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-2019-01627

1. Client

◦ Name : HOSEOTELNET CO., LTD.

◦ Address : Hoseo Plaza B/D 7F, 416, Gangseo-ro, Gangseo-gu, Seoul, Korea

◦ Date of Receipt : 2019-03-29

2. Manufacturer

◦ Name : HOSEOTELNET CO., LTD.

◦ Address : Hoseo Plaza B/D 7F, 416, Gangseo-ro, Gangseo-gu, Seoul, Korea

3. Use of Report : For FCC Certification

4. Test Sample / Model : Motion Detector / RAY-PIR2-HS

5. Date of Test : 2019-04-11 to 2019-04-19

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.249

7. Testing Environment : Temp.: (24 ± 1) ℃, Humidity: (48 ± 5) % 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)

2019-04-30

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

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REPORT REVISION HISTORY

Date	Revision	Page No
2019-04-30	Issued (CTK-2019-01627)	all

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1. General Product Description

1.1 Client Information

Company	HOSEOTELNET CO., LTD.
Contact Point	Hoseo Plaza B/D 7F, 416, Gangseo-ro, Gangseo-gu, Seoul, Korea
Contact Person	Name : Min Kyung il E-mail : dudwns111@hstelnet.com Tel : +82-2-2659-7345

1.2 Product Information

FCC ID	R2SRAY-PIR2-HS
Product Description	Motion Detector
Model name	RAY-PIR2-HS
Operating Frequency	902.4 - 927.6 MHz
RF Output Power	Below 94 dBuV/m @ 3 m
Antenna Specification	Antenna type : Helical antenna Peak Gain : -4.41 dBi
Number of channels	4
Type of Modulation	GFSK
Power Source	DC 3 V (AAA Batteries 2EA)

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Notebook Computer	ASUS	A42J	-
AC Adapter	ASUS	ADP-90CD DB	-

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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	Scope of Accreditation	Registration Number	Logo
USA	**FCC**	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
CANADA	**ISED**	IC EMI (3/10m test site)	8737A-2	
KOREA	**NRRA**	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	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

FCC Part Section(s)	Requirement(s)	Status (Note 1)
15.249(a)	Field Strength of emissions from intentional radiators	C
15.249(d)	Emissions radiated outside of the specified frequency bands	C
15.209	Radiated Emissions	C
15.207	AC Conducted Emission	NA(Note 3)

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 15.249, ANSI C63.10-2013

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.

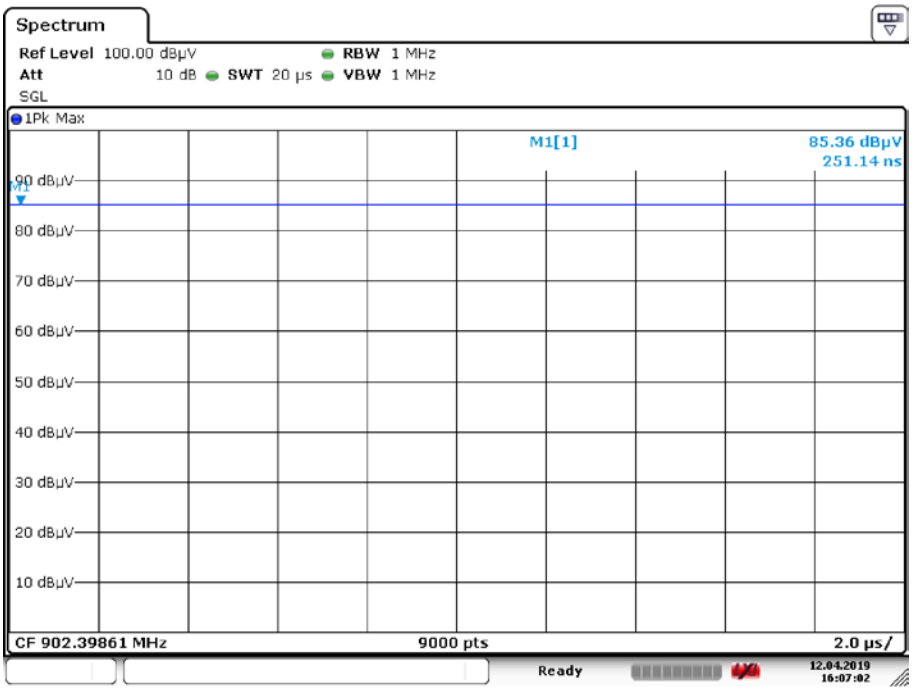
Test Frequency

Lowest channel	Middle channel	Highest channel
902.4 MHz	915.2 MHz	927.6 MHz

Test mode

TX mode	Duty cycle*
Continuous	1 (100.00 %)

***Duty cycle = TX on(time) / T(Period) = 1**



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
Unwanted Emission(conducted)	3.0 dB
Radiated Emissions (f ≤ 1 GHz)	4.0 dB
Radiated Emissions (f > 1 GHz)	5.0 dB

4. Technical Characteristic Test

4.1 Band Edge

Requirement

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Test Procedures(ANSI C63.10-2013 6.10)

a) Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).
b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent "normal mode of operation".
d) Perform the test as follows:

1) Span : Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
2) RBW : 100 kHz
3) VBW : 300 kHz
4) Detector : Peak
5) Sweep time = Coupled
6) Trace : Max hold
7) Attenuation : Auto(at least 10 dB preferred)
8) Allow trace to fully stabilize

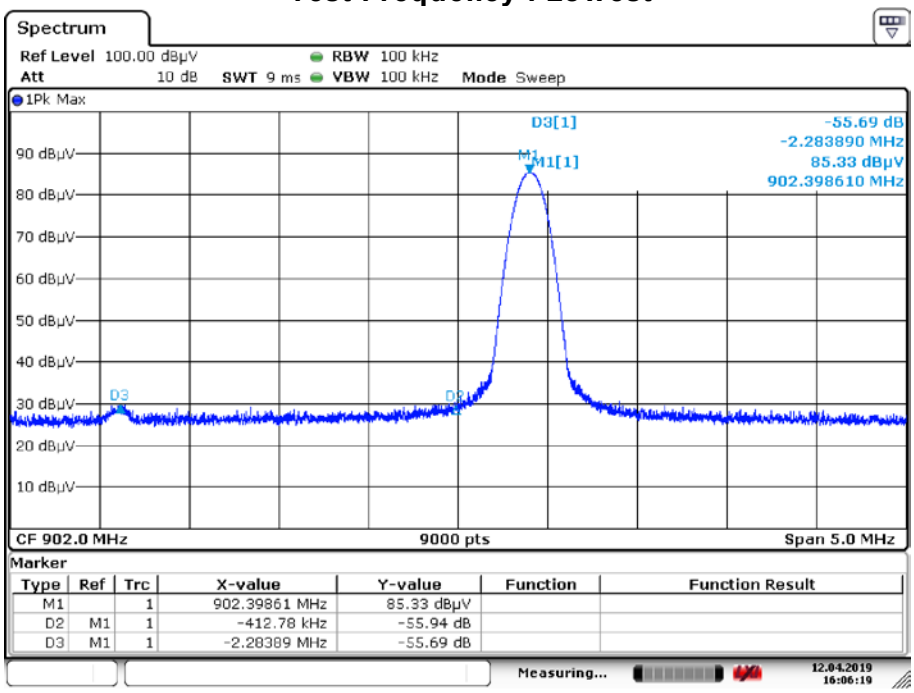
e) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
f) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).
g) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Test results: Complies

See next pages for actual measured spectrum plots.

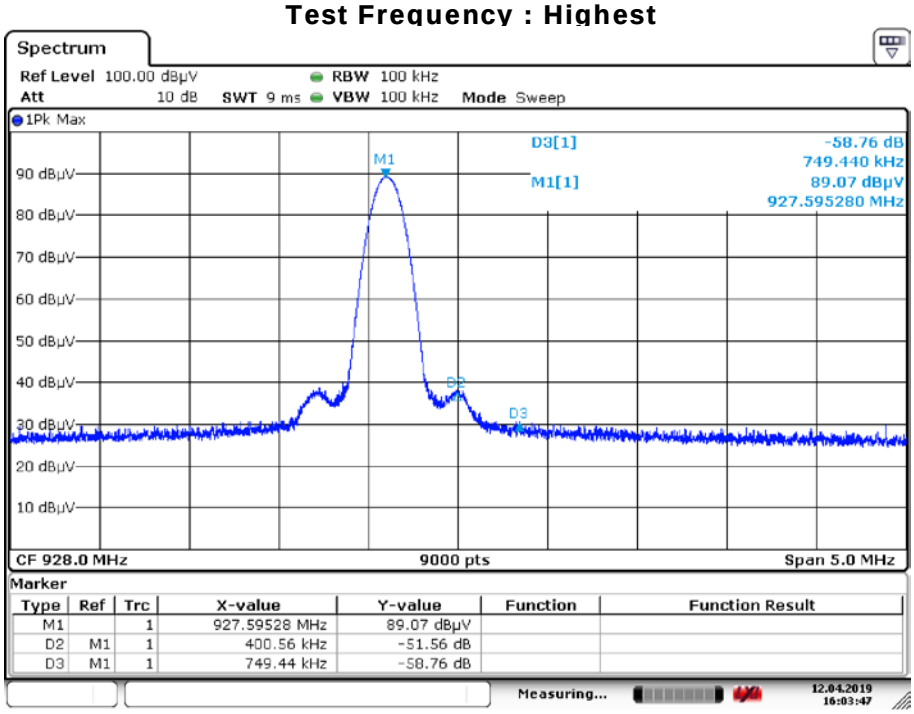
Band-edge

Test Frequency : Lowest



3

Test Frequency : Highest



Remarks

-Emissions radiated outside of the specified frequency bands are attenuated by at least 50 dB below the level of the fundamental.

4.2 Field strength

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 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.

Test Settings:

Frequency Range = 9 kHz ~ 10 GHz (10^{th} harmonic)

a) RBW = 1 MHz for f ≥ 1 GHz, 120 kHz for f < 1 GHz, 9 kHz for f < 30 MHz

b) VBW ≥ RBW

c) Sweep time = auto couple

Requirement :

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental	Field strength of harmonics
902-928 MHz	50 mV/m (94 dBuV/m)	500 uV/m (54 dBuV/m)

Field strength limits are specified at a distance of 3 meters.

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

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 :

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) Average value = Peak value + Duty cycle correction factor(For pulse timing characteristics such as fundamental and harmonic emissions)

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:

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	

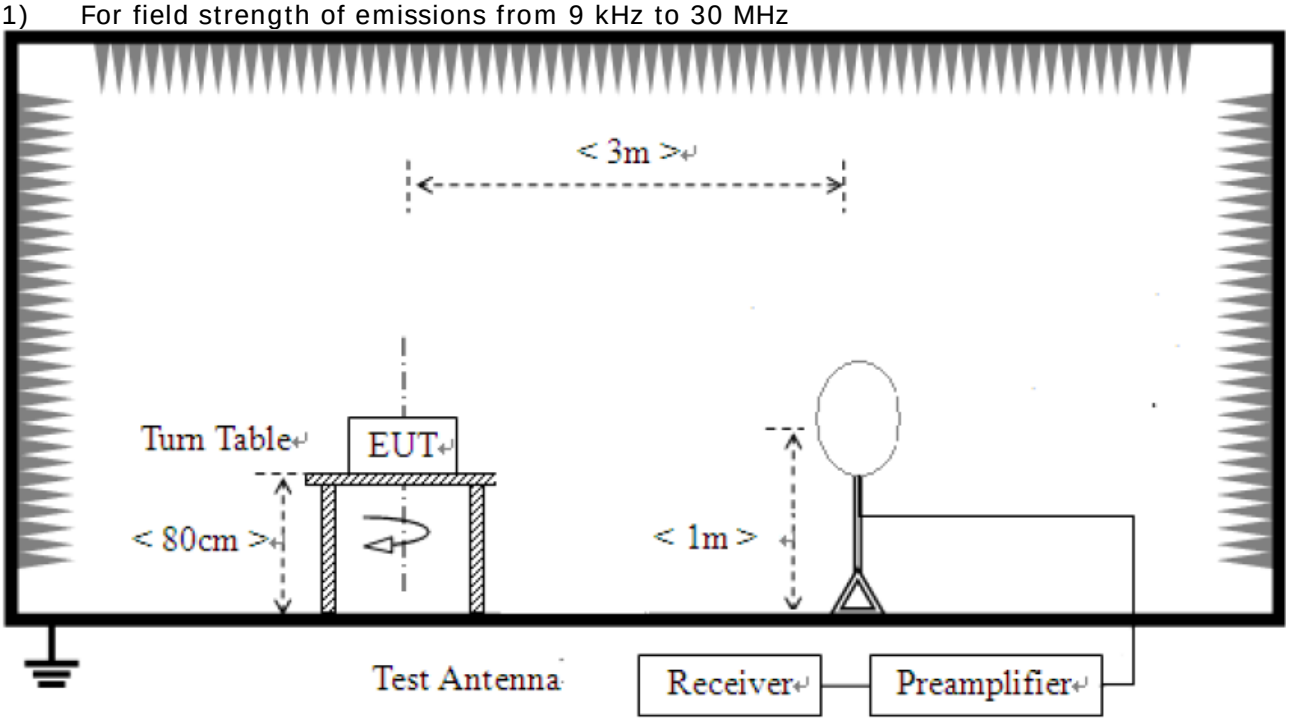
[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

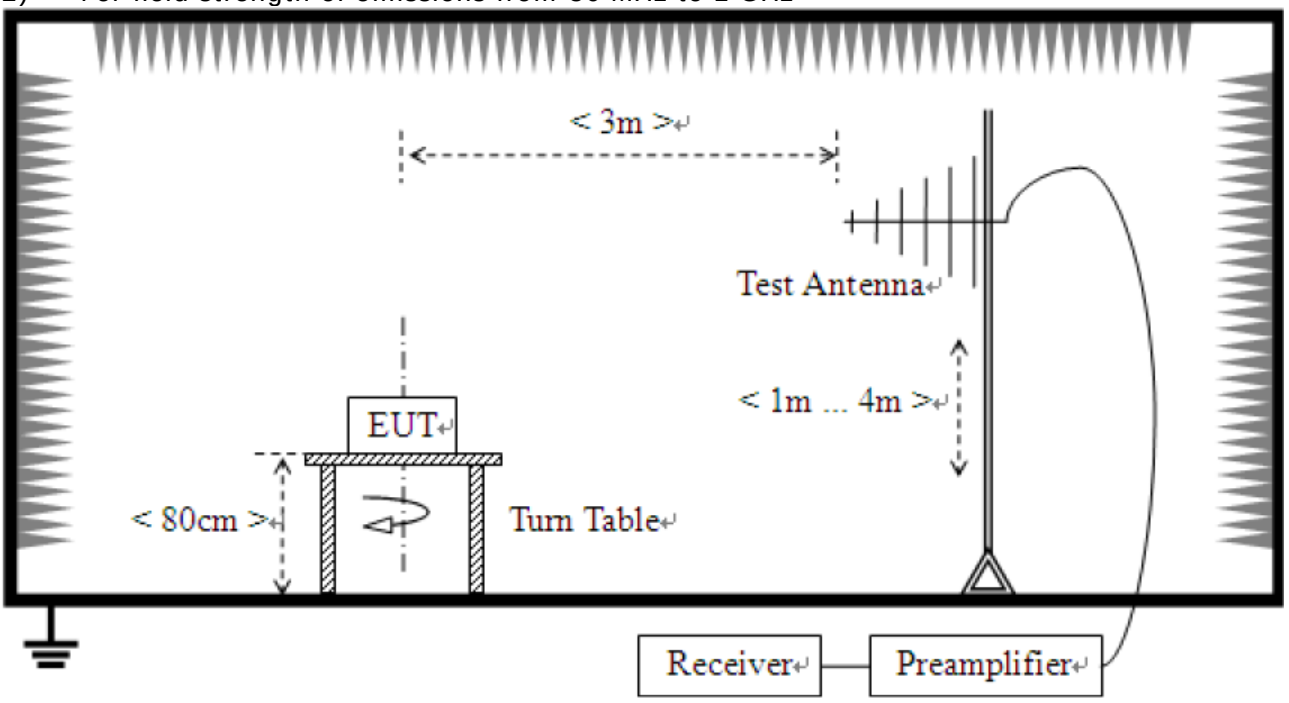
§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using 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.

Test Setup:

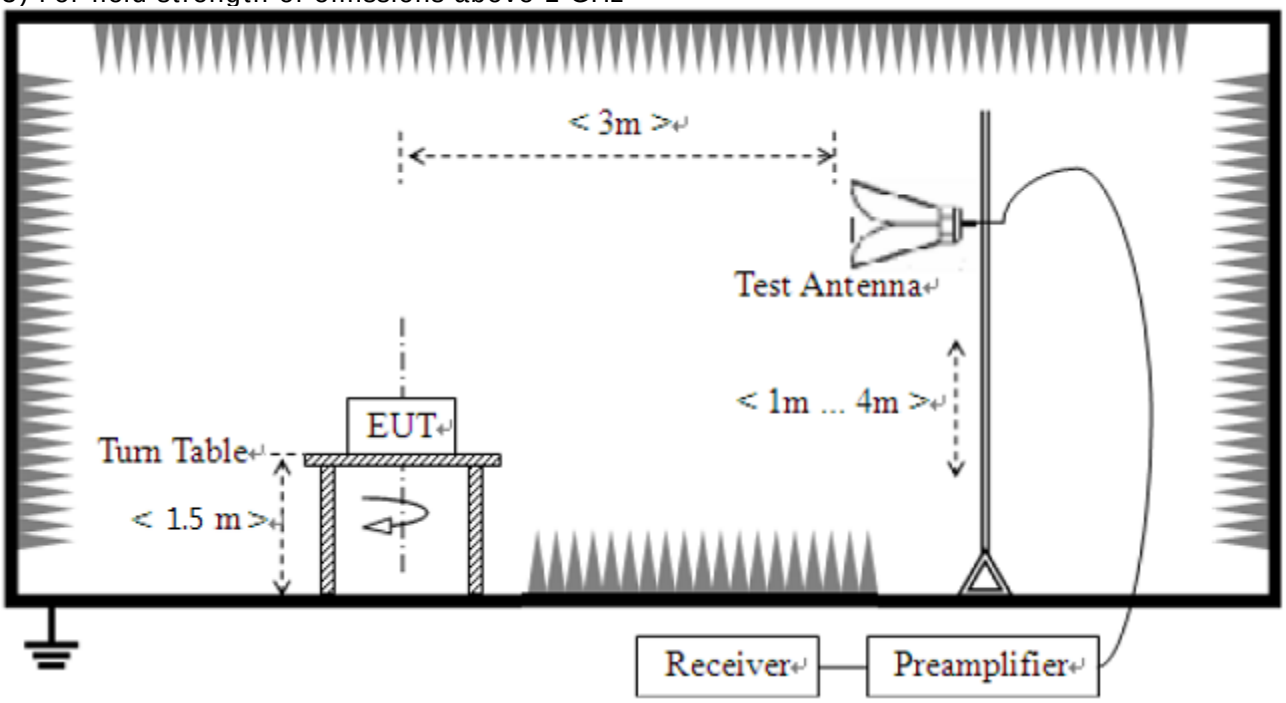
1) For field strength of emissions from 9 kHz to 30 MHz



