EMI TEST REPORT

Test Report No. : 11776318H-B-R1

Applicant	:	**OMRON Automotive Electronics Co. Ltd.**
Type of Equipment	:	**ECU of Keyless Operation System**
Model No.	:	**R328N**
FCC ID	:	**OUCR328N**
Test regulation	:	**FCC Part 15 Subpart B: 2017**
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 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 NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
7. This report is a revised version of 11776318H-B.

Date of test: June 22, 2017

Representative test engineer:

Hiroyuki Furutaka
Engineer
Consumer Technology Division

Approved by:

Motoya Imura
Engineer
Consumer Technology Division

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://japan.ul.com/resources/emc_accredited/

REVISION HISTORY

Original Test Report No.: 11776318H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11776318H-B	August 7, 2017	-	-
1	11776318H-B-R1	August 28, 2017	P.12	Correction of test data

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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	:	ECU of Keyless Operation System
Model No.	:	R328N
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample	:	June 2, 2017
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: R328N (referred to as the EUT in this report) is the ECU of Keyless Operation System.
KOS apparatus consists of LF antenna for transmission and reception, UHF receiver, Base station (transmitting and receiving device for communication with a transponder), and Push Switch for Engine Start.

“Keyless operation system” (hereafter referred to as KOS) is a system to lock/unlock a door/trunk by pressing Lock/Unlock switch on each door (door entry function), and start up the engine without using an existing mechanical key (engine starter function), while holding the registered keyless operation key (hereafter referred to as FOB) in a pocket or bag.
In addition, 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 the engine by pressing a button of a separate transmitter (remote control engine starter), TPMS function which monitors the air pressure of a tire are also installed.

General Specification

Clock frequency	:	16.00 MHz (CPU)
Battery	:	Car Battery (DC 12.0 V)
Operating Voltage	:	DC 12.0 V

KOS has the following radio specifications; UHF receiver, Base station (transmitting and receiving device for communication with a transponder), and Push Switch for Engine Start.

UHF receiver

Equipment Type	:	Receiver
Frequency of Operation	:	315 MHz
Local clock frequency	:	21.948717 MHz
Antenna Type	:	S-type Antenna
Type of Modulation	:	FSK
Method of Frequency Generation	:	Crystal oscillator

Base station

Equipment Type	:	Transceiver
Frequency of Operation	:	125 kHz
Local clock frequency	:	8 MHz
Antenna Type	:	Ferrite Antenna
Type of Modulation	:	ASK
Method of Frequency Generation	:	Ceramic resonator

Push Switch for Engine Start

Equipment Type	:	Transmitter
Frequency of Operation	:	125 kHz
Local clock frequency	:	8 MHz
Antenna Type	:	Coil Antenna
Type of Modulation	:	ASK
Method of Frequency generation	:	CPU Timer

FCC15.111(b)

The receiving antenna (of this EUT) is installed inside the EUT and cannot be removed (permanently attached). Therefore, Radiated emission test was performed.

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart B
FCC Part 15 final revised on June 14, 2017 and effective July 14, 2017

Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

* The revision on June 14, 2017, does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	**FCC:** ANSI C63.4: 2014 7. AC power - line conducted emission measurements	**FCC:**Part 15 Subpart B 15.107(a)	N/A *1)	N/A	N/A
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
Radiated emission	**FCC:** ANSI C63.4: 2014 8. Radiated emission measurements	**FCC:** Part 15 Subpart B 15.109(a)	N/A	27.1 dB 608.600 MHz Vertical, QP	Complied
	IC: RSS-Gen 7	**IC:** RSS-Gen 7.1.2			
*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420. *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.					

3.3 Addition to standard

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.

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1 GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	1 GHz -18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

* Measurement distance

Radiated emission test (3 m)
The data listed in this test report has enough margin, more than the site margin.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

	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	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	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	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	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	4.0 x 4.5 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	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test): 2.0 x 2.0 m 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.

