RADIO TEST REPORT

Test Report No. : 10004231S-A

Applicant	:	**Seiko Epson Corporation**
Type of Equipment	:	**Runner's tool with GPS function**
Model No.	:	**SS-700**
FCC ID	:	**BKMAP002**
Test regulation	:	**FCC Part15 Subpart C: 2012**
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.
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.

Date of test: February 10 to 21, 2013

Representative test engineer:

Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

Approved by :

Toyokazu Imamura
Leader of WiSE Japan,
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".

RTL02610

UL Japan, Inc.
Shonan EMC Lab.
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REVISION HISTORY

Original Test Report No.: 10004231S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10004231S-A	March 14, 2013	-	-
1	10004231S-A	March 22, 2013	P6 P12, 13	P6: Correction of worst margin P12, 13: Correction of errors in data

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Contents

SECTION 1: Customer information

Company Name	:	Seiko Epson Corporation
Address	:	6925 Toyoshina-tazawa, Azumino-shi, Nagano-ken 399-8285 Japan
Telephone Number	:	+81-263-73-5795
Facsimile Number	:	+81-263-73-5795
Contact Person	:	Manabu Komiyama

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

2.1 Identification of E.U.T.

Type of Equipment	:	Runner's tool with GPS function
Model No.	:	SS-700
Serial No.	:	Refer to 4.2 of this report.
Rating	:	DC3.7V
Receipt Date of Sample	:	February 10, 2013
Country of Mass-production	:	Japan
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: SS-700 (referred to as the EUT in this report) is a Runner's tool with GPS function.

Clock frequency(ies) in the system : 16MHz

Radio specification

Equipment type	:	Transceiver
Frequency of operation	:	2457MHz
Type of modulation	:	GFSK
Antenna type	:	Chip
Antenna connector type	:	None
Operation temperature range	:	-5 to +50 deg.C.
ITU code	:	F1D

FCC 15.31 (e)
This EUT provides stable voltage (DC3.0V and DC1.8V) constantly to RF transmitter regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC 15.203
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement.

Derived models of the EUT: SS-500
- Modules are common. Form and the colors of the case are different. (SS-500: Square type, SS-700: Round type)
- The difference of appearance does not affect to the radio function.

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 15.249 Operation within the bands 902-928MHz, 2400-2483.5MHz, 5725-5875MHz, and 24.0-24.25GHz

The EUT complies with FCC Part 15 Subpart B. Refer to the test report: 10004231S-B.

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 *1)	N/A	N/A
20dB bandwidth	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.215	Radiated	N/A	-	-
Electric field strength of fundamental emission	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.249 (a)(e), 15.209	Radiated	N/A	36.4dB Detector: Peak Polarization: Vertical	Complied
Electric field strength of spurious emission	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.205 (a)(b), 15.209, 15.249 (a)(d)(e)	Radiated	N/A	16.9dB Freq.: 4914.000 MHz Detector: Peak Polarization: Vertical	Complied
Frequency tolerance	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.249 (b)	-	N/A *2)	N/A	N/A
Note: UL Japan's EMI Work Procedures No.13-EM-W0420 and 13-EM-W0422 *1) The test is not applicable since the EUT has no AC mains. (The EUT does not perform the radio function during recharging.) *2) The test is not required since this EUT does not operate in the restricted bands and the prohibited TV bands.						

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

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

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[*1]/SR[*2] (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
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
	1GHz-18GHz	4.8 dB	4.8 dB	4.9 dB
	18GHz-26.5GHz	4.8 dB	4.5 dB	4.5 dB

*1: SAC=Semi-Anechoic Chamber
*2: SR= Shielded Room is applied besides radiated emission

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

Antenna port conducted test
Bandwidth measurement uncertainty for this test was: (±) 5.4%

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone number : +81 463 50 6400
Facsimile number : +81 463 50 6401
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
☒ No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ No.4 Full-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
☐ No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
☐ No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
☐ No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☐ 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.

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	Transmitting	2457MHz

Firmware: TEST ver. 13000 (manufactured by Seiko Epson)

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

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	Runner's tool with GPS function	SS-700	7 005 385	Seiko Epson	EUT

SECTION 5: Radiated emission

5.1 Operating environment

Test place : See test data (APPENDIX 1)
Temperature : See test data (APPENDIX 1)
Humidity : See test data (APPENDIX 1)

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 0.5m by 0.5m, raised 0.8m above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

5.3 Test conditions

Frequency range : 9kHz to 26GHz
EUT position : Table top

5.4 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

<9kHz to 30MHz>
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.

* FCC 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])

<30MHz to 26GHz>
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.

The radiated emission measurements were made with the following detection of the test receiver and spectrum analyzer.

	9kHz to 90kHz & 110kHz to 150kHz	90kHz to 110kHz	150kHz to 490kHz	490kHz to 30MHz	30MHz to 1GHz	1GHz to 26GHz
Detector type	PK/AV	QP	PK/AV	QP	QP	PK / PK with Duty Factor
IF Bandwidth	200Hz	200Hz	10kHz	9kHz	120kHz	RBW: 1MHz /VBW: 3MHz

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 position:

Frequency / Antenna polarization	Carrier	Spurious		
		9kHz-30MHz	30-1000MHz	1-26GHz
Horizontal	Y	X	X	Z
Vertical	Z	X	X	X

Figure 1. Direction of the Loop Antenna

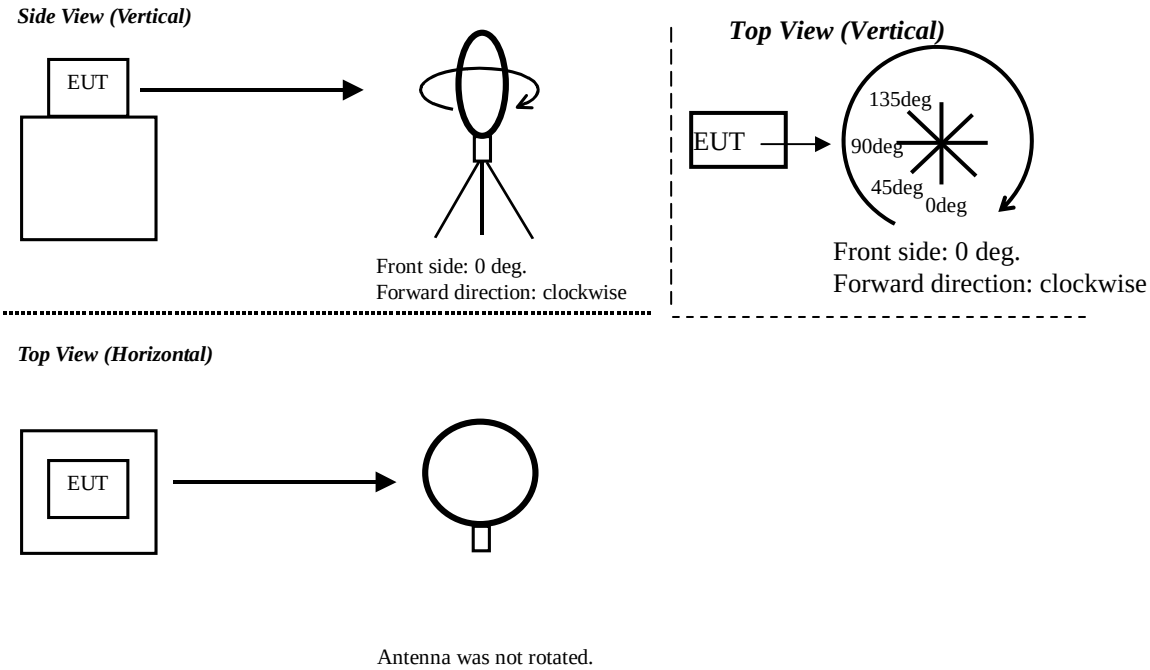
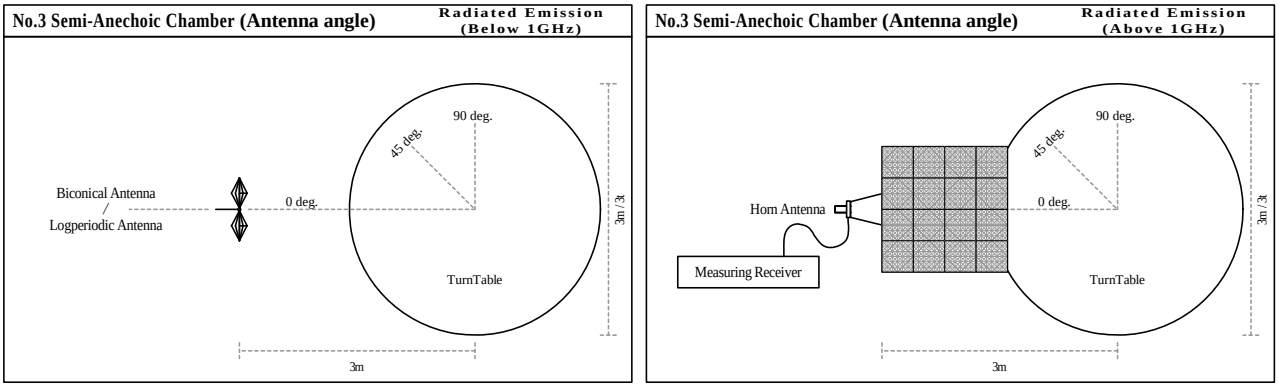


Figure 2. Antenna angle (except Loop antenna)



5.5 Results

Summary of the test results : Pass
* No noise was detected in the 4th to 10th harmonics and below 30MHz.

Refer to APPENDIX 1

SECTION 6: 20dB bandwidth & Occupied bandwidth (99%)

6.1 Test procedure

The measurement was performed in the antenna height to gain the maximum of radiated.

Summary of the test results: Pass

Refer to APPENDIX 1

Contents of APPENDIXES

APPENDIX 1: Test data

20dB bandwidth
Radiated emission
Duty Factor Calculation chart
99% Occupied bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Radiated emission
Pre-check of the worst position

APPENDIX 1: Test data

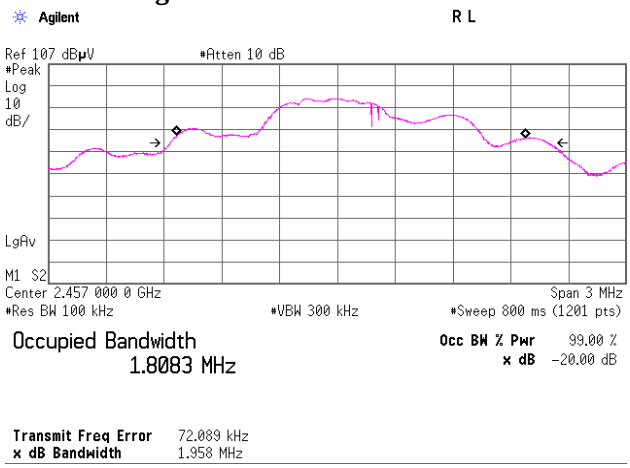
20dB Bandwidth

UL Japan, Inc.
Shonan EMC Lab. No.5 Shielded Room

Company	: Seiko Epson Corporation	Regulation	: FCC Part15C Section 15.215
Equipment	: Runner's tool with GPS function	Test Distance	: 3m
Model	: SS-700	Date	: February 21, 2013
Sample No.	: 7 005 385	Temperature	: 21deg.C
Power	: DC3.7V	Humidity	: 31%RH
Mode	: Transmitting	Engineer	: Tatsuya Arai

	20dB Bandwidth [MHz]
2457MHz	1.958

Transmitting 2457MHz



Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date February 10, 2013
Temperature / Humidity 21 deg.C , 31%RH
Engineer Tatsuya Arai
Mode Tx, 2457 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

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.	30.097	QP	22.9	17.9	6.5	32.2		15.1	40.0	24.9	200	336	
Hori.	188.703	QP	22.5	16.0	7.8	32.1		14.2	43.5	29.3	150	215	
Hori.	857.985	QP	21.7	21.7	10.6	31.3		22.7	46.0	23.3	100	99	
Hori.	2390.000	PK	46.2	27.4	14.2	41.4		46.4	73.9	27.5	100	184	
Hori.	2399.990	PK	46.7	27.4	14.2	41.4		46.9	73.9	27.0	100	184	
Hori.	2457.000	PK	76.9	27.5	14.2	41.4		77.2	113.9	36.7	100	184	
Hori.	2483.500	PK	46.0	27.5	14.3	41.4		46.4	73.9	27.5	100	184	
Hori.	4914.000	PK	58.8	31.4	6.9	41.0		56.1	73.9	17.8	100	321	
Hori.	7371.000	PK	48.8	36.7	8.4	41.5		52.4	73.9	21.5	100	0	
Vert.	31.923	QP	22.9	17.3	6.5	32.2		14.5	40.0	25.5	100	109	
Vert.	212.003	QP	22.5	16.5	8.0	32.0		15.0	43.5	28.5	100	60	
Vert.	700.489	QP	21.3	20.3	10.1	31.9		19.8	46.0	26.2	100	309	
Vert.	929.300	QP	21.4	22.5	10.8	30.9		23.8	46.0	22.2	100	298	
Vert.	2390.000	PK	47.5	27.4	14.2	41.4		47.7	73.9	26.2	100	191	
Vert.	2399.990	PK	47.1	27.4	14.2	41.4		47.3	73.9	26.6	100	191	
Vert.	2457.000	PK	77.2	27.5	14.2	41.4		77.5	113.9	36.4	100	191	
Vert.	2483.500	PK	48.5	27.5	14.3	41.4		48.9	73.9	25.0	100	191	
Vert.	4914.000	PK	59.7	31.4	6.9	41.0		57.0	73.9	16.9	100	196	
Vert.	7371.000	PK	47.8	36.7	8.4	41.5		51.4	73.9	22.5	100	175	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2390.000	PK	46.2	27.4	14.2	41.4	-54.4	-8.0	53.9	61.9	100	184	
Hori.	2399.990	PK	46.7	27.4	14.2	41.4	-54.4	-7.5	53.9	61.4	100	184	
Hori.	2457.000	PK	76.9	27.5	14.2	41.4	-54.4	22.8	93.9	71.1	100	184	
Hori.	2483.500	PK	46.0	27.5	14.3	41.4	-54.4	-8.0	53.9	61.9	100	184	
Hori.	4914.000	PK	58.8	31.4	6.9	41.0	-54.4	1.7	53.9	52.2	100	321	
Hori.	7371.000	PK	48.8	36.7	8.4	41.5	-54.4	-2.0	53.9	55.9	100	0	
Vert.	2390.000	PK	47.5	27.4	14.2	41.4	-54.4	-6.7	53.9	60.6	100	191	
Vert.	2399.990	PK	47.1	27.4	14.2	41.4	-54.4	-7.1	53.9	61.0	100	191	
Vert.	2457.000	PK	77.2	27.5	14.2	41.4	-54.4	23.1	93.9	70.8	100	191	
Vert.	2483.500	PK	48.5	27.5	14.3	41.4	-54.4	-5.5	53.9	59.4	100	191	
Vert.	4914.000	PK	59.7	31.4	6.9	41.0	-54.4	2.6	53.9	51.3	100	196	
Vert.	7371.000	PK	47.8	36.7	8.4	41.5	-54.4	-3.0	53.9	56.9	100	175	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amprifier) + Duty factor (refer to "Duty Factor Calculation")

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

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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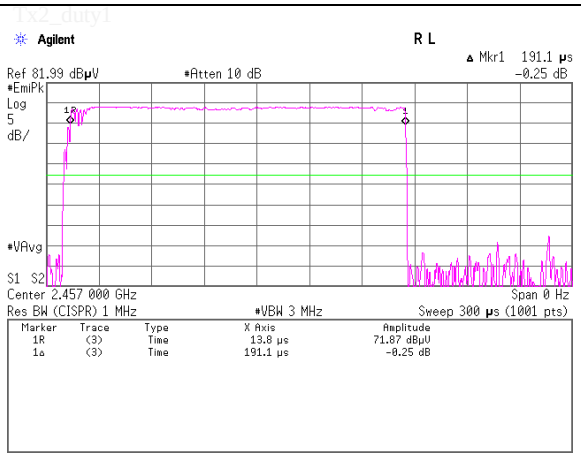
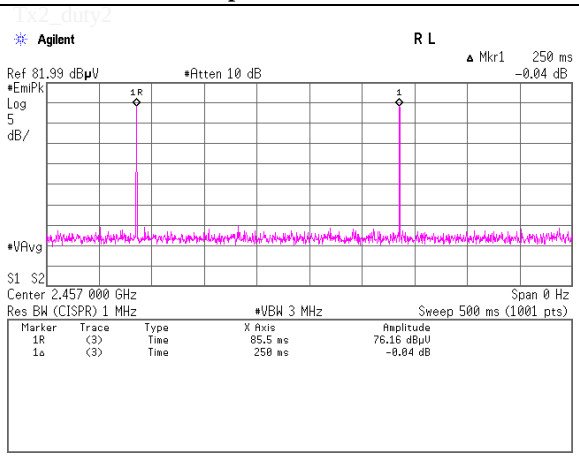
Duty Factor Calculation chart

Duty Factor Calculation	
Duty factor: 20log(0.1911 / 100) = -54.4dB	**Maximum number of pulse in 100msec: 1**
	***Each pulse interval is 250msec.**
	

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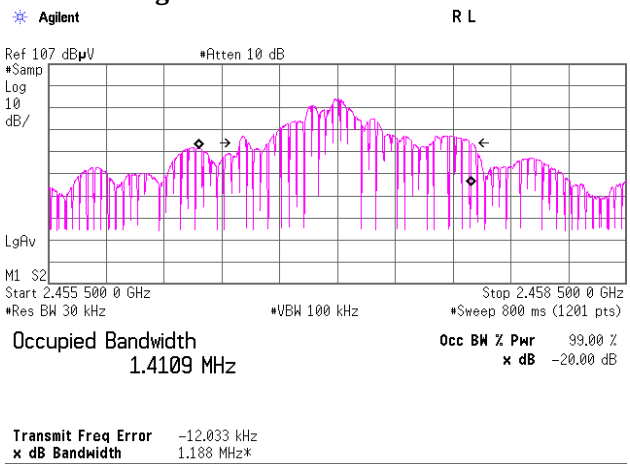
99% Occuiped Bandwidth

UL Japan, Inc.
Shonan EMC Lab. No.5 Shielded Room

Company	: Seiko Epson Corporation	Regulation	: RSS-Gen
Equipment	: Runner's tool with GPS function	Test Distance	: 3m
Model	: SS-700	Date	: February 21, 2013
Sample No.	: 7 005 385	Temperature	: 21deg.C
Power	: DC3.7V	Humidity	: 31%RH
Mode	: Transmitting	Engineer	: Tatsuya Arai

	99% Occupied Bandwidth [kHz]
2457MHz	1410.900

Transmitting 2457MHz



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APPENDIX 3
Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2012/07/18 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	2012/04/10 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2012/05/22 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2012/08/17 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2012/02/06 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE/BW	2012/02/16 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	RE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE/BW	2012/12/18 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2012/12/18 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2012/03/30 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2012/03/12 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2012/03/12 * 12
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/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
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2012/02/07 * 12
SLP-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	RE	2012/10/31 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	BW	2012/09/11 * 12
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-36	1440489	BW	2012/03/12 * 12
SCC-G01	Coaxial Cable	Suhner	SUCOFLEX 104A	46497/4A	BW	2012/04/10 * 12
SCC-G21	Coaxial Cable	Suhner	SUCOFLEX 104	296169/4	BW	2012/05/22 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	BW	2012/08/20 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	BW	2012/02/06 * 12
SJM-08	Measure	PROMART	SEN1935	-	BW	-

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 :
RE: Radiated emission,
BW: Bandwidth