

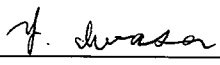
EMI TEST REPORT

Test Report No. : 23CE0043-HO-3

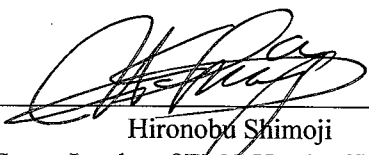
Applicant : AISIN SEIKI CO., LTD.
Type of Equipment : Door/Trunk Oscillator
Model No. : ASAT2
Test standard : FCC Part 15 Subpart C Section 15.209
FCC ID : PENASAT2
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of A-Pex International 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 : December 13 and 17, 2002

Tested by : 
Yoshiaki Iwasa
EMC Head Office Division


Hiroka Umeyama
EMC Head Office Division

Approved by : 
Hironobu Shimoji
Group Leader of EMC Head Office Division

A-Pex International Co., Ltd.

EMC Head Office Division.

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SECTION 1: Client information

Company name : AISIN SEIKI CO., LTD.
Brand name : AISIN
Address : 2-1, Asahi-machi, Kariya, Aichi, 448-8650 Japan
Telephone Number : +81-566-24-9090
Facsimile Number : +81-566-24-9320
Contact Person : Toshinobu Kageyama

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

2.1 Identification of E.U.T.

Type of Equipment : Door/Trunk Oscillator
Model No. : ASAT2
Serial No. : -
Rating : DC 12V
Country of Manufacture : Japan
Receipt Date of Sample : December 11, 2002
Condition of EUT : Engineering prototype

2.2 Product Description

AISIN SEIKI CO., LTD. Model: ASAT2 (referred to as the EUT in this report) is a Door/Trunk Oscillator. ASAT2 that is incorporated into doors and the trunk transmit the signal to the key that is outside of the vehicle.

Intended use/Purpose of the equipment: Transmitter for the key-less entry system of vehicle

Equipment Type : ☒ Transmitter ☐ Receiver ☐ Transceiver
Frequency band : Lower limit N/A
Upper limit N/A
Frequency of Operation : 134.2kHz
Other Clock Frequency : 17.1776MHz

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Type of modulation : Pulse Width Modulation
Bandwidth & channel spacing : N/A
Emission designation (ITU Code) : 50K0L1D
Duty cycle : N/A
Channel access protocol : N/A
Mode of operation : ☒ Simplex ☐ Duplex
Antenna Type : Integral Antenna
Method of Frequency Generation : ☒ Crystal ☐ Synthesizer ☐ Other (Resonator)
Power supply : Vehicle-regulated
Operating voltage : DC12V
Operating temperature range : -40 deg. C to +85 deg. C.
Power&Signal Cable Length : ☒ >3m ☐ ≤ 3m

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SECTION 3: Test specification, procedures and results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C Section 15.209
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.209 Radiated emission limits, general requirements

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Deviation	Worst margin	Results
1	Electric Field Strength of Fundamental Emission	ANSI C63.4:2001	FCC Section 15.209	N/A	16.8dB 134.20kHz 0 deg.	Complied
2	Electric Field Strength of Spurious Emission	ANSI C63.4:2001	FCC Section 15.205 FCC Section 15.209	N/A	5.2 dB 103.08 MHz Horizontal	Complied
3	-20dB Bandwidth	ANSI C63.4:2001	Reference data	N/A	N/A	Complied
4	Conducted Emission	ANSI C63.4:2001	FCC Section 15. 207	Excluded *1	N/A	N/A

*1. This test is not applicable since the EUT does not have AC power port.

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

*FCC Part 15.31 (e)

The host device ASAT2 provide the stable power supply (DC: 12V), and the Door/Trunk Oscillator complies power supply regulation.

*FCC Part 15.203 Antenna requirement

The standard type of antenna connector is applied; however, the EUT complies this requirement since this radio equipment is for professional installation.

3.3 Confirmation

A-Pex International Co., Ltd. hereby confirms that E.U.T. , in the configuration tested, complies with the specifications FCC Part15 Subpart C Section 15.209.

3.4 Uncertainty

Radiated Emission Test

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is ± 1.9 dB.

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is ± 4.5 dB.

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic Antenna is ± 5.2 dB.

☐ The data listed in this test report may exceed the test limit because it does not have enough margin.

☒ The data listed in this test report has enough margin.

