



# RADIO TEST REPORT

Test Report No. : 11306932H

**Applicant** : CONTEC CO., LTD.  
**Type of Equipment** : Wireless LAN Adapter  
**Model No.** : NZ2WL-US  
**FCC ID** : PQRNZ2WL-US  
**Test regulation** : FCC Part 15 Subpart E: 2015  
**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.
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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)

**Date of test:** May 30 to June 2, 2016

**Representative test engineer:**

Keisuke Kawamura  
Engineer  
Consumer Technology Division

**Approved by:**

Tsubasa Takayama  
Engineer  
Consumer Technology Division

NVLAP LAB CODE: 200572-0

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## **SECTION 1: Customer information**

Company Name : CONTEC CO., LTD.  
Address : 3-9-31 Himesato Nishiyodogawa-ku Osaka 555-0025, Japan  
Telephone Number : +81-6-6477-1363  
Facsimile Number : +81-6-6477-6200  
Contact Person : Naoki Ikeda

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

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

Type of Equipment : Wireless LAN Adapter  
Model No. : NZ2WL-US  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 12-24 V  
Receipt Date of Sample : May 24, 2016  
Country of Mass-production : Japan  
Condition of EUT : Production model  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model: NZ2WL-US (referred to as the EUT in this report) is a Wireless LAN Adapter.  
This product is Wireless LAN Adaptor that can switch Access Point/Station corresponding to wide input power supply (12-24VDC). It conforms to the wireless LAN standard specification IEEE802.11a/IEEE802.11b/IEEE802.11g.

### **General Specification**

Clock frequency(ies) in the system : DST410S: 32.768kHz, FCXO-03L-R3H: 20.0MHz,  
CPU(HD6417751RBP240): 240MHz  
XTAL: 40MHz(RF Part)

### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : [11b/g] 2412-2462MHz, [11a] 5180-5240MHz, 5745-5825MHz \*1)  
Bandwidth & Channel Spacing : [11b/g] 20MHz&5MHz, [11a] 20MHz&20MH\*1)  
Type of Modulation : OFDM, DSSS  
Antenna type : Dipole Antenna  
Antenna Gain : 2.14dBi  
Antenna Connector Type : REVERSE SMA-P  
Operating voltage (inner) : DC.3.3V / 1.8V  
Operating temperature range : 0 to 50 deg. C.  
\*1)W58 band is applied for this report.

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart E: 2015, final revised on November 23, 2015  
\*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.

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
26 dB Emission Bandwidth	FCC: KDB Publication Number 789033 IC: -	FCC: 15.407 (a) (1) (2) (3) IC: -		N/A	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)	See data	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)	0.6 dB 5120.042 MHz, AV, 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.

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

The EUT provides stable voltage (DC3.3V / 1.8V) constantly to RF part regardless of input voltage. Therefore, it complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

The EUT has a unique antenna connector (REVERSE SMA-P). Therefore, it complies with the requirement of 15.203.

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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

#### EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .  
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Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz -3 GHz	3 GHz -18 GHz	18 GHz -26.5 GHz	26.5 GHz -40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	

Test distance	Radiated emission (+dB) 9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+dB)		(10 m*)(+dB)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	4.9 dB	5.2 dB	4.9 dB	5.0 dB
Vertical	4.6 dB	5.9 dB	5.0 dB	5.0 dB

Radiated emission				
(3 m*)(+dB)		(1 m*)(+dB)	(0.5 m*)(+dB)	(10 m*)(+dB)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 dB

\*Measurement distance

#### 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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Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 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)**

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11a (11a)	6Mbps, PN9
<p>*Transmitting duty was 100% on all tests.  *The worst antenna (Antenna A) and condition was determined based on the test result of Maximum Peak Output Power.  *EUT has the power settings by the software as follows;  - Power settings: See table below  - Software/Version: apfirm.bin / 5.08.02(2010-10-08)  *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.</p>	

Power settings (dBm)

<b>Mode</b>	<b>11a(5GHz)</b>		
	<b>5745</b>	<b>5765-5785</b>	<b>5805-5825</b>
6 - 24Mbps	18.0	17.5	17.0
36Mbps	16.5	16.5	16.0
48Mbps	14.5	14.0	14.0
54Mbps	13.5	13.0	13.0

\*The details of Operation mode(s)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested Antenna</b>	<b>Tested Frequency</b>
			Upper Band
99 % Occupied Bandwidth, 6 dB Bandwidth Maximum Conducted Output Power, Maximum Power Spectral Density	11a Tx	Antenna A	5745 MHz
		Antenna B	5785 MHz
			5825 MHz
Radiated Spurious Emission (Below 1 GHz)	11a Tx *1)	Antenna A *2)	5745 MHz
Radiated Spurious Emission (Above 1 GHz)	11a Tx	Antenna A *2)	5745 MHz
			5785 MHz
			5825 MHz
Conducted Spurious Emission	11a Tx	Antenna A *2)	5745 MHz
			5785 MHz
			5825 MHz
<p>*1) The mode was tested as a representative, because it had the highest power at antenna terminal test.  *2) After the comparison between Antenna A and Antenna B, test was performed with the antenna that had higher power as a representative.</p>			

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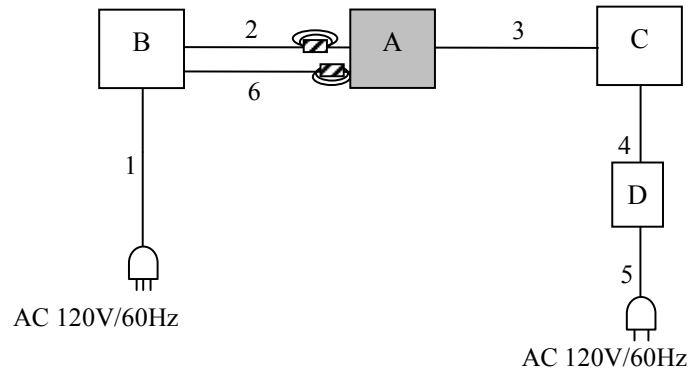
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## 4.2 Configuration and peripherals



☒ : Ferrite Core (Standard Attachment)

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

\* Ferrite Cores are attached to DC and FG Cables according to manufacturer's requirement.

### Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless LAN Adaptor	NZ2WL-US	160811162200006-A	CONTEC	EUT
B	Power Supply	PS5R-SF24	914Y03D01750R	IDEC CORPORATION	-
C	Laptop PC	PB35RNAD4R3A D71	6F026508H	TOSHIBA	-
D	AC Adaptor	PA5177U-1ACA	G71C000GX110	TOSHIBA	-

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	AC Cable	1.7	Unshielded	Unshielded	-
2	DC Cable	1.0	Unshielded	Unshielded	One ferrite core attached. (3 turns, model: E04SR241336A, manufacturer: SEIWA, 6 cm from the EUT)
3	LAN Cable	2.2	Unshielded	Unshielded	-
4	DC Cable	1.8	Unshielded	Unshielded	-
5	AC Cable	0.9	Unshielded	Unshielded	-
6	FG Cable	1.5	Unshielded	Unshielded	One ferrite core attached. (3 turns, model: E04SR241336A, manufacturer: SEIWA, 2 cm from the EUT)

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## **SECTION 6: Radiated Spurious Emission and Band Edge Compliance**

### **Test Procedure**

< Below 1GHz >

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 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 1GHz >

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 1GHz >

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

< Above 1GHz >

Inside of restricted bands (Section 15.205):

Apply to limit in the Section 15.209 (a).

Outside of the restricted bands:

Apply to limit in FCC 16-24.

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 AD *1) RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: ≥ 100 traces If duty cycle was less than 98%, a duty factor was added to the results.
Test Distance	3 m	3.7 m*2) (1 GHz – 10GHz), 1 m*3) (10 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:  $20 \times \log(3.7 \text{ m}/3.0 \text{ m}) = 1.83 \text{ dB}$

\*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(1, 2, and 3), Y(1, 2, and 3) and Z(1, 2, and 3) axes of EUT and antenna to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

**Measurement range** : 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.

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used and Test method</b>
26 dB Bandwidth	Enough to capture the emission	Close to 1 % of EBW	> RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 % to 5 % of OBW	$\geq 3$ 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: 80 MHz BW) (Method PM)
Maximum Power Spectral Density	Encompass the entire EBW	470 kHz *2)	$\geq 3$ RBW	Auto	RMS Power Averaging (200 times)	Clear Write	Spectrum Analyzer
Conducted Spurious Emission*3)	9 kHz – 150 kHz 150 kHz – 30 MHz	200 Hz 9.1 kHz	620 Hz 27 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) 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 ( $10 \log(500 \text{ kHz} / 470 \text{ kHz})$ ) 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 = 9.1 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

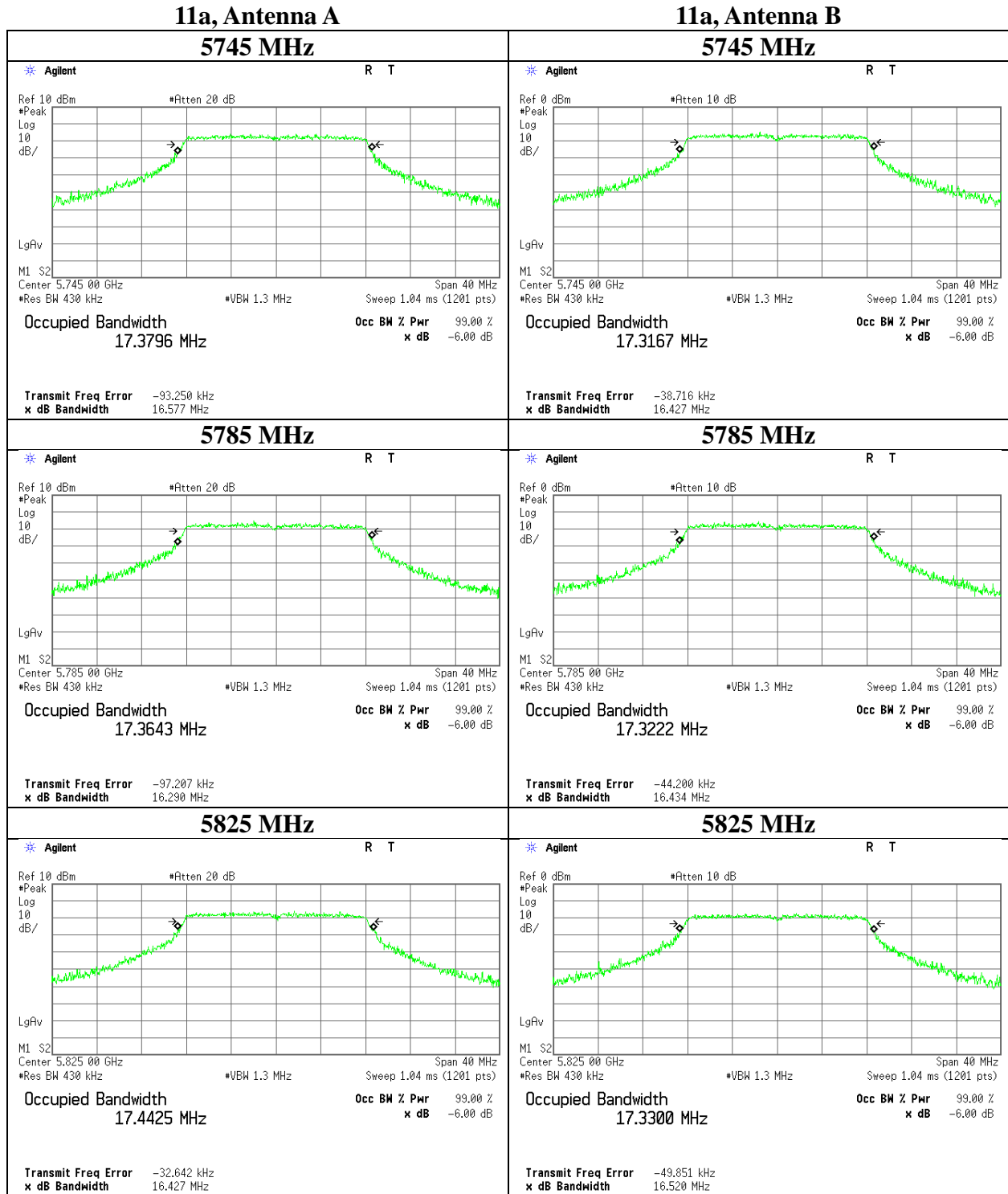
**APPENDIX 1: Test data**

**99 % Occupied Bandwidth**

Test place Ise EMC Lab. No.11 Measurement Room  
Report No. 11306932H  
Date May 30, 2016  
Temperature / Humidity 22deg. C / 61 % RH  
Engineer Kazuya Yoshioka  
Mode Tx

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [MHz]	Limit [MHz]
Antenna A	5745	-	17.380	-
	5785	-	17.364	-
	5825	-	17.443	-
Antenna B	5745	-	17.317	-
	5785	-	17.322	-
	5825	-	17.330	-

