



## RADIO TEST REPORT

Test Report No. : 28KE0185-HO-01

Applicant : SEIKO EPSON CORPORATION  
Type of Equipment : Contact-less power transmission module  
Model No. : S4E964000110000  
Test regulation : FCC Part 15 Subpart C : 2008  
Section 15.207 and 15.209  
FCC ID : BKMDGE001  
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 above regulation.
4. The test results in this 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 NVLAP, NIST, or any agency of the Federal Government.

Date of test:

August 20 to 22, 2008

Tested by:



Takayuki Shimada  
EMC Services



Akio Hayashi  
EMC Services

Approved by:



Mitsuru Fujimura  
Assistant Manager of EMC Services



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.  
\*As for the range of Accreditation in NVLAP, you may refer to the WEB address, <http://uljapan.co.jp/emc/nvlap.htm>

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## **SECTION 1: Customer information**

Company Name : SEIKO EPSON CORPORATION  
Address : 80 Harashinden, Hirooka, Shiojiri-city, Nagano, 399-0875 Japan  
Telephone Number : +81-263-52-5094  
Facsimile Number : +81-263-54-5806  
Contact Person : Akira Inoue

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

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

Type of Equipment : Contact-less power transmission module  
Model No. : S4E964000110000  
Sample No. : 003  
Rating : DC5.4V(AC Adapter: AC120V/60Hz)  
Receipt Date of Sample : August 18, 2008  
Country of Mass-production : Indonesia  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model No: S4E964000110000 (referred to as the EUT in this report) is the Contact-less power transmission module.

Feature of EUT: The primary module and the secondary module (module system) have a function of non-contact less power transmission to the application. For safety transmission, the module system has ID recognition function, and also it has the function of object detection by specific frequency. The input port of the primary module is DC 5.4V input. The primary coil is connected to the primary module by primary cable. This cable specification has 50mm and 110mm. The secondary coil is connected to the secondary module by secondary cable. This cable specification has free length between 0mm to 200mm.

Clock frequencies : 8MHz  
Equipment Type : Transceiver

#### Transmitter part

Frequency of Operation : 114.29kHz, 121.21kHz, 129.03kHz  
Type of modulation : FSK: 121.21kHz-129.03kHz  
No-modulation: 121.21kHz(Power transfer) and 114.29kHz  
Method of operation : Simplex  
Method of Frequency Generation : Ceramic resonator  
Antenna Type : Coil type antenna for LF band resonance  
Antenna connector Type : JST AWG#28  
Operating Voltage(inner) : DC5.0V

#### Receiver part

Type of Receiver : Direct conversion  
Frequency of Operation : 114.29kHz, 121.21kHz, 129.03kHz  
Method of Frequency Generation : Ceramic resonator  
Antenna Type : Coil type antenna for LF band resonance

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

### **3.1 Test Specification**

Test Specification : FCC Part15 Subpart C: 2008, final revised on May 19, 2008  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted Emission  
Section 15.209 Radiated emission limits, general requirements

#### **FCC 15.31 (e)**

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

#### **FCC Part 15.203/212 Antenna requirement**

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

### 3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC> RSS-Gen 7.2.2	<FCC> Section 15.207 <IC> RSS-Gen 7.2.2	-	N/A	<b>QP</b> 13.8dB 4.14859MHz, N (Power transfer 121.21kHz, max load) <b>AV</b> 9.5dB 9.27491MHz, N (Power Transfer 121.21kHz)	Complied
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.6, 2.7	Radiated	N/A	11.1dB 0.11505MHz 0deg, AV (Transmitting 114.29kHz)	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.6, 2.7	Radiated	N/A	4.6dB 338.248MHz, Horizontal (Power Transfer 121.21kHz)	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

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

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

### 3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.6.1	RSS-Gen 4.6.1	Radiated	N/A	N/A	N/A

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### 3.4 Uncertainty

#### EMI

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

Test room	Conducted emission	Radiated emission (10m*)			Radiated emission (3m*)			Radiated emission (3m*)	
	150kHz-30MHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	1GHz-18GHz	18GHz-40GHz
No.1 semi-anechoic chamber (±)	3.7dB	3.1dB	4.7dB	4.4dB	3.2dB	3.7dB	3.9dB	5.9dB	6.1dB
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.3dB	3.9dB	5.9dB	6.1dB
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB

\*10m/3m = Measurement distance

#### Conducted emission test

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

#### Radiated emission test(3m)

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

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### 3.5 Test Location

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	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	313583	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 3.6 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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

### **4.1 Operating Modes**

The mode is used:       \*1) Continuous transmitting mode  
                              -Transmitting 121.21kHz  
                              -Transmitting 129.03kHz  
                              -Transmitting 114.29kHz  
                              -Transmitting 121.21kHz/129.03kHz  
                              \*2) Power Transfer mode  
                              -Power Transfer 121.21kHz  
                              -Power Transfer 121.21kHz, Max load

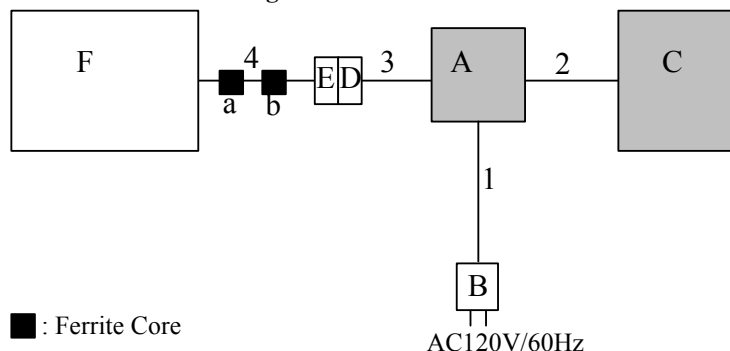
Details of operation:       The primary module is connected with the control unit that generates PN9 code and set the modulation mode(non-modulation or modulation). The EUT has two interface ports, one is PN9 data port and control ports that is directly connected to the transmission module. This is used for test mode only. Another is voltage supply port that is from AC adaptor. EUT transmits continuously by 1 second  $\pm$  50 millisecond ON and OFF at the mode of Transmitting 114.29kHz and it comes to non-modulation at the condition ON.

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



## 4.2 Configuration and peripherals

### \*1) Continuous transmitting mode



\* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

### Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Primary Module	S4E964000110000	003	SEIKO EPSON CORPORATION	EUT*
B	AC Adapter	02	QKB	FUJITSU	-
C	Primary Coil	S4E964000120000	003	SEIKO EPSON CORPORATION	EUT*
D	Jig Connector	-	-	Hirose	-
E	Jig Connector	-	-	Hirose	-
F	Jig	-	-	SEIKO EPSON CORPORATION	-

\*The EUT: Contact-less power transmission module is composed with A (Primary Module) and C (Primary Coil).

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.65	Unshielded	Unshielded	-
2	Primary Cable	0.11/0.05	Unshielded	Unshielded	-
3	Signal Cable	0.04	Unshielded	Unshielded	-
4	Signal Cable	0.12	Unshielded	Unshielded	a: ZCAT1730-0730(TDK), 1 turn, attached at 2cm from F b: SFC-4(Kitagawa), 1 turn, attached at 4cm from E

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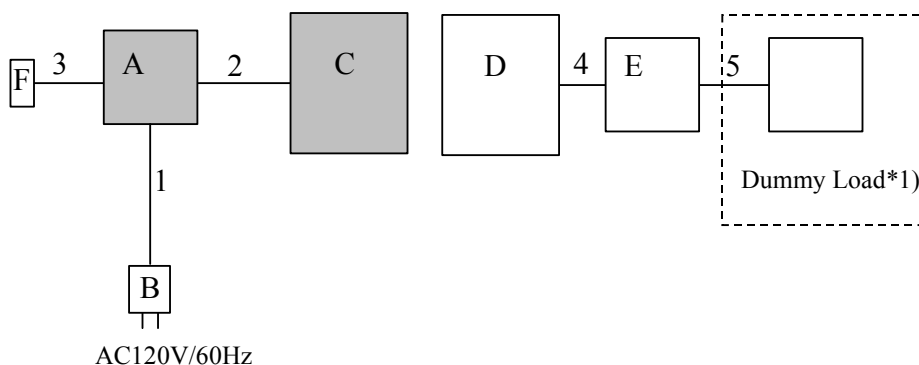
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**\*2) Power Transfer mode**



\* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

\*1) Used for Power Transfer 121.21kHz, Max load mode only.

**Description of EUT and Support equipment**

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Primary Module	S4E964000110000	003	SEIKO EPSON CORPORATION	EUT*
B	AC Adapter	02	QKB	FUJITSU	-
C	Primary Coil	S4E964000120000	003	SEIKO EPSON CORPORATION	EUT*
D	Secondary Coil	S4E964010120000	003	SEIKO EPSON CORPORATION	-
E	Secondary Module	S4E964010110000	003	SEIKO EPSON CORPORATION	-
F	Jig Connector	-	-	Hirose	-

\*The EUT: Contact-less power transmission module is composed with A (Primary Module) and C (Primary Coil).

**List of cables used**

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.65	Unshielded	Unshielded	-
2	Primary Cable	0.11/0.05	Unshielded	Unshielded	-
3	Signal Cable	0.04	Unshielded	Unshielded	-
4	Secondary Cable	0.05/0.1/0.2	Unshielded	Unshielded	-
5	Signal Cable	0.04	Unshielded	Unshielded	-

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, 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.

#### For the tests on EUT with other peripherals (as a whole system)

I/O cable and AC cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

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.

<b>Detector</b>	<b>: CISPR quasi-peak and average detector (IF BW 9 kHz)</b>
<b>Measurement range</b>	<b>: 0.15-30MHz</b>
<b>Test data</b>	<b>: APPENDIX 2</b>
<b>Test result</b>	<b>: Pass</b>

Date: August 21, 2008  
August 22, 2008

Test engineer: Akio Hayashi  
Takayuki Shimada

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

**Test Procedure**

The Radiated Electric Field Strength intensity has been measured on No 3 semi anechoic chamber 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 each antenna angle 0deg. , 45deg. and 90deg and performed at the maximum angle with turning the antenna. Please refer to figure 1, about direction of the Loop antenna. The center of the loop is 1m above the ground.

Frequency : From 30MHz to 1GHz at distance 3m

The measuring antenna height 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 a QP, PK, and AV detector.

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

	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

- The carrier level was 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 were measured.

\* 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])

**Test data : APPENDIX 2**

**Test result : Pass**

Date: August 20, 21, and 22, 2008  
August 20 and 21, 2008

Test engineer: Akio Hayashi  
Takayuki Shimada

**UL Japan, Inc.**

**Head Office EMC Lab.**

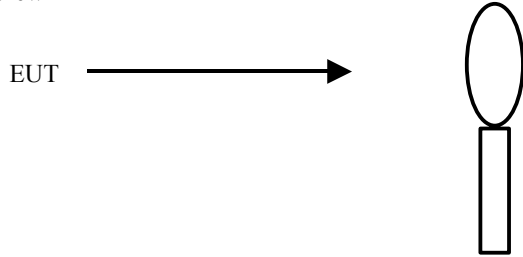
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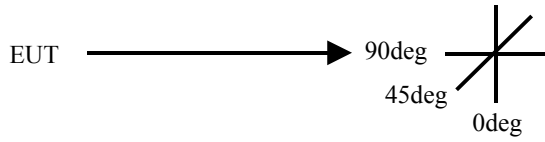
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Figure 1: Direction of the Loop Antenna

Side View



Top View



## **SECTION 7: -26dB Bandwidth**

### **Test Procedure**

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

Test data : APPENDIX 2  
Test result : Pass

## **SECTION 8: 99% Occupied Bandwidth**

### **Test Procedure**

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

Test data : APPENDIX 2  
Test result : Pass