

# TEST REPORT

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                     |                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <p>1. Applicant</p> <ul style="list-style-type: none"> <li>• Name : SAM JIN CO., LTD.</li> <li>• Address : 81, Anyangcheonseo-ro, Manan-gu Anyang-si, Gyeonggi-do, South Korea</li> </ul> <p>2. Test Item</p> <ul style="list-style-type: none"> <li>• Product Name: HUB</li> <li>• Model Name: STH-ETH-300</li> <li>• Brand: None</li> <li>• FCC ID: 2AF4S-STH-ETH-300      • IC : 20753-STHETH300</li> </ul> <p>3. Manufacturer</p> <ul style="list-style-type: none"> <li>• Name : QINGDAO SANJIN ELECTRONIC CO.,LTD.</li> <li>• Address : 81, Anyangcheonseo-ro, Manan-gu Anyang-si, Gyeonggi-do, South Korea</li> </ul> <p>4. Date of Test : 2017. 12. 07. ~ 2017. 12. 08.</p> <p style="text-align: center;">FCC CFR 47, Part 15. Subpart C-15.247<br/>558074 D01 DTS Meas. Guidance v04</p> <p>5. Test Method Used :<br/>                 RSS-GEN Issue 4<br/>                 RSS-247 Issue 2</p> <p>6. Test Result : Compliance</p> <p>7. Note: None</p> |                                                     |                                                                                                                                                                          |
| <p><b>Supplementary Information</b></p> <p>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 <u>ANSI C 63.10-2013</u>.</p> <p>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.</p>                                                                                                                                                                                                                                                                                                                                      |                                                     |                                                                                                                                                                          |
| <p>The results shown in this test report refer only to the sample(s) tested unless otherwise stated.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |                                                                                                                                                                          |
| Affirmation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Tested by<br>Name : Jung, Ho-cheol      (Signature) | Technical Manager<br>Name : Park, Gyeong-Hyeon      (Signature)                                                                                                          |
| <p style="text-align: center;">2018. 04. 18.</p> <p style="text-align: center;"><b>KOSTEC Co., Ltd.</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                     |                                                                                                                                                                          |

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## 1. GENERAL INFORMATION

### 1.1 Test Facility

#### Test laboratory and address

KOSTEC Co., Ltd.

128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

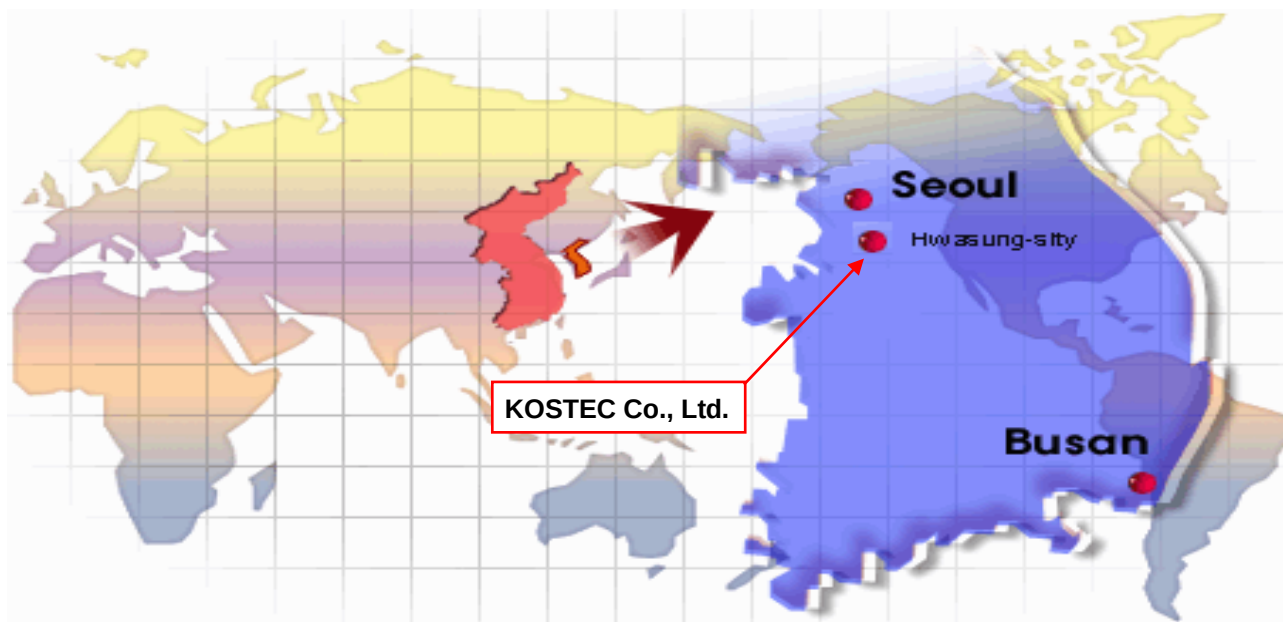
#### Registration information

KOLAS No. : 232

FCC Designation No. : KR0041

IC Registration Site No. : 8305A-1

### 1.2 Location



### 1.3 Revision History of test report

| Rev. | Revisions                        | Effect page | Reviewed           | Date          |
|------|----------------------------------|-------------|--------------------|---------------|
| -    | Initial issue                    | All         | Gyeong Hyeon, Park | 2018. 02. 09. |
| 1    | Revised address and Product name | 1, 5        | Gyeong Hyeon, Park | 2018. 04. 16. |
| 2    | Revised Used Test Equipment List | 8~9         | Gyeong Hyeon, Park | 2018. 04. 18. |

## 2. EQUIPMENT DESCRIPTION

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

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment Name        | HUB                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Model No              | STH-ETH-300                                                                                                                                                                                                                                                                                                                                                                                                              |
| Usage                 | Smart Hub                                                                                                                                                                                                                                                                                                                                                                                                                |
| Serial Number         | Proto type                                                                                                                                                                                                                                                                                                                                                                                                               |
| Modulation type       | QPSK                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Emission Type         | G1D                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Maximum output power  | 9.27 dBm                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Operated Frequency    | 2 405 MHz ~ 2 480 MHz                                                                                                                                                                                                                                                                                                                                                                                                    |
| Channel Number        | 16                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Operation temperature | -10 °C ~ 55 °C                                                                                                                                                                                                                                                                                                                                                                                                           |
| Power Source          | Adapter DC 5.0 V                                                                                                                                                                                                                                                                                                                                                                                                         |
| Antenna Description   | Internal PCB pattern antenna, gain : 2.53 dBi                                                                                                                                                                                                                                                                                                                                                                            |
| Remark                | <ol style="list-style-type: none"> <li>1. The device was operating at its maximum output power for all measurements.</li> <li>2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case (X) is shown in the report.</li> <li>3. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.</li> </ol> |
| FCC ID                | 2AF4S-STH-ETH-300                                                                                                                                                                                                                                                                                                                                                                                                        |
| IC                    | 20753- STHETH300                                                                                                                                                                                                                                                                                                                                                                                                         |

### 3. SYSTEM CONFIGURATION FOR TEST

#### 3.1 Characteristics of equipment

The Equipment Under Test (EUT) contains the following capabilities: This equipment is Smart Hub. The detailed explanation is refer as user manual.

#### 3.2 Used peripherals list

| Description | Model No.  | Serial No.    | Manufacture | Remark       |
|-------------|------------|---------------|-------------|--------------|
| Notebook    | LG15N54    | 412NZET043212 | LG          |              |
| Adapter     | PA-1900-14 | None          | LG          | For notebook |

#### 3.3 Product Modification

N/A

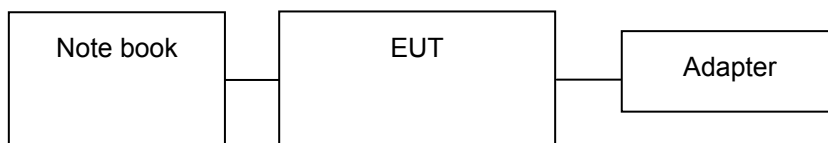
#### 3.4 Operating Mode

Constantly transmitting with a modulated carrier at maximum power on the low, middle and high channels.

#### 3.5 Test Setup of EUT

The measurements were taken in continuous transmit / receive mode using the TEST MODE.

For controlling the EUT as TEST MODE, the test program and the test cables were provided by the applicant.



