



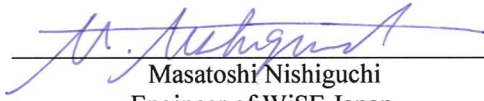
RADIO TEST REPORT


Test Report No. : 10116172H-A

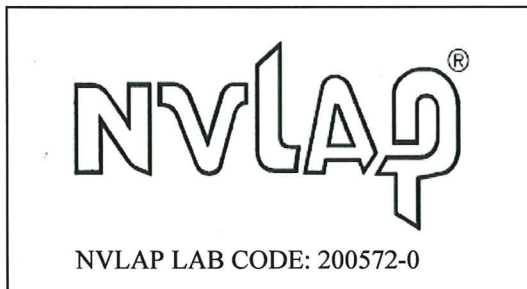
Applicant : OMRON Automotive Electronics Co. Ltd.
Type of Equipment : FOB (Keyless Operation Key)
Model No. : GHR-M003
Test regulation : FCC Part 15 Subpart C: 2013
FCC ID : OUC003M
Test Result : Complied

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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: December 2 and 17, 2013

Representative test engineer: 
Masatoshi Nishiguchi
Engineer of WiSE Japan,
UL Verification Service

Approved by: 
Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



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>

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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 : FOB (Keyless Operation Key)
Model No. : GHR-M003
Serial No. : Refer to Clause 4.2
Receipt Date of Sample : November 28, 2013
Country of Mass-production : China
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: GHR-M003 is the FOB (Keyless Operation Key) (hereafter referred to as FOB).

- FOB is a component part of “Keyless start system” (hereinafter referred to as KOS).
- FOB performs UHF transmission when its button is pressed and it receives LF from KOS. FOB has a transponder that performs mutual communication with KOS at IG ON (engine start).
- KOS is a system to lock/unlock (door entry function) a door /trunk/ETG by pressing switch (for Lock/Unlock/Trunk/ETG) on each door with holding the registered FOB and start up an engine (engine starter function) without using a mechanical ignition key. These operation can be done without pulling FOB from a pocket or bag.

General Specification

Operating Voltage : DC 2.1V to 3.3V
Battery : Lithium battery (CR2032)
Operating Temperature : -20 deg. C to +60 deg. C

Radio Specification

[Transmitter]

Radio Type : Transmitter
Frequency of Operation : 315MHz
Local clock frequency : 18.610MHz
Modulation : FSK
Method of Frequency Generation : Crystal resonator

[Receiver]*

Radio Type : Receiver
Frequency of Operation : 125kHz
Clock frequency : 16MHz
Modulation : ASK

* Receiver part was tested according to FCC Part 15 Subpart B standard. Please see UL Japan, Inc. Test Report No. 10116172H-B.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2013, final revised on September 30, 2013 and effective October 30, 2013

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.231 Periodic operation in the band 40.66 - 40.70MHz
and above 70MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
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	N/A*1)	-
Automatically Deactivate	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators ----- IC: -	FCC: Section 15.231(a)(1) ----- IC: RSS-210 A1.1.1	N/A	Complied	Radiated
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators ----- IC: RSS-Gen 4.8	FCC: Section 15.231(b) ----- IC: RSS-210 A1.1.2	0.9dB 315.000MHz Horizontal PK with Duty factor	Complied	Radiated
Electric Field Strength of Spurious Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators ----- IC: RSS-Gen 4.9	FCC: Section 15.205 Section 15.209 Section 15.231(b) ----- IC: RSS-210 A1.1.2, 2.5.1 RSS-Gen 7.2.5	5.9dB 3150.000MHz Vertical PK with Duty factor	Complied	Radiated
-20dB Bandwidth	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators ----- IC: -	FCC: Section 15.231(c) ----- IC: Reference data	N/A	Complied	Radiated

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 does not have AC Mains.

FCC 15.31 (e)

This test was performed with the New Battery (DC 3.0V) and the constant voltage was supplied to the EUT during the tests. Therefore, the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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 of Section 15.203.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	N/A	Complied	Radiated

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						
	(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	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

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

Radiated emission test (3m)

[Electric Field Strength of Fundamental Emission]

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

[Electric Field Strength of Spurious Emission]

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

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3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
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Telephone : +81 596 24 8999 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	-	-	8.8 x 4.6 x 2.8m	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.

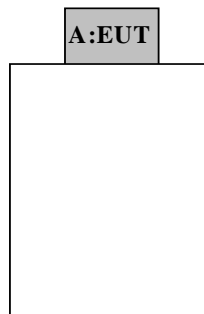
Refer to APPENDIX.

