TEST REPORT

Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR24-SRF0123-A Page (1) of (27)	eurofins | KCTL

1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2024-07-23

2. Use of Report : Certification

3. Name of Product / Model : Motion Detection Sensor / MDRDI304

4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Korea

5. FCC ID : A3LMDRDI304

6. IC : 649E-MDRDI304

7. Date of Test : 2024-08-09 to 2024-08-21

8. Location of Test : ■ Permanent Testing Lab □ On Site Testing
(Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

9. Test method used : FCC Part 15.255
RSS-210 Issue 11 June 2024, RSS-Gen Issue 5 February 2021

10. Test Result : Refer to the test result in the test report

Affirmation	Tested by Name : Seongil Choi (Signature)	Technical Manager Name : Harim Lee (Signature)

2024-08-26

Eurofins KCTL Co.,Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2024-08-22	Originally issued	-
2024-08-26	Revised	4, 5, 6, 7, 9

Note. The report No. KR24-SRF0123 is superseded by the report No. KR24-SRF0123-A.

General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

CONTENTS

1. General information

Client	:	Samsung Electronics Co., Ltd.
Address	:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Manufacturer	:	Samsung Electronics Co., Ltd.
Address	:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Factory 1	:	CHEMTRONICS CO., LTD.
Address 1	:	35, Buk-ri, Namsa-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
Factory 2	:	CHEMTROVINA COMPANY LIMITED
Address 2	:	Nhon Trach 2 - Loc Khang IZ, Hiep Phuoc Town, Nhon Trach District,, Dong Nai Province, Vietnam
Laboratory	:	Eurofins KCTL Co.,Ltd.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 CAB Identifier: KR0040 ISED Number: 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	Motion Detection Sensor
Model	:	MDRDI304
Modulation technique	:	Pulsed-CW
Frequency range	:	61 000 ㎒ ~ 61 500 ㎒
Power source	:	DC 3.3 Ⅴ
Antenna specification	:	Patch type antenna
Antenna gain	:	6 dBi
Operation temperature	:	-10 ℃ ~ 80 ℃
Test device serial No.	:	037

2.1. Frequency/channel operations

This device contains the following capabilities:
Pulsed-CW

Ch.	Frequency (㎓)
01	61.0 ~ 61.5

Table 2.1.1. Pulsed-CW

2.2. Far field distance

Far field distance(R_m)

Freq range [㎒]	Speed of light	Freq [㎒]	wavelength(λ) [m]	Largest Antenna Dimension [m]		Far Field Distance [m]	Measurement Distance [m]
				Measurement Antenna	EUT		
40 000 – 60 000	300	60 000	0.005 0	**0.058 2**	0.001 6	1.35	1.50
60 000 – 90 000	300	90 000	0.003 3	**0.037 8**	0.001 6	0.86	1.50
90 000 – 140 000	300	140 000	0.002 1	**0.024 8**	0.001 6	0.57	1.50
140 000 – 220 000	300	220 000	0.001 4	**0.015 8**	0.001 6	0.37	1.50
61 000 – 61 500	300	61 500	0.003 7	**0.047 5**	0.001 6	0.92	1.50

Note: EUT antenna dimension was provided by customer.

All measurements shall be made in the far-field of the measurement antenna. The far-field boundary for mm-wave antennas is $2D^2 / \lambda$.
For fundamental or out-of-band emissions the far-field boundary distance of the EUT antenna or measurement antenna, whichever is largest, shall be used. For spurious and harmonic emissions the farfield boundary distance shall be based on the measurement antenna.

2.3. RF power setting in TEST SW

Test condition	Test Program	Frequency (㎓)	Power Setting
Pulsed-CW	N/A	61.25	Default

3. Summary of tests

FCC Part section(s)	IC Rule reference	Parameter	Test condition	Test results
15.255(c)(2)(v)	RSS-210 J.3.2 a	EIRP	Radiated	Pass
15.255(c)(2)(v)	RSS-210 J.3.2 a RSS-Gen, 6.7	Emission bandwidth, 99% bandwidth		Pass
15.255(d) 15.209(a)	RSS-210 J.4 RSS-Gen 8.9	Spurious emissions		Pass
15.255(f)	RSS-210 J.6	Frequency stability		Pass
15.207(a)	RSS-Gen 8.8	AC power line conducted emissions		Pass

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
3. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation.
4. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2020
   - KDB 364244 D01

4. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10

All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

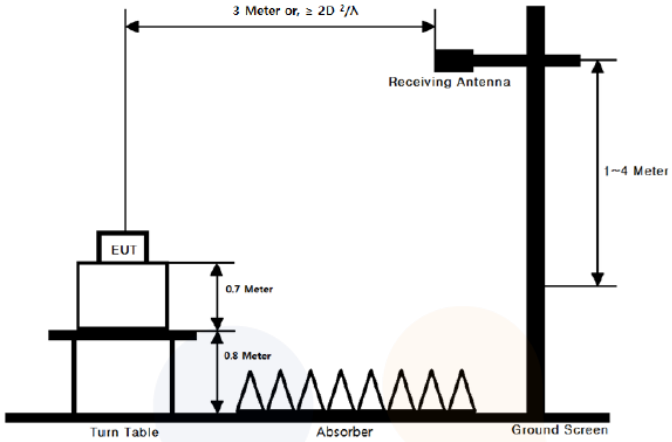
Parameter	Expanded uncertainty (±)	
Bandwidth	0.1 %	
Frequency Stability	344.1 ㎑	
Radiated spurious emissions	30 ㎒ ~ 1 000 ㎒	2.5 ㏈
	1 000 ㎒ ~ 18 000 ㎒	4.7 ㏈
	Above 18 000 ㎓	4.8 ㏈
Radiated spurious emissions	150 ㎑ ~ 30 ㎒	2.8 ㏈

5. Test results

5.1. Emission bandwidth, 99% bandwidth

Test setup

Above 1 ㎓



These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 1.5-meters above a turntable which is flush with the ground plance and 1.5 meters from the receive antenna. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 ㎓, the absorbers are removed.

