



RADIO TEST REPORT

Test Report No. : 11196086S-R2

Applicant : HON HAI PRECISION IND. CO., LTD.
Type of Equipment : WIFI 11A/N MODULE
Model No. : MIC-B2
FCC ID : MCLMICB2
Test regulation : FCC Part 15 Subpart E: 2015
W58 (5745 MHz - 5825 MHz Band) only
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11196086S-R1. 11196086S-R1 is replaced with this report.

Date of test: May 11 to 18, 2016

Representative test engineer:

S. Takano

Shinichi Takano
Engineer
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A. Hayashi

Akio Hayashi
Leader
Consumer Technology Division



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

UL Japan, Inc.

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11196086S

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SECTION 1: Customer information

Company Name	:	HON HAI PRECISION IND. CO., LTD.
Address	:	5F-1, 5 HSIN-AN ROAD HSINCHU SCIENCE-BASED INDUSTRIAL PARK TAIWAN, R.O.C.
Telephone Number	:	886-3-5784975
Facsimile Number	:	886-3-5775100
Contact Person	:	Rio Chen

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

2.1 Identification of E.U.T.

Type of Equipment	:	WIFI 11A/N MODULE
Model No.	:	MIC-B2
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V to DC 3.6 V (Typ: DC 3.3 V)
Receipt Date of Sample	:	March 31, 2016
Country of Mass-production	:	China
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab.

2.2 Product Description

Model: MIC-B2 (referred to as the EUT in this report) is a WIFI 11A/N MODULE.

General Specification

Clock frequency(ies) in the system	:	20 MHz
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Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	5745 MHz - 5825 MHz, 5755 MHz - 5795 MHz
Modulation	:	OFDM
Power Supply (radio part input)	:	DC 1.2 V, DC 3.3 V
Antenna type	:	PIFA
Antenna Gain	:	1.23 dBi for SISO mode 4.23 dBi for MIMO mode

Remarks: This Wireless Module consists of 1 chip each of 5 GHz band.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015
 Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted limits
 Section 15.247 Operation within the bands 902-92 8MHz,
 2400-2483.5 MHz, and 5725-5850 MHz

*Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013	FCC: 15.407 (b) (6) / 15.207	14.1 dB, 0.20656 MHz, L1, QP Tx 5745 MHz 11n-20 (MMIO)	Complied	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
26 dB Emission Bandwidth	FCC: KDB Publication Number 789033	FCC: 15.407 (a) (1) (2) (3)	See data	N/A	Conducted
	IC: -	IC: -			
Maximum Conducted Output Power	FCC: KDB Publication Number 789033	FCC: 15.407 (a) (1) (2) (3)		Complied	Conducted
	IC: -	IC: RSS-247 6.2.1 (1) 6.2.2 (1) 6.2.3 (1) 6.2.4 (1)			
Maximum Power Spectral Density	FCC: KDB Publication Number 789033	FCC : 15.407 (a) (1) (2) (3)	See data	Complied	Conducted
	IC: -	IC: RSS-247 6.2.1 (1) 6.2.2 (1) 6.2.3 (1) 6.2.4 (1)			
Spurious Emission Restricted Band Edge	FCC: ANSI C63.10-2013 KDB Publication Number 789033	FCC: 15.407 (b), 15.205 and 15.209		Complied	Conducted (< 30 MHz) / Radiated (> 30 MHz) *1) *2)
	IC: -	IC: RSS-247 6.2.1 (2) 6.2.2 (2) 6.2.3 (2) 6.2.4 (2)			
6 dB Emission Bandwidth	FCC: ANSI C63.10-2013	FCC: 15.407 (e)	See data	Complied	Conducted
	IC: -	IC: RSS-247 6.2.4 (1)			

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

*1) Radiated test was selected over 30 MHz based on section FCC 15.407 (b) and KDB 789033 D02 G.3.b).

*2) FCC 15.407(b)(4)(ii) was applied based on Note Code 49 of KDB926956 D01 UNII Transition Plan v01r06.

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

The RF Module has its own regulator. The RF part is constantly provided voltage (DC 1.2 V, DC 3.3 V). Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The EUT has a unique coupling/antenna connector (U.FL). Therefore the equipment complies with the requirement.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	RSS-Gen 6.6	IC: -	N/A	N/A	Conducted

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

3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.
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Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.1 dB	2.1 dB	2.6 dB	2.2 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	2.7 dB	2.7 dB	3.1 dB	-
	30 MHz-300 MHz	4.4 dB	4.4 dB	4.6 dB	-
	300 MHz-1 GHz	5.6 dB	5.5 dB	5.3 dB	-
	1 GHz-13 GHz	5.2 dB	5.2 dB	5.2 dB	-
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	4.9 dB	4.9 dB	4.9 dB	-
	18 GHz-40 GHz	4.9 dB	4.9 dB	4.9 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	1.5 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.4 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.5 dB
Bandwidth Measurement	0.66 %
Duty cycle and Time Measurement	0.012 %

Conducted Emission test

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

Radiated emission test

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

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
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	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

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

Mode	Remarks*
IEEE 802.11a (11a)	6 Mbps, PN9
IEEE 802.11n SISO 20 MHz BW (11n-20 SISO)	MCS 4, PN9
IEEE 802.11n MIMO 20 MHz BW (11n-20 MIMO)	MCS 8, PN9
IEEE 802.11n SISO 40 MHz BW (11n-40 SISO)	MCS 1, PN9
IEEE 802.11n MIMO 40 MHz BW (11n-40 MIMO)	MCS 8, PN9
*The worst antenna and condition was determined based on the test result of Maximum Conducted Output Power.	
Power settings: -1 (q dBm Index)	
Software: Mtool.exe Version 2.0.1.6	
*This setting of software is the worst case.	
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 Operation mode(s)

Test Item	Operating Mode *2)	Tested Frequency
Conducted emission Radiated Spurious Emission (Below 1 GHz) Conducted Spurious Emission	11n-20 MIMO Tx *1)	5745 MHz *1)
99 % Occupied Bandwidth, Maximum Conducted Output Power, Maximum Power Spectral Density 6 dB Bandwidth	11a Tx 11n-20 SISO Tx 11n-20 MIMO Tx 11n-40 SISO Tx 11n-40 MIMO Tx	5745 MHz / 5785 MHz / 5825 MHz (20 MHz band) 5755 MHz / 5795 MHz (40 MHz band)
Radiated Spurious Emission (Above 1 GHz)	11n-20 MIMO Tx 11n-40 MIMO Tx	5745 MHz / 5785 MHz / 5825 MHz (20 MHz band) 5755 MHz / 5795 MHz (40 MHz band)
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test.		
*2) The worse antenna port was determined based on the test result of Maximum Peak Output Power.		

Measured antenna port:

	Single output (IEEE 802.11a, 11n SISO)	Multi output (IEEE 802.11n MIMO)
Maximum peak output power	Antenna A Antenna B	Antenna A + Antenna B
Maximum Power Spectral Density, Radiated emission	Antenna A or Antenna B *3)	Antenna A + Antenna B
Other tests	Antenna A or Antenna B *3)	Antenna A or Antenna B *3)

*3) The worse antenna port was determined based on the test result of Maximum Peak Output Power.

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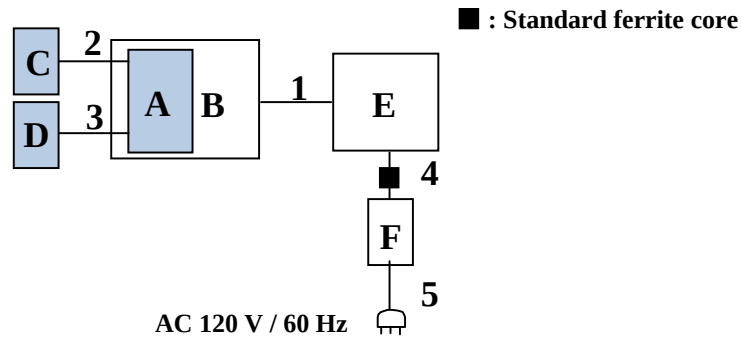
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4.2 Configuration and peripherals



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

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	WIFI 11A/N MODULE	MIC-B2	40D28AD9C77A *1) 40D28AD9C079 *2)	Hon Hai Precision Ind. Co., Ltd.	EUT
B	MIC B Conversion board	-	-	FOXCONN	*3)
C	Antenna	361.00236.005	1	FOXCONN	EUT
D	Antenna	361.00237.005	2	FOXCONN	EUT
E	Laptop PC	2373-L32	99-NHR9F	IBM	-
F	AC Adapter	08K8208	11S08K8208Z1Z9MA4A GA68	IBM	-

*1) Used for Antenna Terminal conducted test

*2) Used for Conducted Emission test and Radiated Emission test

*3) The use of a board does not influence on the test result.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Flat cable	0.23	Unshielded	Unshielded	-
2	Antenna cable	0.21	Shielded	Shielded	Antenna: ANT R
3	Antenna cable	0.29	Shielded	Shielded	Antenna: ANT G
4	DC cable	1.8	Unshielded	Unshielded	-
5	AC cable	1.0	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a shielded room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR Average
Measurement range	: 0.15 MHz-30 MHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

< Below 1 GHz >

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

< Above 1 GHz >

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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

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

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

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

< Below 1 GHz >

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

< Above 1 GHz >

Inside of restricted bands (Section 15.205):

Apply to limit in the Section 15.209 (a).

Outside of the restricted bands:

Apply to limit in the Section 15.209 (a).

Since this limit is severer than the limit of the inside of restricted bands.

Restricted band edge:

Apply to limit in the Section 15. 407(b)(4)(ii) based on Note Code 49 of KDB926956 D01 UNII Transition Plan v01r06.

*Electric field strength to e.i.r.p. conversion:

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

Test Antennas are used as below;

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

Frequency	Below 1 GHz	Above 1 GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	Peak	Average
IF Bandwidth	BW: 120 kHz	RBW: 1 MHz VBW: 3 MHz	Method VB *1) RBW: 1 MHz VBW: 11n-20: 1.1 kHz, 11n-40: 2.2 kHz Detector: Peak Trace: Maxhold
Test Distance	3 m	3 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 40 GHz)	

*1) The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v01r02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on April 8, 2016)".

*2) Distance Factor: $20 \times \log(4.4 \text{ m}/3.0 \text{ m}) = 3.3 \text{ dB}$

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

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.

Subject	Antenna polarization	Carrier (Band edge)	Spurious					
			Below 1 GHz	1 GHz - 6.4 GHz	6.4 GHz - 13 GHz	13 GHz - 18 GHz	18 GHz – 26.5 GHz	26.5 GHz – 40 GHz
Module	Horizontal	Z	X	Z	Z	Z	Y	Z
Antenna		X	X	X	X	X	X	X
Module	Vertical	Z	X	Z	Z	X	X	Z
Antenna		X	X	X	X	X	X	X

* The definition of the axis was listed in a 'Pre-check of the worst position' in APPENDIX.

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

Measurement range : 30 MHz-40 GHz
Test data : APPENDIX
Test result : Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used and Test method
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 % to 5 % of OBW	≥ 3 RBW	Auto	Peak	Max Hold	Spectrum Analyzer
6 dB Bandwidth	Enough to capture the emission	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Conducted Output Power	-	-	-	Auto	Average	-	Power Meter (Sensor: 160 MHz BW(SPM-07) (Method PM)
Maximum Power Spectral Density	Encompass the entire EBW	100 kHz *2)	≥ 3 RBW	Auto	RMS Power Averaging (100 times)	Clear Write	Spectrum Analyzer
Conducted Spurious Emission*3)	9 kHz – 150 kHz 150 kHz – 30 MHz	200 Hz 10 kHz	620 Hz 30 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

* The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v01r02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on April 8, 2016)".

*1) Peak hold was applied as Worst-case measurement.

*2) FCC standard says that RBW is set to be 500 kHz for 5.725 GHz-5.850 GHz, but it is not possible with spectrum analyzer, so $10\log(500 \text{ kHz}/100 \text{ kHz})$ was added to the test result.

*3) In the frequency range below 30 MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz-150 kHz: RBW = 200 Hz, 150 kHz-30 MHz: RBW = 10 kHz)

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

Test data : **APPENDIX**

Test result : **Pass**

APPENDIX 1: Test data

Conducted Emission

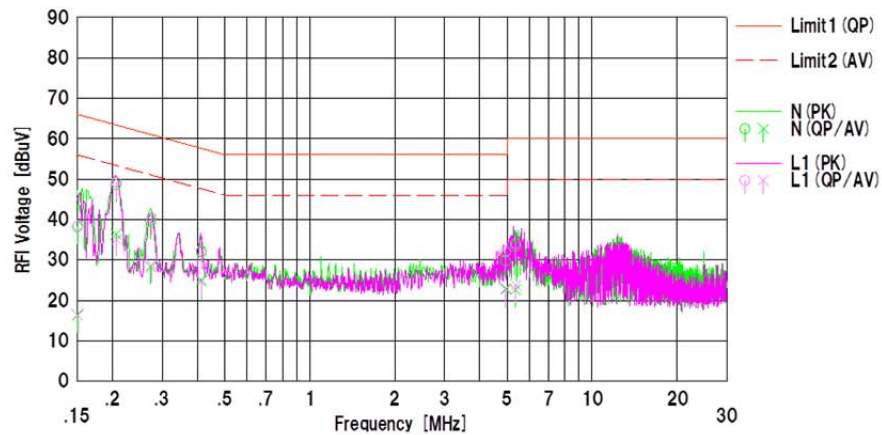
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2016/05/18

Mode : Tx 11n-20 5745MHz (MIMO)
Power : DC 3.3V
Temp./Humi. : 25 deg.C / 51 %RH

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Yohsuke Matsuzawa



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.18020	25.60	3.80	12.58	38.18	16.38	65.99	55.99	27.8	39.6	N	
2	0.20600	36.00	23.70	12.59	48.59	36.29	63.37	53.37	14.7	17.0	N	
3	0.27400	27.00	15.70	12.59	39.59	28.29	61.00	51.00	21.4	22.7	N	
4	0.41280	19.30	12.10	12.62	31.92	24.72	57.59	47.59	25.6	22.8	N	
5	4.95178	16.80	9.80	12.92	29.72	22.72	56.00	46.00	26.2	23.2	N	
6	5.36409	20.40	9.70	12.94	33.34	23.64	60.00	50.00	26.6	27.3	N	
7	0.15098	25.80	3.70	12.58	38.38	16.28	65.95	55.95	27.5	39.6	L1	
8	0.20656	36.60	22.50	12.59	49.19	35.09	63.34	53.34	14.1	18.2	L1	
9	0.27530	27.70	16.20	12.59	40.29	28.79	60.96	50.96	20.6	22.1	L1	
10	0.41270	19.70	12.50	12.62	32.32	25.12	57.59	47.59	25.2	22.4	L1	
11	4.94874	19.10	10.00	12.92	32.02	22.92	56.00	46.00	23.9	23.0	L1	
12	5.36080	21.10	10.80	12.94	34.04	23.74	60.00	50.00	25.9	26.2	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-03

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99 % Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11196086S-R2
Date	May 13, 2016
Temperature / Humidity	25deg. C / 52 % RH
Engineer	Shinichi Takano
Mode	Tx

Tx 11a, Antenna B

Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]	Limit [MHz]
5745	17.145	-
5785	17.084	-
5825	17.106	-

Tx 11n-20 SISO, Antenna A

Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]	Limit [MHz]
5745	17.750	-
5785	17.715	-
5825	17.704	-

Tx 11n-20 MIMO, Antenna A

Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]	Limit [MHz]
5745	17.813	-
5785	17.808	-
5825	17.812	-

Tx 11n-40 SISO, Antenna A

Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]	Limit [MHz]
5755	36.717	-
5795	36.770	-

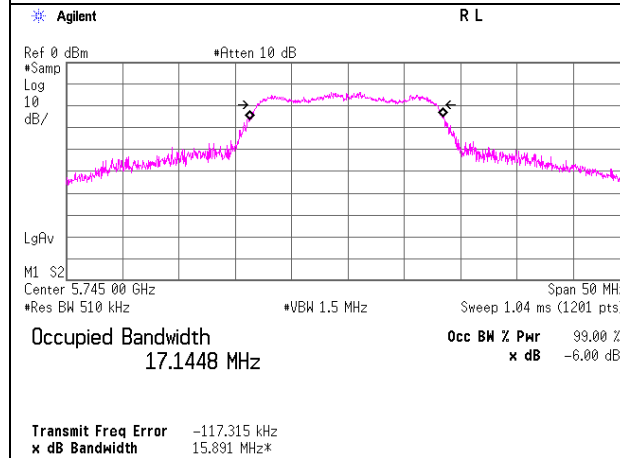
Tx 11n-40 MIMO, Antenna A

Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]	Limit [MHz]
5755	36.750	-
5795	36.778	-

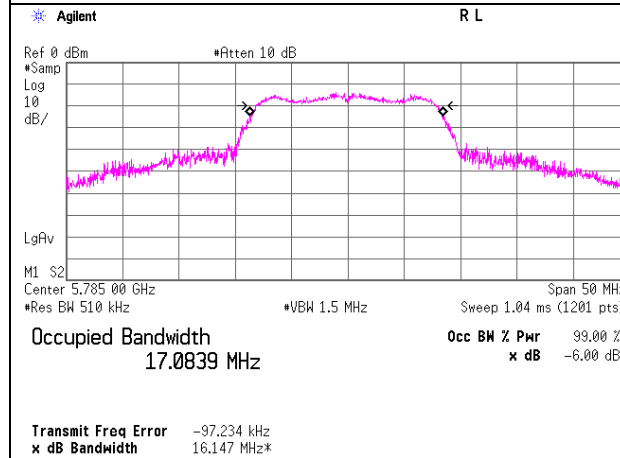
99 % Occupied Bandwidth

11a, Antenna B

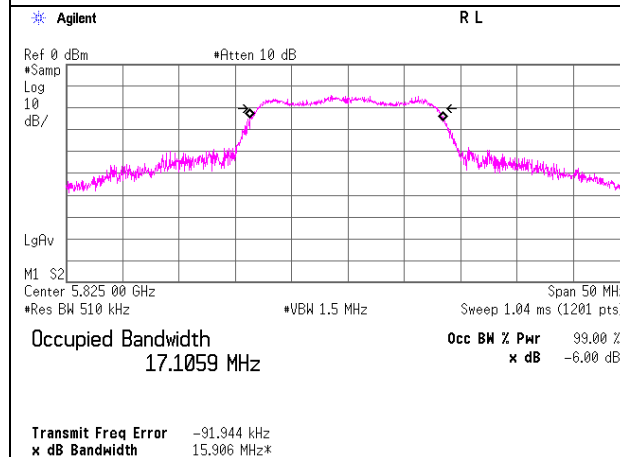
5745 MHz



5785 MHz

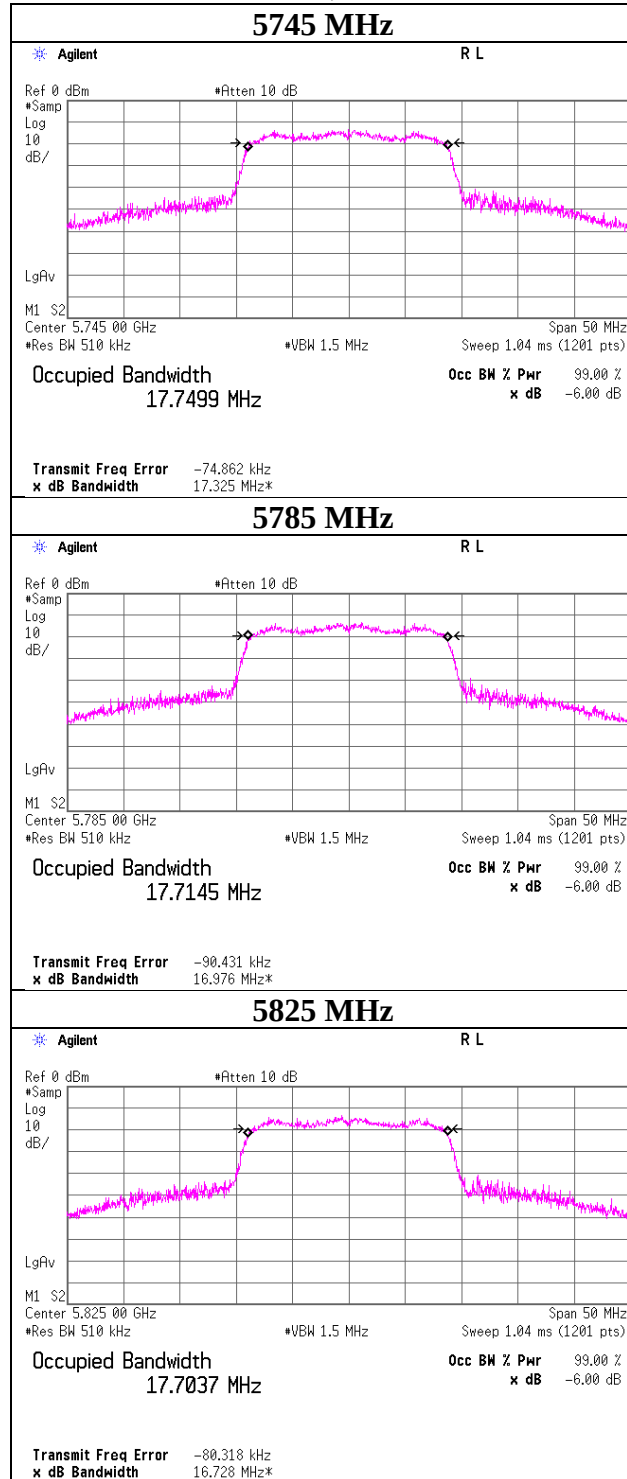


5825 MHz



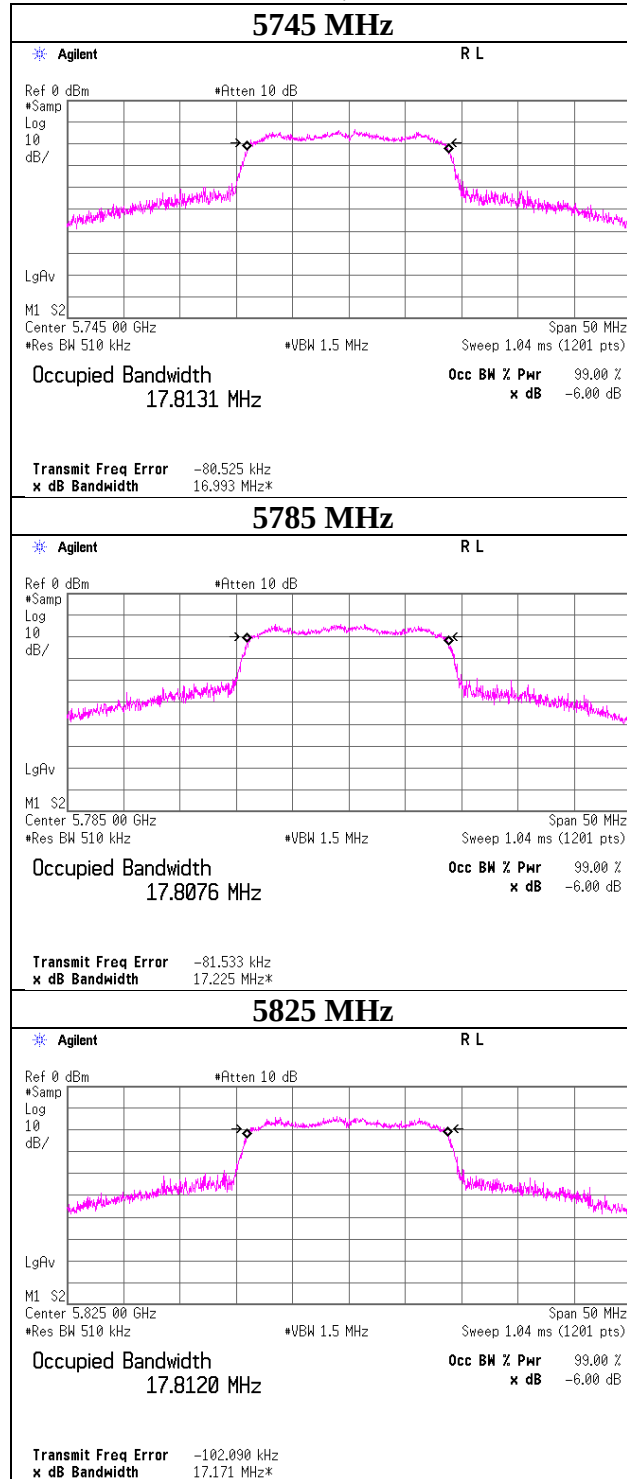
99 % Occupied Bandwidth

11n-20 SISO, Antenna A



99 % Occupied Bandwidth

11n-20 MIMO, Antenna A



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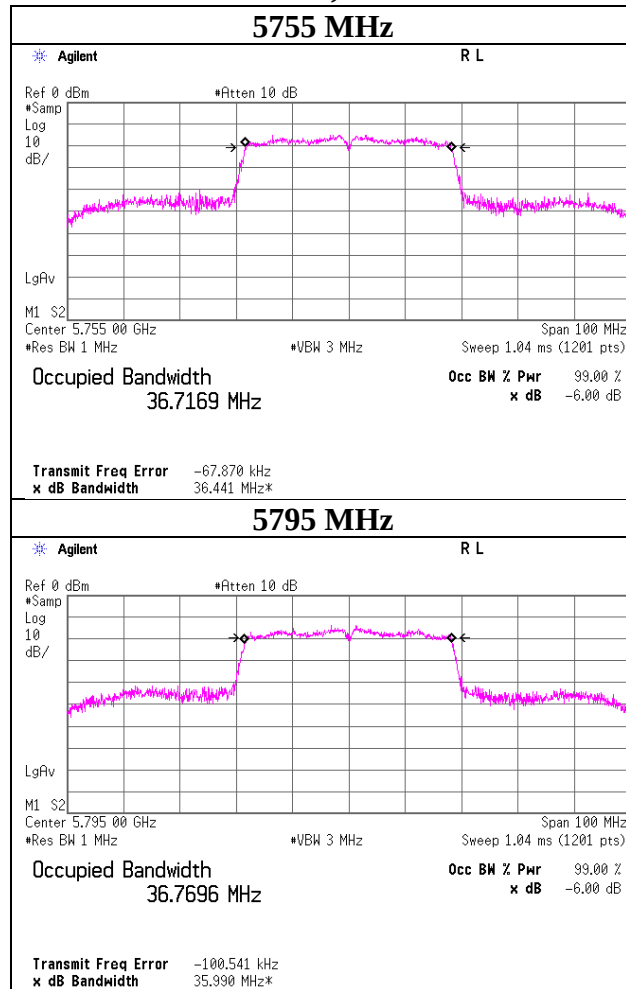
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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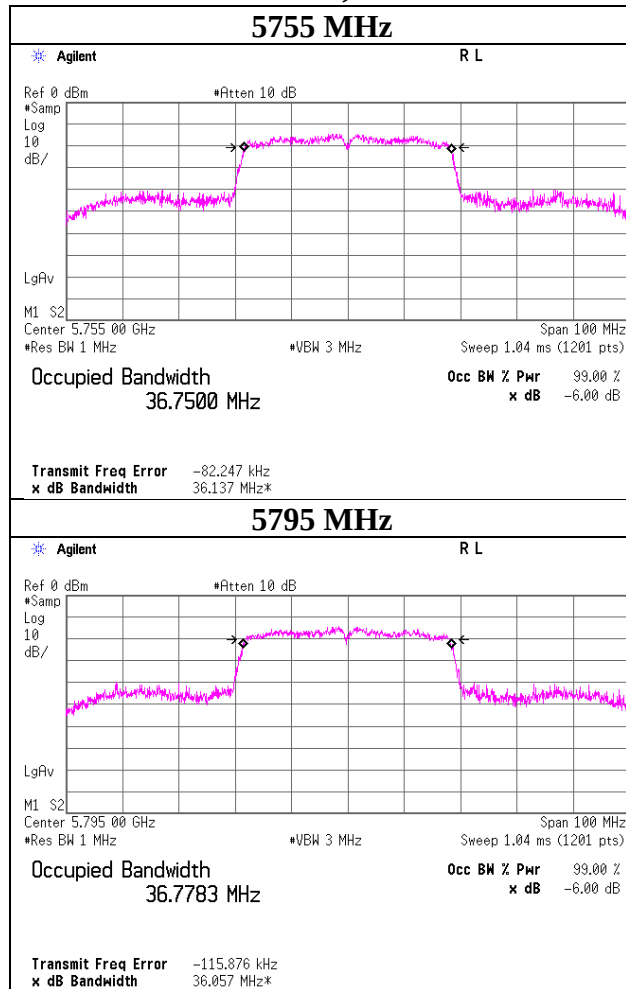
99 % Occupied Bandwidth

11n-40 SISO, Antenna A



99 % Occupied Bandwidth

11n-40 MIMO, Antenna A



6 dB Bandwidth

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx

Tx 11a, Antenna B

Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5745	15.103	> 500
5785	15.106	> 500
5825	15.075	> 500

Tx 11n-20 SISO, Antenna A

Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5745	16.558	> 500
5785	15.748	> 500
5825	15.798	> 500

Tx 11n-20 MIMO, Antenna A

Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5745	15.299	> 500
5785	15.353	> 500
5825	15.041	> 500

Tx 11n-40 SISO, Antenna A

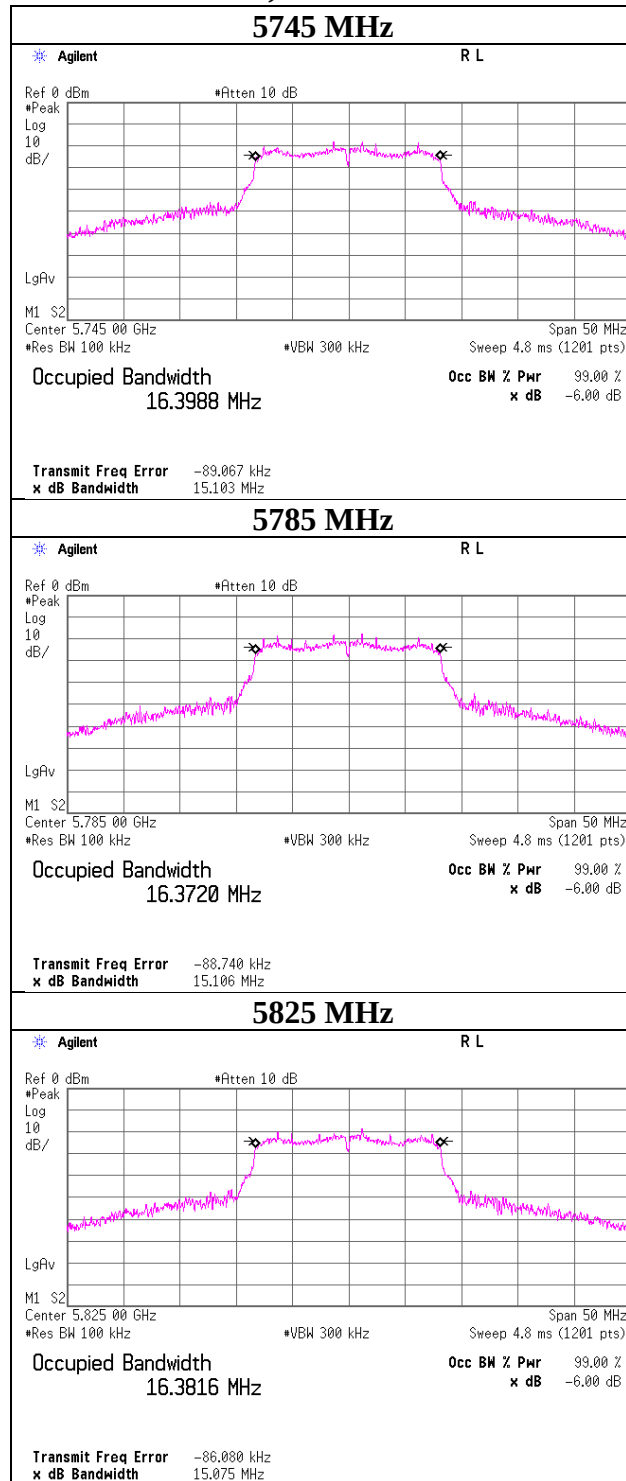
Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5755	35.824	> 500
5795	35.938	> 500

Tx 11n-40 MIMO, Antenna A

Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5755	35.165	> 500
5795	36.386	> 500

6 dB Bandwidth

11a, Antenna B



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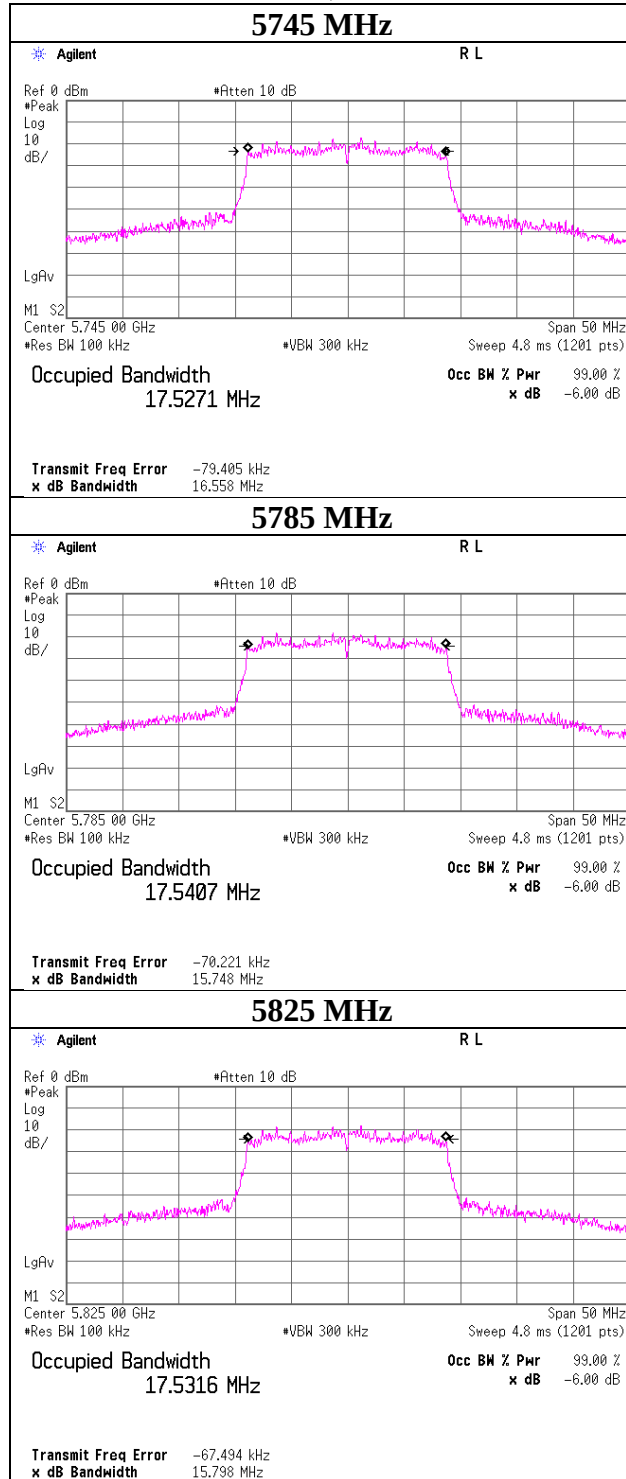
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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6 dB Bandwidth

11n-20 SISO, Antenna A



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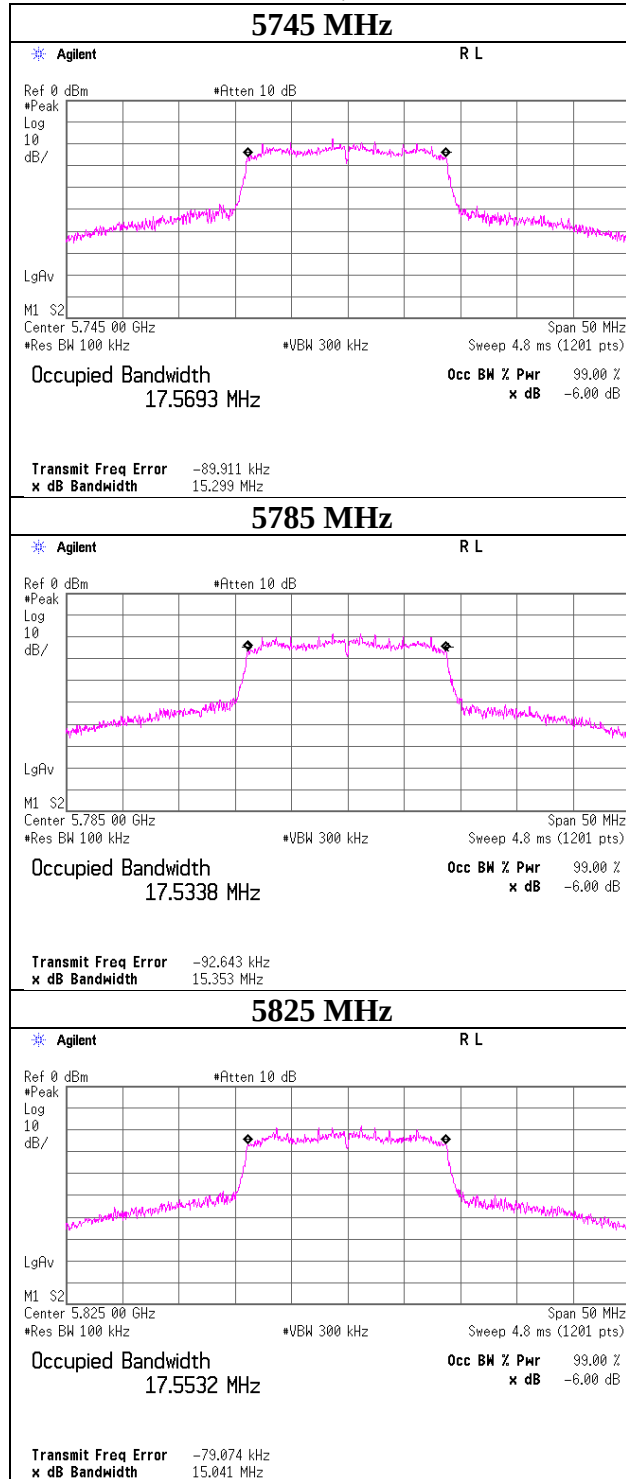
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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6 dB Bandwidth

11n-20 MIMO, Antenna A



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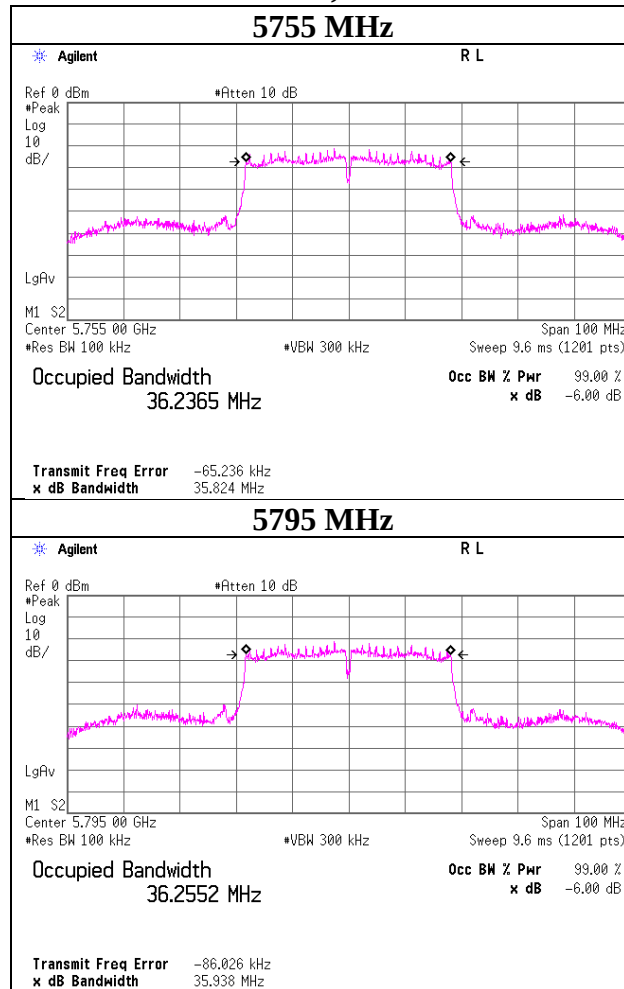
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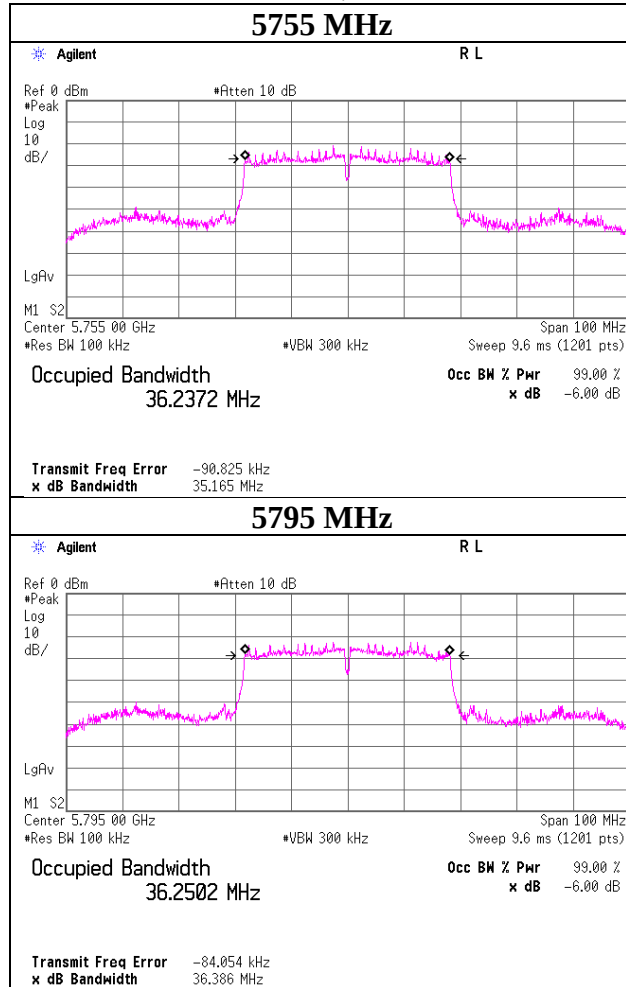
6 dB Bandwidth

11n-40 SISO, Antenna A



6 dB Bandwidth

11n-40 MIMO, Antenna A



Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 11a

Antenna B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for 1C) [MHz]	Conducted Power				e.i.r.p.			
								Result	Limit	Margin		Result	Limit	Margin	
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5745	-8.80	1.73	20.10	0.20	1.23	-	-	13.23	21.04	30.00	16.77	14.46	27.93	36.00	21.54
5785	-8.79	1.74	20.11	0.20	1.23	-	-	13.26	21.18	30.00	16.74	14.49	28.12	36.00	21.51
5825	-8.89	1.76	20.12	0.20	1.23	-	-	13.19	20.84	30.00	16.81	14.42	27.67	36.00	21.58

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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Shonan EMC Lab.

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Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 11a

Antenna A, 5785 MHz

Mode	Rate Mbps	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11a	6	-8.82	0.20	-8.62	
	9	-8.90	0.27	-8.63	
	12	-9.03	0.36	-8.67	
	18	-9.38	0.54	-8.84	
	24	-9.37	0.67	-8.70	
	36	-9.73	0.95	-8.78	
	48	-10.16	1.26	-8.90	
	54	-10.07	1.38	-8.69	

Antenna B, 5785 MHz

Mode	Rate Mbps	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11a	6	-8.79	0.20	-8.59	*
	9	-8.89	0.27	-8.62	
	12	-9.02	0.36	-8.66	
	18	-9.24	0.54	-8.70	
	24	-9.36	0.67	-8.69	
	36	-9.70	0.95	-8.75	
	48	-9.91	1.26	-8.65	
	54	-10.08	1.38	-8.70	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 11n-20 SISO

Antenna B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for 1C) [MHz]	Conducted Power				e.i.r.p.			
								Result	Limit	Margin		Result	Limit	Margin	
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5745	-9.68	1.74	20.10	1.12	1.23	-	-	13.28	21.28	30.00	16.72	14.51	28.25	36.00	21.49
5785	-9.69	1.75	20.11	1.12	1.23	-	-	13.29	21.33	30.00	16.71	14.52	28.31	36.00	21.48
5825	-9.70	1.77	20.12	1.12	1.23	-	-	13.31	21.43	30.00	16.69	14.54	28.44	36.00	21.46

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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Shonan EMC Lab.

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Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 11n-20 SISO

Antenna A, 5785 MHz

Mode	Rate MCS	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11n HT20	0	-8.83	0.22	-8.61	
	1	-9.12	0.43	-8.69	
	2	-9.23	0.56	-8.67	
	3	-9.39	0.72	-8.67	
	4	-9.69	1.12	-8.57	*
	5	-10.21	1.41	-8.80	
	6	-10.13	1.43	-8.70	
	7	-10.20	1.54	-8.66	

Antenna B, 5785 MHz

Mode	Rate Mbps	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11n HT20	0	-8.88	0.22	-8.66	
	1	-9.18	0.43	-8.75	
	2	-9.23	0.56	-8.67	
	3	-9.41	0.72	-8.69	
	4	-9.77	1.12	-8.65	
	5	-10.05	1.41	-8.64	
	6	-10.13	1.43	-8.70	
	7	-10.24	1.54	-8.70	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

Maximum Conducted Output Power

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 11196086S-R2
Date : May 12, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Makoto Hosaka
Mode : Tx 11n-20 MIMO

FCC
Client

Antenna A+B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for 1C) [MHz]	Conducted power						e.i.r.p.					
			Antenna			Result [dBm]	Limit [dBm]	Margin [dB]	Antenna			Result [dBm]	Limit [dBm]	Margin [dB]
			1 [mW]	2 [mW]	Sum [mW]				1 [mW]	2 [mW]	Sum [mW]			
5745	-	-	22.23	21.04	43.27	16.36	30.00	13.64	29.51	27.93	57.44	17.59	36.00	18.41
5785	-	-	21.13	20.56	41.69	16.20	30.00	13.80	28.05	27.29	55.34	17.43	36.00	18.57
5825	-	-	20.56	20.84	41.40	16.17	30.00	13.83	27.29	27.67	54.96	17.40	36.00	18.60

Antenna A								Antenna B					
Tested Frequency [MHz]	Duty Factor [dB]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Cond. Power [dBm]	Result e.i.r.p. [dBm]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Cond. Power [dBm]	Result e.i.r.p. [dBm]
5745	0.39	-8.76	1.74	20.10	1.23	13.47	14.70	-8.99	1.73	20.10	1.23	13.23	14.46
5785	0.39	-9.00	1.75	20.11	1.23	13.25	14.48	-9.11	1.74	20.11	1.23	13.13	14.36
5825	0.39	-9.15	1.77	20.12	1.23	13.13	14.36	-9.08	1.76	20.12	1.23	13.19	14.42

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

e.i.r.p. Result = Conducted Power Result + Antenna Gain

Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 11n-20 MIMO

5785 MHz

Mode	MCS Number	Reading (timed average)						Duty factor	Burst power			Remarks
		Antenna							Antenna			
		A [dBm]	B [dBm]	A [mW]	B [mW]	A+B [mW]	A+B [dBm]		A [dBm]	B [dBm]	A+B [dBm]	
11n	8	-9.00	-9.11	0.13	0.12	0.25	-6.04	0.39	-	-	-5.65	*
	9	-9.53	-9.59	0.11	0.11	0.22	-6.55	0.74	-	-	-5.81	
	10	-9.99	-9.79	0.10	0.10	0.21	-6.88	1.03	-	-	-5.85	
	11	-10.30	-10.05	0.09	0.10	0.19	-7.16	1.31	-	-	-5.85	
	12	-10.73	-10.54	0.08	0.09	0.17	-7.62	1.73	-	-	-5.89	
	13	-10.91	-10.89	0.08	0.08	0.16	-7.89	2.08	-	-	-5.81	
	14	-11.06	-11.10	0.08	0.08	0.16	-8.07	2.23	-	-	-5.84	
	15	-11.45	-11.34	0.07	0.07	0.15	-8.38	2.39	-	-	-5.99	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 11n-40 SISO

Antenna B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for 1C) [MHz]	Conducted Power				e.i.r.p.			
								Result	Limit	Margin		Result	Limit	Margin	
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5755	-9.60	1.74	20.10	0.82	1.23	-	-	13.06	20.23	30.00	16.94	14.29	26.85	36.00	21.71
5795	-9.95	1.75	20.11	0.82	1.23	-	-	12.73	18.75	30.00	17.27	13.96	24.89	36.00	22.04

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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Shonan EMC Lab.

