



FCC ID: 2A3MR-OSA-79G-AL
Report No.: TMWK2111001137KR

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FCC 47 CFR PART 95 SUBPART M

TEST REPORT

For

79G RADAR

Model: OSA-79G-AL

Trade Name: AKT

Issued to
AKASAKATEC INC.

3F, Marina Plaza, 4-2 Shiraho, Kanazawa-ku, Yokohama-shi, Kanagawa, Japan

Issued by

**Compliance Certification Services Inc.
Wugu Laboratory**

**No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City, Taiwan. (R.O.C.)**

Issued Date: November 29, 2021

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|------|-------------------|---------------|-------------|------------|
| 00 | November 29, 2021 | Initial Issue | ALL | Doris Chu |

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1. TEST RESULT CERTIFICATION

Applicant: AKASAKATEC INC.
3F, Marina Plaza, 4-2 Shiraho, Kanazawa-ku, Yokohama-shi,
Kanagawa, Japan

Equipment Under Test: 79G RADAR

Trade Name: AKT

Model: OSA-79G-AL

Date of Test: November 10 ~ 12, 2021

| APPLICABLE STANDARDS | |
|---|-------------------------|
| STANDARD | TEST RESULT |
| FCC 47 CFR Part 95 Subpart M | No non-compliance noted |
| Statements of Conformity | |
| Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty. | |

We hereby certify that:

All test results conform to above mentioned standards.

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 95.3367, 95.3379 and FCC KDB 653005 D01.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:



Shawn Wu
Supervisor



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2. EUT DESCRIPTION

| | |
|----------------------------|----------------------------------|
| Product | 79G RADAR |
| Trade Name | AKT |
| Model Number | OSA-79G-AL |
| Model Discrepancy | N/A |
| Received Date | November 10, 2021 |
| Power Supply | Power from host device. (DC 12V) |
| Frequency Band | 78.1~79.78 GHz |
| Modulation | FMCW |
| Number of Channel | 1 |
| Antenna Designation | Patch antenna / Gain: 12.01dBi |
| Hardware Version | 1A1G |
| Software Version | A1G |

Remark:

1. The sample selected for test was production product and was provided by manufacturer.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

3. TEST SUMMARY

| Report Section | FCC Standard Section | Test Item | Result |
|----------------|----------------------|--|--------|
| 8.1 | 95.3367 | Equivalent Isotropically Radiated Power (EIRP) | Pass |
| 8.2 | 95.3379(a) | Radiated spurious emissions | Pass |
| 8.3 | 95.3379(b) | Frequency stability | Pass |

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 , ANSI 63.4 2014, ANSI 63.26:2015 and FCC CFR 47 Part 95.3367, 95.3379, FCC KDB 653005 D01.

4.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in ANSI C63.10: 2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 1.5 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10: 2013.

4.4 DESCRIPTION OF TEST MODES

The EUT (model: OSA-79G-AL) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed. The worst case data rate is determined as the data rate with highest output power.

The product does not transmits in stop condition.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

| Radiated Emission Measurement Above 1G | |
|--|---|
| Test Condition | Radiated Emission Above 1G |
| Power supply Mode | Mode 1: EUT power by DC (12V) |
| Worst Mode | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4 |
| Worst Position | <input type="checkbox"/> Placed in fixed position. <input type="checkbox"/> Placed in fixed position at X-Plane (E2-Plane) <input type="checkbox"/> Placed in fixed position at Y-Plane (E1-Plane) <input checked="" type="checkbox"/> Placed in fixed position at Z-Plane (H-Plane) |

| Radiated Emission Measurement Below 1G | |
|--|--|
| Test Condition | Radiated Emission Below 1G |
| Power supply Mode | Mode 1: EUT power by DC (12V) |
| Worst Mode | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4 |

Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, for radiated measurement. The worst case(Z-Plane) were recorded in this report

5. INSTRUMENT CALIBRATION

5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: Each piece of equipment is scheduled for calibration once a year.

| Conducted Emissions Test Site | | | | | |
|-------------------------------|---------------|---------------------|----------------|------------|------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Cal Date | Cal Due |
| Coaxial Cable | Woken | WC12 | SS01 | 06/28/2021 | 06/27/2022 |
| Coaxial Cable | Woken | WC12 | SS02 | 06/28/2021 | 06/27/2022 |
| Horn Antenna / Harmonic Mixer | ROHDE&SCHWARZ | FH-PP-110 / FS-Z110 | 10003 / 100096 | 12/09/2019 | 12/08/2021 |
| Signal Analyzer | R&S | FSV 40 | 101073 | 09/07/2021 | 09/06/2022 |
| DC Power Supplies | GW Instek | SPS-3610 | GPE880163 | 01/05/2021 | 01/04/2022 |
| Thermostatic/Humidity Chamber | GWINSTEK | GTC-288MH-CC | TH160402 | 05/10/2021 | 05/09/2022 |
| Software | N/A | | | | |

| 3M 966 Chamber Test Site Above 40GHz | | | | | |
|--|--------------------------|---------------------|---------------------|------------|------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Cal Date | Cal Due |
| Coaxial Cable | Woken | WC12 | SS01 | 06/28/2021 | 06/27/2022 |
| Coaxial Cable | Woken | WC12 | SS02 | 06/28/2021 | 06/27/2022 |
| Horn Antenna / Harmonic Mixer | ROHDE&SCHWARZ | FH-PP-110 / FS-Z110 | 10003 / 100096 | 12/09/2019 | 12/08/2021 |
| Horn Antenna / Harmonic Mixer | A-INFOMW / ROHDE&SCHWARZ | LB-19-20-A / FS-Z60 | J202020872 / 100142 | 12/09/2019 | 12/08/2021 |
| Horn Antenna / Harmonic Mixer | ROHDE&SCHWARZ | FH-PP-75 / FS-Z75 | 10001 / 100162 | 12/09/2019 | 12/08/2021 |
| Horn Antenna / Spectrum Analyzer Mixer | Radiometer Physics GmbH | FH-PP-220 / SAM-220 | 10003 / 20013 | 12/09/2019 | 12/08/2021 |
| Horn Antenna / Spectrum Analyzer Mixer | Radiometer Physics GmbH | FH-PP-170 / SAM-170 | 10003 / 20011 | 12/09/2019 | 12/08/2021 |
| Horn Antenna / Spectrum Analyzer Mixer | Radiometer Physics GmbH | FH-PP-325 / SAM-325 | 10007 / 20048 | 12/09/2019 | 12/08/2021 |
| Signal Analyzer | R&S | FSV 40 | 101073 | 09/07/2021 | 09/06/2022 |
| Software | e3 6.11-20180419c | | | | |

| 3M 966 Chamber Test Site | | | | | |
|----------------------------|------------------|---------------------------|-----------------|------------|------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Cal Date | Cal Due |
| Bilog Antenna | Sunol Sciences | JB3 | A030105 | 07/19/2021 | 07/18/2022 |
| Coaxial Cable | HUBER SUHNER | SUCOFLEX 104PEA | 20995 | 02/24/2021 | 02/23/2022 |
| Coaxial Cable | EMCI | EMC105 | 190914+111 1 | 09/17/2021 | 09/16/2022 |
| Digital Thermo-Hygro Meter | WISEWIND | 1206 | D07 | 01/06/2021 | 01/05/2022 |
| Horn Antenna | ETS LINDGREN | 3116 | 26370 | 12/11/2020 | 12/10/2021 |
| Horn Antenna | ETS LINDGREN | 3117 | 55165 | 07/29/2021 | 07/28/2022 |
| K Type Cable | Huber+Suhner | SUCOFLEX 102 | 29406/2 | 12/09/2020 | 12/08/2021 |
| K Type Cable | Huber+Suhner | SUCOFLEX 102 | 22470/2 | 12/09/2020 | 12/08/2021 |
| Pre-Amplifier | EMEC | EM330 | 060609 | 02/24/2021 | 02/23/2022 |
| Loop Ant | COM-POWER | AL-130 | 121051 | 04/07/2021 | 04/06/2022 |
| Pre-Amplifier | HP | 8449B | 3008A0096 5 | 12/25/2020 | 12/24/2021 |
| Pre-Amplifier | MITEQ | AMF-6F-180040 00-37-8P | 985646 | 09/08/2021 | 09/07/2022 |
| Spectrum Analyzer | Agilent | E4446A | US4251026 8 | 09/23/2021 | 09/22/2022 |
| Antenna Tower | CCS | CC-A-1F | N/A | N.C.R | N.C.R |
| Controller | CCS | CC-C-1F | N/A | N.C.R | N.C.R |
| Turn Table | CCS | CC-T-1F | N/A | N.C.R | N.C.R |
| Software | e3 6.11-20180413 | | | | |

5.3 MEASUREMENT UNCERTAINTY

| PARAMETER | UNCERTAINTY |
|---|-------------|
| AC Powerline Conducted Emission | +/- 1.2575 |
| Emission bandwidth, 6dB bandwidth | +/- 0.0014 |
| RF output power, conducted | +/- 1.14 |
| Power density, conducted | +/- 1.40 |
| 3M Semi Anechoic Chamber / 30 MHz ~1 GHz (Horizontally) | +/- 3.91 |
| 3M Semi Anechoic Chamber / 30 MHz ~1 GHz (Vertically) | +/- 4.57 |
| 3M Semi Anechoic Chamber / 1 GHz ~ 6 GHz | +/- 5.20 |
| 3M Semi Anechoic Chamber / 6 GHz ~ 18 GHz | +/- 5.18 |
| 3M Semi Anechoic Chamber / 18 GHz ~ 40 GHz | +/- 3.68 |
| 3M Semi Anechoic Chamber / 40 GHz ~ 60 GHz | +/- 4.64 |
| 3M Semi Anechoic Chamber / 60 GHz ~ 75 GHz | +/- 4.64 |
| 3M Semi Anechoic Chamber / 75 GHz ~ 110 GHz | +/- 4.65 |
| 3M Semi Anechoic Chamber / 110 GHz ~ 170 GHz | +/- 4.69 |
| 3M Semi Anechoic Chamber / 170 GHz ~ 220 GHz | +/- 5.31 |
| 3M Semi Anechoic Chamber / 220 GHz ~ 325 GHz | +/- 5.73 |

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)

Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."



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7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

7.2 SUPPORT EQUIPMENT

| No. | Device Type | Brand | Model | Series No. | FCC ID |
|-----|-------------|---------|---------------|------------|----------|
| 1 | NB(J) | TOSHIBA | PT345T-00L002 | N/A | PD97260H |

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8. TEST REQUIREMENTS

8.1 EQUIVALENT ISOTROPICALLY RADIATED POWER (EIRP)

LIMIT

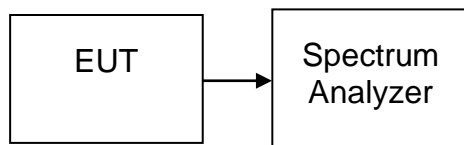
The fundamental radiated emission limits within the 76-81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as follows:

According to FCC 95.3367.

The maximum power (EIRP) within the 76-81 GHz band shall not exceed 50 dBm based on measurements employing a power averaging detector with a 1 MHz Resolution Bandwidth (RBW).

