RF MEASUREMENT REPORT

CERTIFICATION OF COMPLIANCE

PRODUCT	:	**RFID Card Reader**
MODEL/TYPE NO	:	**HVD-200G**
FCC ID	:	**TJHHVD-200G**
TRADE NAME	:	**HISMARTECH** HST
APPLICANT	:	**HismarTech Co., Ltd.**
FCC RULE PART(S)	:	**FCC Part 15, Subpart C**
FCC PROCEDURE	:	**Certification**
FCC CLASSIFICATION	:	**Low Power Communication Device Transmitter (DXX)**
EMISSION DESIGNATOR	:	**A1D**
FREQUENCY RANGE	:	**13.56 MHz**
EMISSION LEVEL	:	**Below 10000 μV/m (at 30 meters)**
DATES OF TEST	:	**August 8, 2005**
DATES OF ISSUE	:	**August 29, 2005**
TEST REPORT No.	:	**BWS-05-RF-023**
TEST LAB.	:	**BWS Tech., Inc. (Registration No. : 553281)**

This RFID Card Reader Model HVD-200G has been tested in accordance with the measurement procedures specified CFR 47 Part 2.947 and ANSI C63.4-2000 at the BWS TECH/RF Test Laboratory and has been shown to be complied with the FCC Technical Specification described above.
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.

TaeHyun Nam
Chief of Laboratory Division
BWS TECH Inc.

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RF TEST REPORT

Scope – *Measurement and determination of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of relevant international standard*

1. General Information

Applicant Information

Company Name	:	HismarTech Co., Ltd.
Company Address	:	3F Samwhan Bldg 98-20, Woonnidong Jongro-gu, Seoul
Phone/Fax	:	Phone : +82-2708-2950 Fax : +82-2708-2801

Other Information

EUT Type	:	RFID Card Reader
Model Name	:	HVD-200G
FCC Identifier	:	TJHHVD-200G
Brand Name	:	HISMARTECH
S/N	:	ProtoType
Freq. Range	:	13.56 MHz
Emission Level	:	Below 10000 µV/m (at 30 meters)
Emission Designator	:	A1D
FCC Classification	:	Low Power Communication Device Transmitter (DXX)
Rule Part(s)	:	FCC Part 15, Subpart C
Test Procedure	:	Certification
Dates of Tests	:	August 8, 2005
Place of Tests	:	BWS TECH Inc. 611-1 Maesan-Ri, Mohyun-Myun, Yongin-City, Gyunggi-Do 449-853, Korea EMC Testing Laboratory (FCC Registration Number : 553281) TEL: +82 31 333 5997 FAX: +82 31 333 0017
Test Report No.	:	BWS-05-RF-023

2. DESCRIPTION OF ATTACHMENTS

Appendix 1. FCC ID Label and Location
-. Sample FCC ID Label and location information is shown

Appendix 2. Test Setup Photos
-. Radiated Emission Test setup photos are shown

Appendix 3. External Photos
-. External photos are shown

Appendix 4. Internal Photos
-. Internal photos are shown

Appendix 5. Block Diagram
-. The block diagram is shown

Appendix 6. Schematics
-. The circuit diagrams are shown

Appendix 7. Layout
-. The layouts are shown.

Appendix 8. Part List
-. The part lists are shown.

Appendix 9. User Manual
-. The user manual is shown.

3. INTRODUCTION

The measurement tests were conducted at the open area test site of BWS TECH Inc. facility located at 611-1 Maesan-Ri, Mohyun-Myun, Yongin-City, Gyunggi-Do 449-853, Korea. The measurement facilities were constructed in conformance with the requirements of the ANSI C63.4-2000 and CISPR Publication 16. The BWS 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 C63.4-2000 and registered to the Federal Communications Commission(Registration Number : 553281).
All measurements contained in this application were conducted in accordance with FCC Rules and regulations CFR 47and American National Standard Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-2000).

Measurement Procedure

The radiated and spurious measurements were made outdoors at a 3-meter test range (see Figure2).
The equipment under testing was placed on a wooden turntable, 3-meters from the receive antenna. The receive antenna height and turntable rotations was adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This level was recorded.
For readings above 1 GHZ, the above procedure would be repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

4. PRODUCT INFORMATION

4.1 Equipment Description

This product supports Radio Frequency (RF) interface and Infrared Financial Message (IrFM) interface, which has been developed to be attached to POS terminals and C.A.T terminals in merchants stores. From the Dongle Terminal customers can use the smartcards more conveniently and safely without using PIN Pad.

