KOSTEC Co., Ltd.
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# TEST REPORT

Report No: KST-FCR-100001

| | | |
|---|---|---|
| **Applicant** | Name | UNEEDS Commerce Co.,Ltd. |
| | Address | Digital EmpireII, 486, Shin Dong, Yongtong Gu, Suwon, Gyeonggi Do, South Korea |
| **Manufacturer** | Name | UNEEDS Commerce Co.,Ltd. |
| | Address | Digital EmpireII, 486, Shin Dong, Yongtong Gu, Suwon, Gyeonggi Do, South Korea |

| | | |
|---|---|---|
| **Equipment** | Name | AUDIO DONGLE |
| | Model No | UD-3000TV |
| | Brand Name | None |
| | FCC ID | WM5UD-3000TV |

| | |
|---|---|
| **Test Standard** | FCC CFR 47, Part 15. Subpart C-15.247 |
| **Test Date(s)** | 2010. 02. 08 ~ 2009. 02. 10 |
| **Issue Date** | 2008. 02. 11 |
| **Test Result** | Compliance |

## Supplementary Information

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI C 63.4-2003.

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

| | | | |
|---|---|---|---|
| Tested by | Mi Young, Lee | Approved by | Gyeong Hyeon, Park |
| Signature |  | Signature |  |

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# 1. GENERAL INFORMATION

## 1.1 Test Facility

### Test laboratory and address

KOSTEC Co., Ltd.

180-254, Annyeong-dong, Hwaseong-si, Gyeonggi-do, South Korea

The open area field test site and conducted measurement facility are used for these testing. This site at was fully described in a reports submitted to the Federal Communications Commission (FCC).

The details of these reports have been found to be in complies with the requirements of Section 2.948 of the FCC Rules on November 14, 2002. The facility also complies with the radiated and conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission (FCC) has the reports on file and KOSTEC Co., Ltd. is listed under FCC Registration No.525762. The test site has been approved by the FCC for public use and is list in the FCC Public Access Link CORES (Commission Registration System) and Industry Canada office (Industry Canada Site No.: 8305A)

### Registration information

KCC (Korea Communications Commission) Number : KR0041

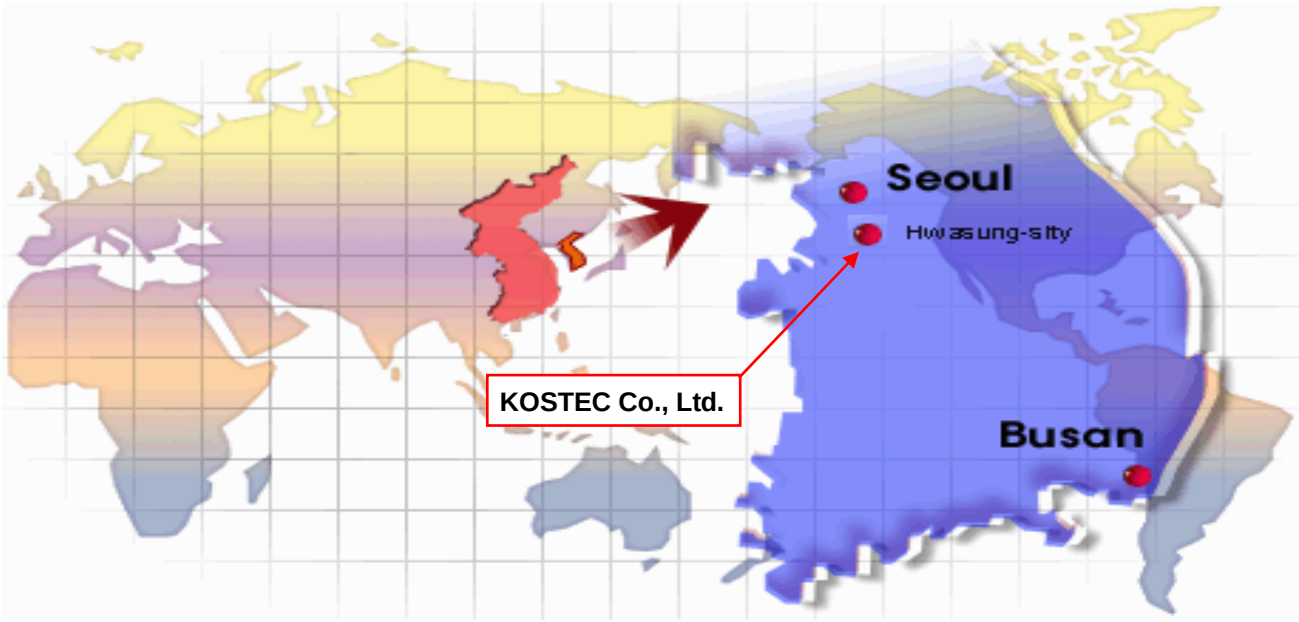
KOLAS(Korea Laboratory Accreditation Scheme) Number : 232

FCC Registration Number(FRN) : 525762

IC Company Number(C,N) : 8305A

VCCI Registration Number : R-1657 / C –1763

## 1.2 Location



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## 2. EQUIPMENT DESCRIPTION

The product operation described herein was declared by manufacturer. and refer to user's manual for the details.

| | |
|---|---|
| 1) Equipment Name | AUDIO DONGLE |
| 2) Model No | UD-3000TV |
| 3) Brand Name | None |
| 4) Serial Number | Prototype |
| 5) Emission Type | F1D |
| 6) Oscillation Type | PLL (Phase Local Loop) |
| 7) Modulation Type | Gaussian Frequency Shift Keying (GFSK) |
| 8) Operated Frequency | TX/RX : 2 402 MHz ~ 2 480 MHz |
| 9) Power | Max. 5.00 mW (Conducted power declared by applicant) |
| 9) Channel spacing | 79 Ch |
| 10) Communication Type | Half duplex |
| 11) Communication access Method | FHSS (Frequency Hopping Spread Spectrum) |
| 12) Micro Processor | U6(MAS3529H) |
| 13) Weight / Dimension | 78g / 12.5(L) cm x 8.5(W) cm x 1.5(D) cm |
| 14) Operation temperature | - 40℃~ + 70℃ |
| 15) Power Source | Voltage: 6.0 $V_{DC}$ (External Adaptor output) |
| | Current: 500 mA (TX Operation) |
| 16) Antenna Description | Class : Chip ANT, Connect type: Internal fixed on PCB, Gain : 1.1 dBi |
| 17) Bluetooth Version | 2.0 |
| 18) Bluetooth Profile | A2DP |
| 19) FCC ID | WM5UD-3000TV |

# 3. SYSTEM CONFIGURATION FOR TEST

## 3.1 Characteristics of equipment

This equipment is named AUDIO DONGLE and it is a standardized, short range wireless solution.

and in much the same way LAN technologies created wide and local area networks of connected devices.

It is transceiver which can transmit the bluetooth signal to two headsets through Digital TV or Digital Media Devices such as PDA, PMP, Laptop, Audio, etc.

RF part of this product is consist of two chip BT Module type on PCB board and used frequency band is 2 402 MHz ~2 480 MHz, Maximum conduction power is 5.0 mW and also when during communication, two chip on PCB is made not harmful Interference signal by random hopping technology

Power source is supplied 6.0 $V_{DC}$ 500 mA from external adaptor

## 3.2 Configuration of EUT

| Description | Model No. | Serial No. | Manufacture | Remark |
|---|---|---|---|---|
| AUDION DONGLE | UD-3000TV | None | UNEEDS Commerce Co.,Ltd. | EUT (Stand alone type) |
| Adaptor | SP0701A | SB0908000844 | Seung Bo Elecom Co.,Ltd. | |

## 3.3 Product Modification

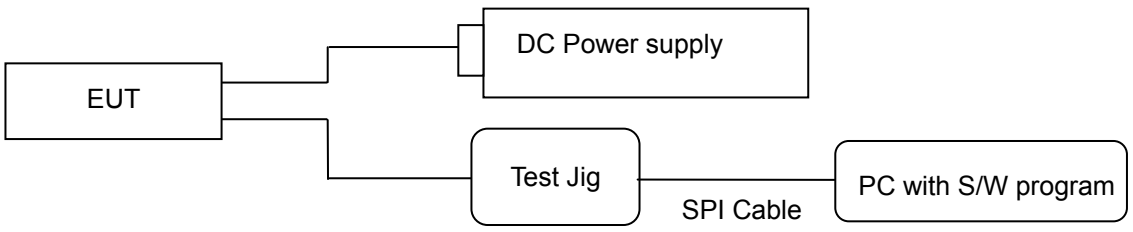
N/A

## 3.4 Operating Mode

The transmitter was operated in a continuous modulation transmit mode and all measurements were intended to emit maximum RF signal

## 3.5 Test Configuration

The below test setup configuration from EUT is a same as in this clause 5.1 to 5.8



## 3.6 Table for Test condition

| Test Items | Channel No | Frequency (MHz) | Operated Condition |
|---|---|---|---|
| Carrier frequency separation | 1, 2 | 2 402, 2 403 | Hopping on and continuous modulation setting mode |
| | 40, 41 | 2 441, 2 442 | |
| | 78, 79 | 2 479, 2 480 | |
| Number of hopping frequencies | 1 ~ 79 | 2 402 ~ 2 480 | Hopping on mode |
| Time of occupancy (Dwell Time) | 40 | 2 441 | Hopping on mode |
| Conducted peak output power | 1 | 2 402 | Hopping off and continuous modulation setting mode |
| | 40 | 2 441 | |
| | 79 | 2 480 | |
| Band-edge Compliance | 1 | 2 402 | Hopping off and continuous modulation setting mode |
| | 79 | 2 480 | |
| Spurious RF conducted emissions | - | - | Frequency band setting by required standard (FCC Rules)* |
| Spurious radiated emissions | - | - | |

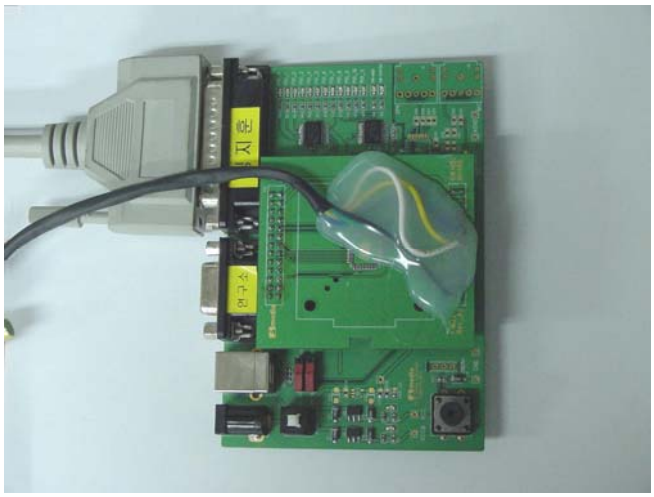
*Channel number is based on lowest, middle, highest channel setting and also hopping on/off mode operation

Please see plot shown in this chapter 5.6 and 5.7

## 3.7 Test Jig

For test, the below test Jig which is used to the control the channel select & modulated signal and carrier with the software program(Version 2.0) by supplier .

▣ Test Jig photograph



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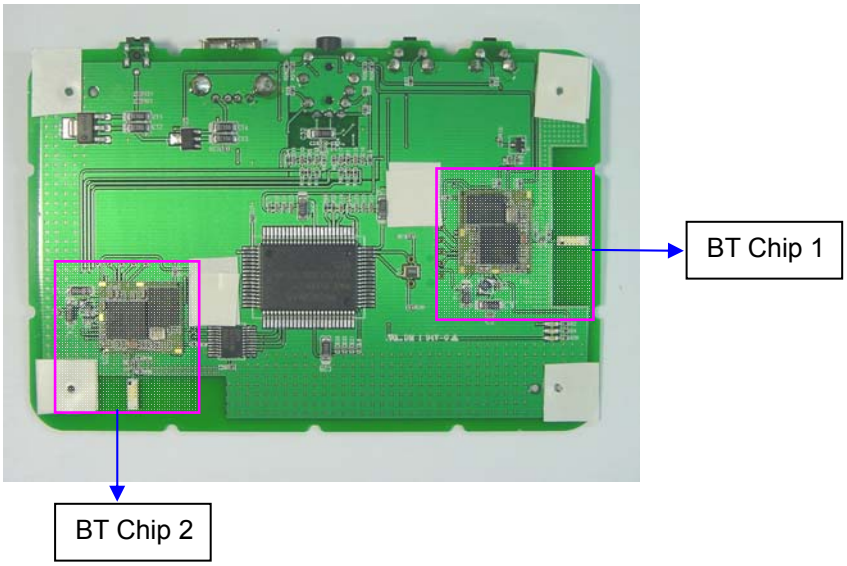
## 3.8 Used Test Equipment List

| No. | Instrument | Model | Serial No. | Manufacturer | Due to Cal. Date | Used |
|---|---|---|---|---|---|---|
| 1 | Spectrum Analyzer | 8563E | 3846A10662 | Agilent Technology | 2010.05.20 | ☒ |
| 2 | Test Receiver | ESCS30 | 100111 | Rohde & Schwarz | 2010.03.07 | ☒ |
| 3 | Test Receiver | ESPI3 | 100109 | Rohde & Schwarz | 2010.03.03 | ☐ |
| 4 | LISN | ESH2-Z5 | 100044 | Rohde & Schwarz | 2010.03.16 | ☒ |
| 5 | LISN | ESH3-Z5 | 100147 | Rohde & Schwarz | 2010.06.25 | ☐ |
| 6 | Ultra broadband Antenna | HL562 | 100075 | Rohde & Schwarz | 2010.03.20 | ☒ |
| 7 | Ultra broadband Antenna | HL562 | 100076 | Rohde & Schwarz | 2010.04.14 | ☐ |
| 8 | Dipole Antenna | HZ-12 | 100005 | Rohde & Schwarz | 2010.04.03 | ☐ |
| 9 | Dipole Antenna | HZ-13 | 100007 | Rohde & Schwarz | 2010.04.03 | ☐ |
| 10 | Horn Antenna | 3115 | 2996 | EMCO | 2010.06.13 | ☒ |
| 11 | Loop Antenna | 6502 | 9203-0493 | EMCO | 2011.06.11 | ☐ |
| 12 | Digital Signal Generator | E4436B | US39260458 | H.P | 2010.05.20 | ☒ |
| 13 | Tracking CW Signal Source | 85645A | 070521-A1 | H.P | 2010.05.20 | ☒ |
| 14 | RF Power Amplifier | 8347A | 3307A01571 | H.P | 2010.05.20 | ☒ |
| 15 | Microwave Amplifier | 8349B | 2627A01037 | H.P | 2010.05.20 | ☒ |
| 16 | Attenuator | 8498A | 3318A09485 | H.P | 2010.05.20 | ☒ |
| 17 | Temperature & Humidity Chamber | EY-101 | 90E14260 | TABAI ESPEC | 2010.03.16 | ☐ |
| 18 | EPM Series Power meter | E4418B | GB39512547 | Agilent Technology | 2010.05.20 | ☐ |
| 19 | RF Power Sensor | ECP-E18A | US37181768 | Agilent Technology | 2010.05.20 | ☐ |
| 20 | Microwave Frequency Counter | 5352B | 2908A00480 | Agilent Technology | 2010.05.20 | ☐ |
| 20 | Band rejection filter | WTR-BRF2442-84NM | 09020001 | WAVE TECH Co.,Ltd. | 2010.03.03 | ☐ |
| 21 | SLIDAC | None | 0207-4 | Myoung-Sung Electronic Co., Ltd. | 2010.05.20 | ☐ |
| 22 | DC Power supply | DRP-5030 | 9028029 | Digital Electronic Co.,Ltd | 2010.06.04 | ☐ |
| 23 | DC Power supply | UP-3005T | 68 | Unicon Co.,Ltd | 2010.05.20 | ☐ |
| 24 | DC Power supply | E3610A | KR24104505 | Agilent Technology | 2010.05.20 | ☒ |
| 25 | Antenna Master | - | - | Daeil EMC | - | ☒ |
| 26 | Turn Table | - | - | Daeil EMC | - | ☒ |

## 4. SUMMARY TEST RESULTS

| Description of Test | Standard Section | Reference Section | Used | Remark |
|---|---|---|---|---|
| Carrier frequency separation (20 dB bandwidth) | 15.247(a)(1) | Clause 5.1 | Compliance | |
| | 15.247(a)(1) | Clause 5.1 | Compliance | |
| Number of hopping frequencies | 15.247(a)(1)(iii) | Clause 5.2 | Compliance | |
| Time of occupancy (Dwell Time) | 15.247(a)(1)(iii) | Clause 5.3 | Compliance | |
| Max. Conducted peak output power | 15.247(b)(1) | Clause 5.4 | Compliance | Module 1<br>Module 2 |
| Band edge compliance of RF emissions | 15.247(d) | Clause 5.5 | Compliance | |
| Spurious RF conducted emissions | 15.247(d) | Clause 5.6 | Compliance | |
| Spurious RF radiated emissions | 15.247(d), 15.209 | Clause 5.7 | Compliance | Module 1<br>Module 2 |
| AC Power line Conducted emission | 15.207 | Clause 5.8 | Compliance | |
| Antenna requirement | 15.203, 15.247 | Clause 5.9 | Compliance | |
| Compliance : The EUT complies with the essential requirements in the standard.<br>Not Compliance : The EUT does not comply with the essential requirements in the standard.<br>N/A : The test was not applicable in the standard. | | | | |

Note: Module 1 and Module 2 of Remark on above Table is mean respectably measurement because of a two(2) chip Bluetooth Module part is consist of on PCB board in this Product as describe in this clause 3.1 Characteristics of equipment. and the other Test Item is performed to worst case among two chip BT Module Please see a below internal PCB Layout photo of product



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# 5. MEASUREMENT RESULTS

## 5.1 Carrier Frequency Separation

### 5.1.1 Standard Applicable [FCC §15.247(a),(1)]

Frequency hopping systems operating in the 2 400 ~ 2 483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

### 5.1.2 Test Environment conditions

• Ambient temperature : 22 ℃,
• Relative Humidity : (47 ~ 48) % R.H.

### 5.1.3 Measurement Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal while EUT had its hopping function enabled.
After the trace being stable, the reading value between the peak of the adjacent channels using the marker-Delta function was recorded as the measurement results.

The spectrum analyzer is set to the as follows :

• Span : wide enough to capture the peak of two adjacent channels
• RBW : ≥ 1% of the span
• VBW : ≥ RBW
• Sweep : auto
• Detector function : peak
• Trace : max hold

### 5.1.4 Measurement Result

| Channel No. | Frequency (MHz) | Test Results | | |
|---|---|---|---|---|
| | | Measured Value MHz] | Result | Limit |
| 1, 2 | 2 402 MHz, 2 403 MHz | 1, 030 | Pass | ≥ 25 kHz or 2/3 20dB bandwidth |
| 40, 41 | 2 441 MHz, 2 442 MHz | 1, 024 | Pass | |
| 78, 79 | 2 479 MHz, 2 480 MHz | 1, 029 | Pass | |

* please see plot in this next page(5.1.5 ~ 5.1.6)

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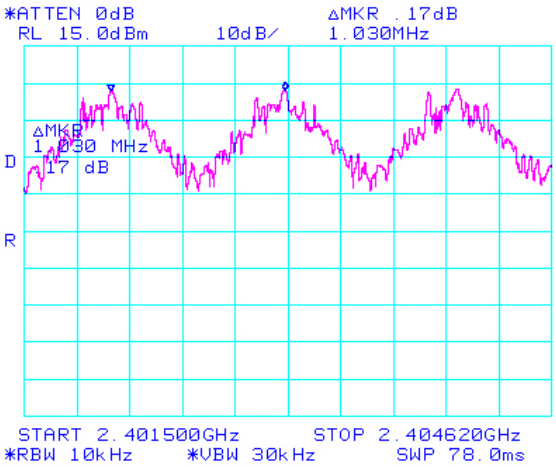
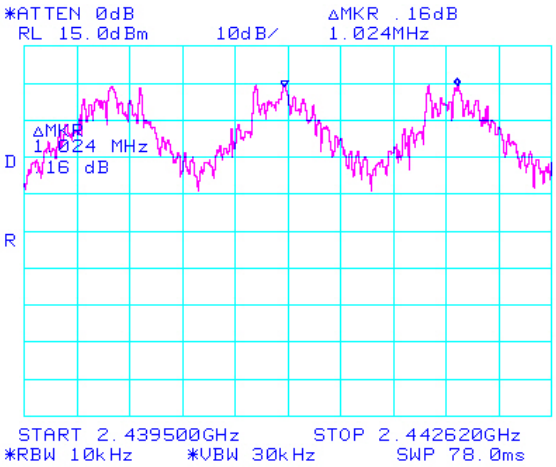
## 5.1.5 Test Plot (separation frequency)

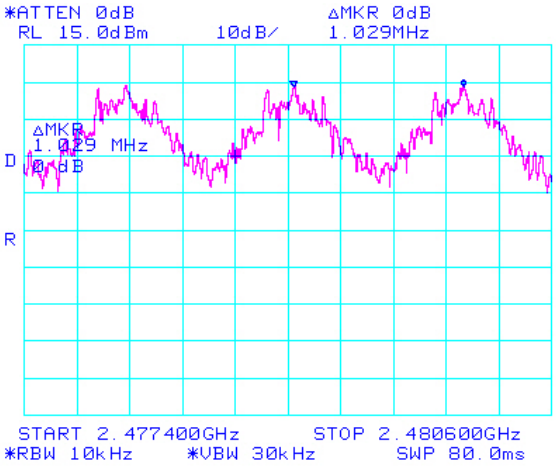
Channel 1, 2 ( 2 402 MHz, 2 403 MHz)




Channel 40, 41 (2 441 MHz, 2 442 MHz)




Channel 78, 79 (2 479 MHz, 2 480 MHz)



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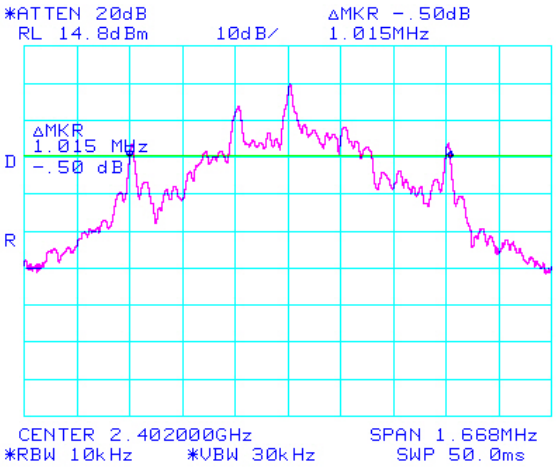
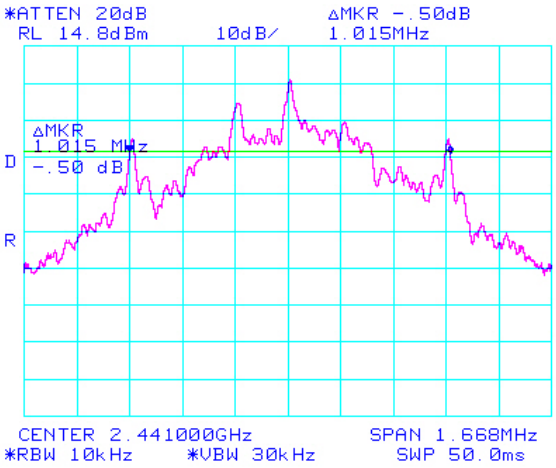
## 5.1.6 Test Plot (20 dB Occupied bandwidth)

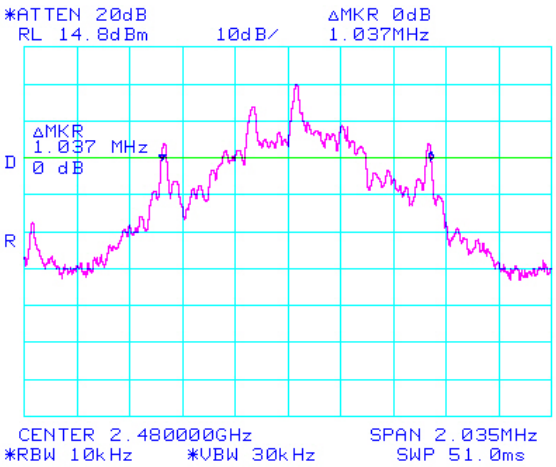
### Channel 1 ( 2 402 MHz)




### Channel 40 (2 441 MHz)




### Channel 79 (2 480 MHz)



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* Note : above the 20 dB Bandwidth measurement method is described FCC Public Notice(DA 00-705), and setting method on spectrum analyzer is as follows ;

- Span : approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW : ≥ 1% of the 20 dB bandwidth
- VBW : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

## 5.2 Number of hopping frequencies

### 5.2.1 Standard Applicable [FCC §15.247(a),(1)(iii)]

Frequency hopping systems in the 2 400 MHz ~ 2 483.5 MHz band shall use at least 15 channels

### 5.2.2 Test Environment conditions

• Ambient temperature : 22 ℃,
• Relative Humidity : (47 ~ 48) % R.H.

### 5.2.3 Measurement Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna Terminal to get higher resolution, two frequency ranges within the 2 400 MHz ~ 2 483.5 MHz Frequency Hopping band were examined. The EUT must have its hoping function enabled.
After the trace being stable, it may prove necessary to break the span up to sections, in order to clearly show All of the hopping frequencies. The limit is specified in this paragraph 5.2.4

The spectrum analyzer is set to the as follows :

- Span : the frequency band of operation
- Resolution (or IF) Bandwidth(RBW) : ≥ 1% of the span
- Video (or Average) Bandwidth(VBW) : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

### 5.2.4 Measurement Result

| Channel Number | Hopping frequency band (MHz) | Test Results | | |
|---|---|---|---|---|
| | | Measured total number of Hopping Channels | Limit | Result |
| 1 ~ 79 | 2 402 MHz ~ 2 480 MHz | 79 | ≥ 15 | Complies |

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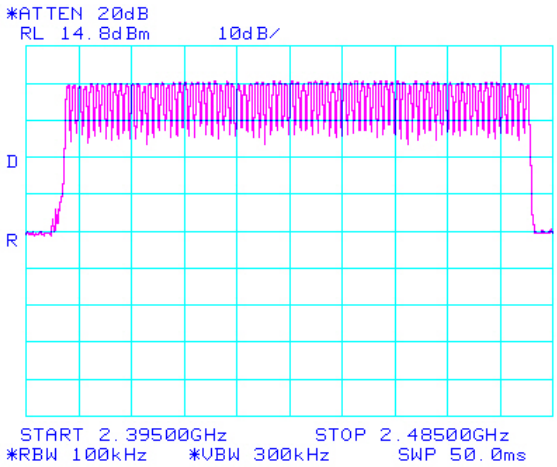
## 5.2.5 Test Plot

1. Hopping channel number / ch1 ~ ch 79



## 5.3 Time of occupancy ( Dwell Time)

### 5.3.1 Standard Applicable [FCC §15.247(a),(1)(iii)]

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 5.3.2 Test Environment conditions

• Ambient temperature : 22 ℃,

• Relative Humidity : (47 ~ 48) % R.H.

### 5.3.3 Measurement Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled. After used the marker-delta function to determine the dwell time.

The spectrum analyzer is set to the as follows :

• Span : Zero , Centered on a hopping channel

• Resolution (or IF) Bandwidth(RBW) : 1 MHz

• Video (or Average) Bandwidth(VBW) : ≥ RBW

• Sweep : auto

• Detector function : peak

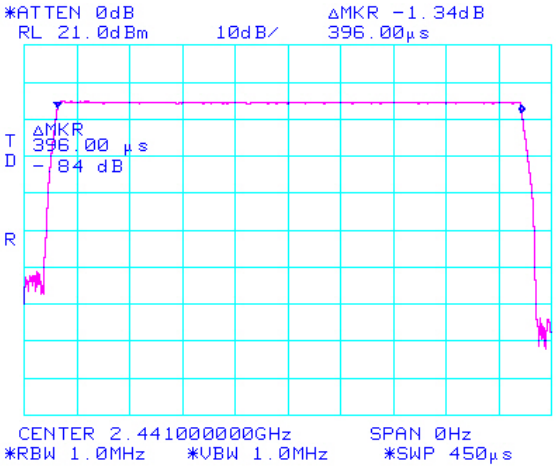
• Trace : max hold

### 5.3.4 Measurement Result

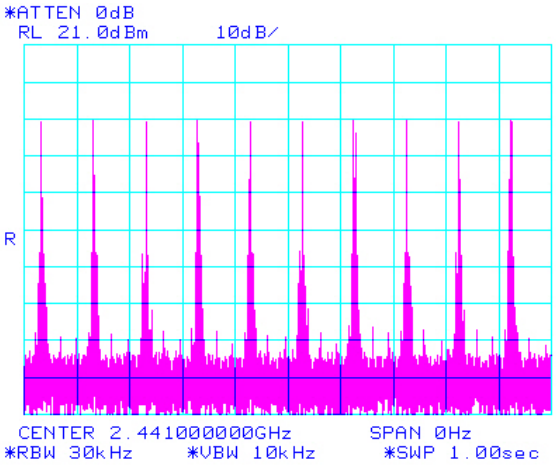
| Bust width per one hop (㎲) | Test Results | | |
|---|---|---|---|
| | Measured dwell time (ms) | Limit | Result |
| 396.00 | 120.763 | ≤ 0.4 | Complies |

## 5.3.5 Test Plot

1. Burst width in one hop (㎲)




2. Number of hop channel per 1 sec




The system makes worst case 1 600 hops per second or 1 time slot has a length of 625㎲ with 79 channels. a DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. So you have each channel 800/79 = 10.13 times a total time of occupancy is get by multiplying the measured number of transmissions occurred during second and so for a period of 0.4 x 79 = 31.6 seconds you have 10.13 x 31.6 = 320.11 times of appearance.
So we have 320.11 x 396 ㎲ = 126.763 ms per 31.6 second.

Dwell time = time slot x hop rate / number of hopping channels x 31.6 s
DH 1 time slot = time slot x (1600/2) / 79 x 31.6 s

※This product is have a only DH 1 Time slot

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## 5.4 Max. Conducted peak output power

### 5.4.1 Standard Applicable [FCC §15.247(b)(3)]

For systems using digital modulation in the 2 400 MHz ~ 2 483.5 MHz bands : 1 Watt.

As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

### 5.4.2 Test Environment conditions

• Ambient temperature : 22 ℃,

• Relative Humidity : (47 ~ 48) % R.H.

### 5.4.3 Measurement Procedure

① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)

② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :

on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]

- dc Block(1.0 dB)+Cable loss( 0.5 dB)+Attenuator (30 dB)

③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.

④ Place the EUT on the table and set it hopping function disable at the highest, middle and the lowest available channels.

⑤ After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission

⑥ The indicated level is the peak output power.

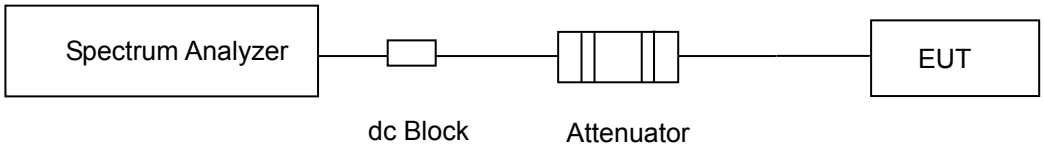
⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705)

∗The spectrum analyzer is set to the as follows ;

- Span : approximately 5 times the 20 dB bandwidth
- RBW : > 20 dB bandwidth of the emission being measured
- VBW : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

* above measurement frequency is selected to the lowest, Middle and Highest channel

### 5.4.4 Test Setup Configuration




### 5.4.5 Measurement Result

▣ BT Chip Module 1

| Channel No. | Frequency [MHz] | Test Results | | |
|---|---|---|---|---|
| | | Measured power [dBm] | Limit [dBm] | Result |
| 1 | 2 402 | 4.27** | ≤ 30 | Pass |
| 40 | 2 441 | 5.20** | | Pass |
| 79 | 2 480 | 4.77** | | Pass |

** it is conducted power

▣ BT Chip Module 2

| Channel No. | Frequency [MHz] | Test Results | | |
|---|---|---|---|---|
| | | Measured power [dBm] | Limit [dBm] | Result |
| 1 | 2 402 | 5.17** | ≤ 30 | Pass |
| 40 | 2 441 | 6.17** | | Pass |
| 79 | 2 480 | 5.83** | | Pass |

** it is conducted power

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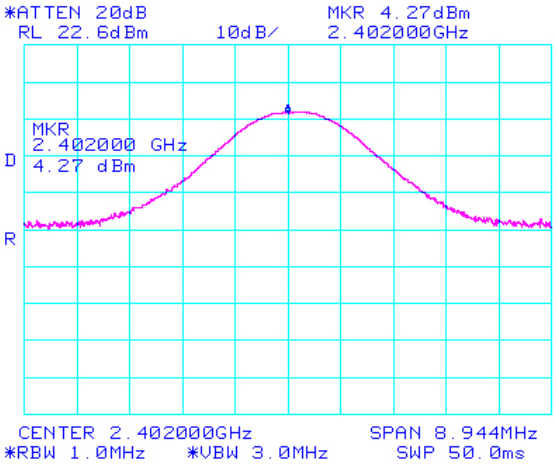
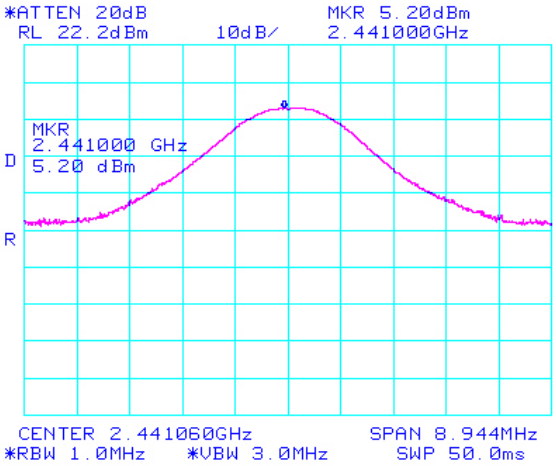
## 5.4.6 Test Plot (BT Chip Module 1)

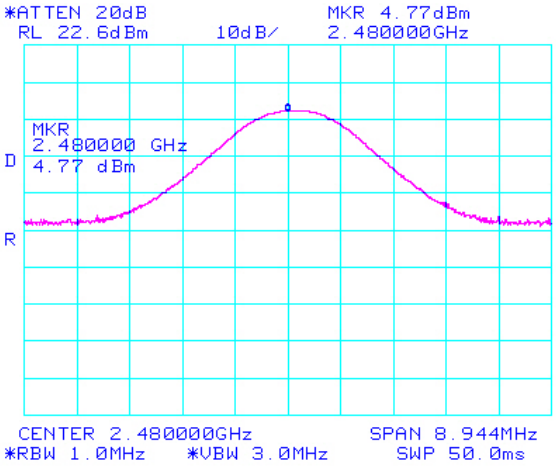
⇒ Channel 1 (2 402 MHz)




⇒ Channel 40 (2 441 MHz)

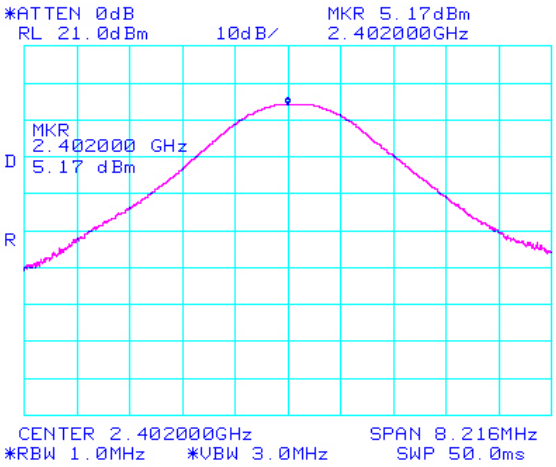



⇒ Channel 79 (2 480 MHz)

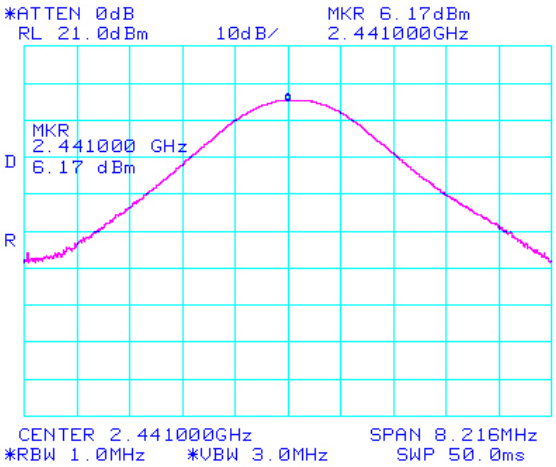


## 5.4.7 Test Plot (BT Chip Module 2)

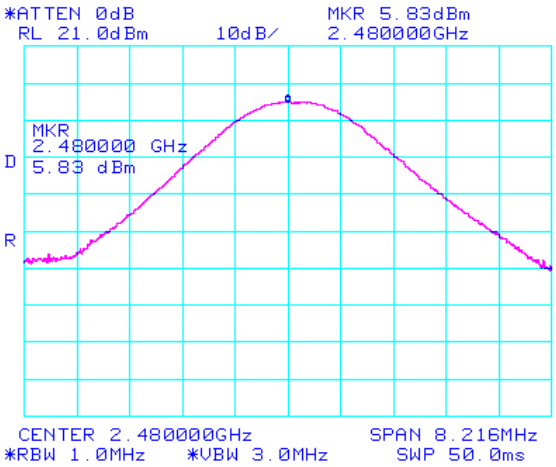
⇒ Channel 1 (2 402 MHz)




⇒ Channel 40 (2 441 MHz)




⇒ Channel 79 (2 480 MHz)



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## 5.5 Bandedge Compliance of RF emission

### 5.5.1 Standard Applicable [FCC §15.247(d)]

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

### 5.5.2 Test Environment conditions

• Ambient temperature : 22 ℃,

• Relative Humidity : (47 ~ 48) % R.H.

### 5.5.3 Measurement Procedure

① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)

② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :

on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]

- dc Block(1.0 dB)+Cable loss( 0.5 dB)+Attenuator (30 dB)

③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.

④ Place the EUT on the table and set on the emission at the band-edge,

⑤ After the trace being stable, Use the marker-to-peak function to move the marker to the peak of the in-band emission.

⑥ The marker-delta value now displayed must comply with the limit specified in above standard.

⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705)

The spectrum analyzer is set to the as follows :

• Span : Wide enough to capture the peak level of the emission operating on the channel closet to the Band-edge, as well as any modulation products which fall outside of the authorized band of operation

• RBW : ≥ 1 % of the span

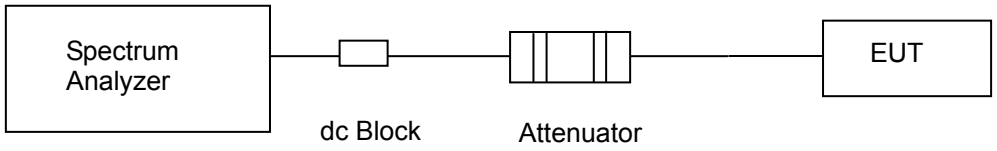
• VBW : ≥ RBW

• Sweep : auto

• Detector function : peak

• Trace : Max hold

### 5.5.4 Test Setup Configuration

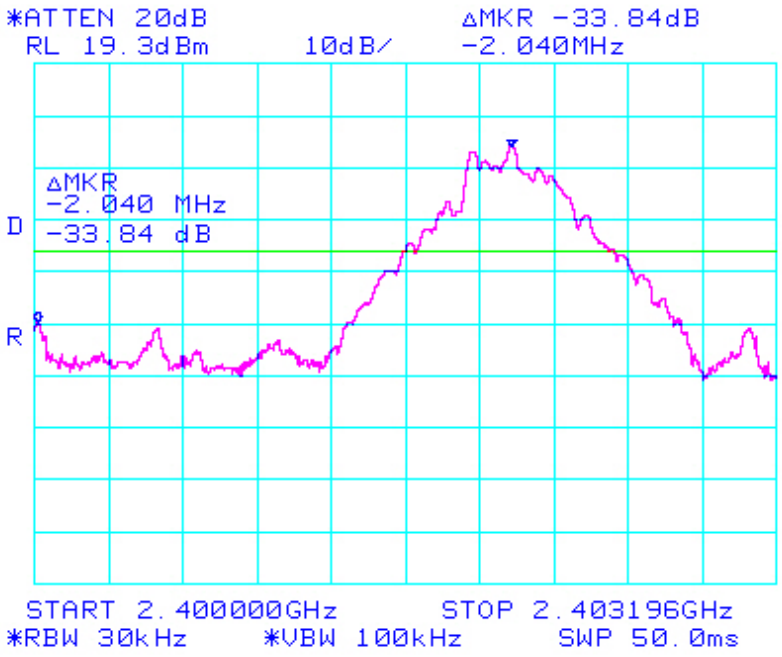



### 5.5.5 Measurement Result

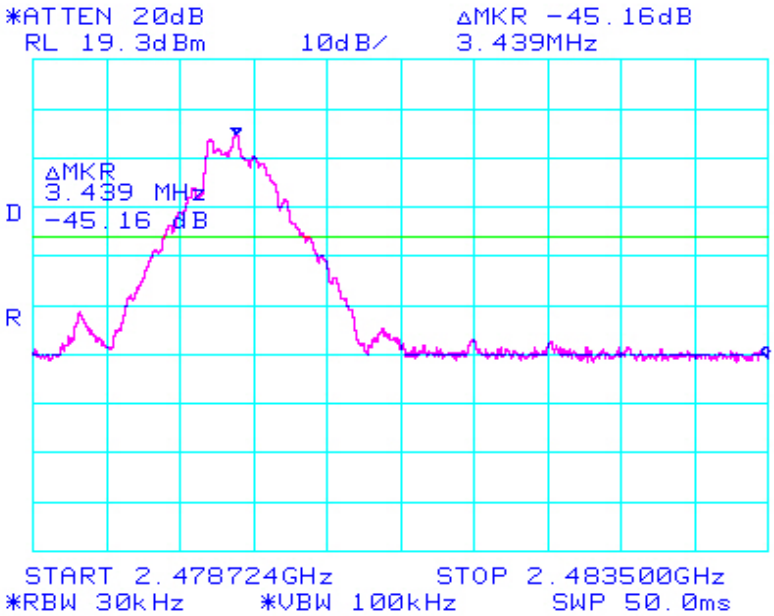
| Setting Channel | Frequency Range [MHz] | Test Results | | |
|---|---|---|---|---|
| | | Measured value [dBc] | Limit [dBc] | Result |
| Lowest channel ( 2 402 MHz ) | 2,400 000 MHz ~ 2,403 196 MHz | - 33.84 | ≤ - 20 | Pass |
| Highest channel ( 2 478 MHz ) | 2.478 724 MHz ~ 2.483 500 MHz | - 45.16 | | Pass |

## 5.5.6 Test Plot

Lowest Channel (2 402 MHz)




Highest Channel (2 480 MHz)




※ Above measured delta value is displayed at band edge point from lowest and highest frequency

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## 5.6 Spurious RF conducted emissions

### 5.6.1 Standard Applicable [FCC §15.247(d)]

In additional in this clause 5.4.1 In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall e at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

### 5.6.2 Test Environment conditions

• Ambient temperature : 22 ℃,

• Relative Humidity : (47 ~ 48) % R.H.

### 5.6.3 Measurement Procedure

① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)

② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :

on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]

- dc Block(1.0 dB)+Cable loss( 0.5 dB)+Attenuator (30 dB)

③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.

④ Place the EUT on the table and set on the emission at the out band

⑤ After the trace being stable, Use the marker-to-peak function to move the marker to the peak of the in-band emission.

⑥ The marker-delta value now displayed spurious emission must comply with the limit specified in above standard.

⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705)

The spectrum analyzer is set to the as follows :

• Span : wide enough to capture the peak level of the in-band emission and all spurious emissions from the Lowest frequency generated in the EUT up through the $10^{th}$ harmonic. Typically, several plots are required to cover this entire span.

• RBW : 100 kHz

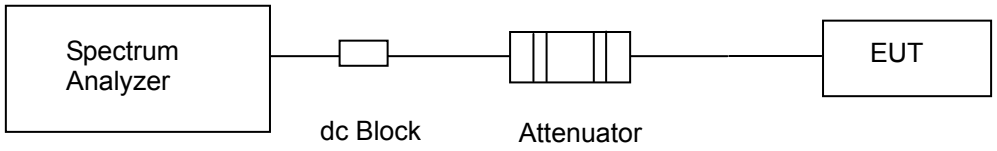
• VBW : ≥ RBW

• Sweep : Auto

• Detector function : Peak

• Trace : Max hold

### 5.6.4 Test Setup Configuration




### 5.6.5 Measurement Result

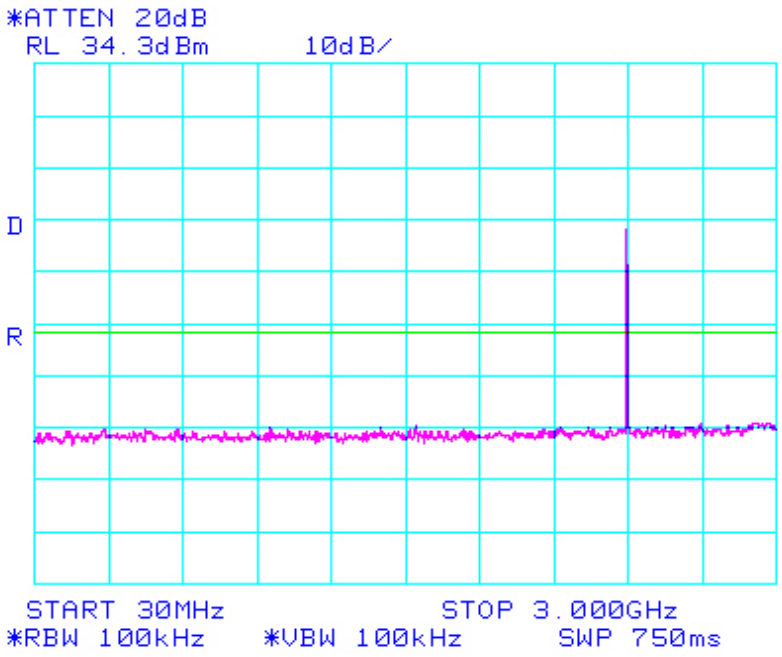
| Hopping mode | Setting Channel [MHz] | Frequency band [MHz] | Test Results | | |
|---|---|---|---|---|---|
| | | | Measured value [dBc] | Limit [dBc] | Result |
| Hopping off | Lowest channel ( 2 402 MHz ) | 30 MHz ~ 3.0 GHz | Below than Limit Value | ≤ - 20 | Pass |
| | | 1GHz ~ 26.5 GHz | | | Pass |
| | Middle channel ( 2 441 MHz ) | 30 MHz ~ 3.0 GHz | | | Pass |
| | | 1GHz ~ 26.5 GHz | | | Pass |
| | Highest channel ( 2 480 MHz ) | 30 MHz ~ 3.0 GHz | | | Pass |
| | | 1GHz ~ 26.5 GHz | | | Pass |
| Hopping on | Hopping ch (1~79) | 30 MHz ~ 3.0 GHz | Below than Limit Value | | Pass |
| | | 2 GHz ~ 26.5 GHz | | | Pass |

*Note: Spurious level at Hopping mode is 20dB below within the band that contains the highest level of the desired power. Please see a Test Plot of 5.6.6 and 5.6.7

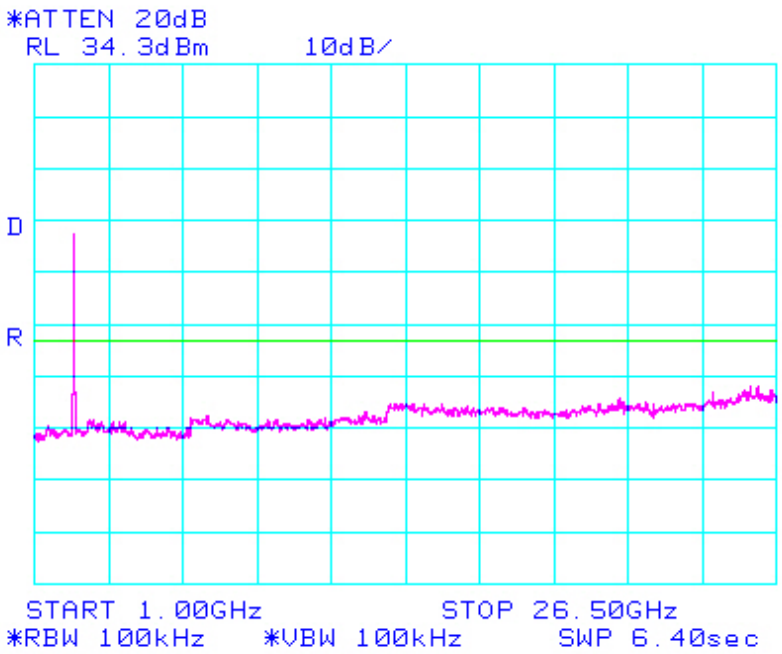
## 5.6.6 Test Plot (Hopping off)

▣ Setting Channel (2 402 MHz)

⇒Frequency Range(30 MHz ~ 3.0 GHz)

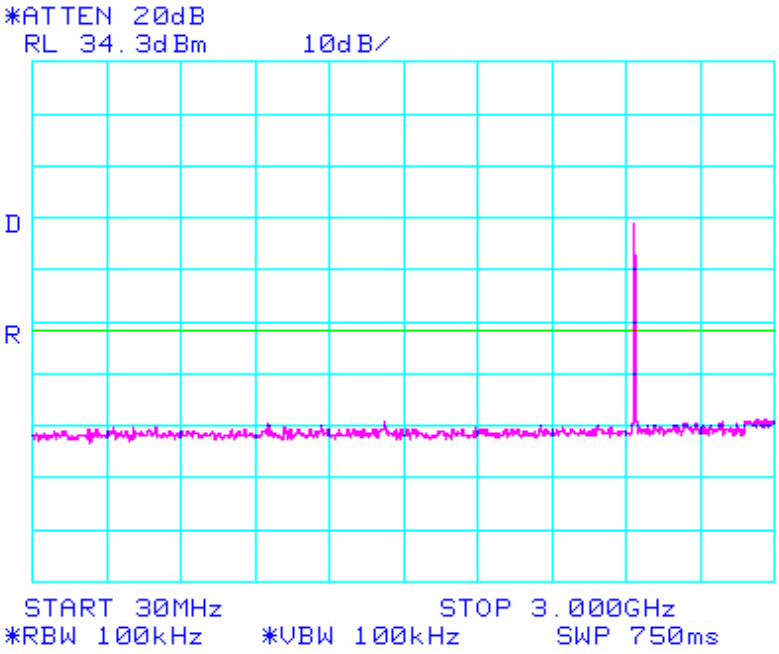



⇒Frequency Range (1 GHz ~ 26.5 GHz)

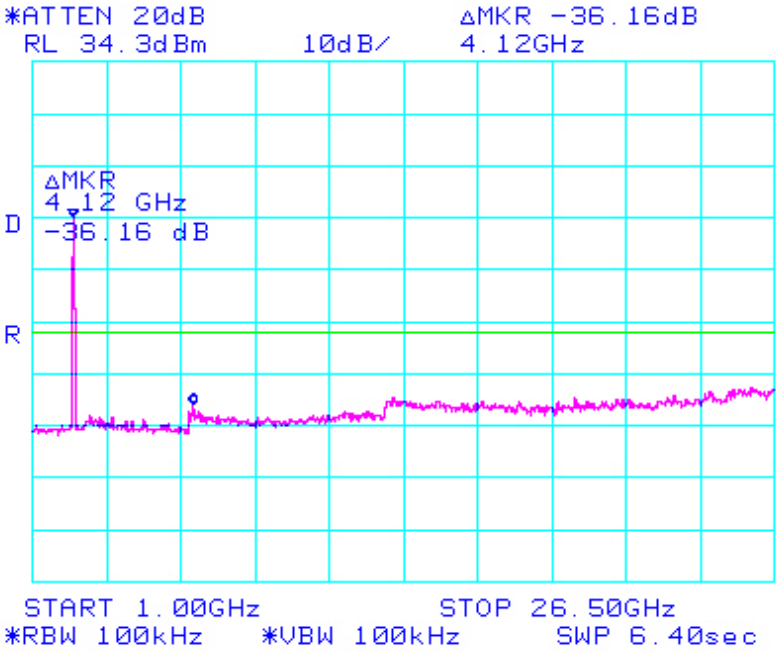


▣ Setting Channel (2 441 MHz)

⇒Frequency Range(30 MHz ~ 3.0 GHz)

