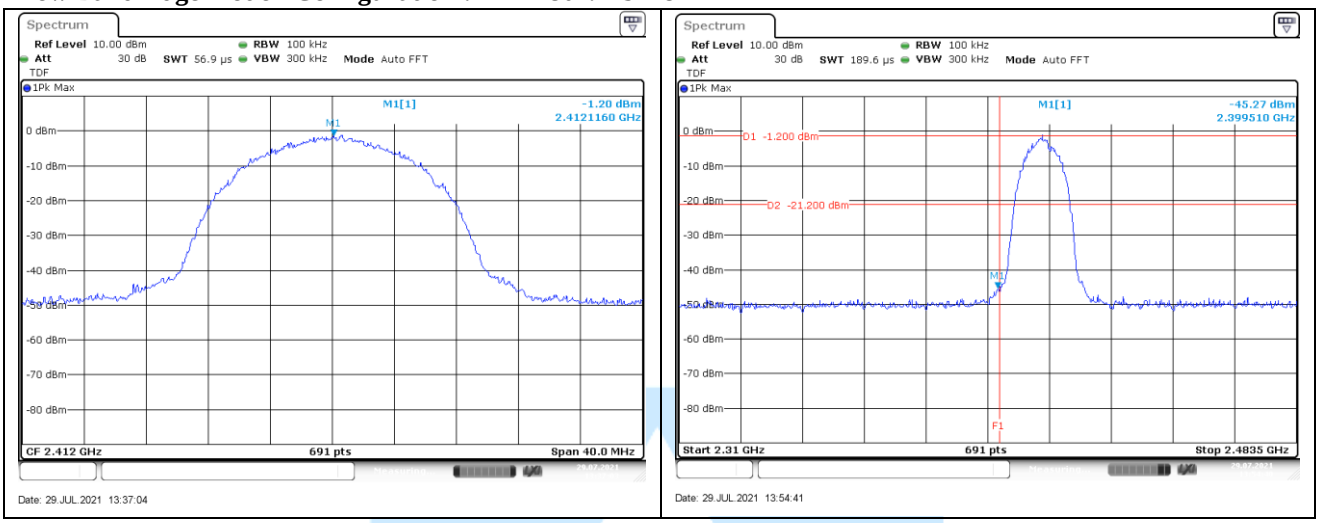
**Conducted spurious Emission Plot on Configuration : IEEE 802.11n 6 ch**