4.2 Technical Specification

General System Electrical Specification

Classification	Content
CPU	8/16 bit Micom
Frequency	13.56Mhz (transmit/receive)
Pulse	A1D
Communication	Simplex operation system
Oscillation	X-Tai method
Modulation	ASK
Power	DC 7.5V, 500mA
Out put	less than 200uV/M
Environment	0 ℃~ +45℃, less than 90%
Weight	251g (exclude adapter)
Size	152mm x 90mm x 99.4mm

4.3 Variations covered by this report

Model Difference : N/A

Technical Deviation : N/A

4.4 Additional information related to Testing

☑ **Note.**

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☑ **Note.**

Please refer to the duties and responsibilities of the Responsible Party attached.

5. DESCRIPTION OF TESTS

5.1 Power Line Conducted Emission Measurement §15.207

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2000. The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50Ω/50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

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 sidewall of the chamber room. Two LISNs are bonded to the shielded room. The EUT is powered from the PMM LISN and the support equipment is powered from the LISN. Power to the LISNs is filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 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 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 to determine the frequency producing the max. Emission from the EUT. The frequency producing the max. Level was reexamined using the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.45 to 30MHz. The bandwidth of the Spectrum Analyzer was set to 9kHz. 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.

5.2 Radiated Emission Measurement §15.209

Preliminary measurements were made at indoors 3-meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.

Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configurations, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using bi-log antenna and above 1000MHz, linearly polarized double ridge horn antennas were used. Above 1GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies, which were selected as bottom, middle, and top frequency in the operating band. Emission level from the EUT with various configurations was examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 3-meter test range using biconical and log periodic, Horn antenna. The output from the antenna was connected, via a preselector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer (for above 25GHz). The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. 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 preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission The EUT, support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Varying the mode of operating frequencies of the EUT maximized each emission. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst-case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20dB/decade) as per section 15.31(f).

Photographs of the worst-case emission test setup can be seen in Appendix A.

5.3 Frequency Tolerance - §15.225(c)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.4 Occupied Bandwidth - §15.215

Additional provisions to the general radiated emission limitations.

(a) The regulations in Secs. 15.217 through 15.255 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.
(b) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in Sec. 15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.
(c) For those bands of frequencies where alternative radiated emission limitations apply and for which a frequency stability is not specified, it is recommended that the fundamental frequency be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.
(d) Where the following sections specify limits on the bandwidth of the emissions, the bandwidth limits include the effects of frequency sweeping, frequency hopping, and other modulation techniques which may be employed.

6. TEST RESULTS

6.1 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.

FCC Rules Section	Description	Test Result
Part 15.207	Power Line Conducted Spurious	☒ **Pass** ☐ Fail
Part 15.209 & 15.225	Radiated Emission	☒ **Pass** ☐ Fail
Part 15.225	Emission Mask	☒ **Pass** ☐ Fail
Part 2.1049	Occupied Bandwidth	☒ **Pass** ☐ Fail
Part 2.1055 & 15.225	Frequency Tolerance	☒ **Pass** ☐ Fail

The data collected shows that the product complies with technical requirements of the FCC Rule Part 15.225

6.2 Modification to EUT

The device tested 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.

7. TEST DATA

7.1 Power Line Conducted Emission

Test Standard	: FCC Part 15.207
Operating Frequency	: 13.56 MHz
Operating Mode	: CW

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Power Line Conducted Emission Test Data

Detector Mode ; CISPR Quasi Peak mode (6dB Bandwidth : 9kHz)

Freq [MHz]	Correcton		Test Condition	Phase [H/N]	Peak Mode		
	AMN	C.L			Limit [dBuV]	Reading [dBuV]	Emission Level [dBuV]
0.213	0.07	0.10	Normal	H	64.30	45.80	45.97
0.836	0.08	0.30	Normal	H	56.00	31.50	31.88
10.000	0.08	1.03	Normal	N	60.00	22.80	23.91
13.560	0.06	1.20	50Ω Term.	H		58.24	59.50
13.560	0.06	1.20	Normal	H		75.20	76.46
20.000	0.05	1.35	Normal	H		15.80	17.20
27.120	0.19	1.55	Normal	H		43.80	45.54
30.000	0.28	1.68	Normal	N		42.20	44.16

