



# **RADIO TEST REPORT**


**Test Report No.: 31IE0161-SH-02-A**

**Applicant** : CANON INC.  
**Type of Equipment** : Wireless LAN Module  
**Model No.** : BM70659  
**FCC ID** : AZDBM70659  
**Test regulation** : FCC Part15 Subpart C: 2010  
**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. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

**Date of test:** May 15 - 25, 2011

**Representative test engineer:**

  
Hikaru Shirasawa  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by :**

  
Ichiro Isozaki  
Leader of WiSE Japan,  
UL Verification Service

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
☒ There is no testing item of "Non-accreditation".



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13-EM-F0429

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**SECTION 1: Customer information**

Company Name : CANON INC.  
Address : 30-2, Shimomaruko, 3-chome, Ohta-ku, Tokyo, 146-8501 Japan  
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Facsimile Number : +81-3-5482-9284  
Contact Person : Hideki Hosoya

**SECTION 2: Equipment under test (E.U.T.)****2.1 Identification of E.U.T.**

Type of Equipment : Wireless LAN Module  
Model Number : BM70659  
Serial Number : DE2-17  
Rating : DC3.5V  
Country of Mass-production : Japan  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Receipt Date of Sample : May 14, 2011  
Modification of EUT : No modification by the test lab.

**2.2 Product description**

Model: BM70659 (referred to as the EUT in this report) is a Wireless LAN Module.

Clock frequency(ies) in the system : 38.4MHz

Equipment type : Transceiver  
Frequency of operation \* : IEEE802.11b/g: 2412-2462MHz  
IEEE802.11n-20: 2412-2462MHz, 5180-5240MHz, 5745-5825MHz  
IEEE802.11n-40: 2422-2452MHz, 5190-5230MHz, 5755-5795MHz  
IEEE802.11a: 5180-5240MHz, 5745-5825MHz  
Bandwidth & channel spacing : IEEE802.11b/g/n-20: 20MHz & 5MHz  
IEEE802.11n-40: 40MHz & 5MHz  
IEEE802.11a: 18MHz & 20MHz  
Type of modulation : IEEE802.11a: OFDM (BPSK, QPSK, 16QAM, 64QAM)  
IEEE802.11b: DSSS (DBPSK, DQPSK, CCK)  
IEEE802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)  
Antenna type : Planar Inverted F Antenna  
Antenna gain with cable loss : 2400-2500MHz: -3.790dBi  
5000-6000MHz: +3.714dBi  
Antenna connector type : U.FL  
ITU code : D1D, G1D  
Operation temperature range : 0 to 45 deg.C.

\* Refer to 31IE0161-SH-02-B, FCC part 15E (FCC 15.407) report.

**FCC Part15.31 (e)**

The Wireless LAN Module is provided with stable power supply DC 3.5V from the host device and has power supply regulator which provides DC 3.0V and DC 1.8V, therefore, the equipment complies power supply regulation.

**FCC Part15.203**

The EUT has a unique coupling/antenna connector (U.FL). Therefore the equipment complies with the requirement of 15.203.

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**SECTION 3: Test specification, procedures & results****3.1 Test specification**

Test specification : FCC Part 15 Subpart C: 2010, final revised on December 6, 2010  
and effective January 5, 2011

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits, general requirements  
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,  
and 5725-5850MHz

The EUT complies with FCC Part 15 Subpart B: 2010 although the test has been performed on the host device. Refer to the test report: 31IE0161-SH-06-D/G.

**3.2 Procedures & Results**

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC 15.207	-	N/A	19.8dB Freq.: 0.48301MHz Phase: L1 Detection: Quasi-Peak Mode: Tx 11g 2437MHz	Complied
6dB bandwidth	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (a)(2) & 15.209	Conducted	N/A	See data	Complied
Maximum peak output power	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (b)(3) & 15.209	Conducted	N/A		Complied
Spurious emission & Restricted band edges	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	2.3dB Freq.: 2390.0MHz Polarization: Horizontal Detection: Average Mode: 11n-40 Tx 2422MHz	Complied
Power density	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (e)	Conducted	N/A	See data	Complied

Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2003 13. Measurement of intentional radiators, RSS-Gen 4.6.1	RSS-Gen 4.6.1	Conducted	-	-
Note: UL Japan's Work Procedures No.13-EM-W0420 and 13-EM-W0422					

\* Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Item	Frequency range	No.1 SAC <sup>*1</sup> /SR <sup>*2</sup> (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
<b>Conducted emission (AC Mains) AMN/LISN</b>	150kHz-30MHz	3.0 dB	2.7 dB	3.1 dB
<b>Radiated emission (Measurement distance: 3m)</b>	9kHz-30MHz	3.3 dB	2.7 dB	3.4 dB
	30MHz-300MHz	4.7 dB	4.5 dB	4.7 dB
	300MHz-1GHz	4.5 dB	4.6 dB	4.6 dB
	1GHz-13GHz	3.9 dB	3.9 dB	4.0 dB
<b>Radiated emission (Measurement distance: 1m)</b>	13GHz-18GHz	4.8 dB	4.8 dB	4.8 dB
	18GHz-40GHz	4.4 dB	4.2 dB	4.2 dB

\*1: SAC=Semi-Anechoic Chamber

\*2: SR= Shielded Room is applied besides radiated emission

#### Conducted emission test

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

#### Radiated emission test

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

#### Antenna port conducted test

Power Measurement uncertainty above 1GHz for this test was: (±) 1.3dB

Spurious emission (Conducted), Power density Measurement (below 1GHz) uncertainty for this test was: (±) 1.9dB

Spurious emission (Conducted), Power density Measurement (1G-3GHz) uncertainty for this test was: (±) 2.5dB

Spurious emission (Conducted), Power density Measurement (3G-18GHz) uncertainty for this test was: (±) 3.8dB

Spurious emission (Conducted), Power density Measurement (18G-26.5GHz) uncertainty for this test was: (±) 4.1dB

Bandwidth Measurement uncertainty for this test was: (±) 5.4%

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### 3.5 Test location

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JAB Accreditation No. : RTL02610

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
<input checked="" type="checkbox"/> No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input checked="" type="checkbox"/> No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
<input type="checkbox"/> No.4 Full-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
<input checked="" type="checkbox"/> No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input checked="" type="checkbox"/> No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
<input type="checkbox"/> No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
<input checked="" type="checkbox"/> No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.6 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

### 3.6 Test setup, Data of test & Test instruments

Refer to Appendix 1 to 3.

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

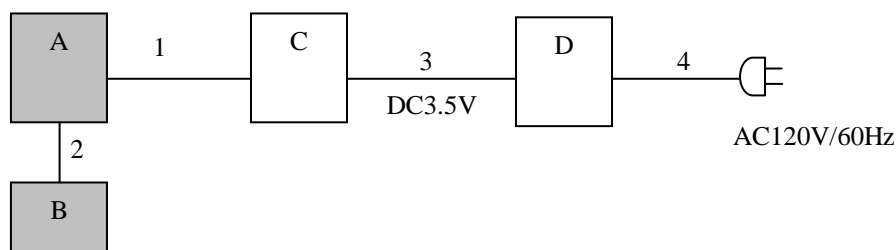
### 4.1 Operating mode

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

Test item	Mode	Tested frequency	Power setting *1)	Worst data rate *2)
All items	Transmitting IEEE 802.11b	2412MHz, 2437MHz, 2462MHz	12dBm	2Mbps, PN9
	Transmitting IEEE 802.11g	2412MHz, 2437MHz, 2462MHz	12dBm	24Mbps, PN9
	Transmitting IEEE 802.11n-20: 2.4G Band	2412MHz, 2437MHz, 2462MHz	12dBm	MCS3, PN9
	Transmitting IEEE 802.11n-40: 2.4G Band	2422MHz, 2437MHz, 2452MHz	11dBm	MCS3, PN9
	Transmitting IEEE 802.11a	5745MHz, 5785MHz, 5825MHz	11dBm	24Mbps, PN9
	Transmitting IEEE 802.11n-20: 5G Band	5745MHz, 5785MHz, 5825MHz	11dBm	MCS1, PN9
	Transmitting IEEE 802.11n-40: 5G Band	5755MHz, 5795MHz	11dBm	MCS5, PN9
*1) Software: Dut lab tool ver. 1.0.6.21				
*2) The worst condition was determined based on the test result of Maximum Peak Output Power (Low Channel)				

