

FCC TEST REPORT

Reference No. : G-44-2014-00652

Applicant Name : SEJIN ELECTRON INC.

Equipment Under Test (EUT) :

Product Name : MINI TRACKBALL KEYBOARD

Model Name : SPR-8695T

FCC Type : Verification

Applied Standards : FCC Part 15 Subpart B Class B

Date of Receipt : February 20, 2014

Date of Test : March 26, 2014 ~ March 27, 2014

Date of Issue : April 03, 2014

Test Results : Complied

Tested by

:


Richard Kim

Reviewed by

:


Carl Lee

Remarks :

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1. General Information

1.1 Client Information

Applicant : SEJIN ELECTRON INC.
Address of Applicant : 4F, SJ-technoville, 60-19, Gasan-dong, Geumcheon-gu, Seoul, Korea 153-769

Manufacturer : SEJIN ELECTRON INC.
Address of Manufacturer : 4F, SJ-technoville, 60-19, Gasan-dong, Geumcheon-gu, Seoul, Korea 153-769

FCC ID : GJJSPR-8695T

1.2 Test Laboratory

Name and Address : SGS Korea Co., Ltd.
23, Giheungdanji-ro 24beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Korea
35, Giheungdanji-ro 121beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Korea
FCC Registration No. : 656853
Phone : + 82 31 548 0711
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e-mail : Carl.Lee@sgs.com

1.3 General Information of E.U.T.

Product Name	MINI TRACKBALL KEYBOARD
Model Name	SPR-8695T
Serial No.	None
EMI Classification	Class B
I/O Ports	PS/2 Keyboard, PS/2 Mouse
Test Voltage	120V 60Hz
Internal Clock Frequency	6 MHz

1.4 Operating Modes and Conditions

Operating mode	Operating condition
Operating Mode	Was measured at a controlling state of a personal computer.

1.4.1 Monitoring Method

- Was confirmed the operating status and error.

1.5 Auxiliary Equipments

Description	Model	Serial No.	Manufacturer
LCD Monitor	L1753TS	-	LG Electronics Inc.
Personal computer	-	-	Dell

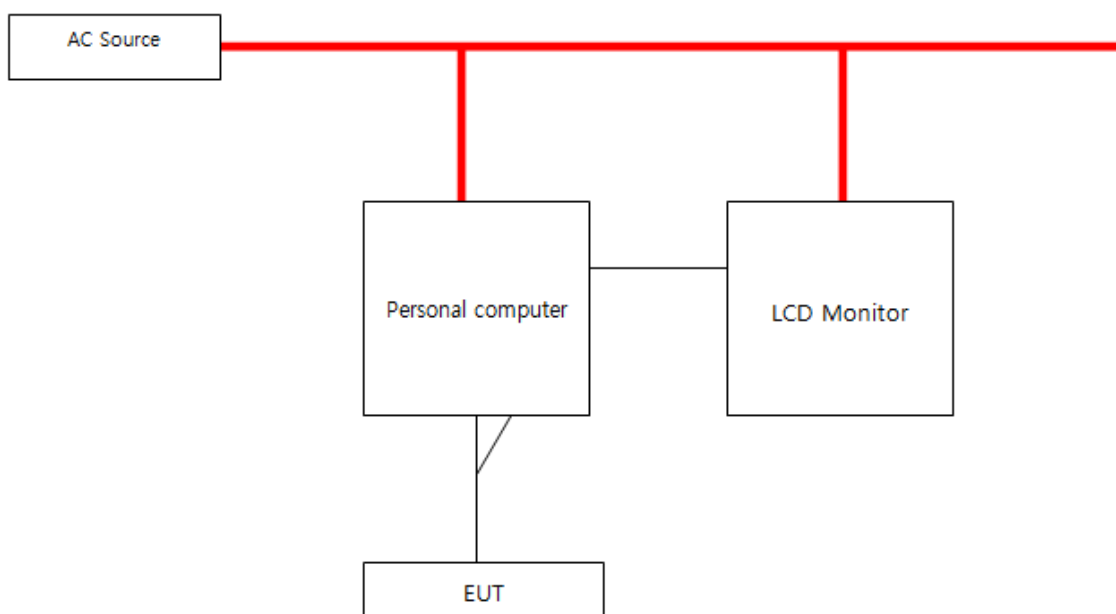
1.6 Cable List

Start		END		Cable Spec.	
Name	I/O Port	Name	I/O Port	Length(m)	Shield
EUT	PS/2 KEYBOARD	Personal computer	PS/2 KEYBOARD	1.0	Unshield
	PS/2 MOUSE		PS/2 MOUSE	1.0	Unshield
Personal computer	RGB	LCD 모니터	RGB	1.7	Unshield
	AC IN	AC Source	-	1.5	Unshield
LCD Monitor	AC IN	AC Source	-	1.3	Unshield

1.7 System Configurations

Description	Model	Serial No.	Manufacturer
Main Board	SPR-8695T REV 1.1	321-001-0675	SEJIN ELECTRON INC.
SENSOR Board	OPTICAL SENSOR REV 0.1	321-001-0679	-
Pattern Board 1	SWK-8695 KO-3 C/T UPPER REV.0	411-001-0241	-
Pattern Board 2	SWK-8695 KO-3 C/T BOTTOM REV.0	411-002-0243	-

1.8 Test System Layout



1.9 Modifications

There was no modified item during the test.

1.10 Applicable Standards for Testing

Standards	Status	Deviation
FCC Part 15 : Subpart B ANSI C63.4 : 2009	Applicable	No Deviation

1.11 Summary of Test Results

Test Item	Standards	Results
Conducted Emission	FCC Part 15 : Subpart B ANSI C63.4 : 2009	Complied
Radiated Emission	FCC Part 15 : Subpart B ANSI C63.4 : 2009	Complied

Note : Test methods of all test items are performed according to the basic standards in this table.

