



RADIO TEST REPORT

Test Report No.: 31CE0052-HO-01-J

Applicant : CANON INC.
Type of Equipment : Wireless Module
Model No. : CH9-1225
FCC ID : AZD214
Test regulation : FCC Part15 Subpart C: 2011
Test result : Complied

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Date of test: May 18 to June 24, 2011

Representative test engineer:

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13-EM-F0429

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SECTION 1: Customer information

Company Name : Canon Inc.
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Telephone Number : +81 3 3757 6798
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Contact Person : Kiyoshi Sahoyama

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless Module
Model No. : CH9-1225
Serial No. : Refer to 4.2 in this report.
Rating : DC3.3V
Receipt Date of Sample : May 9, 2011
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No modification by the test lab.

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2.2 Product description

Model: CH9-1225 (referred to as the EUT in this report) is a Wireless Module.

General specification

Clock frequency(ies) in the system : 38.4MHz, 32.768kHz

Radio specification

Equipment type : Transceiver
Antenna type : Planar Inverted F Antenna
Antenna connector type : U.FL
Operation temperature range : -20 to +70 deg.C.

Bluetooth*1)

Frequency of operation : 2402-2480MHz
Bandwidth / Channel spacing : 79MHz & 1MHz
Type of modulation : FHSS
Antenna gain with cable loss : 1.95dBi
ITU code : F1D, G1D

*1) Refer to the test report 31CE0052-HO-01-I for this function.

Wireless LAN

Frequency of operation *2) : 2412-2462MHz (IEEE 802.11b, 11g, 11n-HT20)
2422-2452MHz (IEEE 802.11n-HT40)
5180-5320MHz (IEEE 802.11a, 11n-HT20)
5190-5310MHz (IEEE 802.11n-HT40)
5745-5825MHz (IEEE 802.11a, 11n-HT20)
5755-5795MHz (IEEE 802.11n-HT40)
Bandwidth & channel spacing : Bandwidth :
20MHz (IEEE 802.11b, 11g, 11a, 11n-HT20), 40MHz (IEEE 802.11n-HT40)
Channel spacing :
5MHz (2.4GHz), 20MHz (5GHz)
Type of modulation : DSSS (IEEE 802.11b)
OFDM (IEEE 802.11a/g/n)
Antenna gain with cable loss : +1.95 dBi (2400/2450/2500MHz)
-1.32 dBi (5160/5250/5340MHz)
-0.43 dBi (5725/5785/5845MHz)
ITU code : D1D, G1D

*2) Refer to the test report 31CE0052-HO-01-K/L for FCC 15.407.

FCC Part15.31 (e)

The Wireless Module is provided with stable power supply DC 3.3V from the host device and has power supply regulator which provides DC 2.85V 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: 2011, final revised on July 8, 2011
and effective August 8, 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 revision on July 8, 2011 does not affect the test specification applied to the EUT.

The EUT has been tested for compliance with FCC Part 15 Subpart B: 2011. Refer to the test report 31CE0052-SH-03-B.

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 | 21.0dB Freq.: 0.40303MHz Phase: N Detection: Quasi-Peak Mode: Tx 2437MHz IEEE 802.11b | Complied |
| | | | | | 21.0dB Freq.: 0.41245MHz Phase: N Detection: Quasi-Peak Mode: Tx 2437MHz IEEE 802.11g | |
| | | | | | 21.0dB Freq.: 0.40481MHz, 0.42130MHz Phase: N, L1 Detection: Quasi-Peak Mode: Tx 2437MHz IEEE 802.11n-20 | |
| | | | | | 21.0dB Freq.: 0.40162MHz, 0.40606MHz Phase: N, L1 Detection: Quasi-Peak Mode: Tx 2437MHz IEEE 802.11n-40 | |
| 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 | 6.1dB Freq.: 9848.000MHz Polarization: Vertical Detection: Average Mode: Tx 2462MHz IEEE 802.11b | 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 | 3.6 dB | 3.6 dB | 3.6 dB |
| Radiated emission (Measurement distance: 3m) | 9kHz-30MHz | 3.7 dB | 3.7 dB | 3.6 dB |
| | 30MHz-300MHz | 4.9 dB | 5.1 dB | 5.0 dB |
| | 300MHz-1GHz | 5.0 dB | 5.2 dB | 5.0 dB |
| | 1GHz-13GHz | 4.8 dB | 4.8 dB | 4.9 dB |
| Radiated emission (Measurement distance: 1m) | 13GHz-18GHz | 5.6 dB | 5.6 dB | 5.6 dB |
| | 18GHz-40GHz | 4.8 dB | 4.3 dB | 4.4 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: (±) 1.9dB

