



RADIO TEST REPORT

Test Report No. : 12079930H-B-R1

Applicant : Sony Interactive Entertainment Inc.
Type of Equipment : Wireless communication module
Model No. : AW-CB262
FCC ID : AK8M16DAM2
Test regulation : FCC Part 15 Subpart C: 2018
For Permissive Change
*WLAN, Bluetooth Low Energy parts
(Radiated Spurious Emission test only)
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. 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)
7. This report is a revised version of 12079930H-B. 12079930H-B is replaced with this report.

Date of test: December 8 to 20, 2017

Representative test engineer:

T. Noguchi

Takafumi Noguchi
Engineer
Consumer Technology Division

Approved by:

Takayuki S.

Takayuki Shimada
Leader
Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12079930H-B

[illegible]

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SECTION 1: Customer information

Company Name	Sony Interactive Entertainment Inc.
Brand Name	SONY
Address	1-7-1 Konan, Minato-ku, Tokyo, 108-0075 Japan
Telephone Number	+81-50-3807-5639
Facsimile Number	+81-50-3807-9594
Contact Person	Kiyoto Sasaki

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

2.1 Identification of E.U.T.

Type of Equipment	Wireless communication module
Model No	AW-CB262
Serial No	Refer to Clause 4.2
Country of Manufacture	China/Japan
Receipt Date of Sample	December 7, 2017
Condition of EUT	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	No modification by the test lab.

2.2 Product Description

AW-CB262 is the Wireless communication module.

Product Specification

Clock frequency in the system (radio part)	40 MHz
Operating Temperature	-10 deg. C - +85 deg. C
Power Supply	DC 3.3 V / DC 1.8 V
Size	20 x 18 x 3.0 mm , 55 pin LGA

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Radio Specification

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

Equipment Type	Transceiver
Frequency of Operation	2412 MHz - 2462 MHz
Type of Modulation	DSSS, OFDM
Bandwidth & Channel spacing	Less than 20 MHz & 5 MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 3.3 V / DC 1.8 V / DC 1.1 V
Antenna Type	IFA (Antenna port WA for 2.4 GHz / Antenna port WB for 2.4 GHz)
Antenna Gain: G _{ANT}	4.0 dBi (Antenna port WA for 2.4 GHz), 4.2 dBi (Antenna port WB for 2.4 GHz)
Directional Gain *1)	7.11 dBi

WLAN (IEEE802.11a/11n-20/11ac-20/11n-40/11ac-40/11ac-80)

Equipment Type	Transceiver
Frequency of Operation	U-NII-1: 5180 MHz - 5240 MHz U-NII-2A: 5260 MHz - 5320 MHz U-NII-2C: 5500 MHz - 5700 MHz U-NII-3: 5745 MHz - 5825 MHz
Type of Modulation	OFDM
Bandwidth & Channel spacing	Less than 20 MHz / 40 MHz / 80 MHz & 20 MHz / 40 MHz / 80 MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 3.3 V / DC 1.8 V / DC 1.1 V
Antenna Type	IFA (Antenna port WA for 5 GHz), PIFA (Antenna port WC for 5 GHz)
Antenna Gain: G _{ANT}	5.0 dBi (Antenna port WA for 5 GHz) 3.5 dBi (Antenna port WC for 5 GHz)
Directional Gain *1)	7.29 dBi

Bluetooth (BDR/EDR)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz - 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Bandwidth & Channel spacing	79 MHz & 1 MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 3.3 V / DC 1.8 V / DC 1.1 V
Antenna Type	PIFA (Antenna port WC for 2.4 GHz)
Antenna Gain	6.4 dBi (Antenna port WC for 2.4 GHz)

Bluetooth (Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz - 2480 MHz
Type of Modulation	GFSK
Bandwidth & Channel spacing	1 MHz & 2 MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 3.3 V / DC 1.8 V / DC 1.1 V
Antenna Type	PIFA (Antenna port WC for 2.4 GHz)
Antenna Gain	6.4 dBi (Antenna port WC for 2.4 GHz)

*1) Directional antenna gain = $10 \log \left(\frac{G_{ANT1}}{(10^{20}} + \frac{G_{ANT2}}{10^{20}}) \right)^2 / 2$

*This test report applies to WLAN (2.4 GHz band) and Bluetooth Low Energy.

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<Contents of the change from original model>

Test Report Number of original model is 11240438H-B-R1 (issued by UL Japan, Inc.).

Specification was changed from the original model as follows:

Antenna of the EUT was modified.

The radio specification is identical to the original.

Therefore only Radiated Spurious Emission test were performed in this report.

Additionally, only the information of modified antenna is described in this report.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on January 2, 2018 and effective February 1, 2018

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 January 2, 2018, 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
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	5.4 dB 2737.538 MHz, Horizontal, AV	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

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

FCC Part 15.31 (e)

The EUT has the power supply regulator. However one of the input voltages to RF part doesn't go through the regulator. The stable voltage will be supplied by the end product, which will be required to have a power supply regulator. Therefore, the EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The EUT has unique coupling/antenna connectors (U.FL) for antenna ports WC and also has a pattern antenna (Antenna port WA and WB) that is not removable from the EUT.

Therefore the equipment complies with the requirement of 15.203/212.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.
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Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
		(Vertical) 5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
		(Vertical) 6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
		(Vertical) 4.9 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
		(Vertical) 5.0 dB
3 m	1 GHz to 6 GHz	5.0 dB
	6 GHz to 18 GHz	5.3 dB
1 m	10 GHz to 26.5 GHz	5.8 dB
	26.5 GHz to 40 GHz	5.8 dB
10 m	1 GHz to 18 GHz	5.2 dB

Radiated emission test

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

3.5 Test Location

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 NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

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 2.0 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)

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

Mode	Remarks*
IEEE 802.11b (11b)	1Mbps, PN9
IEEE 802.11n MIMO 20MHz BW (11n-20)	MCS 0, PN9
Bluetooth Low Energy(BT LE)	Maximum Packet Size, PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: WLAN 8(dBm) Bluetooth (LE) Same as production model Software: Opro_DOS_Labtool_Ver2.0.0.93 *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.	

*Details of Operating mode for WLAN

Test Item	Operating Mode	Used Antenna port	Tested frequency
Radiated Spurious Emission (Below 1 GHz)	11n-20 Tx *1)	WA + WB	2462MHz
Radiated Spurious Emission (Above 1 GHz)	11b Tx 11n-20 Tx *2)	WA + WB	2412MHz 2437MHz 2462MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) The test was performed on 11n-20 Tx mode according to “Section 1 of 6 802.11 a/b/g/n testing- Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009, as the 11n-20 Tx mode had higher power than 11g mode at antenna terminal test.			

*Details of Operating mode for BT LE

Test Item	Operating Mode	Tested frequency
Radiated Spurious Emission	BT LE	2402MHz 2440MHz 2480MHz

*Simultaneously transmission

Test Item	Mode *1)
Radiated Spurious Emission	Tx BT LE 2402 MHz + 11a 5180 MHz Tx BT LE 2440 MHz + 11a 5180 MHz Tx BT LE 2480 MHz + 11a 5180 MHz
*1) The test was performed on the mode as a representative, because it had the highest power of 5GHz band at antenna terminal test.	

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4.2 Configuration and peripherals

This page has been submitted for a separate exhibit.

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[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 *1)	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	3.75 m / 4.5 m *2) (1 GHz - 10 GHz), 1 m *3) (10 GHz - 26.5 GHz)		3.75 m / 4.5 m *2) (1 GHz - 10 GHz), 1 m *3) (10 GHz - 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

*2) Distance Factor: $20 \times \log(3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$ (for WLAN, BT LE),

Distance Factor: $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.54 \text{ dB}$ (for WLAN + BT LE)

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

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- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT (Antenna and Module) 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

APPENDIX 1: Test data

Radiated Spurious Emission

Report No.	12079930H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.3
Date	December 8, 2017	December 18, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH
Engineer	Takafumi Noguchi	Yuta Moriya
	(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	46.8	27.0	5.1	34.6	-	44.3	73.9	29.6	
Hori	3215.977	PK	46.3	28.1	5.7	34.4	-	45.7	73.9	28.2	
Hori	4824.000	PK	45.2	31.3	7.4	33.8	-	50.1	73.9	23.8	
Hori	7236.000	PK	42.4	35.7	7.2	33.9	-	51.4	73.9	22.5	Floor noise
Hori	9648.000	PK	42.6	38.2	8.3	34.5	-	54.6	73.9	19.3	Floor noise
Hori	2390.000	AV	37.8	27.0	5.1	34.6	-	35.3	53.9	18.6	
Hori	3215.977	AV	39.4	28.1	5.7	34.4	-	38.8	53.9	15.1	
Hori	4824.000	AV	38.9	31.3	7.4	33.8	-	43.8	53.9	10.1	
Hori	7236.000	AV	33.5	35.7	7.2	33.9	-	42.5	53.9	11.4	Floor noise
Hori	9648.000	AV	34.0	38.2	8.3	34.5	-	46.0	53.9	7.9	Floor noise
Vert	2390.000	PK	46.7	27.0	5.1	34.6	-	44.2	73.9	29.7	
Vert	3215.977	PK	45.9	28.1	5.7	34.4	-	45.3	73.9	28.6	
Vert	4824.000	PK	44.7	31.3	7.4	33.8	-	49.6	73.9	24.3	
Vert	7236.000	PK	42.3	35.7	7.2	33.9	-	51.3	73.9	22.6	Floor noise
Vert	9648.000	PK	42.5	38.2	8.3	34.5	-	54.5	73.9	19.4	Floor noise
Vert	2390.000	AV	37.4	27.0	5.1	34.6	-	34.9	53.9	19.0	
Vert	3215.977	AV	38.3	28.1	5.7	34.4	-	37.7	53.9	16.2	
Vert	4824.000	AV	37.7	31.3	7.4	33.8	-	42.6	53.9	11.3	
Vert	7236.000	AV	33.4	35.7	7.2	33.9	-	42.4	53.9	11.5	Floor noise
Vert	9648.000	AV	33.9	38.2	8.3	34.5	-	45.9	53.9	8.0	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 $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
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	2412.000	PK	99.9	27.0	5.1	34.6	97.4	-	-	Carrier
Hori	2400.000	PK	42.9	27.0	5.1	34.6	40.4	77.4	37.0	
Hori	2397.238	PK	53.9	27.0	5.1	34.6	51.4	77.4	26.0	
Vert	2412.000	PK	99.5	27.0	5.1	34.6	97.0	-	-	Carrier
Vert	2400.000	PK	41.6	27.0	5.1	34.6	39.1	77.0	37.9	
Vert	2397.238	PK	52.3	27.0	5.1	34.6	49.8	77.0	27.2	