The maximum peak power (EIRP) within the 76-81 GHz band shall not exceed 55 dBm based on measurements employing a peak detector with a 1 MHz RBW.

Test Configuration



TEST RESULTS

No non-compliance noted.



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Temperature: 20.3 ~ 21.1°C

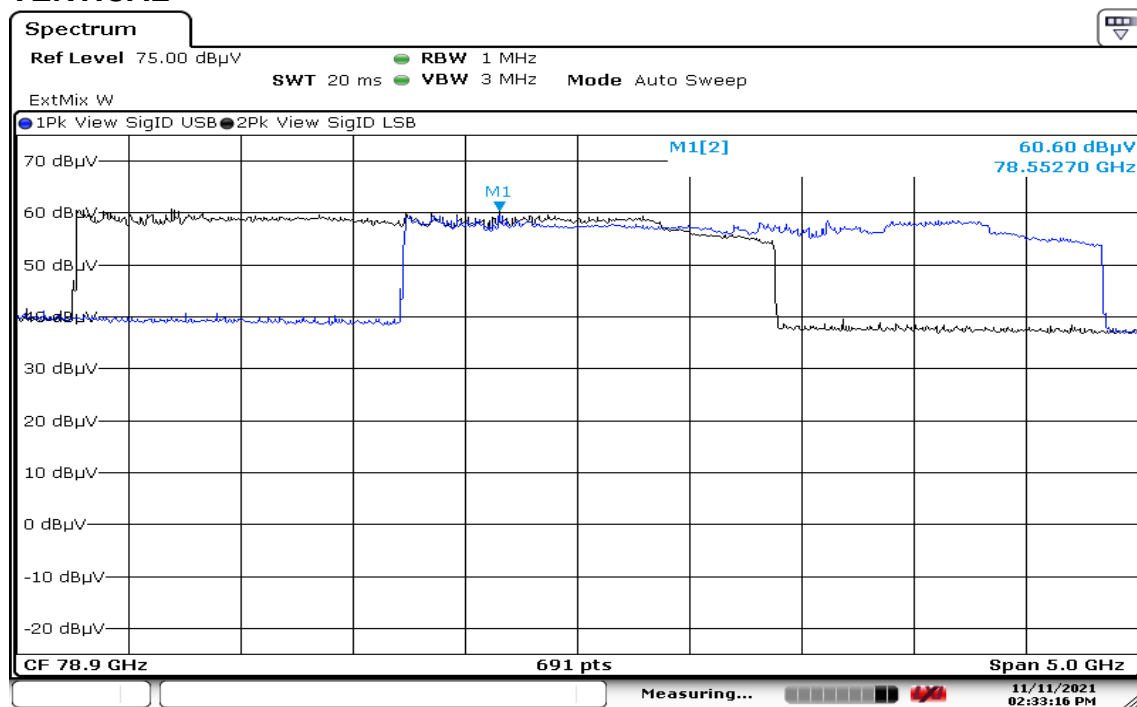
Test date: November 10 ~ 11, 2021

Humidity: 53 ~ 55% RH

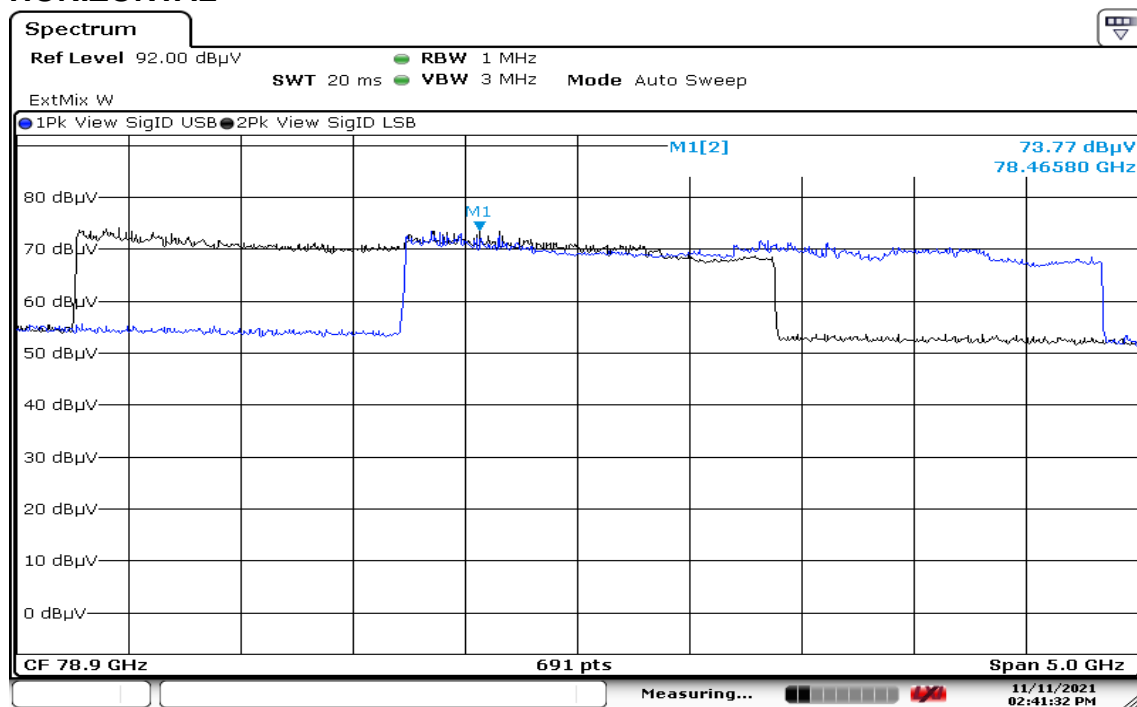
Tested by: Dally Hong

| Freuqnecy (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | E.I.R.P.(dBm) | E.I.R.P. Limit (dBm) | Detector | ANT Pol |
|--------------------|-------------------------------|--------------------------|-----------------|--------|---------------|----------------------------|----------|------------|
| 78.4658 | 73.77 | 50.28 | 1 | 124.05 | 19.25 | ≤55 | Peak | H |
| 78.2488 | 56.36 | 50.27 | 1 | 106.63 | 1.83 | ≤50 | RMS | H |
| 78.5527 | 60.6 | 50.28 | 1 | 110.88 | 6.08 | ≤ 55 | Peak | V |
| 78.133 | 41.15 | 50.26 | 1 | 91.41 | -13.39 | ≤ 50 | RMS | V |

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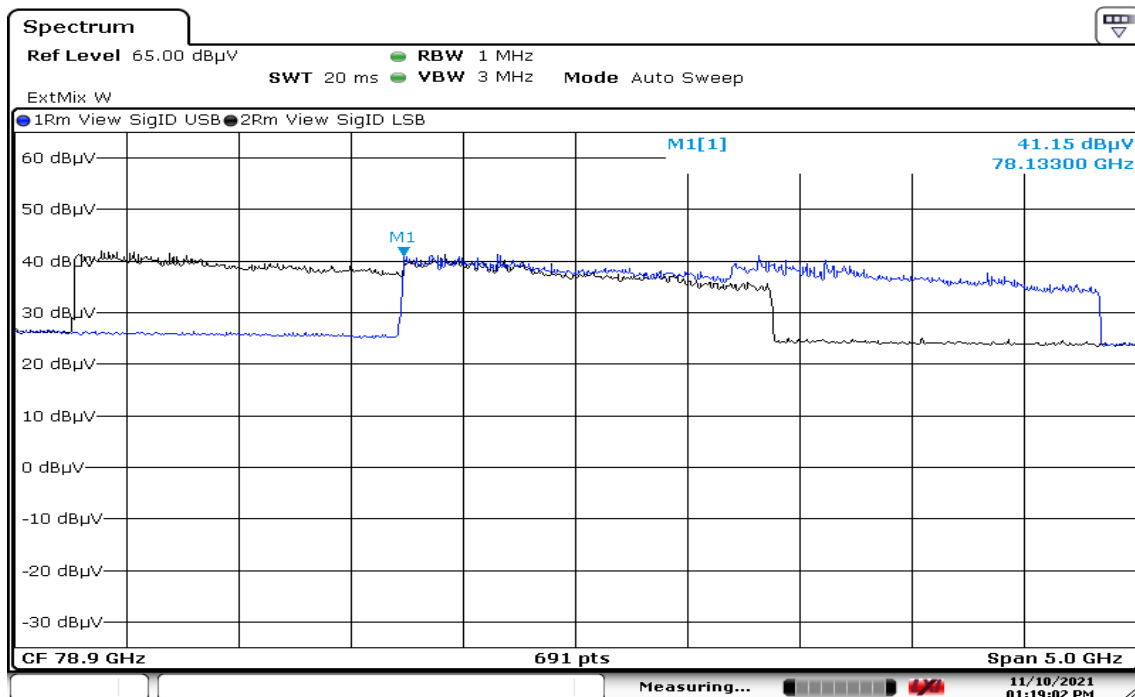
Test Data**Peak Power****VERTICAL**

Date: 11.NOV.2021 14:33:17

HORIZONTAL

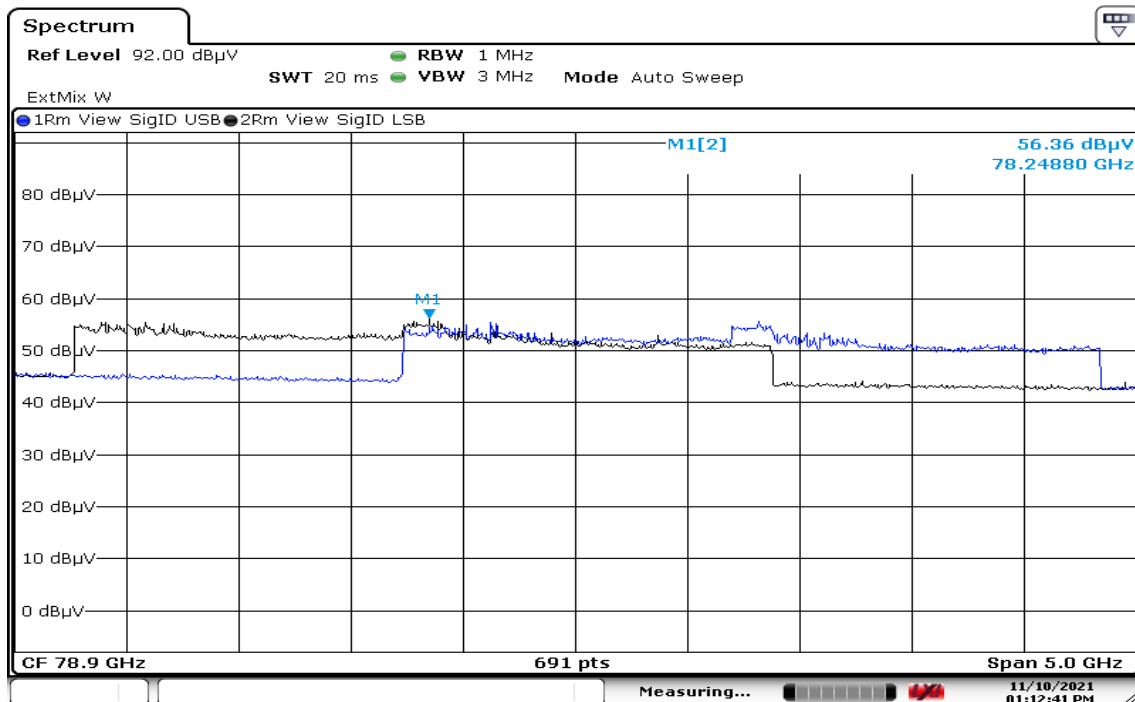
Date: 11.NOV.2021 14:41:33

RMS Power VERTICAL



Date: 10.NOV.2021 13:19:02

HORIZONTAL



Date: 10.NOV.2021 13:12:41

8.2 SPURIOUS EMISSIONS

8.2.1 Radiated Emissions

LIMIT

1. According to FCC PART 95.3379(a), Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

| Frequency (MHz) | Field Strength (μV/m) | Measurement Distance (m) |
|-----------------|-----------------------|--------------------------|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