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Maximum Conducted Output Power

Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 11196086S-R2
Date May 12, 2016
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx 11n-40 SISO

Antenna A, 5755 MHz

Mode	Rate MCS	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11n HT40	0	-9.27	0.40	-8.87	
	1	-9.60	0.82	-8.78	*
	2	-10.24	1.15	-9.09	
	3	-10.24	1.29	-8.95	
	4	-10.73	1.76	-8.97	
	5	-11.12	2.34	-8.78	
	6	-11.15	2.30	-8.85	
	7	-11.46	2.50	-8.96	

Antenna B, 5755 MHz

Mode	Rate Mbps	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11n HT40	0	-9.44	0.40	-9.04	
	1	-9.81	0.82	-8.99	
	2	-10.22	1.15	-9.07	
	3	-10.55	1.29	-9.26	
	4	-11.04	1.76	-9.28	
	5	-11.46	2.34	-9.12	
	6	-11.65	2.30	-9.35	
	7	-11.70	2.50	-9.20	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

Maximum Conducted Output Power

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 11196086S-R2
Date : May 12, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Makoto Hosaka
Mode : Tx 11n-40 MIMO

FCC
Client

Antenna A+B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for 1C) [MHz]	Conducted power						e.i.r.p.					
			Antenna			Result [dBm]	Limit [dBm]	Margin [dB]	Antenna			Result [dBm]	Limit [dBm]	Margin [dB]
			A [mW]	B [mW]	Sum [mW]				A [mW]	B [mW]	Sum [mW]			
5745	-	-	19.54	19.45	39.00	15.91	30.00	14.09	25.94	25.82	51.76	17.14	36.00	18.86
5825	-	-	19.23	18.84	38.07	15.81	30.00	14.19	25.53	25.00	50.53	17.04	36.00	18.96

Antenna A								Antenna B					
Tested Frequency [MHz]	Duty Factor [dB]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result		Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result	
						Cond. Power [dBm]	e.i.r.p. [dBm]					Cond. Power [dBm]	e.i.r.p. [dBm]
5745	0.76	-9.69	1.74	20.10	1.23	12.91	14.14	-9.70	1.73	20.10	1.23	12.89	14.12
5825	0.76	-9.78	1.75	20.11	1.23	12.84	14.07	-9.86	1.74	20.11	1.23	12.75	13.98

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

e.i.r.p. Result = Conducted Power Result + Antenna Gain

Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 11n-40 MIMO

5785 MHz

Mode	MCS Number	Reading (timed average)						Duty factor	Burst power			Remarks
		Antenna							Antenna			
		A [dBm]	B [dBm]	A [mW]	B [mW]	A+B [mW]	A+B [dBm]		A [dBm]	B [dBm]	A+B [dBm]	
11n	8	-9.69	-9.70	0.11	0.11	0.21	-6.68	0.76	-	-	-5.92	*
	9	-10.47	-10.42	0.09	0.09	0.18	-7.43	1.34	-	-	-6.09	
	10	-10.91	-10.82	0.08	0.08	0.16	-7.85	1.78	-	-	-6.07	
	11	-11.23	-11.20	0.08	0.08	0.15	-8.20	2.12	-	-	-6.08	
	12	-11.75	-11.81	0.07	0.07	0.13	-8.77	2.67	-	-	-6.10	
	13	-12.06	-12.26	0.06	0.06	0.12	-9.15	3.05	-	-	-6.10	
	14	-12.39	-12.48	0.06	0.06	0.11	-9.42	3.23	-	-	-6.19	
	15	-12.39	-12.69	0.06	0.05	0.11	-9.53	3.36	-	-	-6.17	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

Average Output Power
(Reference data for RF Exposure)

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 11196086S-R2
Date : May 12, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Makoto Hosaka
Mode : Tx

Tx 11n-20 MIMO

Antenna A					Antenna B				Antenna A+B			
Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average) [dBm]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average) [dBm]	Result (Timed average)			
									Antenna		Sum	
									1 [mW]	2 [mW]	1+2 [mW]	[dBm]
5745	-8.96	1.74	20.10	12.88	-9.19	1.73	20.10	12.64	19.41	18.37	37.77	15.77
5785	-9.16	1.75	20.11	12.70	-9.51	1.74	20.11	12.34	18.62	17.14	35.76	15.53
5825	-9.15	1.77	20.12	12.74	-9.18	1.76	20.12	12.70	18.79	18.62	37.41	15.73

Sample Calculation:

Result (Timed average) = Reading + Cable Loss + Atten. Loss

Tx 11n-40 MIMO

Antenna A					Antenna B				Antenna A+B			
Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average) [dBm]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average) [dBm]	Result (Timed average)			
									Antenna		Sum	
									1 [mW]	2 [mW]	1+2 [mW]	[dBm]
5755	-9.74	1.74	20.10	12.10	-9.70	1.73	20.10	12.13	16.22	16.33	32.55	15.13
5795	-9.58	1.75	20.11	12.28	-9.81	1.74	20.11	12.04	16.90	16.00	32.90	15.17

Sample Calculation:

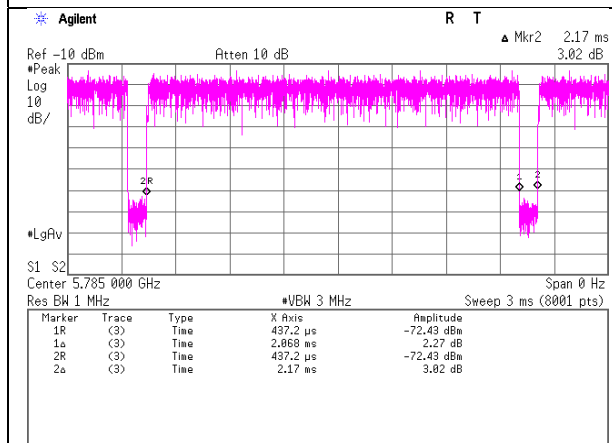
Result (Timed average) = Reading + Cable Loss + Atten. Loss

Burst rate confirmation

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 11196086S-R2
Date : May 12, 2016
Temperature / Humidity : 27 deg. C / 51 % RH
Engineer : Wataru Kojima
Mode : Tx

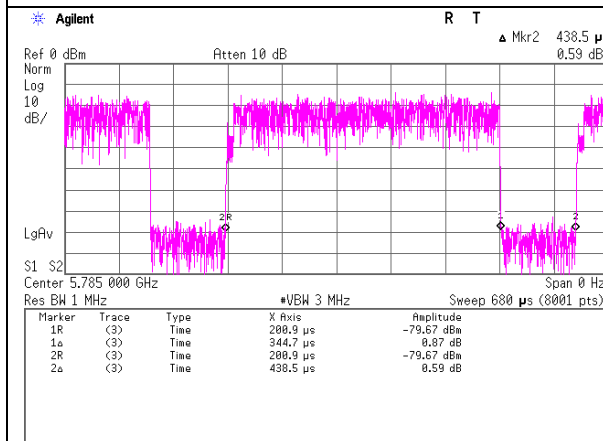
11a 6 Mbps

$Tx\ on / (Tx\ on + Tx\ off) = 0.954$
 $Tx\ on / (Tx\ on + Tx\ off) * 100 = 95.4\ \%$
 $Duty\ factor = 10 * \log (2.17 / 2.07) = 0.20\ dB$



11n-20 SISO MCS4

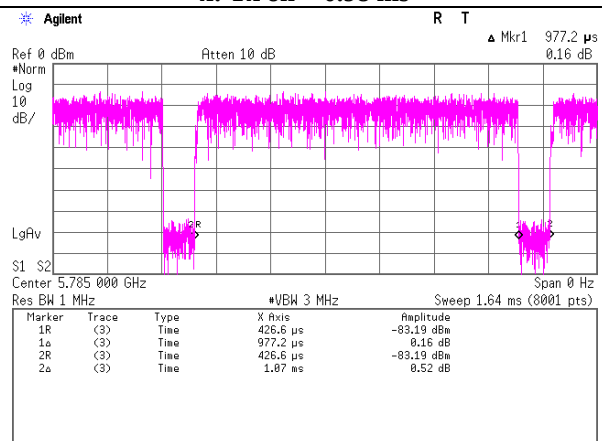
$Tx\ on / (Tx\ on + Tx\ off) = 0.773$
 $Tx\ on / (Tx\ on + Tx\ off) * 100 = 77.3\ \%$
 $Duty\ factor = 10 * \log (0.44 / 0.34) = 1.12\ dB$



11n-20 MIMO MCS8

$Tx\ on / (Tx\ on + Tx\ off) = 0.913$
 $Tx\ on / (Tx\ on + Tx\ off) * 100 = 91.3\ \%$
 $Duty\ factor = 10 * \log (1.07 / 0.98) = 0.39\ dB$

VBW: $1/x = 1024\ Hz < 1100\ Hz$
x: Tx on = 0.98 ms

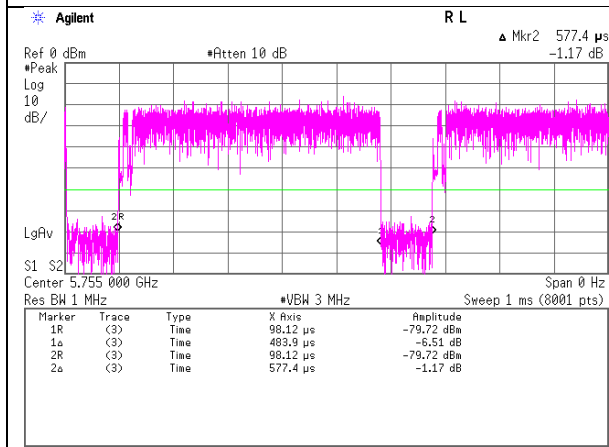


Burst rate confirmation

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11196086S-R2
Date	May 12, 2016
Temperature / Humidity	27 deg. C / 51 % RH
Engineer	Wataru Kojima
Mode	Tx

11n-40 SISO MCS1

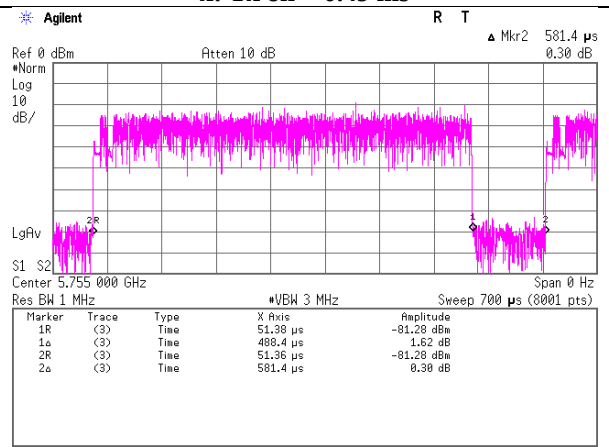
Tx on / (Tx on + Tx off) =	0.828
Tx on / (Tx on + Tx off) * 100 =	82.8 %
Duty factor = 10 * log (0.58 / 0.48) =	0.82 dB



11n-40 MIMO MCS8

Tx on / (Tx on + Tx off) =	0.840
Tx on / (Tx on + Tx off) * 100 =	84.0 %
Duty factor = 10 * log (0.58 / 0.49) =	0.76 dB

VBW: 1/x = 2048 Hz < 2200 Hz
x: Tx on = 0.49 ms



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Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11a, Antenna B

Antenna B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5745	-26.64	1.73	20.10	0.20	2.55	6.99	2.38	30.00	27.62	4.93	36.00	31.07
5785	-26.39	1.74	20.11	0.20	2.55	6.99	2.65	30.00	27.35	5.20	36.00	30.80
5825	-26.78	1.76	20.12	0.20	2.55	6.99	2.30	30.00	27.71	4.85	36.00	31.16

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss + Atten. Loss + Duty Factor + RBW Correction Factor

PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

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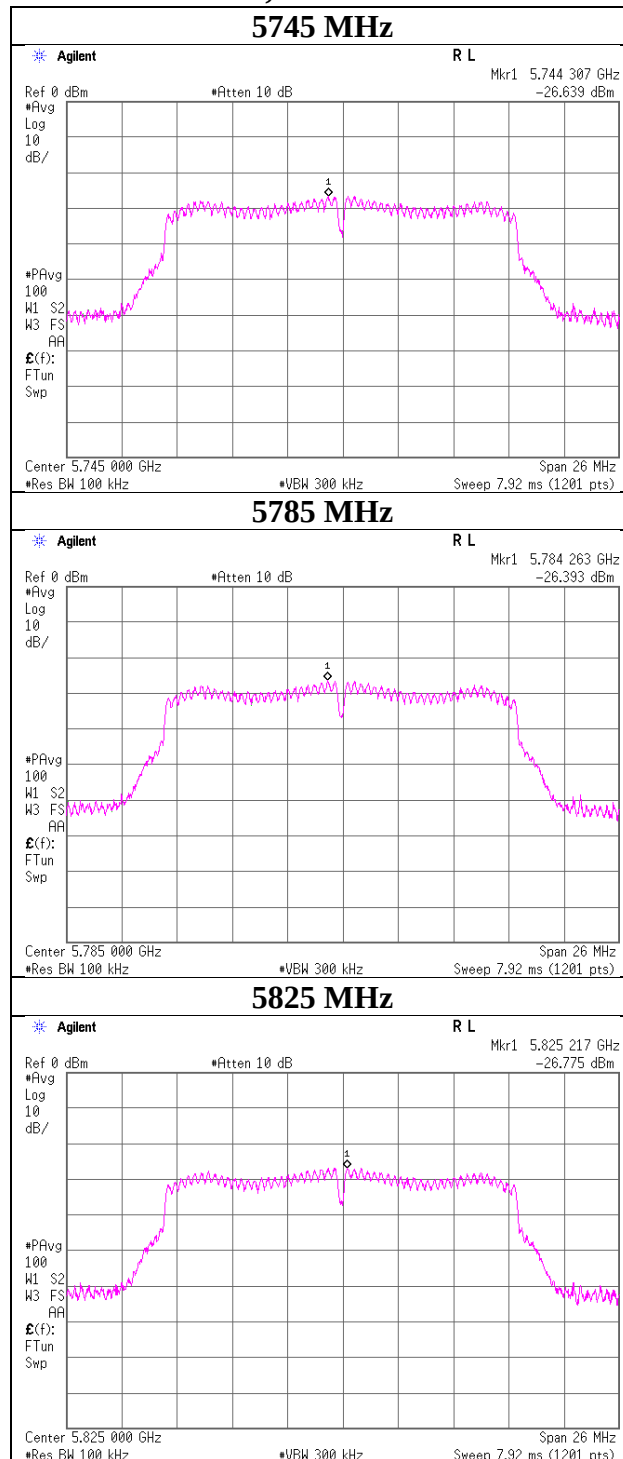
Telephone : +81 463 50 6400

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Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11a, Antenna B

11a, Antenna B



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Maximum Power Spectral Density

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11196086S-R2
Date May 13, 2016
Temperature / Humidity 25deg. C / 52 % RH
Engineer Shinichi Takano
Mode Tx 11n-20 SISO, Antenna A

Antenna A

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5745	-26.61	1.74	20.10	1.12	2.55	6.99	3.34	30.00	26.66	5.89	36.00	30.11
5785	-27.00	1.75	20.11	1.12	2.55	6.99	2.97	30.00	27.03	5.52	36.00	30.48
5825	-27.76	1.77	20.12	1.12	2.55	6.99	2.24	30.00	27.76	4.79	36.00	31.21

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss + Atten. Loss + Duty Factor + RBW Correction Factor

PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

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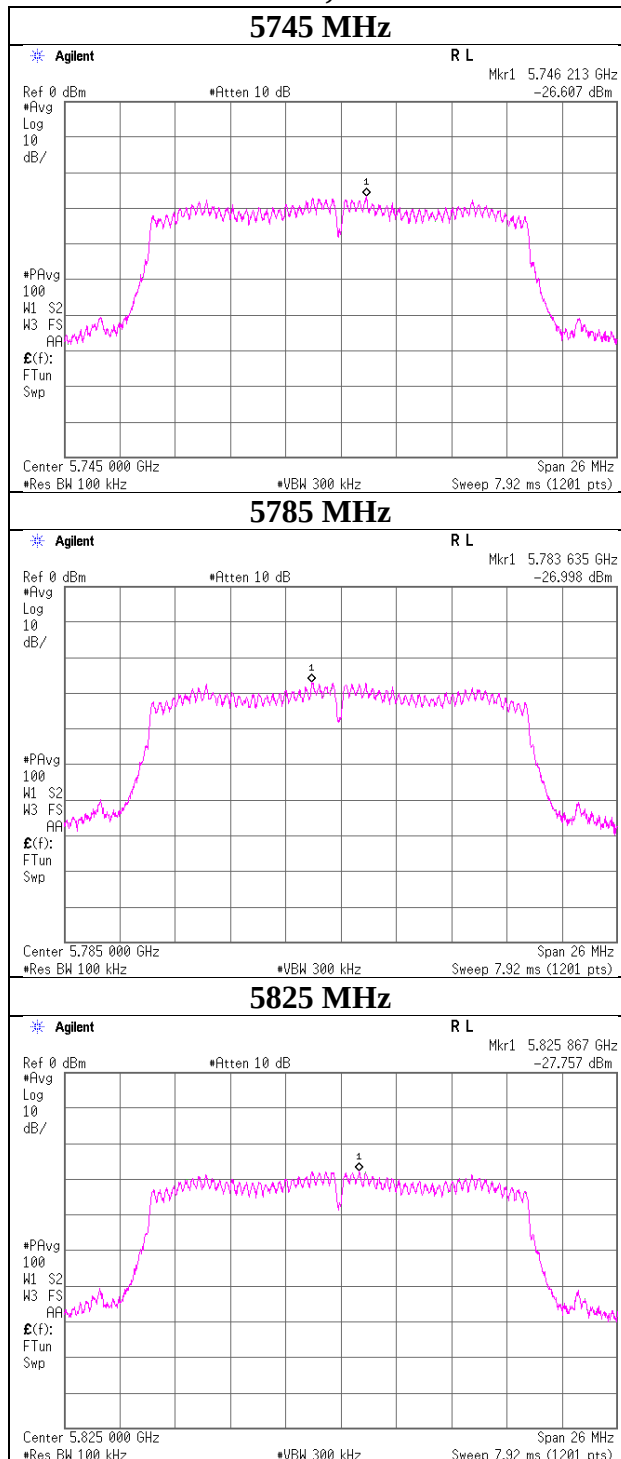
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Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-20 SISO, Antenna A

11n-20 SISO, Antenna A



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Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-20 MIMO

Antenna A+B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD (Conducted)						PSD (e.i.r.p.)					
	Antenna			Result	Limit	Margin	Antenna			Result	Limit	Margin
	1	2	Sum				1	2	Sum			
[mW/MHz]	[mW/MHz]	[mW/MHz]	[dBm/MHz]	[dBm/MHz]	[dB]		[mW/MHz]	[mW/MHz]	[dBm/MHz]	[dBm/MHz]	[dB]	
5745	1.85	1.61	3.46	5.39	30.00	24.61	3.33	2.89	6.22	7.94	36.00	28.06
5785	1.74	1.56	3.30	5.19	30.00	24.81	3.13	2.81	5.94	7.74	36.00	28.26
5825	1.66	1.56	3.22	5.07	30.00	24.93	2.99	2.80	5.78	7.62	36.00	28.38

			Antenna A							Antenna B						
Tested Frequency	Duty Factor	RBW Correction Factor	PSD Reading	Cable Loss	Atten. Loss	Antenna Gain	PSD Cond.	PSD Result e.i.r.p.	PSD Reading	Cable Loss	Atten. Loss	Antenna Gain	PSD Cond.	PSD Result e.i.r.p.		
[MHz]	[dB]	[dB]	[dBm/MHz]	[dB]	[dB]	[dBi]	[dBm/MHz]	[dBm/MHz]	[dBm/MHz]	[dB]	[dB]	[dBi]	[dBm/MHz]	[dBm/MHz]		
5745	0.39	6.99	-26.54	1.74	20.10	2.55	2.68	5.23	-27.16	1.74	20.10	2.55	2.06	4.61		
5785	0.39	6.99	-26.83	1.75	20.11	2.55	2.41	4.96	-27.31	1.75	20.11	2.55	1.93	4.48		
5825	0.39	6.99	-27.07	1.77	20.12	2.55	2.20	4.75	-27.35	1.77	20.12	2.55	1.92	4.47		

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 \cdot \log(\text{Specified bandwidth} / \text{Measured bandwidth})$

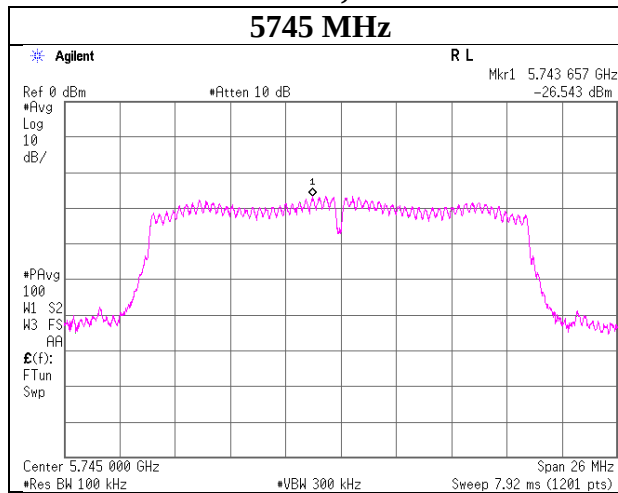
PSD Result (Conducted) = Reading + Cable Loss + Atten. Loss + Duty Factor + RBW Correction Factor

PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

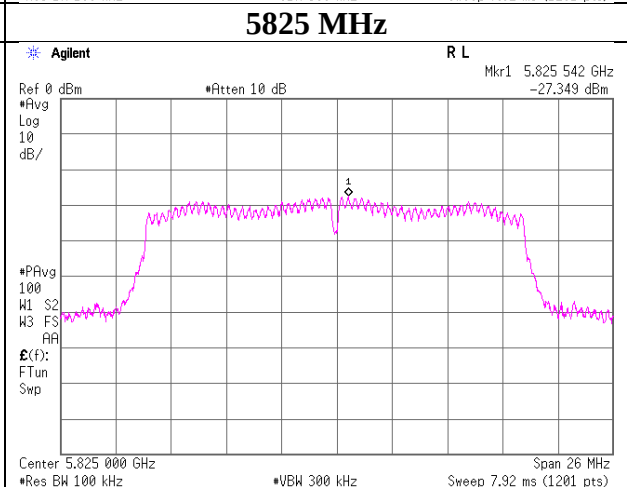
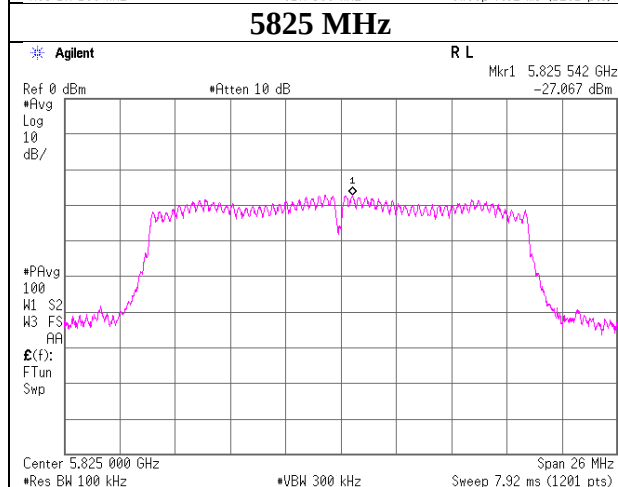
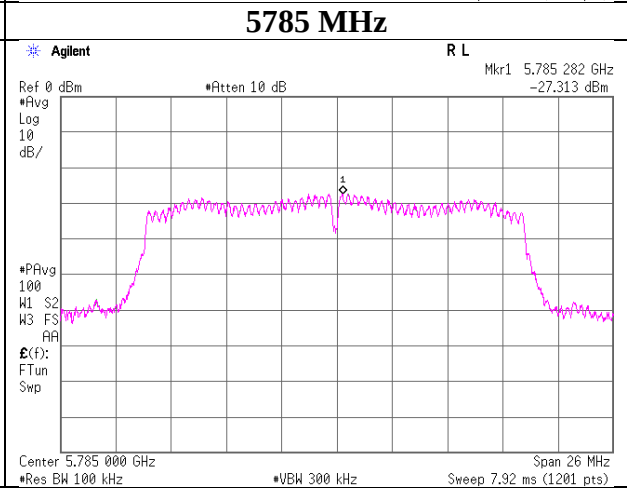
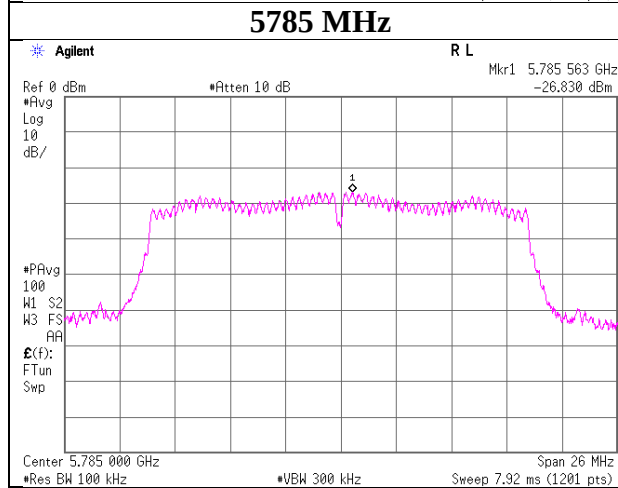
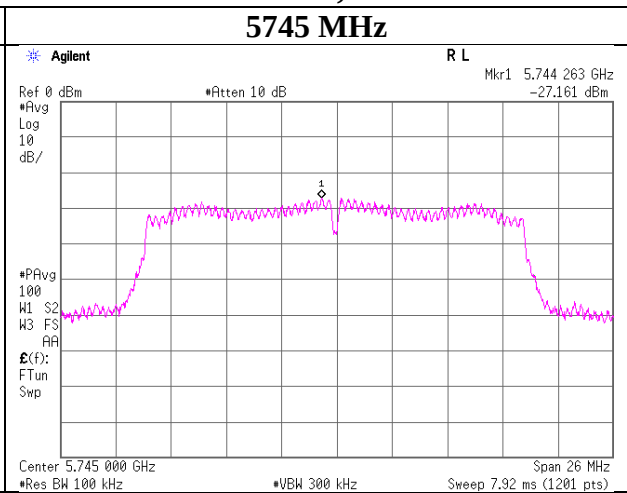
Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-20 MIMO

11n-20 MIMO, Antenna 0



11n-20 MIMO, Antenna 1



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Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-40 SISO, Antenna A

Antenna A

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5755	-31.06	1.74	20.10	0.82	2.55	6.99	-1.41	30.00	31.41	1.14	36.00	34.86
5795	-31.05	1.75	20.11	0.82	2.55	6.99	-1.38	30.00	31.38	1.17	36.00	34.83

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss + Atten. Loss + Duty Factor + RBW Correction Factor

PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

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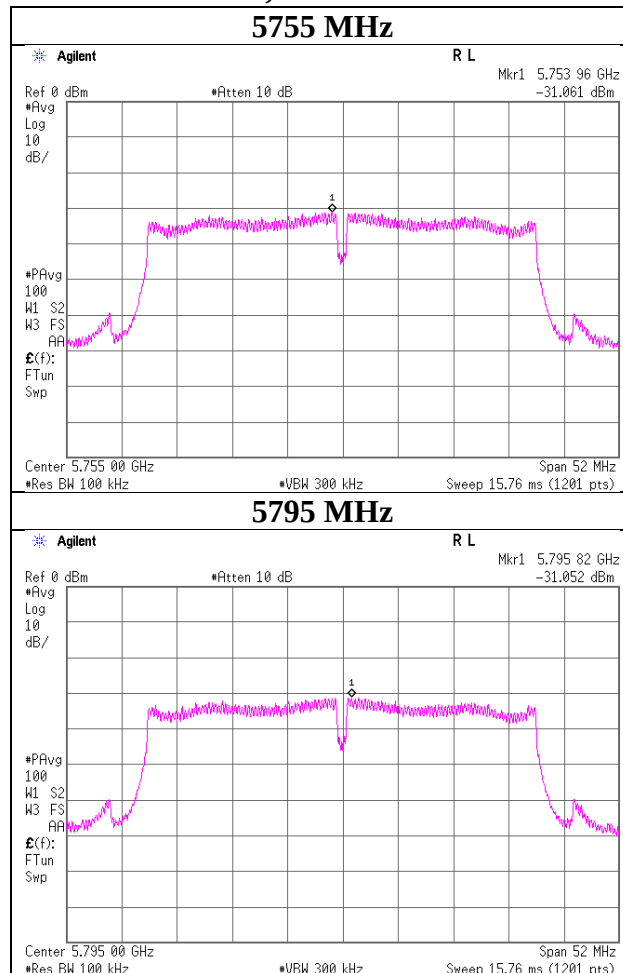
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Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-40 SISO, Antenna A

11a, Antenna B



Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-40 MIMO

Antenna A+B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD (Conducted)						PSD (e.i.r.p.)					
	Antenna			Result	Limit	Margin	Antenna			Result	Limit	Margin
	1	2	Sum				1	2	Sum			
[mW/MHz]	[mW/MHz]	[mW/MHz]	[mW/MHz]	[dBm/MHz]	[dBm/MHz]	[dB]	[mW/MHz]	[mW/MHz]	[mW/MHz]	[dBm/MHz]	[dBm/MHz]	[dB]
5755	0.71	0.70	1.42	1.52	30.00	28.48	1.28	1.27	2.55	4.07	36.00	31.93
5795	0.66	0.71	1.37	1.37	30.00	28.63	1.19	1.28	2.47	3.92	36.00	32.08

			Antenna A						Antenna B					
Tested Frequency	Duty Factor	RBW Correction Factor	PSD Reading	Cable Loss	Atten. Loss	Antenna Gain	PSD Result Cond.	PSD Result e.i.r.p.	PSD Reading	Cable Loss	Atten. Loss	Antenna Gain	PSD Result Cond.	PSD Result e.i.r.p.
[MHz]	[dB]	[dB]	[dBm/MHz]	[dB]	[dB]	[dBi]	[dBm/MHz]	[dBm/MHz]	[dBm/MHz]	[dB]	[dB]	[dBi]	[dBm/MHz]	[dBm/MHz]
5755	0.76	6.99	-31.06	1.74	20.10	2.55	-1.47	1.08	-31.11	1.74	20.10	2.55	-1.52	1.03
5795	0.76	6.99	-31.42	1.75	20.11	2.55	-1.81	0.74	-31.09	1.75	20.11	2.55	-1.48	1.07

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 \cdot \log(\text{Specified bandwidth} / \text{Measured bandwidth})$

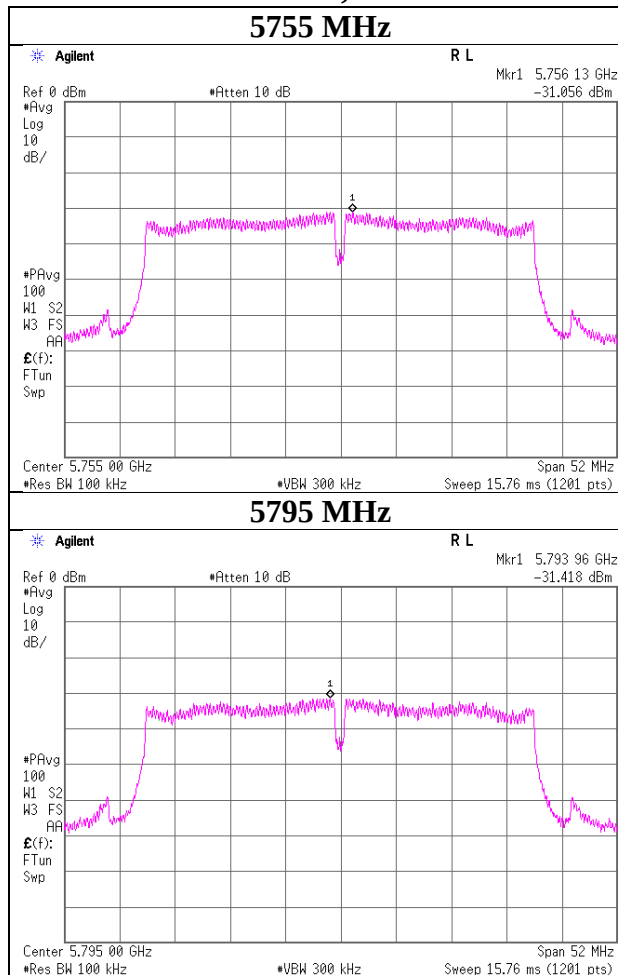
PSD Result (Conducted) = Reading + Cable Loss + Atten. Loss + Duty Factor + RBW Correction Factor

PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

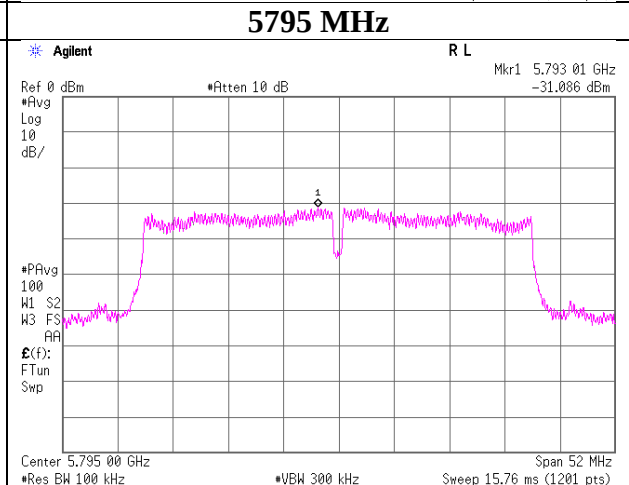
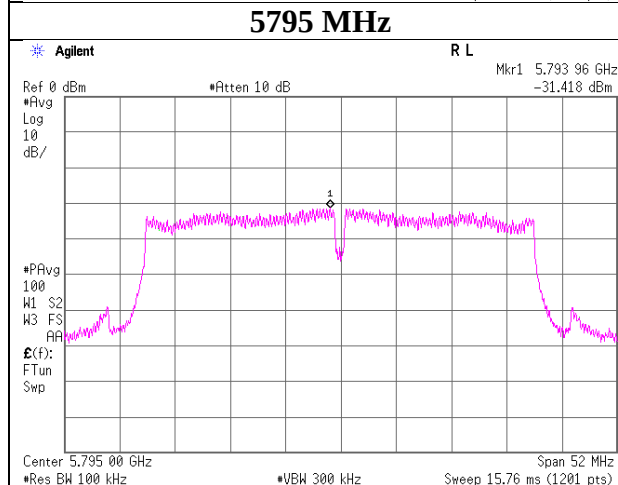
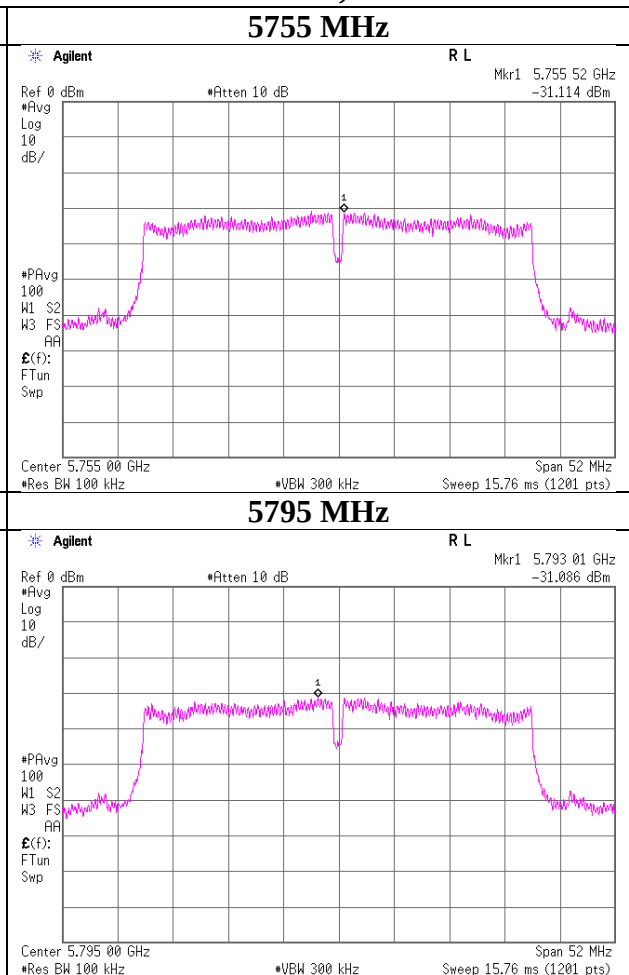
Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-40 MIMO

11n-40 MIMO, Antenna 0



11n-40 MIMO, Antenna 1



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Radiated Spurious Emission

Test place	Shonan EMC Lab.				
Report No.	11196086S-R2				
Semi Anechoic Chamber No	3	3	1	2	2
Date	May 14, 2016	May 15, 2016	May 16, 2016	May 17, 2016	May 18, 2016
Temperature /	24 deg.C /	24 deg.C /	23 deg.C /	23 deg.C /	23 deg.C /
Humidity	54 %RH	52 %RH	49 %RH	55 %RH	50 %RH
Engineer	Hiroyuki Morikawa	Kazutaka Takeyama	Kazutaka Takeyama	Takahiro Suzuki	Takahiro Suzuki
	(1 GHz – 13 GHz)	(13 GHz – 18 GHz)	(18 GHz – 26.5 GHz)	(26.5 GHz – 40 GHz)	(30 MHz – 1000 MHz)
Mode	Tx 11n-20 MIMO 5745 MHz				

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	99.365	QP	46.5	10.0	8.0	31.9	0.0	32.6	43.5	10.9	198	219	
Hori.	139.086	QP	42.3	14.3	8.4	31.8	0.0	33.2	43.5	10.3	194	275	
Hori.	238.489	QP	40.7	17.5	9.3	31.7	0.0	35.8	46.0	10.2	252	50	
Hori.	482.720	QP	30.0	17.3	7.8	31.6	0.0	23.5	46.0	22.5	142	1	
Hori.	682.911	QP	30.2	20.1	8.9	31.6	0.0	27.6	46.0	18.4	100	67	
Hori.	11490.000	PK	45.1	40.0	8.5	38.8	3.3	58.1	73.9	15.8	150	0	
Hori.	17235.000	PK	44.4	42.0	11.4	39.3	-9.5	49.0	73.9	24.9	143	0	
Hori.	22980.000	PK	43.5	40.3	24.1	46.9	-9.5	51.5	73.9	22.4	168	40	
Hori.	11490.000	AV	33.7	40.0	8.5	38.8	3.3	46.7	53.9	7.2	150	0	VBW:1.1 kHz
Hori.	17235.000	AV	32.6	42.0	11.4	39.3	-9.5	37.2	53.9	16.7	143	0	VBW:1.1 kHz
Hori.	22980.000	AV	33.0	40.3	24.1	46.9	-9.5	41.0	53.9	12.9	168	40	VBW:1.1 kHz
Vert.	129.625	QP	42.8	13.7	8.1	31.8	0.0	32.8	43.5	10.7	100	108	
Vert.	199.036	QP	39.7	16.4	8.8	31.8	0.0	33.1	43.5	10.4	100	96	
Vert.	432.037	QP	31.5	16.7	7.5	31.6	0.0	24.1	46.0	21.9	100	80	
Vert.	720.801	QP	32.2	20.4	9.0	31.5	0.0	30.1	46.0	15.9	100	55	
Vert.	829.016	QP	29.8	21.3	9.6	31.2	0.0	29.5	46.0	16.5	100	241	
Vert.	11490.000	PK	45.3	40.0	8.5	38.8	3.3	58.3	73.9	15.6	150	0	
Vert.	17235.000	PK	45.6	42.0	11.4	39.3	-9.5	50.2	73.9	23.7	150	0	
Vert.	22980.000	PK	43.4	40.3	24.1	46.9	-9.5	51.4	73.9	22.5	208	117	
Vert.	11490.000	AV	33.6	40.0	8.5	38.8	3.3	46.6	53.9	7.3	150	0	VBW:1.1 kHz
Vert.	17235.000	AV	32.4	42.0	11.4	39.3	-9.5	37.0	53.9	16.9	150	0	VBW:1.1 kHz
Vert.	22980.000	AV	32.8	40.3	24.1	46.9	-9.5	40.8	53.9	13.1	208	117	VBW:1.1 kHz

Result = Reading + Ant. Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	5745.000	PK	88.2	32.7	15.8	38.8	3.3	101.2	-	-	Carrier
Hori.	5715.000	PK	44.8	32.6	15.8	38.8	3.3	57.7	81.2	23.5	
Hori.	5725.000	PK	51.0	32.6	15.8	38.8	3.3	63.9	81.2	17.3	
Vert.	5745.000	PK	88.7	32.7	15.8	38.8	3.3	101.7	-	-	Carrier
Vert.	5715.000	PK	44.8	32.6	15.8	38.8	3.3	57.7	81.7	24.0	
Vert.	5725.000	PK	50.3	32.6	15.8	38.8	3.3	63.2	81.7	18.5	

Result = Reading + Ant. Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

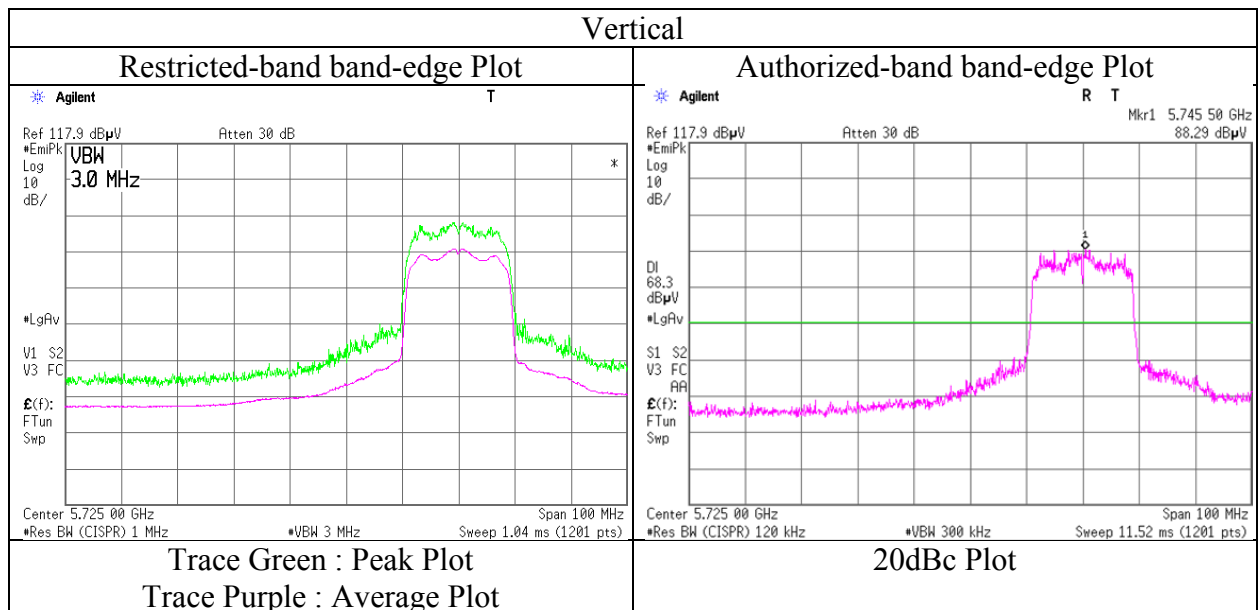
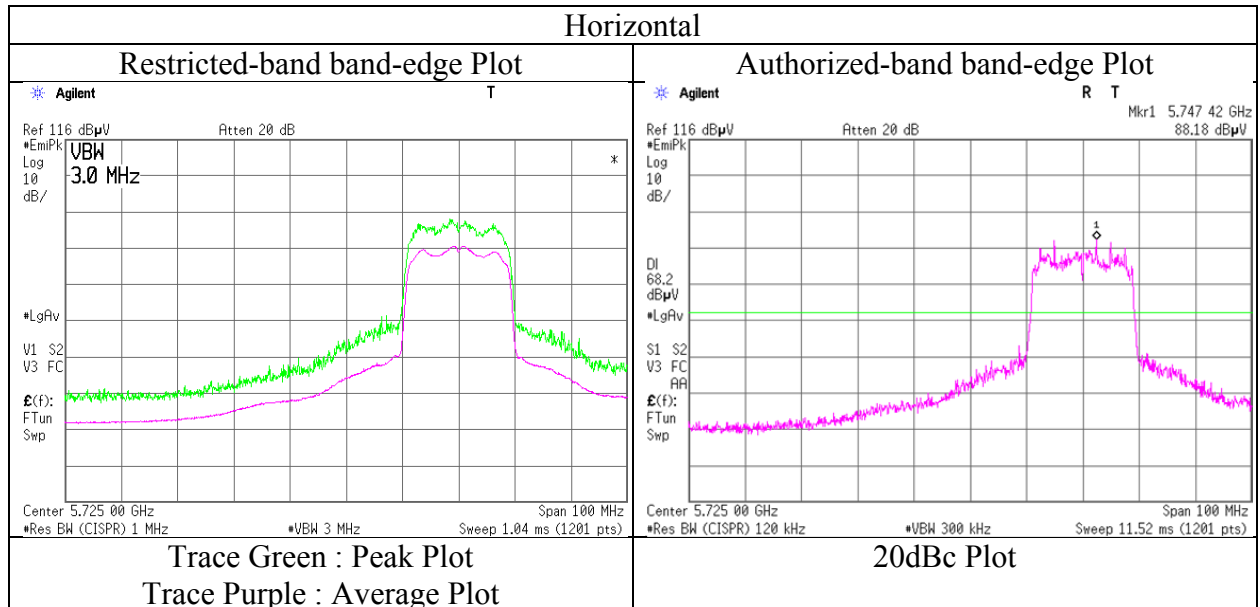
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11196086S-R2
Date	May 14, 2016
Temperature / Humidity	24 deg.C / 54 %RH
Engineer	Hiroyuki Morikawa
Mode	Tx 11n-20 MIMO 5745 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place	Shonan EMC Lab.			
Report No.	11196086S-R2			
Semi Anechoic Chamber No	3	3	1	2
Date	May 14, 2016	May 15, 2016	May 16, 2016	May 17, 2016
Temperature / Humidity	24 deg.C / 54 %RH	24 deg.C / 52 %RH	23 deg.C / 49 %RH	23 deg.C / 55 %RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)	Kazutaka Takeyama (13 GHz - 18 GHz)	Kazutaka Takeyama (18 GHz - 26.5 GHz)	Takahiro Suzuki (26.5 GHz - 40 GHz)
Mode	Tx 11n-20 MIMO 5785 MHz			

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	11570.000	PK	45.0	39.9	8.5	38.9	3.3	57.8	73.9	16.1	150	0	
Hori.	17355.000	PK	45.5	42.4	11.5	39.2	-9.5	50.7	73.9	23.2	150	0	
Hori.	23140.000	PK	42.8	40.3	24.2	46.7	-9.5	51.1	73.9	22.8	162	327	
Hori.	11570.000	AV	33.8	39.9	8.5	38.9	3.3	46.6	53.9	7.3	150	0	VBW:1.1 kHz
Hori.	17355.000	AV	33.0	42.4	11.5	39.2	-9.5	38.2	53.9	15.7	150	0	VBW:1.1 kHz
Hori.	23140.000	AV	31.9	40.3	24.2	46.7	-9.5	40.2	53.9	13.7	162	327	VBW:1.1 kHz
Vert.	11570.000	PK	45.2	39.9	8.5	38.9	3.3	58.0	73.9	15.9	150	0	
Vert.	17355.000	PK	45.6	42.4	11.5	39.2	-9.5	50.8	73.9	23.1	150	0	
Vert.	23140.000	PK	45.1	40.3	24.2	46.7	-9.5	53.4	73.9	20.5	180	121	
Vert.	11570.000	AV	33.9	39.9	8.5	38.9	3.3	46.7	53.9	7.2	150	0	VBW:1.1 kHz
Vert.	17355.000	AV	33.3	42.4	11.5	39.2	-9.5	38.5	53.9	15.4	150	0	VBW:1.1 kHz
Vert.	23140.000	AV	32.3	40.3	24.2	46.7	-9.5	40.6	53.9	13.3	180	121	VBW:1.1 kHz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

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

Radiated Spurious Emission

Test place Shonan EMC Lab.
Report No. 11196086S-R2
Semi Anechoic Chamber No. 3 3 1 2
Date May 14, 2016 May 15, 2016 May 16, 2016 May 17, 2016
Temperature / Humidity 24 deg.C / 54 %RH 24 deg.C / 52 %RH 23 deg.C / 49 %RH 23 deg.C / 55 %RH
Engineer Hiroyuki Morikawa Kazutaka Takeyama Kazutaka Takeyama Takahiro Suzuki
(1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz) (26.5 GHz - 40 GHz)
Mode Tx 11n-20 MIMO 5825 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	11650.000	PK	45.2	39.9	8.5	39.0	3.3	57.9	73.9	16.0	150	0	
Hori.	17475.000	PK	44.9	42.8	11.5	39.1	-9.5	50.6	73.9	23.3	150	0	
Hori.	23300.000	PK	42.3	40.2	24.2	46.6	-9.5	50.6	73.9	23.3	167	245	
Hori.	11650.000	AV	34.2	39.9	8.5	39.0	3.3	46.9	53.9	7.0	150	0	VBW:1.1 kHz
Hori.	17475.000	AV	32.7	42.8	11.5	39.1	-9.5	38.4	53.9	15.5	150	0	VBW:1.1 kHz
Hori.	23300.000	AV	30.7	40.2	24.2	46.6	-9.5	39.0	53.9	14.9	167	245	VBW:1.1 kHz
Vert.	11650.000	PK	45.7	39.9	8.5	39.0	3.3	58.4	73.9	15.5	150	0	
Vert.	17475.000	PK	44.7	42.8	11.5	39.1	-9.5	50.4	73.9	23.5	150	0	
Vert.	23300.000	PK	42.7	40.2	24.2	46.6	-9.5	51.0	73.9	22.9	181	120	
Vert.	11650.000	AV	34.3	39.9	8.5	39.0	3.3	47.0	53.9	6.9	150	0	VBW:1.1 kHz
Vert.	17475.000	AV	32.8	42.8	11.5	39.1	-9.5	38.5	53.9	15.4	150	0	VBW:1.1 kHz
Vert.	23300.000	AV	31.3	40.2	24.2	46.6	-9.5	39.6	53.9	14.3	181	120	VBW:1.1 kHz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	5825.000	PK	89.3	32.8	15.8	38.8	3.3	102.4	-	-	Carrier
Hori.	5850.000	PK	44.7	32.9	15.8	38.8	3.3	57.9	82.4	24.5	
Hori.	5860.000	PK	41.6	32.9	15.8	38.8	3.3	54.8	82.4	27.6	
Vert.	5825.000	PK	93.4	32.8	15.8	38.8	3.3	106.5	-	-	Carrier
Vert.	5850.000	PK	48.0	32.9	15.8	38.8	3.3	61.2	86.5	25.3	
Vert.	5860.000	PK	45.6	32.9	15.8	38.8	3.3	58.8	86.5	27.7	

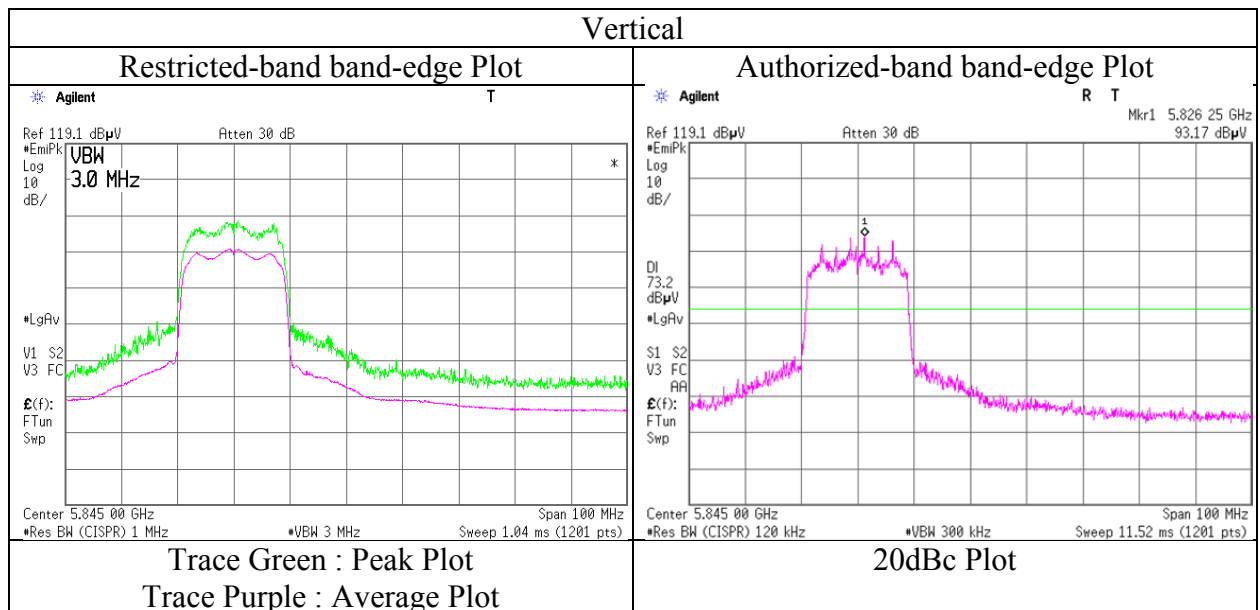
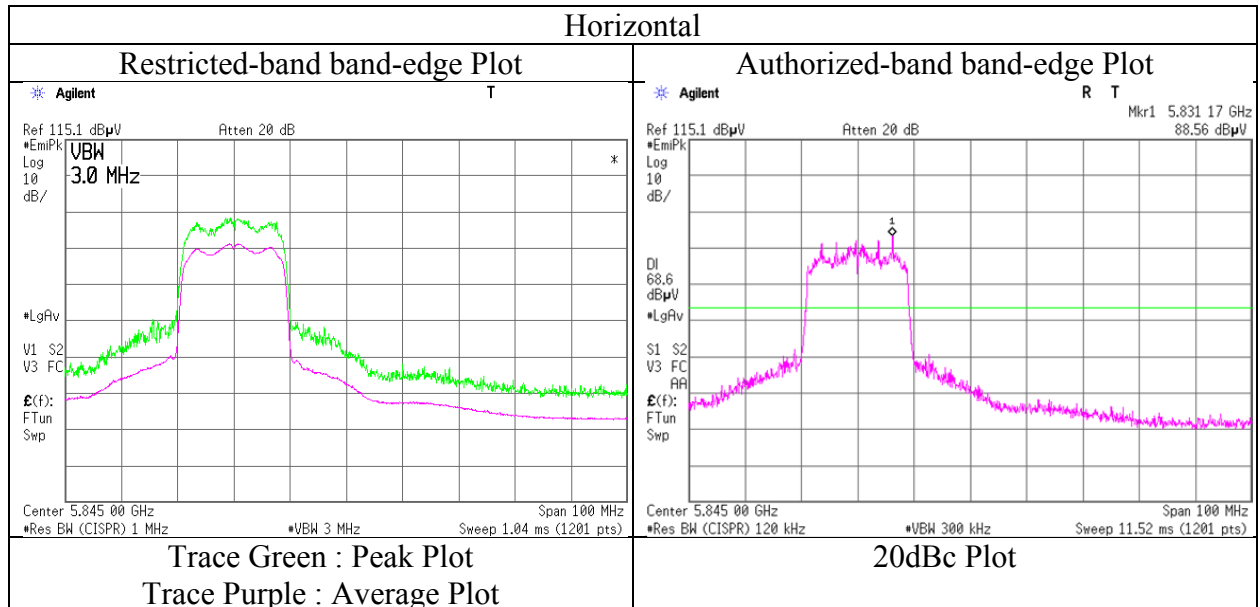
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11196086S-R2
Date	May 14, 2016
Temperature / Humidity	24 deg.C / 54 %RH
Engineer	Hiroyuki Morikawa
Mode	Tx 11n-20 MIMO 5825 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place Shonan EMC Lab.
Report No. 11196086S-R2
Semi Anechoic Chamber No. 3 3 1 2
Date May 14, 2016 May 15, 2016 May 16, 2016 May 17, 2016
Temperature / Humidity 24 deg.C / 54 %RH 24 deg.C / 52 %RH 23 deg.C / 49 %RH 23 deg.C / 55 %RH
Engineer Hiroyuki Morikawa Kazutaka Takeyama Kazutaka Takeyama Takahiro Suzuki
(1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz) (26.5 GHz - 40 GHz)
Mode Tx 11n-40 MIMO 5755 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	11510.000	PK	44.9	40.0	8.5	38.8	3.3	57.9	73.9	16.0	150	0	
Hori.	17265.000	PK	44.7	42.1	11.4	39.3	-9.5	49.4	73.9	24.5	150	0	
Hori.	23020.000	PK	43.4	40.3	24.1	46.8	-9.5	51.5	73.9	22.4	168	326	
Hori.	11510.000	AV	34.1	40.0	8.5	38.8	3.3	47.1	53.9	6.8	150	0	VBW:2.2 kHz
Hori.	17265.000	AV	33.0	42.1	11.4	39.3	-9.5	37.7	53.9	16.2	150	0	VBW:2.2 kHz
Hori.	23020.000	AV	32.8	40.3	24.1	46.8	-9.5	40.9	53.9	13.0	168	326	VBW:2.2 kHz
Vert.	11510.000	PK	44.7	40.0	8.5	38.8	3.3	57.7	73.9	16.2	150	0	
Vert.	17265.000	PK	45.5	42.1	11.4	39.3	-9.5	50.2	73.9	23.7	150	0	
Vert.	23020.000	PK	43.4	40.3	24.1	46.8	-9.5	51.5	73.9	22.4	182	129	
Vert.	11510.000	AV	34.4	40.0	8.5	38.8	3.3	47.4	53.9	6.5	150	0	VBW:2.2 kHz
Vert.	17265.000	AV	33.2	42.1	11.4	39.3	-9.5	37.9	53.9	16.0	150	0	VBW:2.2 kHz
Vert.	23020.000	AV	33.5	40.3	24.1	46.8	-9.5	41.6	53.9	12.3	182	129	VBW:2.2 kHz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	5755.000	PK	89.7	32.7	15.8	38.8	3.3	102.7	-	-	Carrier
Hori.	5715.000	PK	56.3	32.6	15.8	38.8	3.3	69.2	82.7	13.5	
Hori.	5717.381	PK	58.6	32.6	15.8	38.8	3.3	71.5	82.7	11.2	
Hori.	5725.000	PK	54.1	32.6	15.8	38.8	3.3	67.0	82.7	15.7	
Vert.	5755.000	PK	88.7	32.7	15.8	38.8	3.3	101.7	-	-	Carrier
Vert.	5715.000	PK	55.7	32.6	15.8	38.8	3.3	68.6	81.7	13.1	
Vert.	5717.381	PK	57.3	32.6	15.8	38.8	3.3	70.2	81.7	11.5	
Vert.	5725.000	PK	54.3	32.6	15.8	38.8	3.3	67.2	81.7	14.5	

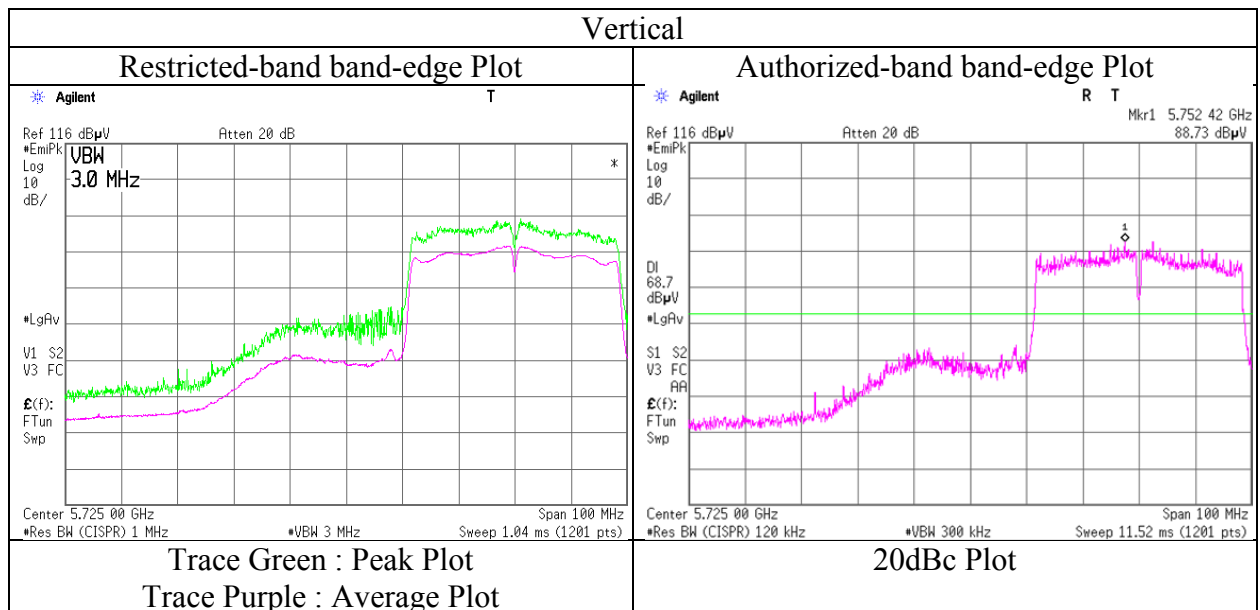
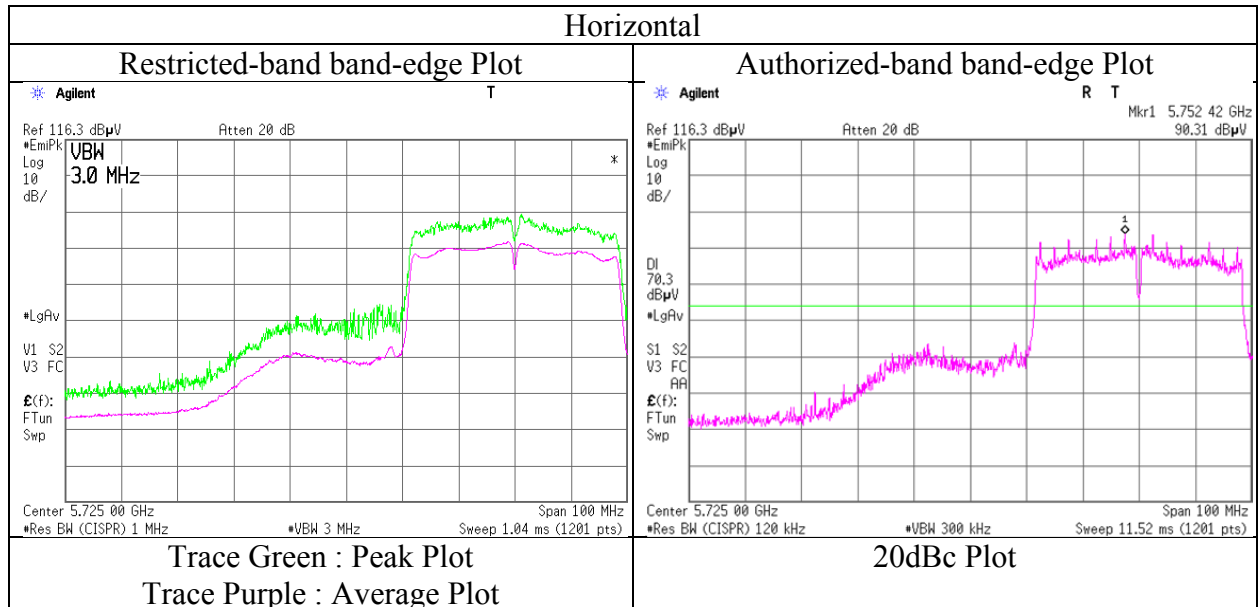
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11196086S-R2
Date	May 14, 2016
Temperature / Humidity	24 deg.C / 54 %RH
Engineer	Hiroyuki Morikawa
Mode	Tx 11n-40 MIMO 5755 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place Shonan EMC Lab.
Report No. 11196086S-R2
Semi Anechoic Chamber No. 3 3 1 2
Date May 14, 2016 May 15, 2016 May 16, 2016 May 17, 2016
Temperature / Humidity 24 deg.C / 54 %RH 24 deg.C / 52 %RH 23 deg.C / 49 %RH 23 deg.C / 55 %RH
Engineer Hiroyuki Morikawa Kazutaka Takeyama Kazutaka Takeyama Takahiro Suzuki
(1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz) (26.5 GHz - 40 GHz)
Mode Tx 11n-40 MIMO 5795 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	11590.000	PK	45.0	39.9	8.5	38.9	3.3	57.8	73.9	16.1	150	0	
Hori.	17385.000	PK	45.7	42.5	11.5	39.2	-9.5	51.0	73.9	22.9	150	0	
Hori.	23180.000	PK	42.3	40.3	24.2	46.7	-9.5	50.6	73.9	23.3	163	328	
Hori.	11590.000	AV	34.6	39.9	8.5	38.9	3.3	47.4	53.9	6.5	150	0	VBW:2.2 kHz
Hori.	17385.000	AV	33.1	42.5	11.5	39.2	-9.5	38.4	53.9	15.5	150	0	VBW:2.2 kHz
Hori.	23180.000	AV	31.2	40.3	24.2	46.7	-9.5	39.5	53.9	14.4	163	328	VBW:2.2 kHz
Vert.	11590.000	PK	45.1	39.9	8.5	38.9	3.3	57.9	73.9	16.0	150	0	
Vert.	17385.000	PK	46.4	42.5	11.5	39.2	-9.5	51.7	73.9	22.2	150	0	
Vert.	23180.000	PK	42.0	40.3	24.2	46.7	-9.5	50.3	73.9	23.6	184	131	
Vert.	11590.000	AV	34.6	39.9	8.5	38.9	3.3	47.4	53.9	6.5	150	0	VBW:2.2 kHz
Vert.	17385.000	AV	32.9	42.5	11.5	39.2	-9.5	38.2	53.9	15.7	150	0	VBW:2.2 kHz
Vert.	23180.000	AV	31.5	40.3	24.2	46.7	-9.5	39.8	53.9	14.1	184	131	VBW:2.2 kHz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	5795.000	PK	85.5	32.8	15.8	38.8	3.3	98.6	-	-	Carrier
Hori.	5850.000	PK	45.5	32.9	15.8	38.8	3.3	58.7	78.6	19.9	
Hori.	5860.000	PK	41.9	32.9	15.8	38.8	3.3	55.1	78.6	23.5	
Vert.	5795.000	PK	86.8	32.8	15.8	38.8	3.3	99.9	-	-	Carrier
Vert.	5850.000	PK	44.8	32.9	15.8	38.8	3.3	58.0	79.9	21.9	
Vert.	5860.000	PK	42.4	32.9	15.8	38.8	3.3	55.6	79.9	24.3	