**99 % Occupied Bandwidth**



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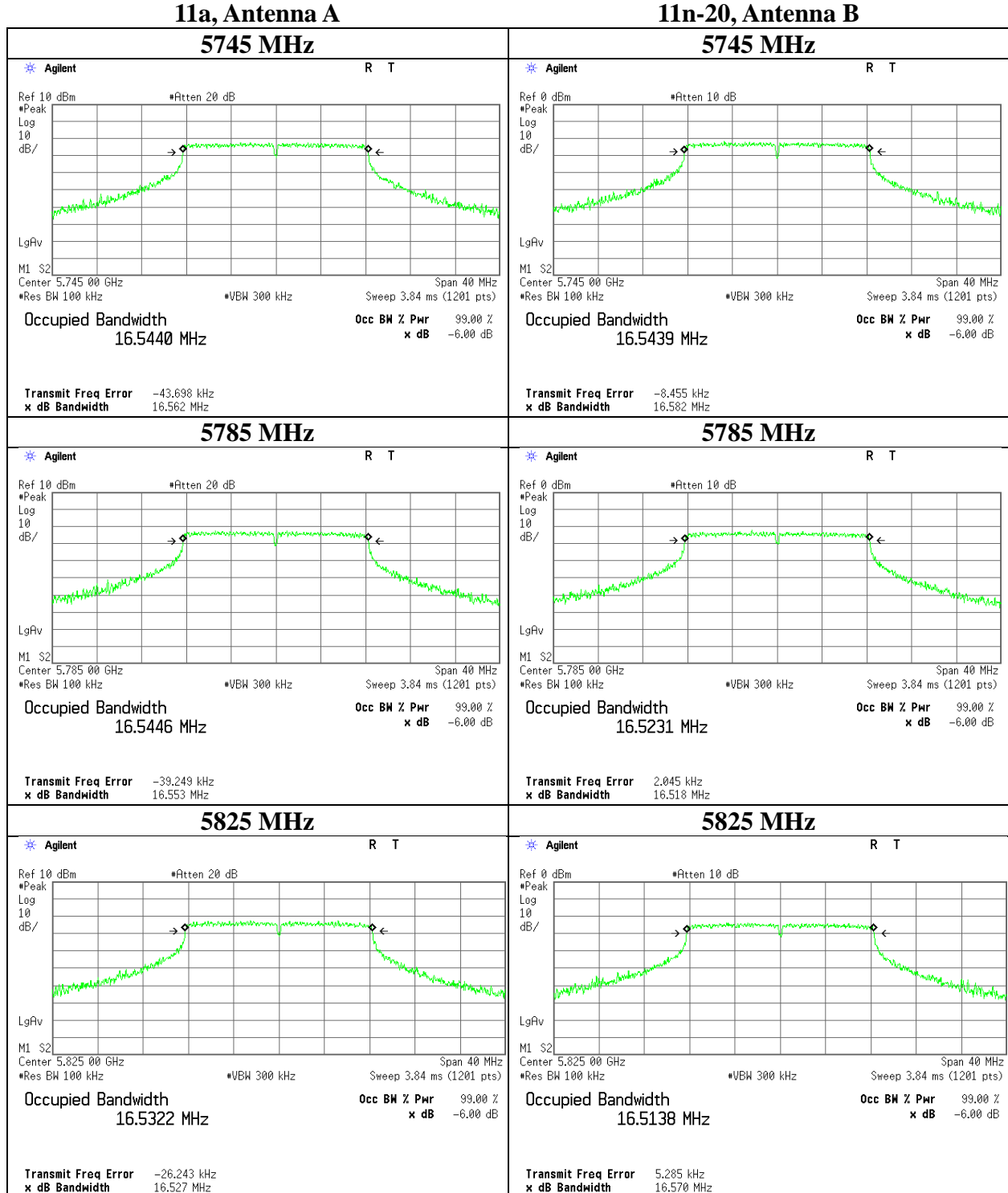
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### **6 dB Bandwidth**

Test place Ise EMC Lab. No.11 Measurement Room  
Report No. 11306932H  
Date May 30, 2016  
Temperature / Humidity 22deg. C / 61 % RH  
Engineer Kazuya Yoshioka  
Mode Tx

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
Antenna A	5745	16.562	> 500
	5785	16.553	> 500
	5825	16.527	> 500
Antenna B	5745	16.582	> 500
	5785	16.518	> 500
	5825	16.570	> 500

**6 dB Bandwidth**





## Maximum Conducted Output Power

Test place : Ise EMC Lab. No.11 Measurement Room  
Report No. : 11306932H  
Date : May 30, 2016  
Temperature / Humidity : 22deg. C / 61 % RH  
Engineer : Kazuya Yoshioka  
Mode : Tx

### Antenna A

Applied limit: 15.407

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 IC) [MHz]	Conducted Power			e.i.r.p.				
								Result [dBm]	Limit [dBm]	Margin [dB]	Result [dBm]	Limit [dBm]	Margin [dB]		
5745	2.13	2.12	9.95	0.00	2.14	-	-	14.20	26.30	30.00	15.80	16.34	43.05	36.00	19.66
5785	1.38	2.13	9.95	0.00	2.14	-	-	13.46	22.18	30.00	16.54	15.60	36.31	36.00	20.40
5825	0.85	2.14	9.95	0.00	2.14	-	-	12.94	19.68	30.00	17.06	15.08	32.21	36.00	20.92

Sample Calculation:

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

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

Conducted Power Limit (5725 - 5850 MHz) = 1W (30dBm)

e.i.r.p. Limit (5725 - 5850 MHz) = 2W (36dBm)

### Antenna B

Applied limit: 15.407

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 IC) [MHz]	Conducted Power			e.i.r.p.				
								Result [dBm]	Limit [dBm]	Margin [dB]	Result [dBm]	Limit [dBm]	Margin [dB]		
5745	-7.89	2.12	0.00	0.00	2.14	-	-	-5.77	0.26	30.00	35.77	-3.63	0.43	36.00	39.63
5785	-9.06	2.13	0.00	0.00	2.14	-	-	-6.93	0.20	30.00	36.93	-4.79	0.33	36.00	40.79
5825	-10.24	2.14	0.00	0.00	2.14	-	-	-8.10	0.15	30.00	38.10	-5.96	0.25	36.00	41.96

Sample Calculation:

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

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

Conducted Power Limit (5725 - 5850 MHz) = 1W (30dBm)

e.i.r.p. Limit (5725 - 5850 MHz) = 2W (36dBm)

## Maximum Conducted Output Power

Test place : Ise EMC Lab. No.11 Measurement Room  
Report No. : 11306932H  
Date : May 30, 2016  
Temperature / Humidity : 22deg. C / 61 % RH  
Engineer : Kazuya Yoshioka  
Mode : Tx

### Antenna A, 5745 MHz

Mode	Rate Mbps	Reading (timed average) [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11a	6	2.13	0.00	2.13	*
	9	2.01	0.00	2.01	
	12	1.92	0.00	1.92	
	18	1.86	0.00	1.86	
	24	1.72	0.00	1.72	
	36	-0.80	0.00	-0.80	
	48	-2.50	0.00	-2.50	
	54	-3.83	0.00	-3.83	

\* Worst rate

Sample Calculation:

$$\text{Burst power} = \text{Reading (timed average)} + \text{Duty factor}$$

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

**Average Output Power**  
**(Reference data for RF Exposure)**

Test place Ise EMC Lab. No.11 Measurement Room  
Report No. 11306932H  
Date May 30, 2016  
Temperature / Humidity 22deg. C / 61 % RH  
Engineer Kazuya Yoshioka  
Mode Tx

**Antenna A**

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average)	
				[dBm]	[mW]
5745	2.13	2.12	9.95	14.20	26.30
5785	1.38	2.13	9.95	13.46	22.18
5825	0.85	2.14	9.95	12.94	19.68

Sample Calculation:

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

**Antenna B**

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Timed average)	
				[dBm]	[mW]
5745	-7.89	2.12	0.00	-5.77	0.26
5785	-9.06	2.13	0.00	-6.93	0.20
5825	-10.24	2.14	0.00	-8.10	0.15

Sample Calculation:

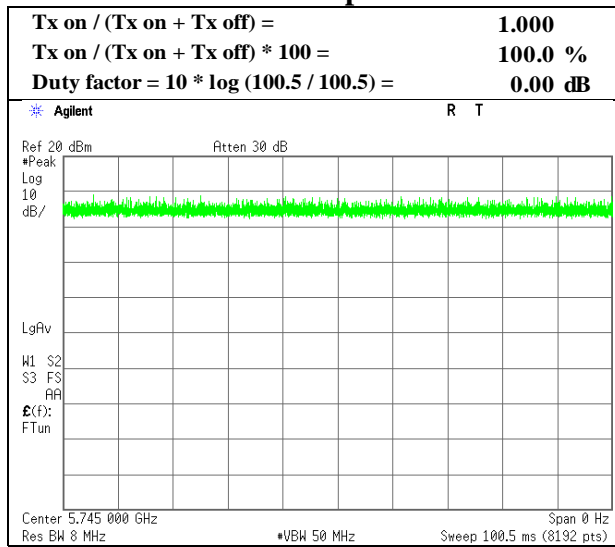
Result (Timed average) = Reading + Cable Loss + Atten. Loss

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

### Burst rate confirmation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11306932H
Date	May 30, 2016
Temperature / Humidity	22deg. C / 61 % RH
Engineer	Kazuya Yoshioka
Mode	Tx

#### 11a 6Mbps



## Maximum Power Spectral Density

Test place : Ise EMC Lab. No.11 Measurement Room  
Report No. : 11306932H  
Date : May 30, 2016  
Temperature / Humidity : 22deg. C / 61 % RH  
Engineer : Kazuya Yoshioka  
Mode : Tx

### Antenna A

Applied limit: 15.407

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	-12.51	2.12	9.95	0.00	2.14	0.27	-0.17	30.00	30.17	1.97	36.00	34.03
5785	-12.41	2.13	9.95	0.00	2.14	0.27	-0.06	30.00	30.06	2.08	36.00	33.92
5825	-13.04	2.14	9.95	0.00	2.14	0.27	-0.68	30.00	30.68	1.46	36.00	34.54

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

### Antenna B

Applied limit: 15.407

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	-22.27	2.12	0.00	0.00	2.14	0.27	-19.88	30.00	49.88	-17.74	36.00	53.74
5785	-22.53	2.13	0.00	0.00	2.14	0.27	-20.13	30.00	50.13	-17.99	36.00	53.99
5825	-23.79	2.14	0.00	0.00	2.14	0.27	-21.39	30.00	51.39	-19.25	36.00	55.25

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

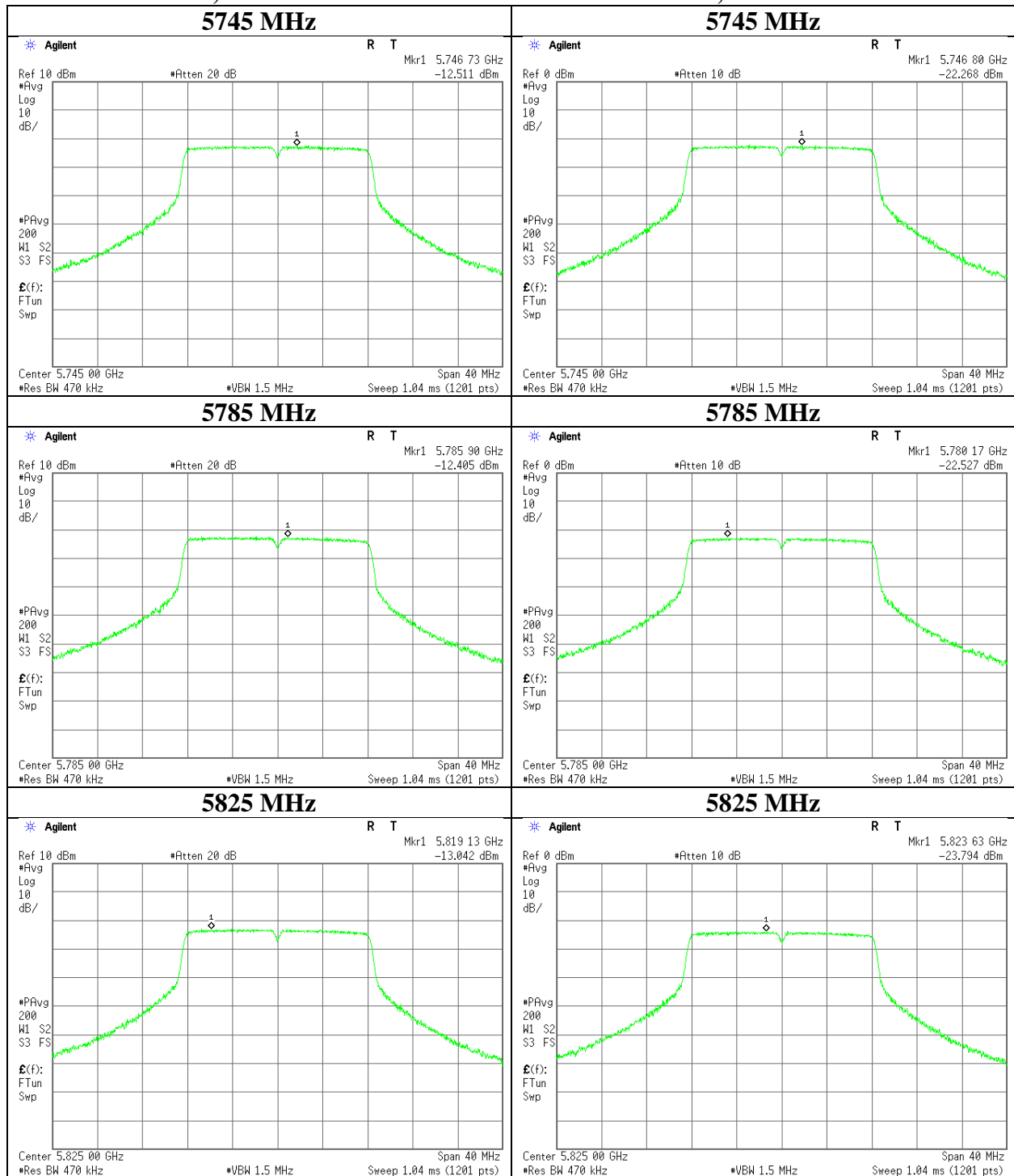
PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

