Certification of Compliance

CFR 47 Part 15 Subpart C

Test Report File No. : 06-IST-0289 **Date of Issue** : Jul 8, 2006

Model(s)	:	**DFM-100**
Kind of Product	:	FM Transmitter
FCC ID	:	PCMDFM-100
Applicant	:	HYUN WON INC.
Address	:	4th Floor, e-Venture Center, 74-2 Shinchen3-dong, Dong Gu, Daegu City, South Korea
Manufacturer	:	HYUN WON INC.
Address	:	4th Floor, e-Venture Center, 74-2 Shinchen3-dong, Dong Gu, Daegu City, South Korea

Test Result ■ **Positive** □ **Negative**

Reviewed By

S.J.CHO / EMC Group Manager

Approved By

J.H.LEE / Chief

Comment(s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C.
- The test report with appendix consists of 20 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST EMC Laboratory.
- This equipment as for has been shown to be capable of continued 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

I assume full responsibility for accuracy and completeness of these data.

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Note:

INFORMATIONS OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd. ***(FCC Filing Lab.)***
80, Jeil-Ri, Yangji-Myun, Yongin-City
Kyonggi-Do, 449-860, Korea
TEL : +82 31 333 9018 FAX : +82 31 333 9019

ENVIRONMENTAL CONDITIONS

Temperature	27 ℃
Humidity	43 %
Atmospheric pressure	1010 mbar

POWER SUPPLY SYSTEM USED

Power supply system	DC 5V(Built-in Rechargeable Lithium Ion Battery) (Refer to the product information)

PRODUCT INFORMATION

The Equipment Under Test(EUT) is FM Transmitter of HYUN WON INC.
(FCC ID : PCMDFM-100)

a) Type of EUT	FM Transmitter
b) Model No.	DFM-100
c) Working Frequency	88.3MHz, 88.7MHz, 88.9MHz(3 channel)
d) Power Supply	DC 5V(Built-in Rechargeable Lithium Ion Battery)

- EMC suppression device is not used during the test.
- Please refer to user's manual.

DESCRIPTION OF TEST

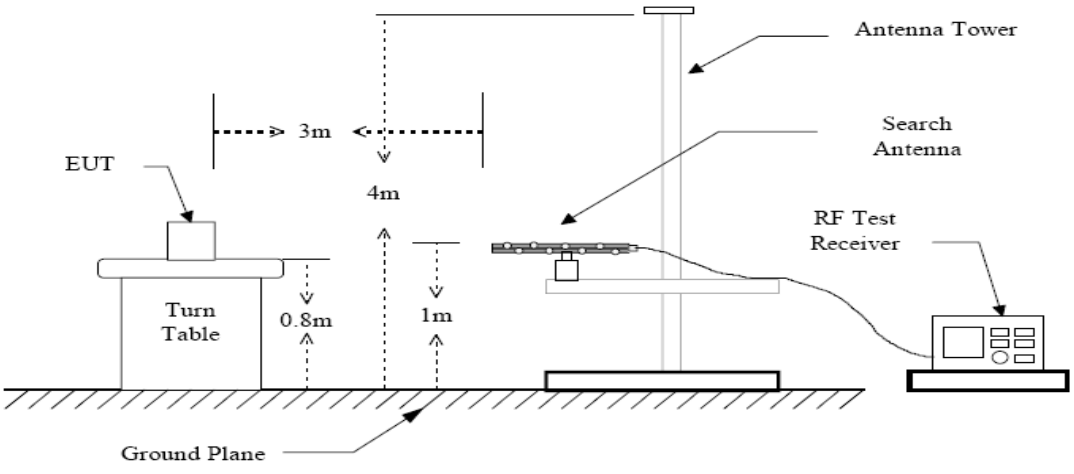
Radiated Emissions:

The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120KHz.

-Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral 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 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral 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 nonmetallic 1 x 1.5 meter table. The EUT, peripheral 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 maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission.

Figure 1 : Frequencies measured below 1 GHz configuration



Definition and limits

1 Definition

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

2 limit

(1) Radiated Emission Limits :

According to 15.239 the field strength of emissions from intentional radiators operated under these frequency bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental	
	μV/meter	dBμV/meter
88 - 108	250	48

Field strength limits are at the distance of 3 meters, emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209,as following table:

Other Frequencies (MHz)	Field Strength of Fundamental	
	μV/meter	dBμV/meter
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

(2) Antenna Requirement :

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

(3) Emissions Band Limits :

According to 15.239(a), emissions from the intentional radiator shall be confined within a band 200kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz.