Limit

FCC

Within the designated 61.0 - 61.5 ㎓ frequency band

According to §15.255(c)(2)(v), For field disturbance sensors/radars that occupy 500 MHz bandwidth or less that are contained wholly within the frequency band 61.0-61.5 ㎓

IC

According to RSS-210 J.2.1(a), FDS devices that occupy a bandwidth of 500 MHz or less and where this bandwidth is contained wholly within the frequency band 61.0-61.5 GHz.

According to RSS-GEN(6.7), The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained.

Test procedure

ANSI C63.10-2020 - Section 9

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

Test settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 20 dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 ~ 5% of the expected EBW(OBW) & VBW ≥ 3 X RBW
3. Detector = Peak
4. Trance mode = Max hold
5. Sweep = No faster than coupled (auto) time.
6. The trace was allowed to stabilize
7. If necessary, step 2 ~ 6 were repeated after changing the RBW such that it would be within 1 ~5 % of the 99 % occupied band width observed in step 6.

Note: The RBW and VBW were setting up to the limitations of the test equipment.

Test results

99% Bandwidth

Test Mode	Frequency [MHz]	99% Bandwidth [MHz]	The Lower Frequency [MHz]	The Upper Frequency [MHz]
Pulse	61 250.0	17.71	61 238.20	61 255.91

20 dB bandwidth

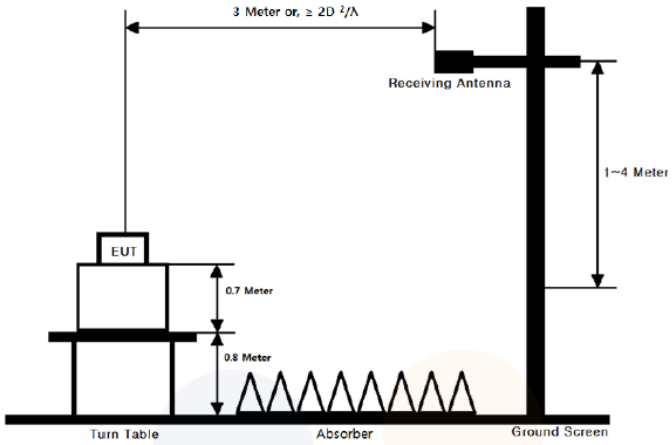
Test Mode	Frequency [MHz]	20dB Bandwidth [MHz]	The Lower Frequency [MHz]	The Upper Frequency [MHz]
Pulse	61 250.3	17.46	61 238.68	61 256.13

20dB Bandwidth & 99% Bandwidth

5.2. EIRP

Test setup

Above 1 ㎓



These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 1.5-meters above a turntable which is flush with the ground plance and 1.5 meters from the receive antenna. For measurements above 1 ㎓ absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 ㎓, the absorbers are removed.

Limit

FCC

According to §15.255(c)(2)(v), the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

According to §15.255(e)(1), the peak transmitter conducted output power of devices other than field disturbance sensors/radars shall not exceed 500 mW.

IC

According to RSS-210 J.2.1(a), the equipment shall not exceed 40 dBm average e.i.r.p. and 43 dBm peak e.i.r.p. in the 61.0-61.5 GHz band. In addition, the average and peak e.i.r.p. of any emission outside of the band 61.0-61.5 GHz, but still within the band 57-71 GHz, shall not exceed 10 dBm average e.i.r.p. and 13 dBm peak e.i.r.p.

Test procedure

ANSI C63.10-2020 - Section 9

Test setting

-Maximum power(EIRP) – Averaging detector

Note: The maximum power(averaging detector) measurements are performed using the “channel power” measurement capability and integrated over the 99 % OBW to obtain the result.

1. Measurement capability of instrument = channel power
2. Set RBW = 1 ㎒
3. Set VBW ≥ 3 X RBW
4. span to 2 x to 3 x the OBW
5. Channel bandwidth setting of instrument ≥ OBW
6. Detector = power averaging (rms)
7. Set number of points in sweep ≥ 2 x span / RBW
8. Sweep time = auto-couple
9. Trace = averaging

-Maximum peak power(EIRP) – Peak detector

1. Set RBW = 1 ㎒
2. Set VBW ≥ 3 X RBW
3. span to 2 x to 3 x the OBW
4. Detector = Peak
5. Set number of points in sweep ≥ 2 x span / RBW
6. Sweep time = auto-couple
7. Trace = max-hold

Note1.
Sample Calculation
E(㏈㎶/m)= Measured level(㏈m) +107 +AFCL(㏈/m)
Where, E=field strength / AFCL= Antenna Factor(㏈/m) + Cable Loss(㏈)
The mixer loss was applied to the measured level by SA correction factor.
EIRP(㏈m)= E(㏈㎶/m) +20log(D)-104.8;where, D is measurement distance(in the far field region) in m.

Test results

Peak EIRP

Measurement distance(D)	Frequency (㎓)	ANT Pol	EUT Position (Axis)	Measured Level (dBm)	AFCL (dB/m)	E (dBμV/m)	EIRP (dBm)	Limit (dBm)
1.5 m	61.25	H	X	-62.07	62.88	107.81	6.53	43.00

Note.
1. The EIRP was measured in each axis EUT positions and the worst case data was reported.

Average EIRP

Measurement distance(D)	Frequency (㎓)	ANT Pol	EUT Position (Axis)	Peak EIRP (dBm)	D.C.F. (dB)	Average EIRP (dBm)	Limit (dBm)
1.5 m	61.25	H	X	6.53	16.60	-10.07	40.00

Note.
1. Average Power = Peak Power – Duty Cycle Factor

Peak Output Power

Measurement distance(D)	Frequency (㎓)	Peak EIRP (dBm)	Antenna Gain (dBi)	Peak Output Power (dBm)	Limit (dBm)
1.5 m	61.25	5.12	6.00	-0.88	27

Note.
1. Peak Output Power = Peak EIRP – Antenna Gain

Duty cycle

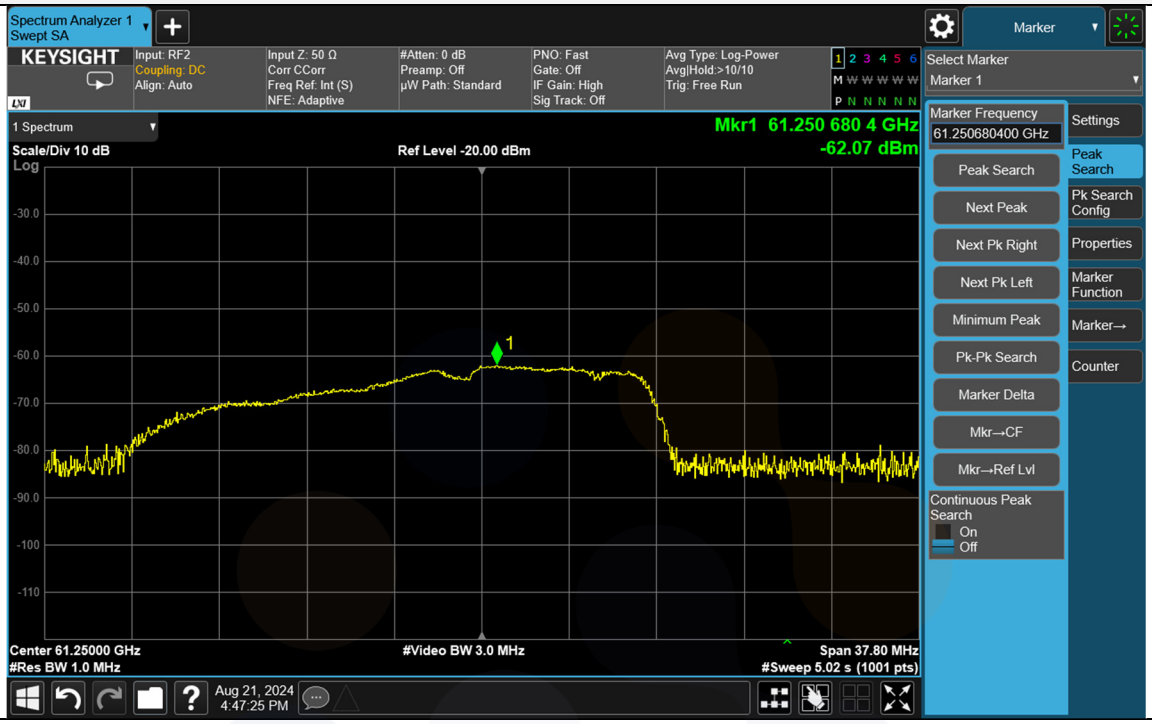
Frequency (GHz)	Tx_on+off (us)	Tx_on (us)	Duty Cycle (%)	Duty Cycle Factor (dB)
1.5 m	490.70	10.73	2.19	16.60

Note.
1. Duty Cycle = (Tx_on time / Tx_on time+off time) * 100

Test results

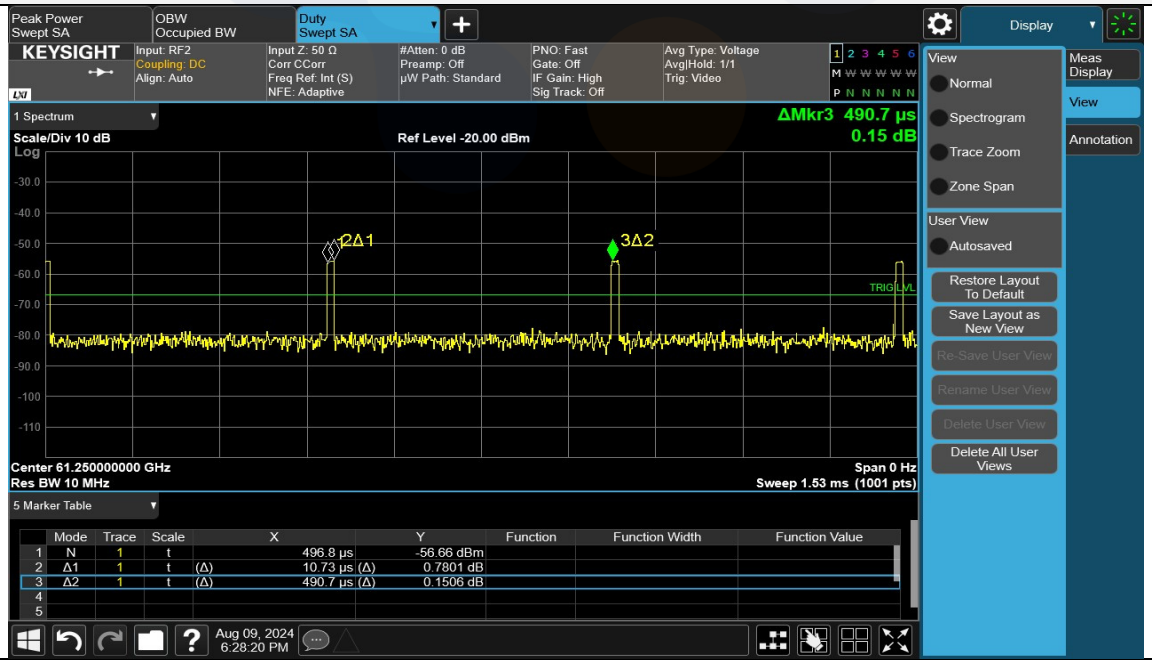
EIRP

Maximum Peak power(EIRP)



