

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-2022-02718
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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 : 2022-09-16

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 & ISED Certification

5. Test Sample / Model: ESL Label / EL022F3WRA

6. Date of Test : 2022-10-19 to 2022-10-21


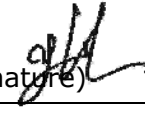
7. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247
ANSI C63.10-2013, RSS-247, RSS-Gen

8. Testing Environment: Temp.: (23 ± 1) °C, Humidity: (48 ± 5) % 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, 17142 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 Gwanyong Kim: (Signature)  | Technical Manager Young-taek Lee: (Signature)  |
|----------|--|--|

Remark. This report is not related to KOLAS accreditation and relevant regulation

2022-10-21

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REPORT REVISION HISTORY

| Date | Revision | Page No |
|------------|-------------------------|---------|
| 2022-10-21 | Issued (CTK-2022-02718) | all |
| | | |
| | | |

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1. General Product Description

1.1 Client Information

| | |
|----------------|--|
| Company | SOLUM CO., LTD |
| Contact Point | 4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Korea (Zip16914) |
| Contact Person | Name : Ki Dong Lee E-mail : kdlee@solu-m.com Tel : +82-31-8006-7677 |

1.2 Product Information

| | |
|-----------------------------|--|
| FCC ID | 2AFWN-EL022F3WRA |
| Certification Number ISED | 22800-EL022F3WRA |
| Product Description | ESL Label |
| Basic model (HVIN) | EL022F3WRA |
| Variant Model name | EL022F3BRA, EL022F3WYA, EL022F3BYA (There is no technological difference between the basic model and the variant model, the addition of the model name and color for marketing purposes.) |
| Operating Frequency | 2 401 MHz - 2 480 MHz |
| RF Output Power | 3.61 dBm (2.296 mW) |
| Antenna type | Metal Antenna |
| Antenna gain | -0.59 dBi |
| Number of channels | 80 |
| Channel Spacing | 1 MHz |
| Type of Modulation | GFSK |
| Power Source | DC 3.0 V (CR2450 Battery) |
| FVIN | V23 |
| Test Software | Tera Term Version 4.88 |
| RF Power setting in Test SW | Power setting input "40" |

1.3 Peripheral Devices

| Device | Manufacturer | Model No. | Serial No. |
|---------------|--------------|------------|------------|
| Note Computer | HP | 15-bs563TU | CND7253R6P |
| AC/DC Adapter | HP | HSTNN-LA40 | 7628011101 |

2. 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 5) | 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 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 4:</i> The tests were performed according to the method of measurements prescribed in KDB No.558074, ANSI C63.10-2013 | | | | |
| <i>Note 5:</i> The equipment is operated on battery power only. | | | | |

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 %, $k = 2$) |
| Power Spectral Density | 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 ($f \leq 30$ MHz) | 1.5 dB (C.L. : Approx. 95 %, $k = 2$) |
| Radiated Emissions ($f \leq 1$ GHz) | 3.88 dB (C.L. : Approx. 95 %, $k = 2$) |
| Radiated Emissions ($f > 1$ GHz) | 4.62 dB (C.L. : Approx. 95 %, $k = 2$) |



4. Technical Characteristic Test

4.1 6 dB Bandwidth and 99 % Bandwidth

Test Procedures

KDB 558074 – Section 8.2
 ANSI C63.10-2013 – Section 6.9.2
 RSS-Gen – Section 6.7

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Procedures

ANSI C63.10-2013 – Section 6.9.3
 RSS-Gen – Section 6.7

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission.

Use the 99 % power bandwidth function of the instrument and report the measured bandwidth.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz (6dB Bandwidth)
- b) RBW = 1 % to 5 % of the OBW
(99 % Bandwidth)
- c) VBW \geq 3 x RBW
- d) Detector = peak
- e) Trace mode = Max hold
- f) Sweep = auto couple
- g) Allow trace to fully stabilize
- h) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Limit : 6 dB Bandwidth

6 dB Bandwidth > 500 kHz

Limit : 99 % Bandwidth

N/A



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Test Data :

| Channel | Frequency [MHz] | 6 dB Bandwidth [MHz] | 99 % Bandwidth [MHz] | Result |
|---------|-----------------|----------------------|----------------------|----------|
| Lowest | 2 401 | 0.564 | 0.987 | Complies |
| Middle | 2 440 | 0.565 | 0.986 | |
| Highest | 2 480 | 0.563 | 0.990 | |

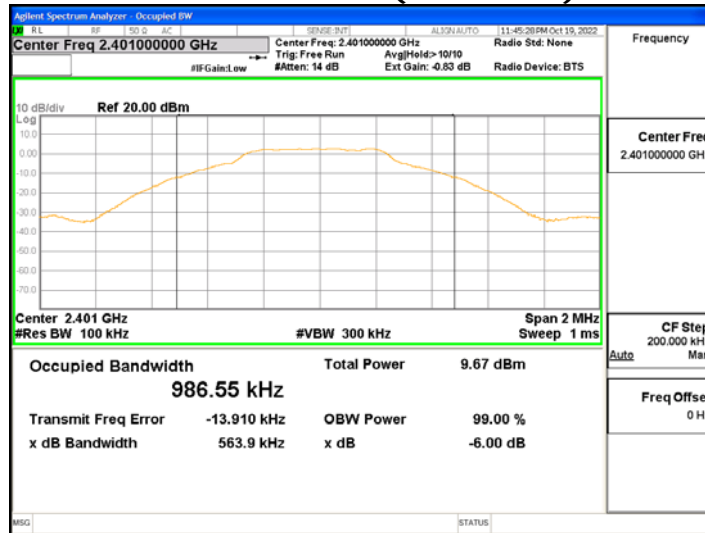
See next pages for actual measured spectrum plots.



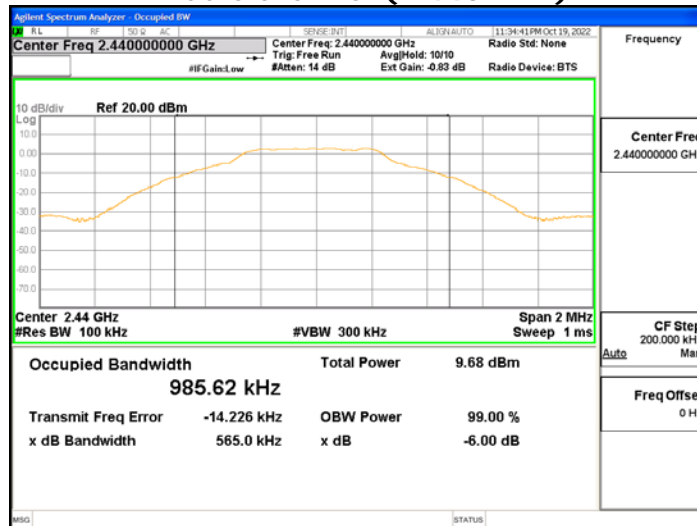
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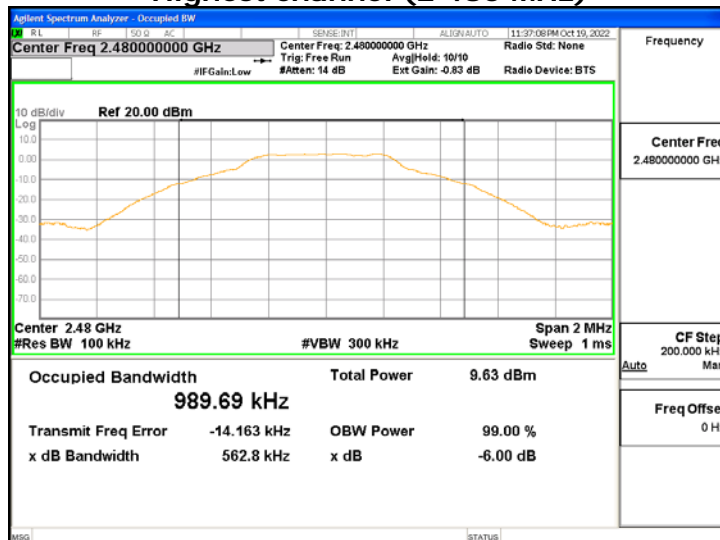
Lowest channel (2 401 MHz)



Middle channel (2 440 MHz)



Highest channel (2 480 MHz)





4.2 Maximum peak Conducted Output Power

Test Procedures

KDB 558074 – Section 8.3.1.1
ANSI C63.10-2013 – Section 11.9.1.1
RSS-Gen – Section 6.12

The following procedure can be used when the maximum available RBW of the instrument is greater 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 |
|---------|-----------------|------------------------|-------------|----------|
| Lowest | 2 401 | 3.61 | 30 | Complies |
| Middle | 2 440 | 3.54 | 30 | |
| Highest | 2 480 | 3.58 | 30 | |

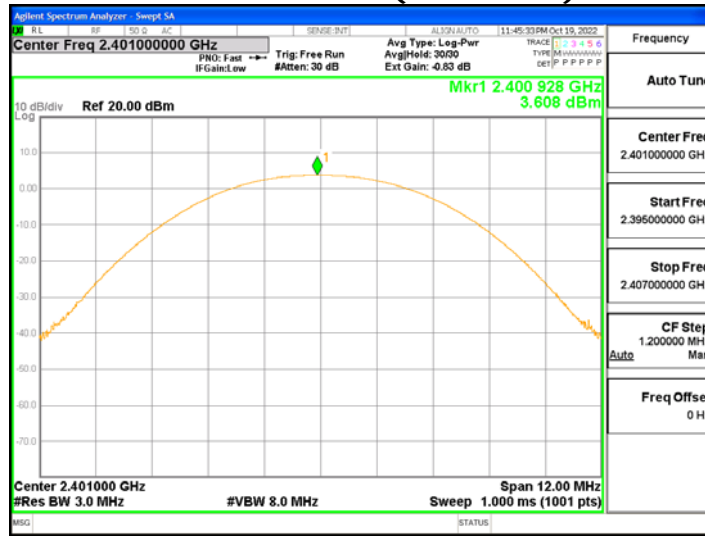
See next pages for actual measured spectrum plots.