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



3) For field strength of emissions above 1 GHz



Test Data :

1) Field strength of fundamental

The requirements are:
☒ Complies

Frequency [MHz]	Ant. Pol. (V/H)	Reading* [dBuV/m]	C.F [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
902.4	V	96.9	-4.0	**92.9**	94	1.1	-
	H	92.9	-4.0	**88.9**	94	5.1	-
915.2	V	94.7	-3.9	**90.8**	94	3.2	-
	H	91.7	-3.9	**87.8**	94	6.2	-
927.6	V	92.7	-3.7	**89.0**	94	5.0	-
	H	89.5	-3.7	**85.8**	94	8.2	-

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

*This data is the peak value.

2) Field strength of outside of the specified frequency bands – 9 kHz to 30 MHz

The requirements are:
☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

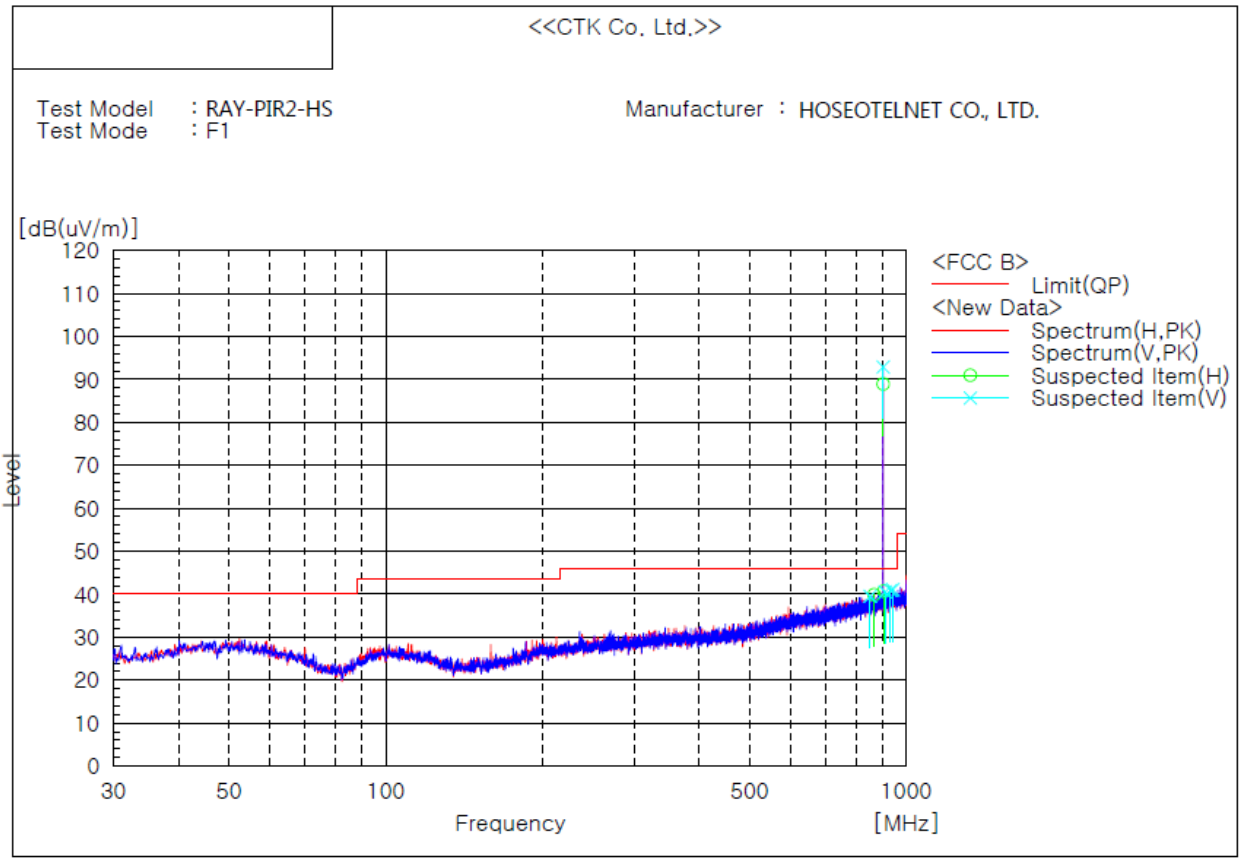
Note :
The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

