



# RADIO TEST REPORT

**Test Report No.: 10005706S-A-R1**

**Applicant** : Sony Corporation

**Type of Equipment** : Contactless IC Card Reader / Writer

**Model No.** : RC-S640/IB

**FCC ID** : AK8RCS640IB

**Test regulation** : FCC Part15 Subpart C: 2012

**Test result** : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This report is a revised version of 10005706S-A. 10005706S-A is replaced with this report.

**Date of test:** March 12 to April 24, 2013

**Tested by:**

*S. Takano*

Shinichi Takano  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by :**

*T. Anomura*

Toyokazu Imamura  
Leader of EMC Service,  
UL Verification Service



- The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
- There is no testing item of "Non-accreditation".

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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name : Sony EMCS Corporation Kisarazu Site  
Brand Name : SONY  
Address : 8-4 Shiomi Kisarazu-shi, Chiba, 292-0834 Japan  
Telephone Number : +81-438-37-3982  
Facsimile Number : +81-438-37-4705  
Contact Person : Yuuki Fujiwara

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

### **2.1 Identification of E.U.T.**

Type of Equipment : Contactless IC Card Reader / Writer  
Model Number : RC-S640/IB  
Serial Number : Refer to clause 4.2  
Rating : DC 3.3V  
Country of Mass-production : Japan  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Receipt Date of Sample : March 12, 2013  
Modification of EUT : No modification by the test lab.

### **2.2 Product description**

Model: RC-S640/IB (referred to as the EUT in this report) is a Contactless IC Card Reader / Writer.

Clock frequency(ies) in the system : 27.12MHz

<Radio part>

Equipment type : Transceiver  
Frequency of operation : 13.56MHz  
Type of modulation : ASK  
Antenna type : Loop  
Antenna connector type : FPC connector  
ITU code : A1D  
Operation temperature range : -10 to +60 deg.C.

FCC 15.31 (e)

The RFID transmitter is provided the stable voltage (DC1.8V and DC3.3V) via regulator.

Therefore, this EUT complies with the requirement.

FCC Part 15.203

This module has a unique antenna coupler, FPC connector. This modular transmitter will always be used in the configuration in which it was authorized.

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## **SECTION 3: Test specification, procedures & results**

### **3.1 Test specification**

Test specification : FCC Part 15 Subpart C: 2012, final revised on December 27, 2012 and effective January 28, 2013  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits, general requirements  
Section 15.215 Additional provisions to the general radiated emission limitations  
Section 15.225 Operation within the band 13.110-14.010MHz

The EUT complies with FCC Part 15 Subpart B. Refer to the test report: 10005706S-C.

### **3.2 Procedures & Results**

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.4:2009 7. AC powerline conducted emission measurements	FCC 15.207	-	N/A	3.2dB Freq.: 13.56MHz Detector: Average Phase: N	Complied
Electric field strength of Fundamental emission	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (a)	Radiated	N/A	62.2dB Polarization: Vertical	Complied
Electric field strength of Spurious emission (within the 13.110-14.010MHz band)	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (b)(c)	Radiated	N/A	43.1dB Freq.: 13.567MHz Polarization: Vertical	Complied
Electric field strength of Spurious emission (outside of the 13.110-14.010MHz band)	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.209 FCC 15.225 (d)	Radiated	N/A	5.7dB Freq.: 40.68MHz Polarization: Vertical	Complied
20dB bandwidth	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.215 (c)	Radiated	N/A	-	-
Frequency tolerance	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (e)	Radiated	*1)	-	Complied

Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422  
\*1) The temperature variation for testing was set to -30 to +60 deg.C, according to the customer's request.  
The voltage variation for testing was set to 3.135 to 3.465V, according to the EUT's specification. The EUT does not operate outside the range.

### **3.3 Addition to standard**

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2009 13. Measurement of intentional radiators, RSS-Gen 4.6.1	RSS-Gen 4.6.1	Radiated	-	-

Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422

\* Other than above, no addition, exclusion nor deviation has been made from the standard.

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### 3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Item	Frequency range	No.1 SAC <sup>*1</sup> /SR <sup>*2</sup> (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	150kHz-30MHz	3.6 dB	3.6 dB	3.5 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.7 dB	3.7 dB	3.6 dB
	30MHz-300MHz	4.9 dB	5.1 dB	4.9 dB
	300MHz-1GHz	5.0 dB	5.2 dB	4.9 dB

\*1: SAC=Semi-Anechoic Chamber

\*2: SR= Shielded Room is applied besides radiated emission

#### Conducted emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

#### Radiated emission test

The data listed in this test report has enough margin, more than site margin.