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

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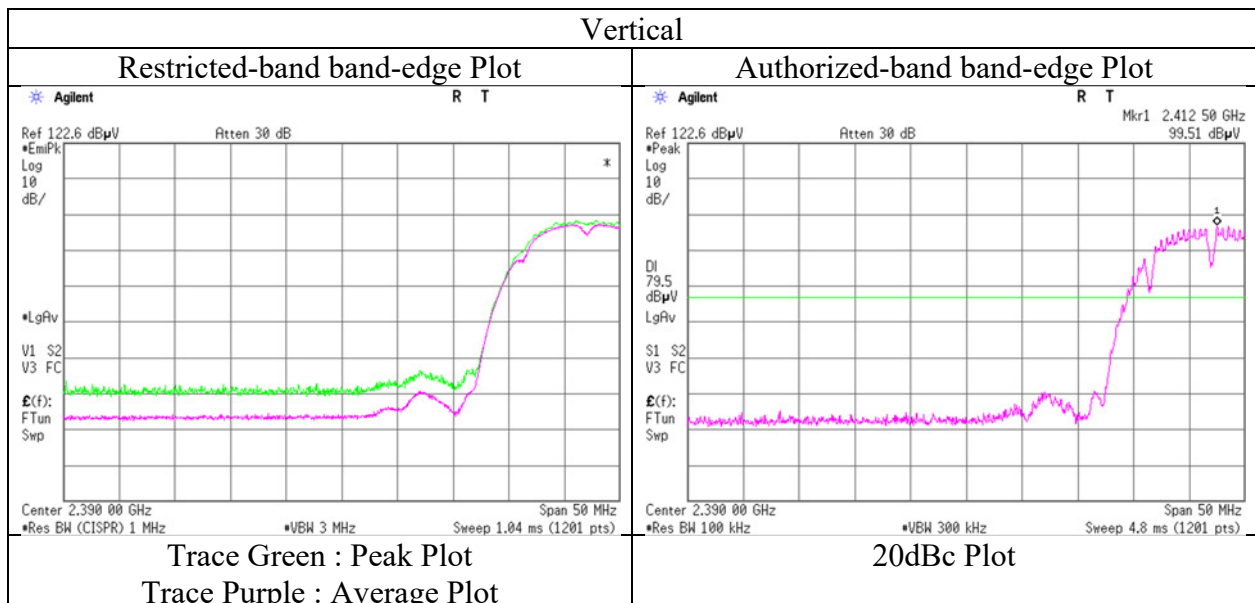
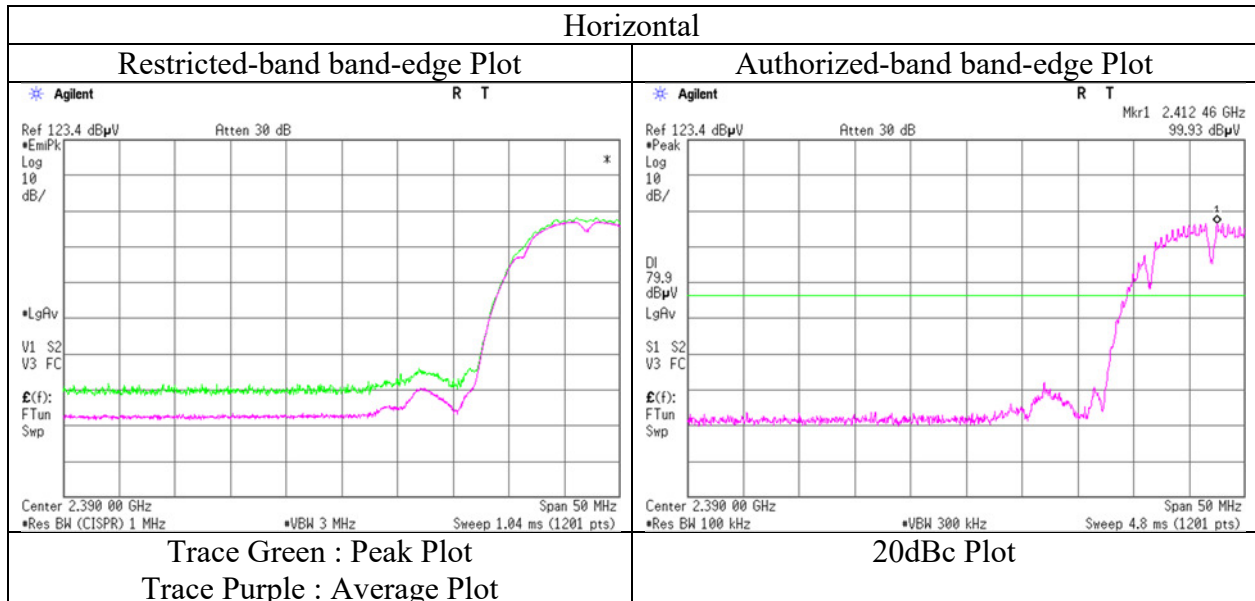
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12079930H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	December 8, 2017
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takafumi Noguchi
	(1 GHz - 10 GHz)
Mode	Tx 11b 2412 MHz