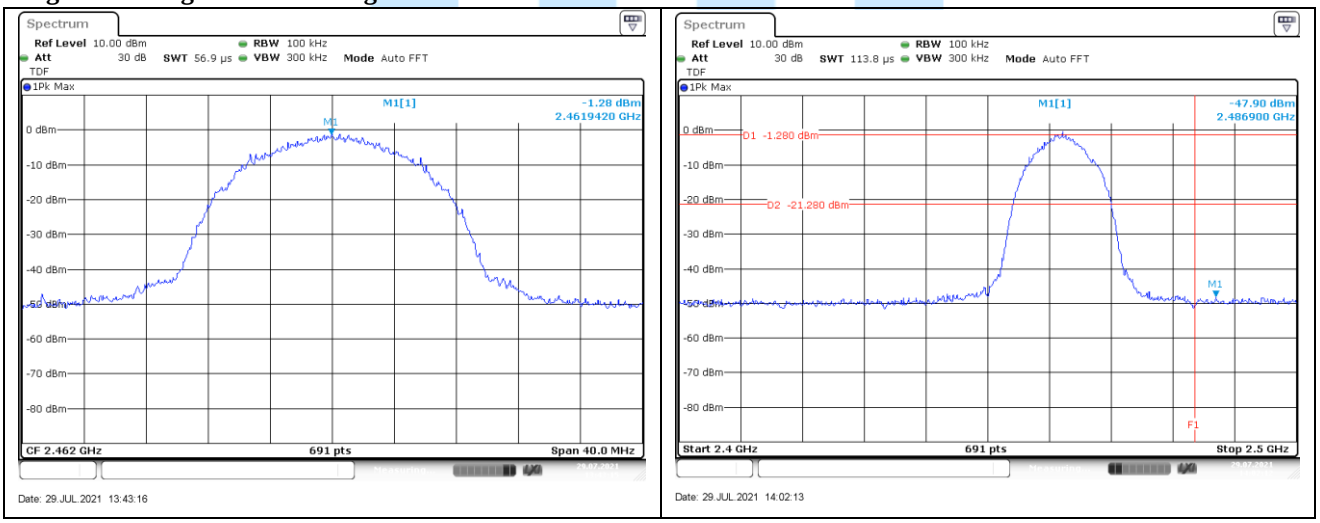

**Conducted spurious Emission Plot on Configuration : IEEE 802.11n 11 ch**



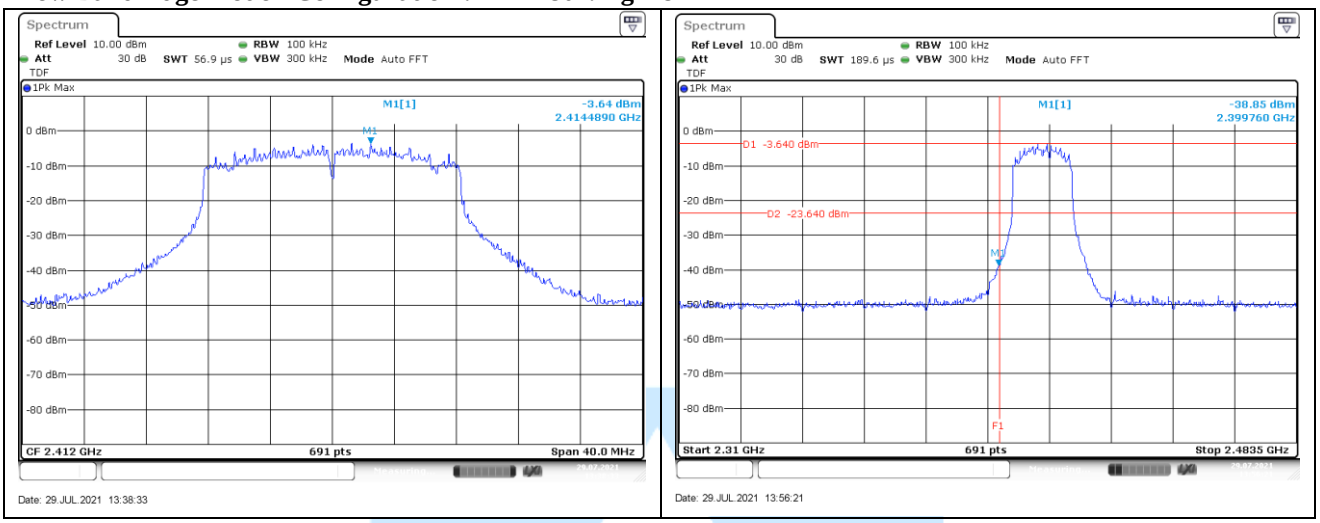
**Low Band Edge Plot on Configuration : IEEE 802.11b 1 ch**



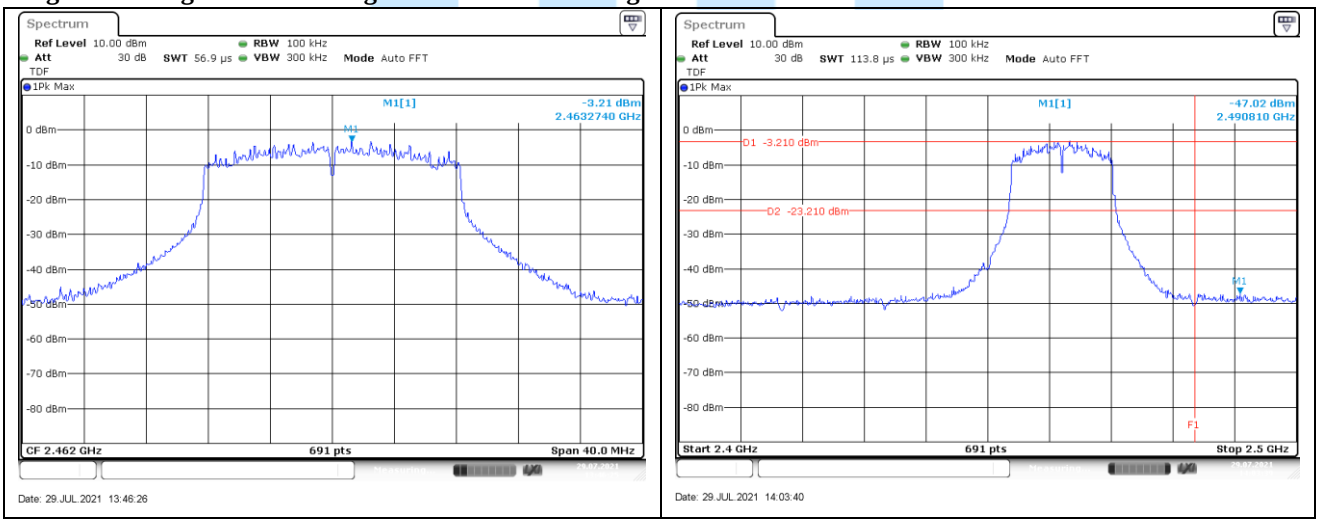

**High Band Edge Plot on Configuration : IEEE 802.11b 11 ch**



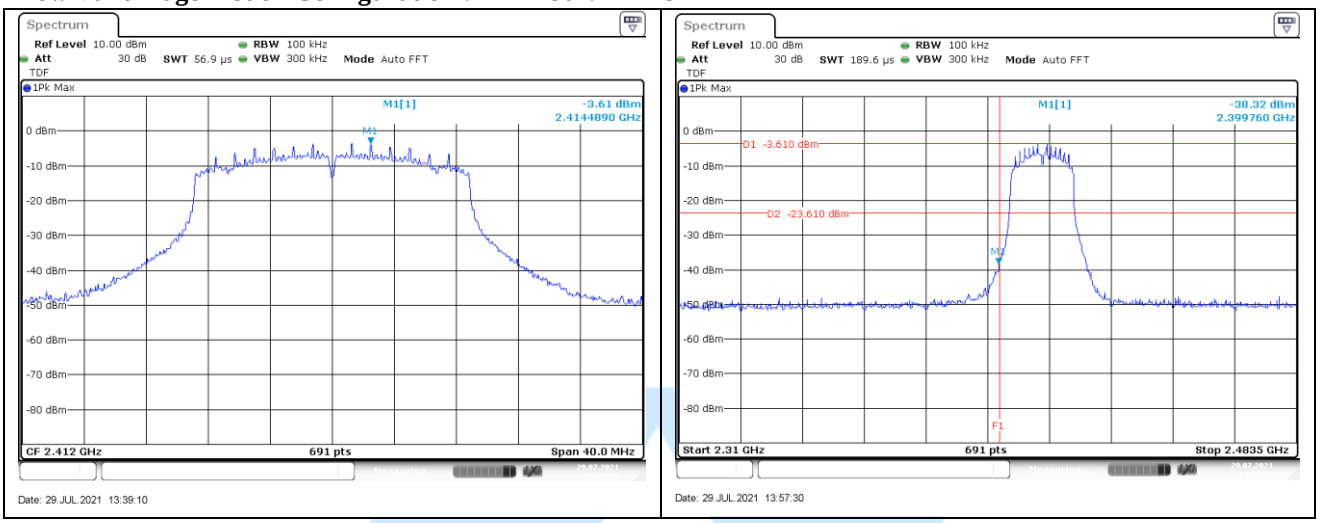
**Low Band Edge Plot on Configuration : IEEE 802.11g 1 ch**



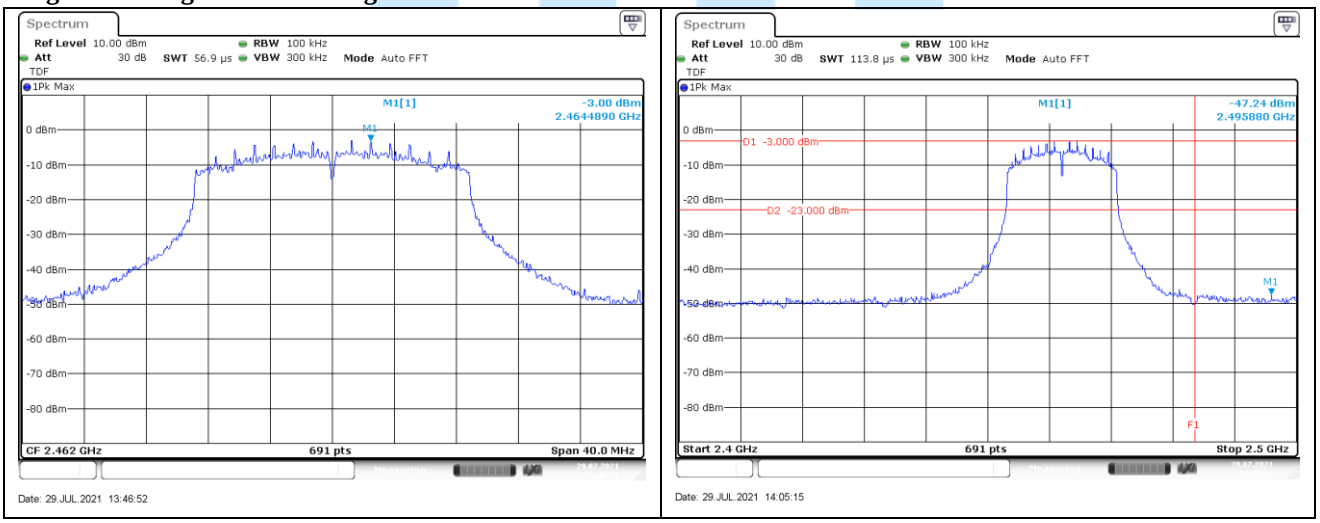

**High Band Edge Plot on Configuration : IEEE 802.11g 11 ch**



**Low Band Edge Plot on Configuration : IEEE 802.11n 1 ch**




**High Band Edge Plot on Configuration : IEEE 802.11n 11 ch**



## 12. AC Power line Conducted emission

**-Test Description**

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (Test firm Registration Number: 269701)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ENV216). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCI).

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

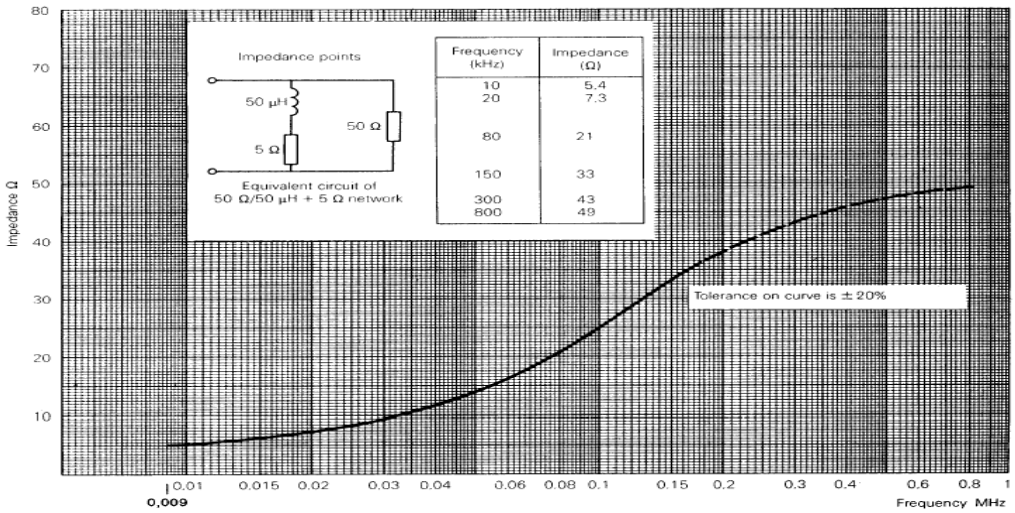



Fig 2. Impedance of LISN

### 12.1 Operating Environment

Temperature : 23.6 °C
Relative Humidity : 38.4 % R.H.

### 12.2 Test Set-up

The conducted emission measurements were performed in the shielded room.
The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.
AMN is bonded on horizontal reference ground plane.
The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

### 12.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement.”
The measurement uncertainty was given with a confidence of 95 %.

| Test Items | Uncertainty | Remark |
|---|---|---|
| Conducted emission (9 kHz ~ 150 kHz) | 3.78 dB | Confidence level of approximately 95 % ($k$ = 2) |
| Conducted emission (150 kHz ~ 30 MHz) | 3.31 dB | Confidence level of approximately 95 % ($k$ = 2) |

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.
The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results

**12.4 Limit**

| RFI Conducted | FCC Limit(dBμV/m) Class B | |
|---|---|---|
| Freq. Range | Quasi-Peak | Average |
| 150 kHz ~ 0.5 MHz | 66 ~ 56* | 56 ~ 46* |
| 0.5 MHz ~ 5 MHz | 56 | 46 |
| 5 MHz ~ 30 MHz | 60 | 50 |
| *Limits decreases linearly with the logarithm of frequency. | | |

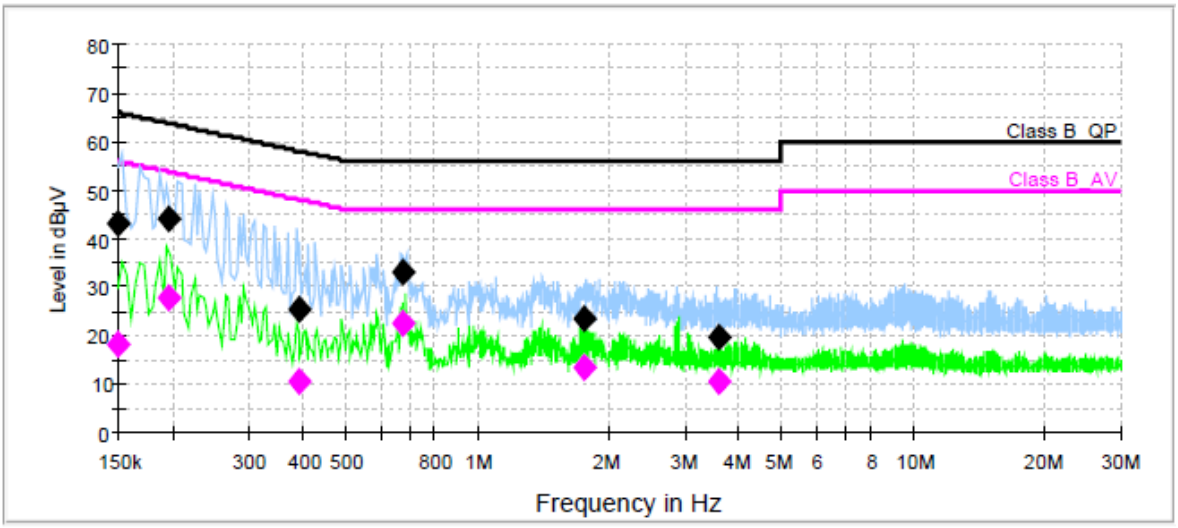
**12.5 Test Equipment used**

| | Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■- | ESCI | Rohde & Schwarz | EMI test receiver | 100237 | Apr. 08, 2022 |
| □- | ENV216 | Rohde & Schwarz | LISN | 100172 | Apr. 07, 2022 |
| ■- | ENV216 | Rohde & Schwarz | LISN | 100173 | Apr. 07, 2022 |
| □- | EMC 32 | Rohde & Schwarz | Testing Software | VER8.53 | N/A |