### 3.6 Parameters of Test Software Setting

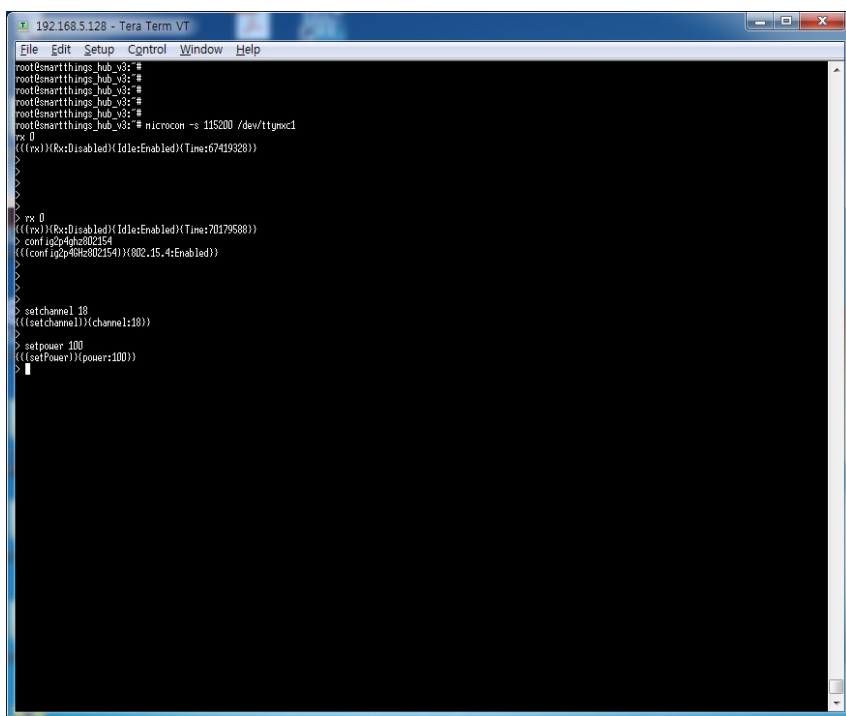
During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

#### ■ TX Power setting value during test

| Band         | Rate | TX Power setting value |           |         |
|--------------|------|------------------------|-----------|---------|
|              |      | Low CH                 | Middle CH | High CH |
| 2.4 GHz band | -    | 100                    | 100       | 100     |

#### ■ Test Program

Tera Term – v4.96



```

192.168.5.128 - Tera Term VT
File Edit Setup Control Window Help
root@earththings_hub_v3: #
root@earththings_hub_v3: #
root@earththings_hub_v3: #
root@earththings_hub_v3: #
root@earththings_hub_v3: # microcon -s 115200 /dev/ttync1
rx 0
(((rx))((RxdDisabled))((IdlesEnabled))((Time:6749328)))
>
>
> rx 0
(((rx))((RxdDisabled))((IdlesEnabled))((Time:70179588)))
> conf igp4ghz802154
(((conf igp4ghz802154))((802.15.4sEnabled)))
>
>
> setchannel 18
(((setchannel))((channel:18)))
>
> setpower 100
(((setPower))((power:100)))
  
```

### 3.7 Table for Carrier Frequencies

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 11      | 2 405           | 19      | 2 445           |
| 12      | 2 410           | 20      | 2 450           |
| 13      | 2 415           | 21      | 2 455           |
| 14      | 2 420           | 22      | 2 460           |
| 15      | 2 425           | 23      | 2 465           |
| 16      | 2 430           | 24      | 2 470           |
| 17      | 2 435           | 25      | 2 475           |
| 18      | 2 440           | 26      | 2 480           |

### 3.9 Used Test Equipment List

| No. | Instrument                    | Model        | S/N          | Manufacturer               | Due to cal date | Cal interval | used                                |
|-----|-------------------------------|--------------|--------------|----------------------------|-----------------|--------------|-------------------------------------|
| 1   | T & H Chamber                 | EY-101       | 90E14260     | TABAI ESPEC                | 2018.09.06      | 1 year       | <input checked="" type="checkbox"/> |
| 2   | T & H Chamber                 | SH-641       | 92006831     | ESPEC CORP                 | 2018.05.31      | 1 year       | <input type="checkbox"/>            |
| 3   | Spectrum Analyzer             | 8563E        | 3846A10662   | Agilent Technology         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 4   | Spectrum Analyzer             | 8593E        | 3710A02859   | Agilent Technology         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 5   | Spectrum Analyzer             | FSV30        | 20-353063    | Rohde & Schwarz            | 2018.02.01      | 1 year       | <input checked="" type="checkbox"/> |
| 6   | Signal Analyzer               | N9010A       | MY56070441   | Agilent Technologies       | 2018.05.15      | 1 year       | <input type="checkbox"/>            |
| 7   | EMI Test Receiver             | ESCI7        | 100823       | Rohde & Schwarz            | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 8   | EMI Test Receiver             | ESI          | 837514/004   | Rohde & Schwarz            | 2017.09.07      | 1 year       | <input type="checkbox"/>            |
| 9   | Vector Signal Analyzer        | 89441A       | 3416A02620   | Agilent Technology         | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 10  | Network Analyzer              | 8753ES       | US39172348   | AGILENT                    | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 11  | EPM Series Power meter        | E4418B       | GB39512547   | Agilent Technology         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 12  | RF Power Sensor               | E9300A       | MY41496631   | Agilent Technology         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 13  | Microwave Frequency Counter   | 5352B        | 2908A00480   | Agilent Technology         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 14  | Modulation Analyzer           | 8901A        | 3538A07071   | Agilent Technology         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 15  | Audio Analyzer                | 8903B        | 3514A16919   | Agilent Technology         | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 16  | Audio Telephone Analyzer      | DD-5601CID   | 520010281    | CREDIX                     | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 17  | Digital storage Oscilloscope  | TDS3052      | B015962      | Tektronix                  | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 18  | ESG-D Series Signal Generator | E4436B       | US39260458   | Agilent Technology         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 19  | Vector Signal Generator       | SMBV100A     | 257557       | Rohde & Schwarz            | 2018.02.02      | 1 year       | <input checked="" type="checkbox"/> |
| 20  | Signal Generator              | SMB100A      | 179628       | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input checked="" type="checkbox"/> |
| 21  | Tracking Source               | 85645A       | 070521-A1    | Agilent Technology         | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 22  | SLIDAC                        | None         | 0207-4       | Myoung sung Ele.           | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 23  | DC Power supply               | DRP-5030     | 9028029      | Digital Electronic Co.,Ltd | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 24  | DC Power supply               | 6038A        | 3440A12674   | Agilent Technology         | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 25  | DC Power supply               | E3610A       | KR24104505   | Agilent Technology         | 2018.01.31      | 1 year       | <input checked="" type="checkbox"/> |
| 26  | DC Power supply               | UP-3005T     | 68           | Unicon Co.,Ltd             | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 27  | DC Power Supply               | SM 3004-D    | 114701000117 | DELTAELEKTRONIKA           | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 28  | Dummy Load                    | 8173         | 3780         | Bird Electronic Co., Corp  | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 29  | Attenuator                    | 50FH-030-500 | 140410 9433  | JEW Industries Inc.        | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 30  | Attenuator                    | 24-30-34     | BX5630       | Aeroflex / Weinschel       | 2017.12.27      | 1 year       | <input type="checkbox"/>            |
| 31  | Attenuator                    | 8498A        | 3318A09485   | HP                         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 32  | Step Attenuator               | 8494B        | 3308A32809   | HP                         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 33  | Attenuator                    | 18B50W-20F   | 64671        | INMET                      | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 34  | Attenuator                    | 10 dB        | 1            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input checked="" type="checkbox"/> |
| 35  | Attenuator                    | 10 dB        | 2            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 36  | Attenuator                    | 10 dB        | 3            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 37  | Attenuator                    | 10 dB        | 4            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 38  | Attenuator                    | 54A-10       | 74564        | WEINSCHHEL                 | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 39  | Attenuator                    | 56-10        | 66920        | WEINSCHHEL                 | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 40  | Power divider                 | 11636B       | 51212        | HP                         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 41  | 3Way Power divider            | KPDSU3W      | 00070365     | KMW                        | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 42  | 4Way Power divider            | 70052651     | 173834       | KRYTAR                     | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 43  | 3Way Power divider            | 1580         | SQ361        | WEINSCHHEL                 | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 44  | OSP                           | OSP120       | 101577       | Rohde & Schwarz            | 2018.05.19      | 1 year       | <input type="checkbox"/>            |
| 45  | White noise audio filter      | ST31EQ       | 101902       | SoundTech                  | 2017.09.07      | 1 year       | <input type="checkbox"/>            |
| 46  | Dual directional coupler      | 778D         | 17693        | HEWLETT PACKARD            | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 47  | Dual directional coupler      | 772D         | 2839A00924   | HEWLETT PACKARD            | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 48  | Band rejection filter         | 3TNF-0006    | 26           | DOVER Tech                 | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 49  | Band rejection filter         | 3TNF-0008    | 317          | DOVER Tech                 | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 50  | Band rejection filter         | 3TNF-0007    | 311          | DOVER Tech                 | 2018.02.03      | 1 year       | <input type="checkbox"/>            |

