



# **RADIO TEST REPORT**

**Test Report No. : 31JE0038-SH-01-A-R1**

**Applicant** : FUJIFILM Corporation  
**Type of Equipment** : Flat Panel Sensor  
**Model No.** : DR-ID 613SE  
**FCC ID** : W2Z-01000004  
**Test regulation** : FCC Part 15 Subpart E: 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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This report is a revised version of 31JE0038-SH-01-A. 31JE0038-SH-01-A is replaced with this report.

**Date of test:** May 9 to 30, 2012

**Representative test engineer:**

Tatsuya Arai  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by:**

Toyokazu Imamura  
Leader of WiSE Japan,  
UL Verification Service

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13-EM-F0429

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## **SECTION 1: Customer information**

Company Name : FUJIFILM Corporation  
Address : 798 Miyanodai, Kaisei-Machi, Ashigarakami-Gun, Kanagawa-ken,  
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Telephone Number : +81-465-85-4054  
Facsimile Number : +81-465-85-2043  
Contact Person : Tomonari Sendai

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

### **2.1 Identification of E.U.T.**

Type of Equipment : Flat Panel Sensor  
Model No. : DR-ID 613SE  
Serial No. : E120017  
Rating : DC12V  
Receipt Date of Sample : February 17, 2012  
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**

Model No: DR-ID 613SE (referred to as the EUT in this report) is a Flat Panel Sensor.

#### **Radio Specification**

Radio Type : Transceiver  
Method of Frequency Generation : Synthesizer  
Power Supply (inner) : DC3.3V  
Antenna Gain : 2.14dBi  
Antenna Cable loss : 2.3dB(5.15GHz)~2.5dB(5.25GHz)  
\*The cable loss is proportional from 5.15GHz to 5.25GHz.  
Clock frequency : 40MHz

	IEEE802.11a	IEEE802.11n (20 M band)	IEEE802.11n (40 M band)
Frequency of operation	5180-5240MHz	5180-5240MHz	5190 - 5230MHz
Type of modulation	OFDM (64QAM, 16QAM, QPSK, BPSK)		
Channel spacing	20MHz	20MHz	40MHz
Antenna type	Planer inverted F antenna		
Antenna Connector type	U.FL Alternative connector		

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## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : Test specification: FCC Part 15 Subpart E: 2012, final revised on May 17, 2012 and effective June 18, 2012  
\*The revision on May 17, 2012 does not affect the test specification applied to the EUT.

Title : FCC 47CFR Part15 Radio Frequency Device Subpart E  
Unlicensed National Information Infrastructure Devices  
Section 15.407 General technical requirements  
\*The EUT has been tested for compliance with FCC Part 15 Subpart B by the customer.

### 3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC :ANSI C63.4:2003 IC: RSS-Gen 7.2.4	FCC: 15.407(b)(6) / 15.207 IC: RSS-Gen 7.2.4	N/A	N/A *1)	-
26dB Emission Bandwidth	FCC :ANSI C63.4:2003 FCC KDB 789033 D01 v01r01 IC: -	FCC : 15.407(a)(1)(2)(3) IC: -	See data	N/A	Conducted
Maximum Peak Output Power	FCC :ANSI C63.4:2003, FCC KDB 789033 D01 v01r01 IC: -	FCC : 15.407(a)(1)(2)(3) IC: RSS-210 A9.2(1)(2)(3)		Complied	Conducted
Peak Power Spectral Density	FCC :ANSI C63.4:2003, FCC KDB 789033 D01 v01r01 IC: -	FCC : 15.407(a)(1)(2)(3) IC: RSS-210 A9.2(1)(2)(3)		Complied	Conducted
Peak Excursion Ratio	FCC :ANSI C63.4:2003, FCC KDB 789033 D01 v01r01 IC: -	FCC : 15.407(a)(6) IC: -		Complied	Conducted
Spurious Emission Restricted Band Edge	FCC: ANSI C63.4:2003 FCC KDB 789033 D01 v01r01 IC: -	FCC : 15.407(b), 15.205 and 15.209 IC: RSS-210 A.9.2(1)(2)(3)	7.7dB 5150.000MHz, AV, Vertical.	Complied	Conducted / Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.  
\*1) This equipment cannot operate WLAN card when it is connected to the control box at the interface cable. In that case, it can only use wire communication mode.

#### **FCC 15.31 (e)**

This EUT provides stable voltage (DC3.3V) 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 the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 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.

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### 3.4 Uncertainty

#### EMI (Shonan EMC Lab.)

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 <sup>*1</sup> /SR <sup>*2</sup> (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
<b>Radiated emission</b> (Measurement distance: 3m)	30MHz-300MHz	4.9 dB	5.1 dB	5.0 dB
	300MHz-1GHz	5.0 dB	5.2 dB	5.0 dB
	1GHz-15GHz	4.8 dB	4.8 dB	4.9 dB
<b>Radiated emission</b> (Measurement distance: 1m)	15GHz-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

\*3: Value of Antenna Terminal Voltage measurement is also applies to the No.5 and No.6 Shielded Room.

Power Measurement uncertainty above 1GHz for this test was: (±) 1.9dB

#### EMI (Head Office EMC Lab.)

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

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

#### Radiated emission test(3m)

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

### 3.5 Test Location

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JAB Accreditation No. : RTL02610

No.1/ No.2/ No.3 anechoic chamber has been fully described in a report submitted to FCC office, and accepted on April 17, 2009 (Registration No.: 697847).

	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 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 Semi-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 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 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	-

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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 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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## 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)	54Mbps, PN9
IEEE 802.11n MIMO 20MHz BW (11n-20): 5GHz	MCS 8, PN9
IEEE 802.11n MIMO 40MHz BW (11n-40): 5GHz	MCS 8, PN9
*Transmitting duty was close to 100% on all tests.	
*The worst condition was determined based on the test result of Maximum Peak Output Power.	
*EUT has the power settings by the software as follows; Power settings: 11a(54Mbps): 12.5dBm(5180 to 5240MHz) 11n-20 5GHz (MCS8): 11.0dBm(5180 to 5240MHz) 11n-40 5GHz (MCS8): 10.0dBm(5190MHz), 11.0dBm(5230MHz)  Software: Atheros Radio Test (ART) - Revision 0.9 BUILD #27 ART_11n - Customer Version (ANWI BUILD)	
*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.	

\*The details of Operating mode(s)

Test Item	Operating Mode	Tested Antenna	Tested Frequency	
			Low Band	Middle Band
26dB Emission Bandwidth, 99% Occupied Bandwidth, Peak Excursion Ratio, Spurious Emission(Conducted)	11a Tx	1 *2)	5180MHz 5220MHz 5240MHz	-
	11n-20 Tx	0 *2)	5180MHz 5220MHz 5240MHz	-
	11n-40 Tx	1 *2)	5190MHz 5230MHz	-
Maximum Peak Output Power, Peak Power Spectral Density,	11a Tx	1 *2)	5180MHz 5220MHz 5240MHz	-
	11n-20 Tx	0, 1, 0+1	5180MHz 5220MHz 5240MHz	-
	11n-40 Tx	0, 1, 0+1	5190MHz 5230MHz	-
Spurious Emission(Radiated)	11n-20 Tx *1)	0+1	5180MHz 5240MHz	-
	11n-40 Tx	0+1	5190MHz 5230MHz	-

\*1) Since 11a and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.

\*2) After the comparison between Antenna 0 and Antenna 1, test was performed with the antenna that had higher power as a representative.

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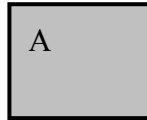
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#### 4.2 Configuration and peripherals



##### Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID (Remark)
A	Flat Panel Sensor	DR-ID 613SE	E120017	FUJIFILM	W2Z-01000004 (EUT)

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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 0.5m, 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. <sup>\*</sup>)  
in the Section 15.407(b)(1)(2)(3).

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

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

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**Test Antennas are used as below;**

Frequency	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	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	Method 1 *1) RBW: 1MHz VBW: 3MHz Detector and averaging type set for linear voltage averaging.  Method 2*1) RBW: 1MHz When duty cycle $\geq$ 98 percent (or duty cycle < 98 percent when a video trigger with the trigger level set to enable triggering only on full power pulse is used), VBW was set at 10Hz.  duty cycle is < 98 percent, set VBW $\geq$ 1/T
Test Distance	3m	3m (below 15GHz), 1m*2) (above 15GHz)	

\*1) The test method was also referred to FCC KDB 789033 D01 "Guidelines for Compliance Testing of unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E".

\*2) 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-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.

<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 and Test method</b>
26dB Bandwidth	30MHz, 60MHz	Close to 1% of EBW	Greater than RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	Close to 1% of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power, Peak Power Spectral Density	40MHz, 80MHz	1MHz	3MHz	Auto	RMS Power Averaging (100 times)	Clear Write	SA-1
Peak Excursion Ratio	40MHz, 80MHz	1MHz	3MHz	Auto	Peak RMS Power Averaging (100 times)	Max Hold Clear Write	Spectrum Analyzer
Conducted Spurious Emission	9kHz-150kHz 150kHz-30MHz	200Hz 9.1kHz	620Hz 27kHz	Auto	Peak	Max Hold	Spectrum Analyzer

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

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

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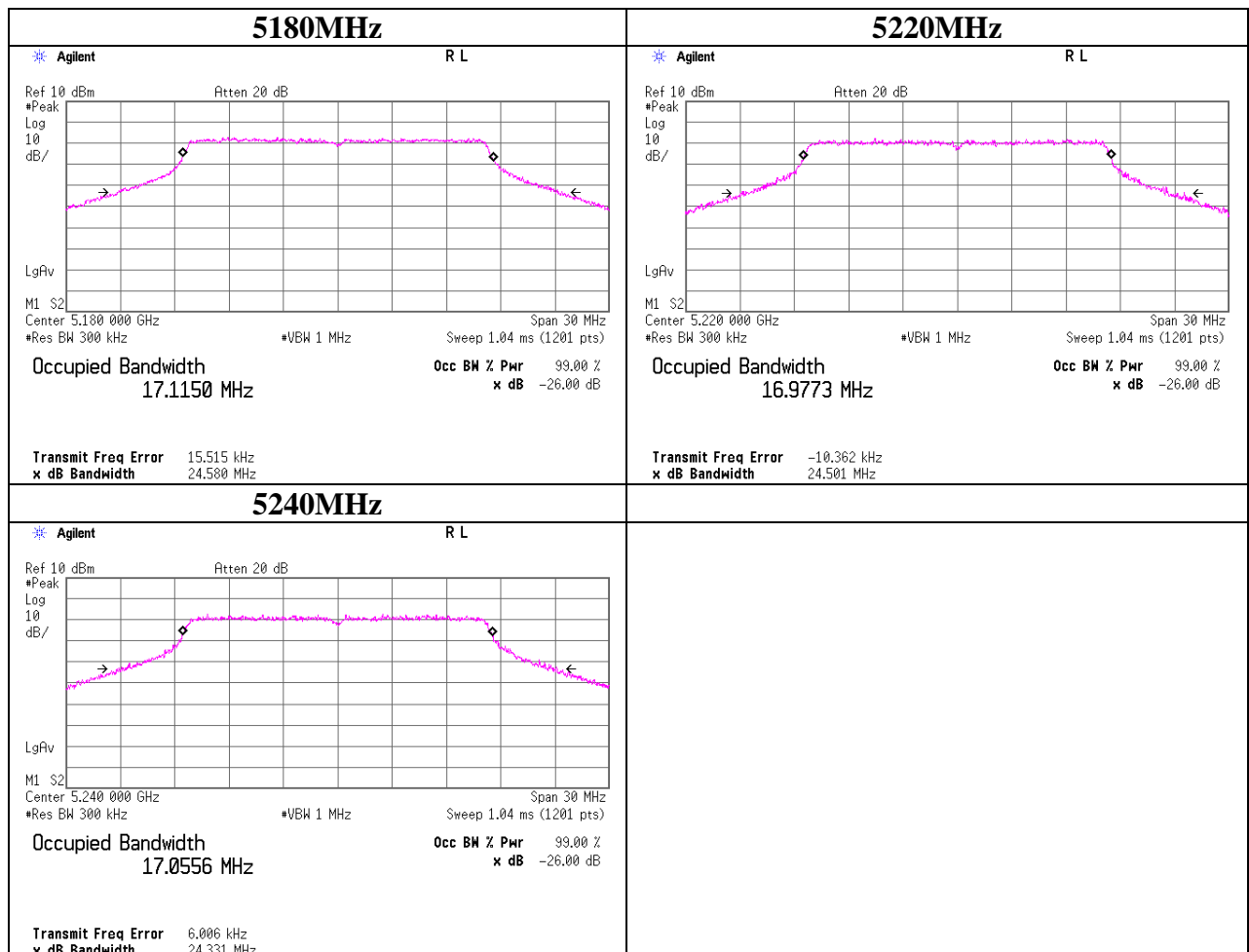
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## APPENDIX 1: Data of EMI test

