



EMI TEST REPORT

Test Report No. : 10291830H-J

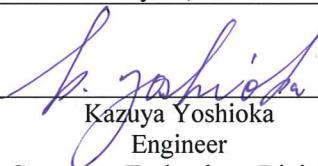
Applicant : DENSO CORPORATION
Type of Equipment : Passive Entry Passive Start System (LF Transmitter)
Model No. : U22B0
FCC ID : HYQU22B0
Test regulation : FCC Part 15 Subpart B: 2015
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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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)

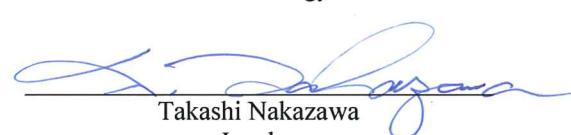
Date of test:

May 10, 2014

**Representative test
engineer:**


Kazuya Yoshioka
Engineer
Consumer Technology Division

Approved by:


Takashi Nakazawa
Leader
Consumer Technology Division

NVLAP[®]

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.
Ise EMC Lab.**

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10291830H-J

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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 : +81-566-61-5234
Facsimile Number : +81-566-25-4837
Contact Person : Akihiro Taguchi

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

2.1 Identification of E.U.T.

Type of Equipment : Passive Entry Passive Start System (LF Transmitter)
Model No. : U22B0
Serial No. : Refer to Section 4, Clause 4.2
Receipt Date of Sample : April 24, 2014
Country of Mass-production : United states of America and 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: U22B0 (referred to as the EUT in this report) is the Passive Entry Passive Start System (LF Transmitter).

General Specification

Clock frequency(ies) in the system : MPU: 4MHz

Radio Specification

[Transmitter part]

Radio Type : LF Transmitter
Frequency of Operation : 125kHz
Oscillation circuit : Ceramic resonator
Oscillator frequency : 8MHz
Modulation : OOK
Power Supply (inner) : DC 12.0V
Antenna port type : ANT1: External antenna
ANT2: External antenna
ANT3: External antenna
ANT4: External antenna
ANT5: External antenna
ANT6: External antenna
*The EUT does not transmit simultaneously from multiple antennas.
Antenna specification : Ferrite antenna coil

[Receiver part]

Frequency of Operation : 433.92MHz
Oscillator frequency : 21.948717MHz
Type of receiving system : Super-heterodyne
Power Supply (inner) : DC 5.0V
Antenna type : Internal antenna (loop antenna)

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 : FCC Part 15 Subpart B: 2015, final revised on January 21, 2015

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

* The revision on January 21, 2015 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: 2003 7. AC powerline conducted emission measurements	FCC:Part 15 Subpart B 15.107(a)	N/A	N/A *1)	N/A
Radiated emission	FCC: ANSI C63.4: 2003 8. Radiated emission measurements	FCC: Part 15 Subpart B 15.109(a)	N/A	5.6dB 128.109MHz Vertical, QP	Complied

*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	4.0dB	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)

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

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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 2.0m 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.

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

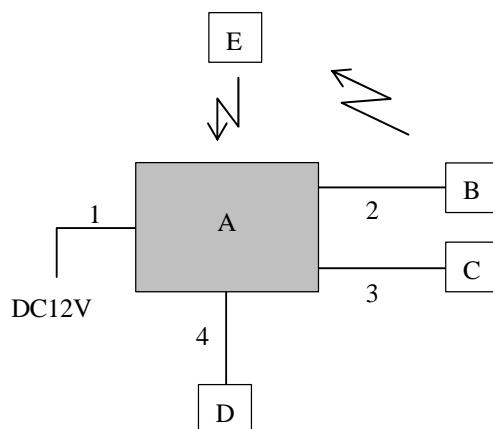
4.1 Operating modes

The mode is used: Receiving mode*

* The test was performed with the EUT receiving 433.92MHz.

*The test signal level was confirmed to be sufficient to stabilize the local oscillator of the 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	Remarks
A	Passive Entry Passive Start System (LF Transmitter)	U22B0	1114 0370 0050 0212	DENSO CORPORATION	EUT
B	Ant3	Normal-L	01	DENSO CORPORATION	*1)
C	Ant4	Hi-L	01	DENSO CORPORATION	*1)
D	Evaluation Bench	-	-	DENSO CORPORATION	-
E	Transmitter	-	-	-	-

*1) Ant3 and Ant4 are the antenna for LF transmitter.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	3.0	Unshielded	Unshielded	-
2	Antenna Cable	3.0	Unshielded	Unshielded	-
3	Antenna Cable	3.0	Unshielded	Unshielded	-
4	Signal Cable	3.0	Unshielded	Unshielded	-

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

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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, 1.0m by 1.5m, 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 3.

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

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

- 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.