#### Frequency tolerance

Frequency (Normal condition) Measurement uncertainty for this test was: (±)  $7.9 \times 10^{-8}$ .

Frequency (Extreme condition) Measurement uncertainty for this test was: (±)  $7.9 \times 10^{-8}$ .

#### Other tests

Bandwidth Measurement uncertainty for this test was: (±) 5.4%

### 3.5 Test location

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JAB Accreditation No. : RTL02610

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
<input type="checkbox"/> No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input checked="" type="checkbox"/> No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
<input type="checkbox"/> No.4 Semi-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
<input checked="" type="checkbox"/> No.1 Shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.2 Shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.3 Shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
<input type="checkbox"/> No.4 Shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
<input checked="" type="checkbox"/> No.5 Shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.6 Shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

### 3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

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

### **4.1 Operating mode**

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

<b>Test item</b>	<b>Operating mode</b>	<b>Tested frequency</b>
All items except for Frequency tolerances	Transmitting  ISO/IEC 14443-3 Type A Request <ul style="list-style-type: none"> <li>• Modulation ASK100%</li> <li>• Bit coding Modified Miller</li> <li>• Data transfer rate 106kbps</li> </ul> ISO/IEC 14443-3 Type B Request <ul style="list-style-type: none"> <li>• Modulation ASK8-14%</li> <li>• Bit coding NRZ</li> <li>• Data transfer rate 106kbps</li> </ul> FeliCa 212kbps Request <ul style="list-style-type: none"> <li>• Modulation ASK8-12%</li> <li>• Bit coding Manchester</li> <li>• Data transfer rate 212kbps</li> </ul>	13.56MHz
Frequency tolerances	Transmitting (Unmodulated)	13.56MHz

\*EUT has the power settings by the software as follows;

Power settings: Setting is controlled by the firmware and cannot be changed.

Software: PN544Poll.exe version 1.0.1.13

- Parameter file(TypeA Modulated): Polling Type A.bat
- Parameter file(TypeB Modulated): Polling Type B.bat
- Parameter file(TypeF Modulated): Polling Type F.bat
- Parameter file(Unmodulated): CarrierOut.bat

The Contactless IC Card Reader / Writer and antenna were fixed each position by the customer's specification.

The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The carrier level and noise levels were confirmed with and without IC card (type A, B or F), and the test was made with IC card that was worse condition.

Combinations of the worst case

Test item	Conducted emission	Radiated emission (Carrier)	Radiated emission (Below 30MHz)	Radiated emission (Above 30MHz)
Antenna polarization				
Horizontal	-	Y	X	Z
Vertical	-	Y	X	Z
Card type	Type B	Type B	Type B	Type B

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

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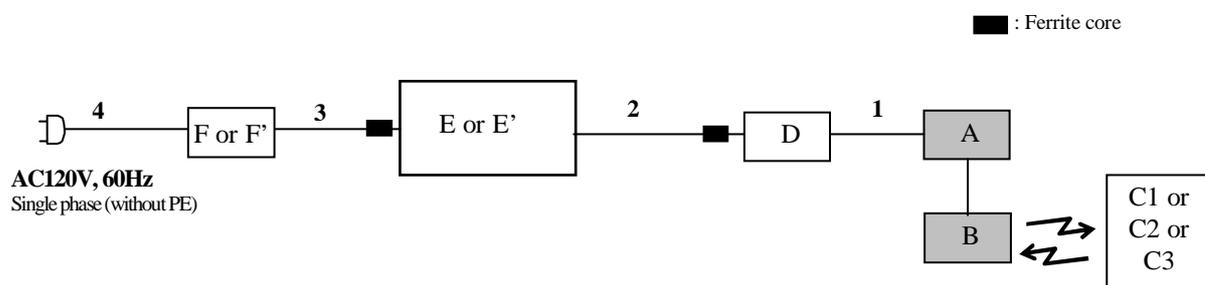
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## 4.2 Configuration and peripherals



\* Test data was taken under worse case conditions.

### Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Contactless IC Card Reader / Writer	RC-S640/IB	0000003	Sony	EUT
B	Antenna				
C1	IC Card	-	-	-	Type A
C2	IC Card	-	-	-	Type B
C3	IC Card	-	-	-	FeliCa
D	Jig	-	-	Sony	-
E	Laptop PC	PCG-5D1N	28248612 1001531	Sony	All test items except for CE
E'	Laptop PC	VGN-G1	28248610 1000006	Sony	CE test only
F	AC Adapter	PCGA-AC16V6	147774951 248745	Sony	All test items except for CE
F'	AC Adapter	VGP-AC16V8	147886061 0000512	Sony	CE test only

### List of cables used \*1)

No.	Item	Length(m)	Shield		Remarks
			Cable	Connector	
1	Flat Cable	0.1	Shielded	Shielded	-
2	USB	0.1	Shielded	Shielded	*2)
3	DC	1.8	Unshielded	Unshielded	*3)
4	AC	0.7	Unshielded	Unshielded	-

\*1) All cables used for the measurement are exclusive use or marketed.