**12.6 Test data for Conducted Emission**

-. Test Date : Dec. 27, 2021
-. Reference Standard : FCC Part 15 subpart B, Sec. 15.207(a)
-. Test Procedure(s) : ANSI C63.10 (2013)
-. Operating Condition : Charge mode
-. Power Source : AC 120 V / 60 Hz (EUT power: DC 3.7 V)
-. Frequency rage : 0.15 MHz to 30 MHz
-. Line : AC power line (L, N)
-. Comment : -

**AC power line Conducted Emission**




Class B_QP
Preview Result 2-AVG
Class B_AV
Final Result 1-QPK
Preview Result 1-PK+
Final Result 2-CAV

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 0.150000 | 43.0 | 1000.0 | 9.000 | Off | N | 9.6 | 23.0 | 66.0 | |
| 0.197125 | 44.0 | 1000.0 | 9.000 | Off | L1 | 9.6 | 19.7 | 63.7 | |
| 0.389569 | 25.3 | 1000.0 | 9.000 | Off | N | 9.6 | 32.8 | 58.1 | |
| 0.679531 | 33.0 | 1000.0 | 9.000 | Off | L1 | 9.6 | 23.0 | 56.0 | |
| 1.764519 | 23.7 | 1000.0 | 9.000 | Off | L1 | 9.7 | 32.3 | 56.0 | |
| 3.573400 | 19.7 | 1000.0 | 9.000 | Off | L1 | 9.7 | 36.3 | 56.0 | |

| Frequency (MHz) | CAverage (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 0.150000 | 18.1 | 1000.0 | 9.000 | Off | N | 9.6 | 37.9 | 56.0 | |
| 0.197125 | 27.6 | 1000.0 | 9.000 | Off | L1 | 9.6 | 26.1 | 53.7 | |
| 0.389569 | 10.5 | 1000.0 | 9.000 | Off | N | 9.6 | 37.6 | 48.1 | |
| 0.679531 | 22.3 | 1000.0 | 9.000 | Off | L1 | 9.6 | 23.7 | 46.0 | |
| 1.764519 | 13.6 | 1000.0 | 9.000 | Off | L1 | 9.7 | 32.4 | 46.0 | |
| 3.573400 | 10.4 | 1000.0 | 9.000 | Off | L1 | 9.7 | 35.6 | 46.0 | |

## 13. Radiated Spurious & Restricted Band Edge Emission

Exploratory Radiated measurements were conducted at the 3m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.
Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1GHz were made at 3m or 10 m Chamber that complies with CISPR 16/ANSI C63.10.
Above 1GHz final measurements were conducted at the 3m Chamber only.

For measurements above 1GHz, the bottom side of 3m chamber was installed with absorbers in order to meet SVSWR Limit.
Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1GHz) and Peak & Average mode (Above 1GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

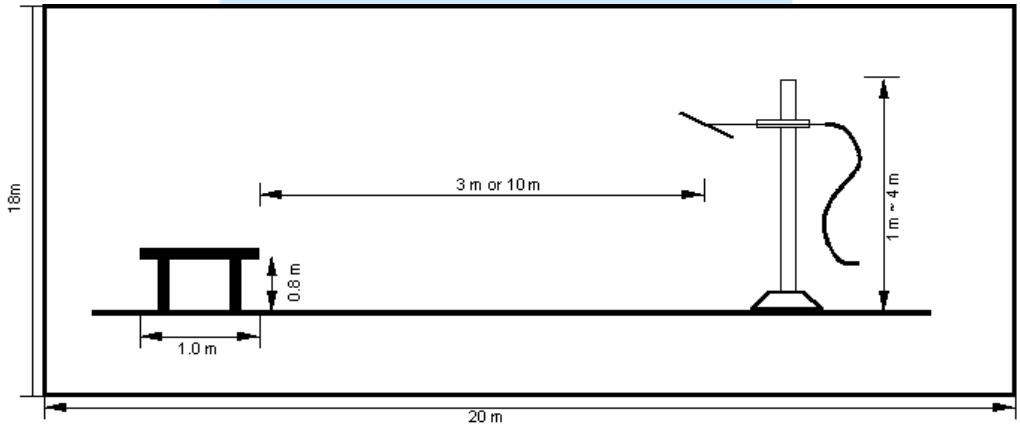



Fig 3. Dimensions of test site (Below 1GHz)

