

TEST REPORT



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2023-00484-1
Page (1) / (27) Pages

1. Applicant

- Name : SOLUM CO., LTD
- Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do,
Korea (Zip 16914)
- Date of Receipt : 2022-12-19

2. Manufacturer

- Name : SOLUM CO., LTD
- Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do,
Korea (Zip 16914)

3. Factory

- Name : SOLUM VINA CO., LTD
- Address : Plot B3, Ba Thien 2 Industrial park, Thien Ke Ward, Binh Xuyen District,
Vinh Phuc Province, 281200., People's Republic of Vietnam

4. Use of Report : For FCC Certification & Canadian Certification

5. Test Sample / Model : ESL Label / EL022F4WRC

6. Date of Test : 2023-01-18 to 2023-02-28

7. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247,
ANSI C63.10-2013, RSS-247, RSS-Gen



8. Testing Environment : Temp.: (23 ± 1) °C, Humidity: (51 ± 3) % R.H.

9. Test Results : Compliance

10. Location of Test : Permanent Testing Lab On Site Testing

(Address : 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, 17141 Korea)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This report cannot be reproduced or copied without the written consent of CTK.

| | | |
|----------|--|---|
| Approval | Tested by | Technical Manager |
| | Bong-seok Kim: (Signature)  | Young-taek Lee: (Signature)  |

Remark. This report is not related to KOLAS accreditation and relevant regulation.
2023-03-01

CTK Co., Ltd.



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REPORT REVISION HISTORY

| Date | Revision | Page No |
|------------|---|---------|
| 2023-03-01 | Issued (CTK-2023-00484) | all |
| 2023-03-01 | Issued (CTK-2023-00484-1) -Add variant model | all |

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|  CTK Co., Ltd. <small>The Prime Leader of Global Regulatory Certification</small> | CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501 | Report No. : CTK-2023-00484-1 Page (4) / (27) Pages | |
|---|---|---|--|

1. General Product Description

1.1 Applicant Information

| | |
|-----------------------|---|
| Company | SOLUM CO.,LTD. |
| Contact Point | 4,5,6th F, 357, Guseong-ro, Giheung-gu, Gyeonggi-do, Yongin-si, Republic of Korea |
| Contact Person | Name : Ki Dong Lee E-mail : kdlee007@solu-m.com Tel : +82-31-8006-7677 |

1.2 Product Information

| | |
|-------------------------------|--|
| FCC ID | 2AFWN-EL022F4WRC |
| IC | 22800-EL022F4WRC |
| Product Description | ESL Label |
| Model name | EL022F4WRC |
| Variant Model name | EL022F4BRC, EL022F4WYC, EL022F4BYC (There is no technological difference between the basic model and the variant model, the addition of the model name for marketing purposes.) |
| Operating Frequency | 2 401 MHz - 2 480 MHz |
| RF Output Power | 3.45 dBm(2.213 mW) |
| Antenna Specification | Antenna type : PCB Antenna Peak Gain : 0.73 dBi |
| Number of channels | 80 |
| Channel Spacing | 1 MHz |
| Type of Modulation | GFSK |
| Power Source | DC 3.0 V(Battery) |
| FVIN | V1.0 |
| Test Software(Version) | Tera term (Version 4.8.5) |

1.3 Peripheral Devices

-For Conducted Measurement and Radiated Measurement

| Device | Manufacturer | Model No. | Serial No. |
|------------|--------------|-------------------|------------|
| Notebook | HP Inc. | HP Probook 455 G7 | 5CD0234DWM |
| AC Adapter | HP Inc. | PPP012D-S | 677777-003 |



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2. Facility and Accreditations

2.1 Laboratory Accreditations and Listings

| Country | Agency | Registration Number |
|---------|--------|---------------------|
| USA | FCC | 805871 |
| CANADA | ISED | 8737A |
| KOREA | NRRA | KR0025 |

2.2 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3. Test Specifications

3.1 Standards

| Section in FCC | Section in RSS | Requirement(s) | Status (Note 1) | Test Condition |
|---|----------------|-------------------------------------|-----------------|----------------|
| 15.247(a) | RSS-247 5.2(a) | 6 dB Bandwidth | C | Conducted |
| 15.247(e) | RSS-247 5.2(b) | Transmitter power spectral density | C | |
| 15.247(b) | RSS-247 5.4(d) | Maximum peak conducted output power | C | |
| 15.247(d) | RSS-247 5.5 | Unwanted emission | C | |
| 15.209 | RSS-Gen 6.13 | Transmitter emission | C | Radiated |
| 15.207(a) | RSS-Gen 8.8 | AC Conducted Emission | NA(Note 3) | Line Conducted |
| <i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable | | | | |
| <i>Note 2:</i> The data in this test report are traceable to the national or international standards. | | | | |
| <i>Note 3:</i> The equipment is operated on battery power only. | | | | |
| <i>Note 4:</i> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2, RSS-Gen Issue 5. | | | | |
| <i>Note 5:</i> The tests were performed according to the method of measurements prescribed in KDB No.558074. | | | | |
| <i>Note 6:</i> This equipment has been tested in a 100% duty cycle transmission situation using applicant supplied software. KDB No.558074. | | | | |

3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments. During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests. The results are only attached worst cases.

Test Frequency

| Lowest channel | Middle channel | Highest channel |
|----------------|----------------|-----------------|
| 2 401 MHz | 2 440 MHz | 2 480 MHz |

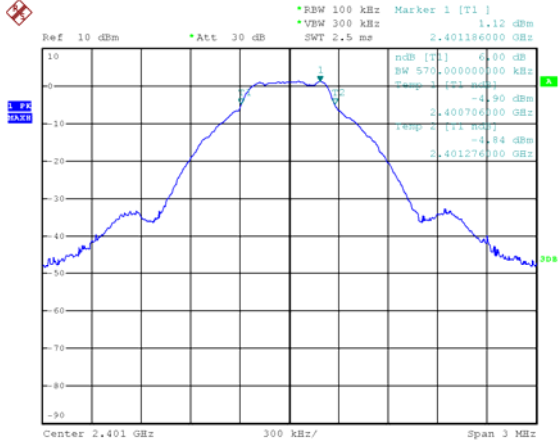
3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter. Coverage factor $k = 2$, Confidence levels of 95 %

| Description | Uncertainty |
|--------------------------------------|--------------------------------------|
| Conducted RF Output Power | 1.5 dB (C.L. : Approx. 95%, $k=2$) |
| Occupied Bandwidth | 0.1 MHz (C.L. : Approx. 95%, $k=2$) |
| Unwanted Emission(conducted) | 3.0 dB (C.L. : Approx. 95%, $k=2$) |
| Radiated Emissions ($f \leq 1$ GHz) | 4.0 dB (C.L. : Approx. 95%, $k=2$) |
| Radiated Emissions ($f > 1$ GHz) | 5.0 dB (C.L. : Approx. 95%, $k=2$) |

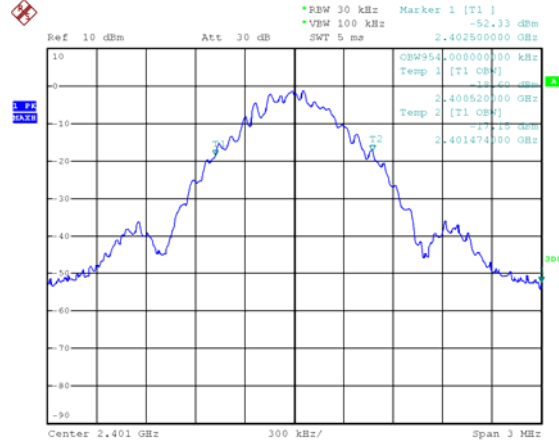


6 dB Bandwidth[MHz]
 Low channel



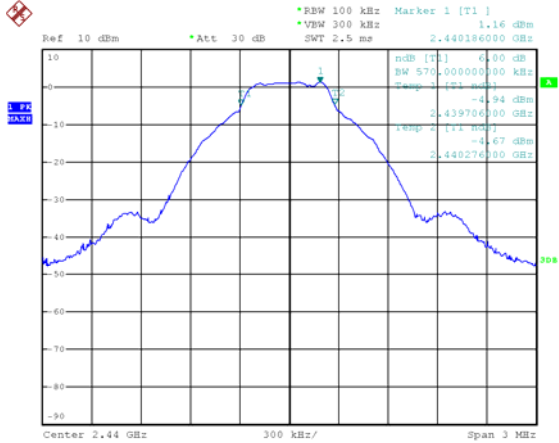
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99% Bandwidth[MHz]
 Low channel



