




RADIO TEST REPORT

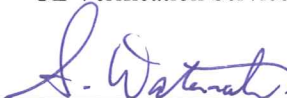
Test Report No. : 32GE0120-HO-01-B-R2

Applicant : OMRON Automotive Electronics Co. Ltd.
Type of Equipment : Keyless Operation System
Model No. : GGM-M003
FCC ID : OUCGGM-M003
Test regulation : FCC Part 15 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 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.
6. This report is a revised version of 32GE0120-HO-01-B-R1. 32GE0120-HO-01-B-R1 is replaced with this report.

Date of test: May 16 and 25, 2012

Representative test engineer: 
Motoya Imura
Engineer of WiSE Japan,
UL Verification Service

Approved by: 
Shinya Watanabe
Leader of WiSE Japan,
UL Verification Service



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://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

CONTENTS	PAGE
SECTION 1: Customer information	3
SECTION 2: Equipment under test (E.U.T.).....	3
SECTION 3: Test specification, procedures & results	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Radiated emission (Fundamental and Spurious Emission).....	10
SECTION 6: -26dB Bandwidth.....	12
SECTION 7: 99% Occupied Bandwidth.....	12
APPENDIX 1: Data of EMI test.....	13
Radiated Emission below 30MHz (Fundamental and Spurious Emission)	13
Radiated Emission above 30MHz (Spurious Emission).....	15
-26dB Bandwidth.....	17
99% Occupied Bandwidth.....	18
APPENDIX 2: Test instruments	19
APPENDIX 3: Photographs of test setup	20
Radiated Emission.....	20
Worst Case Position (EUT: X-axis / Antenna: X-axis)	21

SECTION 1: Customer information

Company Name : OMRON Automotive Electronics Co. Ltd.
Address : 6368 NENJOZAKA OKUSA KOMAKI AICHI 485-0802 JAPAN
Telephone Number : +81-568-78-6159
Facsimile Number : +81-568-78-7659
Contact Person : Masashi Matsuda

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

2.1 Identification of E.U.T.

Type of Equipment : Keyless Operation System
Model No. : GGM-M003
Serial No. : Refer to Section 4, Clause 4.2
Receipt Date of Sample : April 18, 2012
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 No: GGM-M003 (referred to as the EUT in this report) is the Keyless Operation System.
KOS consists of KOS ECU, LF ANT, and FOB BOX.

Keyless operation system is a system to lock/unlock (door entry function) a door /trunk by pressing Lock/Unlock SW on each door with holding the registered keyless operation key (hereafter referred to as FOB) and start up an engine (engine starter function) without using an existing mechanical key. These operations can be done without pulling FOB from a pocket or bag.

The keyless entry function to lock/unlock doors by pressing a button on FOB, immobilizer function for antitheft and remote engine starter function to start up/stop an engine by pressing a button of a separate transmitter (remote control engine starter) are installed.

General Specification

Operating Voltage : DC8 to 16V
Operating Temperature : -40 deg. C. - +85 deg. C

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116
Facsimile : +81 596 24 8124

KOS has the following radio functions: Immobilizer system and Smart System (LF Transmitting/RF Receiving).

Immobilizer system function^{*1)}

Equipment Type : Transceiver
Frequency of Operation : 125kHz
Type of Modulation : BPLM
Mode of Operation : Simplex
Antenna Type : Coil Antenna
Method of Frequency Generation : Ceramic Resonator
Operating Voltage (inner) : DC5V (The stable voltage: DC5V is provided to RF part regardless of input voltage fluctuation (Car Battery).)

Smart System: LF Transmitting function^{*2)}

Equipment Type : Transmitter
Frequency of Operation : 125kHz
Type of Modulation : ASK
Mode of Operation : Simplex
Antenna Type : Ferrite Antenna
Method of Frequency Generation : Crystal and CPU timer
Operating Voltage (inner) : DC8V (The stable voltage: DC8V is provided to RF part regardless of input voltage fluctuation (Car Battery).)