### 26dB Emission Bandwidth and 99% Occupied Bandwidth

Test place Head Office EMC Lab. No.11 Measurement Room  
Date 05/09/2012  
Temperature/ Humidity 26deg. C / 52% RH  
Engineer Yutaka Yoshida  
Mode 11a Tx, 54Mbps

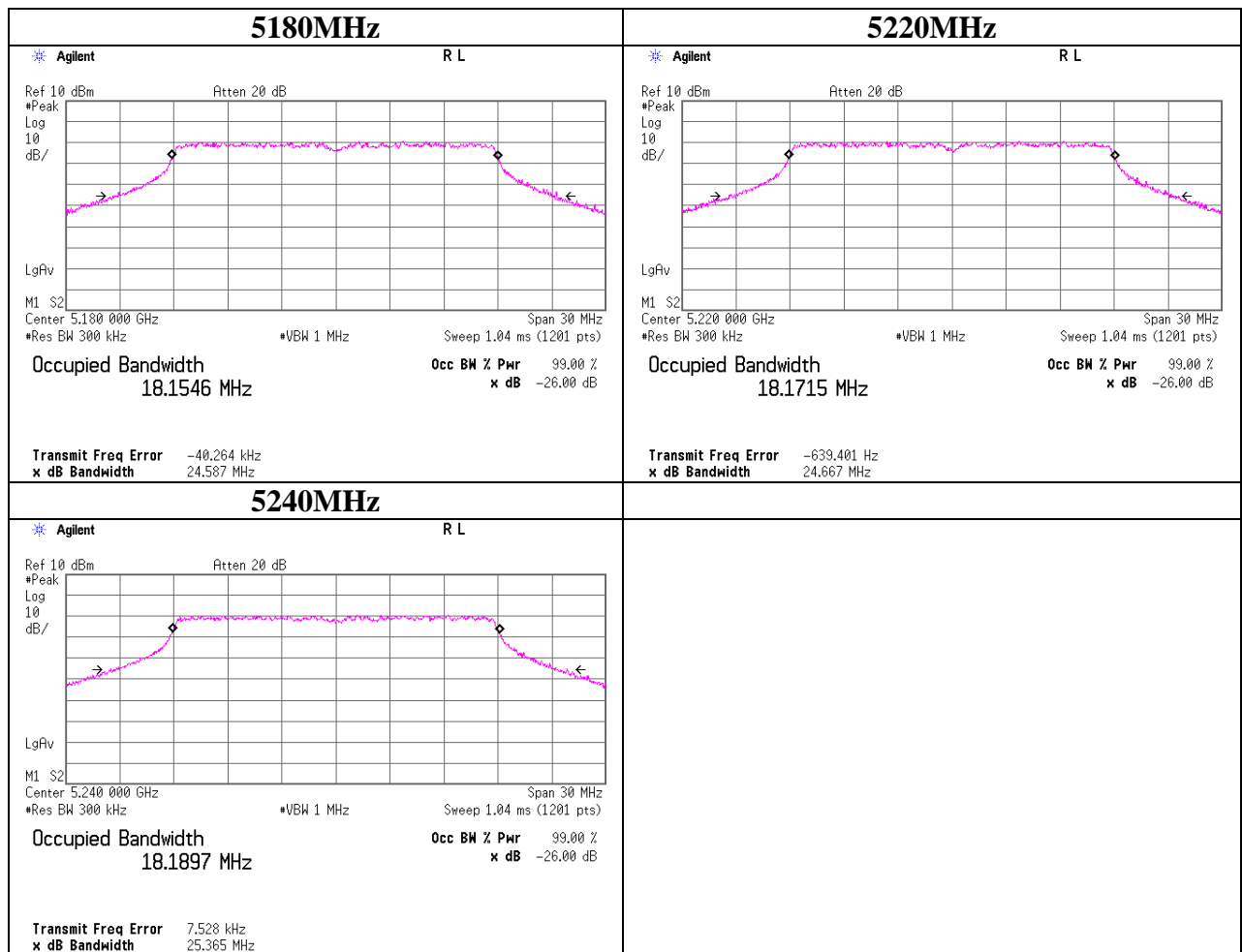
Antenna	Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
1	5180	24.580	17.115	-
	5220	24.501	16.977	-
	5240	24.331	17.056	-



## 26dB Emission Bandwidth and 99% Occupied Bandwidth

Test place : Head Office EMC Lab. No.11 Measurement Room  
Date : 05/09/2012  
Temperature/ Humidity : 26deg. C / 52% RH  
Engineer : Yutaka Yoshida  
Mode : 11n-20(MIMO) Tx, MCS 8

Antenna	Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
0	5180	24.587	18.155	-
	5220	24.667	18.172	-
	5240	25.365	18.190	-



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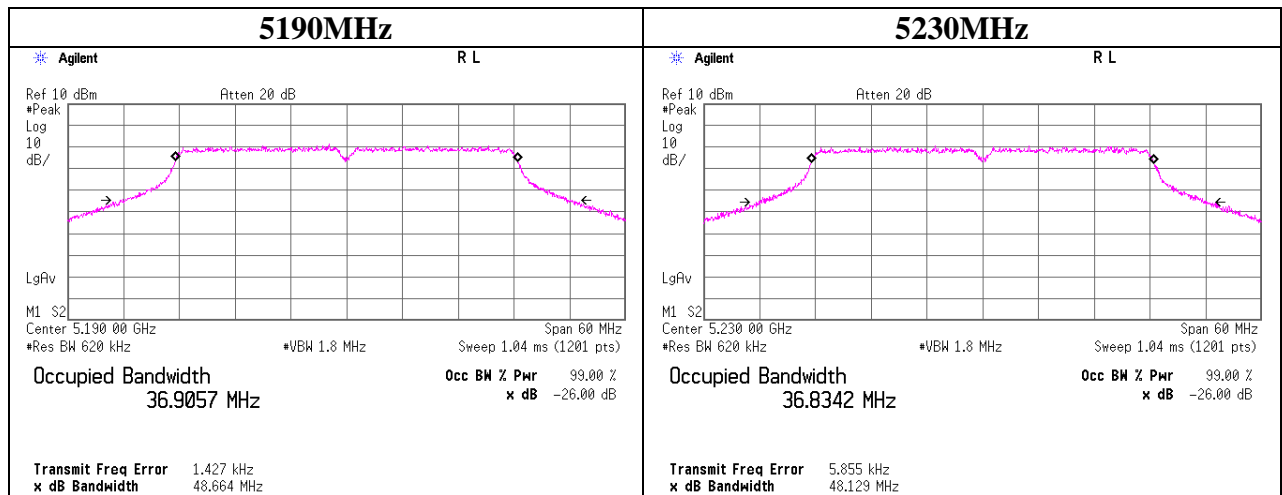
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## 26dB Emission Bandwidth and 99% Occupied Bandwidth

Test place Head Office EMC Lab. No.11 Measurement Room  
Date 05/09/2012  
Temperature/ Humidity 26deg. C / 52% RH  
Engineer Yutaka Yoshida  
Mode 11n-40(MIMO) Tx, MCS 8

Antenna	Frequency	26dB Emission Bandwidth	99% Occupied Bandwidth	Limit
	[MHz]	[MHz]	[MHz]	[MHz]
1	5190	48.664	36.906	-
	5230	48.129	36.834	-



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## Maximum Peak Output Power

Test place : Shonan EMC Lab. No.7 Shielded Room  
Date : 05/16/2012  
Temperature/ Humidity : 25deg.C. / 47%  
Engineer : Tatsuya Arai  
Mode : 11a Tx, 6Mbps

### Antenna 1 (\* S/A: Spectrum Analyzer)

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (e.i.r.p.) [dBm]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5180.0	0.29	1.68	10.05	-0.22	12.02	11.80	16.98	-	4.96	-
5220.0	0.28	1.80	10.04	-0.30	12.12	11.82	16.98	-	4.86	-
5240.0	0.29	1.86	10.04	-0.34	12.19	11.85	16.98	-	4.79	-

Result(Cond.) = Reading + Cable Loss + Atten.Loss

Result(e.i.r.p.) = Reading+ Cable Loss + Atten.Loss + Antenna Gain (with antenna cable loss)

15.407(a)(1) Limit(Cond.) = 16.98dBm(50mW) or  $4 + 10\log(26\text{dB BW})$  dBm

15.407(a)(2) Limit(Cond.) = 23.97dBm(250mW) or  $11 + 10\log(26\text{dB BW})$  dBm

**\*ON time was only measured using Gate function.**



## Maximum Peak Output Power

Test place : Shonan EMC Lab. No.7 Shielded Room  
Date : 05/16/2012  
Temperature/ Humidity : 25deg.C. / 47%  
Engineer : Tatsuya Arai  
Mode : 11n-20(MIMO) Tx, MCS 8

### Antenna 0+1

Freq. [MHz]	Result (Cond.) [dBm]	Result (e.i.r.p.) [dBm]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5180.0	13.57	13.35	16.98	-	3.41	-
5220.0	13.84	13.54	16.98	-	3.14	-
5240.0	13.78	13.44	16.98	-	3.20	-

Result [dBm] =  $10 \times \log(10^{(\text{Antenna 1 Result [dBm]} / 10)} + 10^{(\text{Antenna 2 Result [dBm]} / 10)})$

### Antenna 0 (\* S/A: Spectrum Analyzer)

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (e.i.r.p.) [dBm]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5180.0	-0.94	1.68	10.05	-0.22	10.79	10.57	16.98	-	6.19	-
5220.0	-0.79	1.80	10.04	-0.30	11.05	10.75	16.98	-	5.93	-
5240.0	-0.82	1.86	10.04	-0.34	11.08	10.74	16.98	-	5.90	-

### Antenna 1 (\* S/A: Spectrum Analyzer)

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (e.i.r.p.) [dBm]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5180.0	-1.42	1.68	10.05	-0.22	10.31	10.09	16.98	-	6.67	-
5220.0	-1.25	1.80	10.04	-0.30	10.59	10.29	16.98	-	6.39	-
5240.0	-1.47	1.86	10.04	-0.34	10.43	10.09	16.98	-	6.55	-

Result(Cond.) = Reading + Cable Loss + Atten.Loss

Result(e.i.r.p.) = Reading + Cable Loss + Atten.Loss + Antenna Gain (with antenna cable loss)

15.407(a)(1) Limit(Cond.) = 16.98dBm(50mW) or  $4 + 10\log(26\text{dB BW})$  dBm

15.407(a)(2) Limit(Cond.) = 23.97dBm(250mW) or  $11 + 10\log(26\text{dB BW})$  dBm

\*ON time was only measured using Gate function.

