



# RADIO TEST REPORT

**Test Report No. : 11547841H-B**

**Applicant** : CASIO COMPUTER CO., LTD.  
**Type of Equipment** : RF Module  
**Model No.** : WSD-F20  
**FCC ID** : BBQ-WSDF20  
**Test regulation** : FCC Part 15 Subpart C: 2016  
\*WLAN Part  
**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. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
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:** November 18 to 25, 2016

**Representative test engineer:**

*T. Noguchi*

Takafumi Noguchi  
Engineer  
Consumer Technology Division

**Approved by:**

*Takayuki S.*

Takayuki Shimada  
Engineer  
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name : CASIO COMPUTER CO., LTD.  
Address : 2-1, Sakaecho 3 chome, Hamura-shi, Tokyo 205-8555 Japan  
Telephone Number : +81-42-579-7249  
Contact Person : Takashi Suenaga

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

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

Type of Equipment : RF Module  
Model No. : WSD-F20  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 3.8 V(Battery), DC5.0 V(USB)  
Receipt Date of Sample : November 17, 2016  
Country of Mass-production : Japan  
Condition of EUT : Prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model: WSD-F20 (referred to as the EUT in this report) is a RF Module.

### **Radio Specification**

Clock frequency(Crystal) : 32.768 KHz

#### **WLAN (IEEE802.11b/g/n-20)**

Radio Type : Transceiver  
Frequency of Operation : 2412 MHz - 2462 MHz  
Modulation : DSSS, OFDM  
Power Supply (radio part input) : DC 1.35 V  
Antenna type : Reverse L type  
Antenna Gain : -7.1 dBi

#### **Bluetooth (Ver. 4.1 with EDR function)**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : BT: FHSS (GFSK,  $\pi/4$ DQPSK, 8DPSK)  
LE: GFSK  
Power Supply (radio part input) : DC 1.35 V  
Antenna type : Reverse L type  
Antenna Gain : -7.1 dBi

\*This test report applies for WLAN and Bluetooth Low Energy parts.

\*\*Wireless LAN and Bluetooth do not transmit simultaneously.

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928MHz,  
2400-2483.5MHz, and 5725-5850MHz

\* The revision on November 14, 2016, does not affect the test specification applied to the EUT.  
\* Also the EUT complies with FCC Part 15 Subpart B.

### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	QP 9.7 dB, 10.35213 MHz, N AV 6.8 dB, 10.75213 MHz, N	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10		1.8 dB 73.930 MHz, QP, Vertical	Complied
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 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r05 12.2.7.					

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

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

This EUT provides stable voltage (DC 1.35 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

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

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	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	2.6 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 – 0.15MHz	3.5 dB
0.15 – 30MHz	3.0 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

\*Measurement distance

#### 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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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 m x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

### **4.1 Operating 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.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	6 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 0, PN9
Bluetooth(BT) Low Energy (LE)	Maximum Packet Size, PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power	
For WLAN *Power of the EUT was set by the software as follows; Power settings: WLAN(11b) 17dBm WLAN(11g) 13dBm WLAN(11n) 12dBm Software: WSD-F20-radio  for Bluetooth Power settings: BT(LE) 3.5dBm Software: Blue tool version 1.8.8.4  *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 Operating mode(s)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Conducted Emission	11g Tx *1)	2412 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
Radiated Spurious Emission (Below 1 GHz), Conducted Spurious Emission	11g Tx *1)	2412 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
Radiated Spurious Emission	11b Tx	2412 MHz
	11g Tx *2)	2437 MHz 2462 MHz
	11n-20 Tx *3)	2412 MHz 2462 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx	2412 MHz
	11g Tx 11n-20 Tx	2437 MHz 2462 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power *3) Only band edge test was tested on this mode, because the 11g Tx mode had the higher power at antenna terminal test.		

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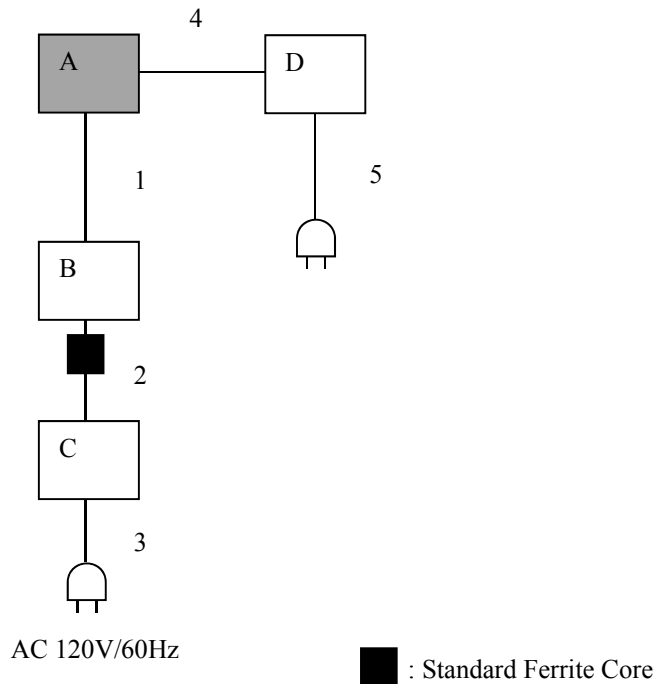
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## 4.2 Configuration and peripherals



\* 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	RF Module	WSD-F20	No.7 *1) No.2 *2)	CASIO COMPUTER CO., LTD.	EUT
B	Laptop PC	CF-N8HWCDPS	0CKSA09265	Panasonic	-
C	AC Adaptor	CF-AA6372B	6372BM610X10953E	Panasonic	-
D	DC Power Supply	PMC35-2A	13090501	KIKUSUI	*3)

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	DC Cable	1.1	Shielded	Shielded	-
3	AC Cable	0.9	Unshielded	Unshielded	-
4	DC Cable	0.1 *3) 2.0 *4)	Unshielded	Unshielded	-
5	AC Cable	2.3	Unshielded	Unshielded	*3)

\*1) Used for Conducted Emission test and Radiated Emission test.

\*2) Used for Antenna Terminal Conducted test only.

\*3) Used for Conducted Emission test only.

\*4) Used for Radiated Emission test only.

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## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane 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 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 80cm 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.

#### For the tests on EUT with other peripherals (as a whole system)

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. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

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 AV  
**Measurement range** : 0.15 MHz – 30 MHz  
**Test data** : APPENDIX  
**Test result** : Pass

## **SECTION 6: Radiated Spurious Emission**

### **Test Procedure**

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r05".

[For below 1 GHz]

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.

[For 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.

### **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

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

**20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *3)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: 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.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	4.5 m *1) (1 GHz – 10 GHz), 1.0 m *2) (10 GHz – 26.5 GHz)		4.5 m *1) (1 GHz – 10 GHz), 1.0 m *2) (10 GHz – 26.5 GHz)

\*1) Distance Factor:  $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.53 \text{ dB}$

\*2) Distance Factor:  $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

\*3) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r05"

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

**Measurement range : 30 MHz - 26.5 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</b>
6dB Bandwidth	20 MHz/3 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r05". *4) In the frequency range below 30MHz, 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**

**Conducted Emission**

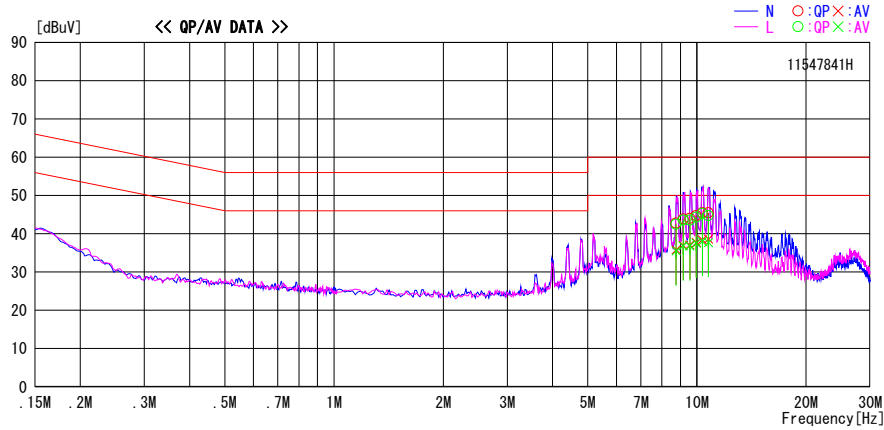
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber  
Date : 2016/11/25

Report No. : 11547841H  
Temp./Humi. : 23deg. C / 34% RH  
Engineer : Takafumi Noguchi

Mode / Remarks : Tx 11g 2412MHz

LIMIT : FCC15.207 QP  
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
8.76011	28.6	21.7	14.1	42.7	35.8	60.0	50.0	17.3	14.2	N	
9.16011	29.6	22.8	14.2	43.8	37.0	60.0	50.0	16.2	13.0	N	
9.56012	29.8	22.9	14.2	44.0	37.1	60.0	50.0	16.0	12.9	N	
9.96012	30.4	23.4	14.3	44.7	37.7	60.0	50.0	15.3	12.3	N	
10.35213	31.2	24.1	14.3	45.5	38.4	60.0	50.0	14.5	11.6	N	
10.75213	31.2	24.3	14.3	45.5	38.6	60.0	50.0	14.5	11.4	N	
8.76010	28.4	21.4	14.1	42.5	35.5	60.0	50.0	17.5	14.5	L	
9.16011	29.4	22.6	14.2	43.6	36.8	60.0	50.0	16.4	13.2	L	
9.56011	29.4	22.6	14.2	43.6	36.8	60.0	50.0	16.4	13.2	L	
9.96012	30.0	23.2	14.3	44.3	37.5	60.0	50.0	15.7	12.5	L	
10.35213	31.0	23.7	14.3	45.3	38.0	60.0	50.0	14.7	12.0	L	
10.75213	30.4	23.4	14.3	44.7	37.7	60.0	50.0	15.3	12.3	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN + CABLE)  
Except for the above table : adequate margin data below the limits.

## Conducted Emission

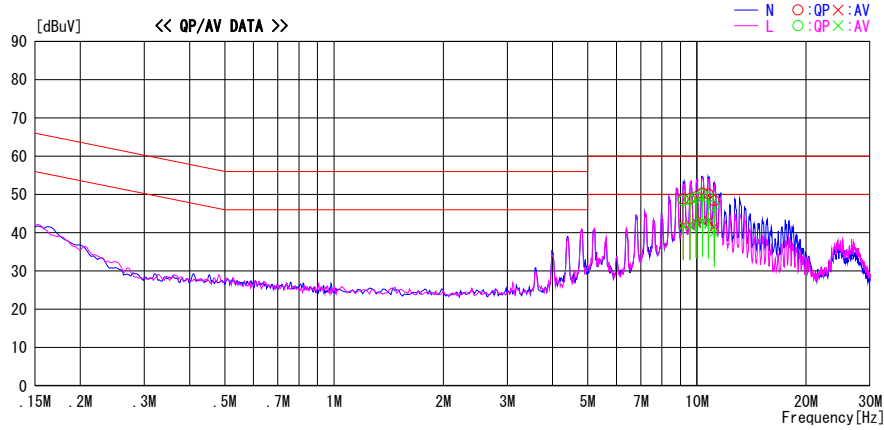
### DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No. 4 Semi Anechoic Chamber  
 Date : 2016/11/25

Report No. : 11547841H  
 Temp./Humi. : 23deg. C / 34% RH  
 Engineer : Takafumi Noguchi

Mode / Remarks : Tx BT LE 2480MHz

LIMIT : FCC15.207 QP  
FCC15.207 AV

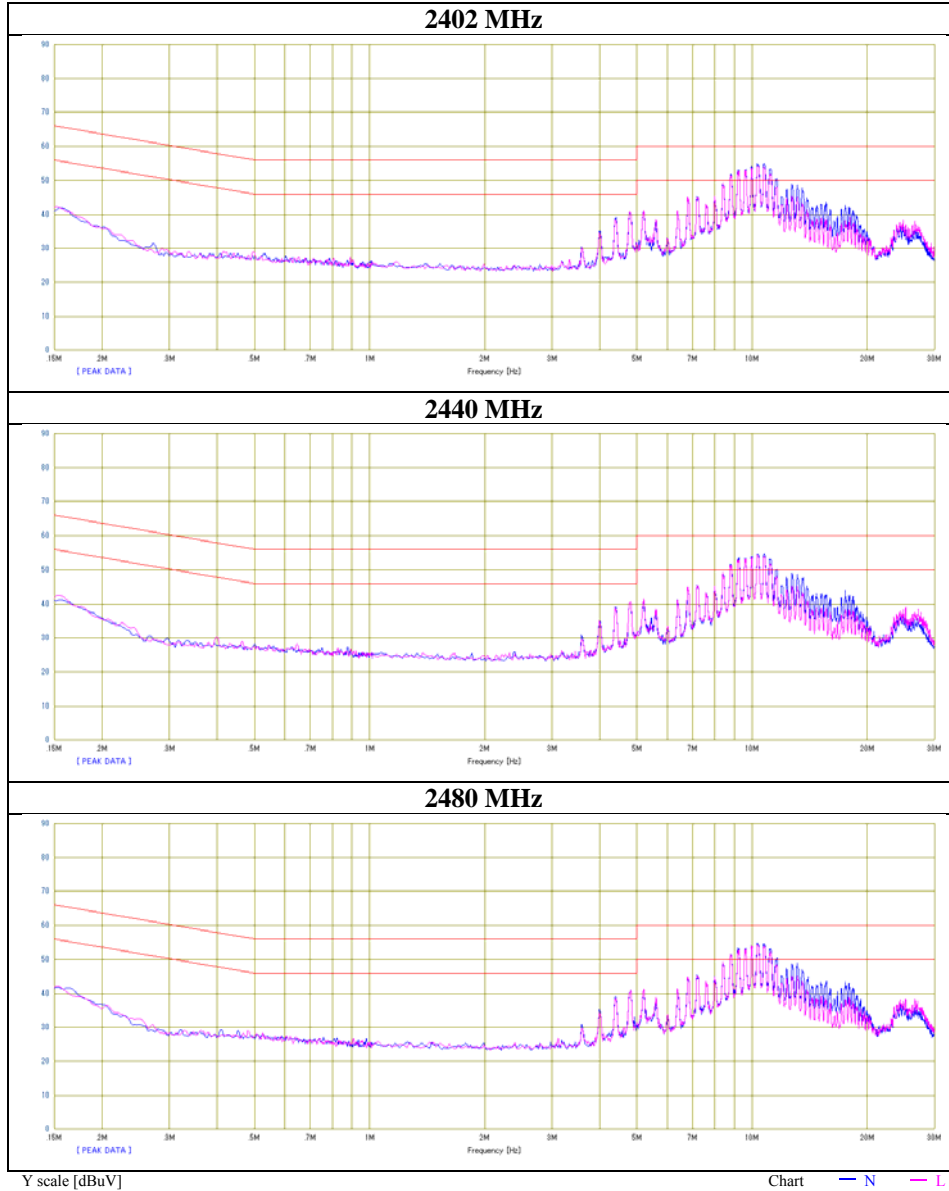


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
9.16011	34.6	27.9	14.2	48.8	42.1	60.0	50.0	11.2	7.9	N	
9.56012	34.6	27.9	14.2	48.8	42.1	60.0	50.0	11.2	7.9	N	
9.96012	35.1	28.3	14.3	49.4	42.6	60.0	50.0	10.6	7.4	N	
10.35213	36.0	28.8	14.3	50.3	43.1	60.0	50.0	9.7	6.9	N	
10.75213	35.8	28.9	14.3	50.1	43.2	60.0	50.0	9.9	6.8	N	
11.15214	34.1	27.2	14.3	48.4	41.5	60.0	50.0	11.6	8.5	N	
9.16011	34.2	27.6	14.2	48.4	41.8	60.0	50.0	11.6	8.2	L	
9.56012	34.4	27.6	14.2	48.6	41.8	60.0	50.0	11.4	8.2	L	
9.96012	34.9	28.0	14.3	49.2	42.3	60.0	50.0	10.8	7.7	L	
10.35213	35.6	28.5	14.3	49.9	42.8	60.0	50.0	10.1	7.2	L	
10.75213	35.0	28.0	14.3	49.3	42.3	60.0	50.0	10.7	7.7	L	
11.15213	32.8	25.8	14.3	47.1	40.1	60.0	50.0	12.9	9.9	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTN + CABLE)  
 Except for the above table : adequate margin data below the limits.