2. For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.
3. For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

Notes:

$$P(\text{mW}) = \text{Power density (mW/m}^2) \times 4\pi(r)^2$$

$$600 \text{ pW/cm}^2 = -1.7 \text{ dBm @ 3m} = 7.84 \text{ dBm @ 1m}$$

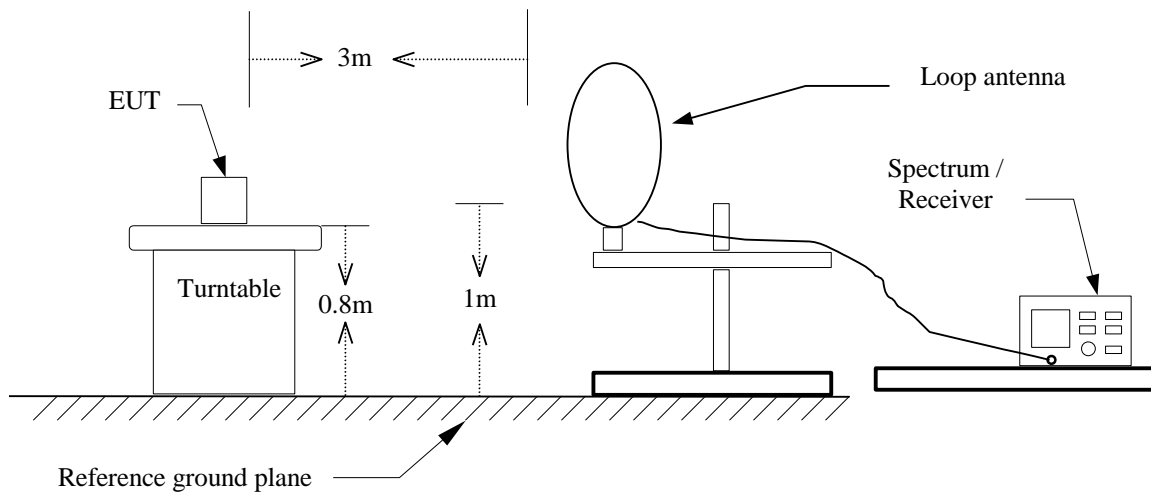
$$1000 \text{ pW/cm}^2 = 0.5 \text{ dBm @ 3m} = 10.04 \text{ dBm @ 1m}$$

P: Power

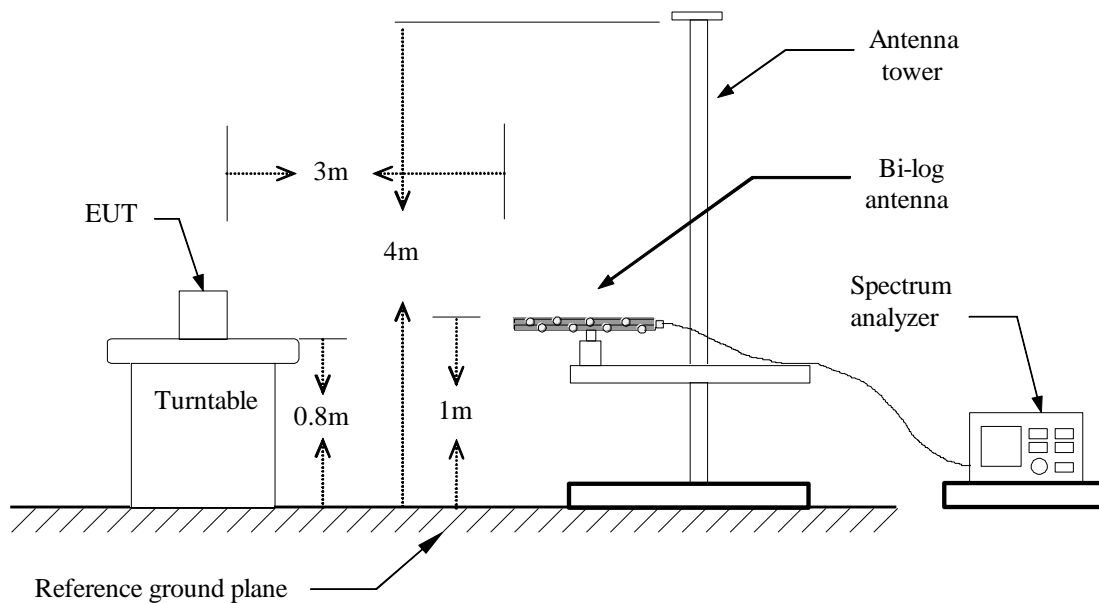
r: measurement distance(m)

Test Configuration

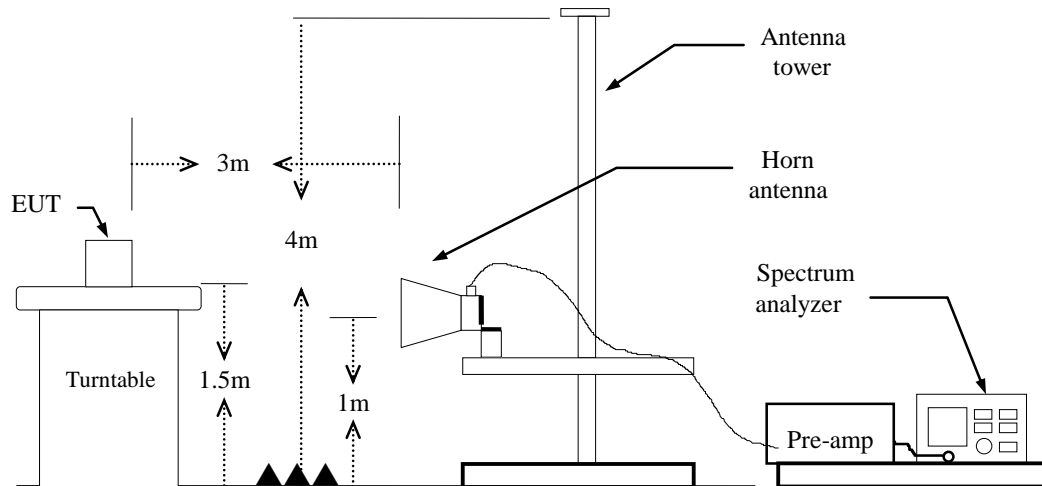
9kHz ~ 30MHz



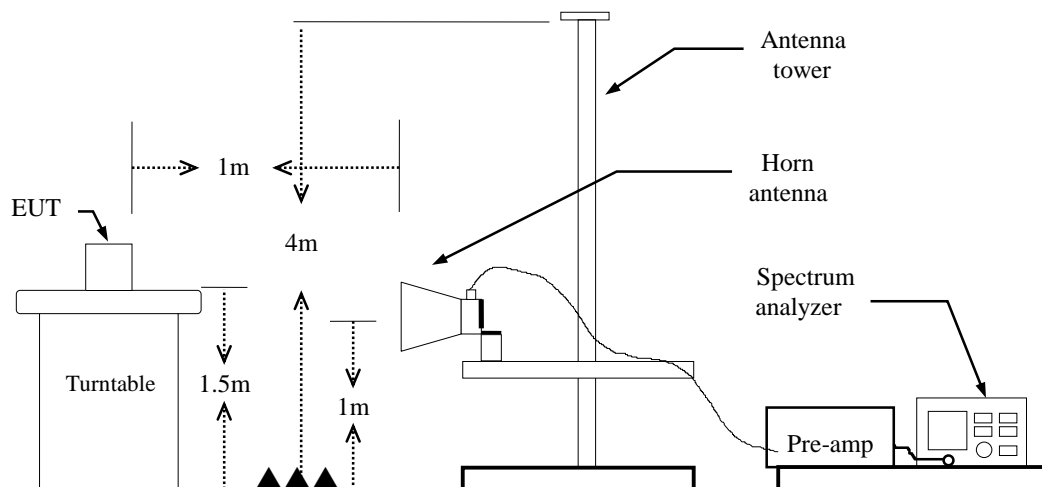
30MHz ~ 1 GHz

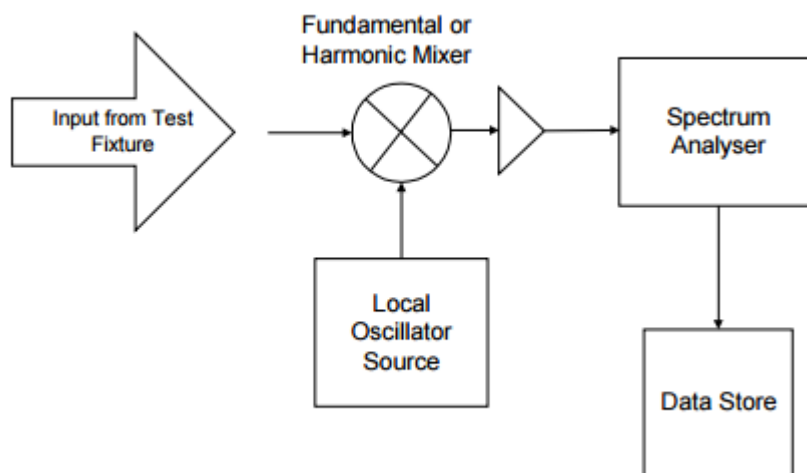


Above 1 GHz ~ 18GHz



18GHz ~ 40GHz



Above 40 GHz

TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a)PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO

(b)AVERAGE: RBW=1MHz,

Above 40GHz:

RBW = 1 MHz, VBW= 3 MHz,

Detector = Peak, Trace mode = max hold, Sweep = AUTO.

