



RADIO TEST REPORT

Test Report No.: 31EE0027-HO-01-A

Applicant : CANON INC.
Type of Equipment : Wireless Module
Model No. : CH9-1216
FCC ID : AZD216
Test regulation : FCC Part15 Subpart C: 2010
Test result : Complied

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Date of test: July 14, 15 and 19, 2011

Representative test engineer:

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Go Ishiwata
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UL Verification Service

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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
Telephone Number : +81-3-3757-6218
Facsimile Number : +81-3-3757-8431
Contact Person : Takato Matsuura

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless Module
Model Number : CH9-1216
Serial Number : Refer to Section 4.2
Rating : DC3.0V \pm 10%
Country of Mass-production : Japan
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : July 14, 2011
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: CH9-1216 (referred to as the EUT in this report) is a Wireless Module.

Clock frequency(ies) in the system : 32MHz

Equipment type : Transceiver
Frequency of operation : 2405-2475MHz
Bandwidth & channel spacing : 2MHz & 5MHz
Type of modulation : DSSS (DBPSK, DQPSK, CCK)
Antenna type : Multilayer Chip
Antenna gain with cable loss : 2dBi
Antenna connector type : None (Micro Coaxial Connector is attached for testing.)
ITU code : G1D
Operation temperature range : -20 to +45 deg.C.

FCC Part15.31 (e)

The module is provided with stable power supply DC 3.0V from the host device, therefore, the equipment complies power supply regulation.

FCC Part15.203

The antenna is not removable from the module. Therefore the equipment complies with the requirement of 15.203.

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

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	32.2dB Freq.: 0.2000MHz Phase: N Detection: Quasi-Peak Mode: Tx 2440MHz	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	5.8dB Freq.: 2373.033MHz Polarization: Horizontal Detection: Average Mode: Tx 2405MHz	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* ¹ /SR* ² (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	150kHz-30MHz	3.0 dB	2.7 dB	3.1 dB
Radiated emission (Measurement distance: 3m)	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
Radiated emission (Measurement distance: 1m)	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 test report has enough margin, more than site margin.

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 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 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

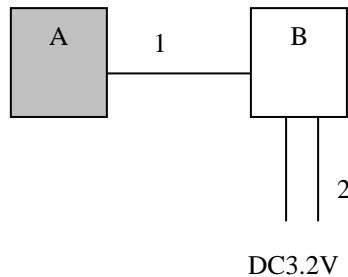
4.1 Operating mode

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
All items	Transmitting IEEE 802.15.4	2405MHz, 2440MHz, 2475MHz
*1) Software: IFWCONT.exe		
*2) Power setting: Fixed (End users cannot change the settings of the output power of the product.)		
*3) 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 Module	CH9-1216	*1)	CANON	EUT
B	Jig	ZIG-NO-DTB-1	AJS110005	CANON	-

*1) T029B: Conducted emission and Radiated emission, 003: Other test

List of cables used

No.	Name	Length (m)	Shield (Cable)	Shield (Connector)	Remarks
1	Ribbon	0.1	Unshielded	Unshielded	-
2	DC	0.1+1.3	Unshielded	Unshielded	+3.0V, G

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 2.0m, 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.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 26.5GHz
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	1000-26500MHz	
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 to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst position:

	Carrier	Spurious			
		30M-1GHz	1-13GHz	13-18GHz	18-26.5GHz
Horizontal	X	X	X	X	X
Vertical	Z	X	Z	Z	Z

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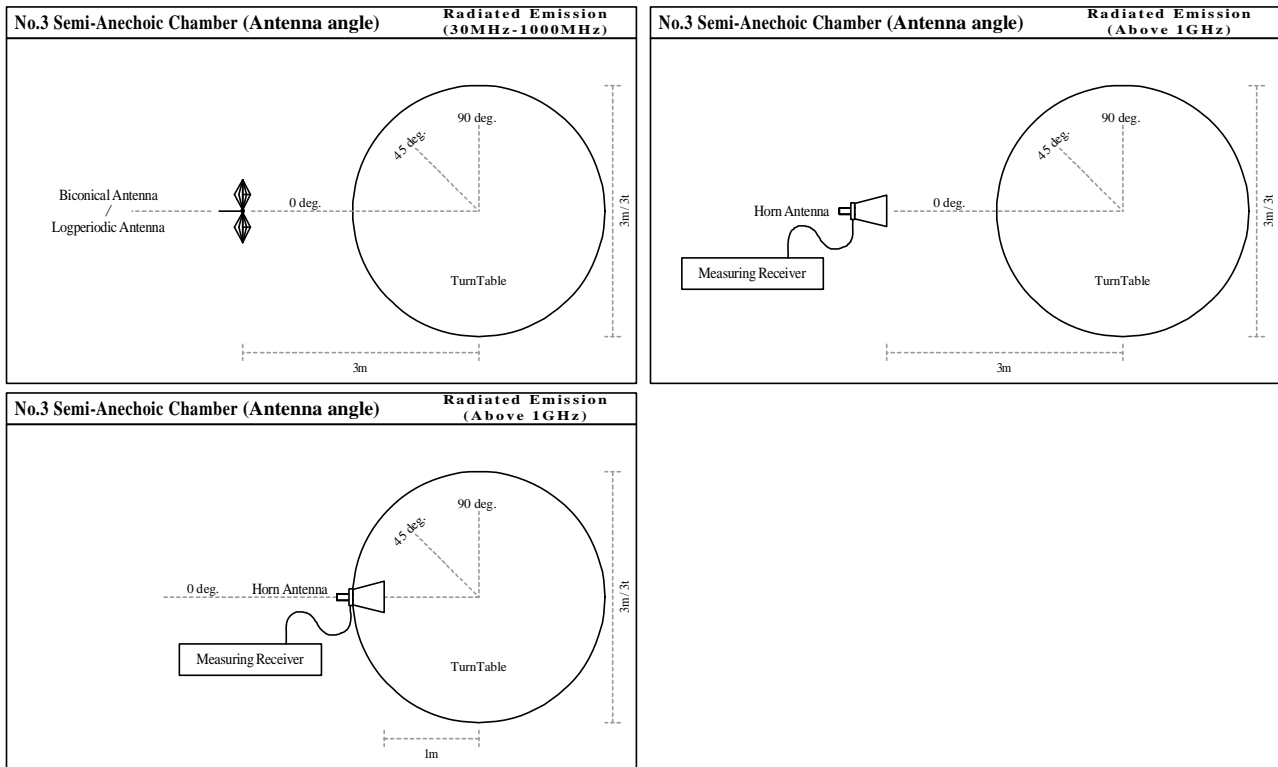
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Figure 1. Antenna angle



11.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier. Refer to the data of Spurious emission (Conducted). Band edge level at 2390MHz and 2483.5MHz 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

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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