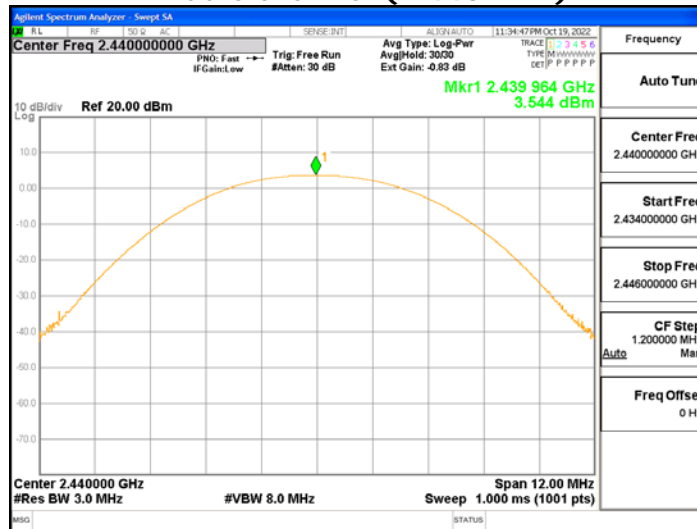
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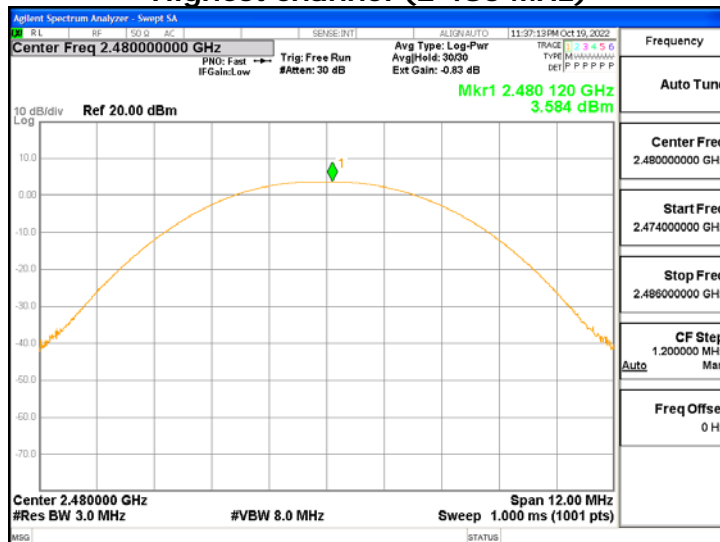
Lowest channel (2 401 MHz)



Middle channel (2 440 MHz)



Highest channel (2 480 MHz)



4.3 Power Spectral Density

Test Procedures

KDB 558074 – Section 8.4
ANSI C63.10-2013 – Section 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 :

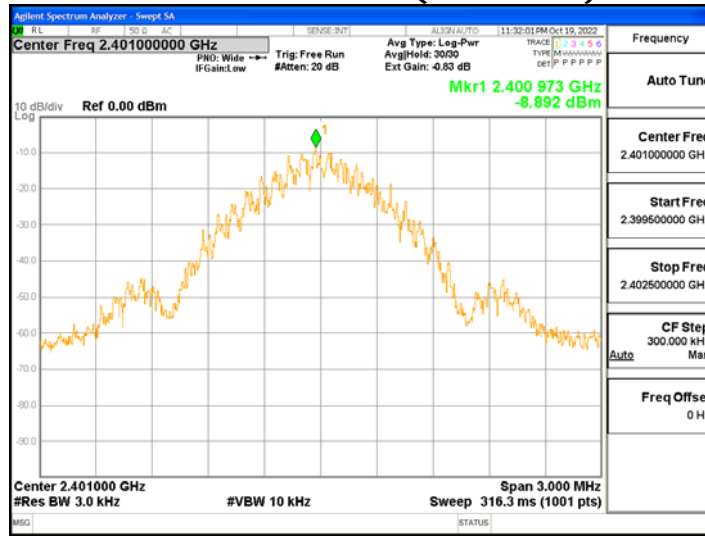
Power Spectral Density < 8 dBm @ 3 kHz BW

Test Data :

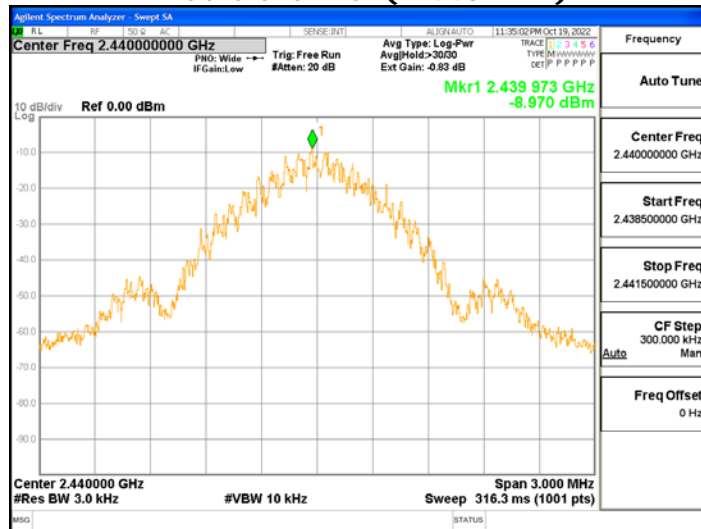
| Channel | Frequency [MHz] | Measurement data [dBm] | Limit [dBm] | Result |
|---------|-----------------|------------------------|-------------|----------|
| Lowest | 2 401 | -8.892 | 8 | Complies |
| Middle | 2 440 | -8.970 | | |
| Highest | 2 480 | -8.960 | | |

See next pages for actual measured spectrum plots.

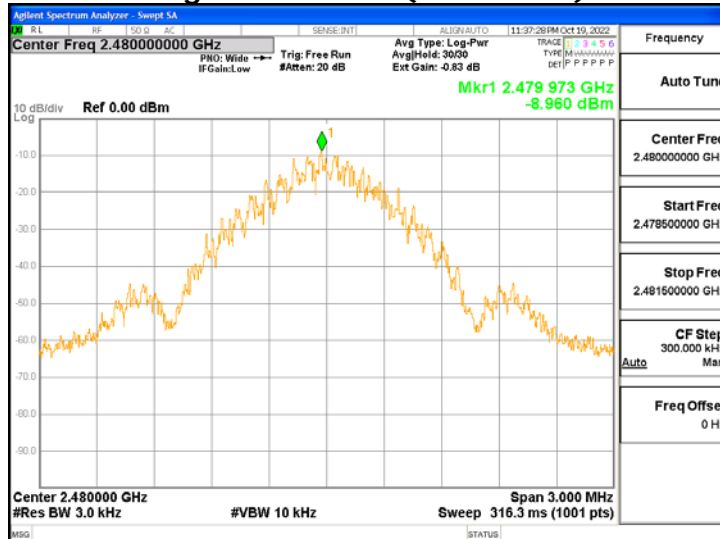
Lowest channel (2 401 MHz)



Middle channel (2 440 MHz)



Highest channel (2 480 MHz)



4.4 Band Edge & Conducted Spurious emission

Test Procedures

KDB 558074 – Section 8.5
ANSI C63.10-2013 – Section 11.11.3
RSS-Gen – Section 6.13

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(d), 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 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest in-band spectral density. Therefore the applying equipment meets the requirement.