*KOS has 5 or 6 LF antennas depending on the vehicles on which the EUT is mounted, and all the antennas are same in specification. Each antenna does not transmit at the same time. ECU controls the power for each antenna. The test was performed with maximum power and minimum power which were settable. The end-user cannot set the power setting value since it is defined each vehicle.

Smart System: RF Receiving function^{*3)}

Type of Receiver : Super Heterodyne
Receiving Frequency : 315MHz
Oscillator Frequency : 10.178125MHz (Crystal)
Local Oscillator Frequency : 325.7MHz(10.178125MHz*32)
Intermediate Frequency : 10.7MHz
Antenna Type : S type Antenna
Method of Frequency Generation : Crystal
Operating Voltage (inner) : DC5V (The stable voltage: DC5V is provided to RF part regardless of input voltage fluctuation (Car Battery).)

*1) Immobilizer system function is applied for other test report. (Test Report No.: 32GE0120-HO-01-A)

*2) This test report applies for LF Transmitting function.

*3) RF Receiving function is applied for other test report. (Test Report No.: 32GE0120-HO-01-E)

* Immobilizer system function and LF Transmitting function do not transmit 125kHz at the same time.

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2012, final revised on July 23, 2012 and effective August 22, 2012

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

* The revision on July 23, 2012 does not affect the test specification applied to the EUT.

FCC 15.31(e)

The EUT provides the stable voltage (DC8V for LF Transmitter, DC5V for Immobilizer) constantly to RF part regardless of input voltage. Therefore, the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the LF transmitting antenna, because it is mounted inside of the vehicle and users cannot access it. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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 7.2.4	<FCC> Section 15.207 <IC> RSS-Gen 7.2.4	-	N/A *1)	N/A	N/A
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 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	43.1dB 0.125000MHz, 0deg., PK	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 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	20.4dB 1.25000MHz, QP	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. 13-EM-W0420 and 13-EM-W0422.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.3 Addition to standard

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

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

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 (semi-anechoic chamber)	Radiated emission (10m*)(±dB)		
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz
No.1	4.1dB	5.0dB	4.8dB
No.2	-	-	-
No.3	-	-	-
No.4	-	-	-

*10m = Measurement distance

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(±dB)				(1m*)(±dB)		(0.5m*)(±dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.2dB	5.0dB	5.1dB	4.7dB	5.7dB	4.4dB	4.3dB
No.2	4.1dB	5.2dB	5.1dB	4.8dB	5.6dB	4.3dB	4.2dB
No.3	4.5dB	5.0dB	5.2dB	4.8dB	5.6dB	4.5dB	4.2dB
No.4	4.7dB	5.2dB	5.2dB	4.8dB	5.6dB	5.1dB	4.2dB

*3m/1m/0.5m = Measurement distance

Radiated emission test (3m and 10m)

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

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

	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 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

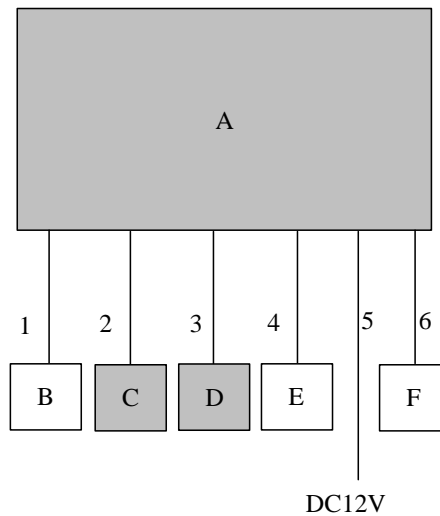
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

Test mode	Remarks
Transmitting mode	125kHz

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

4.2 Configuration and peripherals



* 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	Remark
A	KOS ECU	GGM-M003 *1)	001	OMRON Automotive Electronics Co. Ltd.	EUT
B	KEYLESS OPERATION KEY BOX	C8Z-F116M	00076	OMRON Automotive Electronics Co. Ltd.	-
C	LF ANT	G8D-841M-ANT *1)	1-244	OMRON Automotive Electronics Co. Ltd.	EUT Maximum Output
D	LF ANT	G8D-841M-ANT *1)	1-245	OMRON Automotive Electronics Co. Ltd.	EUT Minimum Output
E	DAMMY ECU	-	-	OMRON Automotive Electronics Co. Ltd.	-
F	JIG	-	-	OMRON Automotive Electronics Co. Ltd.	-

*1) Keyless Operation System is composed with these Items and the system model number is GGM-M003.

