TEST REPORT

CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
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1. Client

◦ Name : SOLUM CO.,LTD.

◦ Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Gyeonggi-do, Yongin-si, Republic of Korea

◦ Date of Receipt : 2022-02-17

2. Manufacturer

◦ Name #1 : SOLUM CO.,LTD.

◦ Address #1 : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Gyeonggi-do, Yongin-si, Republic of Korea

◦ Name #2 : SOLUM VINA CO., LTD

◦ Address #2 : Plot B3, Ba Thien 2 Industrial park, Thien Ke Ward, Binh Xuyen District, Vinh Phuc Province, 281200., People's Republic of Vietnam

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

4. Test Sample / Model : ESL Label / EL022H4WRC

5. Date of Test : 2022-03-02 to 2022-03-10

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

7. Testing Environment : Temp.: (23 ± 1) ℃, Humidity: (51 ± 3) % R.H.

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

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

2022-03-14

Republic of KOREA **CTK Co., Ltd.**

REPORT REVISION HISTORY

Date	Revision	Page No
2022-03-14	Issued (CTK-2022-00766)	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, Gyeonggi-do, Yongin-si, Republic of Korea
Contact Person	Name : Ki Dong Lee E-mail : kdlee007@solu-m.com Tel : +82-31-8006-7677

1.2 Product Information

FCC ID	2AFWN-EL016H4WRC
IC	22800-EL016H4WRC
Product Description	NEWTON LITE S-Label
Model name	EL022H4WRC(Basic Model name : EL016H4WRC)
Variant Model name	EL022H4WRC (This is a device that has changed the FPCB size and PCB size. There are no changes to the RF module.)
Operating Frequency	2 402 MHz - 2 480 MHz
Antenna Specification	Antenna type : PCB Antenna Peak Gain : -0.58 dBi
Number of channels	40
Channel Spacing	2 MHz
Type of Modulation	GFSK
Power Source	DC 3.0 V(Battery)
Firmware Version Id Number(FVIN)	6.0
RF Power setting in Test SW	Initial value

1.3 Peripheral Devices

-For Radiated Measurement

Device	Manufacturer	Model No.	Serial No.
Notebook	HP Inc.	HP Probook 650 G1	5CG5114K13
AC Adapter	HP Inc.	PPP012D-S	677777-003

2. Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

2.3 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	NT(Note 6)	Conducted
15.247(e)	RSS-247 5.2(b)	Transmitter power spectral density	NT(Note 6)	
15.247(b)	RSS-247 5.4(d)	Maximum peak conducted output power	NT(Note 6)	
15.247(d)	RSS-247 5.5	Unwanted emission	NT(Note 6)	
15.209	RSS-Gen 6.13	Transmitter emission	C	Radiated
15.207(a)	RSS-Gen 8.8	AC Conducted Emission	NA(Note 3)	Line Conducted

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

Note 3: The equipment is operated on battery power only.

Note 4: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2

Note 5: The tests were performed according to the method of measurements prescribed in KDB No.558074.

Note 6 : The test was performed according to the class II permissive change. This change is not related to the conducted-measurement item.

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
2 402 MHz	2 440 MHz	2 480 MHz

Test mode

Modulation	Duty Cycle
GFSK	86 %

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
Radiated Emissions (f ≤ 1 GHz)	4.0 dB
Radiated Emissions (f > 1 GHz)	5.0 dB

4. Technical Characteristic Test

4.1 Radiated Emission

Test Location

☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)
☒ 3 m SAC (test distance : 3 m)

Test Procedures

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

Instrument Settings

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

a) RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz

b) VBW ≥ RBW

c) Sweep time = auto couple

Limit :