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

4.1 Operating Modes

Test Item*	Mode
Automatically Deactivate	Normal use mode, 315MHz
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth Duty Cycle	Transmitting mode, 315MHz *1)
<p>* The system was configured in typical fashion (as a customer would normally use it) for testing. *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit when transceiver button is being pressed (For Normal use mode, EUT stops when transceiver button is disengaged.) End users cannot change the settings of the output power of the product.</p>	

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	FOB (Keyless Operation Key)	GHR-M003	001 *1) 002 *2)	OMRON Automotive Electronics Co. Ltd.	EUT

*1) Used for Transmitting mode only.

*2) Used for Normal use mode only.

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SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane. The EUT was set on the center of the tabletop.
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.

[Transmitting mode]

(Below 30MHz)

The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

(Above 30MHz)

The Radiated Electric Field Strength has been measured on Semi anechoic chamber with a ground plane and at a distance of 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 strength.

The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detector function of the test receiver/spectrum analyzer.

Test Antennas are used as below;

Frequency	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

	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	Above 1GHz
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200Hz	200Hz	9.1kHz	9.1kHz	120kHz	PK: S/A:RBW 1MHz, VBW 3MHz

- 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.

Noise levels of all the frequencies were measured at the position.

This EUT has two modes which mechanical key is inserted or not. The worst case was confirmed with and without mechanical key, as a result, the test without mechanical key was the worst case. Therefore the test without mechanical key was performed only.

*The result is rounded off to the second decimal place, so some differences might be observed.

Measurement range : 9kHz-3.2GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Automatically deactivate

Test Procedure

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data : APPENDIX
Test result : Pass

SECTION 7: -20dB and 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
20dB Bandwidth	300kHz	3kHz	9.1kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 % of Span	Three times of RBW	Auto (Single)	Sample	Max Hold	Spectrum Analyzer

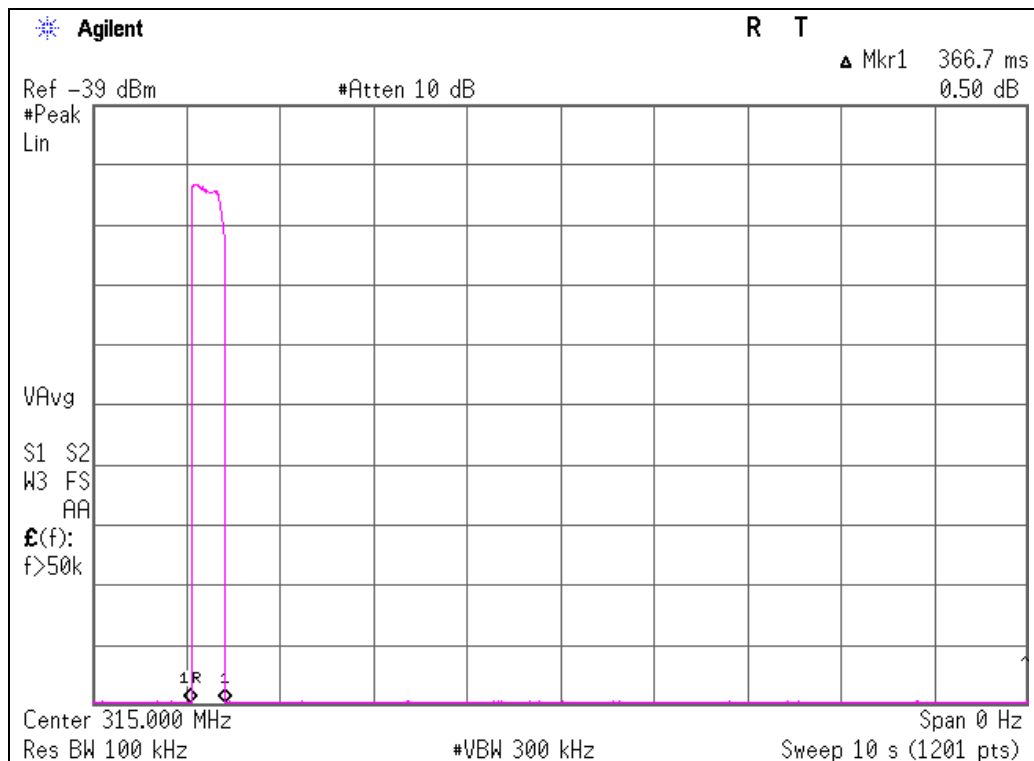
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Data of EMI test

Automatically deactivate

Test place Head Office EMC Lab. No.2 Semi Anechoic Chamber
 Report No. 10116172H
 Date 12/02/2013
 Temperature/ Humidity 22 deg. C / 35% RH
 Engineer Masatoshi Nishiguchi
 Mode Normal use mode (315MHz)

