

TEST REPORT

Report No: KST-FCR-160004(1)

Applicant	Name	CHANG SHIN INFOTEL CO.,LTD
	Address	3F, Yonhap News Bldg, 64, Deadeok-Daero, 168beon-gil, seo-gu, Deajeon, South Korea
Manufacturer	Name	CHANG SHIN INFOTEL CO.,LTD
	Address	3F, Yonhap News Bldg, 64, Deadeok-Daero, 168beon-gil, seo-gu, Deajeon, South Korea
Equipment	Name	Access Controlled Security System with zigbee & RFID
	Model No	SG-2000
	Brand	huinu
	FCC ID	2ABZV-SG-2000
Test Standard	FCC CFR 47, Part 15. Subpart C-15.225	
Test Date(s)	2016. 03. 28 - 2016. 03. 29	
Issue Date	2016. 03. 31	
Test Result	Compliance	
Note	-	

Supplementary Information

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI C 63.10-2013.

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by Mi-Young, Lee

Approved by Gyeong-Hyeon, Park

Signature



Signature



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1. GENERAL INFORMATION

1.1 Test Facility

Test laboratory and address

KOSTEC Co., Ltd.

128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Registration information

KOLAS No. : 232

FCC Designation No. : KR0041

FCC Registration No. : 525762

IC Registration Site No. : 8305A

1.2 Location



Revision History of test report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Gyeong-Hyeon, Park	2016.03.31
1	Add Procedure Reference	11	Gyeong-Hyeon, Park	2016.04.22

2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

Equipment Name	Access Controlled Security System with zigbee&RFID
Model No	SG-2000
Usage	Access Controlled Security System with zigbee&RFID
Serial Number	Proto type
Modulation type	ASK
Oscillation Type	X-tal
Maximum output power	12.22 dB μ V/m @ 30 meter
Operated Frequency	13.56 MHz
Channel Number	1
Operation temperature	-20 °C - + 50 °C
Power Source	AC/DC Adaptor, output: DC 12 V PoE, DC 48 V
Antenna Description	Internal PCB antenna
Remark	1. The device was operating at its maximum output power for all measurements. 2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case (X) is shown in the report. 3. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.
FCC ID	2ABZV-SG-2000

3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

This equipment is a wireless authentication key that you wirelessly communicate with each other in 2.4GHz zigbee. It is used as a key of access control systems as the product which satisfies users' convenience and security. As it doesn't require users' authentication behaviors like RF-ID or finer scan

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
Notebook	BCM-1063	2Z7S1Z1	Dell Inc	
Adapter	DA65NM111-00	None	Dell Inc	For notebook

3.3 Product Modification

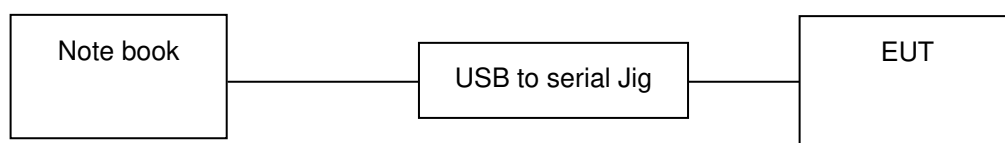
N/A

3.4 Operating Mode

Constantly transmitting with a modulated carrier at maximum power.

3.5 Test Setup of EUT

The measurements were taken in continuous transmit mode using the test mode which controlled by Tera Term. The test command and the test Jig and cables were provided by the applicant.



3.7 Used Test Equipment List

No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
1	T & H Chamber	EY-101	90E14260	TABAI ESPEC	2016.09.17	1 year	☒
2	T & H Chamber	SH-641	92006831	ESPEC CORP	2017.02.04	1 year	☐
3	Constant switch Tester	DS-COT	None	Dong sung Ele.	N/A	N/A	☐
4	Vibration Tester	70UA	L90016	IDEX Co.,Ltd	N/A	N/A	☐
5	Vibration Meter	VM-6360	N225098	LANDTEK	2016.04.07	1 year	☐
6	Falling Tester	SWD-8000	None	Sinwoo	N/A	N/A	☐
7	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2017.02.02	1 year	☐
8	Spectrum Analyzer	8593E	3710A02859	Agilent Technology	2017.02.02	1 year	☐
9	Spectrum Analyzer	FSV30	20-353063	Rohde & Schwarz	2017.02.02	1 year	☒
10	EMI Test Receiver	ESCI7	100823	Rohde & Schwarz	2017.02.02	1 year	☒
11	EMI Test Receiver	ESI	837514/004	Rohde & Schwarz	2016.10.08	1 year	☐
12	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2017.02.04	1 year	☐
13	Network Analyzer	8753ES	US39172348	AGILENT	2016.09.16	1 year	☐
14	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2017.02.03	1 year	☐
15	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2017.02.03	1 year	☐
16	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2017.02.01	1 year	☐
17	Modulation Analyzer	8901A	3538A07071	Agilent Technology	2017.02.03	1 year	☐
18	Audio Analyzer	8903B	3514A16919	Agilent Technology	2017.02.01	1 year	☐
19	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2017.02.04	1 year	☐
20	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2016.09.16	1 year	☐
21	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2017.02.03	1 year	☐
22	ESG Vector Signal Generator	E4438C	MY42083133	Agilent Technology	2016.09.16	1 year	☐
23	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2017.02.03	1 year	☐
24	Tracking Source	85645A	070521-A1	Agilent Technology	2017.02.02	1 year	☐
25	SLIDAC	None	0207-4	Myoung sung Ele.	2017.02.01	1 year	☐
26	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2017.02.01	1 year	☐
27	DC Power supply	6038A	3440A12674	Agilent Technology	2017.02.01	1 year	☐
28	DC Power supply	E3610A	KR24104505	Agilent Technology	2017.02.01	1 year	☐
29	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2017.02.01	1 year	☐
30	DC Power Supply	SM 3004-D	114701000117	DELTAELEKTRONIKA	2017.02.01	1 year	☐
31	Dummy Load	8173	3780	Bird Electronic Co., Corp	2017.02.03	1 year	☐
32	Attenuator	50FH-030-500	140410 9433	JEW Industries Inc.	2017.02.03	1 year	☐
33	Attenuator	765-20	9703	Narda	2016.09.16	1 year	☐
34	Attenuator	8498A	3318A09485	HP	2017.02.03	1 year	☐
35	Step Attenuator	8494B	3308A32809	HP	2017.02.03	1 year	☐
36	Step Attenuator	8495D	3308A01464	HP	2017.02.02	1 year	☒
37	Power divider	11636B	51212	HP	2017.02.02	1 year	☐
38	3Way Power divider	KPDSU3W	00070365	KMW	2016.09.16	1 year	☐
39	4Way Power divider	70052651	173834	KRYTAR	2017.02.02	1 year	☐
40	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2017.02.03	1 year	☐
41	White noise audio filter	ST31EQ	101902	SoundTech	2016.09.16	1 year	☐
42	Dual directional coupler	778D	17693	HEWLETT PACKARD	2017.02.03	1 year	☐
43	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2017.02.03	1 year	☐
44	Band rejection filter	3TNF-0006	26	DOVER Tech	2017.02.04	1 year	☐
45	Band rejection filter	3TNF-0008	317	DOVER Tech	2017.02.04	1 year	☐
46	Band rejection filter	3TNF-0007	311	DOVER Tech	2017.02.04	1 year	☐
47	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2017.02.03	1 year	☐
48	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2017.02.03	1 year	☐
49	Radio Communication Alalyzer	MT8815A	6200429622	ANRITSU	2017.02.04	1 year	☐
50	CDMA Mobile Station Test Set	E8285A	US40081298	AGILENT	2017.02.04	1 year	☐
51	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2017.02.04	1 year	☐
52	Radio Communication Tester	CMU 200	112026	Rohde & Schwarz	2017.02.03	1 year	☐

No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
53	Bluetooth Tester	TC-3000B	3000B6A0166	TESCOM CO., LTD.	2017.02.03	1 year	☐
54	RF Up/Down Converter	DCP-1780	980901003	CREDIX	2017.02.03	1 year	☐
55	DECT Test set	8923B	3829U00364	HP	2017.02.04	1 year	☐
56	DECT Test set	CMD60	840677/005	Rohde & Schwarz	2016.09.16	1 year	☐
57	Loop Antenna	6502	9203-0493	EMCO	2017.06.04	2 year	☒
58	Dipole Antenna	HZ-12	100005	Rohde & Schwarz	2016.07.01	2 year	☐
59	Dipole Antenna	HZ-13	100007	Rohde & Schwarz	2016.07.01	2 year	☐
60	BiconiLog Antenna	3142B	1745	EMCO	2016.06.16	2 year	☒
61	Horn Antenna	3115	9605-4834	EMCO	2016.06.16	2 year	☐
62	Horn Antenna	3115	2996	EMCO	2018.02.12	2 year	☐
63	Horn Antenna	BBHA9170	BBHA9170152	SCHWARZBECK	2017.04.30	2 year	☐
64	Antenna Mast(OSA)	AT14	None	Daeil EMC	N/A	N/A	☐
65	Turn table(OSA)	None	None	Daeil EMC	N/A	N/A	☐
66	RF Amplifier(OSA)	8447D	2944A07881	AGILENT	2017.02.01	1 year	☐
67	Antenna Master(3)	AT13	None	AUDIX	N/A	N/A	☐
68	Turn Table(3)	None	None	AUDIX	N/A	N/A	☐
69	PREAMPLIFIER(3)	8449B	3008A02577	Agilent	2016.02.05	1 year	☐
70	Antenna Master(10)	MA4000-EP	None	inno systems GmbH	N/A	N/A	☒
71	Turn Table(10)	None	None	inno systems GmbH	N/A	N/A	☒
72	AMPLIFIER(10)	TK-PA6S	120009	TESTEK	2017.02.02	1 year	☒
73	Vernier Calipers	None	8280373	Mitutoyo	2016.09.17	1 year	☐

4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
Carrier frequency tolerance	15.225(e)	Clause 5.1	☒	Compliance
Field strength of radiated emission	15.225(a) ~ (d)	Clause 5.2	☒	Compliance
AC Conducted emission	15.207	Clause 5.3	☒	Compliance
Antenna requirement	15.203, 15.247	Clause 5.4	☒	Compliance
20 dB bandwidth measurement	2.1049	Clause 5.5	☒	Compliance
Compliance/pass : The EUT complies with the essential requirements in the standard. Not Compliance : The EUT does not comply with the essential requirements in the standard. N/A : The test was not applicable in the standard.				

Procedure Reference

FCC CFR 47, Part 15. Subpart C-15.225

ANSI C 63.10-2013

5. MEASUREMENT RESULTS

5.1 Carrier Frequency tolerance

5.1.1 Standard Applicable [FCC §15.225(e)]

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency Over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation In the primary supply from 85 % to 115 % of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

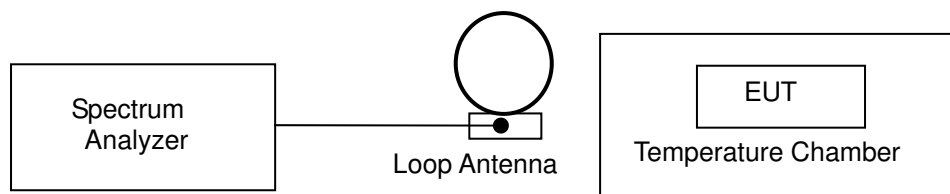
5.1.2 Test Environment conditions

- Ambient temperature : (22 - 23) °C
- Relative Humidity : (50 - 52) % R.H.

5.1.3 Measurement Procedure

Before measurements are made the equipment shall have reached thermal balance in the Test chamber period. and then it is normal operating for about 15 minutes after thermal balance has been reached. For tests at the extreme temperature, the equipment shall be left in the test chamber until thermal balance is attained, then the standby or receive condition for a period of a few minute after which the equipment shall meet the specified requirements. The test data sheet recorded measured value by frequency counter.

5.1.4 Test setup



5.1.5 Measurement Result

■ Adapter

Frequency (13.56 MHz)			Measured frequency [Hz]	Frequency Tolerance	
				%	Hz
T _{NOM} + 22 °C	V _{NOM} 12.0 Vdc		13 560 128	0.0009	128
	V _{MIN} 10.2 Vdc		13 560 127	0.0009	127
	V _{MAX} 13.8 Vdc		13 560 128	0.0009	128
T _{MIN} - 20 °C	V _{NOM} 12.0 Vdc		13 560 129	0.0010	129
T _{MAX} + 55 °C	V _{NOM} 12.0 Vdc		13 560 129	0.0010	129
Limit			Within in (±) 0.01 % or (±) 1 356 Hz		
Max. Tolerance			0.0010 %, (±)129 Hz		
Result			Compliance		

■ PoE

Frequency (13.56 MHz)			Measured frequency [Hz]	Frequency Tolerance	
				%	Hz
T _{NOM} + 22 °C	V _{NOM}	48.0 Vdc	13 560 136	0.0010	136
	V _{MIN}	40.8 Vdc	13 560 135	0.0010	135
	V _{MAX}	55.2 Vdc	13 560 138	0.0010	138
T _{MIN} - 20 °C	V _{NOM}	48.0 Vdc	13 560 122	0.0009	122
T _{MAX} + 55 °C	V _{NOM}	48.0 Vdc	13 560 141	0.0010	141
Limit			Within in (±) 0.01 % or (±) 1 356 Hz		
Max. Tolerance			0.0010 %, 141 Hz		
Result			Compliance		

5.2 Field strength of radiated emissions

5.2.1 Standard Applicable [FCC §15.225 (a) ~ (d)]

(a) The Field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 $\mu\text{V}/\text{m}$ at 30 meter

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 micro volts/meter at 30 meter

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 micro volts/meter at 30 meter

(d) The Field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed The general radiated emission limits in §15.209

Above required standard (a ~ c) and (d) is brief describe table as follows

§ 15.225 [(a) ~ (c)] : Limit for in-band field strength

Frequency Band (MHz)	Limit		Measurement distance (meter)
	($\mu\text{V}/\text{m}$)	(dB $\mu\text{V}/\text{m}$)	
13.553 – 13.567	15,848	84.00	30
13.410 – 13.553 13.567 – 13.710	334	50.47	30
13.110 – 13.410 13.710 – 14.010	106	40.50	30

§15.209. limits for radiated emissions measurements

Frequency Band	Limit [$\mu\text{V}/\text{m}$]	Limit [dB $\mu\text{V}/\text{m}$]	Measurement distance (meter)	Detector
0.009 – 0.490	2 400/F (kHz)	-	300	
0.490 – 1.705	2 4000/F (kHz)	-	30	
1.705 – 30.0	30	29.54	30	Quasi peak
30 - 88	100 **	40.0	3	Quasi peak
88 - 216	150 **	43.5	3	Quasi peak
216 - 960	200 **	46.0	3	Quasi peak
Above 960	500	54.0	3	Peak & Average

** fundamental emissions from intentional radiators operation 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 Section 15.231 and 15.241

§15.205. Restrict Band of Operation

Only spurious emissions are permitted in any of the frequency bands listed below ;

[MHz]	[MHz]	[MHz]	[GHz]
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505**	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6

** Until February 1, 1999, this restricted band shall be 0.490-0.510

5.2.2 Test Environment conditions

- Ambient temperature : (19 - 21) °C
- Relative Humidity : (36 - 37) % R.H.

5.2.3 Measurement Procedure

The measurements procedure of the transmitter radiated E-field is as following describe method.

The test is performed in a Shield chamber to determine the accurate frequencies, after maximum emissions level will be checked on a test chamber and measuring distance is 3 m from EUT to test antenna.

(The chamber is ensured that comply with at least 6 dB above the ambient noise level)

- ① The EUT was powered ON with continuously operating mode and placed on a 0.8 meter high non-conductive table on the reference ground plane.
- ② The test antenna was used on Horn antenna for above 1 GHz, and if the below 1 GHz, broad-band antenna and Loop antenna were used for below 30 MHz and it's antenna positioned in both the horizontal and vertical plane was location at EUT during the test for maximized the emission measurement.
- ③ The output of the test antenna will be connected to a measuring receiver, and it is set to tuned over the frequency range according to required standard
- ④ The measuring detector type of the measurement receiver is based on average value of measurement instrumentation employing a CISPR Quasi Peak detector according to required standard and for above 1 GHz, set the spectrum analyzer on a average and peak detector for the provisions in §15.35 and investigated frequency range is set the spectrum analyzer according to §15.33.
- ⑤ The fundamental frequency at which a relevant radiated signal component is detected, the test antenna will be raised and lowered through the specified range of heights in horizontal and vertical polarized orientation, until an maximum signal level is detected on the measuring receiver.
- ⑥ The transmitter is position x,y,z axis on rotating through 360 degrees, until the maximum signal level is detected by the measuring receiver.

⑦ The receiver is scanned from requested measuring frequency band and then the maximum meter reading is recorded. The radiated emissions were measured with required standard.

- The measurement results are obtained as described below:

$$\text{Result(dB } \mu\text{V/m)} = \text{Reading(dB } \mu\text{V)} + \text{Antenna factor(dB/m)} + \text{CL(dB)} + \text{other applicable factor (dB)}$$

- According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

※ if necessary, additionally receiver is adopted high-pass filter and preamp because lower radiated signal

※ The transmitter radiated spectrum was investigated from 9 kHz to 1 GHz

5.2.4 Measurement Uncertainty

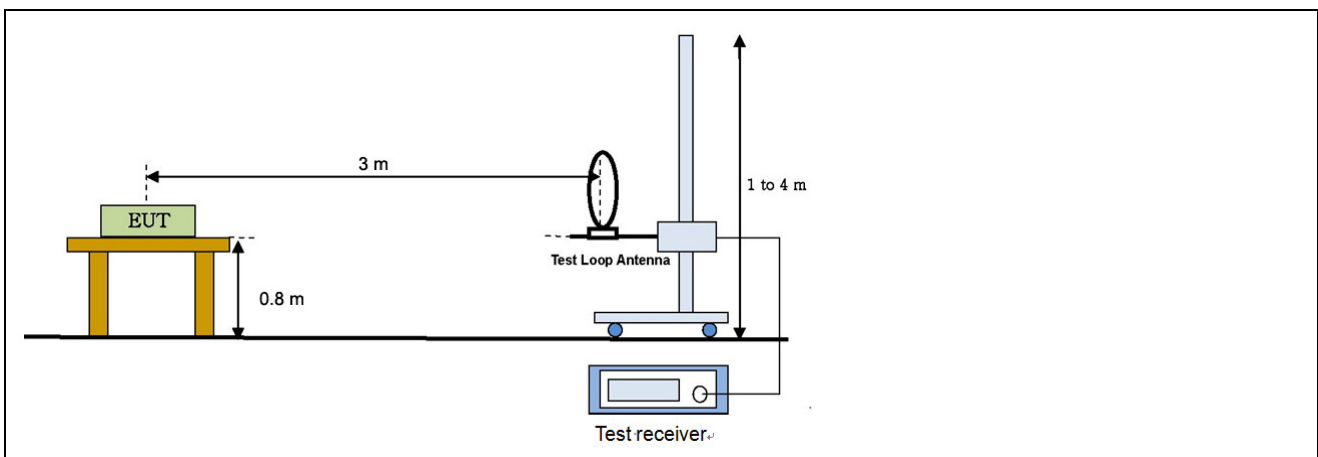
All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are test receiver, Cable loss, Antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, Antenna frequency interpolation, measurement distance variation, Site imperfection, mismatch, and system repeatability based on NIS 80,81.