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

### 4.2 Configuration and peripherals



\* 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	BM70659	DE2-17	CANON	EUT
B	Antenna	PADCAN-002		IIDA	EUT
C	Test jig	-	-	CANON	-
D	DC Power Supply	PAN35-10A	NA000955	Kikusui	-

#### List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	Ribbon	0.06	Unshielded	Unshielded
2	Antenna	0.06	Shielded	Shielded
3	DC	2.4	Unshielded	Unshielded
4	DC	1.8	Unshielded	Unshielded

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## **SECTION 5: Conducted emission**

### **5.1 Operating environment**

The test was carried out in No.1 shielded room.

Temperature : Refer to test data (APPENDIX 2)

Humidity : Refer to test data (APPENDIX 2)

### **5.2 Test configuration**

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.

The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT was aligned and was flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN and excess AC cable was bundled in center.

Photographs of the set up are shown in Appendix 1.

### **5.3 Test conditions**

Frequency range : 0.15 - 30MHz

EUT position : Table top

### **5.4 Test procedure**

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT within a screened room. The EUT was connected to a Line Impedance Stabilization Network (LISN).

An overview sweep with peak detection has been performed.

The measurements had been performed with a quasi-peak detector and if required, an average detector.

The conducted emission measurements were made with the following detector of the test receiver.

Detector Type : Quasi-Peak/ Average

IF Bandwidth : 9kHz

### **5.5 Results**

Summary of the test results : Pass

Refer to APPENDIX 2

## **SECTION 6: 6dB bandwidth & Occupied bandwidth (99%)**

### **Test procedure**

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

Summary of the test results: Pass

Refer to APPENDIX 2

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## **SECTION 7: Maximum peak output power**

### **Test procedure**

The Maximum Peak Output Power was measured with a power meter connected to the antenna port.

Summary of the test results: Pass

Refer to APPENDIX 2

## **SECTION 8: Spurious emission (Antenna port conducted)**

### **Test procedure**

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

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.

In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.  
(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

Summary of the test results: Pass

Refer to APPENDIX 2

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## SECTION 9: Radiated emission

### 9.1 Operating environment

The test was carried out in No.1 / No.3 Semi-Anechoic Chamber.

Temperature : Refer to test data (APPENDIX 2)

Humidity : Refer to test data (APPENDIX 2)

### 9.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.

The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The rear of EUT, including its peripherals was aligned and flushed with rear of 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 1.

### 9.3 Test conditions

Frequency range : 30MHz to 40GHz

EUT position : Table top

### 9.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 13GHz) / 1m (above 13GHz). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was 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.

The radiated emission measurements were made with the following detection of the test receiver and Spectrum Analyzer.

Frequency	:	30-1000MHz	1000-40000MHz	
Detection Type	:	Quasi-Peak	Peak	* Average
IF Bandwidth	:	120kHz	RBW: 1MHz/VBW: 3MHz	RBW: 1MHz/VBW: 10Hz

\* When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

\* The VBW was based on the inverse of the duty cycle (Refer to Appendix 2).

The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT and its antenna to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst position:

Subject	Frequency Band Test Antenna	Carrier		Spurious							
		2.4G	5G (W58)	30M-1GHz	1-13GHz	13-18GHz	18-26.5GHz	26.5-40GHz	2.4G	5G (W58)	5G (W58)
EUT Antenna	Horizontal	X	Z	Z	Z	Z	X	X	Y	Z	Z
	Vertical	Y	Y	X	X	Z	X	Z	X	Z	Z
Module	Horizontal	Y	Y	X	Z	Y	Y	X	Y	X	X
	Vertical	Z	Y	X	X	X	X	Z	Z	Y	Y

