



RADIO TEST REPORT

Test Report No. : 31IE0027-HO-01-B-R2

Applicant : Nikon Corporation
Type of Equipment : Wireless Transmitter
Model No. : WT-5A
FCC ID : CGJ1148EA
Test regulation : FCC Part 15 Subpart E: 2012
Test Result : Complied

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6. This report is a revised version of 31IE0027-HO-01-B-R1. 31IE0027-HO-01-B-R1 is replaced with this report.

Date of test: June 24 to July 6, 2011

Representative test engineer:

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SECTION 1: Customer information

Company Name : Nikon Corporation
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Contact Person : Okuemon Oyama

***Remarks:**

Nikon Corporation designates NEC Access Technica, Ltd. as manufacturer of the product (Wireless Transmitter).

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless Transmitter
Model No. : WT-5A
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC5.0V
Receipt Date of Sample : May 20, 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

2.2 Product Description

Feature of EUT

- The wireless LAN unit (built-in antenna) compatible with the IEEE802.11a/b/g/n standard.
- EUT has 2 colors of LED and a connector for expansion terminal connections for camera (Model No.: D4).
- Power supply and the wireless LAN unit are controlled on the camera side via an expansion terminal.

General Specification

Clock frequency(ies) in the system : 38.4MHz

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Specification of WLAN (IEEE802.11a/b/g)

Type of radio	Wireless LAN (IEEE802.11a)	Wireless LAN (IEEE802.11b/g)
Equipment Type	Transceiver	
Frequency of Operation	5180MHz - 5320MHz 5745MHz - 5825MHz	2412MHz - 2462MHz
Bandwidth & Channel spacing	Bandwidth : 20MHz Ch spacing : 20MHz	Bandwidth : 20MHz Ch spacing : 5MHz
Type of Modulation	OFDM	11b: DSSS 11g: OFDM
Antenna Type	Pattern antenna (Inverted L type)	
Antenna Gain	5180-5320MHz: -0.43dBi 5745-5825MHz: -1.87dBi	2412MHz - 2462MHz: 1.55dBi
Power Supply	DC 3.3V / 1.8V	
Operating temperature range	0 to +40 deg. C.	

Specification of WLAN (IEEE802.11n)

Type of radio	Wireless LAN (IEEE802.11n)			
	2.4G Band SISO (20M Band)	2.4G Band SISO (40M Band)	5G Band SISO (20M Band)	5G Band SISO (40M Band)
Equipment Type	Transceiver			
Frequency of Operation	2412MHz - 2462MHz	2422MHz - 2452MHz	5180MHz - 5320MHz 5745MHz - 5825MHz	5190MHz - 5310MHz 5755MHz - 5795MHz
Bandwidth & Channel spacing	Bandwidth : 20MHz Ch spacing : 5MHz	Bandwidth : 40MHz Ch spacing : 5MHz	Bandwidth : 20MHz Ch spacing : 20MHz	Bandwidth : 40MHz Ch spacing : 40MHz
Type of Modulation	OFDM			
Antenna Type	Pattern antenna (Inverted L type)			
Antenna Gain	2412MHz - 2462MHz: 1.55dBi		5180-5320MHz: -0.43dBi 5745-5825MHz: -1.87dBi	
Power Supply	DC 3.3V / 1.8V			
Operating temperature range	0 to +40 deg. C.			

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2012, final revised on February 1, 2012
Title : FCC 47CFR Part15 Radio Frequency Device Subpart E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

*The revision on February 1, 2012 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC :ANSI C63.4:2003	FCC: 15.407(b)(6) / 15.207	QP 20.9dB, 0.53620MHz, N AV 11.5dB, 0.53620MHz, N	Complied	-
	IC: RSS-Gen 7.2.4	IC: RSS-Gen 7.2.4			
26dB Emission Bandwidth	FCC :ANSI C63.4:2003 KDB 789033 D01	FCC : 15.407(a)(1)(2)(3)	See data	N/A	Conducted
	IC: -	IC: -			
Maximum Peak Output Power	FCC :ANSI C63.4:2003, KDB 789033 D01	FCC : 15.407(a)(1)(2)(3)		Complied	Conducted
	IC: -	IC: RSS-210 A9.2(1)(2)(3)			
Peak Power Spectral Density	FCC :ANSI C63.4:2003, KDB 789033 D01	FCC : 15.407(a)(1)(2)(3)		Complied	Conducted
	IC: -	IC: RSS-210 A9.2(1)(2)(3)			
Peak Excursion Ratio	FCC :ANSI C63.4:2003, KDB 789033 D01	FCC : 15.407(a)(6)	Complied	Conducted	
	IC: -	IC: -			
Spurious Emission Restricted Band Edge	FCC: ANSI C63.4:2003	FCC : 15.407(b), 15.205 and 15.209	5.7dB 41.564MHz, QP, Vert.	Complied	Conducted / Radiated
	IC: -	IC: RSS-210 A.9.2(1)(2)(3)			

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
For DFS tests, please see the test report number 31IE0027-HO-01-C issued by UL Japan, Inc.

*These tests were also referred to KDB 789033 D01 General UNII Test Procedures v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E".

FCC 15.31 (e)

This EUT provides stable voltage (DC3.3/1.8V) constantly to RF Part regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement of 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Band Width	RSS-Gen 4.6.1	RSS-210 A9.2 (1)(2)(3)	N/A	N/A	Conducted

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 (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	2.6dB
No.2	2.9dB
No.3	3.3dB
No.4	2.8dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(±dB)				(1m*)(±dB)		(0.5m*)(±dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
	No.1	2.9dB	4.8dB	5.0dB	3.9dB	4.3dB	4.5dB
No.2	3.5dB	4.8dB	5.1dB	4.0dB	4.2dB	4.4dB	4.2dB
No.3	3.8dB	4.6dB	4.7dB	4.0dB	4.2dB	4.5dB	4.2dB
No.4	3.5dB	4.4dB	4.9dB	4.0dB	4.2dB	4.6dB	4.2dB

*3m/1m/0.5m = Measurement distance

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.0dB	1.1dB	2.7dB	3.2dB	3.3dB	1.5dB

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.

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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.

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

4.1 Operating Modes

Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11a (11a)	6Mbps, PN9
IEEE 802.11n SISO 20MHz BW (11n-20)	MCS 0, PN9
IEEE 802.11n SISO 40MHz BW (11n-40)	MCS 0, PN9

*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel).

*Power of the EUT was set by the software as follows:
Power settings: 12dBm (Min power: 8dBm)
Software name & version: Dut Bridge Labtool Version 1.0.5.38

* Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.

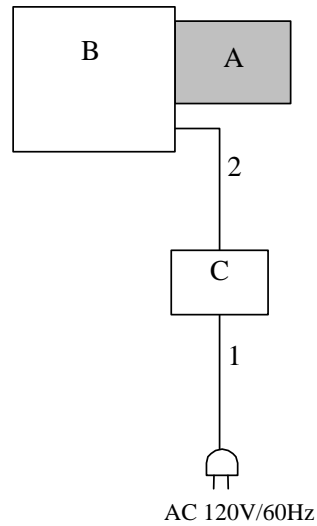
*Details of Operating mode(s)

Test Item	Operating Mode	Tested Frequency	
		Low Band	Middle Band
Conducted emission	11a Tx *1)	5240MHz *1)	
Spurious Emission (Radiated)	11a Tx	5180MHz	
	11n-20 Tx	5240MHz 5320MHz	
	-----	-----	
	11n-40 Tx	5190MHz 5230MHz 5270MHz 5310MHz	
26dB Emission Bandwidth, 99% Occupied Bandwidth, Maximum Peak Output Power, Peak Power Spectral Density,	11a Tx	5180MHz	5260MHz
	11n-20 Tx	5220MHz 5240MHz	5300MHz 5320MHz
Spurious Emission (Conducted) Peak Excursion Ratio	-----	-----	
	11n-40 Tx	5190MHz 5230MHz	5270MHz 5310MHz

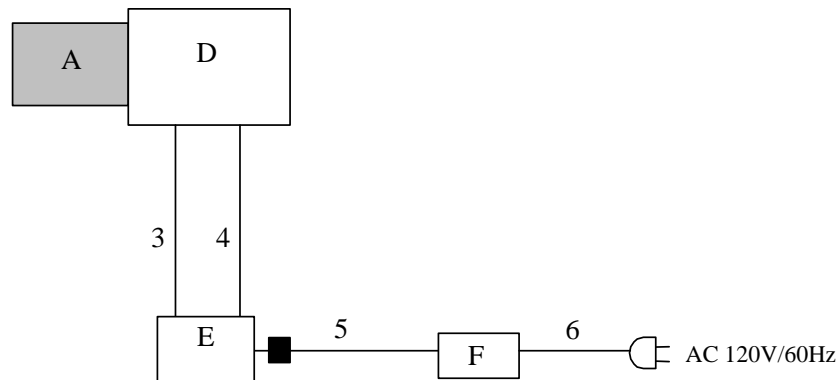
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test and the noise levels at the mode/tested frequencies were equivalent to those of other modes/tested frequencies.

4.2 Configuration and peripherals

[Conducted Emission test]



[Except for Conducted Emission test]



■ : Standard Ferrite Core

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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless Transmitter	WT-5A	15800106S *1) 15800103S *2)	Nikon	EUT
B	Digital Camera	D3	36	Nikon	-
C	AC Adapter	EH-6b	2	Nikon	-
D	Jig	-	-	Nikon	-
E	Laptop PC	7661-CB9	L3-Y3936	lenovo	-
F	AC Adapter	92P1156	11S92P1156Z1ZDXN85 M5PY	lenovo	-

*1) Used for Conducted Emission and Radiated Spurious Emission tests.

*2) Used for all tests except for Conducted Emission and Radiated Spurious Emission tests.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	AC Cable	1.4	Unshielded	Unshielded	-
2	DC Cable	1.6	Unshielded	Unshielded	-
3	USB Cable	1.6	Shielded	Shielded	-
4	LAN Cable	1.6	Unshielded	Unshielded	-
5	DC Cable	1.8	Unshielded	Unshielded	-
6	AC Cable	1.0	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0m by 0.5m, 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.

1) 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	: QP and AV
Measurement range	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

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 has been measured in a Semi Anechoic Chamber with a ground plane.

The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

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.

Below 1GHz

The result also satisfied with the general limits specified in section 15.209(a).

Above 1GHz

Inside of restricted bands(Section 15.205): Apply to limit in the Section 15.209(a).

Outside of the restricted bands: Apply to limit 68.2dBuV/m(-27dBm e.i.r.p. *) in the Section 15.407(b)(1)(2)(3).

Restricted bandedge: Apply to limit in the Section 15.209(a).

*Electric Field Strength to e.i.r.p. Conversion

$$E = \frac{1000000\sqrt{30P}}{3} \text{ (uV/m)} \quad :P \text{ is the e.i.r.p. (Watts)}$$

Test Antennas are used as below;

Frequency	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

Frequency	Below 1GHz	Above 1GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	PK	AV
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz*1)
Test Distance	3m	3m (below 10GHz), 1m*2) (above 10GHz), 0.5m*3) (above 26.5GHz)	

*1) The test was performed with VBW 10Hz since the EUT had no intervals during which the transmitter was off (see Appendix).

*2) Distance Factor: $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

*3) Distance Factor: $20 \times \log(3.0\text{m}/0.5\text{m}) = 15.6\text{dB}$

- 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.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 30M-40GHz

Test data : APPENDIX

Test result : Pass

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port with Spectrum Analyzer.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Remarks
26dB Bandwidth	30MHz, 60MHz	Close to 1% of EBW	Greater than RBW	Auto	Peak	Max Hold	-
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	Close to 1% of Span	Three times of RBW	Auto	Peak	Max Hold	-
Maximum Peak Output Power	48MHz / 98MHz	1MHz	3MHz	Auto	Sample Power Averaging (100 times)	Clear Write	method SA-1
Peak Power Spectral Density	48MHz / 98MHz	1MHz	3MHz	Auto	Sample Power Averaging (100 times)	Clear Write	method SA-1
Peak Excursion Ratio	Enough width to display Emission Bandwidth	1MHz	3MHz	Auto	Peak	Max Hold	-
					Sample Power Averaging (100 times)	Clear Write	
Conducted Spurious Emission *1)	Range: 9kHz-150kHz	200Hz	620Hz	Auto	Peak	Max Hold	-
	Range: 150kHz-30MHz	9.1kHz	27kHz				
	Range: 30MHz-1GHz	100kHz	300kHz				
	Range: 1GHz-40GHz (Less or equal to 5GHz)	1MHz	3MHz				

*1) 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.

*EBW: Enough width to display Bandwidth

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass