

## Electromagnetic Emission

# F C C M E A S U R E M E N T R E P O R T

### CERTIFICATION OF COMPLIANCE

#### FCC Part 15 Certification Measurement

**PRODUCT** : MP3 Player  
**MODEL/TYPE NO** : IMP-2000A  
**FCC ID** : R8DIMP-2000A  
**APPLICANT** : WAVESYSTE Co., Ltd  
Daeryung Techno Town 6 – 901, 493-6 Gasan-dong,  
Geumchun-gu, Seoul, Korea  
Attn. : Kwang-Ho, Kim / R & D Director  
**FCC CLASSIFICATION** : Class B personal computers and peripherals  
**FCC RULE PART(S)** : FCC Part 15 Subpart B  
**FCC PROCEDURE** : Certification  
**TRADE NAME** : WAVESISTEC  
**TEST REPORT No.** : E05.0711.FCC.402N  
**DATES OF TEST** : July 01 – 11, 2005  
**DATES OF ISSUE** : July 11, 2005  
**TEST LABORATORY** : ETL Inc ( FCC Registration Number : 95422)  
#584 Sangwhal-ri, Kanam-myon, Yaju-kun, Kyounggi-do,  
469-885, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074

This is MP3 Player. Model IMP-2000A has been tested in accordance with the measurement procedures specified in ANSI C63.4-2001 at the ETL/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B :

I attest to the accuracy of data. All measurement herein were performed by me or were made under my supervision and are correct to the best 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.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.



Yo Han, Park / Chief Engineer



**ETL Inc.**

**#584 Sangwhal-ri, Kanam-myon, Yaju-kun,  
Kyounggi-do, 469-885, Korea**

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**Scope** – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

## General Information

<b>Applicant Name</b>	: WAVESYSTE Co., Ltd
<b>Address</b>	: Daeryung Techno Town 6 – 901, 493-6, Gasan-dong, Gumchun-gu, Seoul, Korea
<b>Attention</b>	: Kwang-Ho Kim / R & D Director

- **EUT Type :** MP3 Player
- **Model Number :** INP-2000A
- **FCC ID :** R8DIMP-2000A
- **S/N :** N/A
- **FCC Rule Part(s) :** FCC Part 15 Subpart B
- **Test Procedure :** ANSI C63.4-2001
- **FCC Classification :** Class B personal computers and peripherals
- **Dates of Tests :** July 11, 2005  
ETL Inc.  
EMC Testing Lab (FCC Registration Number : 95422)
- **Place of Tests :** 584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,  
Kyounggi-Do, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074
- **Test Report No. :** E05.0711.FCC.402N

## 1. INTRODUCTION

The measurement for radiated and conducted emission test were conducted at the open area test site of E-RAE Testing Laboratory Inc. facility located at 584, Sangwhal-ri, Ganam-myun, Youju-kun, Kyounggi-do, Korea. The open area test site is constructed in conformance with the requirements of the ANSI C63.4-2001 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 and 10 meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-2001 and registered to the Federal Communications Commission(Registration Number : 95422 ).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-2001) was used in determining radiated and conducted emissions from the WAVESYSTECo., Ltd Model: IMP-2000A.

## 2. PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the WAVESYSTECo., Ltd., MP3 Player, IMP-2000A.

### 2.2 General Specification

<b>Model name</b>	IMP-2000A
<b>Supported Compression Formats</b>	MP3(8 – 320 kbps), ADPCM(32 kbps), WMA
<b>Internal Storage Capacity</b>	128 / 256 / 512 MB
<b>Display</b>	Graphic (128 * 64) LCD (Blue Color LED backlight)
<b>Supported Languages</b>	36
<b>User Interface Language</b>	English
<b>File Transfer Rate</b>	Max. 20 MB
<b>Earphone Output</b>	20 mW(L) + 20 mW(R)
<b>Signal to Noise Ratio</b>	Min. 85 dB
<b>Output Frequency Range</b>	20 Hz – 20 kHz
<b>Battery</b>	AAA Battery 1EA
<b>Playing Time</b>	18 hrs
<b>FM Frequency Range</b>	87.5 MHz to 108.0 MHz
<b>Dimensions / Weight</b>	32(W) * 77.8(H) * 21.5(D) mm / 42 g (Including Battery)