| No. | Instrument                          | Model                            | S/N         | Manufacturer                | Due to cal date | Cal interval | used                                |
|-----|-------------------------------------|----------------------------------|-------------|-----------------------------|-----------------|--------------|-------------------------------------|
| 51  | Band rejection filter               | WTR-BRF2442-84NN                 | 09020001    | WAVE TECH Co.,LTD           | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 52  | Band rejection filter               | WRCJV12-5695-5725-5825-5855-50SS | 1           | Wainwright Instruments GmbH | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 53  | Band rejection filter               | WRCJV12-5120-5150-5350-5380-40SS | 4           | Wainwright Instruments GmbH | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 54  | Band rejection filter               | WRCGV10-2360-2400-2500-2540-50SS | 2           | Wainwright Instruments GmbH | 2018.05.18      | 1 year       | <input checked="" type="checkbox"/> |
| 55  | Highpass Filter                     | WHJS1100-10EF                    | 1           | WAINWRIGHT                  | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 56  | Highpass Filter                     | WHJS3000-10EF                    | 1           | WAINWRIGHT                  | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 57  | Highpass Filter                     | WHNX6-5530-3000-26500-40CC       | 2           | Wainwright Instruments GmbH | 2018.05.19      | 1 year       | <input type="checkbox"/>            |
| 58  | Highpass Filter                     | WHNX6-2370-7000-26500-40CC       | 4           | Wainwright Instruments GmbH | 2018.05.19      | 1 year       | <input checked="" type="checkbox"/> |
| 59  | WideBand Radio Communication Tester | CMW500                           | 102276      | Rohde & Schwarz             | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 60  | Radio Communication Tester          | CMU 200                          | 112026      | Rohde & Schwarz             | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 61  | Bluetooth Tester                    | TC-3000B                         | 3000B6A0166 | TESCOM CO., LTD.            | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 62  | Loop Antenna                        | 6502                             | 9203-0493   | EMCO                        | 2019.05.29      | 2 year       | <input checked="" type="checkbox"/> |
| 63  | BiconiLog Antenna                   | 3142B                            | 9910-1432   | EMCO                        | 2018.04.25      | 2 year       | <input checked="" type="checkbox"/> |
| 64  | Trilog-Broadband Antenna            | VULB 9168                        | 9168-606    | SCHWARZBECK                 | 2018.09.09      | 2 year       | <input type="checkbox"/>            |
| 65  | Horn Antenna                        | 3115                             | 2996        | EMCO                        | 2018.02.11      | 2 year       | <input checked="" type="checkbox"/> |
| 66  | Horn Antenna                        | BBHA9170                         | BBHA9170152 | SCHWARZBECK                 | 2019.04.25      | 2 year       | <input checked="" type="checkbox"/> |
| 67  | Antenna Master(3)                   | AT13                             | None        | AUDIX                       | N/A             | N/A          | <input type="checkbox"/>            |
| 68  | Turn Table(3)                       | None                             | None        | AUDIX                       | N/A             | N/A          | <input type="checkbox"/>            |
| 69  | PREAMPLIFIER(3)                     | 8449B                            | 3008A02577  | Agilent                     | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 70  | Antenna Master(10)                  | MA4000-EP                        | None        | inno systems GmbH           | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 71  | Turn Table(10)                      | None                             | None        | inno systems GmbH           | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 72  | AMPLIFIER(10)                       | TK-PA6S                          | 120009      | TESTEK                      | 2018.01.31      | 1 year       | <input checked="" type="checkbox"/> |
| 73  | AMPLIFIER                           | 8447D                            | 2944A07881  | H.P                         | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 74  | Antenna Mast                        | MA2000-EP                        | None        | inno systems GmbH           | N/A             | N/A          | <input type="checkbox"/>            |
| 75  | Turn Device                         | DE3700-RH                        | None        | inno systems GmbH           | N/A             | N/A          | <input type="checkbox"/>            |

## 4. SUMMARY TEST RESULTS

| Description of Test                                                                                                                                                                                                                    | FCC Rule                | IC Rule         | Reference Clause | Used                                | Test Result |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------|------------------|-------------------------------------|-------------|
| Max. Conducted output power                                                                                                                                                                                                            | 15.247(b)               | RSS-247, 5.4(d) | Clause 5.1       | <input checked="" type="checkbox"/> | Compliance  |
| Power spectral density                                                                                                                                                                                                                 | 15.247(e)               | RSS-247, 5.2(b) | Clause 5.2       | <input checked="" type="checkbox"/> | Compliance  |
| 6 dB spectrum Bandwidth                                                                                                                                                                                                                | 15.247(a)(2)            | RSS-247, 5.2(a) | Clause 5.3       | <input checked="" type="checkbox"/> | Compliance  |
| Band edge of RF conducted emissions                                                                                                                                                                                                    | 15.247(d)               | RSS-247, 5.5    | Clause 5.4       | <input checked="" type="checkbox"/> | Compliance  |
| Spurious RF radiated emissions                                                                                                                                                                                                         | 15.247(d),<br>15.209(a) | RSS-247, 5.5    | Clause 5.5       | <input checked="" type="checkbox"/> | Compliance  |
| Antenna requirement                                                                                                                                                                                                                    | 15.203,<br>15.247(b)    | -               | Clause 5.6       | <input checked="" type="checkbox"/> | Compliance  |
| AC Power Conducted emissions                                                                                                                                                                                                           | 15.207                  | RSS-GEN, 8.8    | Clause 5.7       | <input checked="" type="checkbox"/> | Compliance  |
| Compliance/pass : 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. |                         |                 |                  |                                     |             |

### Procedure Reference

FCC CFR 47, Part 15. Subpart C-15.247

558074 D01 DTS Meas. Guidance v04

RSS-GEN Issue 4

RSS-247 Issue 2

ANSI C 63.10-2013

## 5. MEASUREMENT RESULTS

### 5.1 Max. Conducted output power

#### 5.1.1 Standard Applicable [FCC §15.247(b)(3) and RSS-247 5.4 (d)]

##### FCC

For systems using digital modulation in the 902 ~ 928 MHz, 2 400 ~ 2 483.5 MHz, and 5 725 ~ 5 850 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.

##### IC

For DTS employing digital modulation techniques operating in the bands 902 – 928 MHz and 2400 – 2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W. Fixed point-to-point systems in the bands 2400-2483.5 MHz and 5725-5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding an e.i.r.p. of 4 W.

#### 5.1.2 Test Environment conditions

- Ambient temperature : (24 ~ 25) °C • Relative Humidity : (49 ~ 55) % R.H.

#### 5.1.3 Measurement Procedure

The transmitter output was connected to the spectrum analyzer with an attenuator. The maximum peak output power was measured and recorded with the spectrum analyzer. EUT was programmed to be in continuously transmitting mode.

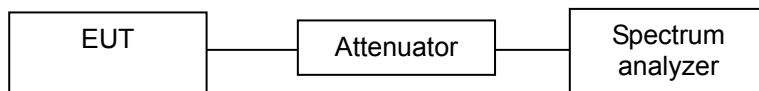
All conducted power tests were performed using a test receiver in accordance with FCC KDB 558074 v04 Section 9.1.1 Measurement Procedure RBW  $\geq$  DTS bandwidth and 9.2.2.4.

The spectrum analyzer is set to the as follows :

##### Peak Power

- Set RBW  $\geq$  DTS bandwidth
- Set the VBW  $\geq 3 \times$  RBW.
- Set the span  $3 \times$  RBW.
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

#### 5.1.4 Test setup

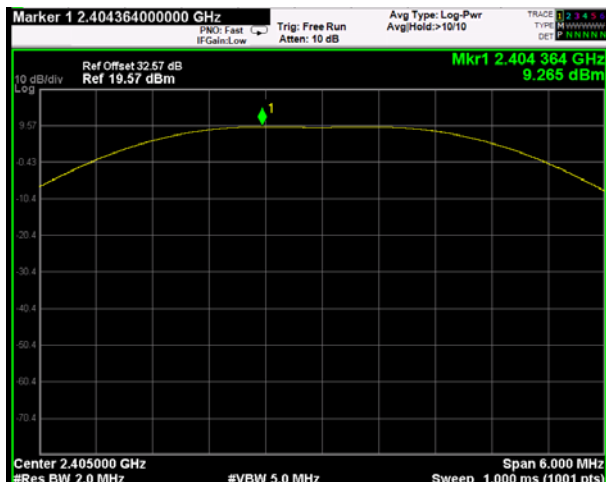


### 5.1.5 Measurement Result

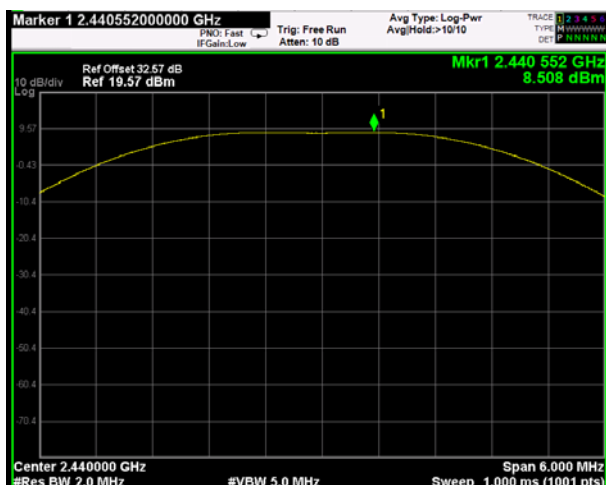
| Channel | Frequency<br>[MHz] | Conducted Power | Limit<br>[dBm] | Test Results |
|---------|--------------------|-----------------|----------------|--------------|
|         |                    | [dBm]           |                |              |
| 11      | 2 405              | 9.27            | 30             | Compliance   |
| 18      | 2 440              | 8.51            | 30             | Compliance   |
| 26      | 2 480              | 9.07            | 30             | Compliance   |

## 5.1.6 Test Plot

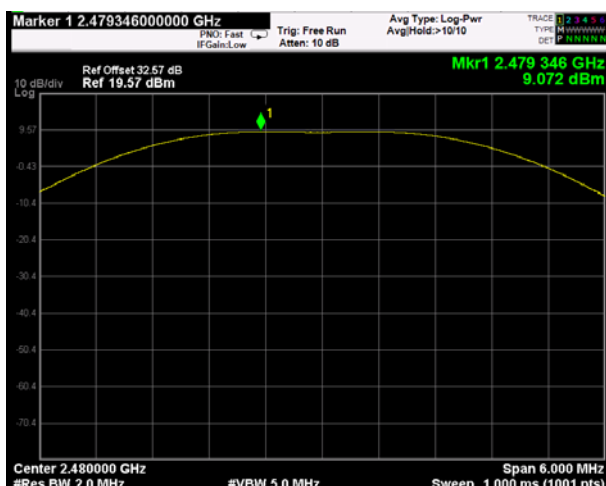
### CH Low



### CH Middle



### CH High



## 5.2 Power spectral density

### 5.2.1 Standard Applicable [FCC §15.247(e) and RSS-247 5.2(b)]

#### FCC

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 transmit

#### IC

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

### 5.2.2 Test Environment conditions

- Ambient temperature : (24 ~ 25) °C
- Relative Humidity : (49 ~ 55) % R.H.