Measurement Uncertainty Calculations

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Contribution (Conducted Emissions)	Probability Distribution	Uncertainty (±dB) 0.15-30MHz
Receiver Specification	Rectangular	1.5
LISN Coupling Specification	Rectangular	1.5
Cable and Input Attenuator Calibration	Normal (k=2)	0.5
Mismatch to Reciver	U-Shaped	-0.8 / +0.7
System Repeatability	Normal (k=1)	0.2
Combined Standard Uncertainty	Normal (k=2)	-1.85 / +1.71
Expanded Uncertainty U	Normal (k=2)	-3.7 / +3.42

$U_{c,minus}$ = -1.85, $U_{c,plus}$ = 1.71

U = -3.70 / +3.42 (k=2, 95.45% confidence level)

Contribution (Radiated Emissions)	Probability Distribution	Uncertainties(±dB) 3 m
Antenna		
Factor	Normal (k=2)	0.9968
Frequency Interpolation	Rectangular	0.1039
Height Variation	Rectangular	-2.6 / +1.5
Directivity Difference	Rectangular	-1.0 / +0
Phase Center Location	Rectangular	1.0
Cable Loss	Normal (k=2)	0.5
Receiver		
Voltage Accuracy	Normal (k=2)	2.0
Pulse Response	Rectangular	1.5
Absolute Repetition Rate	Rectangular	1.5
Mismatch to Receiver $\lvert \Gamma_{antenna} \rvert = 0.33$ $\lvert \Gamma_{receiver} \rvert = 0.33$	U-Shaped	-1.0 / +0.9
System Repeatibility	Std Deviation	0.5
Combined Standard Uncertainty	Normal	-2.6048 / 2.2775
Expanded Uncertainty U	Normal (k=2)	-5.21 / +4.55

$U_{c,minus}$ = -2.6048, $U_{c,plus}$ = 2.2775

U = -5.21 / +4.55 (k=2, 95.45% confidence level)

Equipment Under Test

EUT Type :

■ Table-Top. ☐ Floor-Standing.

☐ Table-Top and Floor-Standing(Combination).

Operation - mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

☐ Standby Mode

■ Operational Condition : ■ MP3 File Play mode & charging

Configuration of the equipment under test :

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

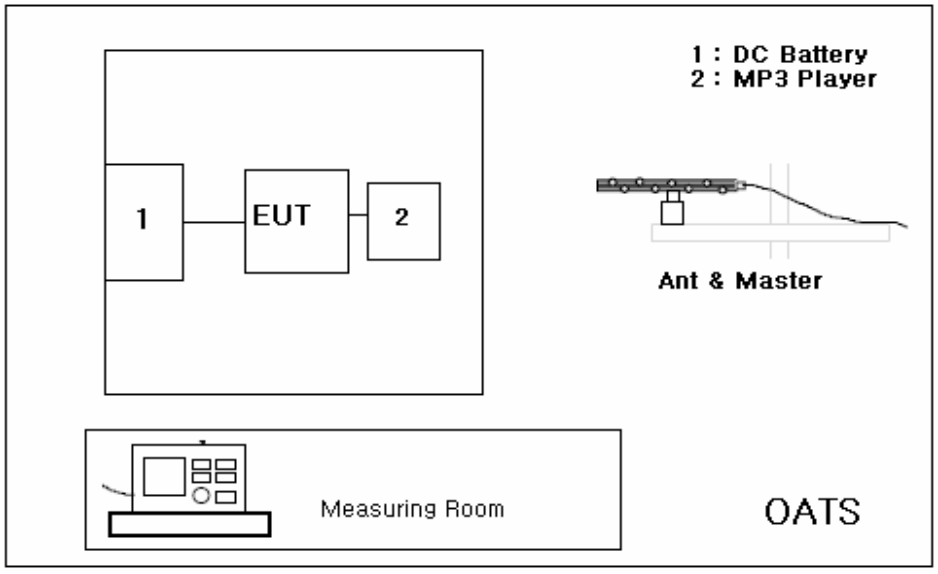
Equipment	Type	Brand	Serial No.
TX80L	Car battery	ATLASBX CO.LTD.	N/A
CA-U250	MP3 Player	CM TECH	N/A

Connecting Interface Cables :

Unshielded POWER(12V) cable(without ferrite core) : 0.5 m

Note :

Test Set-Up



Radiated Emissions

SUMMARY

Emissions

■ Radiated Emission

The requirements are ● MET ○ Not MET

Minimum limit margin 12.2 dB at 88.3 MHz

Maximum limit exceeding

Remarks : EUT was tested for maximize emission and Bandwidth in the state of maximize volume level.

Find the test data in following page 9 to 11.

■ Emission Band Measurement

The requirements are ● MET ○ Not MET

Remarks : EUT was tested for maximize emission and Bandwidth in the state of maximize volume level.

Find the test data in following page 13 to 15.

Test Date

Begin of Testing : Jun 14, 2006

End of Testing : Jul 08, 2006

Prepared By

C.W.Kim / Project Engineer

Note :

- ■ means the test is applicable,
- □ is not applicable.

