RADIO TEST REPORT

Test Report No. : 31JE0097-HO-01-C-R1

Applicant	:	**DENSO WAVE INCORPORATED**
Type of Equipment	:	**High Frequency 13.56 MHz Transceiver**
Model No.	:	**56RF-TR-8090 (Rectangle Transceiver)**
Test standard	:	**FCC Part 15 Subpart C: 2011**
FCC ID	:	**PZWAN21R01**
Test Result	:	**Complied**

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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.
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6. This report is a revised version of 31JE0097-HO-01-C. 31JE0097-HO-01-C is replaced with this report.

Date of test: August 23 to September 2, 2011

Representative test engineer:
Satofumi Matsuyama
Engineer of WiSE Japan,
UL Verification Service

Approved by:
Mitsuru Fujimura
Leader of WiSE Japan,
UL Verification Service

NVLAP LAB CODE: 200572-0

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*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.
Head Office EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116
Facsimile : +81 596 24 8124

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SECTION 1: Customer information

Company Name	:	DENSO WAVE INCORPORATED
Address	:	1 Yoshiike, Kusagi, Agui-cho, Chita-gun, Aichi 470-2297 Japan
Telephone Number	:	+81-569-49-5302
Facsimile Number	:	+81-569-49-5488
Contact Person	:	AKIHIRO SUGIURA

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

2.1 Identification of E.U.T.

Type of Equipment	:	High Frequency 13.56 MHz Transceiver
Model No.	:	56RF-TR-8090 (Rectangle Transceiver)
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 24V
Receipt Date of Sample	:	August 12, 2011
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering 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

General Specification

Clock frequency(ies) in the system	:	13.56MHz

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56MHz
Modulation	:	ASK
Power Supply (inner)	:	Transmitter: DC 7V, Receiver: DC 5V
Antenna type	:	Loop Coil
Antenna Gain	:	-51dBi
Operating Temperature	:	-25 deg. C. - +70 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2011, final revised on July 8, 2011 and effective August 8, 2011
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.225 : Operation within the band 13.110-14.010MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements	Section 15.207	N/A	N/A *1)	-
	<IC>RSS-Gen 7.2.2	<IC>RSS-Gen 7.2.2			
Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(a)	42.8dB, 13.56000MHz, QP, 135deg.	Complied	Radiated
	<IC> RSS-Gen 4.8, 4.11	<IC>RSS-210 A2.6			
Spectrum Mask	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(b)(c)	24.3dB, 13.56700MHz, QP, 135deg.	Complied	Radiated
	<IC>RSS-Gen 4.9, 4.11	<IC> RSS-210 A2.6			
20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.215(c)	See data	Complied	Radiated
	<IC> -	<IC> -			
Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.209, Section 15.225 (d)	9.2dB 67.799MHz, Vertical, QP	Complied	Radiated
	<IC>RSS-Gen 4.9, 4.11	<IC>RSS-210 A2.6			
Frequency Tolerance	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.225(e)	See data	Complied	Radiated
	<IC>RSS-Gen 4.7	<IC> RSS-210 A2.6			
Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15 *1) The test was not performed since the EUT was DC device.					

FCC 15.31 (e)
This EUT provides stable voltage(Transmitter: DC 7V, Receiver: DC 5V) constantly to RF Part regardless of input voltage. Therefore, this 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.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Band Width	RSS-Gen 4.6.1	RSS-Gen 4.6.1	N/A	N/A	Radiated

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	3.5dB	5.1dB	5.2dB	4.8dB	5.1dB	4.4dB	4.3dB
No.2	4.0dB	5.1dB	5.2dB	4.8dB	5.0dB	4.3dB	4.2dB
No.3	4.2dB	4.7dB	5.2dB	4.8dB	5.0dB	4.5dB	4.2dB
No.4	4.0dB	5.0dB	5.1dB	4.8dB	5.0dB	5.1dB	4.2dB

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

Frequency counter (±)	
Normal condition	Extreme condition
7×10^{-6}	9×10^{-6}

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

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 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	-	-	8.0 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.