### Conducted Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11547841H  
Date November 25, 2016  
Temperature / Humidity 23 deg. C / 34 % RH  
Engineer Takafumi Noguchi  
Mode Tx BT LE



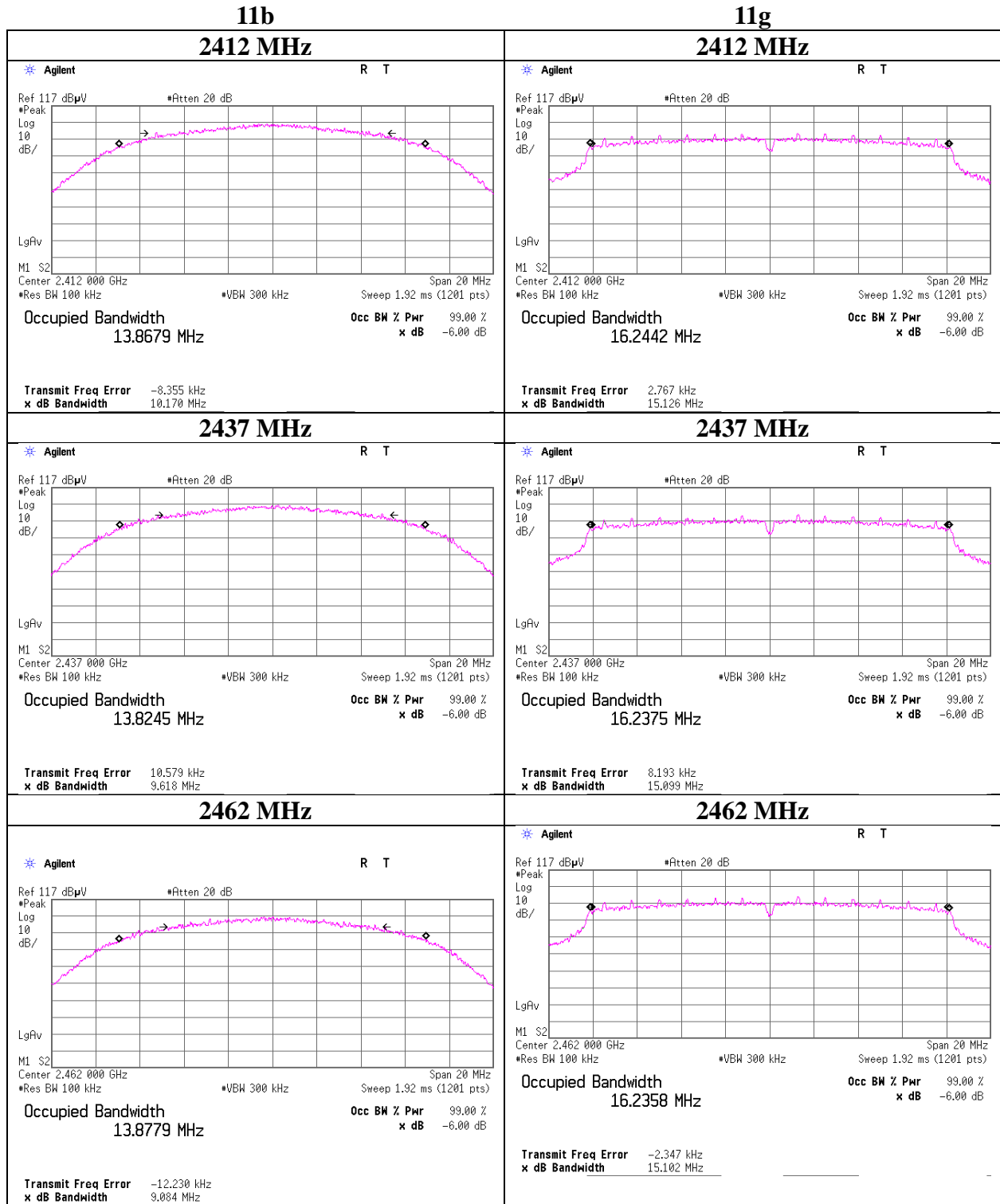


### 6dB Bandwidth

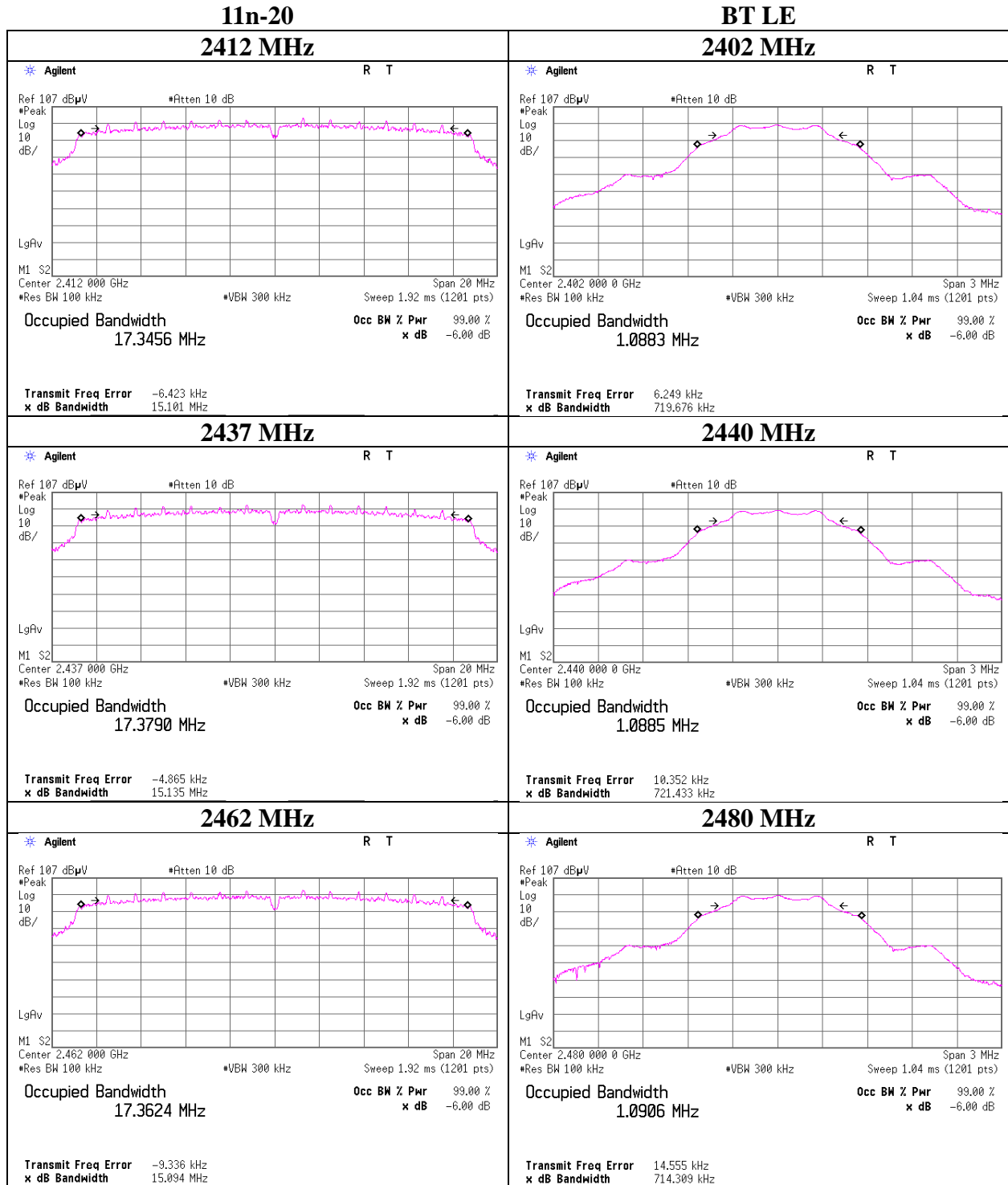
Test place Ise EMC Lab. No.3 Measurement Room  
Report No. 11547841H  
Date November 18, 2016  
Temperature / Humidity 24 deg. C / 35 % RH  
Engineer Hironobu Ohnishi  
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	10.170	> 500
	2437	9.618	> 500
	2462	9.084	> 500
11g	2412	15.126	> 500
	2437	15.099	> 500
	2462	15.102	> 500
11n-20	2412	15.101	> 500
	2437	15.135	> 500
	2462	15.094	> 500
BT LE	2402	0.720	> 500
	2440	0.721	> 500
	2480	0.714	> 500

### 6dB Bandwidth



**6dB Bandwidth**



## Maximum Peak Output Power

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 17, 2016
Temperature / Humidity	24deg. C / 41 % RH
Engineer	Shuichi Ohyama
Mode	Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	10.39	1.07	10.03	21.49	140.77	30.00	1000	8.52
2437	10.12	1.07	10.03	21.22	132.28	30.00	1000	8.79
2462	10.23	1.08	10.03	21.34	135.99	30.00	1000	8.67

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	10.07	
2	10.04	
5.5	10.09	
11	10.12	*

\*: Worst Rate

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

## Maximum Peak Output Power

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 17, 2016
Temperature / Humidity	24deg. C / 41 % RH
Engineer	Shuichi Ohyama
Mode	Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	13.20	1.07	10.03	24.30	268.84	30.00	1000	5.71
2437	13.19	1.07	10.03	24.29	268.23	30.00	1000	5.72
2462	13.13	1.08	10.03	24.24	265.16	30.00	1000	5.77

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	13.19	*
9	13.15	
12	12.99	
18	12.90	
24	13.09	
36	13.01	
48	12.94	
54	12.91	

\*: Worst Rate

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

## Maximum Peak Output Power

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 17, 2016
Temperature / Humidity	24deg. C / 41 % RH
Engineer	Shuichi Ohyama
Mode	Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	12.44	1.07	10.03	23.54	225.68	30.00	1000	6.47
2437	12.39	1.07	10.03	23.49	223.10	30.00	1000	6.52
2462	12.36	1.08	10.03	23.47	222.08	30.00	1000	6.54

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

2437 MHz

MCS Number	Reading [dBm]	Remark
0	12.39	*
1	12.28	
2	12.19	
3	12.24	
4	12.27	
5	12.20	
6	12.04	
7	12.01	

\*: Worst Rate

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

### Maximum Peak Output Power

Test place Ise EMC Lab. No.11 Measurement Room  
Report No. 11547841H  
Date December 13, 2016  
Temperature / Humidity 24deg. C / 35 % RH  
Engineer Yuta Moriya  
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-3.85	1.13	10.03	7.31	5.38	30.00	1000	22.70
2440	-3.83	1.14	10.03	7.34	5.41	30.00	1000	22.67
2480	-3.94	1.14	10.03	7.23	5.28	30.00	1000	22.78

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

**Average Output Power**  
**(Reference data for SAR testing)**

Test place : Ise EMC Lab. No.3 and No.11 Measurement Room  
Report No. : 11547841H  
Date : November 17, 2016                      December 13, 2016  
Temperature / Humidity : 24deg. C / 41 % RH                      24deg. C / 35 % RH  
Engineer : Shuichi Ohyama                      Yuta Moriya  
Mode : Tx

**11b 1 Mbps**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	7.47	1.07	10.03	18.57	71.94	0.04	18.61	72.61
2437	7.54	1.07	10.03	18.64	73.11	0.04	18.68	73.79
2462	7.38	1.08	10.03	18.49	70.63	0.04	18.53	71.29

**11g 6 Mbps**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	3.53	1.07	10.03	14.63	29.04	0.29	14.92	31.05
2437	3.60	1.07	10.03	14.70	29.51	0.29	14.99	31.55
2462	3.48	1.08	10.03	14.59	28.77	0.29	14.88	30.76

**11n-20 MCS0**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	2.34	1.07	10.03	13.44	22.08	0.31	13.75	23.71
2437	2.30	1.07	10.03	13.40	21.88	0.31	13.71	23.50
2462	2.26	1.08	10.03	13.37	21.73	0.31	13.68	23.33

**BT LE**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-6.09	1.13	10.03	5.07	3.21	1.78	6.85	4.84
2440	-6.11	1.14	10.03	5.06	3.21	1.78	6.84	4.83
2480	-6.21	1.14	10.03	4.96	3.13	1.78	6.74	4.72

Sample Calculation:

Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss  
Result (Burst power average) = Time average + Duty factor

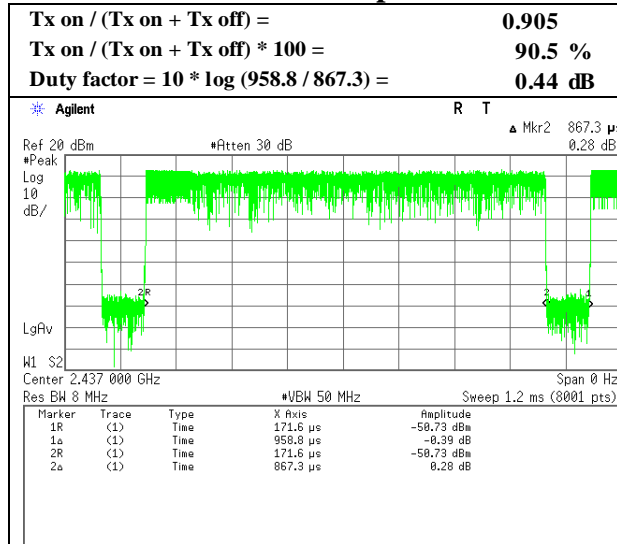
**The average output power was measured with the lowest order modulation and  
lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01 v02r02.**