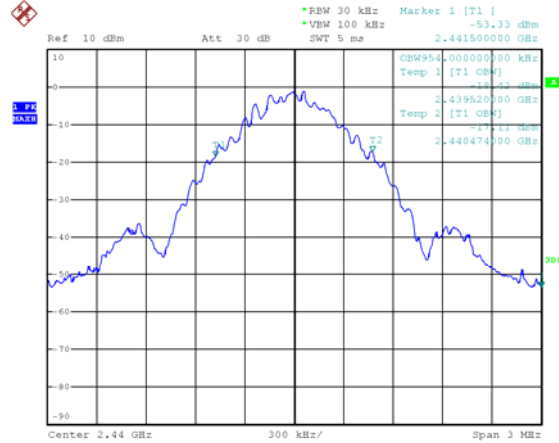
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Middle channel



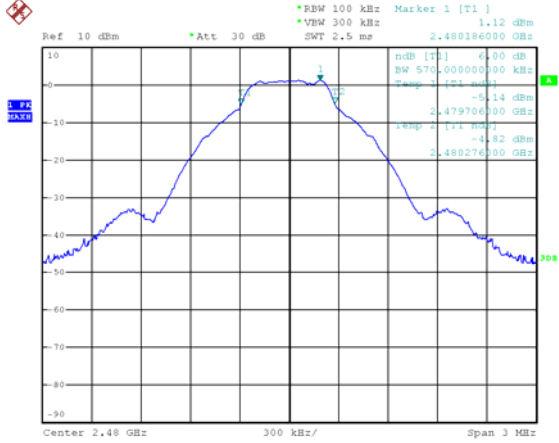
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Middle channel



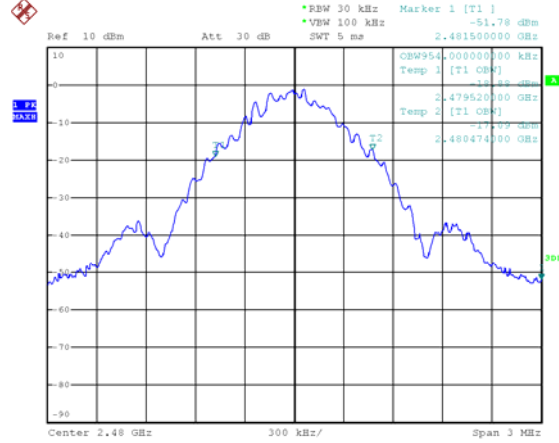
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High channel



Date: 1.FEB.2023 19:30:14

High channel



Date: 1.FEB.2023 19:30:29



4.2 Maximum peak Conducted Output Power

Test Procedures(ANSI C63.10-2013 11.9.1)

The following procedure can be used when the maximum available RBW of the instrument is less than the DTS bandwidth:

Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) $RBW \geq DTS \text{ Bandwidth}$
- b) $VBW \geq 3 \times RBW$
- c) $span \geq 3 \times RBW$
- d) Sweep time = auto couple
- e) Detector = peak
- f) Trace mode= max hold
- g) Allow trace to fully stabilize
- h) Use peak marker function to determine the peak amplitude level.

Limit :

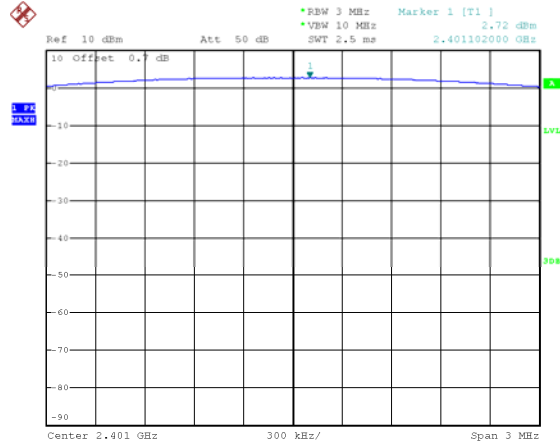
Maximum Output Power < 1 W (30 dBm)

Test Data :

| Channel | Frequency [MHz] | Measurement data [dBm] | Limit [dBm] | Result |
|---------|-----------------|------------------------|-------------|----------|
| Low | 2 401 | 2.72 | 30 | Complies |
| Middle | 2 440 | 2.69 | 30 | Complies |
| High | 2 480 | 2.69 | 30 | Complies |

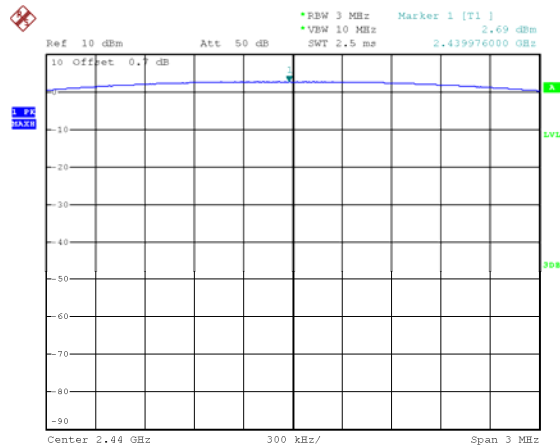
See next pages for actual measured spectrum plots.

Output Power Low channel



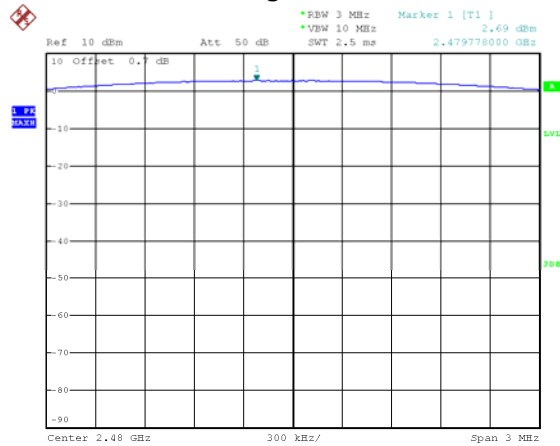
Date: 1.FEB.2023 19:25:03

Middle channel



Date: 1.FEB.2023 19:27:25

High channel



Date: 1.FEB.2023 19:29:43



4.3 Power Spectral Density

Test Procedures(ANSI C63.10-2013 11.10.2)

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance.

Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) RBW : $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- b) VBW $\geq 3 \times \text{RBW}$
- c) span $\geq 1.5 \times \text{DTS bandwidth}$
- d) Sweep time = auto couple
- e) Detector = peak
- f) Trace mode= max hold
- g) Allow trace to fully stabilize
- h) Use the peak marker function to determine the maximum amplitude level within the RBW.

Limit :

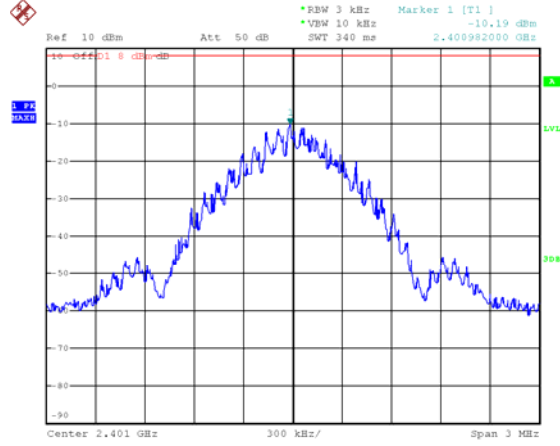
Power Spectral Density < 8 dBm @ 3 kHz BW

Test Data :

| Channel | Frequency [MHz] | Measurement data [dBm] | Limit [dBm] | Result |
|---------|-----------------|------------------------|-------------|----------|
| Low | 2 401 | -10.19 | 8 | Complies |
| Middle | 2 440 | -10.14 | 8 | Complies |
| High | 2 480 | -10.13 | 8 | Complies |

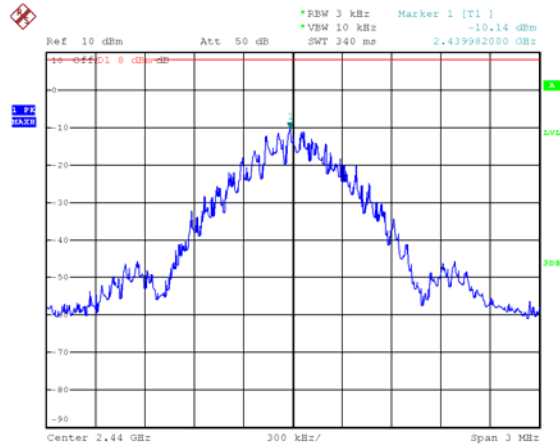
See next pages for actual measured spectrum plots.