Duty Cycle

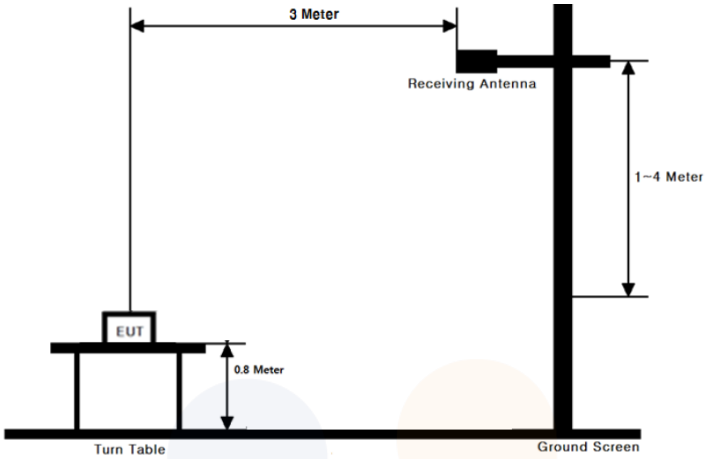
Duty Cycle



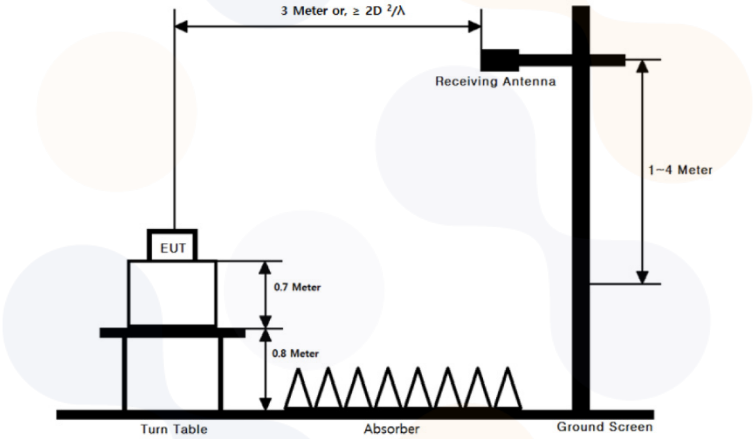
5.3. Spurious emissions

Test setup

Below 1 ㎓



Above 1 ㎓



These measurements were performed at 3 test site. The equipment under test is placed on a non-conductive table 1.5-meters above a turntable which is flush with the ground plane and 3 meters(for below 1 ㎓: 0.8-m) from the receive antenna. For measurements above 1 ㎓ absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections.
For measurements below 1 ㎓, the absorbers are removed.

Limit

FCC

According to §15.255(d),
(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
(2) Radiated emissions below 40 GHz shall not exceed the general limits in § 15.209.
(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm2 at a distance of 3 meters.
(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

According to §15.255(c)(2)(v), In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

According to section 15.209, radiated emissions below 40 ㎓ shall not exceed the field strength as shown in the following emissions table.

Frequency (㎒)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(㎑)	300
0.490-1.705	24000/F(㎑)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

(i) In the emissions table in paragraph (a)(1) of this section, the tighter limit applies at the band edges.
(ii) The limits in the table in paragraph (a)(1) of this section are based on the frequency of the unwanted emissions and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
(iii) The emissions limits shown in the table in paragraph (a)(1) of this section are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9.0-90.0 ㎑, 110.0-490.0 ㎑, and above 1000 ㎒. Radiated emissions limits in these three bands are based on measurements employing an average detector with a 1 ㎒ RBW.

According to section 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

㎒	㎒	㎒	㎓
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	25	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	156.7 - 156.9	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	162.012 5 - 167.17	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	167.72 - 173.2	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	240 - 285	3 600 – 4 400	Above 38.6
13.36 - 13.41	322 - 335.4		

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 1 000 ㎒, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 ㎒, 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.

IC

According to RSS-210 J.4,
a. the fundamental emission levels
b. the general field strength limits specified in RSS-Gen, General Requirements for Compliance of Radio Apparatus, for emissions below 40 GHz
c. 90 pW/cm2 at a distance of 3 m for emissions between 40 GHz and 200 GHz

According to RSS-210 J.3.2a, In addition, the average and peak e.i.r.p. of any emission outside of the band 61.0-61.5 GHz, but still within the band 57-71 GHz, shall not exceed 10 dBm average e.i.r.p. and 13 dBm peak e.i.r.p.

According to RSS-Gen(8.9), Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5- General field strength limits at frequencies above 30 ㎒

Frequency(㎒)	Field strength (μV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 6- General field strength limits at frequencies below 30 ㎒

Frequency	Magnetic field strength (H-Field) (μA/m)	Measurement distance(m)
9 – 490 ㎑ 1)	6.37/F (F in ㎑)	300
490 – 1705 ㎑	63.7/F (F in ㎑)	30
1.705 - 30 ㎒	0.08	30

Note 1: The emission limits for the ranges 9-90 ㎑ and 110-490 ㎑ are based on measurements employing a linear average detector.

According to RSS-Gen(8.10), Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.
(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7- Restricted frequency bands*

MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 - 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 - 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 - 8500	
108 - 138	--	

* Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

Test procedure

ANSI C63.10-2020 – Section 9

Test settings

Below 1 ㎓

RBW = 100 or 120 ㎑, VBW = 3 x RBW, Detector= Peak or Quasi Peak

Above 1 ㎓

Peak Measurement

RBW: 1 ㎒, VBW= 3 ㎒, Detector = Peak, Sweep time = Auto,
Trace mode = Max Hold until the trace stabilizes

Average Measurement

RBW: 1 ㎒, VBW= 3 ㎒, Detector = RMS, Sweep time = Auto,
Trace mode = Averaging or Max Hold

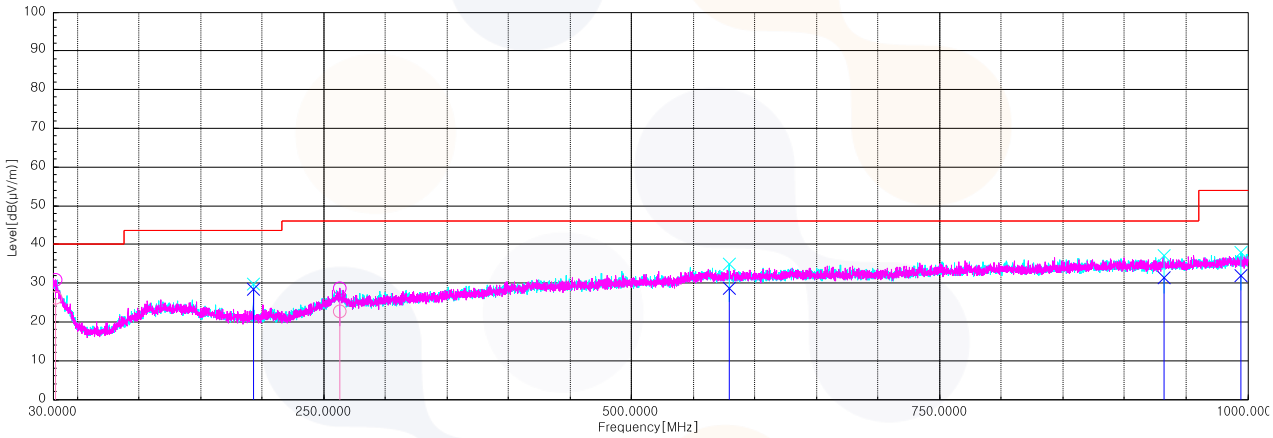
The limits in CFR 47, part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impendance of 377Ω. For example, the measurement frequency X ㎑ resulted in a level of Y ㏈㎶/m, which is equivalent to Y - 51.5 = Z ㏈㎶/m, which has the same margin, W ㏈, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209 (a) limit.

Test results

Frequency Range: 30 ㎒ ~ 1 ㎓

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
31.94	H	34.40	23.74	-31.84	26.30	40.00	13.70
192.72	V	44.70	14.80	-31.12	28.38	43.50	15.12
*263.16	H	33.70	20.04	-30.97	22.77	46.00	23.23
578.90	V	34.50	24.56	-30.39	28.67	46.00	17.33
931.74	V	33.60	26.49	-28.61	31.48	46.00	14.52
*994.54	V	32.30	27.30	-27.77	31.83	54.00	22.17

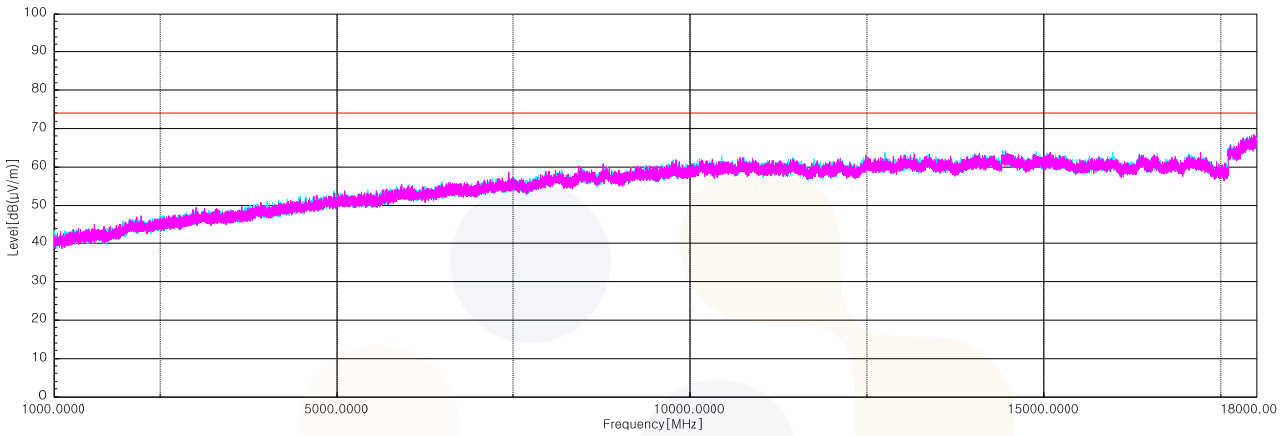
Horizontal/Vertical



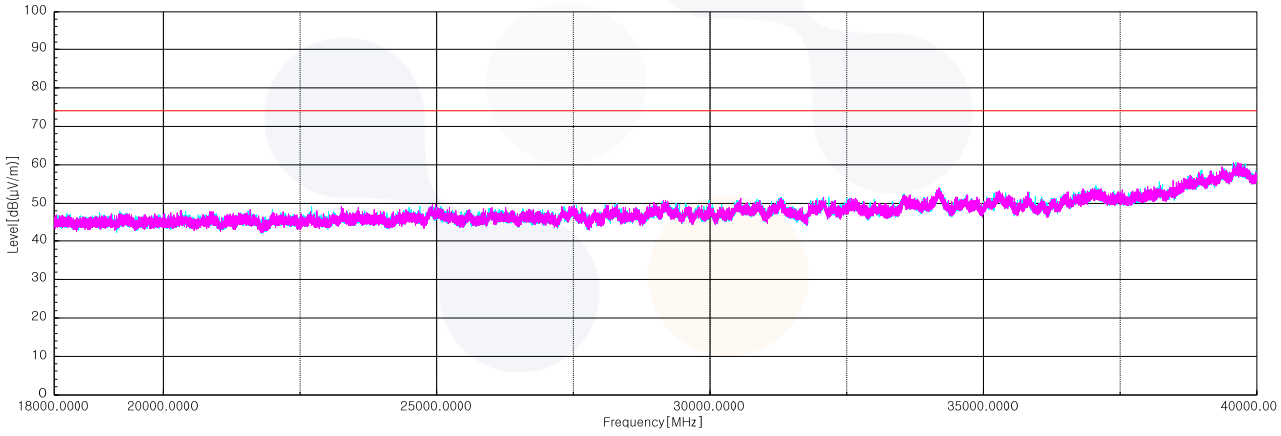
Frequency Range: 1 ㎓ ~ 40 ㎓

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
No spurious emissions were detected.							

Horizontal/Vertical_1~18 ㎓



Horizontal/Vertical_18 ~ 40 ㎓

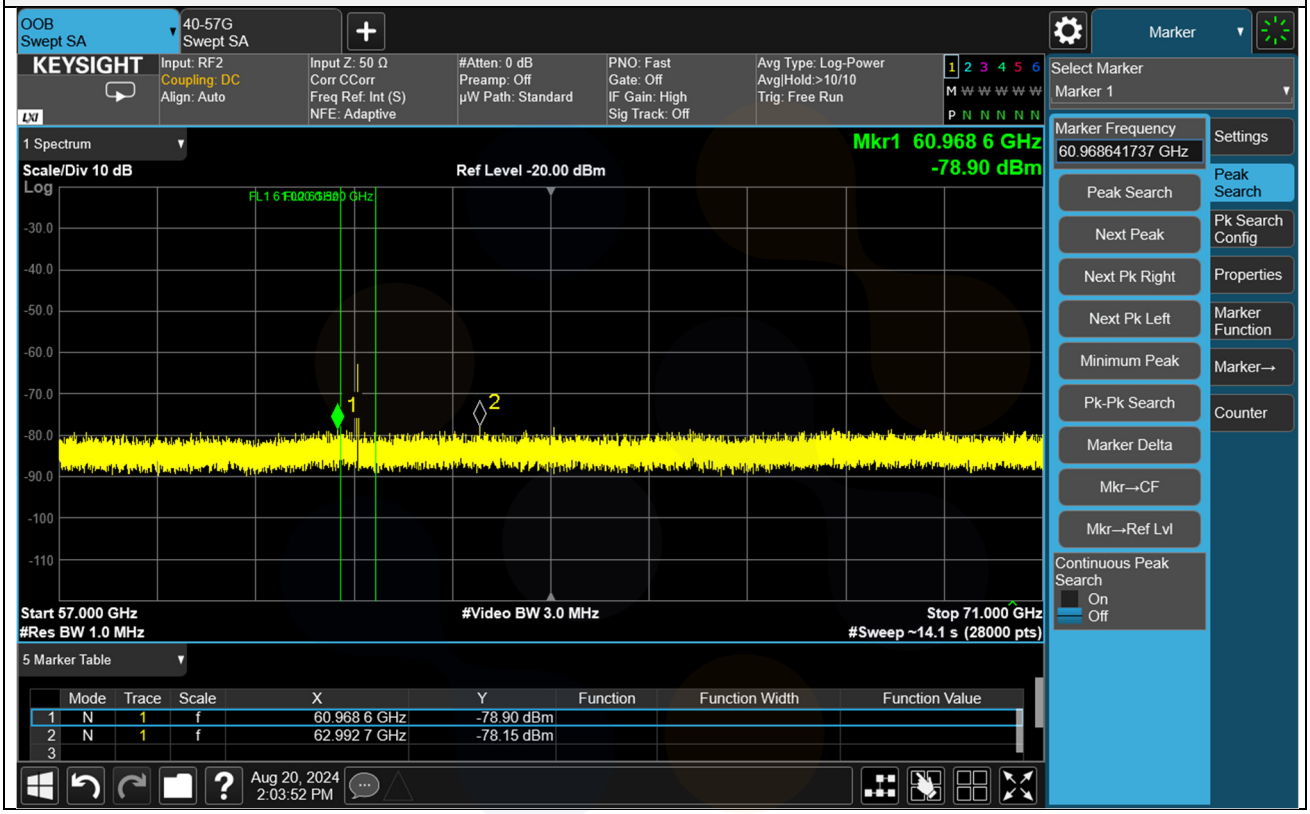


Note.
1. No other spurious and harmonic emissions were found above listed frequencies.

Frequency Range: 57 ㎓ ~ 71 ㎓ (Outside 61.0 ㎓ ~ 61.5 ㎓)

Measurement distance (m)	Frequency (㎓)	Pol. (V/H)	Detecter Mode	Measured Level (dBm)	AFCL (dB/m)	D.C.F. (dB)	E-Field (dB㎶/m)	EIRP (dBm)	Limit (dBm)
1.5	60.97	H	Peak	-78.90	66.44	-	94.54	-6.64	13.00
1.5	60.97	H	Average	-78.90	66.44	16.60	77.94	-23.24	10.00
1.5	62.99	H	Peak	-78.15	69.06	-	97.91	-3.27	13.00
1.5	62.99	H	Average	-78.15	69.06	16.60	81.31	-19.87	10.00

Horizontal/Vertical for Worst Data

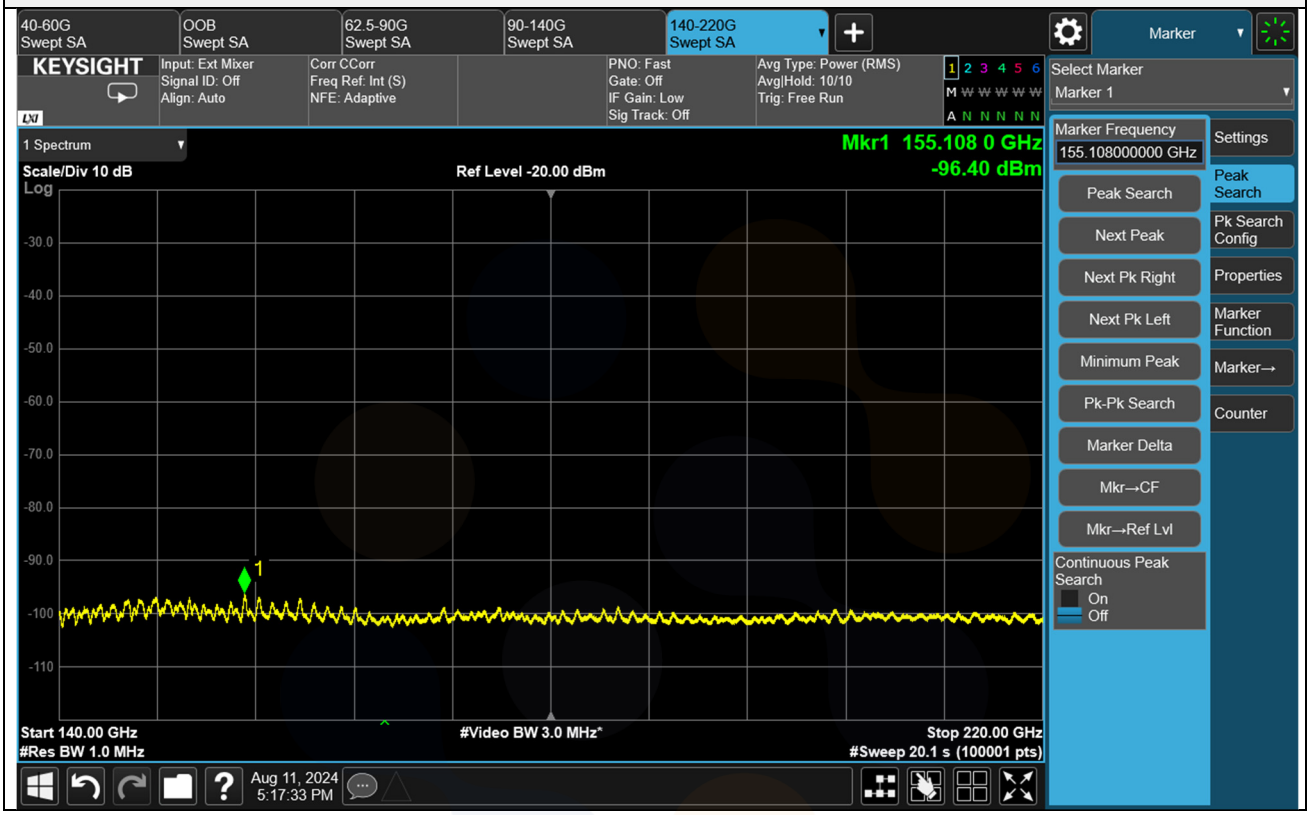


Note.
1. Sample Calculation.
E(dB㎶/m) = Measured level (dBm) + 107 +AFCL(dB/m)
Where, E=field strength / AFCL = Antenna Factor(dB/m) + Cable Loss(dB/m)
EIRP(dBm) = E(dB㎶/m) + 20log(D) - 104.8; where, D is measurement distance(in the far field region) in m.
Average Power = Peak Power - D.C.F.

Frequency Range: 40 ㎓ ~ 200 ㎓

Measurement distance (m)	Frequency (㎓)	Pol. (V/H)	Measured Level (dBm)	AFCL (dB/m)	E (dB(㎶/m))	EIRP (dBm)	Power density (pW/cm²)	Limit (pW/cm²)
No spurious emissions were detected.								

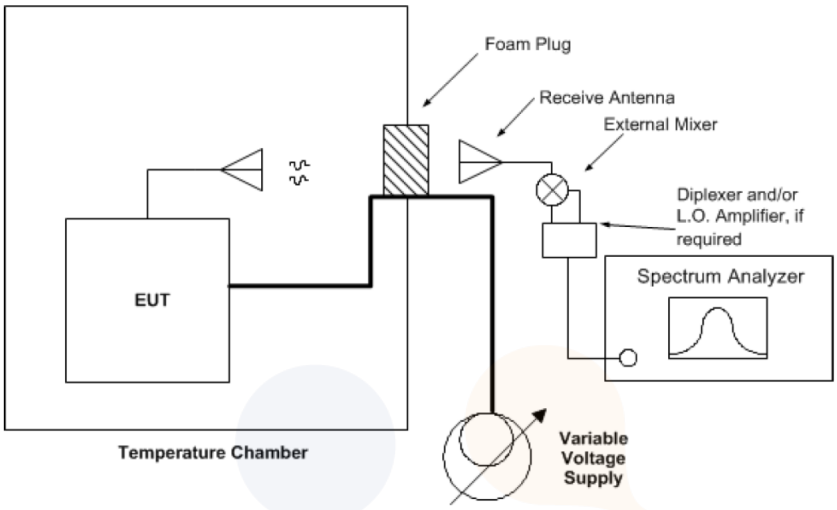
Horizontal/Vertical for Worst Data



Note.
1. The radiated emissions were investigated up to 220 ㎓. And no other spurious and harmonic emissions were found above listed frequencies.

5.4. Frequency stability

Test setup



Limit

FCC

According to § 15.255(f), 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 −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

IC

According to RSS 210 J.6, Fundamental emissions shall be contained within the frequency bands specified in this annex during all conditions of operation when tested at the temperature and voltage variations specified for the frequency stability measurement in RSS-Gen.

RSS GSN(8.11), If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation.In addition, its occupied bandwidth shall be entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, and 470-602 MHz, unless otherwise indicated.

Test procedure

ANSI C63.10-2020 – Section 9

The following procedure shall be used for determining frequency stability of millimeter-wave systems:

a) Arrange EUT and test equipment as shown above test setup. Suitable temperature chambers have a window or other opening that permits locating the receive antenna and instrumentation outside the chamber.

b) Install an RF transparent foam plug in the chamber opening.

c) As applicable, install RF absorber sheets on the inside walls of the chamber, particularly in any areas illuminated by the EUT antenna beam.

d) With the EUT at ambient temperature (approximately 25 °C) and voltage source set to the EUT nominal operating voltage (100%), record the frequency excursion of the spectrum mask of the EUT emission on the spectrum analyzer. Alternatively, if the EUT has a test mode to transmit a CW frequency, the frequency can be measured using the spectrum analyzer's internal frequency count function.

e) Follow the test methods of ANCI 63.10-2020 Section 6.8

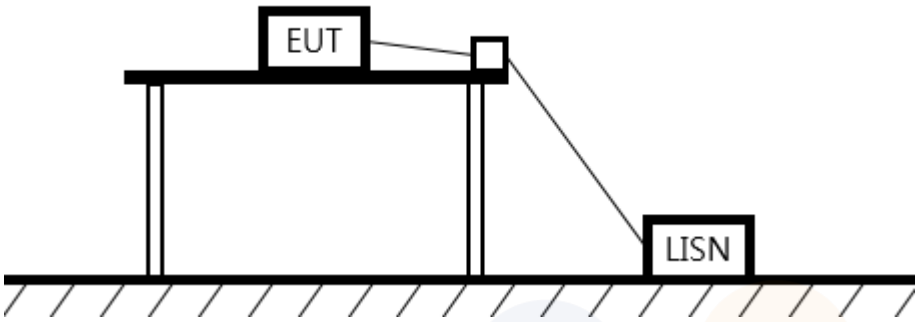
Test results

Voltage	Voltage	TEMP	Measure Frequency(F_L)	Measure Frequency(F_H)
[%]	[V]	[℃]	[㎒]	[㎒]
100	3.3	20(Ref.)	61 238.84	61 256.68
		-10	61 244.06	61 257.10
		0	61 242.40	61 256.73
		10	61 240.66	61 256.85
		20	61 239.09	61 256.77
		30	61 238.44	61 256.86
		40	61 237.67	61 256.49
		50	61 237.30	61 256.11
		60	61 237.32	61 255.83
		70	61 237.30	61 255.85
		80	61 237.12	61 256.24
*110	*3.63	20(Ref.)	61 238.48	61 256.49
*90	*2.97	20(Ref.)	61 238.54	61 256.63

Note:
1. Fundamental emissions were contained within the frequency bands.
2. * The device tests to minimum and maximum allowable voltages according to the manufacturer's declared s pecifications.

5.5. AC power line conducted emissions

Test setup



Limit

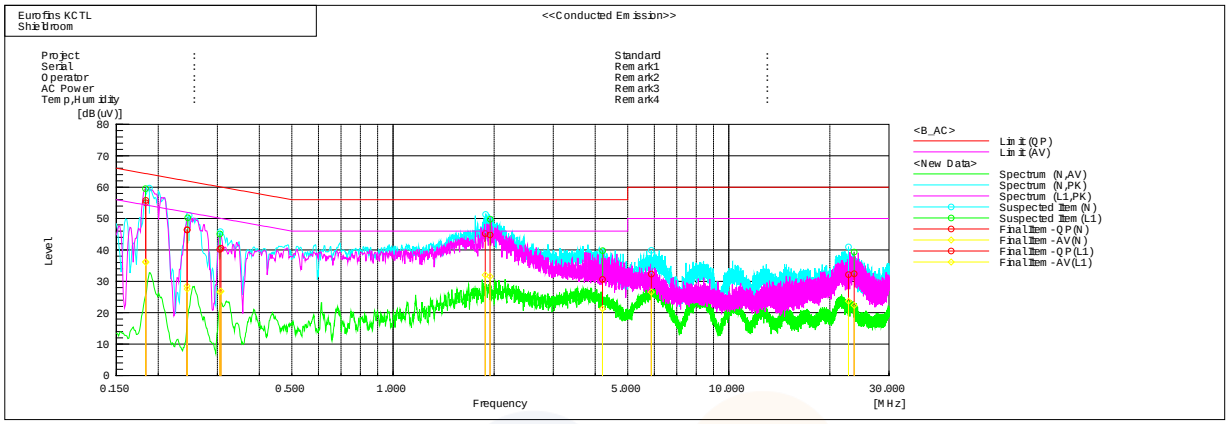
According to 15.207(a) and RSS-Gen(8.8), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (㎒)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 ㎒ to 30 ㎒.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 ㎑ or to quasi-peak and average within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

Test results



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.18332	44.9	26.2	10.1	55.0	36.3	64.3	54.3	9.3	18.0
2	0.2437	36.7	18.8	9.7	46.4	28.5	62.0	52.0	15.6	23.5
3	0.30512	30.5	16.9	9.7	40.2	26.6	60.1	50.1	19.9	23.5
4	1.88305	35.4	22.2	9.8	45.2	32.0	56.0	46.0	10.8	14.0
5	5.88052	22.4	16.7	9.9	32.3	26.6	60.0	50.0	27.7	23.4
6	22.71721	22.2	13.7	10.0	32.2	23.7	60.0	50.0	27.8	26.3

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.1837	45.7	26.0	10.1	55.8	36.1	64.3	54.3	8.5	18.2
2	0.24375	36.8	18.0	9.6	46.4	27.6	62.0	52.0	15.6	24.4
3	0.30737	30.8	17.2	9.7	40.5	26.9	60.0	50.0	19.5	23.1
4	1.94506	35.0	21.8	9.8	44.8	31.6	56.0	46.0	11.2	14.4
5	4.20501	20.8	11.5	9.8	30.6	21.3	56.0	46.0	25.4	24.7
6	23.63877	22.3	12.2	10.1	32.4	22.3	60.0	50.0	27.6	27.7

6. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
UXA Signal Analyzer	KEYSIGHT	N9041B	MY60100003	25.02.01
Temp & Humid Chamber	Myeongseong R&P	CTHC-50P-DT	20150824-1	24.10.13
DC Power Supply	AGILENT	E3632A	MY40027567	25.04.24
Millimeter Wave Source Module	OML, Inc.	S19MS-A	190725-1	25.01.30
Millimeter Wave Source Module	OML, Inc.	S12MS-A	190621-1	24.10.23
Millimeter Wave Source Module	OML, Inc.	S08MS-A	190621-1	24.10.23
Millimeter Wave Source Module	OML, Inc.	S05MS-A	190621-1	24.10.24
Harmonic Mixer	OML, Inc.	M19HWD	190621-1	24.10.23
Harmonic Mixer	OML, Inc.	M12HWD	190621-1	24.10.23
Harmonic Mixer	OML, Inc.	M08HWD	190621-1	24.10.23
Harmonic Mixer	OML, Inc.	M05HWD	190621-1	24.10.24
Horn Antenna	OML, Inc.	M19RH	190621-1	24.10.24
Horn Antenna	OML, Inc.	M12RH	190621-1	24.10.23
Horn Antenna	OML, Inc.	M08RH	190621-1	24.10.23
Horn Antenna	OML, Inc.	M05RH	190621-1	24.10.23
Horn Antenna	OML, Inc.	M19RH	190621-2	24.10.24
Horn Antenna	OML, Inc.	M12RH	190621-2	24.10.23
Horn Antenna	OML, Inc.	M08RH	190621-2	24.10.23
Horn Antenna	OML, Inc.	M05RH	190621-2	24.10.23
Horn Antenna	ERAVANT	SAZ-2410-15-S1	01731-04	25.01.25
Spectrum Analyzer	R&S	FSV40	100988	25.05.27
Horn antenna	SCHWARZBECK	BBHA9120D	2763	24.10.18
Horn antenna	SCHWARZBECK	BBHA9170	1266	24.10.16
AMPLIFIER	TESTEK	TK-PA18H	220123-L	24.10.12
AMPLIFIER	TESTEK	TK-PA1840H	220133-L	24.10.17
Bilog Antenna	Teseq GmbH	CBL 6112D	61521	24.11.17
AMPLIFIER	SONOMA	310N	421910	24.10.12
Turn Table	Innco Systems	CO3000	1442/54370322/P	
Antenna Mast	Innco Systems	MA4640-XP-ET	AM002	--
mmWave Single-Axis measuring jig	C&K Technologies, Inc.	-	-	-
EMI TEST RECEIVER	R&S	ESCI3	101408	25.08.12
TWO-LINE V-NETWORK	R&S	ENV216	101358	24.09.27

End of test report