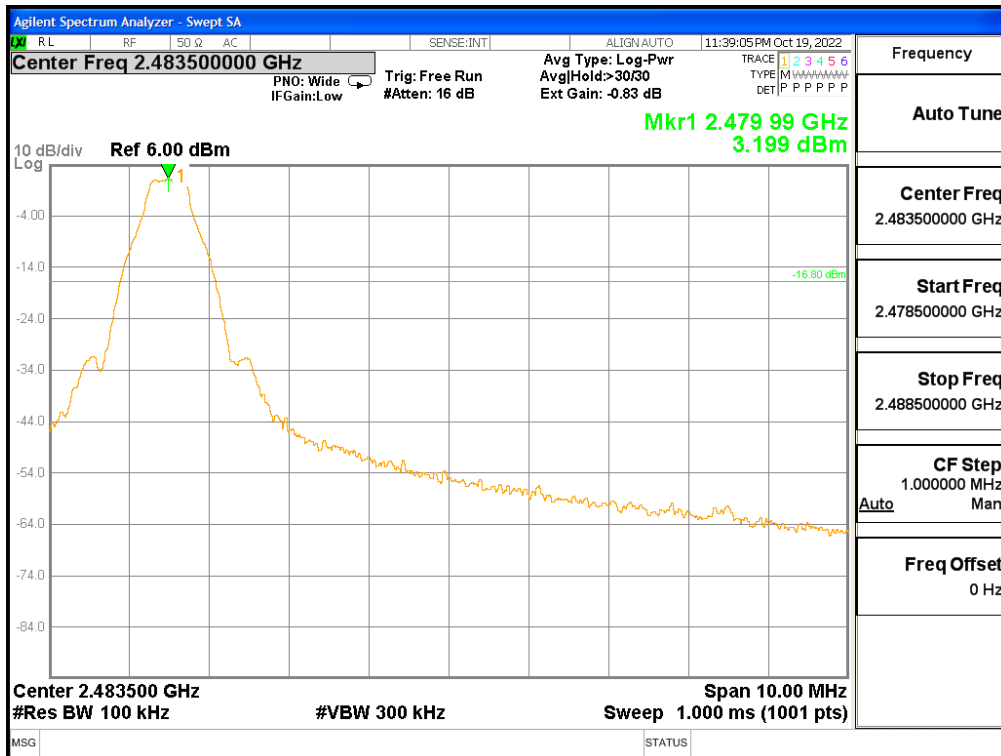
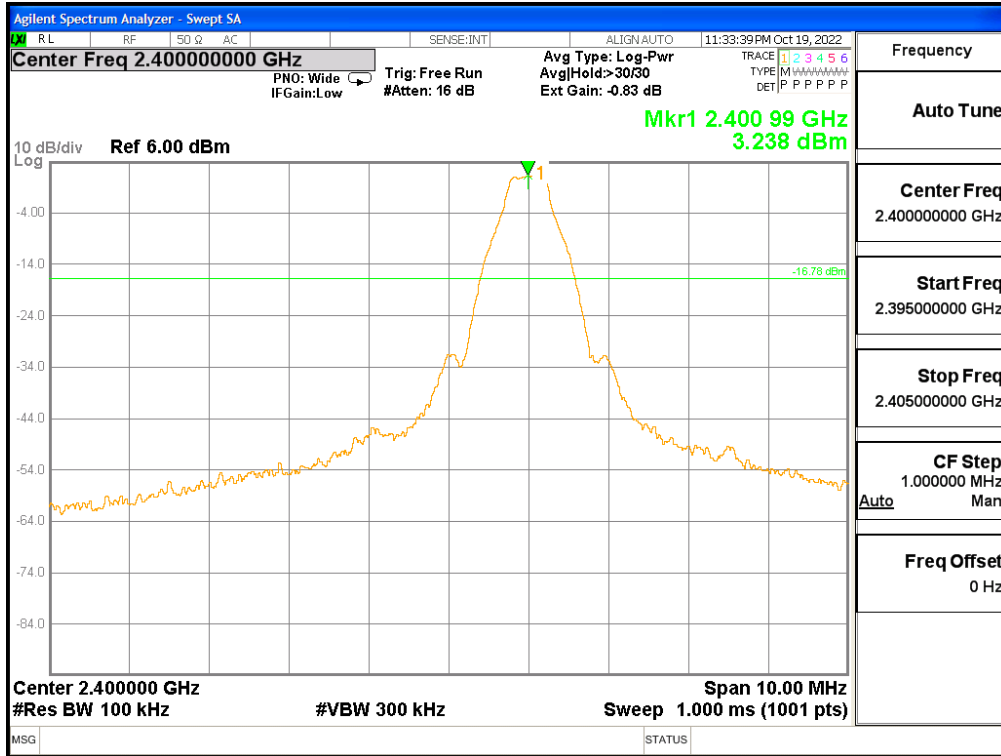
See next pages for actual measured spectrum plots.



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Band-edge



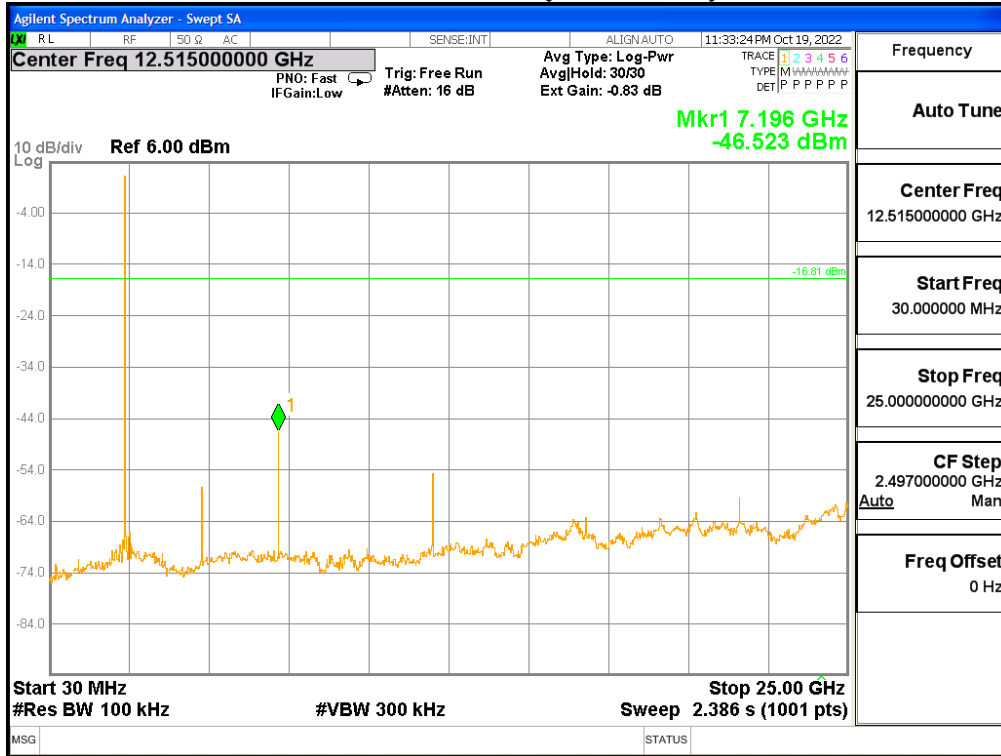


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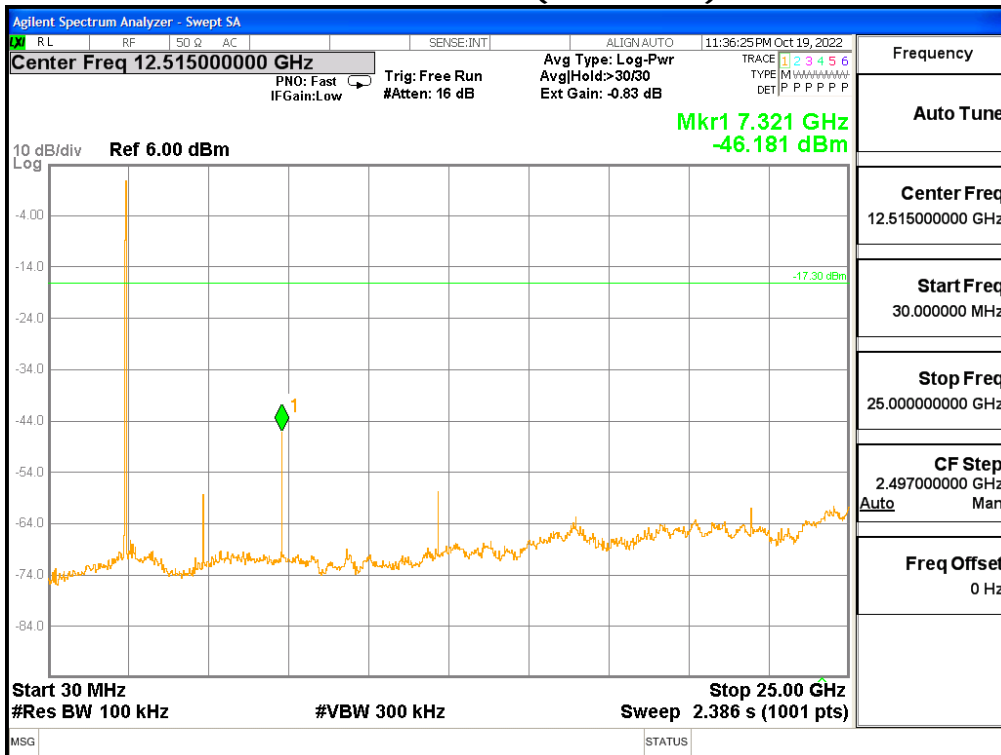
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Conducted Spurious emission

Lowest channel (2 401 MHz)



Middle channel (2 440 MHz)

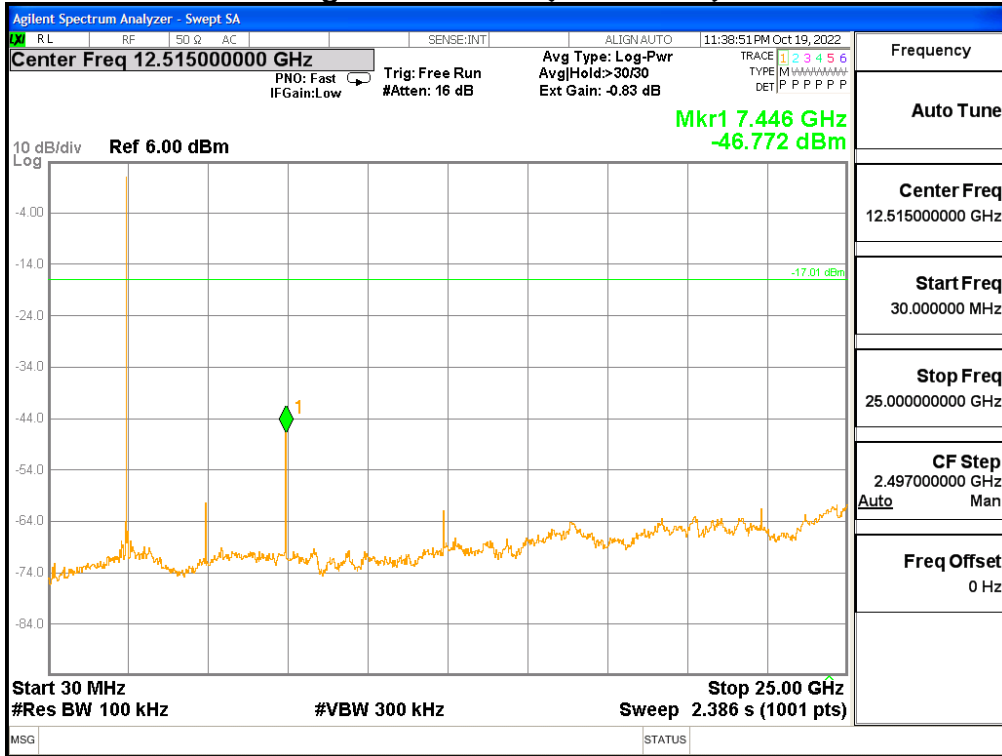




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Highest channel (2 480 MHz)





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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

KDB 558074 – Section 8.5, 8.6
ANSI C63.10-2013 – Section 11.11, 11.12
RSS-Gen – Section 6.13

- 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 3 m away from the EUT. Test Antenna height is carried from 1 m to 4 m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

Test Settings :

Frequency Range = 9 kHz ~ 26.5 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,
200 Hz for $f < 150$ kHz
- b) VBW \geq RBW
- c) Sweep time = auto couple



Limit :

Unwanted emissions that do not fall within the restricted frequency bands of Table 1 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

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.

