



## EMI TEST REPORT

**Test Report No. : 32GE0032-HO-01-A**

**Applicant** : DENSO CORPORATION  
**Type of Equipment** : Remote Keyless Entry System (Receiver)  
**Model No.** : 13BDW  
**FCC ID** : HYQ13BDW  
**Test standard** : FCC Part 15 Subpart B: 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 the 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:** February 11, 2012

**Representative test engineer:**

*T. Shimada*

Takumi Shimada  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by:**

*S. Watanabe*

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>

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13-EM-F0429

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## **SECTION 1: Customer information**

Company Name : DENSO CORPORATION  
Address : 1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan  
Telephone Number : +81-566-61-7252  
Facsimile Number : +81-566-25-4837  
Contact Person : HIROMICHI HANAI

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

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

Type of Equipment : Remote Keyless Entry System (Receiver)  
Model No. : 13BDW  
Serial No. : Refer to Section 4, Clause 4.2  
Receipt Date of Sample : February 9, 2012  
Country of Mass-production : Japan  
Condition of EUT : Production model  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model No: 13BDW (referred to as the EUT in this report) is the Remote Keyless Entry System (Receiver).

Feature of EUT : This system is mainly used for locking or unlocking the doors of the vehicle.  
The transmitter sends a radio wave signal while the button is pushed.  
The receiver becomes active in response to the signal from the transmitter.  
Frequency of Operation : 314.35MHz  
Oscillator Frequency : 21.948717MHz (Crystal)  
Type of modulation : ASK (A1D)  
Type of receiver : Super-heterodyne  
Intermediate frequency : 325.05MHz  
Operating voltage (inner) : DC 12.0V  
Antenna type : Built-in type (Fixed)

### **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.

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

### **3.1 Test specification**

Test Specification : Test specification: FCC Part 15 Subpart B: 2012, final revised on February 1, 2012  
 Title : FCC 47CFR Part15 Radio Frequency Device Subpart B Unintentional Radiators

### **3.2 Procedures and results**

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	<b>FCC: ANSI C63.4: 2003</b> 7. AC powerline conducted emission measurements	<b>FCC:Part 15 Subpart B 15.107(a)</b>	N/A *1)	N/A	N/A
	<b>IC: RSS-Gen 7.2.4</b>	<b>IC: RSS-Gen 7.2.4</b>			
Radiated emission	<b>FCC: ANSI C63.4: 2003</b> 8. Radiated emission measurements	<b>FCC: Part 15 Subpart B 15.109(a)</b>	N/A	23.6dB 650.100MHz Horizontal, QP Vertical, QP	Complied
	<b>IC: RSS-Gen 4.10</b>	<b>IC: RSS-Gen 6.1</b>			

\*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.

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)**

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

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### 3.5 Test Location

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	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 Test set up, Data of EMI, and Test instruments

Refer to APPENDIX.

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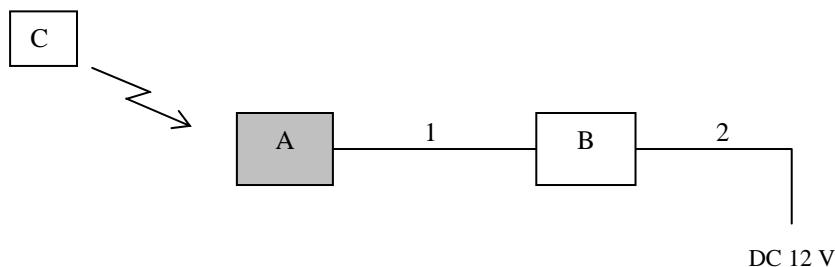
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## SECTION 4: Operation of E.U.T. during testing

### 4.1 Operating modes

The mode is used : Receiving (Rx) mode  
 \* Electronic Key was operated manually by a test engineer and the test was performed with the EUT receiving 314.35MHz and tuning was confirmed to be locked by checking that LED of checker bench was lighted.

### 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	Remote Keyless Entry System (Receiver)	13BDW	001	DENSO CORPORATION	EUT
B	Checker Bench	-	-	DENSO CORPORATION	-
C	Electronic Key	-	-	DENSO CORPORATION	-

#### List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal and DC Cable	2.0	Unshielded	Unshielded	-
2	DC Cable	1.1	Unshielded	Unshielded	-

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## **SECTION 5: Radiated Emission**

### **5.1 Operating environment**

Test place : No. 3 semi anechoic chamber  
Temperature : See data  
Humidity : See data

### **5.2 Test configuration**

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 edge 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.

### **5.3 Test conditions**

Frequency range : 30MHz-300MHz (Biconical antenna) / 300MHz-1000MHz (Logperiodic antenna)  
1000MHz - 2000MHz (Horn antenna)  
Test distance : 3m  
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 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 with the Test Receiver, or the Spectrum Analyzer.