### 5.2.3 Measurement Procedure

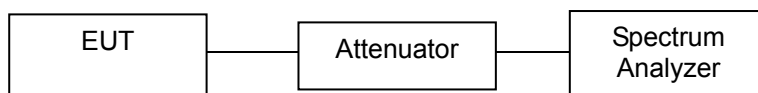
The power spectral density conducted from the intentional radiator was measured with a spectrum analyzer connected to the antenna terminal, while EUT had the highest, middle and the lowest available channels. After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak power spectral density.

All conducted power tests were performed using a test receiver in accordance with FCC KDB 558074 v04 Section 10.1

The spectrum analyzer is set to the as follows :

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- Set the VBW  $\geq 3 \times \text{RBW}$ .
- 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.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 5.2.4 Test setup

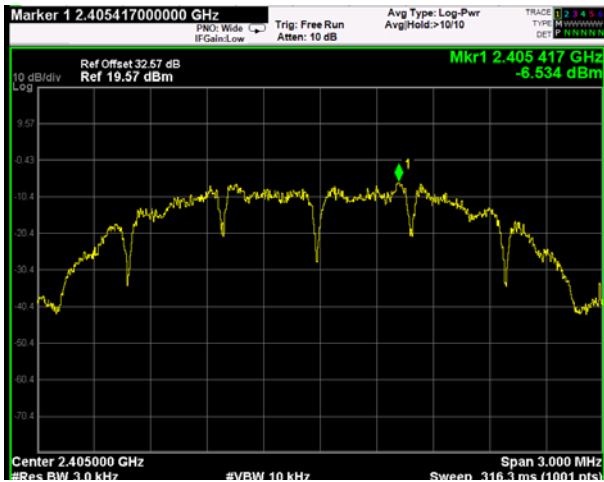


### 5.2.5 Measurement Result

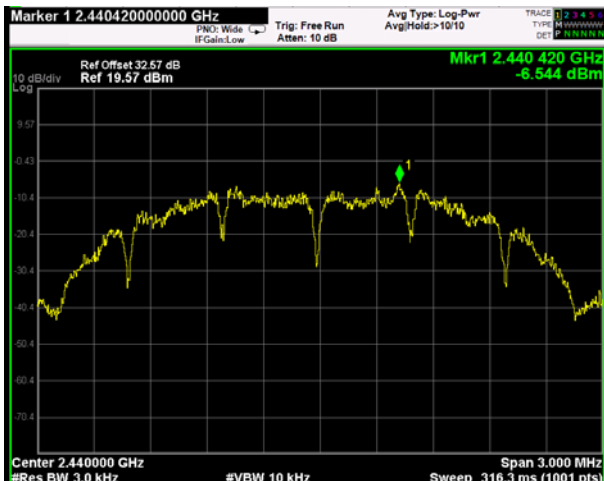
| Channel | Frequency [MHz] | Result Value [dBm/3kHz] | Limit [dBm/3kHz] | Test Results |
|---------|-----------------|-------------------------|------------------|--------------|
| 11      | 2 405           | -6.53                   | 8                | Compliance   |
| 18      | 2 440           | -6.54                   | 8                | Compliance   |
| 26      | 2 480           | -6.19                   | 8                | Compliance   |

## 5.2.6 Test Plot

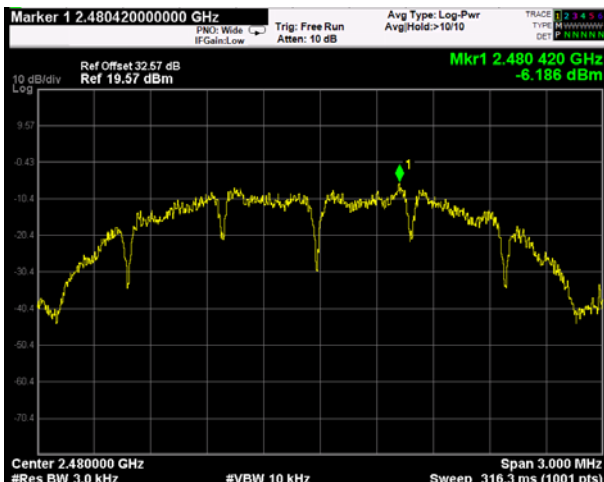
### CH Low



### CH Middle



### CH High



## 5.3 6 dB spectrum Bandwidth

### 5.3.1 Standard Applicable [FCC §15.247(a)(2) and RSS-247 5.2(a)]

#### FCC and IC

Systems using digital modulation techniques may operate in the 902 ~ 928 MHz, 2400 ~ 2483.5 MHz, and 5725 ~ 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 5.3.2 Test Environment conditions

- Ambient temperature : (24 ~ 25) °C
- Relative Humidity : (49 ~ 55) % R.H.

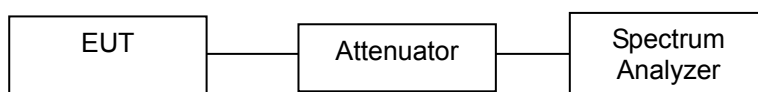
### 5.3.3 Measurement Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
3. Measured the spectrum width with power higher than 6 dB below carrier.

The spectrum analyzer is set to the as follows :

- 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.

### 5.3.4 Test setup

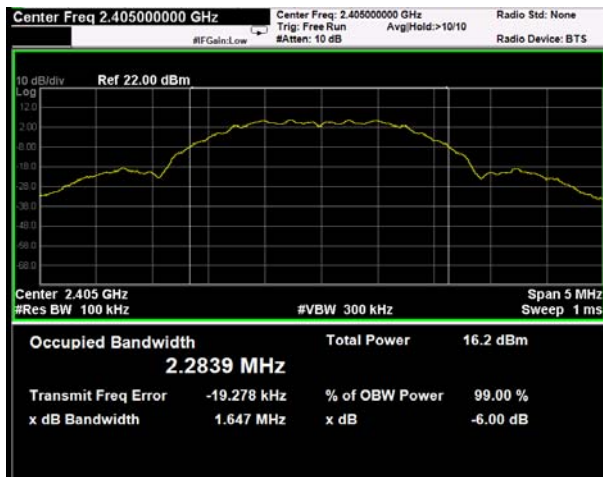


### 5.3.5 Measurement Result

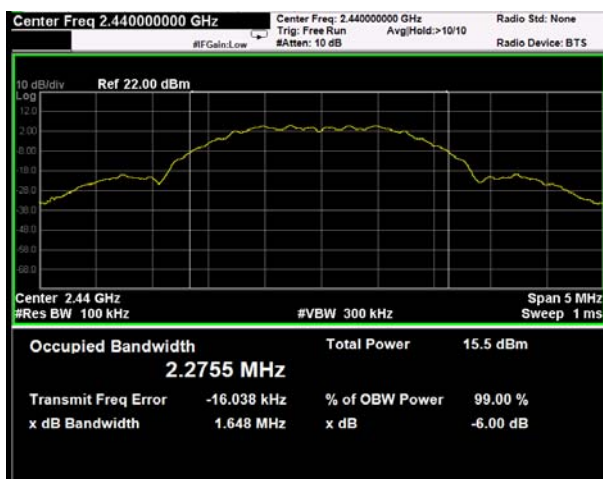
| Channel | Frequency [MHz] | 6 dB Bandwidth [MHz] | 99 % Bandwidth [MHz] | Limit [MHz] | Test Results |
|---------|-----------------|----------------------|----------------------|-------------|--------------|
| 11      | 2 405           | 1.65                 | 2.28                 | >0.5        | Compliance   |
| 18      | 2 440           | 1.65                 | 2.28                 | >0.5        | Compliance   |
| 26      | 2 480           | 1.65                 | 2.28                 | >0.5        | Compliance   |

### 5.3.6 Test Plot

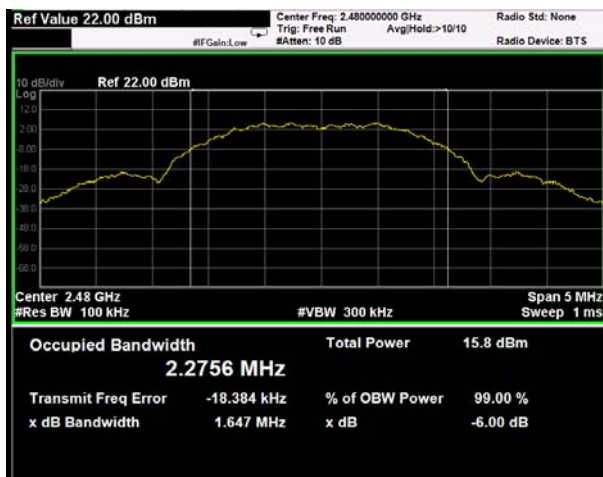
#### CH Low



#### CH Middle



#### CH High



## 5.4 Band-edge Compliance of RF Conducted emissions

### 5.4.1 Standard Applicable [ FCC §15.247(d) and RSS-247 5.5 ]

#### FCC and IC

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on RF conducted.