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## Maximum Peak Output Power

Test place : Shonan EMC Lab. No.7 Shielded Room  
Date : 05/16/2012  
Temperature/ Humidity : 25deg.C. / 47%  
Engineer : Tatsuya Arai  
Mode : 11n-40(MIMO) Tx, MCS 8

### Antenna 0+1

Freq. [MHz]	Result (Cond.) [dBm]	Result (e.i.r.p.) [dBm]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5190.0	12.87	12.63	16.98	-	4.11	-
5230.0	13.89	13.57	16.98	-	3.09	-

Result [dBm] =  $10 \times \log(10^{\text{Antenna 0 Result [dBm]} / 10} + 10^{\text{Antenna 1 Result [dBm]} / 10})$

### Antenna 0 (\* S/A: Spectrum Analyzer)

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (e.i.r.p.) [dBm]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5190.0	-2.10	1.71	10.05	-0.24	9.66	9.42	16.98	-	7.32	-
5230.0	-1.16	1.83	10.04	-0.32	10.71	10.39	16.98	-	6.27	-

### Antenna 1 (\* S/A: Spectrum Analyzer)

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (e.i.r.p.) [dBm]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5190.0	-1.70	1.71	10.05	-0.24	10.06	9.82	16.98	-	6.92	-
5230.0	-0.83	1.83	10.04	-0.32	11.04	10.72	16.98	-	5.94	-

Result(Cond.) = Reading + Cable Loss + Atten.Loss

Result(e.i.r.p.) = Reading + Cable Loss + Atten.Loss + Antenna Gain (with antenna cable loss)

15.407(a)(1) Limit(Cond.) = 16.98dBm(50mW) or  $4 + 10\log(26\text{dB BW})$  dBm

15.407(a)(2) Limit(Cond.) = 23.97dBm(250mW) or  $11 + 10\log(26\text{dB BW})$  dBm

\*ON time was only measured using Gate function.

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### **Peak Power Spectral Density**

Test place                      Shonan EMC Lab. No.7 Shielded Room  
Date                              05/16/2012  
Temperature/ Humidity      25deg.C. / 47%  
Engineer                        Tatsuya Arai  
Mode                              11a Tx, 54Mbps

Antenna 1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
5180.0	-11.35	1.68	10.05	0.37	4.00	3.63
5220.0	-11.56	1.80	10.04	0.28	4.00	3.72
5240.0	-11.54	1.86	10.04	0.36	4.00	3.64

Result = Reading + Cable Loss + Attenuator

**\*ON time was only measured using Gate function.**

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### Peak Power Spectral Density

Test place                      Shonan EMC Lab. No.7 Shielded Room  
Date                              05/16/2012  
Temperature/ Humidity      25deg.C. / 47%  
Engineer                        Tatsuya Arai  
Mode                              11n-20(MIMO) Tx, MCS 8

#### Antenna 0+1

Freq.	Result	Limit	Margin
[MHz]	[dBm]	[dBm]	[dB]
5180.0	1.74	4.00	2.26
5220.0	2.03	4.00	1.97
5240.0	1.88	4.00	2.12

Result [dBm] =  $10 \times \log (10^{\wedge} (\text{Antenna 0 Result [dBm]} / 10) + 10^{\wedge} (\text{Antenna 1 Result [dBm]} / 10))$

#### Antenna 0

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
5180.0	-12.73	1.68	10.05	-1.00	4.00	5.00
5220.0	-12.68	1.80	10.04	-0.84	4.00	4.84
5240.0	-12.75	1.86	10.04	-0.84	4.00	4.84

#### Antenna 1

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
5180.0	-13.29	1.68	10.05	-1.57	4.00	5.57
5220.0	-12.97	1.80	10.04	-1.12	4.00	5.12
5240.0	-13.34	1.86	10.04	-1.44	4.00	5.44

Result = Reading + Cable Loss + Attenuator

**\*ON time was only measured using Gate function.**

## Peak Power Spectral Density

Test place : Shonan EMC Lab. No.7 Shielded Room  
Date : 05/16/2012  
Temperature/ Humidity : 25deg.C. / 47%  
Engineer : Tatsuya Arai  
Mode : 11n-40(MIMO) Tx, MCS 8

### Antenna 0+1

Freq.	Result	Limit	Margin
[MHz]	[dBm]	[dBm]	[dB]
5190.0	-2.06	4.00	6.06
5230.0	-1.07	4.00	5.07

Result [dBm] =  $10 \times \log (10^{(\text{Antenna 0 Result [dBm]} / 10)} + 10^{(\text{Antenna 1 Result [dBm]} / 10)})$

### Antenna 0

Freq.	Reading	Cable Loss	Atten.	Result	Limit
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]
5190.0	-17.04	1.71	10.05	-5.28	4.00
5230.0	-16.09	1.83	10.04	-4.22	4.00

### Antenna 1

Freq.	Reading	Cable Loss	Atten.	Result	Limit
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]
5190.0	-16.62	1.71	10.05	-4.86	4.00
5230.0	-15.81	1.83	10.04	-3.94	4.00

Result = Reading + Cable Loss + Attenuator

**\*ON time was only measured using Gate function.**

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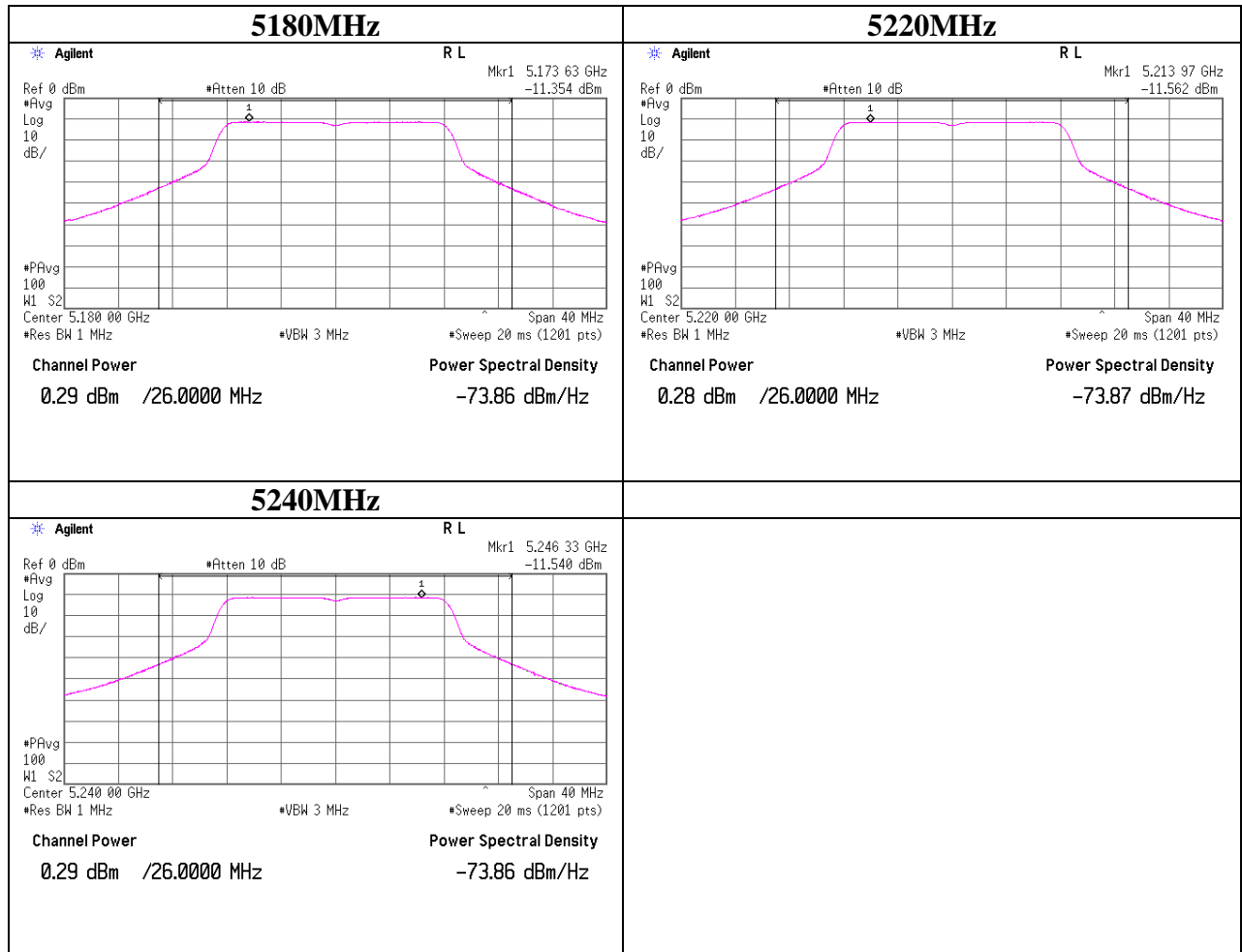
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## Maximum Peak Output Power & Peak Power Spectral Density

### 11a Antenna 1



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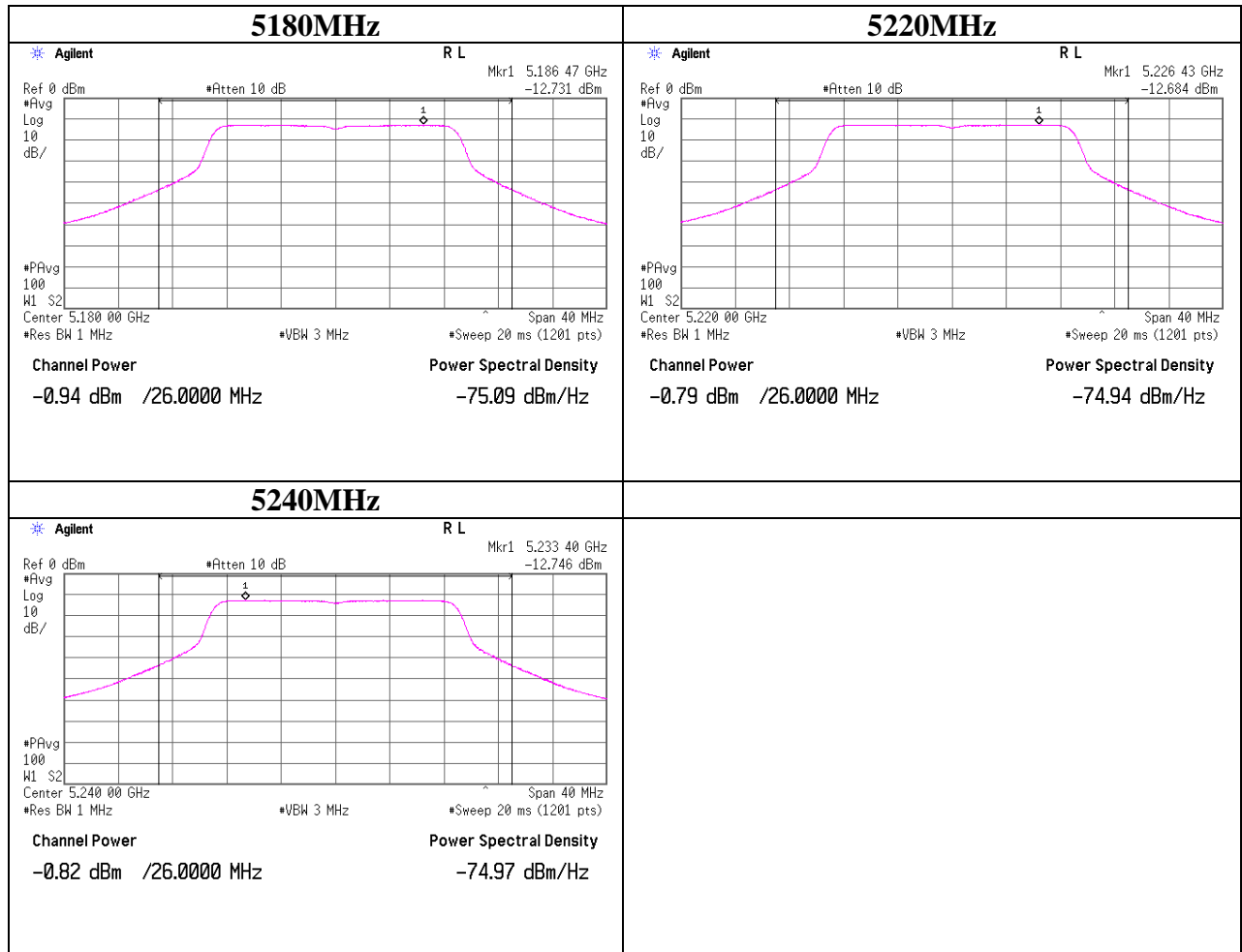
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## Maximum Peak Output Power & Peak Power Spectral Density