Power Spectral Density Low channel



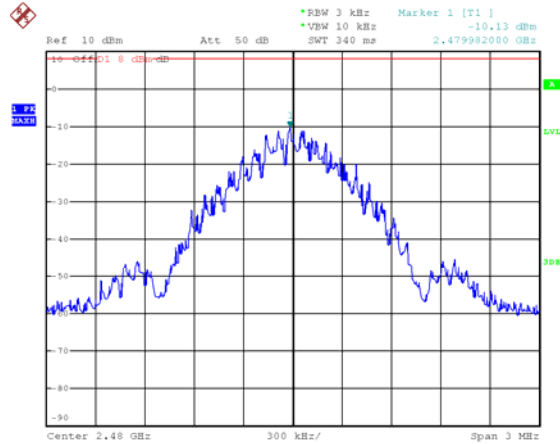
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Middle channel



Date: 1.FEB.2023 19:27:42

High channel



Date: 1.FEB.2023 19:30:00



4.4 Band Edge & Conducted Spurious emission

Test Procedures(ANSI C63.10-2013 11.11.3)

The Unwanted emission from the EUT were measured according to the dictates PKPSD measurement procedure in section 11.11 of ANSI C63.10-2013.

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.

Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW $\geq 3 \times$ RBW
- c) Detector = peak
- d) Sweep time = auto couple
- e) Trace mode= max hold
- f) Allow trace to fully stabilize
- g) Use the peak marker function to determine the maximum amplitude level.

Limit :

Emission level < 20 dBc

Test results: Complies

- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest in-band spectral density. Therefore the applying equipment meets the requirement.

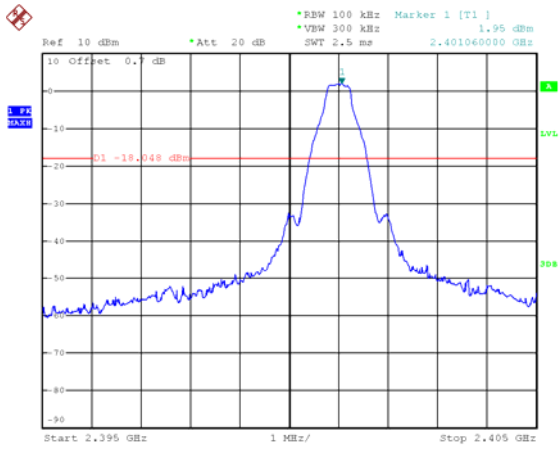
See next pages for actual measured spectrum plots.



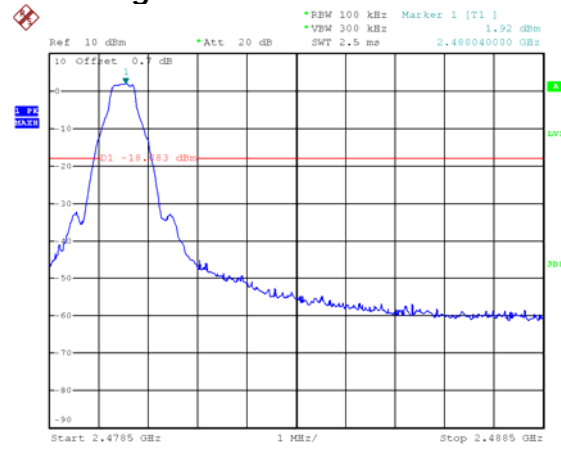
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Conducted Band-Edge



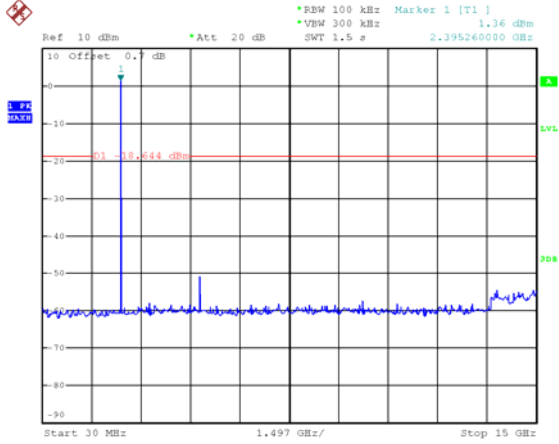
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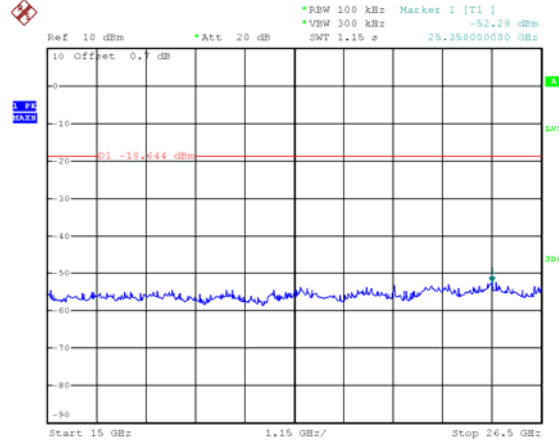
Date: 1.FEB.2023 19:31:14

Conducted Spurious Emission

Low channel

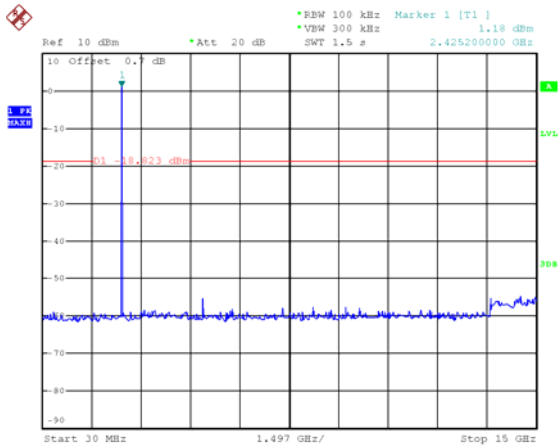


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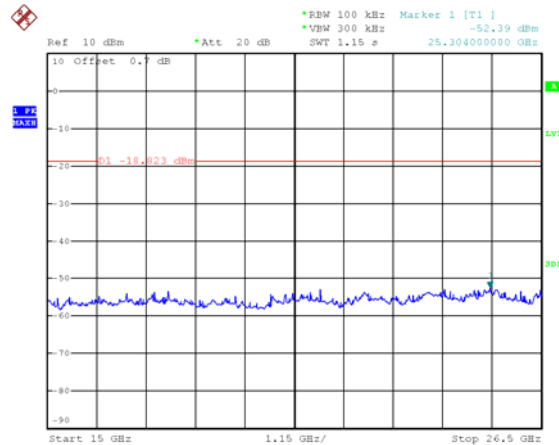


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Middle channel

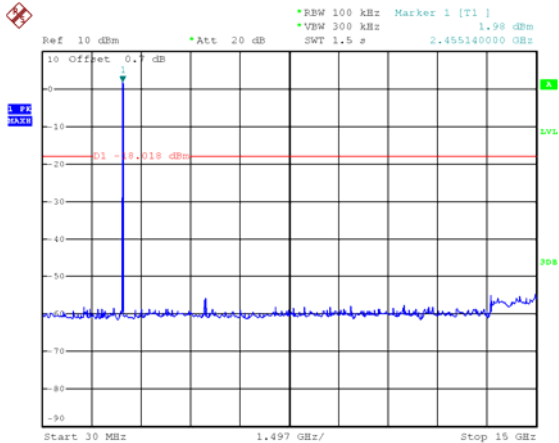


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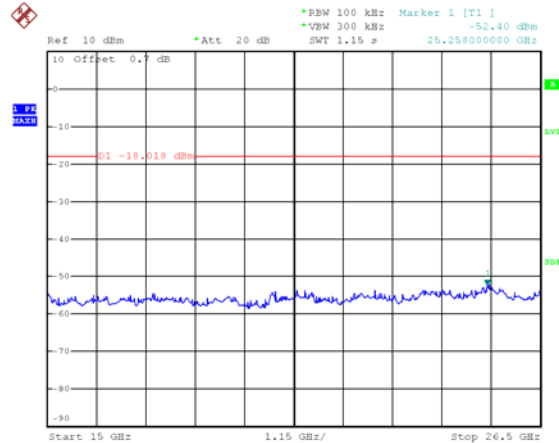


Date: 1.FEB.2023 19:28:41

High channel



Date: 1.FEB.2023 19:30:45



Date: 1.FEB.2023 19:30:58



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4.5 Radiated Emission

Test Location

- 10 m SAC (test distance : 10 m, 3 m)
- 3 m SAC (test distance : 3 m)

Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

Instrument Settings

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10th harmonic)

- a) RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9 kHz for $f < 30$ MHz
- b) VBW \geq RBW
- c) Sweep time = auto couple



Limit :