### 5.4.2 Test Environment conditions

- Ambient temperature : (24 ~ 25) °C
- Relative Humidity : (49 ~ 55) % 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 signal generator.
- (2) Reference frequency generated from the signal generator is supply to spectrum analyzer input port via RF cable and attenuator, and then, it's applied to offset value on spectrum analyzer.
- (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 KDB 558074 v04.

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 : 100 kHz ( $\geq 1\%$  of the span)
- VBW :  $\geq$  RBW
- Sweep : auto
- Detector function : peak
- Trace : Max hold

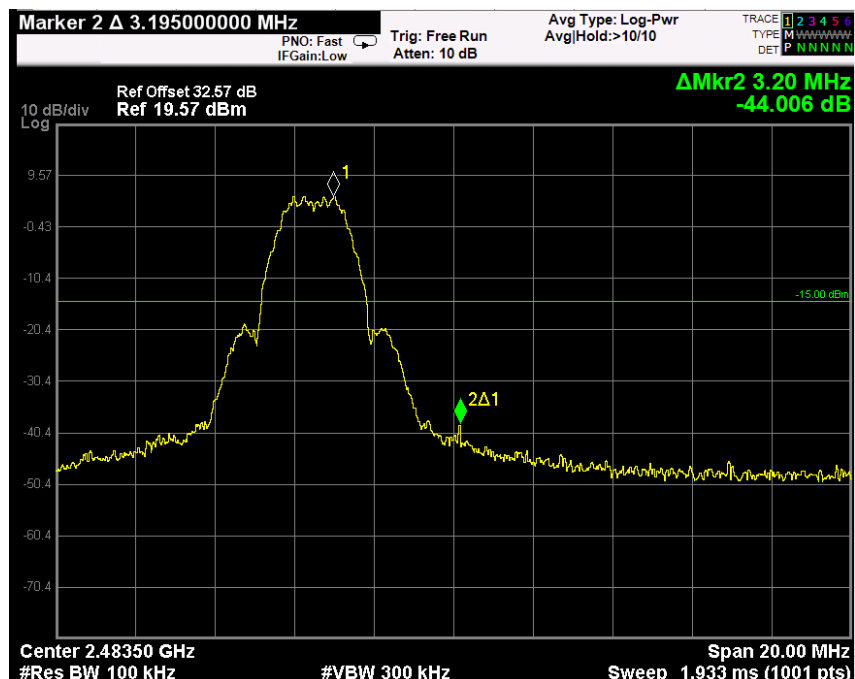
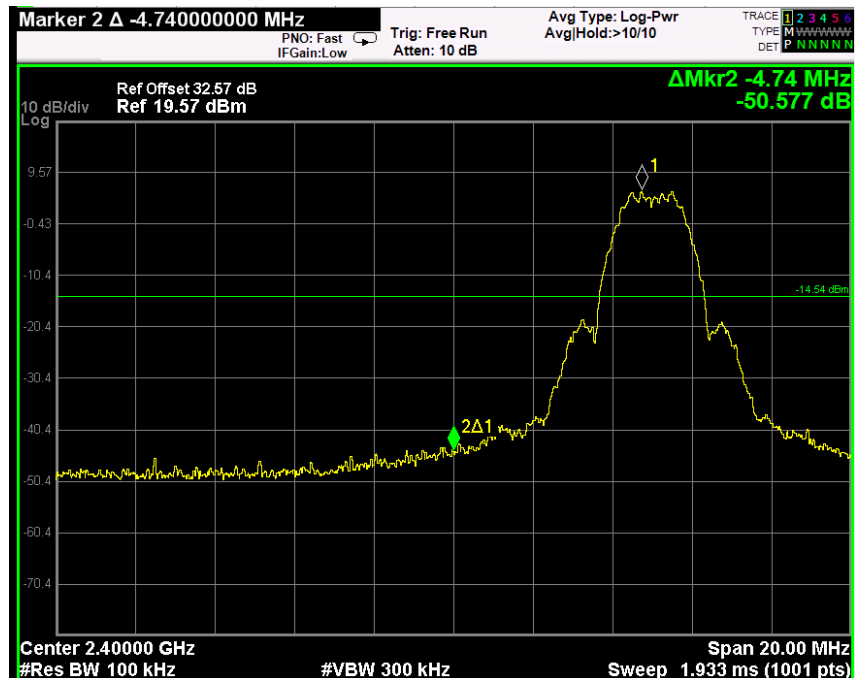
### 5.4.4 Test setup

Please refer 5.3.4

### 5.4.5 Measurement Result

| Setting Channel |               | Test Results        |                          |            |
|-----------------|---------------|---------------------|--------------------------|------------|
|                 |               | Measured value [dB] | Limit [dB]               | Result     |
| CH 11           | ~ 2 400 MHz   | -50.58              | $\leq 20$ than PSD level | Compliance |
| CH 26           | 2 483.5 MHz ~ | -44.01              |                          | Compliance |

#### 5.4.6 Test Plot (Band-edge)



## 5.5 Spurious RF Radiated emissions

### 5.5.1 Standard Applicable [ FCC §15.247(d) and RSS-247 5.5 ]

#### FCC

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)

#### IC

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

§15.209 and RSS-Gen limits for radiated emissions measurements (distance at 3 m)

| Frequency Band [MHz] | DISTANCE [Meters] | Limit [ $\mu\text{V/m}$ ]                                         | Limit [dB $\mu\text{V/m}$ ] | Detector   |
|----------------------|-------------------|-------------------------------------------------------------------|-----------------------------|------------|
| 0.009 ~ 0.490        | 300               | 2400/F(kHz)                                                       | 67.6-20log(F)               | Peak       |
| 0.490 ~ 1.705        | 30                | 24000/F(kHz)                                                      | 87.6-20log(F)               | Peak       |
| 1.705 ~ 30.0         | 30                | 30                                                                | 29.54                       | Peak       |
| 30 - 88              | 3                 | 100 **                                                            | 40.00                       | Quasi peak |
| 88 - 216             | 3                 | 150 **                                                            | 43.52                       | Quasi peak |
| 216 - 960            | 3                 | 200 **                                                            | 46.02                       | Quasi peak |
| Above 960            | 3                 | 500                                                               | 54.00                       | Average    |
| Above 1000           | 3                 | 74.0 dB $\mu\text{V/m}$ (Peak), 54.0 dB $\mu\text{V/m}$ (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. Restrict Band of Operation for FCC

| [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 - 13.4  |
| 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    |
| 13.36 - 13.41         |                         |                   |               |

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

## §15.205. Restrict Band of Operation for IC

| [MHz]                | [MHz]                   | [MHz]             | [GHz]         |
|----------------------|-------------------------|-------------------|---------------|
| 0.090 - 0.110        | 12.519 75 - 12.520 25   | 399.9 - 410       | 5.35 - 5.46   |
| 2.173 5 - 2.190 5    | 12.576 75 - 12.577 25   | 608 - 614         | 7.25 - 7.75   |
| 3.020 - 3.026        | 13.36 - 13.41           | 960 - 1 427       | 8.025 - 8.    |
| 4.125 - 4.128        | 16.42 - 16.423          | 1 435 - 1 626.5   | 9.0 - 9.2     |
| 4.177 25 - 4.177 75  | 16.694 75 - 16.695 25   | 1 645.5 - 1 646.5 | 9.3 - 9.5     |
| 4.207 25 - 4.207 75  | 16.804 25 - 16.804 75   | 1 660 - 1 710     | 10.6 - 12.7   |
| 5.677 - 5.683        | 25.5 - 25.67            | 1 718.8 - 1 722.2 | 13.25 - 13.4  |
| 6.215 - 6.218        | 37.5 - 38.25            | 2 200 - 2 300     | 14.47 - 14.5  |
| 6.26775-6.26825      | 73 - 74.6               | 2 310 - 2 390     | 15.35 - 16.2  |
| 6.31175-6.31225      | 74.8 - 75.2             | 2 655 - 2 900     | 17.7 - 21.4   |
| 8.291 - 8.294        | 108 - 138               | 3 260 - 3 267     | 22.01 - 23.12 |
| 8.362 - 8.366        | 156.524 75 - 156.525 25 | 3 332 - 3 339     | 23.6 - 24.0   |
| 8.376 25 - 8.38 6 75 | 156.7 - 156.9           | 3 345.8 - 3 358   | 31.2 - 31.8   |
| 8.414 25 - 8.414 75  | 240 - 285               | 3 500 - 4 400     | 36.43 - 36.5  |
| 12.29 - 12.293       | 322 - 335.4             | 4 500 - 5 150     | Above 38.6    |

## 5.5.2 Test Environment conditions

- Ambient temperature : (24 ~ 25) °C • Relative Humidity : (49 ~ 55) % R.H.

## 5.5.3 Measurement Procedure

The measurements procedure of the Spurious RF Radiated emissions is as following describe method.