7. Repeat above procedures until the measurements for all frequencies are complete.

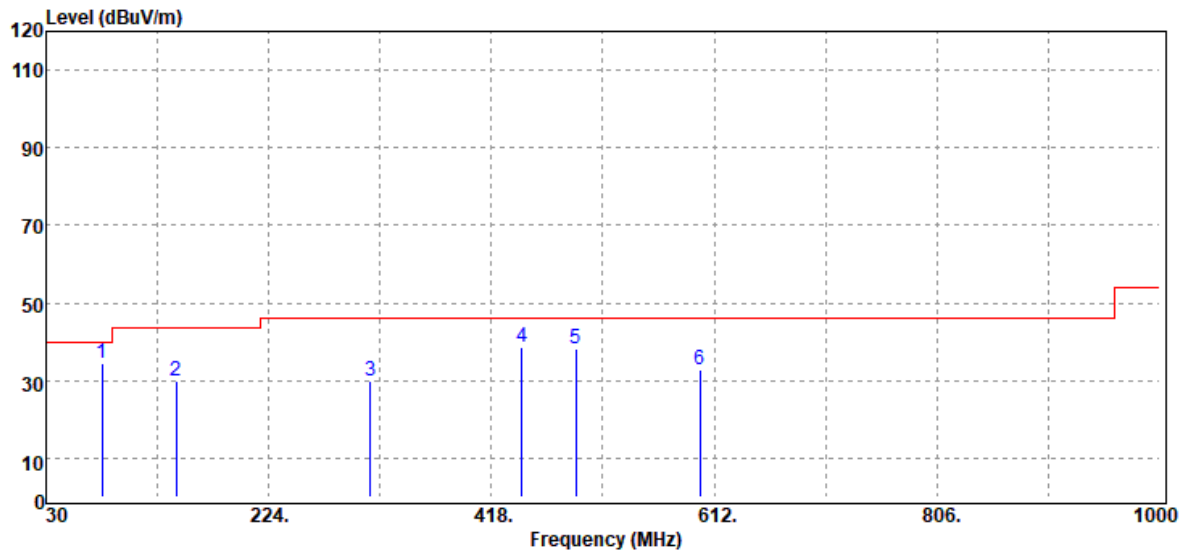
Below 1 GHz**Operation Mode:** TX CH Mid**Polarity:** Ver. / Hor.**Temperature:** 20.3°C**Tested by:** Tony Chao**Humidity:** 51% RH**Test Date:** November 12, 2021

| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB | Ant. Pol. (H/V) |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|-----------------------|
| 78.50 | Peak | 50.04 | -15.53 | 34.51 | 40.00 | -5.49 | V |
| 143.49 | Peak | 39.99 | -10.17 | 29.82 | 43.50 | -13.68 | V |
| 312.27 | Peak | 38.08 | -8.36 | 29.72 | 46.00 | -16.28 | V |
| 444.19 | Peak | 43.06 | -4.55 | 38.51 | 46.00 | -7.49 | V |
| 491.72 | Peak | 41.60 | -3.43 | 38.17 | 46.00 | -7.83 | V |
| 599.39 | Peak | 35.16 | -2.27 | 32.89 | 46.00 | -13.11 | V |
| 143.49 | Peak | 47.91 | -10.17 | 37.74 | 43.50 | -5.76 | H |
| 263.77 | Peak | 47.48 | -9.47 | 38.01 | 46.00 | -7.99 | H |
| 395.69 | Peak | 43.05 | -6.20 | 36.85 | 46.00 | -9.15 | H |
| 444.19 | Peak | 41.71 | -4.55 | 37.16 | 46.00 | -8.84 | H |
| 491.72 | Peak | 39.53 | -3.43 | 36.10 | 46.00 | -9.90 | H |
| 576.11 | Peak | 32.91 | -2.13 | 30.78 | 46.00 | -15.22 | H |

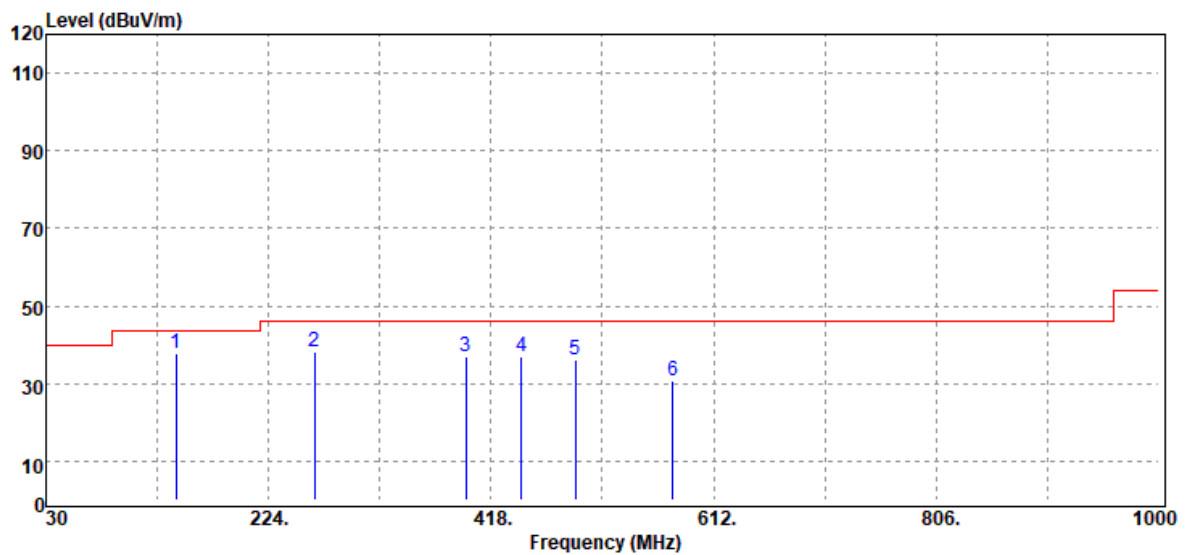
Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

Polarity : Vertical



Polarity : Horizontal



Above 1 GHz**Operation Mode:** TX CH Mid**Polarity:**

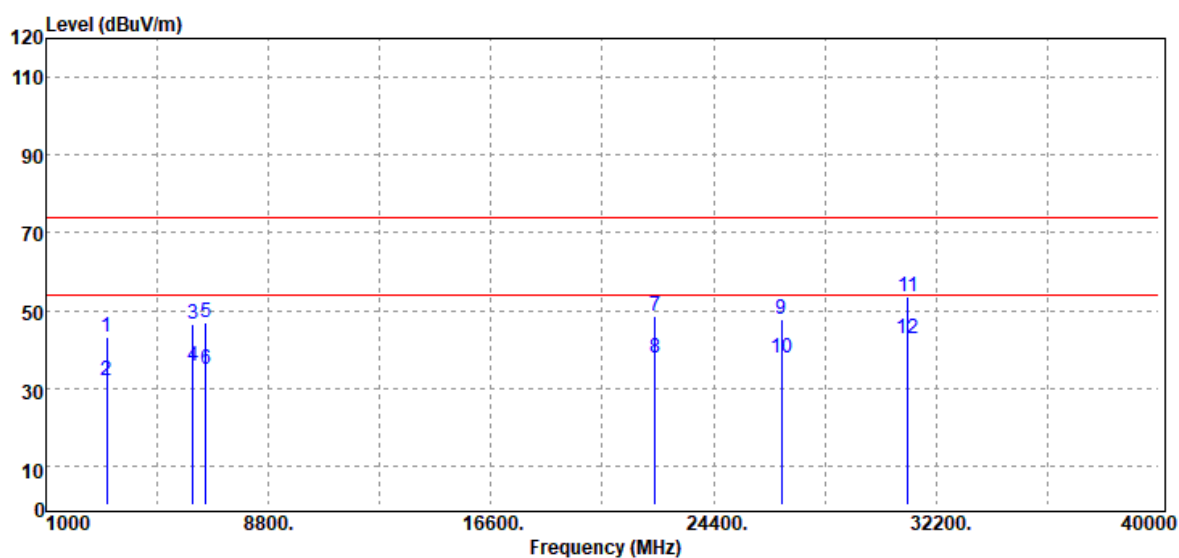
Ver.

Temperature: 20.3°C**Tested by:**

Tony Chao

Humidity: 51% RH**Test Date:**

November 12, 2021



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB | Ant. Pol. (H/V) |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|-----------------------|
| 3144.20 | Peak | 36.97 | 6.09 | 43.06 | 74.00 | -30.94 | V |
| 3144.20 | Average | 25.77 | 6.09 | 31.86 | 54.00 | -22.14 | V |
| 6161.70 | Peak | 33.78 | 12.59 | 46.37 | 74.00 | -27.63 | V |
| 6161.70 | Average | 23.19 | 12.59 | 35.78 | 54.00 | -18.22 | V |
| 6601.90 | Peak | 33.96 | 12.80 | 46.76 | 74.00 | -27.24 | V |
| 6601.90 | Average | 22.07 | 12.80 | 34.87 | 54.00 | -19.13 | V |
| 22356.00 | Peak | 31.99 | 16.56 | 48.55 | 74.00 | -25.45 | V |
| 22356.00 | Average | 21.15 | 16.56 | 37.71 | 54.00 | -16.29 | V |
| 26778.00 | Peak | 34.24 | 13.44 | 47.68 | 74.00 | -26.32 | V |
| 26778.00 | Average | 24.54 | 13.44 | 37.98 | 54.00 | -16.02 | V |
| 31200.00 | Peak | 35.39 | 18.01 | 53.40 | 74.00 | -20.60 | V |
| 31200.00 | Average | 24.68 | 18.01 | 42.69 | 54.00 | -11.31 | V |

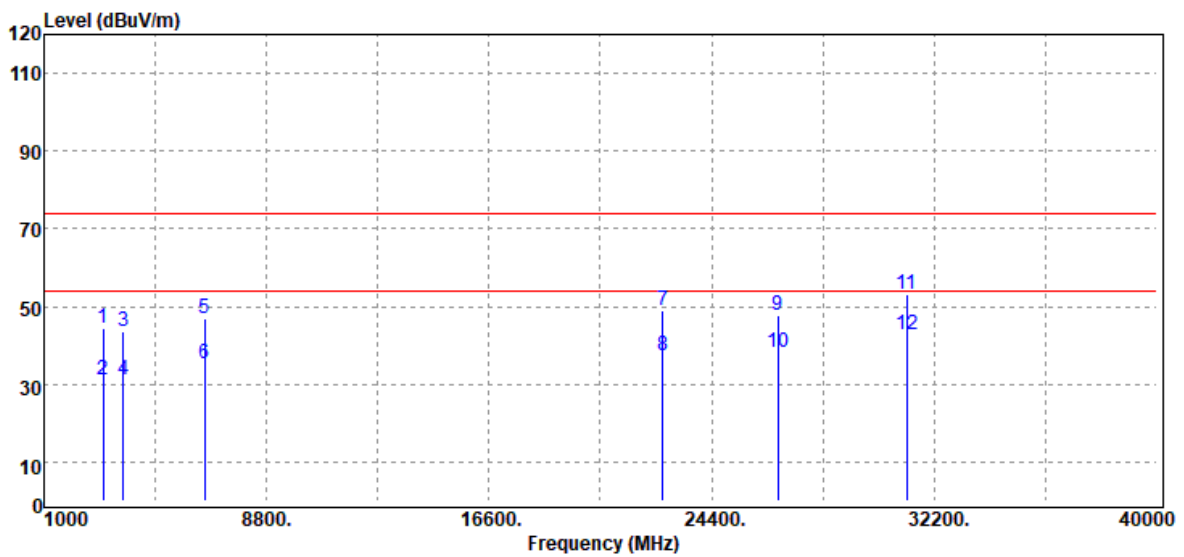
Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