Spurious emission (Conducted), Power density Measurement (below 1GHz) uncertainty for this test was: (±) 1.8dB

Spurious emission (Conducted), Power density Measurement (1G-3GHz) uncertainty for this test was: (±) 2.3dB

Spurious emission (Conducted), Power density Measurement (3G-18GHz) uncertainty for this test was: (±) 3.6dB

Spurious emission (Conducted), Power density Measurement (18G-26.5GHz) uncertainty for this test was: (±) 4.0dB

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 checked="" 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 type="checkbox"/> No.1 shielded room | - | - | 6.8 x 4.1 x 2.7 | 6.8 x 4.1 | - |
| <input checked="" 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 checked="" 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.

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.

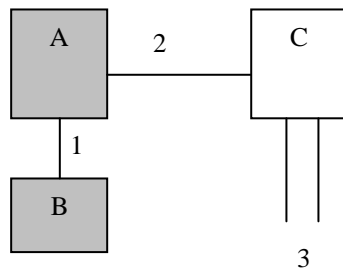
| Test item | Mode | Tested frequency | Power setting *1) | Worst data rate *2) |
|-----------|---|---------------------------|-------------------|---------------------|
| All items | Transmitting IEEE 802.11b | 2412MHz, 2437MHz, 2462MHz | 13dBm | 1Mbps, PN9 |
| | Transmitting IEEE 802.11g | 2412MHz, 2437MHz, 2462MHz | 13dBm | 6Mbps, PN9 |
| | Transmitting IEEE 802.11n-20: 2.4G Band | 2412MHz, 2437MHz, 2462MHz | 13dBm | MCS0, PN9 |
| | Transmitting IEEE 802.11n-40: 2.4G Band | 2422MHz, 2437MHz, 2452MHz | 13dBm | MCS5, PN9 |
| | Transmitting IEEE 802.11a | 5745MHz, 5785MHz, 5825MHz | 13dBm | 24Mbps, PN9 |
| | Transmitting IEEE 802.11n-20: 5G Band | 5745MHz, 5785MHz, 5825MHz | 13dBm | MCS2, PN9 |
| | Transmitting IEEE 802.11n-40: 5G Band | 5755MHz, 5795MHz | 13dBm | MCS5, PN9 |

*1) Software: Tera Term v4.69

*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 Module | CH9-1225 | *1) | CANON | EUT |
| B | Antenna | Dual Band WLAN Antenna Cable Assembly 2011 | 001 | Tyco Electronics | EUT |
| C | Extender | TSS-T6 | - | CANON | - |

*1) ES4101: Conducted emission and Radiated emission, ES4006: Other test

List of cables used

| No. | Name | Length (m) | Shield (Cable) | Shield (Connector) | Remarks |
|-----|---------|------------|----------------|--------------------|----------|
| 1 | Antenna | 0.025 | Unshielded | Unshielded | - |
| 2 | Jig | 0.04 | Unshielded | Unshielded | - |
| 3 | DC | 1.5 | Unshielded | Unshielded | +3.3V, G |

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SECTION 5: Conducted emission

