GUMI COLLEGE
EMC CENTER

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FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer : Hyun Won Inc.
333-1 Shindea-Ri, Kumho-Eip, Youngcheon-City,
Gyeongsangbuk-Do, Korea
Attn : Mr. Taek-kyun Shin, General Manager

Date of Issue : February 24, 2003
Test Report S/N : GETEC-E3-03-008
Test Site : Gumi College EMC Center

FCC ID	**PCMDAH700**
APPLICANT	Hyun Won Inc.

Rule Part(s)	**: FCC Part 15 Subpart B**
Equipment Class	**: Class B Device**
EUT Type	**: MP3 Player**
Model No.	**: DAH-700**
Trade name	**: Hyun Won**

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Jea-Woon Choi, EMC engineer
GUMI College EMC center

Reviewed by,

Tae-Sig Park, Technical manager
GUMI College EMC center

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1. Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

Responsible Party: Hyun Won Inc.

Contact Person: Taek – Kyun Shin, General Manager / R&D Center Dept.

Manufacturer: 333-1 Shindea-Ri, Kumho-Eup, Youngcheon-City Gyeongsangbuk-Do, Korea
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- **FCC ID** PCMDAH700
- **Equipment Class** Class B Device
- **EUT Type** MP3 Player
- **Model No.** DAH-700
- **Trade Name** Hyun Won
- **Rule Part(s)** FCC Part 15 Subpart B
- **Test Procedure(s)** ANSI C63.4 (1992)
- **Dates of Test** February 13~17, 2003
- **Place of Test** Gumi College EMC Center
- **Test Report No.** GETEC-E3-03-008

2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ASNI C63.4-1992) was used in determining radiated and conducted emissions emanating from **Hyun Won Inc. MP3 Player (Model No.: DAH-700)**

These measurement tests were conducted at **Gumi College EMC Center**.
The site address is 407, Bugok-Dong, Gumi-Si, Gyeongsangbuk-Do, Korea
This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daege city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 on October 19, 1992

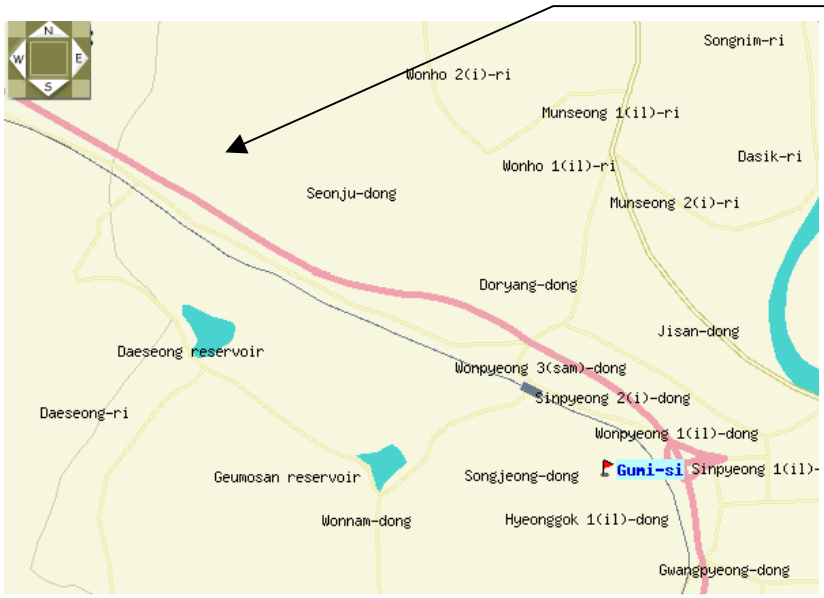

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Fig 1. The map above shows the Gumi College in vicinity area.