### Maximum Power Spectral Density

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11306932H
Date	May 30, 2016
Temperature / Humidity	22deg. C / 61 % RH
Engineer	Kazuya Yoshioka
Mode	Tx

**11a, Antenna A**

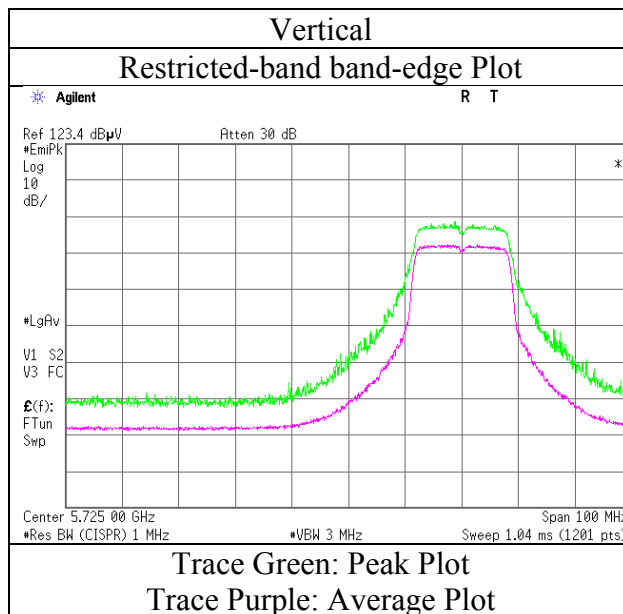
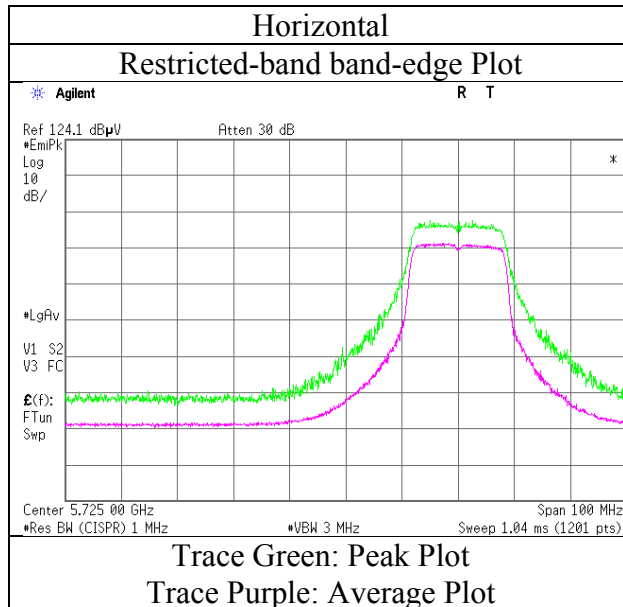
**11a, Antenna B**





## Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11306932H
Date	June 2, 2016
Temperature / Humidity	22deg. C / 40 % RH
Engineer	Keisuke Kawamura
Mode	Tx 11a 5745 MHz