NOTES :

1. *H : Hot Line , N :Neutral Line*
2. *Emission Level = Reading + Correction Factor*
3. *Measurements were performed at the AC Power Inlet of the host PC with the EUT plugged in the frequency band of 150kHz ~ 30MHz.*
4. *Signal at 13.56MHz is fundamental signal.*
5. *The measurements were performed at the shielded room with environmental conditions of 23℃, 62%RH*

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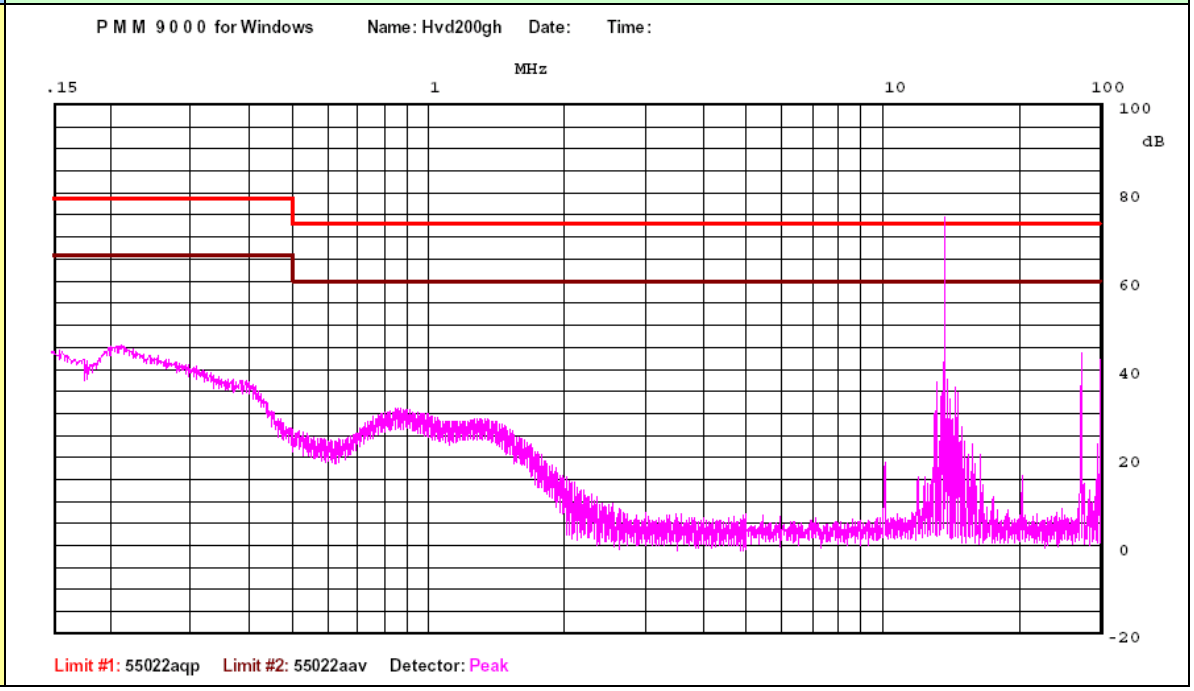
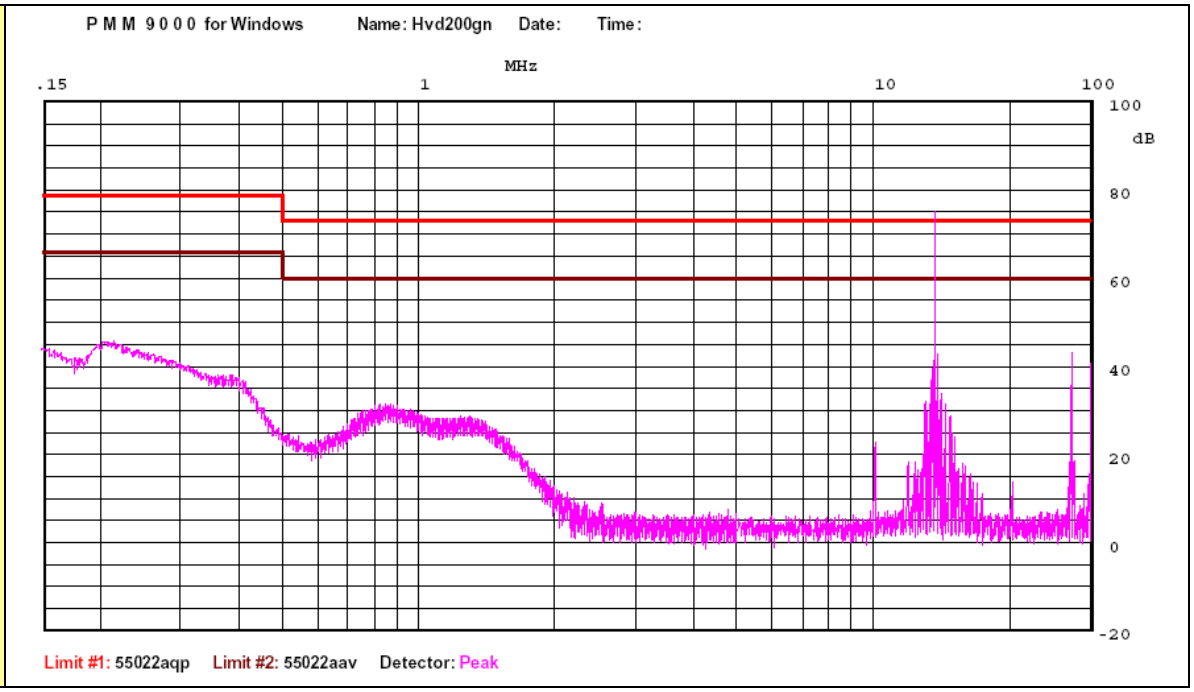
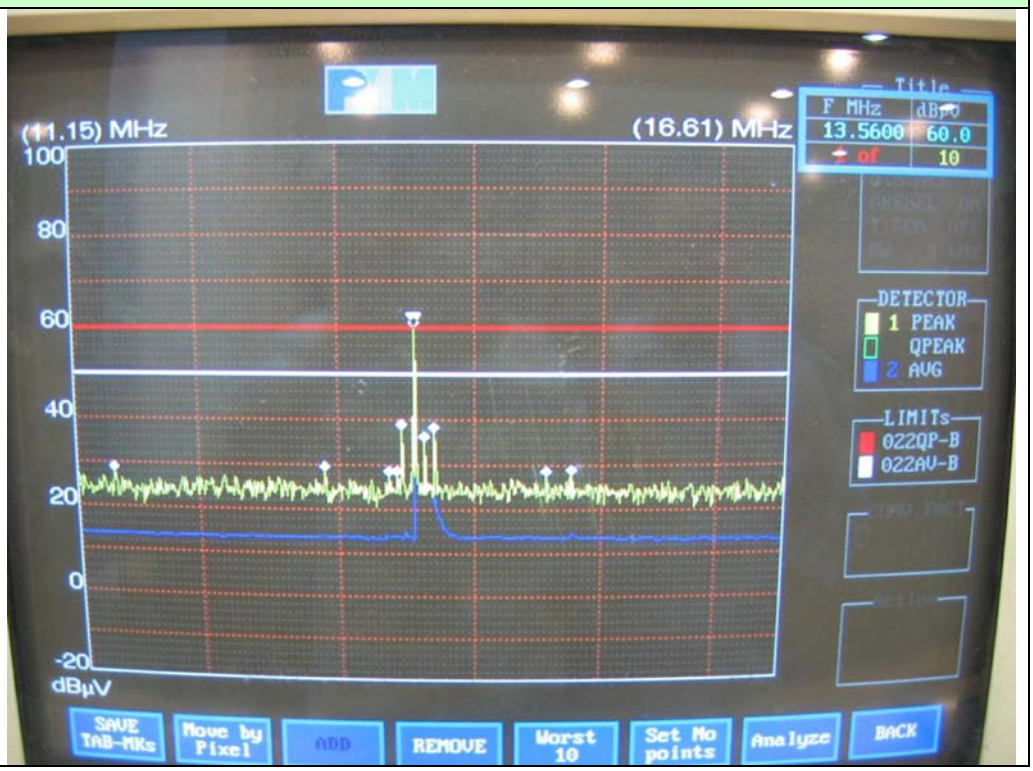
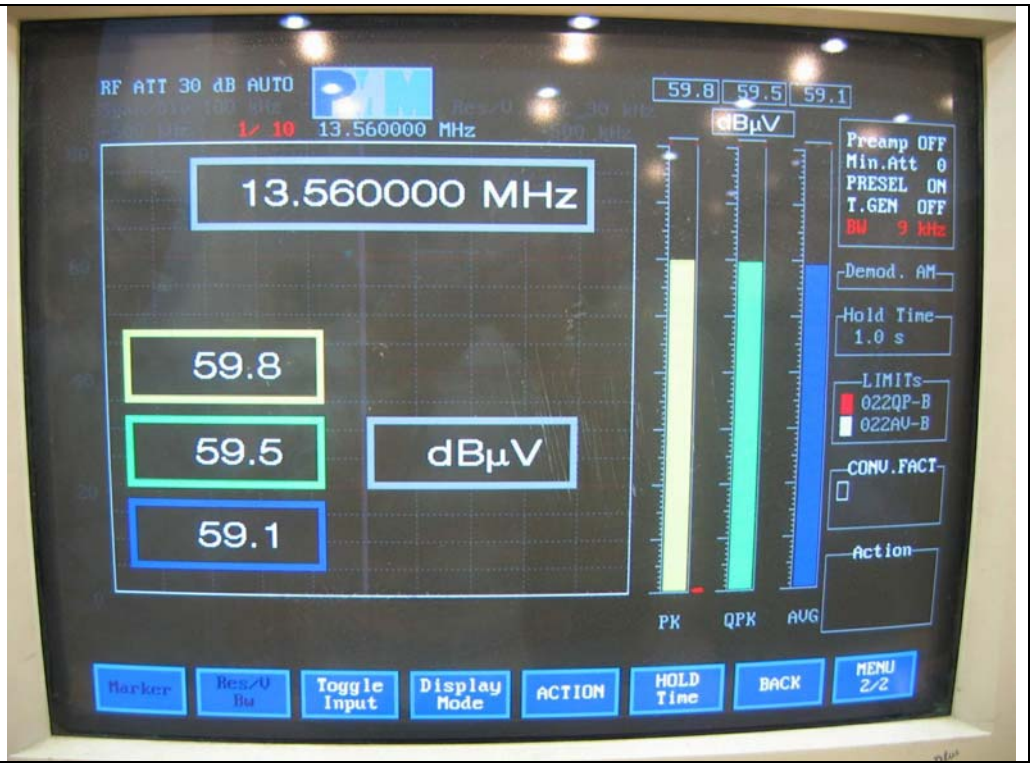
Plots of Power Line Conducted Emission

