



## ***FCC EVALUATION REPORT FOR CERTIFICATION***

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

**Date of Issue: April 21, 2017**

**#181 Gongdan-dong, Gumi-si, Gyeongsangbuk-Do**

**Order Number: GETEC-C1-17-175**

**South Korea**

**Test Report Number: GETEC-E3-17-014**

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

**Test Site: GUMI UNIVERSITY EMC CENTER**

**(Test firm Registration Number: 269701)**

**FCC ID. : OZ5B702**

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

**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 : Remote Controller**

**Type of Authority : Certification**

**Model Name : B702**

**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,**

**Reviewed by,**

**Soon-Hoon Jeong, Senior Engineer  
GUMI UNIVERSITY EMC CENTER**

**Jae-Hoon Jeong, Technical Manager  
GUMI UNIVERSITY EMC CENTER**



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**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, Gyeongsangbuk-Do, South Korea

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

**Manufacturer Address:** #181 Gongdan-dong, Gumi-si, Gyeongsangbuk-Do, South Korea

**Contact Person:** Hak Ki, Kim / General Manager

**Telephone Number:** +82-54-468-7281      **Fax Number:** +82-54-461-8368

- **FCC ID.** OZ5B702
- **Equipment Class** Digital Transmission System (DTS)
- **EUT Type** Remote Controller
- **Model Name** B702
- **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 v03r05(April 8,2016)
- **Dates of Test** April 06 ~ 14, 2017
- **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-E3-17-014
- **Dates of Issue** April 21, 2017

**EUT Type:** Remote Controller

**FCC ID.:** OZ5B702





## 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. Remote Controller (Model name: B702)**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**.

The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Gyeongnam 641-713, 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 Daejeon 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)

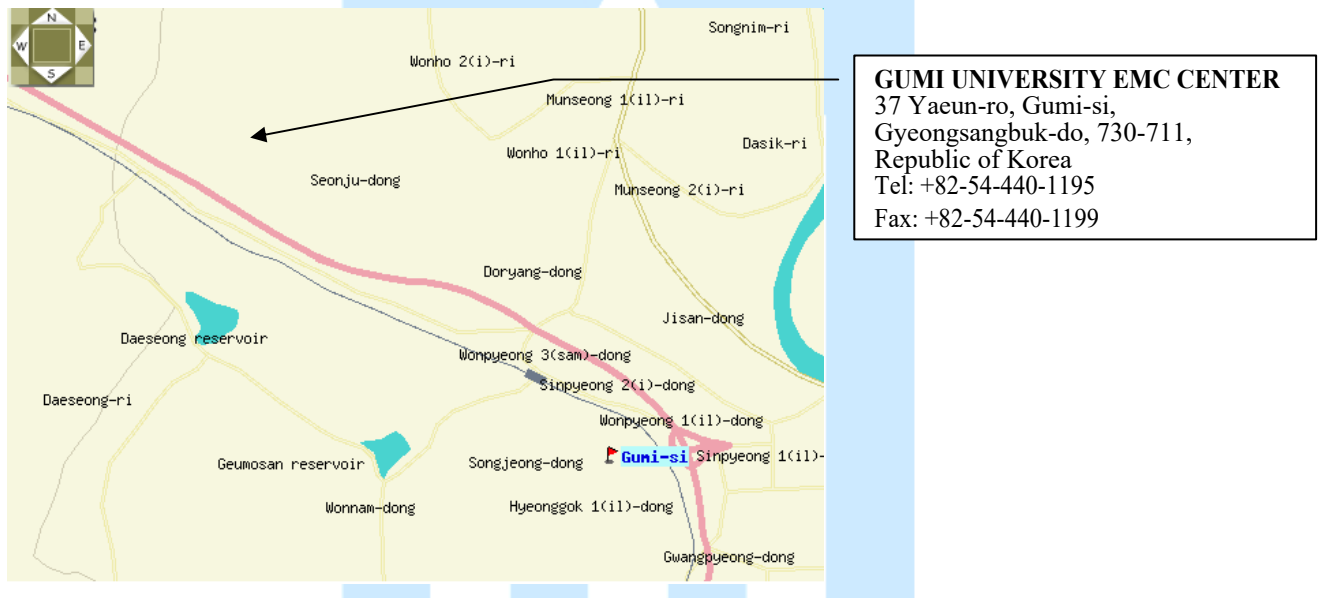


Fig 1. The map above shows the Gumi University in vicinity area.



### 3. Product Information

#### 3.1 Description of EUT

The Equipment under Test (EUT) is the **Ohsung Electronics Co., Ltd. Remote Controller**  
**(Model Name: B702) FCC ID.: OZ5B702**

|                         |                                                                                                       |
|-------------------------|-------------------------------------------------------------------------------------------------------|
| - Equipment             | : Remote Controller                                                                                   |
| - Model name            | : B702                                                                                                |
| - Serial number         | : Proto type                                                                                          |
| - Electrical Rating     | : DC 3 V                                                                                              |
| - Manufacturer          | : Ohsung electronics Co., Ltd.                                                                        |
| - Channel Separations   | : 2 MHz                                                                                               |
| - Type of Modulation    | : GFSK                                                                                                |
| - Channel frequency     | : 2 402 MHz ~ 2 480 MHz                                                                               |
| - Number of channel     | : 40                                                                                                  |
| - Type of chain         | : One                                                                                                 |
| - Antenna specification | : Manufacturer: Ohsung Electronics Co., Ltd.<br>Antenna type : PCB pattern antenna<br>Gain : 1.23 dBi |
| - Hardware version      | : V02                                                                                                 |
| - Software version      | : V02                                                                                                 |

#### 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 <sup>1)</sup> | SAMSUNG       | NT-Q45     | S/N: CNBA4300168AI00682D5800<br>FCC ID.: N/A |
| CC Debugger                     | TI Instrument | Proto type | S/N : None.<br>FCC ID.: None.                |

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. Remote Controller**. comply with the requirement of §15.203 with a PCB printed 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 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 |
|----------------------|-------------------|-----------------|-----------------------|
| Bluetooth Low Energy | 0 ~ 39            | 2402 ~ 2480 MHz | GFSK                  |

- EUT set condition (RF power setting value)

|                       |                   |
|-----------------------|-------------------|
| Test Software         | Smart RF Studio 7 |
| Test Software version | V1.10.2           |

#### 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 v03r05 (April 08, 2016): 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 Peak 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        | N/A <sup>1)</sup> |
| §15.205, 15.209            | Radiated Spurious Emissions              | Pass              |
| §15.247(d), 15.205, 15.209 | Radiated Restricted Band Edge            | Pass              |

Note)

1) The power supply of this device is only DC(internal battery) and Bluetooth function is disabled in charge status

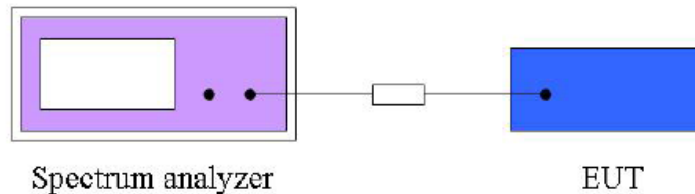


## 8. 6 dB Bandwidth Measurement

### 8.1 Operating environment

Temperature : 17.6 °C  
Relative Humidity : 26.3 % R.H.