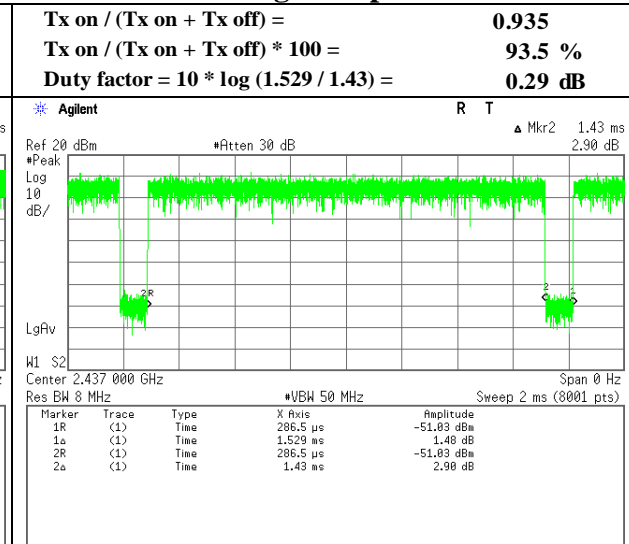
### Burst rate confirmation

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 18, 2016
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Hironobu Ohnishi
Mode	Tx

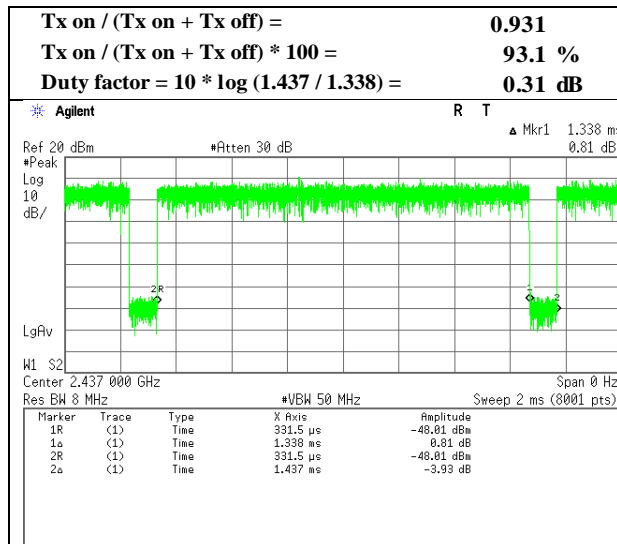
#### 11b 11 Mbps



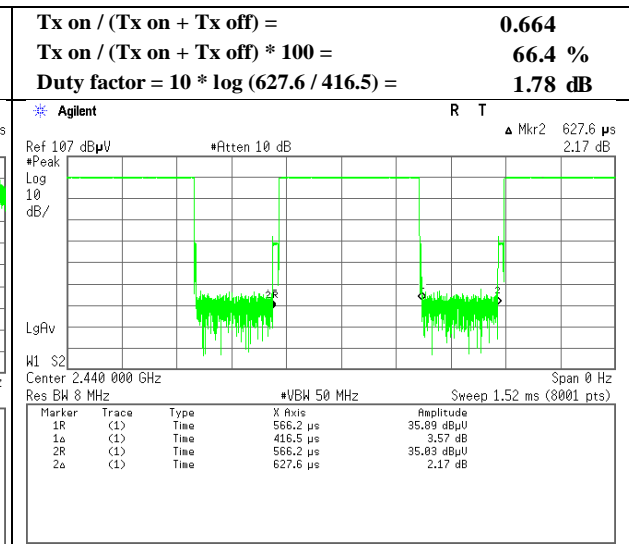
#### 11g 6 Mbps



#### 11n-20 MCS 0



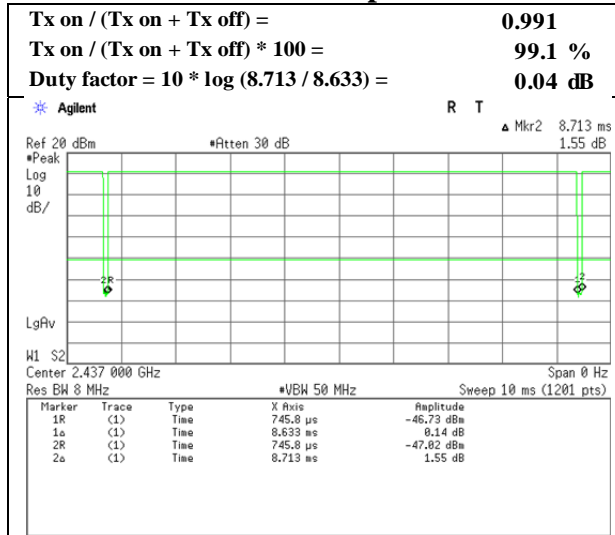
#### BT LE



### Burst rate confirmation

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 18, 2016
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Hironobu Ohnishi
Mode	Tx

#### 11b 1 Mbps



## Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11547841H  
Date November 23, 2016 November 25, 2016  
Temperature / Humidity 22 deg. C / 40 % RH 23 deg. C / 40 % RH  
Engineer Takafumi Noguchi Hiroyuki Furutaka  
(1 GHz -10 GHz) (10 GHz -26.5 GHz)

Mode Tx 11b 2412 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	2390.000	PK	48.1	27.4	6.7	32.1	-	50.1	73.9	23.8	
Hori	4824.000	PK	40.2	30.9	7.9	31.2	-	47.8	73.9	26.1	Floor noise
Hori	7236.000	PK	41.5	36.3	8.8	32.4	-	54.2	73.9	19.7	Floor noise
Hori	9648.000	PK	41.8	38.5	9.5	32.8	-	57.0	73.9	16.9	Floor noise
Hori	12060.000	PK	48.4	40.3	-1.2	33.0	-	54.5	73.9	19.4	
Hori	2390.000	AV	39.4	27.4	6.7	32.1	0.4	41.8	53.9	12.1	*1)
Hori	4824.000	AV	30.9	30.9	7.9	31.2	-	38.5	53.9	15.4	Floor noise
Hori	7236.000	AV	32.2	36.3	8.8	32.4	-	44.9	53.9	9.0	Floor noise
Hori	9648.000	AV	32.5	38.5	9.5	32.8	-	47.7	53.9	6.2	Floor noise
Hori	12060.000	AV	40.3	40.3	-1.2	33.0	0.4	46.8	53.9	7.1	
Vert	2390.000	PK	45.2	27.4	6.7	32.1	-	47.2	73.9	26.7	
Vert	4824.000	PK	45.5	30.9	9.3	31.2	-	54.5	73.9	19.4	
Vert	7236.000	PK	40.8	36.3	8.8	32.4	-	53.5	73.9	20.4	Floor noise
Vert	9648.000	PK	41.5	38.5	9.5	32.8	-	56.7	73.9	17.2	Floor noise
Vert	12060.000	PK	46.5	40.3	-1.2	33.0	-	52.6	73.9	21.3	
Vert	2390.000	AV	35.6	27.4	6.7	32.1	0.4	38.0	53.9	15.9	*1)
Vert	4824.000	AV	36.5	30.9	9.3	31.2	0.4	45.9	53.9	8.0	
Vert	7236.000	AV	32.0	36.3	8.8	32.4	-	44.7	53.9	9.2	Floor noise
Vert	9648.000	AV	32.7	38.5	9.5	32.8	-	47.9	53.9	6.0	Floor noise
Vert	12060.000	AV	37.5	40.3	-1.2	33.0	0.4	44.0	53.9	9.9	

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

\*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(4.5 m / 3.0 m) = 3.53 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

\*1) Not Out of Band emission(Leakage Power)

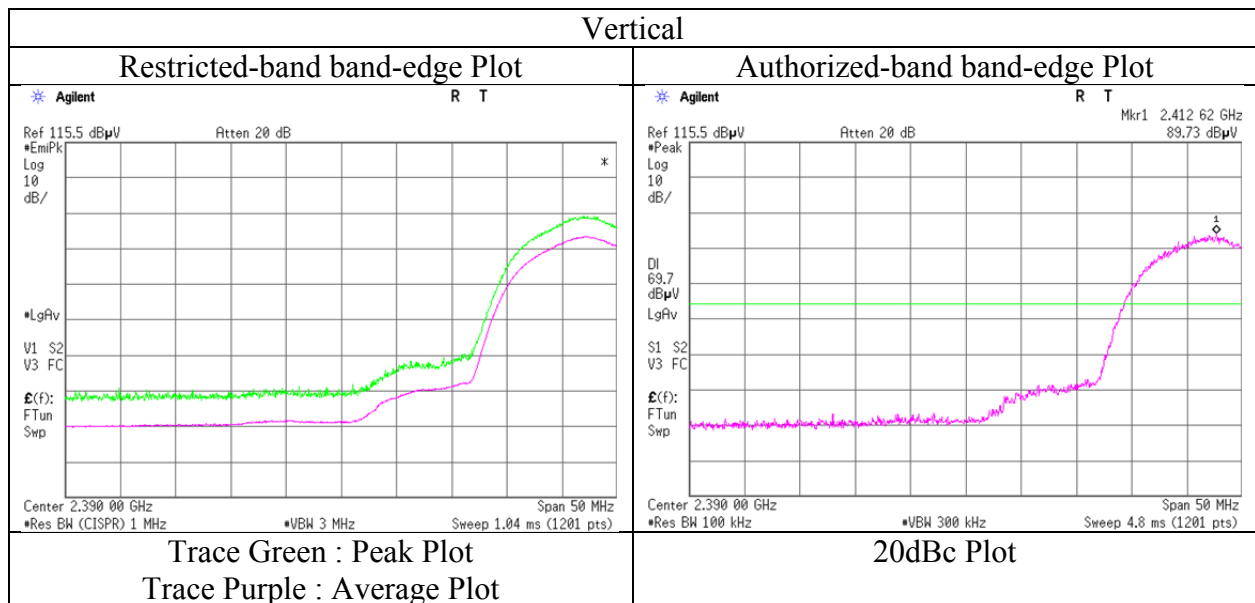
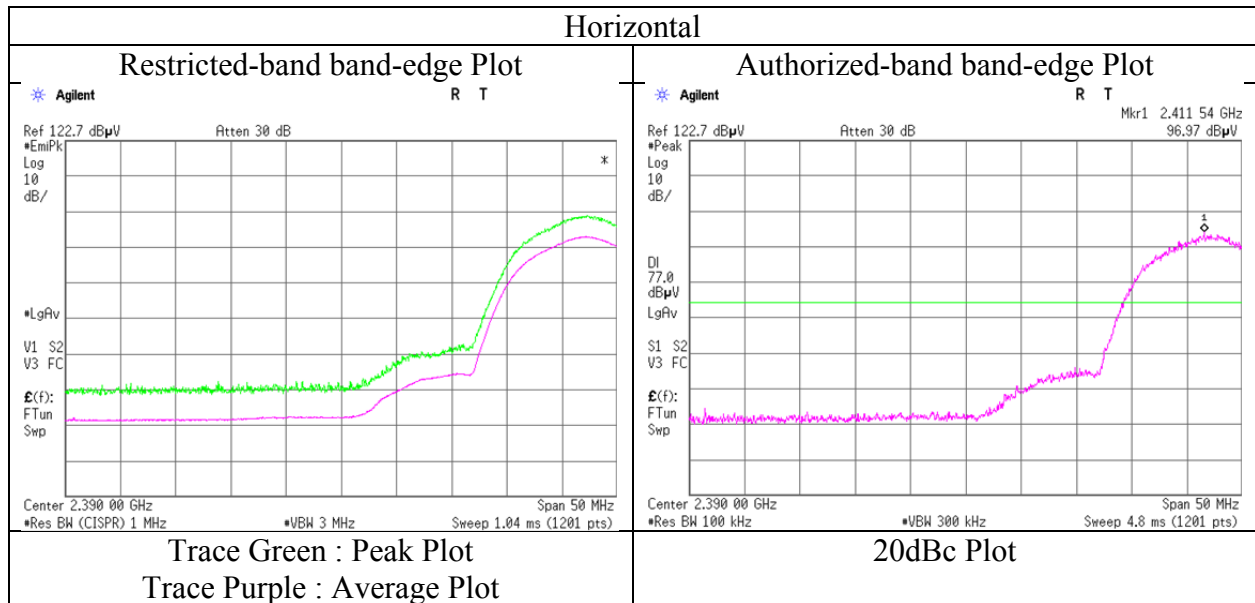
### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	97.0	27.4	6.8	32.1	99.1	-	-	Carrier
Hori	2400.000	PK	58.9	27.4	6.7	32.1	60.9	79.1	18.2	
Vert	2412.000	PK	89.7	27.4	6.8	32.1	91.8	-	-	Carrier
Vert	2400.000	PK	48.7	27.4	6.7	32.1	50.7	71.8	21.1	

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

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11547841H
Date	November 23, 2016
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Takafumi Noguchi
	(1 GHz -10 GHz)
Mode	Tx 11b 2412 MHz



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

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. : 11547841H  
Date : November 23, 2016      November 25, 2016  
Temperature / Humidity : 22 deg. C / 40 % RH      23 deg. C / 40 % RH  
Engineer : Takafumi Noguchi      Hiroyuki Furutaka  
(1 GHz -10 GHz)      (10 GHz -26.5 GHz)