*Certain frequency bands listed in Table 1 and in band above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200- and 300-series of RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus

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 2 :

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 (uV/m) | Field Strength (dBuV/m) | Deasurement Distance (meters) |
|----------------|-----------------------|-------------------------|-------------------------------|
| 0.009-0.490 | 2400/F(kHz) | 48.5 – 13.8 | 300 |
| 0.490-1.705 | 24000/F(kHz) | 33.8 – 23 | 30 |
| 1.705-30 | 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 |

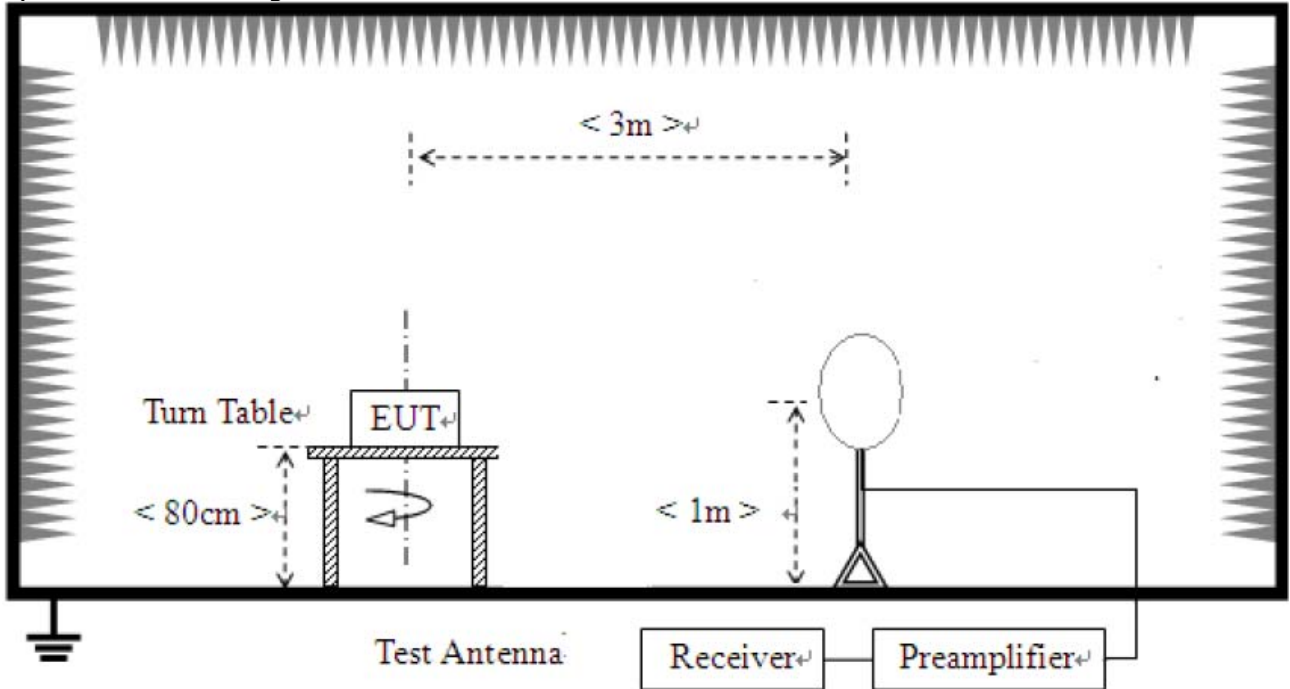
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part,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

Note :

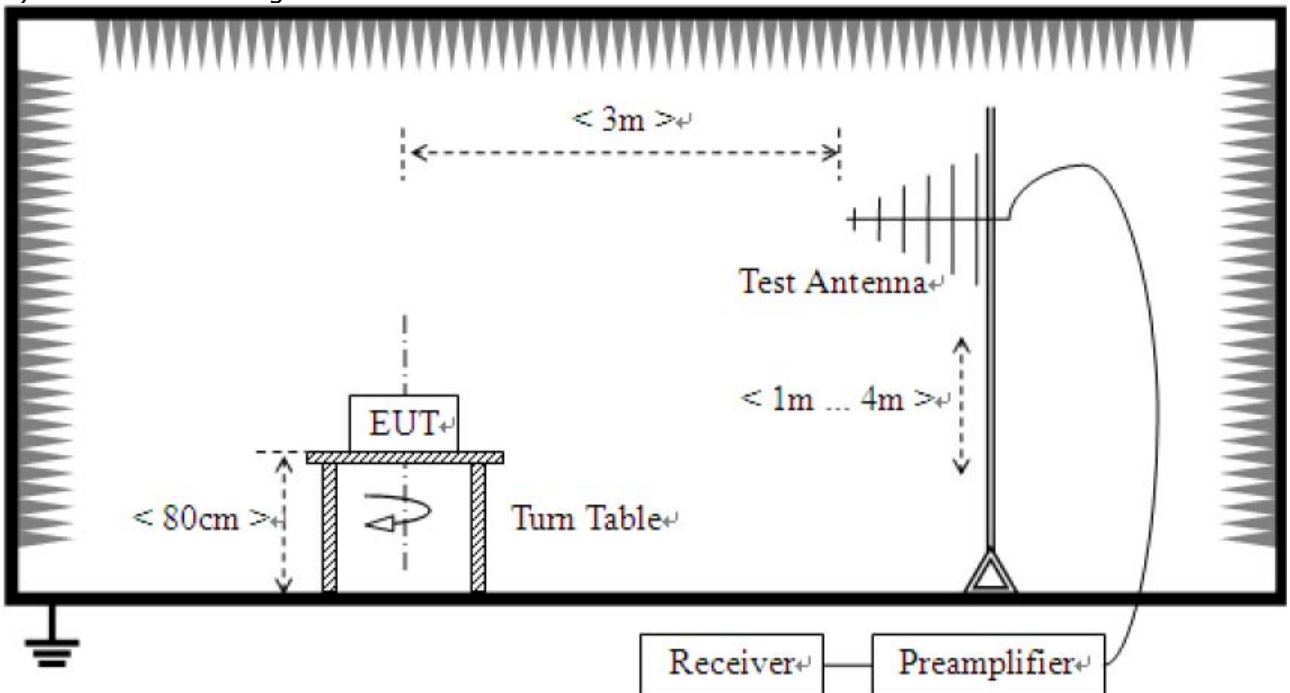
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength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

Test Setup:

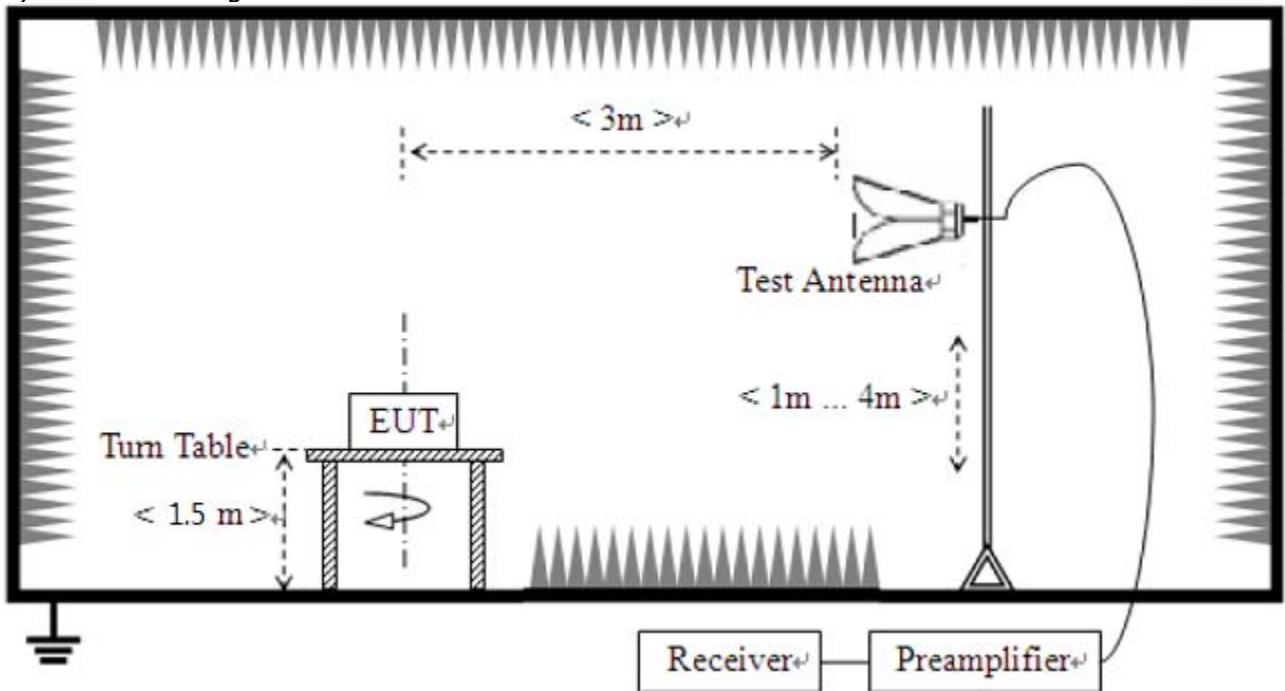
- 1) For field strength of emissions from 9 kHz to 30 MHz