\*2) The ferrite core was attached during spurious emission measurement to remove the effect of spurious emission from Jig.

\*3) The ferrite core was not attached to reduce the noise from the EUT but was used to reduce the noise from Laptop PC. Therefore, that does not affect the emission level of the EUT. Since it was difficult to prepare a cable for Laptop PC to which a ferrite core was not attached, the measurement was performed with the cable with the ferrite core.

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## **SECTION 5: Conducted emission**

### **5.1 Operating environment**

The test was carried out in No.1 shielded room.

### **5.2 Test configuration**

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.

The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT was aligned and was 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 LISN. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.

Each EUT current-carrying power lead was individually connected through a LISN to the input power source.

Photographs of the set up are shown in Appendix 1.

### **5.3 Test conditions**

Frequency range : 0.15 - 30MHz  
EUT position : Table top  
EUT operation mode : Refer to SECTION 4.1

### **5.4 Test procedure**

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT via Laptop PC within a Shielded room. The EUT was connected to a Line Impedance Stabilization Network (LISN).

An overview sweep with peak detection has been performed.

The measurements had been performed with a quasi-peak detector and if required, an average detector.

The conducted emission measurements were made with the following detection of the test receiver.

Detection Type : Quasi-Peak/ Average  
IF Bandwidth : 9kHz

### **5.5 Results**

Summary of the test results : Pass

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## **SECTION 6: Radiated emission (Fundamental and Spurious emission)**

### **6.1 Operating environment**

The test was carried out in No.3 semi-anechoic chamber.

Temperature : See test data (APPENDIX 2)

Humidity : See test data (APPENDIX 2)

### **6.2 Test configuration**

EUT was placed on a urethane platform of nominal size, 0.5m by 1m, raised 0.8m above the conducting ground plane. Photographs of the set up are shown in Appendix 1.

### **6.3 Test conditions**

Frequency range : 9kHz - 1GHz

Test distance : 3m

EUT position : Table top

EUT operation mode : Refer to SECTION 4.1

### **6.4 Test procedure**

The Radiated Electric Field Strength intensity has been measured with a ground plane and at a distance of 3m

Frequency: From 9kHz to 30MHz at distance 3m

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0deg.to 360deg.) and horizontal polarization. Drawing of the antenna direction is shown in Figure 2.

Frequency: From 30MHz to 1GHz at distance 3m(Refer to Figure 1).

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

The measurements were performed for both vertical and horizontal antenna polarization.

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

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

	9kHz to 90kHz & 110kHz to 150kHz	90kHz to 110kHz	150kHz to 490kHz	490kHz to 30MHz	30MHz to 1GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz
Measuring antenna	Loop antenna				Biconical (30-299.99MHz) Logperiodic (300MHz-1GHz)

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

9kHz – 490kHz [Limit at 3m]= [Limit at 300m]-40log (3[m]/300[m])

490kHz – 30MHz [Limit at 3m]= [Limit at 30m]-40log (3[m]/30[m])

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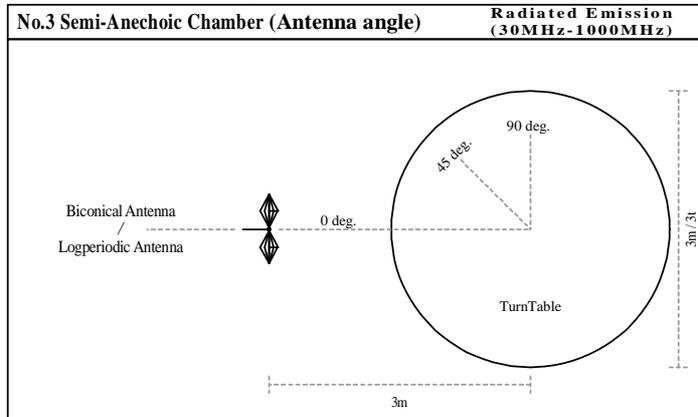
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## 6.5 Results

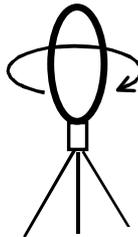
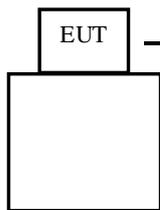
Summary of the test results : Pass  
Refer to APPENDIX

**Figure 1. Antenna angle**



**Figure 2. Direction of the Loop Antenna**

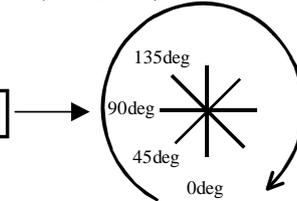
*Side View (Vertical)*



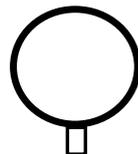
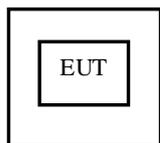
Front side: 0 deg.