Mode : Tx 11b 2437 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	4874.000	PK	39.4	31.0	7.9	31.2	-	47.1	73.9	26.8	Floor noise
Hori	7311.000	PK	40.9	36.4	8.8	32.5	-	53.6	73.9	20.3	Floor noise
Hori	9748.000	PK	41.1	38.6	9.5	32.8	-	56.4	73.9	17.5	Floor noise
Hori	12185.000	PK	50.0	40.2	-1.1	33.0	-	56.1	73.9	17.8	
Hori	4874.000	AV	30.9	31.0	7.9	31.2	-	38.6	53.9	15.3	Floor noise
Hori	7311.000	AV	32.2	36.4	8.8	32.5	-	44.9	53.9	9.0	Floor noise
Hori	9748.000	AV	32.5	38.6	9.5	32.8	-	47.8	53.9	6.1	Floor noise
Hori	12185.000	AV	42.7	40.2	-1.1	33.0	0.4	49.2	53.9	4.7	
Vert	4874.000	PK	45.9	31.0	9.3	31.2	-	55.0	73.9	18.9	
Vert	7311.000	PK	41.0	36.4	8.8	32.5	-	53.7	73.9	20.2	Floor noise
Vert	9748.000	PK	41.2	38.6	9.5	32.8	-	56.5	73.9	17.4	Floor noise
Vert	12185.000	PK	46.9	40.2	-1.1	33.0	-	53.0	73.9	20.9	
Vert	4874.000	AV	37.6	31.0	9.3	31.2	0.4	47.1	53.9	6.8	
Vert	7311.000	AV	32.4	36.4	8.8	32.5	-	45.1	53.9	8.8	Floor noise
Vert	9748.000	AV	32.5	38.6	9.5	32.8	-	47.8	53.9	6.1	Floor noise
Vert	12185.000	AV	37.4	40.2	-1.1	33.0	0.4	43.9	53.9	10.0	

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

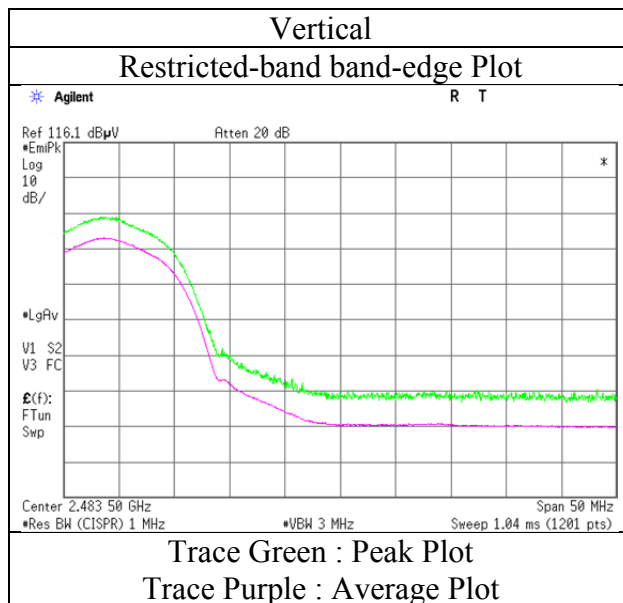
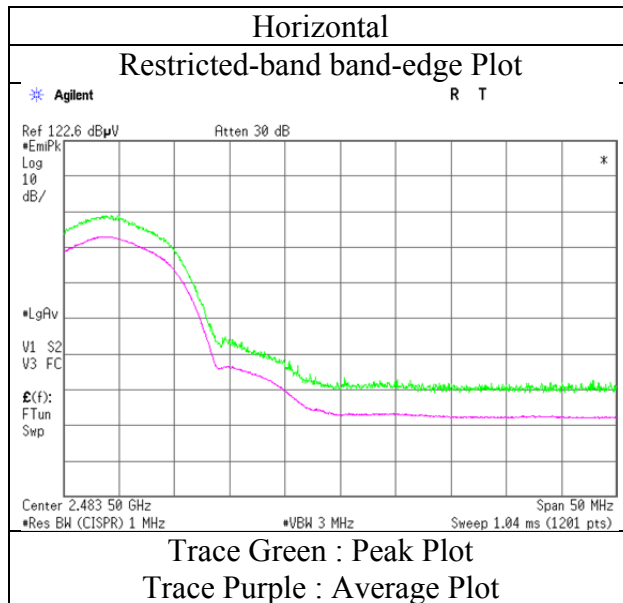
\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor:      1 GHz - 10 GHz      20log(4.5 m / 3.0 m) = 3.53 dB  
                                 10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB



**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11547841H
Date	November 23, 2016
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Takafumi Noguchi
	(1 GHz -10 GHz)
Mode	Tx 11b 2462 MHz



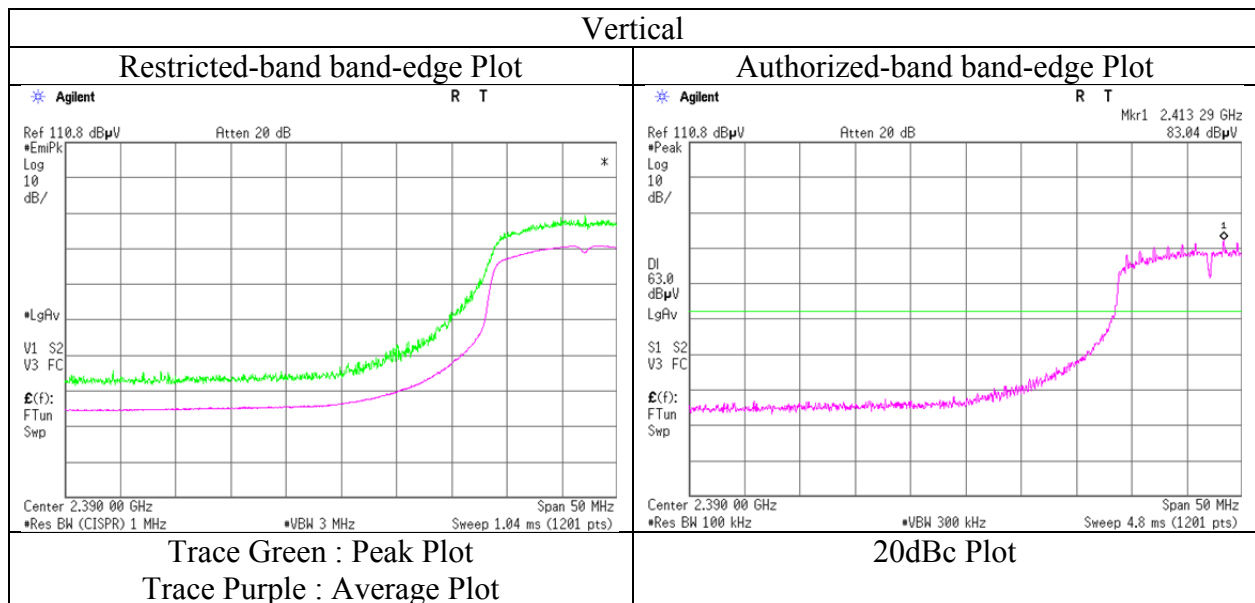
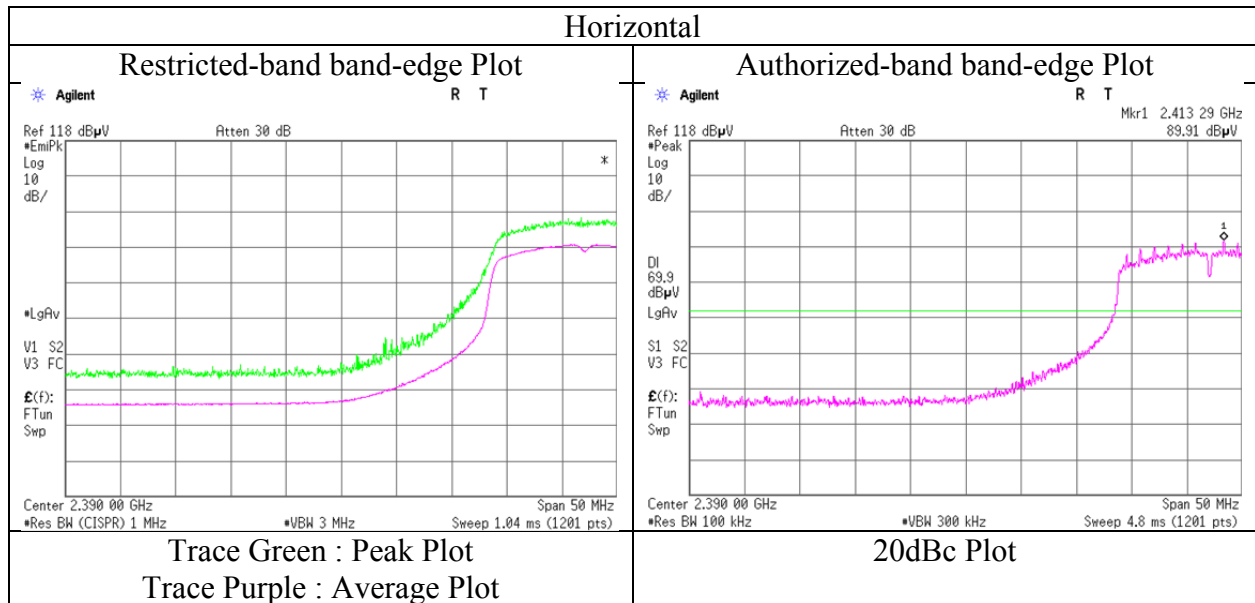
\* Final result of restricted band edge was shown in tabular data.





**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11547841H
Date	November 23, 2016
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz -10 GHz)
Mode	Tx 11g 2412 MHz



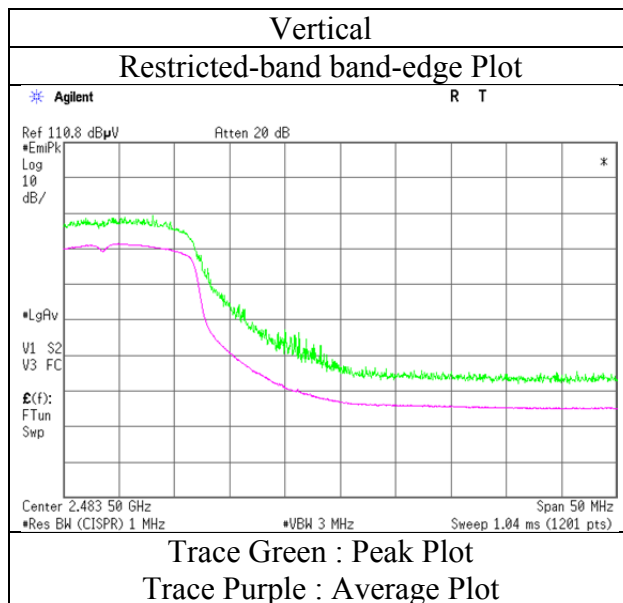
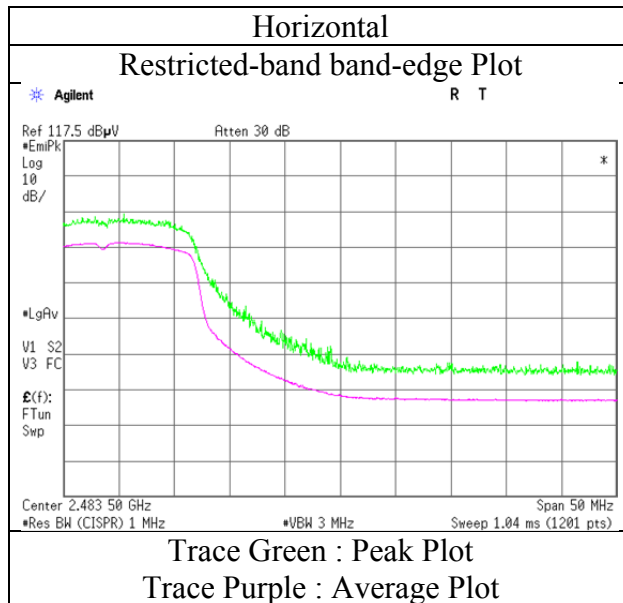
\* Final result of restricted band edge was shown in tabular data.





**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11547841H  
Date November 23, 2016  
Temperature / Humidity 22 deg. C / 40 % RH  
Engineer Takafumi Noguchi  
(1 GHz -10 GHz)  
Mode Tx 11g 2462 MHz

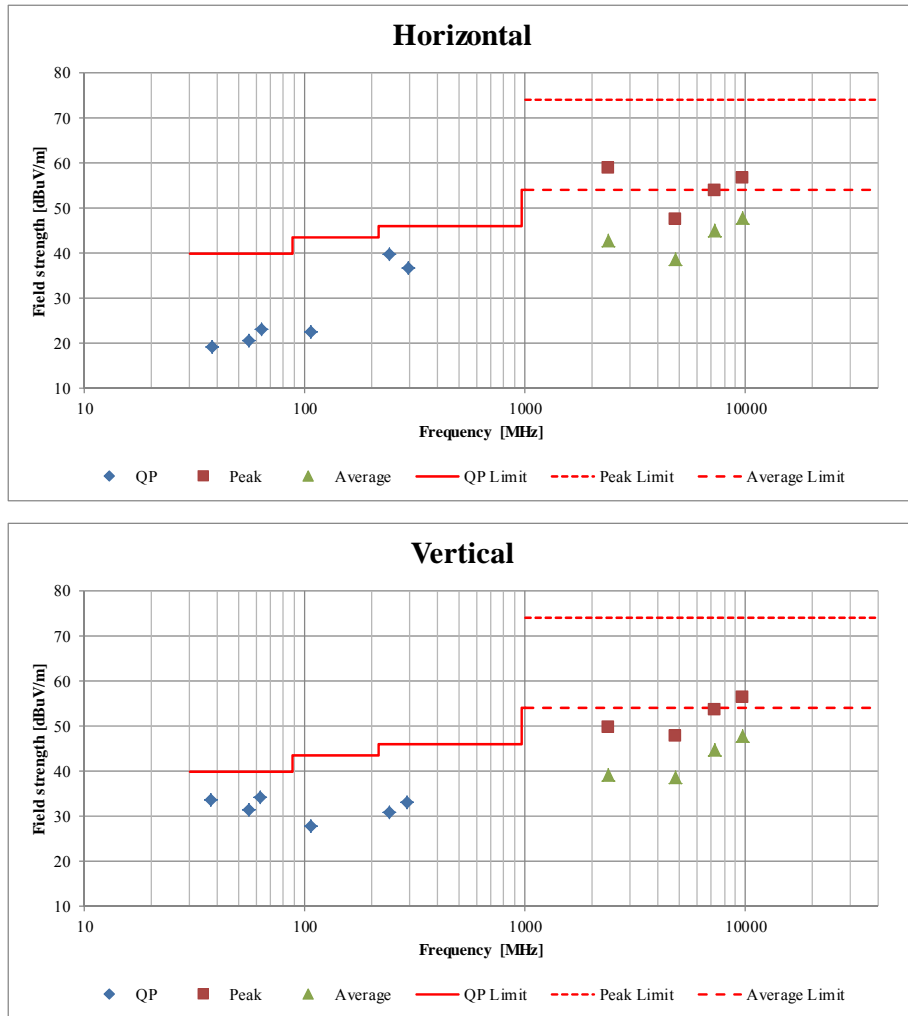


\* Final result of restricted band edge was shown in tabular data.