Report No.: TMWK2111001137KR

Operation Mode: TX CH Mid
Temperature: 20.3°C
Humidity: 51% RH

Polarity: Hor.
Tested by: Tony Chao
Test Date: November 12, 2021

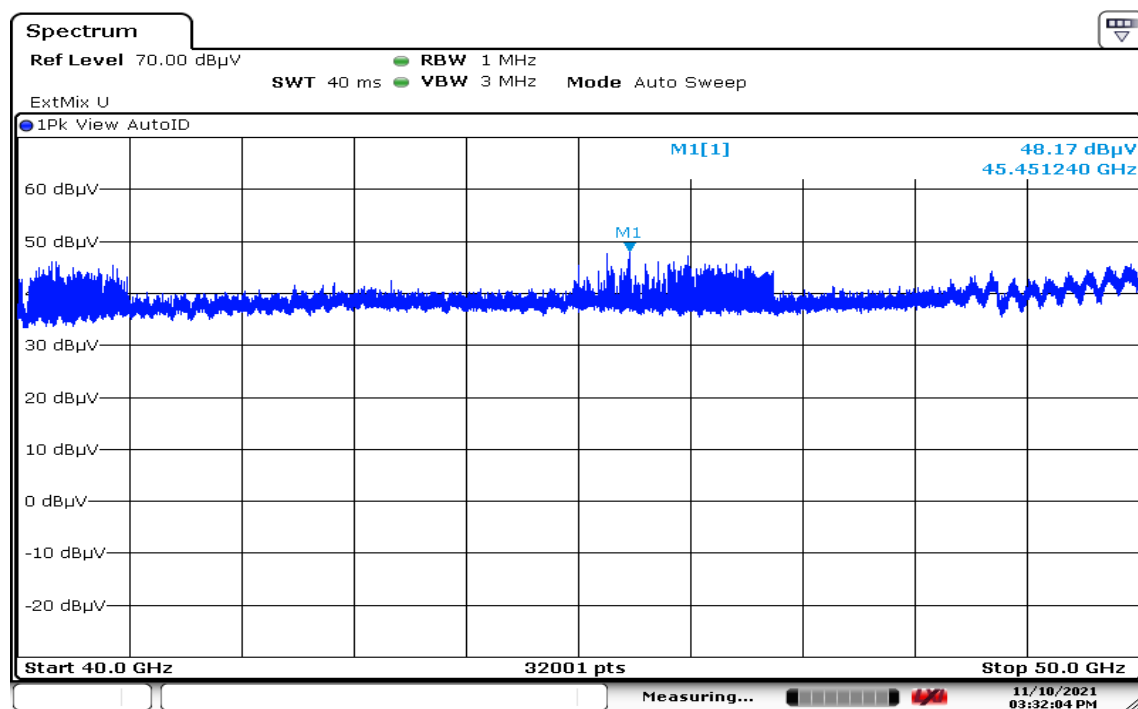


| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB | Ant. Pol. (H/V) |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|-----------------------|
| 3072.00 | Peak | 38.89 | 5.65 | 44.54 | 74.00 | -29.46 | H |
| 3072.00 | Average | 25.69 | 5.65 | 31.34 | 54.00 | -22.66 | H |
| 3779.00 | Peak | 35.77 | 7.79 | 43.56 | 74.00 | -30.44 | H |
| 3779.00 | Average | 23.28 | 7.79 | 31.07 | 54.00 | -22.93 | H |
| 6635.00 | Peak | 33.91 | 12.92 | 46.83 | 74.00 | -27.17 | H |
| 6635.00 | Average | 22.38 | 12.92 | 35.30 | 54.00 | -18.70 | H |
| 22686.00 | Peak | 32.84 | 16.27 | 49.11 | 74.00 | -24.89 | H |
| 22686.00 | Average | 21.23 | 16.27 | 37.50 | 54.00 | -16.50 | H |
| 26712.00 | Peak | 34.28 | 13.47 | 47.75 | 74.00 | -26.25 | H |
| 26712.00 | Average | 24.62 | 13.47 | 38.09 | 54.00 | -15.91 | H |
| 31244.00 | Peak | 35.26 | 17.98 | 53.24 | 74.00 | -20.76 | H |
| 31244.00 | Average | 24.79 | 17.98 | 42.77 | 54.00 | -11.23 | H |

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

Report No.: TMWK2111001137KR

40G-50G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 15:32:04

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 45.45124 | 48.17 | 46.62 | 1 | 94.79 | ≤103.08 | Peak |

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

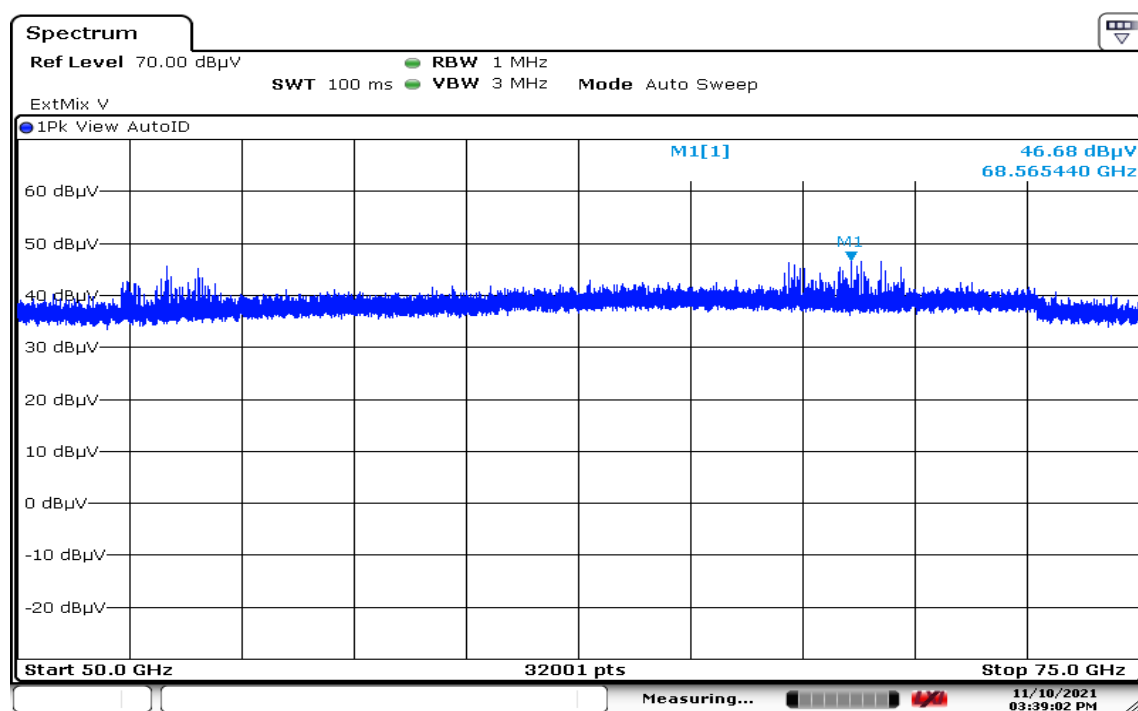
2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.5m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 109.1dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

Report No.: TMWK2111001137KR

50G-75G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 15:39:03

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 68.56544 | 46.68 | 47.99 | 1 | 94.67 | ≤103.08 | Peak |

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

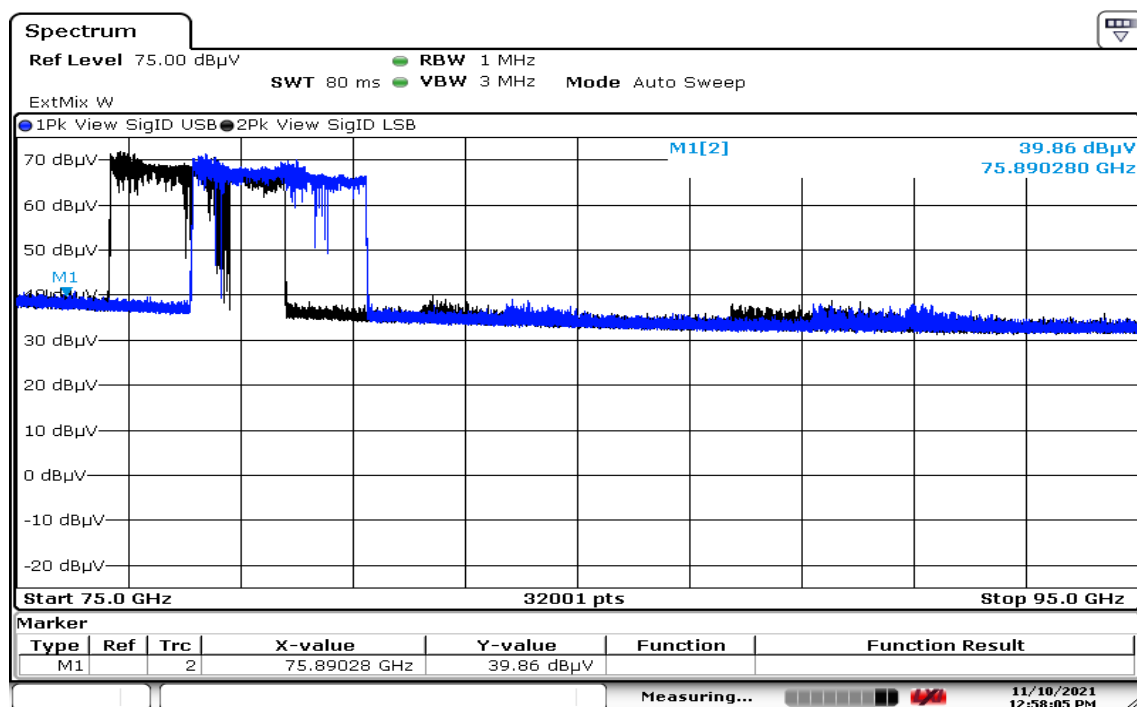
2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.5m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 109.1dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

Report No.: TMWK2111001137KR

75G-95G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 12:58:05

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 75.89028 | 39.86 | 50.16 | 1 | 90.02 | ≤103.08 | Peak |

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

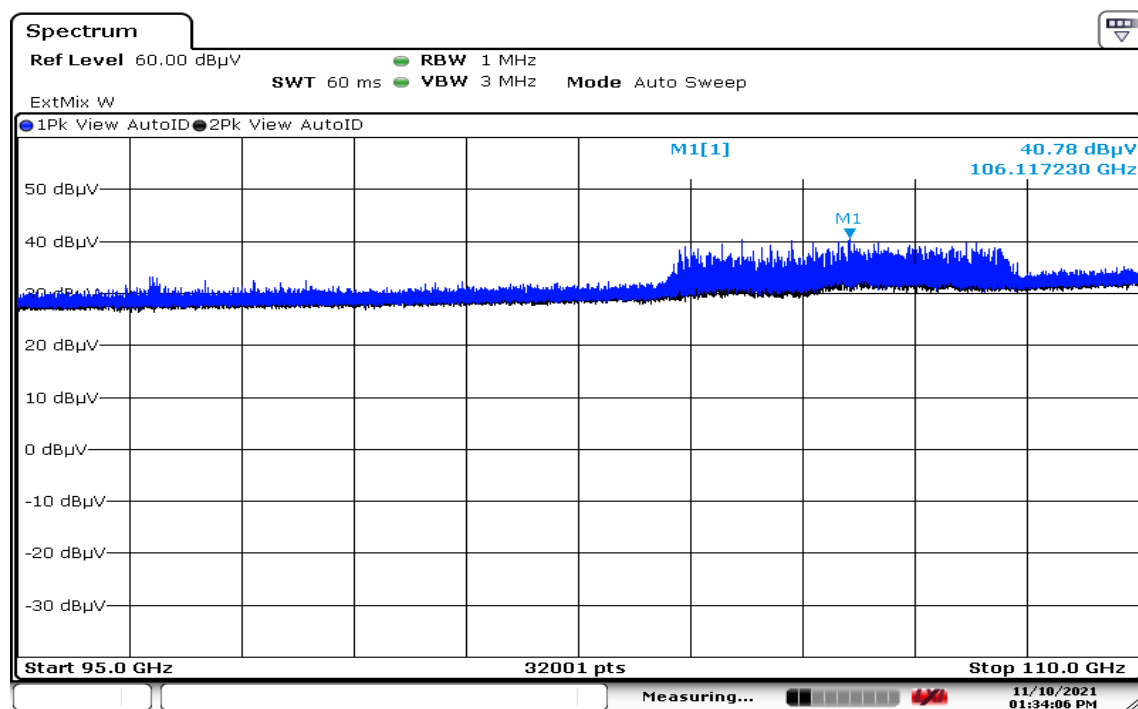
2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.5m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 109.1dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