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

Table 1. Restricted Frequency Bands

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

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

[2] Above 38.6

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

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

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

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

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

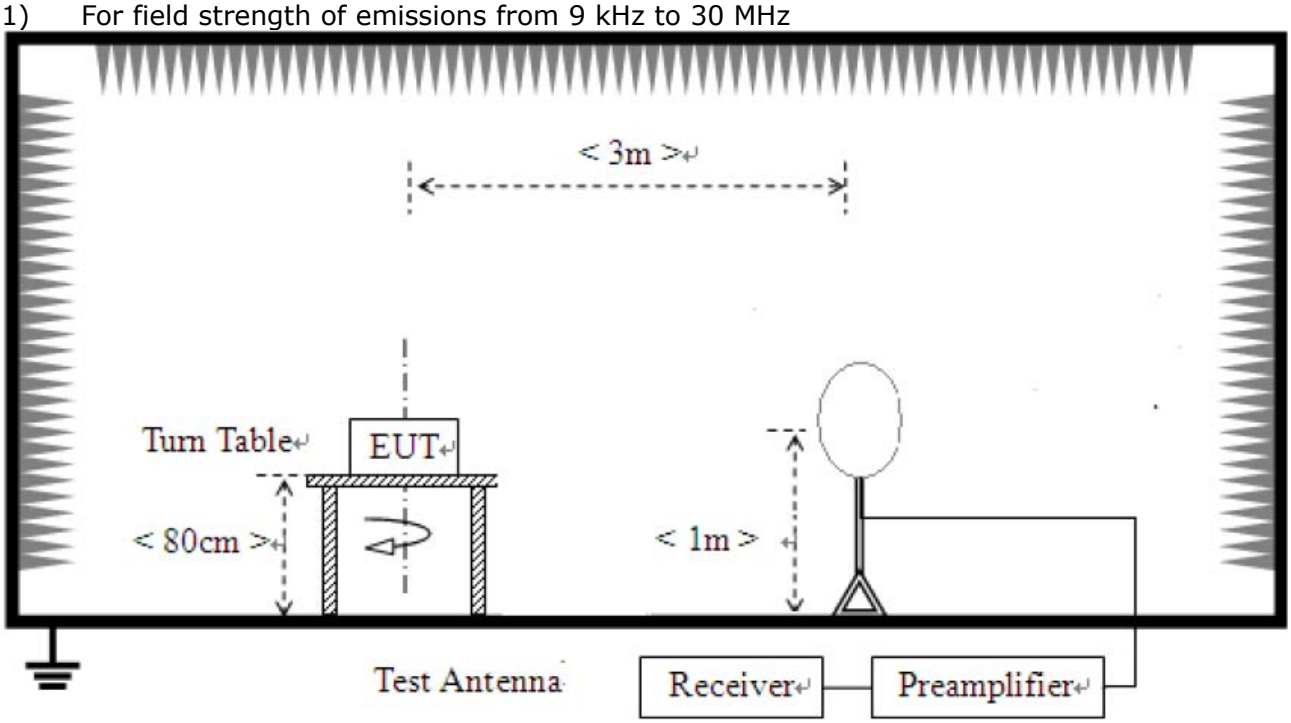
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231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

Note :

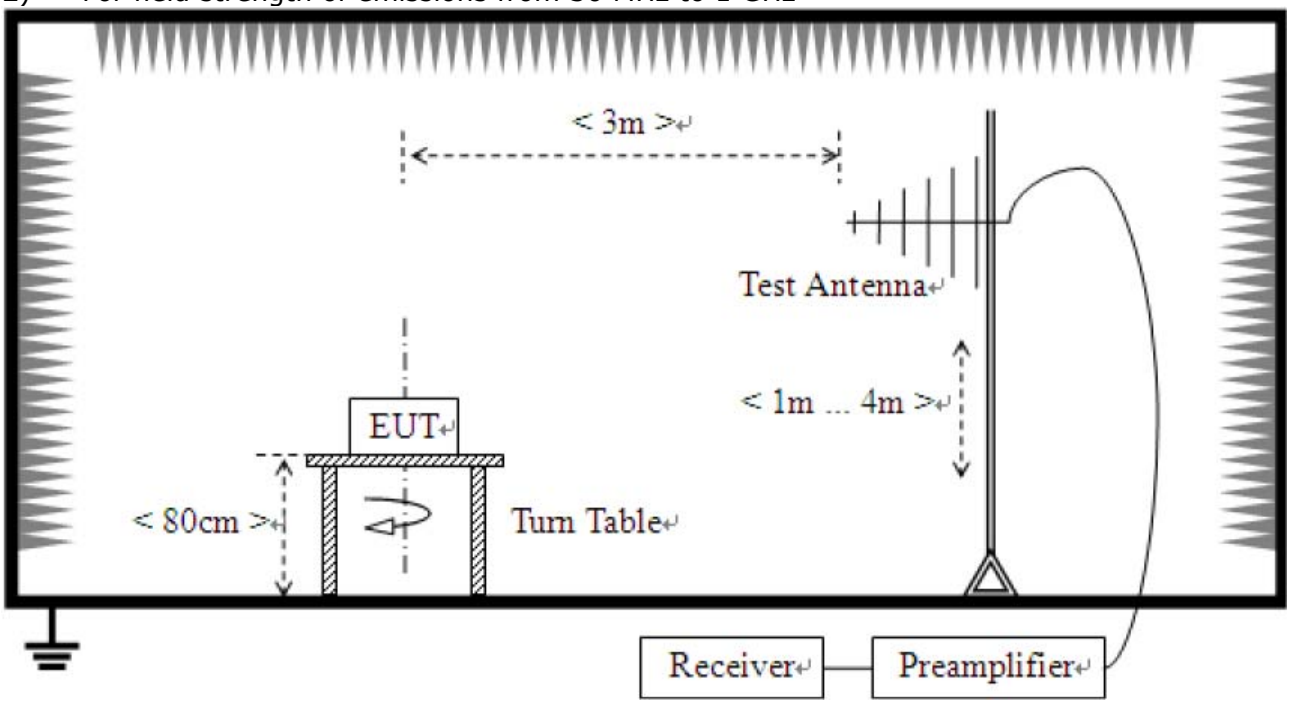
1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength of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

Test Setup:

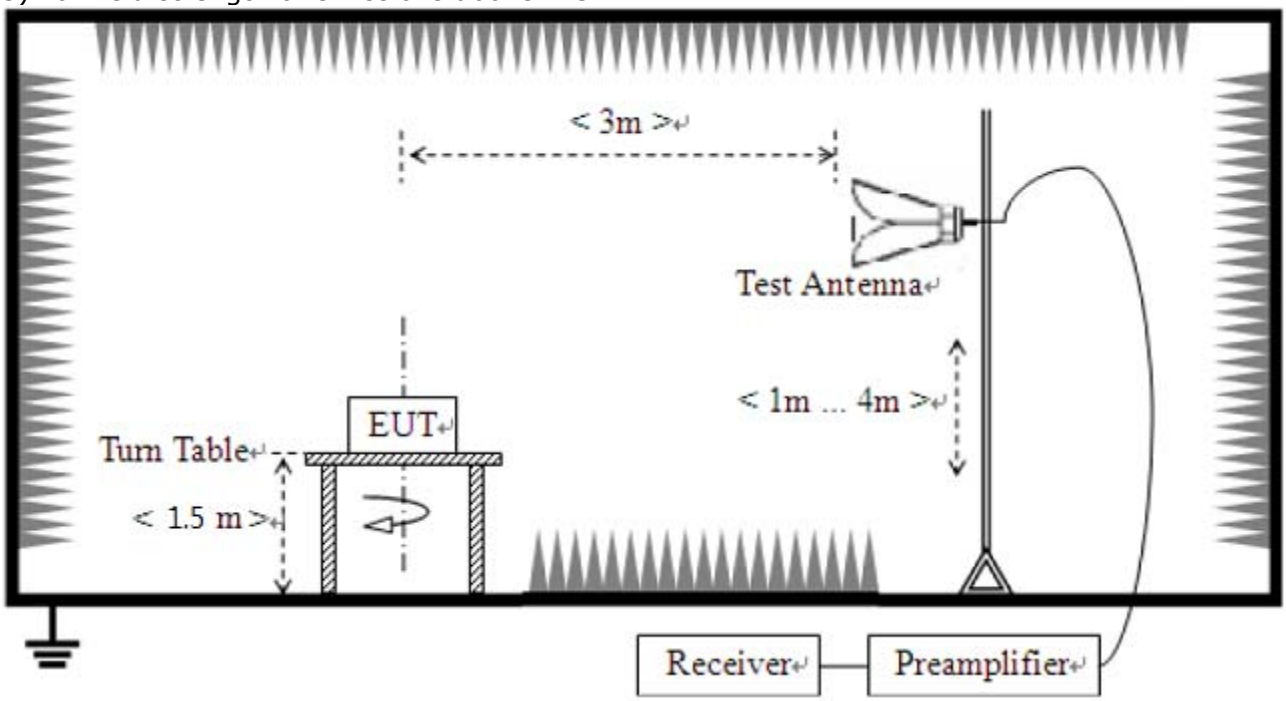
1) For field strength of emissions from 9 kHz to 30 MHz



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



3) For field strength of emissions above 1 GHz



Test results

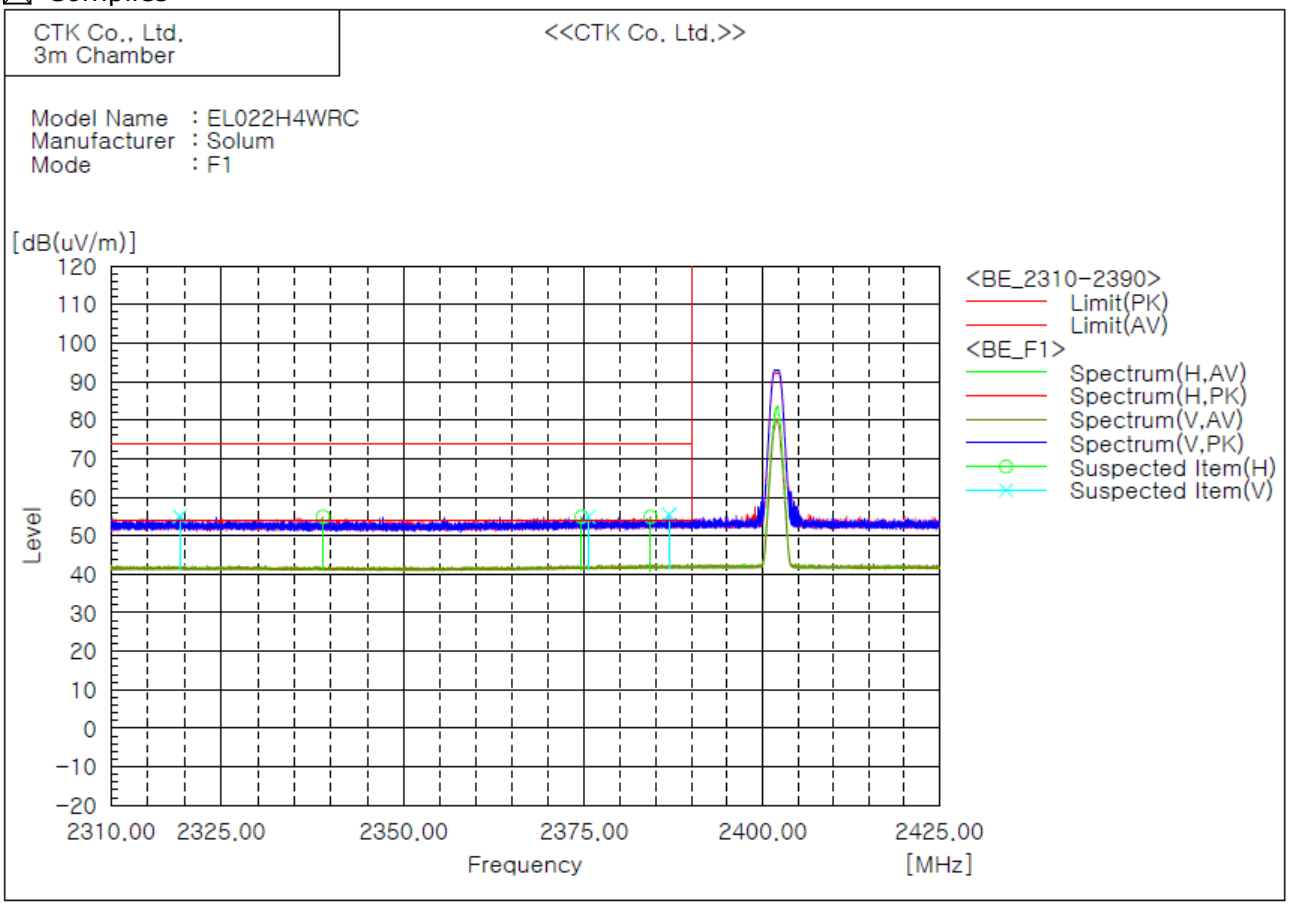
1) Restricted Frequency Bands

1. 2 310 MHz to 2 390 MHz

Test mode : Transmit, Low Channel

The requirements are:

☒ Complies



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin PK [dB]	Height [cm]	Angle [deg]
1	2319.373	V	48.6	6.4	55.0	74.0	19.0	224.5	153.7
2	2338.937	H	48.7	6.2	54.9	74.0	19.1	99.9	8.0
3	2374.673	H	48.4	6.5	54.9	74.0	19.1	234.8	97.7
4	2375.622	V	48.4	6.5	54.9	74.0	19.1	99.9	351.6
5	2384.304	H	48.2	6.7	54.9	74.0	19.1	464.3	49.3
6	2386.863	V	48.7	6.7	55.4	74.0	18.6	464.3	231.7

Remark :

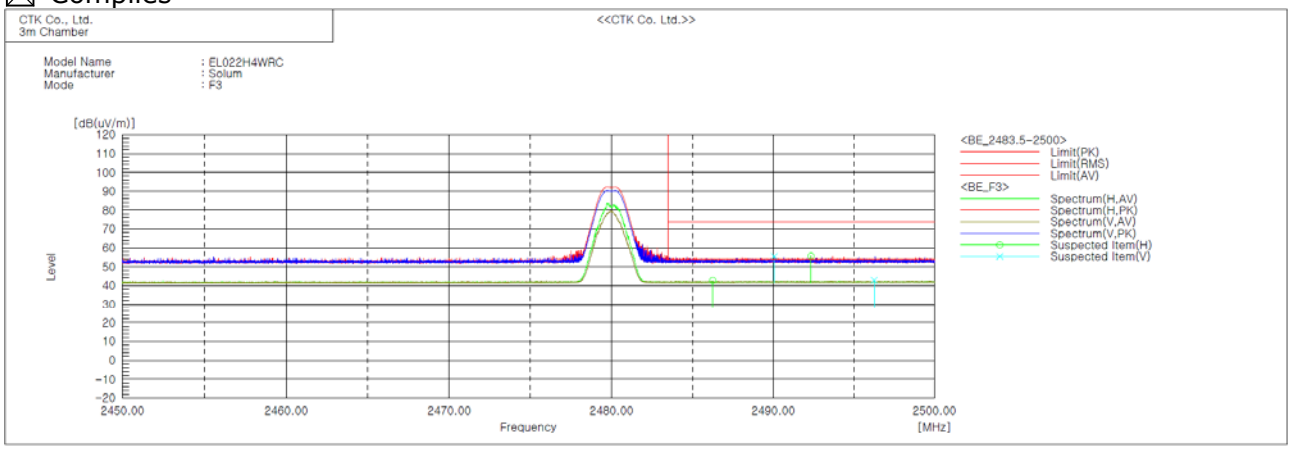
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor +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

*Measurement results 1, 2, 3 and 4 are not spurious.