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal Cable	1.6	Unshielded	Unshielded	Dedicated
2	Antenna Cable	1.7	Unshielded	Unshielded	Dedicated
3	Antenna Cable	1.7	Unshielded	Unshielded	Dedicated
4	Signal Cable	1.6	Unshielded	Unshielded	-
5	DC Cable	2.5	Unshielded	Unshielded	-
6	Signal Cable	1.3	Unshielded	Unshielded	-

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

The Radiated Electric Field Strength intensity has been measured on No 1 and No.4 semi anechoic chamber with a ground plane and at a distance of 3m and 10m.

Frequency : From 9kHz to 30MHz at distance 3m and 10m

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., 45deg., 90deg., 135 deg. and 180 deg.)

and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

The test of Max power was performed at a distance of 10m, the test of Min power was performed at a distance of 3m.

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 receiver.

	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 (or, noise levels) was (or were) 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])

[Limit at 10m]=[Limit at 300m]-40 x log (10[m]/300[m])

[Limit at 10m]=[Limit at 30m]-40 x log (10[m]/30[m])

Test data : APPENDIX 1
Test result : Pass

UL Japan, Inc.

Head Office EMC Lab.

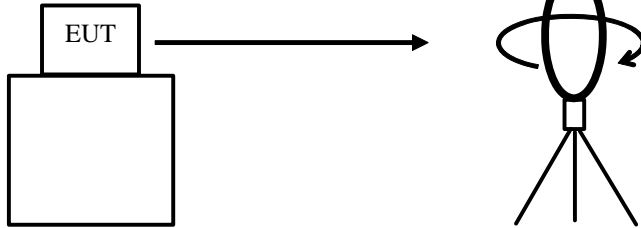
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

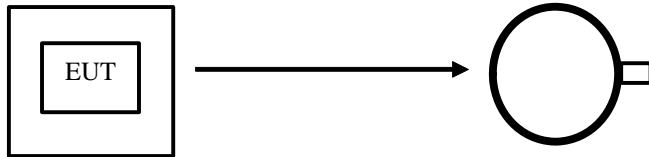
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

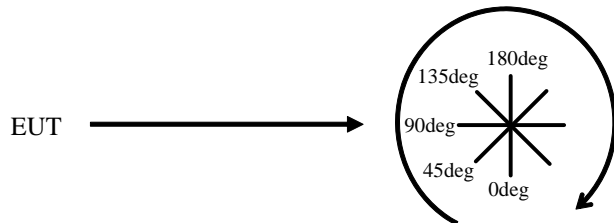


.....
Top View (Horizontal)



Antenna was not rotated.

.....
Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 6: -26dB Bandwidth

Test Procedure

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

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26dB Bandwidth	200kHz	2kHz	6.2kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 99% Occupied Bandwidth

Test Procedure

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

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 % of Span	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer

*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.

Test data : APPENDIX 1
Test result : Pass

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

APPENDIX 1: Data of EMI test

Radiated Emission below 30MHz (Fundamental and Spurious Emission)
[Max Power]

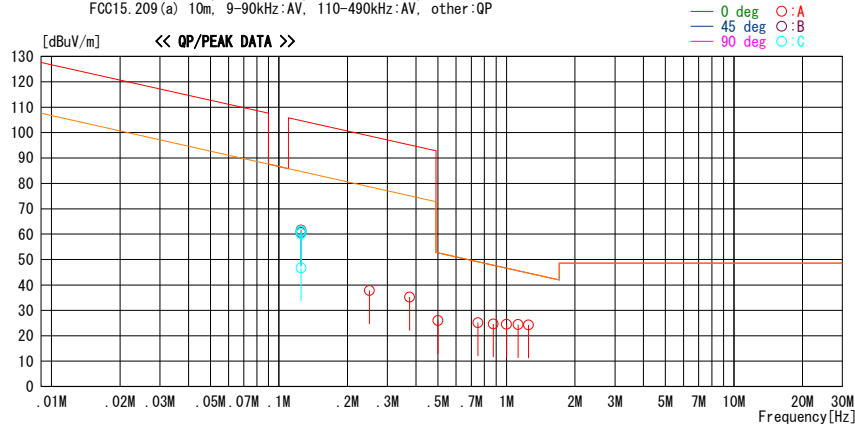
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2012/05/16