Report No.: TMWK2111001137KR

95G-110G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 13:34:07

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 106.11723 | 40.78 | 52.84 | 1 | 93.62 | ≤103.08 | Peak |

Remark:

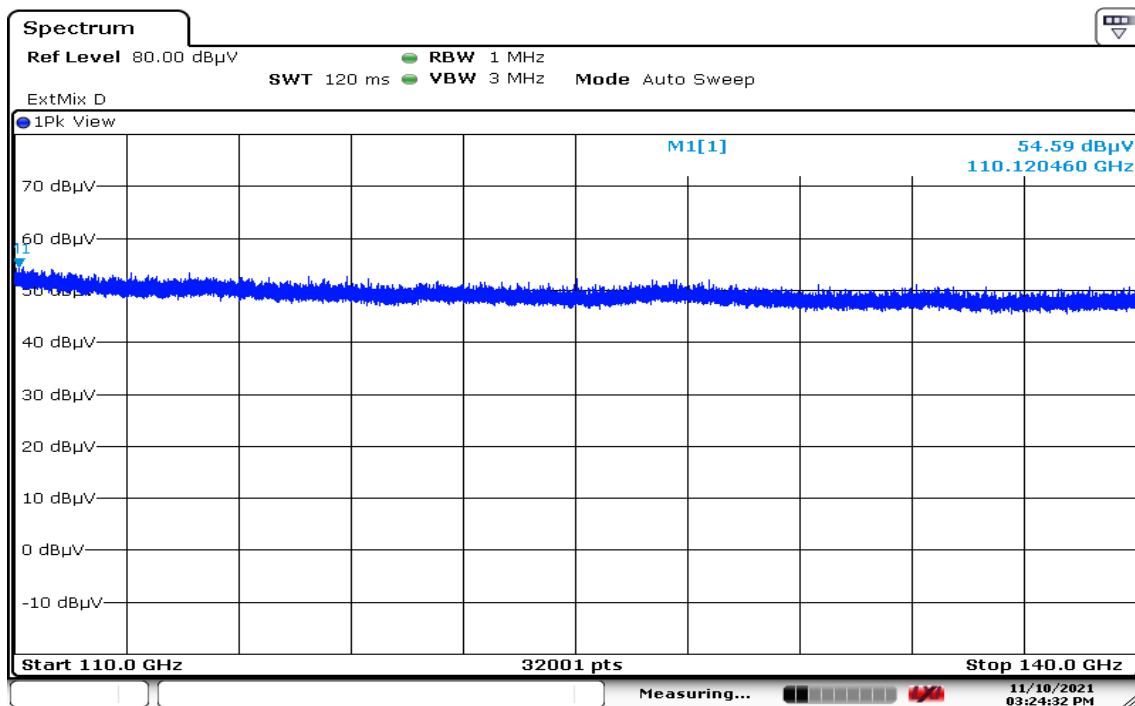
1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.5m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 109.1dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

110G-140G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 15:24:32

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 110.12046 | 54.59 | 54.48 | 0.4 | 109.07 | ≤111.04 | Peak |

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

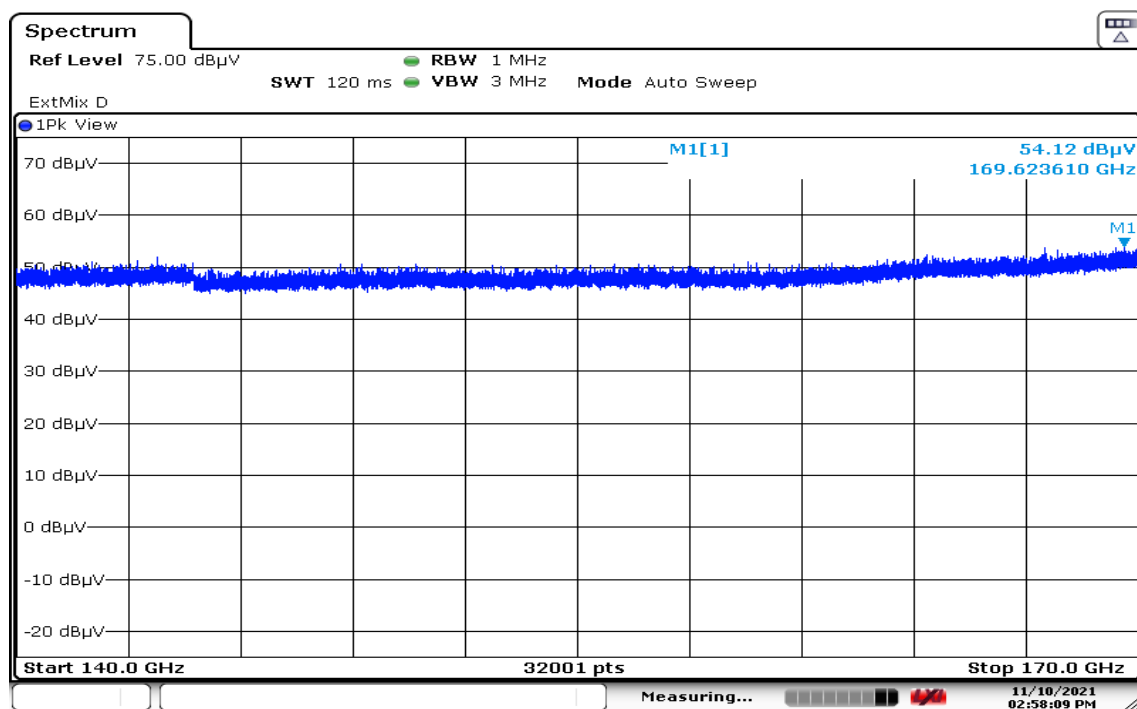
2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.4m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 111.04dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

Report No.: TMWK2111001137KR

140G-170G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 14:58:10

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 169.62361 | 54.12 | 56.71 | 0.4 | 110.83 | ≤111.04 | Peak |

Remark:

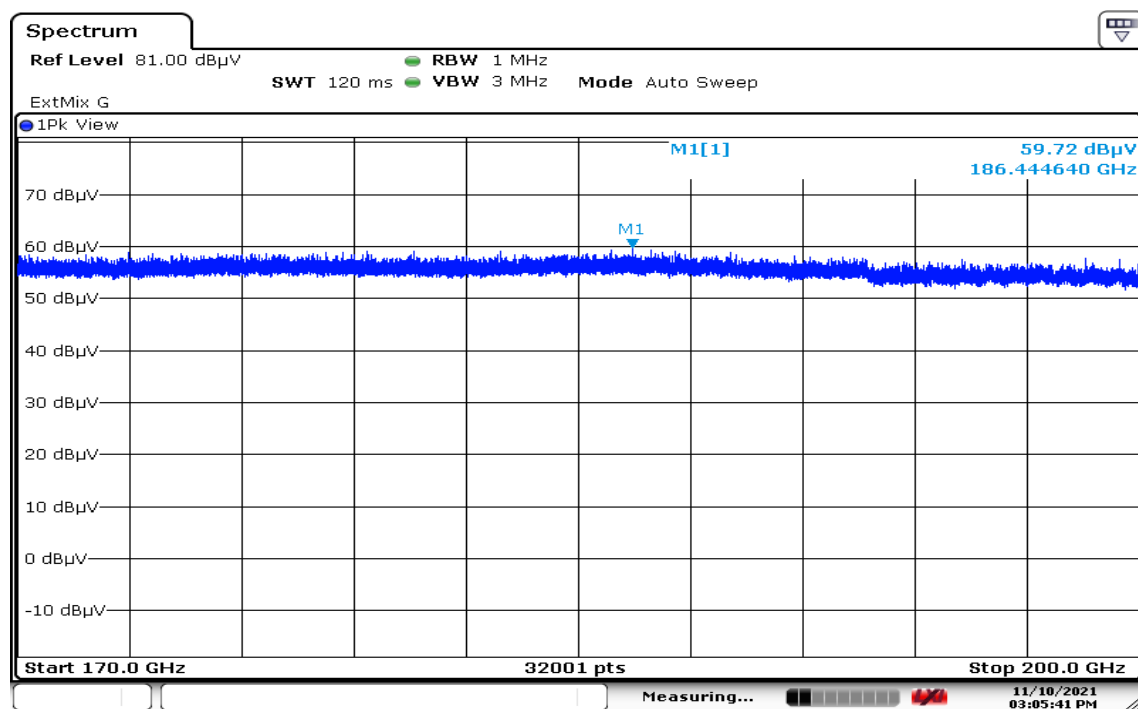
1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.4m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 111.04dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

170G-200G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 15:05:41

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 186.44464 | 59.72 | 57.23 | 0.2 | 116.95 | ≤117.06 | Peak |

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

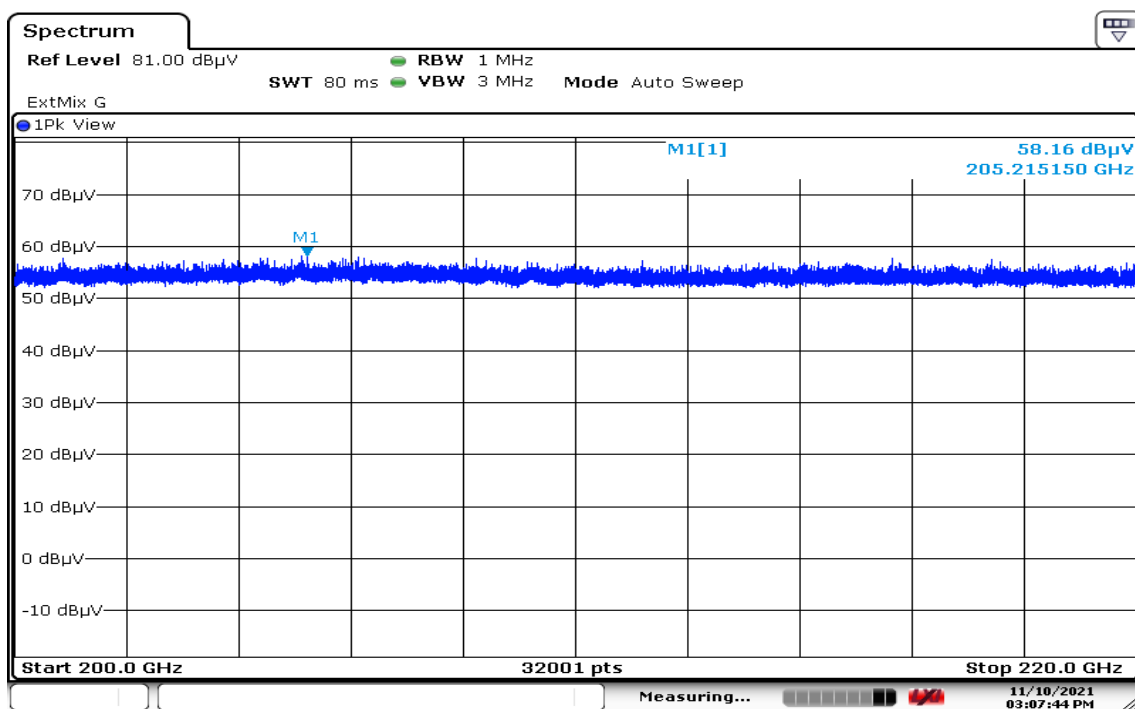
2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.5m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 109.1dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