3. Test Conditions & EUT Information

3.1 Description of EUT

The Equipment Under Test (EUT) is **Hyun Won Inc. MP3 Player (Model No.: DAH-700)**
FCC ID : PCMDAH700

Test Mode	Download Mode Playing Mode FM Broadcast receiver Mode
Frequency Response	20Hz ~ 20KHz (Audio) 87.5MHz ~ 108.0MHz (FM Tuner)
Power supply	DC 1.5V AAA Size Battery ×2
Flash memory	64 / 128 / 256MB (On-board)
Signal to Noise Ratio	90dB (Audio) 50dB (FM Tuner)
Accessory	Earphones USB cable Line-in cable
Cable(s)	1.2m USB cable (with a ferrite core) Connected to the EUT and PC 0.7m Earphone cable Connected to the EUT
File download speed	Down to 4Mbps internal memory
Dimensions	90×60×20mm
Weight	55g

3.2 Support Equipment used

Notebook PC	COMPAQ PP2030 S/N: AE5 93600T4X 12DC 6458 FCC ID: DoC	Connected to the EUT and AC/DC Adapter
AC/DC Adapter	Dongguang Lite Power 2nd Plant PA-1530-02CV Input: 100~240Vac 50/60Hz 1.3A Output: 18.5Vdc 2.7A	Connected to the Notebook PC and main power source
Printer	H.P Deskjet 970cxi S/N: MY9B01F1FG FCC ID: DoC	Connected to the parallel port of Notebook PC
Serial Mouse	Microsoft 61402 S/N: 00696998 FCC ID: C3KKS3	Connected to the serial port of Notebook PC
PS/2 Key-board	COMPAQ 166516-AD6 S/N: B13BBOR39I006D FCC ID: AQ6-23K15	Connected to the PS/2 port of Notebook PC

See "Appendix E – Test Setup Photographs" for actual system test set-up

4. Description of tests

4.1 Conducted Emission

The Line conducted emission test facility is inside a 4×8×2.5 meter shielded enclosure.
The EUT was placed on a non-conducting 1.0 by 1.5 meter table, which is 0.8 meters in height and 0.4 meters away from the vertical wall of the shielded enclosure.
The EUT was powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.
Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCS30).
The EMI test receiver was scanned from 150kHz to 30MHz with 20msec sweep time to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was re-examined using Quasi-Peak mode of the EMI test receiver.
The bandwidth of Quasi-peak mode was set to 9KHz. Each emission was maximized consistent with typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum diagram emission. Excess cable lengths were bundled at center with 30 – 40 centi-meters.
Each EME reported was calibrated using the R/S signal generator