Report No. : 32GE0120-HO-01
Power : DC 12.0V
Temp./ Humi. : 24deg. C / 42% RH
Engineer : Takumi Shimada

Mode / Remarks : Transmitting 125kHz Worst Axis (Max Power)

LIMIT : FCC15.209 (a) 10m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209 (a) 10m, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
0.12500	67.9	PEAK	19.9	6.0	32.2	61.6	104.7	43.1	0	A	180
0.12500	67.0	PEAK	19.9	6.0	32.2	60.7	104.7	44.0	45	B	133
0.12500	66.5	PEAK	19.9	6.0	32.2	60.2	104.7	44.5	90	C	284
0.12500	67.3	PEAK	19.9	6.0	32.2	61.0	104.7	43.7	135	C	215
0.12500	67.7	PEAK	19.9	6.0	32.2	61.4	104.7	43.3	180	C	182
0.12500	53.0	PEAK	19.9	6.0	32.2	46.7	104.7	58.0	0	C	293
0.25000	44.2	PEAK	19.7	6.1	32.2	37.8	98.7	60.9	0	A	180
0.37500	41.6	PEAK	19.7	6.1	32.2	35.2	95.1	59.9	0	A	180
0.50000	32.6	QP	19.6	6.1	32.3	26.0	52.6	26.6	0	A	180
0.75000	31.5	QP	19.6	6.2	32.2	25.1	49.1	24.0	0	A	180
0.87500	31.2	QP	19.5	6.2	32.2	24.7	47.8	23.1	0	A	180
1.00000	31.0	QP	19.5	6.2	32.2	24.5	46.6	22.1	0	A	180
1.12500	30.9	QP	19.5	6.2	32.2	24.4	45.6	21.2	0	A	180
1.25000	30.8	QP	19.5	6.2	32.2	24.3	44.7	20.4	0	A	180

CHART: WITH FACTOR, ANT TYPE: LOOP. Except for the data below: adequate margin data below the limits.
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN.) - GAIN(AMP.)

- *The test result is rounded off to one or two decimal places, so some differences might be observed.
- *Testing with an average detector was excluded, because emission level with a peak detector met the limit of an average detector.

Radiated Emission below 30MHz (Fundamental and Spurious Emission)
[Min Power]

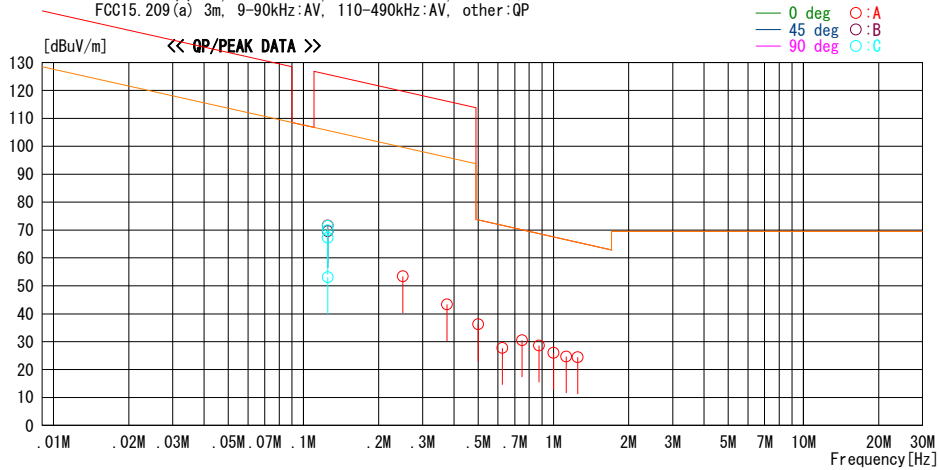
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/05/25

Report No. : 32GE0120-HO-01
Power : DC 12.0V
Temp. / Humi. : 23deg. C. / 56%RH
Engineer : Motoya Imura

Mode / Remarks : Transmitting 125kHz Worst Axis (Min Power)

LIMIT : FCC15. 209 (a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15. 209 (a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
0.12500	78.0	PEAK	19.9	5.9	32.2	71.6	125.7	54.1	0	A	0
0.12500	76.0	PEAK	19.9	5.9	32.2	69.6	125.7	56.1	45	B	147
0.12500	73.6	PEAK	19.9	5.9	32.2	67.2	125.7	58.5	90	C	91
0.12500	76.3	PEAK	19.9	5.9	32.2	69.9	125.7	55.8	135	C	242
0.12500	77.9	PEAK	19.9	5.9	32.2	71.5	125.7	54.2	180	C	0
0.12500	59.5	PEAK	19.9	5.9	32.2	53.1	125.7	72.6	180	C	77 Loop Hor
0.25000	60.0	PEAK	19.7	5.9	32.2	53.4	119.7	66.3	0	A	0
0.37500	49.9	PEAK	19.7	5.9	32.2	43.3	116.1	72.8	0	A	0
0.50000	43.0	QP	19.6	5.9	32.3	36.2	73.6	37.4	0	A	0
0.62500	34.4	QP	19.6	5.9	32.2	27.7	71.7	44.0	0	A	113
0.75000	37.2	QP	19.6	5.9	32.2	30.5	70.1	39.6	0	A	234
0.87500	35.4	QP	19.5	5.9	32.2	28.6	68.7	40.1	0	A	0
1.00000	32.8	QP	19.5	5.9	32.2	26.0	67.6	41.6	0	A	0
1.12500	31.5	QP	19.5	5.9	32.2	24.7	66.5	41.8	0	A	0
1.25000	31.2	QP	19.5	5.9	32.2	24.4	65.6	41.2	0	A	0

CHART: WITH FACTOR, ANT TYPE: LOOP, Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS (CABLE + ATTEN.) - GAIN (AMP.)

*The test result is rounded off to one or two decimal places, so some differences might be observed.
*Testing with an average detector was excluded, because emission level with a peak detector met the limit of an average detector.

Radiated Emission above 30MHz (Spurious Emission)
[Max Power]

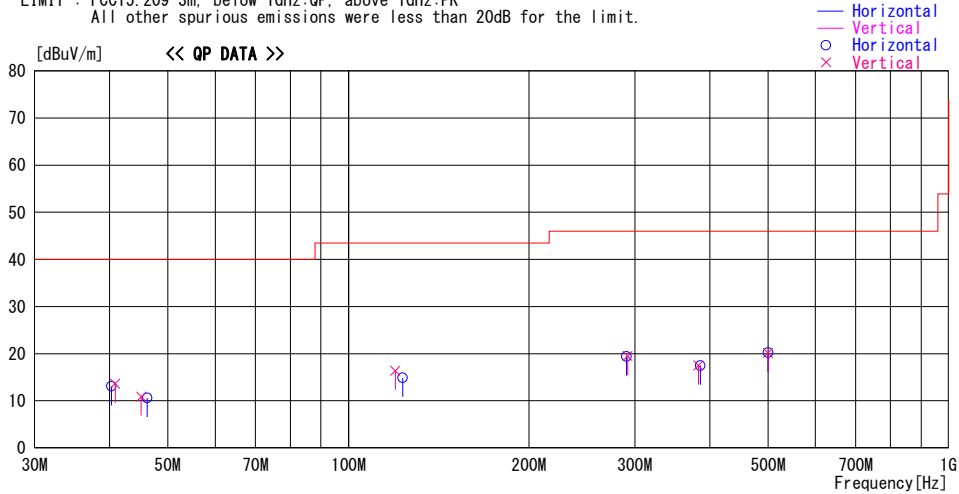
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/05/25

Report No. : 32GE0120-H0-01
Power : DC 12.0V
Temp. / Humi. : 23deg.C / 56% RH
Engineer : Motoya Imura