### 8.2 Test Set-up (Layout)



### 8.3 Limit

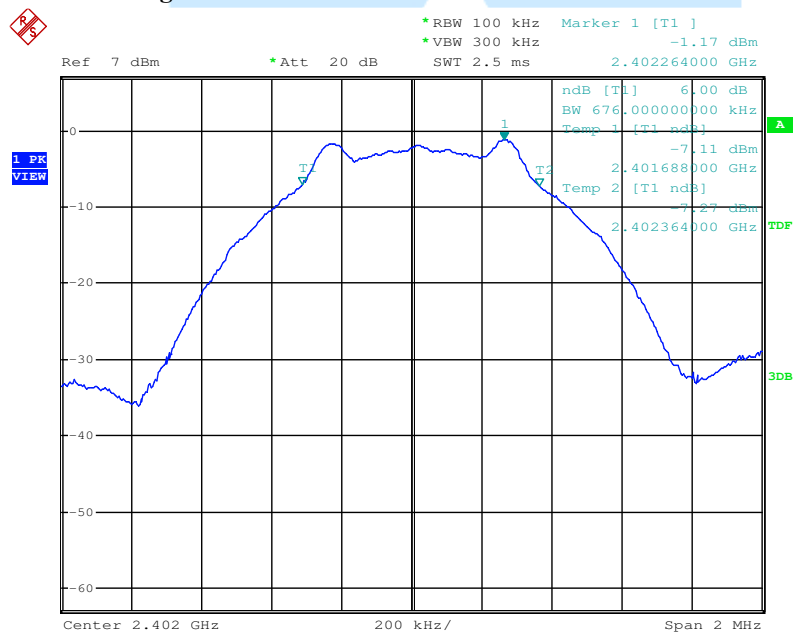
For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

### 8.4 Test Equipment used

| Model Name | Manufacturer    | Description       | Serial Number | Due to Calibration |
|------------|-----------------|-------------------|---------------|--------------------|
| ■ - FSP    | Rohde & Schwarz | Spectrum Analyzer | 101431        | Dec. 08, 2017      |
| ■ - 56-10  | Weinschel       | 10 dB Attenuator  | 53184         | Apr. 20, 2017      |

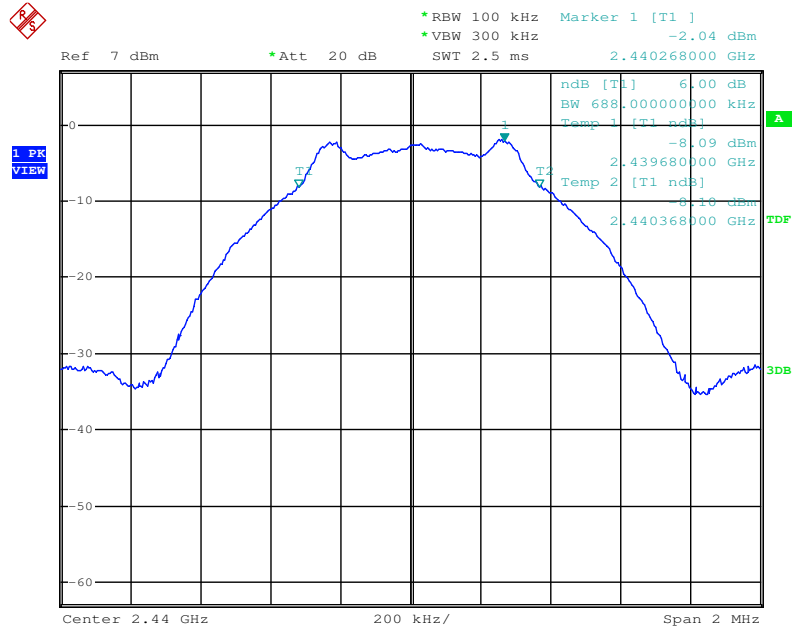
### 8.5 Test Test Procedure

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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.



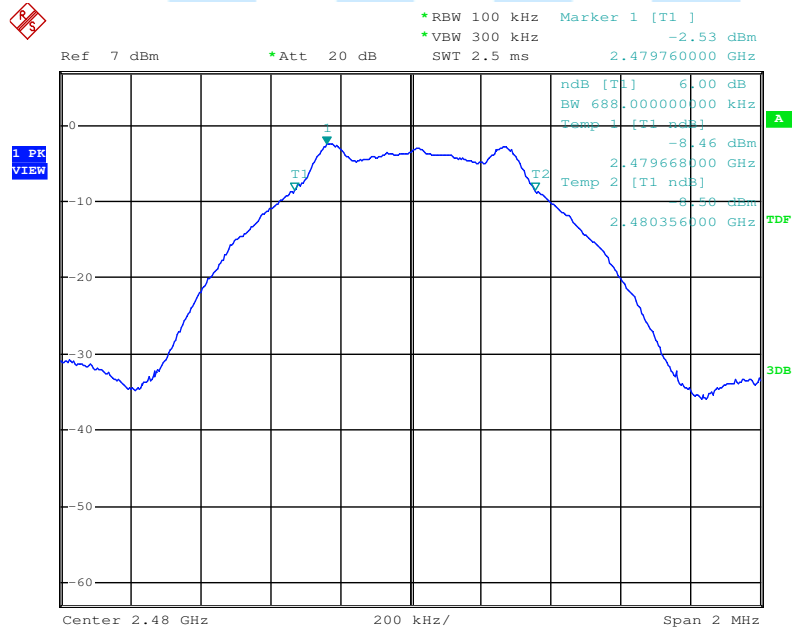


### 6 dB Bandwidth Plot on Configuration : 19ch



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### 6 dB Bandwidth Plot on Configuration : 39ch



Date: 6.APR.2017 17:06:57

EUT Type: Remote Controller

FCC ID.: OZ5B702



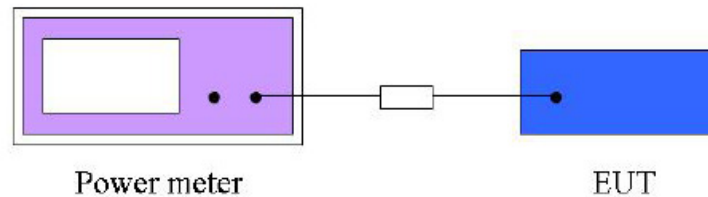


## 9. Conducted Maximum Peak Output Power Measurement

### 9.1 Operating environment

Temperature : 15.1 °C  
Relative Humidity : 26.4 % 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 limit has to be reduced by the amount in dB that the gain of the antenna exceeds 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 |
|-------------|-----------------|----------------------------|---------------|--------------------|
| ■ - NRV-Z32 | Rohde & Schwarz | Peak Power sensor          | 100049        | Dec. 06, 2017      |
| ■ - NRVS    | Rohde & Schwarz | Single Channel Power Meter | 101008        | Apr 19, 2017       |
| ■ - NRP-Z51 | Rohde & Schwarz | Power sensor               | 1138.0005.02  | Apr. 20, 2017      |
| ■ - 56-10   | Weinschel       | 10 dB Attenuator           | 53184         | Apr. 20. 2017      |

### 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 : April 06, 2017
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(2)
- Test Procedure(s) : ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v03r05(April 8,2016)
- Operating Condition : RF transmitting mode (0 ch: 2 402 MHz, 19 ch: 2 440 MHz, 39 ch: 2 480 MHz)
- Power Source : DC 3.0V

| Frequency (MHz) | Average Conducted Power <sup>1)</sup> (dBm) | Peak Conducted Power (dBm) | Max. Limit (dBm) | Result   |
|-----------------|---------------------------------------------|----------------------------|------------------|----------|
| 2 402           | -1.13                                       | -0.78                      | 30.00            | Complies |
| 2 440           | -1.67                                       | -1.30                      | 30.00            | Complies |
| 2 480           | -2.22                                       | -1.93                      | 30.00            | Complies |