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Table 1. Restricted Frequency Bands

| MHz | MHz | MHz | MHz | MHz | GHz |
|--------------------------|-------------------|---------------------|--------------------|-------------|-------------------------|
| 0.09-0.11 | 8.37626-8.38675 | 73-74.6 | 399.9-410 | 2690-2900 | 10.6-12.7 |
| ¹ 0.495-0.505 | 8.41425-8.41475 | 74.8-75.2 | 608-614 | 3260-3267 | 13.25-13.4 |
| 2.1735-2.1905 | 12.29-12.293 | 108-121.94 | 960-1240 | 3332-3339 | 14.47-14.5 |
| 4.125-4.128 | 12.51975-12.52025 | 123-138 | 1300-1427 | 3345.8-3358 | 15.35-16.2 |
| 4.17725-4.17775 | 12.57675-12.57725 | 149.9-150.05 | 1435-1626.5 | 3600-4400 | 17.7-21.4 |
| 4.20725-4.20775 | 13.36-13.41 | 156.52475-156.52525 | 1645.5-1646.5 | 4500-5150 | 22.01-23.12 |
| 6.215-6.218 | 16.42-16.423 | 156.7-156.9 | 1660-1710 | 5350-5460 | 23.6-24 |
| 6.26775-6.26825 | 16.69475-16.69525 | 162.0125-167.17 | 1718.8-1722.2 | 7250-7750 | 31.2-31.8 |
| 6.31175-6.31225 | 16.80425-16.80475 | 167.72-173.2 | 2200-2300 | 8025-8500 | 36.43-36.5 |
| 8.291-8.294 | 25.5-25.67 | 240-285 | 2310-2390 | 9000-9200 | ² Above 38.6 |
| 8.362-8.366 | 37.5-38.25 | 322-335.4 | 2483.5-2500 | 9300-9500 | |

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

² Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



FCC Part 15 § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 2. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 2. General Field Strength Limits for Licence-Exempt Transmitters

| Frequency(MHz) | Field Strength (uA/m) | Field Strength (uV/m) | Field Strength (dBuV/m) | Measurement Distance (meters) |
|----------------|-----------------------|-----------------------|-------------------------|-------------------------------|
| 0.009-0.490 | 6.37/F (F in kHz) | 2400/F(kHz) | 48.5 - 13.8 | 300 |
| 0.490-1.705 | 63.7/F (F in kHz) | 24000/F(kHz) | 33.8 - 23 | 30 |
| 1.705-30 | 0.08 | 30 | 29.5 | 30 |
| 30-88 | - | 100** | 40 | 3 |
| 88-216 | - | 150** | 43.5 | 3 |
| 216-960 | - | 200** | 46 | 3 |
| Above 960 | - | 500 | 54 | 3 |

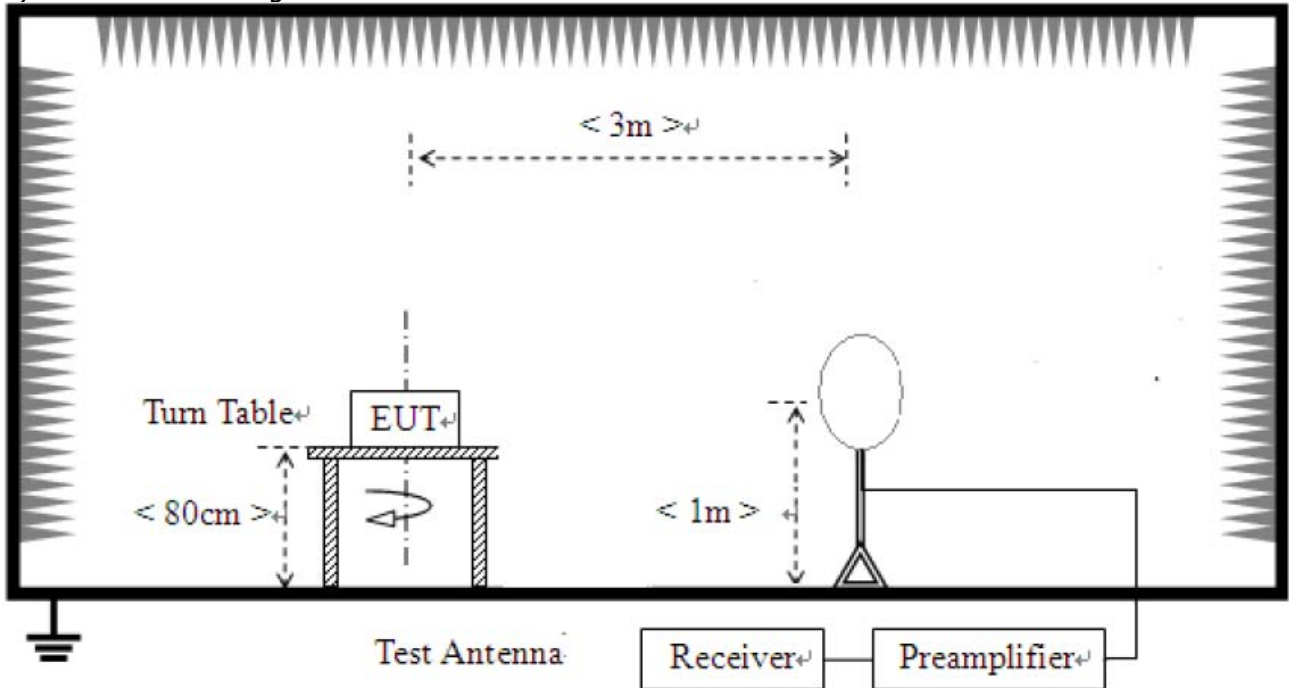
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

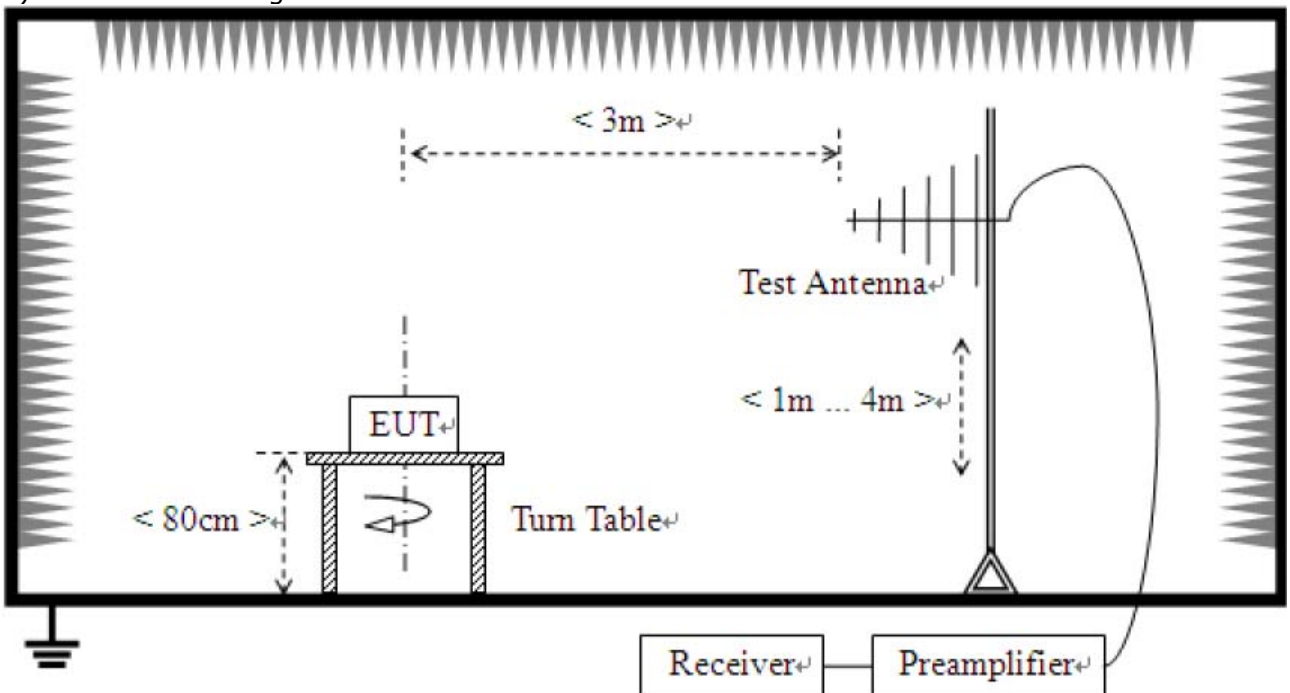
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- 3) For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 3 MHz and detector is peak for peak measurement and detector RMS and Trace Averaging type for average measurement.