## 3. DESCRIPTION OF TESTS

### 3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2001. The measurements were performed over the frequency range of 0.15MHz to 30 MHz using a 50Ω/50uH LISN as the input transducer to a spectrum analyzer or test receiver. The measurements were made with the detector set for "Peak" amplitude within an bandwidth of 10 kHz or for "quasi-peak & average" within a bandwidth of 9 kHz.

#### - Procedure of Test

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1m x 1.5m x 0.8m wooden table which is placed 40cm away from the vertical wall and 1.5m away from the side wall of the chamber room. Two LISN are bonded to the shielded room. The EUT is powered from the LISN and the support equipment is powered from another LISN. Powers to the LISN are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner  $\phi$  1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling (serpentine fashion) to a 1m length. Sufficient time for the 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 spectrum analyzer or test receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using the detector function set to the CISPR Quasi-Peak and average mode by manual, after scanned by automatic Peak mode from 0.15 to 30 MHz. The bandwidth of the spectrum analyzer or test receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

### 3. DESCRIPTION OF TESTS

#### 3.2 Radiated Emission Measurement

Radiated emission measurements were in accordance with § 12.2 in ANSI C63.4-2001 "measurement of information technology equipment ". The measurements were performed over the frequency range of 30 MHz to 1 GHz using antenna as the input transducer to a spectrum analyzer or a field intensity meter. The measurements were made with the detector set for "Quasi-peak" within a bandwidth of 120 kHz.

- Procedure of Test

Preliminary measurements were made at 3 meter using broadband antennas, and spectrum analyzer to determine the frequency producing the maximized emission in shielded room. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000 MHz using broadband antenna. For above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 10-meters. The test equipment was placed on a wooden turn-able table. 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 by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the max. Emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the max emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

## 4. TEST CONDITION

### 4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

### 4.2 EUT operation

Operating Mode	The worst operating condition
Stand-by Mode	
Line recording mode	
Music playing mode	
FM receiving mode	
File upload and download mode (with PC), MP3 file playing mode (with PC)	,

: These tests was carried out.

: Worst case investigated during the test.

### 4.3 Support Equipment Used

Following peripheral devices and interface cables were connected during the measurement:

#### EUT – MP3 Player

FCC ID	: R8DIMP-2000A
Model Name	: IMP-2000A
Serial No.	: N/A
Manufacturer	: WAVESYSTE Co., Ltd
Power Supply Type	: AAA Battery 1EA
Power Cord	: N/A
Data Cable	: 1m Shielded USB Cable, 1m Shielded Audio Cable, 1m Earphone

#### Support Unit 1 – Personal computer (DELL)

FCC ID	: N/A (DoC)
Model Name	: DHM
Serial No.	: H9MB71S
Manufacturer	: DELL
Power Supply Type	: Switching
Power Cord	: Non-Shielded, Detachable: 1.2m
Data Port	: RGB IN:1, Parallel:1, RS-232:1, PS/2: 2, USB: 4, RJ-45:1 : Audio in:1, Audio out:1, MIC IN:1

## Support Unit 2 – LCD Monitor (ERAЕ)

FCC ID	: OIOELM-150
Model Name	: ELM-150B
Serial No.	: N/A
Manufacturer	: ERAЕ Electronics Industry Co., Ltd.
Power Supply Type	: DC 12V From Adaptor
Power Cord	: Non-shielded, Detachable: 1.2m
Data Cable	: Shielded 15Pin D-sub, 1.5m