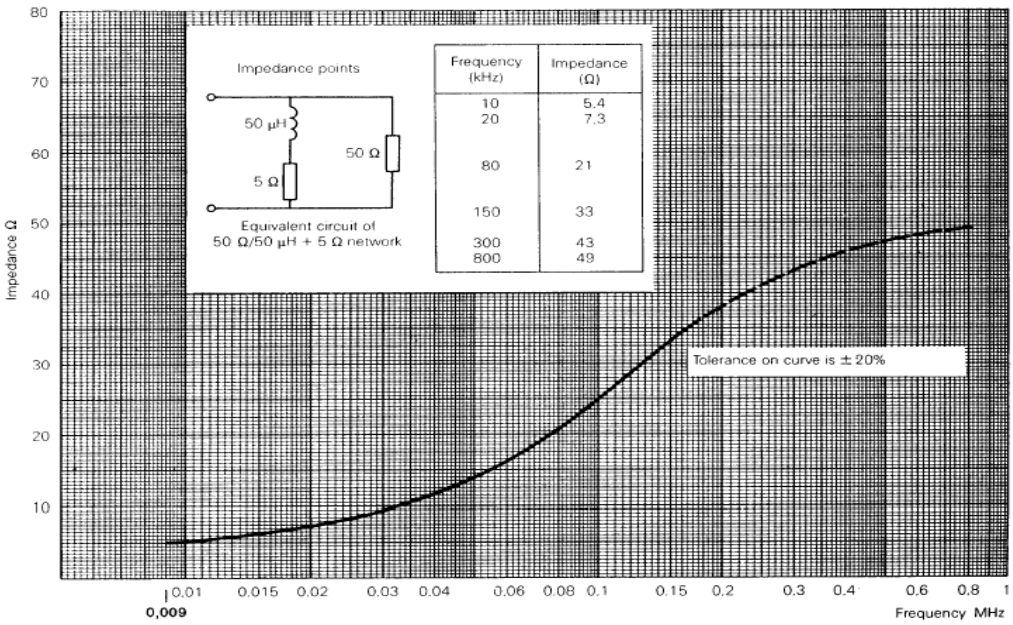


Fig 2. Impedance of LISN

4.2 Radiated Emission

Preliminary measurements were conducted 3m semi anechoic chamber using broadband antennas to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The technology configuration, mode of operation and turntable azimuth with respect to antenna was note for each frequency found.
The spectrum was scanned from 30 to 1000MHz using biconical log antenna (Schwarzbeck, VLB9160). Above 1GHz, horn antenna (Schwarzbeck, BBHA9120D) was used.
Final measurements were made outdoors at 3m-test range using biconical antenna (R&S, HK116) and log-periodic antenna (R&S, HL223).
Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
Each frequency found during pre-scan measurements was re-examined and investigated using EMI test receiver. (ESCS30)
The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120KHz or 1MHz depending on the frequency or type of signal.
The EUT, support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8m high non-metallic 1.0×1.5 meter table.
The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission.
Each EME reported was calibrated using the R/S signal generator

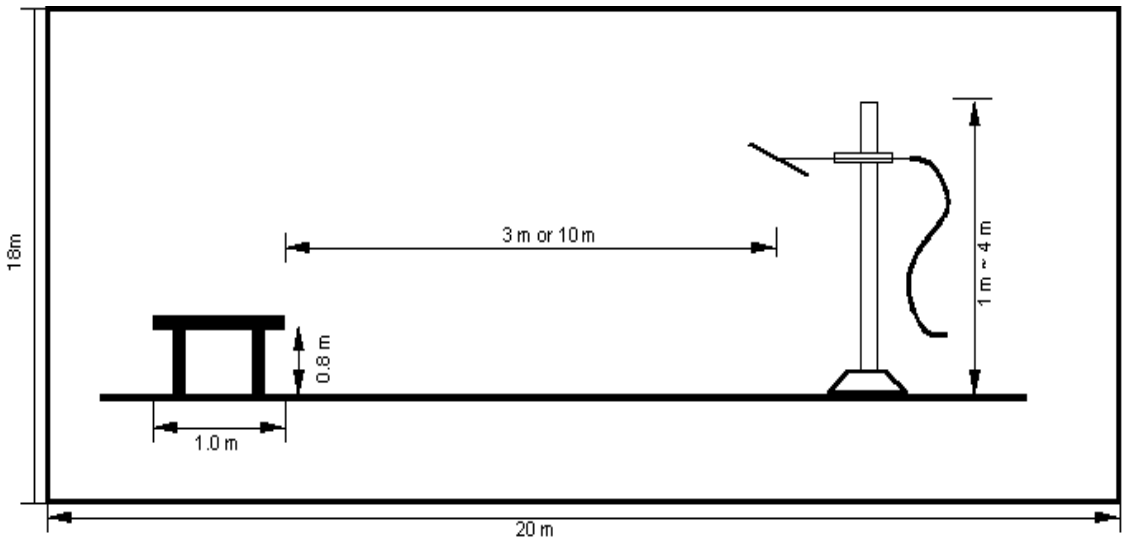


Fig 3. Dimensions of Open Site Test Area

5. Conducted emission

5.1 Operating environment

Temperature : 21℃
Relative humidity : 44 %

5.2 Test set-up

The conducted emission measurements were performed in the shielded room.
The EUT was placed on wooden table, 0.8m heights above the floor, 0.4m from the reference ground plane (GRP) wall and 0.8m from AMN.
AMN is bonded on horizontal reference ground plane.
The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, was filtered.

5.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO "Guide to the expression of uncertainty in measurement".
The measurement uncertainty was given with a confidence of 95%.

Contribution	Probability Distribution	Uncertainty (±dB)	
		Power Port	Communication port
Receiver specification	Rectangular	1.00	1.00
LISN coupling specification	Rectangular	1.50	
ISN coupling specification	Rectangular		1.50
Mismatch LISN VRC : Γl= 0.20 ISN VRC : Γl= 0.20 ATT VRC(IN) : Γg= 0.03 Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.05 -0.05	0.05 -0.05
Mismatch Receiver VRC : Γl= 0.09 ATT VRC : Γg= 0.11 Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.09 -0.09	0.09 -0.09
System repeatability	Std Deviation	0.09	0.09
Cable and input attenuator calibration	Normal (k=2)	0.50	0.50
Repeatability of EUT			
Combined standard uncertainty Uc(y)	Normal	1.16 -1.16	1.16 -1.16
Extended uncertainty U	Normal (k=2)	2.32 -2.32	2.32 -2.32

5.4 Limit

RFI Conducted	FCC Class B Limits dB (μV/m)	
Freq. Range	Quasi-Peak	Average
150kHz – 0.5MHz	66 –56*	56 – 46*
0.5MHz – 5MHz	56	46
5MHz – 30MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

5.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Calibrated Date
■ -	ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	12. 12. 2002
■ -	ESH3-Z5	Rohde & Schwarz	Artificial mains network	838979/020	12. 11. 2002
■ -	ESH2-Z5	Rohde & Schwarz	Artificial mains network	829991/009	12. 11. 2002

5.6 Test data for conducted emission

-. Test Date : February 17, 2003
-. Resolution bandwidth : 9kHz
-. Frequency range : 0.15MHz ~ 30MHz
-. Operating condition : Download Mode
-. Remark : AC Power Source: AC 120V, 60Hz

Frequency (MHz)	Line	Quasi-Peak (dBuV)		Margin (dB)	Average (dBuV)		Margin (dB)
		Emission level	limits		Emission level	limits	
0.16	N	52.15	65.46	13.32	48.45	55.46	7.02
0.215	N	48.15	63.01	14.86	45.65	53.01	7.36
0.27	H	47.46	61.12	13.66	45.96	51.12	5.16
0.325	N	44.17	59.58	15.41	41.87	49.58	7.71
0.375	N	44.44	58.39	13.95	44.24	48.39	4.15
0.43	H	43.96	57.25	13.30	41.06	47.25	6.20
0.54	H	39.19	56.00	16.81	38.09	46.00	7.91
0.915	N	38.14	56.00	17.86	37.74	46.00	8.26
1.13	H	37.59	56.00	18.41	35.59	46.00	10.41
1.185	N	37.65	56.00	18.35	37.05	46.00	8.95
2.48	N	37.78	56.00	18.22	35.28	46.00	10.72
3.77	N	38.44	56.00	17.56	36.34	46.00	9.66
5.28	N	40.18	60.00	19.82	36.68	50.00	13.32
5.6	N	38.68	60.00	21.32	35.08	50.00	14.92
12.55	H	38.47	60.00	21.54	36.07	50.00	13.94

6. Radiated emission

6.1 Operating environment

Temperature : 9℃
Relative humidity : 41 %

6.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber and found frequency for open area test site.
The formal radiated emission was measured at 3m-distance open area test site.
The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane.
The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels.
This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

6.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO "Guide to the expression of uncertainty in measurement".
The measurement uncertainty was given with a confidence of 95%.