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

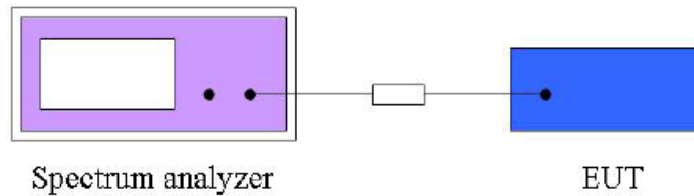


## 10. Power Spectral Density Measurement

### 10.1 Operating Environment

Temperature : 17.5 °C  
Relative Humidity : 26.9 % 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 |
|------------|-----------------|-------------------|---------------|--------------------|
| ■ - FSP    | Rohde & Schwarz | Spectrum Analyzer | 101431        | Dec. 08, 2017      |
| ■ - 56-10  | Weinschel       | 10 dB Attenuator  | 53184         | Apr. 20, 2017      |

### 10.5 Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to 3 kHz
- Set the VBW to 10 kHz
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.



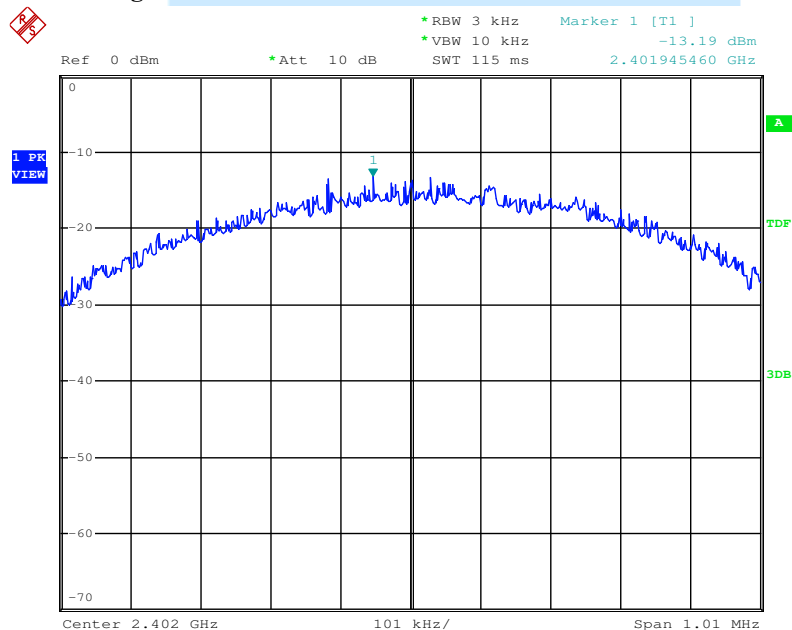


## 10.6 Test Result

- Test Date : April 06, 2017
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(2)
- Test Procedure(s) : ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v03r05(April 8,2016)
- Operating Condition : RF transmitting mode (0 ch: 2 402 MHz, 19 ch: 2 440 MHz, 39 ch: 2 480 MHz)
- Power Source : DC 3.0 V

| Frequency | PSD<br>(dBm/3kHz) | Max. Limit<br>(dBm/3kHz) | Result   |
|-----------|-------------------|--------------------------|----------|
| 2 402 MHz | -13.19            | 8.00                     | Complies |
| 2 440 MHz | -13.85            | 8.00                     | Complies |
| 2 480 MHz | -14.69            | 8.00                     | Complies |

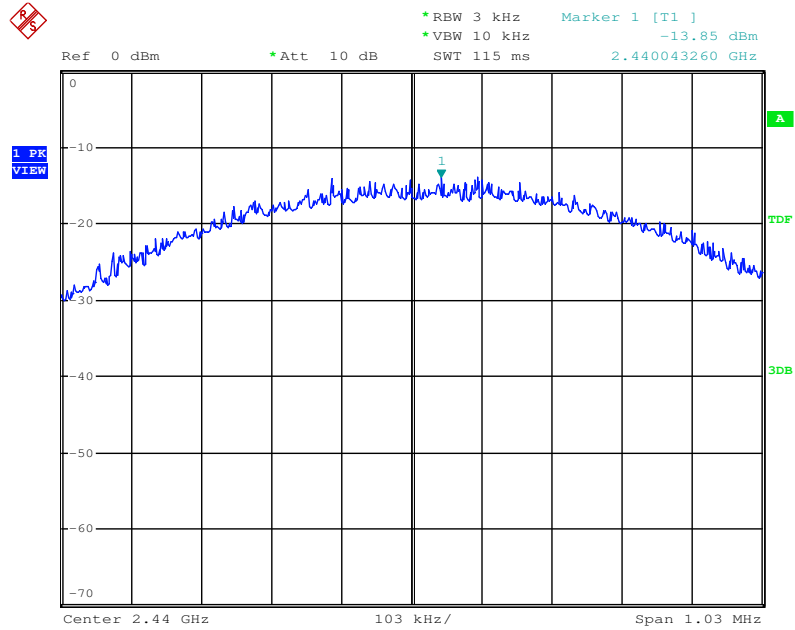
### Power Density Plot on configuration : 0ch



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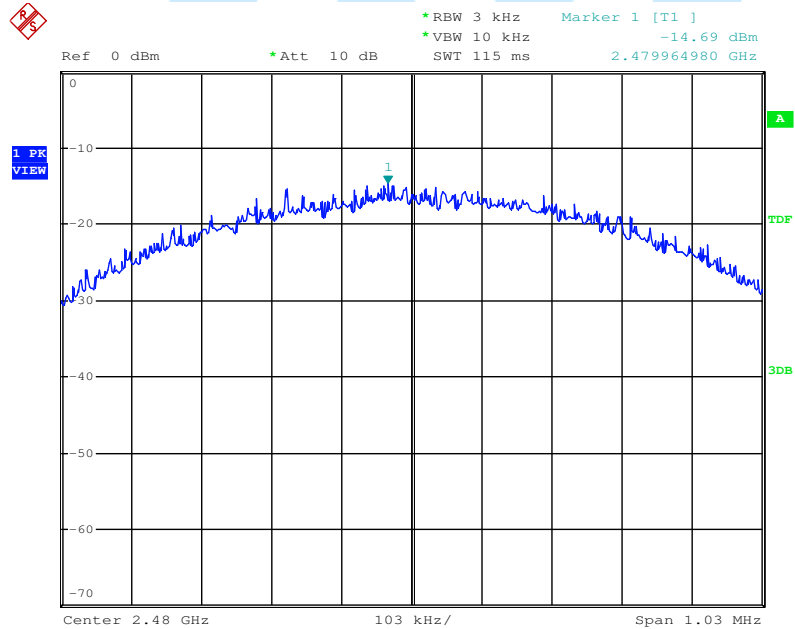


### Power Density Plot on configuration : 19ch



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### Power Density Plot on configuration : 39ch



Date: 6.APR.2017 17:12:33

EUT Type: Remote Controller

FCC ID.: OZ5B702



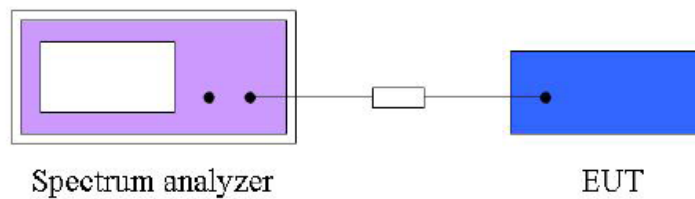


## 11. Conducted Spurious Emission & Out of Band Emission

### 11.1 Operating environment

Temperature : 17.1 °C  
Relative Humidity : 26.1 % 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 |
|------------|-----------------|-------------------|---------------|--------------------|
| ■ - FSP    | Rohde & Schwarz | Spectrum Analyzer | 101431        | Dec. 08, 2017      |
| ■ - 56-10  | Weinschel       | 10 dB Attenuator  | 53184         | Apr. 20, 2017      |

### 11.5 Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to 3 kHz
- Set the VBW to 10 kHz
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.