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

4.1 Operating Modes

The mode is used :

Mode	Remarks*
Transmitting mode (Tx)	The EUT Transmits and Receives at the same time and there is no receiving mode.
The EUT was operated in a manner similar to typical use during the tests. The EUT Transmits and Receives at the same time and there is no receiving mode.	

Test Item	Operating mode*
Electric Field Strength of Fundamental Emission	Tx Mod on,with Tag
Spectrum Mask	Tx Mod on,with Tag
20dB Bandwidth	Tx Mod on,with Tag
Electric Field Strength of Spurious Emission	Tx Mod on,with Tag
Frequency Tolerance	Tx Mod on, without Tag

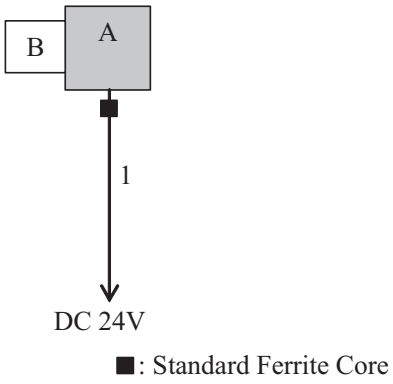
Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

Frequency Tolerance:

Temperature : -30deg.C to +50deg.C Step 10deg.C
Voltage : Normal Voltage DC 24V
Maximum Voltage DC 27.6V, Minimum Voltage DC 20.4V (DC 24V ±15%)

*This EUT provides stable voltage(Transmitter: DC 7V, Receiver: DC 5V) constantly to RF Part regardless of input voltage

4.2 Configuration and peripherals



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.
** Spurious Emissions (Radiated) (≥30 MHz) test was performed with standard ferrite core. The core is attached to the end products.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	High Frequency 13.56 MHz Transceiver	56RF-TR-8090 (Rectangle Transceiver)	013	DENSO WAVE INCORPORATED	EUT
B	TAG (Circle)	56RF-TG-50	No17	DENSO WAVE INCORPORATED	*1)
	TAG (Rectangle)	TG10R-01	No1		

*1) TAG (Circle) was compared with TAG (Rectangle) at the pre-check and the test was performed with higher emission level one.

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.1	Shielded	Shielded	-

SECTION 5: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask)

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.
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 strength.
The measurements were performed for both vertical (angle of loop antenna: 0deg., 45deg., 90deg., and 135 deg.) and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
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 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

Frequency	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	
Instrument used	Test Receiver					Spectrum Analyzer	
Detector	PK/AV	QP	PK/AV	QP	QP	PK	AV
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz

- 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, with tag or without tag. The worst case was confirmed with and without tag, as a result, the test with tag was the worst case. Therefore the test with tag was only performed.

* FCC Part 15 Section 15.31 (f)(2) / IC RSS-Gen 4.11 (9kHz-30MHz)

$$9\text{kHz} - 490\text{kHz}\,[\text{Limit at 3m}] = [\text{Limit at 300m}] - 40\log\left(\frac{3}{300}\right)$$

$$490\text{kHz} - 30\text{MHz}[\text{Limit at 3m}] = [\text{Limit at 30m}] - 40\log\left(\frac{3}{30}\right)$$

Measurement range : 0.09M-1GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Other test

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	100kHz	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter

Test data : APPENDIX
Test result : Pass

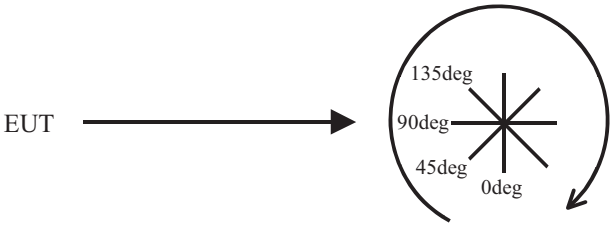
Figure 1: Direction of the Loop Antenna

Side View (Vertical)

Top View (Horizontal)

Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise