



RADIO TEST REPORT

Test Report No. : 10028285S-A

Applicant : FUJIFILM Corporation
Type of Equipment : Flat Panel Sensor
Model No. : DR-ID 911SE
FCC ID : W2Z-01000005
Test regulation : FCC Part 15 Subpart E: 2013
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.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test: May 31, 2012 to July 4, 2013

Representative test engineer:

Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

Approved by:

Toyokazu Imamura
Leader of WiSE Japan,
UL Verification Service



- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 10028285S-A

[illegible]

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SECTION 1: Customer information

Company Name : FUJIFILM Corporation
Address : 798 Miyanodai, Kaisei-Machi, Ashigarakami-Gun, Kanagawa-ken,
258-8538, Japan
Telephone Number : +81-465-85-4500
Facsimile Number : +81-465-85-2043
Contact Person : Kouichi Okada

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 911SE
Serial No. : Refer to Section 4.2
Rating : DC24V
Receipt Date of Sample : February 17, 2012 (S/N: H120003)
July 3, 2013 (S/N: 26820008)
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 911SE (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 : FCC Part 15 Subpart E: 2013, final revised on June 11, 2013 and effective July 11, 2013
*The revision on June 11, 2013 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 C63.4:2009 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 C63.4:2009 FCC KDB 789033 D01 v01r03 IC: -	FCC : 15.407(a)(1)(2)(3) IC: -	See data	N/A	Conducted
Maximum Peak Output Power	FCC :ANSI C63.4:2009, FCC KDB 789033 D01 v01r03 IC: -	FCC : 15.407(a)(1)(2)(3) IC: RSS-210 A9.2(1)(2)(3)		Complied	Conducted
Peak Power Spectral Density	FCC :ANSI C63.4:2009, FCC KDB 789033 D01 v01r03 IC: -	FCC : 15.407(a)(1)(2)(3) IC: RSS-210 A9.2(1)(2)(3)		Complied	Conducted
Peak Excursion Ratio	FCC :ANSI C63.4:2009, FCC KDB 789033 D01 v01r03 IC: -	FCC : 15.407(a)(6) IC: -		Complied	Conducted
Spurious Emission Restricted Band Edge	FCC: ANSI C63.4:2009 FCC KDB 789033 D01 v01r03 IC: -	FCC : 15.407(b), 15.205 and 15.209 IC: RSS-210 A.9.2(1)(2)(3)	6.0dB 30.612MHz, QP, 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

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 (±)
Radiated emission (Measurement distance: 3m)	30MHz-300MHz	4.8 dB	5.0 dB	4.8 dB
	300MHz-1GHz	5.0 dB	5.0 dB	4.8 dB
	1GHz-15GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1m)	15GHz-18GHz	5.7 dB	5.6 dB	5.6 dB
	18GHz-40GHz	5.2 dB	4.3 dB	4.3 dB

*1: SAC=Semi-Anechoic Chamber

*2: SR= Shielded Room is applied besides radiated emission

Radiated emission test(3m)

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

Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.7dB

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 2.3dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 3.0dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.9dB

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

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
☐ No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ No.4 Semi-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
☐ No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
☐ No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
☐ No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☒ No.6 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

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)	6Mbps, 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(6Mbps): 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	0 *2)	5180MHz 5220MHz 5240MHz	-
	11n-20 Tx	0 *2)	5180MHz 5220MHz 5240MHz	-
	11n-40 Tx	0 *2)	5190MHz 5230MHz	-
Maximum Peak Output Power, Peak Power Spectral Density,	11a Tx	0 *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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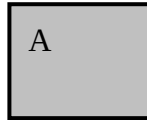
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4.2 Configuration and peripherals



Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID (Remark)
A	Flat Panel Sensor	DR-ID 911SE	*1)	FUJIFILM	W2Z-01000005 (EUT)

*1) H120003: Radiated Emission, 26820008: Other Test

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SECTION 5: 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. ^{*})
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 AD *1) RBW: 1MHz VBW: 3MHz Detector and averaging type set for linear voltage averaging.
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

SECTION 6: 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	Instrument used and Test method
26dB Bandwidth	Enough width to display	Close to 1% of EBW	Greater than RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display	Close to 1% of Span	Three times of RBW	Auto	Sample	Max Hold	Spectrum Analyzer
20dB bandwidth	Enough width to display	Close 1% to 5% of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Conducted Output Power,	-	-	50MHz	-	Average	-	Power Meter Method: PM
Peak Power Spectral Density	Enough width to display	1MHz	3MHz	Auto	RMS Power Averaging (100 times)	Clear Write	Spectrum Analyzer Method: SA-1
Peak Excursion Ratio	Enough width to display	1MHz	3MHz	Auto	Peak RMS Power Averaging (100 times)	Max Hold Clear Write	Spectrum Analyzer Method: SA-1
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

Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

6dB Bandwidth
Occupied Bandwidth
20dB Bandwidth
Maximum conducted output power
Peak power spectral density
Radiated emission
Spurious emission (Antenna port conducted)
Peak Excursion Ratio

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Radiated emission
Pre-check of worst position

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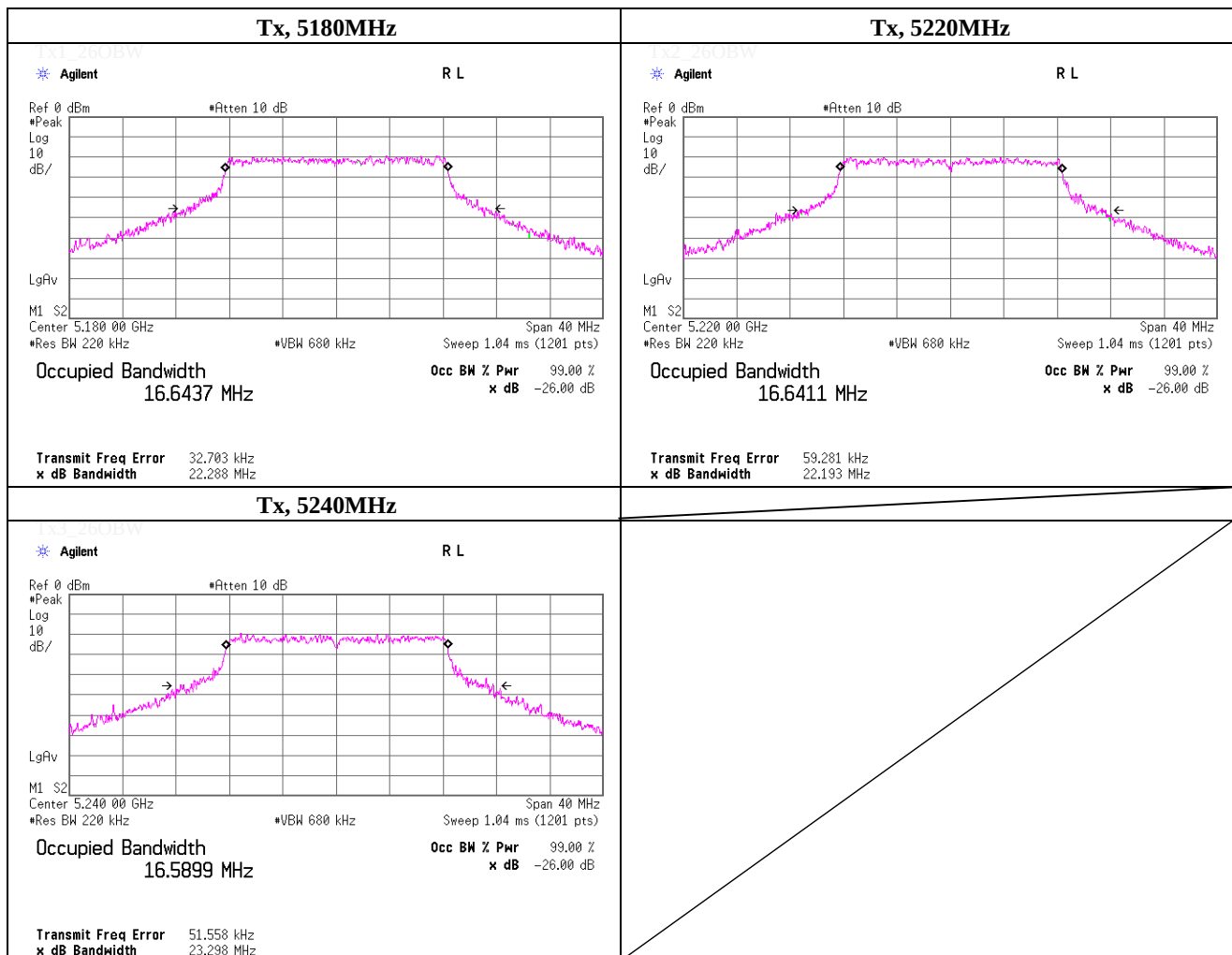
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APPENDIX 1: Data of Radio tests

-26dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11a Single Output, PN9, worst antenna port 0, worst data mode 6[Mbps]	

Freq. [MHz]	-26dB Bandwidth [MHz]
5180.0000	22.288
5220.0000	22.193
5240.0000	23.298



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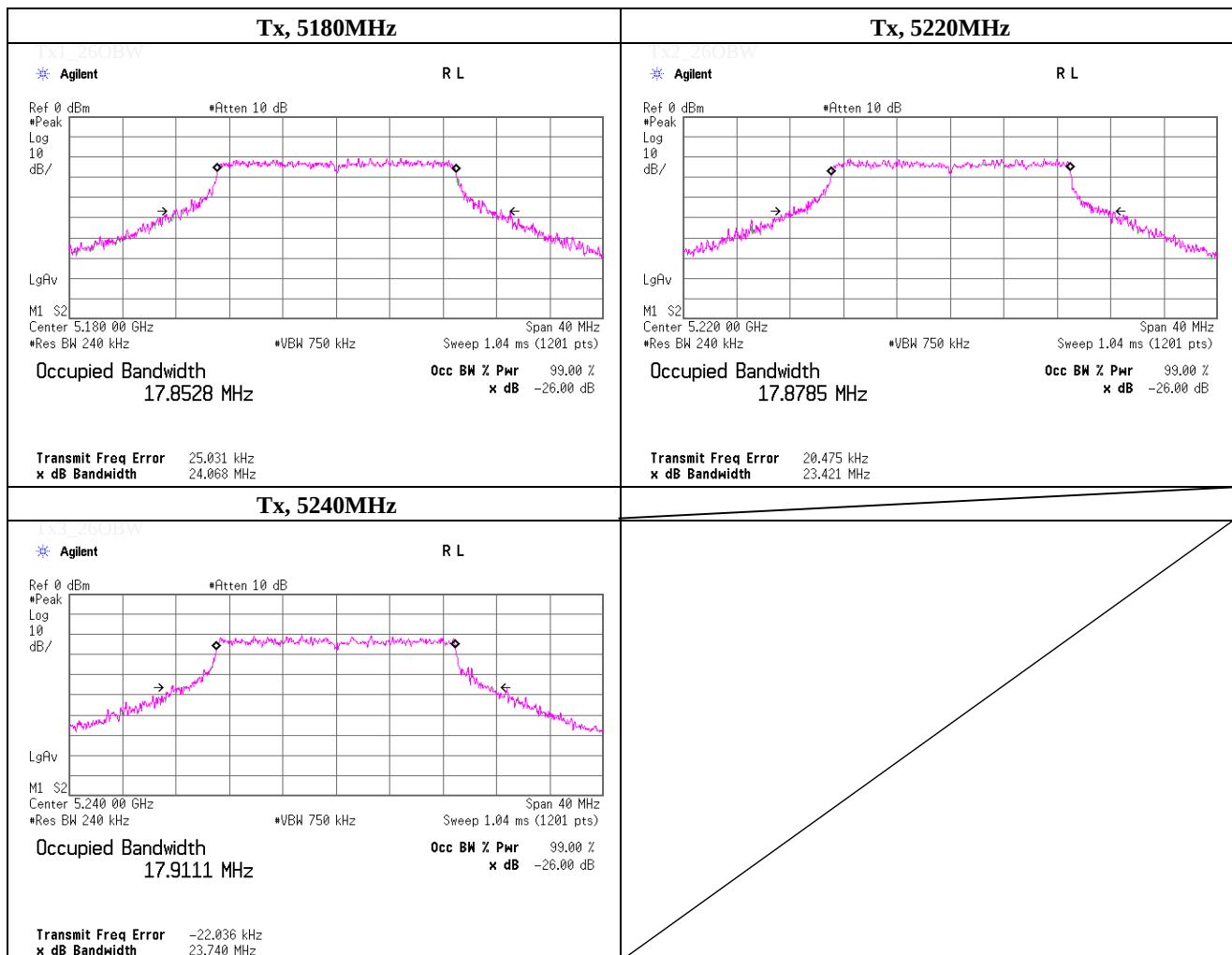
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-26dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT20 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Freq. [MHz]	-26dB Bandwidth [MHz]
5180.0000	24.068
5220.0000	23.421
5240.0000	23.740

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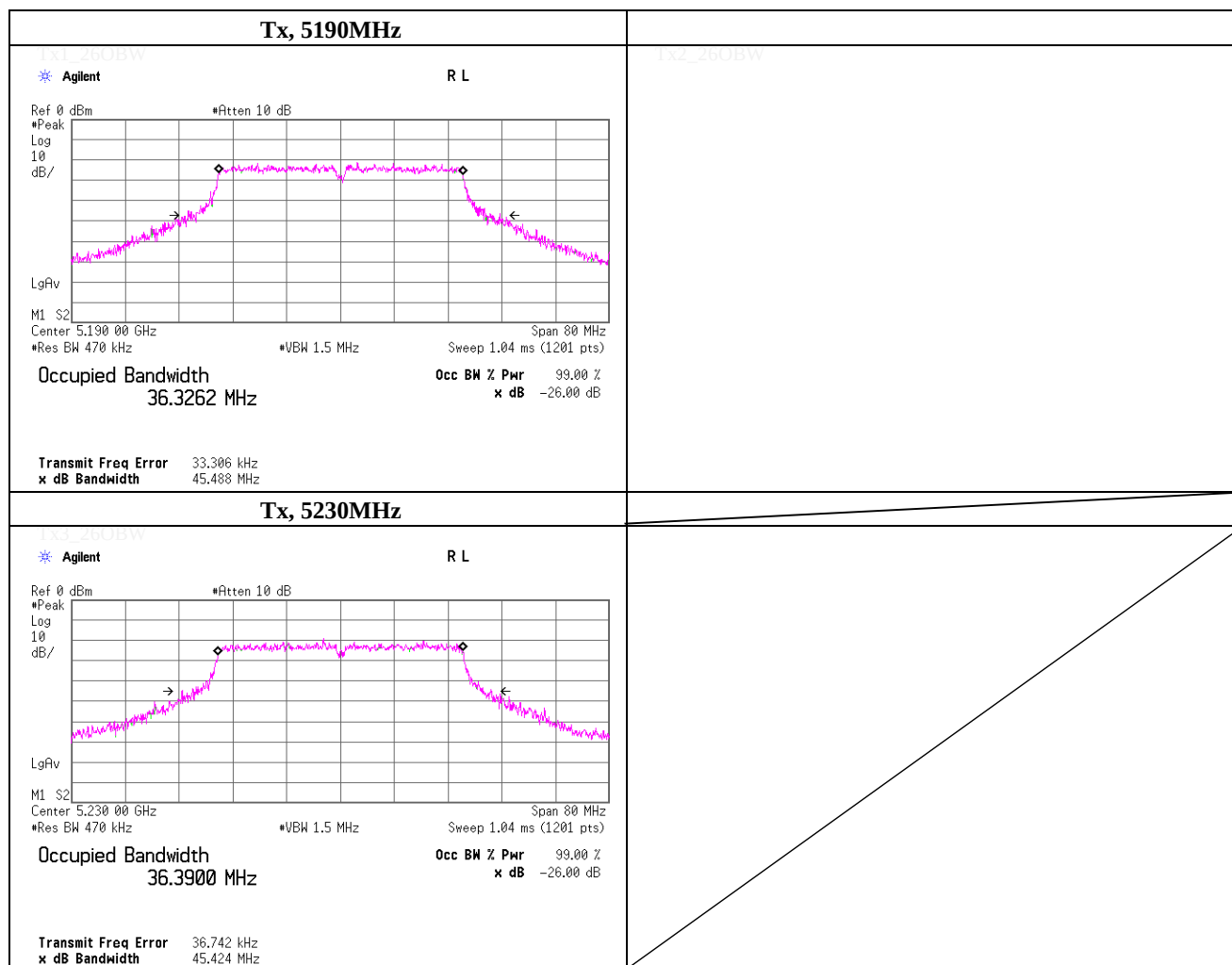
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-26dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT40 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Freq. [MHz]	-26dB Bandwidth [MHz]
5190.0000	45.488
5230.0000	45.424

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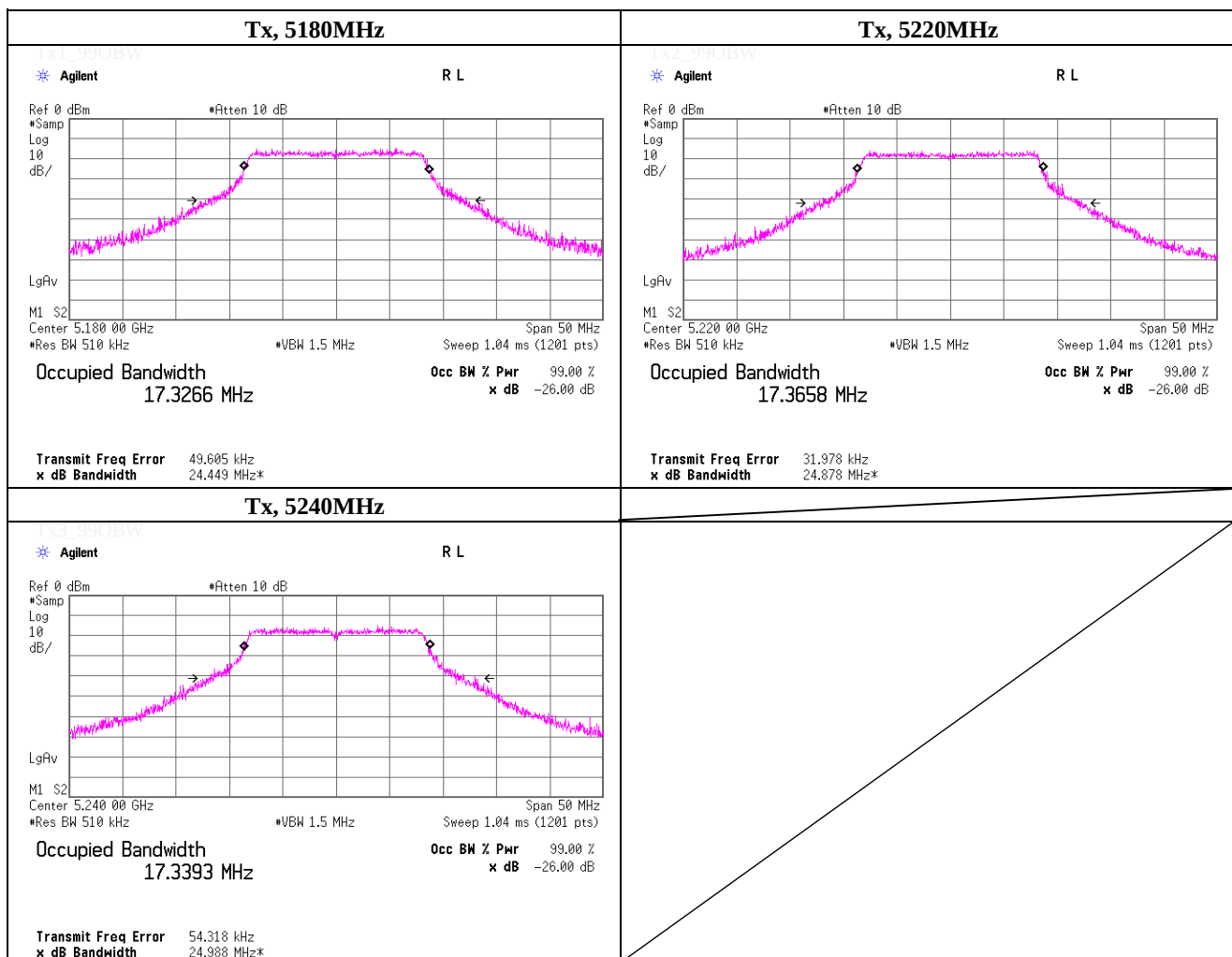
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99% Occupied Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11a Single Output, PN9, worst antenna port 0, worst data mode 6[Mbps]	

Freq. [MHz]	99% Occupied Bandwidth [MHz]
5180.0000	17.327
5220.0000	17.366
5240.0000	17.339



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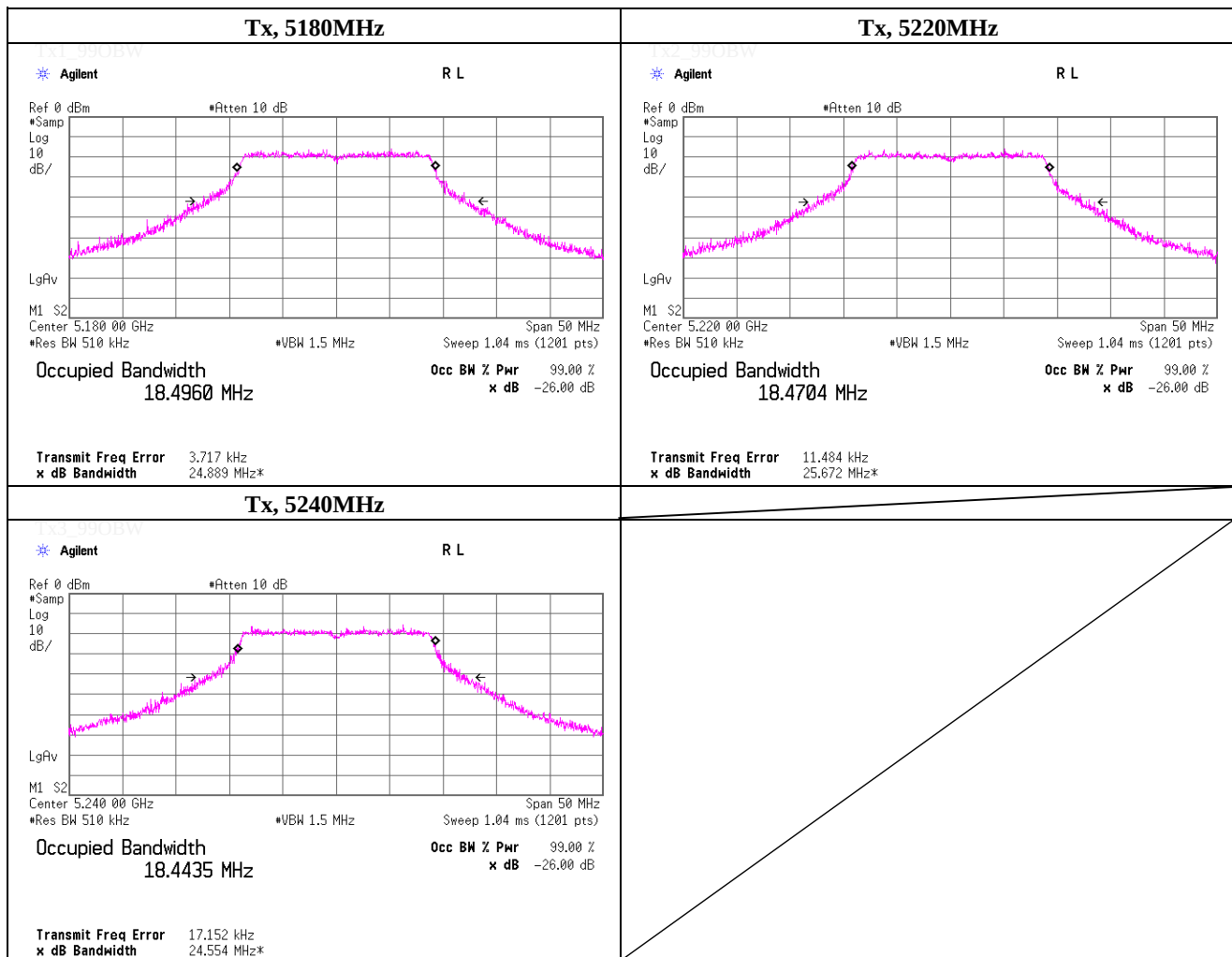
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99% Occupied Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT20 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Freq. [MHz]	99% Occupied Bandwidth [MHz]
5180.0000	18.496
5220.0000	18.470
5240.0000	18.444



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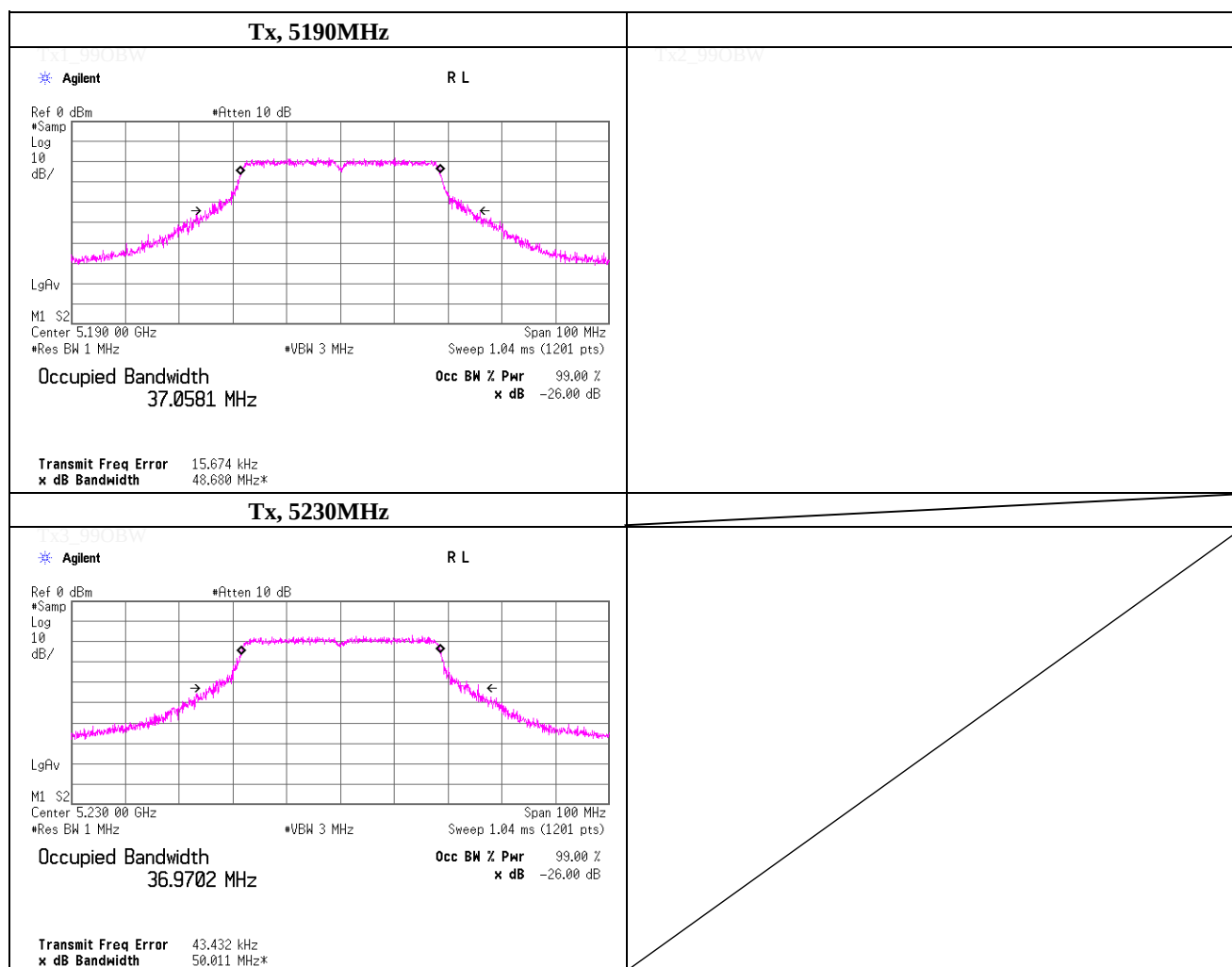
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99% Occupied Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT40 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Freq. [MHz]	99% Occupied Bandwidth [MHz]
5190.0000	37.058
5230.0000	36.970



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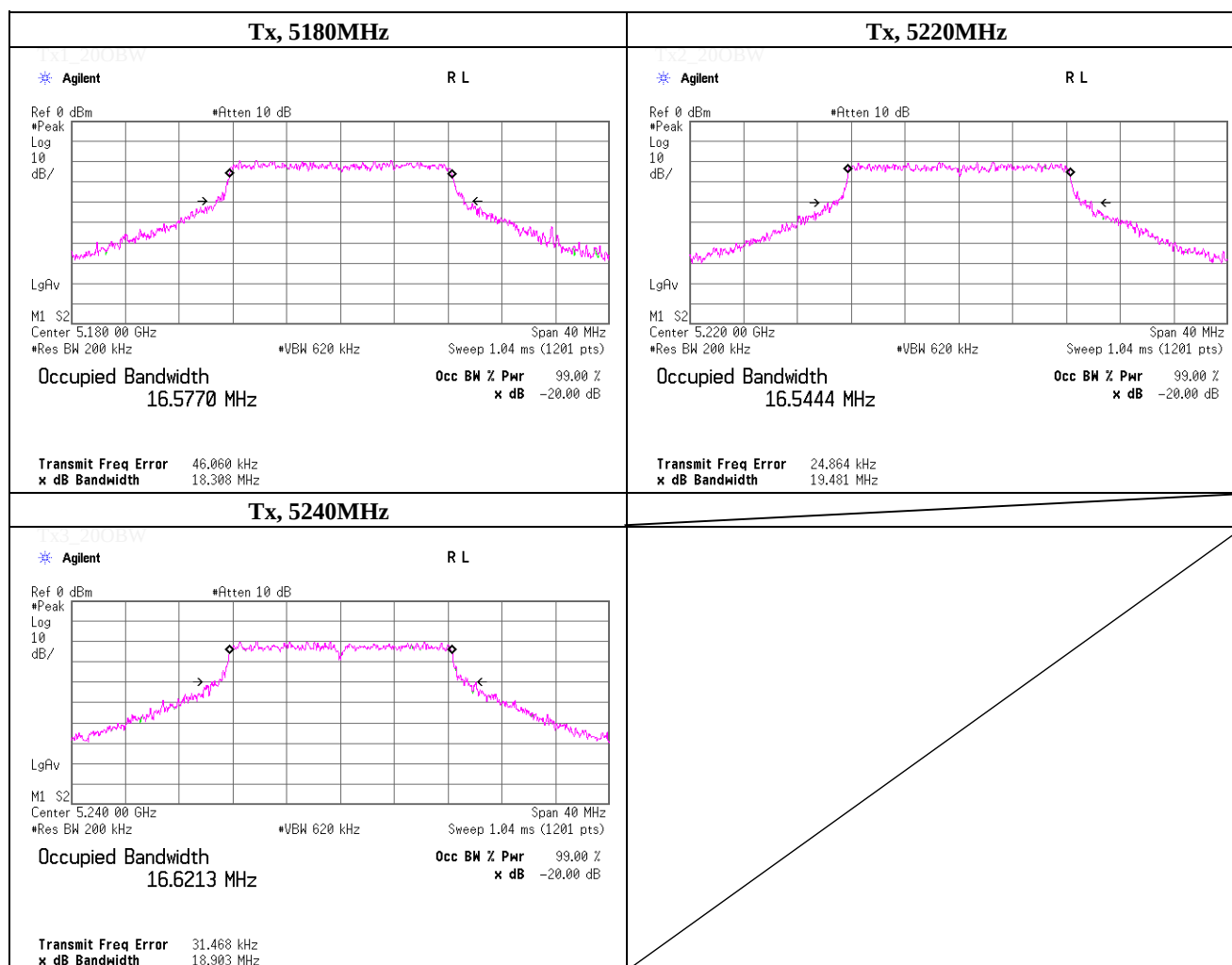
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-20dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11a Single Output, PN9, worst antenna port 0, worst data mode 6[Mbps]	

Freq. [MHz]	-20dB Bandwidth [MHz]
5180.0000	18.308
5220.0000	19.481
5240.0000	18.903



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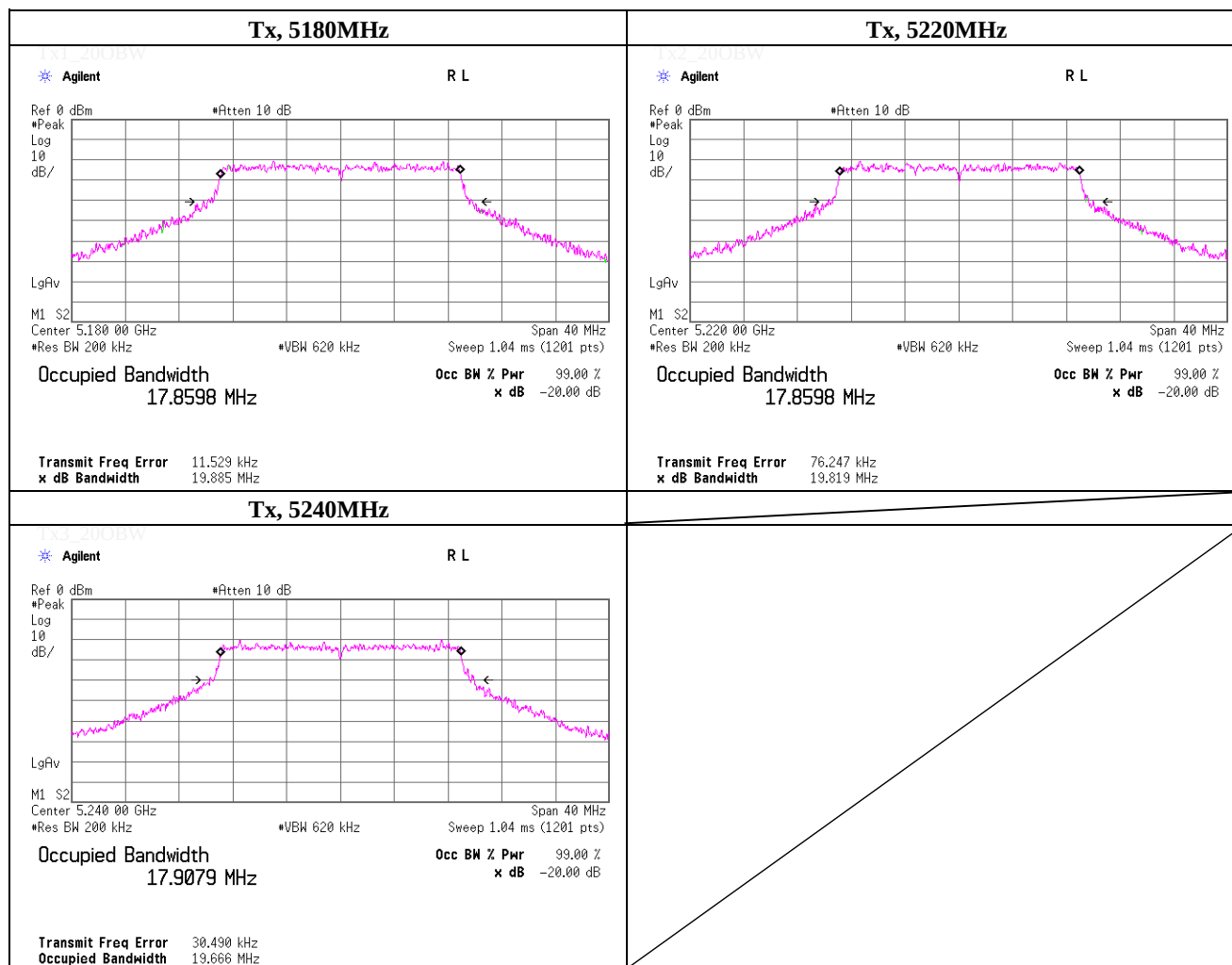
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-20dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT20 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Freq. [MHz]	-20dB Bandwidth [MHz]
5180.0000	19.885
5220.0000	19.819
5240.0000	19.666



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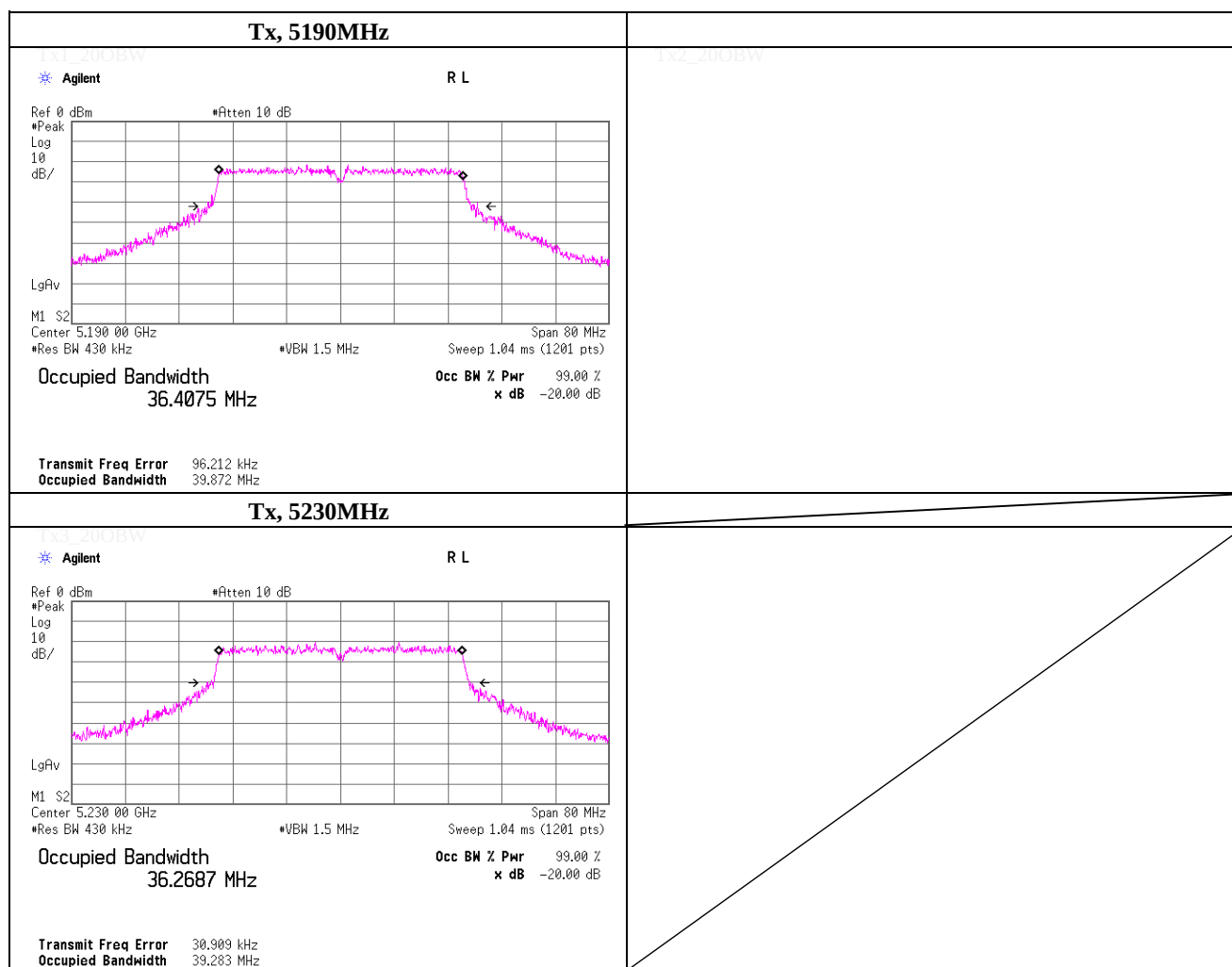
Telephone : +81 463 50 6400

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-20dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT40 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Freq. [MHz]	-20dB Bandwidth [MHz]
5190.0000	39.872
5230.0000	39.283



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Maximum Conducted Output Power (Conducted)

(Method: PM)

Test place UL Japan, Inc. Shonan EMC Lab.
Date July 4, 2013
Temperature / Humidity 24 deg.C , 50 %RH
Engineer Hiroshi Naka
Mode Tx, IEEE802.11a Single Output, PN9

No.6 Shielded Room

worst antenna port : 0
worst data mode : 6 [Mbps]

Total Power

Ch	Freq. [MHz]	Result (Cond.)		Result (e.i.r.p.)		Limit (Cond.)		Limit (e.i.r.p.)		Margin (Cond.) (e.i.r.p.)	
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dBm]
Low	5180.0	12.96	19.77	12.74	18.79	16.99	50.00	-	-	4.03	-
Mid	5220.0	12.57	18.07	12.27	16.87	16.99	50.00	-	-	4.42	-
High	5240.0	12.37	17.26	12.03	15.96	16.99	50.00	-	-	4.62	-

Antenna 0

(* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result (Cond.)		Antenna Gain*1 [dBi]		Result (e.i.r.p.)	
						[dBm]	[mW]			[dBm]	[mW]
Low	5180.0	1.62	1.24	10.08	0.02	12.96	19.77	-0.22		12.74	18.79
Mid	5220.0	1.23	1.24	10.08	0.02	12.57	18.07	-0.30		12.27	16.87
High	5240.0	1.03	1.24	10.08	0.02	12.37	17.26	-0.34		12.03	15.96

*1) include cable loss (Antenna gain [2.14dBi] - cable loss [2.3dB(5.15GHz) - 2.5dB(5.25GHz)])

Sample Calculation:

(Cond.) Result = Reading + [dBm] + Atten. Loss + Duty Factor

(e.i.r.p) Result = Reading + [dBm] + Atten. Loss + Duty Factor + Antenna Gain

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Maximum Conducted Output Power (Conducted)

(Method: PM)

Test place UL Japan, Inc. Shonan EMC Lab.
 Date July 4, 2013
 Temperature / Humidity 24 deg.C , 50 %RH
 Engineer Hiroshi Naka
 Mode Tx, IEEE802.11a Single Output, PN9

No.7 Shielded Room

worst antenna port : 0
 worst data mode : 6 [Mbps]

[Pre check]

Data rate [Mbps]	Freq. [MHz]	Duty factor [dB]	Antenna 0			Antenna 1		
			Reading [dBm]	Result		Reading [dBm]	Result	
				[dBm]	[mW]		[dBm]	[mW]
6	5180.0	0.02	1.62	12.96	19.77	1.57	12.87	19.36
9	5180.0	0.03	1.60	12.95	19.72	1.53	12.84	19.23
12	5180.0	0.04	1.59	12.95	19.72	1.53	12.85	19.28
18	5180.0	0.07	1.47	12.86	19.32	1.49	12.84	19.23
24	5180.0	0.08	1.44	12.84	19.23	1.46	12.82	19.14
36	5180.0	0.10	1.34	12.76	18.88	1.46	12.84	19.23
48	5180.0	0.14	1.39	12.85	19.28	1.42	12.84	19.23
54	5180.0	0.15	1.31	12.78	18.97	1.40	12.83	19.19

Sample Calculation: Result = Reading + Cable Loss (Antenna 0: 1.24dB, Antenna 1: 1.20dB) + Atten. Loss (10.08dB) + Duty Factor

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Maximum Conducted Output Power (Conducted)

(Method: PM)

Test place UL Japan, Inc. Shonan EMC Lab. No.7 Shielded Room
 Date July 4, 2013 total power worst data mode : 8 (MCS)
 Temperature / Humidity 24 deg.C , 50 %RH
 Engineer Hiroshi Naka worst antenna port : 0
 Mode Tx, IEEE802.11n-HT20 Multi Output (2Tx), PN9 worst data mode : 8 (MCS)

Total Power

Ch	Freq. [MHz]	Result (Cond.)		Result (e.i.r.p.)		Limit (Cond.)		Limit (e.i.r.p.)		Margin (Cond.) (e.i.r.p.)	
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dBm]
Low	5180.0	14.43	27.72	14.21	26.35	16.99	50.00	-	-	2.56	-
Mid	5220.0	14.29	26.84	13.99	25.05	16.99	50.00	-	-	2.70	-
High	5240.0	14.18	26.20	13.84	24.23	16.99	50.00	-	-	2.81	-

Sample Calculation: Result [mW] = Antenna 0 Result [mW] + Antenna 1 Result [mW]

Antenna 0

(* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result (Cond.)		Antenna Gain*1 [dBi]		Result (e.i.r.p.)	
						[dBm]	[mW]			[dBm]	[mW]
Low	5180.0	0.20	1.24	10.08	0.04	11.56	14.32	-0.22		11.34	13.61
Mid	5220.0	0.09	1.24	10.08	0.04	11.45	13.96	-0.30		11.15	13.03
High	5240.0	-0.03	1.24	10.08	0.04	11.33	13.58	-0.34		10.99	12.56

Antenna 1

(* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result (Cond.)		Antenna Gain*1 [dBi]		Result (e.i.r.p.)	
						[dBm]	[mW]			[dBm]	[mW]
Low	5180.0	-0.05	1.20	10.08	0.04	11.27	13.40	-0.22		11.05	12.74
Mid	5220.0	-0.22	1.20	10.08	0.04	11.10	12.88	-0.30		10.80	12.02
High	5240.0	-0.31	1.20	10.08	0.04	11.01	12.62	-0.34		10.67	11.67

*1) include cable loss (Antenna gain [2.14dBi] - cable loss [2.3dB(5.15GHz) - 2.5dB(5.25GHz)])

Sample Calculation:

(Cond.) Result = Reading + [dBm] + Atten. Loss + Duty Factor

(e.i.r.p.) Result = Reading + [dBm] + Atten. Loss + Duty Factor + Antenna Gain

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Maximum Conducted Output Power (Conducted)

(Method: PM)

Test place UL Japan, Inc. Shonan EMC Lab.
 Date July 4, 2013
 Temperature / Humidity 24 deg.C , 50 %RH
 Engineer Hiroshi Naka
 Mode Tx, IEEE802.11n-HT20

No.7 Shielded Room

total power worst data mode : 8 (MCS)

worst antenna port : 0

worst data mode : 8 (MCS)

[Pre check]

Single Output

Mode (MCS)	Freq. [MHz]	Duty factor [dB]	Antenna 0			Antenna 1		
			Reading [dBm]	Result [dBm] [mW]		Reading [dBm]	Result [dBm] [mW]	
0	5180.0	0.03	0.19	11.54	14.26	0.08	11.39	13.77
1	5180.0	0.04	0.20	11.56	14.32	-0.03	11.29	13.46
2	5180.0	0.08	0.16	11.56	14.32	-0.02	11.34	13.61
3	5180.0	0.08	0.15	11.55	14.29	-0.08	11.28	13.43
4	5180.0	0.12	0.08	11.52	14.19	-0.03	11.37	13.71
5	5180.0	0.14	0.09	11.55	14.29	-0.09	11.33	13.58
6	5180.0	0.16	0.06	11.54	14.26	-0.10	11.34	13.61
7	5180.0	0.17	-0.25	11.24	13.30	-0.37	11.08	12.82

Multi Output

Mode (MCS)	Freq. [MHz]	Duty factor [dB]	Antenna 0			Antenna 1			MCS8-15 Total Result	
			Reading [dBm]	Result [dBm] [mW]		Reading [dBm]	Result [dBm] [mW]		[dBm]	[mW]
8	5180.0	0.04	0.20	11.56	14.32	-0.05	11.27	13.40	14.43	27.72
9	5180.0	0.08	0.10	11.50	14.13	-0.10	11.26	13.37	14.39	27.49
10	5180.0	0.13	0.09	11.54	14.26	-0.14	11.27	13.40	14.42	27.65
11	5180.0	0.15	0.08	11.55	14.29	-0.20	11.23	13.27	14.40	27.56
12	5180.0	0.20	-0.04	11.48	14.06	-0.21	11.27	13.40	14.39	27.46
13	5180.0	0.25	-0.07	11.50	14.13	-0.25	11.28	13.43	14.40	27.55
14	5180.0	0.28	-0.15	11.45	13.96	-0.25	11.31	13.52	14.39	27.48
15	5180.0	0.29	-0.15	11.46	14.00	-0.38	11.19	13.15	14.34	27.15

Worst

Sample Calculation: Result = Reading + Cable Loss (Antenna 0: 1.24dB, Antenna 1: 1.20dB) + Atten. Loss (10.08dB) + Duty Factor

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Maximum Conducted Output Power (Conducted)

(Method: PM)

Test place: UL Japan, Inc. Shonan EMC Lab. No.7 Shielded Room
Date: July 4, 2013 total power worst data mode : 8 (MCS)
Temperature / Humidity: 24 deg.C , 50 %RH
Engineer: Hiroshi Naka worst antenna port : 0
Mode: Tx, IEEE802.11n-HT40 Multi Output (2Tx), PN9 worst data mode : 8 (MCS)

Total Power

Ch	Freq. [MHz]	Result (Cond.)		Result (e.i.r.p.)		Limit (Cond.)		Limit (e.i.r.p.)		Margin (Cond.) (e.i.r.p.)	
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dBm]
Low	5190.0	13.30	21.37	13.06	20.21	16.99	50.00	-	-	3.69	-
High	5230.0	14.46	27.95	14.14	25.96	16.99	50.00	-	-	2.53	-

Sample Calculation: Result [mW] = Antenna 0 Result [mW] + Antenna 1 Result [mW]

Antenna 0

(* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result (Cond.)		Antenna Gain*1 [dBi]	Result (e.i.r.p.)	
						[dBm]	[mW]		[dBm]	[mW]
Low	5190.0	-0.98	1.24	10.08	0.08	10.42	11.02	-0.24	10.18	10.42
High	5230.0	0.22	1.24	10.08	0.08	11.62	14.52	-0.32	11.30	13.49

Antenna 1

(* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result (Cond.)		Antenna Gain*1 [dBi]	Result (e.i.r.p.)	
						[dBm]	[mW]		[dBm]	[mW]
Low	5190.0	-1.21	1.20	10.08	0.08	10.15	10.35	-0.24	9.91	9.79
High	5230.0	-0.08	1.20	10.08	0.08	11.28	13.43	-0.32	10.96	12.47

*1) include cable loss (Antenna gain [2.14dBi] - cable loss [2.3dB(5.15GHz) - 2.5dB(5.25GHz)])

Sample Calculation:

(Cond.) Result = Reading + [dBm] + Atten. Loss + Duty Factor

(e.i.r.p) Result = Reading + [dBm] + Atten. Loss + Duty Factor + Antenna Gain

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Maximum Conducted Output Power (Conducted)

(Method: PM)

Test place UL Japan, Inc. Shonan EMC Lab.
 Date July 4, 2013
 Temperature / Humidity 24 deg.C , 50 %RH
 Engineer Hiroshi Naka
 Mode Tx, IEEE802.11n-HT40

No.7 Shielded Room

total power worst data mode : 8 (MCS)

worst antenna port : 0

worst data mode : 8 (MCS)

[Pre check]

Single Output

Mode (MCS)	Freq. [MHz]	Duty factor [dB]	Antenna 0			Antenna 1		
			Reading [dBm]	Result [dBm] [mW]		Reading [dBm]	Result [dBm] [mW]	
0	5230.0	0.04	0.11	11.47	14.03	-0.21	11.11	12.91
1	5230.0	0.08	0.09	11.49	14.09	-0.29	11.07	12.79
2	5230.0	0.11	0.07	11.50	14.13	-0.35	11.04	12.71
3	5230.0	0.15	0.08	11.55	14.29	-0.21	11.22	13.24
4	5230.0	0.20	-0.16	11.36	13.68	-0.33	11.15	13.03
5	5230.0	0.26	-0.16	11.42	13.87	-0.38	11.16	13.06
6	5230.0	0.27	-0.14	11.45	13.96	-0.41	11.14	13.00
7	5230.0	0.31	-0.14	11.49	14.09	-0.80	10.79	11.99

Multi Output

Mode (MCS)	Freq. [MHz]	Duty factor [dB]	Antenna 0			Antenna 1			MCS8-15 Total	
			Reading [dBm]	Result [dBm] [mW]		Reading [dBm]	Result [dBm] [mW]		Result [dBm]	Result [mW]
8	5230.0	0.08	0.22	11.62	14.52	-0.08	11.28	13.43	14.46	27.95
9	5230.0	0.15	0.05	11.52	14.19	-0.32	11.11	12.91	14.33	27.10
10	5230.0	0.21	-0.02	11.51	14.16	-0.30	11.19	13.15	14.36	27.31
11	5230.0	0.26	-0.03	11.55	14.29	-0.35	11.19	13.15	14.38	27.44
12	5230.0	0.34	-0.13	11.53	14.22	-0.33	11.29	13.46	14.42	27.68
13	5230.0	0.42	-0.15	11.59	14.42	-0.42	11.28	13.43	14.45	27.85
14	5230.0	0.44	-0.19	11.57	14.35	-0.42	11.30	13.49	14.45	27.84
15	5230.0	0.47	-0.20	11.59	14.42	-0.50	11.25	13.34	14.43	27.76

Worst

Sample Calculation: Result = Reading + Cable Loss (Antenna 0: 1.24dB, Antenna 1: 1.20dB) + Atten. Loss (10.08dB) + Duty Factor

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Peak Power Spectral Density

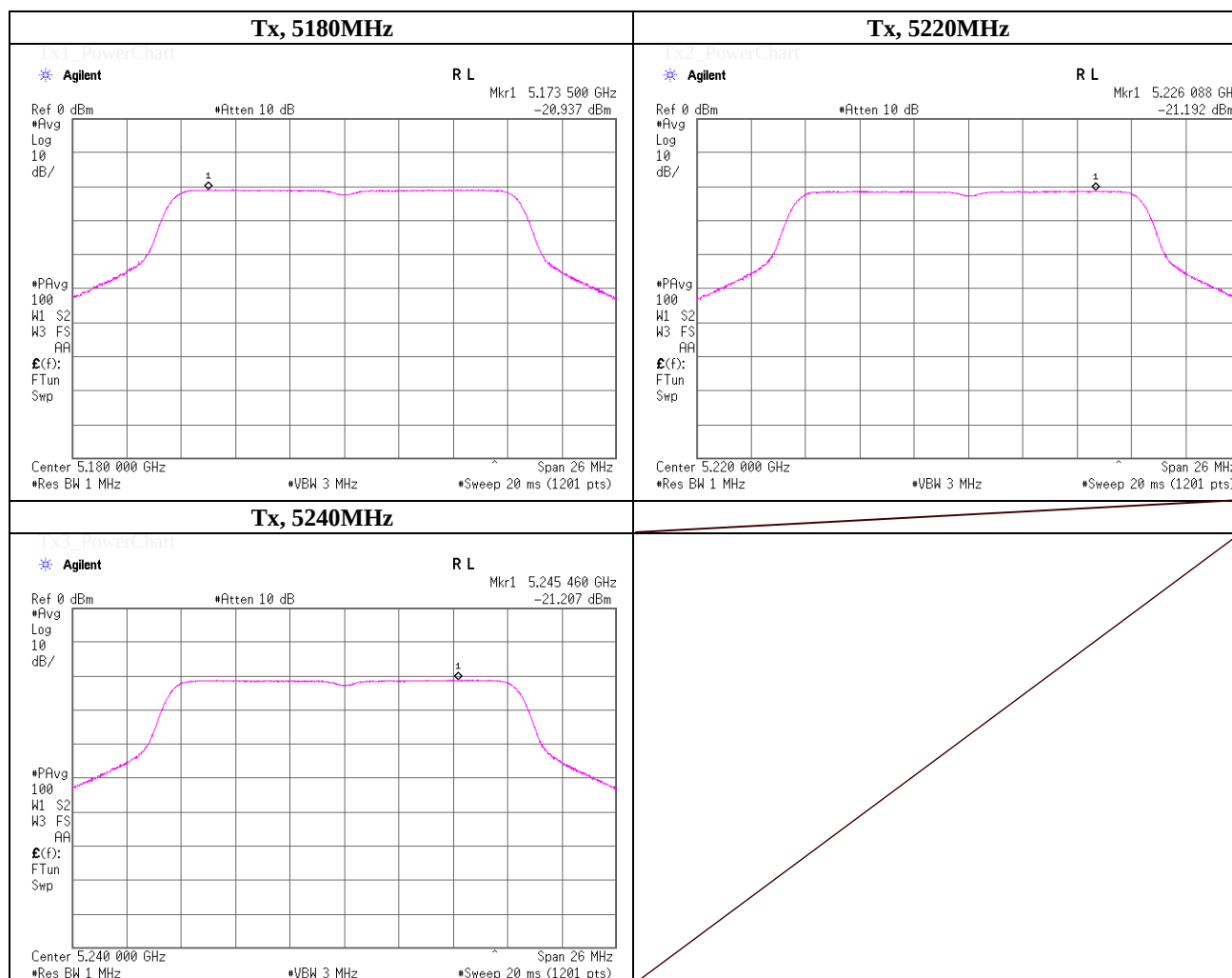
(Method: SA-1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11a Single Output, PN9, worst antenna port 0, worst data mode 6[Mbps]	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm/MHz]	Cable Loss [dB]	Atten. Loss [dB]				Result [dBm/MHz]	Limit [dBm]	Margin [dB]
5180.0000	5173.50	-20.94	2.04	20.05				1.17	4.00	2.83
5220.0000	5226.09	-21.19	2.04	20.05				0.92	4.00	3.08
5240.0000	5245.46	-21.21	2.22	20.05				1.08	4.00	2.92

Sample Calculation:

Result = Reading + Cable Loss + Atten.Loss

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Peak Power Spectral Density

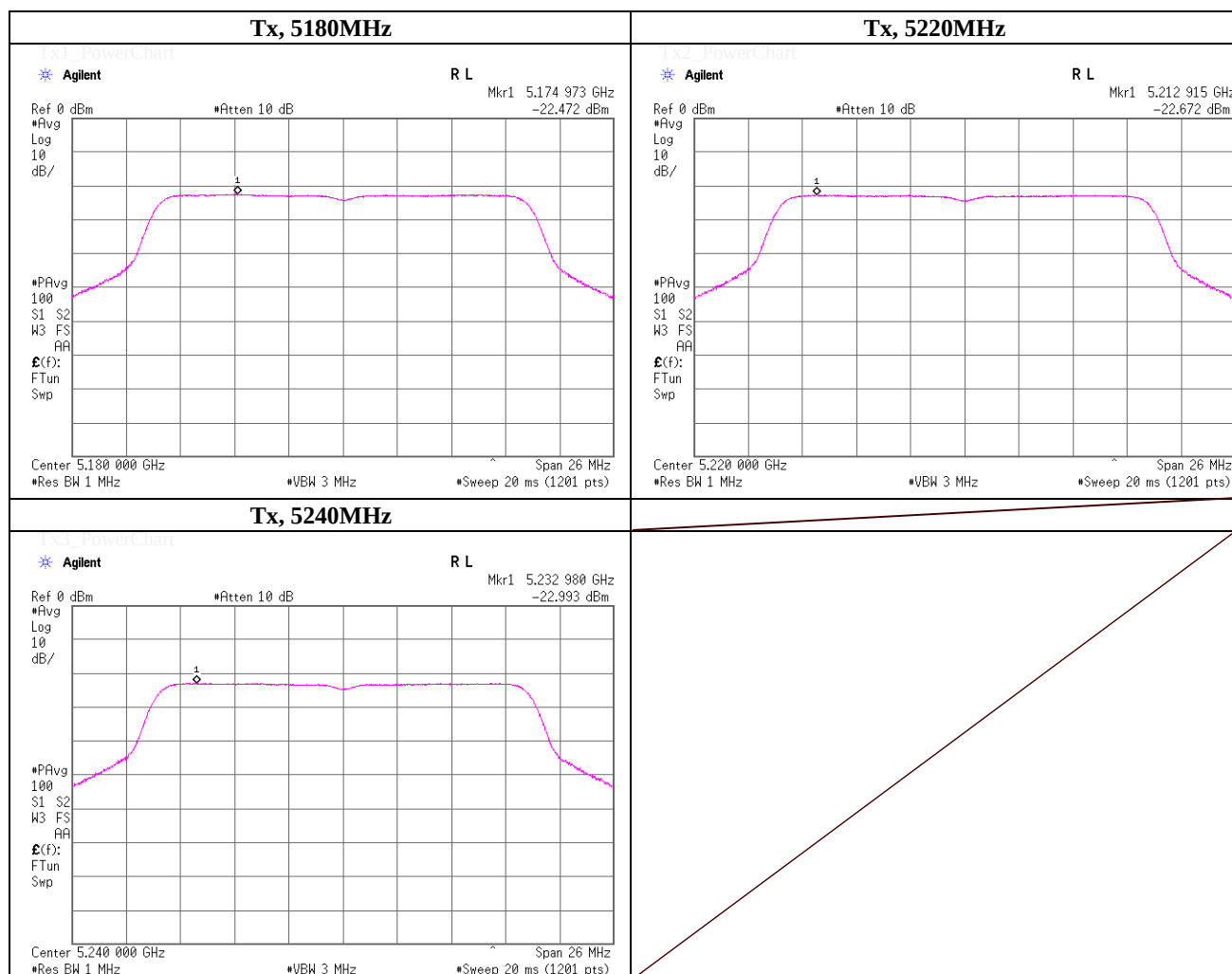
(Method: SA-1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT20 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm/MHz]	Cable Loss [dB]	Atten. Loss [dB]			10log (NANT)* [dB]	Result [dBm/MHz]	Limit [dBm]	Margin [dB]
5180.0000	5174.97	-22.47	2.04	20.05			3.01	2.63	4.00	1.37
5220.0000	5212.92	-22.67	2.04	20.05			3.01	2.43	4.00	1.57
5240.0000	5232.98	-22.99	2.22	20.05			3.01	2.29	4.00	1.71

Sample Calculation:

Result = Reading + Cable Loss + Atten.Loss + 10log(NANT)

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Peak Power Spectral Density

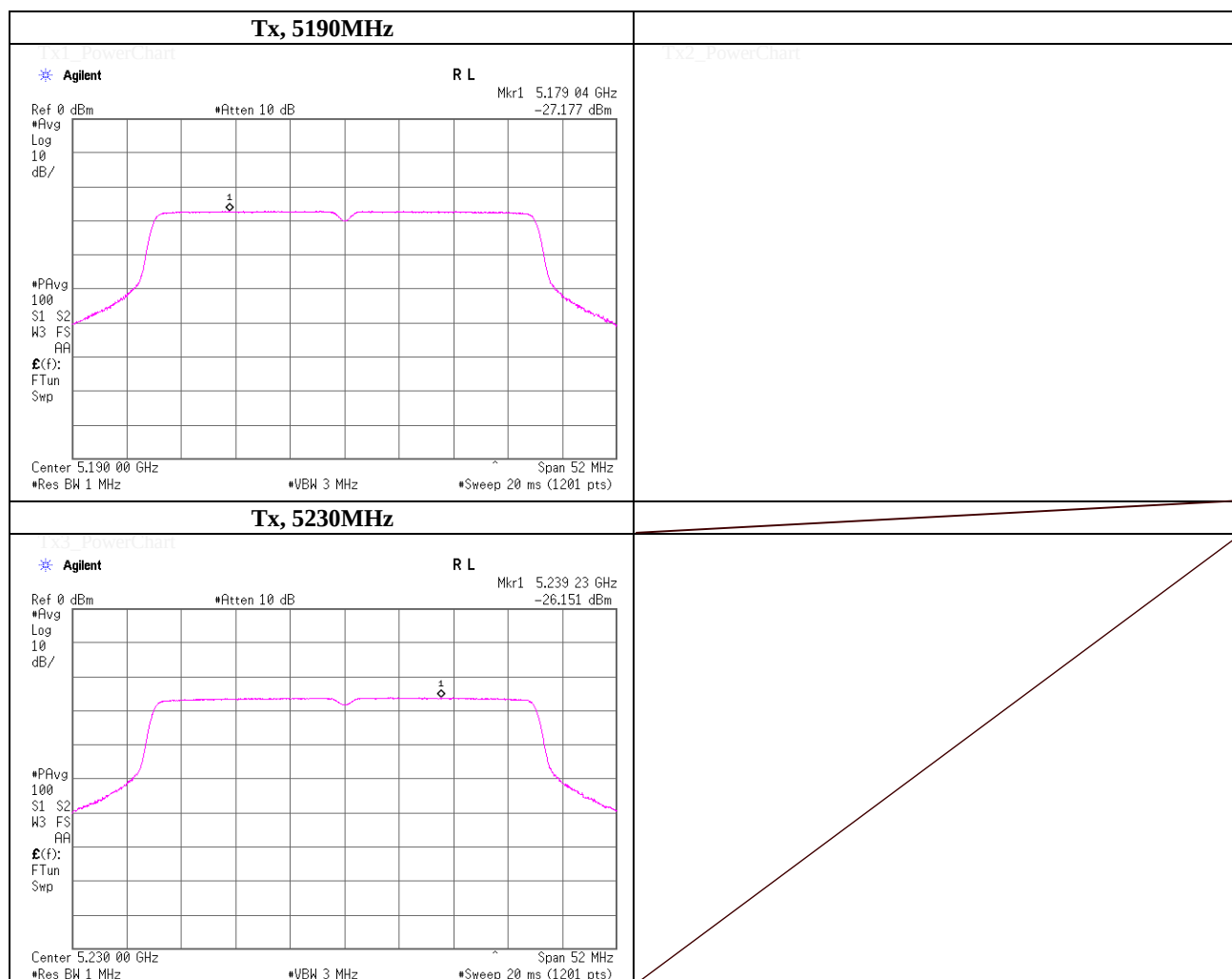
(Method: SA-1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT40 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm/MHz]	Cable Loss [dB]	Atten. Loss [dB]			10log (NANT)* [dB]	Result [dBm/MHz]	Limit [dBm]	Margin [dB]
5190.0000	5179.04	-27.18	2.04	20.05			3.01	-2.08	4.00	6.08
							3.01	-	4.00	-
5230.0000	5239.23	-26.15	2.05	20.05			3.01	-1.04	4.00	5.04

Sample Calculation:

Result = Reading + Cable Loss + Atten.Loss + 10log(NANT)

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Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Anechoic Chamber	
Date	05/31/2012	06/01/2012
Temperature/ Humidity	24deg. C / 56% RH	24deg. C / 56% RH
Engineer	Tatsuya Arai	Akio Hayashi
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.	250.004	QP	34.0	17.2	8.3	32.0	27.5	46.0	18.5	150	177	Inside	
Hori.	400.002	QP	37.9	16.4	9.0	32.0	31.3	46.0	14.7	172	209	Inside	
Hori.	500.004	QP	34.5	17.8	9.4	32.0	29.7	46.0	16.3	143	217	Outside	
Hori.	625.019	QP	35.6	19.4	9.9	32.0	32.9	46.0	13.1	113	170	Outside	
Hori.	699.998	QP	31.0	20.5	10.1	31.9	29.7	46.0	16.3	100	190	Outside	
Vert.	30.628	QP	41.7	17.7	6.6	32.2	33.8	40.0	6.2	100	239	Outside	
Vert.	56.708	QP	42.8	9.2	6.8	32.2	26.6	40.0	13.4	100	282	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.	5150.000	PK	46.8	31.6	16.4	40.7	54.1	68.2	14.1	121	10	Bandedge	
Hori.	6906.699	PK	50.9	35.8	7.8	41.0	53.5	68.2	14.7	111	347	Outside	
Hori.	10360.000	PK	46.7	39.4	9.4	38.6	56.9	68.2	11.3	100	0	Outside	
Hori.	15540.000	PK	45.0	39.6	1.9	38.7	47.8	73.9	26.1	100	0	Inside	
Hori.	5150.000	AV	37.4	31.6	16.4	40.7	44.7	68.2	23.5	121	10	Bandedge	
Hori.	15540.000	AV	35.5	39.6	1.9	38.7	38.3	53.9	15.6	100	0	Inside	
Vert.	5150.000	PK	46.6	31.6	16.4	40.7	53.9	68.2	14.3	133	25	Bandedge	
Vert.	6906.720	PK	51.0	35.8	7.8	41.0	53.6	68.2	14.6	128	352	Outside	
Vert.	10360.000	PK	45.2	39.4	9.4	38.6	55.4	68.2	12.8	100	0	Outside	
Vert.	15540.000	PK	44.8	39.6	1.9	38.7	47.6	73.9	26.3	100	0	Inside	
Vert.	5150.000	AV	37.5	31.6	16.4	40.7	44.8	68.2	23.4	133	25	Bandedge	
Vert.	10360.000	AV	35.2	39.4	9.4	38.6	45.4	68.2	22.8	100	0	Outside	
Vert.	15540.000	AV	35.6	39.6	1.9	38.7	38.4	53.9	15.5	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.

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Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber	
Date	05/31/2012	06/01/2012
Temperature/ Humidity	24deg. C / 56% RH	24deg. C / 56% RH
Engineer	Tatsuya Arai	Akio Hayashi
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.	6960.006	PK	48.7	36.0	7.8	41.1	51.4	68.2	16.8	100	349	Outside	
Hori.	10440.000	PK	46.3	39.5	9.4	38.5	56.7	68.2	11.5	100	0	Outside	
Hori.	15660.000	PK	45.1	39.2	1.9	38.9	47.3	73.9	26.6	100	0	Inside	
Hori.	15660.000	AV	34.8	39.2	1.9	38.9	37.0	53.9	16.9	100	0	Inside	
Vert.	6960.008	PK	49.8	36.0	7.8	41.1	52.5	68.2	15.7	127	340	Outside	
Vert.	10440.000	PK	46.3	39.5	9.4	38.5	56.7	68.2	11.5	100	0	Outside	
Vert.	15660.000	PK	44.9	39.2	1.9	38.9	47.1	73.9	26.8	100	0	Inside	
Vert.	15660.000	AV	34.8	39.2	1.9	38.9	37.0	53.9	16.9	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 $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

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Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber	
Date	05/31/2012	06/01/2012
Temperature/ Humidity	24deg. C / 56% RH	24deg. C / 56% RH
Engineer	Tatsuya Arai	Akio Hayashi
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	47.3	31.8	16.5	40.6	55.0	68.2	13.2	105	10	Bandedge	
Hori.	6986.679	PK	48.5	36.0	7.8	41.2	51.1	68.2	17.1	100	344	Outside	
Hori.	10480.000	PK	45.5	39.6	9.4	38.5	56.0	68.2	12.2	100	0	Outside	
Hori.	15720.000	PK	44.8	39.0	1.9	39.0	46.7	73.9	27.2	100	0	Inside	
Hori.	5350.000	AV	37.3	31.8	16.5	40.6	45.0	53.9	8.9	105	10	Bandedge	
Hori.	15720.000	AV	35.0	39.0	1.9	39.0	36.9	53.9	17.0	100	0	Inside	
Vert.	5350.000	PK	47.1	31.8	16.5	40.6	54.8	68.2	13.4	131	17	Bandedge	
Vert.	6986.678	PK	49.9	36.0	7.8	41.2	52.5	68.2	15.7	148	340	Outside	
Vert.	10480.000	PK	45.6	39.6	9.4	38.5	56.1	68.2	12.1	100	0	Outside	
Vert.	15720.000	PK	44.7	39.0	1.9	39.0	46.6	73.9	27.3	100	0	Inside	
Vert.	5350.000	AV	37.6	31.8	16.5	40.6	45.3	53.9	8.6	131	17	Bandedge	
Vert.	15720.000	AV	34.8	39.0	1.9	39.0	36.7	53.9	17.2	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

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Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber	
Date	05/31/2012	06/01/2012
Temperature/ Humidity	24deg. C / 56% RH	24deg. C / 56% RH
Engineer	Tatsuya Arai	Akio Hayashi
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	46.2	31.6	16.4	40.7	53.5	68.2	14.7	119	10	Bandedge	
Hori.	6920.022	PK	50.8	35.8	7.8	41.1	53.3	68.2	14.9	102	346	Outside	
Hori.	10380.000	PK	45.4	39.4	9.4	38.6	55.6	68.2	12.6	100	0	Outside	
Hori.	15570.000	PK	45.6	39.5	1.9	38.8	48.2	73.9	25.7	100	0	Inside	
Hori.	5150.000	AV	37.2	31.6	16.4	40.7	44.5	53.9	9.4	119	10	Bandedge	
Hori.	15570.000	AV	35.0	39.5	1.9	38.8	37.6	53.9	16.3	100	0	Inside	
Vert.	5150.000	PK	46.8	31.6	16.4	40.7	54.1	68.2	14.1	133	22	Bandedge	
Vert.	6920.032	PK	51.5	35.8	7.8	41.1	54.0	68.2	14.2	140	341	Outside	
Vert.	10380.000	PK	46.7	39.4	9.4	38.6	56.9	68.2	11.3	100	0	Outside	
Vert.	15570.000	PK	44.8	39.5	1.9	38.8	47.4	73.9	26.5	100	0	Inside	
Vert.	5150.000	AV	37.3	31.6	16.4	40.7	44.6	53.9	9.3	133	22	Bandedge	
Vert.	15570.000	AV	36.0	39.5	1.9	38.8	38.6	53.9	15.3	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

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Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Anechoic Chamber	
Date	05/31/2012	06/01/2012
Temperature/ Humidity	24deg. C / 56% RH	24deg. C / 56% RH
Engineer	Tatsuya Arai	Akio Hayashi
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.	125.003	QP	33.1	13.2	7.4	32.1	21.6	43.5	21.9	150	141	Inside	
Hori.	144.000	QP	31.8	14.5	7.6	32.1	21.8	43.5	21.7	224	13	Outside	
Hori.	500.007	QP	36.2	17.8	9.4	32.0	31.4	46.0	14.6	134	201	Outside	
Hori.	625.026	QP	34.2	19.4	9.9	32.0	31.5	46.0	14.5	100	193	Outside	
Hori.	799.994	QP	33.1	21.1	10.4	31.7	32.9	46.0	13.1	146	177	Outside	
Vert.	30.612	QP	41.8	17.8	6.6	32.2	34.0	40.0	6.0	100	237	Outside	
Vert.	56.696	QP	41.7	9.2	6.8	32.2	25.5	40.0	14.5	100	259	Outside	
Vert.	625.026	QP	32.9	19.4	9.9	32.0	30.2	46.0	15.8	100	180	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	47.3	31.8	16.5	40.6	55.0	68.2	13.2	117	11	Bandedge	
Hori.	6973.370	PK	48.9	36.0	7.8	41.1	51.6	68.2	16.6	100	336	Outside	
Hori.	10460.000	PK	46.1	39.5	9.4	38.5	56.5	68.2	11.7	100	0	Outside	
Hori.	15690.000	PK	44.6	39.1	1.9	38.9	46.7	73.9	27.2	100	0	Inside	
Hori.	5350.000	AV	37.5	31.8	16.5	40.6	45.2	53.9	8.7	117	11	Bandedge	
Hori.	15690.000	AV	34.7	39.1	1.9	38.9	36.8	53.9	17.1	100	0	Inside	
Vert.	5350.000	PK	47.1	31.8	16.5	40.6	54.8	68.2	13.4	131	22	Bandedge	
Vert.	6973.359	PK	49.7	36.0	7.8	41.1	52.4	68.2	15.8	138	341	Outside	
Vert.	10460.000	PK	46.0	39.5	9.4	38.5	56.4	68.2	11.8	100	0	Outside	
Vert.	15690.000	PK	44.5	39.1	1.9	38.9	46.6	73.9	27.3	100	0	Inside	
Vert.	5350.000	AV	37.4	31.8	16.5	40.6	45.1	53.9	8.8	131	22	Bandedge	
Vert.	15690.000	AV	34.5	39.1	1.9	38.9	36.6	53.9	17.3	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 $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

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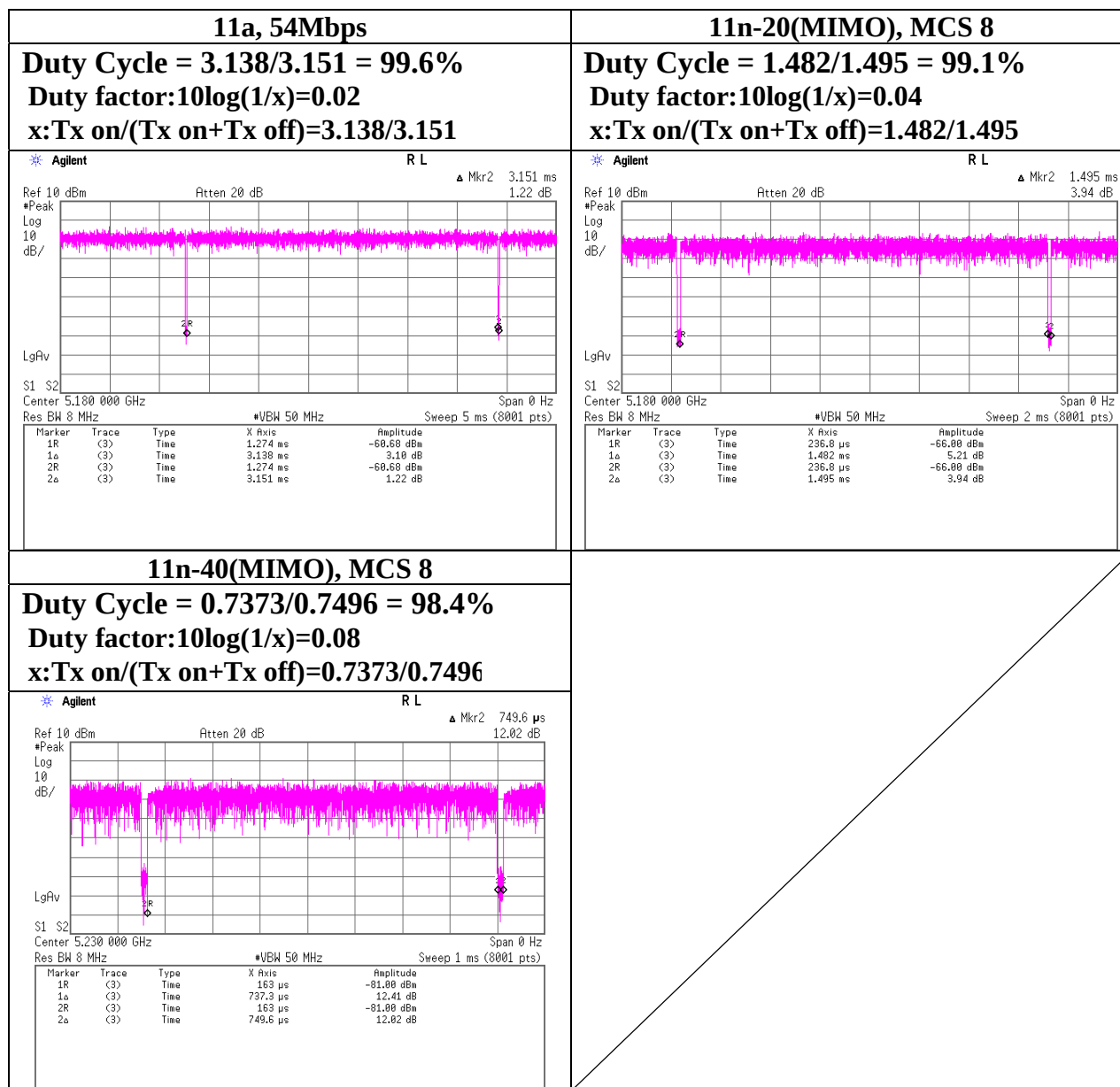
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Duty Cycle



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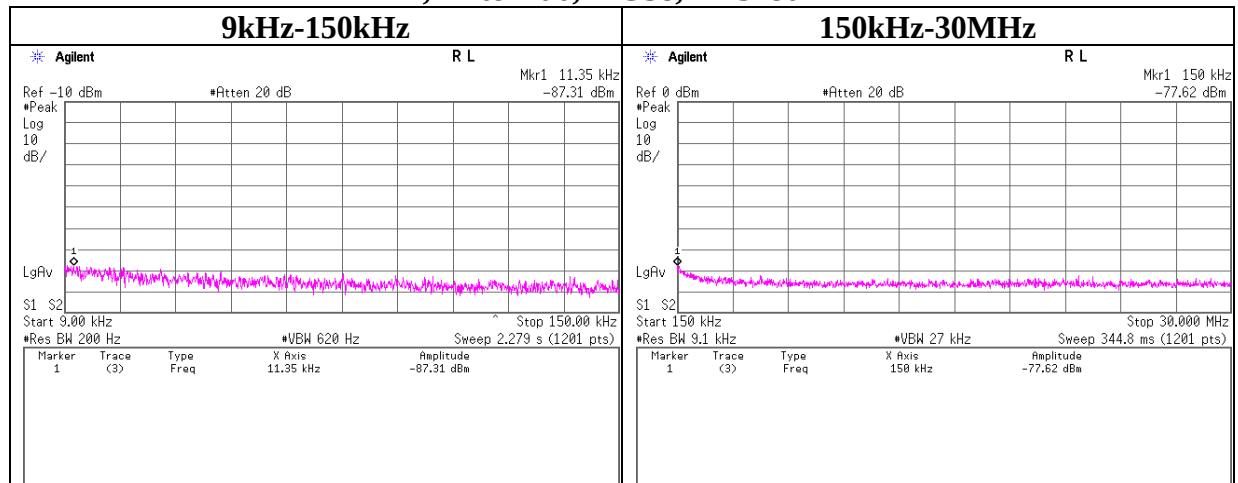
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Conducted Spurious Emission

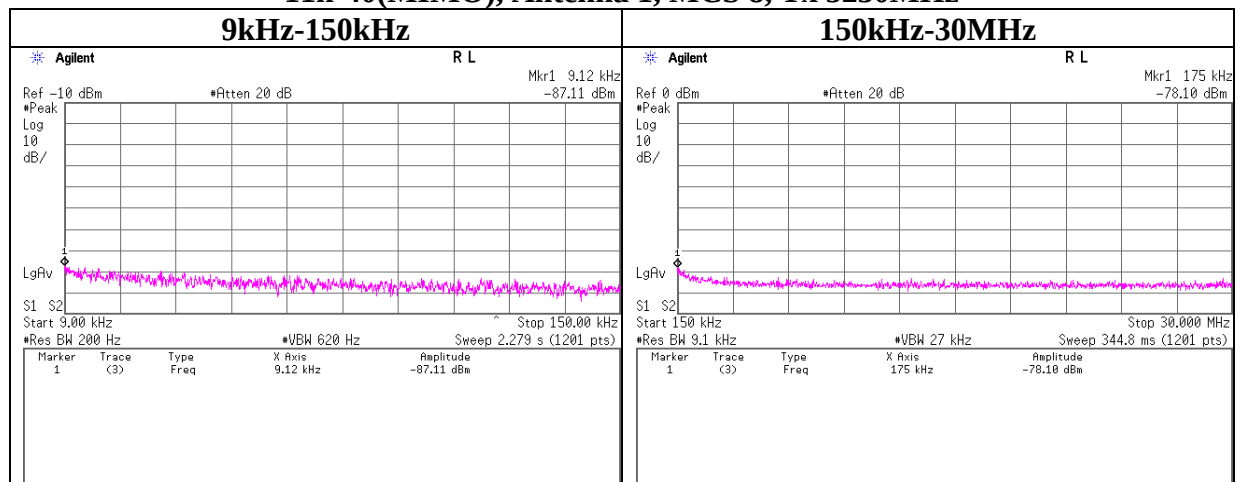
11n, Antenna0, MCS8, Tx 5180MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dB]	N (Number of Output)	EIRP [dBm]	Limit [dBm]	Margin [dB]
11.35	-87.3	2.0	20.1	2.14	2.00	-60.1	-27.0	33.1
150.00	-77.6	2.0	20.1	2.14	2.00	-50.4	-27.0	23.4

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

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)	EIRP [dBm]	Limit [dBm]	Margin [dB]
9.12	-87.1	2.1	20.1	2.14	2	-59.9	-27.0	32.9
175.00	-78.1	2.1	20.1	2.14	2	-50.8	-27.0	23.8

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

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Peak Excursion Ratio

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11a Single Output, PN9, worst antenna port 0, worst data mode 6[Mbps]	

Ch. Freq. [MHz]	Data rate [Mbps]	Peak Reading [dBm]	PPSD Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]			Peak Result [dBm]	PPSD Result [dBm]	Peak Power Excursion [dB]	Limit [dB]	Margin [dB]
5180	6	-12.59	-20.85	2.04	20.05			9.50	1.24	8.26	=<13.0	4.74
	9	-12.39	-20.98	2.04	20.05			9.70	1.11	8.59	=<13.0	4.41
	12	-11.71	-20.76	2.04	20.05			10.38	1.33	9.05	=<13.0	3.95
	18	-11.90	-20.84	2.04	20.05			10.19	1.25	8.94	=<13.0	4.06
	24	-10.94	-20.75	2.04	20.05			11.15	1.34	9.81	=<13.0	3.19
	36	-11.37	-20.75	2.04	20.05			10.72	1.34	9.38	=<13.0	3.62
	48	-11.37	-20.75	2.04	20.05			10.72	1.34	9.38	=<13.0	3.62
	54	-11.27	-20.67	2.04	20.05			10.82	1.42	9.40	=<13.0	3.60

Sample Calculation:

*Peak Power Excursion = Peak Result - PPSP Result

*Peak Result = Reading + Cable Loss + Atten.Loss

*PPSP Result = Reading + Cable Loss + Atten.Loss

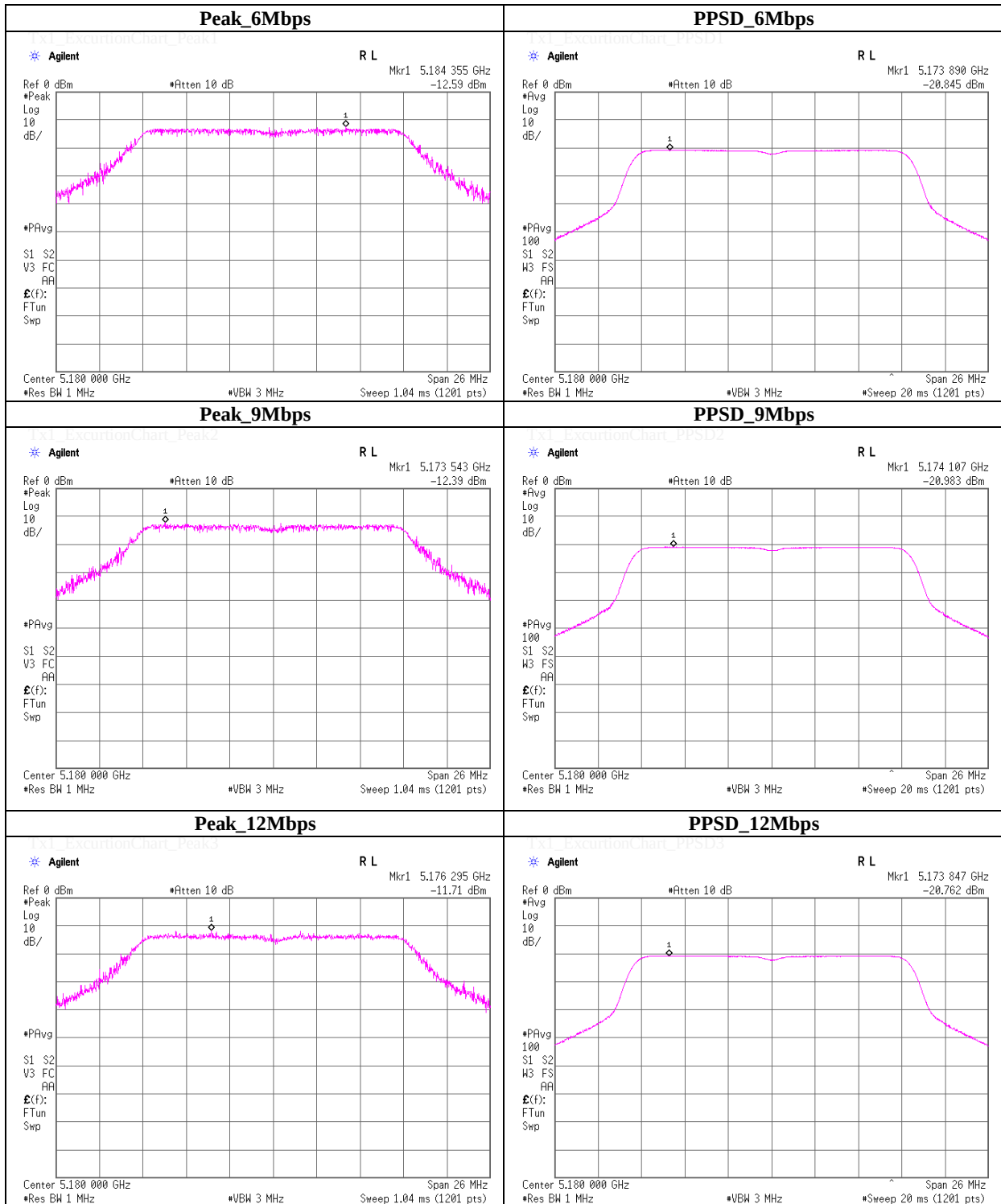
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Peak Excursion Ratio



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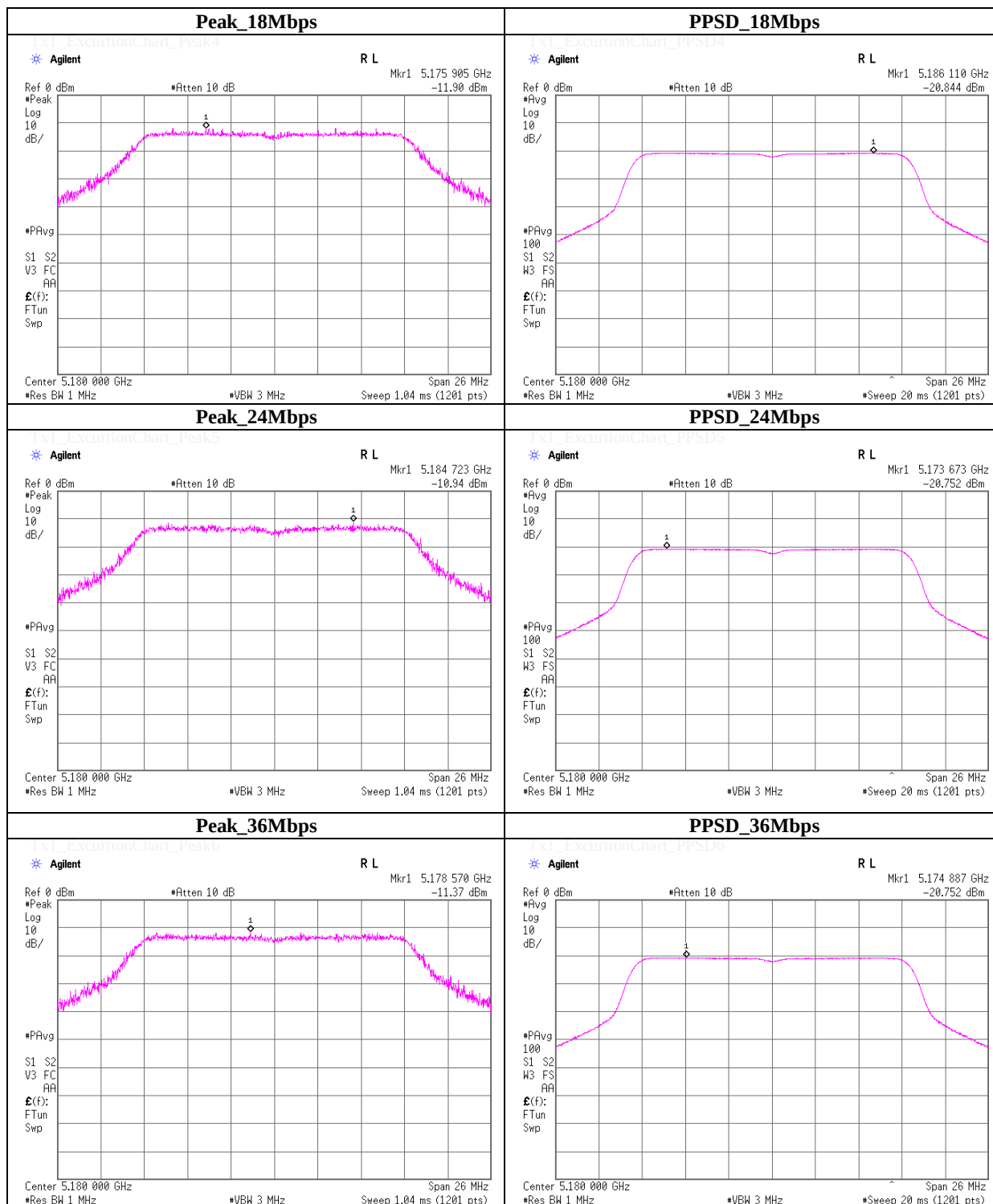
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Peak Excursion Ratio



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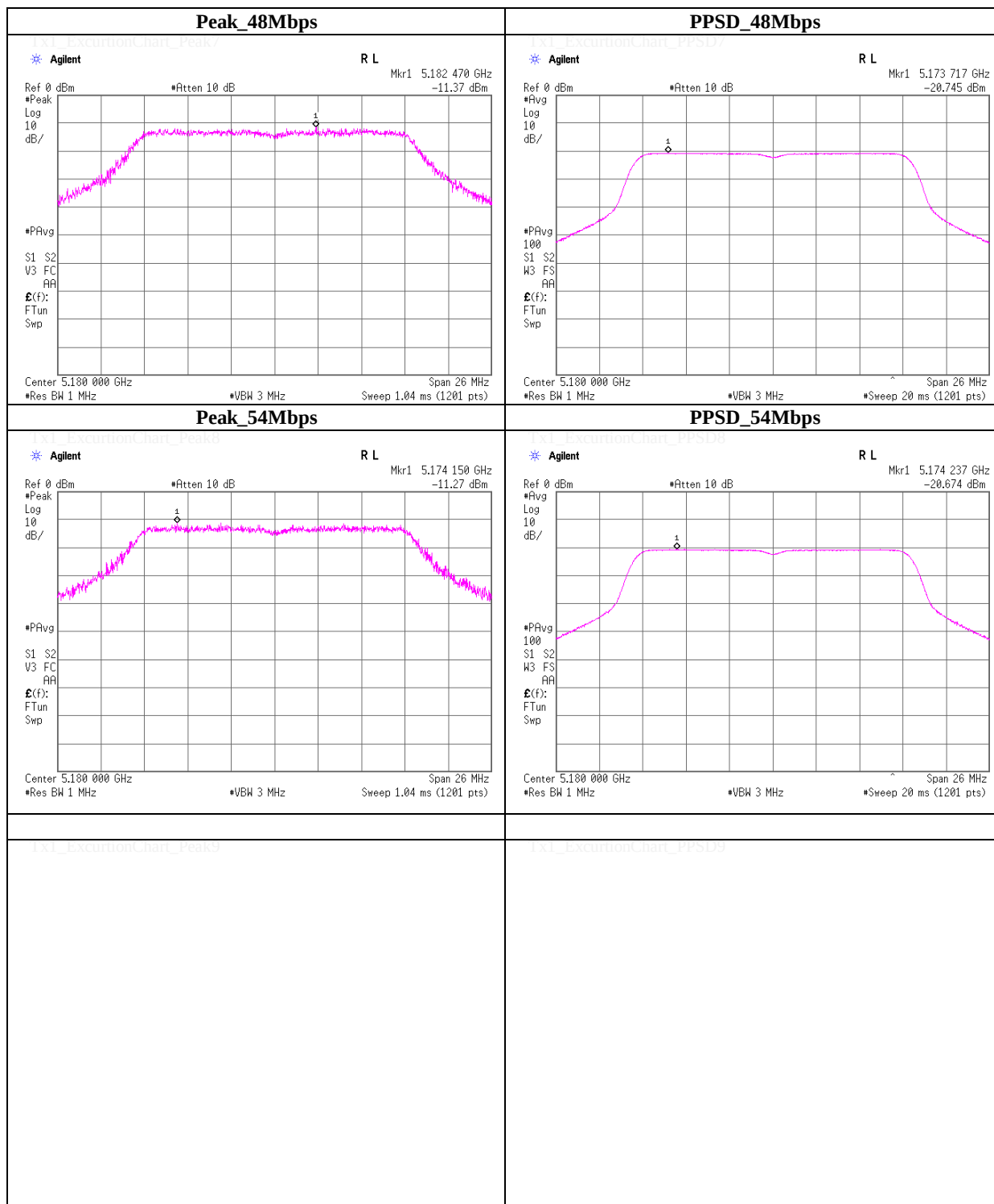
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Peak Excursion Ratio

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT20 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Ch. Freq. [MHz]	Mode (MCS)	Peak Reading [dBm]	PPSD Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]		10log (NANT)* [dB]	Peak Result [dBm]	PPSD Result [dBm]	Peak Power Excursion [dB]	Limit [dB]	Margin [dB]
5180	8	-12.97	-22.47	2.04	20.05		3.01	12.13	2.63	9.50	=<13.0	3.50
	9	-13.05	-22.65	2.04	20.05		3.01	12.05	2.45	9.60	=<13.0	3.40
	10	-12.75	-22.56	2.04	20.05		3.01	12.35	2.54	9.81	=<13.0	3.19
	11	-12.48	-22.55	2.04	20.05		3.01	12.62	2.55	10.07	=<13.0	2.93
	12	-12.58	-22.40	2.04	20.05		3.01	12.52	2.70	9.82	=<13.0	3.18
	13	-11.76	-22.43	2.04	20.05		3.01	13.34	2.67	10.67	=<13.0	2.33
	14	-12.17	-22.45	2.04	20.05		3.01	12.93	2.65	10.28	=<13.0	2.72
	15	-13.26	-22.91	2.04	20.05		3.01	11.84	2.19	9.65	=<13.0	3.35

Sample Calculation:

*Peak Power Excursion = Peak Result - PPSP Result

*Peak Result = Reading + Cable Loss + Atten.Loss + 10log(NANT)

*PPSP Result = Reading + Cable Loss + Atten.Loss + 10log(NANT)

UL Japan, Inc.

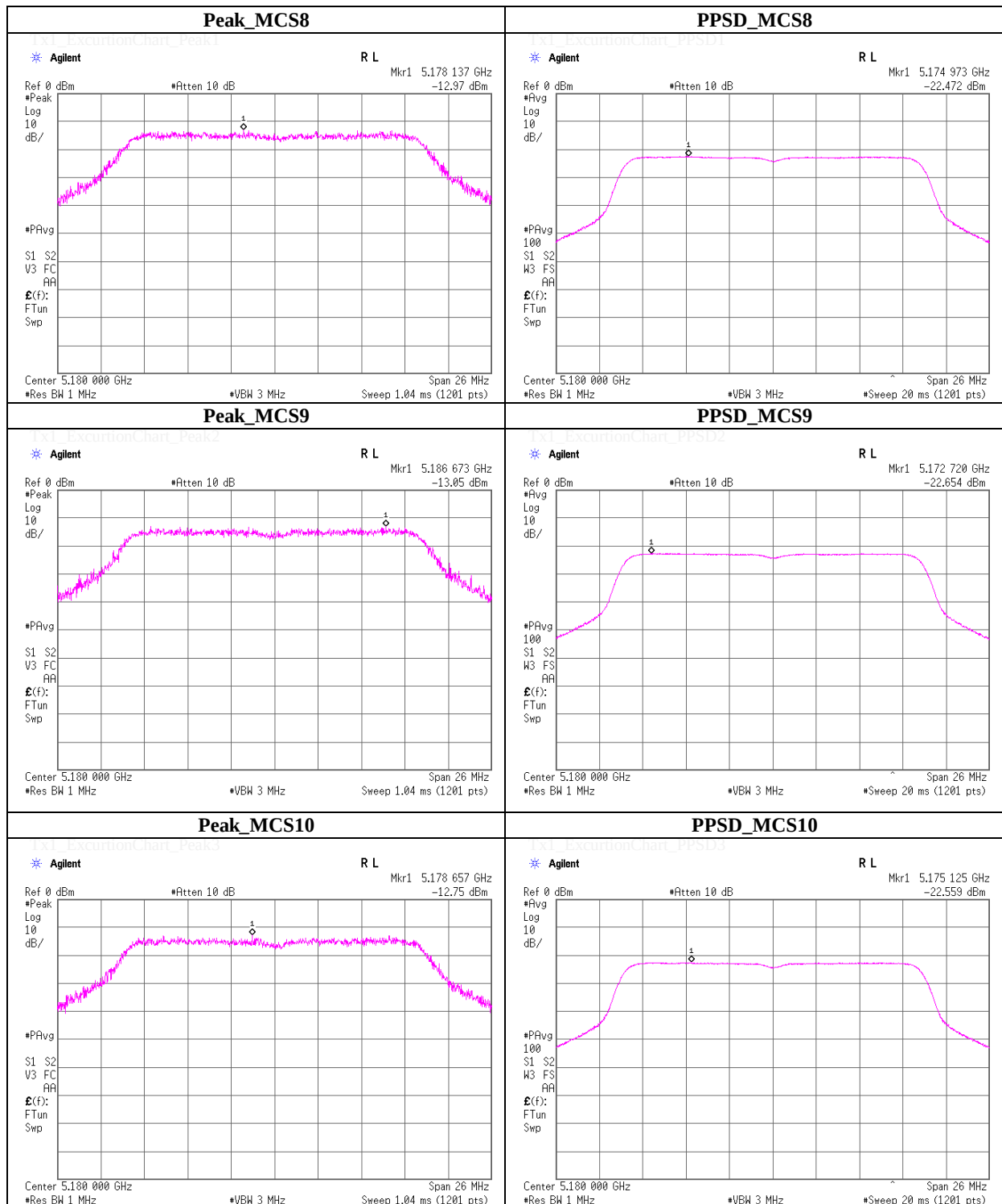
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Peak Excursion Ratio



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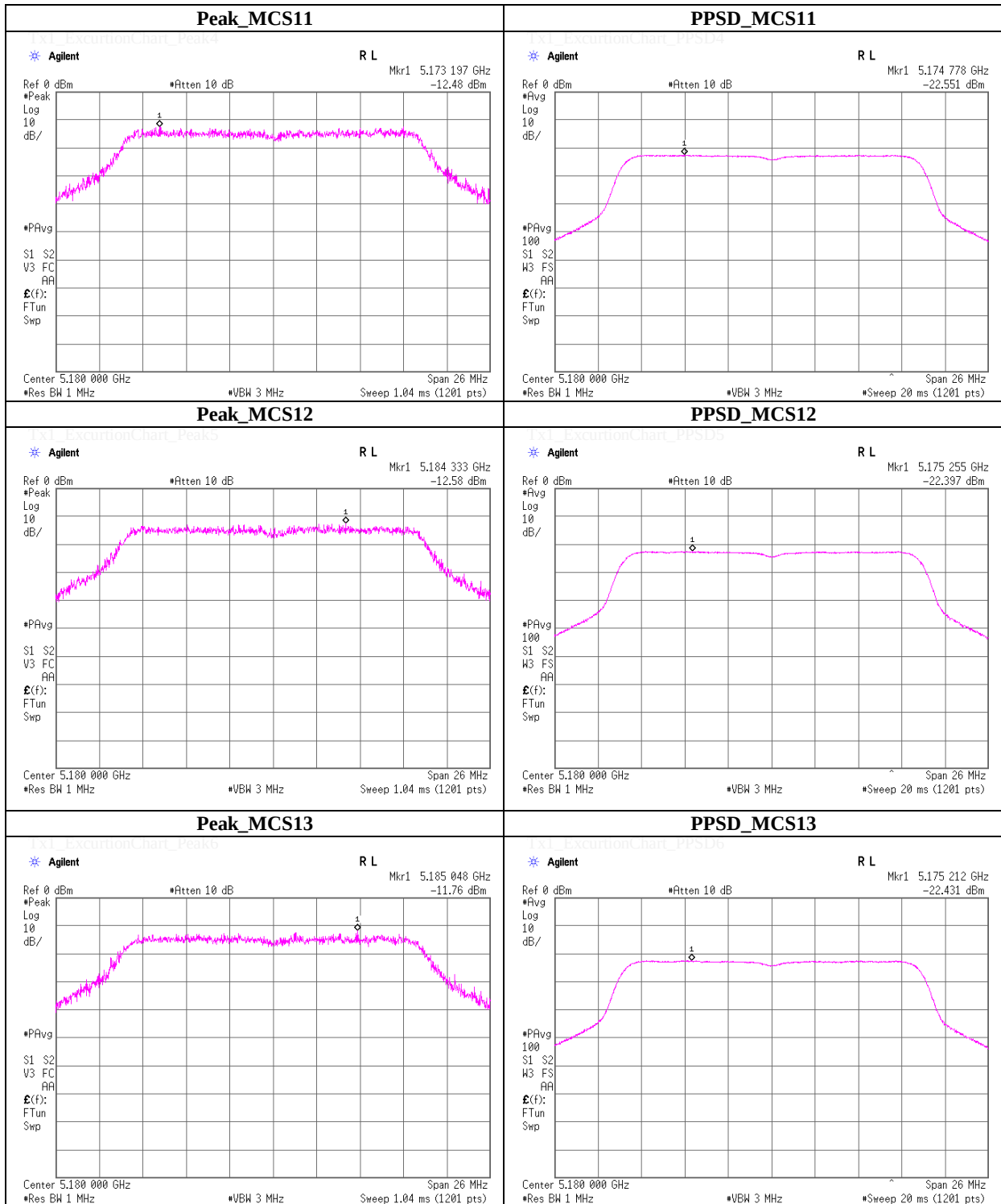
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Peak Excursion Ratio



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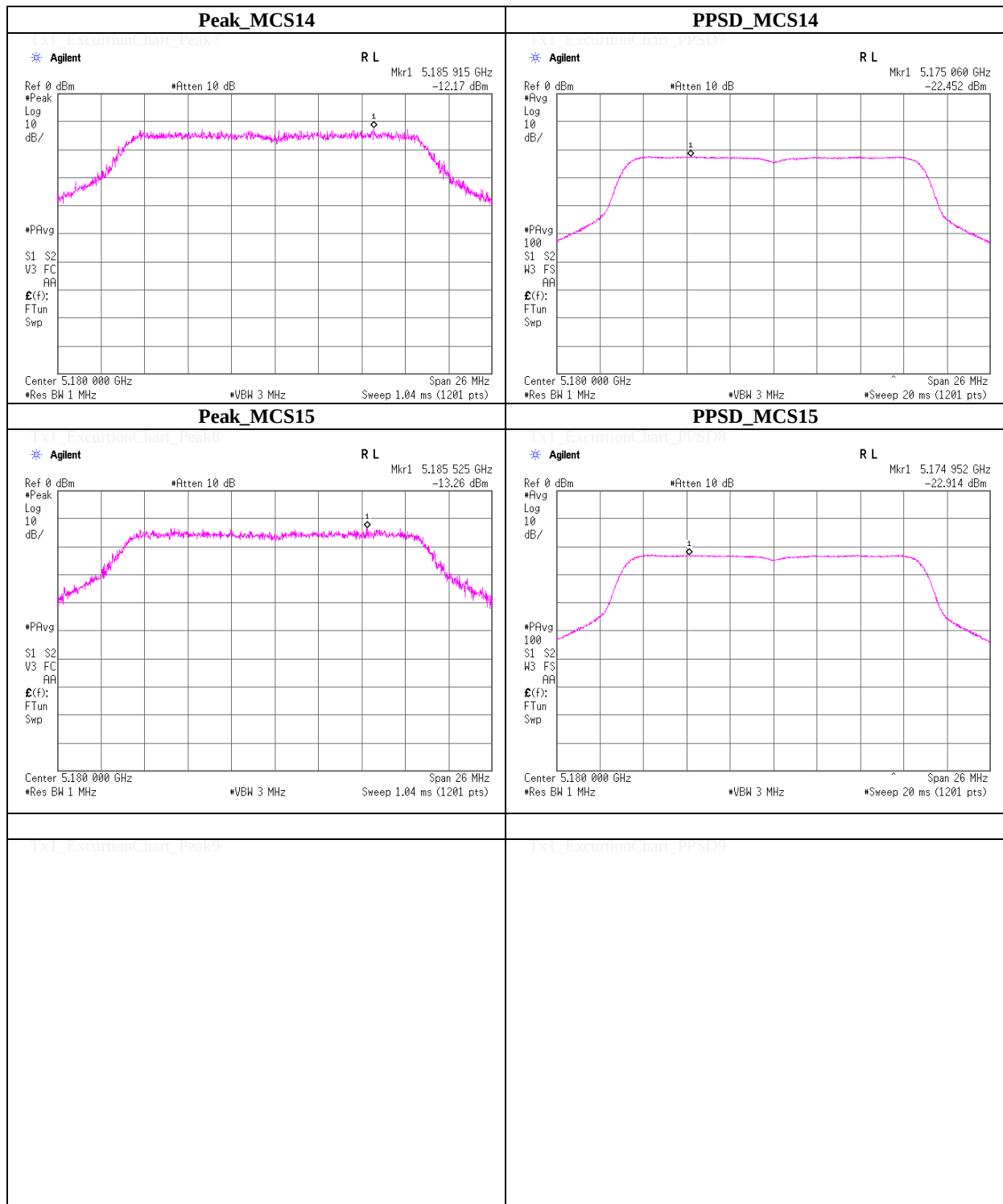
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Peak Excursion Ratio

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
Date	July 3, 2013	
Temperature / Humidity	26 deg.C , 54 %RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n-HT40 Multi Output (2Tx), PN9, worst antenna port 0, worst data mode 8(MCS)	

Ch. Freq. [MHz]	Mode (MCS)	Peak Reading [dBm]	PPSD Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]		10log (NANT)* [dB]	Peak Result [dBm]	PPSD Result [dBm]	Peak Power Excursion [dB]	Limit [dB]	Margin [dB]
5190	8	-17.08	-27.18	2.04	20.05		3.01	8.02	-2.08	10.10	=<13.0	2.90
	9	-17.48	-27.18	2.04	20.05		3.01	7.62	-2.08	9.70	=<13.0	3.30
	10	-17.32	-27.02	2.04	20.05		3.01	7.78	-1.92	9.70	=<13.0	3.30
	11	-17.14	-27.13	2.04	20.05		3.01	7.96	-2.03	9.99	=<13.0	3.01
	12	-17.07	-26.95	2.04	20.05		3.01	8.03	-1.85	9.88	=<13.0	3.12
	13	-17.02	-26.89	2.04	20.05		3.01	8.08	-1.79	9.87	=<13.0	3.13
	14	-17.31	-26.59	2.04	20.05		3.01	7.79	-1.49	9.28	=<13.0	3.72
	15	-17.12	-26.78	2.04	20.05		3.01	7.98	-1.68	9.66	=<13.0	3.34

Sample Calculation:

*Peak Power Excursion = Peak Result - PPSSD Result

*Peak Result = Reading + Cable Loss + Atten.Loss + 10log(NANT)

*PPSD Result = Reading + Cable Loss + Atten.Loss + 10log(NANT)

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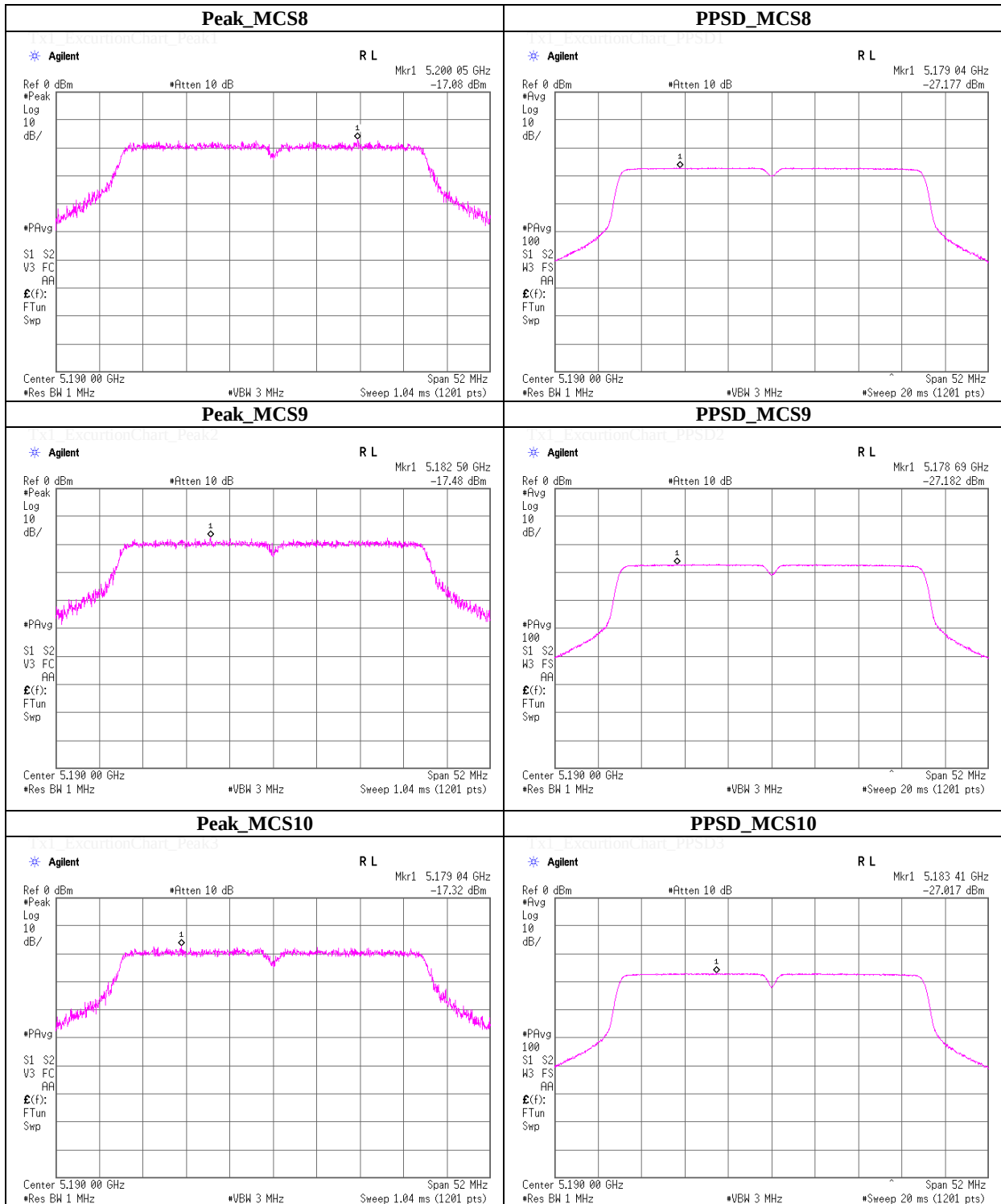
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Peak Excursion Ratio



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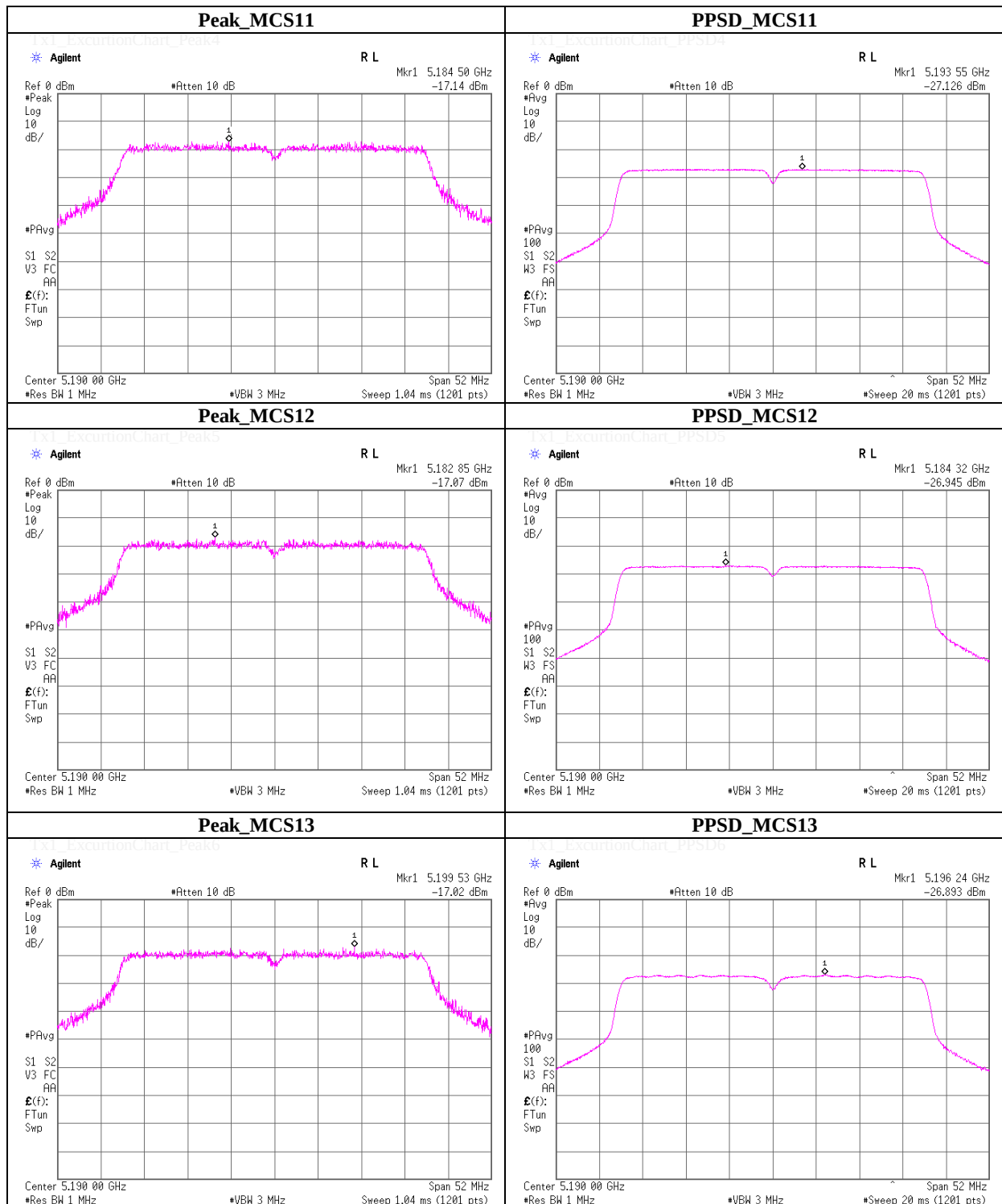
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Peak Excursion Ratio



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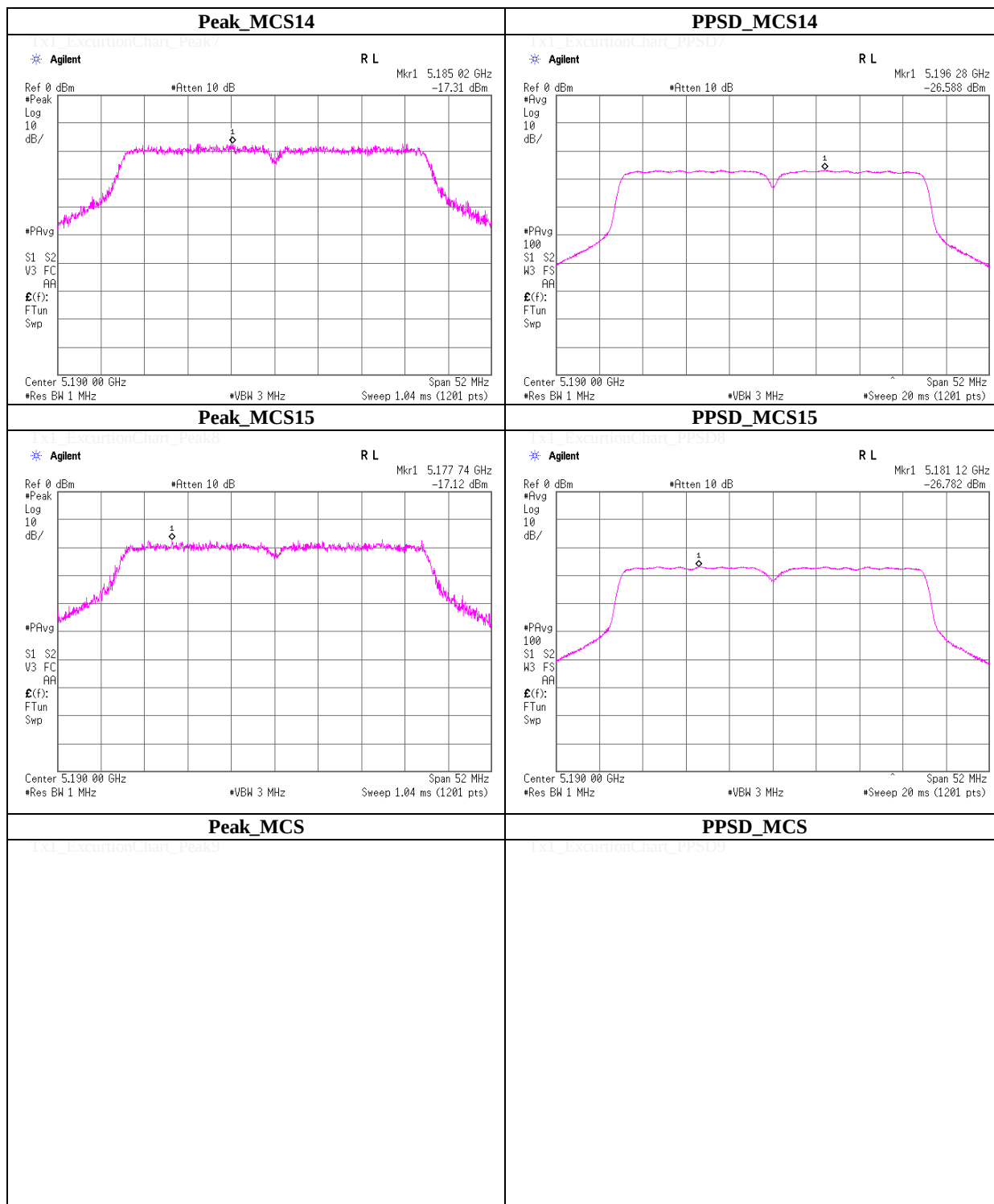
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APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2011/07/19 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	2012/04/10 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2012/05/22 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2011/08/28 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2012/02/06 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2012/03/16 * 12
SJM-10	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
SFL-03	Highpass Filter	MICRO-TRONICS	HPM50112	28	RE	2011/12/27 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2011/12/27 * 12
SHA-05	Horn Antenna	ETS LINDGREN	Sep-60	LM4210	RE	2012/03/30 * 12
SHA-06	Horn Antenna	ETS LINDGREN	Oct-60	LM3459	RE	2012/03/30 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2012/03/12 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2012/03/12 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	18	RE	2012/03/12 * 12
SAF-10	Pre Amplifier	TOYO Corporation	HAP26-40W	10	RE	2012/03/12 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2012/02/10 * 12
SAT6-03	Attenuator	JFW	50HF-006N	-	RE	2012/02/10 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2011/10/23 * 12
SCC-C1/C2/C3/C4/C5 /C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/ Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA/141 PE/141PE/141PE/14 1PE/NS4906	-/0901-271(RF Selector)	RE	2012/04/10 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2011/10/23 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2012/02/07 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2011/09/23 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2013/03/04 * 12
SAT20-07	Attenuator	Weinschel Corp.	54A-20	31484	AT	2013/04/09 * 12
SCC-G29	Coaxial Cable	Junkosha	MWX241- 01000KMSKMS	SEP-20-12-003	AT	2012/09/26 * 12
SOS-10	Humidity Indicator	A&D	AD-5681	4064561	AT	2013/02/27 * 12
KPM-08	Power meter	Anritsu	ML2495A	6K00003356	AT	2012/09/14 * 12
KPSS-04	Power sensor	Anritsu	MA2411B	012088	AT	2012/09/14 * 12
KAT10-S3	Attenuator	Agilent	8490D 010	50924	AT	2013/02/19 * 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.

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

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