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3.5 Test Location

A-Pex International Co., Ltd. EMC Head Office Division. No.2 semi anechoic chamber, 7.5 x 5.8 x 5.2m.
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Telephone: +81 596 24 8116 Facsimile: +81 596 24 8124
This site has been fully described in a report submitted to FCC office, and listed on June 05, 2002
(Registration number: 846015).
*NVLAP Lab. code: 200572-0

3.6 Test setup, Data of EMI and Test instruments

Refer to Appendix 1 to 3.

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

4.1 Operating Modes

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

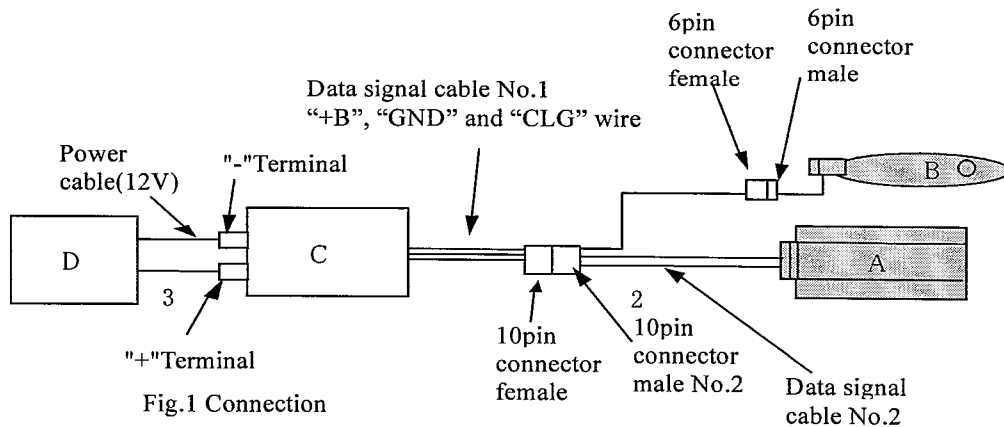
The operating mode/system was as follows:

Operation mode : Transmitting

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

4.2 Configuration and peripherals

Front View



* Cabling was taken into consideration and test data was taken under worst case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	FCC ID
A	Door/trunk Oscillator	ASAT2	-	AISIN SEIKI CO., LTD.	PENASAT2
B	Antenna	-	-	AISIN SEIKI CO., LTD.	-
C	Code generator	-	-	AISIN SEIKI CO., LTD.	-
D	DC 12V Power Supply	B19L	161001C	Panasonic	-

List of cables used

No.	Item	Length (m)	Shield	Backshell Material	Remark
1	Data signal and DC Power cable	0.6	N	Polyvinyl chloride	-
2	Data signal and DC power Cable	0.3	N	Polyvinyl chloride	-
3	DC Power Cable	3.1	N	Polyvinyl chloride	-

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SECTION 5: Radiated emission **(Fundamental and Spurious Emission and -20dB Bandwidth)**

5.1 Operating environment

The test below 1GHz was carried out in No.2 semi anechoic chamber, 7.5 x 5.8 x 5.2m.

Temperature : See data
Humidity : See data

Test Procedure

9kHz-30MHz

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane. In the frequency range of 9kHz to 30MHz, the measurement was performed with the loop antenna which was positioned with its plane vertical at the distance of 3 m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The loop antenna was also positioned horizontally at the distance of 3 m from the EUT. The center of the loop was 1 m above the ground.

30MHz-1000MHz

EUT was placed on a platform of normal size, 1m by 1m, raised 80cm above the conducting ground plane. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The Radiated Electronic Field Strength intensity has been measured on a No.2 semi anechoic chamber, 7.5 x 5.8 x 5.2m with a ground plane and at a distance of 3 m.

The measuring antenna height was varied between 1 to 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electronic field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The EUT was also previously checked at each position of three axes X, Y, Z to find the worst position. The position in which the maximum noise occurred was chosen to put into measurement. Worst cases are referred to following page.

It was operated under transmitting receiving mode.

The radiated emission measurement were made with the following function of the test receiver and spectrum analyzer.

Measurement range : 9kHz to 90kHz AV/PK Detector, IF BW 200Hz (Test receiver)
: 90kHz to 110kHz CISPR QP Detector, IF BW 200Hz (Test receiver)
: 110kHz to 150kHz AV/PK Detector, IF BW 200Hz (Test receiver)
: 150kHz to 490kHz AV/PK Detector, IF BW 10kHz (Test receiver)
: 490kHz to 30MHz QP Detector, IF BW 10kHz (Test receiver)
: 30MHz to 1000MHz CISPR QP Detector, IF BW 120kHz (Test receiver)

Test data : 9kHz - 1000MHz: Page 13-14

Photographs of test setup : Page 12

Test result : Pass

5.2 -20dB Bandwidth (Reference data)

Test data : Page 15

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5.3 Results

Summary of the test results: Pass

Date: December 13, 2002
December 17, 2002

Tested by: Yoshiaki Iwasa
Tested by: Hiroka Umeyama

A-Pex International Co., Ltd.

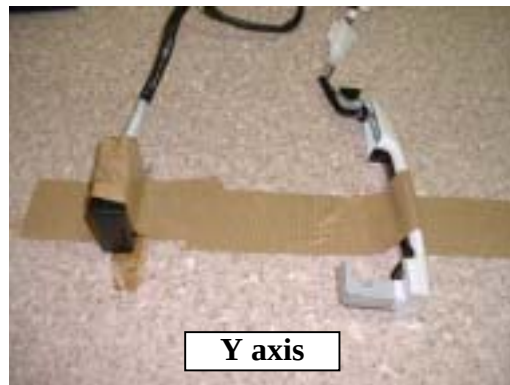
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5.4 Pre check of worse-case position



Worse case Y axis (9kHz – 30MHz, Measurement Loop antenna angle: 0deg)

APPENDIX 1: Photographs of test setup

Page 12 : Radiated emission

APPENDIX 2: Data of EMI test

Page 13-14 : Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Page 15 : -20dB Bandwidth

APPENDIX 3: Test instruments

Page 16 : Test instruments

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EMC Head Office Division.

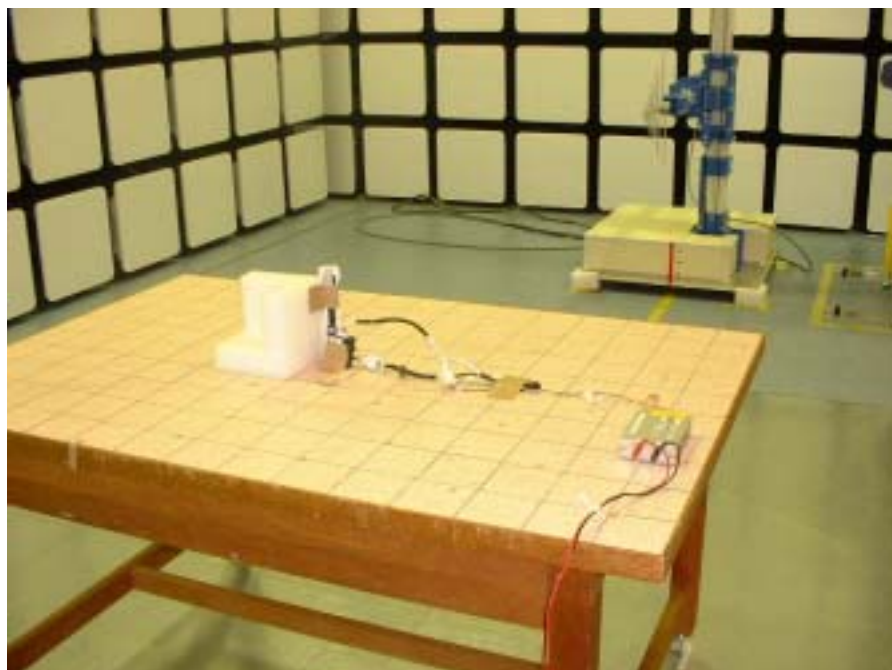
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APPENDIX 1: Photographs of test setup

Radiated emission



Data of carrier and supurious emissions(9kHz to 30MHz)

A-Pex International Co., Ltd.
Head office No.2 Semi Anechoic Chamber

Company : AISIN SEIKI CO., LTD.
Equipment : Door/Trunk Oscillator
Model : ASAT2
Sample No. : -
Power : DC12.0V
Mode : Transmitting , Y-axis / 0deg.C.
Temperature : 23deg.C
Humidity : 33%

Report No. : 23CE0043-HO-3
Regulation : FCC Part15C Section 15.209
Test Distance : 3m
Date : 2002/12/17
FCC ID : PENASAT2