Test Setup:

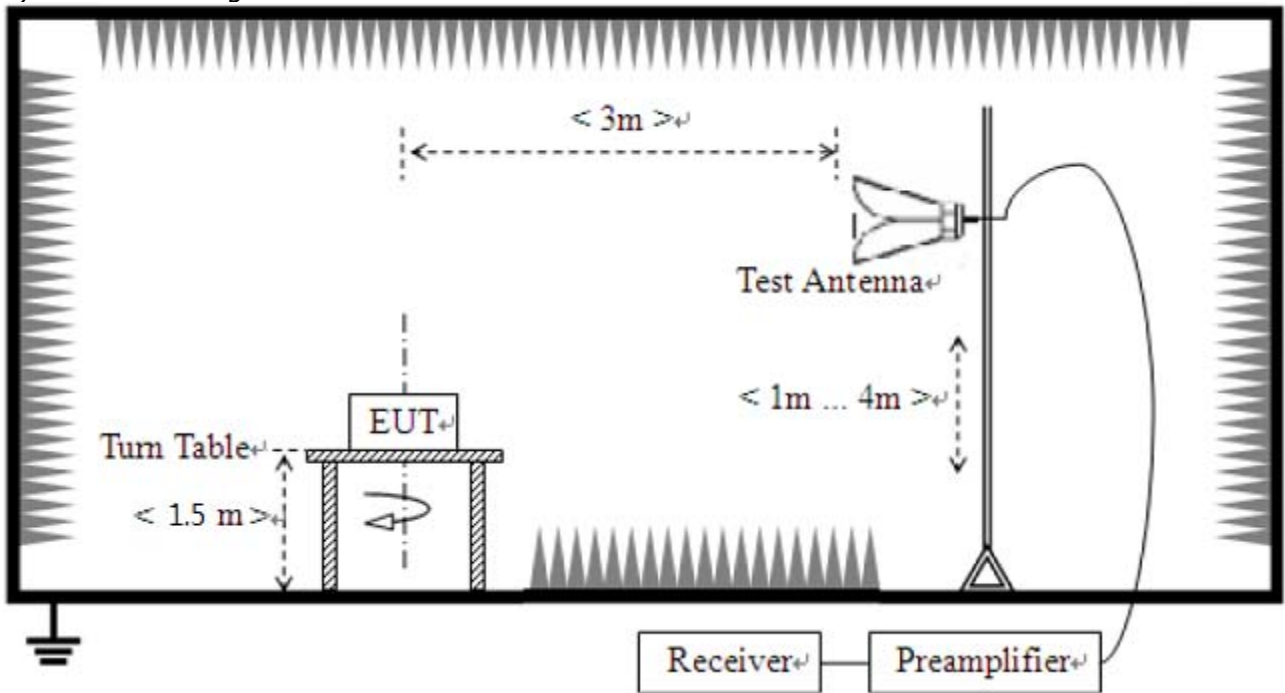
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



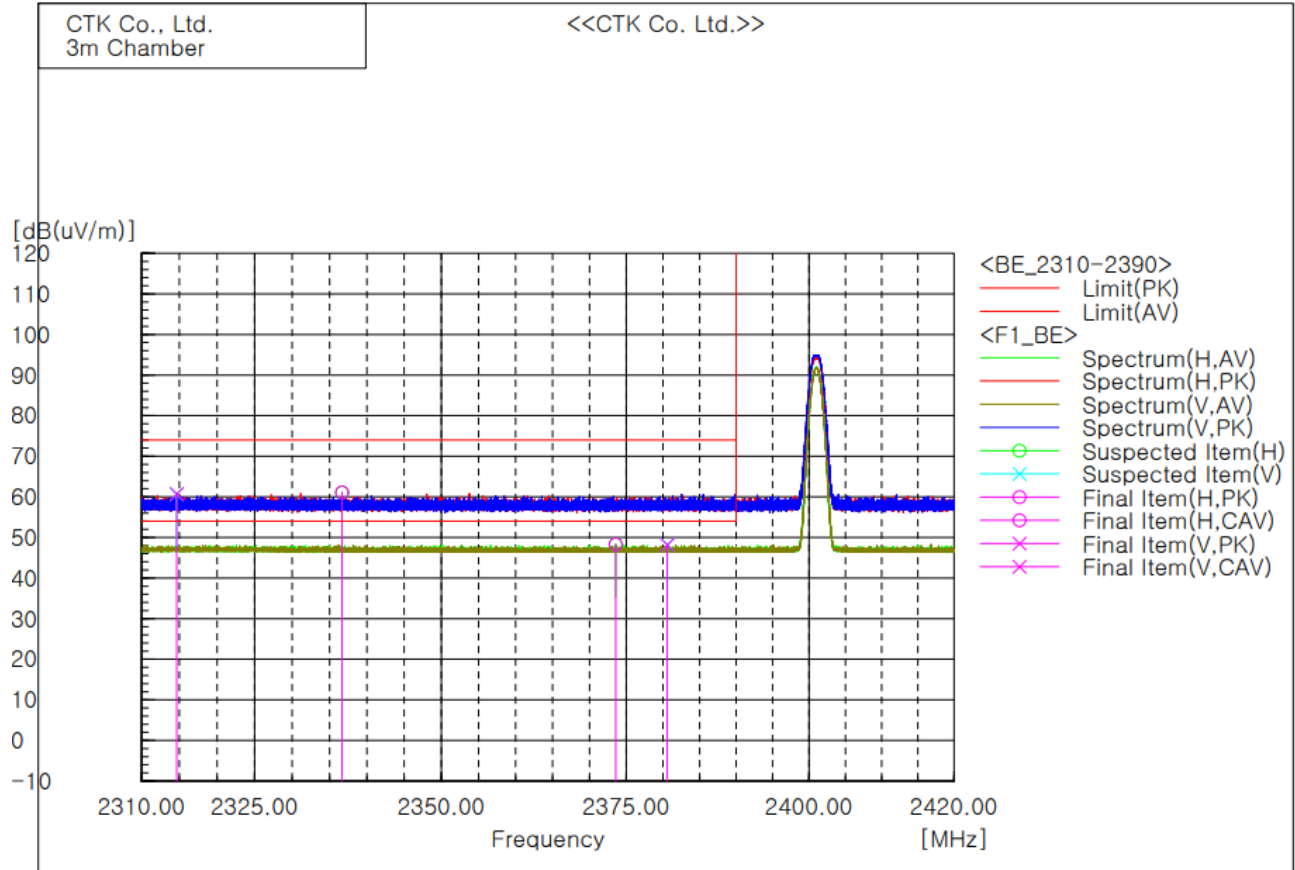
3) For field strength of emissions above 1 GHz



Test results

1) Restricted Frequency Bands

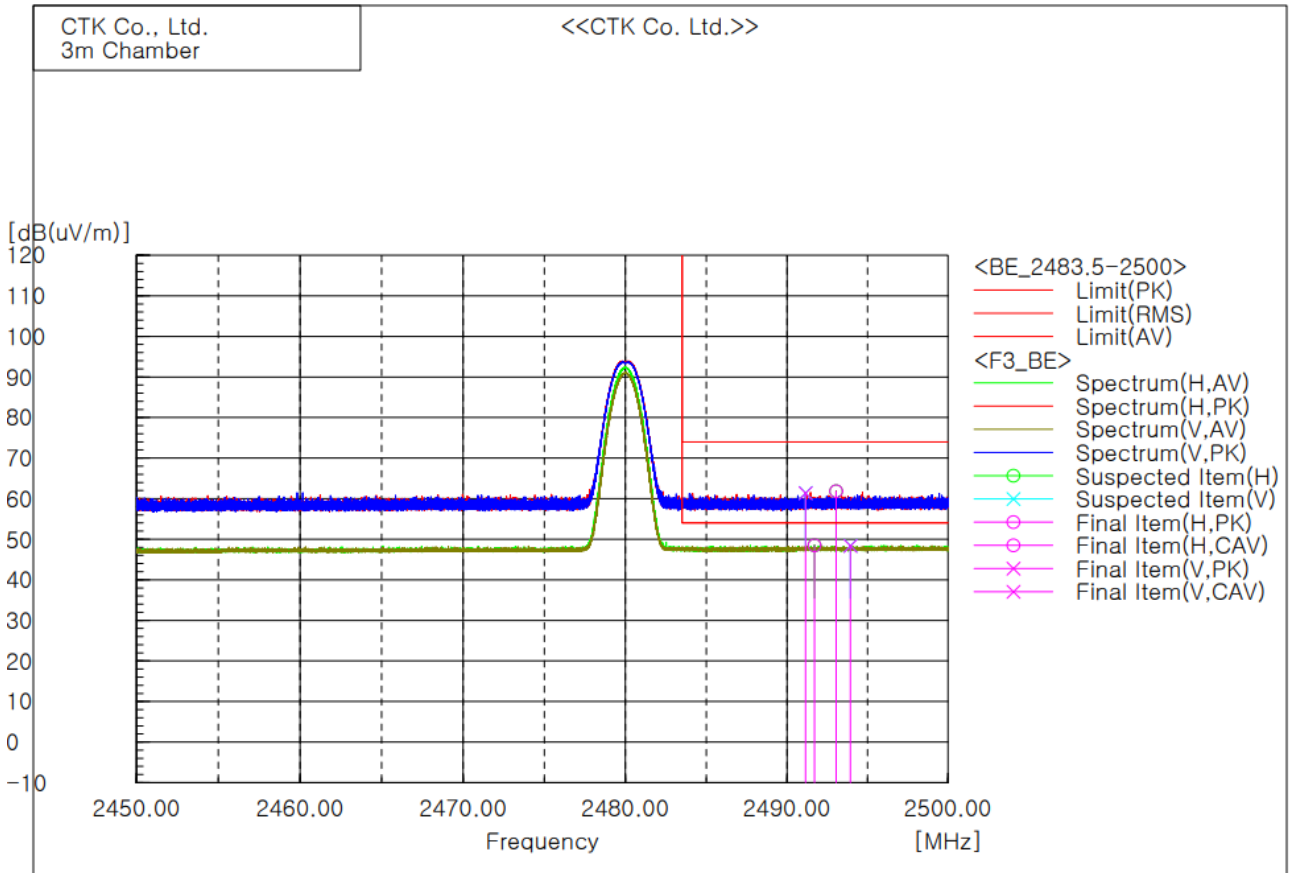
1. 2 310 MHz to 2 390 MHz



Final Result

| No. | Frequency [MHz] | (P) | Reading PK [dB(uV)] | Reading CAV [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Result CAV [dB(uV/m)] | Limit PK [dB(uV/m)] | Limit AV [dB(uV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|----------------------|---------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-------------|
| 1 | 2314.634 | V | 66.7 | --- | -6.0 | 60.7 | --- | 74.0 | 54.0 | 13.3 | --- | 400.2 | 86.2 |
| 2 | 2336.683 | H | 67.1 | --- | -6.0 | 61.1 | --- | 74.0 | 54.0 | 12.9 | --- | 99.9 | 323.2 |
| 3 | 2373.552 | H | --- | 54.2 | -5.9 | --- | 48.3 | 74.0 | 54.0 | --- | 5.7 | 99.9 | 359.1 |
| 4 | 2380.596 | V | --- | 54.1 | -5.9 | --- | 48.2 | 74.0 | 54.0 | --- | 5.8 | 400.2 | 359.3 |

2. 2 483.5 MHz – 2 500 MHz



Final Result

| No. | Frequency [MHz] | (P) | Reading PK [dB(uV)] | Reading CAV [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Result CAV [dB(uV/m)] | Limit PK [dB(uV/m)] | Limit AV [dB(uV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|----------------------|---------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-------------|
| 1 | 2491.152 | V | 66.6 | | -5.2 | 61.4 | | 74.0 | 54.0 | 12.6 | | 99.9 | 172.7 |
| 2 | 2491.702 | H | | 53.7 | -5.2 | | 48.5 | 74.0 | 54.0 | | 5.5 | 100.0 | 359.5 |
| 3 | 2493.050 | H | 67.0 | | -5.2 | 61.8 | | 74.0 | 54.0 | 12.2 | | 300.1 | 65.1 |
| 4 | 2493.934 | V | | 53.6 | -5.2 | | 48.4 | 74.0 | 54.0 | | 5.6 | 400.2 | 359.6 |

Remark :

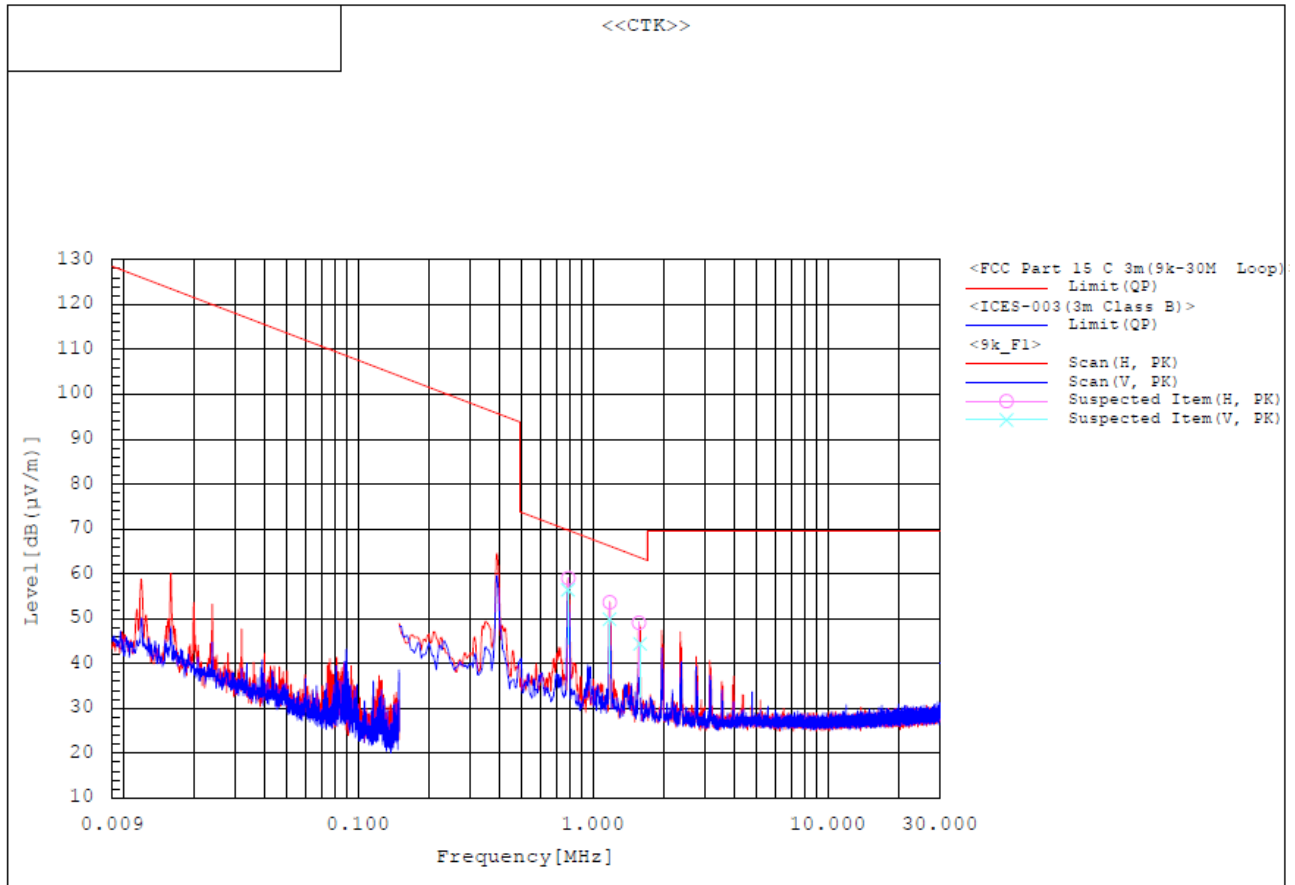
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

2) Spurious
1. 9 kHz to 30 MHz

Test mode : Transmit, Lowest Channel(Worst case)

The requirements are:

Complies



Spectrum Selection

| No. | Frequency [MHz] | Pol | Reading PK [dB(µV)] | c.f [dB(1/m)] | Result PK [dB(µV/m)] | Limit QP [dB(µV/m)] | Margin QP-PK [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|---------------|----------------------|---------------------|-------------------|-------------|-------------|
| 1 | 0.753 | V | 31.4 | 25.0 | 56.4 | 69.7 | 13.3 | 100.0 | 109.7 |
| 2 | 0.756 | H | 34.0 | 25.0 | 59.0 | 69.7 | 10.7 | 100.0 | 160.2 |
| 3 | 1.177 | V | 24.9 | 25.0 | 49.9 | 66.2 | 16.3 | 100.0 | 109.7 |
| 4 | 1.180 | H | 26.6 | 25.0 | 51.6 | 66.2 | 14.6 | 100.0 | 72.2 |
| 5 | 1.571 | H | 24.1 | 25.0 | 49.1 | 69.7 | 14.6 | 100.0 | 35.4 |
| 6 | 1.589 | V | 19.4 | 25.0 | 44.4 | 69.6 | 19.2 | 100.0 | 221.4 |

Note :

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator

* Reading data is the peak value.