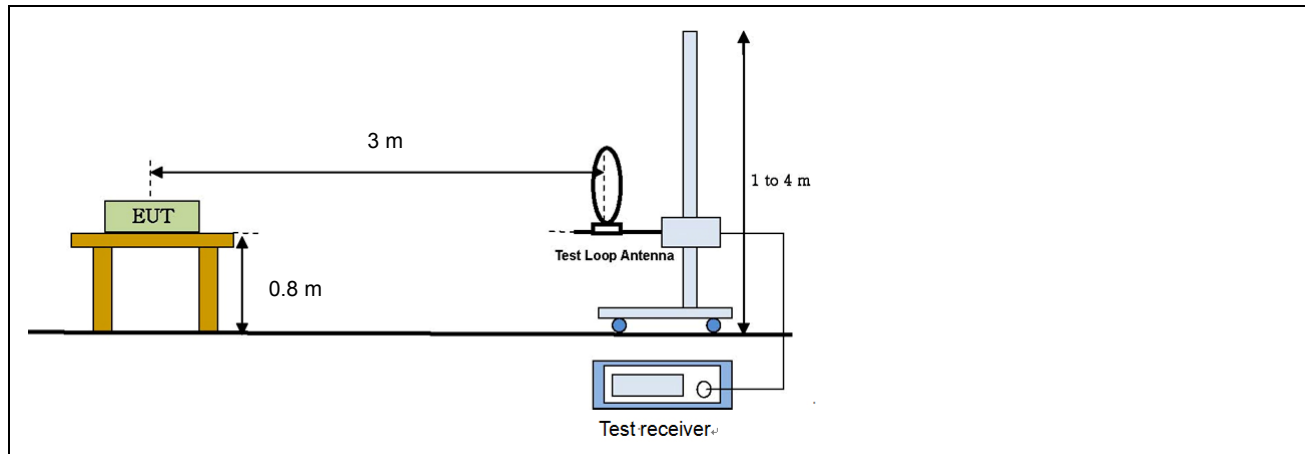
1. The EUT was placed on the top of a rotating table (0.8 meters for below 1 GHz and 1.5 meters for above 1 GHz) above the ground at a 3 meter camber. The table was rotated 360 degree to determine the position of the highest radiation.
  2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna master.
  3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both Horizontal and vertical polarizations of the antenna are set to make the measurement.
  4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotating table was turned from 0 - 360 degrees to find the maximum reading.
  5. The measuring receiver was set to peak detector and specified bandwidth with max hold function.
  6. Low, Middle and high channels were measured, and radiation measurements are performed in X, Y, Z axis positioning. And found the worst axis position and only the test worst case mode is recorded in the report.
- The measurement results are obtained as described below:  
Result(dB  $\mu$ V/m) = Reading(dB  $\mu$ V) + Antenna factor(dB/m) + CL(dB) + other applicable factor (dB)
  - The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for RMS Average (Duty cycle < 98 %) for Average detection (AV) at frequency above 1 GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
  - The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle  $\geq$  98 %) for Average detection (AV) at frequency above 1 GHz.
  - According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

## 5.5.4 Measurement Uncertainty

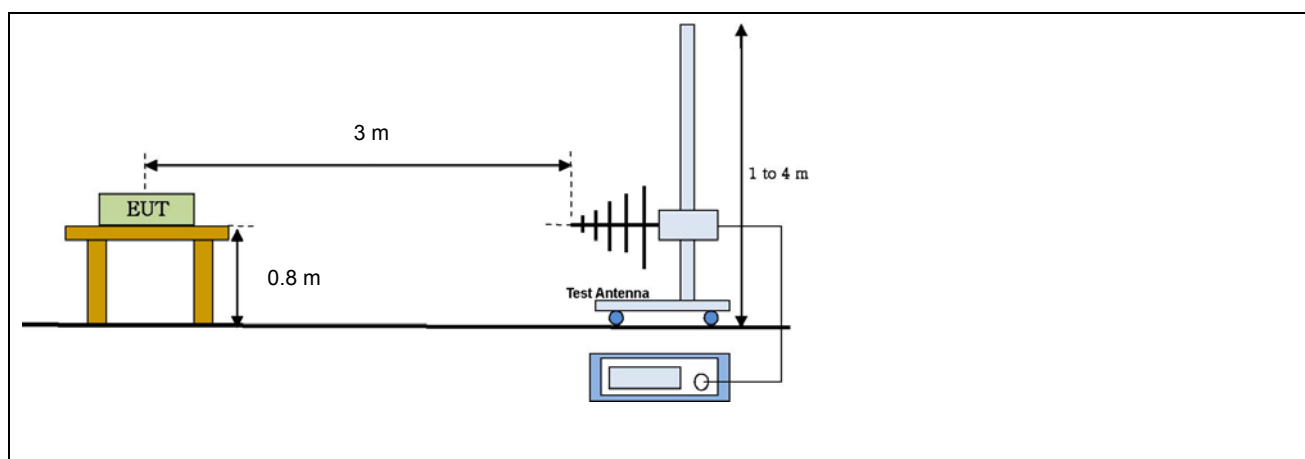
Radiated Emission measurement: Below 1 GHz : 4.32 dB (CL: Approx 95 %, k=2)  
Above 1 GHz : 4.14 dB (CL: Approx 95 %, k=2)

### 5.5.5 Test Configuration

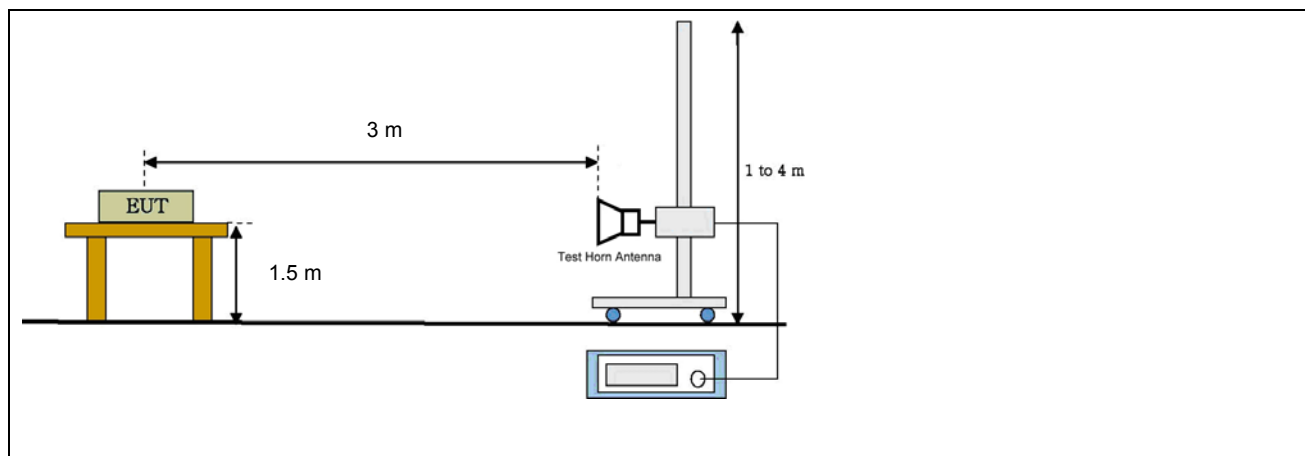
#### Radiated emission setup, Below 30 MHz



#### Radiated emission setup, Below 1 000 MHz



#### Radiated emission setup, Above 1 GHz



## 5.5.6 Measurement Result

Above 1 GHz

CH0 (2 402 MHz)

| Freq.<br>(GHz) | Reading<br>(dB $\mu$ V/m) |       | Table<br>(Deg) | Antenna       |               |                 | CL<br>(dB) | AMP<br>(dB) | Meas Result<br>(dB $\mu$ V/m) |       | Limit<br>(dB $\mu$ V/m) |    | Mgn.<br>(dB) |       | Result     |
|----------------|---------------------------|-------|----------------|---------------|---------------|-----------------|------------|-------------|-------------------------------|-------|-------------------------|----|--------------|-------|------------|
|                | PK                        | AV    |                | Height<br>(m) | Pol.<br>(H/V) | Fctr.<br>(dB/m) |            |             | PK                            | AV    | PK                      | AV | PK           | AV    |            |
| 2.375*         | 43.43                     | 31.03 | 180            | 1.0           | V             | 28.28           | 6.85       | -41.95      | 36.61                         | 24.21 | 74                      | 54 | 37.39        | 29.79 | Compliance |
| 2.375*         | 39.54                     | 25.56 | 180            | 1.0           | H             | 28.28           | 6.85       | -41.95      | 32.72                         | 18.74 | 74                      | 54 | 41.28        | 35.26 | Compliance |

\* Restrict band emissions.

CH19 (2 440 MHz)

| Freq.<br>(GHz) | Reading<br>(dB $\mu$ V/m) |    | Table<br>(Deg) | Antenna       |               |                 | CL<br>(dB) | AMP<br>(dB) | Meas Result<br>(dB $\mu$ V/m) |    | Limit<br>(dB $\mu$ V/m) |    | Mgn.<br>(dB) |    | Result     |
|----------------|---------------------------|----|----------------|---------------|---------------|-----------------|------------|-------------|-------------------------------|----|-------------------------|----|--------------|----|------------|
|                | PK                        | AV |                | Height<br>(m) | Pol.<br>(H/V) | Fctr.<br>(dB/m) |            |             | PK                            | AV | PK                      | AV | PK           | AV |            |
| -              | -                         | -  | -              | -             | -             | -               | -          | -           | -                             | -  | -                       | -  | -            | -  | Compliance |

CH39 (2 480 MHz)

| Freq.<br>(GHz) | Reading<br>(dB $\mu$ V/m) |       | Table<br>(Deg) | Antenna       |               |                 | CL<br>(dB) | AMP<br>(dB) | Meas Result<br>(dB $\mu$ V/m) |       | Limit<br>(dB $\mu$ V/m) |    | Mgn.<br>(dB) |       | Result     |
|----------------|---------------------------|-------|----------------|---------------|---------------|-----------------|------------|-------------|-------------------------------|-------|-------------------------|----|--------------|-------|------------|
|                | PK                        | AV    |                | Height<br>(m) | Pol.<br>(H/V) | Fctr.<br>(dB/m) |            |             | PK                            | AV    | PK                      | AV | PK           | AV    |            |
| 2.485*         | 44.23                     | 32.15 | 180            | 1.0           | V             | 28.57           | 6.93       | -42.26      | 37.47                         | 25.39 | 74                      | 54 | 35.53        | 28.61 | Compliance |
| 2.485*         | 39.32                     | 26.42 | 180            | 1.0           | H             | 28.57           | 6.93       | -42.26      | 32.56                         | 19.66 | 74                      | 54 | 41.44        | 34.34 | Compliance |

\* Restrict band emissions.

### ※Note

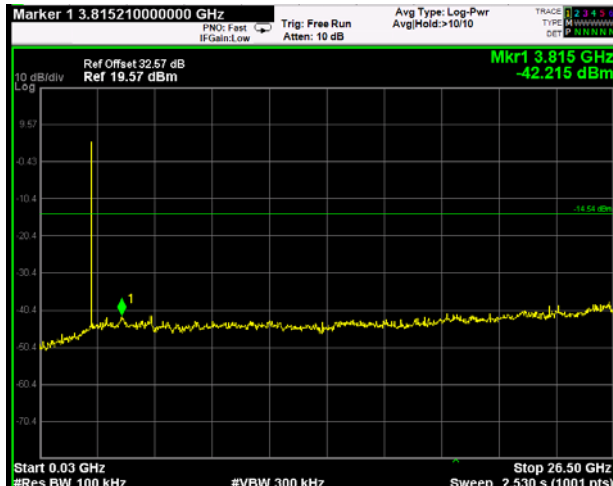
- Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule15.35
- Limit: 54 dB  $\mu$ V/m(Average), 74 dB  $\mu$ V/m(Peak), Attenuated more than 20 dB below the permissible value.
- It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.
- The Reading values are already added value of the duty cycle factor and correction Factor was applied for Average Field Strength.
- For the below 30 MHz and above 2.495 GHz, measured any other signal is not detected on test receiver
- The transmitter radiated spectrum was investigated from 9 kHz to 26.5 GHz.

**Below 1 GHz**

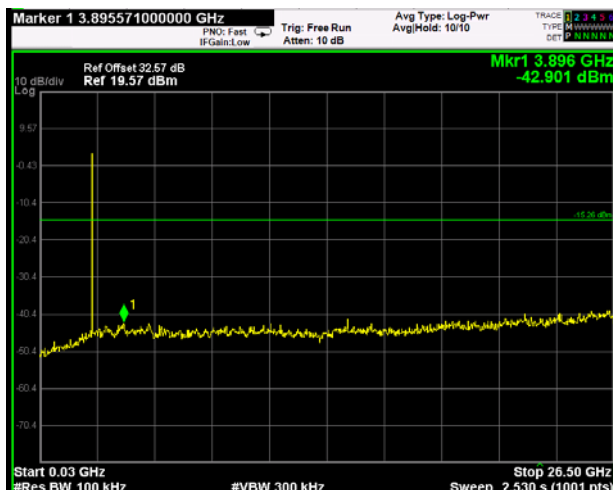
| Freq.<br>(MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Reading<br>(dB $\mu$ V/m) | Table<br>(Deg) | Antenna       |               |                 | CL<br>(dB) | AMP<br>(dB) | Meas<br>Result<br>(dB $\mu$ V/m) | Limit<br>(dB $\mu$ V/m ) | Mgn<br>(dB) | Result     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------|---------------|---------------|-----------------|------------|-------------|----------------------------------|--------------------------|-------------|------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |                | Height<br>(m) | Pol.<br>(H/V) | Fctr.<br>(dB/m) |            |             |                                  |                          |             |            |
| 54.16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 66.31                     | 120            | 1.0           | V             | 7.21            | 2.24       | -41.61      | 34.15                            | 40.00                    | 5.85        | Compliance |
| 69.69                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 59.12                     | 120            | 1.0           | V             | 5.42            | 2.46       | -41.61      | 25.39                            | 40.00                    | 14.61       | Compliance |
| 250.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 56.32                     | 110            | 2.0           | H             | 12.69           | 4.17       | -40.99      | 32.19                            | 46.00                    | 13.81       | Compliance |
| 350.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 52.42                     | 110            | 1.0           | V             | 15.26           | 4.93       | -40.69      | 31.92                            | 46.00                    | 14.08       | Compliance |
| 550.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 46.21                     | 160            | 1.0           | V             | 19.69           | 6.11       | -39.77      | 32.24                            | 46.00                    | 13.76       | Compliance |
| 750.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 46.27                     | 170            | 2.0           | H             | 22.66           | 7.29       | -38.56      | 37.66                            | 46.00                    | 8.34        | Compliance |
| 790.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 42.32                     | 160            | 1.0           | V             | 22.96           | 7.48       | -38.33      | 34.43                            | 46.00                    | 11.57       | Compliance |
| Freq.(MHz) : Measurement frequency, Reading(dB $\mu$ V/m) : Indicated value for test receiver, Table (Deg) : Directional degree of Turn table<br>Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor, Cbl(dB) : Cable loss, Pre AMP(dB) : Preamplifier gain(dB)<br>Meas Result (dB $\mu$ V/m) : Reading(dB $\mu$ V/m)+ Antenna factor.(dB/m) + CL(dB) - Pre AMP(dB)<br>Limit(dB $\mu$ V/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB $\mu$ V/m) – Meas Result(dB $\mu$ V/m) |                           |                |               |               |                 |            |             |                                  |                          |             |            |

## Test Plot (Conducted spurious emissions)

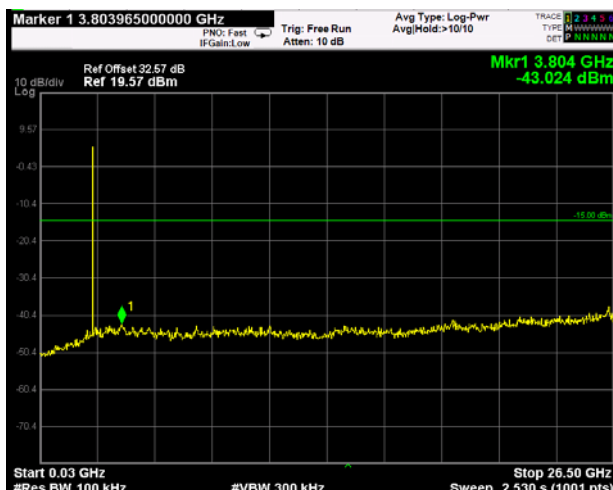
CH Low / Reference signal level: 5.46 dBm



CH Middle / Reference signal level: 4.74 dBm

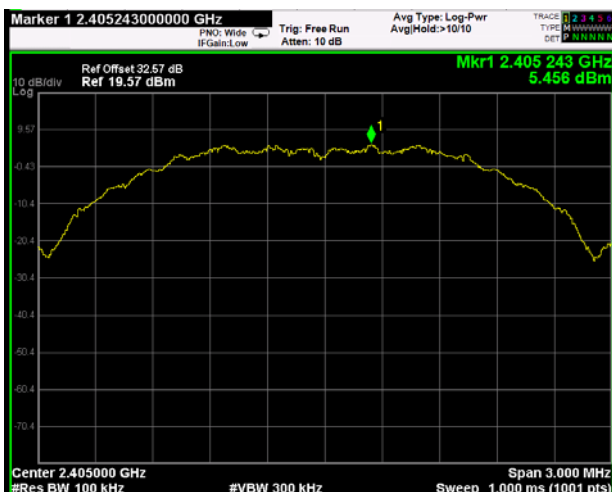


CH High / Reference signal level: 5.00 dBm

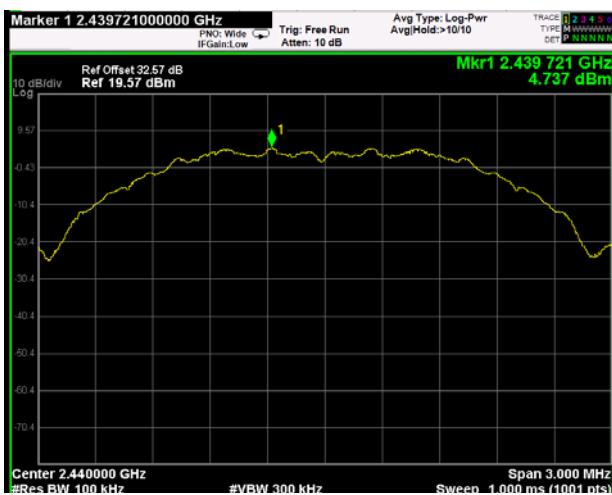


Note: It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits

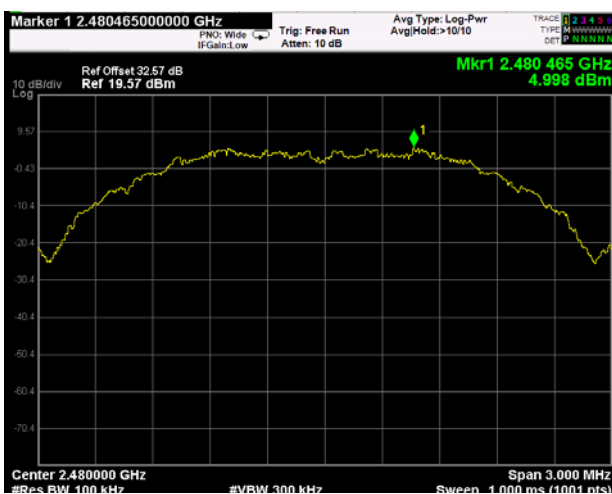
CH Low / Reference signal level: 5.46 dBm



CH Middle / Reference signal level: 4.74 dBm



CH High / Reference signal level: 5.00 dBm



## 5.6 Antenna requirement

### 5.6.1 Standard applicable [FCC §15.203]

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.

