



# RADIO TEST REPORT

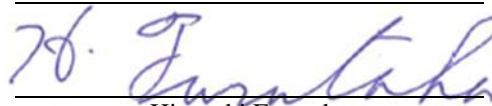
Test Report No. : 11990773H

**Applicant** : OMRON Automotive Electronics Co. Ltd.  
**Type of Equipment** : Immobilizer  
**Model No.** : I55R0  
**FCC ID** : OUCI55R0  
**Test regulation** : FCC Part 15 Subpart C: 2017  
**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.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

**Date of test:** October 13 and 14, 2017

**Representative test engineer:**



Hiroyuki Furutaka

Engineer

Consumer Technology Division

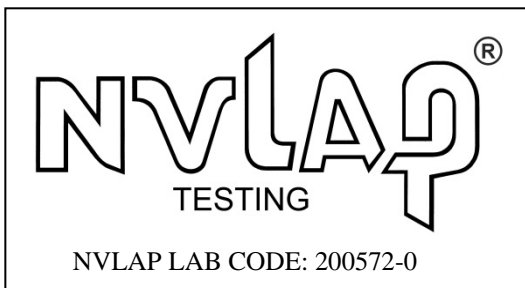
**Approved by:**



Shinichi Miyazono

Engineer

Consumer Technology Division



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://japan.ul.com/resources/emc\\_accredited/](http://japan.ul.com/resources/emc_accredited/)

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**Ise EMC Lab.**

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13-EM-F0429

## REVISION HISTORY

**Original Test Report No.: 11990773H**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11990773H	December 19, 2017	-	-

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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 : Takashi Betsui

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

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

Type of Equipment : Immobilizer  
Model No. : I55R0  
Serial No. : Refer to Clause 4.2  
Rating : DC 12.0 V  
Receipt Date of Sample : October 5, 2017  
Country of Manufacture : Japan and India  
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: I55R0 (referred to as the EUT in this report) is a Immobilizer.

#### **General Specification**

Clock frequency(ies) in the system : 8 MHz

#### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 125 kHz  
Modulation : ASK  
Power Supply (inner) : DC 12.0 V  
Antenna type : Coil Antenna (built-in)

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on November 2, 2017

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits; general requirements.

\* The revision on November 2, 2017, does not affect the test specification applied to the EUT.

### **3.2 Procedures and results**

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 8.8	<FCC> Section 15.207 <IC> RSS-Gen 8.8	-	N/A *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.12	<FCC> Section 15.209 <IC> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	24.2 dB 125 kHz 0 deg. PK with Duty factor	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.13	<FCC> Section 15.209 <IC> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	4.7 dB 61.700 MHz Vertical, QP	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <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.

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

The battery voltage (DC 12V) is provided to the EUT. Input voltage to RF part doesn't go through the regulator. So the test was performed with the supply voltage varied between 85 % and 115% of the nominal rated supply voltage (DC 12 V) and the variation of the input power does not affect the test result, 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 vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99 % Occupied Band Width	RSS-Gen 6.6	-	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 distance	Radiated emission (+/-)
	9 kHz to 30 MHz
3 m	3.8 dB
10 m	3.6 dB

\*Measurement distance

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz to 200 MHz	200 MHz to 1000 MHz	30 MHz to 200 MHz	200 MHz to 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	5.2 dB	6.3 dB	5.0 dB	5.0 dB

#### Radiated emission test(3 m)

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

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### 3.5 Test Location

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NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m 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 data, Test instruments, and Test set up

Refer to APPENDIX.

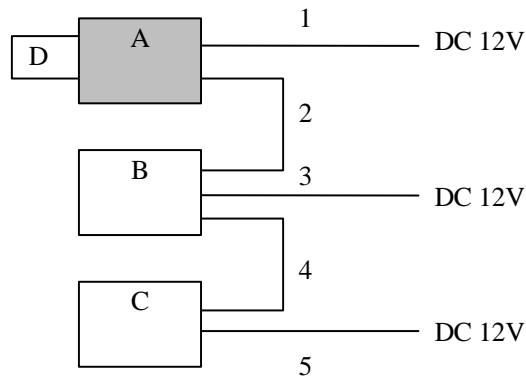
## **SECTION 4: Operation of E.U.T. during testing**

### **4.1 Operating Modes**

Test mode	Remarks
Transmitting mode	-

Justification : The system was configured in typical fashion (as a user 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	Immobilizer	I55R0	007	OMRON Automotive Electronics Co. Ltd.	EUT
B	Jig	-	017	-	-
C	BCM	K56R0	023	OMRON Automotive Electronics Co. Ltd.	EUT
D	Transmitter	T55R1	014	OMRON Automotive Electronics Co. Ltd.	EUT

