



EMI TEST REPORT

Test Report No. : 25BE0028-HO-3

Applicant : SEGA CORPORATION

Type of Equipment : Reader/Writer Unit

Model No. : HW210

Test standard : FCC Part 15 Subpart C : 2004
Section 15.225, 15.209 and 15.207

FCC ID : FJ8CTF09904

Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contain a true representation of the EMC profile.
4. The test results in this report are traceable to the national or international standards.

Date of test:

September 10, 2004

Tested by:

Naoki Sakamoto
EMC Service

Approved by :

Hironobu Shimaji
Group Leader of
EMC Service

UL Apex Co., Ltd.

Head Office EMC Lab.

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SECTION 1: Client Information

Company Name : SEGA CORPORATION
Brand or Trade name : SEGA
Address : 2-12-14 HIGASHIKOJIYA, OHTA-KU, TOKYO, 144-8532 JAPAN
Telephone Number : +81-3-5736-7567
Facsimile Number : +81-3-5736-7580
Contact Person : Takashi Honma

SECTION 2: Equipment under test (E.U.T)

2.1 Identification of E.U.T.

Type of Equipment : Reader/Writer Unit (RFID SYSTEM)
Model No. : HW210
Serial No. : 046019565 B
Country of Manufacture : Japan
Rating : DC5.0V / 0.3A
Receipt Date of Sample : September 09, 2004
Condition of EUT : Production model

2.2 Product Description

Model No: HW210, referred to as the EUT in this report, is a Reader Writer Unit. (RFID SYSTEM)

	RFID System
Clock frequency	Carrier Frequency: 13.56MHz Other clock:19.6608MHz
Feature of EUT	The EUT reads and writes the information stored in a particular IC card. The EUT shall be installed in a game machine of SEGA CORPORATION.

Equipment Type : Transceiver
Type of modulation : Amplitude Shift Keying
Mode of operation : Simplex
Antenna Type : Loop Antenna
Antenna area : less than 0.05m²
Method of Frequency Generation : Crystal (13.56MHz)
Operating Temperature : -20 deg. C. to +60 deg. C.

FCC 15.31 (e)

This EUT provides stable voltage (DC5.0V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna because the antenna is not removable from EUT.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C : 2004
Section 15.225, 15.209 and 15.207

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.225 : Operation within the band 13.110– 14.010 MHz.

3.2 Procedures and results

1) FCC Part 15 Subpart C : 2004

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 8. Radiated emission measurements	Section 15.225(a)	Radiated	N/A	65.2dB 13.5610MHz	Complied
2	Electric Field Strength of Band edges	ANSI C63.4:2003 8. Radiated emission measurements	Section 15.225(b)(c)	Radiated	N/A	44.8dB 14.010MHz	Complied
3	-20dB Bandwidth	ANSI C63.4:2003 Annex H. 6 Occupied bandwidth measurements	Section15.215(c)	Radiated	N/A	-	Complied
4	Electric Field Strength of Spurious Emission	ANSI C63.4:2003 8. Radiated emission measurements	Section15.225(d) Section15.209	Radiated	N/A	12.7dB 40.681MHz Vertical	Complied
5	Frequency Tolerance	ANSI C63.4:2003 Annex H. 5 Frequency measurements	Section15.225(e)	Radiated	N/A	61.65 ppm (Tmin -20°C Vnom DC5.0V 2min)	Complied
6	Conducted emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements	Section15.207	Conducted	N/A	6.3dB (AV) 0.23MHz N *1	Complied

Note: UL Apex's EMI Work Procedures No.QPM05.

*1) AC100V/60Hz was supplied as power supply to AC adaptor, since the input rating of AC adaptor provided by the customer was only AC100V. The AC adaptor was used to supply DC5.0V to EUT, and it is a typical AC Adaptor specified by the customer for operating EUT.

*These tests were performed without any deviations from test procedure except for additions or exclusions.

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3.3 Uncertainty

Fundamental and Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is $\pm 1.8\text{dB}(10\text{m})$.

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is $\pm 4.5\text{dB}(3\text{m})/\pm 4.7\text{dB}(10\text{m})$.

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is $\pm 5.2\text{dB}(3\text{m})/\pm 3.8\text{dB}(10\text{m})$.

The data listed in this test report has enough margin.

3.4 Test Location

UL Apex Co., Ltd. Head Office EMC Lab. *NVLAP Lab. code: 200572-0

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	Listed date (for FCC)	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	February 01, 2002	313583	IC4247	19.2 x 11.2 x 7.7m	7.0 x 6.0m	Preparation room
No.2 semi-anechoic chamber	June 05, 2002	846015	IC4247-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 shielded room	-	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.4 measurement room	-	-	-	3.1 x 5.0 x 2.7m	N/A	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1 and No.2 semi-anechoic and No.3 shielded room.