2. 2 483.5 MHz – 2 500 MHz

Test mode : Transmit, High Channel

The requirements are:
☒ Complies



Spectrum Selection

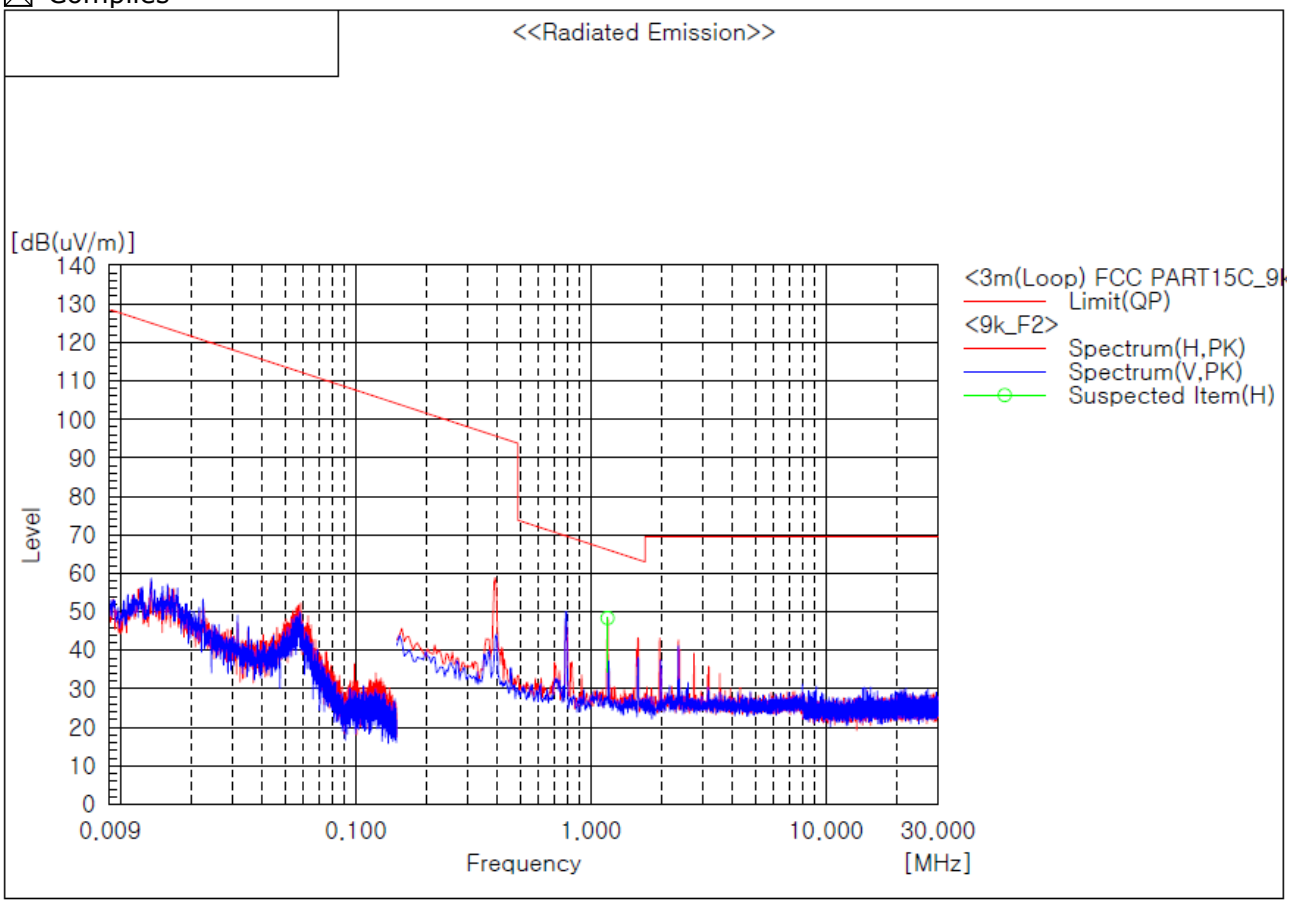
No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin PK [dB]	Height [cm]	Angle [deg]
1	2492.350	H	49.0	6.7	55.7	-----	74.0	18.3	234.7	190.2
2	2486.262	H	36.1	6.6	-----	42.7	54.0	11.3	234.7	0.0
3	2490.069	V	48.9	6.7	55.6	-----	74.0	18.4	99.8	117.6
4	2496.262	V	36.1	6.7	-----	42.8	54.0	12.2	99.8	0.0

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

2) Spurious
1. 9 kHz to 30 MHz

Test mode : Transmit, Middle Channel(Worst case)

The requirements are:
☒ Complies



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	1.180	H	23.4	25.0	48.4	66.2	17.8	101.0	264.0

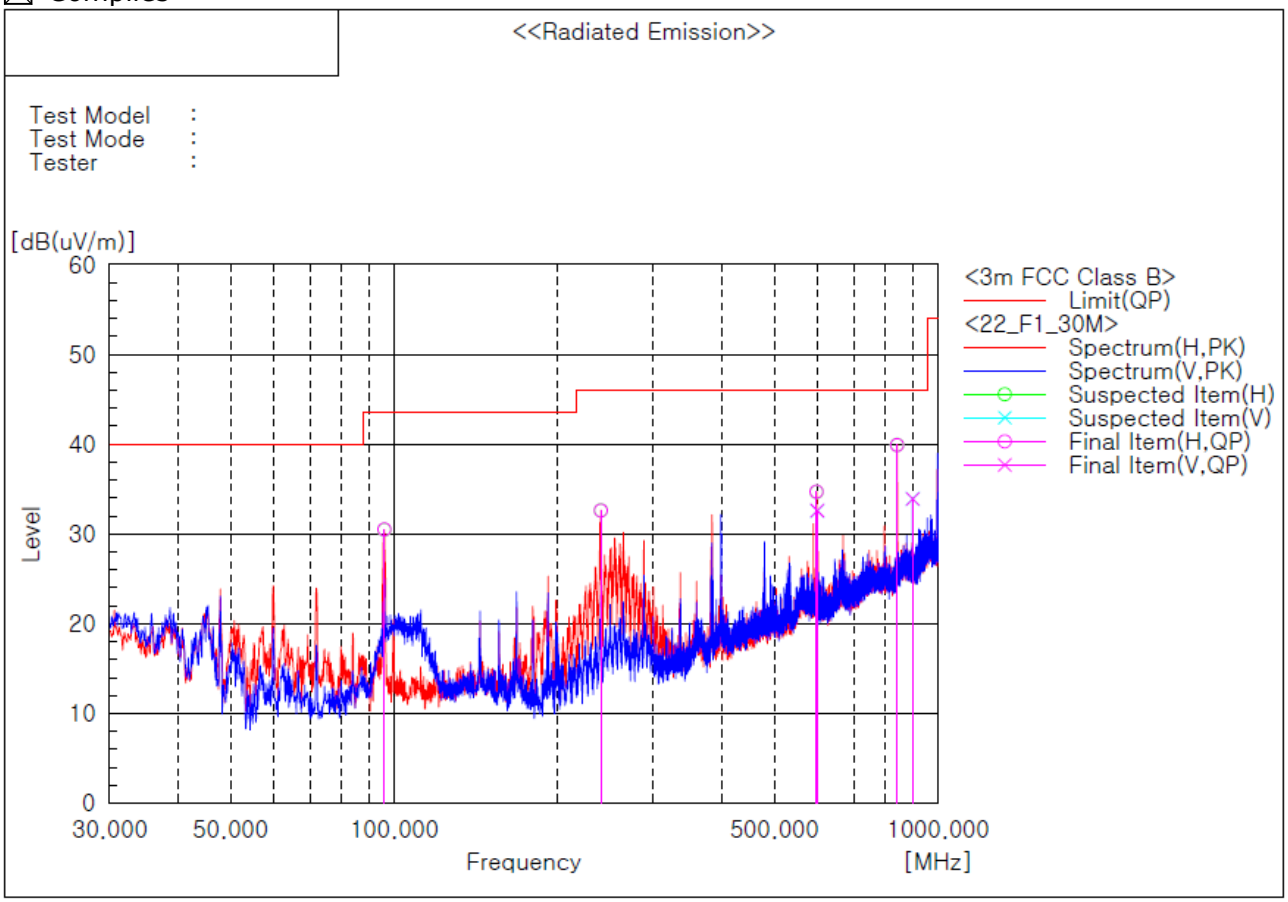
Remark :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna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

* Reading data is the peak value.

2. 30 MHz to 1 GHz

Test mode : Transmit, Middle Channel(Worst case)

The requirements are:
☒ Complies



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	95.960	H	45.3	-14.8	30.5	43.5	13.0	308.0	4.0
2	240.005	H	43.7	-11.1	32.6	46.0	13.4	101.0	218.0
3	598.299	H	34.7	0.0	34.7	46.0	11.3	101.0	302.0
4	599.754	V	32.6	0.0	32.6	46.0	13.4	101.0	349.0
5	841.405	H	35.6	4.3	39.9	46.0	6.1	308.0	232.0
6	898.271	V	28.3	5.6	33.9	46.0	12.1	191.0	10.0

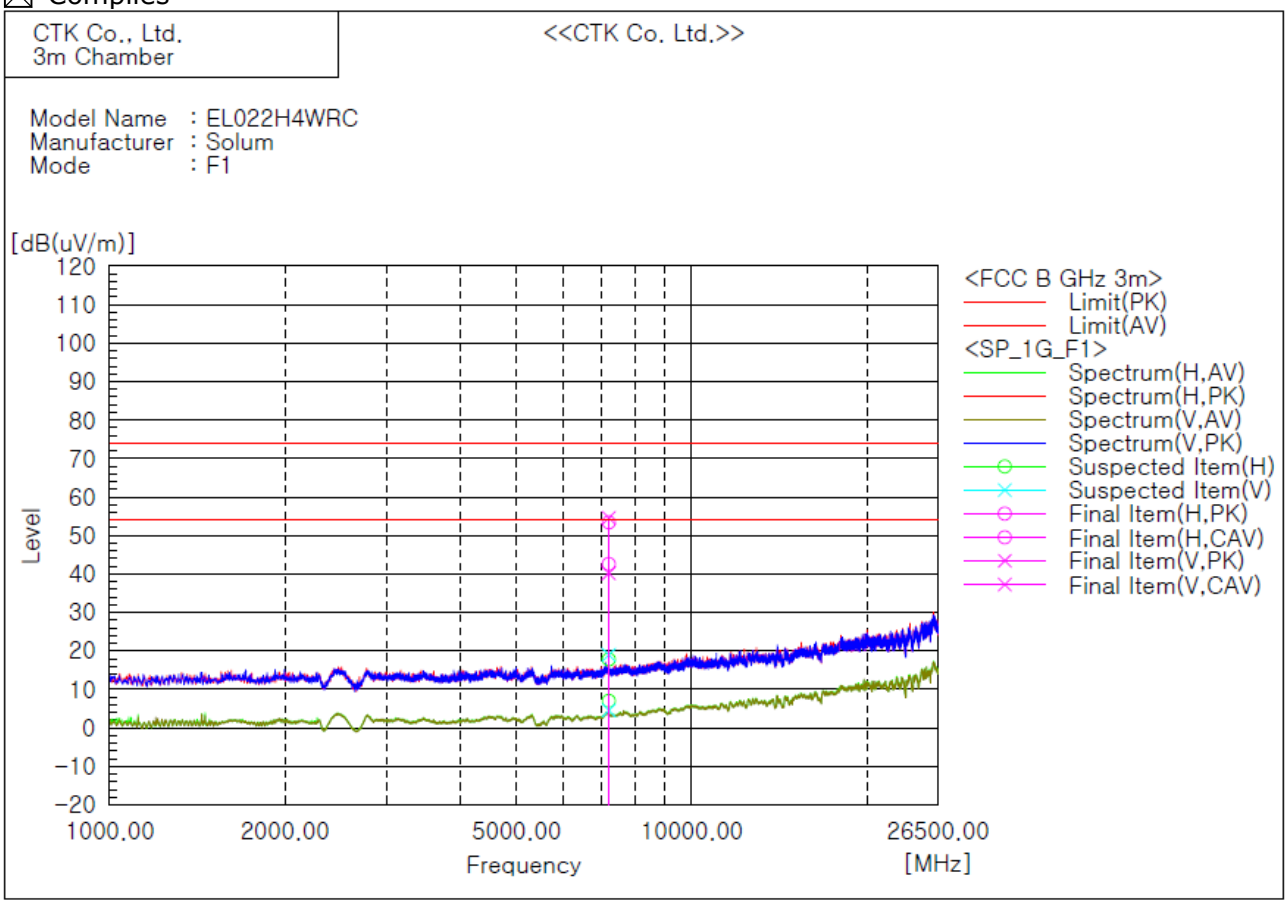
Remark :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna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

* Reading data is the peak value.

3. 1 GHz to 26.5 GHz

Test mode : Transmit, High Channel(Worst case)

The requirements are:
☒ Complies



Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]
1	7205.000	H	49.3	--------	4.1	53.4	--------	74.0	54.0	20.6	--------	344.2	0.0
2	7207.125	H	--------	38.5	4.1	--------	42.6	74.0	54.0	--------	11.4	99.9	355.0
3	7207.125	V	50.5	--------	4.1	54.6	--------	74.0	54.0	19.4	--------	356.1	352.5
4	7205.000	V	--------	36.1	4.1	--------	40.2	74.0	54.0	--------	13.8	99.9	74.0

Remarks

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

APPENDIX A – Test Equipment Used For Tests

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2021-10-20	2022-10-20
2	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2020-05-20	2022-05-20
3	Bilog Antenna	Schaffner	CBL6111C	2551	2021-03-22	2023-03-22
4	AMPLIFIER	SONOMA	310	291721	2022-01-21	2023-01-21
5	6dB Attenuator	R&S	DNF	272.4110.50-2	2021-10-22	2022-10-22
6	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2022-01-11	2023-01-11
7	Double Ridged Guide Antenna	ETS-Lindgren	3117	00154525	2021-10-22	2022-10-21
8	Horn Antenna	SCHWARZBECK	BBHA9170	00967	2021-05-25	2022-05-25
9	Preamplifier	Agilent	8449B	3008A02011	2021-10-24	2022-11-24
10	Band Reject Filter	Micro Tronics	BRM50702	G233	2022-01-07	2023-01-07
11	Signal Generator	R&S	SMB100A	175528	2021-04-12	2022-04-12
12	6dB Attenuator	BIRD	5W 6dB	1744	2021-11-18	2022-11-18

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable (conducted)	Junkosha Inc.	MWX221	1510S087	2022-01-28
2	3m Loop Cable (Radiated)	HUBER+SUHNER	N/A	N/A	2021-10-25
3	3 m 1GHz Above RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2022-01-28
4	3 m 1GHz Below RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 104	N/A (below 1GHz)	2022-01-28
4	3 m 1GHz Above RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 104	MY27573/4	2021-12-12
5	3 m 1GHz Above RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 104	801924/4	2021-12-12
6	3 m 1GHz Above RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 102	MY4728/2	2022-01-28
7	3 m 1GHz Above RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 102	MY2374/2	2022-01-28

APPENDIX B – EUT Photographs