

FCC TEST REPORT

for

47 CFR, Part 15, Subpart C

Equipment : Wireless Keyboard

Model No. : AKM-C35xx, AKM-75C35, AKM-96C35,
AKM-93C35, AKM-105C35, AKM-75Cxx,
AKM-96Cxx, AKM-93Cxx, AKM-105Cxx,
AKM-0350xx, DA-20114

FCC ID : HQXAKM-C35

Filing Type : Certification

Applicant : **SYSGRATION LTD.**
10Fl., No. 868-3, Chung Cheng Rd., Chung Ho, Taipei,
Taiwan, R.O.C., Zip 235

- The test result refers exclusively to the test presented test model / sample.
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SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

SPORTON International Inc.

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History of this test report

Original Report Issue Date: Oct. 31, 2003

No additional attachment.

Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

CERTIFICATE OF COMPLIANCE

for

47 CFR, Part 15, Subpart C

Equipment : Wireless Keyboard

Model No. : AKM-C35xx, AKM-75C35, AKM-96C35,
AKM-93C35, AKM-105C35, AKM-75Cxx,
AKM-96Cxx, AKM-93Cxx, AKM-105Cxx,
AKM-0350xx, DA-20114

FCC ID : HQXAKM-C35

Filing Type : Certification

Applicant : **SYSGRATION LTD.**
10Fl., No. 868-3, Chung Cheng Rd., Chung Ho, Taipei,
Taiwan, R.O.C., Zip 235

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 2001** and the energy emitted by this equipment was **passed** all test items required in FCC Part 15 subpart C, relative to the equipment under test. Testing was carried out on Oct. 06, 2003 at **SPORTON International Inc. LAB.**



Alex Chen
Manager

SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

1. General Description of Equipment under Test

1.1. Applicant

SYSGRATION LTD.

10Fl., No. 868-3, Chung Cheng Rd., Chung Ho, Taipei, Taiwan, R.O.C., Zip 235

1.2. Manufacturer

Sysgration (Shenzhen) Ltd.

Egongling Village, Pinhu Town, Longgang, Shenzhen, China

1.3. Basic Description of Equipment under Test

Equipment : Wireless Keyboard
Model No. : AKM-C35xx, AKM-75C35, AKM-96C35, AKM-93C35, AKM-105C35, AKM-75Cxx,
AKM-96Cxx, AKM-93Cxx, AKM-105Cxx, AKM-0350xx, DA-20114
FCC ID : HQXAKM-C35
Trade Name : Agiler, Sysgration
Power Supply Type : From battery 3V
AC Power Input : N/A

1.4. Feature of Equipment under Test

- Working Frequency: 27.095MHz
- Channel number: 1
- ID Number: 256
- RF output power: 2dBm
- Deviation: 6kHz \pm 2kHz
- Modulation method: FSK
- Power requirements: 3.0V, AA size battery 2 pieces
- Current Dissipation: 4mA (Max.)
- Standby Mode Current: 2mA (Max.)
- Sleeping Mode Current: 0.5mA (Max.)
- Transmitting Angle: 360°
- Working Distance: 1.5 meters (Min.)