3.5 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

The EUT was operated in a manner similar to typical use during the tests.

The mode is used : Continuous Card Reading Mode (Tx: 13.56MHz)

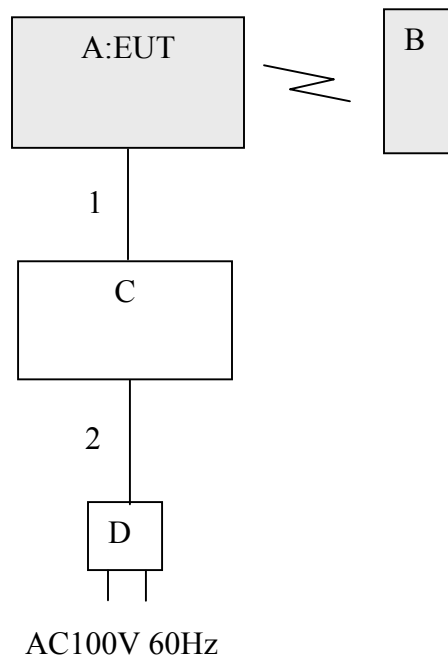
Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

Frequency Tolerance:

Temperature for the extreme tests : -20 deg.C.(minimum) to + 50deg.C.(maximum)
Voltage for the extreme tests : N/A **

** This EUT provides stable voltage (DC5.0V) constantly to RF Module regardless of input voltage.

4.2 Configuration and peripherals



Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID	Remarks
A	Reader/Writer Unit	HW210	046019565 B	SAXA, INC	FJ8CTF09904	EUT
B	IC Card	-	-	SAXA, INC	-	EUT
C	I/F (PCB)	ETR-1 I/F	-	SAXA, INC	-	
D	AC Adaptor	S-8447	-	KAGA COMPONENTS	-	

List of cables used

No.	Name	Length (m)	Shield	Backshell Material
1	I/F Cable	0.1	N	Polyvinyl chloride
2	DC Cable	2.0	N	Polyvinyl chloride

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 0.5m by 0.5m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Detector	: CISPR quasi-peak detector (IF BW 9 kHz)
Measurement range	: 0.15-30MHz
Test data	: APPENDIX 3
Test result	: Pass

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SECTION 6: Radiated emission (Fundamental and Spurious Emission)

6.1 Operating environment

Test place : a No.2 semi Anechoic Chamber (Fundamental and Spurious emission
/below 30MHz and above 30MHz)
Temperature : See data
Humidity : See data

6.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 0.5m, raised 80cm above the conducting ground plane.
The EUT was set on the center of the tabletop and the peripheral was aligned and flushed with rear of tabletop.
Test was made with the Loop antenna positioned in 0° to 180° of the polarization.
Test was made with the Biconical, and Logperiodic antenna positioned in both the horizontal and vertical planes of polarization.
The center of the Loop antenna was 1 m height from the ground plane.
The Biconical, and Logperiodic antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.
A drawing of the set up is shown in the photos of APPENDIX 1.

6.3 Test conditions

Frequency range	: 9kHz -30MHz	: 30MHz-1000MHz
Test distance	: 3m	: 3 m
EUT position	: Tabletop	: Tabletop
EUT operating mode	: Continuous Transmitting (with Card Reading)	: Continuous Transmitting (with Card Reading)

6.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi anechoic chamber with a ground plane and at a distance of 3m.

The measuring antenna height was varied between 1 to 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity (30-1000MHz).

The measurements were performed for 0 deg. to 180 deg. (Loop antenna) or vertical and horizontal (Biconical and Logperiodic antenna) antenna polarization.

The carrier level or noise levels were measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined. With the position, the noise levels of all the frequencies was measured.

Measurements were performed with a QP, PK, and AV detector.

The radiated emission measurements were made with the following detector function of the test receiver.

	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz

* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)

[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

SECTION 7: -20dB Bandwidth

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test data : APPENDIX 3

SECTION 8: Frequency Tolerance

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test data : APPENDIX 3

Test result : Pass

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APPENDIX 1: Photographs of test setup