### **List of cables used**

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.0	Unshielded	Unshielded	-
2	Signal Cable	1.5	Unshielded	Unshielded	-
3	DC Cable	2.0	Unshielded	Unshielded	-
4	Signal Cable	1.5	Unshielded	Unshielded	-
5	DC Cable	2.0	Unshielded	Unshielded	-

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## **SECTION 5: Radiated emission (Fundamental and Spurious Emission)**

### **Test Procedure**

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

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency : From 9 kHz to 30 MHz

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: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

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

Frequency: From 30 MHz to 1 GHz

The measuring antenna height varied between 1 and 4 m 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 test was made with the detector (RBW / VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

### **Test Antennas are used as below;**

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

\*1) Distance Factor:  $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

\*2) Distance Factor:  $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

- 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.

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

The test results and limit are rounded off to one decimal place, so some differences might be observed.

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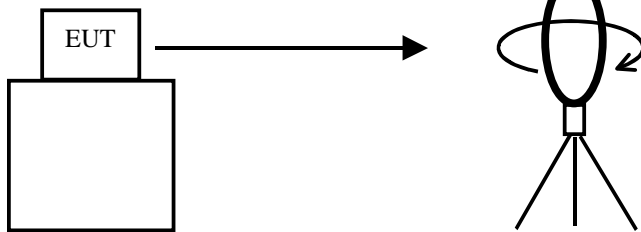
Measurement range : 9 kHz - 1 GHz  
Test data : APPENDIX 1  
Test result : Pass

Date: October 13, 2017  
October 14, 2017

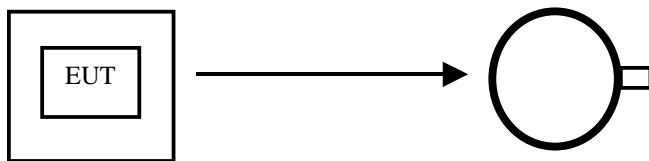
Test engineer: Hiroyuki Furutaka  
Takafumi Noguchi

**Figure 1: Direction of the Loop Antenna**

*Side View (Vertical)*



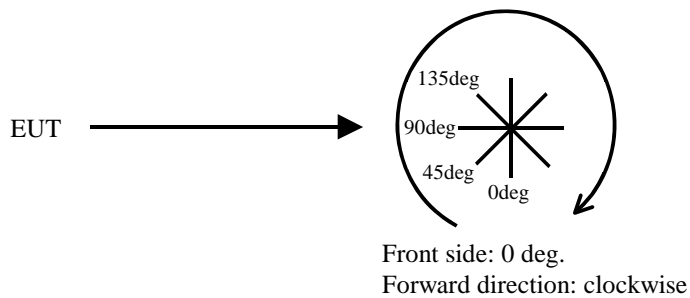
*Top View (Horizontal)*



Antenna was not rotated.

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*Top View (Vertical)*



## **SECTION 6: -26dB Bandwidth**

### **Test Procedure**

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	120 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1

Test result : Pass

## **SECTION 7: 99% Occupied Bandwidth**

### **Test Procedure**

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	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 %.  
Peak hold was applied as Worst-case measurement.

Test data : APPENDIX 1

Test result : Pass

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**APPENDIX 1: Test data**

**Radiated Emission below 30 MHz (Fundamental and Spurious Emission)**

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Order No. 11990773H  
Date 10/13/2017  
Temperature/ Humidity 25 deg. C / 56 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx 125kHz

**PK or QP**

Ant Deg [deg]	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
0	0.12500	PK	87.8	19.7	-73.9	32.2	-	1.4	45.6	44.2	Fundamental (DC 10.2V)
0	0.12500	PK	87.8	19.7	-73.9	32.2	-	1.4	45.6	44.2	Fundamental (DC 12.0V)
0	0.12500	PK	87.8	19.7	-73.9	32.2	-	1.4	45.6	44.2	Fundamental (DC 13.8V)
0	0.25000	PK	42.4	19.6	-73.9	32.2	-	-44.1	39.6	83.7	
0	0.37500	PK	50.0	19.6	-73.9	32.2	-	-36.5	36.1	72.6	
0	0.50000	QP	32.5	19.5	-33.8	32.1	-	-13.9	33.6	47.5	
0	0.62500	QP	38.1	19.5	-33.8	32.2	-	-8.4	31.7	40.1	
0	0.75000	QP	31.4	19.5	-33.8	32.2	-	-15.1	30.1	45.2	
0	0.87500	QP	35.3	19.5	-33.8	32.2	-	-11.2	28.7	39.9	
0	1.00000	QP	31.1	19.5	-33.8	32.2	-	-15.4	27.6	43.0	
0	1.12500	QP	33.2	19.5	-33.8	32.2	-	-13.3	26.5	39.8	
0	1.25000	QP	31.0	19.5	-33.8	32.2	-	-15.5	25.6	41.1	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Ampriifier)

