



TEST REPORT

Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-4904-0113 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR25-SRF0162 Page (1) of (33)	KCTL
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1. Applicant

- Name : THINKWARE CORPORATION
- Address : A, 9FL., Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
- Date of Receipt : 2025-07-30

2. Use of Report : Certification

3. Type of Equipment / Model : CAR DASH CAM / U3000 PRO

4. Manufacturer / Country of Origin : THINKWARE CORPORATION/ South Korea

5. FCC ID : 2ADTG-U3000PRO

6. Date of Test : 2025-08-28 to 2025-09-05

7. Test Standard(method) used : FCC Part 15.255

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

Affirmation	Tested by Name : Seongil Choi (Signature)	Technical Manager Name : Kwonse Kim (Signature)
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2025-09-09

Eurofins KCTL Co.,Ltd.

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REPORT REVISION HISTORY

Date	Revision	Page No
2025-09-09	Originally issued	-

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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

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1. General information

Applicant : THINKWARE CORPORATION.
 Address : A, 9FL., Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
 Manufacturer : THINKWARE CORPORATION
 Address : A, 9FL., Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
 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 : CAR DASH CAM
 Model : U3000 PRO
 Modulation technique : FMCW
 Frequency range : 59 500 Mhz ~ 62 400 Mhz
 Power source : DC 12.0 V, DC 24.0 V
 Antenna specification : Integrated patch Antenna
 Antenna gain : 4.0 dBi
 Software version : V1.0
 Hardware version : V4.0
 Test device serial No. : VHWDAFND011051A
 Operation temperature : -10 °C ~ 60 °C

2.1. Frequency/channel operations

This device contains the following capabilities: FMCW

Ch.	Frequency (GHz)
01	59.5 ~ 62.4

Table 2.1.1. FMCW

2.2. Far field distance

Far field distance(R_m)

Freq range [MHz]	Speed of light [m/s]	Freq [MHz]	wavelength(λ) [m]	Largest Antenna Dimension [m]		Far Field Distance [m]	Measurement Distance [m]
				Measurement Antenna	EUT		
40 000 – 64 000	300	64 000	0.004 7	0.058 2	0.0030	1.44	1.50
60 000 – 90 000	300	90 000	0.003 3	0.037 8	-	0.86	1.00
90 000 – 140 000	300	140 000	0.002 1	0.024 8	-	0.57	1.00
140 000 – 220 000	300	220 000	0.001 4	0.015 8	-	0.37	1.00

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.

3. Summary of tests

FCC Part section(s)	Parameter	Test condition	Test results
15.255 (c)(2)(iii)(A)	Peak EIRP	Radiated	Pass
15.255 (c)(2)(iii)(A)	OFF Time interval		Pass
15.215(c)	Emission bandwidth, 99% bandwidth		Pass
15.255 (d) 15.209	Spurious emissions		Pass
15.255 (f)	Frequency stability		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 kHz to 30 MHz. 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. AC conducted emission is not applicable because the EUT will be installed in vehicles and will not be connected to the public utility (AC) power line.
5. Group Installation is not applicable since there are no external phase-locking inputs in this EUT
6. The test procedure(s) in this report were performed in accordance as following.
 - ♦ ANSI C63.10-2013
 - ♦ 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 or 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.

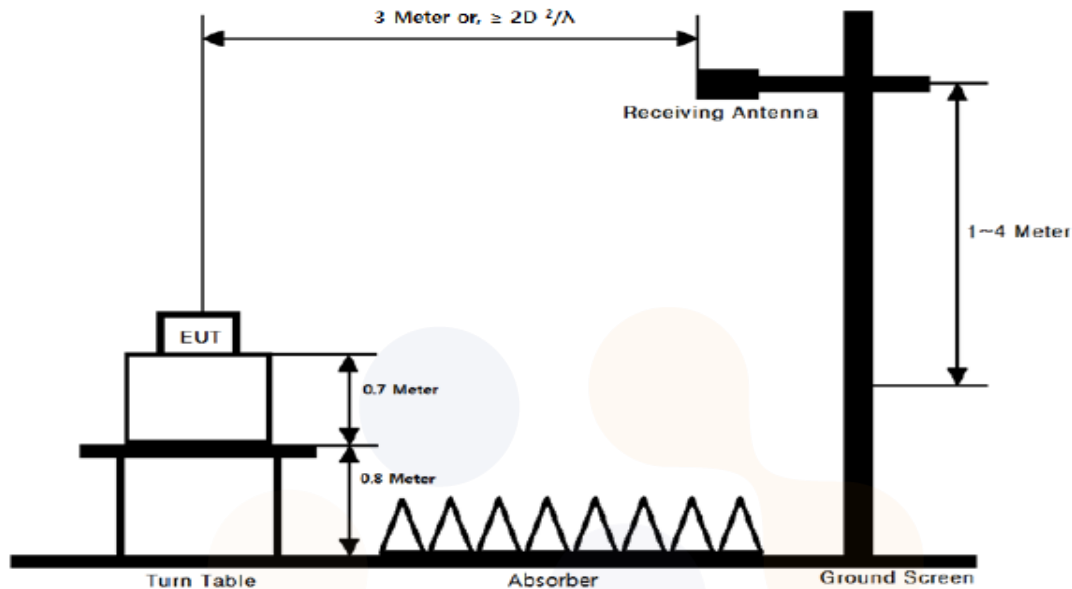
Parameter	Expanded uncertainty ($\pm$)	
Frequency Stability	5.4 kHz	
Radiated spurious emissions	9 kHz ~ 30 MHz	2.3 dB
	30 MHz ~ 1 000 MHz	2.5 dB
	1 000 MHz ~ 18 000 MHz	4.8 dB
	18 000 MHz ~ 40 000 MHz	4.8 dB
	Above 40 000 MHz	5.1 dB

5. Test results

5.1. Emission bandwidth, 99% Occupied bandwidth

Test setup

Above 1 GHz



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 plane 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 GHz, the absorbers are removed.

Limit

According to §15.215(c),

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

Test procedure

ANSI C63.10-2013 - Section 9.3

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Test settings

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.

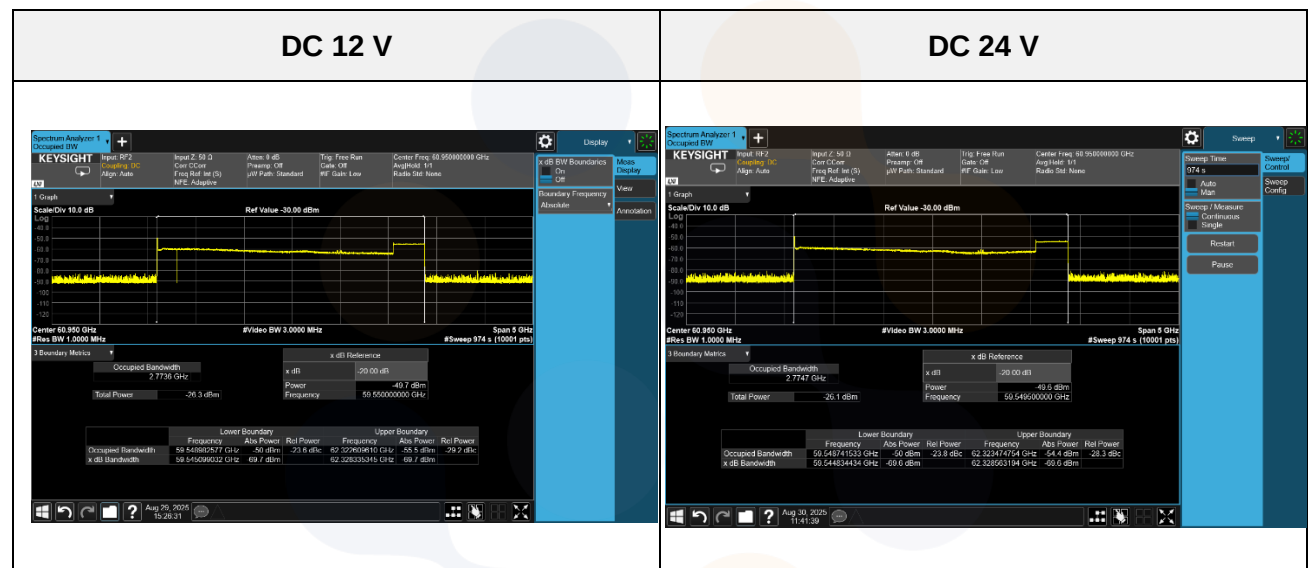
1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 20 dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. $RBW = 1 \sim 5\%$ of the expected $EBW(OBW)$ & $VBW \geq 3 \times RBW$
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

Test Mode	Frequency [MHz]	Emission Bandwidth [GHz]
DC 12 V	60 950.0	2.783
DC 24 V	60 950.0	2.783

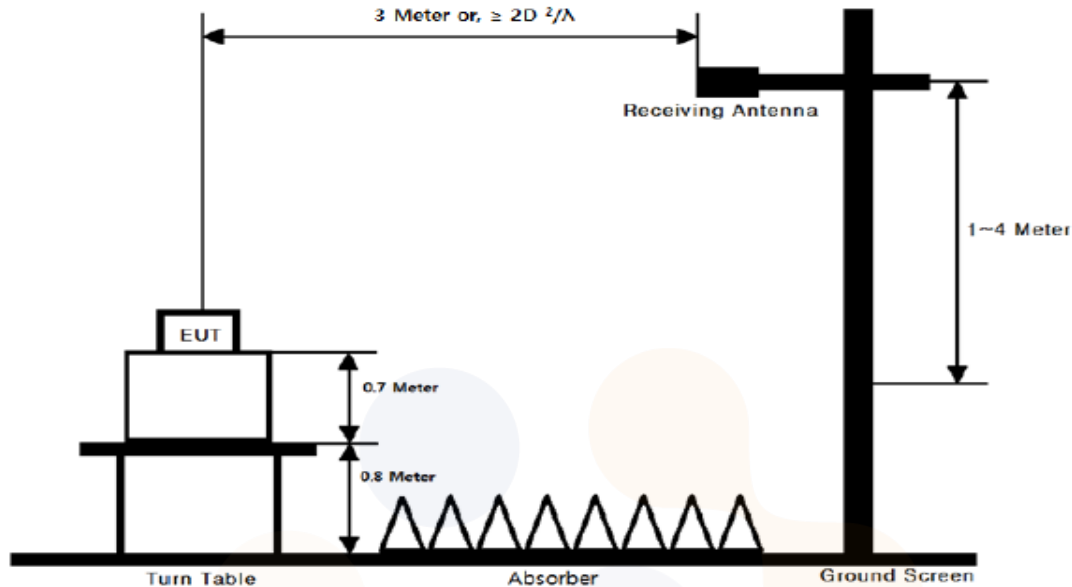
Test Mode	Frequency [MHz]	Occupied Bandwidth [GHz]
DC 12 V	60 950.0	2.774
DC 24 V	60 950.0	2.775



5.2. OFF Time Interval

Test setup

Above 1 GHz



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 plane 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 GHz, the absorbers are removed.