ENGINEER : Hiroka Uneyama

No.	FREQ [kHz]	Loop Max Angle [deg]	detector	T/R	ANT Factor [dB]	ATTEN [dB]	CABLE LOSS [dB]	AMP GAIN [dB]	RESULT	LIMIT	MARGIN
			type	READING [dBuV]					[dBuV/m]	[dBuV/m]	[dB]
1	134.20	0	PK	102.0	19.6	0.0	0.4	26.9	95.1	125.0	29.9
2	134.20	0	AV	95.7	19.6	0.0	0.4	27.5	88.2	105.0	16.8
3	268.40	0	PK	65.2	19.6	0.0	0.5	27.9	57.4	119.0	61.6
4	268.40	0	AV	54.0	19.6	0.0	0.5	28.0	46.1	99.0	52.9
5	402.60	0	PK	68.2	19.6	0.0	0.6	28.1	60.3	115.5	55.2
6	402.60	0	AV	59.3	19.6	0.0	0.6	28.1	51.4	95.5	44.1
7	536.80	0	QP	49.3	19.6	0.0	0.5	28.1	41.3	73.0	31.7
8	671.00	0	QP	49.6	19.5	0.0	0.5	28.1	41.5	71.1	29.6
9	805.20	0	QP	49.3	19.5	0.0	0.6	28.1	41.3	69.5	28.2
10	939.40	0	QP	49.3	19.5	0.0	0.4	28.1	41.1	68.1	27.0
11	1,073.60	0	QP	49.4	19.5	0.0	0.3	28.1	41.1	67.0	25.9
12	1,207.80	0	QP	49.1	19.5	0.0	0.4	28.1	40.9	66.0	25.1
13	1,342.00	0	QP	49.2	19.5	0.0	0.4	28.1	41.0	65.0	24.0

REMARKS

ANTENNA TYPE : 10kHz-30MHz (Loop Antenna)

CALCULATION: READING + ANT Factor + ATTEN + Cable Loss - AMP Gain

For fundamental, the measured field strength was extrapolated to distance 300m, using the formula that field strength varies as the inverse distance square (40dB per decade of distance).

Sample calculation:

Peak: $102.2\text{dBuV/m} - 40\log(300/3) = 102.2 - 80 = 22.2\text{dBuV/m}$ at 300m

Limits for fundamental (section 15.209(a)) $= 20\log(2400/125) + 20 = 45.7\text{dBuV/m}$

Average: $76.7\text{dBuV/m} - 40\log(300/3) = 76.7 - 80 = -3.3\text{dBuV/m}$ at 300m

Limits for fundamental (section 15.209(a)) $= 20\log(2400/125) = 25.7\text{dBuV/m}$

Limit: (9kHz - 490kHz): $2400/\text{Freq}$ (Converted dBuV/m) + $40\log(300/3)$

Limit: (490kHz - 1.705MHz): $24000/\text{Freq}$ (Converted dBuV/m) + $40\log(30/3)$

Limit: (1.705MHz - 30MHz): 30 (Converted dBuV/m) + $40\log(30/3)$

All other spurious emissions are more than 20dB below the limits.

DATA OF RADIATION TEST

A-Pex International Co., Ltd.
No.2 SEMI ANECHOIC CHAMBER
Report No. : 23CE0043-H0 - 3

Applicant : AISIN SEIKI CO., LTD.
Kind of Equipment : Door/trunk Oscillator
Model No. : ASAT2
Serial No. : -
Power : DC 12V
Mode : Continuous Transmitting
Remarks : DETECTOR:QP / Antenna:Z-axis, Oscillator:Z-axis
Date : 12/13/2002
Test Distance : 3 m
Temperature : 24 °C
Humidity : 27 %
Regulation : Fcc 15C § 15.209(a)

J. Iwasa
Engineer : Yoshiaki Iwasa

No.	FREQ. [MHz]	ANT TYPE	READING		ANT FACTOR [dB/m]	AMP GAIN [dB]	CABLE LOSS [dB]	ATTEN. [dB]	RESULT		LIMITS [dB μ V/m]	MARGIN	
			HOR [dB μ V]	VER [dB μ V]					HOR [dB μ V/m]	VER [dB μ V/m]		HOR [dB]	VER [dB]
1.	31.25	BB	26.2	31.4	18.4	27.5	0.7	5.8	23.6	28.8	40.0	16.4	11.2
2.	34.36	BB	29.7	39.3	17.2	27.5	0.7	5.8	25.9	35.5	40.0	14.1	4.5
3.	68.73	BB	39.6	35.4	7.3	27.2	0.9	5.8	26.4	22.2	40.0	13.6	17.8
4.	103.08	BB	47.2	45.3	11.0	26.8	1.1	5.8	38.3	36.4	43.5	5.2	7.1
5.	120.27	BB	38.2	37.4	12.7	26.7	1.2	5.8	31.2	30.4	43.5	12.3	13.1
6.	206.17	BB	36.8	26.9	17.5	26.1	1.7	5.8	35.7	25.8	43.5	7.8	17.7

CALCULATION: READING[dB μ V] + ANT.FACTOR[dB/m] + CABLE LOSS[dB] - AMP.GAIN[dB] + ATTEN[dB].