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

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Radiated Spurious Emission

Report No.	12079930H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.3
Date	December 8, 2017	December 18, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH
Engineer	Takafumi Noguchi	Yuta Moriya
	(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	3249.323	PK	46.4	28.2	5.7	34.4	-	45.9	73.9	28.0	
Hori	4874.000	PK	45.9	31.4	7.4	33.8	-	50.9	73.9	23.0	
Hori	7311.000	PK	42.1	35.7	7.2	33.9	-	51.1	73.9	22.8	Floor noise
Hori	9748.000	PK	42.1	38.2	8.3	34.5	-	54.1	73.9	19.8	Floor noise
Hori	3249.323	AV	39.6	28.2	5.7	34.4	-	39.1	53.9	14.8	
Hori	4874.000	AV	39.2	31.4	7.4	33.8	-	44.2	53.9	9.7	
Hori	7311.000	AV	33.4	35.7	7.2	33.9	-	42.4	53.9	11.5	Floor noise
Hori	9748.000	AV	33.1	38.2	8.3	34.5	-	45.1	53.9	8.8	Floor noise
Vert	3249.323	PK	46.8	28.2	5.7	34.4	-	46.3	73.9	27.6	
Vert	4874.000	PK	44.2	31.4	7.4	33.8	-	49.2	73.9	24.7	
Vert	7311.000	PK	42.0	35.7	7.2	33.9	-	51.0	73.9	22.9	Floor noise
Vert	9748.000	PK	42.0	38.2	8.3	34.5	-	54.0	73.9	19.9	Floor noise
Vert	3249.323	AV	40.0	28.2	5.7	34.4	-	39.5	53.9	14.4	
Vert	4874.000	AV	37.4	31.4	7.4	33.8	-	42.4	53.9	11.5	
Vert	7311.000	AV	33.3	35.7	7.2	33.9	-	42.3	53.9	11.6	Floor noise
Vert	9748.000	AV	33.0	38.2	8.3	34.5	-	45.0	53.9	8.9	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 $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 12079930H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date December 8, 2017 No.3
Temperature / Humidity 21 deg. C / 30 % RH December 18, 2017
Engineer Takafumi Noguchi 21 deg. C / 33 % RH
(1 GHz - 10 GHz) Yuta Moriya
(10 GHz - 26.5 GHz)
Mode Tx 11b 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	46.7	27.0	5.2	34.6	-	44.3	73.9	29.6	
Hori	3282.683	PK	46.5	28.2	5.7	34.3	-	46.1	73.9	27.8	
Hori	4924.000	PK	46.3	31.5	7.5	33.8	-	51.5	73.9	22.4	
Hori	7386.000	PK	41.6	35.8	7.2	34.0	-	50.6	73.9	23.3	Floor noise
Hori	9848.000	PK	41.8	38.2	8.3	34.5	-	53.8	73.9	20.1	Floor noise
Hori	2483.500	AV	37.8	27.0	5.2	34.6	-	35.4	53.9	18.5	
Hori	3282.683	AV	39.3	28.2	5.7	34.3	-	38.9	53.9	15.0	
Hori	4924.000	AV	40.7	31.5	7.5	33.8	-	45.9	53.9	8.0	
Hori	7386.000	AV	32.8	35.8	7.2	34.0	-	41.8	53.9	12.1	Floor noise
Hori	9848.000	AV	33.8	38.2	8.3	34.5	-	45.8	53.9	8.1	Floor noise
Vert	2483.500	PK	46.7	27.0	5.2	34.6	-	44.3	73.9	29.6	
Vert	3282.683	PK	46.7	28.2	5.7	34.3	-	46.3	73.9	27.6	
Vert	4924.000	PK	44.7	31.5	7.5	33.8	-	49.9	73.9	24.0	
Vert	7386.000	PK	41.7	35.8	7.2	34.0	-	50.7	73.9	23.2	Floor noise
Vert	9848.000	PK	41.8	38.2	8.3	34.5	-	53.8	73.9	20.1	Floor noise
Vert	2483.500	AV	37.8	27.0	5.2	34.6	-	35.4	53.9	18.5	
Vert	3282.683	AV	39.9	28.2	5.7	34.3	-	39.5	53.9	14.4	
Vert	4924.000	AV	37.7	31.5	7.5	33.8	-	42.9	53.9	11.0	
Vert	7386.000	AV	32.8	35.8	7.2	34.0	-	41.8	53.9	12.1	Floor noise
Vert	9848.000	AV	33.8	38.2	8.3	34.5	-	45.8	53.9	8.1	Floor noise

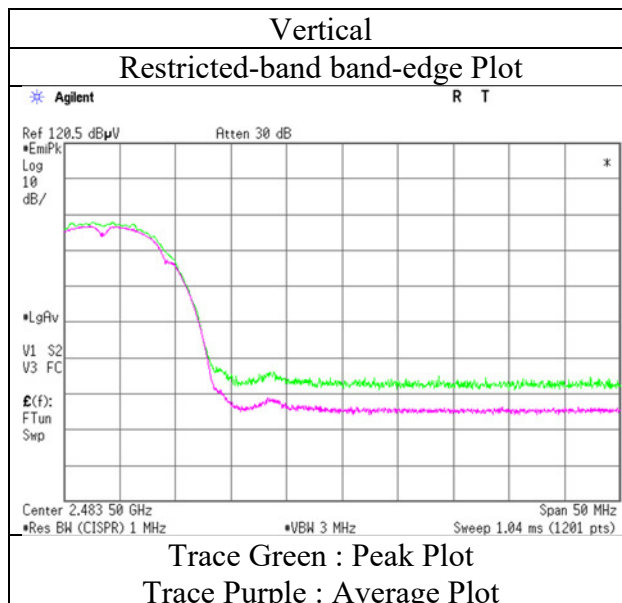
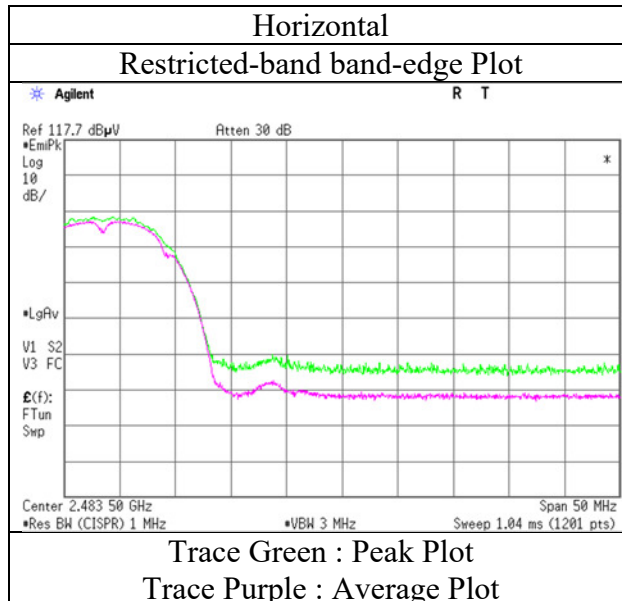
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12079930H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	December 8, 2017
Temperature / Humidity	21 deg. C / 30 % 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