### 11n-20 Antenna 0



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**Shonan EMC Lab.**

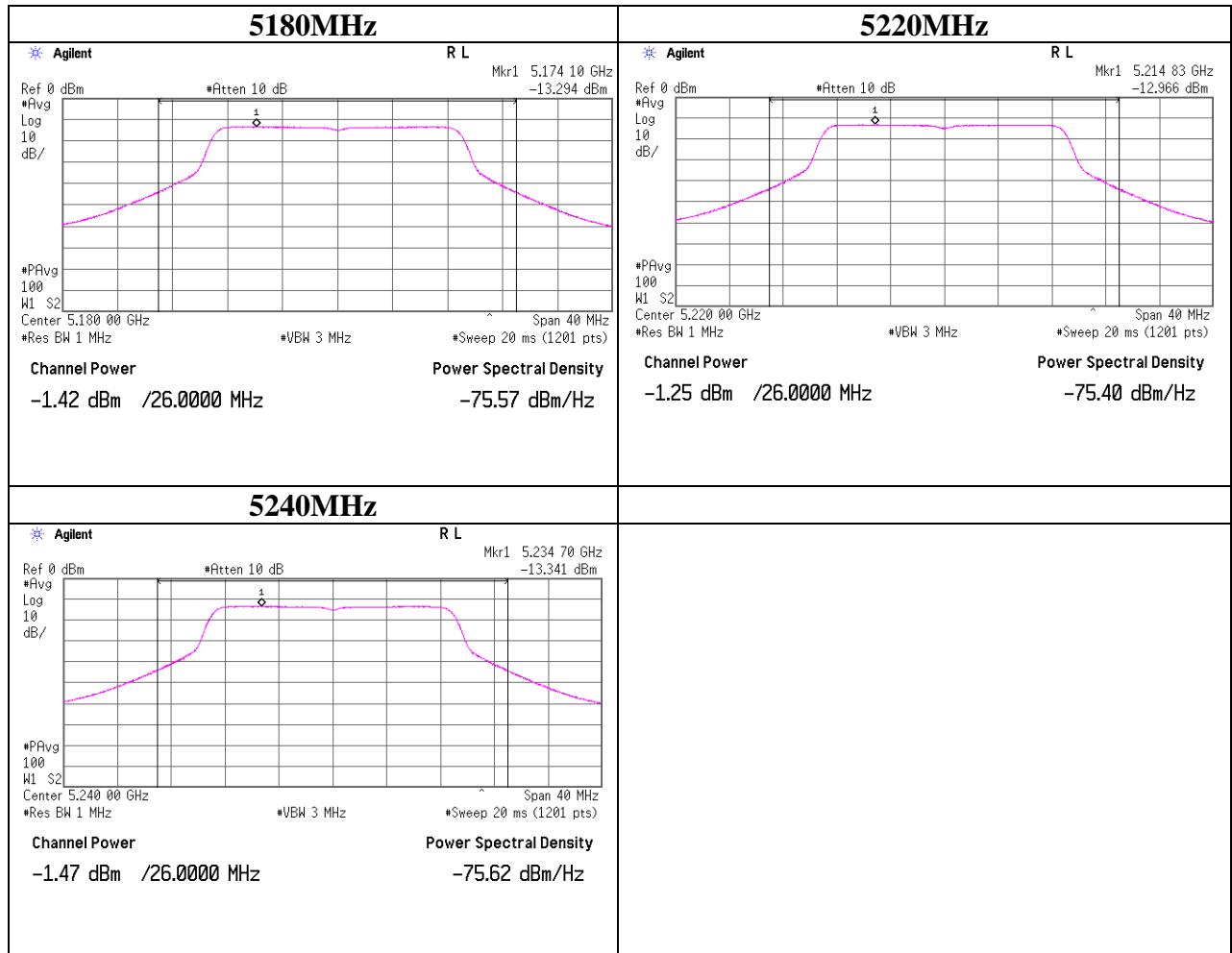
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## Maximum Peak Output Power & Peak Power Spectral Density

### 11n-20 Antenna 1



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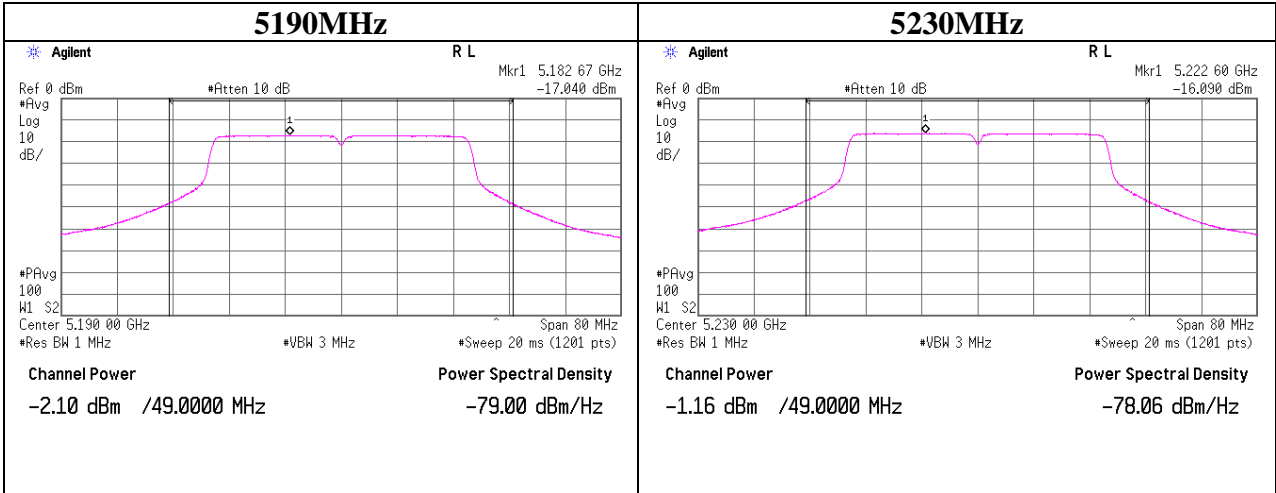
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

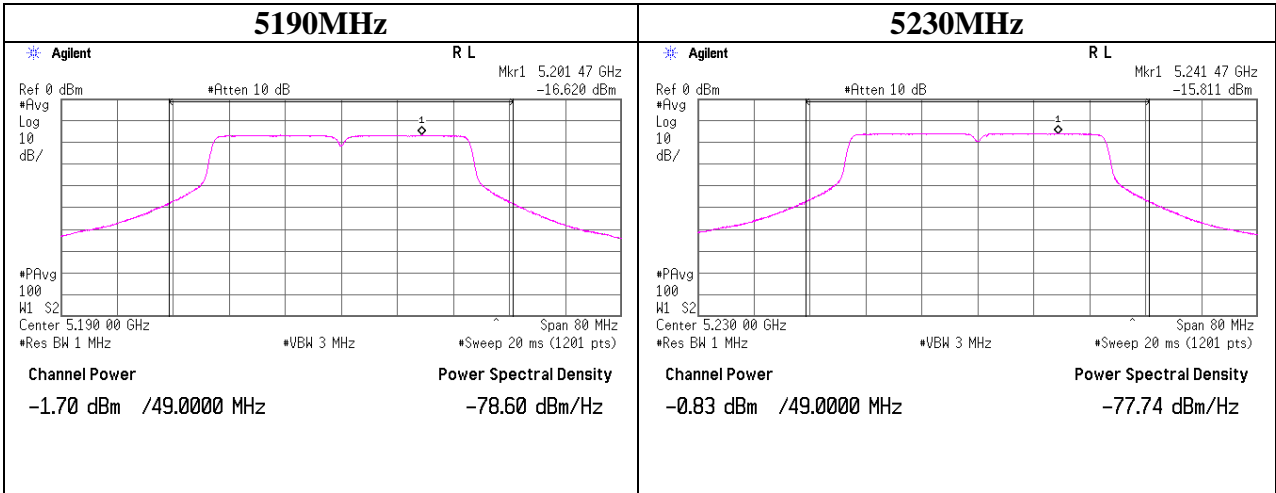


Maximum Peak Output Power & Peak Power Spectral Density

11n-40 Antenna 0



11n-40 Antenna 1



**Maximum Peak Output Power**  
**(Reference data)**

Test place                      Shonan EMC Lab. No.7 Shielded Room  
Date                              05/16/2012  
Temperature/ Humidity        25deg.C. / 47%  
Engineer                        Tatsuya Arai  
Mode                              11a Tx

Antenna 0, 5180MHz

Data Rate [Mbps]	Reading [dBm]	Remark
6	0.10	
9	0.15	
12	0.23	
18	0.17	
24	0.14	
36	0.19	
48	0.17	
54	0.16	

Antenna 1, 5180MHz

Data Rate [Mbps]	Reading [dBm]	Remark
6	0.19	
9	0.25	
12	0.20	
18	0.28	
24	0.23	
36	0.19	
48	0.22	
54	0.29	*

\* Worst Rate

All comparizon were carried out on same frequency and measurement factors.

### Maximum Peak Output Power (Reference data)

Test place : Shonan EMC Lab. No.7 Shielded Room  
Date : 05/16/2012  
Temperature/ Humidity : 25deg.C. / 47%  
Engineer : Tatsuya Arai  
Mode : 11n-20 Tx

11n-20 5180MHz

MCS Number	Reading Antena 0		Reading Antenna 1		Result Antenna 0 + 1		Remark
	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
0	<b>-0.94</b>	0.81	-1.41	0.72	-	-	*(SISO)
1	-0.98	0.80	-1.47	0.71	-	-	
2	-0.99	0.80	-1.49	0.71	-	-	
3	-1.00	0.79	-1.52	0.70	-	-	
4	-1.10	0.78	-1.50	0.71	-	-	
5	-1.03	0.79	-1.51	0.71	-	-	
6	-0.98	0.80	-1.54	0.70	-	-	
7	-1.40	0.72	-1.51	0.71	-	-	
8	-0.94	0.81	-1.42	0.72	<b>1.84</b>	1.53	*(MIMO)
9	-1.20	0.76	-1.44	0.72	1.69	1.48	
10	-1.01	0.79	-1.44	0.72	1.79	1.51	
11	-1.00	0.79	-1.44	0.72	1.80	1.51	
12	-0.94	0.81	-1.44	0.72	1.83	1.52	
13	-0.97	0.80	-1.44	0.72	1.81	1.52	
14	-1.01	0.79	-1.43	0.72	1.80	1.51	
15	-1.30	0.74	-1.43	0.72	1.65	1.46	

\*: Worst Rate

Sample Calculation:

Result Antenna 0 + 1[dBm] = 10\*LOG(Result Antenna 0 + 1[mW])

Result Antenna 0 + 1[mW] = Reading Antenna 0[mW] + Reading Antenna 1[mW]

All comparizon were carried out on same frequency and measurement factors.

### Maximum Peak Output Power (Reference data)

Test place : Shonan EMC Lab. No.7 Shielded Room  
Date : 05/16/2012  
Temperature/ Humidity : 25deg.C. / 47%  
Engineer : Tatsuya Arai  
Mode : 11n-40 Tx

11n-40 5190MHz

MCS Number	Reading Antena 0		Reading Antenna 1		Result Antenna 0 + 1		Remark
	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
0	-2.20	0.60	<b>-1.85</b>	0.65	-	-	*(SISO)
1	-2.22	0.60	-1.87	0.65	-	-	
2	-2.24	0.60	-1.87	0.65	-	-	
3	-2.22	0.60	-1.87	0.65	-	-	
4	-2.24	0.60	-1.88	0.65	-	-	
5	-2.20	0.60	-1.91	0.64	-	-	
6	-2.23	0.60	-1.86	0.65	-	-	
7	-2.26	0.59	-1.87	0.65	-	-	
8	-2.10	0.62	-1.70	0.68	<b>1.11</b>	1.29	*(MIMO)
9	-2.12	0.61	-1.73	0.67	1.09	1.29	
10	-2.12	0.61	-1.72	0.67	1.09	1.29	
11	-2.16	0.61	-1.71	0.67	1.08	1.28	
12	-2.17	0.61	-1.79	0.66	1.03	1.27	
13	-2.13	0.61	-1.71	0.67	1.10	1.29	
14	-2.13	0.61	-1.76	0.67	1.07	1.28	
15	-2.11	0.62	-1.70	0.68	1.11	1.29	

\*: Worst Rate

Sample Calculation:

Result Antenna 0 + 1[dBm] = 10\*LOG(Result Antenna 0 + 1[mW])

Result Antenna 0 + 1[mW] = Reading Antenna 0[mW] + Reading Antenna 1[mW]

All comparizon were carried out on same frequency and measurement factors.

## Maximum Peak Output Power ( Reference data for SAR testing)

Test place : Shonan EMC Lab. No.7 Shielded Room  
Date : 05/17/2012  
Temperature/ Humidity : 25deg.C. / 51%  
Engineer : Hiroshi Naka

### 11a (6Mbps) (\* P/M: Power Meter with power sensor, AV: Average)

Antenna	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result	
						[dBm]	[mW]
Ant0	5180.0	0.92	1.20	10.04	0.02	12.18	16.52
	5220.0	0.63	1.20	10.04	0.02	11.89	15.45
	5240.0	0.55	1.20	10.04	0.02	11.81	15.17
Ant1	5180.0	0.65	1.27	10.04	0.02	11.98	15.78
	5220.0	0.56	1.27	10.04	0.02	11.89	15.45
	5240.0	0.54	1.27	10.04	0.02	11.87	15.38

### 11n-20 (MCS0) (\* P/M: Power Meter with power sensor, AV: Average)

Antenna	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result	
						[dBm]	[mW]
Ant0	5180.0	-0.82	1.20	10.04	0.02	10.44	11.07
	5220.0	-0.86	1.20	10.04	0.02	10.40	10.96
	5240.0	-0.85	1.20	10.04	0.02	10.41	10.99
Ant1	5180.0	-0.59	1.27	10.04	0.02	10.74	11.86
	5220.0	-0.72	1.27	10.04	0.02	10.61	11.51
	5240.0	-0.72	1.27	10.04	0.02	10.61	11.51

### 11n-40 (MCS0) (\* P/M: Power Meter with power sensor, AV: Average)

Antenna	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result	
						[dBm]	[mW]
Ant0	5190.0	-1.59	1.20	10.04	0.04	9.69	9.31
	5230.0	-0.67	1.20	10.04	0.04	10.61	11.51
Ant1	5190.0	-1.60	1.27	10.04	0.04	9.75	9.44
	5230.0	-0.61	1.27	10.04	0.04	10.74	11.86

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss + Duty factor

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## Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber		
Date	05/28/2012	05/29/2012	05/30/2012
Temperature/ Humidity	23deg. C / 49% RH	25deg. C / 54% RH	26deg. C / 45% RH
Engineer	Yasumasa Owaki	Yasumasa Owaki	Yasumasa Owaki
Mode	11n-20(MIMO) Tx 5180MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Inside or Outside of Restricted Bands	Remark
Hori.	5150.000	PK	43.8	31.8	16.3	36.8	55.1	68.2	13.1	171	101	Bandedge	
Hori.	10360.000	PK	45.6	39.6	9.1	37.3	57.0	68.2	11.2	100	0	Outside	
Hori.	15540.000	PK	45.0	39.5	1.7	38.0	48.2	73.9	25.7	100	0	Inside	
Hori.	5150.000	AV	34.1	31.8	16.3	36.8	45.4	53.9	8.5	171	101	Bandedge	
Hori.	15540.000	AV	35.4	39.5	1.7	38.0	38.6	53.9	15.3	100	0	Inside	
Vert.	5150.000	PK	44.8	31.8	16.3	36.8	56.1	68.2	12.1	100	158	Bandedge	
Vert.	10360.000	PK	45.3	39.6	9.1	37.3	56.7	68.2	11.5	100	0	Outside	
Vert.	15540.000	PK	44.7	39.5	1.7	38.0	47.9	73.9	26.0	100	0	Inside	
Vert.	5150.000	AV	34.2	31.8	16.3	36.8	45.5	53.9	8.4	100	158	Bandedge	
Vert.	15540.000	AV	35.3	39.5	1.7	38.0	38.5	53.9	15.4	100	0	Inside	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

\*AV: Method 1

Distance factor: 15GHz-40GHz  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

## Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber		
Date	05/28/2012	05/29/2012	05/30/2012
Temperature/ Humidity	23deg. C / 49% RH	25deg. C / 54% RH	26deg. C / 45% RH
Engineer	Yasumasa Owaki	Yasumasa Owaki	Yasumasa Owaki
Mode	11n-20(MIMO) Tx 5220MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Inside or Outside of Restricted Bands	Remark
Hori.	499.993	QP	31.4	17.3	8.1	31.7	25.1	46.0	20.9	165	233	Outside	
Hori.	599.982	QP	31.8	19.3	8.6	31.7	28.0	46.0	18.0	132	249	Outside	
Hori.	799.985	QP	32.4	20.8	9.5	31.4	31.3	46.0	14.7	100	240	Outside	
Vert.	40.000	QP	22.3	14.8	7.1	31.9	12.3	40.0	27.7	100	17	Outside	
Vert.	599.980	QP	30.0	19.3	8.6	31.7	26.2	46.0	19.8	100	221	Outside	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Inside or Outside of Restricted Bands	Remark
Hori.	10440.000	PK	45.2	39.7	9.1	37.4	56.6	68.2	11.6	100	0	Outside	
Hori.	15660.000	PK	45.1	39.2	1.7	38.0	48.0	73.9	25.9	100	0	Inside	
Hori.	15660.000	AV	34.6	39.2	1.7	38.0	37.5	53.9	16.4	100	0	Inside	
Vert.	10440.000	PK	45.6	39.7	9.1	37.4	57.0	68.2	11.2	100	0	Outside	
Vert.	15660.000	PK	44.4	39.2	1.7	38.0	47.3	73.9	26.6	100	0	Inside	
Vert.	15660.000	AV	34.6	39.2	1.7	38.0	37.5	53.9	16.4	100	0	Inside	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

\*AV: Method 1

Distance factor: 15GHz-40GHz 20log(3.0m/1.0m)= 9.5dB

## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Anechoic Chamber  
Date : 05/28/2012 05/29/2012 05/30/2012  
Temperature/ Humidity : 23deg. C / 49% RH 25deg. C / 54% RH 26deg. C / 45% RH  
Engineer : Yasumasa Owaki Yasumasa Owaki Yasumasa Owaki  
Mode : 11n-20(MIMO) Tx 5240MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Inside or Outside of Restricted Bands	Remark
Hori.	5350.000	PK	43.9	31.9	16.5	36.8	55.5	68.2	12.7	169	106	Bandedge	
Hori.	10480.000	PK	45.1	39.8	9.1	37.4	56.6	68.2	11.6	100	0	Outside	
Hori.	15720.000	PK	44.3	39.0	1.7	37.9	47.1	73.9	26.8	100	0	Inside	
Hori.	5350.000	AV	34.3	31.9	16.5	36.8	45.9	53.9	8.0	169	106	Bandedge	
Hori.	15720.000	AV	34.7	39.0	1.7	37.9	37.5	53.9	16.4	100	0	Inside	
Vert.	5350.000	PK	44.4	31.9	16.5	36.8	56.0	68.2	12.2	100	166	Bandedge	
Vert.	10480.000	PK	45.0	39.8	9.1	37.4	56.5	68.2	11.7	100	0	Outside	
Vert.	15720.000	PK	44.5	39.0	1.7	37.9	47.3	73.9	26.6	100	0	Inside	
Vert.	5350.000	AV	34.2	31.9	16.5	36.8	45.8	53.9	8.1	100	166	Bandedge	
Vert.	15720.000	AV	34.6	39.0	1.7	37.9	37.4	53.9	16.5	100	0	Inside	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty Factor(AV)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

\*AV: Method 1

Distance factor: 15GHz-40GHz  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$



## Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber		
Date	05/28/2012	05/29/2012	05/30/2012
Temperature/ Humidity	23deg. C / 49% RH	25deg. C / 54% RH	26deg. C / 45% RH
Engineer	Yasumasa Owaki	Yasumasa Owaki	Yasumasa Owaki
Mode	11n-40(MIMO) Tx 5190MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Inside or Outside of Restricted Bands	Remark
Hori.	5150.000	PK	44.0	31.8	16.3	36.8	55.3	68.2	12.9	170	105	Bandedge	
Hori.	10380.000	PK	45.1	39.7	9.1	37.3	56.6	68.2	11.6	100	0	Outside	
Hori.	15570.000	PK	45.8	39.5	1.6	38.0	48.9	73.9	25.0	100	0	Inside	
Hori.	5150.000	AV	34.2	31.8	16.3	36.8	45.5	53.9	8.4	170	105	Bandedge	
Vert.	5150.000	PK	44.9	31.8	16.3	36.8	56.2	68.2	12.0	100	159	Bandedge	
Vert.	10380.000	PK	45.6	39.7	9.1	37.3	57.1	68.2	11.1	100	0	Outside	
Vert.	15570.000	PK	44.7	39.5	1.6	38.0	47.8	73.9	26.1	100	0	Inside	
Vert.	5150.000	AV	34.9	31.8	16.3	36.8	46.2	53.9	7.7	100	159	Bandedge	
Vert.	15570.000	AV	35.1	39.5	1.6	38.0	38.2	53.9	15.7	100	0	Inside	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

\*AV: Method 1

Distance factor: 15GHz-40GHz  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

## Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber		
Date	05/28/2012	05/29/2012	05/30/2012
Temperature/ Humidity	23deg. C / 49% RH	25deg. C / 54% RH	26deg. C / 45% RH
Engineer	Yasumasa Owaki	Yasumasa Owaki	Yasumasa Owaki
Mode	11n-40(MIMO) Tx 5230MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Inside or Outside of Restricted Bands	Remark
Hori.	499.995	QP	30.9	17.3	8.1	31.7	24.6	46.0	21.4	164	232	Outside	
Hori.	599.982	QP	31.4	19.3	8.6	31.7	27.6	46.0	18.4	129	245	Outside	
Hori.	799.984	QP	32.0	20.8	9.5	31.4	30.9	46.0	15.1	100	243	Outside	
Vert.	40.000	QP	22.3	14.8	7.1	31.9	12.3	40.0	27.7	100	137	Outside	
Vert.	599.983	QP	30.1	19.3	8.6	31.7	26.3	46.0	19.7	100	226	Outside	
Vert.	799.980	QP	29.6	20.8	9.5	31.4	28.5	46.0	17.5	150	227	Outside	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Inside or Outside of Restricted Bands	Remark
Hori.	5350.000	PK	43.7	31.9	16.5	36.8	55.3	68.2	12.9	171	101	Bandedge	
Hori.	10460.000	PK	45.3	39.8	9.1	37.4	56.8	68.2	11.4	100	0	Outside	
Hori.	15690.000	PK	44.2	39.1	1.6	37.9	47.0	73.9	26.9	100	0	Inside	
Hori.	5350.000	AV	34.1	31.9	16.5	36.8	45.7	53.9	8.2	171	101	Bandedge	
Hori.	15690.000	AV	34.8	39.1	1.6	37.9	37.6	53.9	16.3	100	0	Inside	
Vert.	5350.000	PK	43.9	31.9	16.5	36.8	55.5	68.2	12.7	100	158	Bandedge	
Vert.	10460.000	PK	45.7	39.8	9.1	37.4	57.2	68.2	11.0	100	0	Outside	
Vert.	15690.000	PK	44.4	39.1	1.6	37.9	47.2	73.9	26.7	100	0	Inside	
Vert.	5350.000	AV	34.2	31.9	16.5	36.8	45.8	53.9	8.1	100	158	Bandedge	
Vert.	15690.000	AV	34.8	39.1	1.6	37.9	37.6	53.9	16.3	100	0	Inside	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