Radiated Emission

[Applicable]

◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS30	Test Receiver	Rohde & Schwarz	Jan. 12, 2006	828985/023
VULB 9160	Antenna	Schwarzbeck	Sep. 28, 2005	3071

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

Where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

◆ Test Program MP3 Play mode

◆ Test Date Jun 14~20, 2006

◆ Test Area Open site

Note : The equipment used is calibrated in regular for every year.

Radiated Emissions

(Disturbance Radiation)

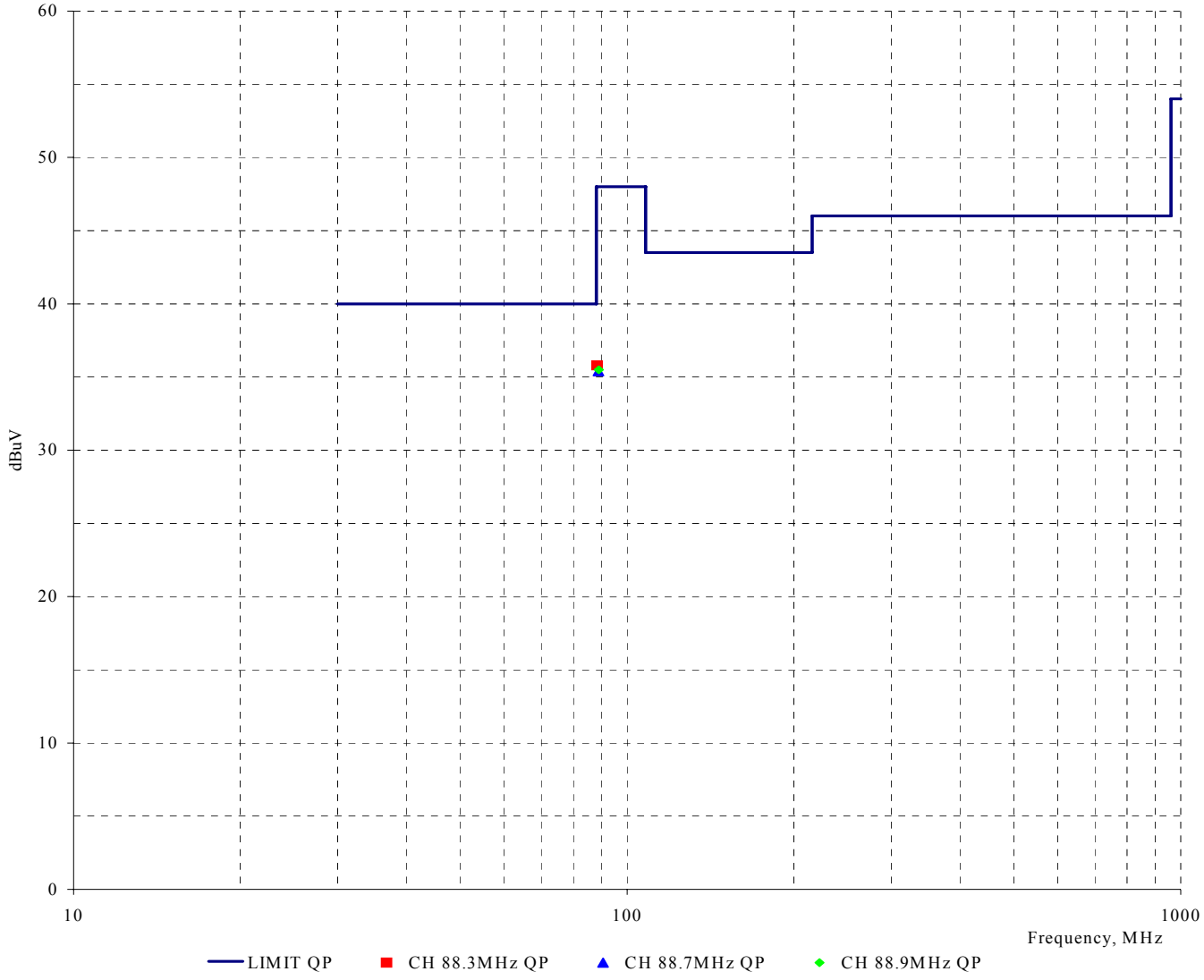
[Applicable]

CH Freq. [MHz]	Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
88.3	88.3(*)	25.8	8.1	1.9	V	35.8	48.0	12.2
	176.6	-	11.2	3.2	-	-	43.5	-
	264.9	-	11.3	4.0	-	-	46.0	-
	353.2	-	13.5	4.9	-	-	46.0	-
	441.0	-	16.3	5.4	-	-	46.0	-
	529.0	-	15.5	6.2	-	-	46.0	-
	618.0	-	18.9	6.8	-	-	46.0	-
88.7	88.7(*)	25.4	8.1	1.9	V	35.4	48.0	12.6
	177.4	-	11.2	3.2	-	-	43.5	-
	266.1	-	11.3	4.0	-	-	46.0	-
	354.8	-	13.5	4.9	-	-	46.0	-
	443.5	-	16.3	5.4	-	-	46.0	-
	532.2	-	15.5	6.2	-	-	46.0	-
	620.9	-	18.9	6.8	-	-	46.0	-
88.9	88.9	25.4	8.2	1.9	H	35.5	48.0	12.5
	177.8	-	11.0	3.2	-	-	43.5	-
	266.7	-	11.4	4.0	-	-	46.0	-
	355.6	-	13.5	4.9	-	-	46.0	-
	444.5	-	16.6	5.5	-	-	46.0	-
	533.4	-	15.5	6.2	-	-	46.0	-
	622.3	-	18.9	6.8	-	-	46.0	-

