



RADIO TEST REPORT

Test Report No. : 12041957S-A-R2

Applicant : Honda Engineering Co., Ltd.
Type of Equipment : WLAN CARD
Model No. : E3000-02-02
FCC ID : N43E30000201
Test regulation : FCC Part 15 Subpart E: 2017
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 12041957S-A-R1. 12041957S-A-R1 is replaced with this report.

Date of test: November 28 to December 10, 2017

Representative test engineer:

Yosuke Ishikawa
Engineer
Consumer Technology Division

Approved by:

Toyokazu Imamura
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".

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12041957S-A

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SECTION 1: Customer information

Applicant:

Company Name	:	Honda Engineering Co., Ltd.
Address	:	6-1, Hagadai, Haga-Machi, Haga-Gun, Tochigi, 321-3395 Japan
Telephone Number	:	+81-28-687-0692
Facsimile Number	:	+81-28-677-5564
Contact Person	:	Akiei Satani

Manufacturer:

Company Name	:	NEC Platforms, Ltd.
Address	:	1753 Shimonumabe, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8666 Japan
Telephone Number	:	+81-44-455-8761
Facsimile Number	:	+81-44-455-8927
Contact Person	:	Eiji Kodama

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

2.1 Identification of E.U.T.

Type of Equipment	:	WLAN CARD
Model No.	:	E3000-02-02
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5 V
Receipt Date of Sample	:	November 20, 2017
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: E3000-02-02 (referred to as the EUT in this report) is a WLAN CARD.

General Specification

Clock frequency(ies) in the system : 32.768 kHz, 26 MHz

Radio specification:

Equipment type	: Transceiver
Frequency of operation *1)	: 2.4 GHz: 2412-2462 MHz (IEEE 802.11b, 11g, 11n-20HT) U-NII-1: 5180-5240 MHz (IEEE 802.11a, 11n-20HT) U-NII-2A: 5260-5320 MHz (IEEE 802.11a, 11n-20HT) U-NII-2C: 5500-5700 MHz (IEEE 802.11a, 11n-20HT) U-NII-3: 5745-5825 MHz (IEEE 802.11a, 11n-20HT)
Bandwidth	: 20 MHz
Channel spacing	: 5 MHz (2.4 GHz), 20 MHz (IEEE 802.11a, 11n-20HT, 5 GHz)
Type of modulation	: DSSS, OFDM
Antenna type	: 2.4 GHz band: $\lambda/4$ monopole, 5 GHz band: $\lambda/4$ dipole
Antenna gain with cable loss	: 2.4 GHz band: 1.6 dBi, 5 GHz band: 4.1 dBi
Antenna connector type	: SMD
ITU code	: D1D, G1D
Operation temperature range	: 0 to +60 deg.C

*1) Refer to the test reports: 10243431S-A for FCC 15.247.

* The EUT does not perform simultaneous transmission of 2.4 GHz and 5 GHz Wireless LAN.

FCC 15.31 (e)

The RF transmitter has its own regulator. The RF transmitter is constantly provided voltage (DC 1.8 V and DC 3.3 V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC 15.203

The antenna is not removable from the EUT. Therefore the equipment complies with the requirement.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart E
FCC Part 15 final revised on November 2, 2017

Title : FCC 47CFR Part15 Radio Frequency Device Subpart E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 IC: RSS-Gen 8.8	FCC: 15.407 (b) (6) / 15.207 IC: RSS-Gen 8.8	8.2 dB, 0.18013 MHz, L1, QP	Complied	-
26 dB Emission Bandwidth	FCC: KDB Publication Number 789033 IC: -	FCC: 15.407 (a) (1) (2) (3) IC: -	See data	Complied	Conducted
Maximum Conducted Output Power	FCC: KDB Publication Number 789033 IC: -	FCC: 15.407 (a) (1) (2) (3) IC: RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.1		Complied	Conducted
Maximum Power Spectral Density	FCC: KDB Publication Number 789033 IC: -	FCC : 15.407 (a) (1) (2) (3) IC: RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.1		Complied	Conducted
Spurious Emission Restricted Band Edge	FCC: ANSI C63.10-2013 KDB Publication Number 789033 IC: -	FCC: 15.407 (b), 15.205 and 15.209 IC: RSS-247 6.2.1.2 6.2.2.2 6.2.3.2 6.2.4.2	2.5 dB 799.985 MHz, QP, Hori.	Complied	Conducted (< 30 MHz) / Radiated (> 30 MHz) *1)
6 dB Emission Bandwidth	FCC: ANSI C63.10-2013 IC: -	FCC: 15.407 (e) IC: RSS-247 6.2.4.1	See data	Complied	Conducted

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).

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

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.

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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 $k=2$.

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.5 dB	2.5 dB	2.5 dB	2.6 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.3 dB	4.3 dB	4.3 dB	-	-
	200 MHz-1 GHz	5.9 dB	5.9 dB	5.9 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 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	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
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 report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

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JAB Accreditation No. RTL02610
FCC Test Firm Registration Number: 839876

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

Test item	Mode	Tested frequency	Worst data mode *1)	Power setting *2)
Conducted emission, Radiated emission (below 1 GHz) *3)	Transmitting IEEE 802.11n-20HT	5785 MHz	PN9, MCS2 (Short GI)	12 dBm
Other items	Transmitting IEEE 802.11a	5745 MHz, 5785 MHz, 5825 MHz	PN9, 36 Mbps	12 dBm
	Transmitting IEEE 802.11n-20HT	5745 MHz, 5785 MHz, 5825 MHz	PN9, MCS2 (Short GI)	12 dBm

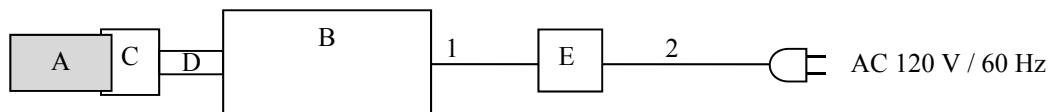
*1) The worst condition was determined based on the test result of Maximum Peak Output Power.

*2) Software for the power setting: WlanCalib ver.1.0.0.0

*3) 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.

Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	WLAN CARD	E3000-02-01	4Z00069	NEC Platforms	EUT
B	3.0G LET	E3000-01	4200110	Honda Engineering	-
C	3.0G LET SUB TEST BOARD	E21-089163-420	-	NEC	-
D	WIRE LESS BOARD FPC	E21-089163-507-2	-	OKI CABLE	-
E	AC Adapter	UIA336-1230	C11-0550444	UNIFIVE Technology	-

List of cables used

No.	Cable Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	1.8	Unshielded	Unshielded	-
2	AC	2.0	Unshielded	Unshielded	-

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

Photographs of the set up are shown in APPENDIX 3.

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 1GHz >

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber.

< 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 68.2 dBuV/m, 3 m (-27 dBm e.i.r.p. ^{*}) in the Section 15.407 (b) (1) (2) (3).

For W58 Bandedge

-27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge in the section 15.407(b)(4)(i).

Restricted band edge:

Apply to limit in the Section 15.209 (a).

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

*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 200 MHz	200 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: 1/T (T: burst length, refer to APPENDIX) Detector: Peak
Test Distance	3 m	3 m (below 1 GHz), 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 v02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".

*2) Distance Factor: $20 \times \log (3.95 \text{ m}/3.0 \text{ m}) = 2.39 \text{ dB}$

*3) Distance Factor: $20 \times \log (1.0 \text{ m}/3.0 \text{ m}) = -9.54 \text{ dB}$

The 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 representative X-axis since no difference was found among each position.

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1-6.4 GHz)	Spurious (6.4-18 GHz)	Spurious (18-26.5 GHz)	Spurious (26.5-40 GHz)
Horizontal	X	X	X	X	X	X
Vertical	Z	Y	Y	Y	Y	X

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 with the test instrument.

Test	pan	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) (Method PM)
Maximum Power Spectral Density	Encompass the entire EBW	100 kHz *2)	300 kHz	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 v02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".