Conducted Emission

Front



Side



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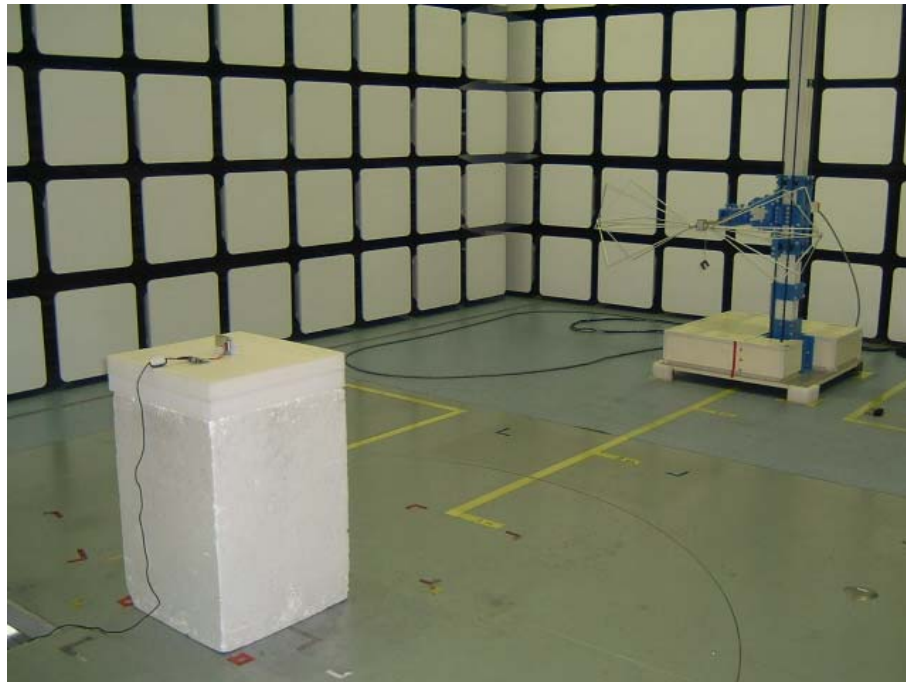
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Radiated emission (Spurious emission)