### 5.6.2 Antenna details

| Frequency Band | Antenna Type                 | Gain [dBi] | Results    |
|----------------|------------------------------|------------|------------|
| 2.4 GHz        | Internal PCB pattern antenna | 2.29       | Compliance |

## 5.7 AC Power Conducted emissions

### 5.7.1 Standard Applicable [ FCC §15.207(a) and RSS-Gen 8.8 ]

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 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/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 (dB $\mu$ V) |            |
|----------------------------|------------------------------|------------|
|                            | 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

### 5.7.2 Test Environment conditions

• Ambient temperature : (24 ~ 25) °C • Relative Humidity : (49 ~ 55) % R.H.

### 5.7.3 Measurement Procedure

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.

### 5.7.4 Used equipment

| Equipment     | Model No. | Serial No. | Manufacturer    | Next cal date | Cal interval | Used                                |
|---------------|-----------|------------|-----------------|---------------|--------------|-------------------------------------|
| Test receiver | ESCS30    | 100111     | Rohde & Schwarz | 2018. 01. 31  | 1 year       | <input checked="" type="checkbox"/> |
| LISN          | ESH2-Z5   | 100044     | R&S             | 2018. 01. 31  | 1 year       | <input type="checkbox"/>            |
|               | ESH3-Z5   | 100147     | R&S             | 2018. 01. 31  | 1 year       | <input checked="" type="checkbox"/> |

\*Test Program: " ESXS-K1 V2.2"

Measurement uncertainty

Conducted Emission measurement: 4.48 dB (CL: Approx 95 %, k=2)

## 5.7.5 Measurement Result

| Freq.<br>[MHz] | Factor<br>[dB] |       | POL | QP               |                    |                   | CISPR AV         |                    |                   |
|----------------|----------------|-------|-----|------------------|--------------------|-------------------|------------------|--------------------|-------------------|
|                |                |       |     | Limit<br>[dB/μV] | Reading<br>[dB/μV] | Result<br>[dB/μV] | Limit<br>[dB/μV] | Reading<br>[dB/μV] | Result<br>[dB/μV] |
| 0.170          | 0.11           | 9.97  | N   | 64.98            | 45.03              | 45.14             | 54.98            | 31.90              | 32.01             |
| 0.396          | 0.12           | 9.98  | N   | 57.93            | 52.08              | 52.20             | 47.93            | 40.70              | 40.82             |
| 0.443          | 0.12           | 9.99  | N   | 57.01            | 47.96              | 48.08             | 47.01            | 38.80              | 38.92             |
| 0.505          | 0.12           | 9.99  | N   | 56.00            | 45.64              | 45.76             | 46.00            | 36.40              | 36.52             |
| 14.021         | 0.60           | 10.35 | L   | 60.00            | 33.99              | 34.59             | 50.00            | 27.50              | 28.10             |
| 15.291         | 0.66           | 10.38 | L   | 60.00            | 41.12              | 41.78             | 50.00            | 32.70              | 33.36             |
| 15.474         | 0.59           | 10.38 | N   | 60.00            | 34.89              | 35.48             | 50.00            | 27.40              | 27.99             |
| 15.705         | 0.66           | 10.38 | L   | 60.00            | 39.55              | 40.21             | 50.00            | 31.20              | 31.86             |
| 16.318         | 0.61           | 10.40 | N   | 60.00            | 33.81              | 34.42             | 50.00            | 29.10              | 29.71             |
| 16.552         | 0.68           | 10.40 | L   | 60.00            | 38.76              | 39.44             | 50.00            | 33.30              | 33.98             |
| 18.580         | 0.71           | 10.44 | L   | 60.00            | 36.70              | 37.41             | 50.00            | 28.90              | 29.61             |
| 20.302         | 0.74           | 10.48 | L   | 60.00            | 31.80              | 32.54             | 50.00            | 26.10              | 26.84             |

- \* LISN: LISN insertion Loss, Cable: Cable Loss, P/L: pulse limiter factor
- \* L: Line. Live, N: Line. Neutral
- \* Reading: test receiver reading value (with cable loss & pulse limiter factor)
- \* Result = LISN + Reading



Line. Live

Kostec Co.,Ltd

### Conducted Emission

EUT: O-17-0260  
Manuf:  
Op Cond: AC 120V , 60Hz  
Operator:  
Test Spec: FCC  
Comment: Live

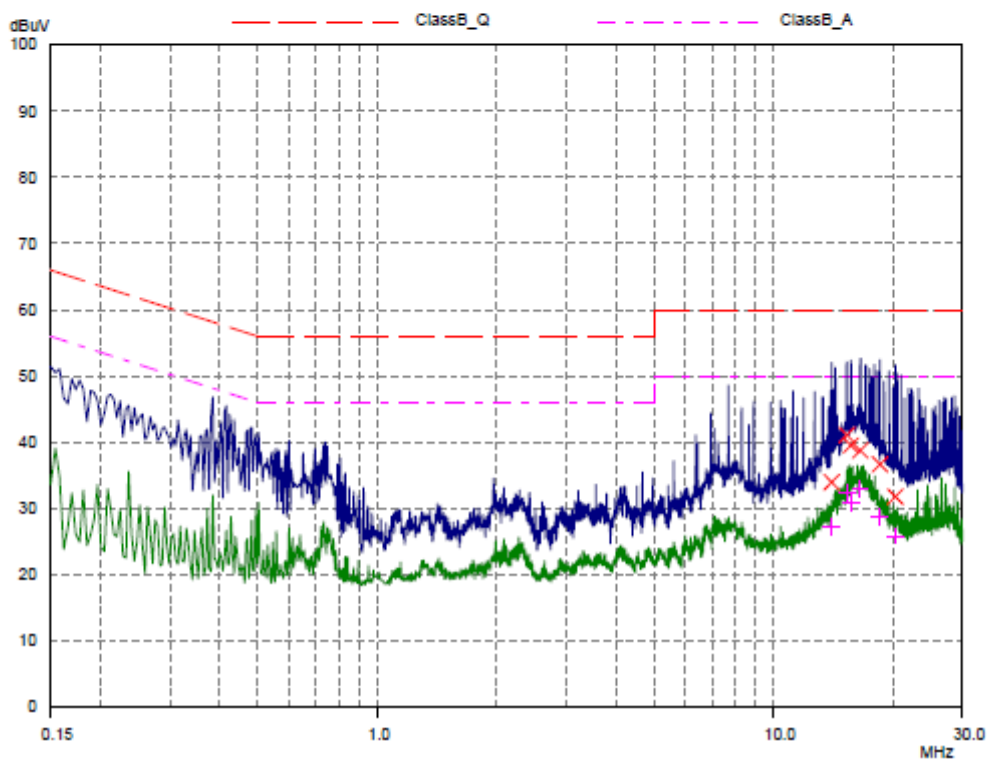
Result File: 0260\_L.dat : New Measurement

#### Scan Settings (1 Range)

| Frequencies |       |           | Receiver Settings |          |        |       |        |       |  |
|-------------|-------|-----------|-------------------|----------|--------|-------|--------|-------|--|
| Start       | Stop  | Step      | IF BW             | Detector | M-Time | Atten | Preamp | OpRge |  |
| 150kHz      | 30MHz | 3.9063kHz | 9kHz              | PK+AV    | 10msec | 15 dB | OFF    | 60dB  |  |

| Transducer | No. | Start | Stop  | Name |
|------------|-----|-------|-------|------|
|            | 11  | 9kHz  | 30MHz | MAIN |

Final Measurement: Detectors: X QP / + AV  
Meas Time: 1sec  
Peaks: 25  
Acc Margin: 50 dB





Line: Neutral

Kostec Co.,Ltd

### Conducted Emission

EUT: O-17-0260  
Manuf:  
Op Cond: AC 120V , 60Hz  
Operator:  
Test Spec: FCC  
Comment: Neutral

Result File: 0260\_n.dat : New Measurement

Scan Settings (1 Range)

| Frequencies |       | Step      |  | IF BW | Detector | Receiver Settings |       |        |       |
|-------------|-------|-----------|--|-------|----------|-------------------|-------|--------|-------|
| Start       | Stop  | Step      |  |       |          | M-Time            | Atten | Preamp | OpRge |
| 150kHz      | 30MHz | 3.9063kHz |  | 9kHz  | PK+AV    | 10msec            | 15 dB | OFF    | 60dB  |

|            |     |       |       |      |
|------------|-----|-------|-------|------|
| Transducer | No. | Start | Stop  | Name |
|            | 11  | 9kHz  | 30MHz | MAIN |

Final Measurement: Detectors: X QP / + AV  
Meas Time: 1sec  
Peaks: 25  
Acc Margin: 50 dB