Forward direction: clockwise

*Side View (Horizontal)*



*Top View (Horizontal)*



Antenna was not rotated.

## **SECTION 7: 20dB bandwidth & Occupied bandwidth (99%)**

### **Test procedure**

The test was measured with a spectrum analyzer using a test fixture.

Summary of the test results: Pass

## **SECTION 8: Frequency tolerances**

### **Test procedure**

The test was measured with a spectrum analyzer using a test fixture.

The temperature test was started after the temperature stabilization time of 30 minutes.

The test was begun from 60 deg.C and the temperature was lowered each 10 deg.C.

Summary of the test results: Pass

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## **Contents of APPENDIXES**

### **APPENDIX 1: Data of Radio tests**

Conducted emission  
Radiated emission  
Frequency tolerance  
Bandwidth

### **APPENDIX 2: Test instruments**

Test instruments

### **APPENDIX 3: Photographs of test setup**

Conducted emission  
Radiated emission

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# DATA OF CONDUCTED EMISSION TEST

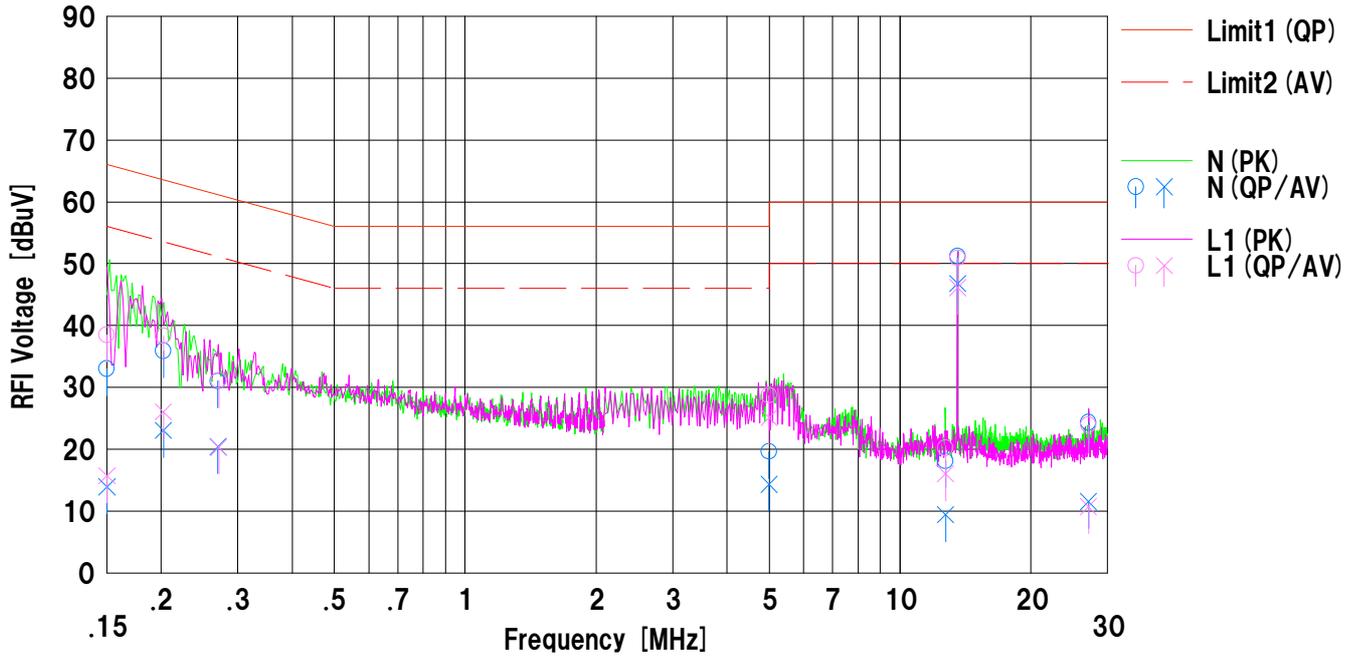
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room  
Date : 2013/04/24