*Note : **FM Transmitter***

1. ***Remark "--" means that the emission level is too low to be measured.***
2. ***Remark "*" means that the emission frequency is produced from local oscillator.***

MEASUREMENT OF DISTURBANCE RADIATION



ANTENNA REQUIREMENT

1 Standard Applicable

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

2 Antenna Construction

The antenna is permanently mounted on PCB, no consideration of replacement.

EMISSION BAND MEASUREMENT

6.1 Standard Applicable

According to 15.239(a), emissions from the intentional radiator shall be confined within a band 200KHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz.

6.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1 and measurement the turn on the EUT. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 10 kHz and 100kHz respectively with a convenient frequency span including 200kHz bandwidth of the emission.
4. Mark the bandwidth of 200kHz points and plot the graph on spectrum analyzer.
5. Repeat above procedures until all measured frequencies were complete.

◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
R3132	spectrum analyzer	AVANTEST	Jul. 21, 2005	110101565
PLOTTER	Inkjet 1200	Hewlett-Packard	-	N/A

◆ Test Program MP3 Play mode

◆ Test Date Jun 21~28, 2006

Test result:

A. The 20 dB bandwidth of 88.3 MHz = 59.0 KHz < 200 KHz.

B. The 20 dB bandwidth of 88.7 MHz =59.4 KHz < 200 KHz.

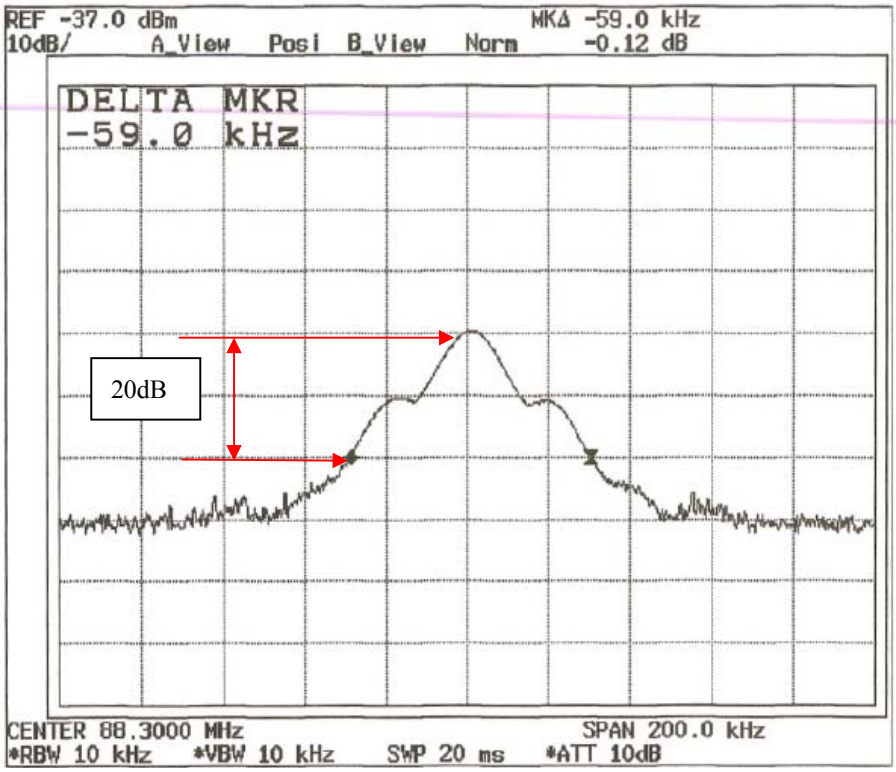
C. The 20 dB bandwidth of 88.9 MHz = 60.2 KHz < 200 KHz.