Time of Transmitting [sec]	Limit [sec]	Result
0.3667	5.00	Pass



Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Test place : Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 10116172H
Date : 12/17/2013
Temperature/ Humidity : 21 deg. C / 30% RH
Engineer : Masatoshi Nishiguchi
Mode : Transmitting mode (315MHz)

PK

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit [dBuV/m]	Margin [dB]		Remark Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
315.000	PK	79.0	74.9	14.6	8.9	27.8	-	74.7	70.6	95.6	20.9	25.0	Carrier
630.000	PK	41.2	40.7	19.7	11.9	32.1	-	40.7	40.2	75.6	34.9	35.4	Outside
945.000	PK	28.4	27.7	23.3	13.5	30.7	-	34.5	33.8	75.6	41.1	41.8	Outside
1260.000	PK	44.7	44.1	24.8	1.9	34.2	-	37.2	36.6	75.6	38.4	39.0	Outside
1575.000	PK	41.9	43.5	25.9	2.1	33.4	-	36.5	38.1	73.9	37.4	35.8	Inside
1890.000	PK	39.9	42.0	26.7	2.2	32.8	-	36.0	38.1	75.6	39.6	37.5	Outside
2205.000	PK	40.7	42.2	27.6	2.4	32.5	-	38.2	39.7	73.9	35.7	34.2	Inside
2520.000	PK	43.2	43.8	28.5	2.6	32.3	-	42.0	42.6	75.6	33.6	33.0	Outside
2835.000	PK	42.7	43.7	28.9	2.7	32.2	-	42.1	43.1	73.9	31.8	30.8	Inside
3150.000	PK	47.5	49.7	29.1	2.9	32.0	-	47.5	49.7	75.6	28.1	25.9	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

PK with Duty factor

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit [dBuV/m]	Margin [dB]		Remark
		Hor	Ver					Hor	Ver		Hor	Ver	
315.000	PK	79.0	74.9	14.6	8.9	27.8	0.0	74.7	70.6	75.6	0.9	5.0	Carrier
630.000	PK	41.2	40.7	19.7	11.9	32.1	0.0	40.7	40.2	55.6	14.9	15.4	Outside
945.000	PK	28.4	27.7	23.3	13.5	30.7	0.0	34.5	33.8	55.6	21.1	21.8	Outside
1260.000	PK	44.7	44.1	24.8	1.9	34.2	0.0	37.2	36.6	55.6	18.4	19.0	Outside
1575.000	PK	41.9	43.5	25.9	2.1	33.4	0.0	36.5	38.1	53.9	17.4	15.8	Inside
1890.000	PK	39.9	42.0	26.7	2.2	32.8	0.0	36.0	38.1	55.6	19.6	17.5	Outside
2205.000	PK	40.7	42.2	27.6	2.4	32.5	0.0	38.2	39.7	53.9	15.7	14.2	Inside
2520.000	PK	43.2	43.8	28.5	2.6	32.3	0.0	42.0	42.6	55.6	13.6	13.0	Outside
2835.000	PK	42.7	43.7	28.9	2.7	32.2	0.0	42.1	43.1	53.9	11.8	10.8	Inside
3150.000	PK	47.5	49.7	29.1	2.9	32.0	0.0	47.5	49.7	55.6	8.1	5.9	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

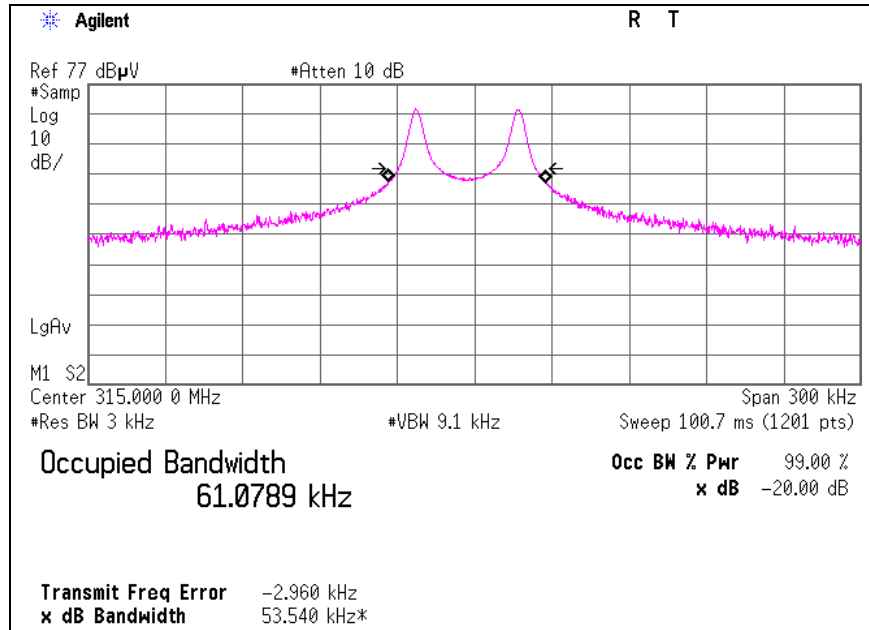
-20dB and 99% Occupied Bandwidth

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
 Report No. 10116172H
 Date 12/17/2013
 Temperature/ Humidity 21 deg. C / 30% RH
 Engineer Masatoshi Nishiguchi
 Mode Transmitting mode (315MHz)