Radiated Emission measurement: 30 - 1000 MHz: 4.4 dB (CL: Approx 95 %, $k=2$)

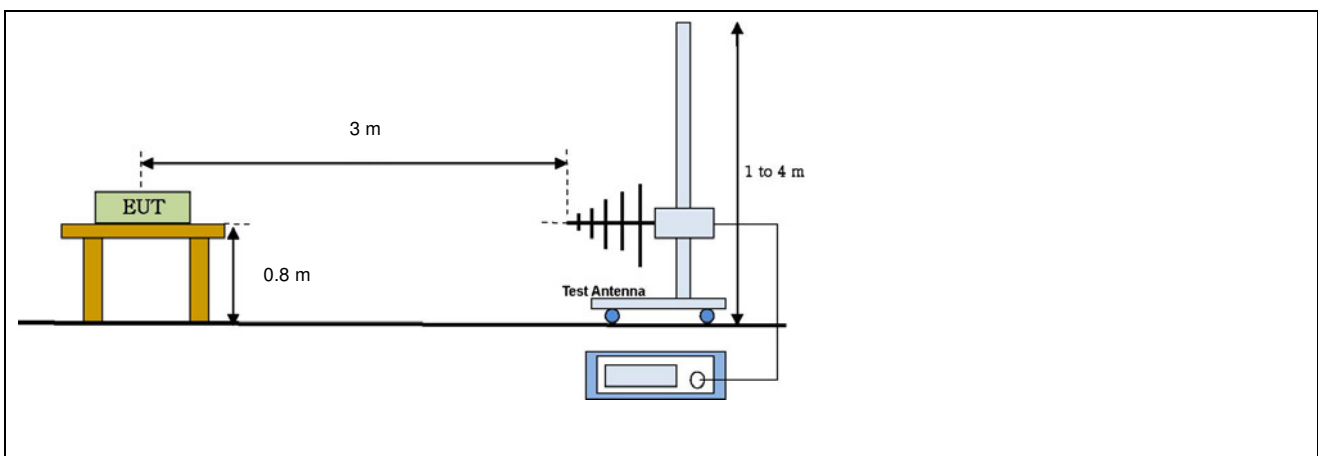
Above 1 GHz: 4.88 dB (CL: Approx 95 %, $k=2$)

5.2.5 Test Configuration

Radiated emission setup, Below 30 MHz



Radiated emission setup, Below 1 000 MHz



5.2.6 Measurement Result

■ IN-BAND

■ Adapter

Freq. (MHz)	Reading (dBμV/m)	Table (Deg)	Pstn (axis)	Antenna			CL (dB)	Pre AMP (dB)	Distn factor (dB)	Meas Result (dBμV/m)	Limit (dBμV/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)							
13.560*	51.99	170	X	1.0	-	9.95	0.60	-	-40	11.99	84.00	72.01	Compliance
13.428	31.84	170	X	1.0	-	9.95	0.60	-	-40	-8.16	50.47	58.63	Compliance
13.480	31.59	170	X	1.0	-	9.95	0.60	-	-40	-8.41	50.47	58.88	Compliance
13.692	32.25	170	X	1.0	-	9.95	0.60	-	-40	-7.75	50.47	58.22	Compliance
13.770	31.52	170	X	1.0	-	9.95	0.60	-	-40	-8.48	40.50	48.98	Compliance

■ PoE

Freq. (MHz)	Reading (dBμV/m)	Table (Deg)	Pstn (axis)	Antenna			CL (dB)	Pre AMP (dB)	Distn factor (dB)	Meas Result (dBμV/m)	Limit (dBμV/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)							
13.560*	52.22	180	X	1	-	9.95	0.6	-	-40	12.22	84.00	71.78	Compliance
43.427	31.50	180	X	1	-	9.95	0.6	-	-40	-8.50	50.47	58.97	Compliance
13.481	32.00	170	X	1	-	9.95	0.6	-	-40	-8.00	50.47	58.47	Compliance
13.691	31.86	170	X	1	-	9.95	0.6	-	-40	-8.14	50.47	58.61	Compliance
13.771	32.10	170	X	1	-	9.95	0.6	-	-40	-7.90	40.50	48.40	Compliance

*It is fundamental frequency

Note1. above measured frequency have been done at 3 m distance and corrected according to required FCC 15.209. e)
 $\therefore$ Extrapolation distance factor : $40\log(3/30) = -40$ dB If Measurement distance is 3 m and Mandatory requirement distance is 30 m at 30 MHz or less, extrapolation distance factor(dB) is 40 / decade = $40\log_{10}^{(MRD/MD)}$
 MRD is Mandatory requirement distance and MD is Measured distance

Note2. above measured frequencies is apply required standard FCC Part 15.225

Note3. All measurements were performed using a loop antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.

Note4. All measurements were recorded using a quasi-peak detector.

Freq.(MHz) : Measurement frequency, Reading(dBμV/m) : Indicated value for test receiver,
 Table (Deg) : Directional degree of Turn table, Pstn(axis) : Location axis of EUT
 Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor
 Cbl(dB) : Cable loss, Distn factor(dB) : distance correction factor [40 dB/decade as per § 15.31f (2)]
 Meas Result (dBμV/m) : Reading(dBμV/m) + Antenna factor.(dB/m) + CL(dB) + Distn factor(dB)
 Limit(dBμV/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dBμV/m) – Meas Result(dBμV/m)

■ OUT- BAND

■ Adapter

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Pre AMP (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)						
40.56	57.32	160	1.3	V	10.68	1.01	-40.51	28.50	40.00	11.50	Compliance
299.25	50.80	160	1.3	V	14.23	2.36	-41.27	26.12	46.00	19.88	Compliance
354.15	51.31	170	1.3	V	16.08	2.52	-41.08	28.83	46.00	17.17	Compliance
404.65	52.53	160	1.3	V	17.52	2.68	-40.93	31.80	46.00	14.20	Compliance
462.35	56.32	160	1.3	V	18.53	2.86	-40.66	37.05	46.00	8.95	Compliance

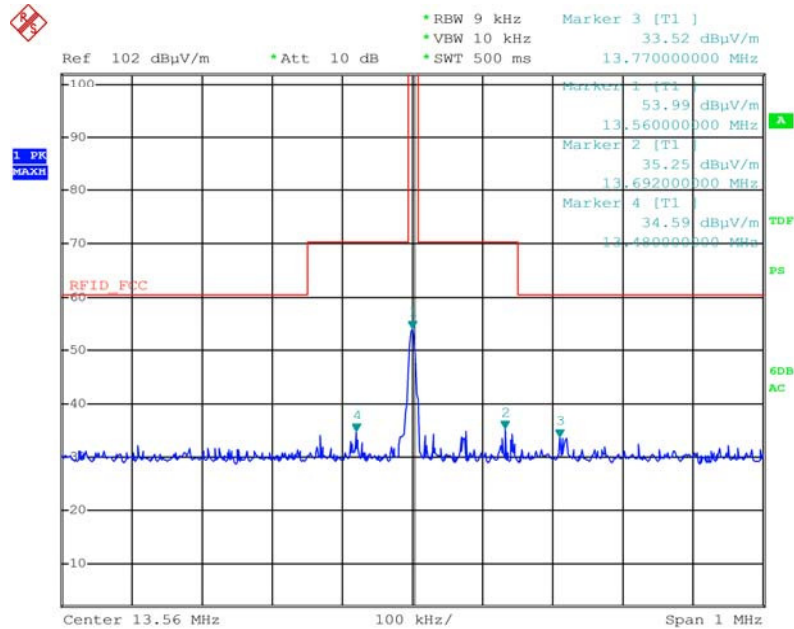
■ PoE

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Pre AMP (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)						
40.55	58.52	170	1.5	V	10.68	1.01	-40.51	29.70	40.00	10.30	Compliance
283.21	50.91	160	1.5	V	13.88	2.32	-41.31	25.80	46.00	20.20	Compliance
352.22	52.09	170	1.5	V	16.03	2.52	-41.09	29.54	46.00	16.46	Compliance
404.50	53.25	160	1.5	V	17.52	2.68	-40.93	32.52	46.00	13.48	Compliance
460.37	57.36	160	1.5	V	18.50	2.86	-40.67	38.05	46.00	7.95	Compliance

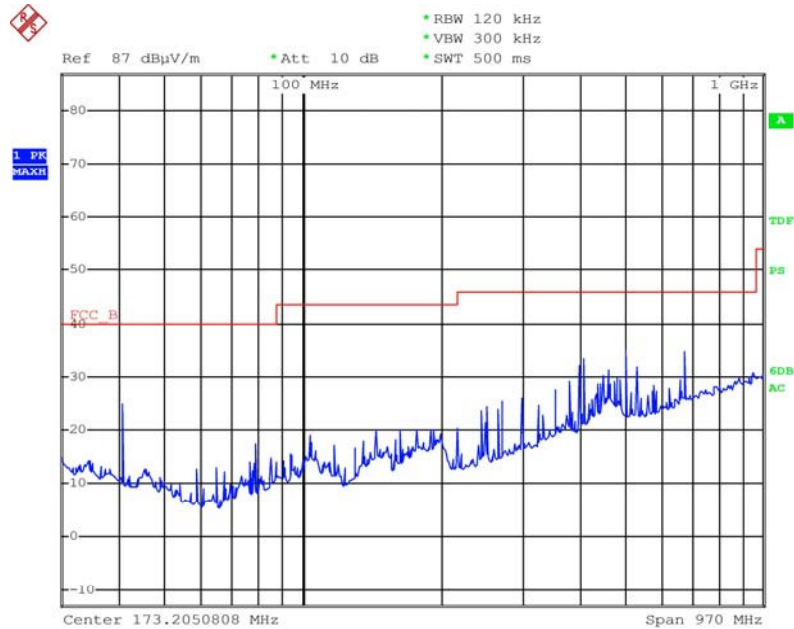
Freq.(MHz) : Measurement frequency, Reading(dB μ V/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table,
Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor
Cbl(dB) : Cable loss, Pre AMP(dB) : Preamplifier gain(dB)
Meas Result (dB μ V/m) : Reading(dB μ V/m)+ Antenna factor.(dB/m) + CL(dB) - Pre AMP(dB)
Limit(dB μ V/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB μ V/m) – Meas Result(dB μ V/m)

5.2.7 Test plot

■ Fundamental frequency level & ≤ 30 MHz spectrum mask



■ OUT- BAND Spurious



* Worst case only

5.3 AC Power Conducted emissions

5.3.1 Standard Applicable [FCC §15.207(a)]

For 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 frequencies hopping mode within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 uH/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

Frequency of Emission(MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

5.3.2 Test Environment conditions

- Ambient temperature : (19 - 21) °C
- Relative Humidity : (36 - 37) % R.H.

5.3.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.3.4 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Cal interval	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2017. 02. 02	1 year	●
LISN	ESH2-Z5	100044	R&S	2017. 02. 02	1 year	●
	ESH3-Z5	100147	R&S	2017. 02. 02	1 year	●

*Test Program: " ESXS-K1 V2.2"

Measurement uncertainty

Conducted Emission measurement: 3.5 dB (CL: Approx 95%, k=2)

5.3.5 Measurement Result

Line. Live

Kostec Co., Ltd.

29 Mar 2016 10:04

Conducted Emission

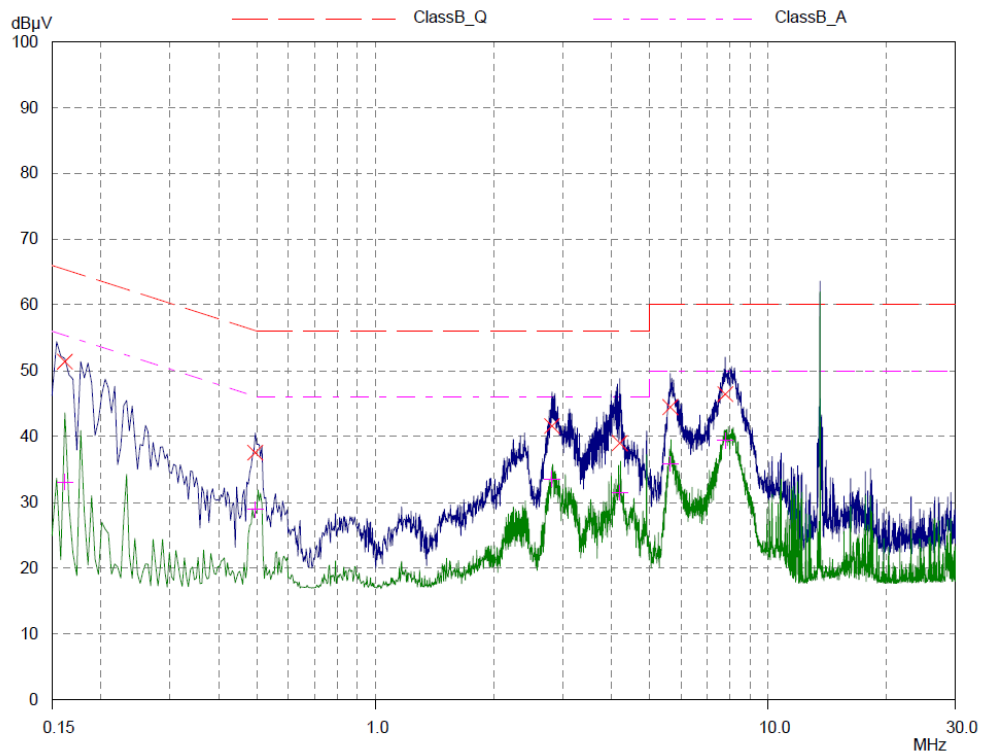
EUT: SG-2000
 Manuf: CHANG SHIN INFOTEL CO.,LTD
 Op Cond: AC 120V 60HZ
 Operator: LEE
 Test Spec: FCC Part 15
 Comment: L

Result File: 0052_1.dat : New Measurement

Scan Settings				Receiver Settings				
(1 Range)								
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	12	9kHz	30MHz	CNEFactor

Final Measurement: Detectors: X QP / + AV
 Meas Time: 1sec
 Subranges: 25
 Acc Margin: 50 dB



PAGE 1

Line. Live

Kostec Co., Ltd.

29 Mar 2016 10:04

Conducted Emission

EUT: SG-2000
Manuf: CHANG SHIN INFOTEL CO.,LTD
Op Cond: AC 120V 60HZ
Operator: LEE
Test Spec: FCC Part 15
Comment: L

Result File: 0052_I.dat : New Measurement

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	12	9kHz	30MHz	CNEFactor

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 50 dB

Final Measurement Results

Frequency MHz	QP Level dBμV	QP Limit dBμV	QP Delta dB
0.16171	51.38	65.38	14.00
0.49375	37.55	56.10	18.55
2.81406	41.61	56.00	14.39
4.18905	39.01	56.00	16.99
5.63437	44.46	60.00	15.54
7.77109	46.43	60.00	13.57

Frequency MHz	AV Level dBμV	AV Limit dBμV	AV Delta dB
0.16171	33.09	55.38	22.29
0.49375	28.94	46.10	17.16
2.81406	33.55	46.00	12.45
4.18905	31.49	46.00	14.51
5.63437	35.85	50.00	14.15
7.77109	39.40	50.00	10.60

* limit exceeded

PAGE 2



Line. Neutral

Kostec Co., Ltd.

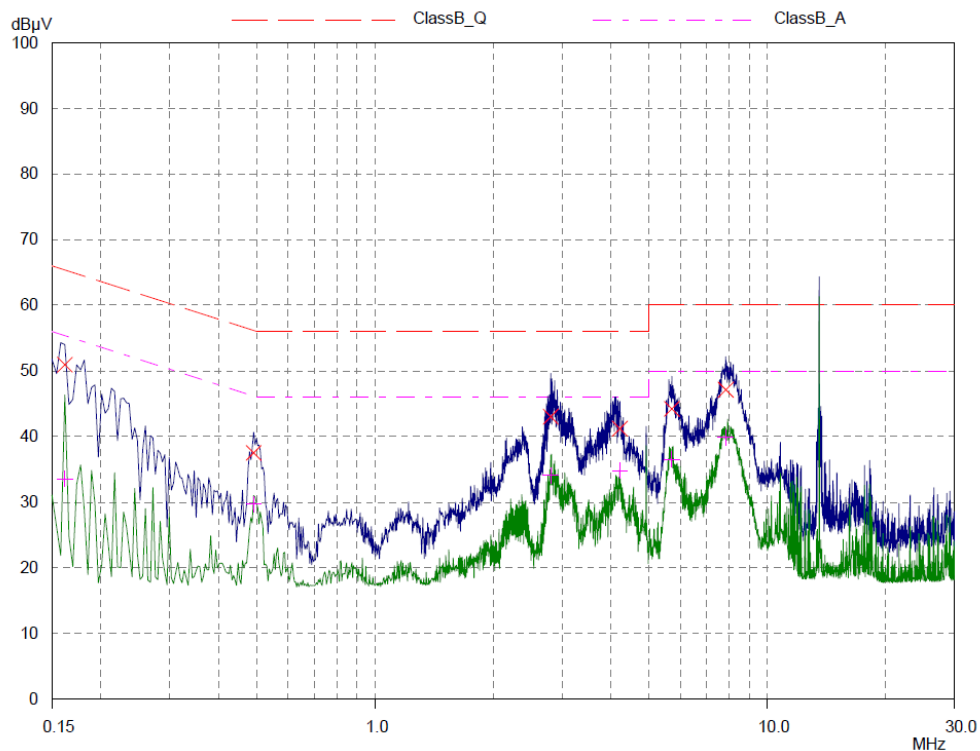
29 Mar 2016 10:10

Conducted Emission

EUT: SG-2000
Manuf: CHANG SHIN INFOTEL CO.,LTD
Op Cond: AC 120V 60HZ
Operator: LEE
Test Spec: FCC Part 15
Comment: N

Result File: 0052_n.dat : New Measurement

Scan Settings		(1 Range)			Receiver Settings				
Frequencies		Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
Start	Stop								
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB	
Transducer	No.	Start	Stop	Name					
	12	9kHz	30MHz	CNEFactor					
Final Measurement:		Detectors:	X QP / + AV						
		Meas Time:	1sec						
		Subranges:	25						
		Acc Margin:	50 dB						



PAGE 1

Line. Neutral

Kostec Co., Ltd.

29 Mar 2016 10:10

Conducted Emission

EUT: SG-2000
Manuf: CHANG SHIN INFOTEL CO.,LTD
Op Cond: AC 120V 60HZ
Operator: LEE
Test Spec: FCC Part 15
Comment: N

Result File: 0052_n.dat : New Measurement

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer No. 12
Start 9kHz
Stop 30MHz
Name CNEFactor

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 50 dB

Final Measurement Results

Frequency MHz	QP Level dBμV	QP Limit dBμV	QP Delta dB
0.16171	50.94	65.38	14.44
0.48984	37.51	56.17	18.66
2.80234	43.03	56.00	12.97
4.20468	41.21	56.00	14.79
5.70468	44.24	60.00	15.76
7.82968	47.13	60.00	12.87

Frequency MHz	AV Level dBμV	AV Limit dBμV	AV Delta dB
0.16171	33.55	55.38	21.83
0.48984	29.68	46.17	16.49
2.80234	34.07	46.00	11.93
4.20468	34.80	46.00	11.20
5.70468	36.53	50.00	13.47
7.82968	39.86	50.00	10.14

* limit exceeded

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5.4 Antenna requirement

5.4.1 Standard applicable [FCC §15.203, §15.247(4)(1)]

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit So that broken antenna can be replaced by the user, but the Use of a standard antenna jack or electrical connector is prohibited.

The NFC antenna is built-in PCB of EUT So this product is complies with the requirement of §15.203.

5.5 20 dB bandwidth measurement

5.5.1 Standard applicable [FCC §2.1049]

The 20 dB bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

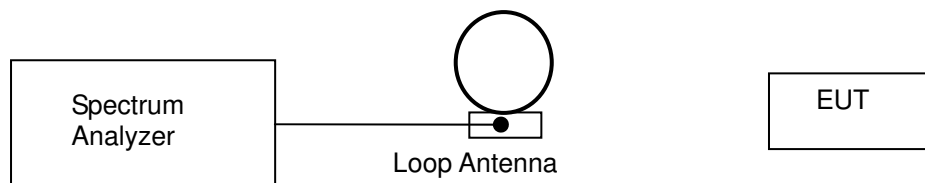
5.5.2 Test Environment conditions

- Ambient temperature : (22 - 23) °C
- Relative Humidity : (50 - 52) % R.H.

5.5.3 Measurement Procedure

Please refer 5.5.1

5.5.4 Test setup



5.5.5 Measurement Result

Frequency	20 dB bandwidth
13.56 MHz	6.19 kHz

5.5.6 Test plot