D. The 200 Khz band lie wholly within the frequency range of 88-108 MHz.

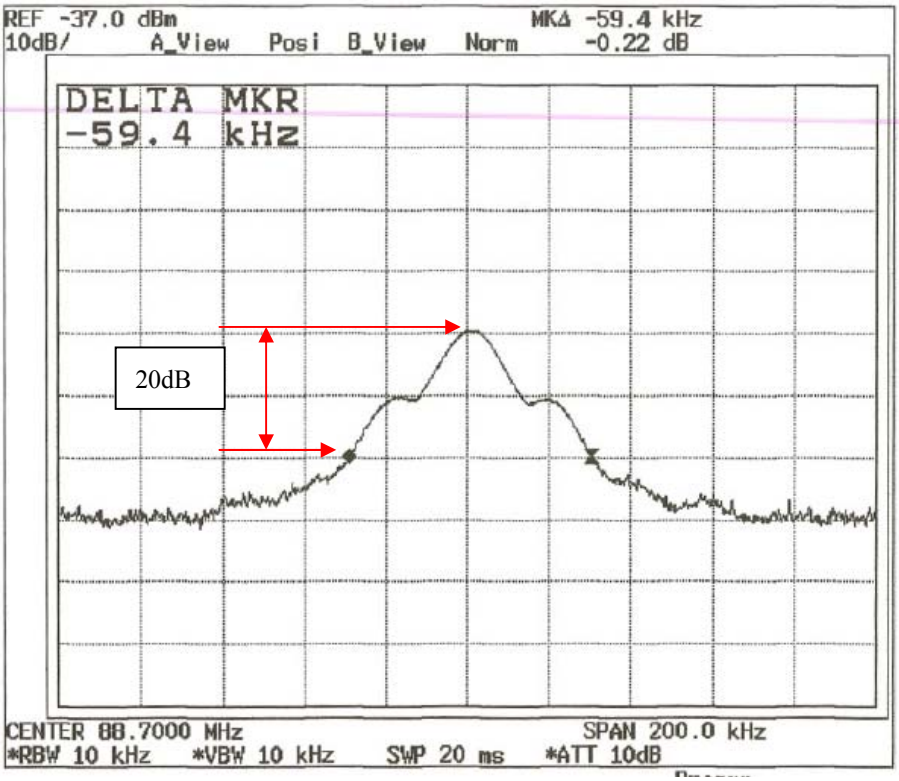
Note : Please see appendix 1 for Plotted Data

Measured the spectrum width with power higher than 20dB below carrier.