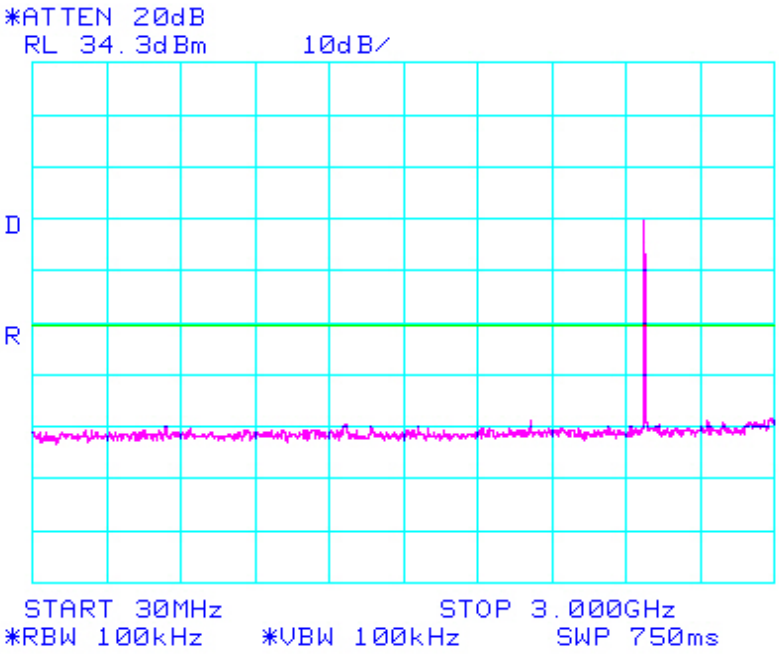



⇒Frequency Range (1 GHz ~ 26.5 GHz)

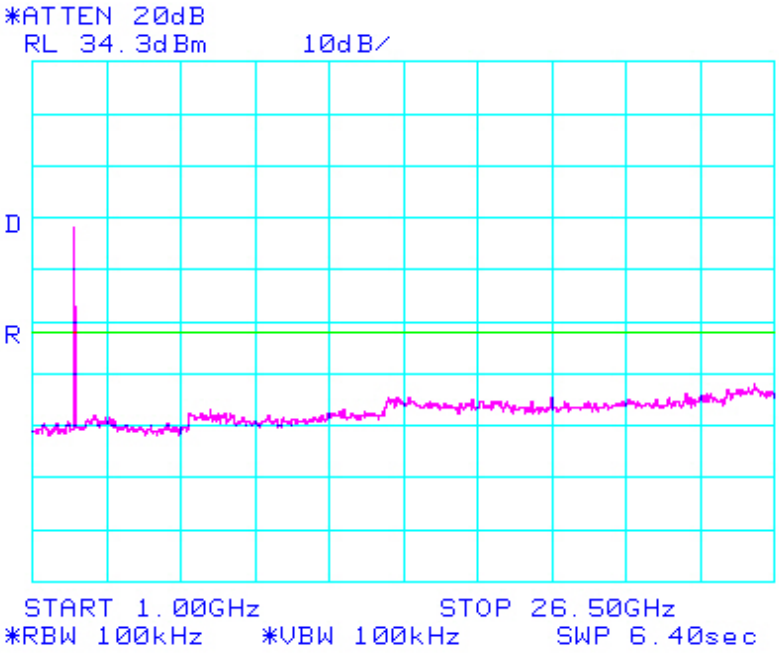


▣ Setting Channel (2 480 MHz)

⇒Frequency Range(30 MHz ~ 3.0 GHz)

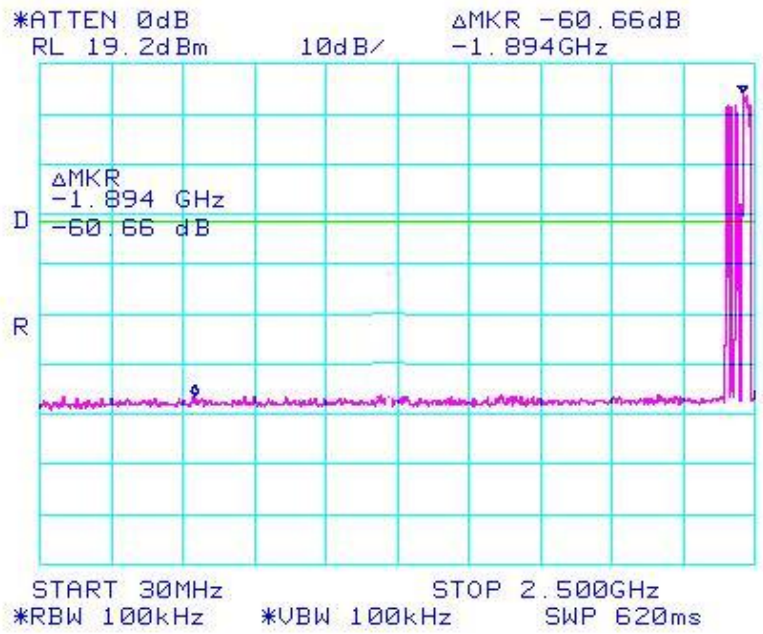



⇒Frequency Range (1 GHz ~ 26.5 GHz)

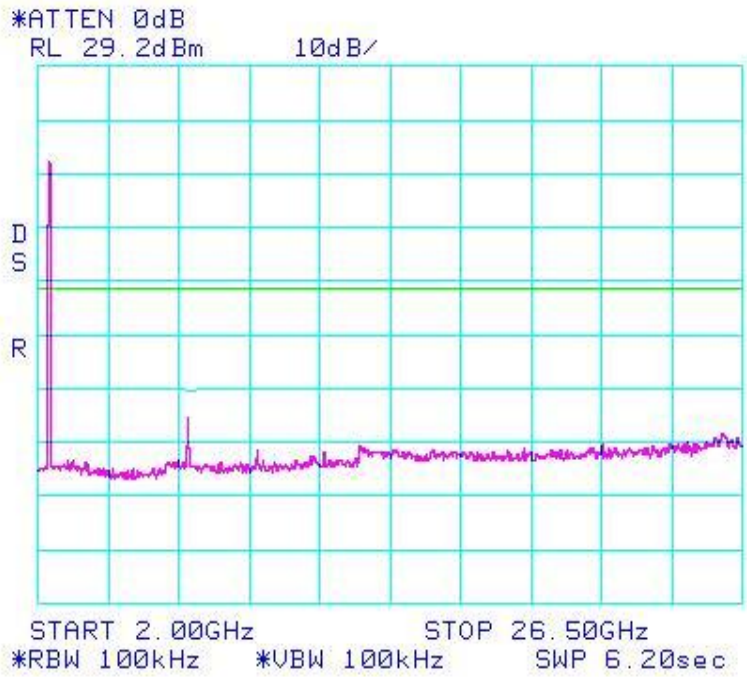


## 5.6.7 Test Plot (Hopping on)

⇒Frequency band (30 MHz ~ 2.5 GHz)




⇒Frequency band (2 GHz ~ 26.5 GHz)



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## 5.7 Spurious RF Radiated emissions

5.7.1 Standard Applicable [ FCC §15.247(d) ]

All other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10 GHz, the frequency Range of measurements : to the tenth harmonic of the highest fundamental frequency or to 40 GHz, Whichever is lower. In addition, radiated emissions which fall in the restricted bands, as defined in Sec.15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a)

§15.209. limits for radiated emissions measurements (distance at 3m)

| Frequency Band [MHz] | Limit [μV/m] | Limit [dBμV/m] | Detector |
|---|---|---|---|
| 30 - 88 | 100 ** | 40.00 | Quasi peak |
| 88 - 216 | 150 ** | 43.52 | Quasi peak |
| 216 - 960 | 200 ** | 46.02 | Quasi peak |
| Above 960 | 500 | 54.00 | Average |

** fundamental emissions from intentional radiators operation under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, or 470-806 MHz. However, operation within these Frequency bands is permitted under other sections of this Part Section 15.231 and 15.241

§15.205. [Table 1] : Restrict Band of Operation

| Only spurious emissions are permitted in any of the frequency bands listed below ; | | | |
|---|---|---|---|
| [MHz] | [MHz] | [MHz] | [GHz] |
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| 0.495 - 0.505** | 16.694 75 - 16.695 25 | 608 - 614 | 5.35 - 5.46 |
| 2.173 5 - 2.190 5 | 16.804 25 - 16.804 75 | 960 – 1 240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1 300 – 1 427 | 8.025 - 8. |
| 4.177 25 - 4.177 75 | 37.5 -38.25 | 1 435 – 1 626.5 | 9.0 - 9.2 |
| 4.207 25 - 4.207 75 | 73 - 74.6 | 1 645.5 – 1 646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1 660 – 1 710 | 10.6 - 12.7 |
| 6.267 75 - 6.268 25 | 108 - 121.94 | 1 718.8 -1 722.2 | 13.25 - 13. |
| 6.311 75 - 6.312 25 | 123 - 138 | 2 200 – 2 300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2 310 – 2 390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.524 75 - 156.525 25 | 2 483.5 – 2 500 | 17.7 - 21.4 |
| 8.376 25 - 8.38 6 75 | 156.7 - 156.9 | 2 690 – 2 900 | 22.01 - 23.12 |
| 8.414 25 - 8.414 75 | 162.012 5 - 167.17 | 3 260 – 3 267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3 332 – 3 339 | 31.2 - 31.8 |
| 12.519 75 - 12.520 25 | 240 - 285 | 3 345.8 – 3 358 | 36.43 - 36.5 |
| 12.576 75 - 12.577 25 | 322 - 335.4 | 3 600 – 4 400 | Above 38.6 |

** Until February 1, 1999, this restricted band shall be 0.490-0.510

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### 5.7.2 Test Environment conditions

• Ambient temperature : 19 ℃,

• Relative Humidity : (48 ~ 50) % R.H.

• Pressure : 100.5 kPa

### 5.7.3 Measurement Procedure

① As below test setup figure, for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is test mode function. Also was placed on a non-metallic table height of 0.8 m above the reference ground plane. If EUT is connected to cables, that were fixed to cause maximum emission. Horn antenna was used to for above 1 GHz and Broadband antenna below 1 GHz. it made with the antenna positioned in both the horizontal and vertical planes of polarization.

② For emission frequencies measured each below and above 1 GHz, a pre-scan is performed in a Shield chamber to determine the accurate frequencies before final test, after maximum emissions level will be checked on a open test site and measuring distance is 3 m from EUT to receiver antenna.