5.1 Operating environment

The test was carried out in No.2 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) via DC power supply. 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.2 / 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 | 1000-4000MHz | |
| 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 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 |
| EUT Antenna | Horizontal | Y | Z | - | 2.4G | 5G (W58) | 2.4G | 5G (W58) | 2.4G | 5G (W58) | 5G (W58) |
| | Vertical | X | Y | X | X | Y | X | X | X | X | X |
| Module | Horizontal | X | Y | X | X | Y | X | X | Z | X | X |
| | Vertical | Z | Z | X | Y | Z | Y | X | Z | X | X |

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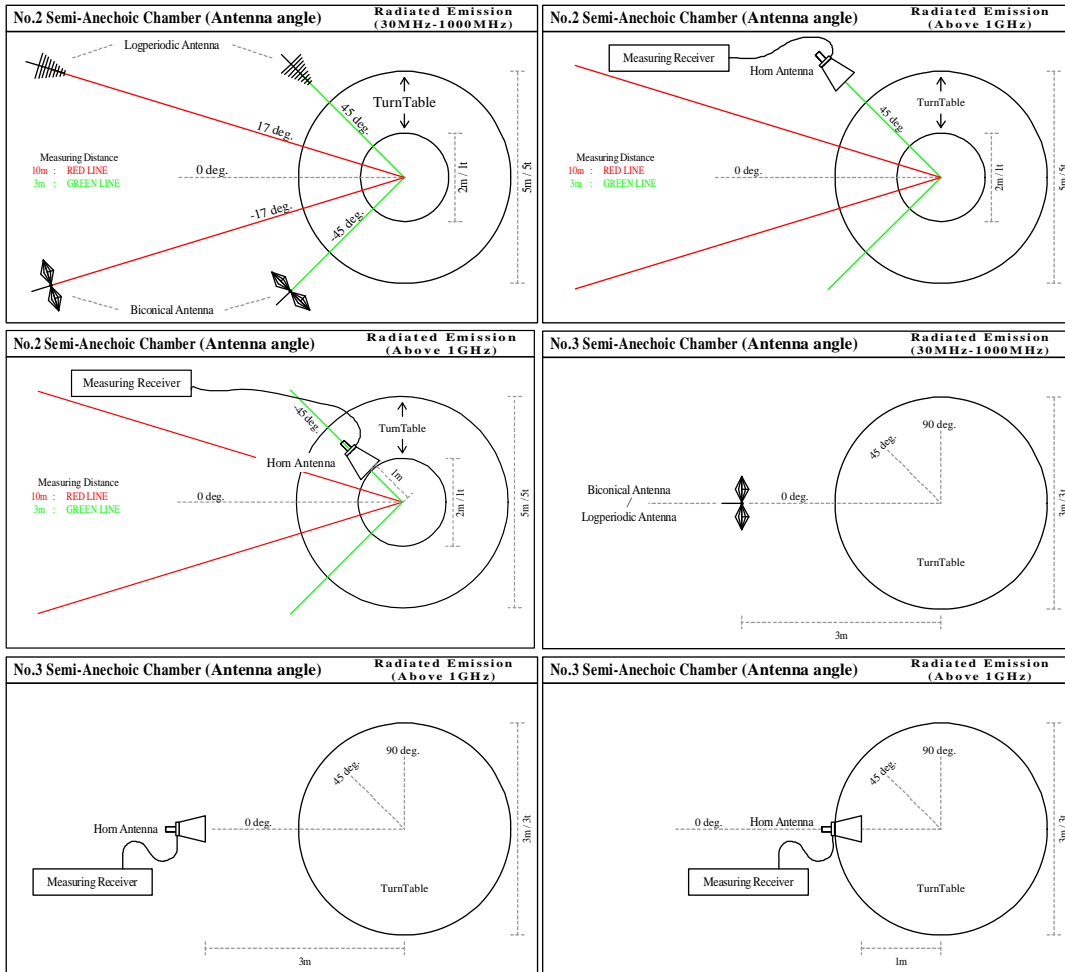
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Figure 1. Antenna angle



9.5 Band edge

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

9.6 Results

Summary of the test results : Pass *No noise was detected above the 8th 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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