\*AV: Method 1

Distance factor: 15GHz-40GHz 20log(3.0m/1.0m)= 9.5dB

**UL Japan, Inc.**

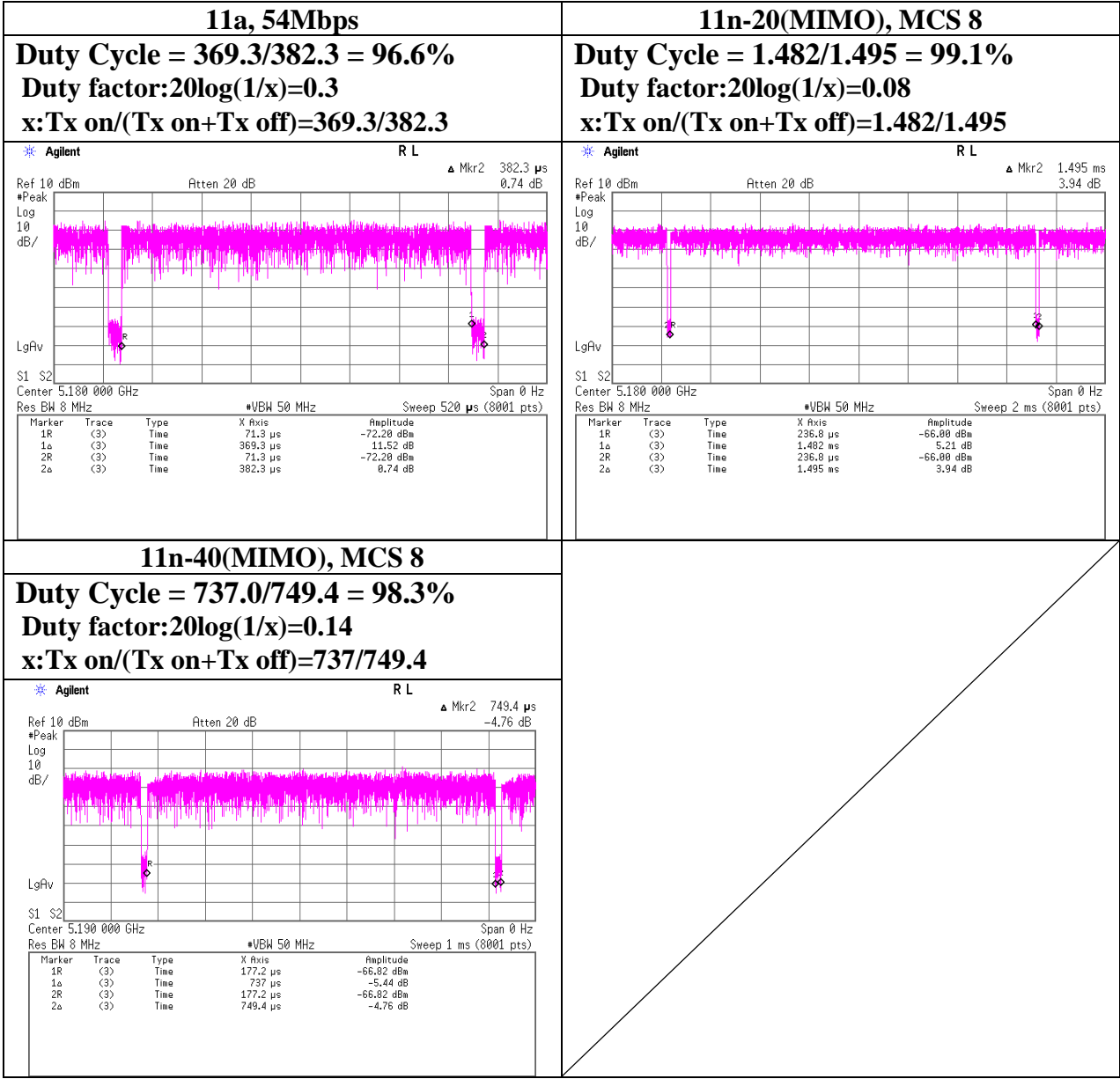
**Shonan EMC Lab.**

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

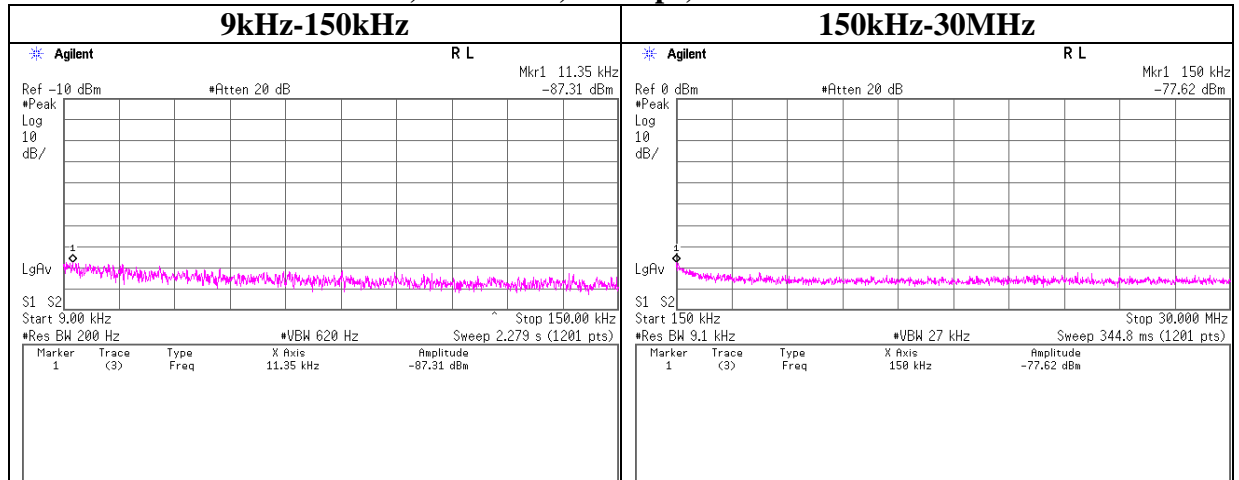
Facsimile : +81 463 50 6401

Duty Cycle



## Conducted Spurious Emission

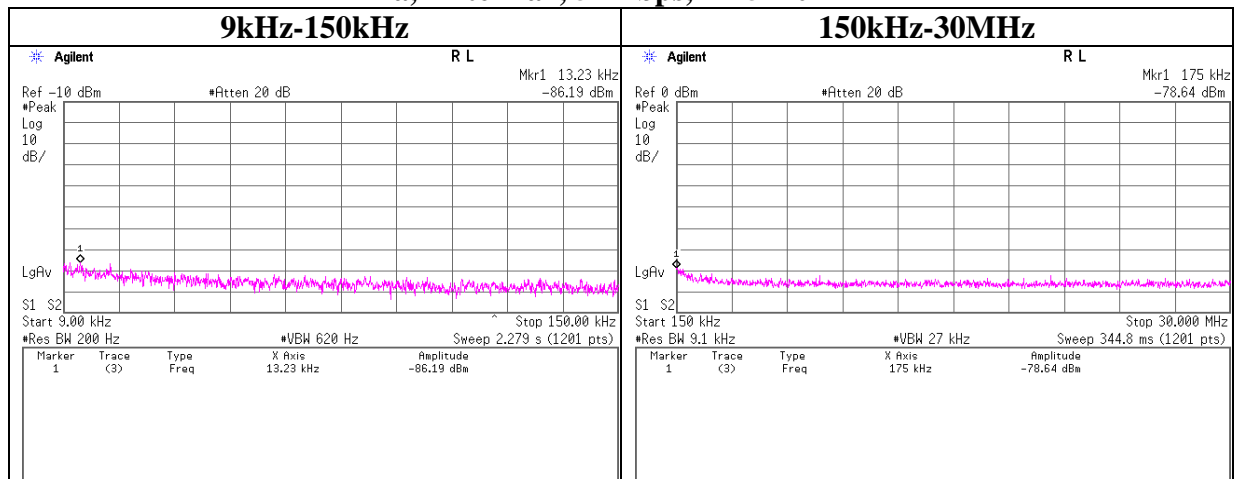
### 11a, Antenna1, 54Mbps, Tx 5180MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	RBW factor	EIRP	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dB]	[dB]	[dBm]	[dBm]	[dB]	
11.35	-87.3	0.0	5.9	2.14	37.0	-42.2	-27.0	15.2	
150.00	-77.6	0.0	5.9	2.14	20.4	-49.2	-27.0	22.2	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + RBW factor

### 11a, Antenna1, 54Mbps, Tx 5220MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	RBW factor	EIRP	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dB]	[dB]	[dBm]	[dBm]	[dB]	
13.23	-86.2	0.0	5.9	2.14	37.0	-41.1	-27.0	14.1	
175.00	-78.6	0.0	5.9	2.14	20.4	-50.2	-27.0	23.2	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + RBW factor

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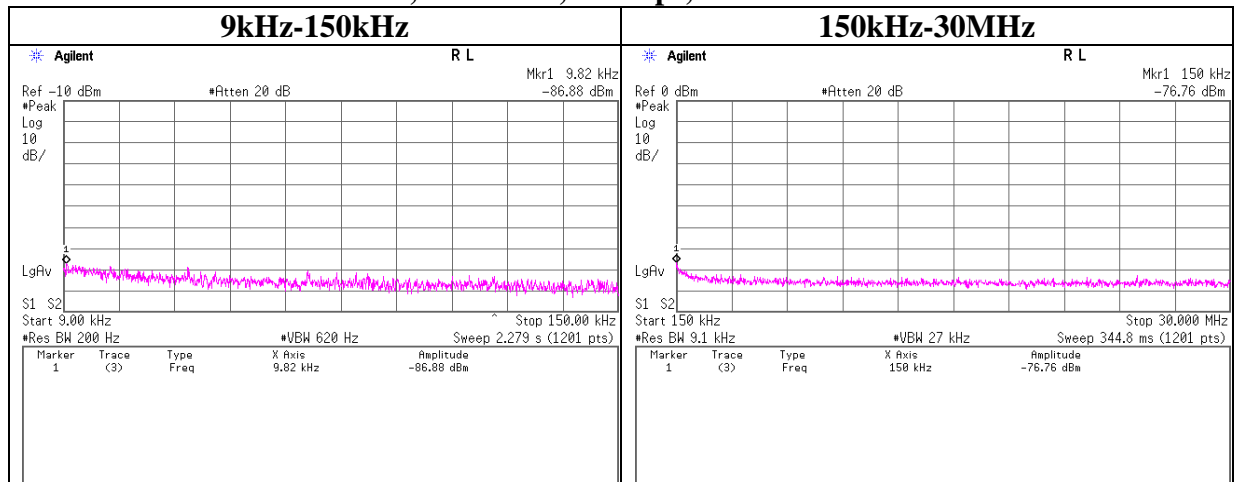
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

## Conducted Spurious Emission

### 11a, Antenna1, 54Mbps, Tx 5240MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	RBW factor	EIRP	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dB]	[dB]	[dBm]	[dBm]	[dB]	
9.82	-86.9	0.0	5.9	2.14	37.0	-41.8	-27.0	14.8	
150.00	-76.8	0.0	5.9	2.14	20.4	-68.8	-27.0	41.8	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + RBW factor

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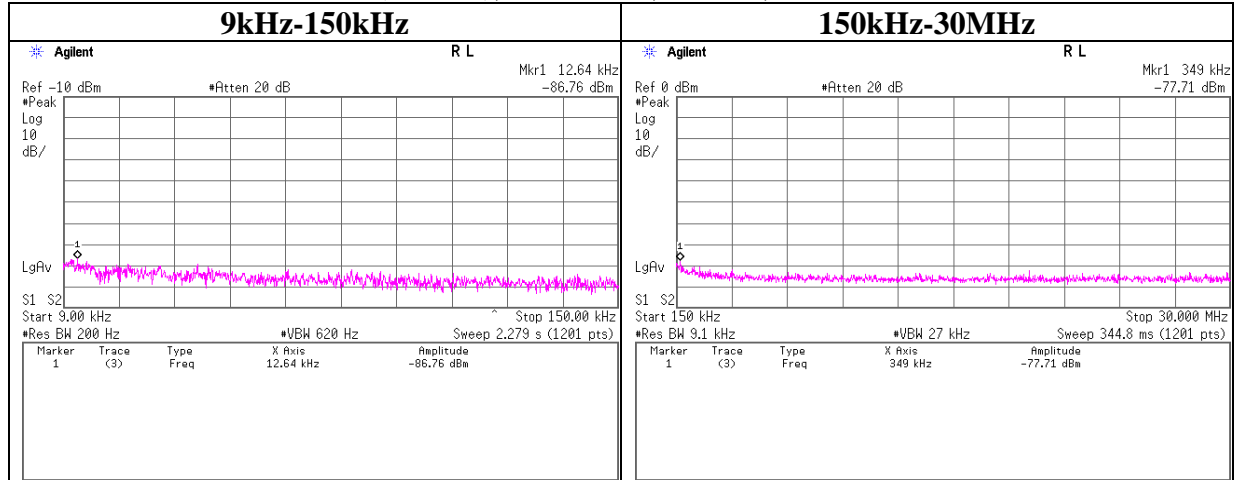
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## Conducted Spurious Emission