Report No.: TMWK2111001137KR

200G-220G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 15:07:45

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 205.51515 | 58.16 | 57.83 | 0.2 | 115.99 | ≤119.28 | Peak |

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

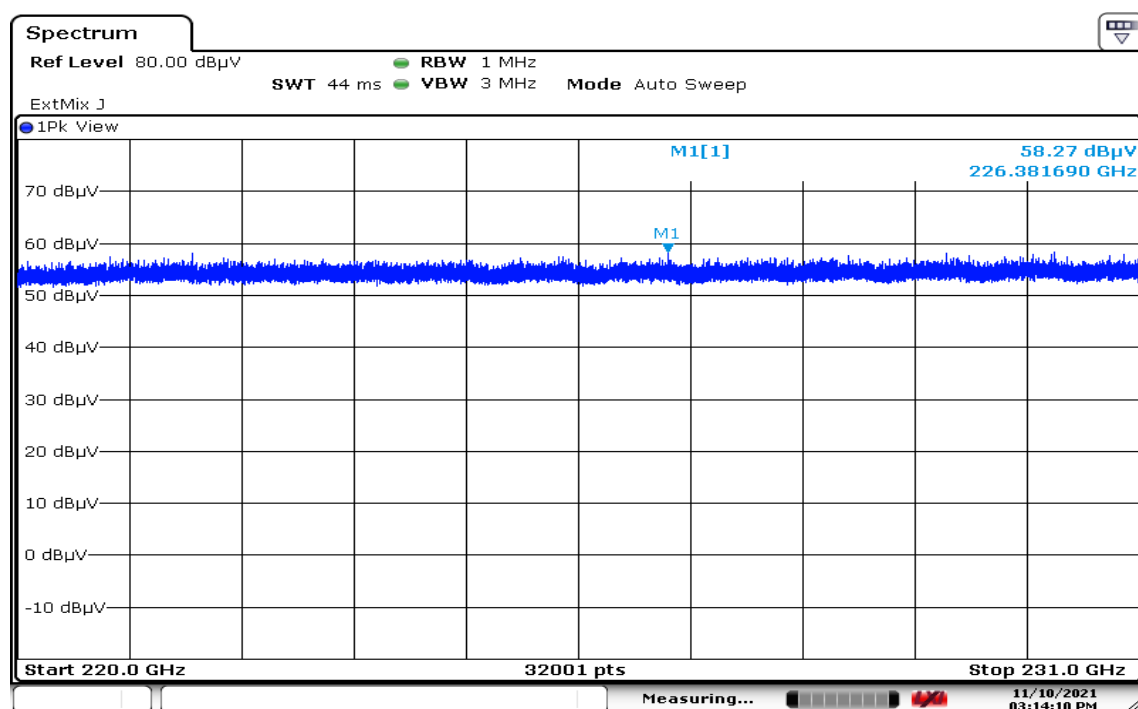
2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.5m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 109.1dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

Report No.: TMWK2111001137KR

220G-231G**Operation Mode:** Test Mode**Temperature:** 20.3 ~ 21.1°C**Test date:** November 10 ~ 11, 2021**Humidity:** 53 ~ 55% RH**Tested by:** Dally Hong

Date: 10.NOV.2021 15:14:11

| Frequency (GHz) | Spectrum Reading (dBuV) | Antenna Factor (dB/m) | Distance (m) | dBuV/m | Limit (dBuV/m) | Detector |
|--------------------|-------------------------------|-----------------------------|-----------------|--------|-------------------|----------|
| 226.38169 | 58.27 | 58.48 | 0.2 | 116.75 | ≤119.28 | Peak |

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

2. 40GHz~200GHz Limit :

@ 3m Limit = $20 \cdot \log \{ (0.000006 \cdot 377)^{0.5} \cdot 1000000 \}$ = 93.54dBuV/m@ 1m Limit = $93.54 + 20 \cdot \log (3/1)$ = 103.08 dBuV/m@ 0.5m Limit = $93.54 + 20 \cdot \log (3/0.5)$ = 109.1dBuV/m@ 0.2m Limit = $93.54 + 20 \cdot \log (3/0.2)$ = 117.06dBuV/m@ 0.15m Limit = $93.54 + 20 \cdot \log (3/0.15)$ = 119.56dBuV/m

Above 200GHz Limit :

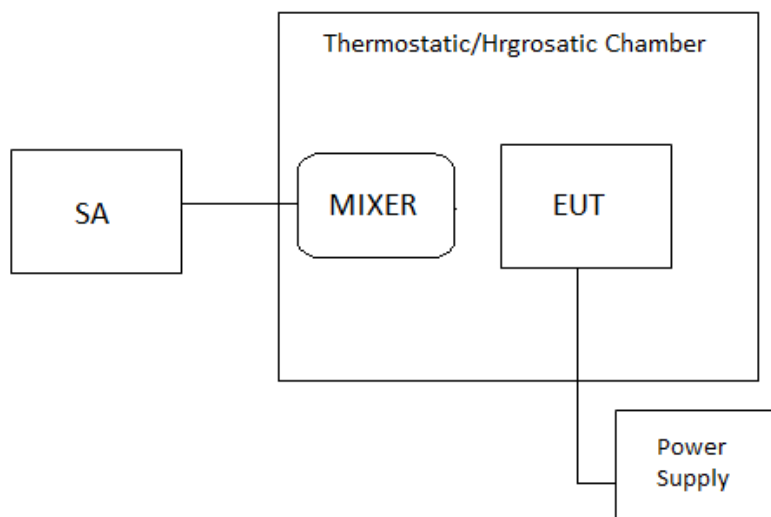
@ 3m Limit = $20 \cdot \log \{ (0.00001 \cdot 377)^{0.5} \cdot 1000000 \}$ = 95.76dBuV/m@ 1m Limit = $95.76 + 20 \cdot \log (3/1)$ = 105.30dBuV/m@ 0.2m Limit = $95.76 + 20 \cdot \log (3/0.2)$ = 119.28dBuV/m

8.3 FREQUENCY STABILITY

LIMIT

According to FCC 95.3379(b), Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -40 to $+85$ degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

Test Configuration



TEST PROCEDURE

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -40°C . After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of $+85^{\circ}\text{C}$ reached.



Report No.: TMWK2111001137KR

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Rev. 00

TEST RESULTS

No non-compliance noted.

Temperature: 20.3°C

Test date: November 10, 2021

Humidity: 53% RH

Tested by: Dally Hong

| Operating Frequency | | | | | |
|-----------------------------|-------------|----------|----------|------------------|-------------|
| Environment Temperature(°C) | Voltage (V) | FL (GHz) | FH (GHz) | Limit Range(GHz) | Test Result |
| 85 | 12 | 78.1332 | 79.7685 | 76-81 | Pass |
| 80 | | 78.1332 | 79.7757 | | Pass |
| 70 | | 78.1332 | 79.7757 | | Pass |
| 60 | | 78.1332 | 79.7757 | | Pass |
| 50 | | 78.1332 | 79.7757 | | Pass |
| 40 | | 78.1332 | 79.7757 | | Pass |
| 30 | | 78.1332 | 79.7757 | | Pass |
| 20 | | 78.1332 | 79.7757 | | Pass |
| 10 | | 78.1404 | 79.7757 | | Pass |
| 0 | | 78.1404 | 79.7612 | | Pass |
| -10 | | 78.1332 | 79.7757 | | Pass |
| -20 | | 78.1404 | 79.7757 | | Pass |
| -30 | | 78.1332 | 79.7757 | | Pass |
| -40 | | 78.1332 | 79.7757 | | Pass |

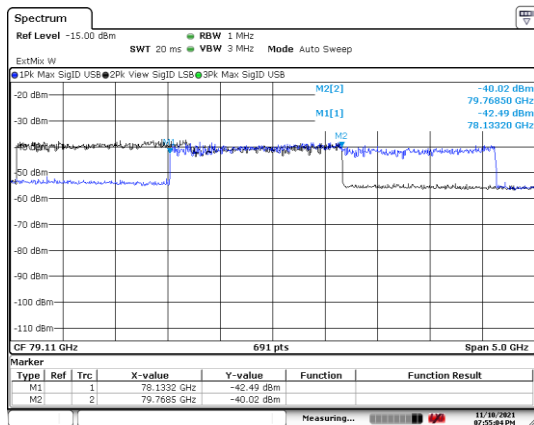
| Operating Frequency | | | | | |
|-----------------------------|-------------|----------|----------|------------------|-------------|
| Environment Temperature(°C) | Voltage (V) | FL (GHz) | FH (GHz) | Limit Range(GHz) | Test Result |
| 20 | 10.2 | 78.1332 | 79.7757 | 76-81 | Pass |
| | 12 | 78.1332 | 79.7757 | | Pass |
| | 13.8 | 78.1404 | 79.7757 | | Pass |

