



## EMI TEST REPORT

**Test Report No. : 27LE0273-HO-B**

**Applicant** : KOITO INDUSTRIES, LTD.  
**Type of Equipment** : Wireless LAN Module  
**Model No.** : KWM-DS540-N2  
**FCC ID** : V5RKWMDS540N2V  
**Test regulation** : FCC Part 15 Subpart E: 2008  
Section 15.407  
**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 above regulation.
4. The test results in this report are traceable to the national or international standards.

**Date of test:**

February 23 to 27, 2008

**Tested by:**

Akio Hayashi  
EMC Services

**Approved by :**

Hironobu Shimoji  
Assistant Manager of EMC Services



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://uljapan.co.jp/emc/nvlap.htm>

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MF060b (09.01.08)

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## **SECTION 1: Customer information**

Company Name	:	KOITO INDUSTRIES, LTD.
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Telephone Number	:	+81-45-826-6738
Facsimile Number	:	+81-45-826-4591
Contact Person	:	Masahiro Kaneko

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

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

Type of Equipment	:	Wireless LAN Module
Model No.	:	KWM-DS540-N2
Serial No.	:	AH0029646
Rating	:	DC5.0V
Country of Manufacture	:	Japan
Receipt Date of Sample	:	February 14, 2008
Condition of EUT	:	Production model
Modification of EUT	:	No modification by the test lab.

### **2.2 Product Description**

Model No: KWM-DS540-N2 (referred to as the EUT in this report) is the Wireless LAN Module.

This EUT serves as a media converter, providing wireless communication when connected with a device equipped with a LAN port. It provides up to 9 channels (36,40,44,48,149,153,157,161,165ch) available under IEEE802.11a. In this report, the tests were performed with Low band (36,44,48ch) and High band (149,153,161ch) as representative channels.

As for the test for 165ch, please refer to Test Report No.27LE0273-HO-A of UL Japan, Inc.

Clock frequency(ies) in the system	:	CPU:240MHz, SDRAM:120MHz
Equipment Type	:	Transceiver
Frequency of Operation	:	5180-5240MHz, 5745-5825MHz
Bandwidth & Channel Spacing	:	20MHz & 20MHz
Modulation	:	DSSS (OFDM)
Operating voltage (inner)	:	DC 3.3V
Antenna Type	:	Sleeve antenna
Antenna Gain	:	2.14 dBi max

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## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part15 Subpart E: 2008, final revised on January 30, 2008  
Title : FCC 47CFR Part15 Radio Frequency Device  
Subpart E Unlicensed National Information Infrastructure Devices  
Section 15.407 General technical requirements

#### **FCC 15.31 (e)**

The RF module of this EUT is constantly provided with stable voltage(DC3.3V) regardless of input voltage. Therefore, this EUT complies with the requirement.

### 3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	26dB Emission Bandwidth	ANSI C63.4:2003	15.407(a)	Conducted	N/A	See data	Complied
2	Maximum Peak Output Power	ANSI C63.4:2003	15.407(a)	Conducted	N/A		Complied
3	Peak Power Spectral Density	ANSI C63.4:2003	15.407(a)	Conducted	N/A		Complied
4	Peak Excursion Ratio	ANSI C63.4:2003	15.407(a)(6)	Conducted	N/A		Complied
5	Spurious Emission	ANSI C63.4:2003	15.407(b), 15.205and15.209	Conducted Radiated	N/A N/A	<High band 5765MHz> 1.2dB 360.001MHz, QP Horizontal <High band 5805MHz> 1.2dB 359.998MHz, QP Horizontal	Complied
6	Conducted Emission	ANSI C63.4:2003	15.407(b)(6)/15.207	Conducted	N/A	N/A *1)	N/A
7	Band Edge Compliance	ANSI C63.4:2003	15.407(b)/15.205	Radiated	N/A	3.5dB 5825.00MHz, Vertical	Complied

Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15.

\*1) The test is excluded since this EUT is a DC-Drive Device. (This EUT cannot be connected with AC line.)

\*These tests were also referred to FCC Public Notice DA 02-2138 "Measurement Procedure Updated for Peak Transmit Power in the Unlicensed National Information Infrastructure (U-NII) Bands ".

\*These tests were performed without any deviations from test procedure except for additions or exclusions.

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### 3.3 Addition to standards

No addition, deviation, nor exclusion has been made from standards.

### 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	Conducted emission	Radiated emission (10m*)			Radiated emission (3m*)			Radiated emission (3m*)	
	150kHz-30MHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	1GHz-18GHz	18GHz-40GHz
No.1 semi-anechoic Chamber (±)	3.7dB	3.1dB	4.7dB	4.4dB	3.2dB	3.7dB	4.4dB	5.9dB	6.1dB
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.3dB	3.9dB	5.9dB	6.1dB
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB

\*10m/3m = Measurement distance

#### Radiated emission test(3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

#### Other test except Conducted Emission and Spurious Emission (Radiated)

The measurement uncertainty for this test is 3.0dB.

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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	IC4247	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	IC4247-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	IC4247-3	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	IC4247-4	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, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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

### **4.1 Operating Modes**

Test mode(s)

Test items	Operating mode	Tested frequency
26dB Emission Bandwidth	< Antenna B > Transmitting (Tx) IEEE802.11a mode Payload : PN9	<Low band: Rate 48Mbps> Channel 36: 5180MHz Channel 44: 5220MHz Channel 48: 5240MHz <High band: Rate 24Mbps> Channel 149: 5745MHz Channel 153: 5765MHz Channel 161: 5805MHz
Maximum Peak Output Power	< Antenna A/Antenna B > Transmitting (Tx) IEEE802.11a mode Payload : PN9	<Low band: Rate 48Mbps> Channel 36: 5180MHz Channel 44: 5220MHz Channel 48: 5240MHz <High band: Rate 24Mbps> Channel 149: 5745MHz Channel 153: 5765MHz Channel 161: 5805MHz
Peak Power Spectral Density	< Antenna B > Transmitting (Tx) IEEE802.11a mode Payload : PN9	<Low band: Rate 48Mbps> Channel 36: 5180MHz Channel 44: 5220MHz Channel 48: 5240MHz <High band: Rate 24Mbps> Channel 149: 5745MHz Channel 153: 5765MHz Channel 161: 5805MHz
Peak Excursion Ratio	< Antenna B > Transmitting (Tx) IEEE802.11a mode Payload : PN9	<Low band: Rate 48Mbps> Channel 36: 5180MHz Channel 44: 5220MHz Channel 48: 5240MHz <High band: Rate 24Mbps> Channel 149: 5745MHz Channel 153: 5765MHz Channel 161: 5805MHz
Spurious Emission	< Antenna B > Transmitting (Tx) IEEE802.11a mode Payload : PN9	<for both Conducted/Radiated> <Low band: Rate 48Mbps> Channel 36: 5180MHz Channel 44: 5220MHz Channel 48: 5240MHz <High band: Rate 24Mbps> Channel 149: 5745MHz Channel 153: 5765MHz Channel 161: 5805MHz
Band Edge Compliance	< Antenna B > Transmitting (Tx) IEEE802.11a mode Payload : PN9	<for both Conducted/Radiated> <Low band: Rate 48Mbps> Channel 36: 5180MHz Channel 48: 5240MHz <High band: Rate 24Mbps> Channel 149: 5745MHz Channel 161: 5805MHz

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Test Conditions : 1) IEEE802.11a: 6 channels (36,44,48,149,153,161ch)  
2) Antenna A and B (same type)

<Remarks>

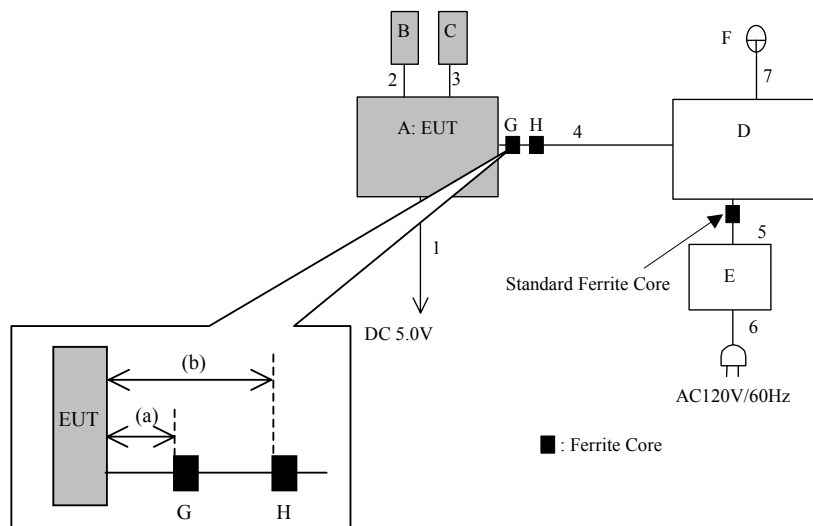
\*We pre-confirmed the above conditions on EUT and performed the final test with the following conditions;

Test items	IEEE802.11a	Antenna
Maximum peak output power	1) Low band: Rate 48Mbps 2) High band: Rate 24Mbps	Antenna A/ Antenna B
The other tests	1) Low band: Rate 48Mbps 2) High band: Rate 24Mbps	Antenna B only *1)

\*1) This EUT has Antenna A and B, and these antennas cannot be transmitted at the same time.  
Antenna B had Maximum transmission rate of 11a (Maximum noise level).  
Therefore the tests were performed with Antenna B as a representative antenna.



## 4.2 Configuration and peripherals



\* Cabling and setup(s) 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	Wireless LAN Module	KWM-DS540-N2	AH0029646	Nippo Electronics	EUT
B	Antenna	AT626	1	Antenna Technology Inc.	EUT
C	Antenna	AT626	2	Antenna Technology Inc.	EUT
D	Notebook PC	1952 D65	L3DM298	IBM	-
E	AC Adapter	92P1160	11S92P1160Z1ZBGH6B6DMD	lenovo	-
F	Mouse	1049	-	Microsoft	-
G	Ferrite Core	ZCAT2035-0930	-	TDK	*1)
H	Ferrite Core	ZCAT2017-0930	-	TDK	*2)

\*1) The distance (a) from EUT to the side of Ferrite core is 30mm (One turn).

\*2) The distance (b) from EUT to the side of Ferrite core is 80mm (One turn).

### List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	DC Cable	4.7	Unshielded	Unshielded
2	Antenna Cable	1.0	Shielded	Shielded
3	Antenna Cable	1.0	Shielded	Shielded
4	LAN Cable	0.9	Unshielded	Unshielded
5	AC Cable	0.9	Unshielded	Unshielded
6	DC Cable	1.8	Unshielded	Unshielded
7	USB Cable	0.8	Shielded	Shielded

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## **SECTION 5: 26dB Emission Bandwidth**

### **Test Procedure**

The 26dB Emission Bandwidth was measured with a spectrum analyzer connected to the antenna port.

<Set of Spectrum analyzer>

- RBW: 300kHz
- VBW: 1MHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

**Test data** : APPENDIX 2

**Test result** : Pass

## **SECTION 6: Maximum Peak Output Power**

### **Test Procedure**

The Peak Transmit Power was measured with a spectrum analyzer connected to the antenna port.  
The test was made with the spectrum analyzer that has a function of channel-power measurement.  
We followed the method 1 specified in DA 02-2138A1.

<Set of Spectrum analyzer>

- RBW: 1MHz
- VBW: 3MHz
- Sweep: Auto
- Detector: Sample
- Trace: Clear Write
- Average Type: Power Average
- Average Time: 100

**Test data** : APPENDIX 2

**Test result** : Pass

## **SECTION 7: Peak Power Spectral Density**

### **Test Procedure**

The Peak Power Spectral Density was measured with a spectrum analyzer connected to the antenna port.  
We followed the method 2 specified in DA 02-2138A1.

<Set of Spectrum analyzer>

- RBW: 1MHz
- VBW: 3MHz
- Sweep: Auto
- Detector: Sample
- Trace: Clear Write
- Average Type: Power Average
- Average Time: 100

**Test data** : APPENDIX 2

**Test result** : Pass

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## **SECTION 8: Peak Excursion Ratio**

### **Test Procedure**

The Peak Excursion Ratio was measured with a spectrum analyzer connected to the antenna port.

The second Sweep was measured based on Method 1 specified in DA 02-2138A1.

<Set of Spectrum analyzer>

#### **<1<sup>st</sup> Trace>**

- RBW: 1MHz
- VBW: 3MHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

<Set of Spectrum analyzer>

#### **<2<sup>nd</sup> Trace>**

- RBW: 1MHz
- VBW: 3MHz
- Sweep: Auto
- Detector: Sample
- Trace: Clear Write
- Average Type: Power Average
- Average Time: 100

**Test data : APPENDIX 2**

**Test result : Pass**

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## **SECTION 9: Spurious Emission and Band Edge Compliance**

### **[Conducted]**

#### **Test Procedure**

The Out of Band Emission was measured with a spectrum analyzer connected to the antenna port.

**Test data** : APPENDIX 2

**Test result** : Pass

### **[Radiated]**

#### **Test Procedure**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 80cm above the conducting ground plane. The Radiated Electric Field Strength intensity has been measured in a Semi Anechoic Chamber with a ground plane and at a distance of 3m(Below 10GHz) , 1m(10-26.5GHz, Distance Factor :  $20\log(3[m]/1[m])$ ) and 0.5m( Upper 26.5GHz, Distance Factor :  $20\log(3[m]/0.5[m])$  ).

The height of the measuring 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.

#### **Below 1GHz**

The result also satisfied with the general limits specified in section 15.209(a).

#### **Above 1GHz**

Inside of the restricted bands (Section 15.205): Apply to limit in the Section 15.209(a)

Outside of the restricted bands (Section 15.407): Limit -27dBm EIRP

-17dBm EIRP (5.725-5.825GHz Band Edge)

Frequency	Below 1GHz	Above 1GHz (Inside of the restricted bands)	Above 1GHz (Outside of the restricted bands)
Instrument used	Test Receiver	Spectrum Analyzer	Spectrum Analyzer
Detector IF Bandwidth	QP: BW 120kHz	PK: RBW:1MHz/VBW: 1MHz AV: RBW:1MHz/VBW:10Hz	RBW:1MHz/VBW: 1MHz

\*All the measured noise was pulse emission.

\*The test above 1GHz was performed with Peak detect. Average emission values were calculated with Peak detect and Duty Cycle factor.

\*Duty factor was calculated with the assumption of the worst condition in 100msec.

**Test data** : APPENDIX 2

**Test result** : Pass

\*The noise from the EUT was not seen in the above 18GHz. The measurement was made in the residual noise levels.

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