③ For emission frequencies measured below 1 GHz, set the Test Receiver on a 120 KHz resolution bandwidth using measurement instrumentation employing a CISPR quasi-peak detector. and for above 1 GHz set the spectrum analyzer on a 1 MHz resolution bandwidth with average and peak detector for each frequency measured in step② and then EUT is located Position X,Y,Z on turn table (in this EUT is only Y axis)

④ The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0º to 360º with a speed as slow as possible, and keep the highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

⑤ Repeat step④ until all frequencies to be measured were complete.

⑥ Repeat step⑤ with search antenna in vertical polarized orientations.

⑦ Check the frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worst case and record the result.

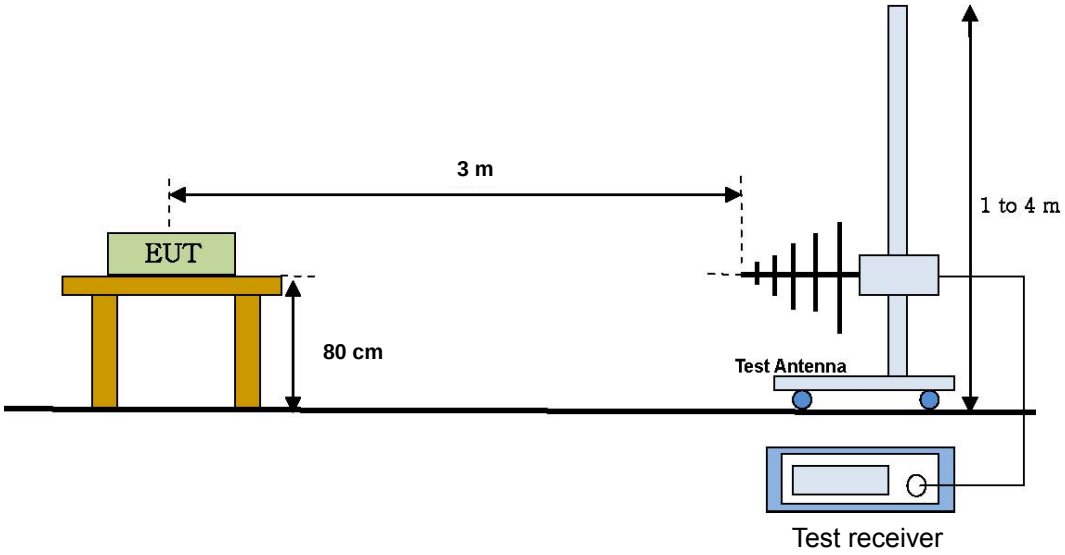
The measurement results are obtained as described below:

Result(dB$\mu$V/m) = Reading(dB$\mu$V/m) + Antenna factor(dB/m)+ CL(dB) + other applicable factor (dB)

### 5.7.4 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are test receiver, Cable loss, Antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, Antenna frequency interpolation, measurement distance variation, Site imperfection, mismatch, and system repeatability based on NIS 80,81, The measurement uncertainty level with a 95 % confidence level were apply to Uncertainty of a radiation emissions measurement at OATS(Open Area Test Site) of KOSTEC is ± 4.0 dB

### 5.7.5 Test Configuration




※ In case of above 1 GHz is using the Horn antenna instead of Broadband Antennal

[ Radiated emission setup ]

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## 5.7.6 Measurement Result (BT Chip Module 1)

### ▣ Lowest Channel 1 ( 2 402 MHz )

Below 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 647.48 | 33.56 | 180 | 1.8 | V | 17.71 | 8.50 | 25 | 34.77 | 46.02 | 11.25 | Pass |
| Above 647.48 | Nil emission | | | | | | | | | | |

Above 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1,128 | 35.60 | 95 | 1.5 | H | 24.72 | 2.51 | 25 | 37.83 | 54 | 16.17 | Pass |
| 1,128 | 39.46 | 95 | 1.5 | H | 24.72 | 2.51 | 25 | 41.69 | 74 | 32.31 | Pass |
| 4,803 | 31.25 | 114 | 1.6 | V | 32.06 | 5.23 | 25 | 38.82 | 54 | 15.18 | Pass |
| 4,803 | 35.34 | 114 | 1.6 | V | 32.06 | 5.23 | 25 | 47.63 | 74 | 26.37 | Pass |
| Above 4,803 | Nil emission | | | | | | | | | | |

※ Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule15.35
※ Limit: 54dB㎶/m(Average), 74dB㎶/m(Peak)

Freq.(㎒) : Measurement frequency, Reading(dB㎶/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table,

Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor
Cbl(dB) : Cable loss, Pre AMP(dB) : Preamplifier gain(dB)

Meas Result (dB㎶/m ) :Reading(dB㎶/m)+ Antenna factor.(dB/m )+ CL(dB) - Pre AMP(dB)
Limit(dB㎶/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB㎶/m) – Meas Result(dB㎶/m),

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## ▣ Middle Channel 40 ( 2 441 MHz )

Below 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 726.25 | 34.46 | 110 | 1.7 | H | 16.97 | 8.48 | 25 | 34.91 | 46.02 | 11.11 | Pass |
| Above 726.25 | Nil emission | | | | | | | | | | |

Above 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1,112 | 30.25 | 105 | 1.5 | H | 23.92 | 2.44 | 25 | 31.61 | 54 | 22.39 | Pass |
| 1,112 | 35.12 | 105 | 1.5 | H | 23.92 | 2.44 | 25 | 36.48 | 74 | 37.52 | Pass |
| 4,880 | 32.24 | 125 | 1.6 | V | 32.13 | 5.60 | 25 | 44.97 | 54 | 9.03 | Pass |
| 4,880 | 36.10 | 125 | 1.6 | V | 32.13 | 5.60 | 25 | 48.83 | 74 | 25.17 | Pass |
| Above 4,880 | Nil emission | | | | | | | | | | |

※ Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule 15.35
※ Limit: 54dB㎶/m(Average), 74dB㎶/m(Peak)

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## ▣ Highest Channel 79 ( 2 480 MHz )

Below 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 895.65 | 30.56 | 115 | 1.6 | H | 17.26 | 9.15 | 25 | 31.97 | 46.02 | 14.05 | Pass |
| Above 895.65 | Nil emission | | | | | | | | | | |

Above 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1,238 | 35.66 | 80 | 1.7 | H | 24.73 | 5.62 | 25 | 41.01 | 54 | 12.99 | Pass |
| 1,238 | 40.56 | 80 | 1.7 | H | 24.73 | 5.62 | 25 | 45.91 | 74 | 28.09 | Pass |
| 4,936 | 29.37 | 115 | 1.6 | V | 33.08 | 5.98 | 25 | 43.43 | 54 | 10.57 | Pass |
| 4,936 | 32.85 | 115 | 1.6 | V | 33.08 | 5.98 | 25 | 46.91 | 74 | 27.09 | Pass |
| Above 4,936 | Nil emission | | | | | | | | | | |

※ Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule 15.35
※ Limit: 54dB㎶/m(Average), 74dB㎶/m(Peak)

Freq.(㎒) : Measurement frequency, Reading(dB㎶/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table,

Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor
Cbl(dB) : Cable loss, Preamplifier gain(dB)

Meas Result (dB㎶/m ) :Reading(dB㎶/m)+ Antenna factor.(dB/m )+ CL(dB) - Pre AMP(dB)
Limit(dB㎶/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB㎶/m) – Meas Result(dB㎶/m),

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## 5.7.7 Measurement Result (BT Chip Module 2)

### ▣ Lowest Channel 1 ( 2 402 MHz )

Below 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 647.44 | 34.67 | 180 | 1.8 | V | 17.71 | 8.50 | 25 | 35.88 | 46.02 | 10.14 | Pass |
| Above 647.48 | Nil emission | | | | | | | | | | |

Above 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1,127 | 36.56 | 95 | 1.5 | H | 24.72 | 2.52 | 25 | 38.80 | 54 | 15.20 | Pass |
| 1,127 | 40.02 | 95 | 1.5 | H | 24.72 | 2.52 | 25 | 42.26 | 74 | 31.74 | Pass |
| 4,802 | 30.25 | 114 | 1.6 | V | 32.06 | 5.23 | 25 | 42.54 | 54 | 11.46 | Pass |
| 4,802 | 35.00 | 114 | 1.6 | V | 32.06 | 5.23 | 25 | 47.29 | 74 | 26.71 | Pass |
| Above 4,802 | Nil emission | | | | | | | | | | |

※ Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule15.35
※ Limit: 54dB㎶/m(Average), 74dB㎶/m(Peak)

Freq.(㎒) : Measurement frequency, Reading(dB㎶/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table,

Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor
Cbl(dB) : Cable loss, Pre AMP(dB) : Preamplifier gain(dB)

Meas Result (dB㎶/m ) :Reading(dB㎶/m)+ Antenna factor.(dB/m )+ CL(dB) - Pre AMP(dB)
Limit(dB㎶/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB㎶/m) – Meas Result(dB㎶/m),

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## ▣ Middle Channel 40 ( 2 441 MHz )

Below 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 726.28 | 35.24 | 110 | 1.7 | H | 16.95 | 8.47 | 25 | 35.66 | 46.02 | 10.36 | Pass |
| Above 726.28 | Nil emission | | | | | | | | | | |

Above 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1,109 | 32.43 | 90 | 1.5 | H | 23.91 | 2.42 | 25 | 33.76 | 54 | 20.24 | Pass |
| 1,109 | 36.56 | 90 | 1.5 | H | 23.91 | 2.42 | 25 | 37.89 | 74 | 36.11 | Pass |
| 4,878 | 31.25 | 110 | 1.7 | V | 32.13 | 5.59 | 25 | 43.97 | 54 | 10.03 | Pass |
| 4,878 | 35.89 | 110 | 1.7 | V | 32.13 | 5.59 | 25 | 48.61 | 74 | 25.39 | Pass |
| Above 4,878 | Nil emission | | | | | | | | | | |

※ Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule 15.35
※ Limit: 54dB㎶/m(Average), 74dB㎶/m(Peak)

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## ▣ Highest Channel 79 ( 2 480 MHz )

Below 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 895.63 | 29.89 | 110 | 1.6 | H | 17.25 | 9.14 | 25 | 31.28 | 46.02 | 14.74 | Pass |
| Above 895.65 | Nil emission | | | | | | | | | | |

Above 1 ㎓

| Freq. (㎒) | Reading (dB㎶/m) | Table (Deg) | Antenna | | | CL (dB) | Pre AMP (dB) | Meas Result (dB㎶/m) | Limit (dB㎶/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1,236 | 34.65 | 116 | 1.6 | H | 24.71 | 5.61 | 25 | 39.97 | 54 | 14.03 | Pass |
| 1,236 | 39.97 | 116 | 1.6 | H | 24.71 | 5.61 | 25 | 45.29 | 74 | 28.71 | Pass |
| 4,935 | 30.28 | 94 | 1.8 | V | 33.07 | 5.97 | 25 | 38.35 | 54 | 15.65 | Pass |
| 4,935 | 31.25 | 94 | 1.8 | V | 33.07 | 5.97 | 25 | 45.29 | 74 | 28.71 | Pass |
| Above 4,936 | Nil emission | | | | | | | | | | |

※ Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule 15.35
※ Limit: 54dB㎶/m(Average), 74dB㎶/m(Peak)

Freq.(㎒) : Measurement frequency, Reading(dB㎶/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table,

Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor
Cbl(dB) : Cable loss, Preamplifier gain(dB)

Meas Result (dB㎶/m ) :Reading(dB㎶/m)+ Antenna factor.(dB/m )+ CL(dB) - Pre AMP(dB)
Limit(dB㎶/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB㎶/m) – Meas Result(dB㎶/m),

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## 5.8 AC Power Conducted emissions

### 5.8.1 Standard Applicable [FCC §15.207(a)]

For intentional radiator that is designed to be connected to the public utility(AC)power line, the radio frequency Voltage that is conducted back onto the AC power line on any frequencies hopping mode within the band 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50uH/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on The measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

| Frequency of Emission(MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

* Decreases with the logarithm of the frequency

### 5.8.2 EUT used cable

| Cable Type | Shield | Length (m) | Ferrite | Connector | Connection Port 1 | Connection Port 2 |
|---|---|---|---|---|---|---|
| Power Cable | No | 1.0 | No | Din | DC(IN) | Adaptor |
| Audio Cable | Yes | 1.5 | No | Jack | Audio (IN) | PC |
| USB Cable | Yes | 1.0 | No | USB | USB | Headset |

※Connection Port 1 is subject to E.U.T.