Limit

According to §15.255(c)(2)(iii)(A),

The peak EIRP shall not exceed 14 dBm, and the sum of continuous transmitter off-times of at least two milliseconds shall equal at least 25.5 milliseconds within any contiguous interval of 33 milliseconds.

Test procedure

ANSI C63.10-2013 - Section 9

Test settings

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.

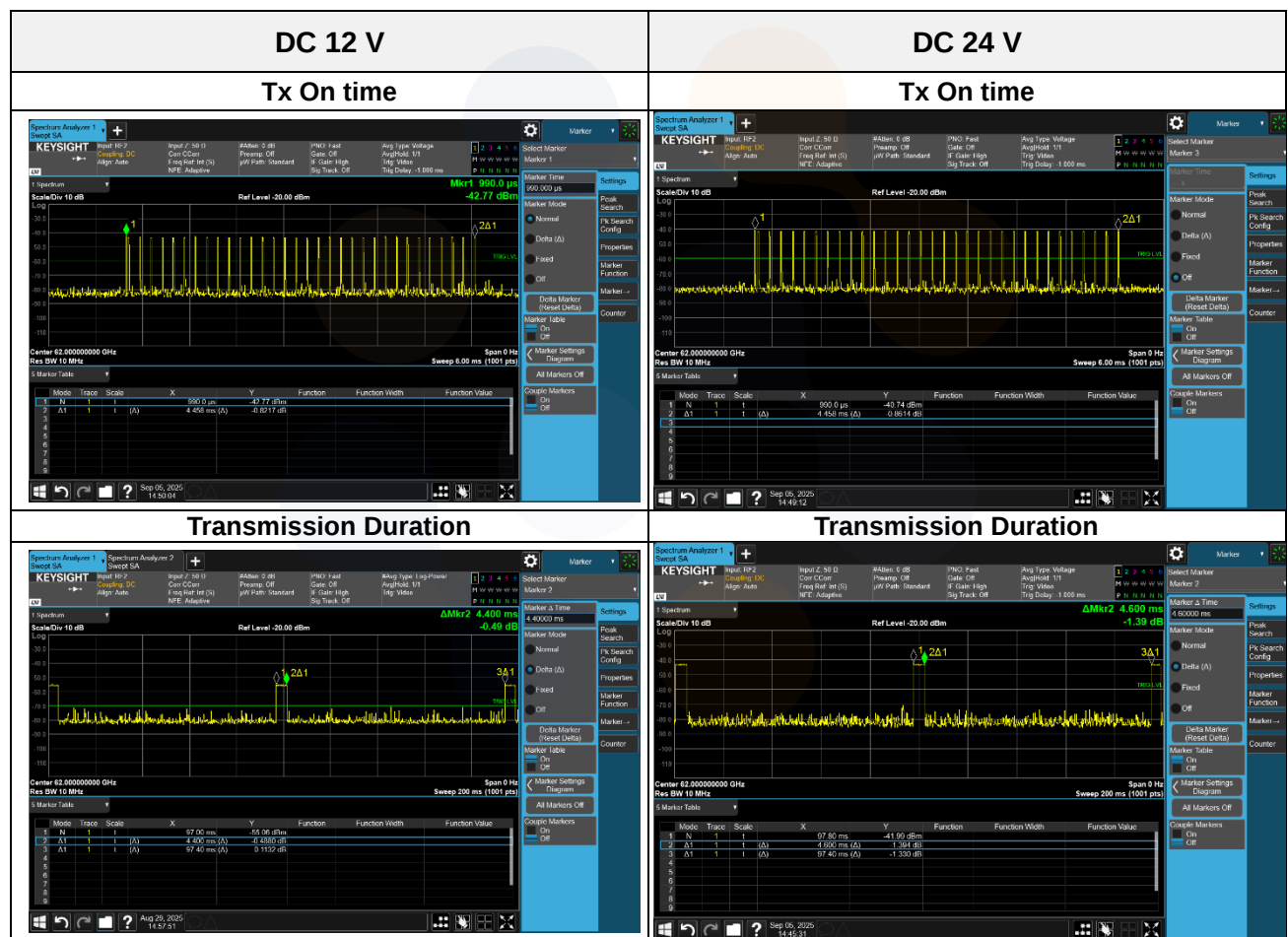
1. Place the EUT on the table and set it in the transmitting mode
2. RBW = 10 MHz
3. VBW = 50 MHz
4. SPAN = Zero
5. Detector = Peak
6. Trace: Clear/Write
7. Mask Hold

Test results

Test Mode	Transmission Duration [ms]	Tx On time [ms]	Tx OFF time [ms]	Duty Cycle [%]	The Ratio of TX OFF Time Limit [%]
DC 12 V	97.40	4.458	92.94	95.42	≥ 77.27
DC 24 V	97.40	4.458	92.94	95.42	≥ 77.27

Note.

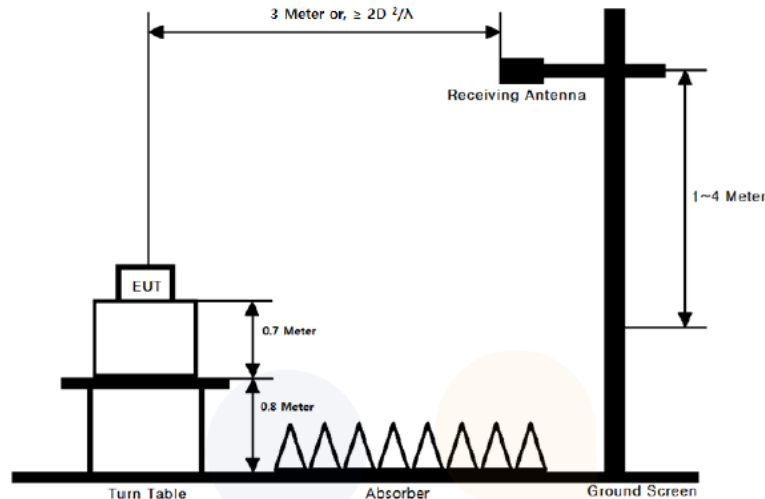
1. Duty Cycle = (Tx OFF time / Transmission Duration) * 100
2. TX OFF Time Limit = (25.5 / 33) * 100 = 77.27 %



5.3. Peak EIRP

Test setup

Above 1 GHz



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 plane 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 GHz, the absorbers are removed.

Limit

According to §15.255(c)(2)(iii)(A),

The peak EIRP shall not exceed 14 dBm, and the sum of continuous transmitter off-times of at least two milliseconds shall equal at least 25.5 milliseconds within any contiguous interval of 33 milliseconds.

Test procedure

ANSI C63.10-2013 - Section 9

Test setting

-peak power(EIRP) – Peak detector

1. Set RBW = 1 MHz
2. Set VBW $\geq 3 \times$ RBW
3. span to 2 x to 3 x the OBW
4. Detector = Peak
5. Set number of points in sweep $\geq 2 \times$ span / RBW
6. Sweep time = Transmission duration x 2 x span / RBW
7. Trace = max-hold

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According to FCC Part 15.35(b), the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

The desensitization correction factor was applied to the Fundamental Emission results. The derivation of the Pulse Desensitization Factor is given in the Keysight Technologies Application Note 5952-1039.