Mode / Remarks : Transmitting 125kHz Worst Axis (Max Power)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss& Gain [dB]							
40.281	23.2	QP	14.7	-24.8	13.1	134	300	Hori.	40.0	26.9	
40.850	23.9	QP	14.5	-24.8	13.6	237	100	Vert.	40.0	26.4	
45.150	23.0	QP	12.7	-24.8	10.9	176	100	Vert.	40.0	29.1	
46.232	23.1	QP	12.3	-24.8	10.6	27	300	Hori.	40.0	29.4	
119.740	27.2	QP	12.9	-23.7	16.4	107	100	Vert.	43.5	27.1	
123.066	25.4	QP	13.2	-23.7	14.9	350	243	Hori.	43.5	28.6	
290.800	22.2	QP	19.7	-22.5	19.4	24	300	Hori.	46.0	26.6	NS
291.882	22.2	QP	19.7	-22.4	19.5	4	100	Vert.	46.0	26.5	NS
382.765	21.9	QP	17.4	-21.8	17.5	223	100	Vert.	46.0	28.5	NS
385.571	21.9	QP	17.4	-21.8	17.5	352	100	Hori.	46.0	28.5	NS
500.000	22.2	QP	19.0	-21.0	20.2	325	100	Hori.	46.0	25.8	NS
500.000	22.2	QP	19.0	-21.0	20.2	307	100	Vert.	46.0	25.8	NS

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz--:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission above 30MHz (Spurious Emission)
[Min Power]

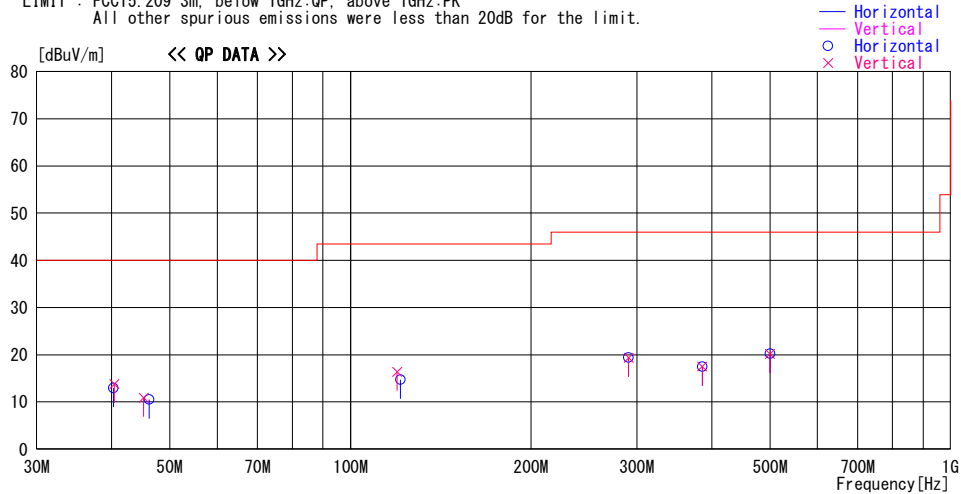
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/05/25

Report No. : 32GE0120-H0-01
Power : DC 12.0V
Temp. / Humi. : 23deg.C / 56% RH
Engineer : Motoya Imura

Mode / Remarks : Transmitting 125kHz Worst Axis (Min Power)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss& Gain [dB]							
40.283	23.0	QP	14.7	-24.8	12.9	124	300	Hori.	40.0	27.1	
40.432	24.0	QP	14.6	-24.8	13.8	223	100	Vert.	40.0	26.2	
45.241	23.0	QP	12.7	-24.8	10.9	178	100	Vert.	40.0	29.1	
46.231	23.0	QP	12.3	-24.8	10.5	343	300	Hori.	40.0	29.5	
119.630	27.2	QP	12.9	-23.7	16.4	114	100	Vert.	43.5	27.1	
121.146	25.4	QP	13.0	-23.7	14.7	350	254	Hori.	43.5	28.8	
290.800	22.2	QP	19.7	-22.5	19.4	24	300	Hori.	46.0	26.6	NS
290.801	22.2	QP	19.7	-22.5	19.4	4	100	Vert.	46.0	26.6	NS
385.569	21.9	QP	17.4	-21.8	17.5	223	100	Vert.	46.0	28.5	NS
385.571	21.9	QP	17.4	-21.8	17.5	352	100	Hori.	46.0	28.5	NS
500.000	22.2	QP	19.0	-21.0	20.2	325	100	Hori.	46.0	25.8	NS
500.000	22.2	QP	19.0	-21.0	20.2	307	100	Vert.	46.0	25.8	NS