2. Test Configuration of Equipment under Test

2.1. Test Manner

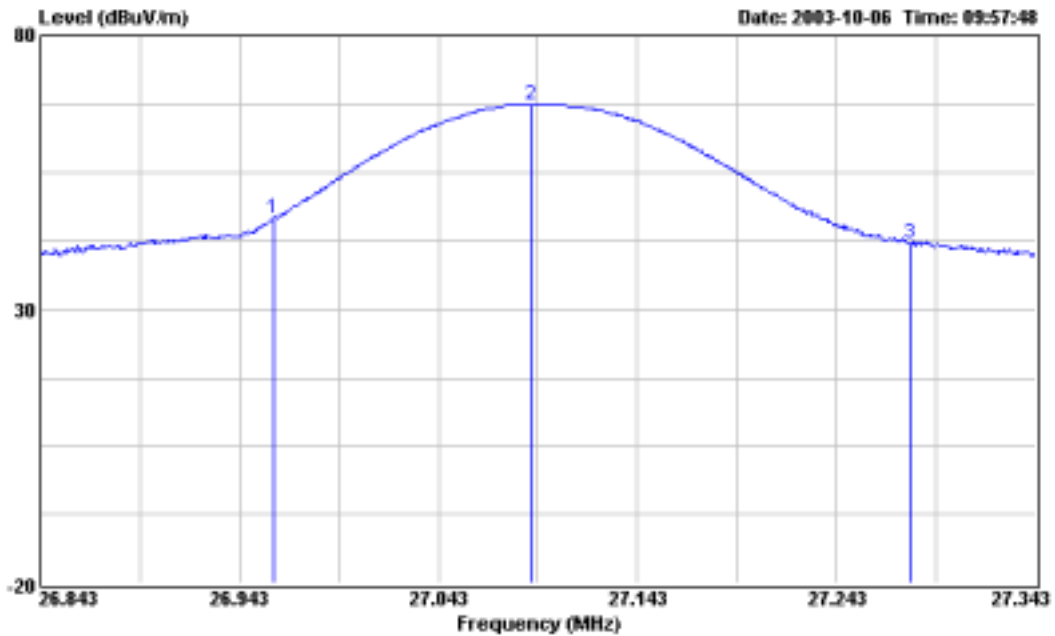
- a. The EUT has been associated with personal computer and peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner which tended to maximize its emission characteristics in a typical application.
- b. Frequency range investigated: radiation 30 MHz to 1000MHz.

2.2. Description of Test System

The EUT was tested alone. No support devices is needed for testing.

2.3. Band edge compliance plot per 15.227(b).

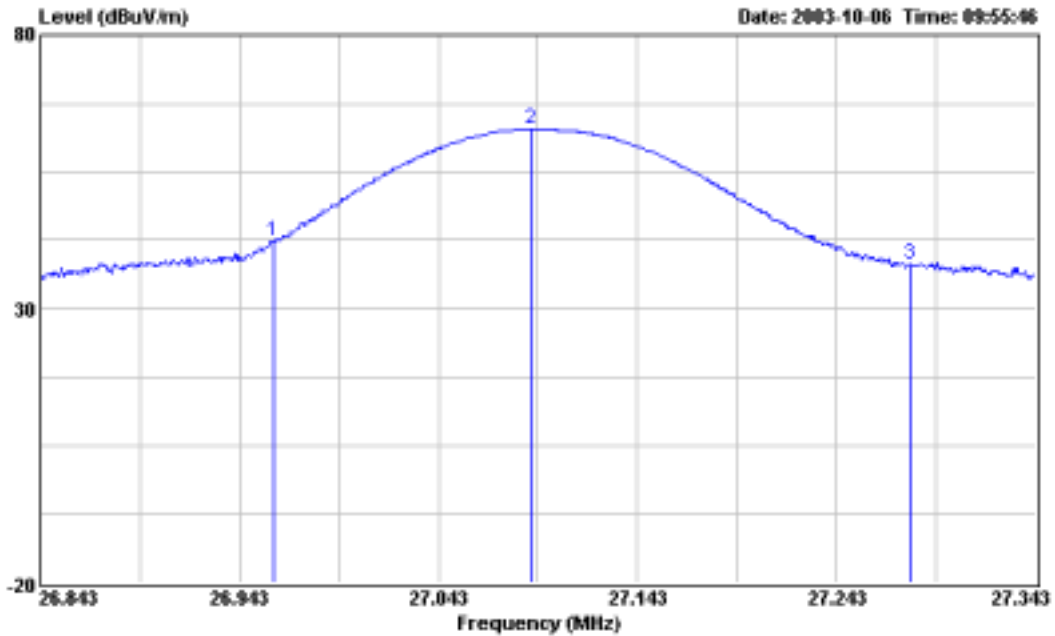
<HORIZONTAL>



Conformation of the fundamental frequency

Frequency (MHz)	Antenna Polarity	Cable Factor	Cable Loss	Reading (dBuV)	Limits (dBuV/m)	Emission (uV/m)	Level (dBuV/m)	Margin (uV/m)	Margin (dB)
26.960	H	15.40	0.93	16.15	69.54	2999.16	32.48	42.07	-37.06
27.090	H	15.40	0.93	37.18	80.00	10000.00	53.51	473.70	-26.49
27.280	H	15.40	0.93	11.75	69.54	2999.16	28.08	25.35	-41.46

<VERTICAL>



Conformation of the fundamental frequency

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	Emission (uV/m)	Level (dBuV/m)	Margin (uV/m)	Margin (dB)
26.960	V	15.40	0.93	12.18	69.54	2999.16	28.51	26.64	-41.03
27.090	V	15.40	0.93	32.56	80.00	10000.00	48.89	278.29	-31.11
27.280	V	15.40	0.93	7.82	69.54	2999.16	24.15	16.13	-45.39

2.4. Connection Diagram of Test System



3. Test Software

During testing, the EUT kept transmitting signals at fixed frequency.

4. General Information of Test

4.1. Test Facility

Test Site Location : No. 52, Hwa Ya 1St Road, Hwa Ya Technology Park,
Kwei-Shan Hsiang, TaoYuan Hsien, Taiwan, R.O.C.
TEL : 886-3-3273456
FAX : 886-3-3180055

Test Site No. : 03CH02-HY

4.2. Test Voltage

DC 3V

4.3. Standard for Methods of Measurement

ANSI C63.4-2001

4.4. Frequency Range Investigated

FCC Part 15, Subpart C 15.227

4.5. Frequency Range Investigated

a. Radiation: from 30 MHz to 1000 MHz

4.6. Test Distance

The test distance of radiated emission from antenna to EUT is 3 M.

5. Test of Conducted Powerline

The power supply of the EUT is from Battery.

So Conducted Powerline test is not applicable to this equipment.

6. Test of Radiated Emission

Radiated emissions from 30 MHz to 1 GHz were measured with a bandwidth of 120 kHz according to the methods defines in ANSI C63.4-2001. The EUT was placed on a nonmetallic stand, 0.8 meter above the ground plane, as shown in section 6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions.

6.1. Major Measuring Instruments

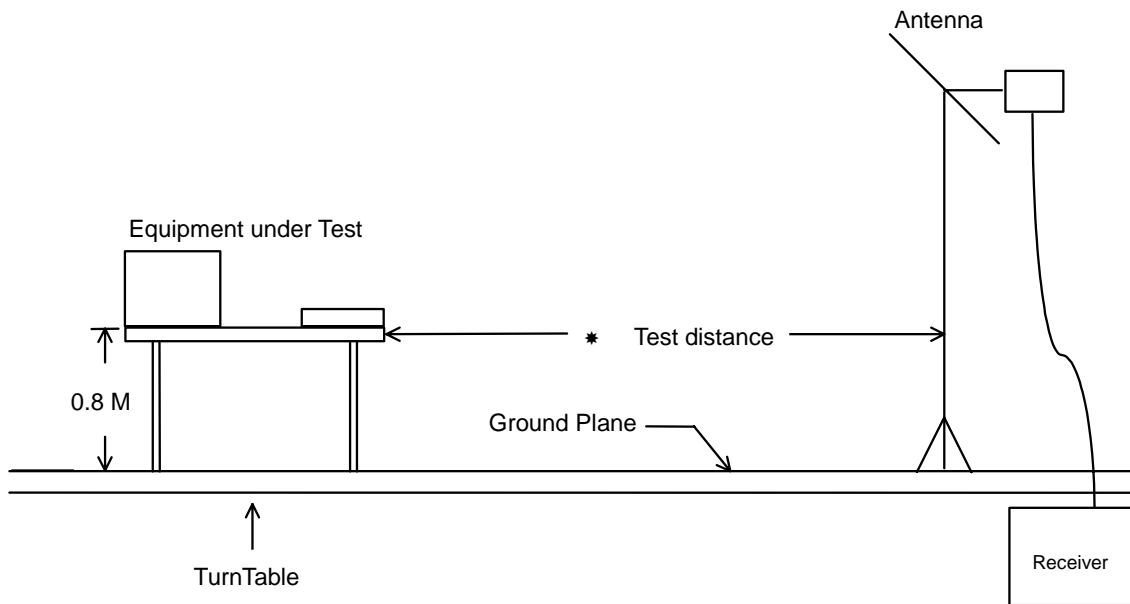
- Amplifier (ADVANTEST BB525C)
 - RF Gain 30 dB
 - Signal Input 9 KHz to 3 GHz

- Spectrum Analyzer (R&S FSP7)
 - Attenuation 10 dB
 - Start Frequency 30 MHz
 - Stop Frequency 1000 MHz
 - Resolution Bandwidth 120 KHz
 - Signal Input 9 KHz to 7 GHz

6.2. Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a half wave dipole and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.

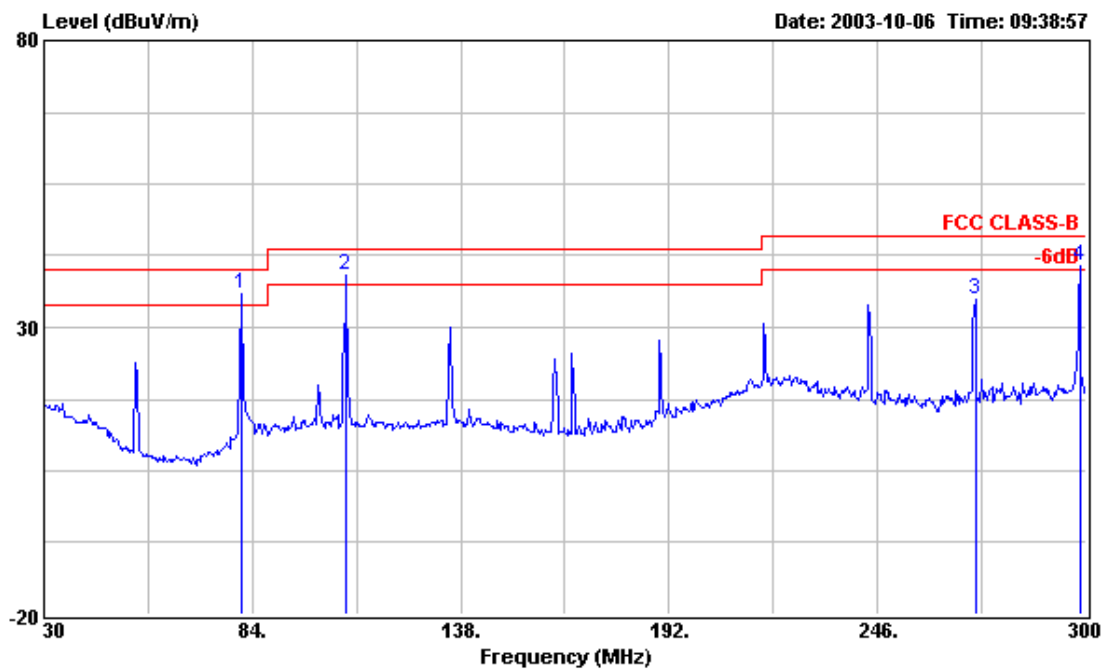
6.3. Typical Test Setup Layout of Radiated Emission



6.4. Test Result of Radiated Emission

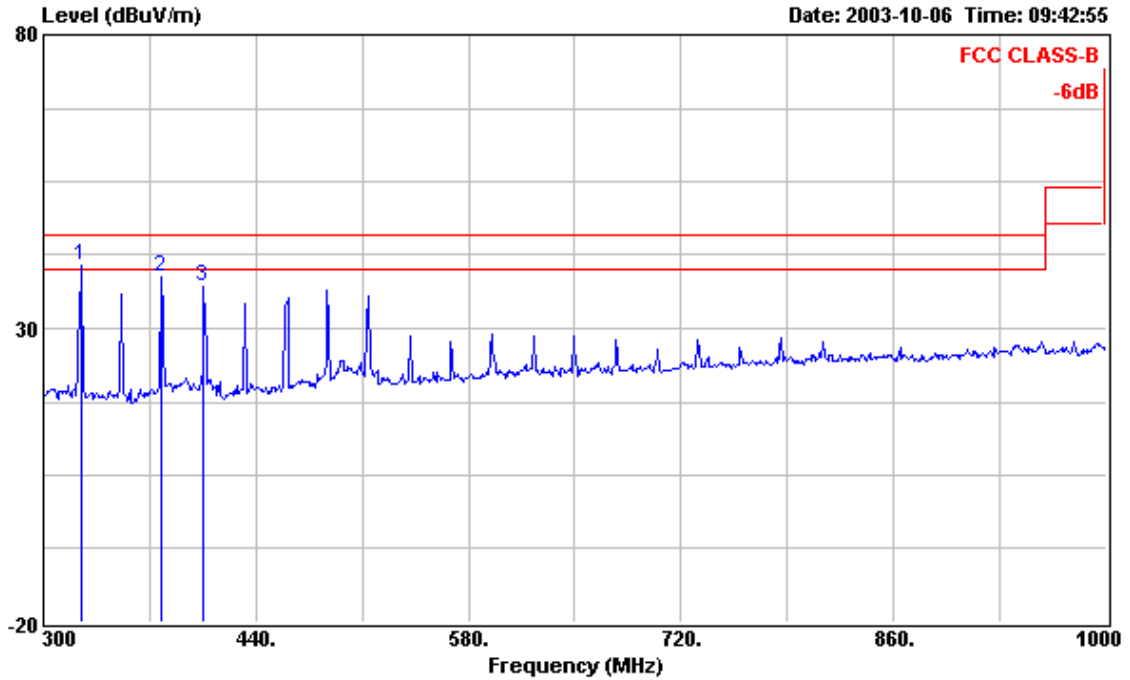
- Test Distance: 3 M
- Temperature: 26°C
- Relative Humidity: 64 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