## Support Unit 2 – Keyboard (COMPAQ)

FCC ID	: N/A (DoC)
Model Name	: KB-9963
Serial No.	: B26960GBUKO13F
Manufacturer	: COMPAQ
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: Shielded, 1.5m

## Support Unit 3 – Mouse (LOGITECH)

FCC ID	: DZL211029
Model Name	: M-S34
Serial No.	: LZC01002314
Manufacturer	: LOGITECH
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: None-Shielded, 1.2m

## Support Unit 5 – Serial Mouse (PETRA)

FCC ID	: JKGMUS5S01
Model Name	: MUS5S
Serial No.	: E183027
Manufacturer	: PETRA
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: Shielded, 1.2m

## Support Unit 6 – Printer (LEXMARK INTERNATIONAL)

FCC ID	: N/A
Model Name	: Color cap 330
Serial No.	: 11-03098
Manufacturer	: LEXMARK INTERNATIONAL INC.
Power Supply Type	: AC 110V~220V
Power Cord	: Non-Shield, 1.5m
Data Cable	: Shielded, 1.5m

## 5. TEST RESULTS

### 5.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

Test Rule Parts	Measurement Required	Result
15.107	Conducted Emissions Measurement	Passed
15.109	Radiated Emissions Measurement	Passed

The data collected shows that the **WAVESYSTECo., Ltd / MP3 Player / IMP-2000A** complies with technical requirements of above rules part 15.107 and 15.109 Class B Limits and CISPR Publication 22.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

## 5. TEST RESULTS

### 5.2 Conducted Emissions Measurement

<b>EUT</b>	MP3 Player / IMP-2000A (SN: N/A)
<b>Limit apply to</b>	FCC Part 15. 107(CISPR Pub.22 Class B)
<b>Test Date</b>	July 04, 2005
<b>Operating Condition</b>	File upload and download mode (with PC), MP3 file playing mode (with PC)
<b>Environment Condition</b>	Humidity Level : 42 %RH, Temperature : 24
<b>Result</b>	Passed by 10.0 dB

#### Conducted Emission Test Data

The following table shows the highest levels of conducted emissions on both polarizations of Hot and neutral line.  
Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 9 kHz )

Frequency [MHz]	Result [dB $\mu$ V]		Phase (*H/**N)	Limit [dB $\mu$ V]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Quasi-peak	Average
0.191	48.9	—	N	64.0	54.0	15.1	—
0.232	47.1	—		62.4	52.4	15.3	—
0.280	42.9	—		60.8	50.8	17.9	—
0.311	41.8	—		59.9	49.9	18.1	—
0.356	42.7	—		58.8	48.8	16.1	—
0.478	42.0	—		56.4	46.4	14.3	—
0.709	39.1	33.1		56.00	46.00	16.9	12.9
2.171	37.9	32.6				18.1	13.4
3.748	39.1	32.5				16.9	13.5
4.065	42.1	36.0				13.9	10.0
4.320	38.2	32.4				17.8	13.6
4.604	40.1	33.4				15.9	12.6
5.050	45.0	—				15.0	—
5.455	44.3	—				15.7	—
6.061	42.5	—				17.5	—
6.485	40.4	—				19.6	—
7.131	39.8	—				20.2	—
8.161	37.8	—				22.2	—