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

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Report No.	11547841H	
Date	November 23, 2016	November 25, 2016
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz -10 GHz)	Hiroyuki Furutaka (10 GHz -26.5 GHz) (Below 1GHz)

Mode Tx 11g 2412 MHz



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

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. : 11547841H  
Date : November 23, 2016  
Temperature / Humidity : 22 deg. C / 40 % RH  
Engineer : Takafumi Noguchi  
(1 GHz -10 GHz)  
Mode : Tx 11n-20 2412 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	2390.000	PK	57.1	27.4	6.7	32.1	-	59.1	73.9	14.8	
Hori	2390.000	AV	40.7	27.4	6.7	32.1	0.3	43.0	53.9	10.9	*1)
Vert	2390.000	PK	51.3	27.4	6.7	32.1	-	53.3	73.9	20.6	
Vert	2390.000	AV	37.2	27.4	6.7	32.1	0.3	39.5	53.9	14.4	*1)

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

\*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 (4.5 m / 3.0 m) = 3.53 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

\*1) Not Out of Band emission(Leakage Power)

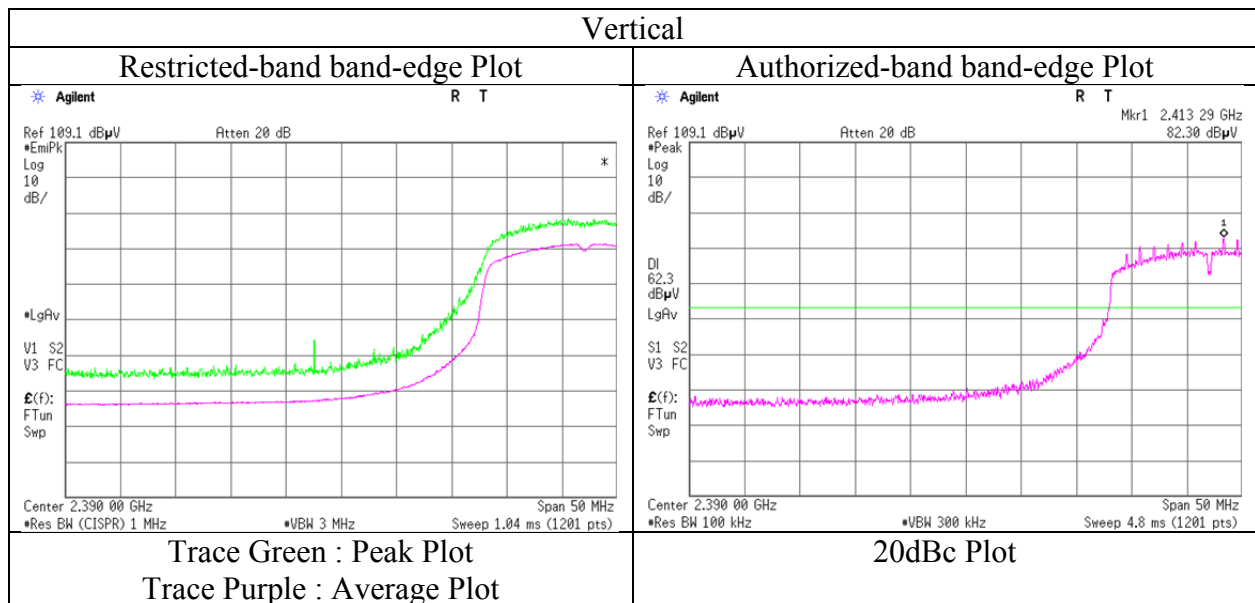
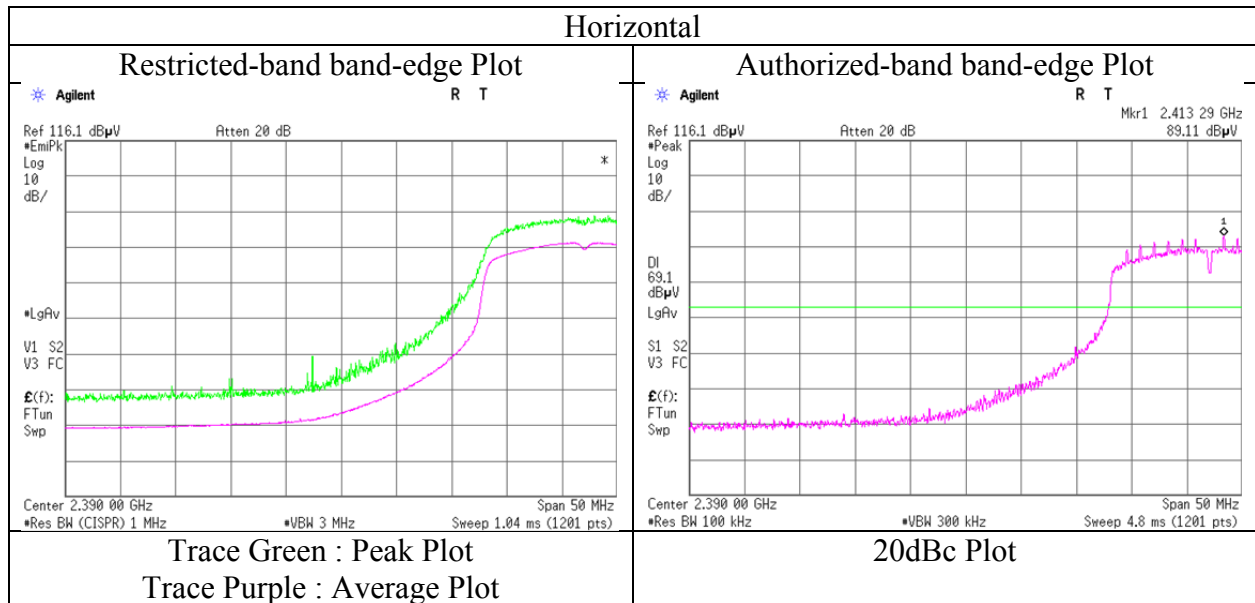
### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	89.1	27.4	6.8	32.1	91.2	-	-	Carrier
Hori	2400.000	PK	56.1	27.4	6.7	32.1	58.1	71.2	13.1	
Vert	2412.000	PK	82.3	27.4	6.8	32.1	84.4	-	-	Carrier
Vert	2400.000	PK	48.5	27.4	6.7	32.1	50.5	64.4	13.9	

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

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. : 11547841H  
Date : November 23, 2016  
Temperature / Humidity : 22 deg. C / 40 % RH  
Engineer : Takafumi Noguchi  
(1 GHz -10 GHz)  
Mode : Tx 11n-20 2412 MHz



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

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. : 11547841H  
Date : November 23, 2016  
Temperature / Humidity : 22 deg. C / 40 % RH  
Engineer : Takafumi Noguchi  
(1 GHz -10 GHz)  
Mode : Tx 11n-20 2462 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	2483.500	PK	57.5	27.4	6.9	32.0	-	59.8	73.9	14.1	
Hori	2483.500	AV	42.8	27.4	6.9	32.0	0.3	45.4	53.9	8.5	*1)
Vert	2483.500	PK	50.0	27.4	6.9	32.0	-	52.3	73.9	21.6	
Vert	2483.500	AV	37.2	27.4	6.9	32.0	0.3	39.8	53.9	14.1	*1)

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

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

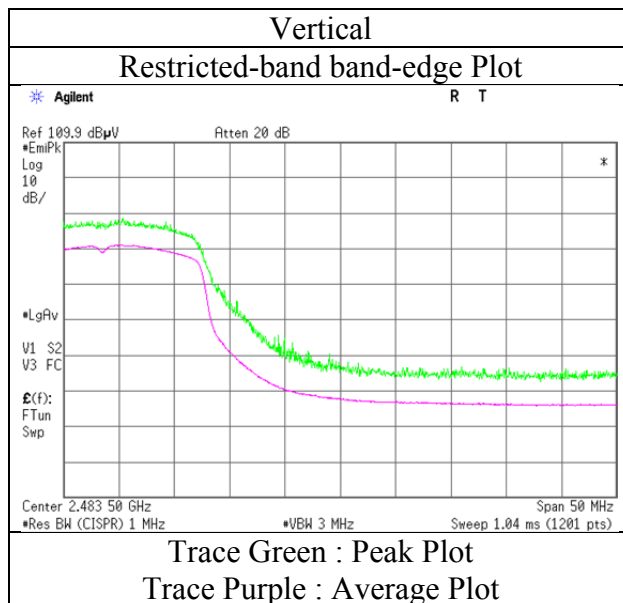
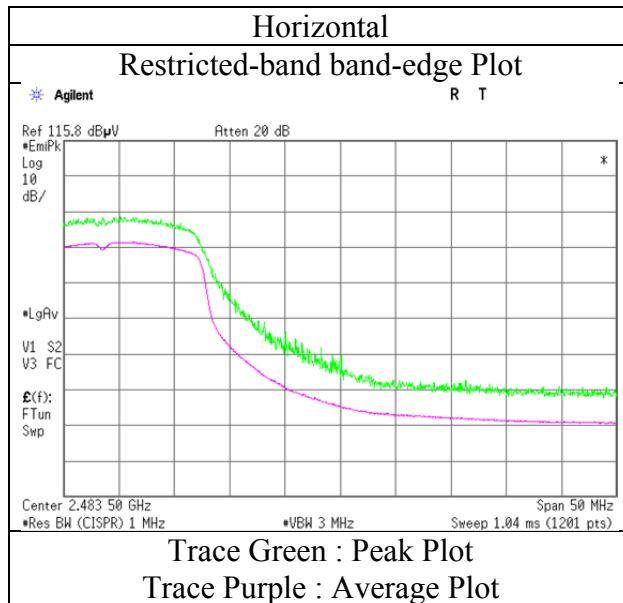
Distance factor: 1 GHz - 10 GHz  $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

\*1) Not Out of Band emission(Leakage Power)



**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. : 11547841H  
Date : November 23, 2016  
Temperature / Humidity : 22 deg. C / 40 % RH  
Engineer : Takafumi Noguchi  
(1 GHz -10 GHz)  
Mode : Tx 11n-20 2462 MHz



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

## Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.2	No.4
Report No.	11547841H		
Date	December 12, 2016	December 13, 2016	November 20, 2016
Temperature / Humidity	23 deg. C / 30 % RH	21 deg. C / 31 % RH	22 deg. C / 43 % RH
Engineer	Takafumi Noguchi	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)	(Below 1GHz)
Mode	Tx BT LE 2402 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	54.820	QP	39.1	9.3	7.7	32.1	-	24.0	40.0	16.0	
Hori	74.987	QP	48.2	6.2	8.0	32.1	-	30.3	40.0	9.7	
Hori	134.010	QP	43.9	14.1	8.6	32.0	-	34.6	43.5	8.9	
Hori	180.000	QP	39.2	16.1	9.0	32.0	-	32.3	43.5	11.2	
Hori	241.990	QP	51.3	12.1	9.5	31.9	-	41.0	46.0	5.0	
Hori	720.000	QP	34.0	20.0	12.2	32.1	-	34.1	46.0	11.9	
Hori	2390.000	PK	42.2	27.4	6.7	32.1	-	44.2	73.9	29.7	
Hori	4804.000	PK	44.2	30.8	9.3	31.2	-	53.1	73.9	20.8	
Hori	7206.000	PK	41.0	36.2	8.8	32.4	-	53.6	73.9	20.3	Floor noise
Hori	9608.000	PK	41.5	38.4	9.4	32.7	-	56.6	73.9	17.3	Floor noise
Hori	2390.000	AV	33.0	27.4	6.7	32.1	1.8	36.8	53.9	17.1	*1)
Hori	4804.000	AV	36.2	30.8	9.3	31.2	1.8	46.9	53.9	7.0	
Hori	7206.000	AV	32.1	36.2	8.8	32.4	-	44.7	53.9	9.2	Floor noise
Hori	9608.000	AV	32.6	38.4	9.4	32.7	-	47.7	53.9	6.2	Floor noise
Vert	43.677	QP	43.5	12.9	7.5	32.1	-	31.8	40.0	8.2	
Vert	54.420	QP	51.8	9.4	7.7	32.1	-	36.8	40.0	3.2	
Vert	68.360	QP	54.5	6.6	7.9	32.1	-	36.9	40.0	3.1	
Vert	73.930	QP	56.2	6.2	7.9	32.1	-	38.2	40.0	1.8	
Vert	84.640	QP	51.7	7.0	8.1	32.1	-	34.7	40.0	5.3	
Vert	134.000	QP	45.5	14.1	8.6	32.0	-	36.2	43.5	7.3	
Vert	241.600	QP	48.7	12.1	9.5	31.9	-	38.4	46.0	7.6	
Vert	2390.000	PK	41.8	27.4	6.7	32.1	-	43.8	73.9	30.1	
Vert	4804.000	PK	42.7	30.8	9.3	31.2	-	51.6	73.9	22.3	
Vert	7206.000	PK	40.7	36.2	8.8	32.4	-	53.3	73.9	20.6	Floor noise
Vert	9608.000	PK	41.5	38.4	9.4	32.7	-	56.6	73.9	17.3	Floor noise
Vert	2390.000	AV	33.2	27.4	6.7	32.1	1.8	37.0	53.9	16.9	*1)
Vert	4804.000	AV	34.4	30.8	9.3	31.2	1.8	45.1	53.9	8.8	
Vert	7206.000	AV	32.1	36.2	8.8	32.4	-	44.7	53.9	9.2	Floor noise
Vert	9608.000	AV	32.6	38.4	9.4	32.7	-	47.7	53.9	6.2	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz  $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