Mode	Plot
Hot	
Neutral	

Plots of Power Line Conducted Emission (Fundamental)

Mode	Plot
Plot	
Data	

7.2 Radiated Emission

Test Standard	: FCC Part 15.209 & 15.225
Operating Frequency	: 13.56 MHz
Operating Mode	: CW

Radiated Emission Test Data

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

Detector mode : CISPR Quasi-Peak mode (6dB Bandwidth : 9 kHz / 120 kHz)

Measurement Distance : 3 meters

Frequency [MHz]	Reading [dBμV]	Polarization [*H/**V]	Ant.Factor [dB]	Cable Loss [dB]	Limit [dBμV/m]	Emission Level [dBμV/m]	Margin [dB]
13.56	46.00	-	22.00	0.70	124.00	68.70	-55.30
98.96	13.65	V	9.74	2.20	43.50	25.59	-17.91
197.87	23.13	V	10.32	3.13	43.50	36.59	-6.91
296.77	14.47	V	13.30	3.86	46.00	31.63	-14.37
395.63	6.42	V	15.69	4.52	46.00	26.62	-19.38
494.49	2.83	V	17.60	5.05	46.00	25.48	-20.52
593.30	6.76	V	19.72	5.55	46.00	32.03	-13.97
692.13	0.26	H	20.86	6.11	46.00	27.22	-18.78
790.95	-2.99	V	22.56	6.69	46.00	26.26	-19.74
889.31	-1.45	V	23.38	7.10	46.00	29.04	-16.96

NOTES :

1. ** H : Horizontal polarization , ** V : Vertical polarization*
2. *Emission Level = Reading + Antenna factor + Cable loss*
3. *Extrapolated from the measured distance (3 m) to the specified distance (30 m) using the square of an inverse linear distance extrapolation.*
4. *The field strength of any emissions within this band shall not exceed 15,848 microvolts/meter (84 dBuV/m) at 30 meters.*
5. *Converted limit*
   84 dBuV/m (at 30 m) + 40 dB (Distance Correction Factor) = 124 dBuV/m (at 3 m)
6. *Margin value = Limit - Emission Level*
7. *The measurements were performed at the shielded room with environmental conditions of 23℃, 62%RH*