EMISSION

2.1 Test Results

Test Items	Standards	Test Results
Conducted Emission	FCC Part 15 : Subpart B ANSI C63.4 : 2009	Complied
Radiated Emission	FCC Part 15 : Subpart B ANSI C63.4 : 2009	Complied

2.2 Test Method and Limits

2.2.1 Test Method

Test Items	Measuring Frequency Range	RBW	Measuring Distance
Conducted Emission	0.15 MHz ~ 30 MHz	9 kHz	-
Radiated Emission	30 MHz ~ 1 GHz	120 kHz	10 m & 3 m
	Above 1 GHz	1 MHz	3 m

Note : 10 m method of radiated emission measurement is only applied to Class A equipment over the frequency range of 30 MHz ~ 1 GHz. Except this, 3 m method is applied to Class B equipment over the frequency range of 30 MHz ~ 1 GHz and Class A and Class B equipment above 1 GHz.

2.2.2 Test Limits

-Conducted Emission Limits

Frequency Range	Limits(dB(μ V))		Class
	Quasi-peak	Average	
0.15 MHz ~ 0.5 MHz	79	66	Class A
0.5 MHz ~ 30 MHz	73	60	
0.15 MHz ~ 0.5 MHz	66 to 56	56 to 46	Class B
0.5 MHz ~ 5 MHz	56	46	
5 MHz ~ 30 MHz	60	50	

Note : The lower limit shall apply at the transition frequencies. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

-Radiated Emission Limits below 1 GHz

Frequency Range	Limits(dB(μ V/m))	Class
	Quasi-peak	
30 MHz ~ 88 MHz	39.1	Class A (10 m method)
88 MHz ~ 216 MHz	43.5	
216 MHz ~ 960 MHz	46.4	
960 MHz ~ 1 GHz	49.5	
30 MHz ~ 88 MHz	40	Class B (3 m method)
88 MHz ~ 216 MHz	43.5	
216 MHz ~ 960 MHz	46	
960 MHz ~ 1 GHz	54	

-Radiated Emission Limits above 1 GHz (3m method)

Frequency Range	Limits(dB(μ V/m))		Class
	Average	Peak	
Above 1 GHz	59.5	79.5	Class A
Above 1 GHz	54	74	Class B

Note : The limits of class A equipment is extrapolated using an extrapolation factor of 20 dB/decade because it was measured at 3m distance not 10m distance.

2.3 Conducted Emission

The initial preliminary exploratory scans were performed over the measuring frequency range (0.15 MHz to 30 MHz) using a max hold mode incorporating a Peak detector and Average detector and using the software of EMC32 (Version V8.50 from R&S). The final test data was measured using a Quasi-Peak detector and CISPR Average detector.

2.3.1 Test Equipments

Equipment	Model	Manufacturer	Serial No	Last Cal. Date
EMI TEST RECEIVER	ESU26	R&S	100194	2013.09.13
2-LINE V-NETWORK	ENV216	R&S	101180	2013.05.15
ARTIFICIAL MAIN NETWORK	ESH2-Z5	R&S	100303	2014.01.08
Shield Room	-	SY CORPORATION	-	-

2.3.2 Test Site

Shield Room in Giheung Laboratory

2.3.3 Environment Conditions

Temperature : (22.3 ~ 22.4) °C

Humidity : (35.2 ~ 35.3) %R.H.

Atmospheric Pressure : (101.1 ~ 101.1) kPa

Test Date : March 26, 2014

2.3.4 Test Results

Freq.	Line	Level (dB μ V)		CL	LISN	Result(dB μ V)		Limit (dB μ V)		Margin (dB)	
(MHz)	(H/N)	QP	C-AV	(dB)	(dB)	QP	C-AV	QP	C-AV	QP	C-AV
0.20	N	35.90	23.40	0.00	9.70	45.60	33.10	63.69	53.69	18.09	20.59
0.39	N	28.60	25.80	0.00	9.70	38.30	35.50	57.98	47.98	19.68	12.48
0.59	N	31.15	26.55	0.00	9.65	40.80	36.20	56.00	46.00	15.20	9.80
1.84	N	32.50	27.00	0.00	9.60	42.10	36.60	56.00	46.00	13.90	9.40
12.95	N	34.04	26.34	0.16	9.50	43.70	36.00	60.00	50.00	16.30	14.00
28.39	N	32.70	27.30	0.20	9.70	42.60	37.20	60.00	50.00	17.40	12.80
0.20	H	36.30	26.60	0.00	9.70	46.00	36.30	63.69	53.69	17.69	17.39
0.39	H	30.80	28.20	0.00	9.70	40.50	37.90	57.98	47.98	17.48	10.08
0.85	H	33.90	29.70	0.00	9.70	43.60	39.40	56.00	46.00	12.40	6.60
1.84	H	33.48	28.48	0.00	9.62	43.10	38.10	56.00	46.00	12.90	7.90
5.26	H	31.30	24.80	0.10	9.50	40.90	34.40	60.00	50.00	19.10	15.60
12.96	H	33.52	22.72	0.16	9.62	43.30	32.50	60.00	50.00	16.70	17.50

Measurement Uncertainty : ± 2.67 dB (The confidential level is about 95 %, $K = 2$)

Note : • Line (H) : Hot

• Margin = Limit – Result

• Line (N) : Neutral

• Result = Level + CL + LISN

Ex) In case

Freq ; 0.5 MHz, level ; 30 dB(μ V), CL ; 0.2 dB, LISN ; 9.5 dB

Result = Level + CL + LISN

= 30 + 0.2 + 9.5

= 39.7

Margin = Limit – Result

= 79- 39.7

= 39.3

See Appendix A (Conducted Emission)

2.4 Radiated Emission

The initial preliminary exploratory scans were performed at 3 m distance over the measuring frequency range(30 MHz to 1 GHz) using a max hold mode incorporating a Peak detector and using the software of EMC32 (Version V8.50 from R&S). The final test data was measured using a Quasi-Peak detector. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency.

2.4.1 Test Equipments

Equipment	Model	Manufacturer	Serial No	Last Cal. Date
EMI TEST RECEIVER	ESU8	R&S	100128	2014.02.11
BILOG ANTENNA	VULB 9163	SCHWARZBECK	9163-390	2012.04.19
AMPLIFIER	8447D	HP	2727A05297	2013.07.09
3m SEMI-ANECHOIC CHAMBER	-	Will Tech	-	-

Note : The Antenna calibration period is 2 years, but the other equipment calibration period are 1 year.