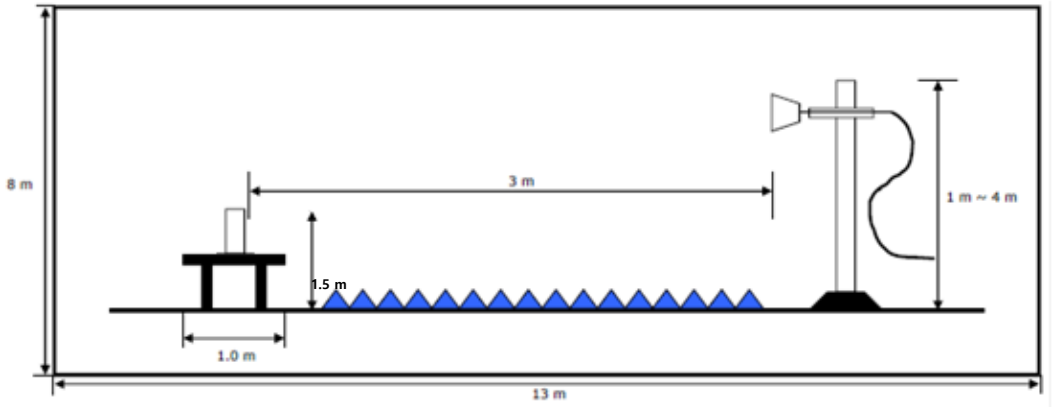



Fig 4. Dimensions of test site (Above 1GHz)

**13.1 Operating environment**

Temperature : 23.6 ℃
Relative humidity : 49.6 % R.H.

**13.2 Test set-up**

A preliminary and final measurement was at 3 m anechoic chamber.
The EUT was placed on a non-conducting table.
For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane.
For emission measurements above 1 GHz, the table height is 1.5 m above the reference ground plane.

The turntable with EUT 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.

**13.3 Measurement uncertainty**

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.
The measurement uncertainty was given with a confidence of 95 %.

| Test items(Anechoic Chamber) | Uncertainty | Remark |
|---|---|---|
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical) | 5.14 dB | Confidence level of approximately 95 % ($k$ = 2) |
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal) | 5.10 dB | Confidence level of approximately 95 % ($k$ = 2) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical) | 6.05 dB | Confidence level of approximately 95 % ($k$ = 2) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal) | 5.19 dB | Confidence level of approximately 95 % ($k$ = 2) |
| Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m, V/H) | 5.20 dB | Confidence level of approximately 95 % (k = 2) |
| Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m, V/H) | 5.20 dB | Confidence level of approximately 95 % ($k$ = 2) |
| Radiated emission (18 000 MHz ~ 26 000 MHz, 3 m, V/H) | 5.53 dB | Confidence level of approximately 95 % ($k$ = 2) |

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.
The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results

**13.4 Limit**

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (microvolt/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 ~ 0.490 | 2 400/F (kHz) | 300 |
| 0.490 ~ 1.705 | 2 400/F (kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

**13.5 Test Equipment used**

| Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|
| ■ - ESU40 | Rohde & Schwarz | EMI Test Receiver | 100266 | Apr. 08, 2022 |
| ■ - HFH2-Z2 | Rohde & Schwarz | Loop Antenna | 100041 | Apr. 28, 2023 |
| ■ - VULB9160 | Schwarzbeck | Broadband Test Antenna | 3313 | Sep. 28, 2023 |
| ■ - BBHA9120D | Schwarzbeck | Horn Antenna | 207 | Sep. 15, 2022 |
| ■ - BBHA9170 | Schwarzbeck | Horn Antenna | 766 | Nov. 18, 2021 |
| ■ - MCU066 | maturo GmbH | Position Controller | 1390306 | N/A |
| ■ - TT2.5SI | maturo GmbH | Turntable | 1390307 | N/A |
| ■ - CO3000 | Innco system GmbH | Position Controller | CO3000/1804/4 2760218/P | N/A |
| ■ - MA4640-XP-ET | Innco system GmbH | Antenna Mast | 5580916 | N/A |
| ■ - TK-PA18H | TESTEK | Low Noise Amplifier | 180001-L | Apr. 09, 2022 |
| ■ - TK-PA1840H | TESTEK | Amplifier | 170007-L | Apr. 09, 2022 |
| ■ - WHKX3.0/18G-10SS | WAINWRIGHT INSTRUMENTS | High pass filter | SN31 | Apr. 07, 2022 |
| ■- EMC 32 | Rohde & Schwarz | Testing Software | VER10.50.10 | N/A |

**13.6 Test data for Radiated Spurious Emission**

-. Test Date : Jul. 29 ~ Aug. 04, 2021
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(d)
-. Measuring Distance : 3 m
-. Resolution Bandwidth : 200 Hz, 9 kHz(Below 30 MHz) / 120 kHz(30 MHz ~ 1GHz) / 1 MHz(Above 1GHz)
-. Detector mode : Quasi Peak detector mode / Peak detector mode / Average detector mode
-. Power Source : DC 3.7 V
-. Note : Through three orthogonal axes were investigated and the worst case is report

**IEEE 802.11b**

Radiated Spurious Emission (9 kHz to 1 000 MHz)

| Ch. | Frequency [MHz] | Pol. | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | N/A[1)] | | | | | | | |
| 6 | 0.98 | V | 21.81 | 19.50 | 41.31 | 47.70 | 6.39 | QPK |
| | 205.71 | H | 25.09 | 13.30 | 38.39 | 43.52 | 5.13 | QPK |
| | 754.31 | V | 7.42 | 28.80 | 36.22 | 46.02 | 9.80 | QPK |
| 11 | 0.82 | V | 19.95 | 19.40 | 39.35 | 49.28 | 9.93 | QPK |
| | 205.70 | H | 26.22 | 13.30 | 39.52 | 43.52 | 4.00 | QPK |
| | 719.97 | H | 11.79 | 28.00 | 39.79 | 46.02 | 6.23 | QPK |