Report No. 12079930H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date December 8, 2017 No.3
Temperature / Humidity 21 deg. C / 30 % RH December 18, 2017
Engineer Takafumi Noguchi Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 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	65.6	27.0	5.1	34.6	-	63.1	73.9	10.8	
Hori	3215.977	PK	46.5	28.1	5.7	34.4	-	45.9	73.9	28.0	
Hori	4824.000	PK	42.6	31.3	6.3	33.8	-	46.4	73.9	27.5	Floor noise
Hori	7236.000	PK	42.6	35.7	7.2	33.9	-	51.6	73.9	22.3	Floor noise
Hori	9648.000	PK	42.7	38.2	8.3	34.5	-	54.7	73.9	19.2	Floor noise
Hori	2390.000	AV	48.9	27.0	5.1	34.6	-	46.4	53.9	7.5	
Hori	3215.977	AV	39.3	28.1	5.7	34.4	-	38.7	53.9	15.2	
Hori	4824.000	AV	33.8	31.3	6.3	33.8	-	37.6	53.9	16.3	Floor noise
Hori	7236.000	AV	33.7	35.7	7.2	33.9	-	42.7	53.9	11.2	Floor noise
Hori	9648.000	AV	34.1	38.2	8.3	34.5	-	46.1	53.9	7.8	Floor noise
Vert	2390.000	PK	62.9	27.0	5.1	34.6	-	60.4	73.9	13.5	
Vert	3215.977	PK	46.3	28.1	5.7	34.4	-	45.7	73.9	28.2	
Vert	4824.000	PK	42.8	31.3	6.3	33.8	-	46.6	73.9	27.3	Floor noise
Vert	7236.000	PK	42.4	35.7	7.2	33.9	-	51.4	73.9	22.5	Floor noise
Vert	9648.000	PK	42.6	38.2	8.3	34.5	-	54.6	73.9	19.3	Floor noise
Vert	2390.000	AV	46.4	27.0	5.1	34.6	-	43.9	53.9	10.0	
Vert	3215.977	AV	38.8	28.1	5.7	34.4	-	38.2	53.9	15.7	
Vert	4824.000	AV	34.0	31.3	6.3	33.8	-	37.8	53.9	16.1	Floor noise
Vert	7236.000	AV	33.5	35.7	7.2	33.9	-	42.5	53.9	11.4	Floor noise
Vert	9648.000	AV	34.0	38.2	8.3	34.5	-	46.0	53.9	7.9	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 (3.75 m / 3.0 m) = 1.94 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 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	2412.000	PK	97.7	27.0	5.1	34.6	95.2	-	-	Carrier
Hori	2400.000	PK	58.4	27.0	5.1	34.6	55.9	75.2	19.3	
Vert	2412.000	PK	98.1	27.0	5.1	34.6	95.6	-	-	Carrier
Vert	2400.000	PK	55.0	27.0	5.1	34.6	52.5	75.6	23.1	

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

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Ise EMC Lab.

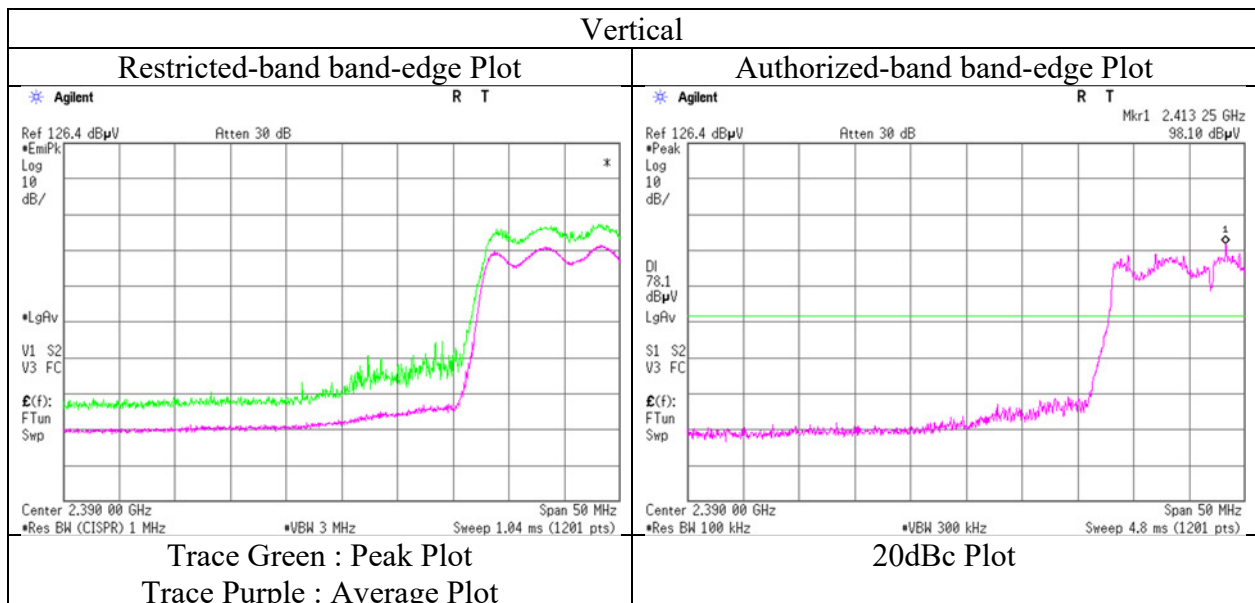
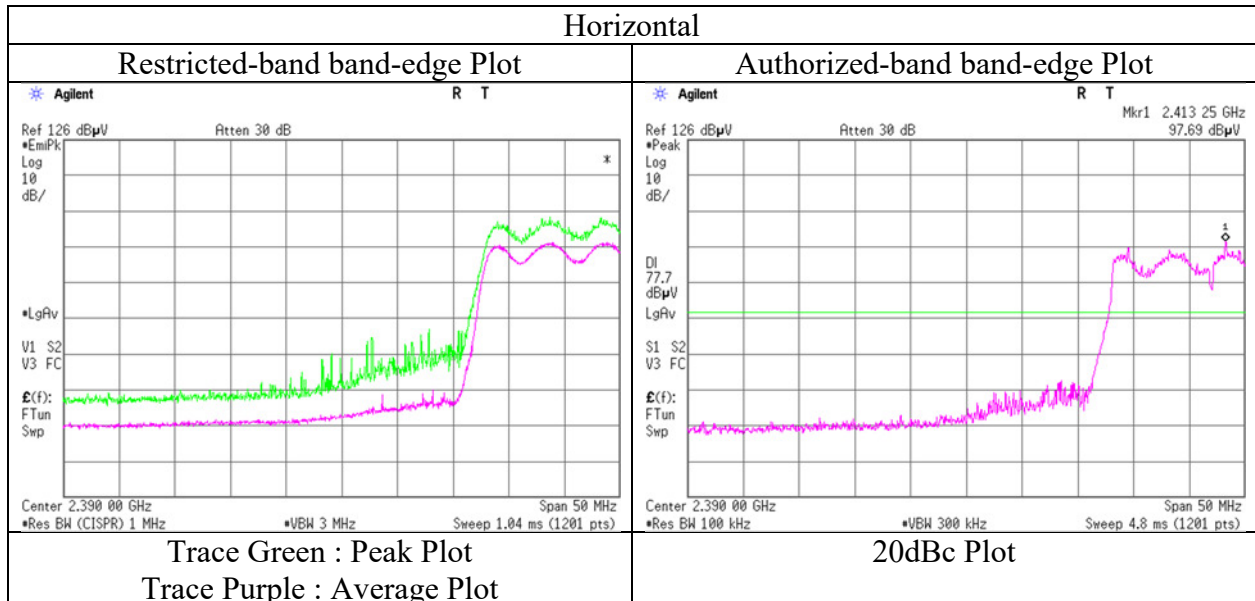
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12079930H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	December 8, 2017
Temperature / Humidity	21 deg. C / 30 % 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.