NOTES : 1. \* H : HOT Line , \*\*N : Neutral Line

2. Margin value = Limit – Result

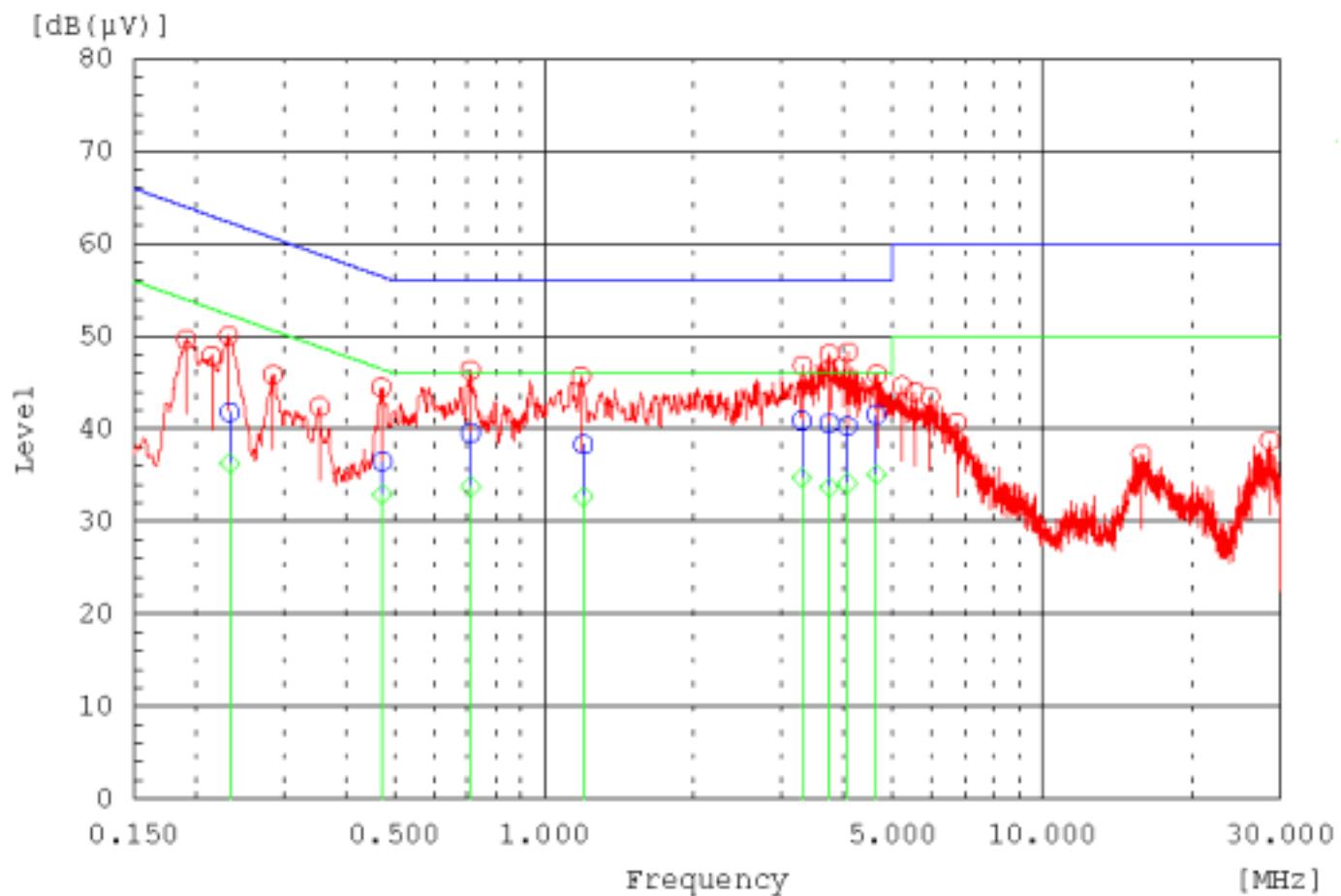
3. Measurement were performed at the AC power line of PC inlet in the frequency band of 150 kHz ~ 30 MHz according to the CISPR 22 Class B and it's same as FCC Part 15.107.