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



## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 11306932H  
Date : June 2, 2016  
Temperature / Humidity : 22deg. C / 40 % RH  
Engineer : Keisuke Kawamura  
(Above 1 GHz)  
Mode : Tx 11a 5785 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	3856.741	PK	53.3	29.4	5.0	33.8	-	53.9	73.9	20.0	
Hori	5120.042	PK	55.6	32.1	5.5	34.1	-	59.1	73.9	14.8	
Hori	11570.000	PK	44.5	40.1	-1.7	33.9	-	49.0	73.9	24.9	Floor noise
Hori	17355.000	PK	44.6	42.9	-0.4	33.0	-	54.1	73.9	19.8	Floor noise
Hori	23140.000	PK	45.5	41.1	-1.3	32.2	-	53.1	73.9	20.8	Floor noise
Hori	28925.000	PK	66.1	44.7	6.0	74.2	-	42.6	73.9	31.3	Floor noise
Hori	34710.000	PK	65.5	44.7	7.7	75.1	-	42.8	73.9	31.1	Floor noise
Hori	3856.741	AV	51.2	29.4	5.0	33.8	-	51.8	53.9	2.1	
Hori	5120.042	AV	49.8	32.1	5.5	34.1	-	53.3	53.9	0.6	
Hori	11570.000	AV	35.2	40.1	-1.7	33.9	-	39.7	53.9	14.2	Floor noise
Hori	17355.000	AV	35.4	42.9	-0.4	33.0	-	44.9	53.9	9.0	Floor noise
Hori	23140.000	AV	36.7	41.1	-1.3	32.2	-	44.3	53.9	9.6	Floor noise
Hori	28925.000	AV	57.3	44.7	6.0	74.2	-	33.8	53.9	20.1	Floor noise
Hori	34710.000	AV	57.0	44.7	7.7	75.1	-	34.3	53.9	19.6	Floor noise
Vert	3856.741	PK	49.2	29.4	5.0	33.8	-	49.8	73.9	24.1	
Vert	5120.042	PK	55.1	32.1	5.5	34.1	-	58.6	73.9	15.3	
Vert	11570.000	PK	48.9	40.1	-1.7	33.9	-	53.4	73.9	20.5	
Vert	17355.000	PK	44.4	42.9	-0.4	33.0	-	53.9	73.9	20.0	Floor noise
Vert	23140.000	PK	45.1	41.1	-1.3	32.2	-	52.7	73.9	21.2	Floor noise
Vert	28925.000	PK	65.3	44.7	6.0	74.2	-	41.8	73.9	32.1	Floor noise
Vert	34710.000	PK	65.7	44.7	7.7	75.1	-	43.0	73.9	30.9	Floor noise
Vert	3856.741	AV	43.9	29.4	5.0	33.8	-	44.5	53.9	9.4	
Vert	5120.042	AV	48.9	32.1	5.5	34.1	-	52.4	53.9	1.5	
Vert	11570.000	AV	38.1	40.1	-1.7	33.9	-	42.6	53.9	11.3	
Vert	17355.000	AV	35.5	42.9	-0.4	33.0	-	45.0	53.9	8.9	Floor noise
Vert	23140.000	AV	36.2	41.1	-1.3	32.2	-	43.8	53.9	10.1	Floor noise
Vert	28925.000	AV	56.7	44.7	6.0	74.2	-	33.2	53.9	20.7	Floor noise
Vert	34710.000	AV	56.9	44.7	7.7	75.1	-	34.2	53.9	19.7	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz  $20\log(3.7\text{ m} / 3.0\text{ m}) = 1.83\text{ dB}$   
10 GHz - 40 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 11306932H  
Date : June 2, 2016  
Temperature / Humidity : 22deg. C / 40 % RH  
Engineer : Keisuke Kawamura  
(Above 1 GHz)  
Mode : Tx 11a 5825 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	3883.420	PK	54.3	29.5	5.0	33.8	-	55.0	73.9	18.9	
Hori	5120.042	PK	55.5	32.1	5.5	34.1	-	59.0	73.9	14.9	
Hori	5850.000	PK	57.2	32.6	5.8	34.0	-	61.6	122.2	60.6	
Hori	5855.000	PK	54.0	32.6	5.8	34.0	-	58.4	110.8	52.4	
Hori	5875.000	PK	43.7	32.6	5.8	34.0	-	48.1	105.2	57.1	
Hori	5925.000	PK	43.3	32.7	5.9	34.1	-	47.8	68.2	20.4	
Hori	11650.000	PK	44.5	40.0	-1.6	33.9	-	49.0	73.9	24.9	Floor noise
Hori	17475.000	PK	44.6	43.4	-0.4	33.1	-	54.5	73.9	19.4	Floor noise
Hori	23300.000	PK	45.5	41.0	-1.2	32.2	-	53.1	73.9	20.8	Floor noise
Hori	29125.000	PK	66.1	44.7	6.0	73.9	-	42.9	73.9	31.0	Floor noise
Hori	34950.000	PK	65.5	44.6	7.7	75.2	-	42.6	73.9	31.3	Floor noise
Hori	3883.420	AV	52.0	29.5	5.0	33.8	-	52.7	53.9	1.2	
Hori	5120.042	AV	49.2	32.1	5.5	34.1	-	52.7	53.9	1.2	
Hori	11650.000	AV	35.2	40.0	-1.6	33.9	-	39.7	53.9	14.2	Floor noise
Hori	17475.000	AV	35.4	43.4	-0.4	33.1	-	45.3	53.9	8.6	Floor noise
Hori	23300.000	AV	36.7	41.0	-1.2	32.2	-	44.3	53.9	9.6	Floor noise
Hori	29125.000	AV	57.3	44.7	6.0	73.9	-	34.1	53.9	19.8	Floor noise
Hori	34950.000	AV	57.0	44.6	7.7	75.2	-	34.1	53.9	19.8	Floor noise
Vert	3883.420	PK	51.1	29.5	5.0	33.8	-	51.8	73.9	22.1	
Vert	5120.042	PK	55.1	32.1	5.5	34.1	-	58.6	73.9	15.3	
Vert	5850.000	PK	59.6	32.6	5.8	34.0	-	64.0	122.2	58.2	
Vert	5855.000	PK	55.8	32.6	5.8	34.0	-	60.2	110.8	50.6	
Vert	5875.000	PK	44.0	32.6	5.8	34.0	-	48.4	105.2	56.8	
Vert	5925.000	PK	43.8	32.7	5.9	34.1	-	48.3	68.2	19.9	
Vert	11650.000	PK	53.6	40.0	-1.6	33.9	-	58.1	73.9	15.8	
Vert	17475.000	PK	44.4	43.4	-0.4	33.1	-	54.3	73.9	19.6	Floor noise
Vert	23300.000	PK	45.1	41.0	-1.2	32.2	-	52.7	73.9	21.2	Floor noise
Vert	29125.000	PK	65.3	44.7	6.0	73.9	-	42.1	73.9	31.8	Floor noise
Vert	34950.000	PK	65.7	44.6	7.7	75.2	-	42.8	73.9	31.1	Floor noise
Vert	3883.420	AV	47.0	29.5	5.0	33.8	-	47.7	53.9	6.2	
Vert	5120.042	AV	48.7	32.1	5.5	34.1	-	52.2	53.9	1.7	
Vert	11650.000	AV	40.9	40.0	-1.6	33.9	-	45.4	53.9	8.5	
Vert	17475.000	AV	35.5	43.4	-0.4	33.1	-	45.4	53.9	8.5	Floor noise
Vert	23300.000	AV	36.2	41.0	-1.2	32.2	-	43.8	53.9	10.1	Floor noise
Vert	29125.000	AV	56.7	44.7	6.0	73.9	-	33.5	53.9	20.4	Floor noise
Vert	34950.000	AV	56.9	44.6	7.7	75.2	-	34.0	53.9	19.9	Floor noise

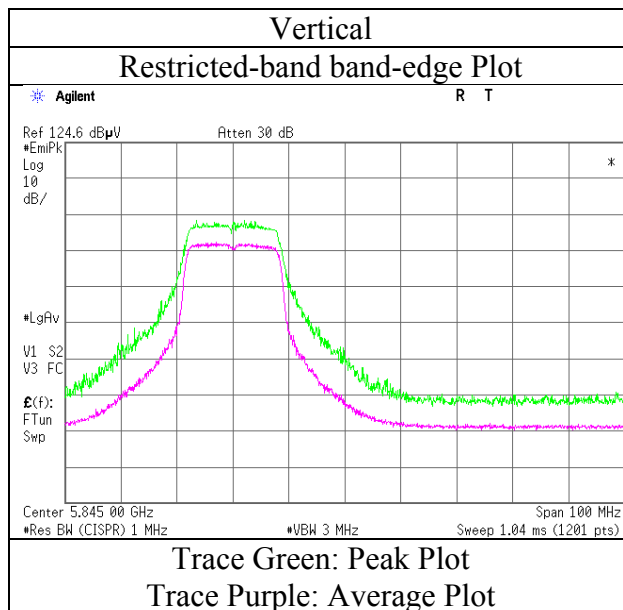
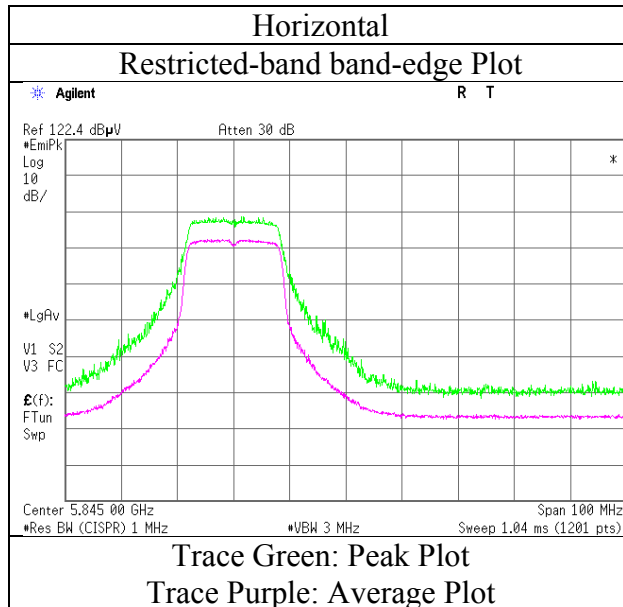
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log(3.7 m / 3.0 m) = 1.83 dB  
10 GHz - 40 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

## Radiated Spurious Emission

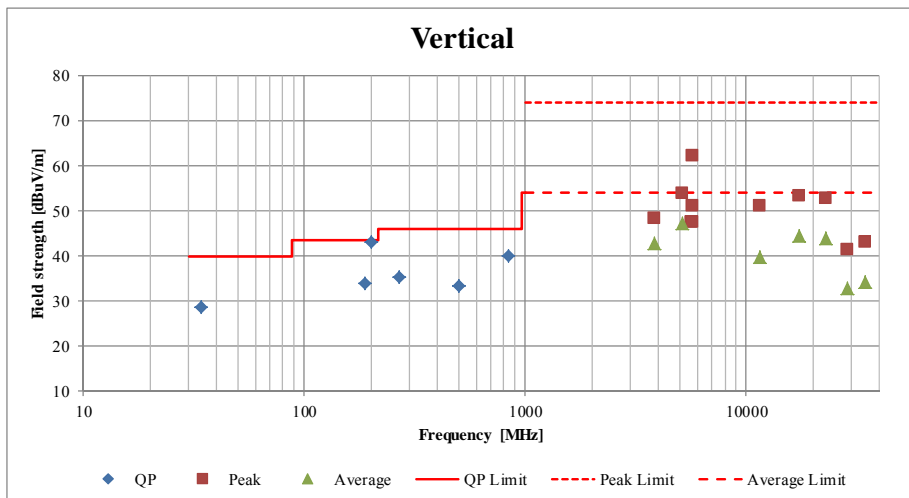
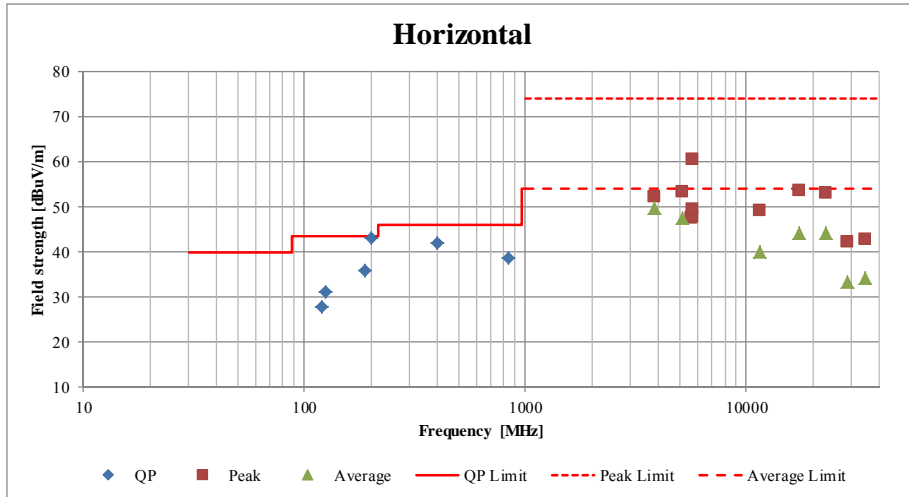
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11306932H
Date	June 2, 2016
Temperature / Humidity	22deg. C / 40 % RH
Engineer	Keisuke Kawamura
Mode	Tx 11a 5825 MHz



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

**Radiated Spurious Emission**  
**(Plot data, Worst case)**

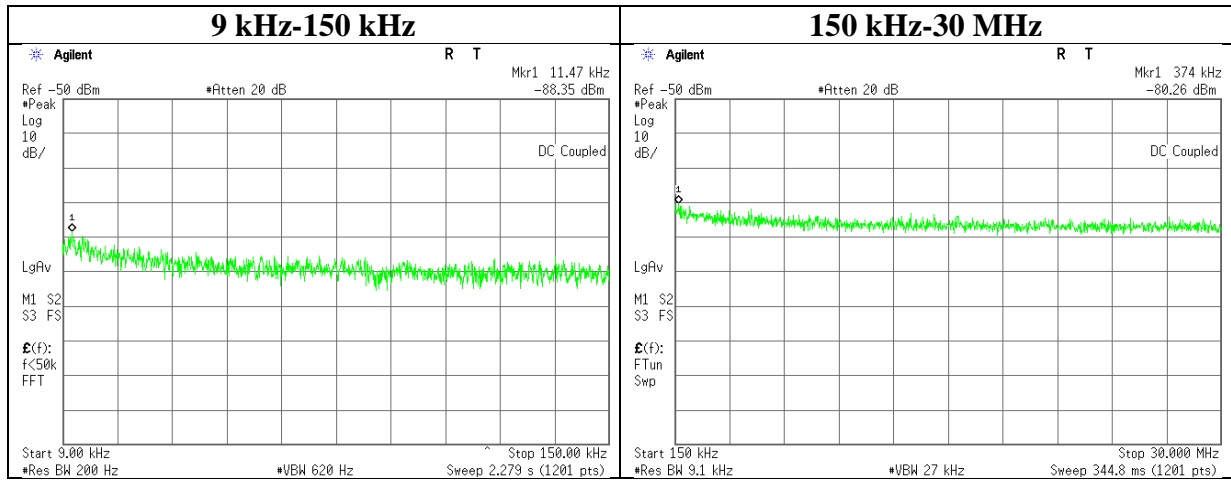
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	11306932H	
Date	June 2, 2016	June 2, 2016
Temperature / Humidity	22deg. C / 40 % RH	24deg. C / 4B % RH
Engineer	Keisuke Kawamura (Above 1 GHz)	Hiroyuki Furutaka (Below 1 GHz)
Mode	Tx 11a 5745 MHz	



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

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11306932H
Date	May 30, 2016
Temperature / Humidity	22deg. C / 61 % RH
Engineer	Kazuya Yoshioka
Mode	Tx 5745 MHz Antenna A

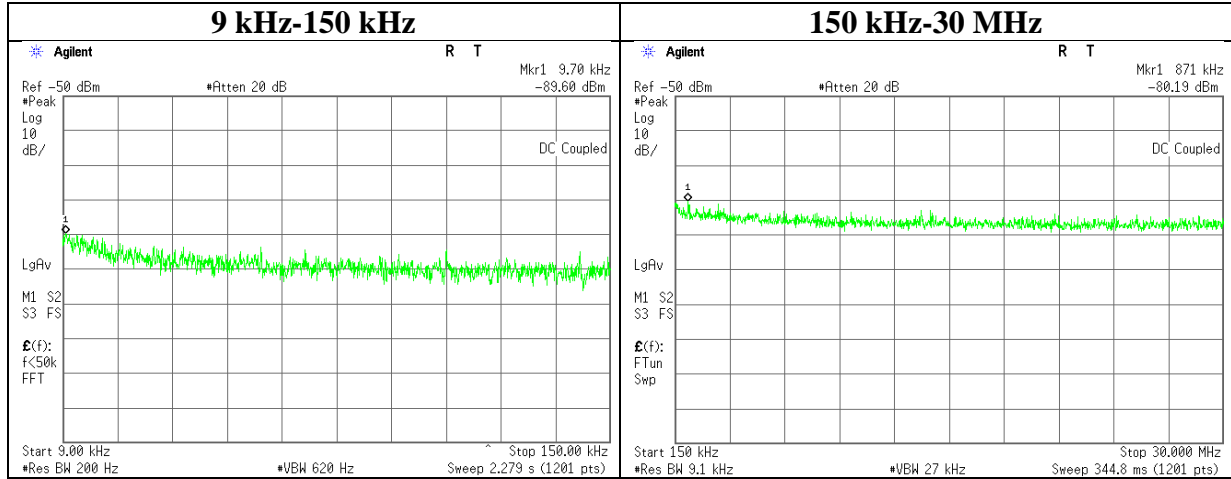


Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.47	-88.4	0.00	9.8	2.14	1	-76.4	300	6.0	-15.1	46.4	61.5	
374.00	-80.3	0.01	9.9	2.14	1	-68.2	300	6.0	-7.0	16.1	23.1	

$E = \text{EIRP} - 20 \cdot \log(D) + \text{Ground bounce} + 104.8 \text{ [dBuV/m]}$   
 $\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain} + 10 \cdot \log(N)$

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11306932H
Date	May 30, 2016
Temperature / Humidity	22deg. C / 61 % RH
Engineer	Kazuya Yoshioka
Mode	Tx 5785 MHz Antenna A



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
9.70	-89.6	0.00	9.8	2.14	1	-77.6	300	6.0	-16.4	47.8	64.2	
871.00	-80.2	0.02	9.9	2.14	1	-68.1	30	6.0	13.2	28.8	15.6	

E = EIRP - 20\*log(D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenuator + Antenna Gain + 10\*log(N)

**UL Japan, Inc.**

**Ise EMC Lab.**

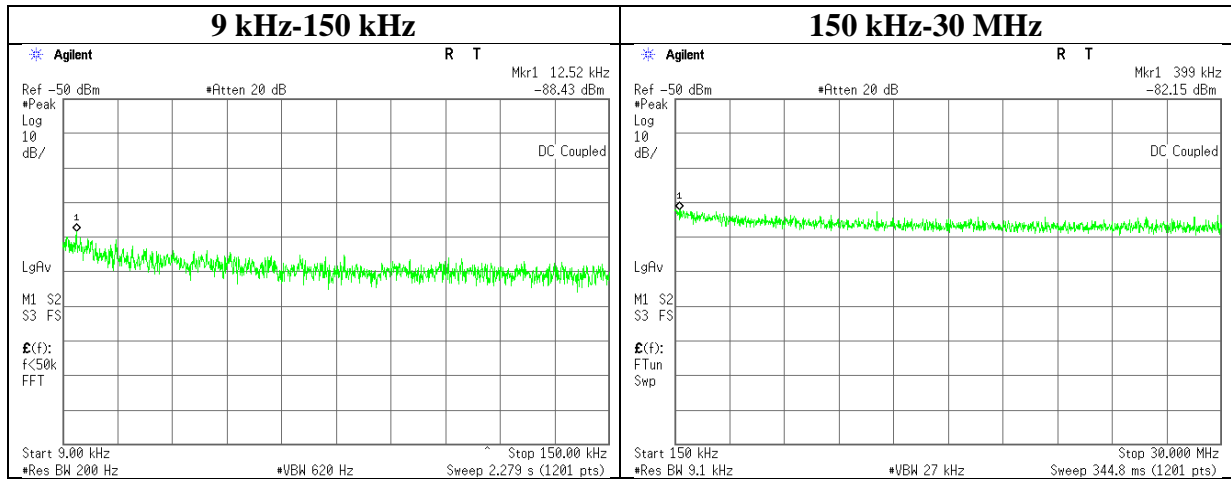
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11306932H
Date	May 30, 2016
Temperature / Humidity	22deg. C / 61 % RH
Engineer	Kazuya Yoshioka
Mode	Tx 5825 MHz Antenna A



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
12.52	-88.4	0.00	9.8	2.14	1	-76.5	300	6.0	-15.2	45.6	60.8	
399.00	-82.2	0.01	9.9	2.14	1	-70.1	300	6.0	-8.9	15.5	24.4	

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

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

**UL Japan, Inc.**

**Ise EMC Lab.**

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## **APPENDIX 2: Test instruments**

### **Test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	AT	2015/06/02 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2015/10/08 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2015/10/08 * 12
MCC-137	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37954/2	AT	2015/10/08 * 12
MAT-92	Attenuator	Weinschel Associates	WA56-10	56100308	AT	2015/06/01 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2016/03/10 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MMM-17	DIGITAL HiTESTER	Hioki	3805	070900530	AT	2016/01/13 * 12
MTA-37	Terminator	-	50Ω SMA	-	AT	Pre Check
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2015/07/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2016/02/24 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2016/02/29 * 12
MCC-168	Microwave Cable	Junkosha	MWX221	1408S016(1m) / 1409S492(5m)	RE	2015/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2016/01/19 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2016/02/29 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2015/08/19 * 12
MHA-29	Horn Antenna 26.5-40GHz	ETS LINDGREN	3160-10	00152399	RE	2015/09/04 * 12
MCC-54	Microwave Cable	Suhner	SUCOFLEX101	2873(1m) / 2876(5m)	RE	2016/03/18 * 12
MPA-22	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-3 3-8P / AMF-4F-2600400-3 3-8P	1871355 /1871328	RE	2015/09/03 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2015/10/11 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2015/10/11 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2016/01/30 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2015/09/04 * 12

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

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

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

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

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