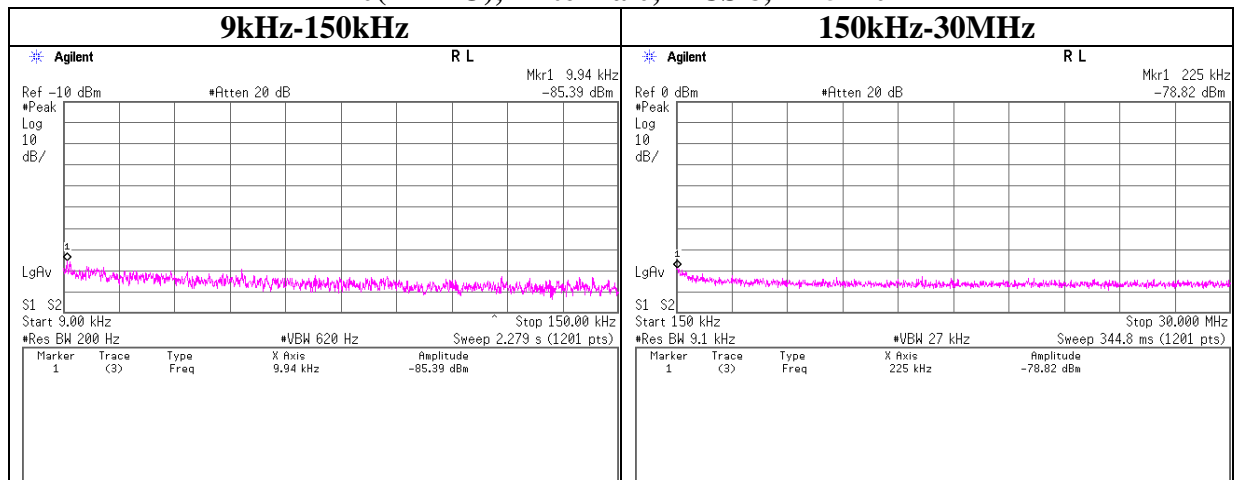
### 11n-20(MIMO), Antenna 0, MCS 8, Tx 5180MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	N	RBW factor	EIRP	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dB]	(Number of Output)	[dB]	[dBm]	[dBm]	[dB]	
12.64	-86.8	0.0	5.9	2.14	2	37.0	-38.7	-27.0	11.7	
349.00	-77.7	0.0	5.9	2.14	2	20.4	-46.3	-27.0	19.3	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + 10\*LOG(N) + RBW factor

### 11n-20(MIMO), Antenna 0, MCS 8, Tx 5220MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	N	RBW factor	EIRP	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dB]	(Number of Output)	[dB]	[dBm]	[dBm]	[dB]	
9.94	-85.4	0.0	5.9	2.14	2	37.0	-37.3	-27.0	10.3	
225.00	-78.8	0.0	5.9	2.14	2	20.4	-47.4	-27.0	20.4	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + 10\*LOG(N) + RBW factor

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**Shonan EMC Lab.**

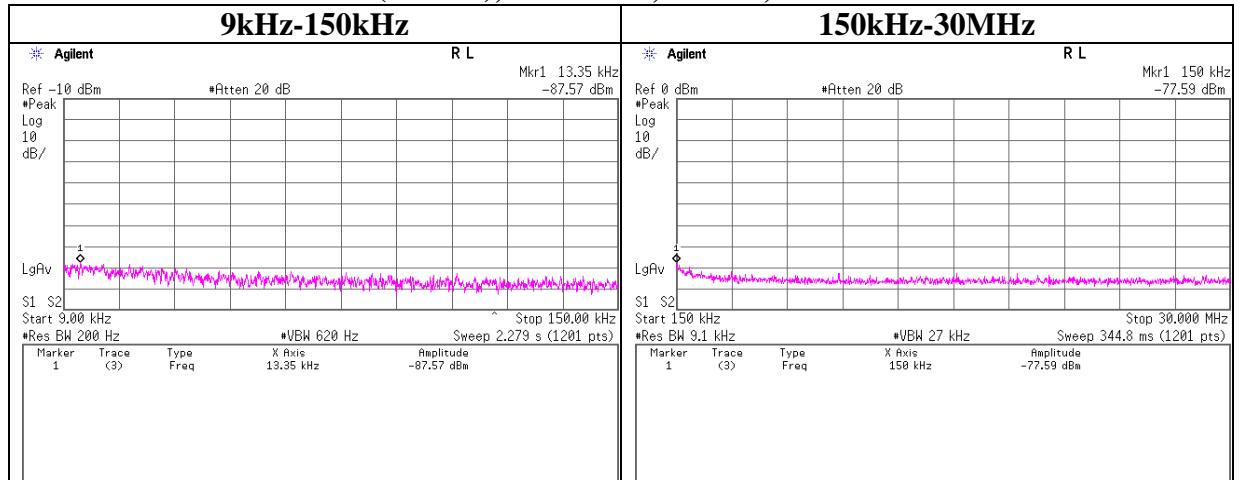
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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## Conducted Spurious Emission

### 11n-20(MIMO), Antenna 0, MCS 8, Tx 5240MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	N (Number of Output)	RBW factor	EIRP	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dB]		[dB]	[dBm]	[dBm]	[dB]	
13.35	-87.6	0.0	5.9	2.14	2	37.0	-39.5	-27.0	12.5	
150.00	-77.6	0.0	5.9	2.14	2	20.4	-46.2	-27.0	19.2	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + 10\*LOG(N) + RBW factor

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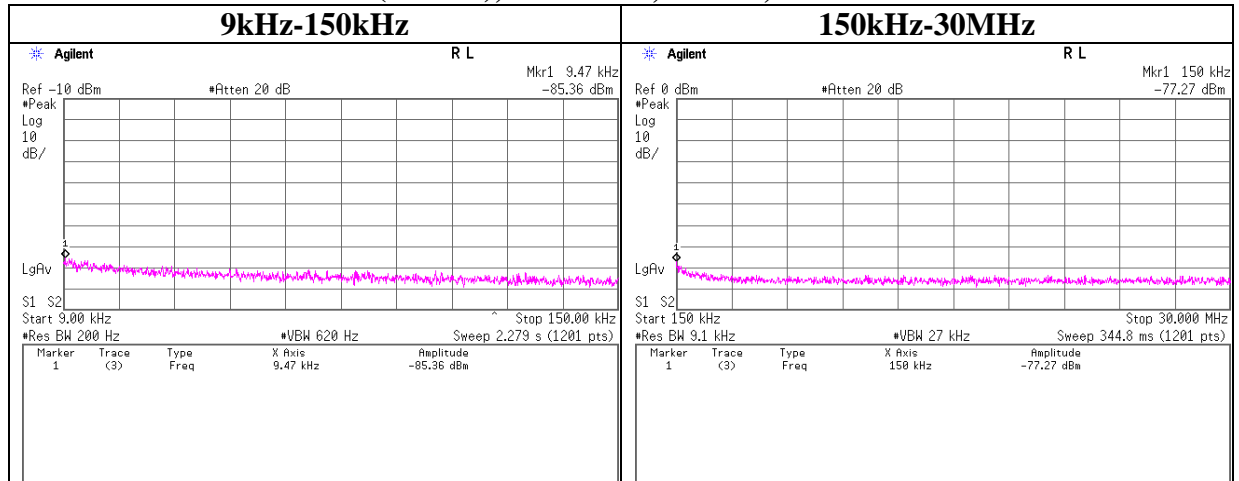
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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## Conducted Spurious Emission

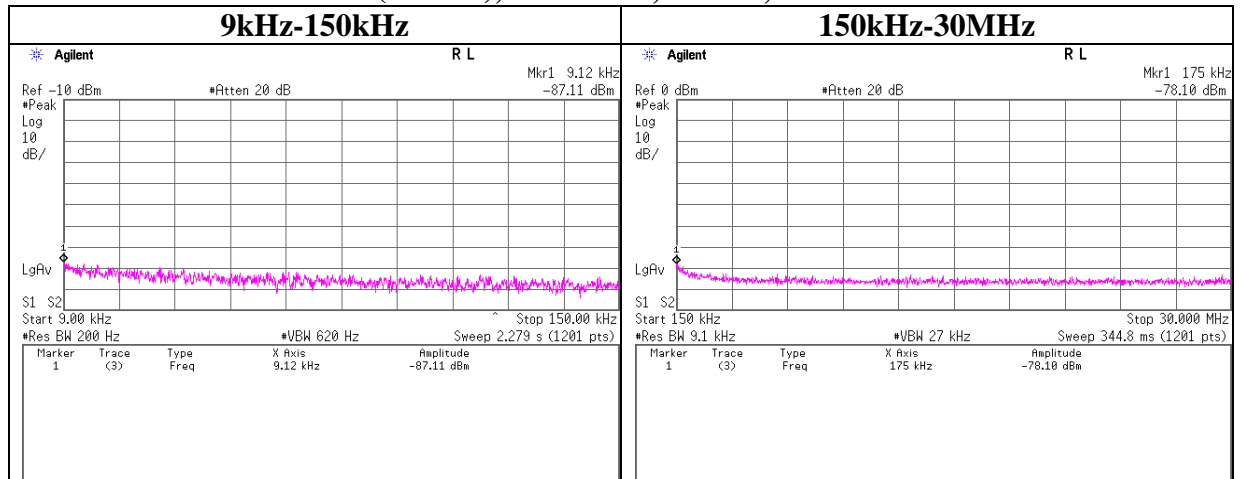
### 11n-40(MIMO), Antenna 1, MCS 8, Tx 5190MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dB]	N (Number of Output)	RBW factor [dB]	EIRP [dBm]	Limit [dBm]	Margin [dB]	Remark
9.47	-85.4	0.0	5.9	2.14	2	37.0	-37.3	-27.0	10.3	
150.00	-77.3	0.0	5.9	2.14	2	20.4	-45.8	-27.0	18.8	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + 10\*LOG(N) + RBW factor

### 11n-40(MIMO), Antenna 1, MCS 8, Tx 5230MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dB]	N (Number of Output)	RBW factor [dB]	EIRP [dBm]	Limit [dBm]	Margin [dB]	Remark
9.12	-87.1	0.0	5.9	2.14	2	37.0	-39.0	-27.0	12.0	
175.00	-78.1	0.0	5.9	2.14	2	20.4	-46.7	-27.0	19.7	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain (without antenna cable loss) + 10\*LOG(N) + RBW factor

**UL Japan, Inc.**  
**Shonan EMC Lab.**

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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### **Peak Excursion Ratio**

Test place Head Office EMC Lab. No.4 Measurement Room  
Report No. 31JE0038-HO-01  
Date 05/10/2012  
Temperature/ Humidity 22deg.C. / 57%  
Engineer Yutaka Yoshida  
Mode 11a Tx, 54Mbps  
Mode 11n-20(MIMO) Tx, MCS 8  
Mode 11n-40(MIMO) Tx, MCS 8

#### 11a

Antenna	Frequency [MHz]	Peak Power Excursion [dB]	Limit [dB]
1	5180	9.91	13.00
	5220	10.33	13.00
	5240	10.42	13.00