2.4.2 Test Site

3m SEMI-ANECHOIC CHAMBER in Giheung Laboratory

2.4.3 Environment Conditions

- Below 1 GHz

Temperature : (12.3 ~ 12.4) °C

Humidity : (27.6 ~ 27.7) % R.H.

Atmospheric Pressure : (101.1 ~ 101.1) kPa

Test Date : March 26, 2014

2.4.4 Test Results

Below 1 GHz (3 m method)

Freq. (MHz)	Level (dB(μ V))	Pol. (H/V)	A ($^{\circ}$)	H (cm)	AF (dB/m)	CL (dB)	Amp. (dB)	Result (dB(μ V/m))	Limit (dB(μ V/m))	Margin (dB)
36.18	44.68	V	44	300	14.40	0.72	26.00	33.80	40.00	6.20
40.67	30.33	H	344	280	11.95	0.81	25.99	17.10	40.00	22.90
61.77	55.38	V	78	270	5.22	1.10	25.90	35.80	40.00	4.20
66.01	44.38	H	213	320	5.42	1.10	25.90	25.00	40.00	15.00
101.17	45.58	V	157	170	10.70	1.31	25.79	31.80	43.50	11.70
114.63	37.88	H	159	380	11.88	1.37	25.73	25.40	43.50	18.10
163.01	50.11	V	87	220	9.35	1.42	25.48	35.40	43.50	8.10
164.59	46.06	H	11	310	9.30	1.42	25.48	31.30	43.50	12.20
245.83	36.81	V	145	160	12.73	1.97	25.21	26.30	46.00	19.70
327.31	36.11	H	347	210	14.76	2.08	25.35	27.60	46.00	18.40

Measurement Uncertainty (Horizontal) : ± 4.50 dB (The confidential level is about 95%, K=2)

Measurement Uncertainty (Vertical) : ± 4.54 dB (The confidential level is about 95%, K=2)

- Note :
- AF = Antenna Factor
 - CL = Cable Loss
 - Amp = Amplifier Gain
 - POL H = Horizontal
 - POL V = Vertical
 - A : Angle
 - H : Height
 - Margin = Limit – F/S
 - Result = Level + AF + CL – Amp

Ex) In case

Freq ; 100 MHz, level ; 30 dB(μ V/m), AF ; 10 dB/m, CL ; 4 dB, Amp ; 25 dB

Result = Level + AF + CL – Amp

$$= 30 + 10 + 4 - 25$$

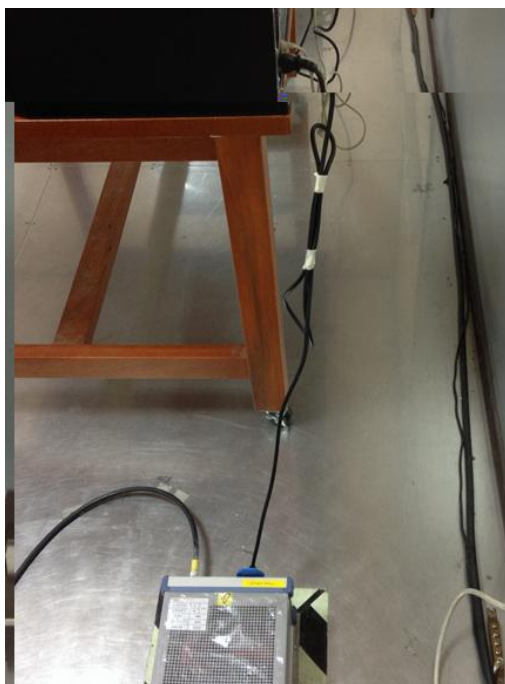
$$= 19$$

Margin = Limit – Result

$$= 43.5 - 19$$

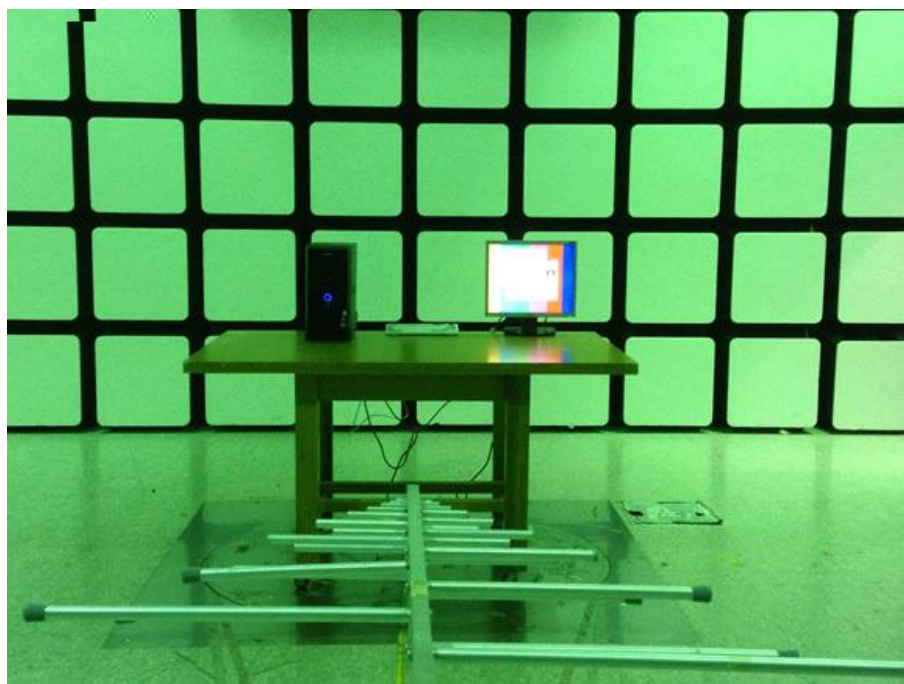
$$= 24.5$$

2.5 Photographs of Conducted Emission



2.6 Photographs of Radiated Emission

Below 1 GHz(3 m Method)