## 11.6 Test Result

- Test Date : April 06, 2017
- Reference standard : Part 15 Subpart C, Sec. 15.247(a)(2)
- Test Procedure(s) : ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v03r05(April 8,2016)
- Operating condition : RF transmitting mode (0 ch: 2 402 MHz, 19 ch: 2 440 MHz, 39 ch: 2 480 MHz)
- Power Source : DC 3.0 V

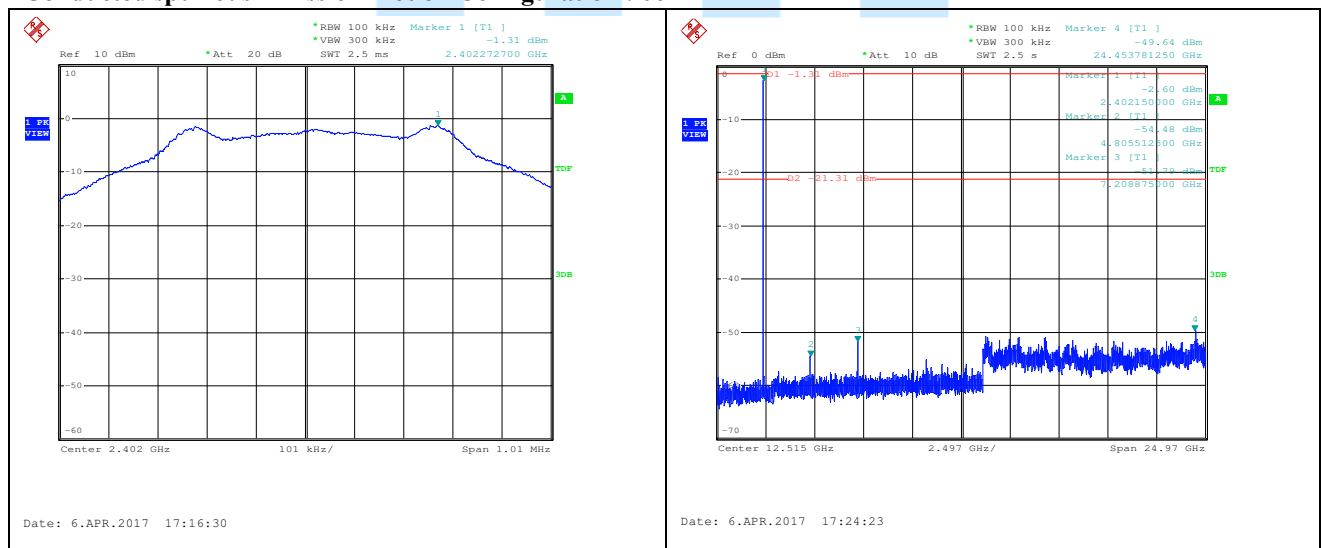
## Conducted Spurious Emission

| Operating Frequency | 100 kHz PSD (dBm) | Spurious Level (dBm) | Deviation (dBc) | Limits (dBc) | Result   |
|---------------------|-------------------|----------------------|-----------------|--------------|----------|
| 2 402 MHz           | -1.31             | -49.64               | -48.33          | -20.00       | Complies |
| 2 440 MHz           | -1.80             | -50.82               | -49.02          |              | Complies |
| 2 480 MHz           | -2.34             | -50.59               | -48.25          |              | Complies |

## Conducted Out of Band(Band Edge) Emission

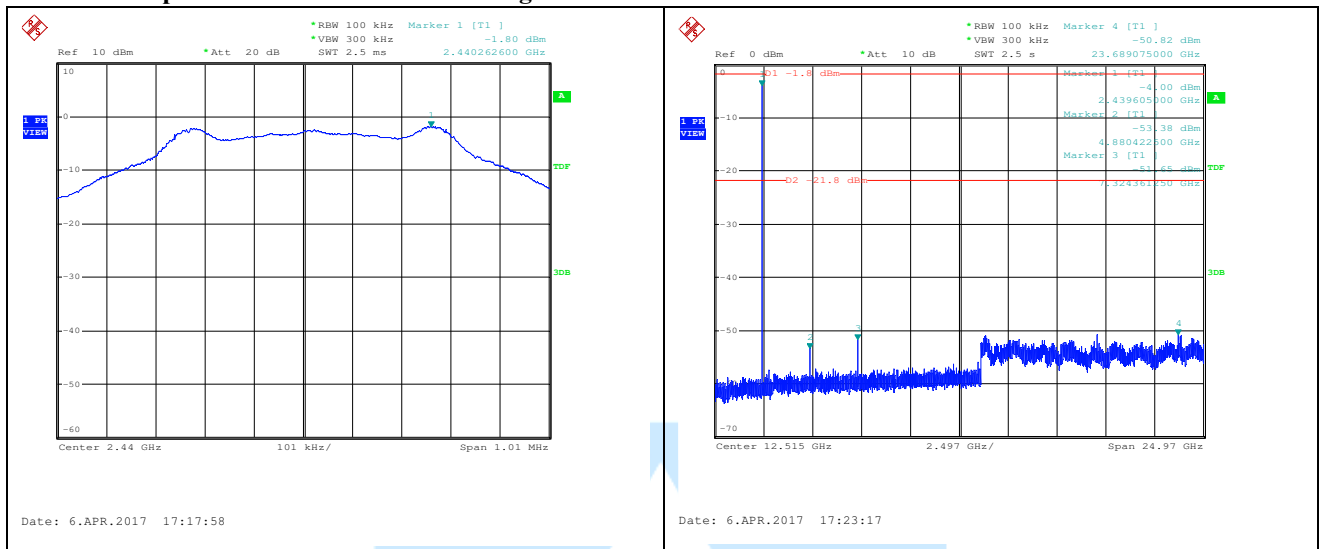
| Operating Frequency | 100 kHz PSD (dBm) | Bandedge Level (dBm) | Deviation (dBc) | Limits (dBc) | Result   |
|---------------------|-------------------|----------------------|-----------------|--------------|----------|
| 2 402 MHz           | -1.31             | -56.69               | -55.38          | -20.00       | Complies |
| 2 480 MHz           | -2.34             | -48.73               | -46.39          |              | Complies |