5.5 Test result

Summary of the test results: Pass

Date: May 10, 2014

Test engineer: Kazuya Yoshioka

**UL Japan, Inc.
Ise EMC Lab.**

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

Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

APPENDIX 1: Data of EMI test

Radiated Emission

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
 Date : 2014/05/10

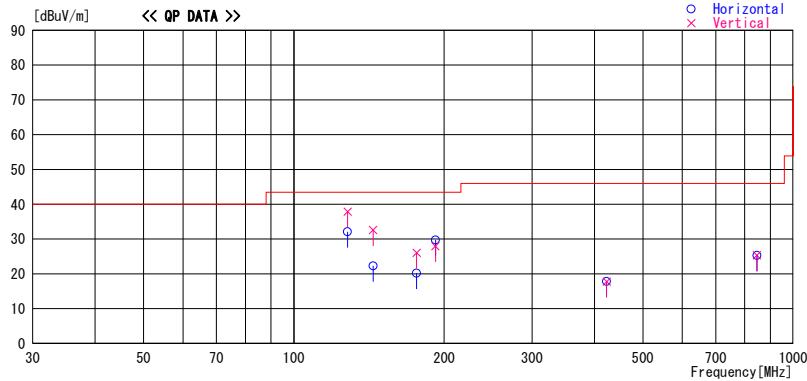
Report No. : 10291830H

Temp./Humi. : 23deg. C / 40% RH
 Engineer : Kazuya Yoshioka

Mode / Remarks : Rx 433.92MHz Worst-axis(Hori:X Vert: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
 X Vertical



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
128.108	42.2	QP	13.6	-23.7	32.1	200	247	Hori.	43.5	11.4	
128.109	48.0	QP	13.6	-23.7	37.9	103	100	Vert.	43.5	5.6	
144.121	31.2	QP	14.7	-23.6	22.3	185	245	Hori.	43.5	21.2	
144.121	41.5	QP	14.7	-23.6	32.6	159	100	Vert.	43.5	10.9	
176.150	27.4	QP	16.0	-23.2	20.2	359	400	Hori.	43.5	23.3	
176.150	33.3	QP	16.0	-23.2	26.1	201	100	Vert.	43.5	17.4	
192.162	36.3	QP	16.4	-23.0	29.7	180	266	Hori.	43.5	13.8	
192.160	34.6	QP	16.4	-23.0	28.0	246	100	Vert.	43.5	15.5	
423.220	21.4	QP	17.7	-21.3	17.8	0	100	Hori.	46.0	28.2	
423.220	21.4	QP	17.7	-21.3	17.8	0	100	Vert.	46.0	28.2	
846.440	21.4	QP	22.1	-18.2	25.3	0	100	Hori.	46.0	20.7	
846.440	21.4	QP	22.1	-18.2	25.3	0	100	Vert.	46.0	20.7	

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

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

Telephone : +81 596 24 8999

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Radiated Emission

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No. 3 Semi Anechoic Chamber
 Date : 2014/05/10

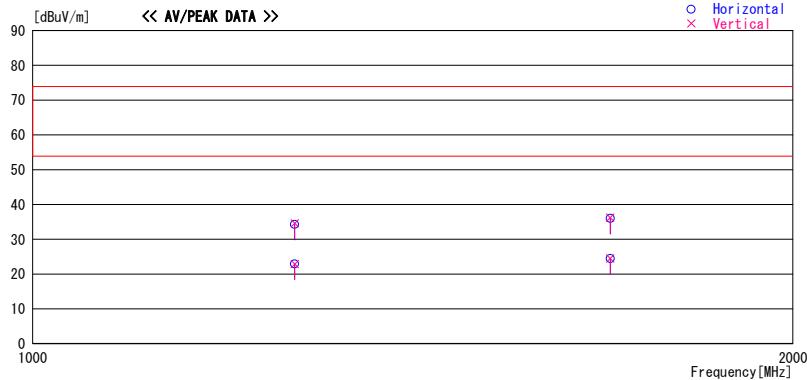
Report No. : 10291830H

Temp./Humi. : 23deg. C / 40% RH
 Engineer : Kazuya Yoshioka

Mode / Remarks : Rx 433.92MHz Worst-axis(Hori:X Vert:X)

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

— Horizontal
 - - - Vertical
 ○ Horizontal
 ✕ Vertical



Frequency [MHz]	Reading [dBuV]	DFT	Antenna	Loss& Factor	Level	Angle	Height	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]				
1269.660	42.1	PK	24.8	-32.6	34.3	0	100	Hori.	73.9	39.6	
1269.660	42.4	PK	24.8	-32.6	34.6	0	100	Vert.	73.9	39.3	
1269.660	30.7	AV	24.8	-32.6	22.9	0	100	Hori.	53.9	31.0	
1269.660	30.7	AV	24.8	-32.6	22.9	0	100	Vert.	53.9	31.0	
1692.880	41.2	PK	26.2	-31.4	36.0	0	100	Hori.	73.9	37.9	
1692.880	41.4	PK	26.2	-31.4	36.2	0	100	Vert.	73.9	37.7	
1692.880	29.7	AV	26.2	-31.4	24.5	0	100	Hori.	53.9	29.4	
1692.880	29.7	AV	26.2	-31.4	24.5	0	100	Vert.	53.9	29.4	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL 300MHz-1000MHz:LOGPFR101C 1000MHz-:HORN
 CALCULATION:RESULT = READING + ANT FACTOR + LOSS(CABLE) - 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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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	2014/02/27 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2014/02/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2014/04/08 * 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	2014/04/14 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2014/03/14 * 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	2014/03/24 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2013/05/17 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2013/11/12 * 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

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Facsimile : +81 596 24 8124