The test was passed at the minimum margin that marked by the frame in the following test record



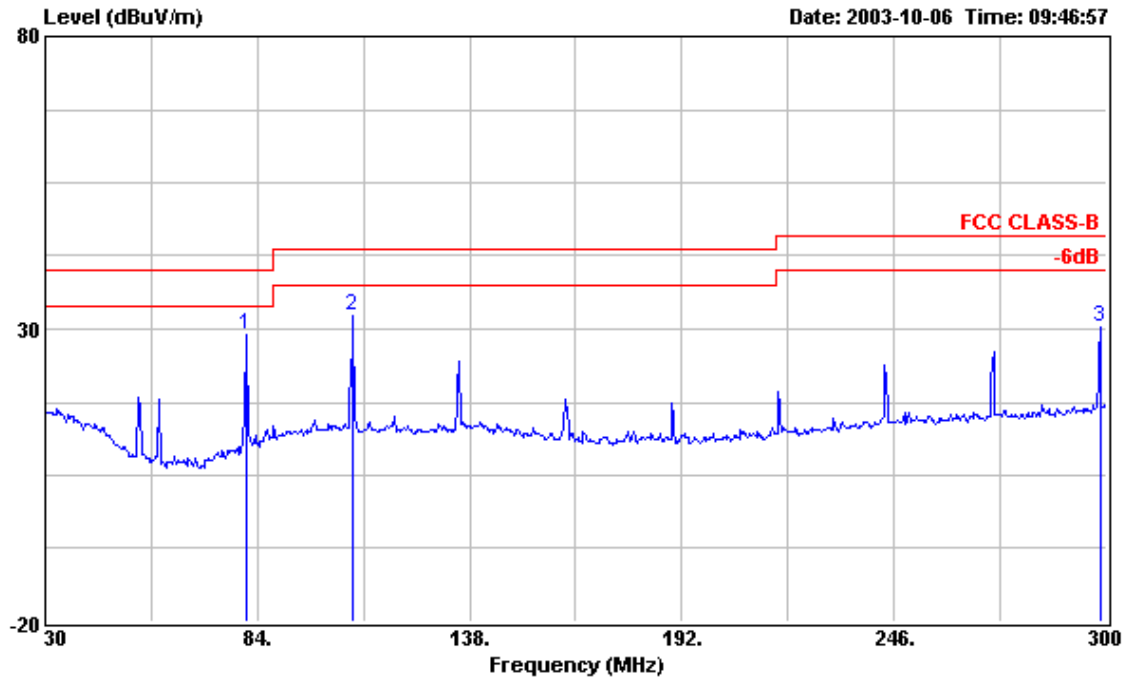
Site : 03CH02-HY
 Condition : 3m CH3-3MAT HORIZONTAL
 EUT : RF Keyboard
 Power : DC 3V
 MODEL : AKM-C35XX
 MEMO : TX
 : F382906

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1 !	81.300	35.92	-4.08	40.00	56.83	8.39	1.70	31.00	Peak	100	94
2 !	108.300	38.94	-4.56	43.50	56.71	11.28	1.92	30.97	Peak	---	---
3	271.380	34.80	-11.20	46.00	49.67	12.60	3.09	30.56	Peak	---	---
4 !	298.380	40.72	-5.28	46.00	54.47	13.53	3.22	30.50	Peak	---	---



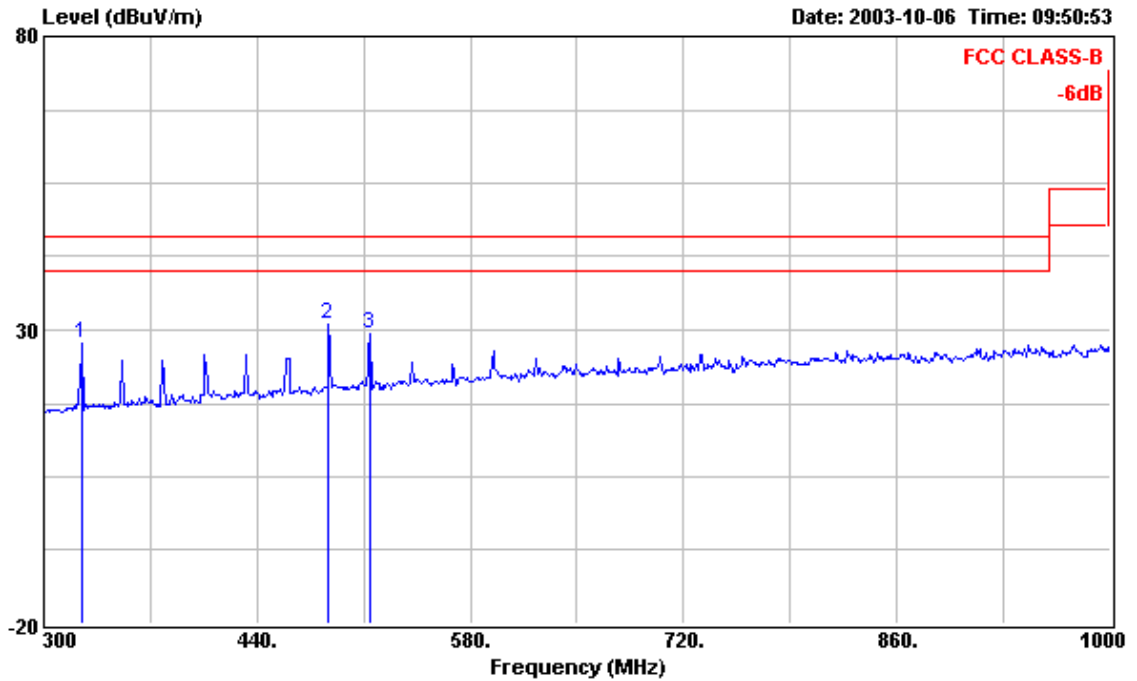
Site : 03CH02-HY
 Condition : 3m CH3-3MAT HORIZONTAL
 EUT : RF Keyboard
 Power : DC 3V
 MODEL : AKM-C35XX
 MEMO : TX
 : F382906

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1 !	324.500	40.63	-5.37	46.00	53.77	14.03	3.31	30.48	Peak	---	---
2	377.700	38.82	-7.18	46.00	50.54	15.02	3.68	30.42	Peak	---	---
3	405.700	37.15	-8.85	46.00	48.05	15.51	3.97	30.38	Peak	---	---



Site : 03CH02-HY
 Condition : 3m CH3-3MAT VERTICAL
 EUT : RF Keyboard
 Power : DC 3V
 MODEL : AKM-C35XX
 MEMO : TX
 : F382906

Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	81.300	28.95	-11.05	40.00	49.86	8.39	1.70	31.00 Peak	---	---
2	108.300	32.42	-11.08	43.50	50.19	11.28	1.92	30.97 Peak	---	---
3	298.380	30.38	-15.62	46.00	44.13	13.53	3.22	30.50 Peak	---	---



Site : 03CH02-HY
 Condition : 3m CH3-3MAT VERTICAL
 EUT : RF Keyboard
 Power : DC 3V
 MODEL : AKM-C35XX
 MEMO : TX
 : F382906

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	324.500	27.76	-18.24	46.00	40.90	14.03	3.31	30.48	Peak	---	---
2	486.900	31.02	-14.98	46.00	40.30	16.56	4.21	30.05	Peak	---	---
3	514.200	29.45	-16.55	46.00	38.18	17.00	4.27	30.00	Peak	---	---

Test Engineer: Steve Chen
 Steve Chen

7. EMI Suppression Component List

1. Ground Plain layout on bottom layer of membrane.
(As the Internal photo No. 3)

2. Add L4 1uH, orientation of L4 adjusted.
(As the Internal photo No. 4)

3. Enhanced Ground Connection Wires added on bottom side of PCB.
(As the Internal photo No. 5)

8. Antenna Factor & Cable Loss

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)
30	15.35	1.00
35	13.83	1.08
40	12.41	1.17
45	11.69	1.24
50	7.77	1.27
55	6.68	1.35
60	5.58	1.47
65	5.51	1.54
70	5.43	1.57
75	6.65	1.60
80	8.11	1.68
85	9.23	1.74
90	10.34	1.75
95	10.85	1.78
100	11.36	1.85
110	11.27	1.93
120	11.17	2.00
130	11.17	2.09
140	11.72	2.18
150	10.52	2.28
160	9.39	2.34
170	8.93	2.38
180	9.20	2.42
190	8.98	2.51
200	8.76	2.61
220	10.01	2.70
240	11.20	2.83
260	12.19	3.03
280	12.89	3.12
300	13.56	3.22
320	13.94	3.33
340	14.32	3.43
360	14.69	3.53
380	15.07	3.73
400	15.43	3.81
450	16.08	4.02
500	16.73	4.30
550	17.70	4.36
600	18.69	4.61
650	18.99	4.83
700	19.30	5.04
750	19.84	4.88
800	20.39	5.09
850	20.60	5.39
900	20.82	5.73
950	20.98	6.02
1000	21.15	6.30

9. List of Measuring Equipments Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz~1GHz 3m	Jun. 14, 2003	Radiation (03CH02-HY)
Spectrum Analyzer	R&S	FSP7	838858/039	9KHz – 7GHz	Jan. 20, 2003	Radiation (03CH02-HY)
Receiver	SCHAFFNER	SCR 3501	416	9 KHz –1GHz	Feb. 19, 2003	Radiation (03CH02-HY)
Amplifier	ADVANTEST	BB525C	CH300001	9KHz – 3GHz	Nov. 18, 2002	Radiation (03CH02-HY)
Bilog Antenna	SCHAFFNER	CBL61128	2681	30MHz –2GHz	Dec. 21, 2002	Radiation (03CH02-HY)
Turn Table	HD	DS 420	420/649/00	0 ~ 360 degree	N/A	Radiation (03CH02-HY)
Antenna Mast	HD	MA 240	240/559/00	1 m - 4 m	N/A	Radiation (03CH02-HY)
RF Cable-R03m	Jye Bao	RG142	CB020	30MHz~1GHz	Jan. 02, 2003	Radiation (03CH02-HY)

Calibration Interval of instruments listed above is one year.

10. Uncertainty of Test Site

Uncertainty of Radiated Emission Measurement

Contribution	Probability Distribution	3m
Antenna factor calibration	normal(k=2)	±1
cable loss calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
Antenna Directivity	rectangular	±3
Antenna Factor V.S. Height	rectangular	±2
Antenna Factor Interpolation for Frequency	rectangular	±0.25
site imperfection	rectangular	±2
Mismatch Receiver VSWR $\Gamma_1=0.09$ Antenna VSWR $\Gamma_2=0.67$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$	U-shaped	±0.54
combined standard uncertainty $U_e(y)$	normal	±2.7
Measuring uncertainty for a level of confidence of 95% $U=2U_e(y)$	normal (k=2)	±5.4

$U = \{ \{(1/2)^2 + (0.3/2)^2 + (2^2 + 0.5^2 + 2^2 + 0.25^2 + 2^2) / 3 + (0.54)^2 / 2 \} = 2.2$ for 10m test distance

$U = \{ \{(1/2)^2 + (0.3/2)^2 + (2^2 + 3^2 + 2^2 + 0.25^2 + 2^2) / 3 + (0.54)^2 / 2 \} = 2.7$ for 3m test distance

Uncertainty of Conducted Emission Measurement

Contribution	Probability Distribution	150KHz – 30MHz
Cable and I/P attenuator calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
LISN coupling specification	rectangular	±1.5
Transducer factor frequency interpolation	rectangular	±0.2
Mismatch Receiver VSWR $\Gamma_1=0.09$ LISN VSWR $\Gamma_2=0.33$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$	U-shaped	0.2
combined standard uncertainty $U_e(y)$	normal	±1.66
Measuring uncertainty for a level of confidence of 95% $U=2U_e(y)$	normal (k=2)	±3.32

$U = \{ (0.3/2)^2 + (2^2 + 1.5^2 + 0.2^2) / 3 + (0.2)^2 / 2 \} = 1.66$