# RADIO TEST REPORT

## Test Report No. : 29KE0214-HO-01-F

| | | |
|---|---|---|
| **Applicant** | : | **Canon Inc.** |
| **Type of Equipment** | : | **WLAN Module** |
| **Model No.** | : | **CH9-1161** |
| **FCC ID** | : | **AZD162** |
| **Test regulation** | : | **FCC Part 15 Subpart C 2009 Section 15.207, Section 15.247** |
| **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 above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

**Date of test:** March 18 to May 3, 2009

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*As for the range of Accreditation in NVLAP, you may refer to the WEB address, http://uljapan.co.jp/emc/nvlap.html



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# SECTION 1: Customer information

| | | |
|---|---|---|
| Company Name | : | Canon Inc. |
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# SECTION 2: Equipment under test (E.U.T.)

## 2.1 Identification of E.U.T.

| | | |
|---|---|---|
| Type of Equipment | : | WLAN Module |
| Model No. | : | CH9-1161 |
| Serial No. | : | ES7004, ES7005, ES7006 |
| Rating | : | DC3.3V |
| Receipt Date of Sample | : | March 18, 2009 |
| Country of Mass-production | : | Japan |
| Condition of EUT | : | Production prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT | : | No Modification by the test lab |

## 2.2 Product Description

Model No: CH9-1161 (referred to as the EUT in this report) is the WLAN Module.

| | | |
|---|---|---|
| Equipment Type | : | Transceiver |
| Clock frequency | : | 38.4MHz |
| Method of Frequency Generation | : | Crystal |
| Operating voltage (inner) | : | DC1.8V, DC2.85V |
| Operating temperature range | : | -10 to +60 deg. C. |

| | IEEE802.11b | IEEE802.11g | IEEE802.11a |
|---|---|---|---|
| Frequency of operation | 2412-2462MHz | 2412-2462MHz | 5180-5240MHz (W52)<br>5260-5320MHz (W53)<br>5500-5700MHz (W56) *1)<br>5745-5825MHz (W58) |
| Type of modulation | DSSS | OFDM | OFDM |
| Channel spacing | 5MHz | 5MHz | 20MHz |
| ITU Code | G1D | D1D | D1D |
| Antenna type | Planar Inverted F antenna | Planar Inverted F antenna | Planar Inverted F antenna |
| Antenna Gain | -2.18dBi | -2.18dBi | 1.85dBi (W52/W53)<br>2.62dBi (W56)<br>1.50dBi (W58) |

*1) Frequency range of 5580-5660MHz is not used in Canada.

# SECTION 3: Test specification, procedures & results

## 3.1 Test Specification

| | | |
|---|---|---|
| Test Specification | : | FCC Part15 Subpart C: 2009, final revised on December 2, 2009 |
| Title | : | FCC 47CFR Part15 Radio Frequency Devices Subpart C Intentional Radiators<br>Section 15.207 Conducted limits<br>Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz |

* The revision on December 2, 2009 does not influence the test specification applied to the EUT.

**FCC 15.31 (e)**
The RF Module has own regulator.
The RF Module is constantly provided voltage (DC1.8 / 2.85V) through own regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.

**FCC Part 15.203/212 Antenna requirement**
The EUT has a unique coupling/antenna connector (UFL). Therefore the equipment complies with the requirement of 15.203/212.

### 3.2 Procedures and results

**[DSSS and other forms of modulation ]**

| No. | Item | Test Procedure | Specification | Remarks | Deviation | Worst margin | Results |
|---|---|---|---|---|---|---|---|
| 1 | Conducted emission | **FCC:** ANSI C63.4:2003 7. AC powerline conducted emission measurements | **FCC:** Section 15.207 | Conducted | N/A | [QP] 17.5dB 0.15100MHz, L [AV] 13.9dB 0.53902MHz, N | Complied |
| | | **IC:** RSS-Gen 7.2.2 | **IC:** RSS-Gen 7.2.2 | | | | |
| 2 | 6dB Bandwidth | **FCC:** "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" | **FCC:** Section 15.247(a)(2) | Conducted | N/A | See data. | Complied |
| | | **IC:** RSS-Gen 4.6.2 | **IC:** RSS-210 A8.2(a) | | | | |
| 3 | Maximum Peak Output Power | **FCC:** "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" | **FCC:** Section 15.247(b)(3) | Conducted | N/A | | Complied |
| | | **IC:** RSS-Gen 4.8 | **IC:** RSS-210 A8.4(4) | | | | |
| 4 | Restricted Band Edges | **FCC:** "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" | **FCC:** Section 15.247 (d) | Conducted/ Radiated | N/A | | Complied |
| | | **IC:** - | **IC:** RSS-210 A8.5 | | | | |
| 5 | Power Density | **FCC:** "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" | **FCC:** Section 15.247 (e) | Conducted | N/A | | Complied |
| | | **IC:** - | **IC:** RSS-210 A8.2(b) | | | | |
| 6 | Spurious Emission | **FCC:** "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" | **FCC:** Section15.247(d) | Conducted/ Radiated | N/A | [Tx] 7.0dB 5725.00MHz, Vertical, AV [Rx] 11.5dB 11570.00MHz, Horizontal, AV | Complied |
| | | **IC:** RSS-Gen 4.9 RSS-Gen 4.10 | **IC:** RSS-210 A8.5 RSS-Gen 7.2.1 and 7.2.3 | | | | |
| Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15. | | | | | | | |

* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

### 3.3 Addition to standard

| No. | Item | Test Procedure | Specification | Remarks | Deviation | Worst margin | Results |
|---|---|---|---|---|---|---|---|
| 1 | 99% Occupied Band Width | RSS-Gen 4.6.1 | RSS-Gen 4.6.1 | Conducted | N/A | N/A | N/A |

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

## 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 | 4.4dB | 4.2dB | 3.2dB | 3.8dB | 3.9dB | 5.9dB | 6.1dB |
| No.2 semi-anechoic chamber (±) | 3.7dB | - | - | - | 3.2dB | 4.4dB | 4.0dB | 5.9dB | 6.1dB |
| No.3 semi-anechoic chamber (±) | 3.7dB | - | - | - | 3.2dB | 4.6dB | 4.0dB | 5.9dB | 6.1dB |
| No.4 semi-anechoic chamber (±) | 3.7dB | - | - | - | 3.2dB | 3.9dB | 3.9dB | 5.9dB | 6.1dB |

*10m/3m = Measurement distance

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

Radiated emission test(3m)
The data listed in this test report has enough margin, more than the site margin.

Other test except Conducted Emission and Spurious Emission (Radiated)
The measurement uncertainty for this test is 3.0dB.

### 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 1 to 3.

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

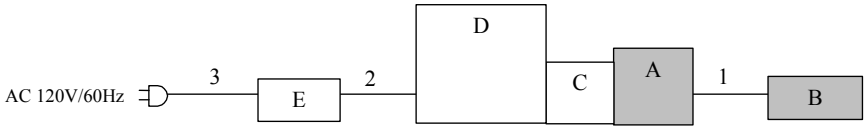
## 4.1 Operating Mode(s)

| Test Item | Operating Mode | Tested frequency |
|---|---|---|
| Conducted Emission<br>Spurious Emission | -IEEE802.11b Transmitting (Tx), 2Mbps, Payload: PN9 | 2412MHz(L)<br>2437MHz(M)<br>2462MHz(H) |
| | -IEEE802.11g Transmitting (Tx), 48Mbps, Payload: PN9 | |
| | -IEEE802.11a Transmitting (Tx), 24Mbps, Payload: PN9 | 5745MHz(L)<br>5785MHz(M)<br>5825MHz(H) |
| | -IEEE802.11b/g Receiving (Rx) | 2437MHz(M) |
| | -IEEE802.11a Receiving (Rx) | 5785MHz(M) |
| 6dB Bandwidth<br>Maximum Peak Output Power<br>Power Density<br>99% Occupied Bandwidth | -IEEE802.11b Transmitting (Tx), 2Mbps, Payload: PN9 | 2412MHz(L)<br>2437MHz(M)<br>2462MHz(H) |
| | -IEEE802.11g Transmitting (Tx), 48Mbps, Payload: PN9 | |
| | -IEEE802.11a Transmitting (Tx), 24Mbps, Payload: PN9 | 5745MHz(L)<br>5785MHz(M)<br>5825MHz(H) |
| Restricted Band Edge | -IEEE802.11b Transmitting (Tx), 2Mbps, Payload: PN9 | 2412MHz(L)<br>2462MHz(H) |
| | -IEEE802.11g Transmitting (Tx), 48Mbps, Payload: PN9 | |
| | -IEEE802.11a Transmitting (Tx), 24Mbps, Payload: PN9 | 5745MHz(L)<br>5825MHz(H) |
| *Transmitting duty was 100% on all tests. | | |

*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum power.