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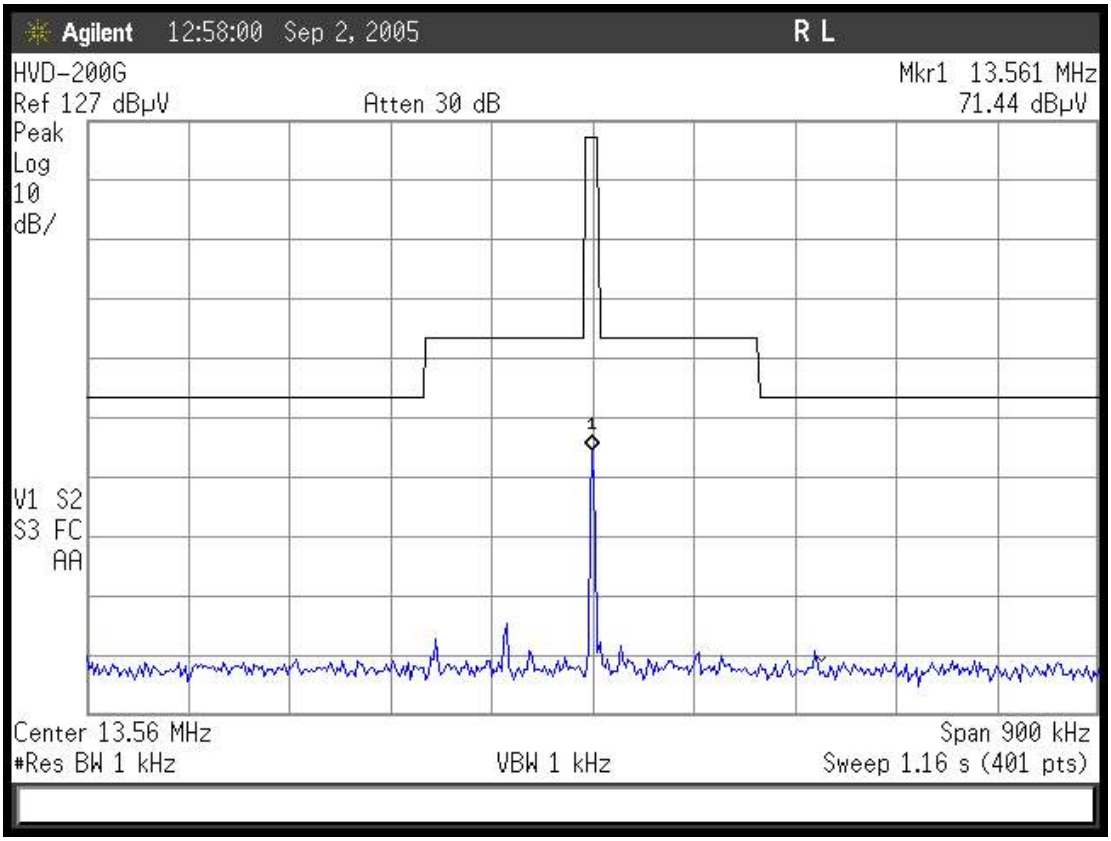
7.3 Emission Mask

Test Standard	: FCC Part 15.225
Operating Frequency	: 13.56 MHz
Operating Mode	: CW



NOTES :

1. *Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (50.47 dBuV/m) at 30 meters.*
2. *Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (40.51 dBuV/m) at 30 meters.*
3. *Extrapolated from the measured distance (3 m) to the specified distance (30 m) using the square of an inverse linear distance extrapolation.*
4. *The measurements were performed at the shielded room with environmental conditions of 23℃, 62%RH*