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



3) For field strength of emissions above 1 GHz



Test results

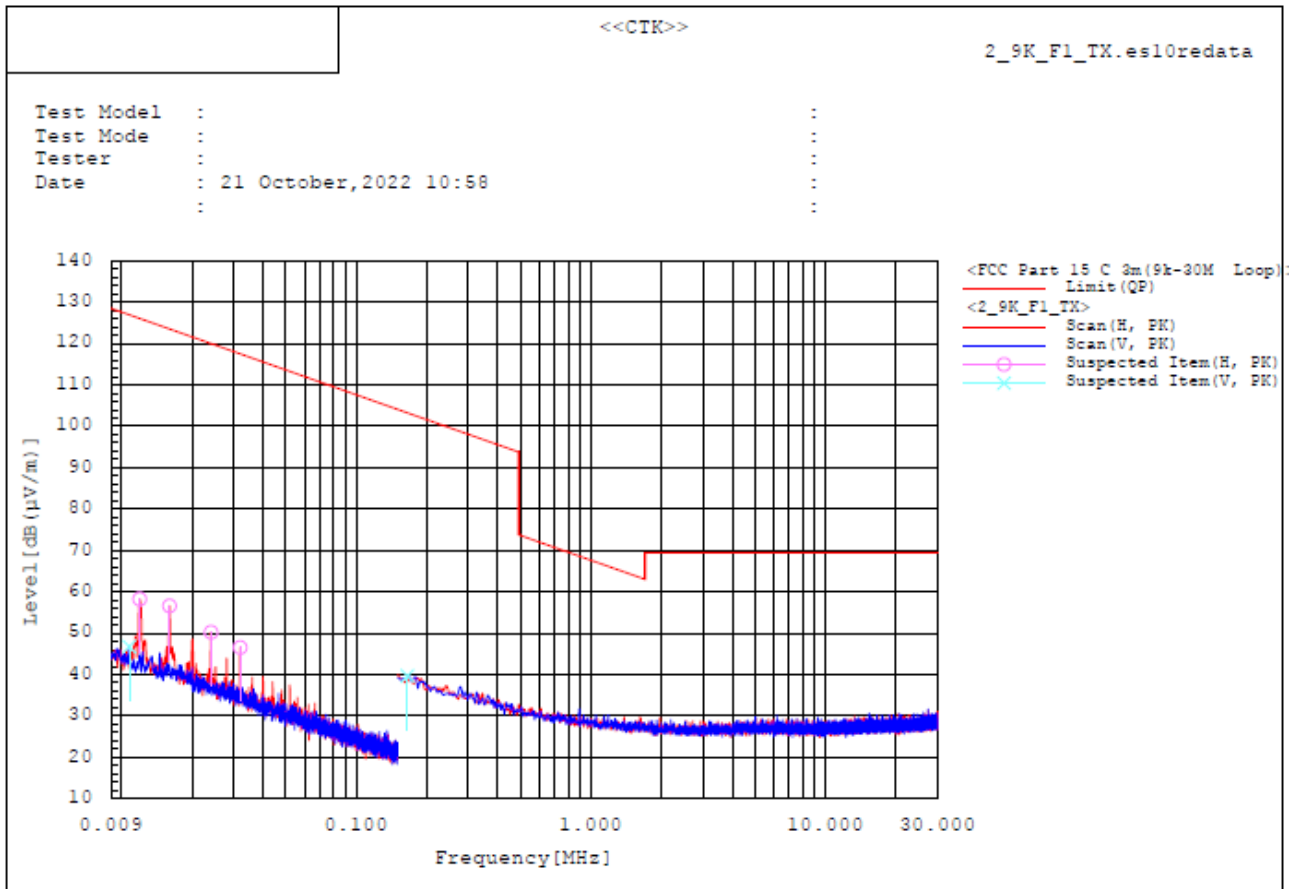
1) 9 kHz to 30 MHz

Test mode : Transmission status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



Result : There are more than 20 dB of margin compared to the reference value.

Remark :

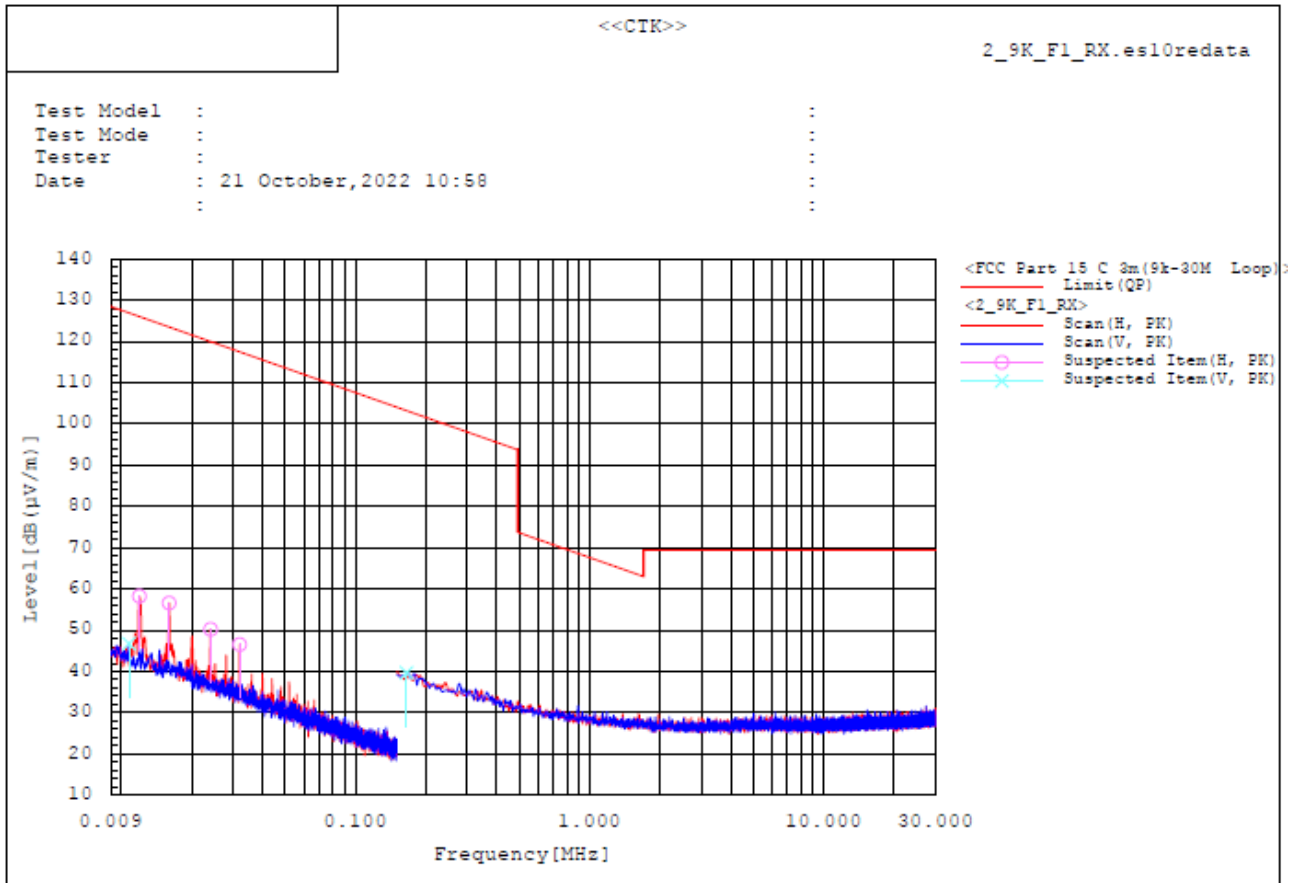
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator
4. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
5. This data is the Peak(PK) value.

Test mode : Receiving status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



Result : There are more than 20 dB of margin compared to the reference value.

Remark :

1. Measuring position : 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(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator
4. Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)
5. This data is the Peak(PK) value.