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

*2) KDB 789033 D02 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 RBW Correction Factor ($10 \log(500 \text{ kHz} / 100 \text{ kHz})$) 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)

Summary of the test results : Pass

Refer to APPENDIX 1

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

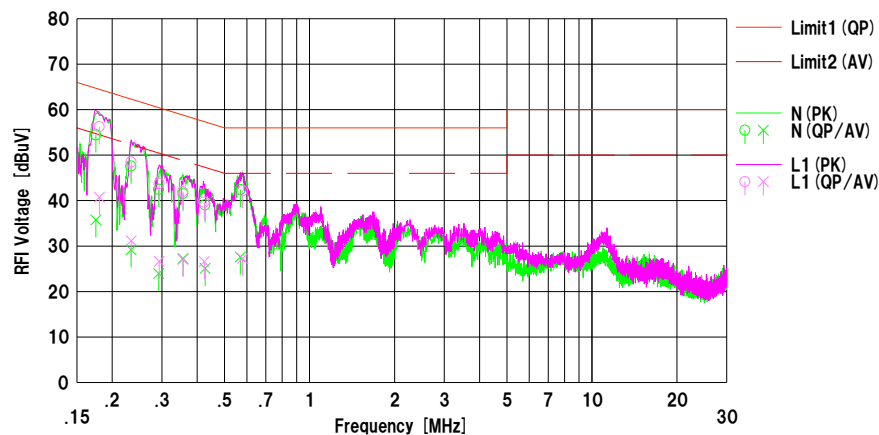
UL Japan, Inc Shonan EMC Lab. No3 Shielded Room
Date : 2017/12/10

Mode : W58. 11n. 5785MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 23 deg.C. / 36 %RH

Remarks : -

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

Engineer : Yosuke Ishikawa



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	0.17504	42.00	23.30	12.45	54.45	35.75	64.72	54.72	10.2	18.9	N	
2	0.23314	35.10	16.70	12.47	47.57	29.17	62.34	52.34	14.7	23.1	N	
3	0.29221	30.00	11.50	12.46	42.46	23.96	60.46	50.46	18.0	26.5	N	
4	0.35636	29.10	14.80	12.47	41.57	27.27	58.81	48.81	17.2	21.5	N	
5	0.42664	26.60	12.60	12.48	39.08	25.08	57.32	47.32	18.2	22.2	N	
6	0.56863	29.90	15.10	12.50	42.40	27.60	56.00	46.00	13.6	18.4	N	
7	0.18013	43.80	28.30	12.45	56.25	40.75	64.48	54.48	8.2	13.7	L1	
8	0.23342	36.00	18.70	12.47	48.47	31.17	62.33	52.33	13.8	21.1	L1	
9	0.29343	31.30	14.20	12.46	43.76	26.66	60.43	50.43	16.6	23.7	L1	
10	0.35578	29.50	14.60	12.47	41.97	27.07	58.83	48.83	16.8	21.7	L1	
11	0.42390	27.20	14.10	12.48	39.68	26.58	57.37	47.37	17.6	20.7	L1	
12	0.57898	29.70	14.80	12.49	42.19	27.29	56.00	46.00	13.8	18.7	L1	

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

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99 % Occupied Bandwidth

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 12041957S-A-R2
Date November 29, 2017
Temperature / Humidity 27deg. C / 41 % RH
Engineer Shiro Kobayashi
Mode Tx

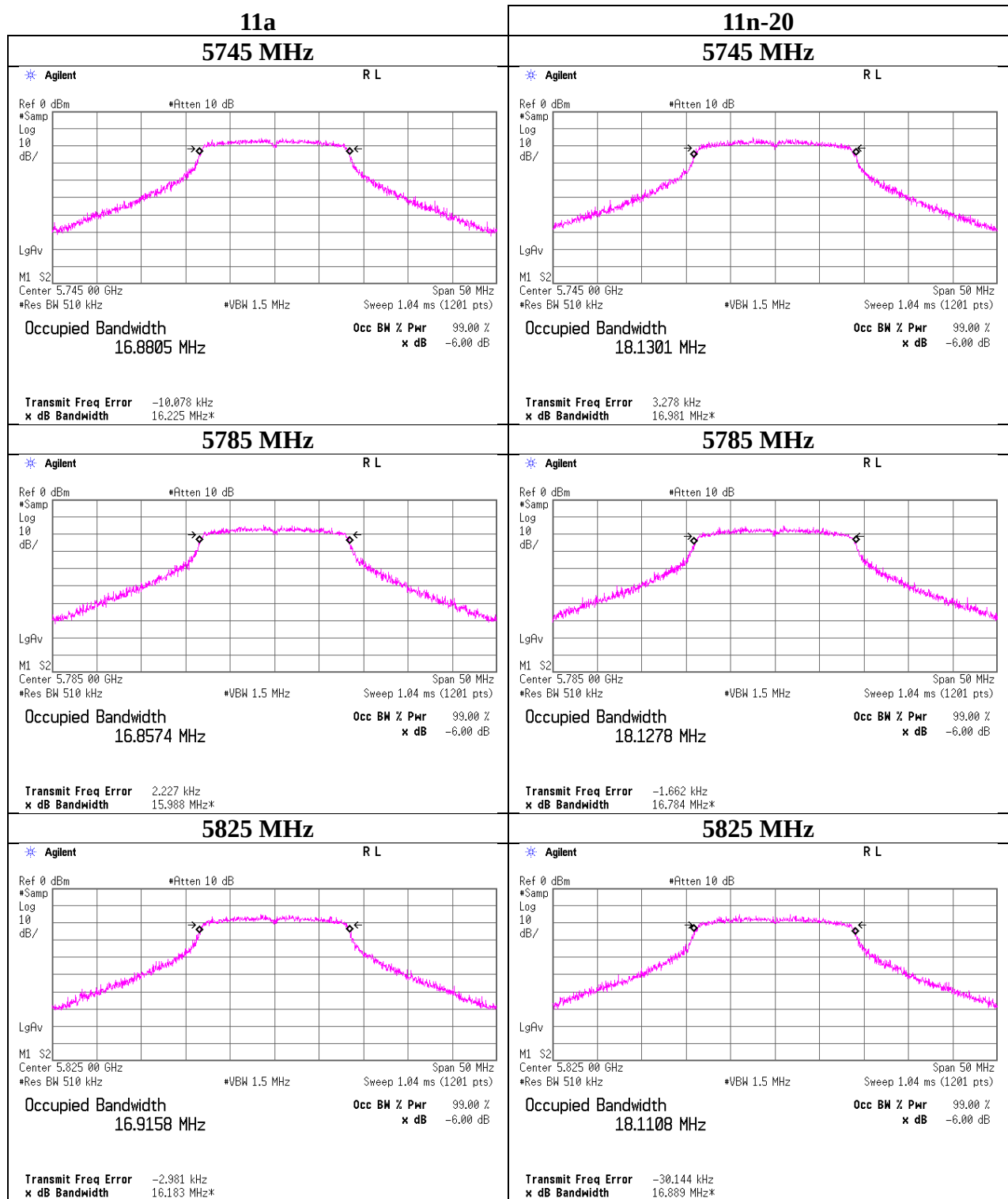
11a

Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]
5745	16.880
5785	16.857
5825	16.916

11n-20

Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]
5745	18.130
5785	18.128
5825	18.111

99 % Occupied Bandwidth



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6 dB Bandwidth

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 12041957S-A-R2
Date November 29, 2017
Temperature / Humidity 27deg. C / 41 % RH
Engineer Shiro Kobayashi
Mode Tx

