



# RADIO TEST REPORT

Test Report No. : 31IE0027-HO-01-A-R3

**Applicant** : Nikon Corporation  
**Type of Equipment** : Wireless Transmitter  
**Model No.** : WT-5A  
**FCC ID** : CGJ1148EA  
**Test regulation** : FCC Part 15 Subpart C 2012  
**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.
6. This report is a revised version of 31IE0027-HO-01-A-R2. 31IE0027-HO-01-A-R2 is replaced with this report.

**Date of test:**

May 23 to July 6, 2011

**Representative  
test engineer:**

Takayuki Shimada  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by:**

Takahiro Hatakeda  
Leader of WiSE Japan,  
UL Verification Service



NVLAP LAB CODE: 200572-0

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**UL Japan, Inc.**

**Head Office EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

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## **SECTION 1: Customer information**

Company Name : Nikon Corporation  
Address : 6-3, Nishi-ohi 1-chome, Shinagawa-ku, Tokyo 140-8601, Japan  
Telephone Number : +81-3-3773-8542  
Facsimile Number : +81-3-3773-1246  
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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**Head Office EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

**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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**Head Office EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

## **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 C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928MHz,  
2400-2483.5MHz, and 5725-5850MHz

\*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 7. AC powerline Conducted Emission measurements ----- IC: RSS-Gen 7.2.4	FCC: Section 15.207 ----- IC: RSS-Gen 7.2.4	QP 20.9dB, 0.53592MHz, N AV 11.6dB, 0.53592MHz, N	Complied	-
6dB Bandwidth	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: RSS-Gen 4.6.2	FCC: Section 15.247(a)(2) ----- IC: RSS-210 A8.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) ----- IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: RSS-Gen 4.9	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 7.2.3	1.6dB 2483.500MHz, AV, Hori.	Complied	Conducted/ Radiated

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

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

#### **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 Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	N/A	-	Conducted

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

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**Head Office EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

### 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	4.3dB
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

Power meter (+dB)	
Below 1GHz	Above 1GHz
1.0dB	1.0dB

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 report meets the limits unless the uncertainty is taken into consideration.

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**Head Office EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

### 3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. \*NVLAP Lab. code: 200572-0  
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

	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 Mode(s)**

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.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11a (11a)	6Mbps, PN9
IEEE 802.11b (11b)	1Mbps, PN9
IEEE 802.11g (11g)	24Mbps, PN9
IEEE 802.11n SISO 20MHz BW (11n-20): 2.4G Band	MCS 4, PN9
IEEE 802.11n SISO 20MHz BW (11n-20): 5G Band	MCS 0, PN9
IEEE 802.11n SISO 40MHz BW (11n-40): 2.4G Band	MCS 3, PN9
IEEE 802.11n SISO 40MHz BW (11n-40): 5G Band	MCS 5, PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel).	

\*EUT has the power settings by the software as follows;

Power settings: 2.4G (11b/g/11n-20) Band: 15dBm (Min power: 8dBm)  
2.4G (11n-40) Band: 12dBm (Min power: 8dBm)  
5G Band: 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) for 2.4GHz band**

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Conducted Emission	11g Tx *1)	2462MHz *1)
Spurious Emission (Radiated / Conducted), Maximum Peak Output Power, 6dB Bandwidth, Power Density, 99% Occupied Bandwidth	11b Tx	2412MHz
	11g Tx	2437MHz
	11n-20 Tx	2462MHz
	11n-40 Tx	2422MHz
		2437MHz
		2452MHz

#### **Details of Operating mode(s) for 5GHz band**

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Conducted Emission	11n-40 Tx *1)	5755MHz *1)
Spurious Emission (Radiated / Conducted), Maximum Peak Output Power, 6dB Bandwidth, Power Density, 99% Occupied Bandwidth	11a Tx	5745MHz
	11n-20 Tx	5785MHz
		5825MHz
	11n-40 Tx	5755MHz
		5795MHz

\*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.

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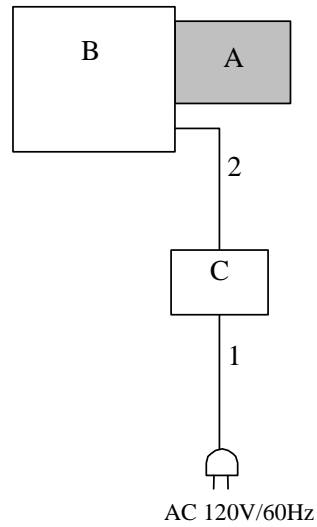
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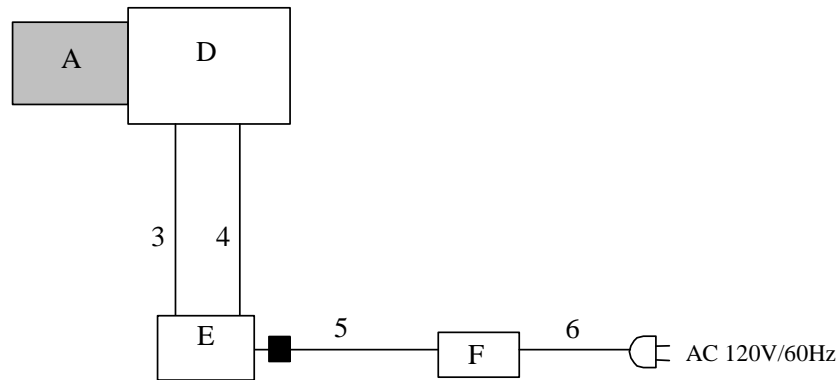
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## 4.2 Configuration and peripherals

[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) 15800105S *2) 15800103S *3)	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 Maximum Peak Output Power, Conducted Spurious Emission and Conducted Emission Band Edge compliance tests.

\*3) Used for Power Density, 6dB Bandwidth and 99% Occupied Bandwidth 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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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

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.

#### For the tests on EUT with other peripherals (as a whole system)

I/O 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. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

**Detector** : QP and AV  
**Measurement range** : 0.15-30MHz  
**Test data** : APPENDIX  
**Test result** : Pass

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

## **SECTION 6: Radiated Spurious Emission**

### **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 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 performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

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

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.

### **Test Antennas are used as below;**

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

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 5 of RSS-Gen 7.2.5(IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).**

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m*1) (above 10GHz)		3m (below 10GHz), 1m*1) (above 10GHz)

\*1) Distance Factor:  $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

- 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-25GHz  
**Test data** : APPENDIX  
**Test result** : Pass

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

## **SECTION 7: Antenna Terminal Conducted Tests**

### **Test Procedure**

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

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
6dB Bandwidth	20MHz / 40MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	18MHz / 38MHz	30kHz	100kHz	600sec 667sec 1334sec	Peak	Max Hold	Spectrum Analyzer *1) *2)
Conducted Spurious Emission *3)	Range: 9kHz-150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	Range: 150kHz-30MHz	9.1kHz	27kHz				
	Range: 30MHz-40GHz (Less or equal to 5GHz)	100kHz	300kHz				

\*1) PSD Option 1 of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247".

\*2) The test was not performed at RBW:3kHz however the measurement is to be performed with RBW:3kHz in the regulation, because, the measurement value with RBW:3kHz is less than the value of RBW:30kHz and the test data met the limit with RBW:30kHz.

\*3) 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.

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

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