Desensitization factor was calculated from follow equation.

$$PDF = 20 \log(\alpha)$$

$$\alpha = \frac{1}{\sqrt[4]{1 + \left(\frac{2 \ln(2)}{\pi}\right)^2 \left(\frac{BW_{Chirp}}{T_{Chirp} B^2}\right)^2}}$$

Where

- α is the reduction in amplitude
- BW_{Chirp} is the FMCW Chirp Bandwidth, which is 2 900 MHz according to manufacturer
- T_{Chirp} is the FMCW Chirp Time, which is 110 μ s
- B is the 3 dB IF Bandwidth = RBW, 1MHz was used during test
- PCF = 0.29 dB

Test results

DC 12 V

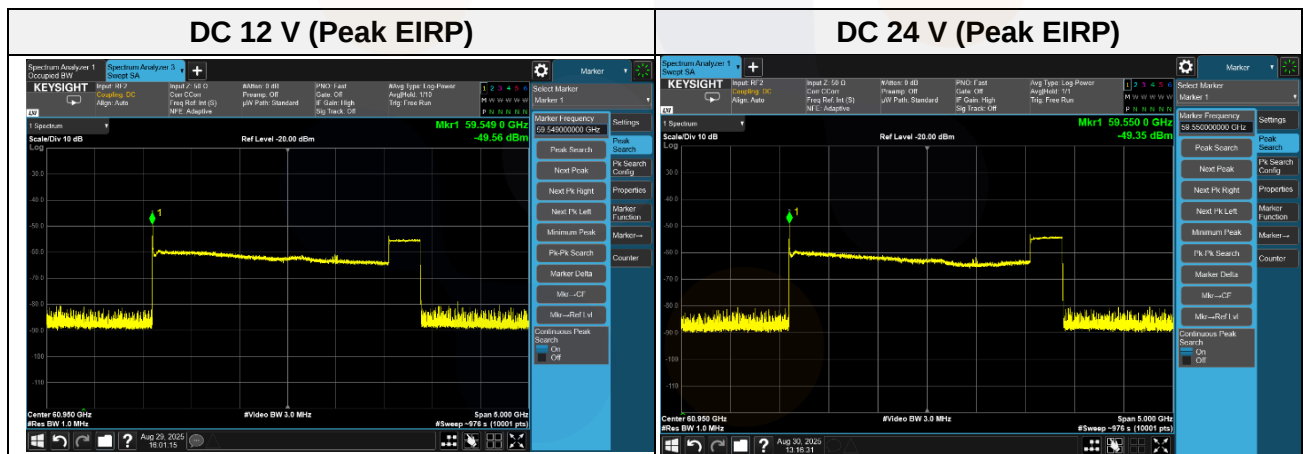
Measurement distance(D) [m]	Frequency [GHz]	ANT Pol	EUT Position [Axis]	Measured Level [dBm]	AFCL [dB/m]	E-Field [dB μ V/m]	EIRP [dBm]	Limit [dBm]
1.0	59.55	H	X	-49.56	57.87	115.31	10.80	14.00

DC 24 V

Measurement distance(D) [m]	Frequency [GHz]	ANT Pol	EUT Position [Axis]	Measured Level [dBm]	AFCL [dB/m]	E-Field [dB μ V/m]	EIRP [dBm]	Limit [dBm]
1.0	59.55	H	X	-49.35	57.87	116.52	11.01	14.00

Note.

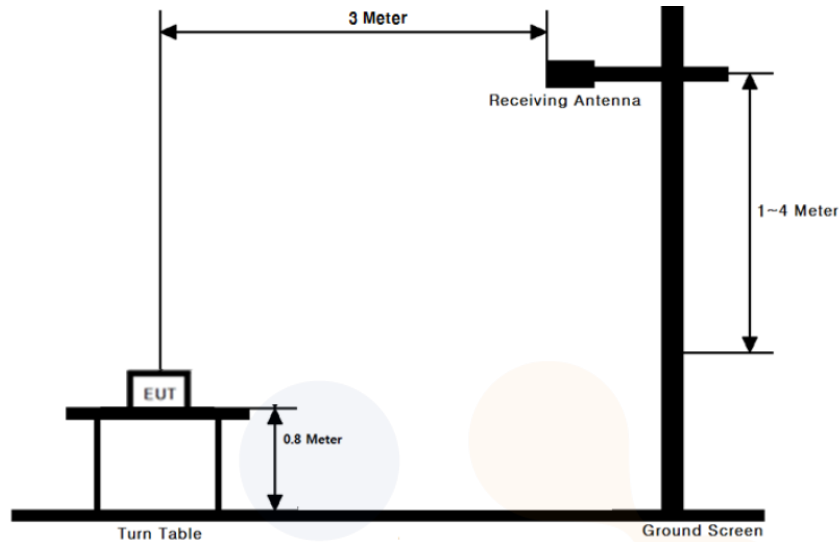
- The EIRP was measured in each axis EUT positions and the worst case data was reported.
- Sample Calculation
 - E-field strength (dB μ V/m) = Measured level(dBm) + 107 + AFCL(dB/m)
 - Where, E = E-field strength (dB μ V/m), AFCL (dB/m) = Antenna Factor(dB/m) + Cable Loss(dB)
- EIRP(dBm) = E(dB μ V/m) + 20 log (D) - 104.8
 - Where, D is measurement distance(in the far field region) in m.
- Final test result included 0.29 dB for P.C.F (Peak Desensitization Correction factor)



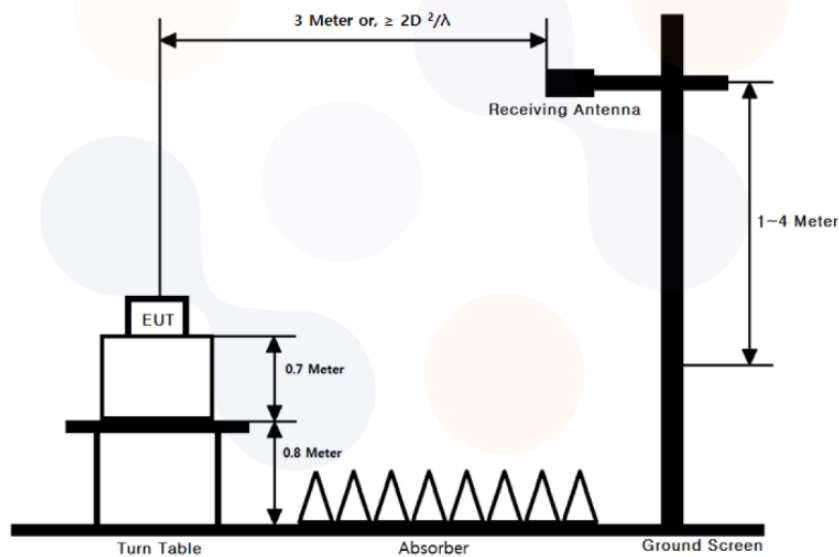
5.4. Spurious emissions

Test setup

Below 1 GHz



Above 1 GHz



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 GHz: 0.8-m) 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 GHz, the absorbers are removed.

Limit

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 section 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:

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

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

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

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

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Test procedure

ANSI C63.10-2013 – Section 9.12, 9.13

Test settings

1. Below 1 GHz

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

2. Above 1 GHz

1) Peak Measurement

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

2) Average Measurement

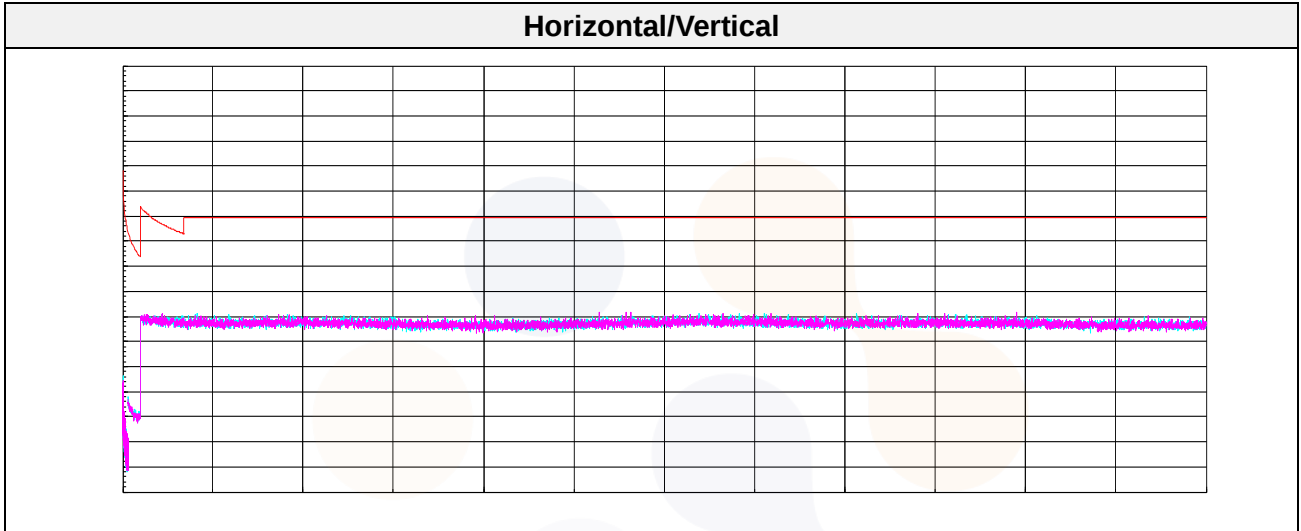
- RBW: 1 MHz, VBW: 3 MHz, Detector: RMS
- Sweep time: Transmission duration x 2 x Span / RBW
- Trace mode: Averaging or Max Hold