3. Photographs of EUT

- Front View of EUT



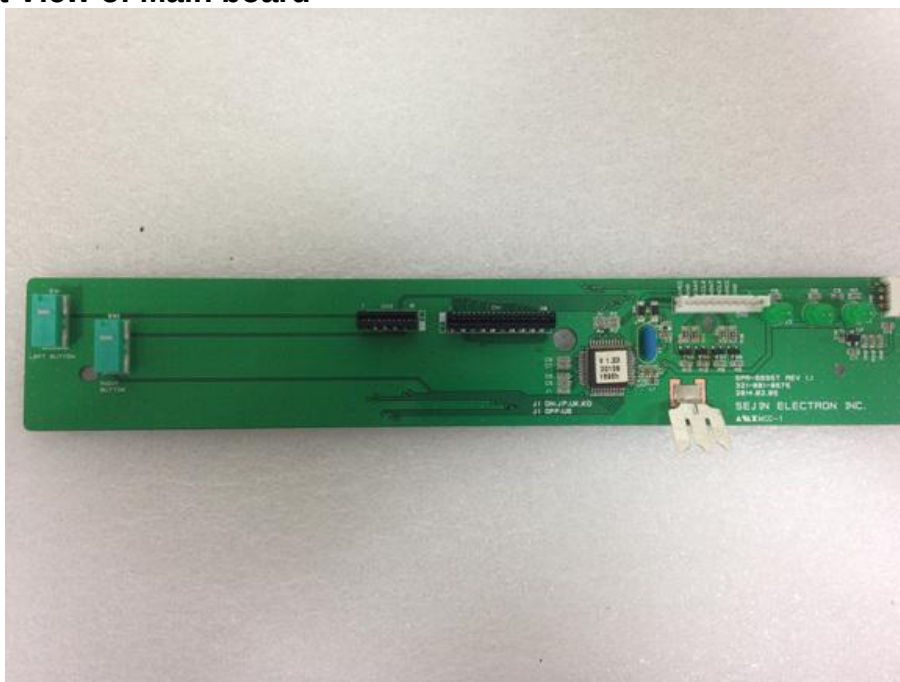
- Rear View of EUT



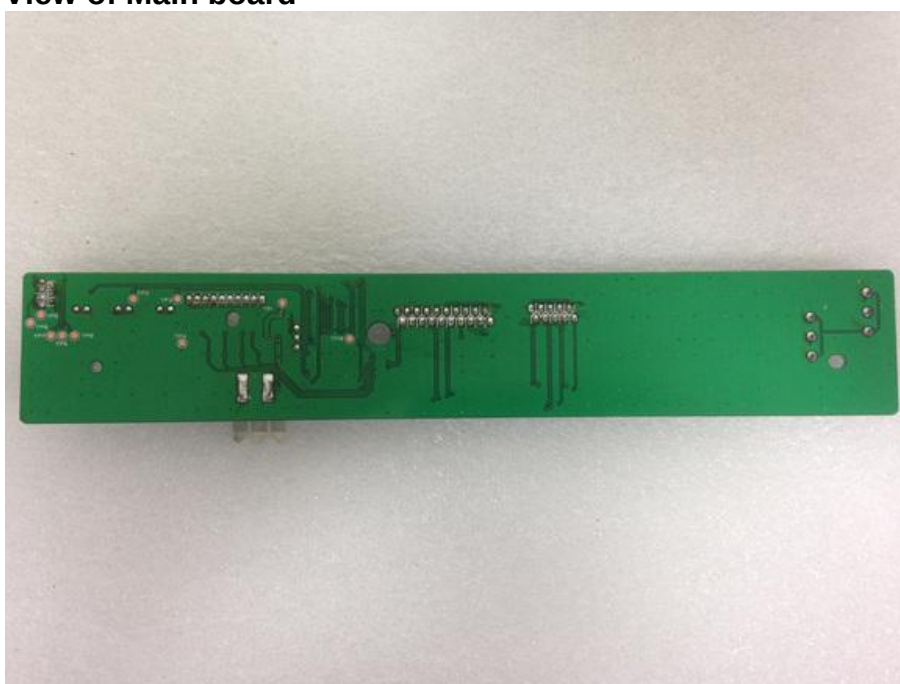
- Internal View of EUT



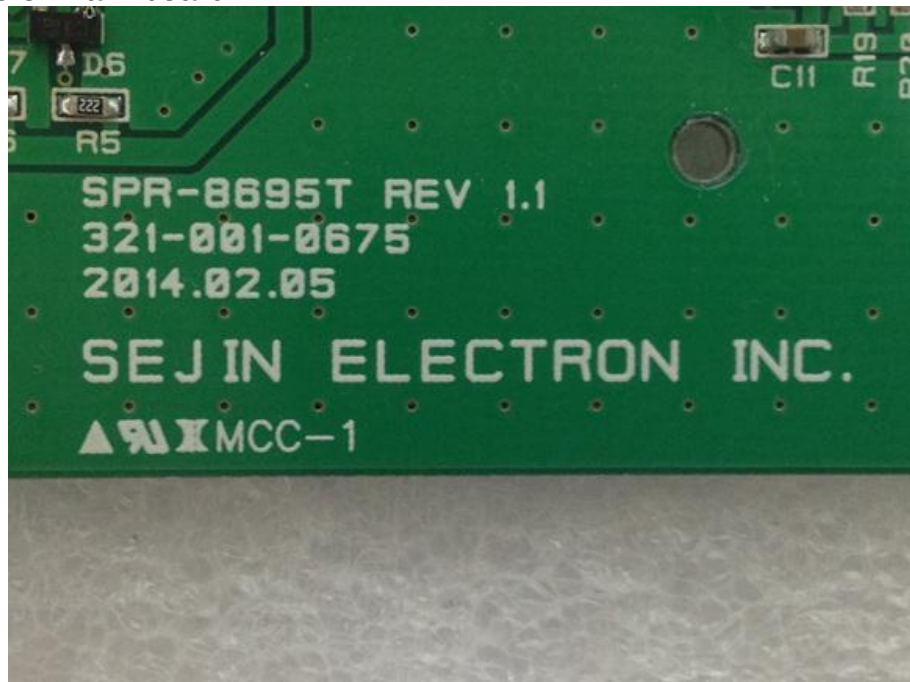
- Front View of Main board