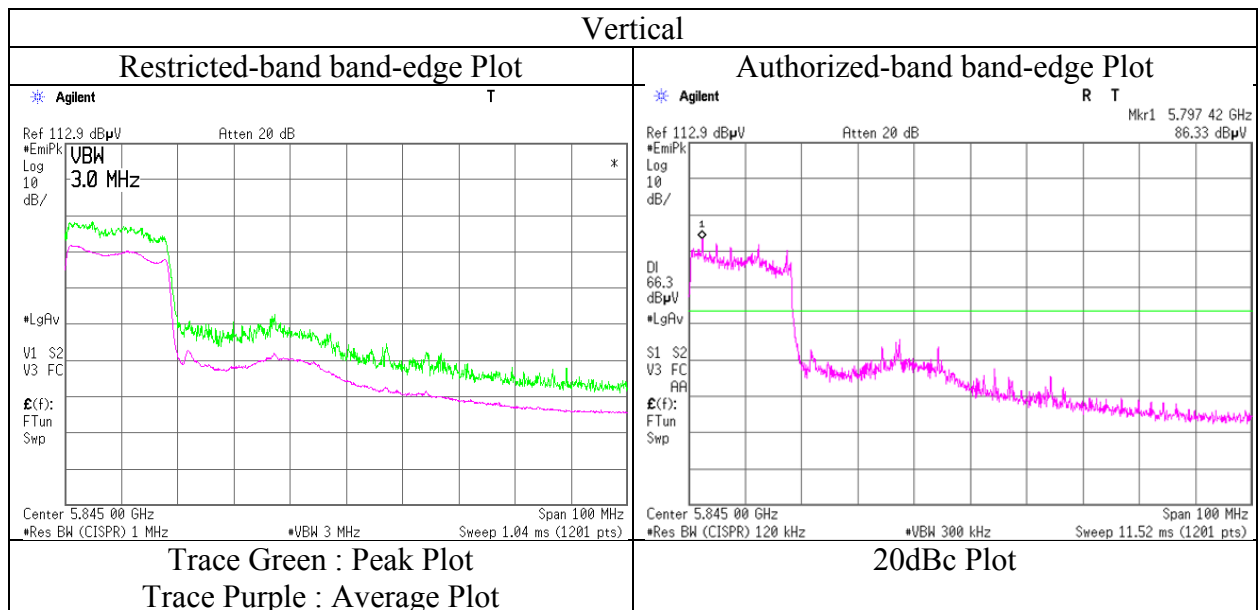
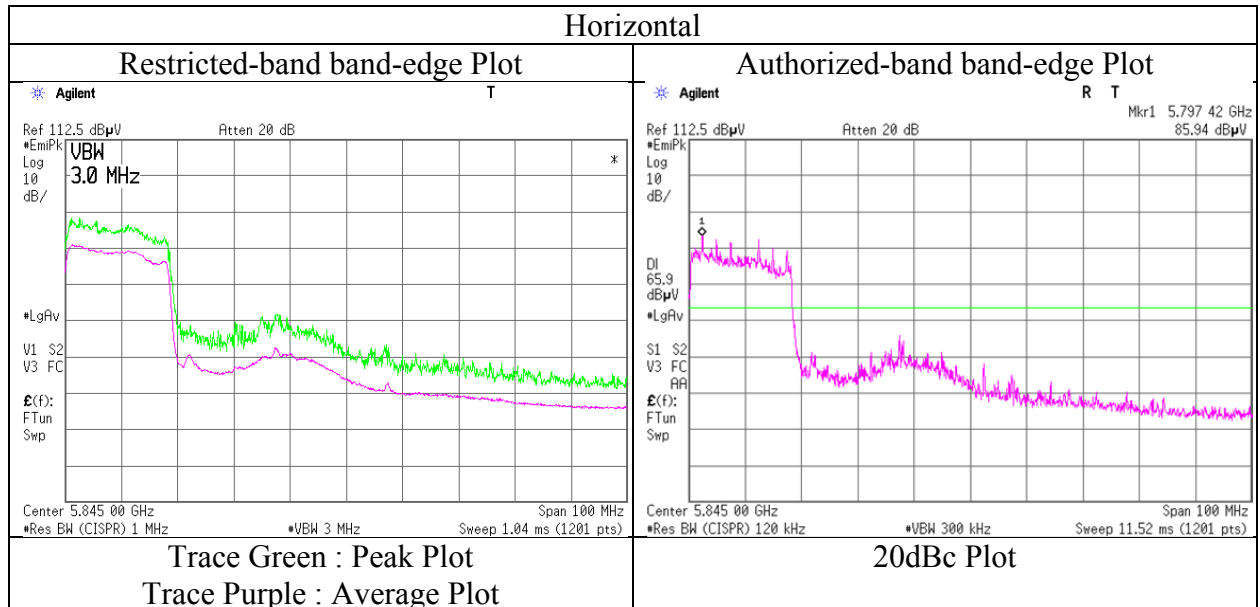
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$

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

Radiated Spurious Emission

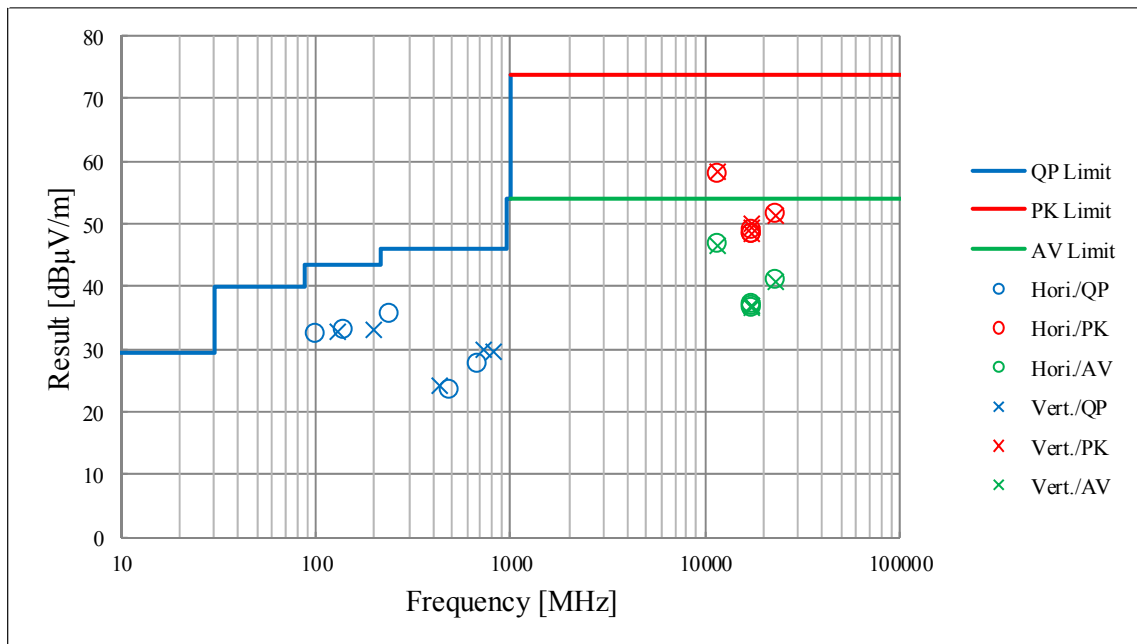
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11196086S-R2
Date	May 14, 2016
Temperature / Humidity	24 deg.C / 54 %RH
Engineer	Hiroyuki Morikawa
Mode	Tx 11n-40 MIMO 5795 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission (Plot data, Worst case)

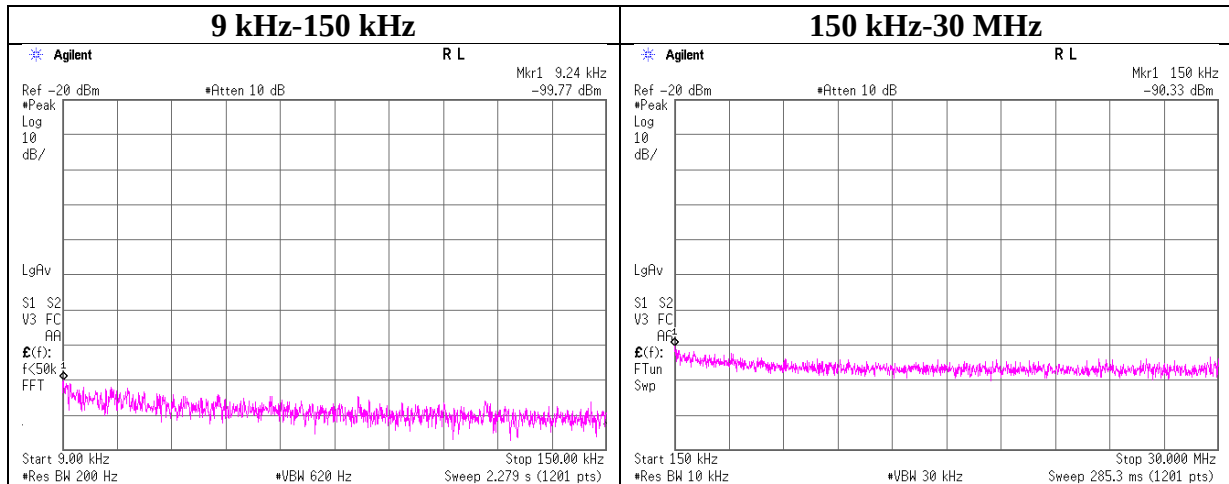
Test place	Shonan EMC Lab.				
Report No.	11196086S-R2				
Semi Anechoic Chamber No	3	3	1	2	2
Date	May 14, 2016	May 15, 2016	May 16, 2016	May 17, 2016	May 18, 2016
Temperature /	24 deg.C /	24 deg.C /	23 deg.C /	23 deg.C /	23 deg.C /
Humidity	54 %RH	52 %RH	49 %RH	55 %RH	50 %RH
Engineer	Hiroyuki Morikawa	Kazutaka Takeyama	Kazutaka Takeyama	Takahiro Suzuki	Takahiro Suzuki
	(1 GHz – 13 GHz)	(13 GHz – 18 GHz)	(18 GHz – 26.5 GHz)	(26.5 GHz – 40 GHz)	(30 MHz – 1000 MHz)
Mode	Tx 11n-20 MIMO 5745 MHz				



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11196086S-R2
Date : May 13, 2016
Temperature / Humidity : 25deg. C / 52 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-20 MIMO, Antenna A, 5745 MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	N	EIRP	Distance	Ground bounce	E	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	(Number of Output)	[dBm]	[m]	[dB]	(field strength) [dBuV/m]	[dBuV/m]	[dB]	
9.24	-99.8	0.01	20.2	2.6	2	-74.0	300	6.0	-12.8	48.2	61.0	
150.00	-90.3	0.02	20.2	2.6	2	-64.6	300	6.0	-3.3	24.0	27.3	

$$E = \text{EIRP} - 20 \cdot \log(D) + \text{Ground bounce} + 104.8 \text{ [dBuV/m]}$$

$$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain} + 10 \cdot \log(N)$$

APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2016/03/23 * 12
SCC-H11	Microwave cable	RS Pro	R-132G7210 100CO	-	AT	2016/04/18 * 12
SCC-H12	Microwave cable	RS Pro	R-132G7210 100CO	-	AT	2016/04/18 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2016/04/04 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2016/04/04 * 12
SAT20-07	Attenuator	Weinschel Corp.	54A-20	31484	AT	2016/04/18 * 12
SRENT-05	Spectrum Analyzer	KEYSIGHT	E4440A	MY46187752	AT	2015/10/05 * 12
SOS-13	Humidity Indicator	Custom	CTH-202	Q.C.17	AT	2015/12/07 * 12
STM-G5	Terminator	Weinschel	M1459A	U6594	AT	2015/07/14 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2015/09/16 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2015/12/07 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2015/07/13 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2016/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2016/03/08 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	RE	2016/04/18 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2016/03/15 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2015/10/22 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2015/11/06 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
STS-01	Digital Hitester	Hioki	3805-50	080997812	RE	2015/11/18 * 12
SHA-06	Horn Antenna	ETS LINDGREN	3160-10	LM3459	RE	2016/03/24 * 12
SAF-10	Pre Amplifier	TOYO Corporation	HAP26-40W	00000010	RE	2016/03/23 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2016/03/08 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	RE	2016/04/18 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2016/03/23 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2015/07/15 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2015/10/22 * 12
SCC-B12/B13/S RSE-02	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-270(RF Selector)	CE	2016/04/22 * 12
SLS-03	LISN	Rohde & Schwarz	ENV216	100513	CE	2016/02/08 * 12
SAT3-06	Attenuator	JFW	50HF-003N	-	RE	2016/02/25 * 12
SOS-04	Humidity Indicator	A&D	AD-5681	4061512	RE	2015/12/07 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	CE, RE	2015/09/04 * 12
SJM-09	Measure	PROMART	SEN1935	-	CE, RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	CE, RE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	CE, RE	2016/03/22 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2016/02/19 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2016/02/25 * 12
KAT3-11	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2015/08/31 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2015/11/02 * 12
SCC-B1/B3/B5/ B7/B8/B13/SRS E-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Su hner/Suhner/Suhner/ Suhner/TOYO	8D2W/12DSFA/141PE/141P E/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2016/04/22 * 12
SCC-B2/B4/B6/ B7/B8/B13/SRS E-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Su hner/Suhner/Suhner/ Suhner/TOYO	8D2W/12DSFA/141PE/141P E/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2016/04/22 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0893	RE	2015/11/03 * 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: CE: Conducted Emission, RE: Radiated Emission, AT: Antenna Terminal Conducted test

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