



RADIO TEST REPORT

Test Report No. : 26BE0183-HO-A-2

Applicant : **DENSO WAVE INCORPORATED**
Type of Equipment : **Wireless LAN Module**
Model No. : **WM-G-MR-01**
FCC ID : **PZWWMGMR01**
Test standard : **FCC Part 15 Subpart C**
Section 15.207, Section 15.247 : 2006
Test Result : **Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with the above regulation. We hereby certify that the data contain a true representation of the EMC profile.
4. The test results in this report are traceable to the national or international standards.

Date of test:

October 6, 2005 to May 24, 2006

Tested by:

Y. Yoshida

Yutaka Yoshida
EMC Services

T. Shimada

Takumi Shimada
EMC Services

Approved by :

[Signature]

Naoki Sakamoto
Group Leader 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://ulapex.jp/emc/nvlap.htm>

UL Apex Co., Ltd.

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

MF060b(01.06.05)

CONTENTS	PAGE
SECTION 1: Client information	3
SECTION 2: Equipment under test (E.U.T.).....	3
SECTION 3: Test specification, procedures & results.....	4
SECTION 4: Operation of E.U.T. during testing	6
SECTION 5: Spurious Emission	8
SECTION 6: Bandwidth	9
SECTION 7: Maximum Peak Output Power	9
SECTION 8: Peak Power Density.....	9
APPENDIX 1: Photographs of test setup	10
Spurious emission (radiated)	10
Worst Case Position (Horizontal: X-axis / Vertical: Y-axis).....	11
APPENDIX 2: Test instruments	12
APPENDIX 3: Data of EMI test.....	13
6dB Bandwidth	13
Maximum Peak OutPut Power[Conducted antenna].....	16
Radiated Spurious Emission	22
Conducted Spurious Emission.....	35
Conducted emission Band Edge compliance	41
Power Density	42
99%Occupied Bandwidth	45

SECTION 1: Client information

Company Name : DENSO WAVE INCORPORATED
Address : 1-1, Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number : +81-566-61-3811
Facsimile Number : +81-566-25-4741
Contact Person : Yasuhito Imai and Tadao Oshima

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless LAN Module
Model No. : WM-G-MR-01
Serial No. : 58902833, 63802482(Maximum peak output power test only)
Country of Manufacture : Japan
Receipt Date of Sample : October 6, 2005 and May 23, 2006
Condition of EUT : Production model
Modification of EUT : No modification by the test lab

2.2 Product Description

The Wireless LAN Module (Model: WM-G-MR-01) is designed by Denso Wave Incorporated.
This modular transmitter will be equipped and used only in handy terminal, which is produced by Denso Wave Incorporated or the manufacturer consigned the production by Denso Wave Incorporated.

Clock frequency	40MHz +/- 25ppm
Feature of EUT	EUT is Wireless LAN installed with IEEE802.11b/g in the Barcode Handy Terminal (Made by DENSO WAVE INCORPORATED)

Equipment Type	Transceiver
Frequency of Operation	2412-2462MHz
Bandwidth & Channel spacing	26MHz & 5MHz/CH
Type of Modulation	DSSS, OFDM
Antenna Type	Inverted-F type multi-layer antenna
Antenna Connector Type	SMT connector
Antenna Gain	2.02 dBi max
ITU code	G1D (DSSS), D1D (OFDM)
Power Supply	DC 3.3V – 3.6V
Operating temperature range	-5 deg.C. to + 50 deg.C.

FCC 15.31 (e)

The module transmitter does not have its own power supply, but regulated power of 3.3V is supplied from handy terminal. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

This EUT has the external (particular) antenna connector, and the installation is to be done by the professionals. Therefore, the equipment complies with the antenna requirement of Section 15.203.

UL Apex Co., Ltd.

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

MF060b(01.06.05)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C : 2006
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements IC: RSS-Gen 7.2.2	FCC: Section 15.207 IC: RSS-Gen 7.2.2	-	N/A*1)	N/A	N/A
2	6dB Bandwidth	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.4.2	FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(1)	Conducted	N/A	See data.	Complied
3	Maximum Peak Output Power	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.6	FCC: Section 15.247(b)(3) IC: RSS-210 A8.4(4)	Conducted	N/A		Complied
4	Restricted Band Edges	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: -	FCC: Section 15.247 (d) IC: RSS-210 A8.5	Conducted/ Radiated	N/A		Complied
5	Power Density	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: -	FCC: Section 15.247 (e) IC: RSS-210 A8.2(2)	Conducted	N/A		Complied
6	Spurious Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.7 RSS-Gen 4.8	FCC: Section15.247(d) IC: RSS-210 A8.5 RSS-Gen 7.2.1 and 7.2.3	Conducted/ Radiated	N/A	<Transmitter> 3.3dB, QP 298.430MHz, Vertical <Receiver> 4.2dB, QP 298.465MHz, Vertical	Complied

Note: UL Apex's EMI Work Procedures No.QPM05 and QPM15.