Test Plot

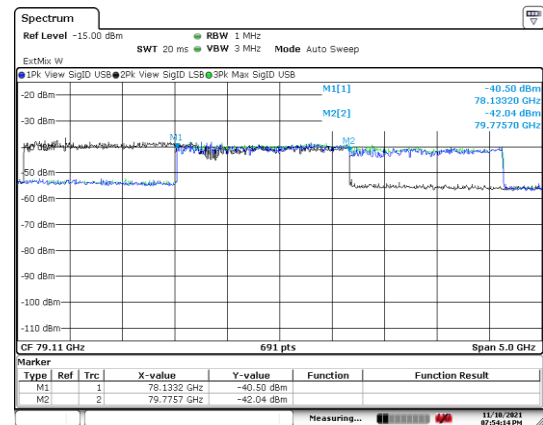
99%

Voltage: 12V

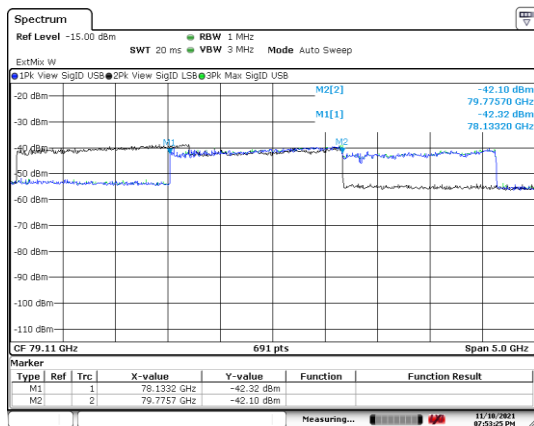
Environment Temperature: 85°C



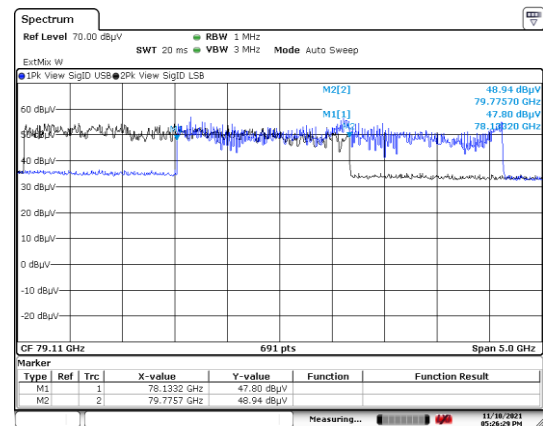
Environment Temperature: 80°C

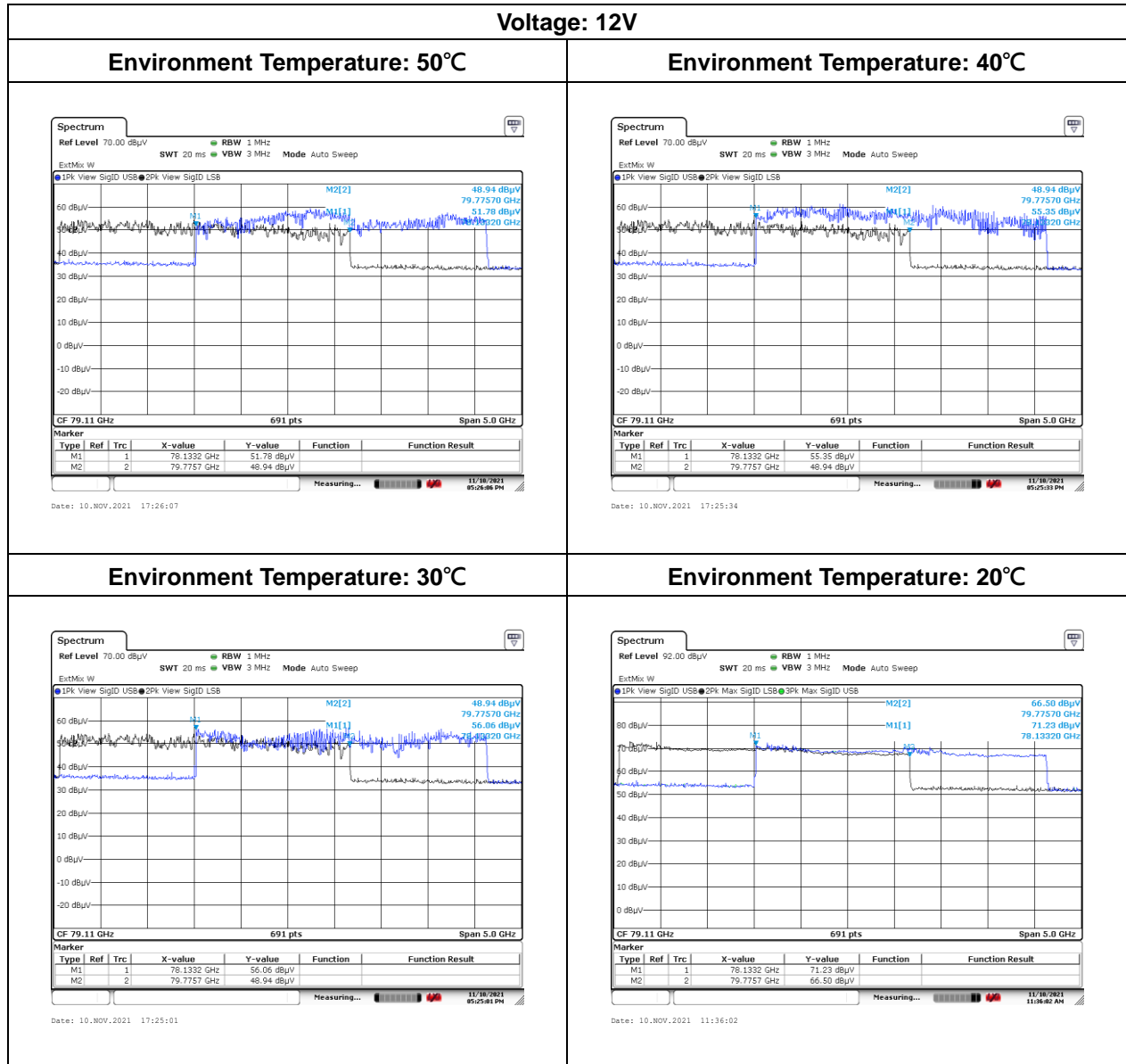


Environment Temperature: 70°C



Environment Temperature: 60°C

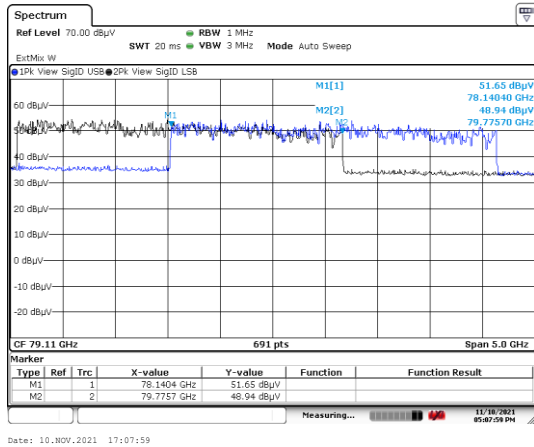




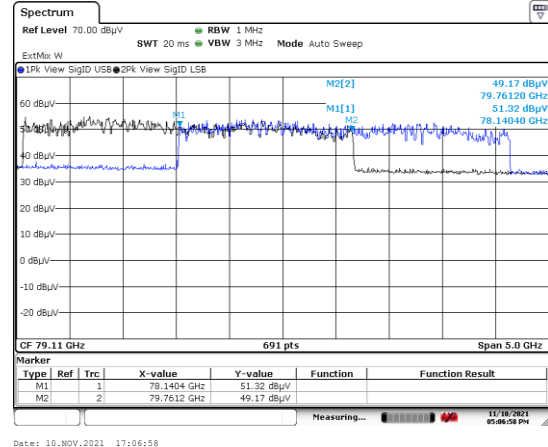
Report No.: TMWK2111001137KR

Voltage: 12V

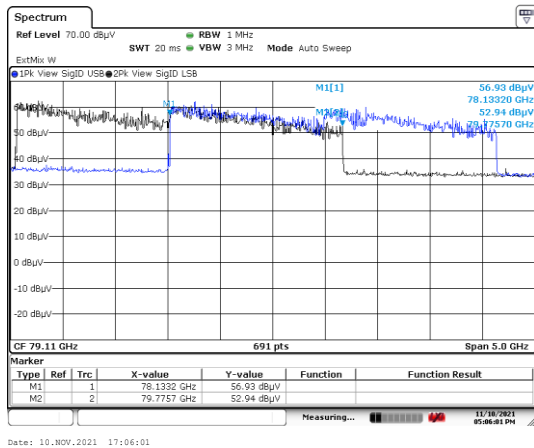
Environment Temperature: 10°C



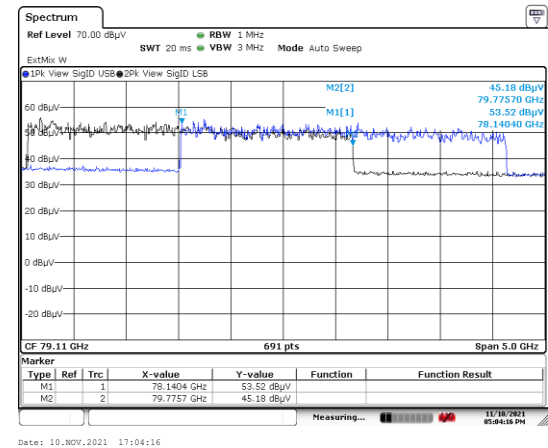
Environment Temperature: 0°C

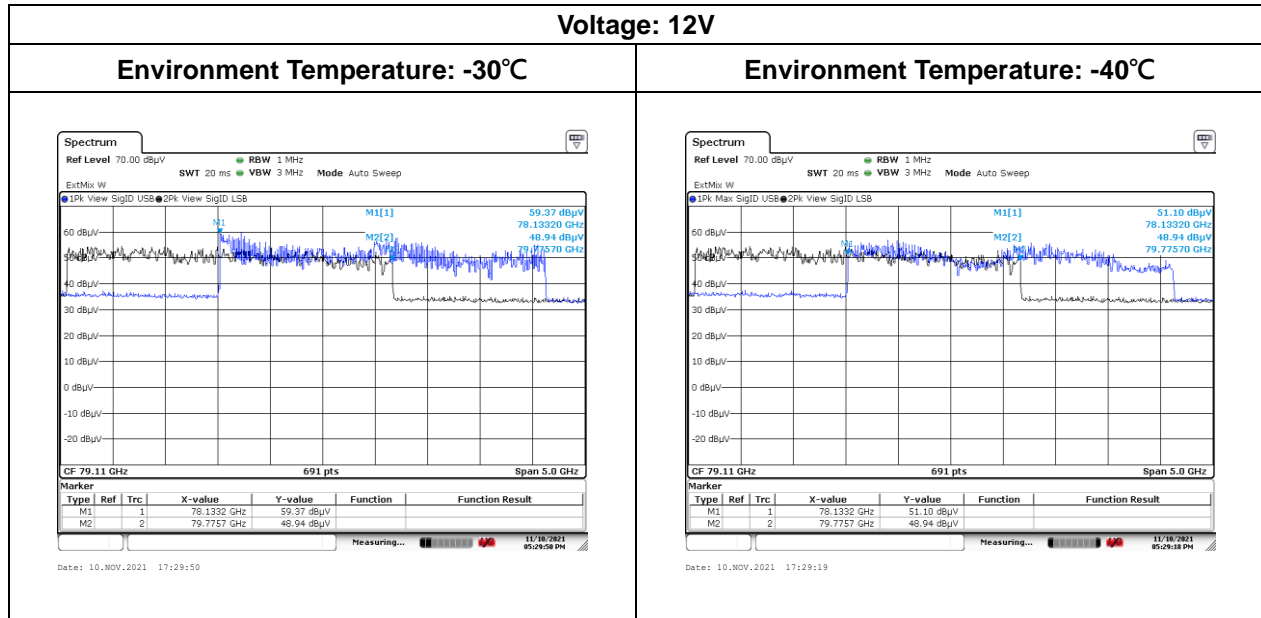


Environment Temperature: -10°C



Environment Temperature: -20°C





- End of Test Report -