Radiated Spurious Emission (1 GHz to 26 GHz)

| Ch. | Frequency [MHz] | Pol. | Frequency Component | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 860.30 | H | Other | 30.12 | 34.90 | 65.02 | 74.00 | 8.98 | PK |
| | 17 860.30 | H | Other | 17.02 | 34.90 | 51.92 | 54.00 | 2.08 | CAV |
| 6 | 17 813.50 | V | Other | 29.77 | 35.10 | 64.87 | 74.00 | 9.13 | PK |
| | 17 813.50 | V | Other | 16.93 | 35.10 | 52.03 | 54.00 | 1.97 | CAV |
| 11 | 17 871.40 | V | Other | 29.71 | 34.80 | 64.51 | 74.00 | 9.49 | PK |
| | 17 871.40 | V | Other | 17.13 | 34.80 | 51.93 | 54.00 | 2.07 | CAV |

Note 1)
Since there is a margin of more than 10dB, the result value is expressed as N/A.

Note 2)
Test Result = Reading + Transducer Factor
Where, Transducer Factor = ACF + CL
ACF = Antenna Collection Factor
CL = Cable loss + Preamplifier gain + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

**IEEE 802.11g**

Radiated Spurious Emission (9 kHz to 1 000 MHz)

| Ch. | Frequency [MHz] | Pol. | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.82 | V | 19.92 | 19.40 | 39.32 | 49.23 | 9.91 | QPK |
| | 205.69 | H | 24.53 | 13.30 | 37.83 | 43.52 | 5.69 | QPK |
| | 308.56 | H | 20.81 | 17.70 | 38.51 | 46.02 | 7.51 | QPK |
| | 720.02 | H | 11.12 | 28.00 | 39.12 | 46.02 | 6.90 | QPK |
| 6 | 0.98 | V | 19.44 | 19.50 | 38.94 | 47.69 | 8.76 | QPK |
| | 205.71 | H | 25.94 | 13.30 | 39.24 | 43.52 | 4.28 | QPK |
| | 822.81 | H | 10.25 | 29.60 | 39.85 | 46.02 | 6.17 | QPK |
| 11 | 0.98 | V | 21.61 | 19.50 | 41.11 | 47.71 | 6.60 | QPK |
| | 205.71 | H | 24.35 | 13.30 | 37.65 | 43.52 | 5.87 | QPK |
| | 925.71 | H | 9.030 | 31.40 | 40.43 | 46.02 | 5.59 | QPK |

Radiated Spurious Emission (1 GHz to 26 GHz)

| Ch. | Frequency [MHz] | Pol. | Frequency Component | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 804.30 | H | Other | 29.20 | 35.20 | 64.40 | 74.00 | 9.60 | PK |
| | 17 804.30 | H | Other | 16.82 | 35.20 | 52.02 | 54.00 | 1.99 | CAV |
| 6 | 17 814.70 | H | Other | 29.52 | 35.10 | 64.62 | 74.00 | 9.38 | PK |
| | 17 814.70 | H | Other | 16.85 | 35.10 | 51.95 | 54.00 | 2.05 | CAV |
| 11 | 17 892.70 | H | Other | 30.09 | 34.70 | 64.79 | 74.00 | 9.21 | PK |
| | 17 892.70 | H | Other | 17.14 | 34.70 | 51.84 | 54.00 | 2.16 | CAV |

Note 1)
Since there is a margin of more than 10dB, the result value is expressed as N/A.

Note 2)
Test Result = Reading + Transducer Factor
Where, Transducer Factor = ACF + CL
ACF = Antenna Collection Factor
CL = Cable loss + Preamplifier gain + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

**IEEE 802.11n**

Radiated Spurious Emission (9 kHz to 1 000 MHz)

| Ch. | Frequency [MHz] | Pol. | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | N/A[1)] | | | | | | | |
| 6 | 0.98 | V | 21.45 | 19.50 | 40.95 | 47.70 | 6.75 | QPK |
| 11 | N/A[1)] | | | | | | | |

Radiated Spurious Emission (1 GHz to 26 GHz)

| Ch. | Frequency [MHz] | Pol. | Frequency Component | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 863.70 | H | Other | 29.80 | 34.90 | 64.70 | 74.00 | 9.30 | PK |
| | 17 863.70 | H | Other | 16.98 | 34.90 | 51.88 | 54.00 | 2.12 | CAV |
| 6 | 17 869.70 | H | Other | 30.27 | 34.80 | 65.07 | 74.00 | 8.93 | PK |
| | 17 869.70 | H | Other | 17.14 | 34.80 | 51.94 | 54.00 | 2.06 | CAV |
| 11 | 17 808.50 | H | Other | 29.79 | 35.10 | 64.89 | 74.00 | 9.11 | PK |
| | 17 808.50 | H | Other | 16.90 | 35.10 | 52.00 | 54.00 | 2.00 | CAV |

Note 1)
Since there is a margin of more than 10dB, the result value is expressed as N/A.