*0) The result is rounded off to the second decimal place. Therefore, there may be 0.1 difference for the result.

*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.

*These tests were also referred to "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247".

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

UL Apex Co., Ltd.

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

MF060b(01.06.05)

3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.4.1	RSS-Gen 4.4.1	Conducted	N/A	N/A	N/A
2	Co-location & Co-operation (Confirmation testing for Radiated Spurious Emission at simultaneous transmission)	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.247(d) RSS-210 A8.5	Radiated	N/A	N/A	N/A

3.4 Uncertainty

Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is $\pm 4.59\text{dB}(3\text{m})/\pm 4.58\text{dB}(10\text{m})$.

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is $\pm 4.62\text{dB}(3\text{m})/\pm 4.60\text{dB}(10\text{m})$.

The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is $\pm 5.27\text{dB}$.
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 (with a 95% confidence level) for this test is $\pm 3.0\text{dB}$.

3.5 Test Location

UL Apex Co., Ltd. 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	IC4247A	19.2 x 11.2 x 7.7m	7.0 x 6.0m	Preparation room
No.2 semi-anechoic chamber	655103	IC4247A-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	IC4247A-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	IC4247A-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	-
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 shielded room	-	-	6.0 x 6.0 x 3.9m	N/A	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	N/A	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	N/A	-
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	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1 and No.2 semi-anechoic and No.7 shielded room.

3.6 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

UL Apex Co., Ltd.

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

MF060b(01.06.05)

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

4.1 Operating Modes

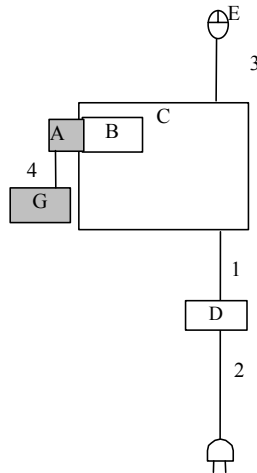
IEEE 802.11b : DSSS (CCK, 11Mbps)

-Transmitting mode
Low channel : 2412MHz
Middle channel : 2437MHz
High channel : 2462MHz
-Receiving mode

IEEE 802.11g : OFDM(64QAM, 54Mbps)

-Transmitting mode
Low channel : 2412MHz
Middle channel : 2437MHz
High channel : 2462MHz
-Receiving mode

4.2 Configuration and peripherals



AC120V/60Hz

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

UL Apex Co., Ltd.

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

MF060b(01.06.05)

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Wireless LAN Module	WM-G-MR-01	58902833, 63802482 *1)	DENSO WAVE INCORPORATED	EUT
B	Card Adapter	RCF-A1	-	TBUFFALO	
C	Note PC	PS2100-T2CWB	99102383A-1	TOSHIBA	-
D	AC Adapter	PA2450U	01819312	TOSHIBA	-
E	Mouse	MUSPR0A	01819312	DENSO	- *1)
G	Antenna	5-496351-566	T574945C	DENSO	- *2) EUT

*1) Maximum peak output power test only

List of cables used

No.	Name	Length (m)	Shield	Remarks
1	DC Cable	2.0	N	-
2	AC Cable	2.0	N	-
3	Mouse Cable	2.0	N	*Used for Antenna terminal test only
4	Antenna Cable	0.15	N	*Used for Radiated emission test only

UL Apex Co., Ltd.

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

MF060b(01.06.05)

SECTION 5: Spurious Emission

[Conducted]

Test Procedure

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

Test data : APPENDIX 3

Test result : Pass

[Radiated]

Test Procedure

EUT was placed on an urethane platform of nominal size, 1.0m by 0.5m, 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) and 1m(Upper 10GHz).

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 (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.

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 and outside the restricted band of 15.205. (FCC)

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver / Spectrum Analyzer	Spectrum Analyzer
Detector	QP: BW 120kHz(T/R)	PK: RBW:1MHz/VBW: 1MHz
IF Bandwidth	20dBc : RBW: 100kHz VBW: 300kHz (S/A)	AV: RBW:1MHz/VBW:10Hz 20dBc : RBW:100kHz/VBW:300kHz

Test data : APPENDIX 3

Test result : Pass

- 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.

UL Apex Co., Ltd.

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

MF060b(01.06.05)

SECTION 6: Bandwidth

Test Procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Test data	: APPENDIX 3
Test result	: Pass

SECTION 7: Maximum Peak Output Power

Test Procedure

The test was made with the spectrum analyzer that has a function of channel-power measurements.
The Maximum Peak Output Power was measured with a spectrum analyzer connected to the antenna port.

Test data	: APPENDIX 3
Test result	: Pass

SECTION 8: Peak Power Density

[Conducted]

Test Procedure

The Peak Power Density was measured with a spectrum analyzer connected to the antenna port.

Test data	:	APPENDIX 3
Test result	:	Pass

UL Apex Co., Ltd.

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

MF060b(01.06.05)