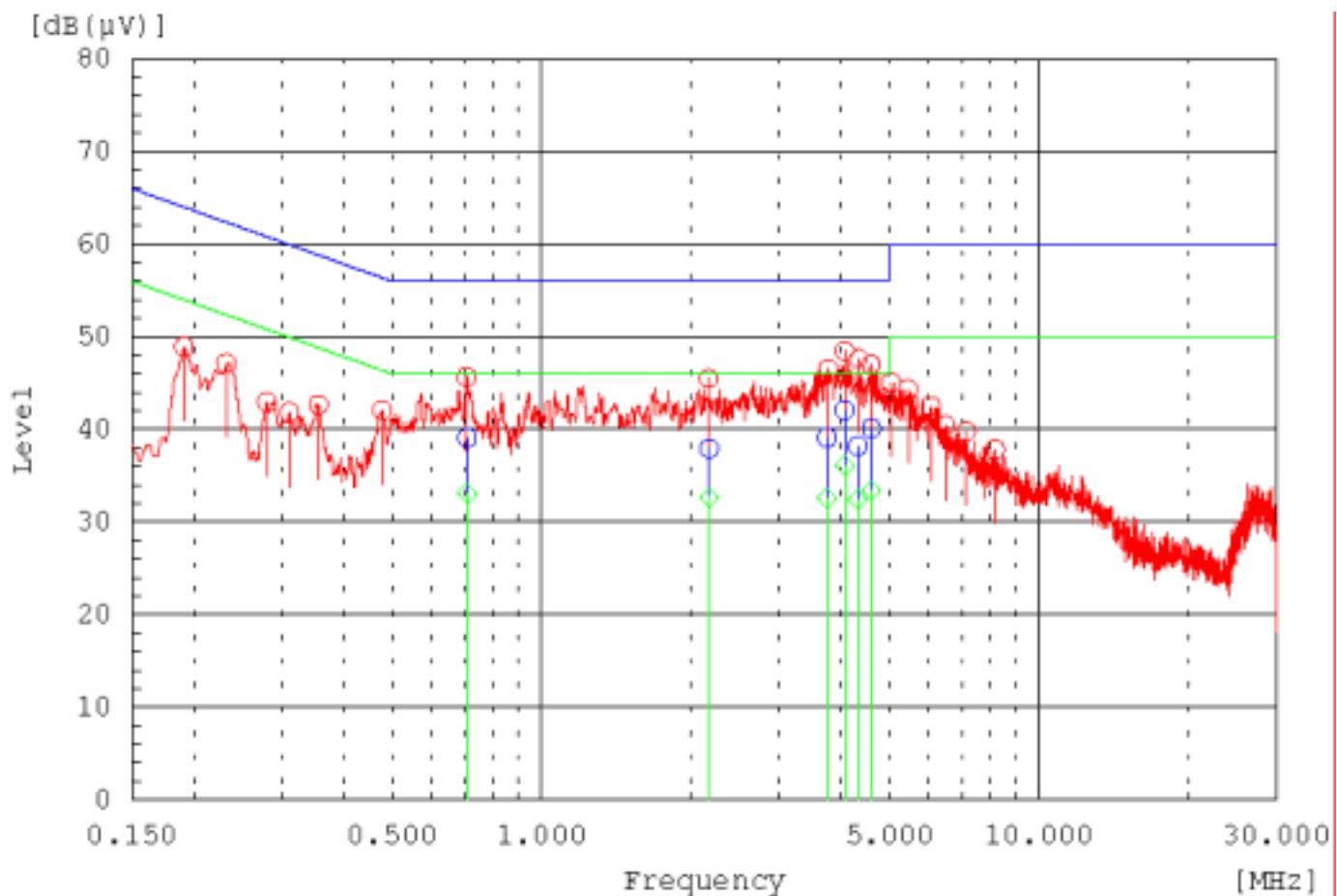
4. If the reading Quasi-Peak value is bellowed the average limit, do not test average mode.



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**5. TEST RESULTS****Line: HOT Line**

**5. TEST RESULTS****Line: Neutral Line**

## 5. TEST RESULTS

### 5.3 Radiated Emissions Measurement

<b>EUT</b>	MP3 Player / IMP-2000A (SN: N/A)
<b>Limit apply to</b>	FCC Part 15. 109(CISPR Pub.22 Class B)
<b>Test Date</b>	July 04, 2005
<b>Operating Condition</b>	File upload and download mode (with PC), MP3 file playing mode (with PC)
<b>Environment Condition</b>	Humidity Level : 46 %RH, Temperature : 25
<b>Result</b>	Passed by 5.80 dB

#### Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 120 kHz )

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB $\mu$ V]	Result [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
32.00	7.74	V	11.52	1.44	20.70	30.0	9.30
50.00	6.36	V	12.34	2.10	20.80	30.0	9.20
56.00	10.19	V	11.91	2.10	24.20	30.0	5.80
72.00	9.85	V	9.63	2.22	21.70	30.0	8.30
166.00	4.73	H	12.61	3.76	21.10	30.0	8.90
200.00	6.84	H	10.06	4.00	20.90	30.0	9.10
240.00	5.27	H	11.03	4.70	21.00	37.0	16.00
300.00	4.04	H	13.16	5.50	22.70	37.0	14.30
312.00	4.76	H	13.39	5.64	23.80	37.0	13.20
362.00	6.48	H	14.40	6.22	27.10	37.0	9.90
480.00	3.53	H	17.23	7.44	28.20	37.0	8.80
662.00	2.74	H	18.09	9.37	30.20	37.0	6.80

NOTES : 1. \*H : Horizontal polarization , \*\* V : Vertical polarization  
2. Result = Reading + Antenna factor + Cable loss  
3. Margin value = Limit - Result  
4. The measurement was performed for the frequency range 30 MHz ~ 1000 MHz according to the CISPR 22 Class B



Test Engineer : Jae Young, Kwon

## 6. SAMPLE CALCULATION

### Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.  
The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

$$dB(\mu V/m) = 20 \log_{10} (\mu V / m) : \text{Equation}$$

Example : @ 56.0 MHz

Class B Limit	=	31.63 $\mu V/m$ = 30 dB $\mu V/m$
Reading	=	10.19 dB $\mu V$
Antenna Factor + Cable Loss	=	11.91 + 2.10 = 14.01 dB/m
Total	=	24.20 dB $\mu V/m$
Margin	=	40 - 24.20 = 5.80 dB
	=	5.80 dB below Limit

## 7. List of used test equipments for measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
<input checked="" type="checkbox"/>	Spectrum Analyzer	E7402A	H.P	US39110107	05-10-18
<input checked="" type="checkbox"/>	Receiver	ESVS 10	R & S	835165/001	06-04-07
<input checked="" type="checkbox"/>	EMI TEST Receiver	ESHS30	R & S	0401901/002	05-10-18
<input type="checkbox"/>	Preamplifier	HP 8347A	HP	2834A00544	06-04-07
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9208-1995	06-04-07
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9006-1669	06-04-06
<input checked="" type="checkbox"/>	Log-Bicon Antenna	VULB9160	Schwarz Beck	3082	05-07-27
<input type="checkbox"/>	Log-Bicon Antenna	VULB9165	Schwarz Beck	2023	06-07-06
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	964	06-06-10
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	965	06-07-09
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	949	06-07-09
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	950	06-06-10
<input type="checkbox"/>	Broad band Horn Antenna	BBHA 9120D	Schwarz Beck	227	06-04-04
<input checked="" type="checkbox"/>	Turn-Table	DETT-03	Daeil EMC	-	N/A
<input checked="" type="checkbox"/>	Antenna Master	DEAM-03	Daeil EMC	-	N/A
<input type="checkbox"/>	Plotter	7440A	H.P	2725A 75722	N/A
<input checked="" type="checkbox"/>	Chamber	DTEC01	DAETONG	-	N/A
<input checked="" type="checkbox"/>	Thermo Hygrograph	3-3122	ISUZU	3312201	06-04-13
<input checked="" type="checkbox"/>	BaroMeter	-	Regulus	-	06-03-15