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

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	QP: BW 120kHz	PK: RBW:1MHz/VBW: 3MHz AV *1): RBW:1MHz/VBW:10Hz

\*1) When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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: February 11, 2012

Test engineer: Takumi Shimada

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## APPENDIX 1: Data of EMI test

### Radiated Emission

#### DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber  
 Date : 2012/02/11

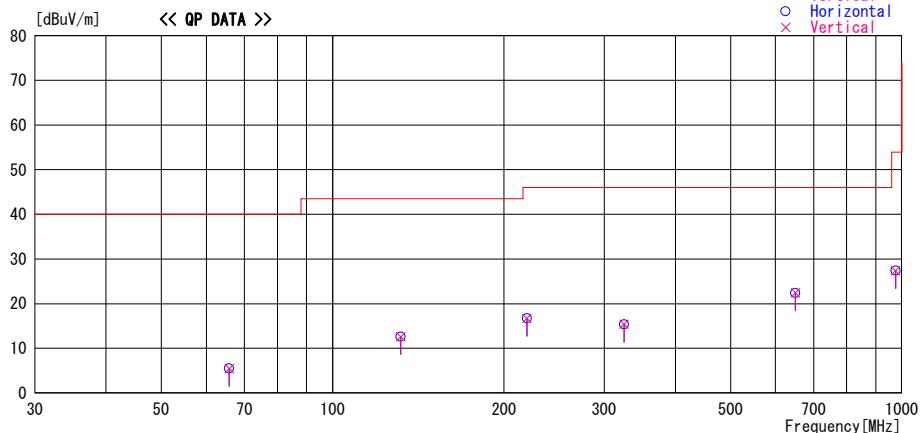
Report No. : 32GE0032-HO-01

Temp./Humi. : 22deg. C / 30% RH  
 Engineer : Takumi Shimada

Mode / Remarks : Receiving mode, Worst-axis(Hor:X, Ver:X)

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

— Horizontal  
 - - - Vertical  
 ○ Horizontal  
 ✕ Vertical



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Loss& Factor	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor	Gain								
65.846	22.7	QP	7.2	-24.4	5.5	0	300	Hori.	40.0	34.5		
65.846	22.7	QP	7.2	-24.4	5.5	0	100	Vert.	40.0	34.5		
131.692	22.4	QP	13.8	-23.6	12.6	0	300	Hori.	43.5	30.9		
131.692	22.4	QP	13.8	-23.6	12.6	0	100	Vert.	43.5	30.9		
219.487	22.3	QP	17.1	-22.7	16.7	0	300	Hori.	46.0	29.3		
219.487	22.3	QP	17.1	-22.7	16.7	0	100	Vert.	46.0	29.3		
325.050	22.1	QP	15.2	-21.9	15.4	0	100	Hori.	46.0	30.6		
325.050	22.1	QP	15.2	-21.9	15.4	0	100	Vert.	46.0	30.6		
650.100	22.2	QP	20.0	-19.8	22.4	0	100	Hori.	46.0	23.6		
650.100	22.2	QP	20.0	-19.8	22.4	0	100	Vert.	46.0	23.6		
975.150	21.2	QP	23.1	-16.9	27.4	0	100	Hori.	53.9	26.5		
975.150	21.2	QP	23.1	-16.9	27.4	0	100	Vert.	53.9	26.5		

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 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.

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## Radiated Emission

### DATA OF RADIATED EMISSION TEST

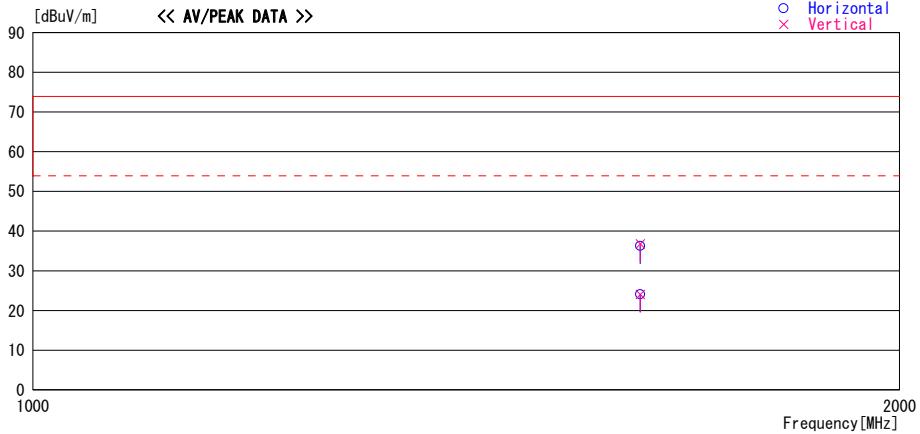
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber  
 Date : 2012/02/11

Report No. : 32GE0032-HO-01

Temp./Humi. : 22deg. C / 30% RH  
 Engineer : Takumi Shimada

Mode / Remarks : Receiving mode, Worst-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		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Antenna Gain [dB/m]	Loss& Gain [dB]							
1625.250	42.5	PK	25.7	-31.9	36.3	0	100	Hori.	73.9	37.6	
1625.250	43.0	PK	25.7	-31.9	36.8	0	100	Vert.	73.9	37.1	
1625.250	30.3	AV	25.7	-31.9	24.1	0	100	Hori.	53.9	29.8	
1625.250	30.3	AV	25.7	-31.9	24.1	0	100	Vert.	53.9	29.8	

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 limit is rounded down to one decimal place.

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## **APPENDIX 2: Test instruments**

### **EMI test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2011/02/22 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-06	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2011/11/23 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2011/08/11 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2011/10/15 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2011/10/15 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2011/07/15 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2011/11/02 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2011/03/04 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2011/05/23 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2011/09/07 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2011/03/10 * 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**

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