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz--HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

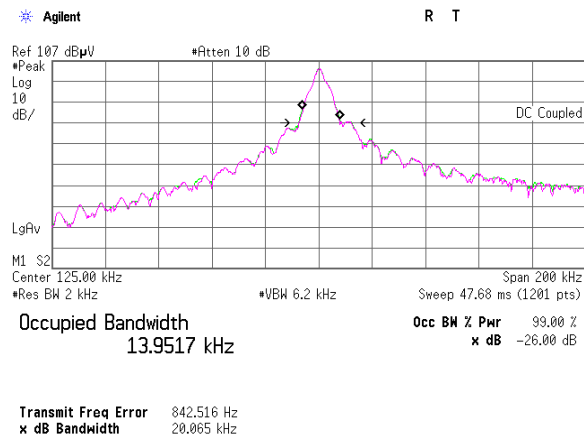
*The test result is rounded off to one or two decimal places, so some differences might be observed.

-26dB Bandwidth

UL Japan, Inc.
 Head Office EMC Lab. No.4 Semi Anechoic Chamber

REPORT NO : 32GE0120-HO-01
 REGULATION : Reference data
 TEST DISTANCE : 3m
 DATE : 5/25/2012
 TEMPERATURE : 23deg. C
 HUMIDITY : 56 % RH
 Engineer : Motoya Imura

FREQ	-26dB Bandwidth
[kHz]	[kHz]
125.0	20.065

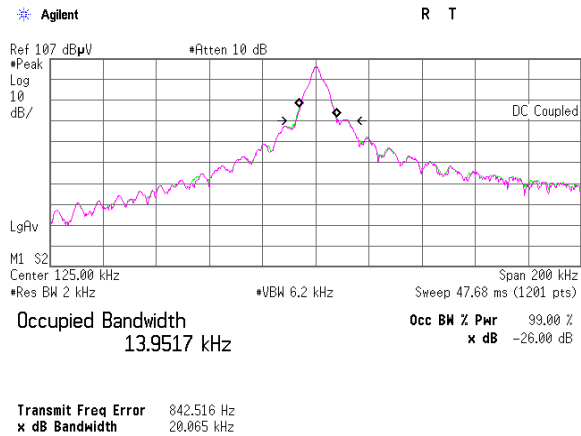


99% Occupied Bandwidth

UL Japan, Inc.
 Head Office EMC Lab. No.4 Semi Anechoic Chamber

REPORT NO : 32GE0120-HO-01
 REGULATION : Reference data
 TEST DISTANCE : 3m
 DATE : 5/25/2012
 TEMPERATURE : 23deg. C
 HUMIDITY : 56 % RH
 Engineer : Motoya Imura

FREQ	99% Occupied Bandwidth
[kHz]	[kHz]
125.0	13.952



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2011/07/10 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2012/02/08 * 12
MJM-01	Measure	KDS	ES19-55	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2011/08/11 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2011/10/19 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/3D-2W(7.5m)/RG400u(1.5m)/RFM-E421(Switcher)	-/01068(Switcher)	RE	2012/01/22 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2011/11/02 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2012/02/29 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2011/11/23 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2012/04/05 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2011/11/16 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2011/11/16 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2012/03/15 * 12
AT-38	Attenuator	Anritsu	MP721B	6200961025	RE	2011/12/08 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2012/03/05 * 12

The expiration date of the calibration is the end of the expired month.

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

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item:

RE: Radiated emission (Fundamental and Spurious Emission), -26dB Bandwidth, 99% Occupied Bandwidth

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124