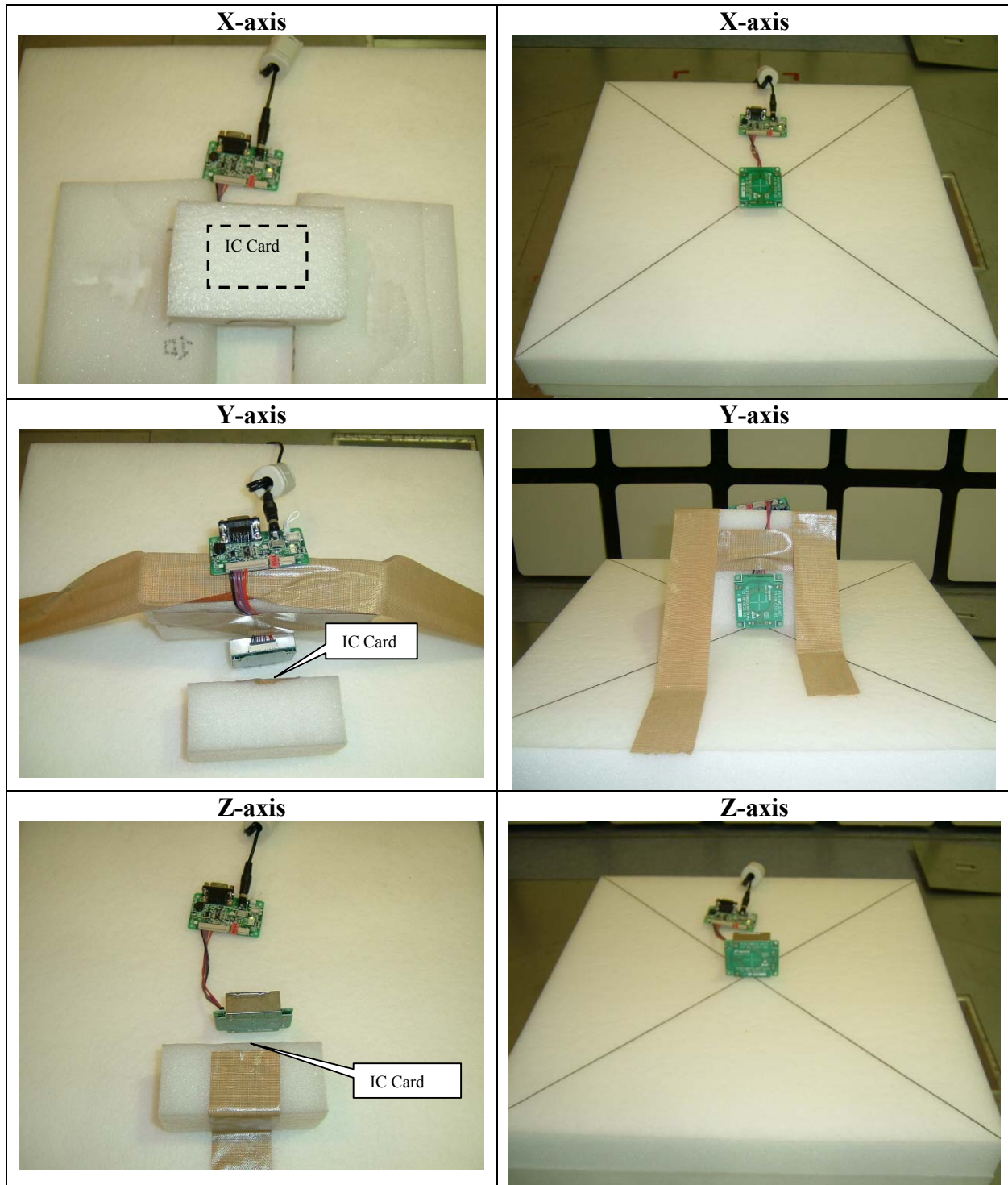
Front



Rear



Worst Case Position (Z-axis: 0deg)



A left side photograph is actual measurement scenery. A right side photograph is reference photograph of only Reader/Writer Unit which removed the IC Card from the left side photograph.

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APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Test Item	Calibration Date * Interval(month)
MAEC-02	Anechoic Chamber	TDK	Semi Anechoic Chamber 3m	1,2,4	2004/04/12 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	1	2003/10/15 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	1	2003/10/15 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	1,2	2004/01/08 * 12
MPA-06	Pre Amplifier	Hewlett Packard	8447D	1,2	2004/08/29 * 12
MAT-06	Attenuator(6dB)	Weinschel Corp	2	1,2	2003/12/16 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	1	2003/12/16 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	1	2004/02/24 * 12
MCC-31	coaxial cable	ULApex	-	1,2	2004/06/12 * 12
MRENT-09	Spectrum Analyzer	Advantest	R3273	1,2,3,4	2004/02/18 * 12
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	1,4	2004/02/03 * 12
MCC-13	Coaxial Cable	Fujikura/Agilent	-	1,2,4	2004/02/24 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	4	2004/02/17 * 12
MCH-01	Temperature and Humidity Chamber	Tabai Espec	PL-2KP	3	2003/12/18 * 12

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

Test Item:

- 1: Fundamental and Spurious Emission**
- 2: -20dB Bandwidth**
- 3: Frequency Tolerance**
- 4: Conducted Emission**

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APPENDIX 3: Data of EMI test

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

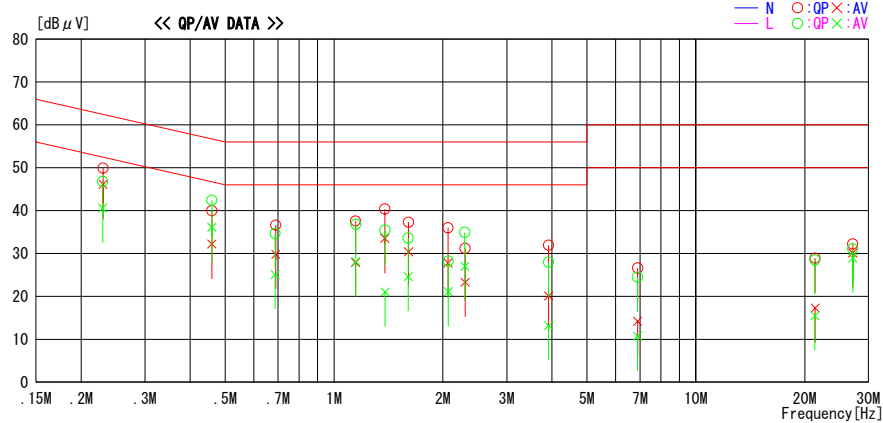
UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2004/09/10 16:19:22

Applicant : SEGA CORPORATION
Kind of EUT : Reader/Writer Unit
Model No. : HW210
Serial No. : 046019565 B

Report No. : 25BE0028-HO
Power : AC100V / 60Hz (DC5.0V)
Temp/C/Humi% : 25deg. C / 62%
Operator : Naoki Sakamoto

Mode / Remarks : Card Reading (13.56MHz)

LIMIT : FCC15C § 15.207 (QP)
FCC15C § 15.207 (AV)



NO	FREQ [MHz]	READING		C. F	RESULT		LIMIT		MARGIN		PHASE
		QP [dB μ V]	AV [dB μ V]		QP [dB μ V]	AV [dB μ V]	QP [dB μ V]	AV [dB μ V]	QP [dB]	AV [dB]	
1	0.2300	49.8	46.0	0.1	49.9	46.1	62.4	52.4	12.5	6.3	N
2	0.4594	39.9	32.1	0.1	40.0	32.2	56.7	46.7	16.7	14.5	N
3	0.6895	36.4	29.6	0.2	36.6	29.8	56.0	46.0	19.4	16.2	N
4	1.1462	37.4	27.7	0.2	37.6	27.9	56.0	46.0	18.4	18.1	N
5	1.3811	40.2	33.3	0.2	40.4	33.5	56.0	46.0	15.6	12.5	N
6	1.6072	37.0	30.1	0.3	37.3	30.4	56.0	46.0	18.7	15.6	N
7	2.0660	35.7	27.5	0.3	36.0	27.8	56.0	46.0	20.0	18.2	N
8	2.3015	30.9	23.0	0.3	31.2	23.3	56.0	46.0	24.8	22.7	N
9	3.9173	31.4	19.6	0.5	31.9	20.1	56.0	46.0	24.1	25.9	N
10	6.8988	25.8	13.4	0.8	26.6	14.2	60.0	50.0	33.4	35.8	N
11	21.3672	26.9	15.3	2.0	28.9	17.3	60.0	50.0	31.1	32.7	N
12	27.1205	29.9	27.8	2.3	32.2	30.1	60.0	50.0	27.8	19.9	N
13	0.2294	46.7	40.5	0.1	46.8	40.6	62.5	52.5	15.7	11.9	L
14	0.4592	42.3	36.0	0.1	42.4	36.1	56.7	46.7	14.3	10.6	L
15	0.6870	34.4	24.9	0.2	34.6	25.1	56.0	46.0	21.4	20.9	L
16	1.1488	36.6	27.9	0.2	36.8	28.1	56.0	46.0	19.2	17.9	L
17	1.3825	35.2	20.8	0.2	35.4	21.0	56.0	46.0	20.6	25.0	L
18	1.6042	33.3	24.3	0.3	33.6	24.6	56.0	46.0	22.4	21.4	L
19	2.0683	27.9	20.8	0.3	28.2	21.1	56.0	46.0	27.8	24.9	L
20	2.2977	34.6	26.7	0.3	34.9	27.0	56.0	46.0	21.1	19.0	L
21	3.9181	27.5	12.7	0.5	28.0	13.2	56.0	46.0	28.0	32.8	L
22	6.8937	23.7	9.9	0.8	24.5	10.7	60.0	50.0	35.5	39.3	L
23	21.3385	26.5	13.5	2.0	28.5	15.5	60.0	50.0	31.5	34.5	L
24	27.1230	28.8	26.6	2.3	31.1	28.9	60.0	50.0	28.9	21.1	L

CHART:WITH FACTOR,Peak hold data.Data is uncorrected. CALCURATION:RESULT=READING+C. F (LISN LOSS+CABLE LOSS)
Except for the above table : adequate margin data below the limits.

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Radiated emission(Fundamental emission)

Transmitter carrier output level (13.56MHz)

UL Apex Co., Ltd.

No.2 SEMI ANECHOIC CHAMBER

COMPANY	: SEGA Corporation	REPORT NO	: 25BE0028-HO
EQUIPMENT	: Reader/Writer Unit	REGULATION	: FCC 15.225 (a)
MODEL	: HW210	TEST DISTANCE	: 3m
S/ N	: 046019565 B	DATE	: 09/10/2004
POWER	: DC 5.0V	TEMPERATURE	: 25 deg. C
MODE	: Card Reading (Tx:13.56MHz) / Z Axis(MAX)	HUMIDITY	: 62%

ENGINEER : Naoki Sakamoto

FREQ	T/R Reading	Ant Factor	C.F	Result	Limit at 10m	Margin	Antenna angle
[MHz]	[dBuV]	[dB/m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg.]
13.5610	59.7	20.2	-21.2	58.7	123.9	65.2	0

Calculation : Reading + Ant. Factor + C.F(Cable loss - AMP.Gain+Atten).

※The data of EUT direction is taken in worse condition.

Max-axis : 0deg.

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DATA OF MAGNETIC RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2004/09/10 13:17:08

Applicant : SEGA CORPORATION
Kind of EUT : Reader/Writer Unit
Model No. : HW210
Serial No. : 046019565 B
Report No. : 25BE0028-H0
Power : DC5.0V
Temp./Humi. : 25 deg.C. / 62 %
Operator : Naoki Sakamoto

Mode / Remarks : Card Reading(13.56MHz)/Z Axis(MAX) /0deg(MAX)