Contribution	Probability Distribution	Uncertainty (dB)			
		Biconical Ant.		Log-periodic Ant.	
		3m	10m	3m	10m
Ambient signal					
Antenna factor calibration	Normal (k=2)	1.00	1.00	1.00	1.00
Receiver specification	Rectangular	1.00	1.00	1.00	1.00
Antenna directivity	Rectangular	0.50	0.00	3.00	0.50
Antenna phase center variation	Rectangular	0.00	0.00	1.00	0.20
Antenna factor frequency interpolation	Rectangular	0.25	0.25	0.25	0.25
Measure distance variation	Rectangular	0.60	0.40	0.60	0.40
Site imperfections	Rectangular	2.83	-2.94	-1.96	-2.96
Mismatch Receiver VRC : Γl= 0.09 Antenna VRC : Γg= 0.43 (Bi) 0.23 (Lp) Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.33 -0.35	0.33 -0.35	0.33 -0.18	0.33 -0.18
System repeatability	Std Deviation	0.07	0.05	0.06	0.10
Cable loss calibration	Normal (k=2)	0.20	0.20	0.20	0.20
Combined standard uncertainty Uc(y)	Normal	1.88 -1.88	1.90 -1.90	2.33 -2.32	1.94 -1.93
Extended uncertainty U	Normal (k=2)	3.77 -3.77	3.80 -3.80	4.65 -4.63	3.87 -3.85

6.4 Limit

Freq. Range(MHz)	Class B Limit (3m)	
	μV/m	dBμV/m
30 – 88	90	40.0
88 – 216	150	43.5
216 – 960	210	46.0
> 960	300	54.0

6.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Calibrated Date
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 12. 2002
■ -	ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	12. 12. 2002
■ -	HK116	Rohde & Schwarz	Biconical antenna	836239/007	12. 18. 2002
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	835998/004	12. 20. 2002
■ -	HD100	HD GmbH	Position Controller	100/692/01	NCR
■ -	DS415S	HD GmbH	Turntable	415/657/01	NCR
■ -	MA240	HD GmbH	Antenna Master	240/565/01	NCR

6.6 Test data for radiated emission

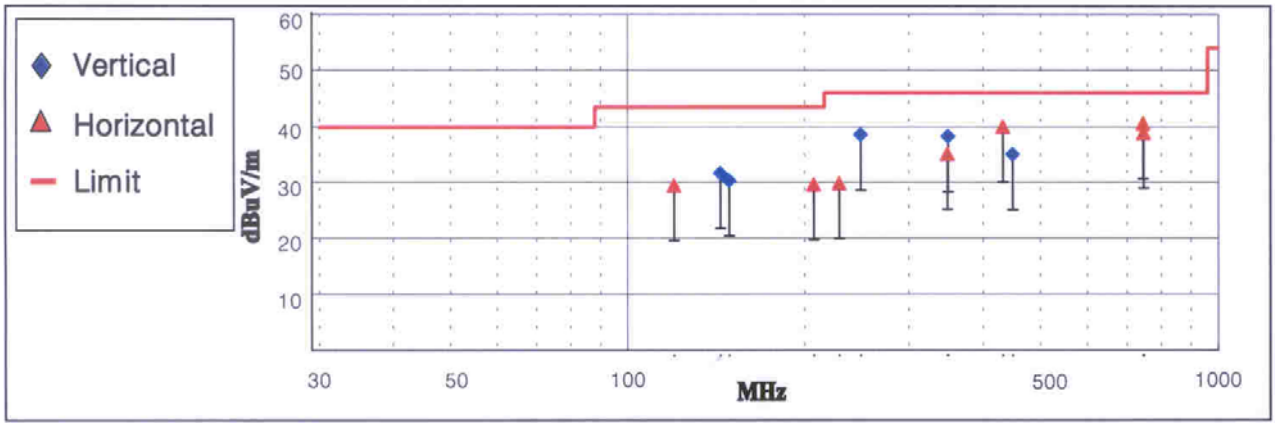
6.6.1 Operating Condition : Download mode