#### 11n-20(MIMO)

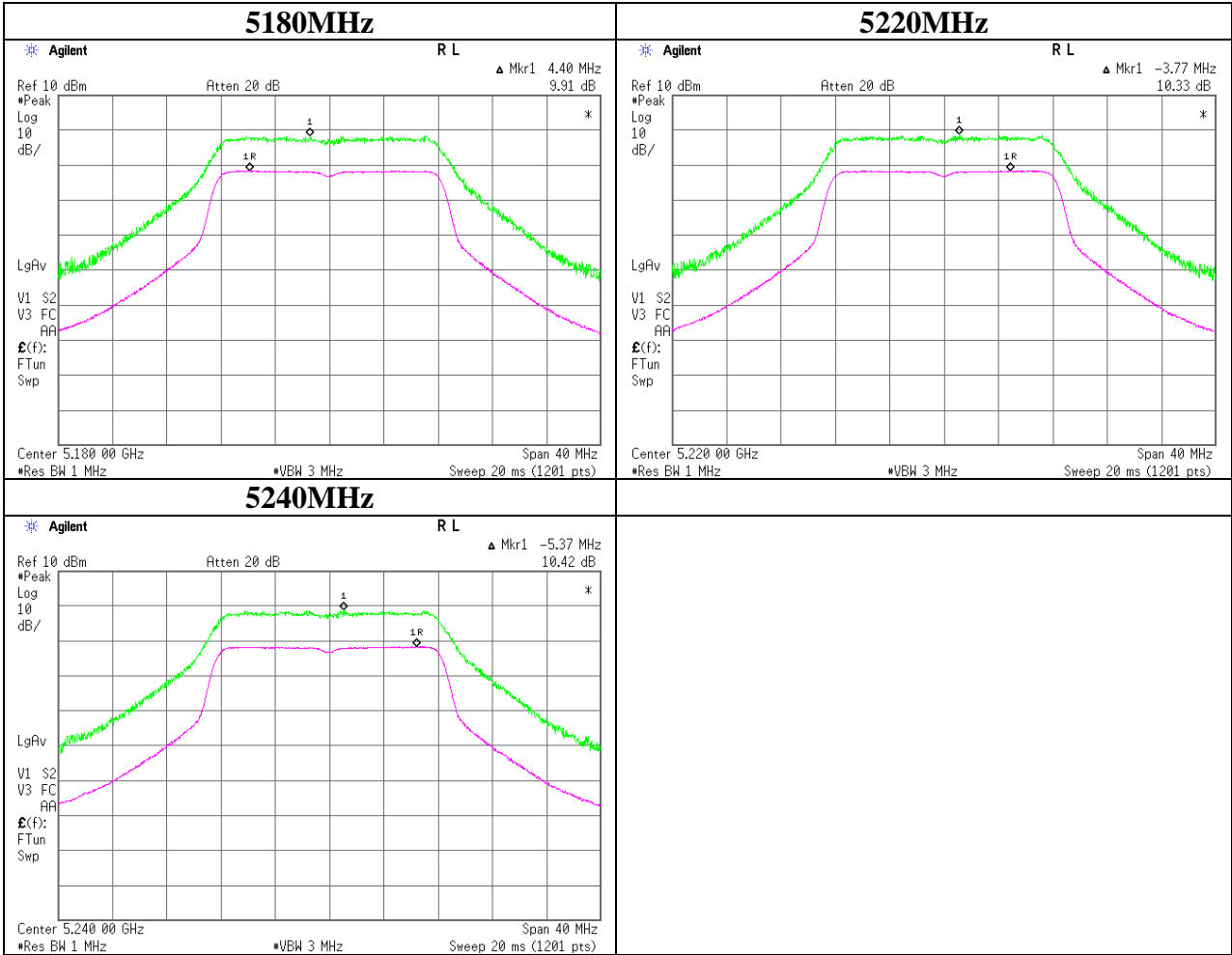
Antenna	Frequency [MHz]	Peak Power Excursion [dB]	Limit [dB]
0	5180	11.12	13.00
	5220	10.63	13.00
	5240	10.51	13.00

#### 11n-40(MIMO)

Antenna	Frequency [MHz]	Peak Power Excursion [dB]	Limit [dB]
1	5190	11.04	13.00
	5230	10.82	13.00

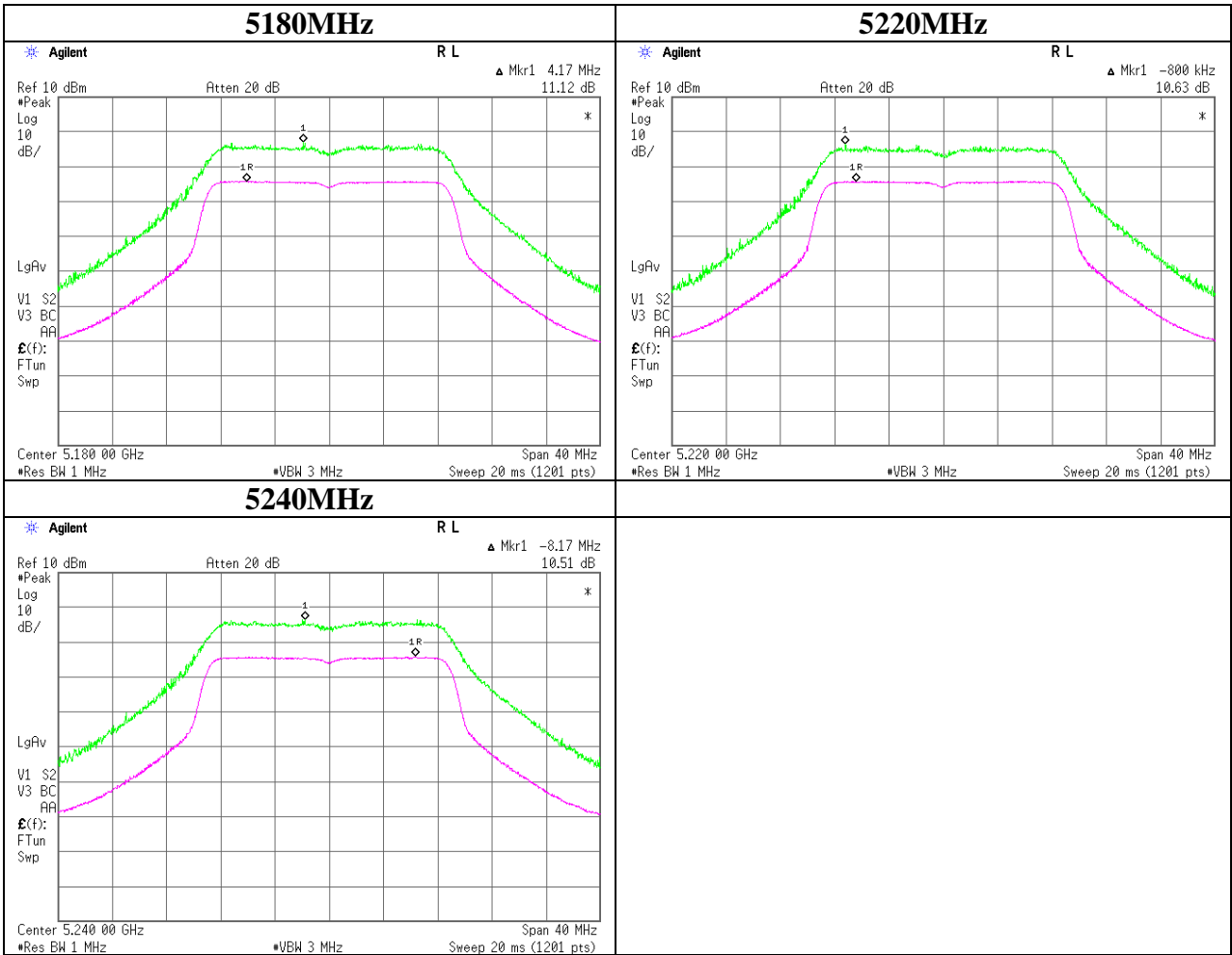
Peak Excursion Ratio

11a Antenna 1



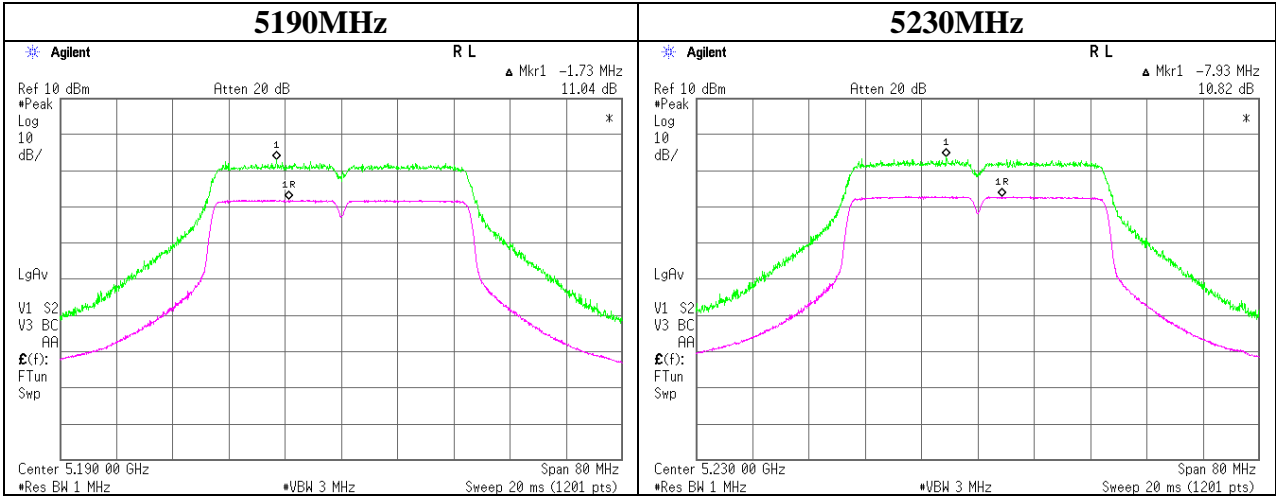
Peak Excursion Ratio

11n-20 Antenna 0



Peak Excursion Ratio

11n-40 Antenna 1



## APPENDIX 2: Test instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2012/04/06 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2011/10/28 * 12
MCC-103	Microwave Cable	Hirose Electric	U.FL-2LP-066J1-A(200)	-	AT	2011/06/24 * 12
MAT-24	Attenuator(10dB)(above1 GHz)	Agilent	8493C	71389	AT	2011/06/23 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2012/03/27 * 12
MCC-105	Microwave Cable	Hirose Electric	U.FL-2LP-066J1-A(200)	-	AT	2011/06/24 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	-	AT	2012/02/06 * 12
MOS-23	Thermo-Hygrometer	Custom	CTH-201	0004	AT	2011/12/09 * 12
MCC-31	Coaxial cable	UL Japan	-	-	AT	2011/07/28 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	AT	2011/11/02 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2012/04/06 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2011/10/28 * 12
MCC-103	Microwave Cable	Hirose Electric	U.FL-2LP-066J1-A(200)	-	AT	2011/06/24 * 12
MAT-24	Attenuator(10dB)(above1 GHz)	Agilent	8493C	71389	AT	2011/06/23 * 12
SCC-G11	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	AT	2012/03/12 * 12
SAT10-11	Attenuator	Weinschel Corp.	54A-10	37588	AT	2012/04/06 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	AT	2012/03/26 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2011/12/27 * 12
SFL-03	Highpass Filter	MICRO-TRONICS	HPM50112	28	RE	2011/12/27 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE/AT	2012/03/16 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2012/03/12 * 12
SCC-G02	Coaxial Cable	Suhner	SUCOFLEX 104A	46498/4A	RE	2012/04/10 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2012/05/22 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2011/08/28 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2012/02/06 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SHA-04	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	RE	2012/03/30 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	19	RE	2012/03/12 * 12
SCC-G17	Coaxial Cable	Suhner	SUCOFLEX 104A	46291/4A	RE	2012/03/12 * 12
SHA-06	Horn Antenna	ETS LINDGREN	Oct-60	LM3459	RE	2012/03/30 * 12
SAF-10	Pre Amplifier	TOYO Corporation	HAP26-40W	10	RE	2012/03/12 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2012/03/12 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2012/02/10 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2012/02/10 * 12
SAT3-02	Attenuator	JFW	50HF-003N	-	RE	2012/02/10 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2011/11/16 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2012/04/10 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2012/04/10 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0893	RE	2011/11/16 * 12
STR-02	Test Receiver	Rohde & Schwarz	ESCI	100575	RE	2011/08/04 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2011/09/25 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: RE: Radiated Emission  
AT: Antenna Terminal Conducted test