## Conducted spurious Emission Plot on Configuration : 0ch

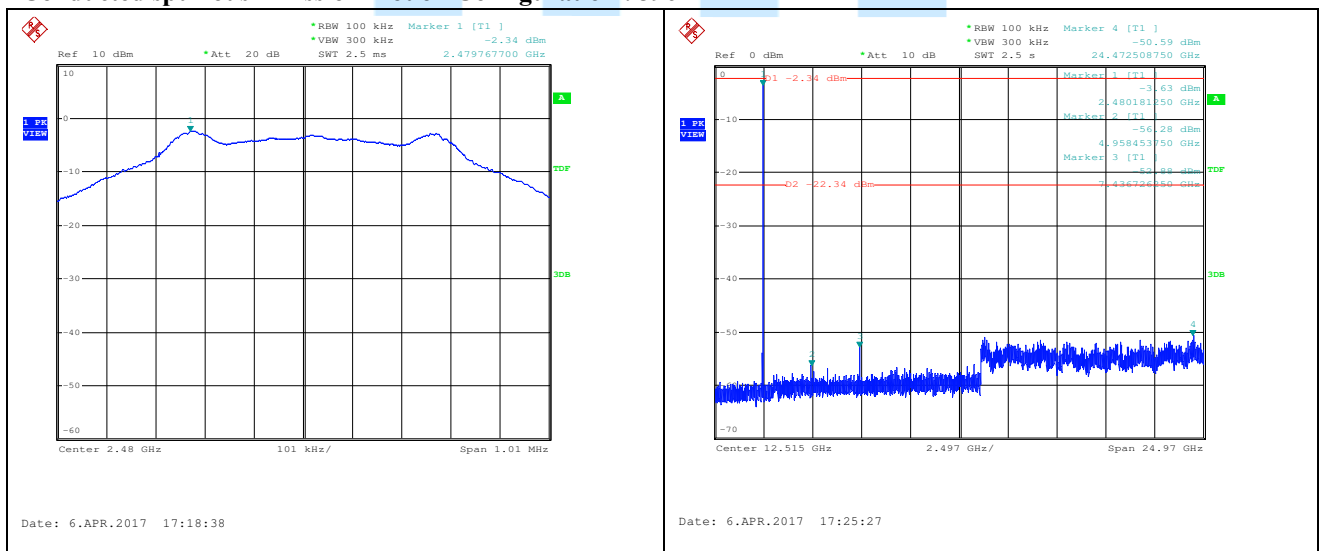




### Conducted spurious Emission Plot on Configuration : 19ch

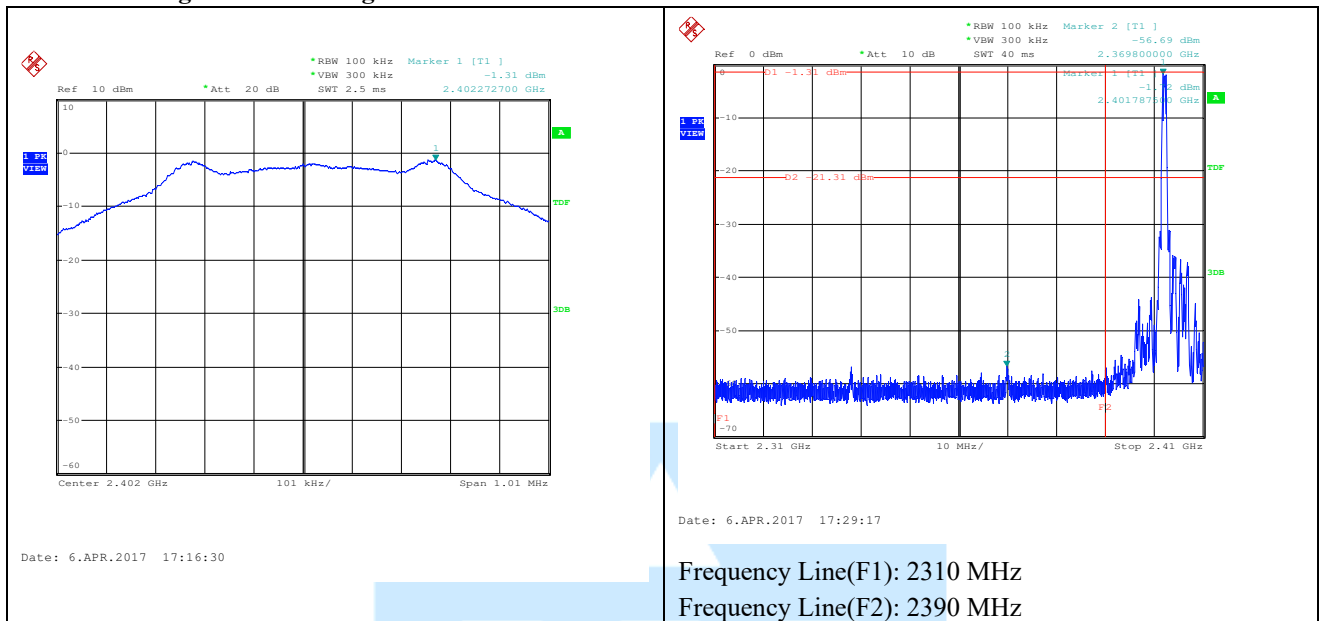


### Conducted spurious Emission Plot on Configuration : 39ch

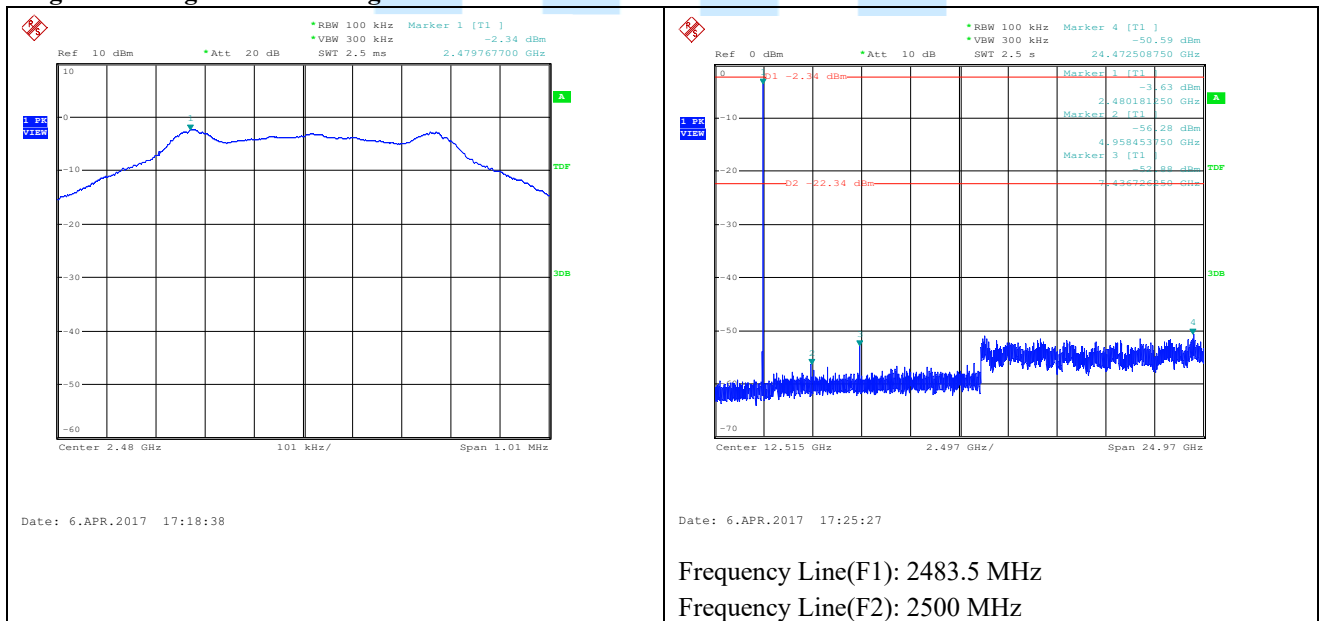




### Low Band Edge Plot on Configuration : 0ch



### High Band Edge Plot on Configuration : 39ch





## 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.

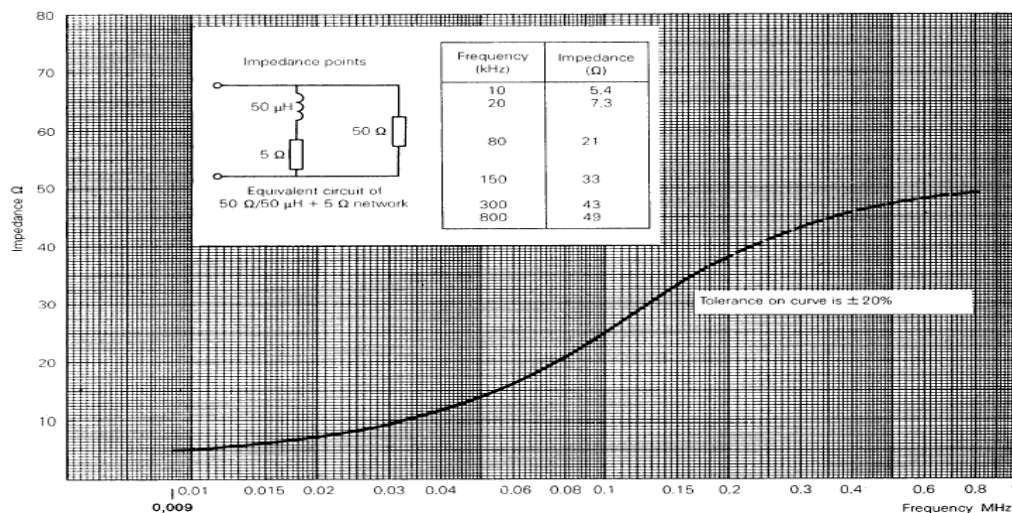


Fig 2. Impedance of LISN



## 12.1 Operating Environment

Temperature : - °C  
Relative Humidity : - % 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)  | 3.85 dB     | Confidence level of approximately 95 % ( $k = 2$ ) |
| Conducted emission (150 kHz ~ 30 MHz) | 3.32 dB     | Confidence level of approximately 95 % ( $k = 2$ ) |





#### 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 |
|-----------------------------------|-----------------|-------------------|---------------|--------------------|
| <input type="checkbox"/> - ESCI   | Rohde & Schwarz | EMI test receiver | 100237        | Apr 18. 2017       |
| <input type="checkbox"/> - ENV216 | Rohde & Schwarz | LISN              | 100172        | Apr 19. 2017       |
| <input type="checkbox"/> - ENV216 | Rohde & Schwarz | LISN              | 100173        | Apr 19. 2017       |
| <input type="checkbox"/> - ISN T8 | TESEQ. GmbH     | ISN               | 24568         | Apr 22. 2017       |
| <input type="checkbox"/> - EMC 32 | Rohde & Schwarz | Testing Software  | VER8.53       | N/A                |

#### 12.6 Test data for Conducted Emission

- Test Date :
- Reference Standard :
- Test Procedure(s) :
- Operating Condition :
- Power Source :
- Frequency rage :
- Line :
- Comment : Not Applicable

The power supply of this device is only DC(internal battery) and Bluetooth function is disabled in charge status

### 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.

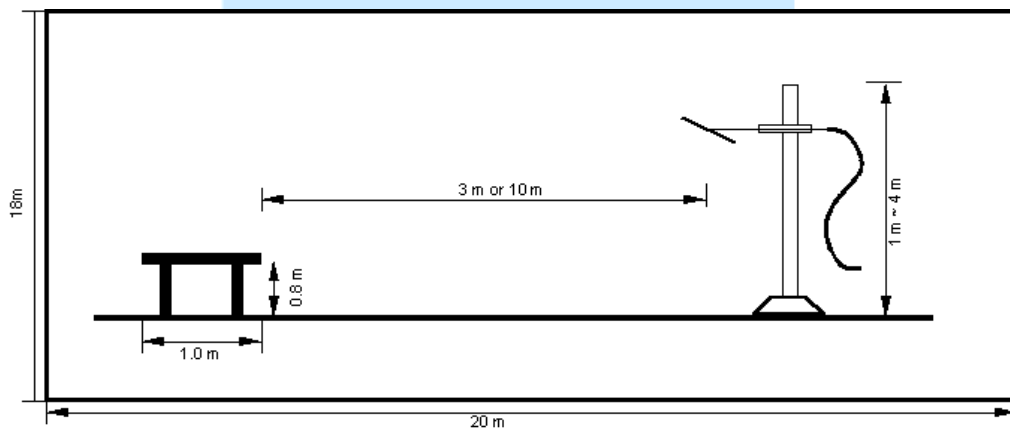


Fig 3. Dimensions of test site (Below 1GHz)

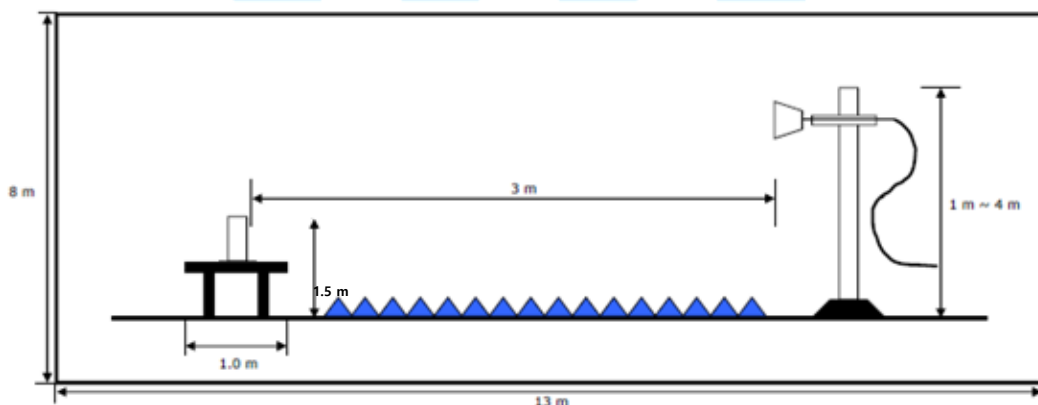


Fig 4. Dimensions of test site (Above 1GHz)



### 13.1 Operating environment

Temperature : 26.7 °C  
Relative humidity : 32.8 % 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)      | 4.78 dB     | Confidence level of approximately 95 % ( $k = 2$ ) |
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)    | 4.77 dB     | Confidence level of approximately 95 % ( $k = 2$ ) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)   | 5.06 dB     | Confidence level of approximately 95 % ( $k = 2$ ) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal) | 5.03 dB     | Confidence level of approximately 95 % ( $k = 2$ ) |
| Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m, V/H)      | 5.42 dB     | Confidence level of approximately 95 % ( $k = 2$ ) |
| Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m, V/H)     | 5.64 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        | Jul. 20, 2017      |
| ■ - HFH2-Z2                   | Rohde & Schwarz        | Loop Antenna           | 100041        | Dec. 21, 2017      |
| ■ - VULB9160                  | Schwarzbeck            | Broadband Test Antenna | 3099          | Aug. 03. 2017      |
| ■ - BBHA9120D                 | Schwarzbeck            | Horn Antenna           | 207           | Oct. 14. 2017      |
| ■ - 3160-09                   | Schwarzbeck            | Horn Antenna           | LM3981        | Oct. 27. 2017      |
| ■ - MCU066                    | maturo GmbH            | Position Controller    | 1390306       | N/A                |
| ■ - TT2.5SI                   | maturo GmbH            | Turntable              | 1390307       | N/A                |
| ■ - AM 4.0                    | maturo GmbH            | Antenna Mast           | 1390308       | N/A                |
| ■ - AFS 44 00101800-25-10P-44 | MITEQ                  | Preamplifier           | 1258943       | Dec. 06. 2017      |
| ■ - SCU-F1826-G47-BZ42-CSS    | BONN Elektronik        | Preamplifier           | 10003         | Dec. 09. 2017      |
| ■ - WHKX3.0/18G-10SS          | WAINWRIGHT INSTRUMENTS | High pass filter       | SN31          | Apr. 19, 2017      |
| ■ - EMC 32                    | Rohde & Schwarz        | Testing Software       | VER9.15       | N/A                |



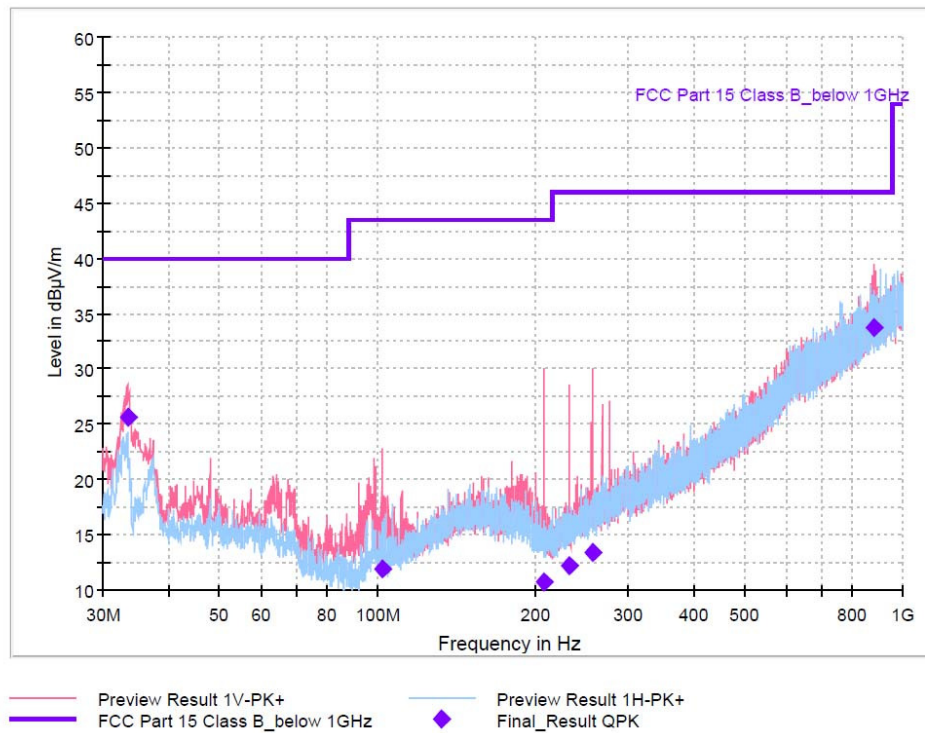
### 13.6 Test data for Radiated Spurious Emission

- Test Date : April 13 ~ 14 , 2017
- 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 V
- Note :

#### Radiated Spurious Emission (9 kHz to 30 MHz)

※ The emission level was not found.

#### Radiated Spurious Emission (30 MHz to 1 000 MHz)



#### Final Result

| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 33.476250       | 25.59              | 40.00          | 14.41       | 1000.0          | 120.000         | 115.0       | V   | 246.0         | 12.6       |
| 101.981250      | 11.97              | 43.50          | 31.53       | 1000.0          | 120.000         | 125.0       | V   | 230.0         | 11.3       |
| 207.423750      | 10.72              | 43.50          | 32.78       | 1000.0          | 120.000         | 125.0       | V   | 342.0         | 12.6       |
| 232.686250      | 12.15              | 46.00          | 33.85       | 1000.0          | 120.000         | 100.0       | V   | 1.0           | 14.1       |
| 256.886875      | 13.45              | 46.00          | 32.55       | 1000.0          | 120.000         | 109.0       | V   | 347.0         | 15.4       |
| 885.101250      | 33.80              | 46.00          | 12.20       | 1000.0          | 120.000         | 125.0       | V   | 15.0          | 31.4       |



### Radiated Spurious Emission (1 GHz to 25 GHz): 0ch

| Frequency<br>(MHz) | Measurement Level         |         |        |          |                          |                         |         | Limit<br>(dBμV/m) |         | Margin<br>(dB) |         | Positioning System |        |       |
|--------------------|---------------------------|---------|--------|----------|--------------------------|-------------------------|---------|-------------------|---------|----------------|---------|--------------------|--------|-------|
|                    | Reading Value<br>(dBμV/m) |         | AF     | AMP / CL | Duty Cycle<br>collection | Test Result<br>(dBμV/m) |         |                   |         |                |         | Pol.               | Height | Angle |
|                    | Peak                      | Average | (dB/m) | (dB)     | (dB)                     | Peak                    | Average | Peak              | Average | Peak           | Average | (H/V)              | (cm)   | (°)   |
| 1094.99            | 60.03                     | 35.06   | 24.79  | -38.49   | -                        | 46.33                   | 21.36   | 74.00             | 54.00   | 27.67          | 32.64   | V                  | 175    | 122   |
| 1596.58            | 56.44                     | 41.84   | 25.15  | -37.53   | -                        | 44.06                   | 29.46   | 74.00             | 54.00   | 29.94          | 24.54   | V                  | 138    | 291   |
| 1994.25            | 55.11                     | 39.96   | 25.64  | -37.33   | -                        | 43.42                   | 28.27   | 74.00             | 54.00   | 30.58          | 25.73   | V                  | 150    | 93    |
| 2302.03            | 48.45                     | 35.36   | 26.62  | -36.94   | -                        | 38.13                   | 25.04   | 74.00             | 54.00   | 35.87          | 28.96   | H                  | 125    | 214   |
| 4804.50            | 55.20                     | 48.29   | 30.70  | -34.83   | -                        | 51.07                   | 44.16   | 74.00             | 54.00   | 22.93          | 9.84    | V                  | 125    | 184   |
| 17990.00           | 6.00                      | 28.91   | 49.38  | -34.10   | -                        | 57.35                   | 44.19   | 74.00             | 54.00   | 16.65          | 9.81    | H                  | 175    | 15    |