3) Field strength of outside of the specified frequency bands – 30 MHz to 1 GHz

The requirements are:
☒ Complies

Test Frequency : Lowest

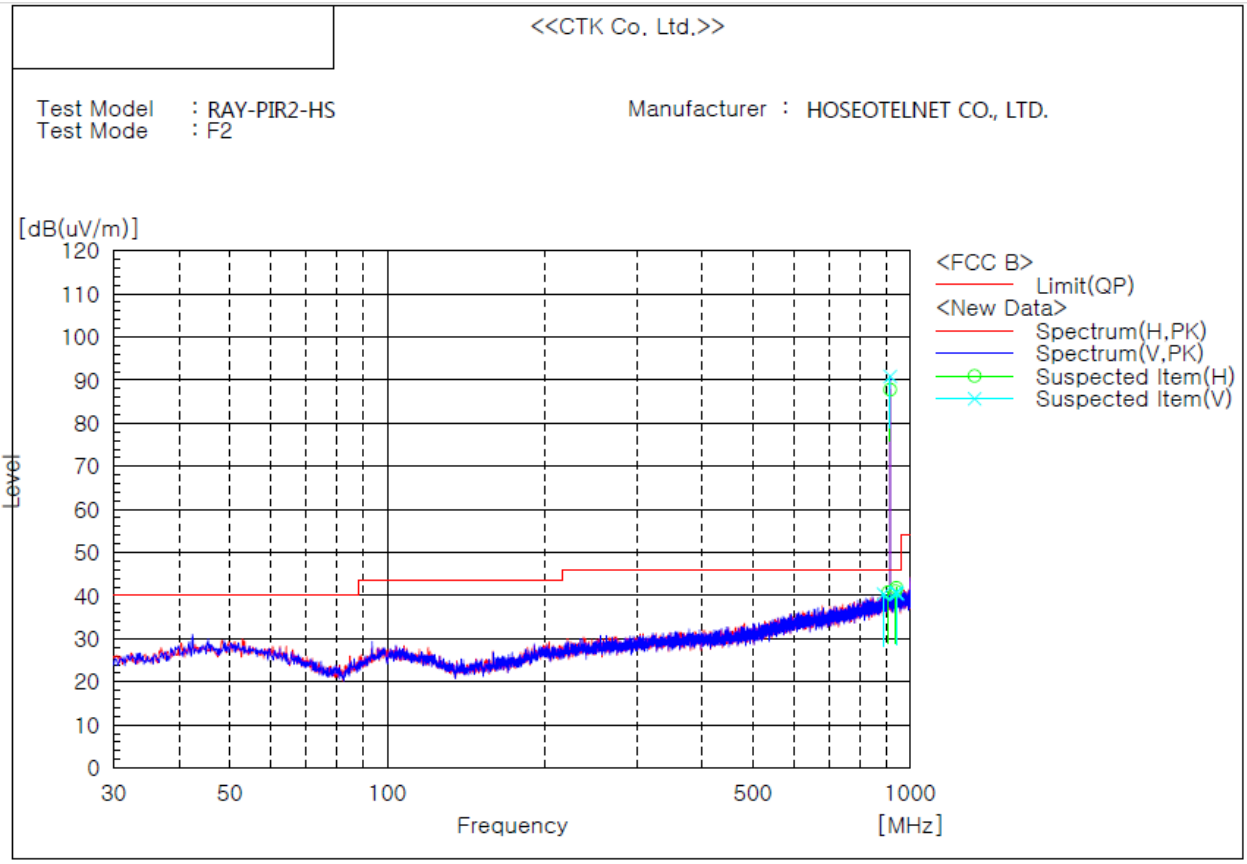


Spectrum Selection

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	851.189	V	44.3	-4.7	39.6	46.0	6.4	99.8	351.0
2	867.192	H	44.3	-4.4	39.9	46.0	6.1	99.8	54.6
3	902.465	V	96.9	-4.0	92.9	46.0	-46.9	99.8	116.2
4	902.465	H	92.9	-4.0	88.9	46.0	-42.9	99.8	213.8
5	905.405	H	44.7	-4.0	40.7	46.0	5.3	99.8	344.3
6	909.868	V	44.4	-3.9	40.5	46.0	5.5	99.8	303.6
7	932.295	V	44.6	-3.7	40.9	46.0	5.1	99.8	351.0
8	941.767	V	44.7	-3.6	41.1	46.0	4.9	99.8	351.0

Remark :
1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. This data is the peak(PK) value.
4. No.3 and No.4 are the carrier frequencies.
5. The Field strength of fundamental was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