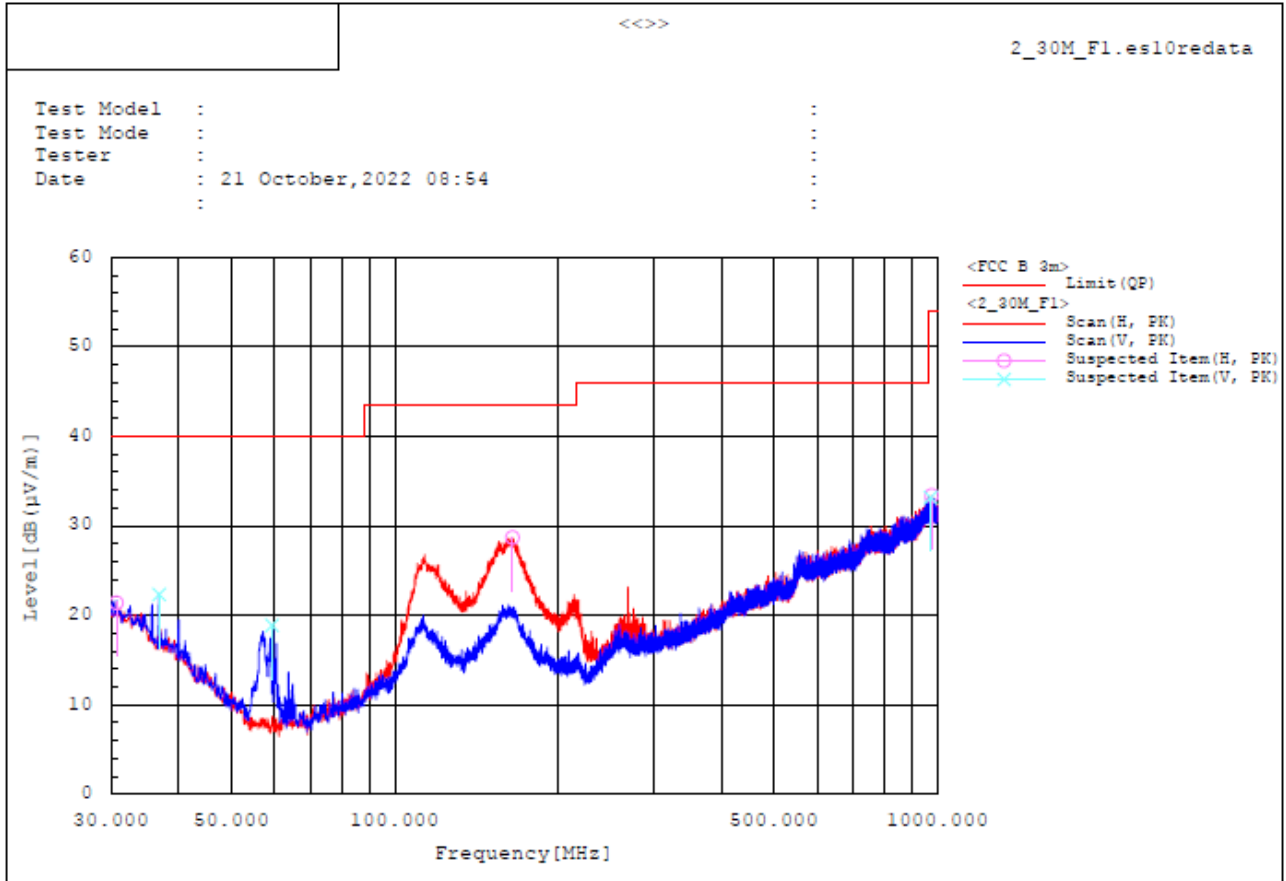
2) 30 MHz to 1 GHz

Test mode : Transmission status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



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] | Remark |
|-----|-----------------|-----|----------------------|----------------|-----------------------|----------------------|-------------------|-------------|-------------|--------|
| 1 | 30.679 | H | 28.0 | -6.6 | 21.4 | 40.0 | 18.6 | 399.9 | 41.2 | |
| 2 | 36.790 | V | 32.2 | -9.9 | 22.3 | 40.0 | 17.7 | 300.0 | 1.0 | |
| 3 | 59.391 | V | 38.3 | -19.4 | 18.9 | 40.0 | 21.1 | 99.9 | 0.0 | |
| 4 | 164.733 | H | 42.5 | -13.8 | 28.7 | 43.5 | 14.8 | 200.1 | 272.4 | |
| 5 | 971.870 | V | 25.5 | 7.7 | 33.2 | 54.0 | 20.8 | 399.9 | 2.5 | |
| 6 | 976.041 | H | 25.8 | 7.6 | 33.4 | 54.0 | 20.6 | 399.9 | 47.8 | |

Remark :

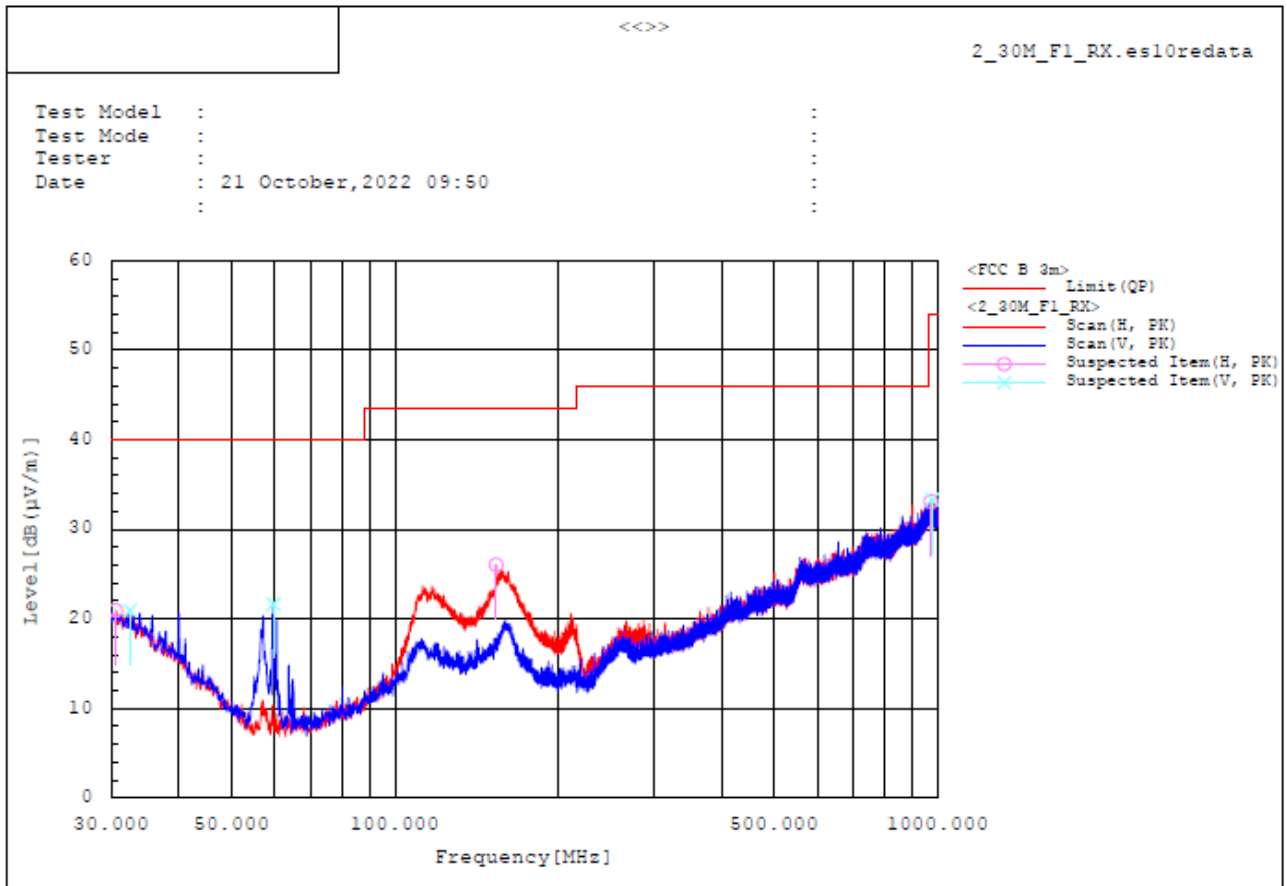
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor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

Test mode : Receiving status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



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] | Remark |
|-----|-----------------|-----|----------------------|----------------|-----------------------|----------------------|-------------------|-------------|-------------|--------|
| 1 | 30.582 | H | 27.5 | -6.6 | 20.9 | 40.0 | 19.1 | 200.0 | 0.3 | |
| 2 | 32.522 | V | 28.5 | -7.6 | 20.9 | 40.0 | 19.1 | 400.0 | 359.5 | |
| 3 | 59.682 | V | 40.9 | -19.3 | 21.6 | 40.0 | 18.4 | 300.0 | 1.5 | |
| 4 | 153.578 | H | 39.1 | -13.1 | 26.0 | 43.5 | 17.5 | 200.0 | 275.3 | |
| 5 | 971.773 | H | 25.4 | 7.7 | 33.1 | 54.0 | 20.9 | 200.0 | 0.9 | |
| 6 | 977.205 | V | 25.7 | 7.6 | 33.3 | 54.0 | 20.7 | 100.0 | 359.9 | |

Remark :

1. Measuring position : 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(Y 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
4. This data is the Peak(PK) value.

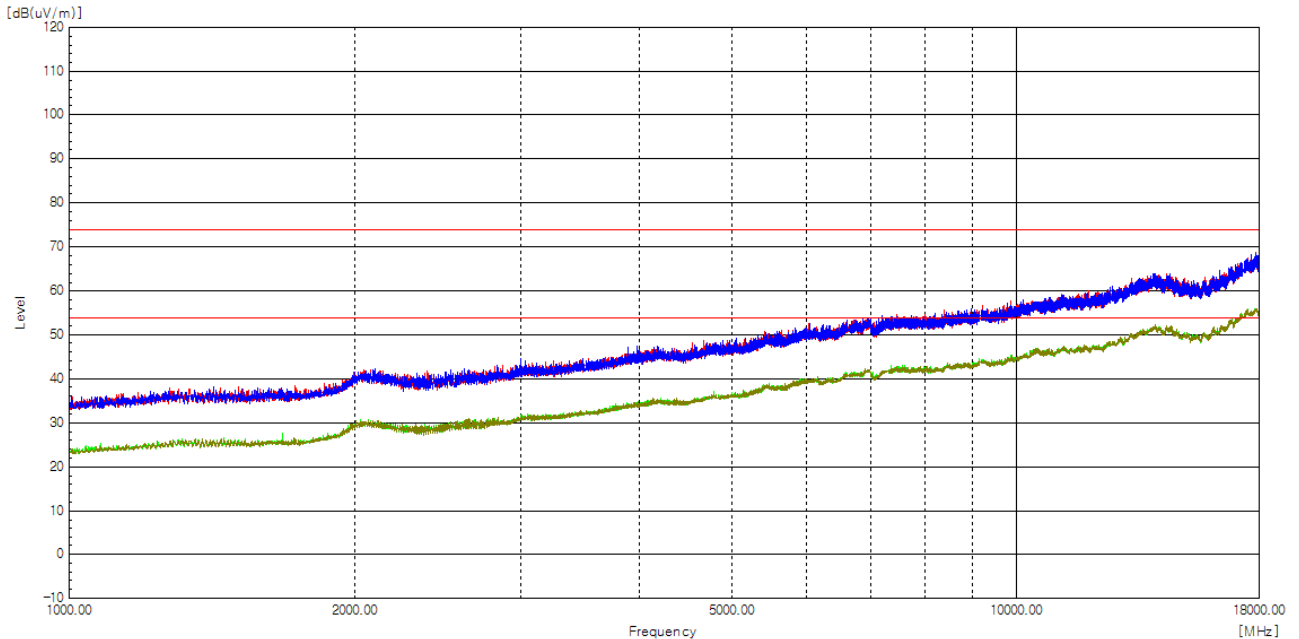
3) 1 GHz to 18 GHz

Test mode : Transmission status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



Result : No peak found

Remarks

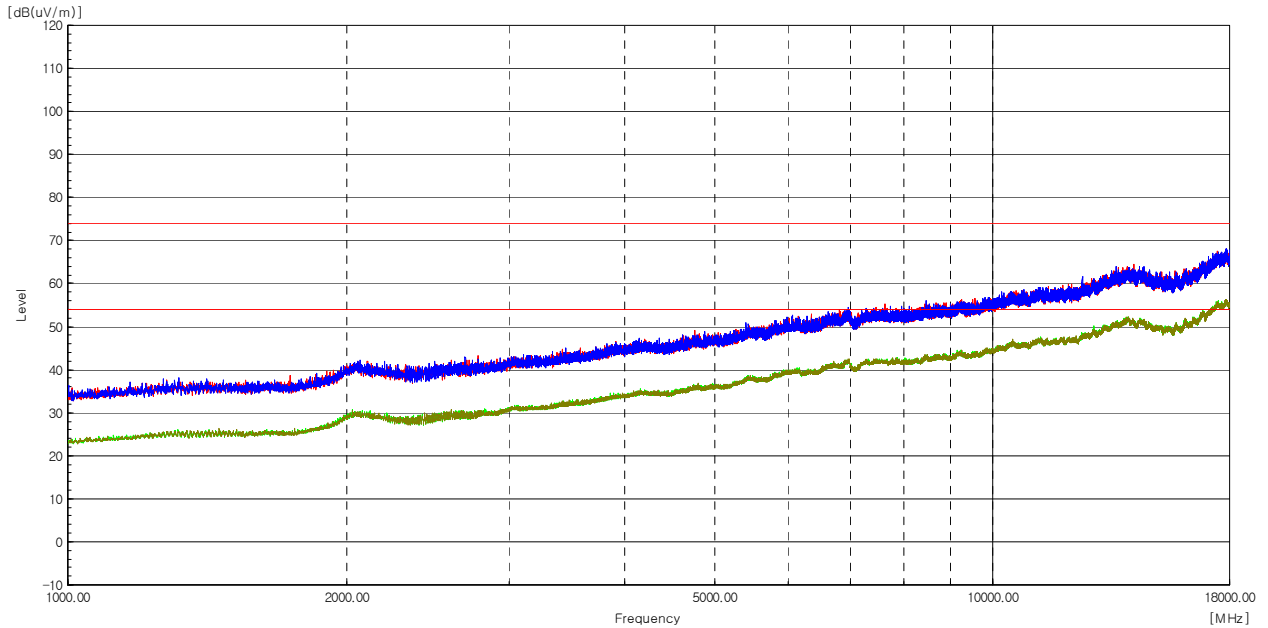
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain
4. Band reject filter was used from 1 GHz to 18 GHz
5. The 18 GHz end had no signal detected. As can be seen from the conducted spurious emission test, no signal was detected in the section.

Test mode : Receiving status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



Result : No peak found

Remarks

1. Measuring position : 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(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain
4. The 18 GHz end had no signal detected. As can be seen from the conducted spurious emission test, no signal was detected in the section.

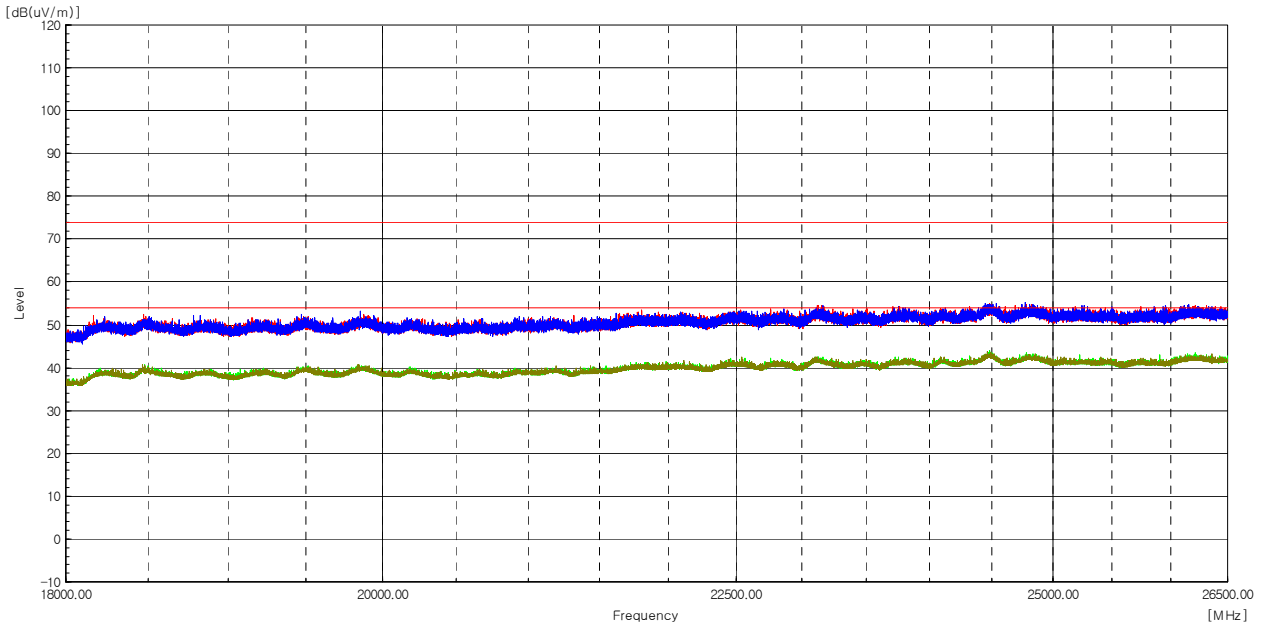
4) 18 GHz to 26.5 GHz

Test mode : Transmission status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



Result : No peak found

Remarks

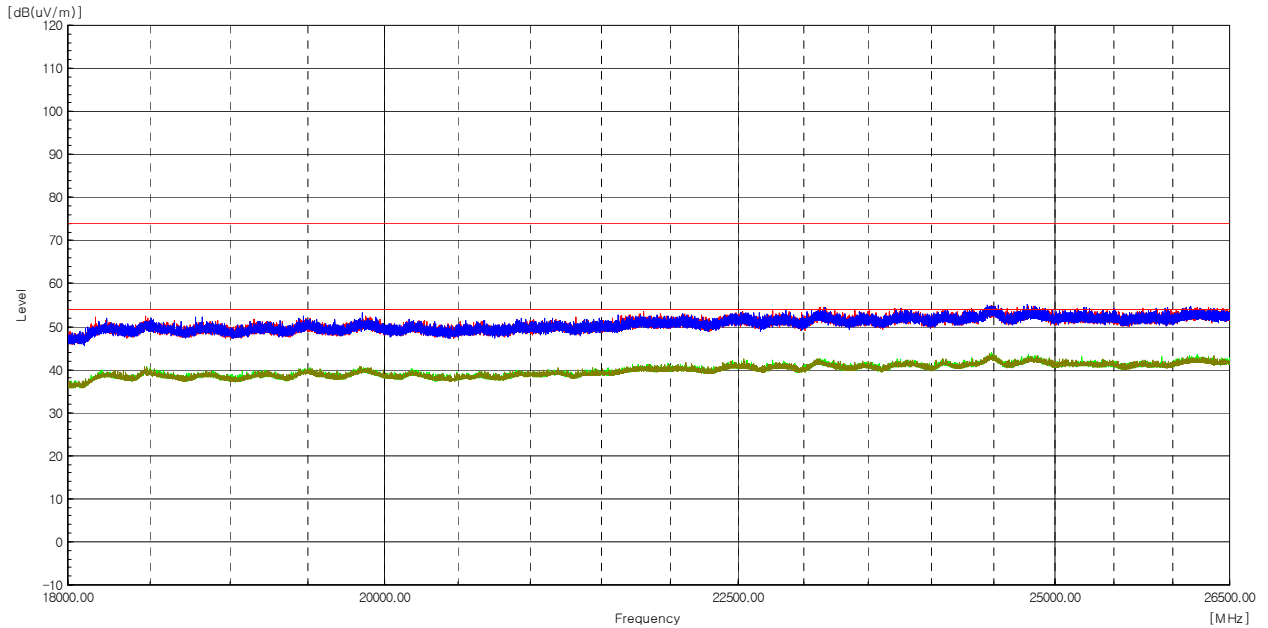
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor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

Test mode : Receiving status Lowest channel(Worst case)

The requirements are:

Complies

Test Data



Result : No peak found

Remarks

1. Measuring position : 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(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

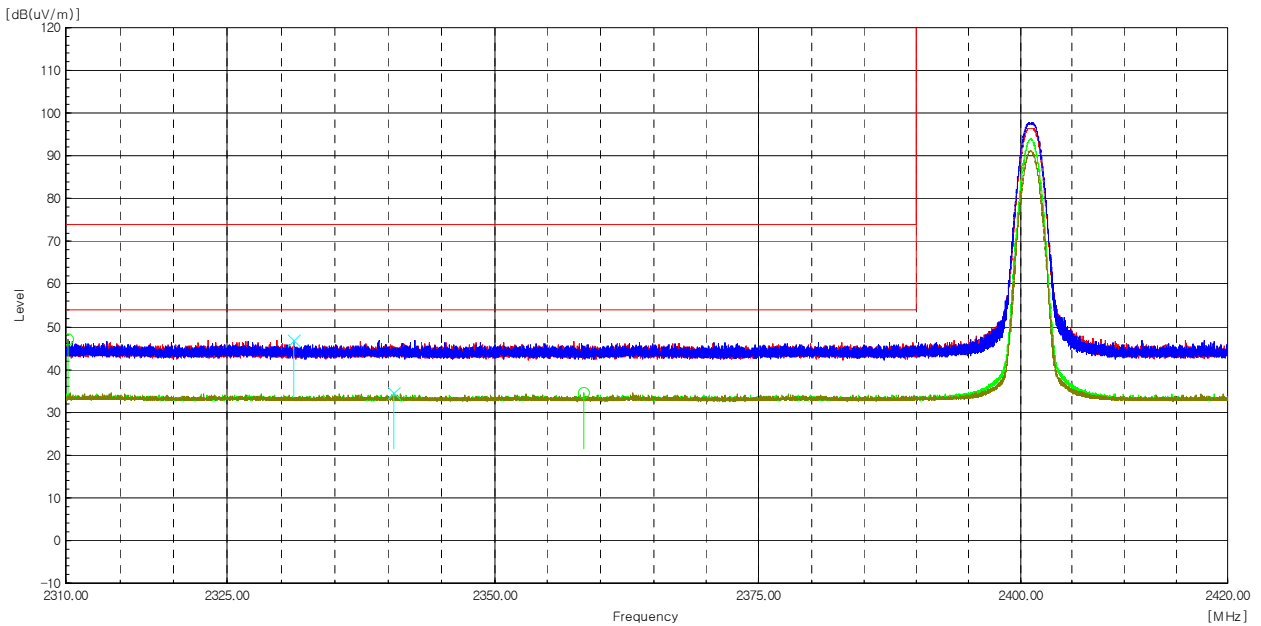
5) Restricted Frequency Bands

Test mode : Transmission status Lowest channel
(Test frequency range : 2 310 MHz – 2 390 MHz)

The requirements are:

Complies

Test Data



| Frequency [MHz] | (P) | Reading PK [dBuV] | Reading AV [dBuV] | c.f [dB(1/m)] | Level PK [dB(uV/m)] | Level AV [dB(uV/m)] | Limit PK [dB(uV/m)] | Limit AV [dB(uV/m)] | Margin PK [dB] | Margin AV [dB] |
|-----------------|-----|-------------------|-------------------|---------------|---------------------|---------------------|---------------------|---------------------|----------------|----------------|
| 2 310.220 | H | 53.0 | ----- | -6.0 | 47.0 | ----- | 74.0 | ----- | 27.0 | ----- |
| 2 358.385 | H | ----- | 40.4 | -6.0 | ----- | 34.4 | ----- | 54.0 | ----- | 19.6 |
| 2 331.152 | V | 52.9 | ----- | -6.0 | 46.9 | ----- | 74.0 | ----- | 27.1 | ----- |
| 2 340.533 | V | ----- | 40.6 | -6.0 | ----- | 34.6 | ----- | 54.0 | ----- | 19.4 |

Remarks

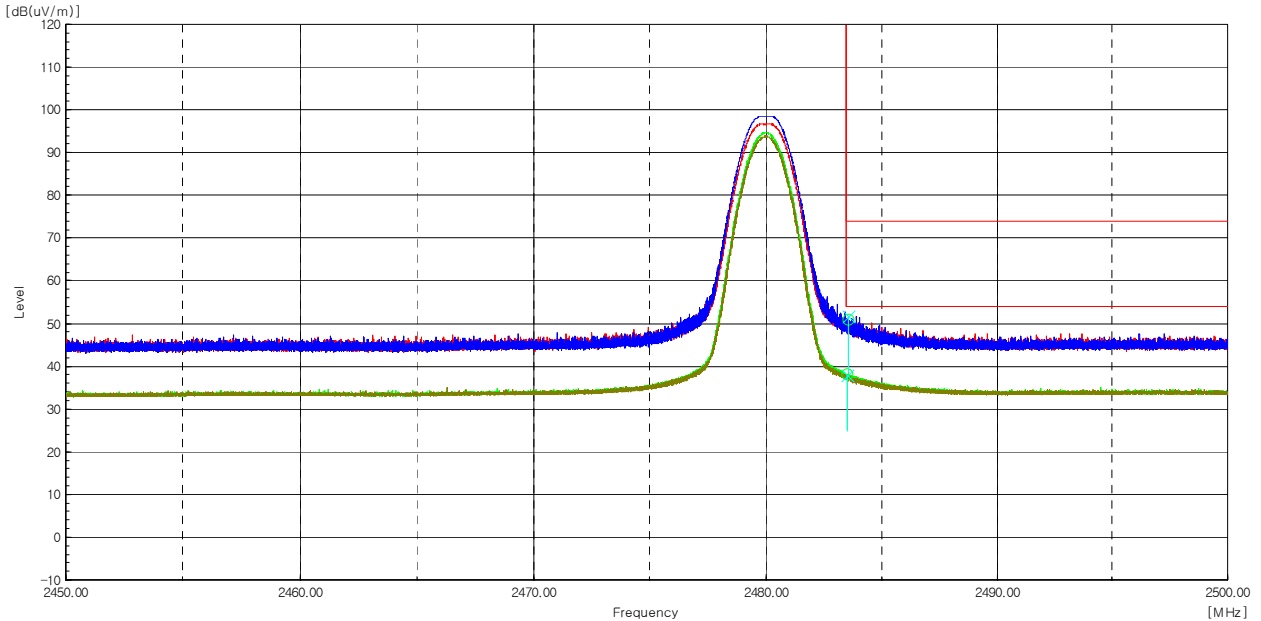
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor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

Test mode : Transmission status Highest channel
(Test frequency range : 2 483.5 MHz – 2 500 MHz)

The requirements are:

Complies

Test Data



| Frequency [MHz] | (P) | Reading PK [dBuV] | Reading AV [dBuV] | c.f [dB(1/m)] | Level PK [dB(uV/m)] | Level AV [dB(uV/m)] | Limit PK [dB(uV/m)] | Limit AV [dB(uV/m)] | Margin PK [dB] | Margin AV [dB] |
|-----------------|-----|-------------------|-------------------|---------------|---------------------|---------------------|---------------------|---------------------|----------------|----------------|
| 2 483.563 | H | 56.2 | ----- | -5.3 | 50.9 | ----- | 74.0 | ----- | 23.1 | ----- |
| 2 483.537 | H | ----- | 43.4 | -5.3 | ----- | 38.1 | ----- | 54.0 | ----- | 15.9 |
| 2 483.573 | V | 56.9 | ----- | -5.3 | 51.6 | ----- | 74.0 | ----- | 22.4 | ----- |
| 2 483.535 | V | ----- | 43.1 | -5.3 | ----- | 37.8 | ----- | 54.0 | ----- | 16.2 |

Remarks

1. Measuring position : 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(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain



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-2022-02718
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5. APPENDIX A – Test Equipment Used For Tests

| | Name of Equipment | Manufacturer | Model No. | Serial No. | Cal Date | Due Date |
|----|-------------------------------|---------------------------------------|-------------|---------------------|------------|------------|
| 1 | Signal Analyzer | Agilent | N9020A | MY50510240 | 2022-07-13 | 2023-07-13 |
| 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 | Bilog Antenna | TESEQ | CBL6111D | 60654 | 2021-09-03 | 2023-09-03 |
| 5 | Active Loop Antenna | SCHWARZBECK | FMZB 1513 | 1513-125 | 2022-04-15 | 2024-04-15 |
| 6 | Attenuator | PASTERNAK | PE7AP006-06 | L20210504000 023 | 2022-08-10 | 2023-08-10 |
| 7 | AMPLIFIER | SONOMA | 310N | 411011 | 2022-08-10 | 2023-08-10 |
| 8 | Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101574 | 2022-01-12 | 2023-01-12 |
| 9 | Preamplifier | Agilent | 8449B | 3008A00620 | 2022-05-10 | 2023-05-10 |
| 10 | Double Ridged Guide Antenna | ETS-Lindgren | 3115 | 00078895 | 2022-04-14 | 2023-04-14 |
| 11 | Horn Antenna | SCHWARZBECK | BBHA9170 | 01153 | 2021-11-16 | 2022-11-16 |
| 12 | Band Reject Filter | Micro Tronics | BRM50702 | G444 | 2022-10-13 | 2023-10-13 |
| 13 | Low Noise Amplifier | TESTEK | TK-PA1840H | 210124-L | 2021-11-15 | 2022-11-15 |
| 14 | Dual-Tracking DC Power Supply | Topward Electric Instruments Co.,Ltd. | 6303D | 711196 | 2022-04-18 | 2023-04-18 |
| 15 | DC POWER SUPPLY | HP | E3632A | KR75305831 | 2022-07-14 | 2023-07-14 |

| | Cable | Manufacturer | Model No. | Serial No. | Check Date |
|---|-----------------------------------|---------------------|--------------|---------------|------------|
| 1 | RF Cable (Conducted) | Junkosha Inc. | MWX221 | 2008S240 | 2022-10-19 |
| 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 |

-END-