LIMIT : FCC15C §15.225 3m

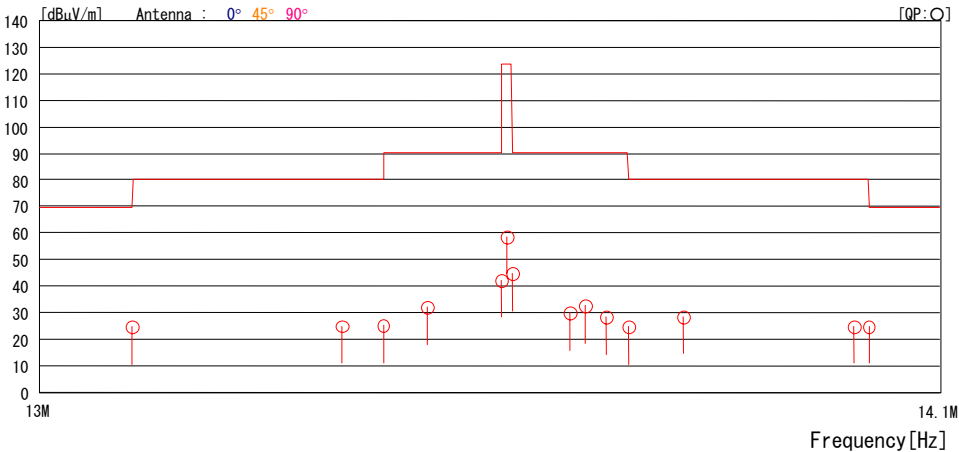


CHART : WITH FACTOR ANT TYPE : LOOP
CALCULATION : READING + ANT FACTOR + LOSS (CABLE + ATTEN. -AMP.)

Page :

Radiated emission (Spurious emission : below 30MHz)

DATA OF MAGNETIC RADIATED EMISSION TEST

UL Apex Co., LTD. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2004/09/10 11:31:38

Applicant : SEGA CORPORATION
Kind of EUT : Reader/Writer Unit
Model No. : HW210
Serial No. : 046019565 B
Report No. : 25BE0028-H0
Power : DC5.0V
Temp./Humi. : 25 deg.C. / 62 %
Operator : Naoki Sakamoto

Mode / Remarks : Card Reading(13.56MHz)/Z Axis(MAX) /0deg(MAX)

LIMIT : FCC15C §15.225(d) 3m

No.	FREQ [MHz]	READING QP [dBμV]	ANT FACTOR [dB/m]	LOSS [dB]	RESULT [dBμV/m]	LIMIT [dBμV/m]	MARGIN [dB]	ANTENNA	TABLE
1	27.120	27.0	20.8	-20.7	27.1	69.5	42.4	0°	0

CHART : WITH FACTOR ANT TYPE : LOOP

CALCULATION : READING + ANT FACTOR + LOSS (CABLE + ATTEN. -AMP.)

Page:

-20dB Bandwidth

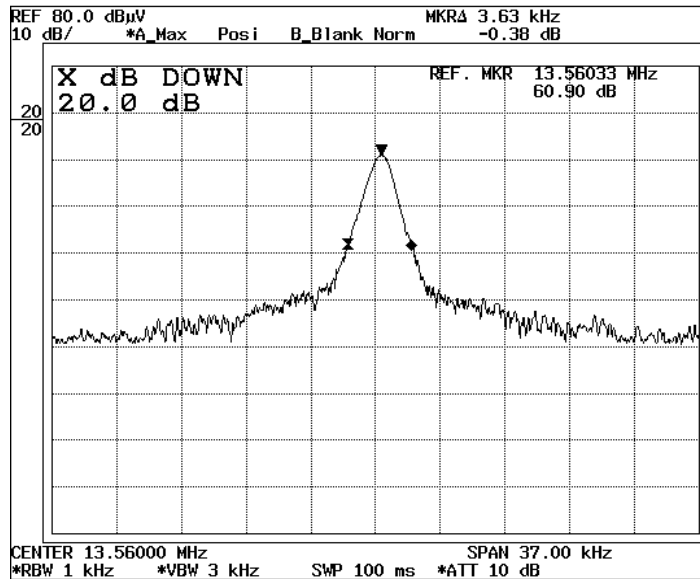
UL Apex Co., Ltd.
No.2 SEMI ANECHOIC CHAMBER

COMPANY : SEGA CORPORATION
EQUIPMENT : Reader/Writer Unit
MODEL : HW210
S/ N : 046019565 B
POWER : DC 5.0V
MODE : Card Reading (Tx:13.56MHz)

REPORT NO : 25BE0028-HO
REGULATION : FCC 15.215 (c)
TEST DISTANCE : 3m
DATE : '09/10/2004
TEMPERATURE : 25 deg. C
HUMIDITY : 62%

ENGINEER : Naoki Sakamoto

FREQ [MHz]	-20dB Bandwidth [kHz]
13.56	3.63



Frequency Tolerance

UL Apex Co., Ltd.
No.3 Measurement room

COMPANY	: SEGA CORPORATION	REPORT NO	: 25BE0028-HO
EQUIPMENT	: Reader/Writer Unit	REGULATION	: FCC 15.225 (e)
MODEL	: HW210	TEST DISTANCE	: -
S/ N	: 046019565 B	DATE	: 09/10/2004
POWER	: DC 5.0V	TEMPERATURE	: 25 deg. C
MODE	: Card Reading (Tx: 13.56MHz)	HUMIDITY	: 62%

ENGINEER : Naoki Sakamoto

Test Condition	Test Timing	Measured freq [MHz]	Freq error [MHz]	Result [ppm]	Limit (+/- 0.01%) [+/- ppm]	Margin [ppm]
T nom 20°C Vnom DC5.0V	Power on	13.56038000	0.00038000	28.02	100.00	71.98
	on 2min.	13.56037000	0.00037000	27.29	100.00	72.71
	on 5min.	13.56039000	0.00039000	28.76	100.00	71.24
	on 10min.	13.56038000	0.00038000	28.02	100.00	71.98
T min -20°C Vnom DC5.0V	Power on	13.56050000	0.00050000	36.87	100.00	63.13
	on 2min.	13.56052000	0.00052000	38.35	100.00	61.65
	on 5min.	13.56048000	0.00048000	35.40	100.00	64.60
	on 10min.	13.56051000	0.00051000	37.61	100.00	62.39
T max 50°C Vnom DC5.0V	Power on	13.56022000	0.00022000	16.22	100.00	83.78
	on 2min.	13.56020000	0.00020000	14.75	100.00	85.25
	on 5min.	13.56019000	0.00019000	14.01	100.00	85.99
	on 10min.	13.56022000	0.00022000	16.22	100.00	83.78

Limit : 13.56 MHz +/-0.01 % (+/- 100ppm)
+/- 0.001356 MHz

UL Apex Co., Ltd.

Head Office EMC Lab.

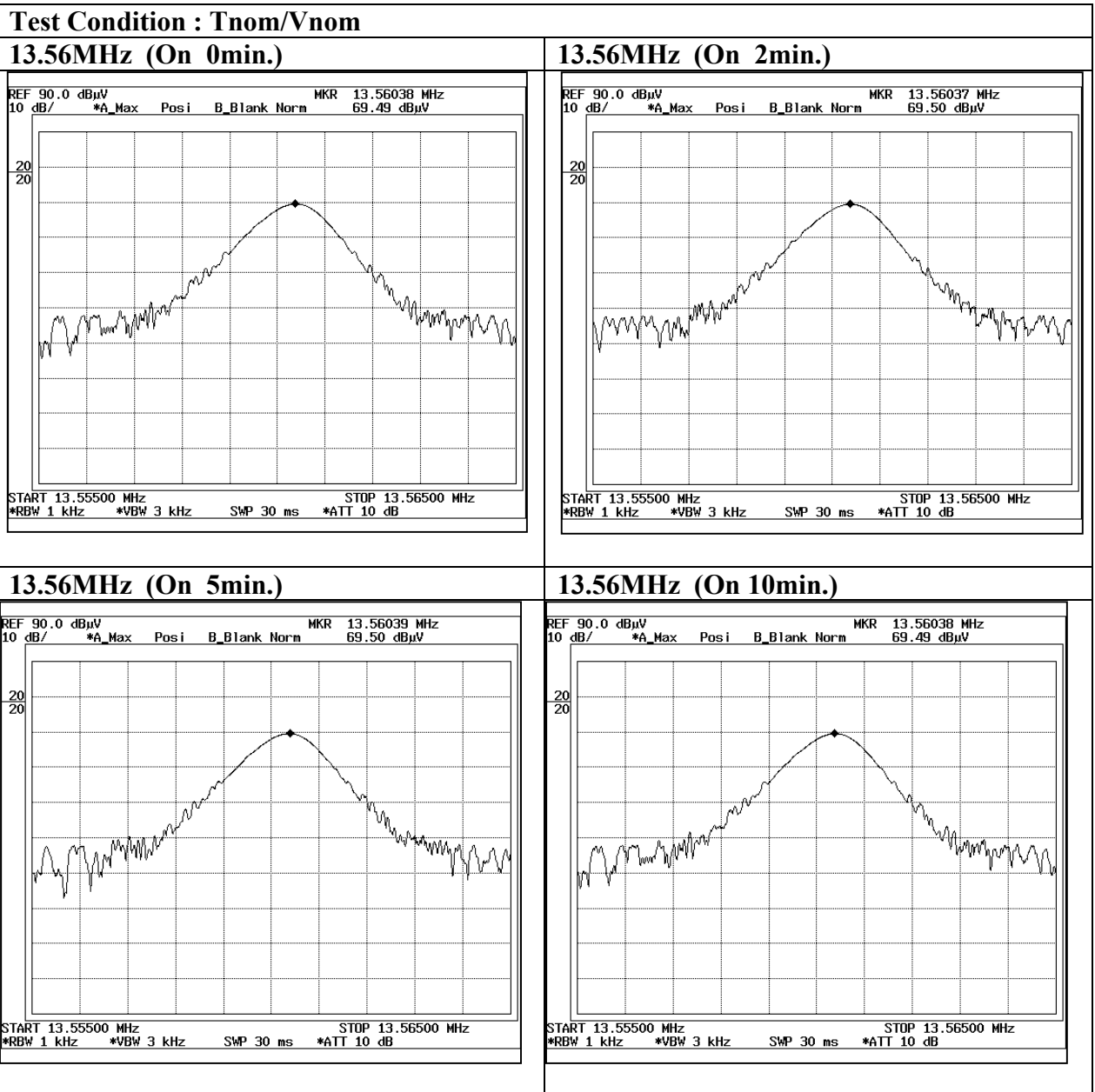
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

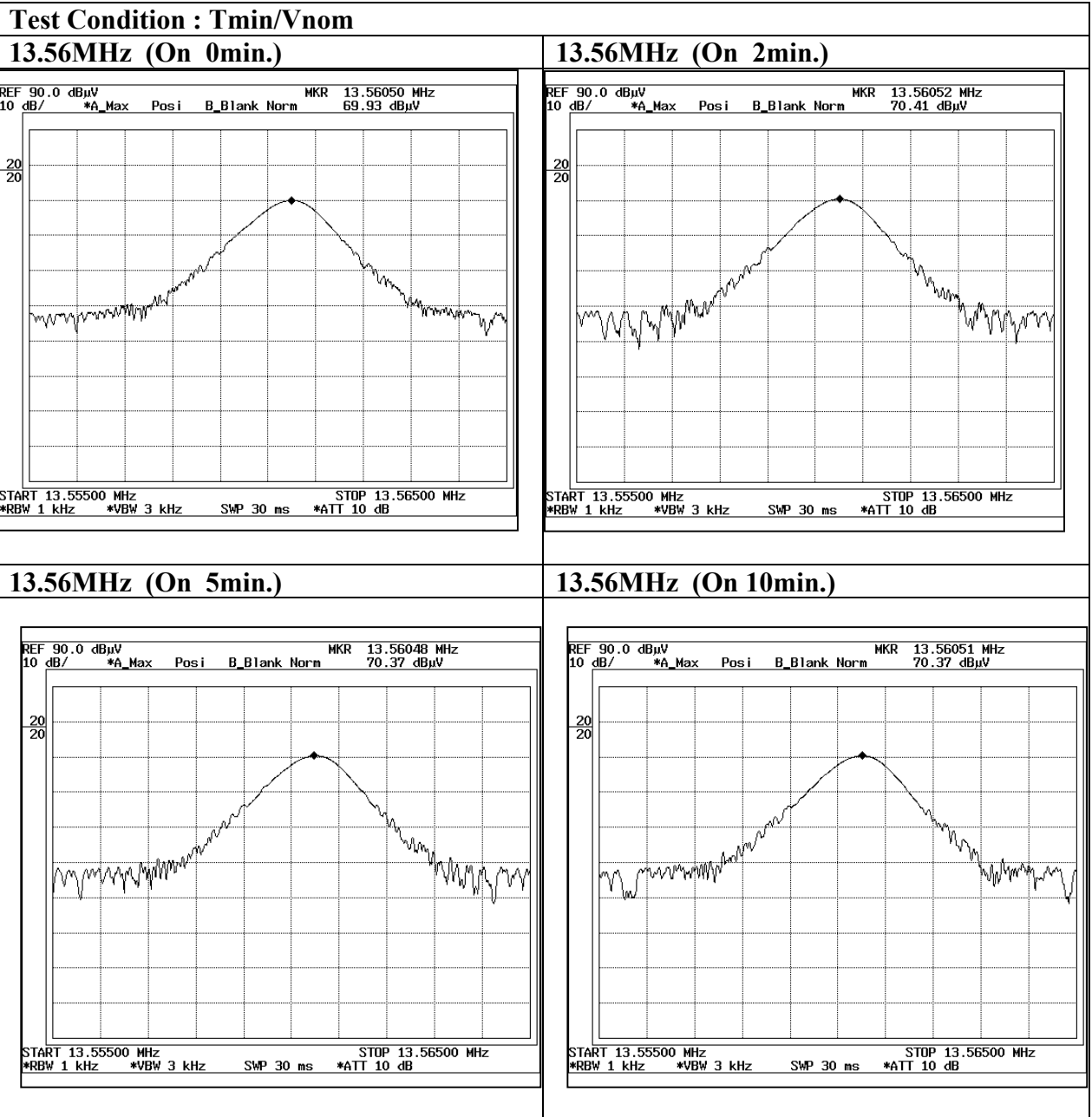
Facsimile : +81 596 24 8124

MF060b(10.04.03)

Frequency Tolerance



Frequency Tolerance



Frequency Tolerance