UL Japan, Inc.

Ise EMC Lab.

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Telephone : +81 596 24 8999

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Radiated Spurious Emission

Report No. 12079930H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.3
Date December 8, 2017 December 18, 2017
Temperature / Humidity 21 deg. C / 30 % RH 21 deg. C / 33 % RH
Engineer Takafumi Noguchi Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx 11n-20 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	3249.323	PK	46.6	28.2	5.7	34.4	-	46.1	73.9	27.8	
Hori	4874.000	PK	41.9	31.4	6.3	33.8	-	45.8	73.9	28.1	Floor noise
Hori	7311.000	PK	42.1	35.7	7.2	33.9	-	51.1	73.9	22.8	Floor noise
Hori	9748.000	PK	42.2	38.2	8.3	34.5	-	54.2	73.9	19.7	Floor noise
Hori	3249.323	AV	39.7	28.2	5.7	34.4	-	39.2	53.9	14.7	
Hori	4874.000	AV	33.8	31.4	6.3	33.8	-	37.7	53.9	16.2	Floor noise
Hori	7311.000	AV	33.4	35.7	7.2	33.9	-	42.4	53.9	11.5	Floor noise
Hori	9748.000	AV	33.1	38.2	8.3	34.5	-	45.1	53.9	8.8	Floor noise
Vert	3249.323	PK	47.1	28.2	5.7	34.4	-	46.6	73.9	27.3	
Vert	4874.000	PK	41.9	31.4	6.3	33.8	-	45.8	73.9	28.1	Floor noise
Vert	7311.000	PK	42.1	35.7	7.2	33.9	-	51.1	73.9	22.8	Floor noise
Vert	9748.000	PK	42.0	38.2	8.3	34.5	-	54.0	73.9	19.9	Floor noise
Vert	3249.323	AV	40.0	28.2	5.7	34.4	-	39.5	53.9	14.4	
Vert	4874.000	AV	33.8	31.4	6.3	33.8	-	37.7	53.9	16.2	Floor noise
Vert	7311.000	AV	33.3	35.7	7.2	33.9	-	42.3	53.9	11.6	Floor noise
Vert	9748.000	AV	33.0	38.2	8.3	34.5	-	45.0	53.9	8.9	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 $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Ise EMC Lab.