### Radiated Spurious Emission (1 GHz to 25 GHz): 20ch

| Frequency<br>(MHz) | Measurement Level         |         |        |          |                          |                         |         | Limit<br>(dBμV/m) |         | Margin<br>(dB) |         | Positioning System |        |       |
|--------------------|---------------------------|---------|--------|----------|--------------------------|-------------------------|---------|-------------------|---------|----------------|---------|--------------------|--------|-------|
|                    | Reading Value<br>(dBμV/m) |         | AF     | AMP / CL | Duty Cycle<br>collection | Test Result<br>(dBμV/m) |         |                   |         |                |         | Pol.               | Height | Angle |
|                    | Peak                      | Average | (dB/m) | (dB)     | (dB)                     | Peak                    | Average | Peak              | Average | Peak           | Average | (H/V)              | (cm)   | (°)   |
| 1094.75            | 60.16                     | 35.02   | 24.79  | -38.49   | -                        | 46.46                   | 21.32   | 74.00             | 54.00   | 27.54          | 32.68   | H                  | 175    | 139   |
| 1199.46            | 58.75                     | 44.81   | 24.85  | -38.33   | -                        | 45.27                   | 31.33   | 74.00             | 54.00   | 28.73          | 22.67   | V                  | 166    | 285   |
| 1597.21            | 56.51                     | 41.19   | 25.15  | -37.53   | -                        | 44.13                   | 28.81   | 74.00             | 54.00   | 29.87          | 25.19   | V                  | 166    | 290   |
| 1662.44            | 55.51                     | 35.90   | 25.23  | -37.53   | -                        | 43.21                   | 23.60   | 74.00             | 54.00   | 30.79          | 30.40   | V                  | 156    | 120   |
| 7324.00            | 49.47                     | 44.89   | 35.97  | -34.10   | -                        | 51.34                   | 46.76   | 74.00             | 54.00   | 22.66          | 7.24    | V                  | 107    | 135   |
| 17991.30           | 41.54                     | 28.68   | 49.40  | -34.10   | -                        | 56.84                   | 43.98   | 74.00             | 54.00   | 17.16          | 10.02   | H                  | 125    | 26    |

### Radiated Spurious Emission (1 GHz to 25 GHz): 39ch

| Frequency<br>(MHz) | Measurement Level         |         |        |          |                          |                         |         | Limit<br>(dBμV/m) |         | Margin<br>(dB) |         | Positioning System |        |       |
|--------------------|---------------------------|---------|--------|----------|--------------------------|-------------------------|---------|-------------------|---------|----------------|---------|--------------------|--------|-------|
|                    | Reading Value<br>(dBμV/m) |         | AF     | AMP / CL | Duty Cycle<br>collection | Test Result<br>(dBμV/m) |         |                   |         |                |         | Pol.               | Height | Angle |
|                    | Peak                      | Average | (dB/m) | (dB)     | (dB)                     | Peak                    | Average | Peak              | Average | Peak           | Average | (H/V)              | (cm)   | (°)   |
| 1171.02            | 58.92                     | 39.34   | 24.84  | -38.33   | -                        | 45.43                   | 25.85   | 74.00             | 54.00   | 28.57          | 28.15   | V                  | 175    | 158   |
| 1594.16            | 56.11                     | 41.69   | 25.15  | -37.53   | -                        | 43.73                   | 29.31   | 74.00             | 54.00   | 30.27          | 24.69   | V                  | 125    | 326   |
| 1995.88            | 55.41                     | 38.13   | 25.64  | -37.33   | -                        | 43.72                   | 26.44   | 74.00             | 54.00   | 30.28          | 27.56   | V                  | 162    | 239   |
| 2544.78            | 48.08                     | 35.87   | 27.33  | -36.93   | -                        | 38.48                   | 26.27   | 74.00             | 54.00   | 35.52          | 27.73   | H                  | 175    | 235   |
| 7439.30            | 55.63                     | 41.45   | 36.19  | -34.10   | -                        | 57.72                   | 43.54   | 74.00             | 54.00   | 16.28          | 10.46   | V                  | 100    | 86    |
| 17986.40           | 41.69                     | 28.79   | 49.33  | -34.10   | -                        | 56.92                   | 44.02   | 74.00             | 54.00   | 17.08          | 9.98    | H                  | 202    | 186   |

Note:

If the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

Test result = Reading: + AF+AMP / CL

Where, AF : Antenna Collection Factor,

AMP / CL = Cable loss + Preamplifier gain + High Pass filter.

※ High Pass filter use to range of 3 GHz to 18 GHz

Pol.: H(Horizontal), V(Vertical)



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

- Test Date : April 13, 2017
- 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 V
- Note : Through three orthogonal axes were investigated and the worst case is report

#### 0ch, 39ch

| Frequency<br>(MHz) | Measurement Level         |         |              |                  |                                  |                         | Limit<br>(dBμV/m) |       | Margin<br>(dB) |       | Positioning System |                |              |         |
|--------------------|---------------------------|---------|--------------|------------------|----------------------------------|-------------------------|-------------------|-------|----------------|-------|--------------------|----------------|--------------|---------|
|                    | Reading Value<br>(dBμV/m) |         | AF<br>(dB/m) | AMP / CL<br>(dB) | Duty Cycle<br>collection<br>(dB) | Test Result<br>(dBμV/m) |                   |       |                |       | Pol.<br>(H/V)      | Height<br>(cm) | Angle<br>(°) |         |
|                    | Peak                      | Average |              |                  |                                  | Peak                    | Average           | Peak  | Average        | Peak  |                    |                |              | Average |
| 2389.19            | 57.39                     | 38.40   | 26.91        | -36.99           | -                                | 47.31                   | 28.32             | 74.00 | 54.00          | 26.69 | 25.68              | H              | 200          | 128     |

| Frequency<br>(MHz) | Measurement Level         |         |              |                  |                                  |                         | Limit<br>(dBμV/m) |       | Margin<br>(dB) |       | Positioning System |                |              |         |
|--------------------|---------------------------|---------|--------------|------------------|----------------------------------|-------------------------|-------------------|-------|----------------|-------|--------------------|----------------|--------------|---------|
|                    | Reading Value<br>(dBμV/m) |         | AF<br>(dB/m) | AMP / CL<br>(dB) | Duty Cycle<br>collection<br>(dB) | Test Result<br>(dBμV/m) |                   |       |                |       | Pol.<br>(H/V)      | Height<br>(cm) | Angle<br>(°) |         |
|                    | Peak                      | Average |              |                  |                                  | Peak                    | Average           | Peak  | Average        | Peak  |                    |                |              | Average |
| 2483.50            | 65.38                     | 56.40   | 27.21        | -36.95           | -                                | 55.64                   | 46.66             | 74.00 | 54.00          | 18.36 | 7.34               | H              | 176          | 225     |

Note:

Test result = Reading: + Transducer Factor.

Where, ACF : Antenna Collection Factor,

CL = Cable loss + Preamplifier gain + High Pass filter

※ High Pass filter use to range of 3 GHz to 18 GHz

Pol.: H(Horizontal), V(Vertical)



## 14. Sample Calculations

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

### 14.1 Example 1 :

#### ■ 20.3 MHz

|                                      |                                                           |
|--------------------------------------|-----------------------------------------------------------|
| Class B Limit                        | = 250 $\mu\text{V}$ = 48 dB $\mu\text{V}$                 |
| Reading                              | = 39.2 dB $\mu\text{V}$                                   |
| $10^{(39.2\text{dB}\mu\text{V}/20)}$ | = 91.2 $\mu\text{V}$                                      |
| Margin                               | = 48 dB $\mu\text{V}$ - 39.2 dB $\mu\text{V}$<br>= 8.8 dB |

### 14.2 Example 2 :

#### ■ 66.7 MHz

|                             |                                                                               |
|-----------------------------|-------------------------------------------------------------------------------|
| Class B Limit               | = 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$                 |
| Reading                     | = 31.0 dB $\mu\text{V}$                                                       |
| Antenna Factor + Cable Loss | = 5.8 dB                                                                      |
| Total                       | = 36.8 dB $\mu\text{V}/\text{m}$                                              |
| Margin                      | = 40.0 dB $\mu\text{V}/\text{m}$ - 36.8 dB $\mu\text{V}/\text{m}$<br>= 3.2 dB |





## 15. Recommendation & Conclusion

The data collected shows that the **Ohsung Electronics Co., Ltd. Remote Controller (Model Name: B702)** was complies with §15.247 of the FCC Rules.

- The end -