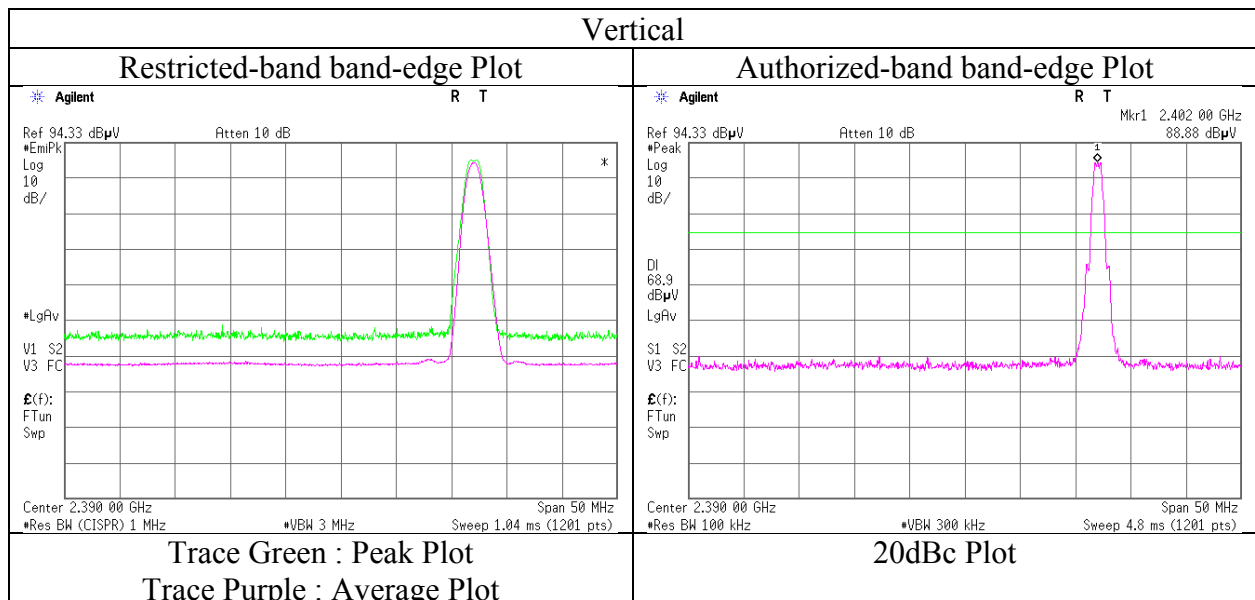
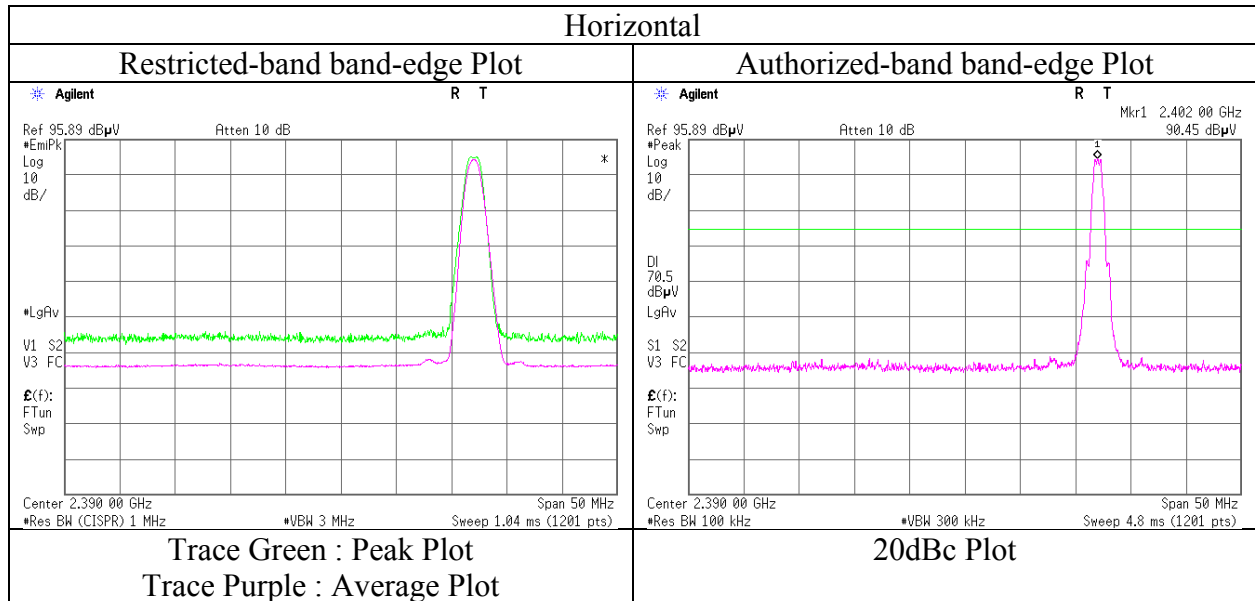
### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	90.5	27.4	6.7	32.1	92.5	-	-	Carrier
Hori	2400.000	PK	36.6	27.4	6.7	32.1	38.6	72.5	33.9	
Vert	2402.000	PK	88.9	27.4	6.7	32.1	90.9	-	-	Carrier
Vert	2400.000	PK	36.5	27.4	6.7	32.1	38.5	70.9	32.4	

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

## Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11547841H
Date	December 12, 2016
Temperature / Humidity	23 deg. C / 30 % RH
Engineer	Takafumi Noguchi (1 GHz -10 GHz)
Mode	Tx BT LE 2402 MHz



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

## Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.2	No.4
Report No.	11547841H		
Date	December 12, 2016	December 13, 2016	November 20, 2016
Temperature / Humidity	23 deg. C / 30 % RH	21 deg. C / 31 % RH	22 deg. C / 43 % RH
Engineer	Takafumi Noguchi	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)	(Below 1GHz)
Mode	Tx BT LE 2440 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	54.820	QP	39.5	9.3	7.7	32.1	-	24.4	40.0	15.6	
Hori	74.781	QP	50.5	6.2	7.9	32.1	-	32.5	40.0	7.5	
Hori	134.010	QP	43.3	14.1	8.6	32.0	-	34.0	43.5	9.5	
Hori	155.758	QP	44.8	15.0	8.8	32.0	-	36.6	43.5	6.9	
Hori	241.990	QP	51.0	12.1	9.5	31.9	-	40.7	46.0	5.3	
Hori	720.000	QP	33.8	20.0	12.2	32.1	-	33.9	46.0	12.1	
Hori	4880.000	PK	45.6	31.1	9.2	31.2	-	54.7	73.9	19.2	
Hori	7320.000	PK	41.1	36.4	8.8	32.5	-	53.8	73.9	20.1	Floor noise
Hori	9760.000	PK	41.1	38.6	9.5	32.8	-	56.4	73.9	17.5	Floor noise
Hori	4880.000	AV	39.0	31.1	9.2	31.2	1.8	49.9	53.9	4.0	
Hori	7320.000	AV	32.4	36.4	8.8	32.5	-	45.1	53.9	8.8	Floor noise
Hori	9760.000	AV	32.6	38.6	9.5	32.8	-	47.9	53.9	6.0	Floor noise
Vert	43.654	QP	43.8	12.9	7.5	32.1	-	32.1	40.0	7.9	
Vert	54.420	QP	51.6	9.4	7.7	32.1	-	36.6	40.0	3.4	
Vert	68.360	QP	55.0	6.6	7.9	32.1	-	37.4	40.0	2.6	
Vert	73.930	QP	55.5	6.2	7.9	32.1	-	37.5	40.0	2.5	
Vert	84.600	QP	51.7	7.0	8.1	32.1	-	34.7	40.0	5.3	
Vert	155.758	QP	48.1	15.0	8.8	32.0	-	39.9	43.5	3.6	
Vert	241.600	QP	48.9	12.1	9.5	31.9	-	38.6	46.0	7.4	
Vert	4880.000	PK	44.8	31.1	9.2	31.2	-	53.9	73.9	20.0	
Vert	7320.000	PK	41.1	36.4	8.8	32.5	-	53.8	73.9	20.1	Floor noise
Vert	9760.000	PK	41.1	38.6	9.5	32.8	-	56.4	73.9	17.5	Floor noise
Vert	4880.000	AV	37.6	31.1	9.2	31.2	1.8	48.5	53.9	5.4	
Vert	7320.000	AV	32.4	36.4	8.8	32.5	-	45.1	53.9	8.8	Floor noise
Vert	9760.000	AV	32.6	38.6	9.5	32.8	-	47.9	53.9	6.0	Floor noise

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

\*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(4.5 m / 3.0 m) = 3.53 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

## Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.2	No.4
Report No.	11547841H		
Date	December 12, 2016	December 13, 2016	November 20, 2016
Temperature / Humidity	23 deg. C / 30 % RH	21 deg. C / 31 % RH	22 deg. C / 43 % RH
Engineer	Takafumi Noguchi	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)	(Below 1GHz)
Mode	Tx BT LE 2480 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	54.820	QP	39.0	9.3	7.7	32.1	-	23.9	40.0	16.1	
Hori	74.808	QP	50.8	6.2	7.9	32.1	-	32.8	40.0	7.2	
Hori	134.010	QP	43.5	14.1	8.6	32.0	-	34.2	43.5	9.3	
Hori	155.596	QP	44.9	15.0	8.8	32.0	-	36.7	43.5	6.8	
Hori	241.992	QP	51.9	12.1	9.5	31.9	-	41.6	46.0	4.4	
Hori	720.000	QP	30.5	20.0	12.2	32.1	-	30.6	46.0	15.4	
Hori	2483.500	PK	44.1	27.4	6.9	32.0	-	46.4	73.9	27.5	
Hori	4960.000	PK	47.4	31.4	9.3	31.1	-	57.0	73.9	16.9	
Hori	7440.000	PK	41.4	36.5	8.8	32.5	-	54.2	73.9	19.7	Floor noise
Hori	9920.000	PK	41.2	38.8	9.6	32.9	-	56.7	73.9	17.2	Floor noise
Hori	2483.500	AV	34.7	27.4	6.9	32.0	1.8	38.8	53.9	15.1	*1)
Hori	4960.000	AV	40.1	31.4	9.3	31.1	1.8	51.5	53.9	2.4	
Hori	7440.000	AV	32.6	36.5	8.8	32.5	-	45.4	53.9	8.5	Floor noise
Hori	9920.000	AV	32.4	38.8	9.6	32.9	-	47.9	53.9	6.0	Floor noise
Vert	43.689	QP	43.6	12.9	7.5	32.1	-	31.9	40.0	8.1	
Vert	54.321	QP	52.0	9.4	7.7	32.1	-	37.0	40.0	3.0	
Vert	68.400	QP	54.9	6.6	7.9	32.1	-	37.3	40.0	2.7	
Vert	73.930	QP	56.0	6.2	7.9	32.1	-	38.0	40.0	2.0	
Vert	84.640	QP	51.7	7.0	8.1	32.1	-	34.7	40.0	5.3	
Vert	155.596	QP	47.8	15.0	8.8	32.0	-	39.6	43.5	3.9	
Vert	241.589	QP	47.3	12.1	9.5	31.9	-	37.0	46.0	9.0	
Vert	2483.500	PK	43.8	27.4	6.9	32.0	-	46.1	73.9	27.8	
Vert	4960.000	PK	44.6	31.4	9.3	31.1	-	54.2	73.9	19.7	
Vert	7440.000	PK	41.3	36.5	8.8	32.5	-	54.1	73.9	19.8	Floor noise
Vert	9920.000	PK	41.1	38.8	9.6	32.9	-	56.6	73.9	17.3	Floor noise
Vert	2483.500	AV	33.9	27.4	6.9	32.0	1.8	38.0	53.9	15.9	*1)
Vert	4960.000	AV	36.4	31.4	9.3	31.1	1.8	47.8	53.9	6.1	
Vert	7440.000	AV	32.6	36.5	8.8	32.5	-	45.4	53.9	8.5	Floor noise
Vert	9920.000	AV	32.4	38.8	9.6	32.9	-	47.9	53.9	6.0	Floor noise

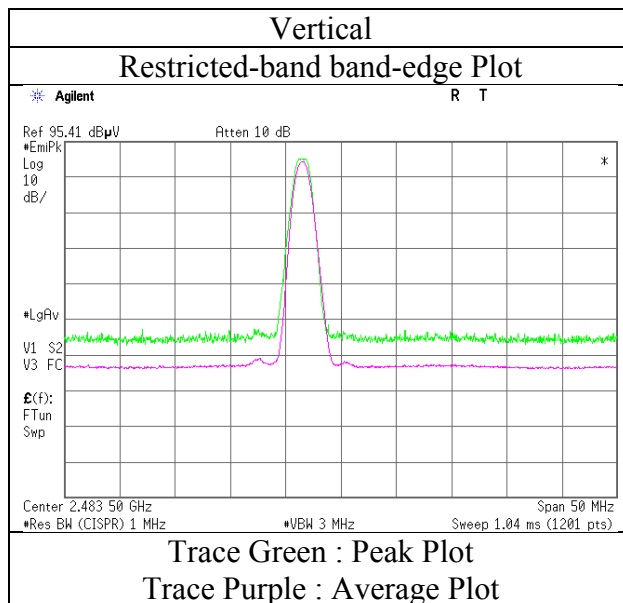
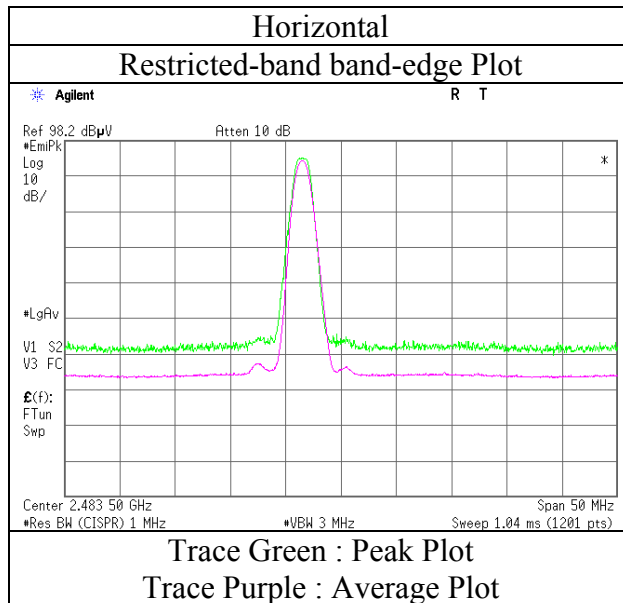
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

\*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 (4.5 m / 3.0 m) = 3.53 dB  
                          10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