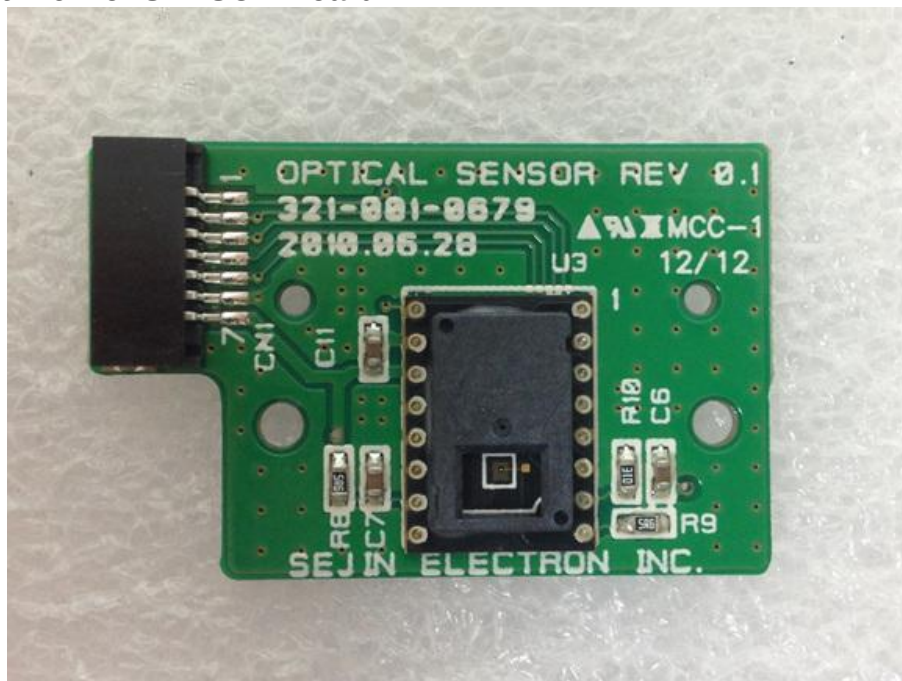
- Rear View of Main board



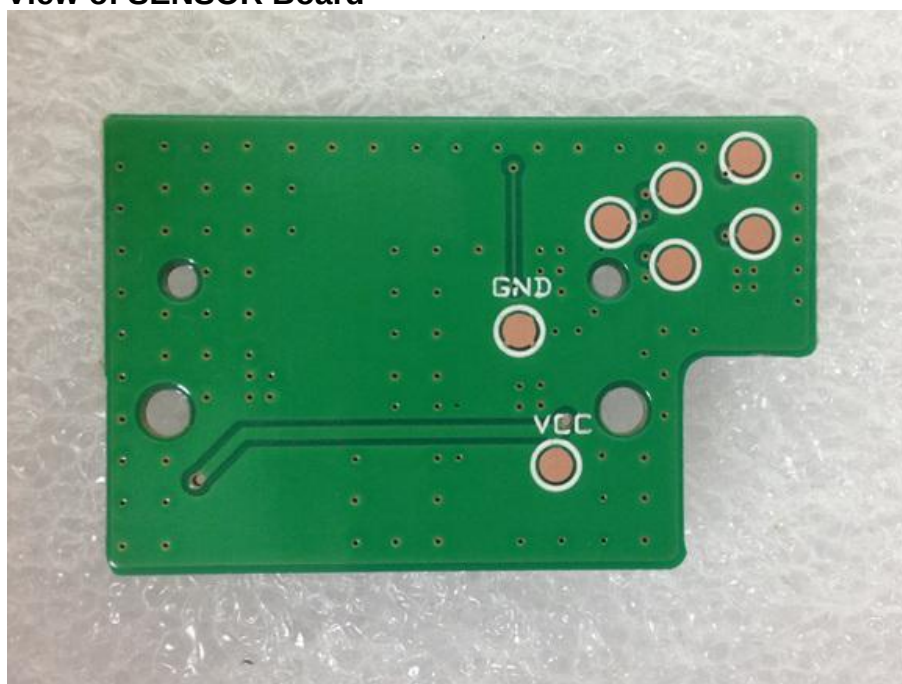
- Lable of Main board



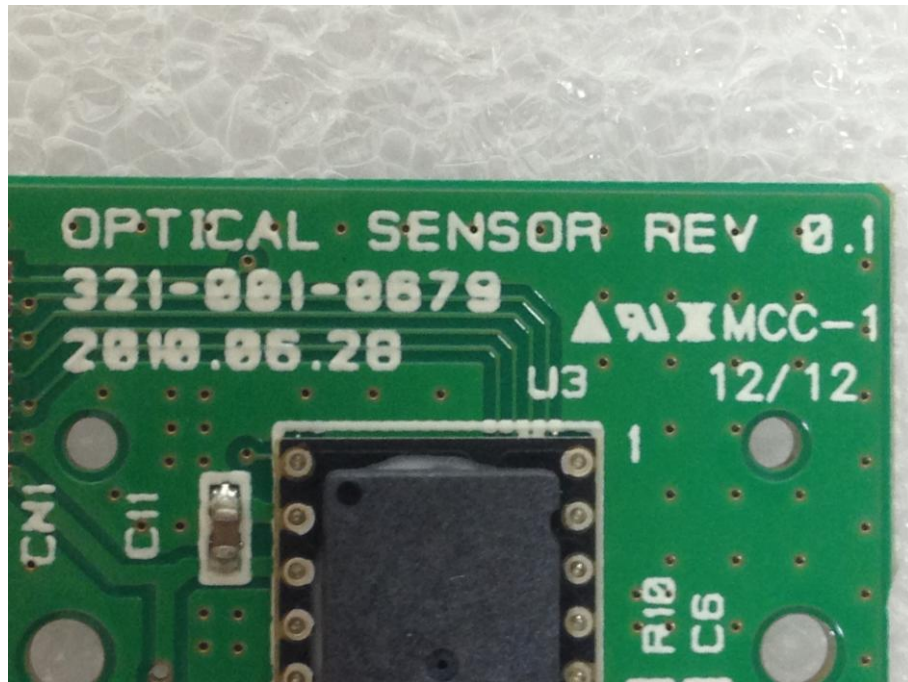
- Front View of SENSOR Board



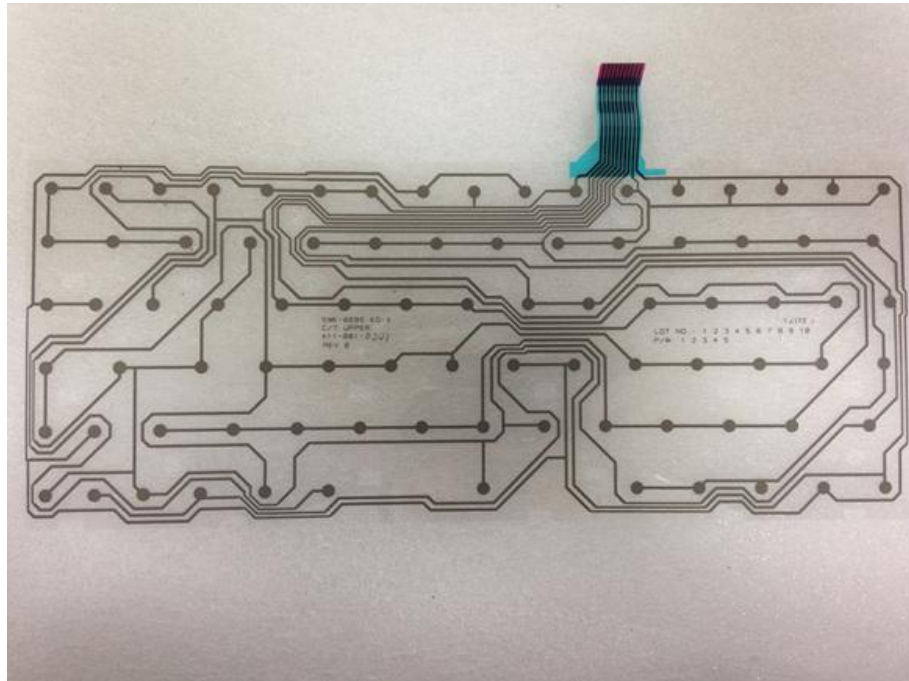
- Rear View of SENSOR Board



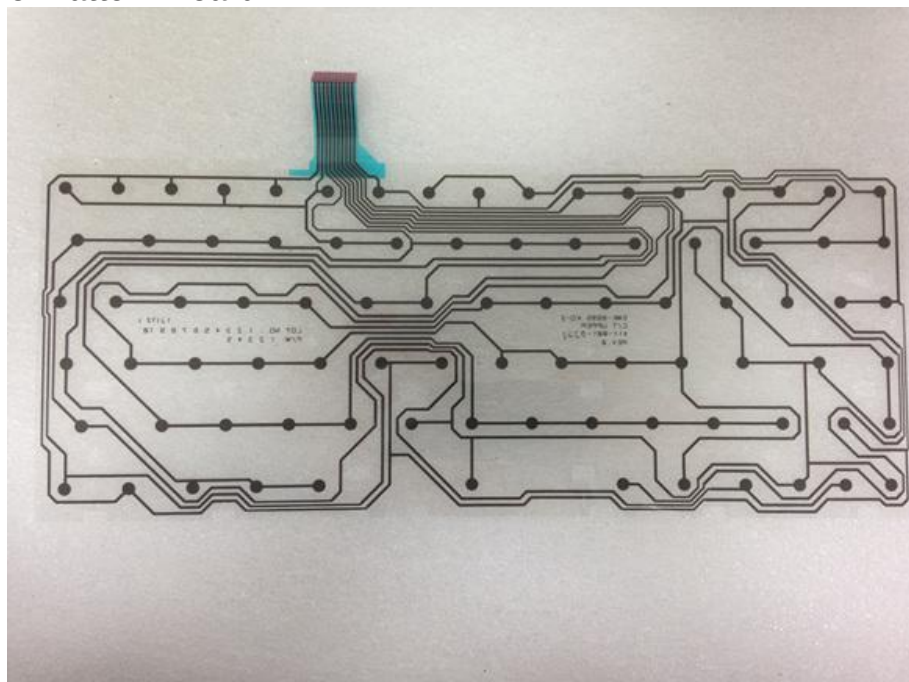
- Lable of SENSOR Board



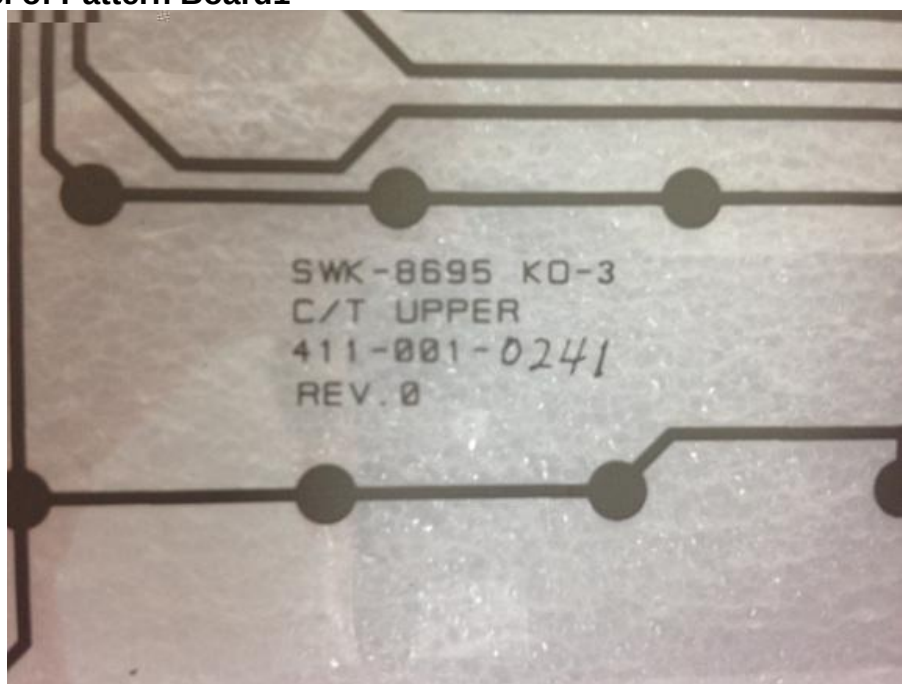
- View of Pattern Board1



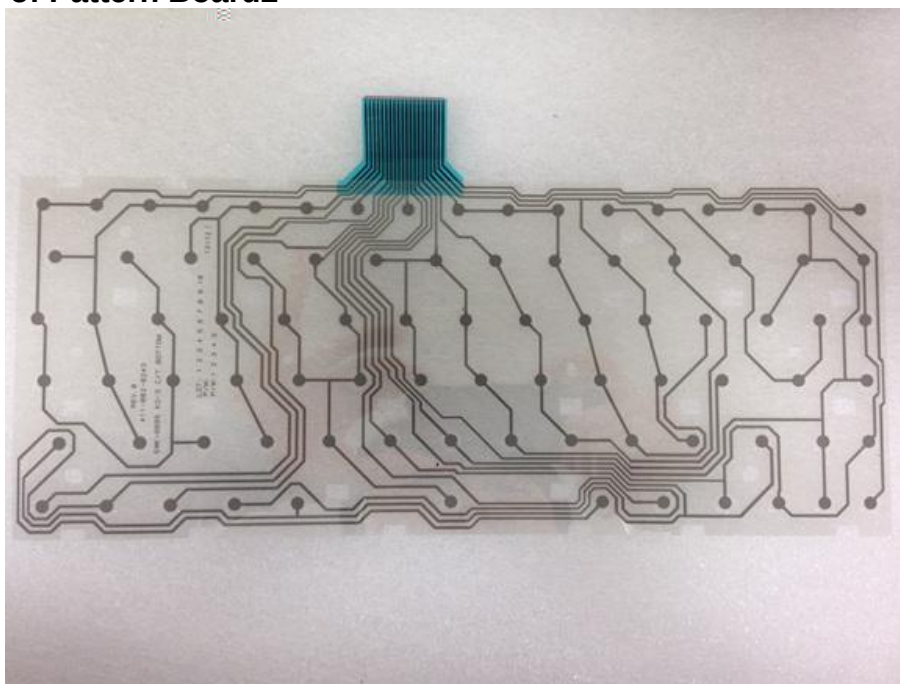
- View of Pattern Board1



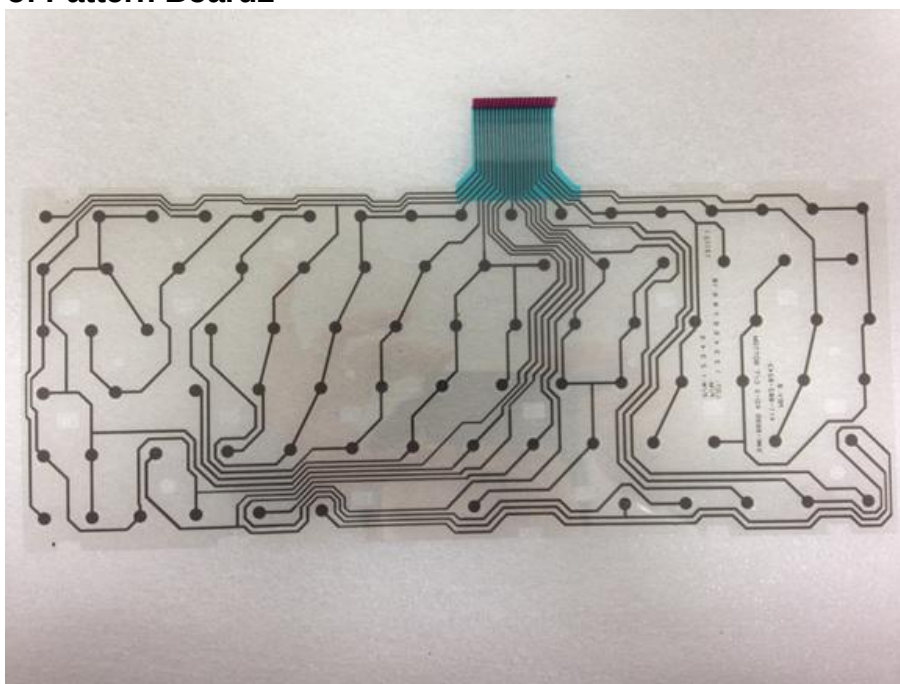
- Label of Pattern Board1



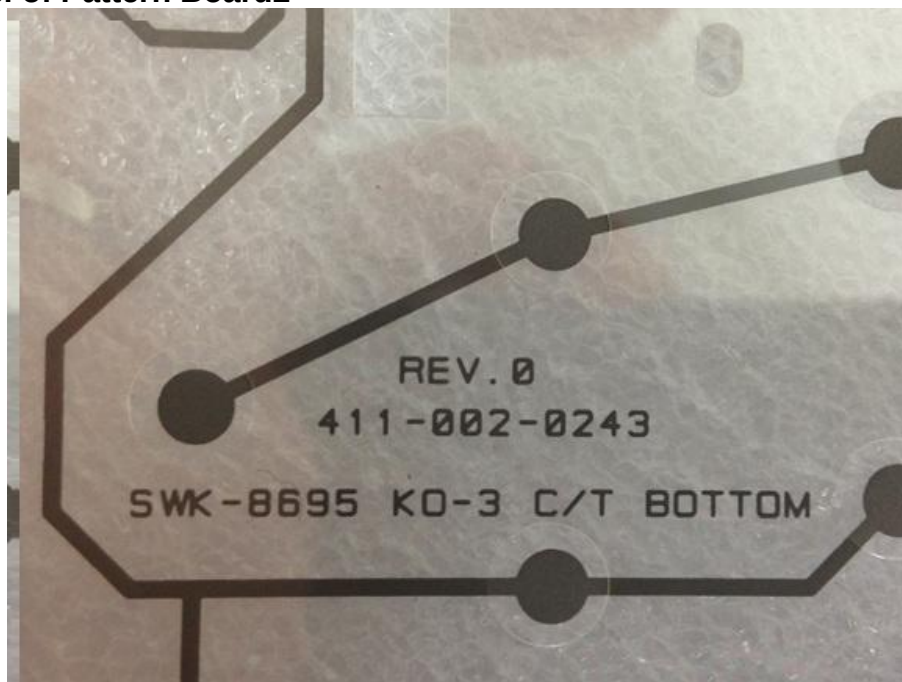
- View of Pattern Board2



- View of Pattern Board2



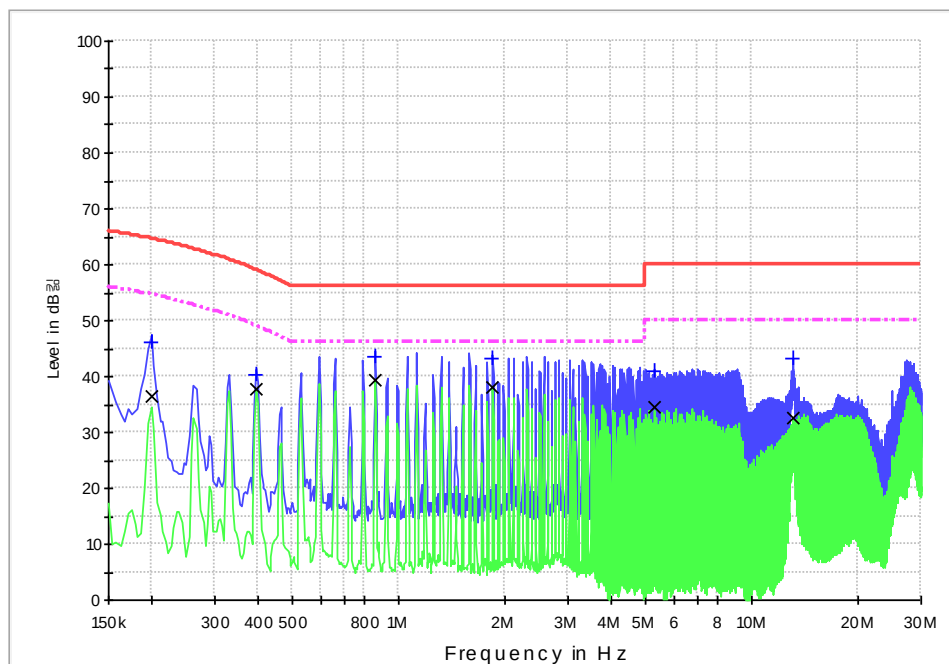
- Label of Pattern Board2