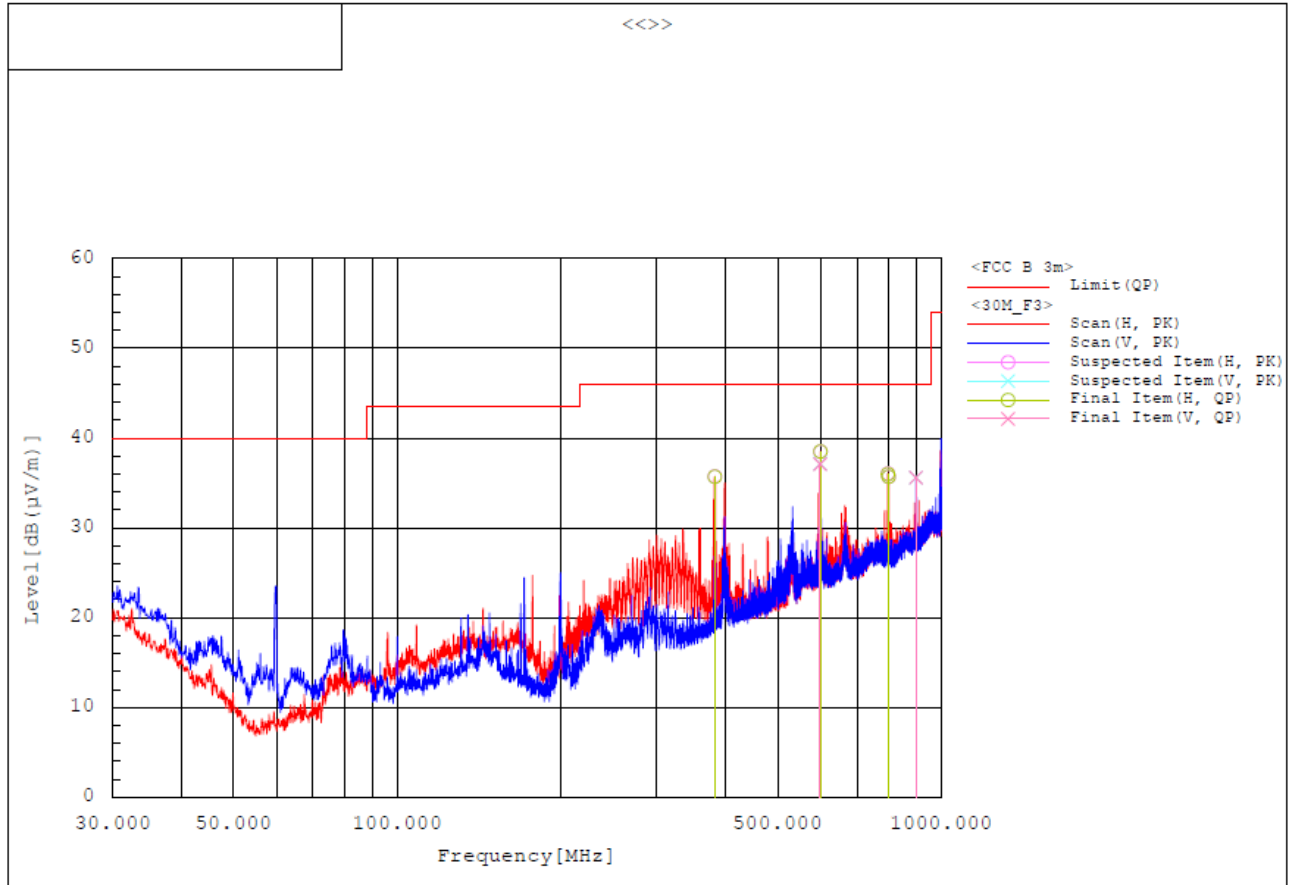
2. 30 MHz to 1 GHz

Test mode : Transmit, Highest Channel(Worst case)

The requirements are:

Complies

Test Data



Final Result

| No. | Frequency [MHz] | Pol | Reading QP [dB(µV)] | c.f [dB(1/m)] | Result QP [dB(µV/m)] | Limit QP [dB(µV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|
| 1 | 383.371 | H | 43.1 | -7.4 | 35.7 | 46.0 | 10.3 | 100.1 | 359.7 |
| 2 | 598.614 | V | 38.9 | -1.8 | 37.1 | 46.0 | 8.9 | 100.0 | 16.0 |
| 3 | 599.487 | H | 40.3 | -1.8 | 38.5 | 46.0 | 7.5 | 200.0 | 359.0 |
| 4 | 797.852 | H | 34.4 | 1.6 | 36.0 | 46.0 | 10.0 | 100.1 | 54.6 |
| 5 | 800.053 | H | 34.1 | 1.6 | 35.7 | 46.0 | 10.3 | 100.1 | 54.6 |
| 6 | 898.247 | V | 31.8 | 3.8 | 35.6 | 46.0 | 10.4 | 100.0 | 359.1 |

Remark :

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

* Reading data is the peak value.

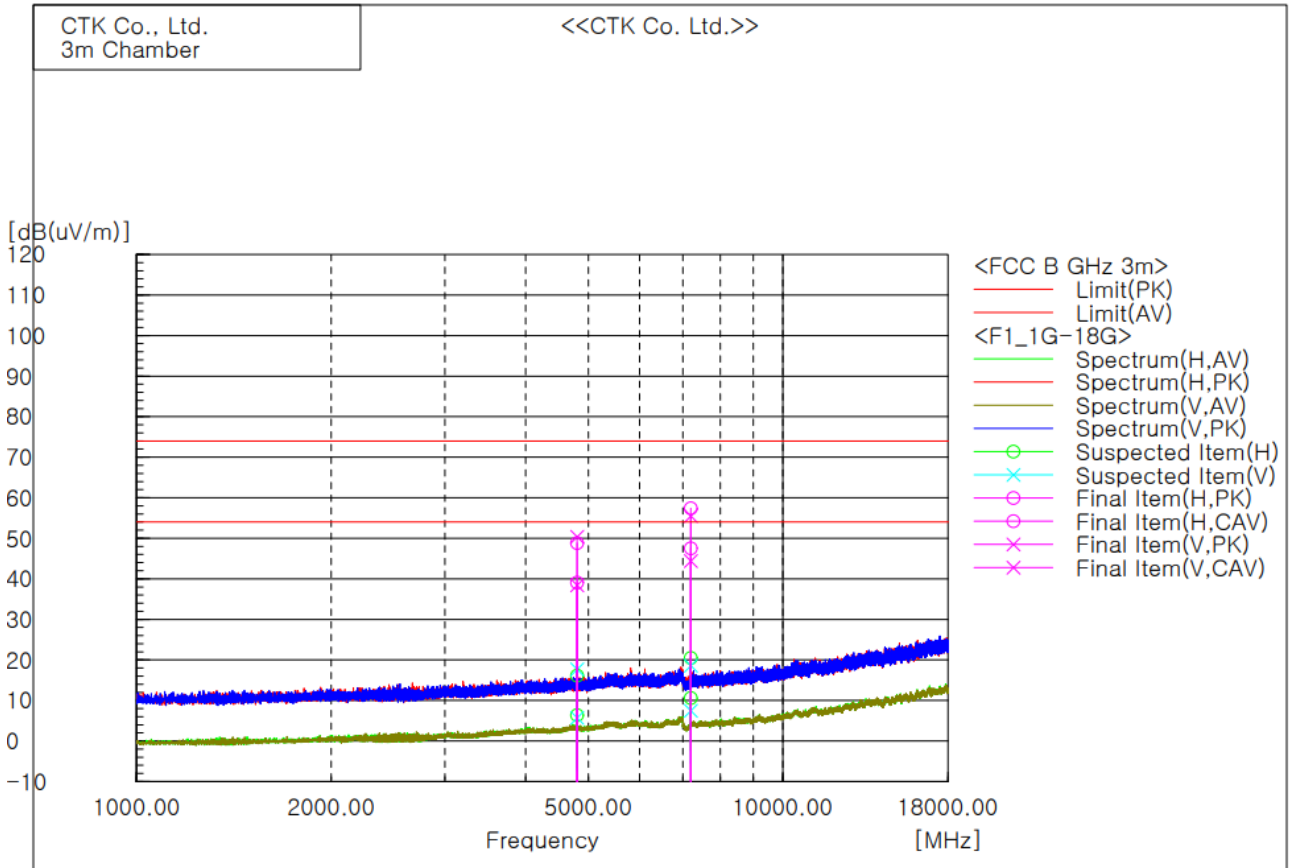
3. 1 GHz to 18 GHz

Test mode : Transmit, Lowest Channel(Worst case)

The requirements are:

Complies

Test Data



Final Result

| No. | Frequency [MHz] | (P) | Reading PK [dB(uV)] | Reading CAV [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Result CAV [dB(uV/m)] | Limit PK [dB(uV/m)] | Limit AV [dB(uV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|----------------------|---------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-------------|
| 1 | 4801.352 | V | 48.3 | ----- | 2.1 | 50.4 | ----- | 74.0 | 54.0 | 23.6 | ----- | 199.7 | 159.5 |
| 2 | 4802.032 | H | 46.7 | ----- | 2.1 | 48.8 | ----- | 74.0 | 54.0 | 25.2 | ----- | 99.9 | 215.0 |
| 3 | 4802.032 | H | ----- | 37.0 | 2.1 | ----- | 39.1 | 74.0 | 54.0 | ----- | 14.9 | 99.9 | 358.6 |
| 4 | 4802.032 | V | ----- | 36.3 | 2.1 | ----- | 38.4 | 74.0 | 54.0 | ----- | 15.6 | 100.0 | 115.5 |
| 5 | 7203.208 | H | ----- | 39.7 | 7.8 | ----- | 47.5 | 74.0 | 54.0 | ----- | 6.5 | 99.9 | 84.4 |
| 6 | 7203.208 | V | ----- | 36.6 | 7.8 | ----- | 44.4 | 74.0 | 54.0 | ----- | 9.6 | 100.0 | 67.0 |
| 7 | 7203.888 | H | 49.6 | ----- | 7.8 | 57.4 | ----- | 74.0 | 54.0 | 16.6 | ----- | 99.9 | 67.0 |
| 8 | 7203.888 | V | 47.7 | ----- | 7.8 | 55.5 | ----- | 74.0 | 54.0 | 18.5 | ----- | 400.1 | 143.3 |

Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

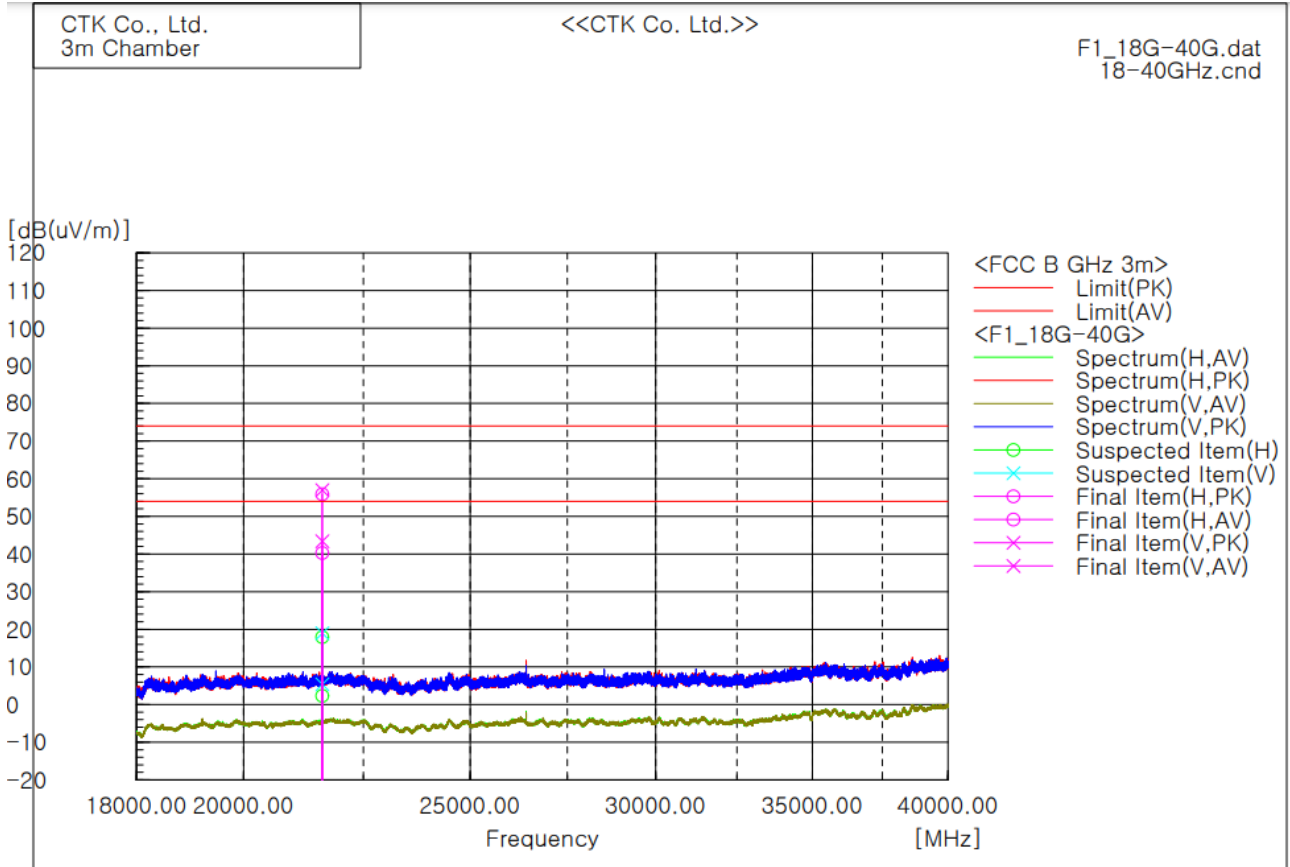
4. 18 GHz to 40 GHz

Test mode : Transmit, Lowest Channel(Worst case)

The requirements are:

Complies

Test Data



Final Result

--- PK Measurement ---

| No. | Frequency [MHz] | Reading [dB(uV)] [H/V] | c.f [dB(1/m)] [H/V] | Result [dB(uV/m)] [H/V] | Limit [dB(uV/m)] | Margin [dB] [H/V] |
|-----|-----------------|------------------------|---------------------|-------------------------|------------------|-------------------|
| 1 | 21607.260 | 58.4/ | -2.5/ | 55.9/ | 74.0 | 18.1/ |
| 2 | 21610.780 | / | / | 59.5/ | 74.0 | 17.0 |

--- AV Measurement ---

| No. | Frequency [MHz] | Reading [dB(uV)] [H/V] | c.f [dB(1/m)] [H/V] | Result [dB(uV/m)] [H/V] | Limit [dB(uV/m)] | Margin [dB] [H/V] |
|-----|-----------------|------------------------|---------------------|-------------------------|------------------|-------------------|
| 1 | 21607.260 | 42.8/ 45.9 | -2.5/ -2.5 | 40.3/ 43.4 | 54.0 | 13.7/ 10.6 |

Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain



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Report No. :
 CTK-2023-00484-1
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APPENDIX A – Test Equipment Used For Tests

| No. | Name of Equipment | Manufacturer | Model No. | Serial No. | Cal Date | Due Date |
|-----|-------------------------------|---------------------------------------|-------------|---------------------|------------|------------|
| 1 | SPECTRUM ANALYZER | R&S | FSP-30 | 100994 | 2022-10-13 | 2023-10-13 |
| 2 | Signal Generator | Rohde & Schwarz | SMB100A | 175528 | 2022-03-25 | 2023-03-25 |
| 3 | EMI TEST RECEIVER | Rohde & Schwarz | ESW44 | 102039 | 2022-05-04 | 2023-05-04 |
| 4 | Active Loop Antenna | SCHWARZBECK | FMZB 1513 | 1513-125 | 2022-04-15 | 2024-04-15 |
| 5 | Bilog Antenna | TESEQ | CBL6111D | 60654 | 2021-09-03 | 2023-09-03 |
| 6 | AMPLIFIER | SONOMA INSTRUMENT | 310N | 411011 | 2022-08-10 | 2023-08-10 |
| 7 | ATTENUATOR | PASTERNAK | PE7AP006-06 | L2021050400002 3 | 2022-08-10 | 2023-08-10 |
| 8 | Preamplifier | Agilent | 8449B | 3008A00620 | 2022-05-10 | 2023-05-10 |
| 9 | Double Ridged Guide Antenna | ETS-Lindgren | 3115 | 00078895 | 2022-04-14 | 2023-04-14 |
| 10 | Horn Antenna | SCHWARZBECK | BBHA9170 | 01153 | 2022-10-31 | 2023-10-31 |
| 11 | Low Noise Amplifier | TESTEK | TK-PA1840H | 210124-L | 2022-11-09 | 2023-11-09 |
| 12 | Band Reject Filter | Micro Tronics | BRM50702 | G233 | 2022-01-07 | 2023-01-07 |
| 13 | Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101574 | 2022-01-12 | 2023-01-12 |
| 14 | Dual-Tracking DC Power Supply | Topward Electric Instruments Co.,Ltd. | 6303D | 711196 | 2022-04-18 | 2023-04-18 |
| 15 | DC Power Supply | Agilent | E3632A | MY40008023 | 2022-04-18 | 2023-04-18 |

| No. | Cable | Manufacturer | Model No. | Serial No. | Check Date |
|-----|--------------------------------------|---------------------|--------------|---------------|------------|
| 1 | RF Cable(conducted) | Junkosha Inc. | MWX221 | 2008S240 | 2022-06-02 |
| 2 | RF Cable (9kHz-1GHz Radiated) | Canare Corporation | L-5D2W | N/A | 2022-09-21 |
| 3 | RF Cable (9kHz-1GHz Radiated) | HUBER+SUHNER | SUCOFLEX 104 | MY27558/4 | 2022-09-21 |
| 4 | RF Cable (1GHz-18GHz Radiated) | Junkosha Inc. | MWX221 | 2008S246 | 2022-04-14 |
| 5 | RF Cable (1GHz-18GHz Radiated) | Rosenberger | NONE | 1520.9927.00 | 2022-04-14 |
| 6 | RF Cable (1GHz-18GHz Radiated) | Sensorview Co., LTD | 9S18 | TPC2204060007 | 2022-04-14 |
| 7 | RF Cable (18GHz-26.5GHz Radiated) | HUBER+SUHNER | SUCOFLEX 102 | MY2372/2 | 2022-04-14 |
| 8 | RF Cable (18GHz-26.5GHz Radiated) | HUBER+SUHNER | SUCOFLEX 102 | MY073/2 | 2022-04-14 |
| 9 | RF Cable (18GHz-26.5GHz Radiated) | Sensorview Co., LTD | 9S40 | TP210713-001 | 2022-04-14 |

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