Appendix 1. Data and Plots

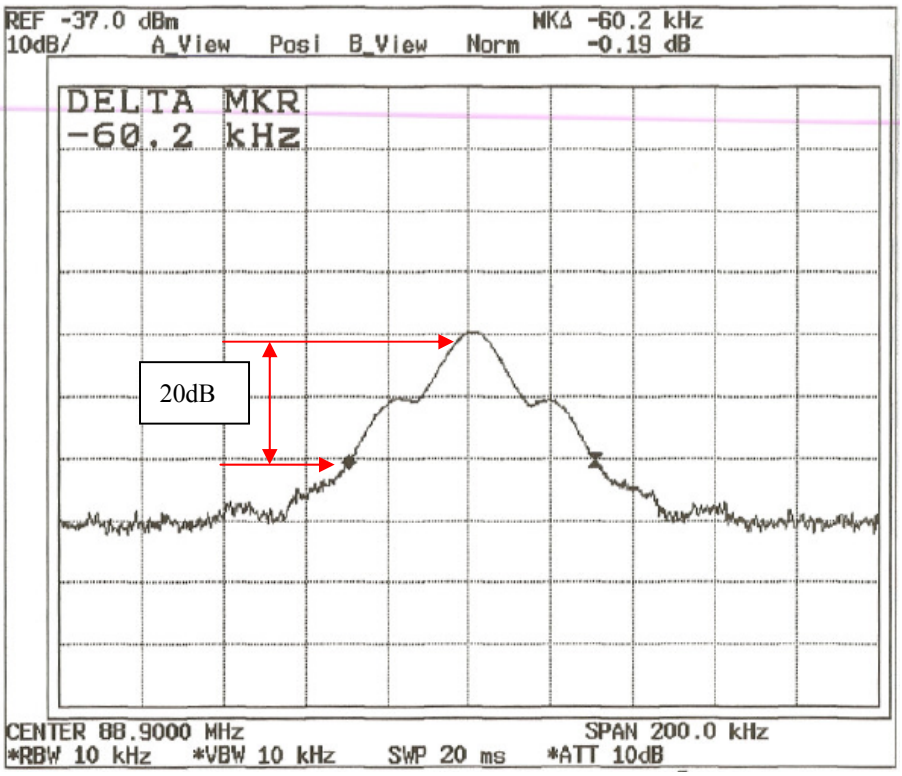


20 dB Bandwidth Plot on 88.3 MHz



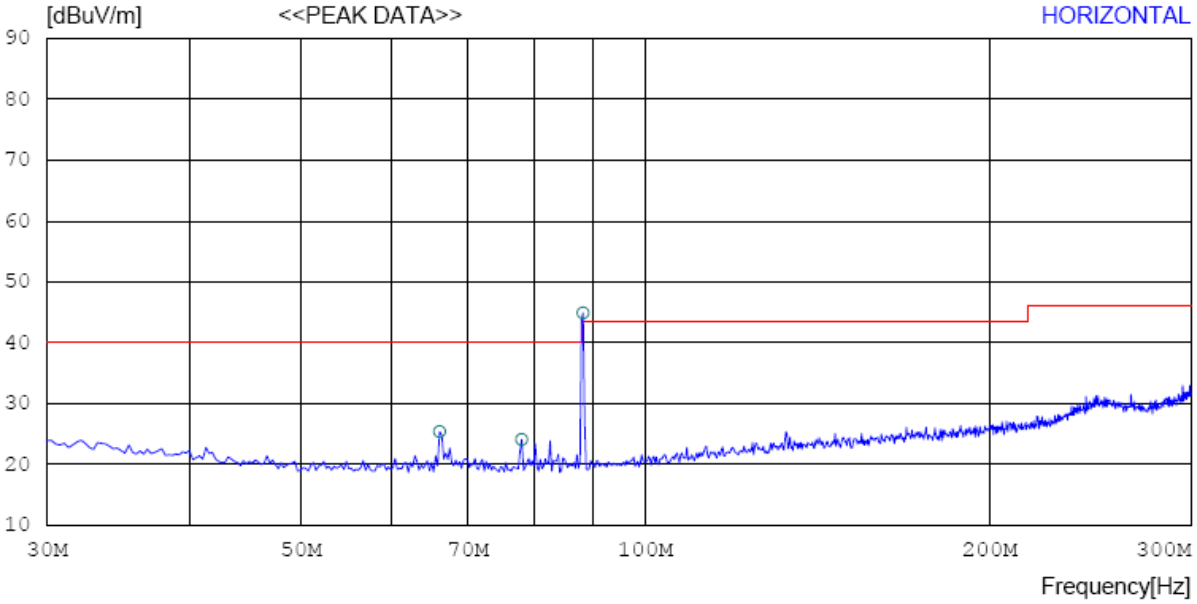
20 dB Bandwidth Plot on 88.7 MHz

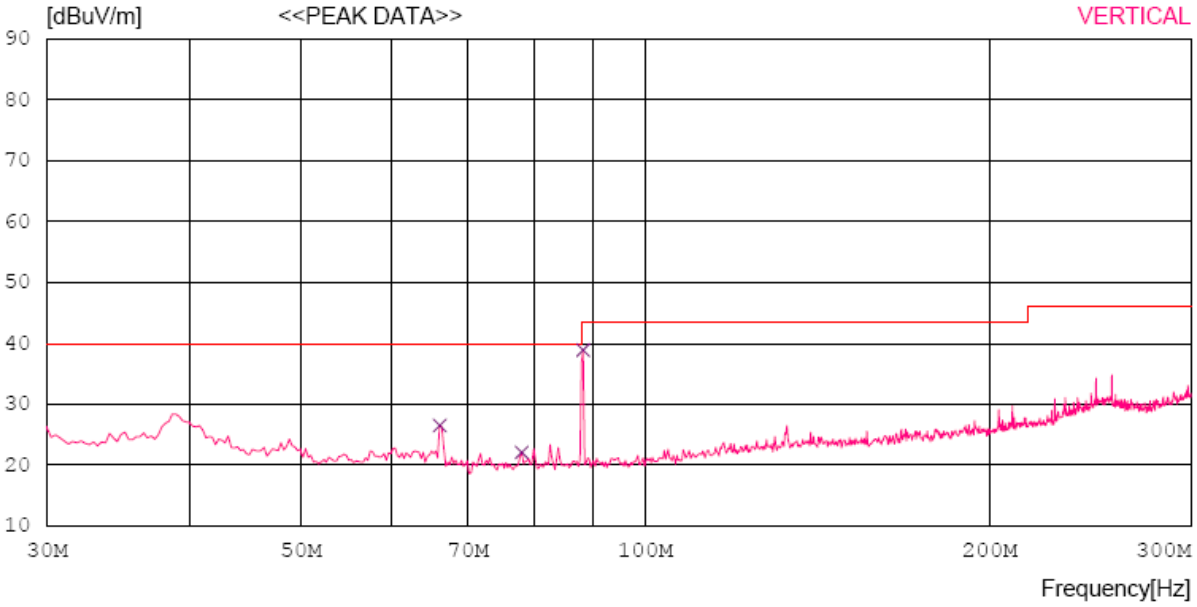
Appendix 1. Data and Plots



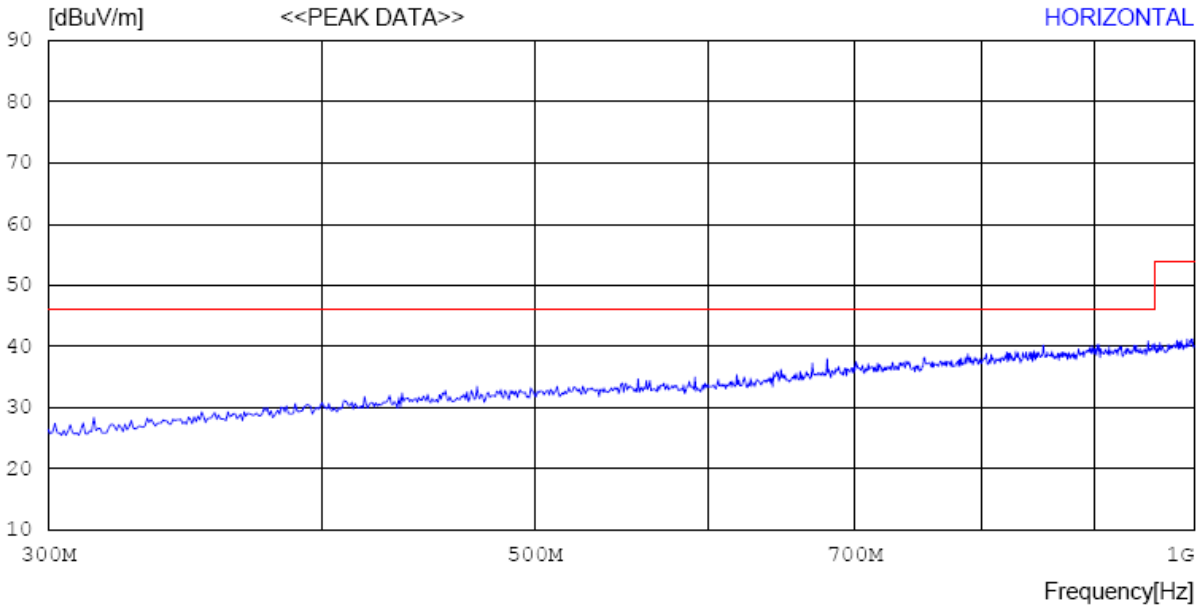
20 dB Bandwidth Plot on 88.9 MHz

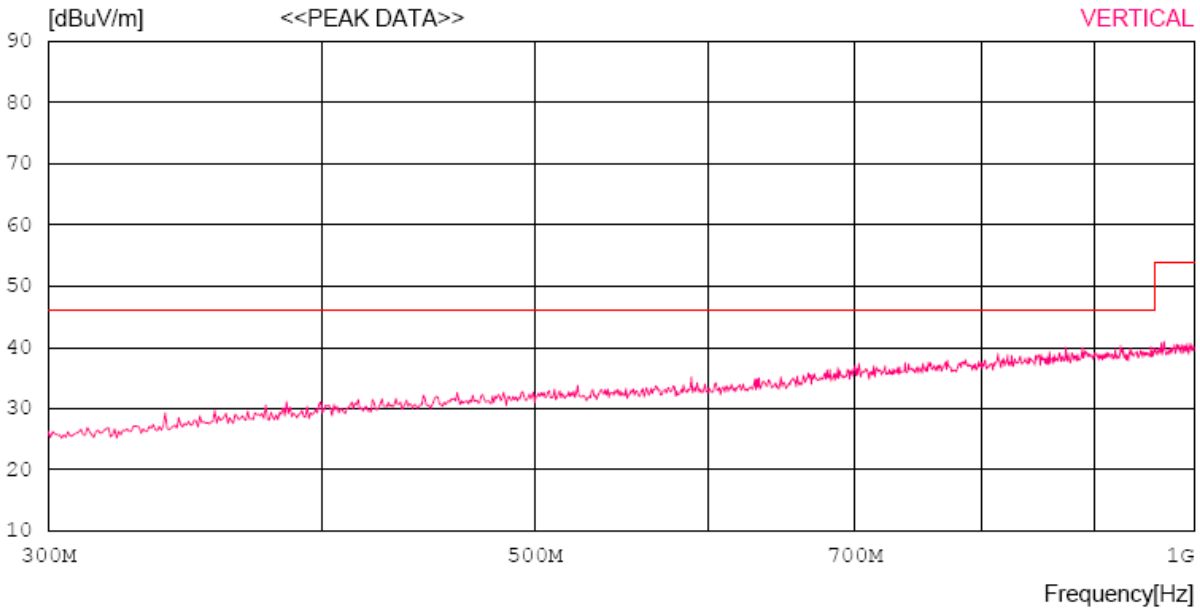
LIMIT : FCC Part15 Class B(3m)/USA



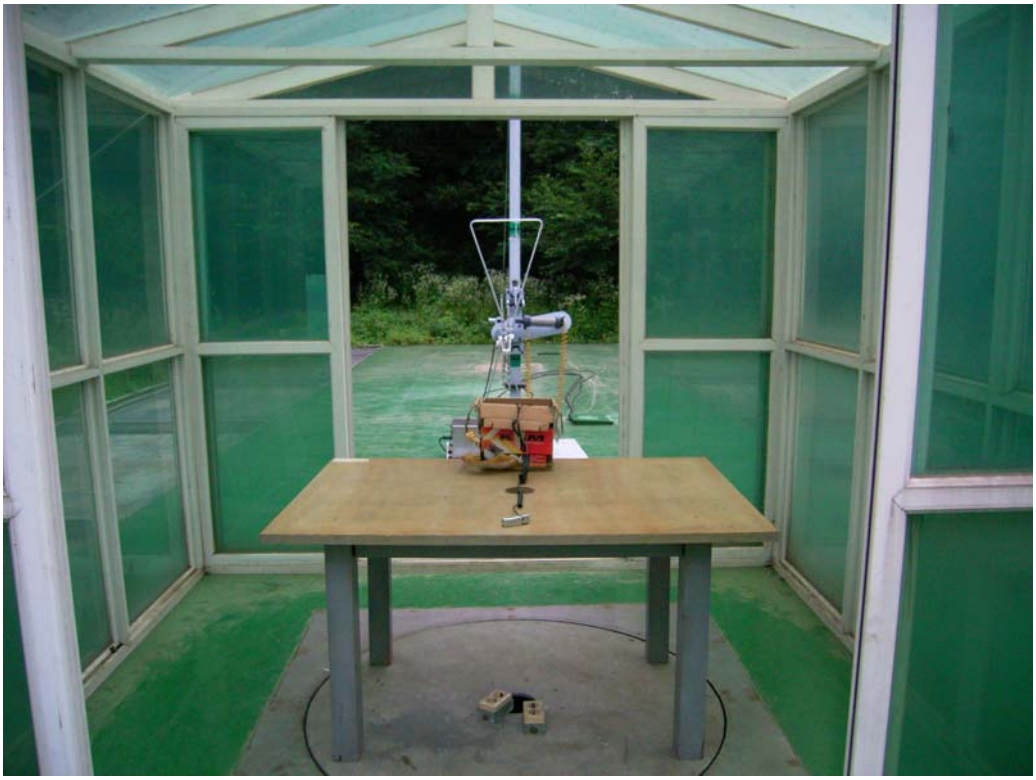


LIMIT : FCC Part15 Class B(3m)/USA

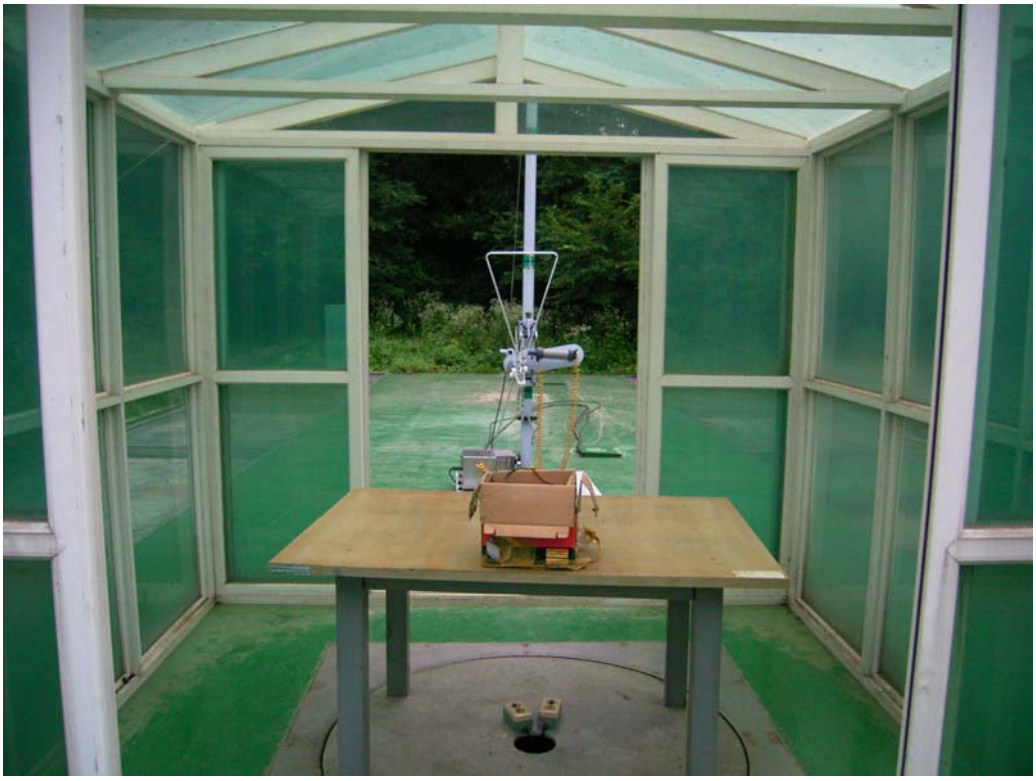




Appendix A. The Photos of Test Setup



Radiated Emissions(charging /Playback mode)- Front View



Radiated Emissions(charging /Playback mode)- Rear View

Appendix B. The Photos of Equipment Under Test

Front View

Rear View

Appendix B. The Photos of Equipment Under Test

power cable

Mp3