Appendix A : Conducted Emission

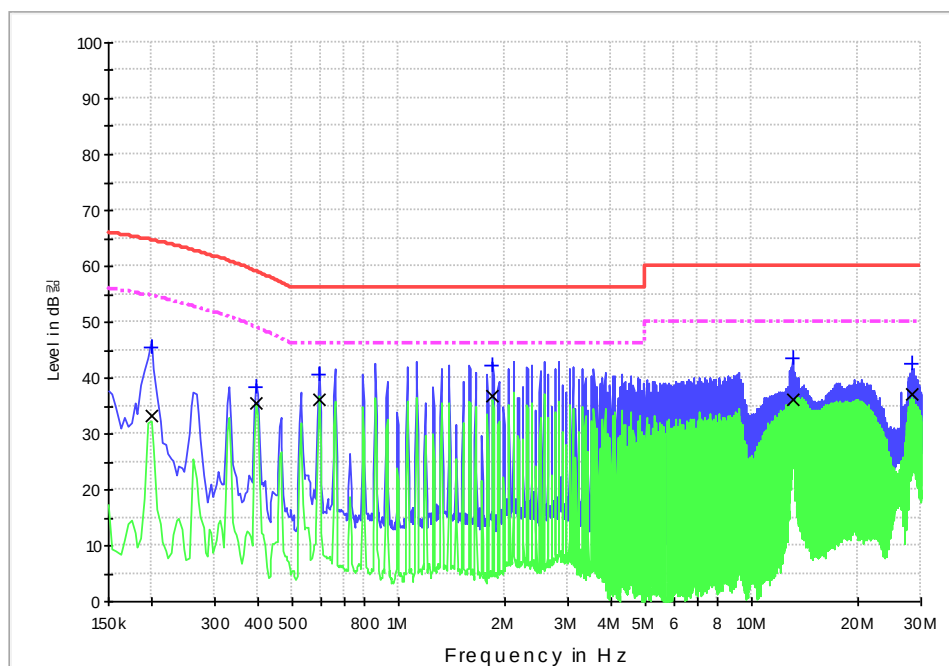
L1

LISN ENV216 (150kHz-30MHz) Pre



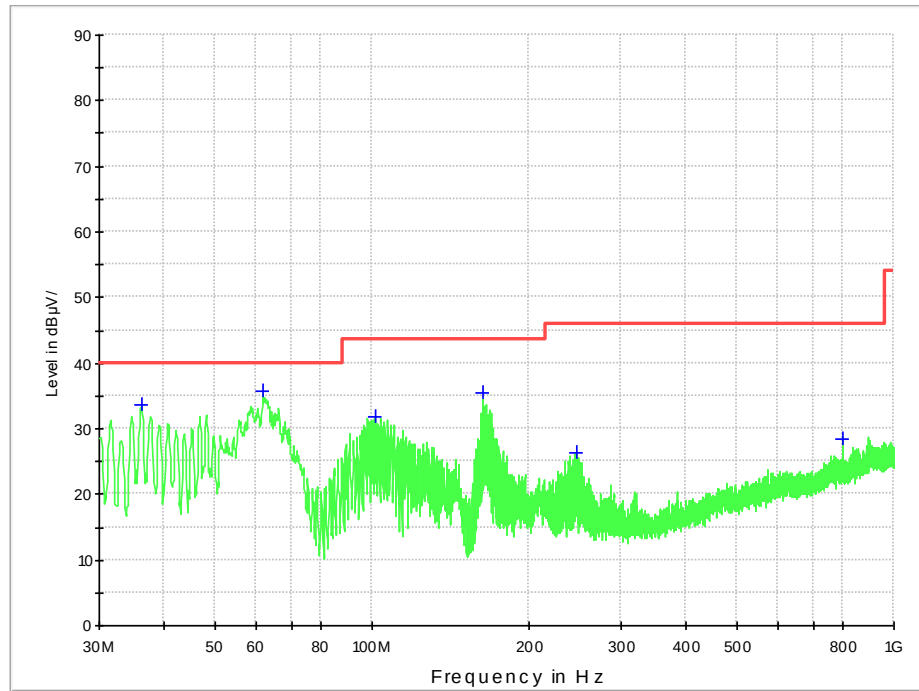
N

LISN ENV216 (150kHz-30MHz) Pre



Appendix B : Radiated Emission Below 1 GHz

Vertical



Horizontal