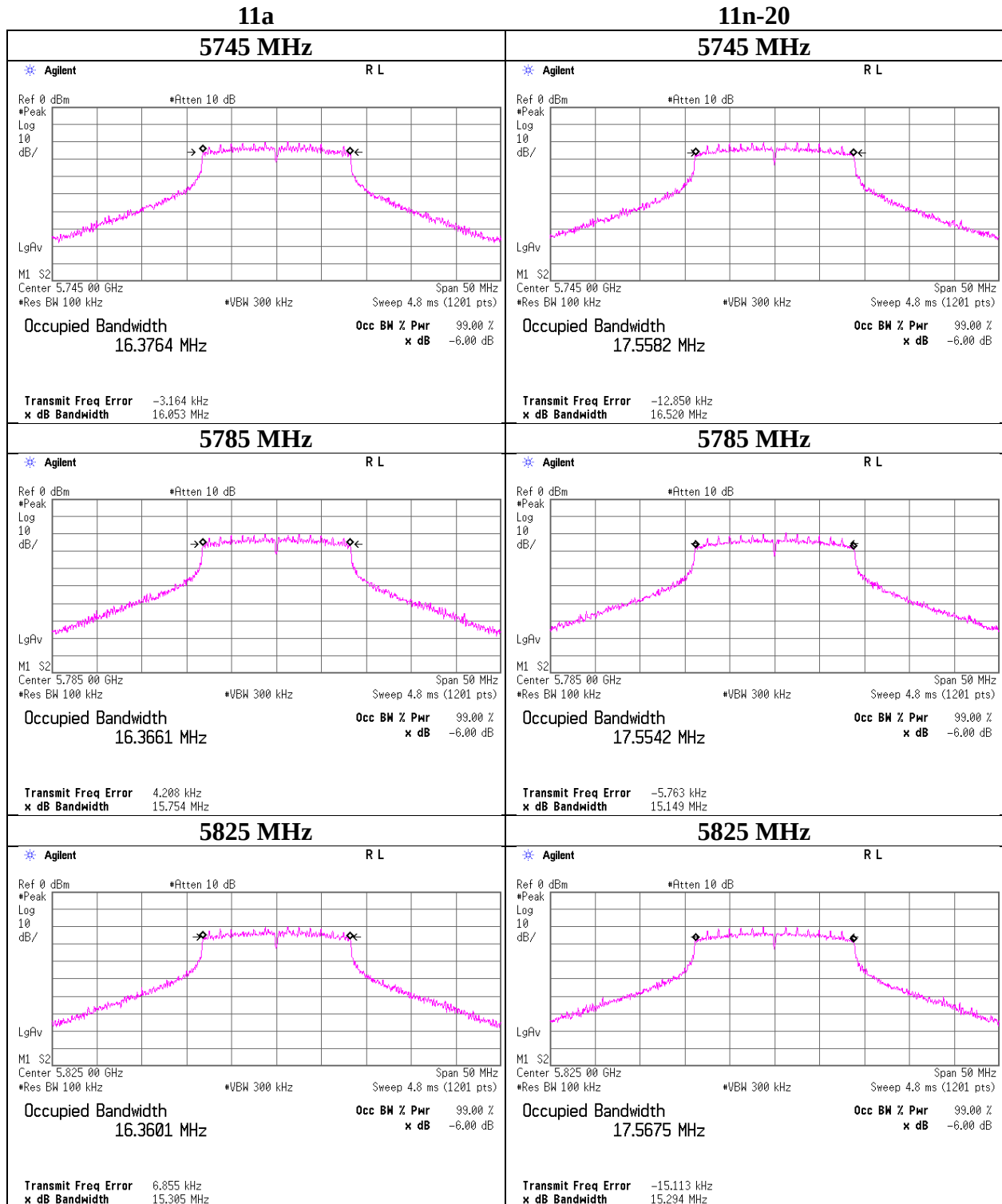
11a

Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5745	16.053	> 500
5785	15.754	> 500
5825	15.305	> 500

11n-20

Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5745	16.520	> 500
5785	15.149	> 500
5825	15.294	> 500

6 dB Bandwidth



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Maximum Conducted Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12041957S-A-R2
Date : November 28, 2017
Temperature / Humidity : 23deg. C / 41 % RH
Engineer : Kazuya Noda
Mode : Tx 11a

11a

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]	Conducted Power				e.i.r.p.			
						Result	Limit	Margin		Result	Limit	Margin	
						[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5745	-10.20	1.32	20.29	0.76	4.1	12.17	16.50	30.00	17.83	16.27	42.40	36.00	19.73
5785	-10.12	1.32	20.30	0.76	4.1	12.26	16.84	30.00	17.74	16.36	43.29	36.00	19.64
5825	-10.27	1.33	20.30	0.76	4.1	12.12	16.31	30.00	17.88	16.22	41.92	36.00	19.78

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.5 Shielded Room
Report No. : 12041957S-A-R2
Date : November 28, 2017
Temperature / Humidity : 23deg. C / 41 % RH
Engineer : Kazuya Noda
Mode : Tx 11n-20

11n-20

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]	Conducted Power				e.i.r.p.			
						Result		Limit	Margin	Result		Limit	Margin
						[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5745	-9.97	1.32	20.29	0.48	4.1	12.12	16.28	30.00	17.88	16.22	41.86	36.00	19.78
5785	-9.94	1.32	20.30	0.48	4.1	12.16	16.44	30.00	17.84	16.26	42.24	36.00	19.74
5825	-10.07	1.33	20.30	0.48	4.1	12.04	15.99	30.00	17.96	16.14	41.09	36.00	19.86

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.5 Shielded Room
Report No.	12041957S-A-R2
Date	November 28, 2017
Temperature / Humidity	23deg. C / 41 % RH
Engineer	Kazuya Noda
Mode	Tx

11a 5785 MHz

Mode	Rate Mbps	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11a	6	-9.58	0.15	-9.43	
	9	-9.60	0.18	-9.42	
	12	-9.67	0.23	-9.44	
	18	-9.82	0.33	-9.49	
	24	-9.99	0.43	-9.56	
	36	-10.12	0.76	-9.36	*
	48	-10.36	0.92	-9.44	
	54	-10.49	0.99	-9.50	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

11n-20 5785 MHz

Mode	MCS Number	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11n (Long GI)	0	-9.71	0.16	-9.55	
	1	-9.79	0.30	-9.49	
	2	-9.91	0.35	-9.56	
	3	-9.97	0.45	-9.52	
	4	-10.28	0.76	-9.52	
	5	-10.51	0.97	-9.54	
	6	-10.53	0.98	-9.55	
	7	-10.55	1.05	-9.50	
11n (Short GI)	0	-9.74	0.18	-9.56	
	1	-9.84	0.27	-9.57	
	2	-9.94	0.48	-9.46	*
	3	-10.10	0.48	-9.62	
	4	-10.39	0.67	-9.72	
	5	-10.48	0.83	-9.65	
	6	-10.73	1.07	-9.66	
	7	-10.68	1.12	-9.56	

* 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.5 Shielded Room
Report No. : 12041957S-A-R2
Date : November 28, 2017
Temperature / Humidity : 23deg. C / 41 % RH
Engineer : Kazuya Noda
Mode : Tx

11a

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average)	
				[dBm]	[mW]
5745	-9.51	1.32	20.29	12.10	16.22
5785	-9.58	1.32	20.30	12.04	16.00
5825	-9.68	1.33	20.30	11.95	15.67

Sample Calculation:

Result (Timed average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

Result (Burst power average) = Time average + Duty factor

*The equipment and cables were not used for factor 0 dB of the data sheets.

11n

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average)	
				[dBm]	[mW]
5745	-9.71	1.32	20.29	11.90	15.49
5785	-9.74	1.32	20.30	11.88	15.42
5825	-9.82	1.33	20.30	11.81	15.17

Sample Calculation:

Result (Timed average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

Result (Burst power average) = Time average + Duty factor

*The equipment and cables were not used for factor 0 dB of the data sheets.

**The average output power was measured with the lowest order modulation and
lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.**

Burst rate confirmation

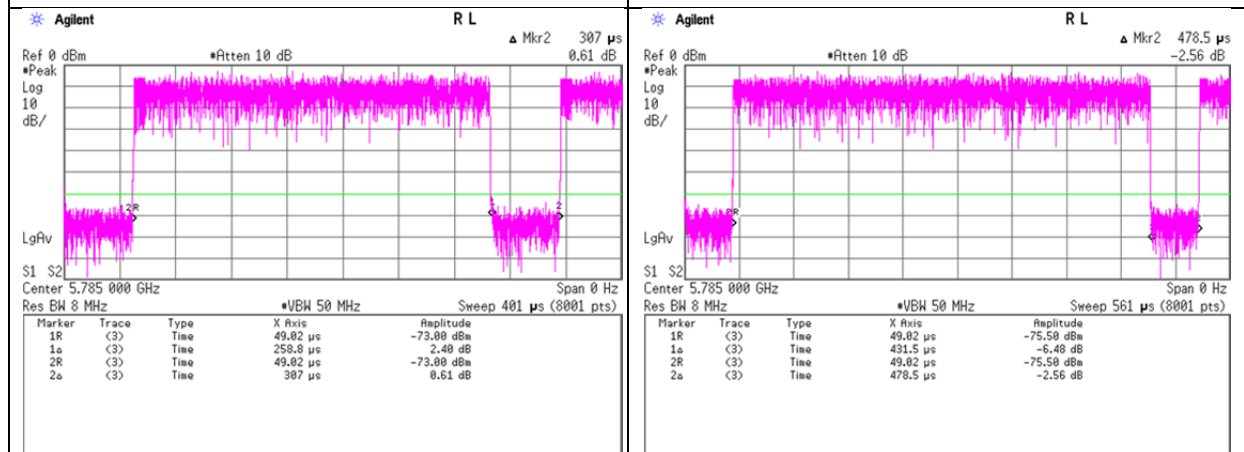
Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12041957S-A-R2
Date : November 29, 2017
Temperature / Humidity : 27deg. C / 41 % RH
Engineer : Shiro Kobayashi
Mode : Tx

11a 36 Mbps

$Tx\ on / (Tx\ on + Tx\ off) = 0.839$
 $Tx\ on / (Tx\ on + Tx\ off) * 100 = 83.9\ \%$
Duty factor = $10 * \log(0.31 / 0.26) = 0.76\ dB$

11n-20 MCS2

$Tx\ on / (Tx\ on + Tx\ off) = 0.896$
 $Tx\ on / (Tx\ on + Tx\ off) * 100 = 89.6\ \%$
Duty factor = $10 * \log(0.48 / 0.43) = 0.48\ dB$



Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12041957S-A-R2
Date : November 29, 2017
Temperature / Humidity : 27deg. C / 41 % RH
Engineer : Shiro Kobayashi
Mode : Tx

11a

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	-28.22	1.32	20.29	0.76	4.1	6.99	1.14	30.00	28.86	5.24	36.00	30.76
5785	-28.57	1.32	20.30	0.76	4.1	6.99	0.80	30.00	29.20	4.90	36.00	31.10
5825	-29.01	1.33	20.30	0.76	4.1	6.99	0.37	30.00	29.63	4.47	36.00	31.53

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 (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

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

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

11n-20

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	-29.18	1.32	20.29	0.48	4.1	6.99	-0.10	30.00	30.10	4.00	36.00	32.00
5785	-27.83	1.32	20.30	0.48	4.1	6.99	1.26	30.00	28.74	5.36	36.00	30.64
5825	-28.93	1.33	20.30	0.48	4.1	6.99	0.16	30.00	29.84	4.26	36.00	31.74

Sample Calculation:

PSD: Power Spectral Density

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

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

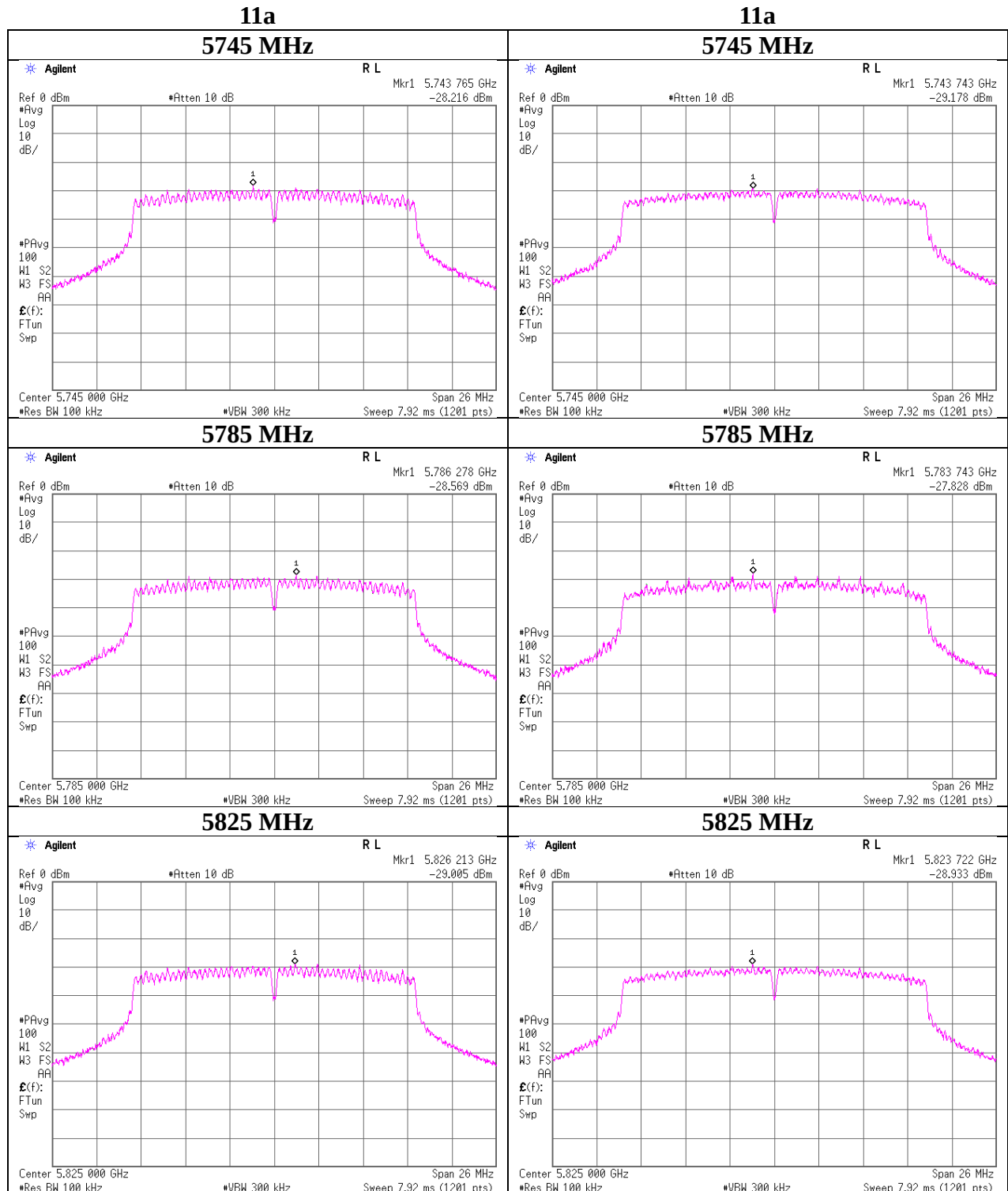
PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

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

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12041957S-A-R2
Date : November 29, 2017
Temperature / Humidity : 27deg. C / 41 % RH
Engineer : Shiro Kobayashi
Mode : Tx



Radiated Spurious Emission

Report No. 12041957S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date December 7, 2017 December 10, 2017
Temperature / Humidity 20 deg. C / 24 % RH 25 deg. C / 31 % RH
Engineer Shiro Kobayashi Yosuke Ishikawa
(1 GHz - 13 GHz) (13 GHz - 40 GHz)
Mode Tx 11a 5745 MHz

(above 1GHz Inside of the restricted band)

(* 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.	11490.000	PK	44.40	40.03	10.23	39.03	2.39	58.02	73.90	15.8	150	0	
Hori.	17235.000	PK	44.26	42.13	12.73	37.97	-9.54	51.61	73.90	22.2	150	0	
Hori.	11490.000	AV	34.39	40.03	10.23	39.03	2.39	48.01	53.90	5.8	150	0	VBW: 3.9kHz
Hori.	17235.000	AV	34.52	42.13	12.73	37.97	-9.54	41.87	53.90	12.0	150	0	VBW: 3.9kHz
Vert.	11490.000	PK	44.84	40.03	10.23	39.03	2.39	58.46	73.90	15.4	150	0	
Vert.	17235.000	PK	43.86	42.13	12.73	37.97	-9.54	51.21	73.90	22.6	150	0	
Vert.	11490.000	AV	34.66	40.03	10.23	39.03	2.39	48.28	53.90	5.6	150	0	VBW: 3.9kHz
Vert.	17235.000	AV	34.84	42.13	12.73	37.97	-9.54	42.19	53.90	11.7	150	0	VBW: 3.9kHz

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

(Calculation) (above 1GHz Outside of the restricted band)