Test results

DC 12 V

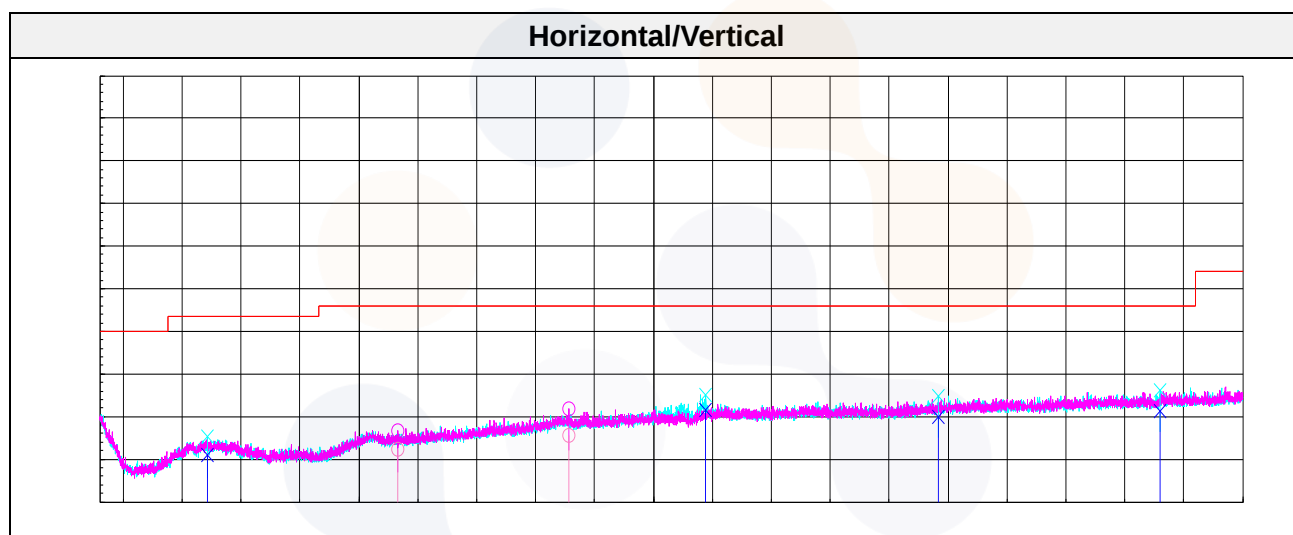
Frequency Range: 9 kHz ~ 30 MHz

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



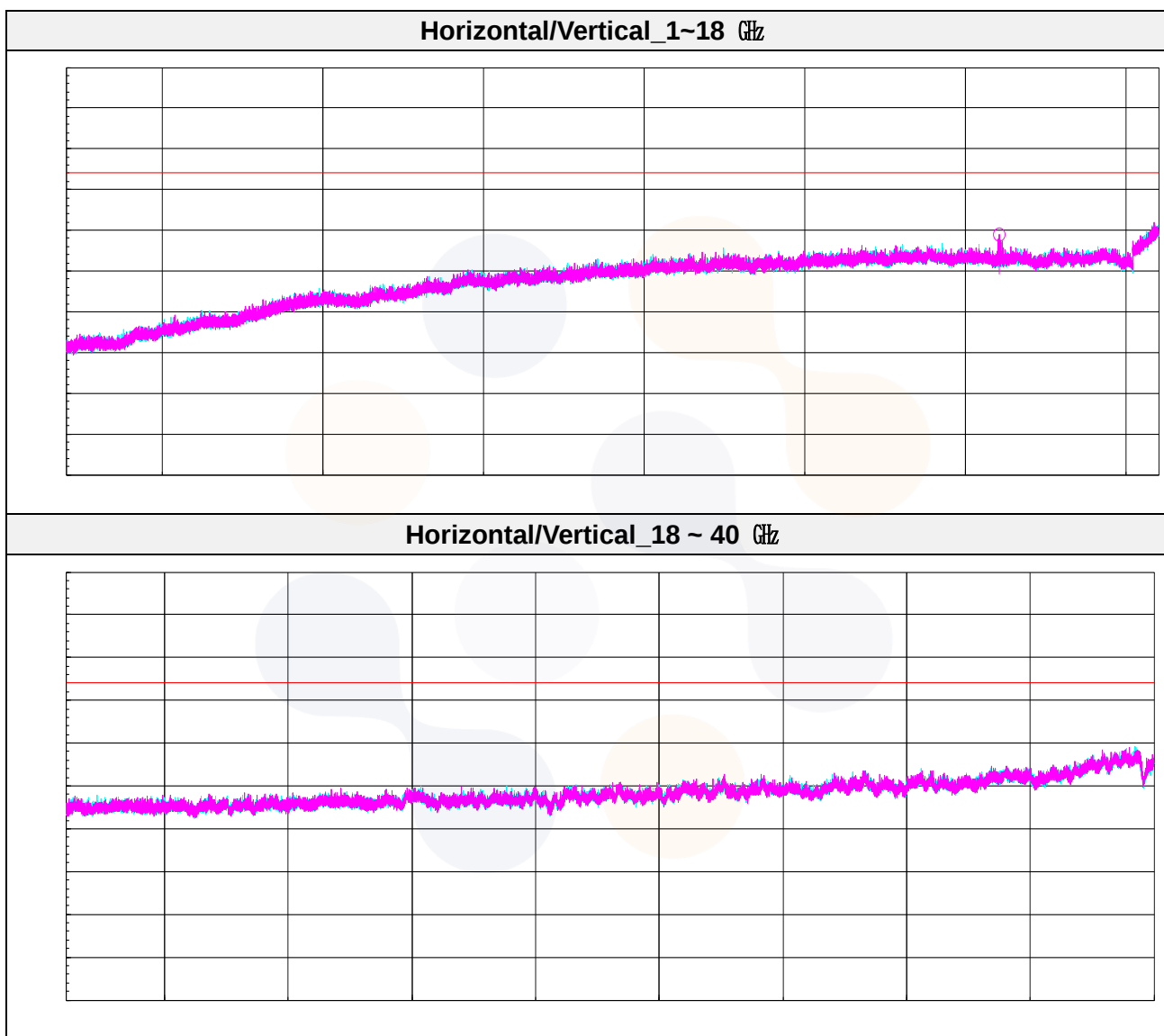
Frequency Range: 30 MHz ~ 1 GHz

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
121.30	V	24.90	17.93	-31.68	11.15	43.50	32.35
283.17	H	24.60	18.80	-31.16	12.24	46.00	33.76
428.19	H	24.00	22.68	-31.07	15.61	46.00	30.39
544.59	V	28.10	24.36	-30.94	21.52	46.00	24.48
741.74	V	24.90	25.60	-30.47	20.03	46.00	25.97
930.40	V	23.50	26.52	-28.85	21.17	46.00	24.83



Frequency Range: 1 GHz ~ 40 GHz

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
15 499.62	H	57.40	38.20	-36.75	58.85	74.00	15.15

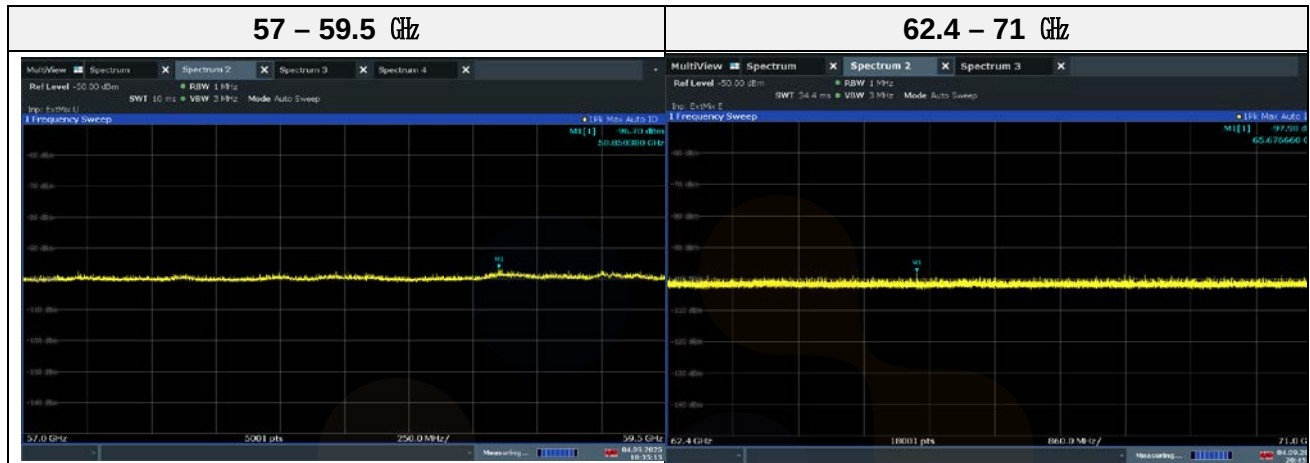


Note.

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

Frequency Range: 57 GHz ~ 71 GHz (Operating band: 59.5 GHz ~ 62.4 GHz)

Measurement distance (m)	Frequency (GHz)	Pol. (V/H)	Detector Mode	Measured Level (dBm)	AFCL (dB/m)	E-Field (dB μ V/m)	EIRP (dBm)	Limit (dBm)
1.5	58.85	H	Peak	-96.70	57.49	67.79	-33.49	14.00
1.0	65.68	H	Peak	-97.98	54.36	63.38	-41.42	14.00



Note.

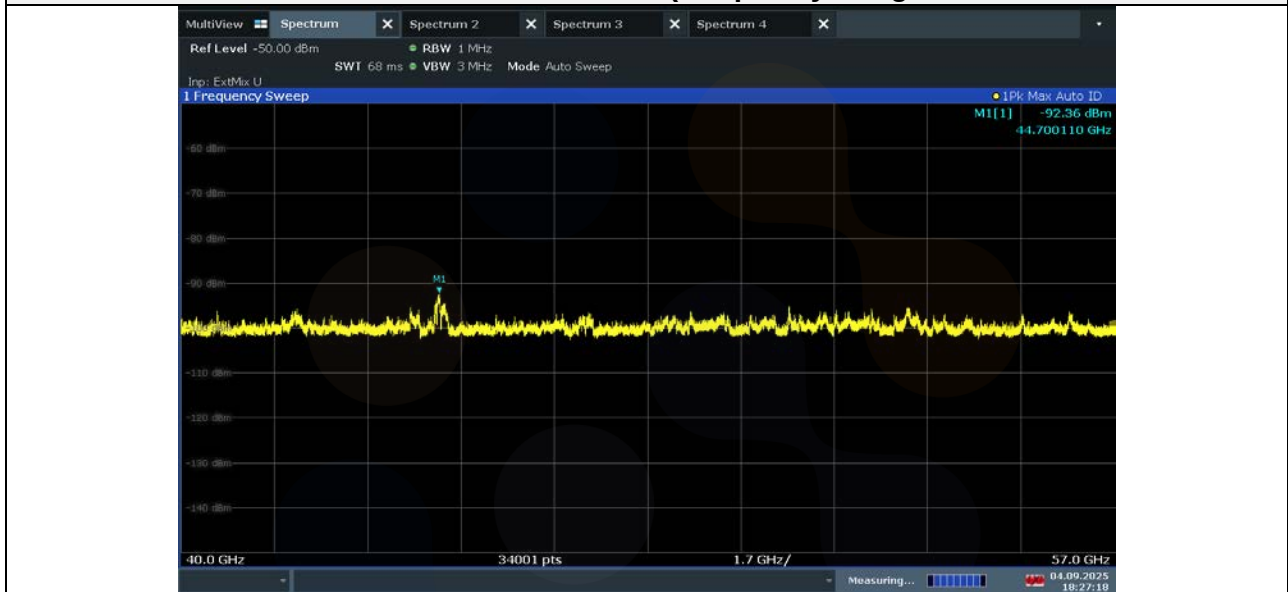
1. Sample Calculation.

- $E(\text{dB}\mu\text{V/m}) = \text{Measured level (dBm)} + 107 + \text{AFCL}(\text{dB/m})$
- Where, E = E-Field strength / AFCL = Antenna Factor(dB/m) + Cable Loss(dB/m)
- $\text{EIRP}(\text{dBm}) = E(\text{dB}\mu\text{V/m}) + 20\log(D) - 104.8$; where, D is measurement distance(in the far field region) in m.

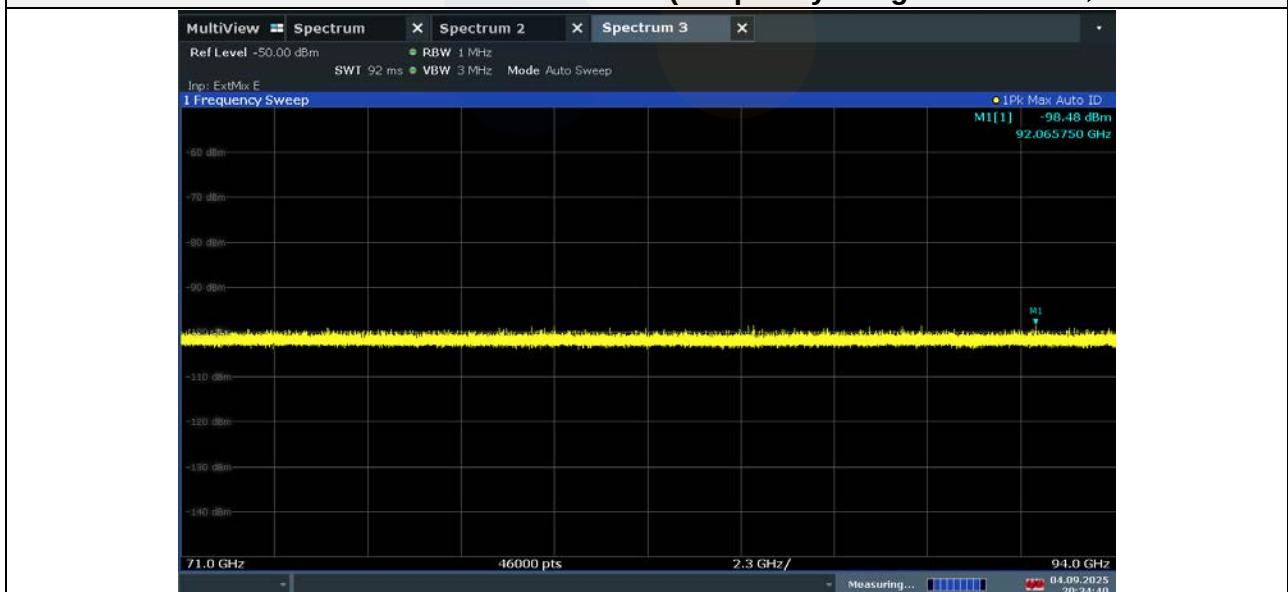
Frequency Range: 40 GHz ~ 220 GHz

Measurement distance (m)	Frequency (GHz)	Pol. (V/H)	Measured Level (dBm)	AFCL (dB/m)	EIRP (dBm)	Power density (pW/cm ²)	Limit (pW/cm ²)
1.5	44.70	H	-92.36	51.65	-34.99	1.12	90.00
1	92.07	H	-98.48	59.25	-37.03	1.58	90.00
1	118.22	H	-96.17	62.40	-31.57	5.54	90.00
1	145.55	H	-93.82	67.63	-23.99	31.73	90.00

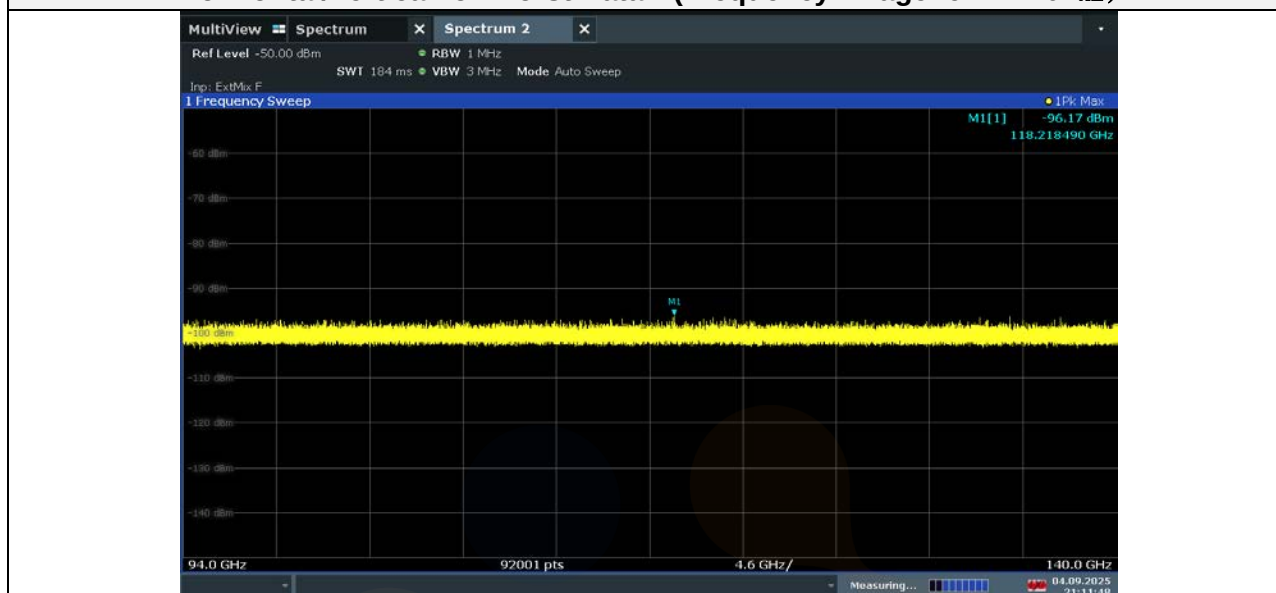
Horizontal/Vertical for Worst Data (Frequency Range: 40 – 57 GHz)



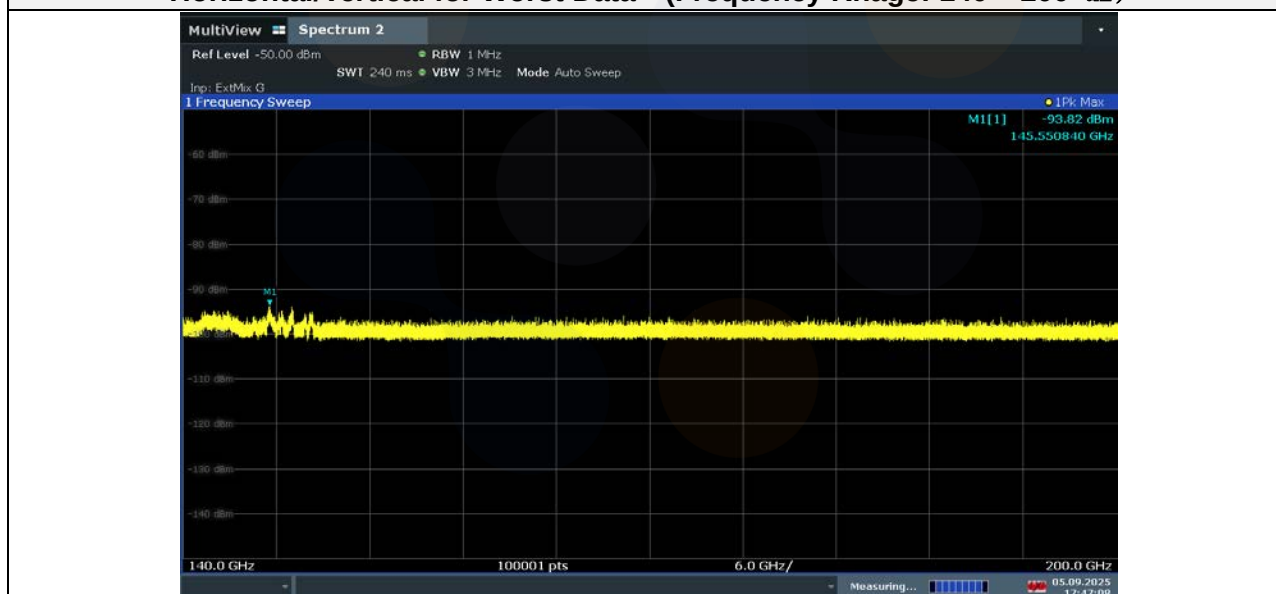
Horizontal/Vertical for Worst Data (Frequency Range: 71 – 94 GHz)



Horizontal/Vertical for Worst Data (Frequency Range: 94 – 140 GHz)



Horizontal/Vertical for Worst Data (Frequency Range: 140 – 200 GHz)



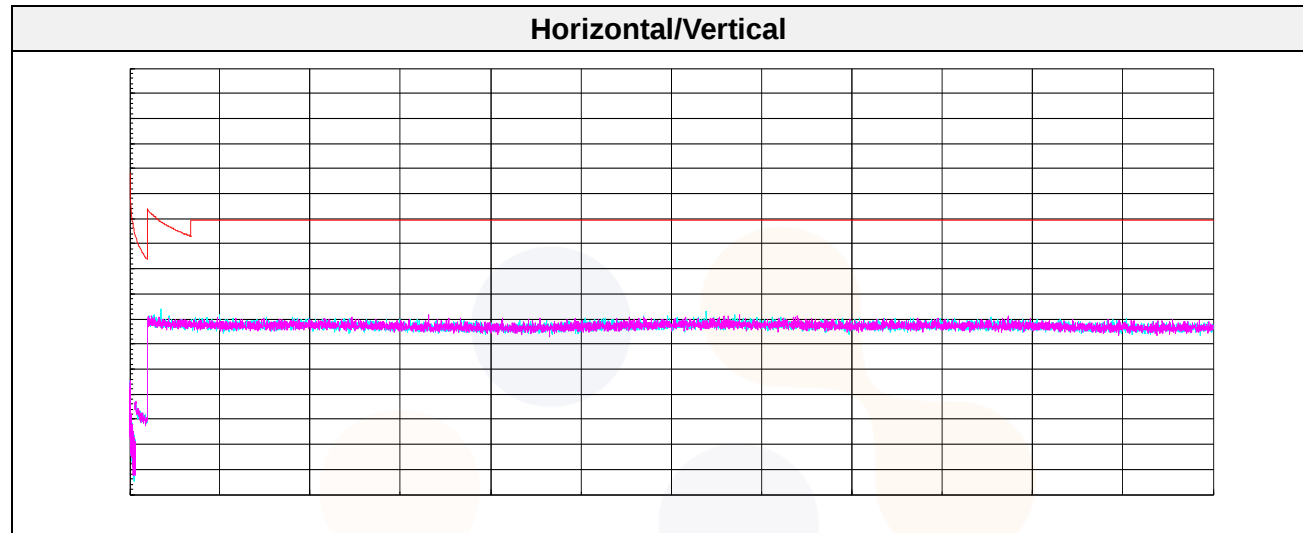
Note.

- The radiated emissions were investigated up to 200 GHz, and no spurious or harmonic emissions were observed other than the frequencies listed above.
- The measurement results shown above represent the highest levels. Final measurements were conducted when emissions were detected.

DC 24 V

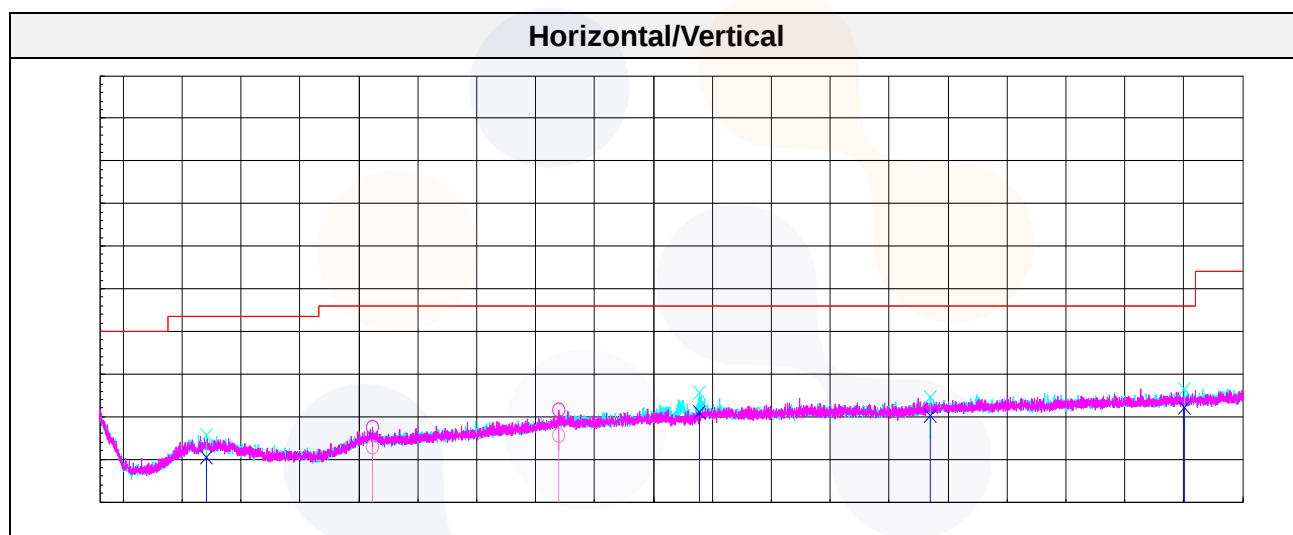
Frequency Range: 9 kHz ~ 30 MHz

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



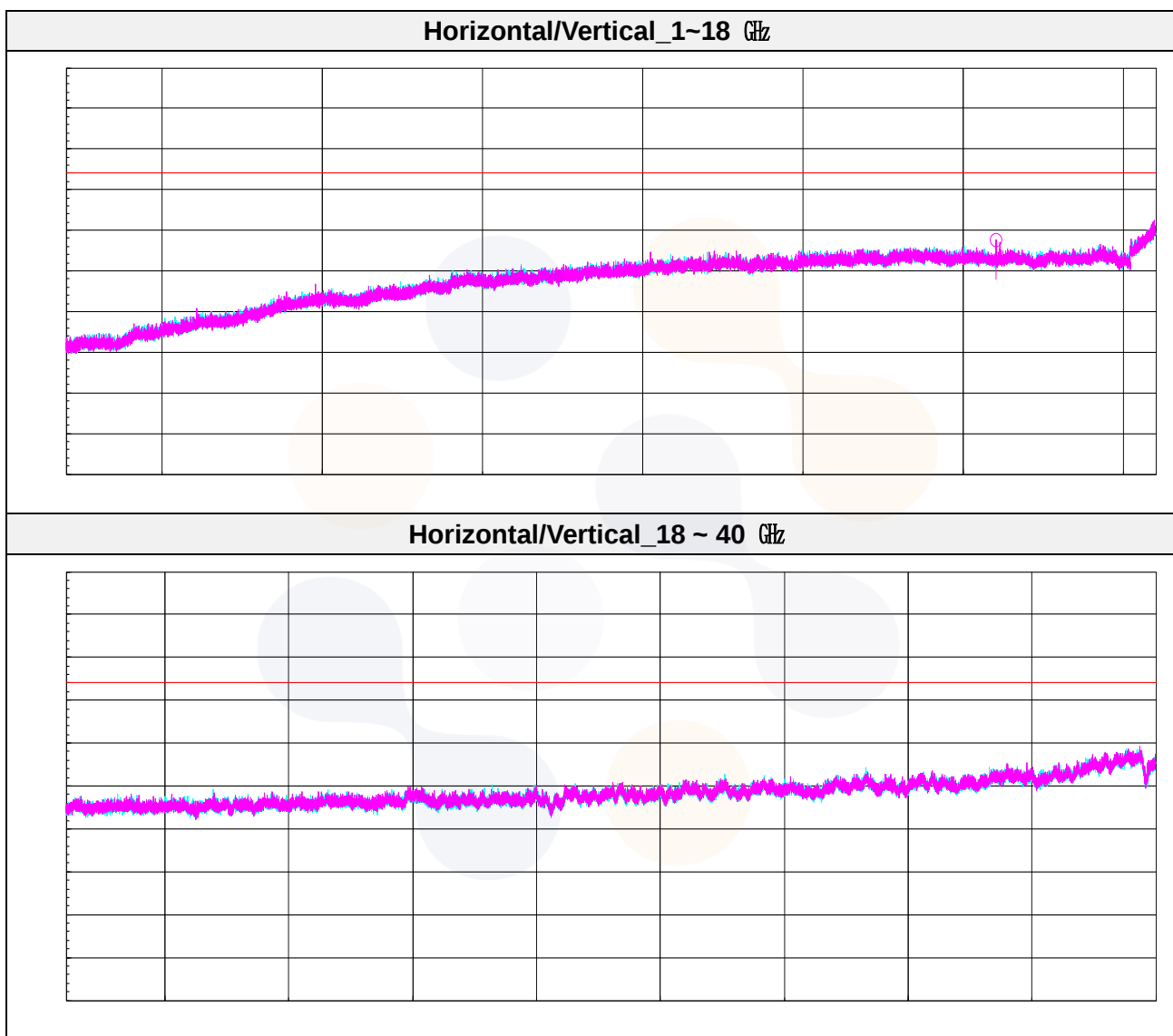
Frequency Range: 30 MHz ~ 1 GHz

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
120.82	V	24.30	17.90	-31.69	10.51	43.50	32.99
261.71	H	24.40	19.69	-31.29	12.80	46.00	33.20
420.06	H	23.90	22.70	-30.95	15.65	46.00	30.35
539.25	V	28.20	23.83	-30.92	21.11	46.00	24.89
734.83	V	25.00	25.50	-30.43	20.07	46.00	25.93
950.65	V	23.80	26.80	-28.55	22.05	46.00	23.95



Frequency Range: 1 GHz ~ 40 GHz

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
15 499.73	H	56.00	38.20	-36.75	57.45	74.00	16.55

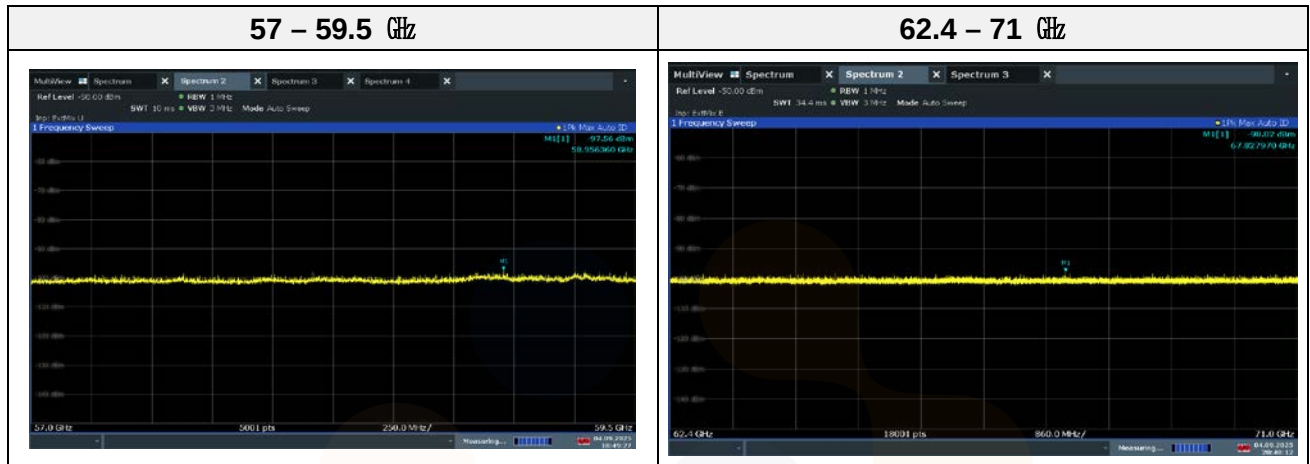


Note.

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

Frequency Range: 57 GHz ~ 71 GHz (Outside 59.5 GHz ~ 62.4 GHz)

Measurement distance (m)	Frequency (GHz)	Pol. (V/H)	Detector Mode	Measured Level (dBm)	AFCL (dB/m)	E-Field (dB μ V/m)	EIRP (dBm)	Limit (dBm)
1.5	58.96	H	Peak	-97.56	57.63	67.07	-34.21	14.00
1	67.83	H	Peak	-98.02	57.41	66.39	-38.41	14.00



Note.

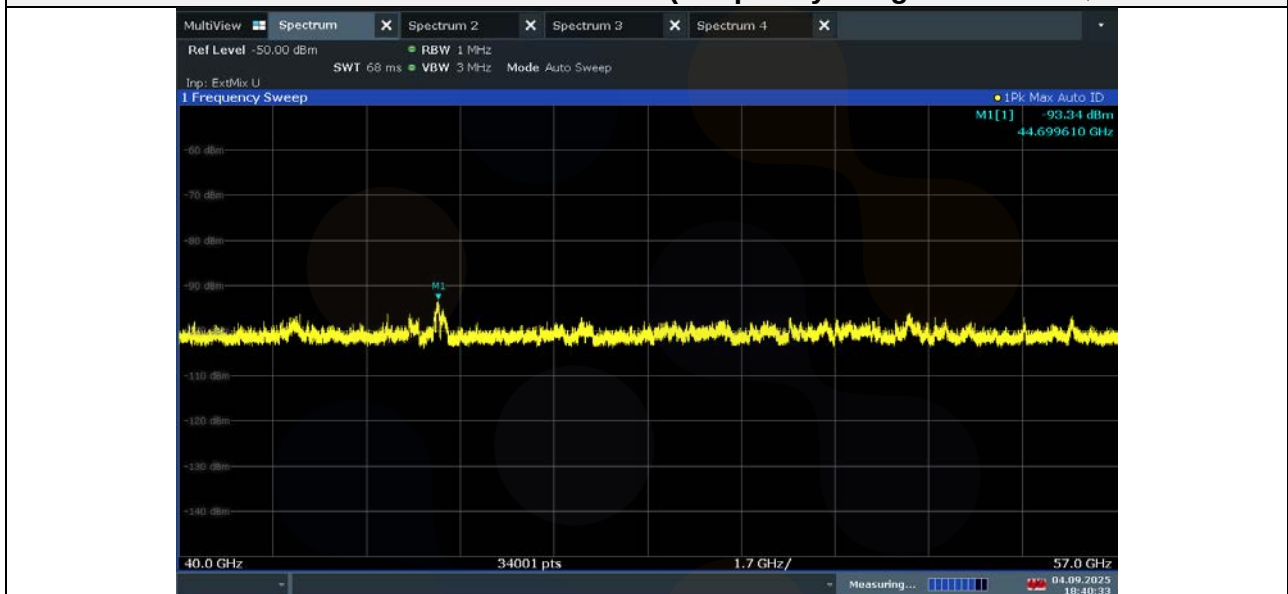
1. Sample Calculation.

- $E(\text{dB}\mu\text{V/m}) = \text{Measured level (dBm)} + 107 + \text{AFCL}(\text{dB/m})$
- Where, E = E-Field strength / AFCL = Antenna Factor(dB/m) + Cable Loss(dB/m)
- $\text{EIRP}(\text{dBm}) = E(\text{dB}\mu\text{V/m}) + 20\log(D) - 104.8$; where, D is measurement distance(in the far field region) in m.

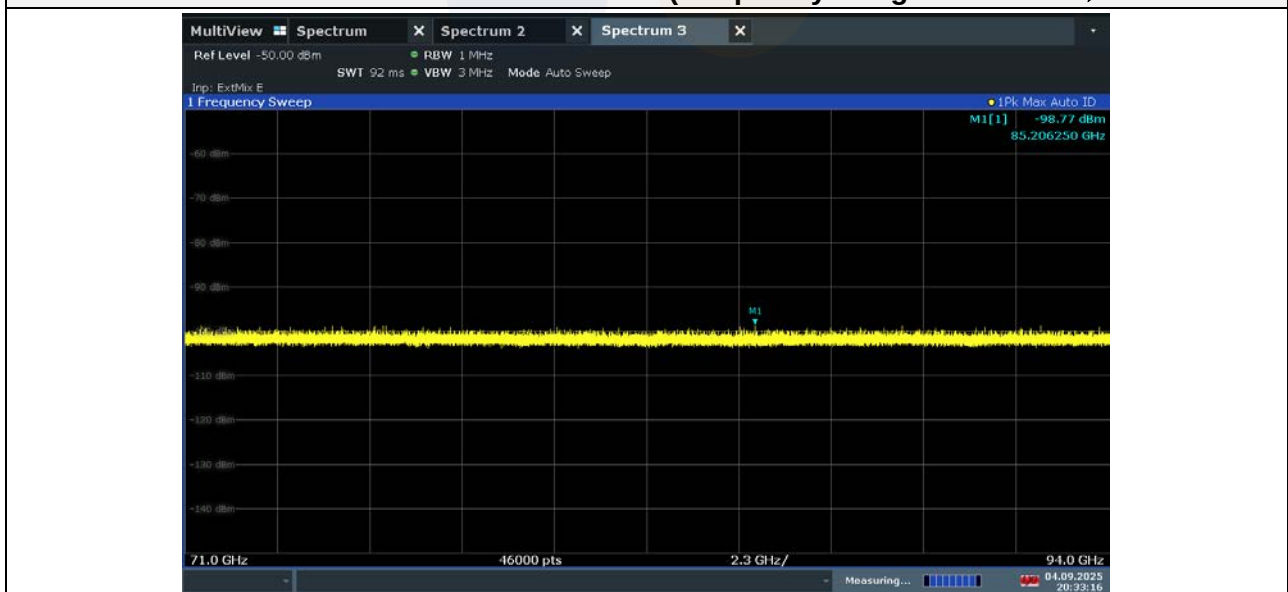
Frequency Range: 40 GHz ~ 220 GHz

Measurement distance (m)	Frequency (GHz)	Pol. (V/H)	Measured Level (dBm)	AFCL (dB/m)	EIRP (dBm)	Power density (pW/cm ²)	Limit (pW/cm ²)
1.5	44.70	H	-93.34	51.65	-35.97	0.89	90.00
1	85.21	H	-98.77	59.07	-37.50	1.42	90.00
1	112.86	H	-95.95	61.92	-31.83	5.22	90.00
1	145.69	H	-93.46	67.67	-23.59	34.78	90.00

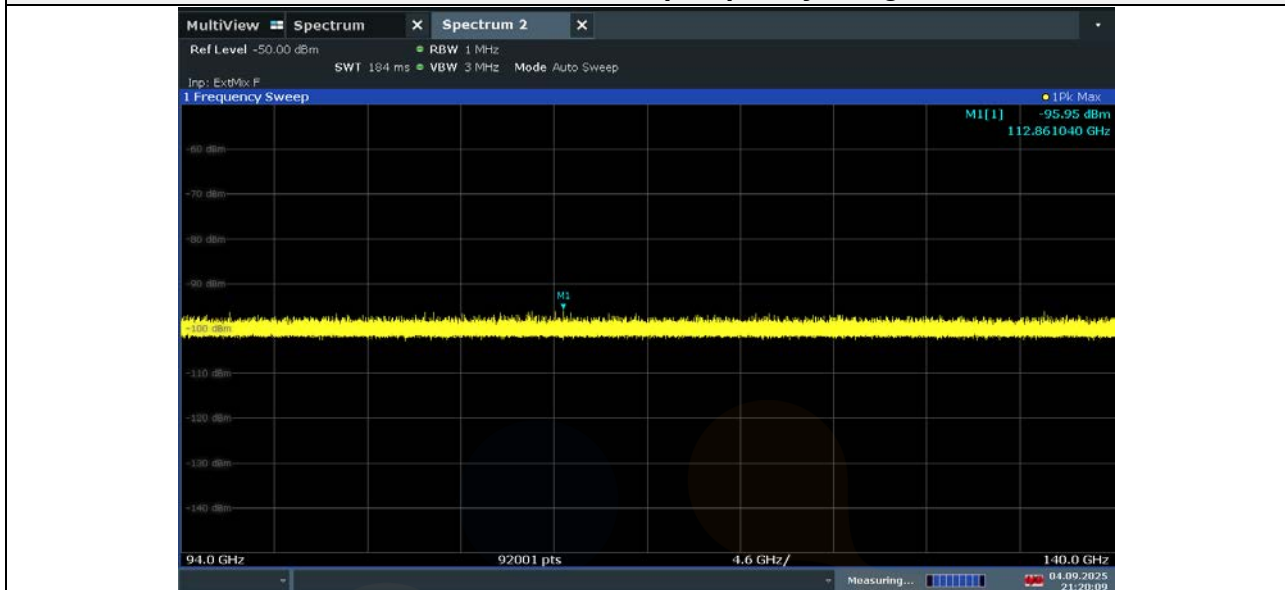
Horizontal/Vertical for Worst Data (Frequency Range: 40 – 57 GHz)



