



# **RADIO TEST REPORT**

**Test Report No. : 31JE0097-HO-01-D-R1**

**Applicant** : **DENSO WAVE INCORPORATED**  
**Type of Equipment** : **High Frequency 13.56 MHz Transceiver**  
**Model No.** : **56RF-TR-4040 (Square Transceiver)**  
**Test standard** : **FCC Part 15 Subpart C: 2011**  
**FCC ID** : **PZWAN20R01**  
**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.
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6. This report is a revised version of 31JE0097-HO-01-D. 31JE0097-HO-01-D is replaced with this report.

**Date of test:** August 23 to September 1, 2011

**Representative test engineer:**



Satofumi Matsuyama  
Engineer of WiSE Japan,  
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**Approved by:**



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<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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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  
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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-4040 (Square 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 6V, Receiver: DC 5V  
Antenna type : Loop Coil  
Antenna Gain : -62dBi  
Operating Temperature : -25 deg. C. - +70 deg. C

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### **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 ----- <IC>RSS-Gen 7.2.2	Section 15.207 ----- <IC>RSS-Gen 7.2.2	N/A	N/A *1)	-
Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators ----- <IC> RSS-Gen 4.8, 4.11	Section 15.225(a) ----- <IC>RSS-210 A2.6	55.5dB, 13.56000MHz, QP, 45deg.	Complied	Radiated
Spectrum Mask	ANSI C63.4:2003 13. Measurement of intentional radiators ----- <IC>RSS-Gen 4.9, 4.11	Section 15.225(b)(c) ----- <IC> RSS-210 A2.6	37.2dB, 13.56700MHz, QP, 45deg.	Complied	Radiated
20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators ----- <IC> -	Section15.215(c) ----- <IC> -	See data	Complied	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators ----- <IC>RSS-Gen 4.9, 4.11	Section15.209, Section 15.225 (d) ----- <IC>RSS-210 A2.6	3.2dB 325.445MHz, Vertical, QP	Complied	Radiated
Frequency Tolerance	ANSI C63.4:2003 13. Measurement of intentional radiators ----- <IC>RSS-Gen 4.7	Section15.225(e) ----- <IC> RSS-210 A2.6	See data	Complied	Radiated

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 6V, 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.

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### 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
$7 \times 10^{-6}$	$9 \times 10^{-6}$

#### Radiated emission test(3m)

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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	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  $\pm$ 15%)

\*This EUT provides stable voltage(Transmitter: DC 6V, Receiver: DC 5V) constantly to RF Part regardless of input voltage

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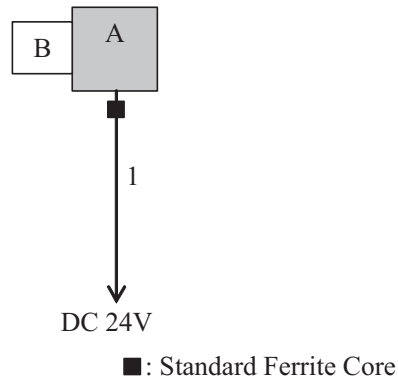
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## 4.2 Configuration and peripherals



\* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

\*\* Spurious Emissions (Radiated) ( $\geq 30$  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-4040 (Square Transceiver)	010	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	-

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## **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

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## SECTION 6: Other test

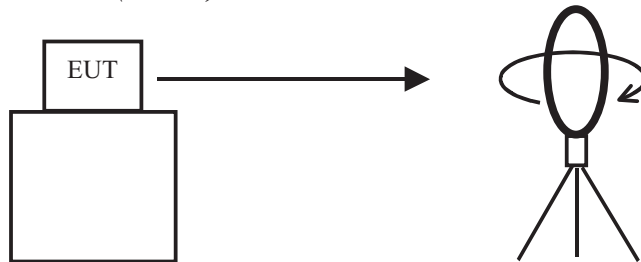
Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	100kHz	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency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

