# TEST REPORT

DT&C Co., Ltd.
42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2101-0005(1)

2. Customer

- Name : THINKWARE Corporation
- Address (FCC) : A, 9FL, Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
- Address (IC) : A, 9FL, Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Seongnam Korea (Republic Of)

3. Use of Report : FCC & IC Certification

4. Product Name / Model Name : RADAR MODULE / TWA-RAD S

FCC ID : 2ADTG-TWARAD2

IC: 12594A-TWARAD2

5. FCC Regulation(s): Part 15.249

IC Standard(s): RSS-210 Issue 10

Test Method used: ANSI C63.10-2013

6. Date of Test : 2020.12.11 ~ 2020.12.16

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment : See appended test report.

9. Test Result : Refer to the attached Test Result

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

| | | |
|---|---|---|
| Affirmation | Tested by<br>Name : JaeHyeok Bang (Signature) | Reviewed by<br>Name : JaeJin Lee (Signature) |

**2021 . 01 . 13 .**

**DT&C Co., Ltd.**

This test report is a general report that does not use the KOLAS accreditation mark and is not related to KS Q ISO/IEC 17025 and KOLAS accreditation.

**If this report is required to confirmation of authenticity, please contact to report@dtnc.net**

# Test Report Version

| Test Report No. | Date | Description | Revised by | Reviewed by |
|---|---|---|---|---|
| DRTFCC2101-0005 | Jan. 12, 2021 | Initial issue | JaeHyeok Bang | JaeJin Lee |
| DRTFCC2101-0005(1) | Jan. 13, 2021 | Changed RSS Standard | JaeHyeok Bang | JaeJin Lee |
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# 1. General Information

## 1.1 Testing Laboratory

| **DT&C Co., Ltd.** | | |
|---|---|---|
| The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.<br>The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.<br><br>**- FCC & IC MRA Designation No. : KR0034**<br>**- ISED #: 5740A** | | |
| www.dtnc.net | | |
| Telephone | : | + 82-31-321-2664 |
| FAX | : | + 82-31-321-1664 |

## 1.2 Test Environment

| **Ambient Condition** | |
|---|---|
| ▪ Temperature | +22 ℃ ~ +25 ℃ |
| ▪ Relative Humidity | 41 % ~ 45% |

## 1.3 Measurement Uncertainty

| Test items | Measurement uncertainty |
|---|---|
| Radiated emission<br>(1 GHz Below) | 5.1 dB (The confidence level is about 95 %, k = 2) |
| Radiated emission<br>(1 GHz ~ 18 GHz) | 5.4 dB (The confidence level is about 95 %, k = 2) |
| Radiated emission<br>(18 GHz Above) | 5.3 dB (The confidence level is about 95 %, k = 2) |

## 1.4 Details of Applicant

| | | |
|---|---|---|
| Applicant | : | THINKWARE Corporation |
| Address (FCC) | : | A, 9FL., Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea |
| Address (IC) | : | 9FL, Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Seongnam Korea (Republic Of) |

## 1.5 Description of EUT

| | |
|---|---|
| **FCC Equipment Class** | Part 15 Low Power Communication Device Transmitter |
| **EUT** | RADAR MODULE |
| **Model Name(HVIN)** | TWA-RAD S |
| **FVIN** | 1.01 |
| **Add Model Name** | NA |
| **Serial Number** | Not defined |
| **Power Supply** | DC 5 V |
| **Frequency Range** | 24.05 GHz ~ 24.25 GHz |
| **Max. field strength (average)** | 100.80 dBuV/m |
| **Modulation Type** | CW |
| **Antenna Specification** | Internal Antenna<br>▪ Max. peak gain : 12.6 dBi |

## 1.6. EUT CAPABILITIES

This module contains the following capabilities:
24 GHz RADAR

# 2. Information about test items

## 2.1 Test Mode

| Test Mode | Power Supply | Description |
|---|---|---|
| TM 1 | 5 V | Continuous transmitting mode |
| - | - | - |

## 2.2 Tested Frequency

| | TX Frequency (GHz) |
|---|---|
| Lowest | 24.09 |
| Middle | 24.15 |
| Highest | 24.23 |

## 2.3 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

# 3. Antenna requirements

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

**The antenna is permanently attached on the PCB.**
**Therefore this E.U.T Complies with the requirement of §15.203**

# 4. Test report

## 4.1 Summary of tests

| FCC Part | RSS Std. | Parameter | Limit | Test Condition | Status Note 1 |
|---|---|---|---|---|---|
| 15.249 (a) | RSS-210 [B.10(a)] | Field Strength Limits | FCC 15.249(a) (See section 4.2.2) | Radiated | C |
| 15.205<br>15.209<br>15.249 | RSS-GEN[8.9]<br>RSS-GEN [8.10]<br>RSS-210[B.10] | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | FCC 15.209 (See section 4.2.2) | | C |
| 15.215(c) | - | 20 dB Bandwidth | NA | | C |
| - | RSS-Gen [6.7] | Occupied Bandwidth (99 %) | RSS-Gen(6.7) (See section 4.2.1) | | C |
| 15.207 | RSS-Gen[8.8] | AC Line Conducted Emissions | FCC 15.207 limits (See section 4.2.3) | AC Line Conducted | NA Note3 |
| 15.203 | - | Antenna Requirements | FCC 15.203 (See section 3) | - | C |

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: This device is installed in a car. Therefore the power source is a battery of car.

## 4.2 Transmitter requirements

### 4.2.1 20dB bandwidth & Occupied BW

**Test Requirements**

- **20dB Bandwidth**

**Part 15.215**

§15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

- **Occupied Bandwidth**

**RSS-Gen [6.7]**

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured.

**▣ TEST CONFIGURATION**

Refer to the APPENDIX I.

**▣ TEST PROCEDURE**

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

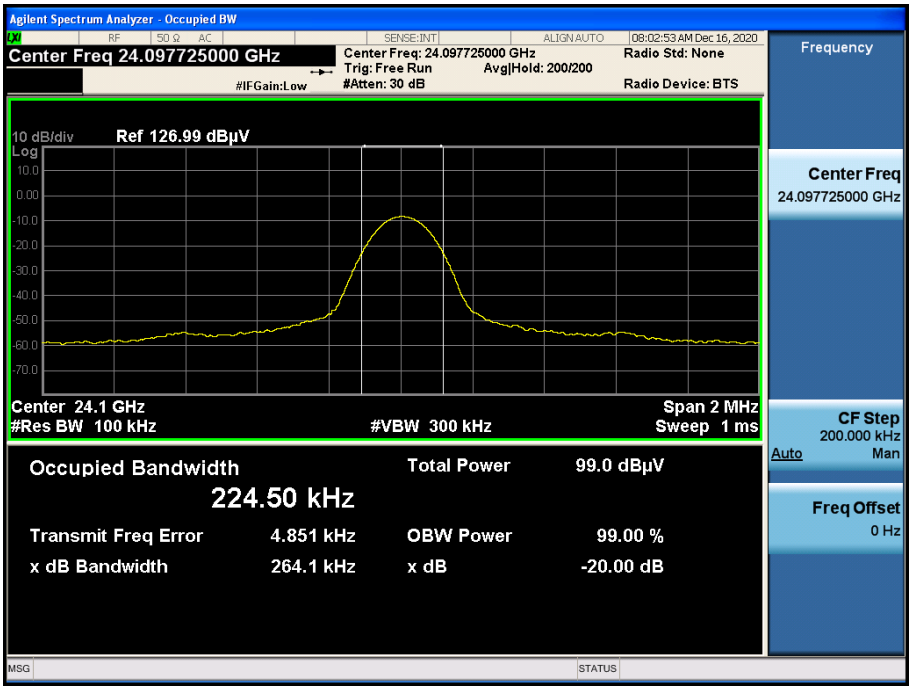
**Note:** Actually, the RBW setting was used 100 kHz. (The RBW setting cannot satisfy the 1.5 % to 5 % of the OBW due to signal characteristics.)

**▣ TEST RESULTS: Comply**

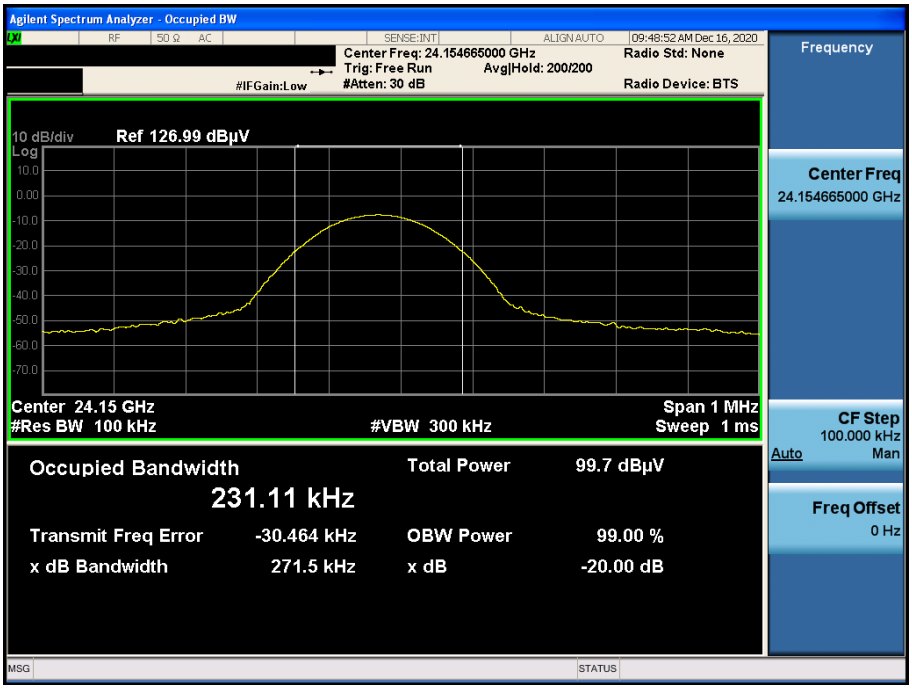
| Test Mode | Frequency | 20 dB BW (MHz) | Occupied BW (MHz) |
|---|---|---|---|
| TM 1 | Lowest | 0.264 | 0.225 |
| | Middle | 0.272 | 0.231 |
| | Highest | 0.271 | 0.231 |

## ▣ RESULT PLOTS

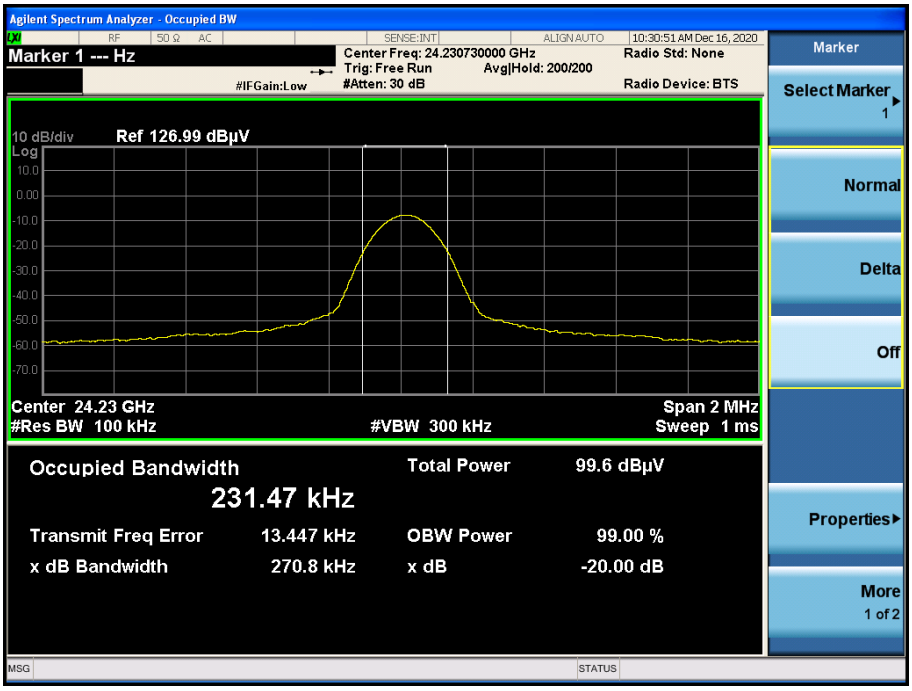
### 20dB Bandwidth & Occupied Bandwidth TM 1 & Lowest




### 20dB Bandwidth & Occupied Bandwidth TM 1 & Middle



## 20dB Bandwidth & Occupied Bandwidth TM 1 & Highest



### 4.2.2 Radiated Emission

**Requirements and limit,**

**- Part 15.249 & RSS-210[B.10]**

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Frequency (MHz) | Limit @ 3m | |
|---|---|---|
| | Field strength of fundamental (mV/m) | Field strength of harmonics (uV/m) |
| 902 ~ 908 | 50 | 500 |
| 2 400 ~ 2 483.5 | 50 | 500 |
| 5 725 ~ 5 825 | 50 | 500 |
| 24 000 ~ 24 250 | 250 | 2 500 |

**(**d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

**- Part 15.209 & RSS-247[8.9]**

| Frequency (MHz) | FCC Limit (uV/m) | IC Limit (μA/m) | Measurement Distance (m) |
|---|---|---|---|
| 0.009 – 0.490 | 2 400 / F (kHz) | 6.37/F (F in kHz) | 300 |
| 0.490 – 1.705 | 2 4000 / F (kHz) | 63.7/F (F in kHz) | 30 |
| 1.705 – 30.0 | 30 | 0.08 | 30 |

| Frequency (MHz) | FCC Limit (uV/m) | IC Limit (uV/m) | Measurement Distance (m) |
|---|---|---|---|
| 30 ~ 88 | 100 ** | 100 | 3 |
| 88 ~ 216 | 150 ** | 150 | 3 |
| 216 ~ 960 | 200 ** | 200 | 3 |
| Above 960 | 500 | 500 | 3 |

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating 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, e.g., §§15.231 and 15.241.

**- Part 15.205(a): Restricted band of operation**

| MHz | MHz | MHz | MHz | GHz | GHz |
|---|---|---|---|---|---|
| 0.009 ~ 0.110 | 8.41425 ~ 8.41475 | 108 ~ 121.94 | 1300 ~ 1427 | 4.5 ~ 5.15 | 14.47 ~ 14.5 |
| 0.495 ~ 0.505 | 12.29 ~ 12.293 | 123 ~ 138 | 1435 ~ 1626.5 | 5.35 ~ 5.46 | 15.35 ~ 16.2 |
| 2.1735 ~ 2.1905 | 12.51975 ~ 12.52025 | 149.9 ~ 150.05 | 1645.5 ~ 1646.5 | 7.25 ~ 7.75 | 17.7 ~ 21.4 |
| 4.125 ~ 4.128 | 12.57675 ~ 12.57725 | 156.52475 ~ | 1660 ~ 1710 | 8.025 ~ 8.5 | 22.01 ~ 23.12 |
| 4.17725 ~ 4.17775 | 13.36 ~ 13.41 | 156.52525 | 1718.8 ~ 1722.2 | 9.0 ~ 9.2 | 23.6 ~ 24.0 |
| 4.20725 ~ 4.20775 | 16.42 ~ 16.423 | 156.7 ~ 156.9 | 2200 ~ 2300 | 9.3 ~ 9.5 | 31.2 ~ 31.8 |
| 6.215 ~ 6.218 | 16.69475 ~ 16.69525 | 162.0125 ~ 167.17 | 2310 ~ 2390 | 10.6 ~ 12.7 | 36.43 ~ 36.5 |
| 6.26775 ~ 6.26825 | 16.80425 ~ 16.80475 | 167.72 ~ 173.2 | 2483.5 ~ 2500 | 13.25 ~ 13.4 | Above 38.6 |
| 6.31175 ~ 6.31225 | 25.5 ~ 25.67 | 240 ~ 285 | 2655 ~ 2900 | | |
| 8.291 ~ 8.294 | 37.5 ~ 38.25 | 322 ~ 335.4 | 3260 ~ 3267 | | |
| 8.362 ~ 8.366 | 73 ~ 74.6 | 399.90 ~ 410 | 3332 ~ 3339 | | |
| 8.37625 ~ 8.38675 | 74.8 ~ 75.2 | 608 ~ 614 | 3345.8 ~ 3358 | | |
| | | 960 ~ 1240 | 3600 ~ 4400 | | |

**- RSS-Gen[8.10]: Restricted frequency bands**

| MHz | MHz | MHz | MHz | MHz | GHz |
|---|---|---|---|---|---|
| 0.090 ~ 0.110 | 8.362 ~ 8.366 | 73 ~ 74.6 | 608 ~ 614 | 3345.8 ~ 3358 | 9.0 ~ 9.2 |
| 0.495 ~ 0.505 | 8.37625 ~ 8.38675 | 74.8 ~ 75.2 | 960 ~ 1427 | 3500 ~ 4400 | 9.3 ~ 9.5 |
| 2.1735 ~ 2.1905 | 8.41425 ~ 8.41475 | 108 ~ 138 | 1435 ~ 1626.5 | 4500 ~ 5150 | 10.6 ~ 12.7 |
| 3.020 ~ 3.026 | 12.29 ~ 12.293 | 149.9 ~ 150.05 | 1645.5 ~ 1646.5 | 5350 ~ 5460 | 13.25 ~ 13.4 |
| 4.125 ~ 4.128 | 12.51975 ~ 12.52025 | 156.52475 ~ | 1660 ~ 1710 | 7250 ~ 7750 | 14.47 ~ 14.5 |
| 4.17725 ~ 4.17775 | 12.57675 ~ 12.57725 | 156.52525 | 1718.8 ~ 1722.2 | 8025 ~ 8500 | 15.35 ~ 16.2 |
| 4.20725 ~ 4.20775 | 13.36 ~ 13.41 | 156.7 ~ 156.9 | 2200 ~ 2300 | | 17.7 ~ 21.4 |
| 5.677 ~ 5.683 | 16.42 ~ 16.423 | 162.0125 ~ 167.17 | 2310 ~ 2390 | | 22.01 ~ 23.12 |
| 6.215 ~ 6.218 | 16.69475 ~ 16.69525 | 167.72 ~ 173.2 | 2483.5 ~ 2500 | | 23.6 ~ 24.0 |
| 6.26775 ~ 6.26825 | 16.80425 ~ 16.80475 | 240 ~ 285 | 2655 ~ 2900 | | 31.2 ~ 31.8 |
| 6.31175 ~ 6.31225 | 25.5 ~ 25.67 | 322 ~ 335.4 | 3260 ~ 3267 | | 36.43 ~ 36.5 |
| 8.291 ~ 8.294 | 37.5 ~ 38.25 | 399.90 ~ 410 | 3332 ~ 3339 | | Above 38.6 |

**Test Configuration**

Refer to the APENDIX I

**Test Procedures**

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
   The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 or 3 meter away from the interference-receiving antenna.
3. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
4. The antenna is a broadband antenna, and its 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.
5. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

**Measurement Instrument Setting**

- Frequency Range Below 1GHz
RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak
- Frequency Range Range > 1 GHz
Peak Measurement
RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes
Average Measurement> 1GHz
RBW = 1MHz, VBW ≥ 1/T, Detector = Peak, Sweep Time = Auto, Trace Mode = Max Hold until the trace stabilizes

## Test Results: TM 1

**▪ Test Notes.**

1. * is fundamental frequency.
2. The radiated emissions were investigated 9 kHz to 5th harmonic of highest fundamental frequency. And no other spurious and harmonic emissions were found above listed frequencies.
3. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance correction factor is applied to the result.
   - Calculation of distance correction factor
   At frequencies below 30 MHz = 40 log( tested distance / specified distance )
   At frequencies at or above 30 MHz = 20 log( tested distance / specified distance )
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   The mixer loss was applied to the measured level by SA correction factor.
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

### ▪ Lowest Frequency

| Frequency (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| *24 092.42 | V | Y | PK | 98.76 | 1.09 | N/A | N/A | 99.85 | 127.95 | 28.10 |
| *24 092.25 | V | Y | AV | 98.70 | 1.09 | N/A | N/A | 99.79 | 107.95 | 8.16 |
| 23 982.29 | V | Y | PK | 56.04 | 1.12 | N/A | N/A | 57.16 | 74.00 | 16.84 |
| 23 985.83 | V | Y | AV | 43.73 | 1.11 | N/A | N/A | 44.84 | 54.00 | 9.16 |
| 48 184.24 | H | X | PK | 64.42 | -2.43 | N/A | -6.02 | 55.97 | 87.96 | 31.99 |
| 48 184.69 | H | X | AV | 64.18 | -2.43 | N/A | -6.02 | 55.73 | 67.96 | 12.23 |
| 72 277.32 | H | Z | PK | 29.21 | 43.94 | N/A | -6.02 | 67.13 | 87.96 | 20.83 |
| 72 277.49 | H | Z | AV | 27.47 | 43.94 | N/A | -6.02 | 65.39 | 67.96 | 2.57 |
| 96 386.06 | V | X | PK | 34.06 | 47.11 | N/A | -15.56 | 65.61 | 87.96 | 22.35 |
| 96 386.16 | V | X | AV | 32.73 | 47.11 | N/A | -15.56 | 64.28 | 67.96 | 3.68 |

### ▪ Middle Frequency

| Frequency (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| *24 153.25 | V | Y | PK | 99.32 | 1.09 | N/A | N/A | 100.41 | 127.95 | 27.54 |
| *24 152.09 | V | Y | AV | 99.20 | 1.09 | N/A | N/A | 100.29 | 107.95 | 7.66 |
| 48 307.70 | H | X | PK | 63.76 | -2.30 | N/A | -6.02 | 55.44 | 87.96 | 32.52 |
| 48 307.27 | H | X | AV | 63.43 | -2.30 | N/A | -6.02 | 55.11 | 67.96 | 12.85 |
| 72 469.19 | H | Z | PK | 28.29 | 43.95 | N/A | -6.02 | 66.22 | 87.96 | 21.74 |
| 72 469.78 | H | Z | AV | 26.74 | 43.95 | N/A | -6.02 | 64.67 | 67.96 | 3.29 |
| 96 604.02 | V | X | PK | 33.26 | 47.12 | N/A | -15.56 | 64.82 | 87.96 | 23.14 |
| 96 604.74 | V | X | AV | 31.85 | 47.12 | N/A | -15.56 | 63.41 | 67.96 | 4.55 |

## ▪ Highest Frequency

| Frequency (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| *24 230.01 | V | Y | PK | 99.76 | 1.09 | N/A | N/A | 100.85 | 127.95 | 27.10 |
| *24 230.37 | V | Y | AV | 99.71 | 1.09 | N/A | N/A | 100.80 | 107.95 | 7.15 |
| 24 250.60 | V | Y | PK | 47.11 | 1.10 | N/A | N/A | 48.21 | 74.00 | 25.79 |
| 24 250.43 | V | Y | AV | 38.79 | 1.10 | N/A | N/A | 39.89 | 54.00 | 14.11 |
| 48 459.77 | H | X | PK | 64.82 | -2.13 | N/A | -6.02 | 56.67 | 87.96 | 31.29 |
| 48 458.99 | H | X | AV | 64.02 | -2.13 | N/A | -6.02 | 55.87 | 67.96 | 12.09 |
| 72 693.41 | H | Z | PK | 28.56 | 43.97 | N/A | -6.02 | 66.51 | 87.96 | 21.45 |
| 72 692.62 | H | Z | AV | 27.39 | 43.95 | N/A | -6.02 | 65.32 | 67.96 | 2.64 |
| 96 920.36 | V | X | PK | 33.32 | 47.12 | N/A | -15.56 | 64.88 | 87.96 | 23.08 |
| 96 919.57 | V | X | AV | 31.76 | 47.12 | N/A | -15.56 | 63.32 | 67.96 | 4.64 |

### 4.2.3 AC Conducted Emissions

**Requirements and limit, §15.207 & RSS-Gen[8.8]**

For an 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 frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

| Frequency Range (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | 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

**Test Configuration**
See test photographs for the actual connections between EUT and support equipment.

**Test Procedure**
1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

**Test Results: NA**

## 4.3 List of Test Equipment

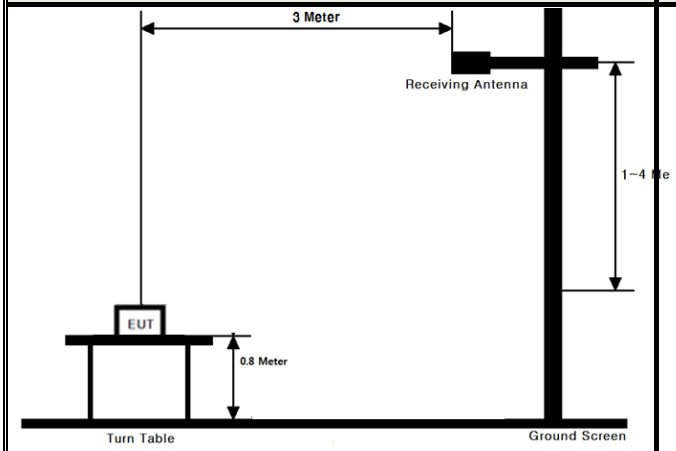
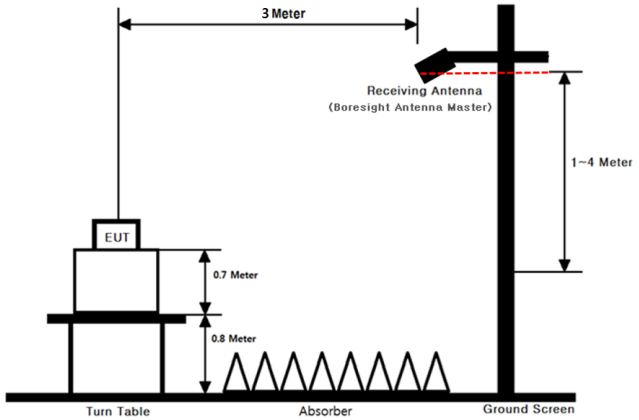
| Type | Manufacturer | Model | Cal.Date (yy/mm/dd) | Next.Cal.Date (yy/mm/dd) | S/N |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent Technologies | N9020A | 20/06/24 | 21/06/24 | US47360812 |
| Spectrum Analyzer | Rohde Schwarz | FSW85 | 20/02/02 | 21/02/02 | 101530 |
| DC Power Supply | SM techno | SDP30-5D | 19/12/16 | 20/12/16 | 305DKA013 |
| Multimeter | FLUKE | 17B+ | 19/12/16 | 20/12/16 | 36390701WS |
| Signal Generator | Rohde Schwarz | SMBV100A | 19/12/16 | 20/12/16 | 255571 |
| Signal Generator | ANRITSU | MG3695C | 19/12/16 | 20/12/16 | 173501 |
| Thermohygrometer | BODYCOM | BJ5478 | 19/12/18 | 20/12/18 | 120612-2 |
| Loop Antenna | ETS-Lindgren | 6502 | 19/09/18 | 21/09/18 | 00226186 |
| BILOG ANTENNA | Schwarzbeck | VULB 9160 | 19/04/23 | 21/04/23 | 3362 |
| HORN ANT | ETS | 3117 | 20/04/24 | 21/04/24 | 00140394 |
| PreAmplifier | H.P | 8447D | 19/12/16 | 20/12/16 | 2944A07774 |
| PreAmplifier | Agilent | 8449B | 20/06/24 | 21/06/24 | 3008A02108 |
| Horn Antenna | A.H. Systems Inc. | SAS-574 | 20/06/24 | 21/06/24 | 155 |
| PreAmplifier | tsj | MLA-1840-J02-45 | 20/06/24 | 21/06/24 | 16966-10728 |
| Horn Antenna | MI Wave | RX ANT-5 261U+410U | 20/08/05 | 21/08/05 | 108 |
| PreAmplifier | Norden Millimeter Inc. | NA4060G50N8P12 | 18/12/21 | 20/12/21 | 1003 |
| Horn Antenna | MI Wave | RX ANT-7 261E | 20/06/16 | 21/06/16 | 112 |
| Harmonic Mixers | Rohde Schwarz | FS-Z90 | 19/08/27 | 21/08/27 | 101714 |
| Horn Antenna | RX ANT-7 261E | RX ANT-8 261F | 20/06/16 | 21/06/16 | 115 |
| Harmonic Mixers | Rohde Schwarz | FS-Z140 | 19/10/14 | 21/10/14 | 101009 |
| High-pass filter | Wainwright | WHKX12-935-1000-15000-40SS | 20/06/24 | 21/06/24 | 7 |
| High-pass filter | Wainwright | WHKX12-2580-3000-18000-80SS | 20/06/24 | 21/06/24 | 3 |
| High-pass filter | Wainwright | WHNX8.5/26.5G-6SS | 20/06/24 | 21/06/24 | 1 |
| Cable | Radiall | TESTPRO3 | 20/01/16 | 21/01/16 | M-01 |
| Cable | Junkosha | MWX315 | 20/01/16 | 21/01/16 | M-03 |
| Cable | Junkosha | MWX221 | 20/01/16 | 21/01/16 | M-06 |
| Cable | DT&C | Cable | 20/01/13 | 21/01/13 | RF-20 |
| Cable | Junkosha | MWX241 | 20/01/13 | 21/01/13 | G-05 |
| Cable | Junkosha | MWX241 | 20/01/13 | 21/01/13 | G-07 |
| Cable | DT&C | Cable | 20/01/13 | 21/01/13 | G-08 |
| Cable | DT&C | Cable | 20/01/13 | 21/01/13 | G-09 |
| Cable | DT&C | Cable | 20/01/13 | 21/01/13 | G-11 |
| Cable | DT&C | Cable | 20/01/13 | 21/01/13 | G-12 |

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.
Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

# APPENDIX I

## Test set up diagrams

- **Radiated Measurement**

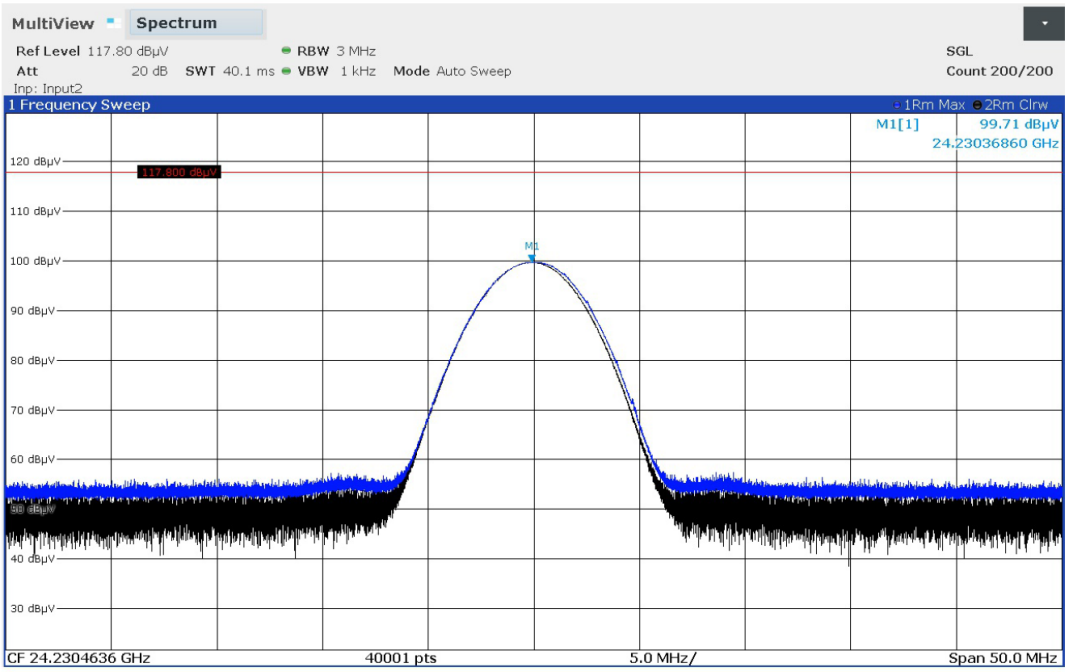
| Below 1GHz | Above 1GHz |
|---|---|
|  |  |

# APPENDIX II

## Worst data plot of radiated test

## Field strength of fundamental

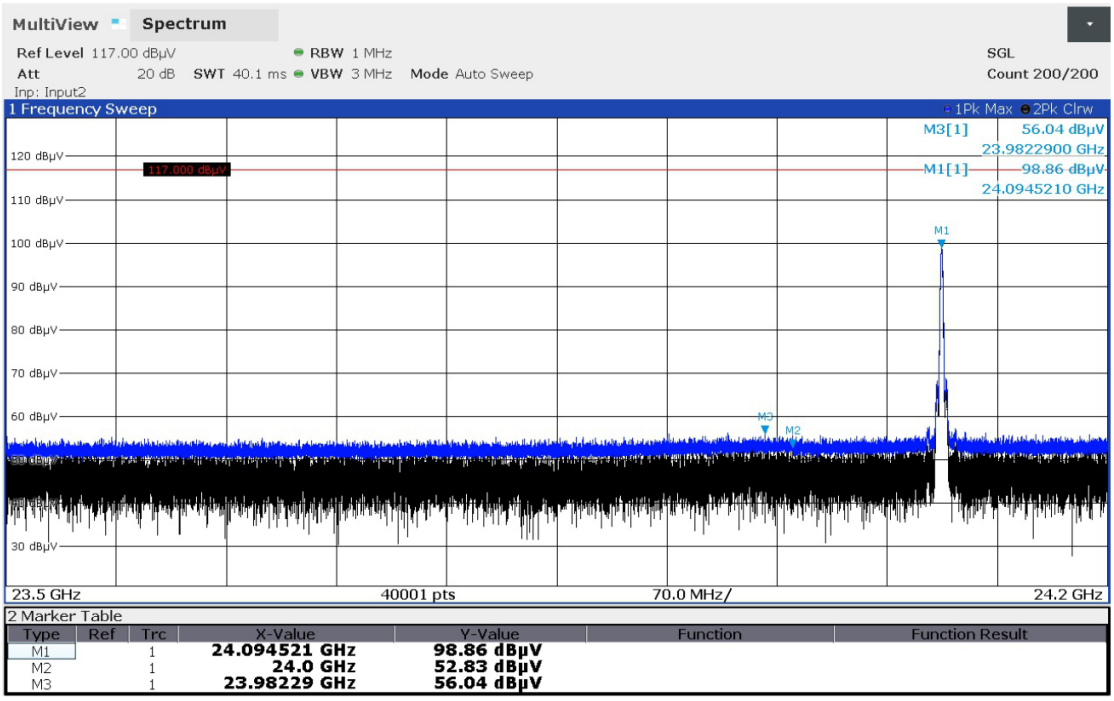
**Highest & Y & Ver** **Detector Mode : AV**



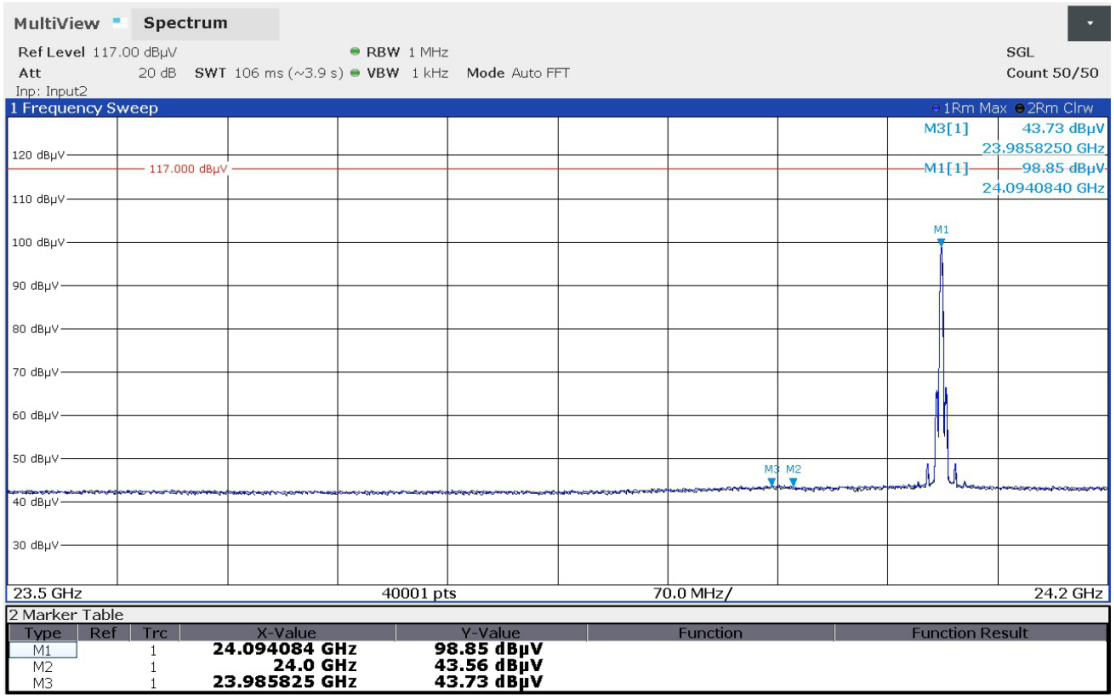

Note: The resolution bandwidth was set greater than occupied bandwidth of fundamental.

## Restricted band edge

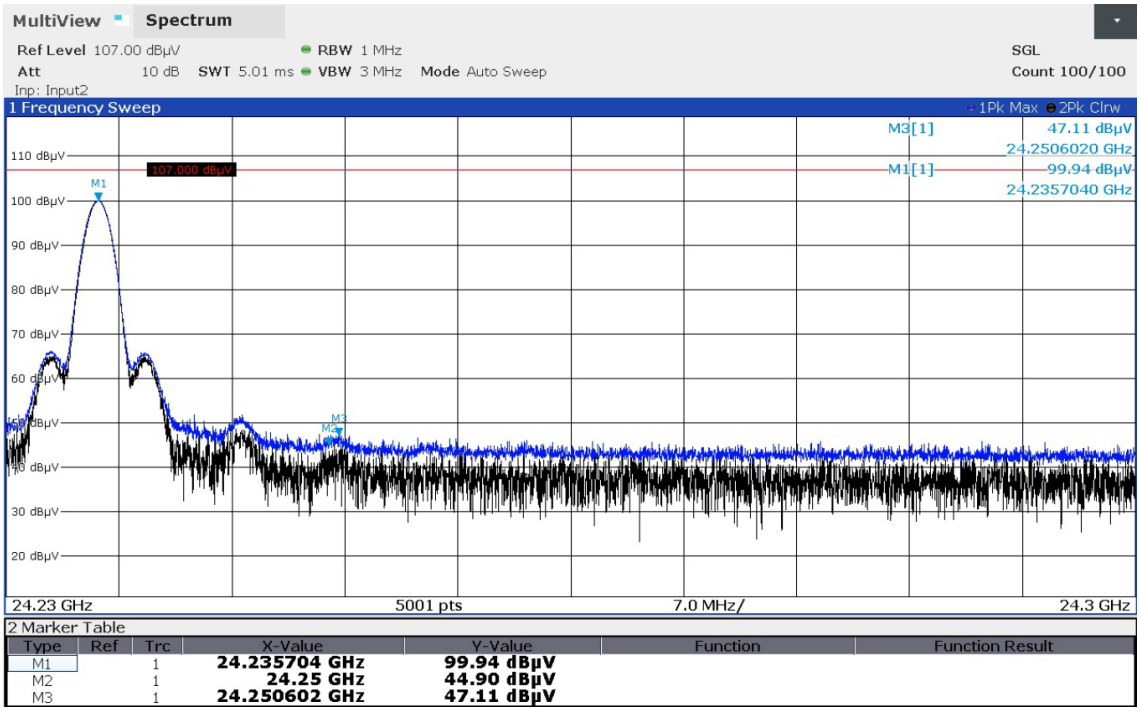
### Lowest & Y & Ver — Detector Mode : PK




### Lowest & Y & Ver — Detector Mode : AV



**Highest & Y & Ver** **Detector Mode : PK**




**Highest & Y & Ver** **Detector Mode : AV**

## Spurious emission

### Lowest & Z & Hor

### Detector Mode : AV