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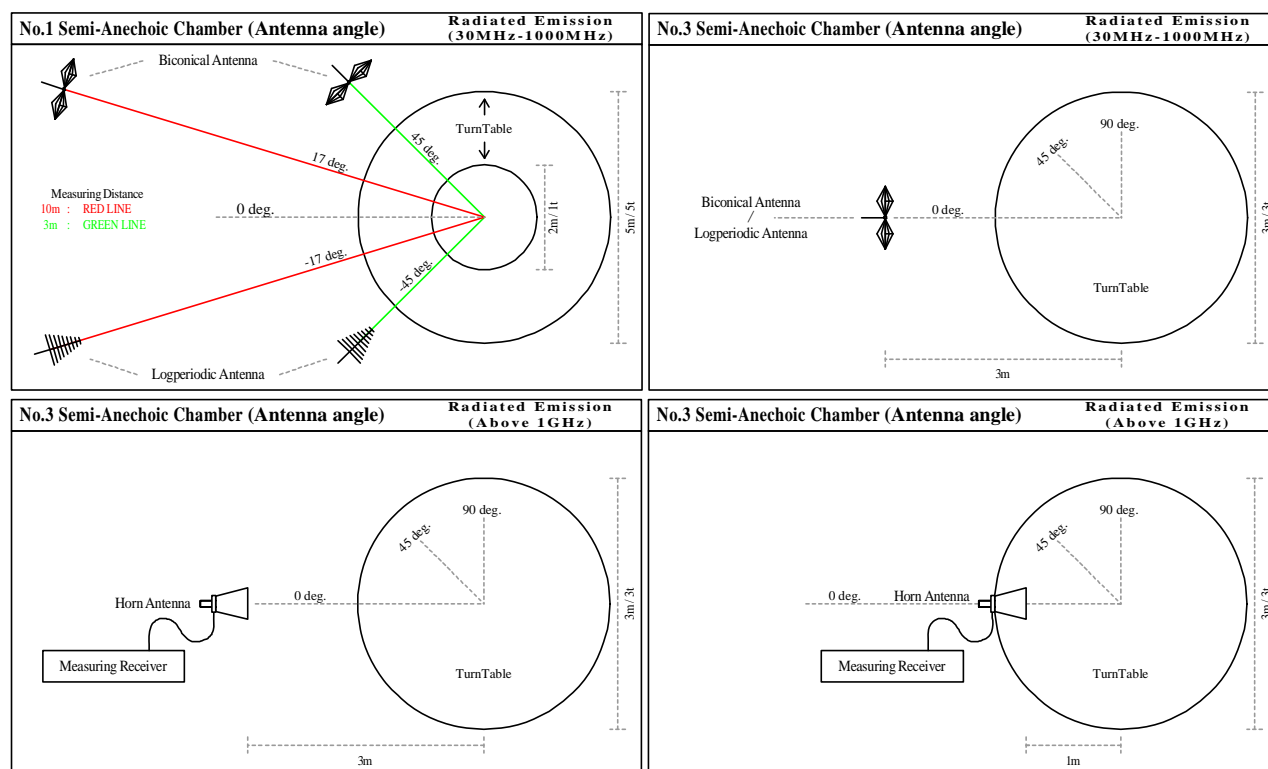
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Figure 1. Antenna angle



## 11.5 Band edge

Band edge level at 2397.475MHz and 2400MHz are less than 20dB of peak point of the carrier. Band edge level at 2390MHz and 2483.5MHz, 5725MHz and 5850MHz are below the limits of FCC 15.209. Refer to the data of Radiated emission.

## 11.6 Results

Summary of the test results : Pass \*No noise was detected above the 5th order harmonics.  
Refer to APPENDIX 2

## SECTION 10: Peak Power density

### Test procedure

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer \*1)  
RBW / VBW : 30kHz / 100kHz \*2)

\*1) PSD Option 1 of " Measurement of Digital Transmission Systems Operating under Section 15.247".

\*2) The test was not performed at RBW: 3kHz that was stated in the Regulation. However, the measurement value with RBW: 3kHz is less than the value of RBW: 30kHz and the test data met the limit with RBW: 30kHz.

Summary of the test results: Pass  
Refer to APPENDIX 2

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## **Contents of appendixes**

### **APPENDIX 1: Photographs of test setup**

Conducted emission  
Radiated emission  
Pre-check of the worst position

### **APPENDIX 2: Test data**

Conducted emission  
6dB bandwidth  
Maximum peak output power  
Radiated emission  
Spurious emission (Antenna port conducted)  
Peak power density  
99% Occupied bandwidth

### **APPENDIX 3: Test instruments**

Test instruments

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