(* 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]	Result (EIRP) [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	5650.000	PK	44.44	32.25	16.49	37.42	2.39	58.15	-37.05	-27.00	10.1	150	23	
Hori.	5700.000	PK	43.52	32.34	16.54	37.45	2.39	57.34	-37.86	10.00	47.9	150	23	
Hori.	5720.000	PK	45.74	32.37	16.57	37.46	2.39	59.61	-35.59	15.60	51.2	150	23	
Hori.	5725.000	PK	54.03	32.38	16.57	37.46	2.39	67.91	-27.29	27.00	54.3	150	23	
Vert.	5650.000	PK	44.05	32.25	16.49	37.42	2.39	57.76	-37.44	-27.00	10.4	105	49	
Vert.	5700.000	PK	43.94	32.34	16.54	37.45	2.39	57.76	-37.44	10.00	47.4	105	49	
Vert.	5720.000	PK	44.48	32.37	16.57	37.46	2.39	58.35	-36.85	15.60	52.5	105	49	
Vert.	5725.000	PK	47.15	32.38	16.57	37.46	2.39	61.03	-34.17	27.00	61.2	105	49	

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

Result(EIRP[dBm])=10*LOG (({ 10 ^ (Electric Field Strength [dBuV/m] / 20) * 10 ^ (-6) * Distance:3[m]) ^ 2 } / 30) *10^3)

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

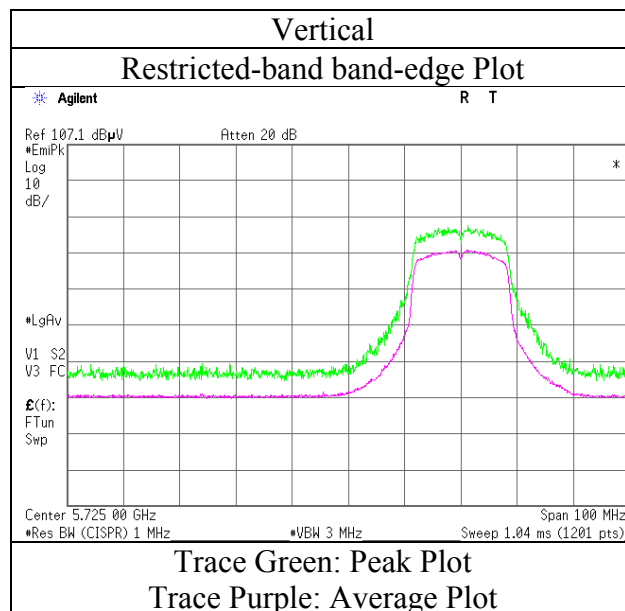
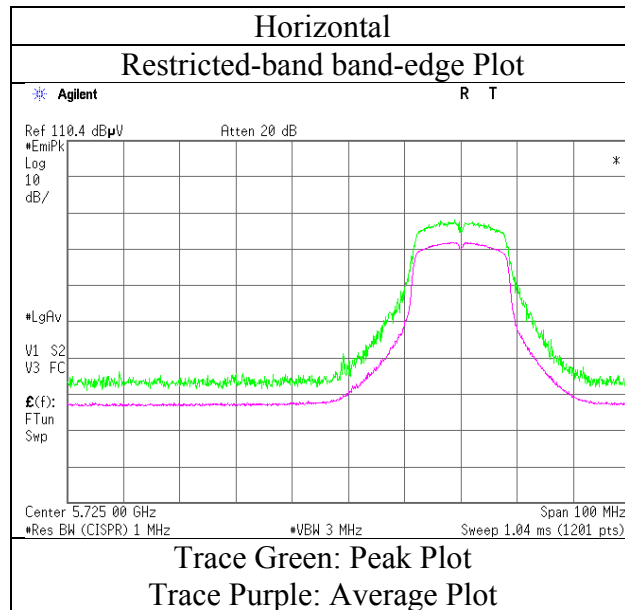
*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission

Report No.	12041957S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	December 7, 2017
Temperature / Humidity	20 deg. C / 24 % RH
Engineer	Shiro Kobayashi (1 GHz - 13 GHz)
Mode	Tx 11a 5745 MHz



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

Radiated Spurious Emission

Report No.	12041957S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	2	2
Date	December 7, 2017	December 10, 2017
Temperature / Humidity	20 deg. C / 24 % RH	25 deg. C / 31 % RH
Engineer	Shiro Kobayashi	Yosuke Ishikawa
	(1 GHz - 13 GHz)	(13 GHz - 40 GHz)
Mode	Tx 11a 5785 MHz	

(above 1GHz Inside of the restricted band)

(* 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	44.83	39.89	10.29	39.05	2.39	58.35	73.90	15.5	150	0	
Hori.	17355.000	PK	43.44	43.21	12.73	37.92	-9.54	51.92	73.90	21.9	150	0	
Hori.	11570.000	AV	33.79	39.89	10.29	39.05	2.39	47.31	53.90	6.5	150	0	VBW: 3.9kHz
Hori.	17355.000	AV	33.54	43.21	12.73	37.92	-9.54	42.02	53.90	11.8	150	0	VBW: 3.9kHz
Vert.	11570.000	PK	44.54	39.89	10.29	39.05	2.39	58.06	73.90	15.8	150	0	
Vert.	17355.000	PK	44.44	43.21	12.73	37.92	-9.54	52.92	73.90	20.9	150	0	
Vert.	11570.000	AV	34.02	39.89	10.29	39.05	2.39	47.54	53.90	6.3	150	0	VBW: 3.9kHz
Vert.	17355.000	AV	33.56	43.21	12.73	37.92	-9.54	42.04	53.90	11.8	150	0	VBW: 3.9kHz

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

UL Japan, Inc.

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Radiated Spurious Emission

Report No. 12041957S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2
Date December 7, 2017 December 10, 2017
Temperature / Humidity 20 deg. C / 24 % RH 25 deg. C / 31 % RH
Engineer Shiro Kobayashi Yosuke Ishikawa
(1 GHz - 13 GHz) (13 GHz - 40 GHz)
Mode Tx 11a 5825 MHz

(above 1GHz Inside of the restricted band)

(* 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	43.58	39.74	10.33	39.08	2.39	56.96	73.90	16.9	150	0	
Hori.	17475.000	PK	43.25	44.29	12.72	37.87	-9.54	52.85	73.90	21.0	150	0	
Hori.	11650.000	AV	33.94	39.74	10.33	39.08	2.39	47.32	53.90	6.5	150	0	VBW: 3.9kHz
Hori.	17475.000	AV	33.61	44.29	12.72	37.87	-9.54	43.21	53.90	10.6	150	0	VBW: 3.9kHz
Vert.	11650.000	PK	44.32	39.74	10.33	39.08	2.39	57.70	73.90	16.2	150	0	
Vert.	17475.000	PK	44.03	44.29	12.72	37.87	-9.54	53.63	73.90	20.2	150	0	
Vert.	11650.000	AV	33.73	39.74	10.33	39.08	2.39	47.11	53.90	6.7	150	0	VBW: 3.9kHz
Vert.	17475.000	AV	33.60	44.29	12.72	37.87	-9.54	43.20	53.90	10.7	150	0	VBW: 3.9kHz

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

(Calculation) (above 1GHz Outside of the restricted band)

(* 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]	Result (EIRP) [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	5850.000	PK	45.00	32.60	16.72	37.53	2.39	59.18	-36.02	27.00	63.0	149	22	
Hori.	5855.000	PK	44.59	32.61	16.72	37.53	2.39	58.78	-36.42	15.60	52.0	149	22	
Hori.	5875.000	PK	44.27	32.64	16.75	37.54	2.39	58.51	-36.69	10.00	46.7	149	22	
Hori.	5925.000	PK	44.08	32.73	16.79	37.57	2.39	58.42	-36.78	-27.00	9.8	149	22	
Vert.	5850.000	PK	44.13	32.60	16.72	37.53	2.39	58.31	-36.89	27.00	63.9	124	52	
Vert.	5855.000	PK	44.00	32.61	16.72	37.53	2.39	58.19	-37.01	15.60	52.6	124	52	
Vert.	5875.000	PK	43.65	32.64	16.75	37.54	2.39	57.89	-37.31	10.00	47.3	124	52	
Vert.	5925.000	PK	43.88	32.73	16.79	37.57	2.39	58.22	-36.98	-27.00	10.0	124	52	

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

Result(EIRP[dBm])=10*LOG (({ 10 ^ (Electric Field Strength [dBuV/m] / 20) * 10 ^ (-6) * Distance:3[m] } ^ 2) / 30) *10^3)

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

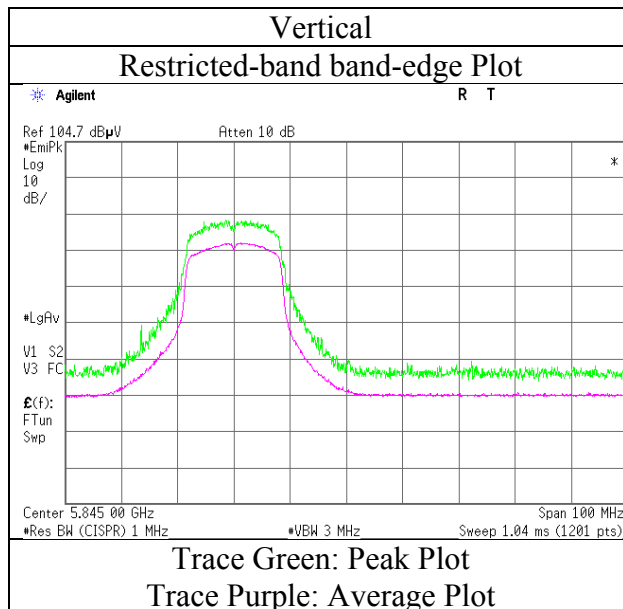
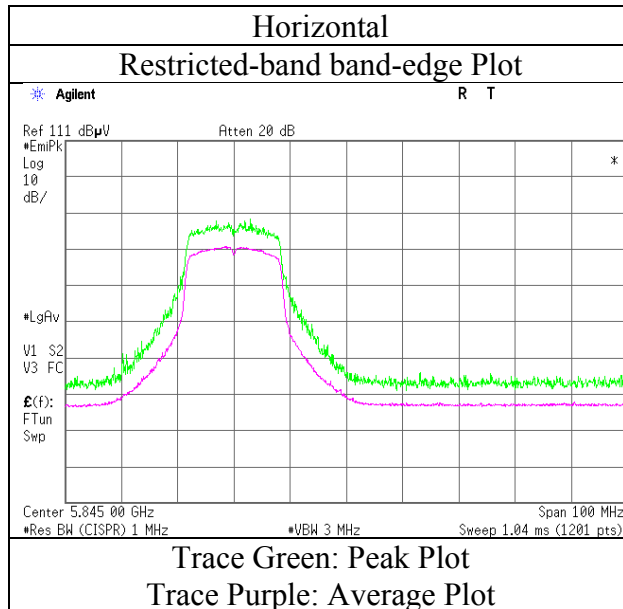
*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission

Report No. 12041957S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2
Date December 7, 2017
Temperature / Humidity 20 deg. C / 24 % RH
Engineer Shiro Kobayashi
Mode Tx 11a 5825 MHz



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

Radiated Spurious Emission

Report No. 12041957S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date December 7, 2017 December 10, 2017
Temperature / Humidity 20 deg. C / 24 % RH 25 deg. C / 31 % RH
Engineer Shiro Kobayashi Yosuke Ishikawa
(1 GHz - 13 GHz) (13 GHz - 40 GHz)
Mode Tx 11n-20 5745 MHz

(above 1GHz Inside of the restricted band)

(* 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.	11490.000	PK	44.74	40.03	10.23	39.03	2.39	58.36	73.90	15.5	150	0	
Hori.	17235.000	PK	43.87	42.13	12.73	37.97	-9.54	51.22	73.90	22.6	150	0	
Hori.	11490.000	AV	34.47	40.03	10.23	39.03	2.39	48.09	53.90	5.8	150	0	VBW: 2.4kHz
Hori.	17235.000	AV	33.13	42.13	12.73	37.97	-9.54	40.48	53.90	13.4	150	0	VBW: 2.4kHz
Vert.	11490.000	PK	44.75	40.03	10.23	39.03	2.39	58.37	73.90	15.5	150	0	
Vert.	17235.000	PK	44.05	42.13	12.73	37.97	-9.54	51.40	73.90	22.5	150	0	
Vert.	11490.000	AV	34.17	40.03	10.23	39.03	2.39	47.79	53.90	6.1	150	0	VBW: 2.4kHz
Vert.	17235.000	AV	33.13	42.13	12.73	37.97	-9.54	40.48	53.90	13.4	150	0	VBW: 2.4kHz

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

(Calculation) (above 1GHz Outside of the restricted band)

(* 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]	Result (EIRP) [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	5650.000	PK	44.06	32.25	16.49	37.42	2.39	57.77	-37.43	-27.00	10.4	150	22	
Hori.	5700.000	PK	43.44	32.34	16.54	37.45	2.39	57.26	-37.94	10.00	47.9	150	22	
Hori.	5720.000	PK	46.35	32.37	16.57	37.46	2.39	60.22	-34.98	15.60	50.6	150	22	
Hori.	5725.000	PK	53.06	32.38	16.57	37.46	2.39	66.94	-28.26	27.00	55.3	150	22	
Vert.	5650.000	PK	43.29	32.25	16.49	37.42	2.39	57.00	-38.20	-27.00	11.2	120	46	
Vert.	5700.000	PK	43.89	32.34	16.54	37.45	2.39	57.71	-37.49	10.00	47.5	120	46	
Vert.	5715.000	PK	43.41	32.36	16.56	37.46	2.39	57.26	-37.94	15.60	53.5	120	46	
Vert.	5725.000	PK	48.19	32.38	16.57	37.46	2.39	62.07	-33.13	27.00	60.1	120	46	

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

Result(EIRP[dBm])=10*LOG (({ 10 ^ (Electric Field Strength [dBuV/m] / 20) * 10 ^ (-6) * Distance:3[m] } ^ 2) / 30) *10^3)

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

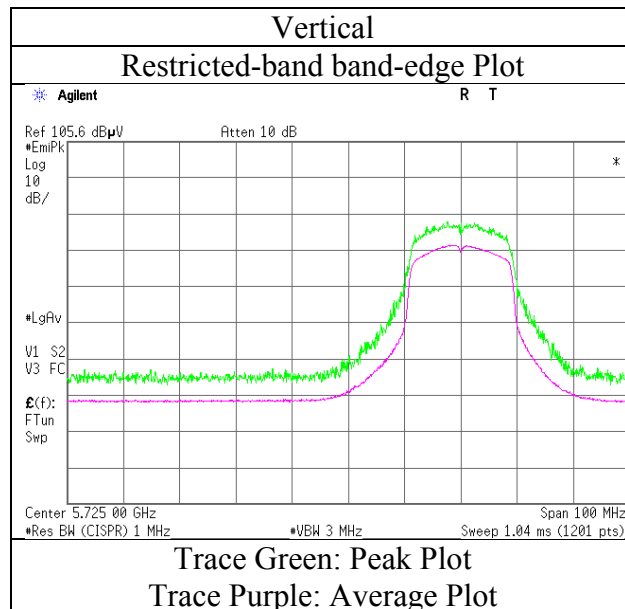
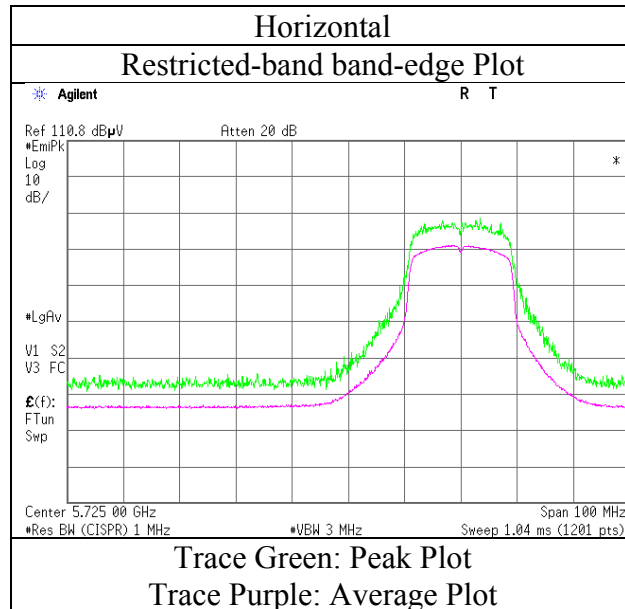
*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission

Report No.	12041957S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	December 7, 2017
Temperature / Humidity	20 deg. C / 24 % RH
Engineer	Shiro Kobayashi
Mode	Tx 11n-20 5745 MHz



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

Radiated Spurious Emission

Report No. 12041957S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2
Date December 7, 2017 December 10, 2017
Temperature / Humidity 20 deg. C / 24 % RH 25 deg. C / 31 % RH
Engineer Shiro Kobayashi Yosuke Ishikawa
(1 GHz - 13 GHz) (13 GHz - 40 GHz)
(30 MHz - 1000 MHz)
Mode Tx 11n-20 5785 MHz

(below 1GHz and above 1GHz Inside of the restricted band)

(* 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.	164.568	QP	42.50	15.51	8.69	31.79	0.00	34.91	43.50	8.5	189	39	
Hori.	167.993	QP	44.30	15.65	8.74	31.79	0.00	36.90	43.50	6.6	185	29	
Hori.	174.848	QP	36.50	15.92	8.80	31.78	0.00	29.44	43.50	14.0	100	246	
Hori.	324.557	QP	35.60	13.99	6.63	31.65	0.00	24.57	46.00	21.4	100	318	
Hori.	349.754	QP	52.00	14.60	6.81	31.61	0.00	41.80	46.00	4.2	100	314	
Hori.	360.027	QP	52.00	14.85	6.87	31.61	0.00	42.11	46.00	3.8	100	315	
Hori.	375.425	QP	41.20	15.22	6.97	31.62	0.00	31.77	46.00	14.2	100	133	
Hori.	401.169	QP	45.30	15.84	7.15	31.63	0.00	36.66	46.00	9.3	100	109	
Hori.	799.985	QP	44.70	20.86	9.18	31.28	0.00	43.46	46.00	2.5	111	119	
Hori.	11570.000	PK	44.68	39.89	10.29	39.05	2.39	58.20	73.90	15.7	150	0	
Hori.	17355.000	PK	43.78	43.21	12.73	37.92	-9.54	52.26	73.90	21.6	150	0	
Hori.	11570.000	AV	33.65	39.89	10.29	39.05	2.39	47.17	53.90	6.7	150	0	VBW: 2.4kHz
Hori.	17355.000	AV	33.14	43.21	12.73	37.92	-9.54	41.62	53.90	12.2	150	0	VBW: 2.4kHz
Vert.	167.987	QP	41.40	15.65	8.74	31.79	0.00	34.00	43.50	9.5	100	338	
Vert.	174.851	QP	36.70	15.92	8.80	31.78	0.00	29.64	43.50	13.8	100	284	
Vert.	11570.000	PK	44.71	39.89	10.29	39.05	2.39	58.23	73.90	15.6	150	0	
Vert.	17355.000	PK	44.27	43.21	12.73	37.92	-9.54	52.75	73.90	21.1	150	0	
Vert.	11570.000	AV	33.76	39.89	10.29	39.05	2.39	47.28	53.90	6.6	150	0	VBW: 2.4kHz
Vert.	17355.000	AV	33.16	43.21	12.73	37.92	-9.54	41.64	53.90	12.2	150	0	VBW: 2.4kHz

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Radiated Spurious Emission

Report No. 12041957S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date December 7, 2017 December 10, 2017
Temperature / Humidity 20 deg. C / 24 % RH 25 deg. C / 31 % RH
Engineer Shiro Kobayashi Yosuke Ishikawa
(1 GHz - 13 GHz) (13 GHz - 40 GHz)
Mode Tx 11n-20 5825 MHz

(above 1GHz Inside of the restricted band)

(* 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	44.35	39.74	10.33	39.08	2.39	57.73	73.90	16.1	150	0	
Hori.	17475.000	PK	44.01	44.29	12.72	37.87	-9.54	53.61	73.90	20.2	150	0	
Hori.	11650.000	AV	33.18	39.74	10.33	39.08	2.39	46.56	53.90	7.3	150	0	VBW: 2.4kHz
Hori.	17475.000	AV	34.42	44.29	12.72	37.87	-9.54	44.02	53.90	9.8	150	0	VBW: 2.4kHz
Vert.	11650.000	PK	44.15	39.74	10.33	39.08	2.39	57.53	73.90	16.3	150	0	
Vert.	17475.000	PK	44.16	44.29	12.72	37.87	-9.54	53.76	73.90	20.1	150	0	
Vert.	11650.000	AV	33.49	39.74	10.33	39.08	2.39	46.87	53.90	7.0	150	0	VBW: 2.4kHz
Vert.	17475.000	AV	34.41	44.29	12.72	37.87	-9.54	44.01	53.90	9.8	150	0	VBW: 2.4kHz

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

(Calculation) (above 1GHz Outside of the restricted band)

(* 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]	Result (EIRP) [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	5850.000	PK	44.24	32.60	16.72	37.53	2.39	58.42	-36.78	27.00	63.8	152	22	
Hori.	5855.000	PK	44.21	32.61	16.72	37.53	2.39	58.40	-36.80	15.60	52.4	152	22	
Hori.	5875.000	PK	44.30	32.64	16.75	37.54	2.39	58.54	-36.66	10.00	46.7	152	22	
Hori.	5925.000	PK	43.94	32.73	16.79	37.57	2.39	58.28	-36.92	-27.00	9.9	152	22	
Vert.	5850.000	PK	43.73	32.60	16.72	37.53	2.39	57.91	-37.29	27.00	64.3	123	52	
Vert.	5855.000	PK	43.57	32.61	16.72	37.53	2.39	57.76	-37.44	15.60	53.0	123	52	
Vert.	5875.000	PK	43.90	32.64	16.75	37.54	2.39	58.14	-37.06	10.00	47.1	123	52	
Vert.	5925.000	PK	43.41	32.73	16.79	37.57	2.39	57.75	-37.45	-27.00	10.5	123	52	

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

Result(EIRP[dBm])=10*LOG (({ 10 ^ (Electric Field Strength [dBuV/m] / 20) * 10 ^ (-6) * Distance:3[m] } ^ 2) / 30) *10^3

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

UL Japan, Inc.

Shonan EMC Lab.

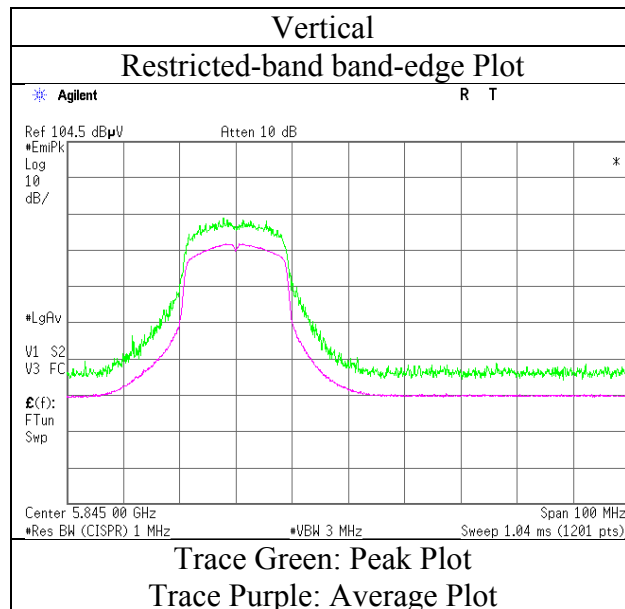
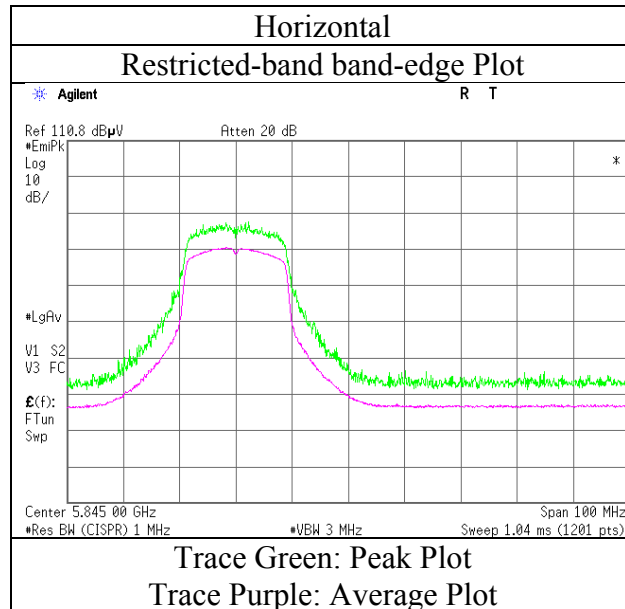
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Radiated Spurious Emission

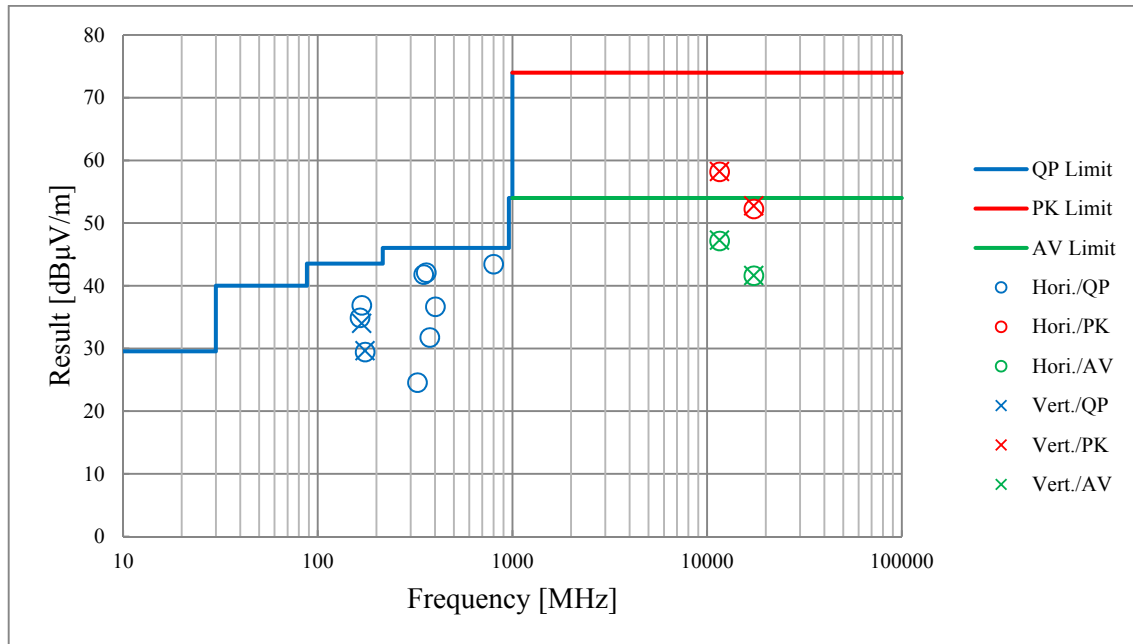
Report No.	12041957S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	December 7, 2017
Temperature / Humidity	20 deg. C / 24 % RH
Engineer	Shiro Kobayashi
Mode	Tx 11a 5825 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

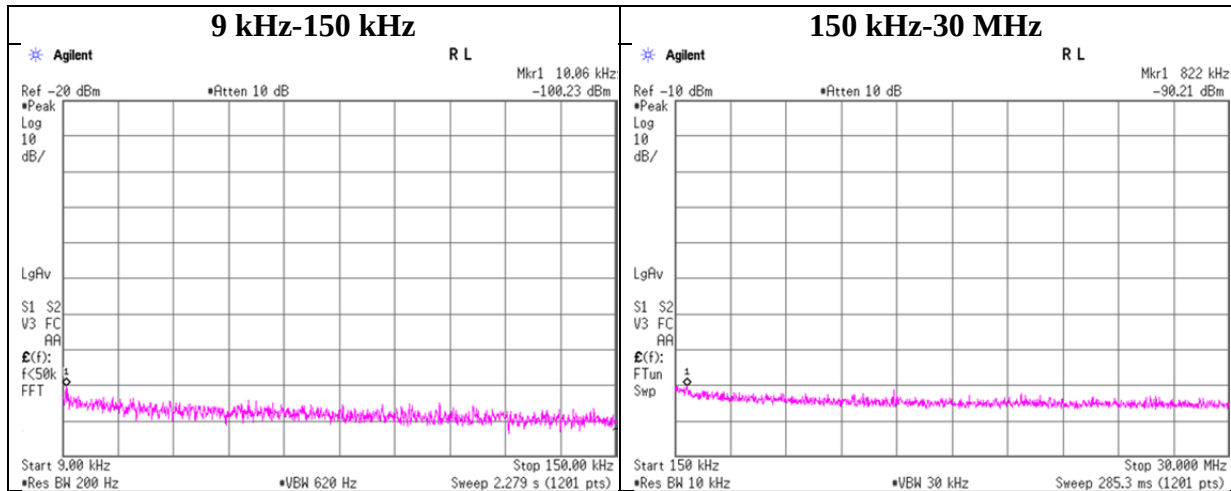
Report No.	12041957S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	2	2
Date	December 7, 2017	December 10, 2017
Temperature / Humidity	20 deg. C / 24 % RH	25 deg. C / 31 % RH
Engineer	Shiro Kobayashi (1 GHz - 13 GHz)	Yosuke Ishikawa (13 GHz - 40 GHz) (30 MHz - 1000 MHz)
Mode	Tx 11n-20 5785 MHz	



*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. : 12041957S-A-R2
Date : November 29, 2017
Temperature / Humidity : 27deg. C / 41 % RH
Engineer : Shiro Kobayashi
Mode : Tx 11n-20 5785 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.06	-100.2	0.01	20.2	4.1	1	-76.0	300	6.0	-14.7	47.5	62.2	
882.00	-90.2	0.01	20.2	4.1	1	-65.9	30	6.0	15.4	28.6	13.2	

E [dBuV/m] = EIRP [dBm] - 20 log (Distance [m]) + Ground bounce [dB] + 104.8 [dBuV/m]

EIRP[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB] + Antenna gain [dBi] + 10 * log (N)

N: Number of output

APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 12
KTS-07	Digital Tester	SANWA	PC500	7019232	AT	2017/10/11 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2017/03/23 * 12
SAT20-07	Attenuator	Weinschel Corp.	54A-20	31484	AT	2017/04/20 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2017/05/01 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT, RE	2017/03/07 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2017/02/17 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	RE	2017/06/13 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2017/05/08 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000 NFSNMS/B	1612S006	RE	2017/01/08 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2017/08/14 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2017/10/30 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE	-
SAEC-02(SVSW R)	Semi-Anechoic Chamber	TDK	SAEC-02(SVSW R)	2	RE	2017/07/18 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,C E,RFI,MF)	-	RE, CE	-
SHA-06	Horn Antenna	ETS LINDGREN	3160-10	LM3459	RE	2017/03/15 * 12
SAF-10	Pre Amplifier	TOYO Corporation	HAP26-40W	00000010	RE	2017/03/17 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2017/04/20 * 12
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE	2017/03/08 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2017/11/22 * 12
SFL-03	Highpass Filter	MICRO-TRONICS	HPM50112	028	RE	2017/11/16 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2017/02/09 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2017/02/09 * 12
SAT3-11	Attenuator	JFW	50HF-003N	-	RE	2017/02/23 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2017/11/23 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SLA-06	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	RE	2017/01/05 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE, CE	2017/09/26 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2017/06/08 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-271(RF Selector)	CE	2017/04/07 * 12
SLS-03	LISN	Rohde & Schwarz	ENV216	100513	CE	2017/02/27 * 12
KAT3-12	Attenuator	JFW IND. INC.	50HF-003N	-	CE	2017/07/24 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2016/12/13 * 12
SJM-02	Measure	KOMELON	KMC-36	-	CE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	CE	2017/10/16 * 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

UL Japan, Inc.

Shonan EMC Lab.

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

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Facsimile : +81 463 50 6401