-. Test Date : February 15, 2003
-. Resolution bandwidth : 120kHz
-. Frequency range : 30MHz ~ 1000MHz
-. Remark : AC Power Source: AC 120V, 60Hz

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
120	16.1	H	10.95	2.51	29.6	43.5	13.9
144	16.9	V	11.91	2.91	31.7	43.5	11.8
149	15.3	V	12.14	2.97	30.4	43.5	13.1
207.42	12.3	H	14.29	3.10	29.7	43.5	13.8
228.84	11.4	H	15.05	3.47	29.9	46.0	16.1
248.9	19.1	V	15.65	3.81	38.6	46.0	7.4
348.32	16.2	H	14.23	4.76	35.2	46.0	10.8
349.14	19.3	V	14.25	4.76	38.3	46.0	7.7
432	18.8	H	16.31	4.93	40.0	46.0	6.0
448.74	13.4	V	16.72	4.95	35.1	46.0	10.9
745.13	13.5	H	20.76	6.38	40.6	46.0	5.4
746.7	11.8	H	20.75	6.37	38.9	46.0	7.1

Note: “H”: Horizontal, “V”: Vertical

[Quasi- peak detector mode]



< Fig 6-1. Radiated emission result>

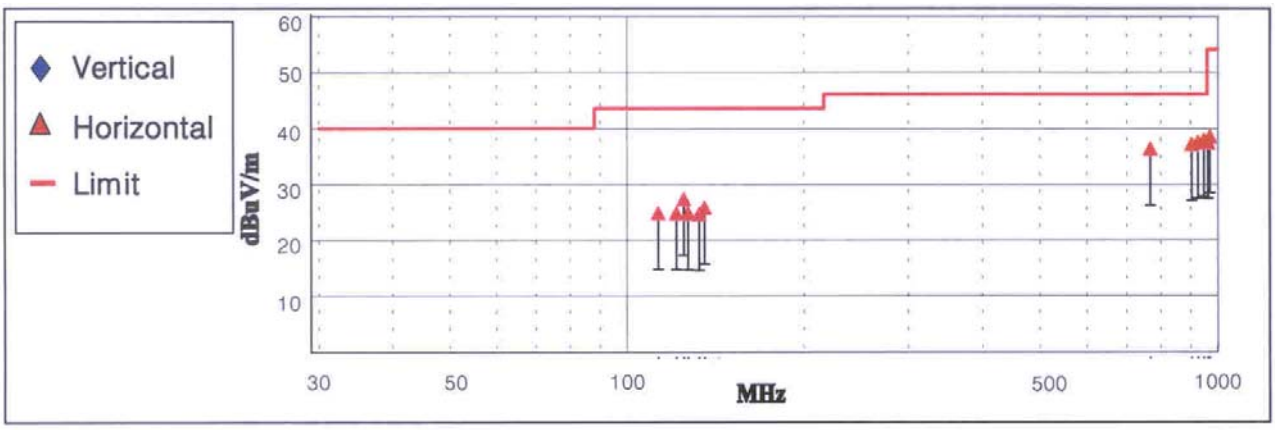
6.6.2 Operating Condition : Playing mode

-. Test Date : February 15, 2003
-. Resolution bandwidth : 120kHz
-. Frequency range : 30MHz ~ 1000MHz
-. Remark : AC Power Source: AC 120V, 60Hz

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
112.98	12	H	10.43	2.36	24.8	43.5	18.7
121.36	11.2	H	11.02	2.53	24.8	43.5	18.7
124.88	13.5	H	11.19	2.60	27.3	43.5	16.2
127.01	10.8	H	11.27	2.63	24.7	43.5	18.8
132.65	10.4	H	11.47	2.73	24.6	43.5	18.9
135.47	11.4	H	11.57	2.78	25.8	43.5	17.7
767.71	9.6	H	20.46	6.21	36.3	46.0	9.7
903.18	9.7	H	22.08	5.35	37.1	46.0	8.9
925.76	9.9	H	22.07	5.55	37.5	46.0	8.5
948.34	10.3	H	21.79	5.75	37.8	46.0	8.2
962.46	9.4	H	22.17	5.87	37.4	46.0	16.6
970.92	10.1	H	22.45	5.94	38.5	46.0	15.5

Note: “H”: Horizontal, “V”: Vertical

[Quasi- peak detector mode]



< Fig 6-2. Radiated emission result>

6.5.3 Operating Condition : FM broadcast receiver mode

-. Test Date : February 15, 2003
-. Resolution bandwidth : 120kHz
-. Frequency range : 30MHz ~ 1000MHz
-. Remark : AC Power Source: AC 120V, 60Hz

Disturbance radiation due to the local oscillator

CH. No. (CH Freq.)	Harmonics	Measuring Frequency (MHz)	Level [dBuV]	Limit [dBuV]	Margin [dBuV]
89.7MHz	1	100.4	-	60	<<
	2	200.8	-	52	<<
	3	301.2	-	56	<<
	4	401.6	-	56	<<
	5	502	-	56	<<
	6	602.4	-	56	<<
	7	702.8	-	56	<<
	8	803.2	-	56	<<
	9	903.6	33.42	56	22.58
99.3MHz	1	110	-	60	<<
	2	220	-	52	<<
	3	330	-	56	<<
	4	440	-	56	<<
	5	550	-	56	<<
	6	660	-	56	<<
	7	770	-	56	<<
	8	880	-	56	<<
	9	990	-	56	<<
103.1MHz	1	113.8	-	60	<<
	2	227.6	-	52	<<
	3	341.4	-	56	<<
	4	455.2	-	56	<<
	5	569	-	56	<<
	6	682.8	-	56	<<
	7	796.6	-	56	<<
	9	910.4	-	56	<<
Other Frequency	-	112.9	31.37	40	8.63
	-	124.18	30.65	40	9.35
	-	135.47	31.11	40	8.89
	-	745.13	32.03	47	14.97
	-	835.45	31.87	47	15.13
	-	858.03	34.65	47	12.35
	-	880.61	35.08	47	11.92

7. Sample Calculations

$$dB\mu V = 20 \text{ Log}_{10}(\mu V/m)$$
$$dB\mu V = dBm + 107$$
$$\mu V = 10^{(dB\mu V/20)}$$

7.1 Example 1 :

■ **20.3 MHz**

Class B Limit	=	**250 μV**	=	**48 dBμV**
Reading	=	**- 67.8 dBm (Calibrated level)**		
Convert to dBμV	=	**- 67.8 dBm + 107**	=	**39.2 dBμV**
$10^{(39.2dB\mu V/20)}$	=	**91.2 dBμV**		
Margin	=	**39.2 – 48**	=	**-8.8**
	=	**8.8 dB below Limit**		

7.2 Example 2 :

■ **66.7 MHz**

Class B Limit	=	**100 μV/m**	=	**40.0 dBμV/m**
Reading	=	**- 76.0 dBm (Calibrated level)**		
Convert to dBμV/m	=	**- 67.8 dBm + 107**	=	**31.0 dBμV/m**
Antenna Factor + Cable Loss	=	**5.8 dB**		
Total	=	**36.8 dBμV/m**		
Margin	=	**36.8 – 40.0**	=	**-3.2**
	=	**3.2 dB below Limit**		

8. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.
Hyun Won Inc. MP3 Player (Model No.: DAH-700) was complies with §15.107 and 15.109 of the FCC Rules.
The highest emission observed was at 0.375MHz for conducted emission with a margin of 4.15dB, at 745.13MHz for radiated emissions with a margin of 5.4dB (Download mode).