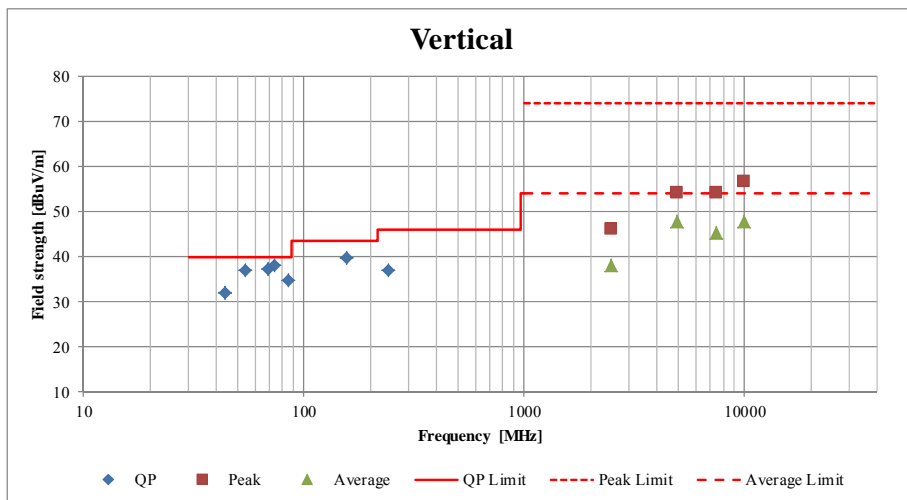
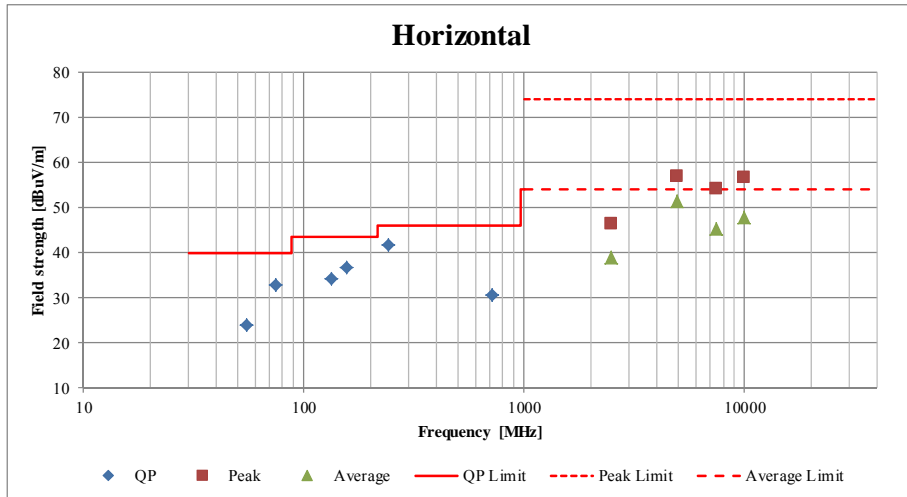
Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. : 11547841H  
Date : December 12, 2016  
Temperature / Humidity : 23 deg. C / 30 % RH  
Engineer : Takafumi Noguchi  
(1 GHz -10 GHz)  
Mode : Tx BT LE 2480 MHz



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

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

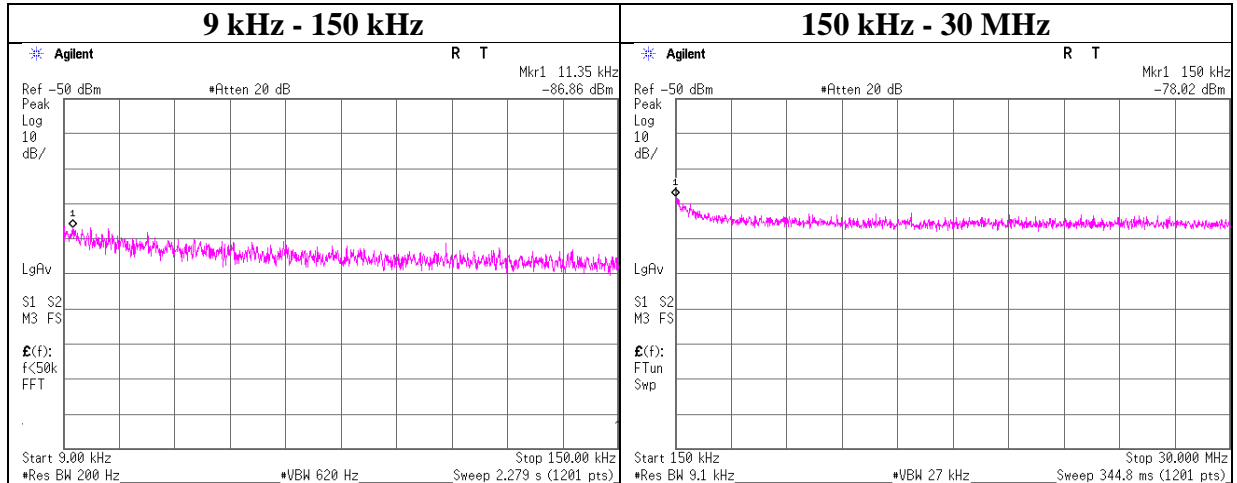
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.2	No.4
Report No.	11547841H		
Date	December 12, 2016	December 13, 2016	November 20, 2016
Temperature / Humidity	23 deg. C / 30 % RH	21 deg. C / 31 % RH	22 deg. C / 43 % RH
Engineer	Takafumi Noguchi	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)	(Below 1GHz)
Mode	Tx BT LE 2480 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.3 Measurement Room  
Report No. : 11547841H  
Date : November 18, 2016  
Temperature / Humidity : 24 deg. C / 35 % RH  
Engineer : Hironobu Ohnishi  
Mode : Tx 11g 2412 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [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
11.35	-86.9	0.12	10.0	2.0	1	-74.7	300	6.0	-13.5	46.5	60.0	
150.00	-78.0	0.12	10.0	2.0	1	-65.9	300	6.0	-4.6	24.0	28.6	

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

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

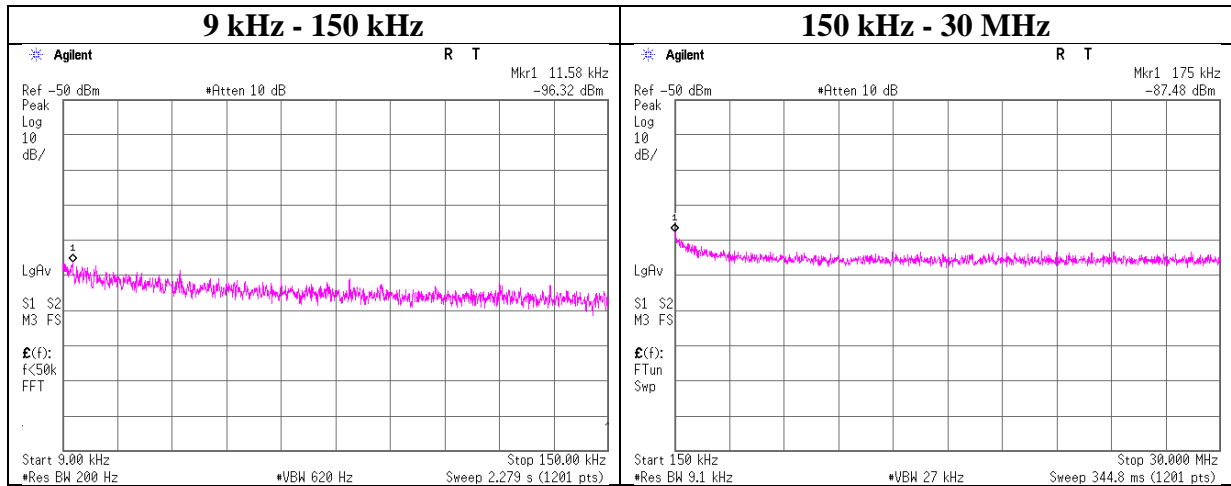
N: Number of output

\*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074.



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 18, 2016
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Hironobu Ohnishi
Mode	Tx BT LE 2402 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [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
11.58	-96.3	0.12	10.0	2.0	1	-84.2	300	6.0	-22.9	46.3	69.2	
175.00	-87.5	0.12	10.0	2.0	1	-75.4	300	6.0	-14.1	22.7	36.8	

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

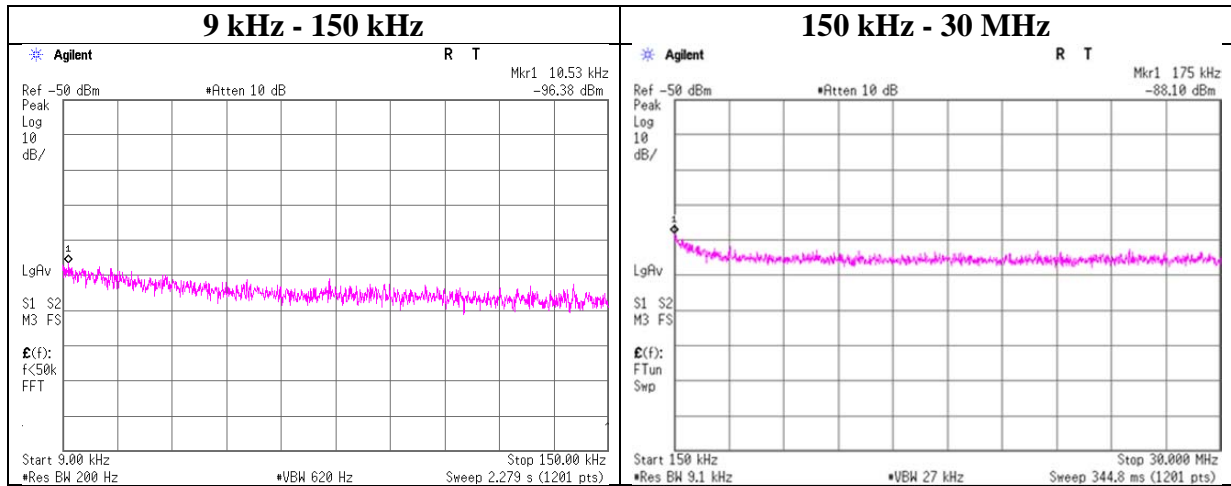
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$$

N: Number of output

\*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074.

### Conducted Spurious Emission

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 18, 2016
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Hironobu Ohnishi
Mode	Tx BT LE 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [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
10.53	-96.4	0.12	10.0	2.0	1	-84.3	300	6.0	-23.0	47.1	70.1	
175.00	-88.1	0.12	10.0	2.0	1	-76.0	300	6.0	-14.7	22.7	37.4	

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

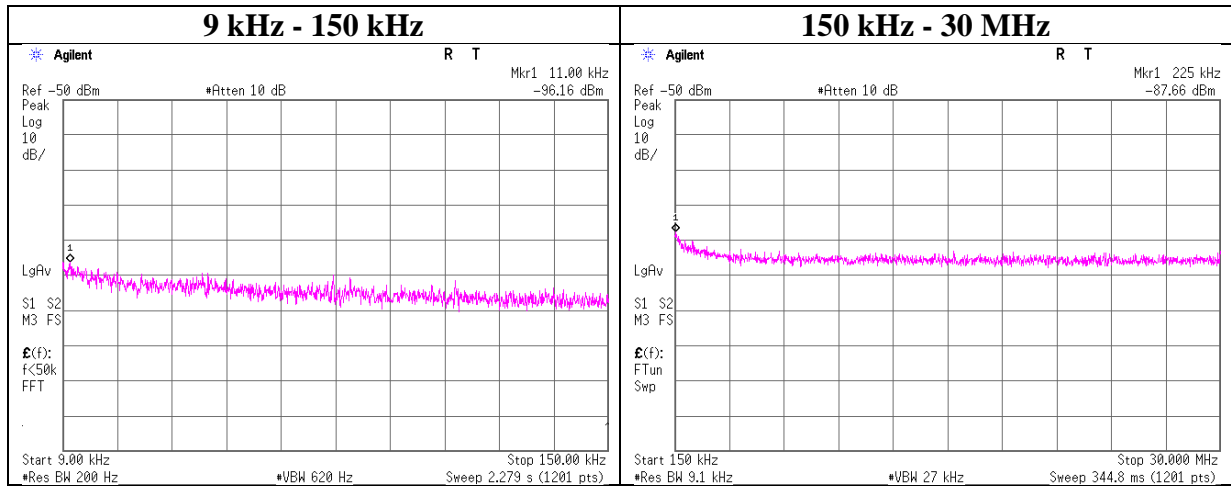
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$$

N: Number of output

\*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074.

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 18, 2016
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Hironobu Ohnishi
Mode	Tx BT LE 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [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
11.00	-96.2	0.12	10.0	2.0	1	-84.0	300	6.0	-22.8	46.7	69.5	
225.00	-87.7	0.12	10.0	2.0	1	-75.5	300	6.0	-14.3	20.5	34.8	

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

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

N: Number of output

\*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074.

### Power Density

Test place : Ise EMC Lab. No.3 Measurement Room  
Report No. : 11547841H  
Date : November 18, 2016  
Temperature / Humidity : 24 deg. C / 35 % RH  
Engineer : Hironobu Ohnishi  
Mode : Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-15.69	1.07	10.03	-4.60	8.00	12.60
2437	-14.27	1.07	10.03	-3.18	8.00	11.18
2462	-15.53	1.08	10.03	-4.43	8.00	12.43

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-20.77	1.07	10.03	-9.68	8.00	17.68
2437	-20.86	1.07	10.03	-9.77	8.00	17.77
2462	-20.60	1.08	10.03	-9.50	8.00	17.50

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-21.63	1.07	10.03	-10.54	8.00	18.54
2437	-22.40	1.07	10.03	-11.31	8.00	19.31
2462	-21.41	1.08	10.03	-10.31	8.00	18.31

BT LE

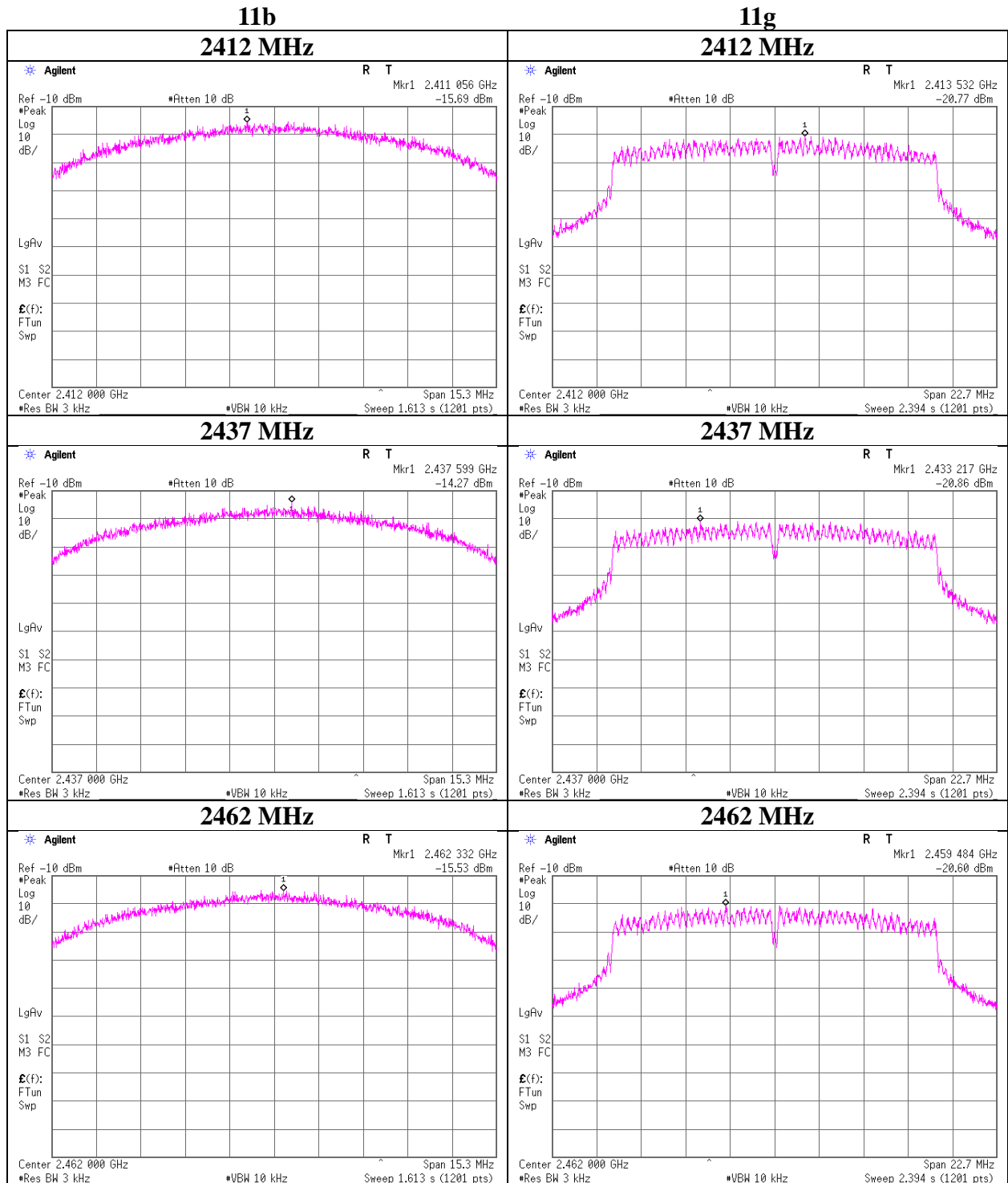
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402	-17.46	1.13	10.03	-6.30	8.00	14.30
2440	-17.47	1.14	10.03	-6.30	8.00	14.30
2480	-17.68	1.14	10.03	-6.51	8.00	14.51

Sample Calculation:

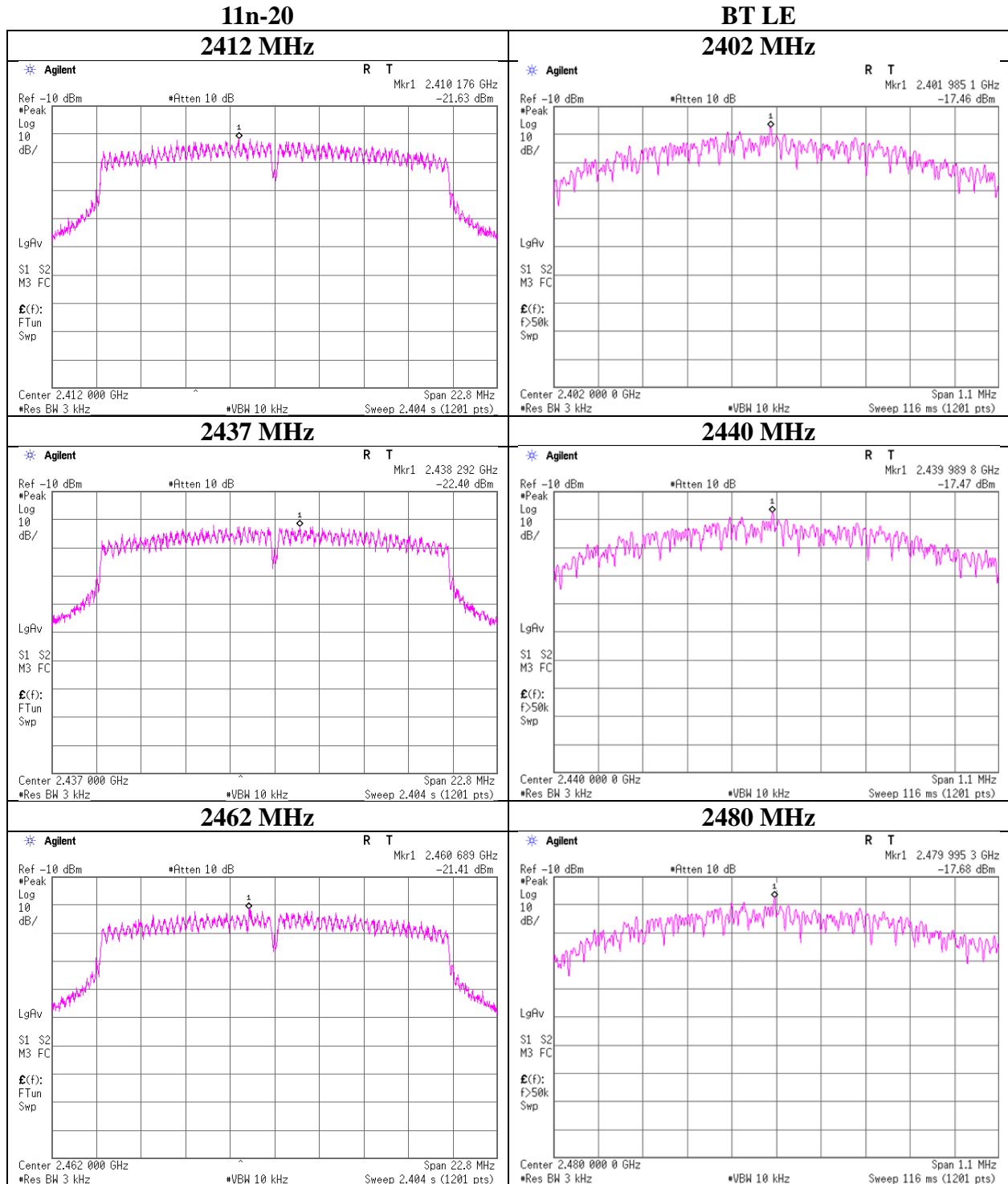
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

**Power Density**

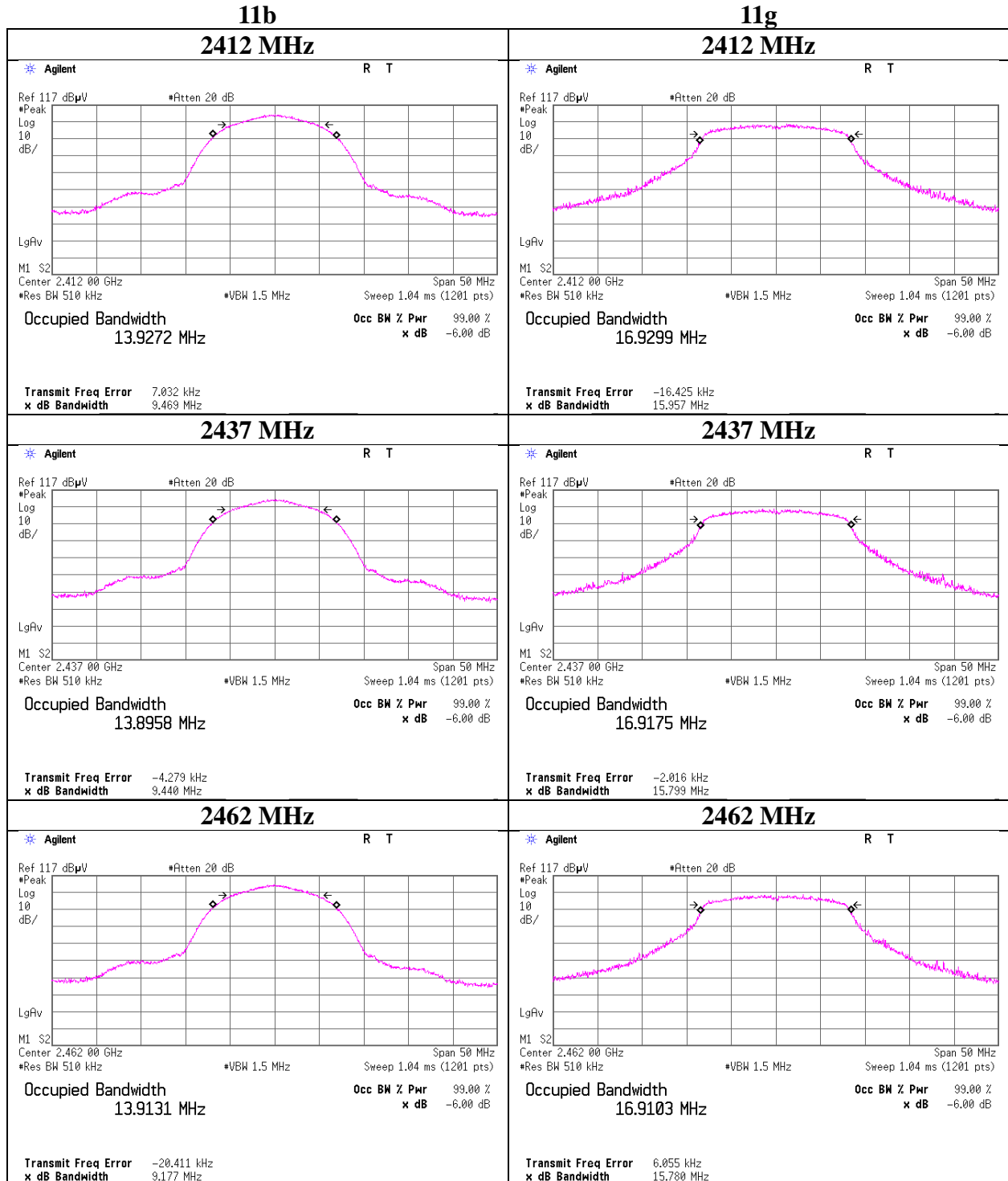


**Power Density**



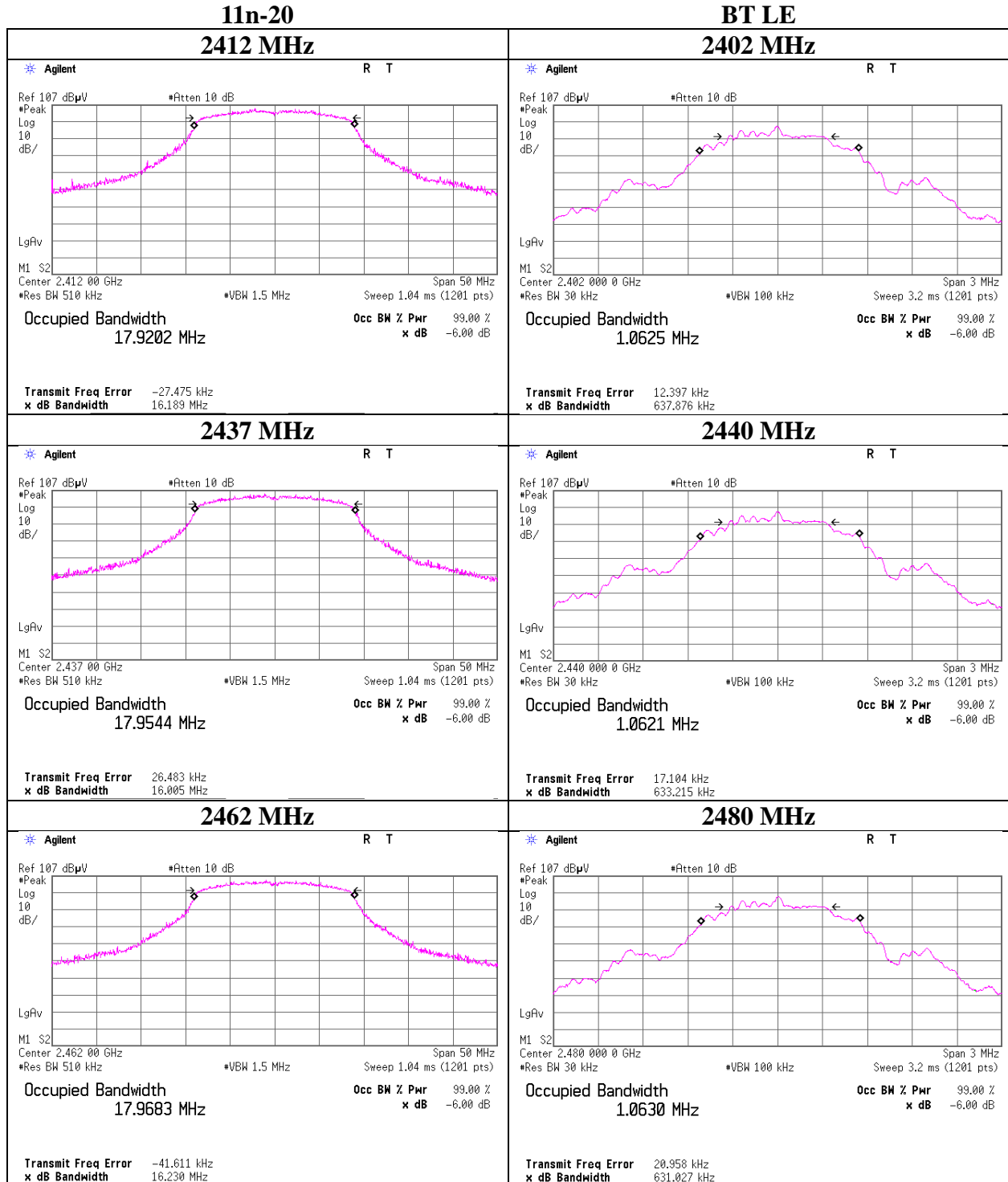
## 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 18, 2016
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Hironobu Ohnishi
Mode	Tx



## 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11547841H
Date	November 18, 2016
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Hironobu Ohnishi
Mode	Tx





## **APPENDIX 2: Test instruments**

### **Test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-29	Thermo-Hygrometer	Custom	CTH-201	2901	AT	2016/01/21 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	AT	2016/01/13 * 12
MOTS-MATM	Antenna Terminal Measurement Software	UL Japan	-	-	AT	-
MCC-144	Microwave Cable	Junkosha	MWX221	1207S407	AT	2016/08/02 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/01/18 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2016/11/10 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2016/11/02 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2016/11/02 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2016/10/19 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE/CE	2016/01/21 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MRENT-126	Spectrum Analyzer	KEYSIGHT	E4440A	MY46185516	RE	2016/07/01 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2016/09/28 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2016/06/21 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2016/10/21 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE/CE	2016/01/18 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2016/06/24 * 12
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE/CE	2016/01/29 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MLA-23	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	RE	2016/01/30 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2016/06/20 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2015/11/12 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2016/03/18 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2016/09/19 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(AE)	2016/07/07 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(EUT)	2016/07/11 * 12
MTA-53	Terminator	TME	CT-01BP	-	CE	2015/12/01 * 12
MAT-67	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM1 41(5m)/421-010(1m )/sucoform141-PE(1 m)/RFM-E121(Swit cher)	-/04178	CE	2016/07/20 * 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 test  
RE: Radiated Emission test  
AT: Antenna Terminal Conducted test**

**UL Japan, Inc.**

**Ise EMC Lab.**

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