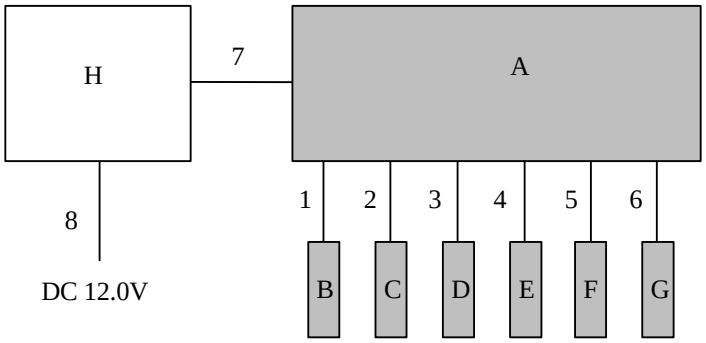
SECTION 4: Operation of E.U.T. during testing

4.1 Operating modes

Mode	Remarks
Receiving mode	-

*The test signal level was confirmed to be sufficient to stabilize the local oscillator of the EUT.
* It was confirmed by using checker that the EUT receives the signal from the transmitter (pair of EUT).

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	ECU	R328N	0337G800001	OMRON Automotive Electronics Co. Ltd.	EUT
B	LF Antenna (INF)	G8D-841M-ANT	K019717402	OMRON Automotive Electronics Co. Ltd.	EUT
C	LF Antenna (INR)	G8D-841M-ANT	K019717403	OMRON Automotive Electronics Co. Ltd.	EUT
D	LF Antenna (TG)	G8D-841M-ANT	K019717404	OMRON Automotive Electronics Co. Ltd.	EUT
E	LF Antenna (DR)	30-1CL	K01679902	OMRON Automotive Electronics Co. Ltd.	EUT
F	LF Antenna (AS)	30-1CR	K01679903	OMRON Automotive Electronics Co. Ltd.	EUT
G	Push Start Switch	CFT-M001	K260063002	OMRON Automotive Electronics Co. Ltd.	-
H	Switch Board	-	-	OMRON Automotive Electronics Co. Ltd.	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal Cable	1.5	Unshielded	Unshielded	-
2	Signal Cable	1.5	Unshielded	Unshielded	-
3	Signal Cable	1.5	Unshielded	Unshielded	-
4	Signal Cable	1.5	Unshielded	Unshielded	-
5	Signal Cable	1.5	Unshielded	Unshielded	-
6	Signal Cable	1.5	Unshielded	Unshielded	-
7	Signal Cable	1.5	Unshielded	Unshielded	-
8	DC Cable	2.3	Unshielded	Unshielded	-

SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.4 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The EUT was set on the center 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 3.

5.3 Test conditions

Frequency range : 30 MHz - 200 MHz (Biconical antenna) / 200 MHz - 1000 MHz (Logperiodic antenna)
1000 MHz - 2000 MHz (Horn antenna)
Test distance : 3 m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The height of the measuring antenna 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 with the Test Receiver.
The radiated emission measurements were made with the following detector function of the Test Receiver.

Frequency	Below 1GHz	Above 1GHz *1)
Instrument used	Test Receiver	Test Receiver
IF Bandwidth	QP: BW 120 kHz	PK: BW 1 MHz, CISPR AV: BW 1 MHz

*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.
Distance Factor: 20 x log (5.30 m / 3 m) = 2.05 dB

The 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 representative X-axis since no difference was found among each position.

5.5 Test result

Summary of the test results: Pass

Date: June 22, 2017 Test engineer: Hiroyuki Furutaka

APPENDIX 1: Test data

Radiated Emission

DATA OF RADIATED EMISSION TEST

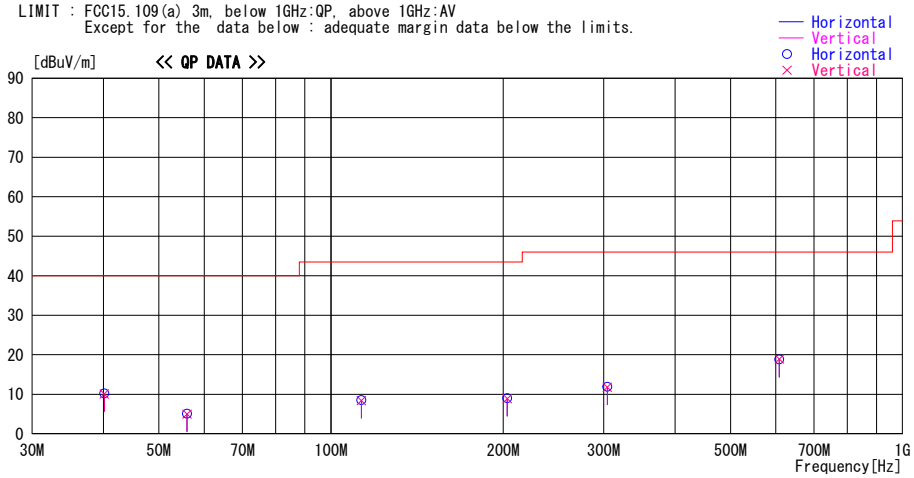
UL Japan, Inc. Ise Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2017/06/22