Test Frequency : Middle

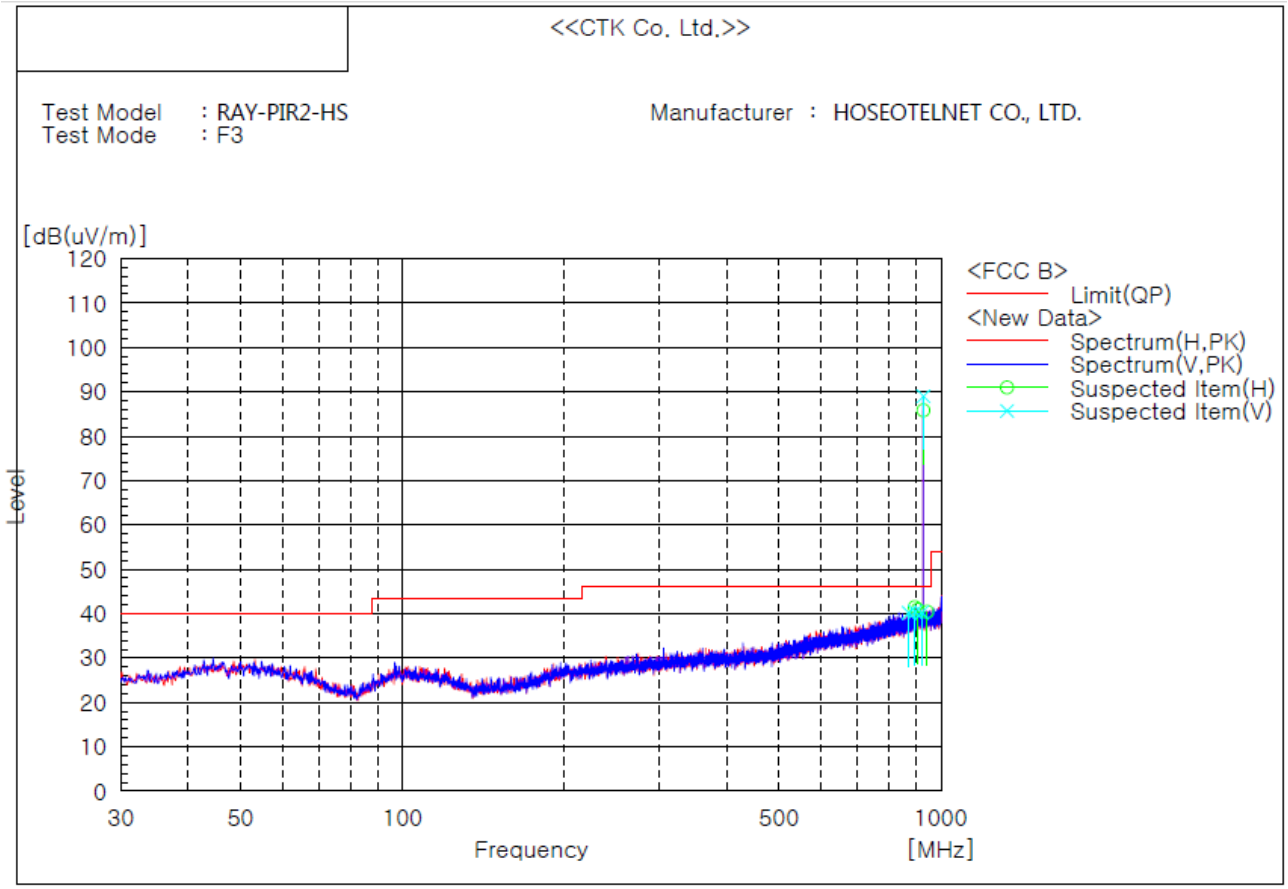


Spectrum Selection

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	887.986	V	44.6	-4.2	40.4	46.0	5.6	99.8	340.3
2	907.691	H	44.7	-3.9	40.8	46.0	5.2	99.8	23.2
3	915.203	V	94.7	-3.9	90.8	46.0	-44.8	99.8	79.5
4	915.203	H	91.7	-3.9	87.8	46.0	-41.8	99.8	215.2
5	936.541	H	44.6	-3.6	41.0	46.0	5.0	99.8	335.5
6	939.372	V	44.3	-3.6	40.7	46.0	5.3	99.8	304.7
7	940.351	H	45.4	-3.6	41.8	46.0	4.2	99.8	323.3
8	943.617	V	44.1	-3.6	40.5	46.0	5.5	99.8	138.7

Remark :
1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. This data is the peak(PK) value.
4. No.3 and No.4 are the carrier frequencies.
5. The Field strength of fundamental was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

Test Frequency : Highest



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	871.547	V	44.6	-4.4	40.2	46.0	5.8	99.8	144.6
2	894.409	V	44.5	-4.1	40.4	46.0	5.6	99.8	34.6
3	894.627	H	45.5	-4.1	41.4	46.0	4.6	99.8	182.5
4	905.731	H	44.9	-4.0	40.9	46.0	5.1	99.8	313.2
5	920.973	V	44.1	-3.8	40.3	46.0	5.7	99.8	10.2
6	927.614	V	92.7	-3.7	89.0	46.0	-43.0	99.8	355.0
7	927.614	H	89.5	-3.7	85.8	46.0	-39.8	99.8	194.4
8	942.855	H	44.1	-3.6	40.5	46.0	5.5	99.8	75.7

Remark :
1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. This data is the peak(PK) value.
4. No.6 and No.7 are the carrier frequencies.
5. The Field strength of fundamental was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

4) Field strength of outside of the specified frequency bands – 1 GHz to 10 GHz

The requirements are:
☒ Complies

Test Frequency : Lowest(902.4 MHz)

Frequency [MHz]	Ant. Pol. (V/H)	Reading* [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
2 707.090	V	40.8	-3.6	**37.2**	54	16.8	Harmonic
2 707.090	H	40.0	-3.6	**36.4**	54	17.6	Harmonic
4 512.160	V	43.0	1.2	**44.2**	54	9.8	Harmonic
4 512.160	H	45.9	1.2	**47.1**	54	6.9	Harmonic

Test Frequency : Middle(915.2 MHz)

Frequency [MHz]	Ant. Pol. (V/H)	Reading* [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
1 830.312	V	48.8	-4.3	**44.5**	54	9.5	Harmonic
1 830.312	H	44.4	-4.3	**40.1**	54	13.9	Harmonic
3 660.636	V	40.8	-0.2	**40.6**	54	13.4	Harmonic
3 660.636	H	43.3	-0.2	**43.1**	54	10.9	Harmonic

Test Frequency : Highest(927.6 MHz)

Frequency [MHz]	Ant. Pol. (V/H)	Reading* [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
1 854.555	V	48.9	-4.2	**44.7**	54	9.3	Harmonic
1 854.555	H	44.4	-4.2	**40.2**	54	13.8	Harmonic
3 710.131	V	40.4	0.1	**40.5**	54	13.5	Harmonic
3 710.131	H	42.4	0.1	**42.5**	54	11.5	Harmonic

Remarks
1. Result = Reading + c.f(correction factor) + Duty cycle c.f
2. Correction factor = Antenna factor + Cable loss - Amp Gain
3. This data is the peak(PK) value.
4. The Field strength of fundamental was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

* Reading data is the peak value.

APPENDIX A – Test Equipment Used For Tests

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	Signal Analyzer	R&S	FSV30	100925	2019-01-21	2020-01-21
2	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2018-10-25	2019-10-25
3	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2019-01-17	2021-01-17
4	Bilog Antenna	Schaffner	CBL6111C	2551	2017-04-19	2019-04-19
5	AMPLIFIER	SONOMA	310	291721	2019-01-28	2020-01-28
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2018-10-25	2019-10-25
7	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2019-01-29	2020-01-29
8	Horn Antenna	ETS-Lindgren	3117	00154525	2019-02-22	2021-02-22
9	Preamplifier	Agilent	8449B	3008A02011	2018-12-03	2019-12-03

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable (conducted)	Junkosha Inc.	MWX221	1510S087	2019-02-02
2	RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2019-02-02
3	RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 104	N/A (below 1GHz)	2019-02-02
4	RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 104	MY27573/4	2018-11-30
5	RF Cable (Radiated)	HUBER+SUHNER	SUCOFLEX 106	N/A (above 1GHz)	2018-11-30