

# RADIO TEST REPORT

**Test Report No.: 31AE0016-SH-01-E**

**Applicant** : Sony Corporation  
**Type of Equipment** : Contactless IC Card Reader / Writer  
**Model No.** : RC-S360/S  
**FCC ID** : AK8RCS360  
**Test regulation** : FCC Part15 Subpart C: 2010  
**Test result** : Complied

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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.
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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

**Date of test:** October 18, 19 and 23, 2010

**Representative  
test engineer:**



Shinichi Takano  
Engineer of EMC Service

**Approved by :**



Go Ishiwata  
Assistant Manager of EMC Service

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## **SECTION 1: Customer information**

Company Name : Sony EMCS Corporation Kisarazu TEC  
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-S360/S  
Serial Number : D200001  
Rating : DC4.75 to 5.25V  
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 : October 18, 2010  
Modification of EUT : No modification by the test lab.

### **2.2 Product description**

Model: RC-S360/S (referred to as the EUT in this report) is a Contactless IC Card Reader/Writer.

Clock frequencies: CPU: 27.12MHz

RC-S360/S has similar model, RC-S360/SH. Both print boards are equivalent. A difference of RC-S360/S and RC-S360/SH is a shape of non-inductive case.

<Radio part>

Equipment type : Transceiver  
Frequency of operation : 13.56MHz  
Type of modulation : ASK  
Antenna type : Loop  
Antenna connector type : None  
ITU code : A1D  
Operation temperature range : +5 to +35 deg.C.

FCC 15.31 (e)

The RFID transmitter has a regulator which regulates the supplied voltage of DC 5V to DC 3.4V. Therefore, the equipment complies power supply regulation.

FCC Part 15.203

The antenna is not removable from the 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: 2010, final revised on October 13, 2010  
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 bands 13.110-14.010MHz.

The EUT complies with FCC Part 15 Subpart B: 2010. Refer to the test report: 31AE0016-SH-01-G.

### **3.2 Procedures & Results**

| Item   | Test Procedure   | Specification                              | Remarks  | Deviation | Worst Margin  | Results  |
|--|--|--|----------|-----------|---|----------|
| Conducted emission                                     | ANSI C63.4:2003<br>7. AC powerline conducted emission measurements | FCC Section15.207                          | -        | N/A       | 10.6dB<br>Freq: 13.56192MHz<br>Detector: Quasi-Peak<br>Phase: N | Complied |
| Electric field strength of Fundamental emission        | ANSI C63.4:2003<br>13. Measurement of intentional radiators        | FCC Section15.225 (a)                      | Radiated | N/A       | 60.4dB<br>Polarization: Vertical                                | Complied |
| Electric field strength of Outside the allocated bands | ANSI C63.4:2003<br>13. Measurement of intentional radiators        | FCC Section15.225 (b)(c)                   | Radiated | N/A       | 41.7dB<br>Freq: 13.553MHz<br>Polarization: Vertical             | Complied |
| Electric field strength of Spurious emission           | ANSI C63.4:2003<br>13. Measurement of intentional radiators        | FCC Section15.209<br>FCC Section15.225 (d) | Radiated | N/A       | 5.4dB<br>Freq: 786.480MHz<br>Polarization: Horizontal           | Complied |
| 20dB bandwidth   | ANSI C63.4:2003<br>13. Measurement of intentional radiators        | FCC Section15.215 (c)                      | Radiated | N/A       | -   | Complied |
| Frequency tolerance                                    | ANSI C63.4:2003<br>13. Measurement of intentional radiators        | FCC Section15.225 (e)                      | Radiated | N/A       | -   | Complied |

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.

### **3.3 Addition to standard**

| Item                     | Test Procedure  | Specification | Remarks  | Worst Margin | Results  |
|--------------------------|---|---------------|----------|--------------|----------|
| Occupied Bandwidth (99%) | ANSI C63.4:2003<br>13. Measurement of intentional radiators,<br>RSS-Gen 4.6.1 | RSS-Gen 4.6.1 | Radiated | -            | Complied |

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.