Report No. : 11776318H

Temp./Humi. : 23 deg. C / 45 % RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : Rx 315MHz Wosrt Axis (Hor:X , Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV
Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
40.120	20.3	QP	14.4	-24.6	10.1	0	100	Vert.	40.0	29.9	
40.120	20.4	QP	14.4	-24.6	10.2	0	100	Hori.	40.0	29.8	
56.000	20.8	QP	8.7	-24.4	5.1	0	100	Hori.	40.0	34.9	
56.000	20.7	QP	8.7	-24.4	5.0	0	100	Vert.	40.0	35.0	
113.000	20.2	QP	11.8	-23.6	8.4	0	100	Vert.	43.5	35.1	
113.000	20.3	QP	11.8	-23.6	8.5	0	100	Hori.	43.5	35.0	
203.450	20.3	QP	11.4	-22.7	9.0	0	100	Hori.	43.5	34.5	
203.450	20.2	QP	11.4	-22.7	8.9	0	100	Vert.	43.5	34.6	
304.300	20.2	QP	13.6	-21.9	11.9	0	100	Hori.	46.0	34.1	
304.300	20.1	QP	13.6	-21.9	11.8	0	100	Vert.	46.0	34.2	
608.600	20.3	QP	19.1	-20.5	18.9	0	100	Vert.	46.0	27.1	
608.600	20.2	QP	19.1	-20.5	18.8	0	100	Hori.	46.0	27.2	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-200MHz:BICONICAL, 200MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE + ATT - GAIN(AMP))

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

Radiated Emission

DATA OF RADIATED EMISSION TEST

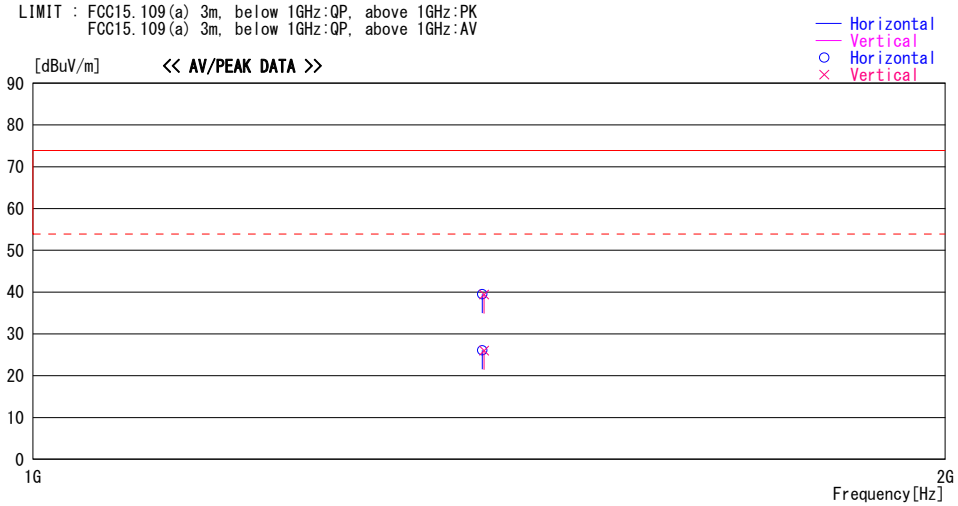
UL Japan, Inc. Ise Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2017/06/22

Report No. : 11776318H

Temp./Humi. : 24 deg. C / 49 % RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : Rx 315MHz Wosrt Axis (Hor:X , Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1406.818	44.0	PK	25.1	-29.6	39.5	0	100	Hori.	73.9	34.4	
1406.818	30.6	AV	25.1	-29.6	26.1	0	100	Hori.	53.9	27.8	
1408.822	43.9	PK	25.1	-29.6	39.4	0	100	Vert.	73.9	34.5	
1408.822	30.5	AV	25.1	-29.6	26.0	0	100	Vert.	53.9	27.9	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-200MHz:BICONICAL, 200MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE + D-FACTOR - GAIN(AMP))

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

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
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
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	2016/06/20 * 12
MAT-97	Attenuator	KEYSIGHT	8491A	MY52462282	RE	2016/10/31 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2017/03/27 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2017/01/19 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2016/09/28 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2016/08/29 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2016/10/21 * 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