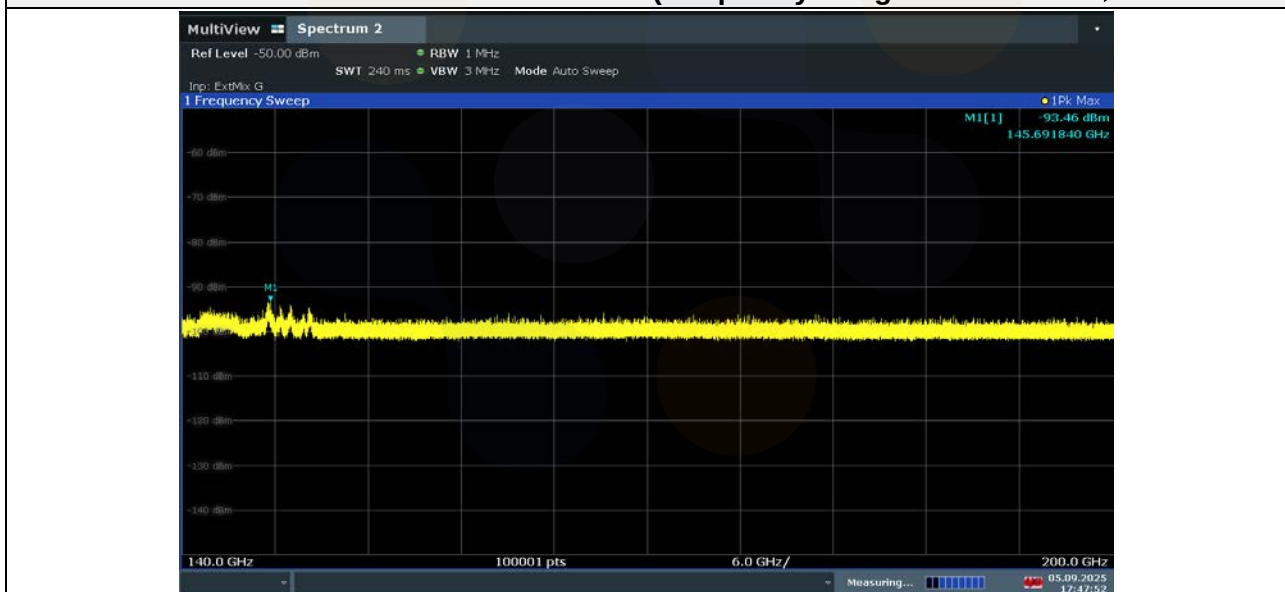
Horizontal/Vertical for Worst Data (Frequency Range: 71 – 94 GHz)



Horizontal/Vertical for Worst Data (Frequency Range: 94 – 140 GHz)



Horizontal/Vertical for Worst Data (Frequency Range: 140 – 200 GHz)

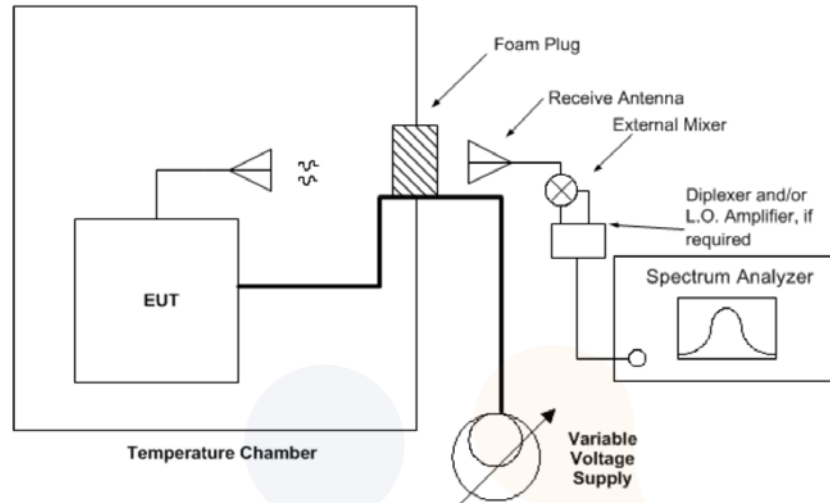


Note.

- The radiated emissions were investigated up to 200 GHz, and no spurious or harmonic emissions were observed other than the frequencies listed above.
- The measurement results shown above represent the highest levels. Final measurements were conducted when emissions were detected.

5.5. 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.

Test procedure

ANSI C63.10-2013 – Section 9.14

Test settings

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

- Arrange EUT and test equipment as shown in Figure 21. Some temperature chambers have a window or other opening that permits locating the receive antenna outside the chamber.
- With the EUT at ambient temperature (approximately 25°C) and voltage source set to the EUT nominal operating voltage (100%), record the spectrum mask of the EUT emission on the spectrum analyzer.
- Vary EUT power supply between 85% and 115% of nominal, and record the frequency excursion of the EUT emission mask.
- Set the power supply to 100% nominal setting, and raise EUT operating temperature to 50°C . Record the frequency excursion of the EUT emission mask.
- Repeat step d) at each 10°C increment down to -20°C .

Test results

DC 12 V

Voltage (%)	Voltage (V)	Temp. (°C)	Frequency(F _L) (MHz)	Frequency(F _H) (MHz)
100	12	20(Ref.)	59 548.38	62 323.66
		-10	59 548.92	62 325.31
		0	59 551.20	62 324.60
		10	59 549.66	62 324.74
		30	59 548.31	62 324.23
		40	59 549.76	62 323.06
		50	59 548.44	62 324.08
		60	59 549.12	62 323.19
115	13.8	20(Ref.)	59 548.53	62 323.19
85	10.2	20(Ref.)	59 554.34	62 323.71

DC 24 V

Voltage (%)	Voltage (V)	Temp. (°C)	Frequency(F _L) (MHz)	Frequency(F _H) (MHz)
100	24	20(Ref.)	59 548.31	62 323.62
		-10	59 548.16	62 325.47
		0	59 547.17	62 324.89
		10	59 548.74	62 324.85
		30	59 545.56	62 323.98
		40	59 549.68	62 324.03
		50	59 555.06	62 324.21
		60	59 548.53	62 323.94
115	26.4	20(Ref.)	59 547.21	62 324.24
85	21.6	20(Ref.)	59 545.98	62 324.01

Note:

1. Fundamental emissions were contained within the frequency bands.

Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-4904-0113 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR25-SRF0162 Page (33) of (33)	
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6. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
UXA Signal Analyzer	KEYSIGHT	N9041B	MY60100003	26.01.21
Spectrum Analyzer	R&S	FSW50	101013	26.06.30
DC Power Supply	AGILENT	E3632A	KR75304571	26.04.23
Millimeter Wave Source Module	OML, Inc.	S19MS-A	190725-1	26.02.11
Millimeter Wave Source Module	OML, Inc.	S12MS-A	190621-1	25.10.16
Millimeter Wave Source Module	OML, Inc.	S08MS-A	190621-1	25.10.16
Horn Antenna	OML, Inc.	M19RH	190621-2	26.02.13
Horn Antenna	OML, Inc.	M12RH	190621-1	25.10.23
Horn Antenna	OML, Inc.	M08RH	190621-1	25.10.23
Horn Antenna	OML, Inc.	M19RH	190621-1	25.10.23
mmWave Down Converter	C&K Technologies, Inc.	DC4060FS-01A	1	26.02.06
mmWave Down Converter	C&K Technologies, Inc.	DC6091FS-01A	1	26.02.06
mmWave Down Converter	C&K Technologies, Inc.	DC90140FS-01A	1	26.02.06
Horn Antenna	OML, Inc.	M19RH	190621-3	26.01.23
Horn Antenna	OML, Inc.	M12RH	190621-3	26.01.23
Horn Antenna	OML, Inc.	M08RH	190621-3	26.01.23
mmWave Single-Axis measuring jig	C&K Technologies, Inc.	N/A	MWJ01	-
Single-Axis Control Driver & Power Supply	C&K Technologies, Inc.	DACD&P-4801	0001	-
Spectrum Analyzer	R&S	FSV40	100988	26.04.24
Low Noise Amplifier	TESTEK	TK-PA18H	220123-L	26.07.01
Horn Antenna	SCHWARZBECK	BBHA9120D	2764	26.06.30
Low Noise Amplifier	TESTEK	TK-PA1840H	220234-L	26.06.30
Horn Antenna	SCHWARZBECK	BBHA9170	1266	26.06.29
Amplifier	SONOMA INSTRUMENT	310N	421910	26.07.01
Bilog Antenna	Teseq GmbH	CBL 6112D	61521	26.12.11
Loop Antenna	R&S	HFH2-Z2	100355	26.06.25
DC Power Supply	POWERCOM	DCP-50100A	20220610-01	26.01.16
Vector Signal Generator	R&S	SMBV100A	257566	26.07.01
Signal Generator	R&S	SMB100A	176206	26.01.17
Controller	INNCO SYSTEMS	CO3000	1442/54370322/P	-
Antenna Mast	INNCO SYSTEMS	MA4640-XP-ET	AM002	-
Turn Device	INNCO SYSTEMS	DS1200-S-1t	0001	-

End of test report