Note 2)
Test Result = Reading + Transducer Factor
Where, Transducer Factor = ACF + CL
ACF = Antenna Collection Factor
CL = Cable loss + Preamplifier gain + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

**13.7 Test data for Radiated Restricted Band Edge Emission**

-. Test Date : Jul. 29 ~ 30, 2021
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(d)
-. Measuring Distance : 3 m
-. Resolution Bandwidth : 1 MHz
-. Detector mode : Peak detector mode / Average detector mode
-. Power Source : DC 3.7 V
-. Note : Through three orthogonal axes were investigated and the worst case is report

**IEEE 802.11b**

| Ch. | Frequency [MHz] | Pol. | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | N/A[1)] | | | | | | | |
| 11 | N/A[1)] | | | | | | | |

Note 1)
Since there is a margin of more than 10dB, the result value is expressed as N/A.

Note 2)
Test Result = Reading + Transducer Factor
Where, Transducer Factor = ACF + CL
ACF = Antenna Collection Factor
CL = Cable loss + Preamplifier gain + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

**IEEE 802.11g**

| Ch. | Frequency [MHz] | Pol. | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 390.00 | H | 79.85 | -14.00 | 65.85 | 74.00 | 8.15 | PK |
| | 2 390.00 | H | 62.04 | -14.00 | 48.04 | 54.00 | 5.96 | CAV |
| 11 | 2 483.50 | H | 83.44 | -13.80 | 69.64 | 74.00 | 4.36 | PK |
| | 2 483.50 | H | 65.02 | -13.80 | 51.22 | 54.00 | 2.78 | CAV |
| | 2 484.14 | H | 82.73 | -13.80 | 68.93 | 74.00 | 5.07 | PK |
| | 2 484.14 | H | 64.78 | -13.80 | 50.98 | 54.00 | 3.02 | CAV |

Note 1)
Since there is a margin of more than 10dB, the result value is expressed as N/A.

Note 2)
Test Result = Reading + Transducer Factor
Where, Transducer Factor = ACF + CL
ACF = Antenna Collection Factor
CL = Cable loss + Preamplifier gain + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

**IEEE 802.11n**

| Ch. | Frequency [MHz] | Pol. | Reading [dBuV] | Transducer Factor [dB] | Test Result [dBuV/m] | Limits [dBuV/m] | Margin [dB] | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 389.24 | H | 60.35 | -14.10 | 46.25 | 54.00 | 7.75 | CAV |
| | 2 390.00 | H | 79.68 | -14.00 | 65.68 | 74.00 | 8.32 | PK |
| | 2 390.00 | H | 63.71 | -14.00 | 49.71 | 54.00 | 4.29 | CAV |
| 11 | 2 483.50 | H | 84.47 | -13.80 | 70.67 | 74.00 | 3.33 | PK |
| | 2 483.50 | H | 64.67 | -13.80 | 50.87 | 54.00 | 3.13 | CAV |
| | 2 483.81 | H | 83.30 | -13.80 | 69.50 | 74.00 | 4.50 | PK |
| | 2 483.81 | H | 64.26 | -13.80 | 50.46 | 54.00 | 3.54 | CAV |
| | 2 485.24 | H | 80.43 | -13.80 | 66.63 | 74.00 | 7.37 | PK |
| | 2 485.24 | H | 61.79 | -13.80 | 47.99 | 54.00 | 6.01 | CAV |

Note 1)
Since there is a margin of more than 10dB, the result value is expressed as N/A.

Note 2)
Test Result = Reading + Transducer Factor
Where, Transducer Factor = ACF + CL
ACF = Antenna Collection Factor
CL = Cable loss + Preamplifier gain + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

## 14. Sample Calculations

$$dB\mu V = 20 \text{ Log } {}_{10}(\mu V/m)$$
$$dB\mu V = dBm + 107$$
$$\mu V = 10^{(dB\mu V/20)}$$

### 14.1 Example 1 :

■ **20.3 MHz**

**Class B Limit** = 250 µV = 48 dBµV

**Reading** = 39.2 dBµV

$10^{(39.2dB\mu V/20)}$ = 91.2 µV

**Margin** = 48 dBµV - 39.2 dBµV

= 8.8 dB

### 14.2 Example 2 :

■ **66.7 MHz**

**Class B Limit** = 100 µV/m = 40.0 dBµV/m

**Reading** = 31.0 dBµV

**Antenna Factor + Cable Loss** = 5.8 dB

**Total** = 36.8 dBµV/m

**Margin** = 40.0 dBµV/m – 36.8 dBµV/m

= 3.2 dB

## 15. Recommendation & Conclusion

The data collected shows that the **Ohsung Electronics Co.,Ltd., RF Remote Controller (Model Name: MX-1400)** was complies with §15.247 of the FCC Rules.

**- The end -**