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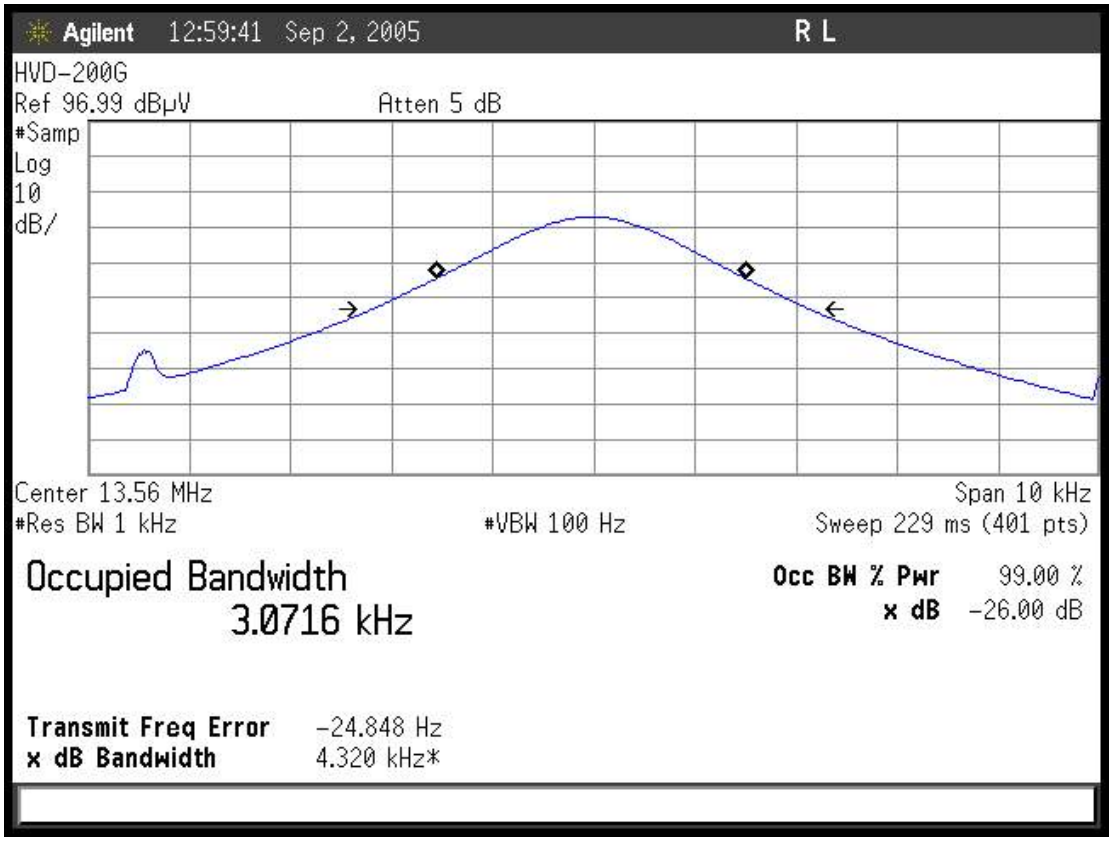
7.4 Occupied Bandwidth

Test Standard	: FCC Part 2.1049
Operating Frequency	: 13.56 MHz
Operating Mode	: CW



NOTES :

1. *99 % Bandwidth : 3.0716 kHz*
2. *26 dB Bandwidth : 4.3200 kHz*
3. *The measurements were performed at the shielded room with environmental conditions of 23℃, 62%RH*

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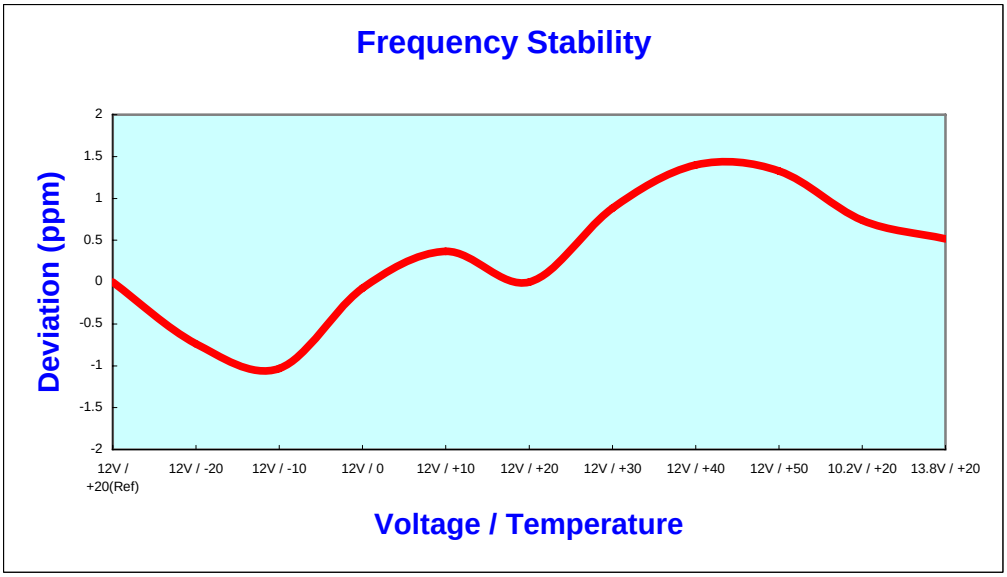
7.5 Frequency Tolerance

Test Standard	: FCC Part 2.1055 & 15.225
Operating Frequency	: 13.56 MHz
Operating Mode	: CW

Voltage (%)	Power Supply (Vdc)	Temperature (°C)	Frequency (Hz)	Deviation (ppm)	Limit (ppm)
100 %	12	+20(Ref)	13561312	-	±100
100 %	12	-20	13561302	-0.737	±100
100 %	12	-10	13561298	-1.032	±100
100 %	12	0	13561311	-0.074	±100
100 %	12	+10	13561317	+0.369	±100
100 %	12	+20	13561312	0	±100
100 %	12	+30	13561324	+0.885	±100
100 %	12	+40	13561331	+1.401	±100
100 %	12	+50	13561330	+1.327	±100
85 %	10.2	+20	13561322	+0.737	±100
115 %	13.8	+20	13561319	+0.516	±100

Note :
1. The worst-case temperature & voltage deviation was recorded.
2. Frequency drift of this unit dose not happen.



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8. TEST EQUIPMENT LIST

List of Test Equipments Used for Measurements

Test Equipment	Model	Mfg.	Serial No.	Cal. Due Date
Spectrum Analyzer	8594E	H.P.	3911A08040	05-12-28
Spectrum Analyzer	E7403A	ADVANTEST	61720002	06-05-18
Receiver	ESH3	ROHDE & SCHWARZ	892580/014	06-08-30
Signal Generator	E4432B	H.P.	US40053157	06-03-10
Signal Generator	GT9000	GIGATRONICS	9604010	06-03-10
Power Meter	E4418A	H.P.	GB38272621	06-03-10
Power Sensor	8481A	H.P.	3318A92101	06-03-10
Audio Analyzer	8903B	H.P.	3011A09344	06-03-10
Modulation Analyzer	8901B	H.P.	3028A03124	06-03-10
Function Generator	FG-2002C	GOLD STAR	207095	06-01-13
Broadband Power Amplifier	100W 10000M 11	Amplifier Research	18649	05-12-29
Broadband Power Amplifier	75A220	Amplifier Research	15326	05-12-29
Preamplifier	8447E	H.P.	2945A02712	05-08-30
Horn Antenna	BBHA 9120 D	Schwarz Beck	234	07-02-07
Horn Antenna	BBHA 9170	Schwarz Beck	157	07-02-07
Dipole Antenna	VDA6106A / UHA9105	Schaffner-chase	1277	05-09-12
Biconical Antenna	VHA9103	Schwarzbeck	-	06-02-04
Log Periodic Antenna	UPA6109	SCHAFFNER	1076	06-02-04
Loop Antenna	HFH2-Z2	ROHDE & SCHWARZ	881056/6	06-08-19
Attenuator	8325	BIRD	4572	06-03-10
Attenuator	RFA500NMF30	RFA500NMF30	9522	05-12-28
Termination	8173	BIRD	2501	-
Dual directional coupler	772D	H.P.	2839A00395	05-12-28
Dual directional coupler	778D	H.P.	1144A08477	05-10-15
LISN	L3-25	PMM	1110KT0403	05-10-02
LISN	LI-115	COM-POWER	8-920-20	05-10-27
Digital Oscilloscope	TDS3032	Tektronix	B081558	05-12-28
Turn-Table	JAC-2	JAEMC	-	-
Antenna Master	JAC-1	Daeil EMC	-	-
Plotter	7550A	H.P	2725A 75529	-
EMC Anechoic Chamber	-	SEMITECH	000815	
Temp/Humidity Chamber	-	Seo jin	-	05-09-03
Thermo Hygrograph	PC-5000TRH-II	SATO	-	자체교정
BaroMeter	KEIRYOKI	SATO	564021	05-09-15
Slidacs	DeaKyong Slidacs	DeaKyong	-	-