Bandwidth Limit : Fundamental Frequency $315 \text{ MHz} \times 0.25\% = 787.50 \text{ kHz}$

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
53.54	787.50	Pass

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
61.08	787.50	Pass



Duty Cycle

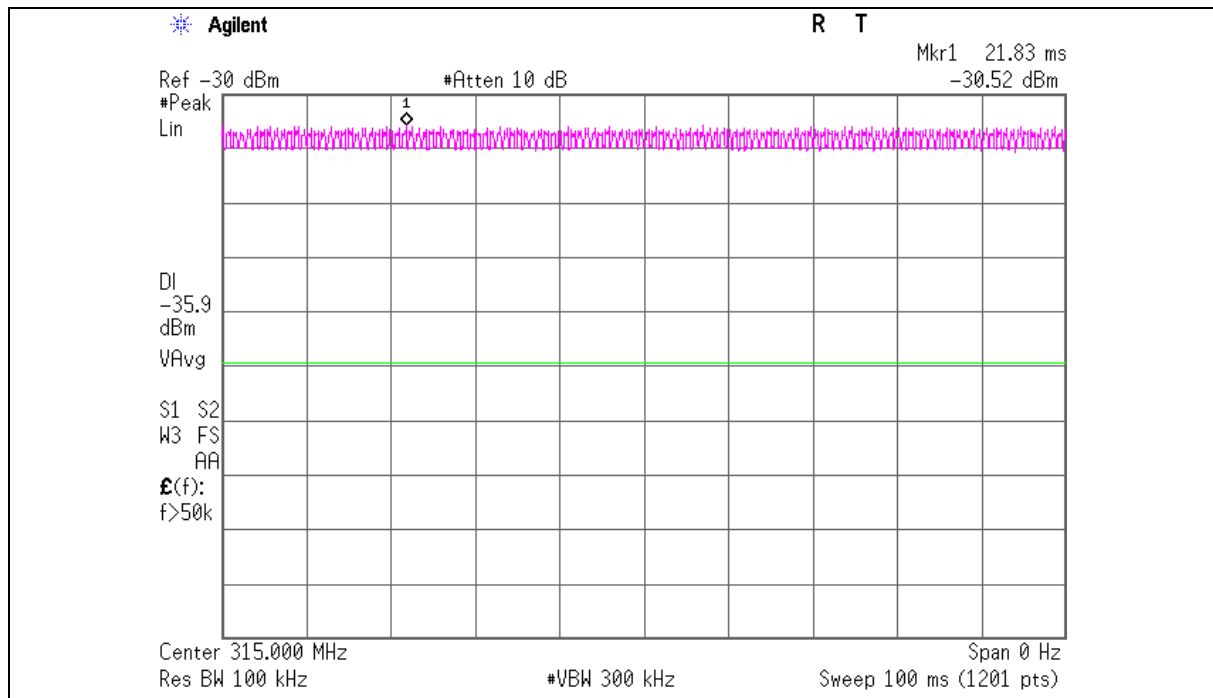
Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10116172H
Date	12/17/2013
Temperature/ Humidity	21 deg. C / 30% RH
Engineer	Masatoshi Nishiguchi
Mode	Transmitting mode (315MHz)

(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
100.00	100.00	1.00	0.0

*1)ON time = Type A's ON time (in 100ms) + Type B's ON time (in 100ms)

*2)Duty = $20\log_{10}(\text{ON time}/\text{Cycle})$



APPENDIX 2: Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2013/06/30 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2013/02/26 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2013/11/15 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2013/06/11 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2013/10/13 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2013/10/13 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2013/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2013/09/12 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2013/02/15 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2013/01/10 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2013/11/27 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2013/02/28 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2013/02/26 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MRENT-114	Spectrum Analyzer	Agilent	E4440A	MY46187105	RE	2013/11/11 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2013/08/20 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2013/10/13 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2013/10/13 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2013/07/23 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2013/04/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2013/03/12 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2013/05/17 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2013/09/27 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2013/03/12 * 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, 99% Occupied Bandwidth, -20dB bandwidth , Automatically deactivate and Duty cycle tests

UL Japan, Inc.

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