\* 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<br>(AC Mains) AMN/LISN       | 150kHz-30MHz    | 3.0 dB                                       | 2.6 dB          | 3.1 dB          |
| Radiated emission<br>(Measurement distance: 3m) | 9kHz-30MHz      | 3.4 dB                                       | 2.7 dB          | 3.4 dB          |
|   | 30MHz-300MHz    | 4.6 dB                                       | 4.5 dB          | 4.9 dB          |
|   | 300MHz-1GHz     | 4.5 dB                                       | 4.6 dB          | 5.1 dB          |

\*1: SAC=Semi-Anechoic Chamber

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

#### Conducted emission test

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

#### Radiated emission test

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

#### Frequency tolerance

Frequency Measurement uncertainty (with a 95% confidence level) for this test was: (±)  $1.3 \times 10^{-6}$ .

### 3.5 Test location

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JAB Accreditation No. : RTL02610

|  | FCC<br>Registration<br>No. | IC<br>Registration<br>No. | Width x Depth x<br>Height (m) | Size of reference<br>ground plane (m) /<br>horizontal<br>conducting plane | Maximum<br>measurement<br>distance |
|--|----------------------------|---------------------------|-------------------------------|---|------------------------------------|
| <input checked="" 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 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 Full-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 checked="" 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, Test data & 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.

| Test item                                 | Operating mode  | Tested frequency |
|---|---|------------------|
| All items except for Frequency tolerances | Transmitting<br>ISO/IEC 14443-3 Type A Request & Anticollision loop<br><ul style="list-style-type: none"> <li>• Modulation ASK100%</li> <li>• Bit coding Modified mirror</li> <li>• Data transfer rate 106kbps</li> </ul> | 13.56MHz         |
| Frequency tolerances                      | Transmitting (Unmodulated)  | 13.56MHz         |

### Software & Setting

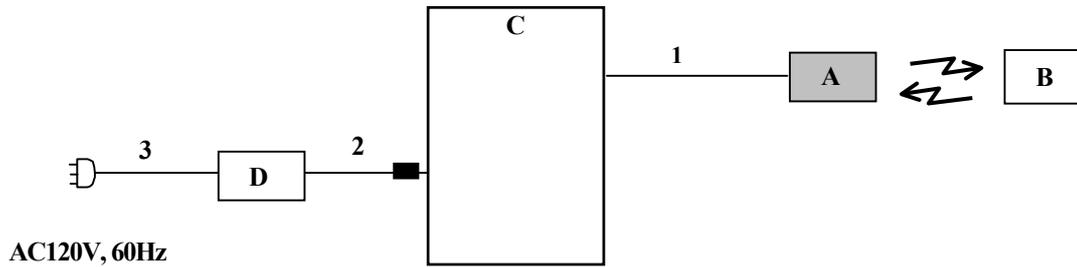
Software: NFCDCCommTestApp.exe, geniepoll.exe  

- Parameter file: RC-S360-Initiator\_TypeA.bat, RC-S360-Initiator\_TypeA.tdt

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

### 4.2 Configuration and peripherals

■ : Ferrite core



\* 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-S360/S    | D200001           | SONY         | EUT     |
| B   | IC Card                           | -            | -                 | SONY         | -       |
| C   | Personal computer                 | VGN-G1       | 28248610 1000006  | SONY         | -       |
| D   | AC Adapter                        | VGP-AC16V8   | 147886031 0018366 | SONY         | -       |

### List of cables used

| No. | Cable    | Length (m) | Shield-Cable | Shield-Connector | Remarks |
|-----|----------|------------|--------------|------------------|---------|
| 1   | USB      | 2.0        | Shielded     | Shielded         | -       |
| 2   | DC power | 1.7        | Unshielded   | Unshielded       | -       |
| 3   | AC power | 2.0        | Unshielded   | Unshielded       | -       |

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

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## **SECTION 5: Conducted emission**

### **5.1 Operating environment**

The test was carried out in No.3 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 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, spurious and outside the allocated bands)**

### **6.1 Operating environment**

The test was carried out in No.1 semi-anechoic chamber.

Temperature : See test data (APPENDIX 2)

Humidity : See test data (APPENDIX 2)

### **6.2 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.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

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 (Refer to Figure 1).

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

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 &<br>110kHz to 150kHz | 90kHz to<br>110kHz | 150kHz<br>to 490kHz | 490kHz to<br>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)<br>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])

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. (Worst axis: Refer to the data)

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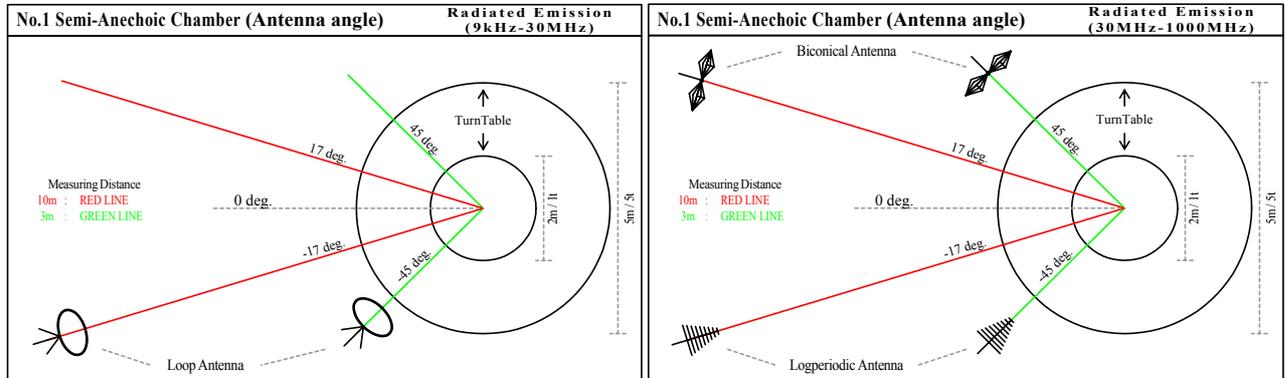
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**6.5 Results**

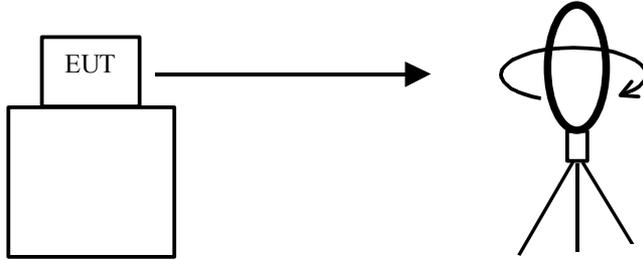
Summary of the test results : Pass

**Figure 1. Antenna angle**

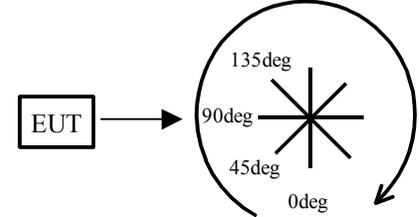


**Figure 2. Direction of the Loop Antenna**

*Side View (Vertical)*



*Side View (Horizontal)*

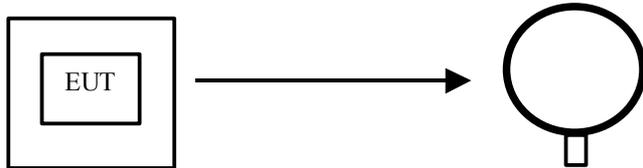


Front side: 0 deg.

Front side: 0 deg.

Forward direction: clockwise

*Top View (Horizontal)*



Antenna was not rotated.

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

**Test procedure**

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

Summary of the test results: Pass

**SECTION 8: Frequency tolerances**

**Test procedure**

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

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

Summary of the test results: Pass

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