### 5.8.3 Operating conditions

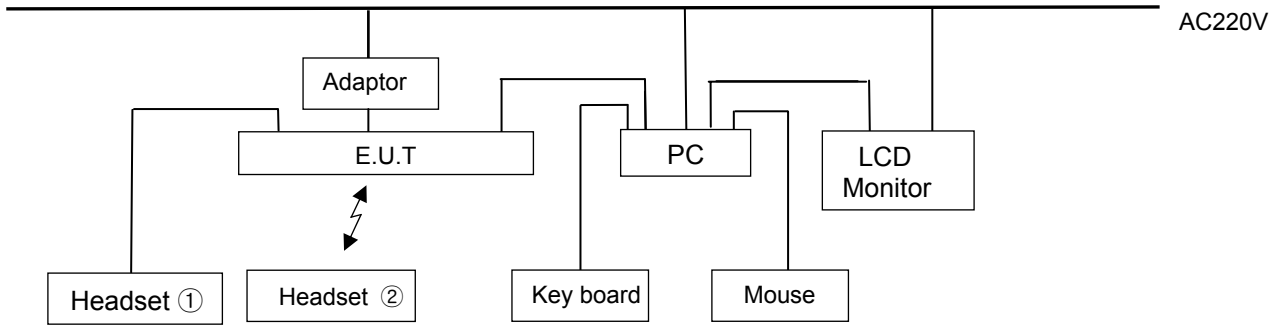
The operating mode/system was as follows in details:

Establish of BT communication link between Headset(EUT) and Mobile phone under the battery charging mode through USB connection. The mobile phone was set up with send to continuous calling (Inquiry mode) In order to search on BT device, So BT is Answer mode on frequencies band (2 402 MHz ~ 2 480 MHz)

### 5.8.4 Used Peripherals

| Description | Manufacturer | Model / Part No | Serial Number |
|---|---|---|---|
| Note book PC | Dell Inc. | PP25L | CN-OXN850-48661-84P-25QH |
| Adaptor | Seung Bo Elecom Co.,Ltd. | SP0701A | SB0908000844 |
| | | | |

### 5.8.5 E.U.T Test Configuration




### 5.8.6 Measurement Procedure

A pretest was performed at 3 m distances in a semi-anechoic chamber for searching correct Frequency.

The final test was done at a 10 m open area test site with a quasi-peak detector. EUT was placed on a non-metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization.

The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

### 5.8.7 Test Data

| FREQ. | LEVEL(dBμV) | | LINE | Loss | LIMIT(dBμV) | | MARGIN(dB) | |
|---|---|---|---|---|---|---|---|---|
| (MHz) | QP | AV | Pol | (dB) | QP | AV | QP | AV |
| 0.154 | 41.43 | 23.92 | N | 0.08 | 65.36 | 55.36 | 23.93 | 31.44 |
| 0.250 | 42.90 | 33.93 | N | 0.29 | 63.53 | 53.53 | 20.63 | 19.60 |
| 0.438 | 36.28 | 31.31 | L | 0.29 | 61.12 | 51.12 | 24.84 | 19.81 |
| 0.634 | 33.56 | 29.40 | N | 0.90 | 56.00 | 46.00 | 22.44 | 16.60 |
| 2.766 | 27.97 | 16.76 | N | 0.57 | 56.00 | 46.00 | 28.03 | 29.24 |
| 4.438 | 31.67 | 19.02 | N | 0.68 | 56.00 | 46.00 | 24.33 | 26.98 |
| 5.166 | 29.73 | 17.96 | L | 0.75 | 60.00 | 50.00 | 30.27 | 32.04 |
| 7.638 | 19.24 | 10.15 | N | 1.20 | 60.00 | 50.00 | 40.76 | 39.85 |
| 14.874 | 26.09 | 18.31 | L | 1.69 | 60.00 | 50.00 | 33.91 | 31.69 |

* Note: Measurement uncertainty ; ± 2.4 dB (*K=2*)

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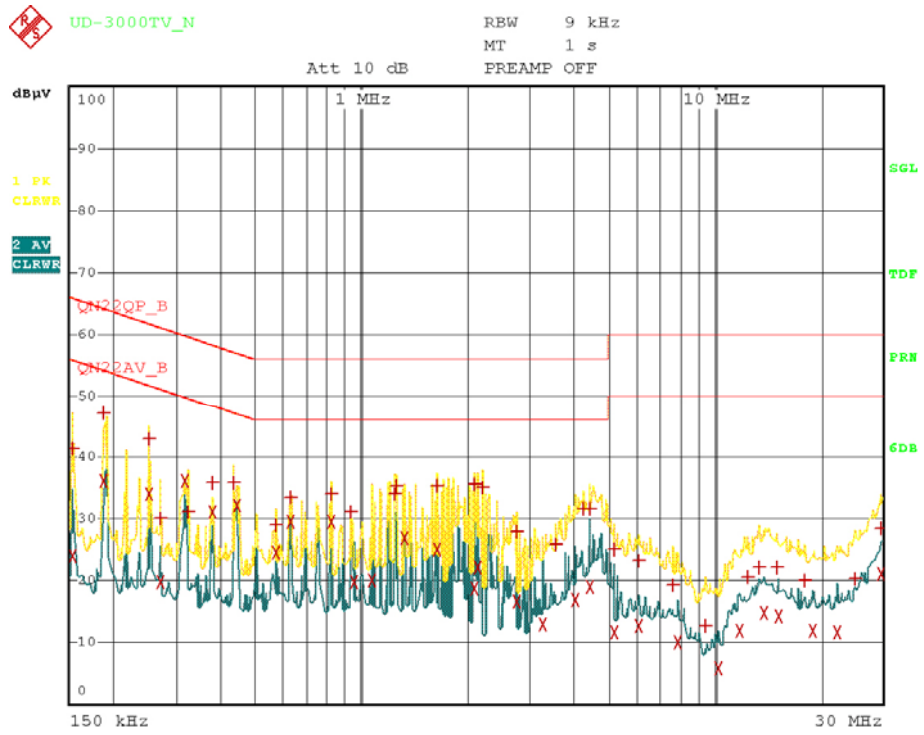
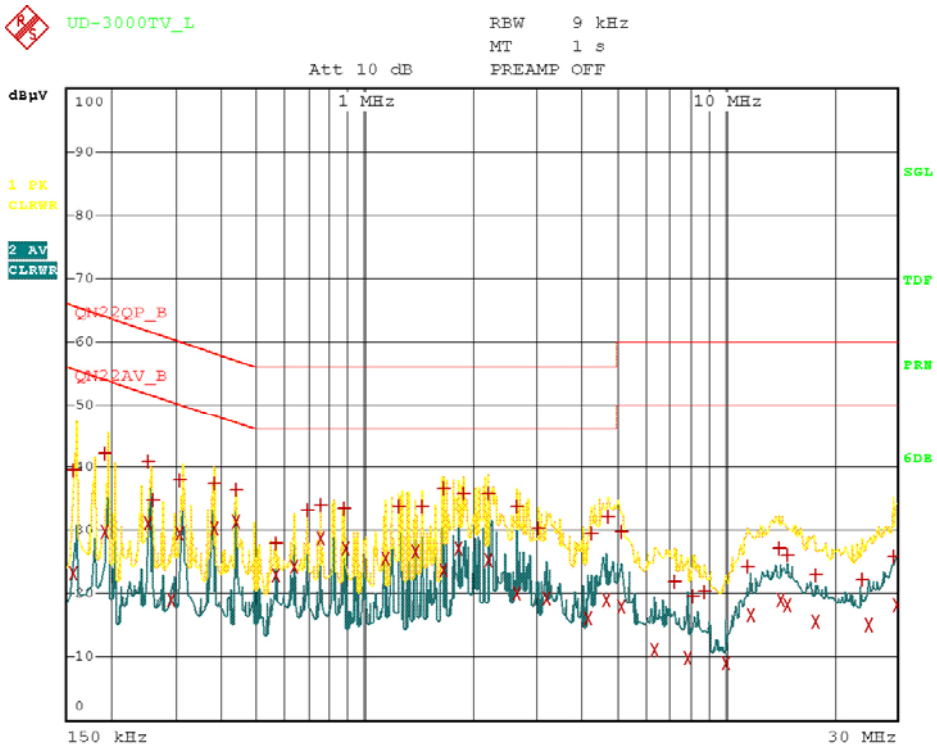
## ■ Conducted Emission test graph

Line. Live




Date: 22.FEB.2010 21:00:17

Line. Neutral




Date: 22.FEB.2010 20:55:52

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## 5.9 Antenna requirement

### 5.9.1 Standard applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit So that broken antenna can be replaced by the user, but the Use of a standard antenna jack or electrical connector is prohibited.

And according to, the conducted output power limit specified in paragraph(b) of this section §15.247 is based on the use of antennas with directional gains that do not exceed 6dBi.

According to above requirement standard's This product's antenna type is an Chip and it's gain is 1.10dBi, (In-band) So, antenna gain in this product is below requirement standard limit

### 5.9.2 Antenna gain

| Frequency Band | Gain [dBi] | Limit [dBi] | Results |
|---|---|---|---|
| 2 402 MHz – 2 480 MHz | 1.10 | ≤ 6 | Compliance |