**PK with Duty factor**

Ant Deg [deg]	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
0	0.125	PK	87.8	19.7	-73.9	32.2	0.0	1.4	25.6	24.2	DC 10.2V
0	0.125	PK	87.8	19.7	-73.9	32.2	0.0	1.4	25.6	24.2	DC 12.0V
0	0.125	PK	87.8	19.7	-73.9	32.2	0.0	1.4	25.6	24.2	DC 13.8V
0	0.250	PK	42.4	19.6	-73.9	32.2	0.0	-44.1	19.6	63.7	
0	0.375	PK	50.0	19.6	-73.9	32.2	0.0	-36.5	16.1	52.6	

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

**PK or QP**

Ant Deg [deg]	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
0	0.12500	PK	87.8	19.7	6.1	32.2	-	81.4	-	-	Fundamental

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

\* All spurious emissions lower than this result.

\*It was confirmed that there was no difference by the input voltage in the spurious emission.

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

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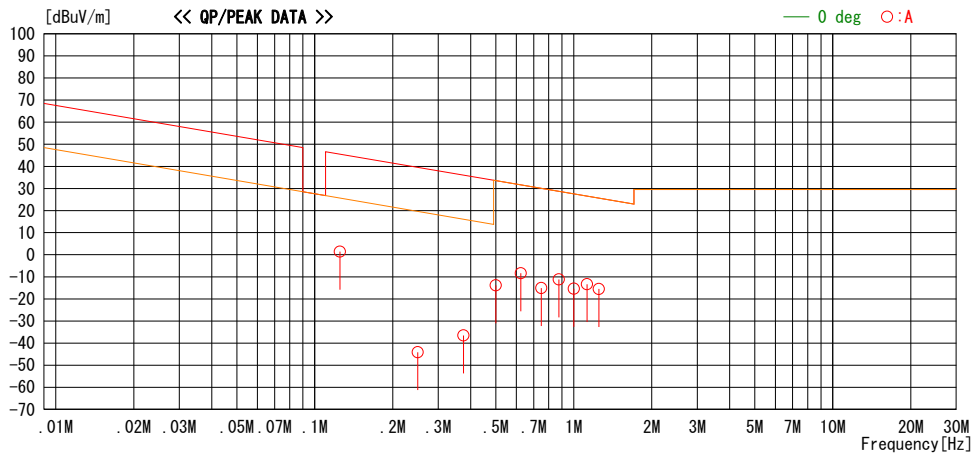
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**Radiated Emission below 30 MHz (Fundamental and Spurious Emission)**  
**(Plot data, Worst case)**

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Order No. : 11990773H  
Date : 10/13/2017  
Temperature/ Humidity : 25 deg. C / 56 % RH  
Engineer : Hiroyuki Furutaka  
Mode : Tx 125kHz

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

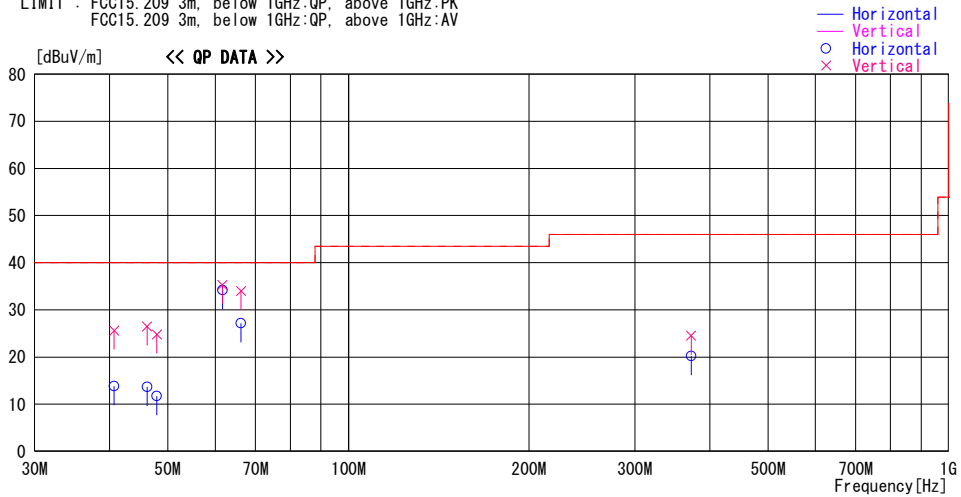


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

**Radiated Emission above 30MHz (Spurious Emission)**

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Order No. : 11990773H  
Date : 10/14/2017  
Temperature/ Humidity : 22 deg. C / 69 % RH  
Engineer : Takafumi Noguchi  
Mode : Tx 125kHz

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK  
FCC15.209 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
40.716	24.5	QP	14.1	-24.8	13.8	294	300	Hori.	40.0	26.2	
40.716	36.3	QP	14.1	-24.8	25.6	217	100	Vert.	40.0	14.4	
46.213	26.3	QP	12.1	-24.7	13.7	297	400	Hori.	40.0	26.3	
46.213	39.1	QP	12.1	-24.7	26.5	206	100	Vert.	40.0	13.5	
47.962	24.8	QP	11.5	-24.6	11.7	296	400	Hori.	40.0	28.3	
47.962	37.9	QP	11.5	-24.6	24.8	231	100	Vert.	40.0	15.2	
61.700	51.4	QP	7.2	-24.4	34.2	198	329	Hori.	40.0	5.8	
61.700	52.5	QP	7.2	-24.4	35.3	264	100	Vert.	40.0	4.7	
66.197	51.9	QP	6.5	-24.4	34.0	265	100	Vert.	40.0	6.0	
66.197	45.1	QP	6.5	-24.4	27.2	53	329	Hori.	40.0	12.8	
372.366	30.9	QP	15.2	-21.6	24.5	321	145	Vert.	46.0	21.5	
372.366	26.6	QP	15.2	-21.6	20.2	168	100	Hori.	46.0	25.8	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

\*It was confirmed that there was no difference by the input voltage in the spurious emission.

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

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**Ise EMC Lab.**

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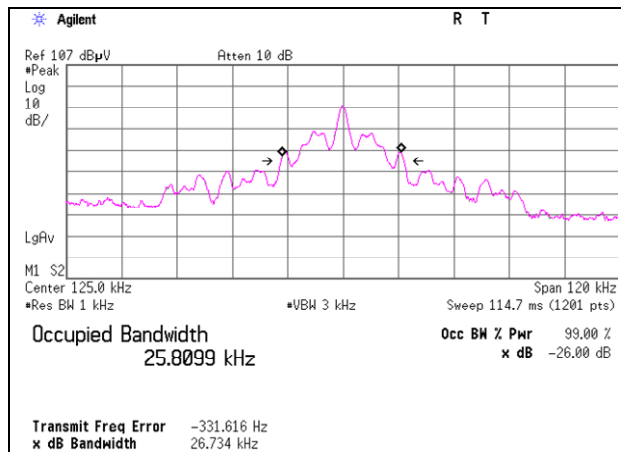
Telephone : +81 596 24 8999

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**-26dB Bandwidth and 99% Occupied Bandwidth**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Order No.	11990773H
Date	10/14/2017
Temperature/ Humidity	25 deg. C / 56 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 125kHz

Frequency [kHz]	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
125	26.734	25.8099



\*It was confirmed that there was no difference by the input voltage.

## **APPENDIX 2: Test instruments**

### **EMI test equipment**

<b>Control No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Serial No</b>	<b>Test Item</b>	<b>Calibration Date * Interval(month)</b>
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/19 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2017/01/20 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE	2017/01/12 * 12
MLPA-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	RE	2016/11/02 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(5m)/ 421-010(1m)/ suoform141-PE(1m)/ RFM-E121(Switcher)	-/04178	RE	2017/07/26 * 12
MCC-219	Coaxial Cable	UL Japan	-	-	RE	2016/11/10 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2017/03/27 * 12
MAT-97	Attenuator	KEYSIGHT	8491A	MY52462282	RE	2017/10/12 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2017/01/19 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2017/05/29 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2016/11/23 * 12
MLA-23	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	RE	2017/01/26 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2017/06/26 * 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: Spurious emission**

**UL Japan, Inc.**

**Ise EMC Lab.**

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