## 4.2 Configuration and peripherals

**[Conducted emission and Antenna Terminal Conducted tests]**




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

**Description of EUT and Support equipment**

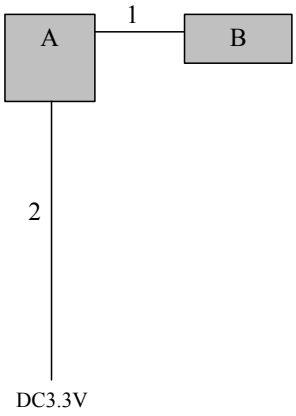
| No. | Item | Model number | Serial number | Manufacturer | Remarks |
|---|---|---|---|---|---|
| A | WLAN Module | CH9-1161 | ES7004*<br>ES7005*<br>ES7006* | Canon Inc. | EUT |
| B | Antenna | TE 2069856-1 | 01 | Canon Inc. | EUT |
| C | Jig Board | - | - | Canon Inc. | - |
| D | Note PC | PORTE6ER500 Series | 88091989H | TOSHIBA | - |
| E | AC Adapter | PA3241U-2ACA | G71C00062310 | TOSHIBA | - |

* Please refer to Appendix 2: Data of EMI test.

**List of cables used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | Antenna Cable | 0.15 | Shielded | Shielded | - |
| 2 | DC Cable | 1.8 | Unshielded | Unshielded | - |
| 3 | AC Cable | 1.8 | Unshielded | Unshielded | - |

**[Radiated emission test]**




* 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 | WLAN Module | CH9-1161 | ES7004*<br>ES7006* | Canon Inc. | EUT |
| B | Antenna | TE 2069856-1 | 01 | Canon Inc. | EUT |

* Please refer to Appendix 2: Data of EMI test.

**List of cables used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | Antenna Cable | 0.15 | Shielded | Shielded | - |
| 2 | DC Cable | 3.0 | Unshielded | Unshielded | - |

## SECTION 5: Conducted Emission

**Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.
The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and 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 a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)
I/O cable and AC cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

**Detector : quasi-peak and average detector (IF BW 9 kHz)**
**Measurement range : 0.15-30MHz**
**Test data : APPENDIX 2**
**Test result : Pass**

## SECTION 6: Spurious Emission

**[Conducted]**
**Test Procedure**
The Out of Band Emission was measured with a spectrum analyzer connected to the antenna port.
It was measured based on "1. RF antenna conducted test" of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 ".
The following spectrum analyzer setting was used:

- RBW: 100kHz
- VBW: 300kHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

**Test data : APPENDIX 2**
**Test result : Pass**

**[Radiated]**
**Test Procedure**
It was measured based on "2. Radiated emission test" of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 ".
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 intensity has been measured in a Semi Anechoic Chamber with a ground plane and at a distance of 3m(Below 10GHz), 1m(10 to 26.5GHz) and 0.5m(Upper 26.5GHz).
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.
The radiated emission measurements were made with the following detector function of the test receiver and the Spectrum analyzer.

In any 100kHz bandwidth outside the restricted 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 / Table 2 of RSS-210 2.7 (IC) and outside the restricted band of FCC15.205 / Table 1 of RSS-210 2.7 (IC).**

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

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

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

**Test data : APPENDIX 2**
**Test result : Pass**

# SECTION 7: Bandwidth

## 6 dB Bandwidth

**Test Procedure**

The bandwidth was measured with a spectrum analyzer connected to the antenna port.
It was measured based on "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 ".
The following spectrum analyzer setting was used:

- Span: 50MHz
- RBW: 100kHz
- VBW: 300kHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

**Test data** **: APPENDIX 2**
**Test result** **: Pass**

## 99% Occupied Bandwidth

**Test Procedure**

The bandwidth was measured with a spectrum analyzer connected to the antenna port.
The following spectrum analyzer setting was used:

- Span: Enough width to display 20dB Bandwidth
- RBW: as close to 1% of the Span as is possible without being below 1%
- VBW: Three times of RBW
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

**Test data** **: APPENDIX 2**
**Test result** **: Pass**

## SECTION 8: Maximum Peak Output Power

**Test Procedure**

The Maximum Peak Output Power was measured with a power meter (tested bandwidth: 50MHz) connected to the antenna port.
It was measured based on "Power Output Option 1" of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 ".

**Test data : APPENDIX 2**
**Test result : Pass**

## SECTION 9: Peak Power Density

**[Conducted]**
**Test Procedure**
The Peak Power Density was measured with a spectrum analyzer connected to the antenna port.
It was measured based on "PSD Option 1" of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 ".

- Span: 18MHz
- RBW: 30kHz*)
- VBW: 100kHz
- Sweep: 600sec (Span/RBW)
- Detector: Peak
- Trace: Max Hold

*) 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: 3kHz.

**Test data : APPENDIX 2**
**Test result : Pass**