All other spurious emissions were less than 20dB for the limit.

ANT.TYPE : 30-300MHz Biconical, 300-1000MHz Logperiodic, 1000MHz- Horn

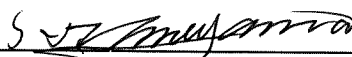
-20dB Bandwidth

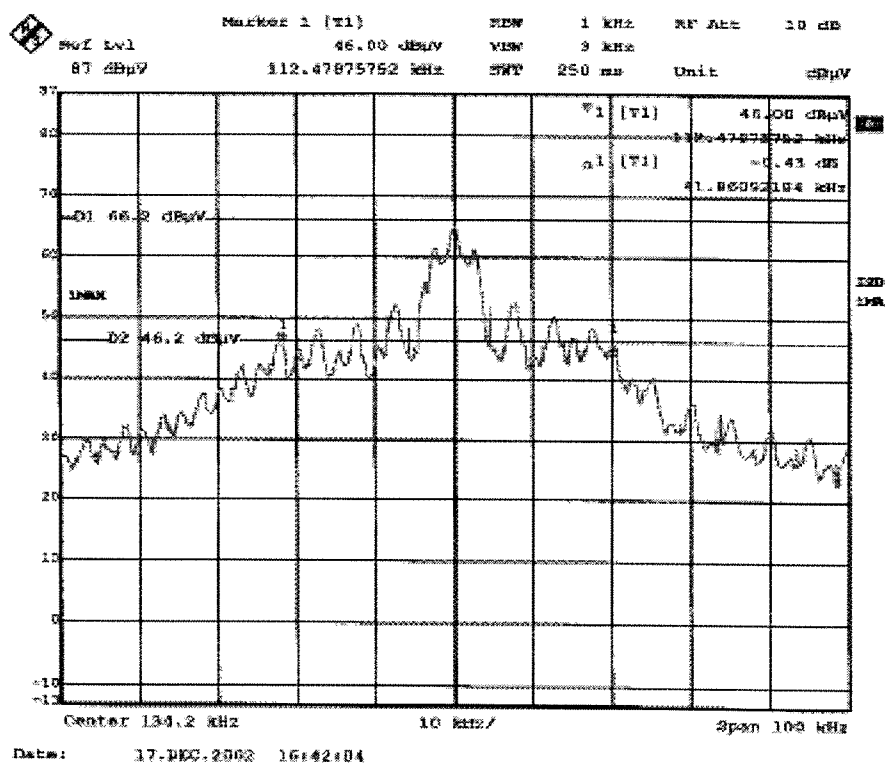
A-Pex International Co., Ltd.

Head office No.2 Semi Anechoic Chamber

Company : AISIN SEIKI CO., LTD.
 Equipment : Door/Trunk Oscillator
 Model : ASAT2
 Sample No. : -
 Power : DC12.0V
 Mode : Transmitting
 Temperature : 23deg.C
 Humidity : 33%

Report No. : 23CE0043-HO-3
 Regulation : FCC Part15C Section 15.209
 Test Distance : 3m
 Date : 2002/12/17
 FCC ID : PENASAT2


 ENGINEER : Hiroka Umeyama



Test Report No : 23CE0043-HO-3

APPENDIX 3 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	RE	2002/04/12 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	RE	2001/12/27 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	RE	2002/05/02 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	MCC-12-01(8D -2W-15m) MCC-12-02(5D -2W-0.7m) MCC-12-05(RF SW) MCC-12-03(5D -2W-0.8m) MCC-12-06(RF SW) MCC-12-04(5D -2W-1m)	RE	2002/05/09 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	RE	2002/05/02 * 12
MPA-04	Pre Amplifier	Agilent	8447D	RE	2002/03/13 * 12
1					*
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	RE	2002/10/11 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	RE	2002/12/13 * 12
SA-01	Spectrum Analyzer	Hewlett Packard	8567A	RE	2002/04/03 * 12
MCC-13	Coaxial Cable	Fujikura/Agilent	MCC-13-01(3D -2W-5m) MCC-13-02(3D -2W-7m) MCC-13-03(5D -2W-5m) MCC-12-05(RF SW) MCC-12-03(5D -2W-0.8m) MCC-12-06 (RF SW) MCC-13-04(5D -2W-1m)	RE	2002/05/09 * 12
MCC-07	coaxial cable	-	-	RE	2002/02/08 * 12
MCC-08	coaxial cable	-	-	RE	2002/02/08 * 12

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

Test Item:

RE: Radiated emission