Company : Sony Corporation  
Kind of EUT : Contactless IC Card Reader/Writer  
Model No. : RC-S640/IB  
Serial No. : 0000003  
Remarks : Card: Type B

Mode : Transmitting (13.56MHz)  
Order No. : 10005706S  
Power : DC3.3V (USB) ,AC120V/60Hz (PC)  
Temp./Humi. : 23deg.C / 34%RH

Limit1 : FCC 15C (15.207) QP  
Limit2 : FCC 15C (15.207) AV

Engineer : Akio Hayashi



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	20.3	1.2	12.7	33.0	13.9	66.0	56.0	33.0	42.1	N	
2	0.20227	23.3	10.4	12.6	35.9	23.0	63.5	53.5	27.6	30.5	N	
3	0.27003	18.3	7.7	12.7	31.0	20.4	61.1	51.1	30.1	30.7	N	
4	4.99623	6.6	1.3	13.0	19.6	14.3	56.0	46.0	36.4	31.7	N	
5	12.71516	4.7	-4.0	13.4	18.1	9.4	60.0	50.0	41.9	40.6	N	
6	13.56000	37.8	33.4	13.4	51.2	46.8	60.0	50.0	8.8	3.2	N	
7	27.12000	10.5	-2.3	13.8	24.3	11.5	60.0	50.0	35.7	38.5	N	
8	0.15000	25.8	3.0	12.7	38.5	15.7	66.0	56.0	27.5	40.3	L1	
9	0.20232	25.7	13.4	12.6	38.3	26.0	63.5	53.5	25.2	27.5	L1	
10	0.27128	18.4	7.6	12.7	31.1	20.3	61.0	51.0	29.9	30.7	L1	
11	4.99623	15.7	12.1	13.0	28.7	25.1	56.0	46.0	27.3	20.9	L1	
12	12.71516	6.8	2.6	13.4	20.2	16.0	60.0	50.0	39.8	34.0	L1	
13	13.56000	37.5	32.7	13.4	50.9	46.1	60.0	50.0	9.1	3.9	L1	
14	27.12000	10.1	-3.1	13.8	23.9	10.7	60.0	50.0	36.1	39.3	L1	

## Data of Electric field strength of Fundamental emission and Spurious emission within the band: FCC15.225(a)(b)(c)

UL Japan, Inc.  
Shonan EMC Lab. No.3 Semi-Anechoic Chamber

Company: Sony Corporation	Regulation: FCC Part15 SupartC 15.225
Equipment: Contactless IC Card Reader/Writer	Test Distance: 3m
Model: RC-S460/IB	Date: March 12, 2013
Sample No.: 0000003	Temperature: 22deg.C
Power: DC3.3V	Humidity: 24% RH
Mode: Transmitting 13.56MHz	ENGINEER: Shinichi Takano

Remarks: : Card: Type B (Axis:Hor\_Y / Ver\_Y) , Vertical polarization (antenna angle) of the worst case: 135deg

### Fundamental emission

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	LOSS [dB]	AMP GAIN [dB]	RESULT		LIMIT (3m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]				Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.560	60.6	68.7	18.9	6.3	32.2	53.6	61.7	123.9	70.3	62.2

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]

Field strength of 13.553MHz to 13.567MHz Limit(3m) = 83.9dBuV/m + 40log 30m/3m  
= 123.9dBuV/m (FCC15.225(a))

### Spurious emission within the band

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	LOSS [dB]	AMP GAIN [dB]	RESULT		LIMIT (3m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]				Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.110	30.2	30.1	18.9	6.3	32.2	23.2	23.1	69.5	46.3	46.4
2	13.410	30.1	30.3	18.9	6.3	32.2	23.1	23.3	80.5	57.4	57.2
3	13.553	43.3	53.2	18.9	6.3	32.2	36.3	46.2	90.4	54.1	44.2
4	13.567	44.5	54.3	18.9	6.3	32.2	37.5	47.3	90.4	52.9	43.1
5	13.710	30.2	30.4	18.9	6.3	32.2	23.2	23.4	80.5	57.3	57.1
6	14.010	30.3	30.4	18.9	6.3	32.2	23.3	23.4	69.5	46.2	46.1

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]

Field strength frequencies

- Fc±7kHz:13.553MHz to 13.567MHz
- Fc±150kHz:13.410MHz to 13.710MHz
- Fc±450kHz:13.110MHz to 14.010MHz
- Fc = 13.56MHz

Limits (3m)

- 13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz : 50.4dBuV/m + 40log30m/3m = 90.4dBuV/m (FCC15.225(b))
- 13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz : 40.5dBuV/m + 40log30m/3m = 80.5dBuV/m (15.225(c))
- Below 13.110MHz and Above 14.010MHz : 29.5dBuV/m + 40log30m/3m = 69.5dBuV/m (FCC15.225(d)and FCC15.209)

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**Radiated Emission**

UL Japan, Inc.  
Shonan EMC Lab., No.3 Semi-Anechoic Chamber

Company:	Sony Corporation	Regulation:	FCC Part15 SupartC 15.225
Equipment:	Contactless IC Card Reader/Writer	Test Distance:	3m
Model:	RC-S460/IB	Date:	March 12, 2013
Sample No.:	0000003	Temperature:	22deg.C
Power:	DC3.3V	Humidity:	24% RH
Mode:	Transmitting 13.56MHz	ENGINEER:	Shinichi Takano
EUT axis:	Below 30MHz( Horizontal X-axis, Vertical X-axis), Card Type B Above 30MHz( Horizontal: Z-axis, Vertical: Z-axis), Card Type B		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	27.12	QP	35.6	19.0	6.5	32.2	28.9	69.5	40.6	-	359	
Hori.	40.68	QP	31.6	14.3	6.6	32.2	20.3	40.0	19.7	326	11	
Hori.	54.24	QP	29.4	9.6	6.7	32.2	13.5	40.0	26.5	393	207	
Hori.	67.80	QP	37.1	6.8	6.5	32.2	18.2	40.0	21.8	282	3	
Hori.	81.36	QP	36.0	6.7	7.5	32.2	18.0	40.0	22.0	229	359	
Hori.	94.92	QP	43.6	9.2	7.4	32.2	28.0	43.5	15.5	192	169	
Hori.	108.48	QP	33.2	11.4	7.2	32.1	19.7	43.5	23.8	294	210	
Hori.	122.04	QP	37.4	13.1	7.2	32.1	25.6	43.5	17.9	146	205	
Hori.	135.60	QP	38.2	14.2	7.4	32.1	27.7	43.5	15.8	240	359	
Hori.	137.86	QP	36.4	14.3	7.5	32.1	26.1	43.5	17.4	235	359	
Hori.	149.81	QP	39.0	14.9	7.7	32.1	29.5	43.5	14.0	221	359	
Hori.	779.97	QP	29.7	20.7	10.4	31.7	29.1	46.0	16.9	109	259	
Vert.	27.12	QP	42.1	19.0	6.5	32.2	35.4	69.5	34.1	-	83	Antenna angle: 90deg
Vert.	33.16	QP	41.0	16.8	6.5	32.2	32.1	40.0	7.9	100	240	
Vert.	40.68	QP	45.6	14.3	6.6	32.2	34.3	40.0	<b>5.7</b>	100	123	
Vert.	54.24	QP	37.6	9.6	6.7	32.2	21.7	40.0	18.3	100	246	
Vert.	67.80	QP	45.2	6.8	6.5	32.2	26.3	40.0	13.7	100	83	
Vert.	81.36	QP	38.4	6.7	7.5	32.2	20.4	40.0	19.6	100	263	
Vert.	94.92	QP	43.3	9.2	7.4	32.2	27.7	43.5	15.8	100	84	
Vert.	108.48	QP	33.6	11.4	7.2	32.1	20.1	43.5	23.4	100	110	
Vert.	122.04	QP	31.6	13.1	7.2	32.1	19.8	43.5	23.7	100	124	
Vert.	135.60	QP	31.7	14.2	7.4	32.1	21.2	43.5	22.3	100	125	
Vert.	901.91	QP	33.1	22.3	10.7	31.1	35.0	46.0	11.0	110	298	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+ Δ AF) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

**Data of Frequency Tolerance: FCC 15.225(e)**

UL Japan, Inc.  
Shonan EMC Lab. No.5 Shield room

Company: Sony Corporation  
Equipment: Contactless IC Card Reader/Writer  
Model: RC-S460/IB  
Sample No.: 0000003  
Power: DC3.3V  
Mode: Transmitting 13.56MHz

Regulation: FCC Part15 SupartC 15.225  
Date: March 22, 2013  
Temperature: 23deg.C  
Humidity: 48%RH  
ENGINEER: Shinichi Takano

**Temperature Variation: 60deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560041	0.000041	0.00030	0.01
after 2minutes	13.56	13.560039	0.000039	0.00029	0.01
after 5minutes	13.56	13.560039	0.000039	0.00029	0.01
after 10minutes	13.56	13.560038	0.000038	0.00028	0.01

**Temperature Variation: 50deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560045	0.000045	0.00033	0.01
after 2minutes	13.56	13.560076	0.000076	0.00056	0.01
after 5minutes	13.56	13.560060	0.000060	0.00044	0.01
after 10minutes	13.56	13.560059	0.000059	0.00044	0.01

**Temperature Variation: 40deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560107	0.000107	0.00079	0.01
after 2minutes	13.56	13.560099	0.000099	0.00073	0.01
after 5minutes	13.56	13.560100	0.000100	0.00074	0.01
after 10minutes	13.56	13.560099	0.000099	0.00073	0.01

**Temperature Variation: 30deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560164	0.000164	0.00121	0.01
after 2minutes	13.56	13.560151	0.000151	0.00111	0.01
after 5minutes	13.56	13.560152	0.000152	0.00112	0.01
after 10minutes	13.56	13.560151	0.000151	0.00111	0.01

**Temperature Variation: 20deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560215	0.000215	0.00159	0.01
after 2minutes	13.56	13.560203	0.000203	0.00150	0.01
after 5minutes	13.56	13.560201	0.000201	0.00148	0.01
after 10minutes	13.56	13.560201	0.000201	0.00148	0.01

**Data of Frequency Tolerance: FCC 15.225(e)**

UL Japan, Inc.  
Shonan EMC Lab. No.5 Shield room

Company: Sony Corporation  
Equipment: Contactless IC Card Reader/Writer  
Model: RC-S460/IB  
Sample No.: 0000003  
Power: DC3.3V  
Mode: Transmitting 13.56MHz

Regulation: FCC Part15 SupartC 15.225  
Date: March 22, 2013  
Temperature: 23deg.C  
Humidity: 48%RH  
ENGINEER: Shinichi Takano

**Temperature Variation: 10deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560241	0.000241	0.00178	0.01
after 2minutes	13.56	13.560245	0.000245	0.00181	0.01
after 5minutes	13.56	13.560245	0.000245	0.00181	0.01
after 10minutes	13.56	13.560246	0.000246	0.00181	0.01

**Temperature Variation: 0deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560282	0.000282	0.00208	0.01
after 2minutes	13.56	13.560280	0.000280	0.00206	0.01
after 5minutes	13.56	13.560280	0.000280	0.00206	0.01
after 10minutes	13.56	13.560279	0.000279	0.00206	0.01

**Temperature Variation: -10deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560287	0.000287	0.00212	0.01
after 2minutes	13.56	13.560290	0.000290	0.00214	0.01
after 5minutes	13.56	13.560291	0.000291	0.00215	0.01
after 10minutes	13.56	13.560291	0.000291	0.00215	0.01

**Temperature Variation: -20deg.C**

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560225	0.000225	0.00166	0.01
after 2minutes	13.56	13.560258	0.000258	0.00190	0.01
after 5minutes	13.56	13.560269	0.000269	0.00198	0.01
after 10minutes	13.56	13.560270	0.000270	0.00199	0.01

**Temperature Variation: -30deg.C**

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560180	0.000180	0.00133	0.01
after 2minutes	13.56	13.560117	0.000117	0.00086	0.01
after 5minutes	13.56	13.560215	0.000215	0.00159	0.01
after 10minutes	13.56	13.560216	0.000216	0.00159	0.01

## Data of Frequency Tolerance: FCC 15.225(e)

UL Japan, Inc.  
Shonan EMC Lab. No.5 Shield room

Company: Sony Corporation  
Equipment: Contactless IC Card Reader/Writer  
Model: RC-S460/IB  
Sample No.: 0000003  
Power: DC3.3V  
Mode: Transmitting 13.56MHz

Regulation: FCC Part15 SupartC 15.225  
Date: March 22, 2013  
Temperature: 23deg.C  
Humidity: 48%RH  
ENGINEER: Shinichi Takano

**Input Voltage:DC3.135V (95%)**

**Temperature Variation: 20deg.C**

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560180	0.000180	0.00133	0.01
after 2minutes	13.56	13.560154	0.000154	0.00114	0.01
after 5minutes	13.56	13.560147	0.000147	0.00108	0.01
after 10minutes	13.56	13.560146	0.000146	0.00108	0.01

**Input Voltage:DC3.465V (105%)**

**Temperature Variation: 20deg.C**

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.560208	0.000208	0.00153	0.01
after 2minutes	13.56	13.560198	0.000198	0.00146	0.01
after 5minutes	13.56	13.560197	0.000197	0.00145	0.01
after 10minutes	13.56	13.560198	0.000198	0.00146	0.01

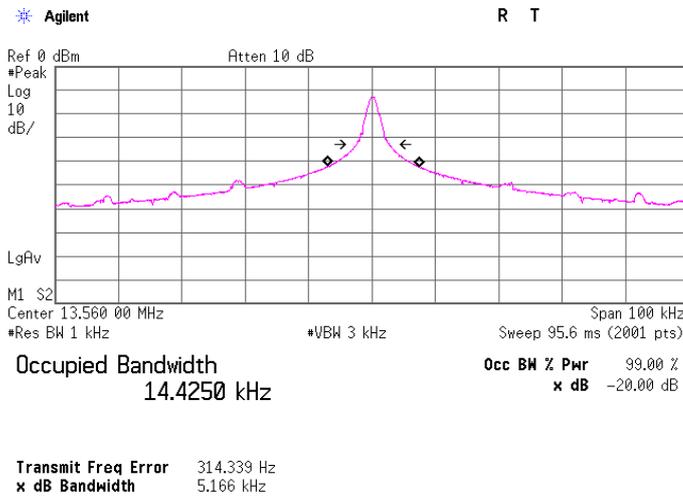
## 20dB bandwidth & 99% Occupied bandwidth: FCC 15.215 / RSS-Gen

UL Japan, Inc.  
Shonan EMC Lab. No.5 Shield room

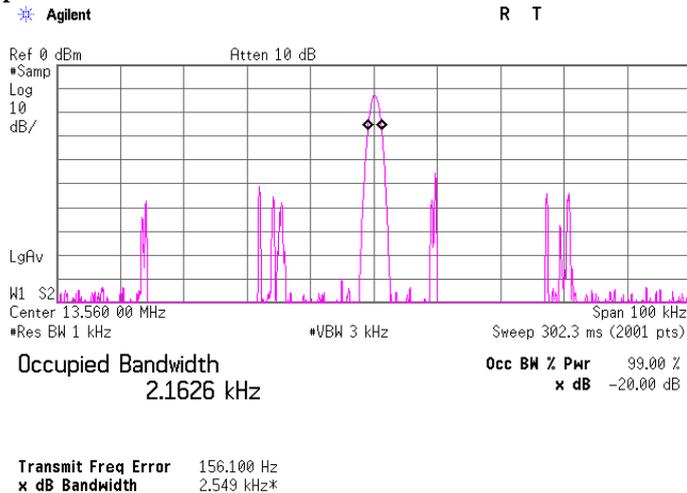
Company: Sony Corporation  
Equipment: Contactless IC Card Reader/Writer  
Model: RC-S460/IB  
Sample No.: 0000003  
Power: DC3.3V  
Mode: Transmitting 13.56MHz

Regulation: FCC Part15 Subpart C 15.215  
Date: March 22, 2013  
Temperature: 23deg.C  
Humidity: 48%RH  
ENGINEER: Shinichi Takano

**20dB Bandwidth:** 5.166 kHz



**99% Occupied Bandwidth:** 2.163 kHz



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## APPENDIX 2 Test Instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2013/02/12 * 12
SAT6-03	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2012/10/08 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271 (RF Selector)	RE	2012/04/10 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2012/10/08 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2013/02/27 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2013/02/27 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE	-
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RF,MF)	-	RE,CE	-
SLP-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	RE	2012/10/31 * 12
SAT6-07	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	TF	2013/03/07 * 12
SCH-01	Temperature and Humidity Chamber	Espec	PL-1KT	14020837	TF	2012/04/04 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	TF	2013/03/04 * 12
SSP-01	Search Probe	Nisshin Electric	NSP-01	-	TF	-
STS-05	Digital Hitester	Hioki	3805-50	080997828	TF	2012/03/23 * 12

The expiration date of the calibration is the end of the expired month .  
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards .

Test Item :

- CE: Conducted emission ,
- RE: Radiated emission ,
- TF: Test Fixture tests

## APPENDIX 2 Test Instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SCC-A9/A10/ A11/A13/SRSE -01	Coaxial Cable&RF Selector	Suhner/Fujikura/Suhner/ Suhner/TOYO	RG223U/12DSFA/ 141PE/NS4906	-/0901-269(RF Selector)	CE	2013/04/04 * 12
SLS-01	LISN	Rohde & Schwarz	ENV216	100511	CE	2013/02/22 * 12
SAT3-03	Attenuator	JFW	50HF-003N	-	CE	2013/02/12 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	CE	2013/02/27 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	CE	2012/10/04 * 12
SJM-08	Measure	PROMART	SEN1935	-	CE	-

The expiration date of the calibration is the end of the expired month .  
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards .

Test Item :

CE: Conducted emission