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	12079930H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.3	No.3
Date	December 8, 2017	December 18, 2017	December 20, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH	23 deg. C / 26 % RH
Engineer	Takafumi Noguchi	Yuta Moriya	Takafumi Noguchi
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(Below 1 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	53.316	QP	21.9	9.5	7.5	32.2	-	6.7	40.0	33.3	
Hori	67.539	QP	22.7	6.4	7.7	32.2	-	4.6	40.0	35.4	
Hori	95.915	QP	26.0	9.4	8.1	32.2	-	11.3	43.5	32.2	
Hori	249.998	QP	27.9	11.8	9.6	32.0	-	17.3	46.0	28.7	
Hori	470.083	QP	21.2	17.1	11.2	32.0	-	17.5	46.0	28.5	
Hori	845.726	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Hori	2483.500	PK	64.0	27.0	5.2	34.6	-	61.6	73.9	12.3	
Hori	3282.683	PK	46.7	28.2	5.7	34.3	-	46.3	73.9	27.6	
Hori	4924.000	PK	41.9	31.5	6.4	33.8	-	46.0	73.9	27.9	Floor noise
Hori	7386.000	PK	41.6	35.8	7.2	34.0	-	50.6	73.9	23.3	Floor noise
Hori	9848.000	PK	42.0	38.2	8.3	34.5	-	54.0	73.9	19.9	Floor noise
Hori	2483.500	AV	48.4	27.0	5.2	34.6	-	46.0	53.9	7.9	
Hori	3282.683	AV	39.5	28.2	5.7	34.3	-	39.1	53.9	14.8	
Hori	4924.000	AV	34.0	31.5	6.4	33.8	-	38.1	53.9	15.8	Floor noise
Hori	7386.000	AV	32.8	35.8	7.2	34.0	-	41.8	53.9	12.1	Floor noise
Hori	9848.000	AV	34.0	38.2	8.3	34.5	-	46.0	53.9	7.9	Floor noise
Vert	53.316	QP	28.7	9.5	7.5	32.2	-	13.5	40.0	26.5	
Vert	67.539	QP	29.1	6.4	7.7	32.2	-	11.0	40.0	29.0	
Vert	95.915	QP	26.0	9.4	8.1	32.2	-	11.3	43.5	32.2	
Vert	249.998	QP	32.1	11.8	9.6	32.0	-	21.5	46.0	24.5	
Vert	470.083	QP	21.2	17.1	11.2	32.0	-	17.5	46.0	28.5	
Vert	845.726	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Vert	2483.500	PK	63.8	27.0	5.2	34.6	-	61.4	73.9	12.5	
Vert	3282.683	PK	46.8	28.2	5.7	34.3	-	46.4	73.9	27.5	
Vert	4924.000	PK	41.8	31.5	6.4	33.8	-	45.9	73.9	28.0	Floor noise
Vert	7386.000	PK	41.7	35.8	7.2	34.0	-	50.7	73.9	23.2	Floor noise
Vert	9848.000	PK	42.0	38.2	8.3	34.5	-	54.0	73.9	19.9	Floor noise
Vert	2483.500	AV	48.4	27.0	5.2	34.6	-	46.0	53.9	7.9	
Vert	3282.683	AV	39.8	28.2	5.7	34.3	-	39.4	53.9	14.5	
Vert	4924.000	AV	33.8	31.5	6.4	33.8	-	37.9	53.9	16.0	Floor noise
Vert	7386.000	AV	32.8	35.8	7.2	34.0	-	41.8	53.9	12.1	Floor noise
Vert	9848.000	AV	34.0	38.2	8.3	34.5	-	46.0	53.9	7.9	Floor noise

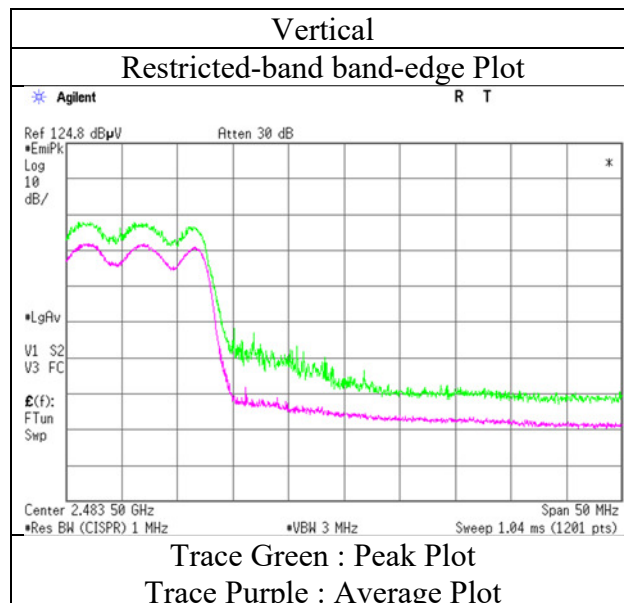
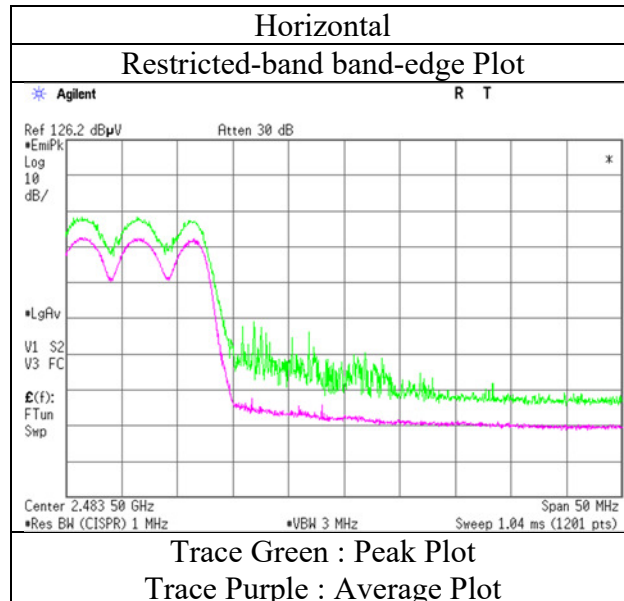
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*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 (3.75 m / 3.0 m) = 1.94 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission (Reference Plot for band-edge)

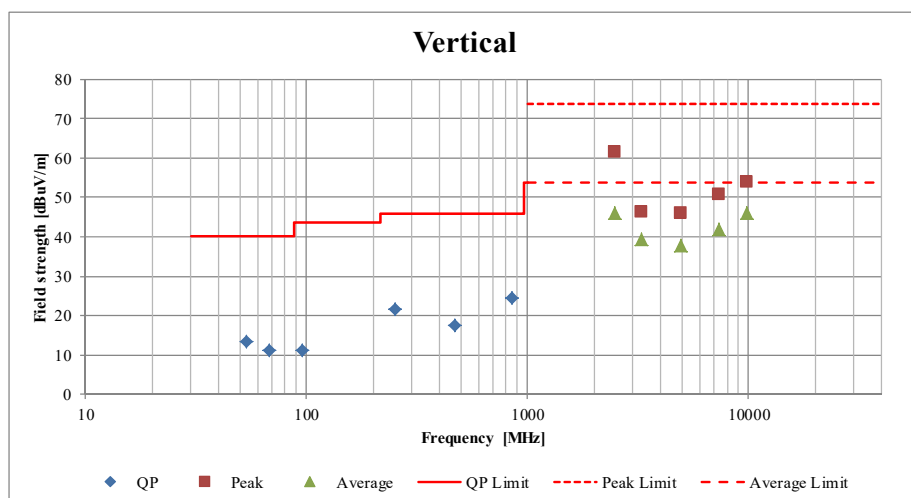
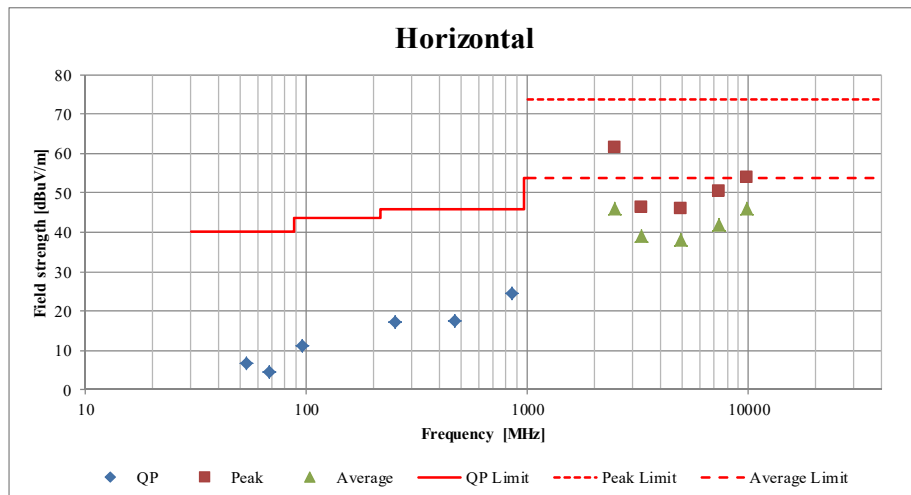
Report No.	12079930H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	December 8, 2017
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takafumi Noguchi
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 2462 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

Report No.	12079930H	No.2	No.3
Test place	Ise EMC Lab.	December 8, 2017	December 18, 2017
Semi Anechoic Chamber	No.2	December 8, 2017	December 20, 2017
Date	December 8, 2017	December 18, 2017	December 20, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH	23 deg. C / 26 % RH
Engineer	Takafumi Noguchi	Yuta Moriya	Takafumi Noguchi
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx 11n-20 2462 MHz		



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

Radiated Spurious Emission

Report No.	12079930H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.3	No.3
Date	December 9, 2017	December 18, 2017	December 20, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Yuta Moriya (10 GHz - 26.5 GHz)	Yuta Moriya (Below 1 GHz)
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	41.633	QP	23.1	13.6	7.3	32.2	-	11.8	40.0	28.2	
Hori	94.899	QP	25.6	9.3	8.1	32.2	-	10.8	43.5	32.7	
Hori	153.376	QP	22.4	15.1	8.8	32.1	-	14.2	43.5	29.3	
Hori	385.522	QP	22.4	15.4	10.6	32.0	-	16.4	46.0	29.6	
Hori	470.321	QP	21.3	17.1	11.2	32.0	-	17.6	46.0	28.4	
Hori	845.578	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Hori	2390.000	PK	54.1	27.0	5.1	34.6	-	51.6	73.9	22.3	
Hori	4804.000	PK	42.7	31.3	6.3	33.8	-	46.5	73.9	27.4	Floor noise
Hori	7206.000	PK	42.5	35.6	7.1	33.9	-	51.3	73.9	22.6	Floor noise
Hori	9608.000	PK	42.7	38.2	8.3	34.5	-	54.7	73.9	19.2	Floor noise
Hori	2390.000	AV	38.9	27.0	5.1	34.6	2.0	38.4	53.9	15.5	*1)
Hori	4804.000	AV	33.9	31.3	6.3	33.8	-	37.7	53.9	16.2	Floor noise
Hori	7206.000	AV	33.3	35.6	7.1	33.9	-	42.1	53.9	11.8	Floor noise
Hori	9608.000	AV	34.8	38.2	8.3	34.5	-	46.8	53.9	7.1	Floor noise
Vert	41.633	QP	23.0	13.6	7.3	32.2	-	11.7	40.0	28.3	
Vert	94.899	QP	25.2	9.3	8.1	32.2	-	10.4	43.5	33.1	
Vert	153.376	QP	22.3	15.1	8.8	32.1	-	14.1	43.5	29.4	
Vert	385.522	QP	22.1	15.4	10.6	32.0	-	16.1	46.0	29.9	
Vert	470.321	QP	21.2	17.1	11.2	32.0	-	17.5	46.0	28.5	
Vert	845.578	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Vert	2390.000	PK	53.9	27.0	5.1	34.6	-	51.4	73.9	22.5	
Vert	4804.000	PK	42.6	31.3	6.3	33.8	-	46.4	73.9	27.5	Floor noise
Vert	7206.000	PK	42.5	35.6	7.1	33.9	-	51.3	73.9	22.6	Floor noise
Vert	9608.000	PK	42.7	38.2	8.3	34.5	-	54.7	73.9	19.2	Floor noise
Vert	2390.000	AV	38.7	27.0	5.1	34.6	2.0	38.2	53.9	15.7	*1)
Vert	4804.000	AV	33.8	31.3	6.3	33.8	-	37.6	53.9	16.3	Floor noise
Vert	7206.000	AV	33.2	35.6	7.1	33.9	-	42.0	53.9	11.9	Floor noise
Vert	9608.000	AV	34.7	38.2	8.3	34.5	-	46.7	53.9	7.2	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 20log (3.75 m / 3.0 m) = 1.94 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	2402.000	PK	98.0	27.0	5.1	34.6	95.5	-	-	Carrier
Hori	2400.000	PK	52.7	27.0	5.1	34.6	50.2	75.5	25.3	
Vert	2402.000	PK	98.0	27.0	5.1	34.6	95.5	-	-	Carrier
Vert	2400.000	PK	52.7	27.0	5.1	34.6	50.2	75.5	25.3	

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

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Ise EMC Lab.

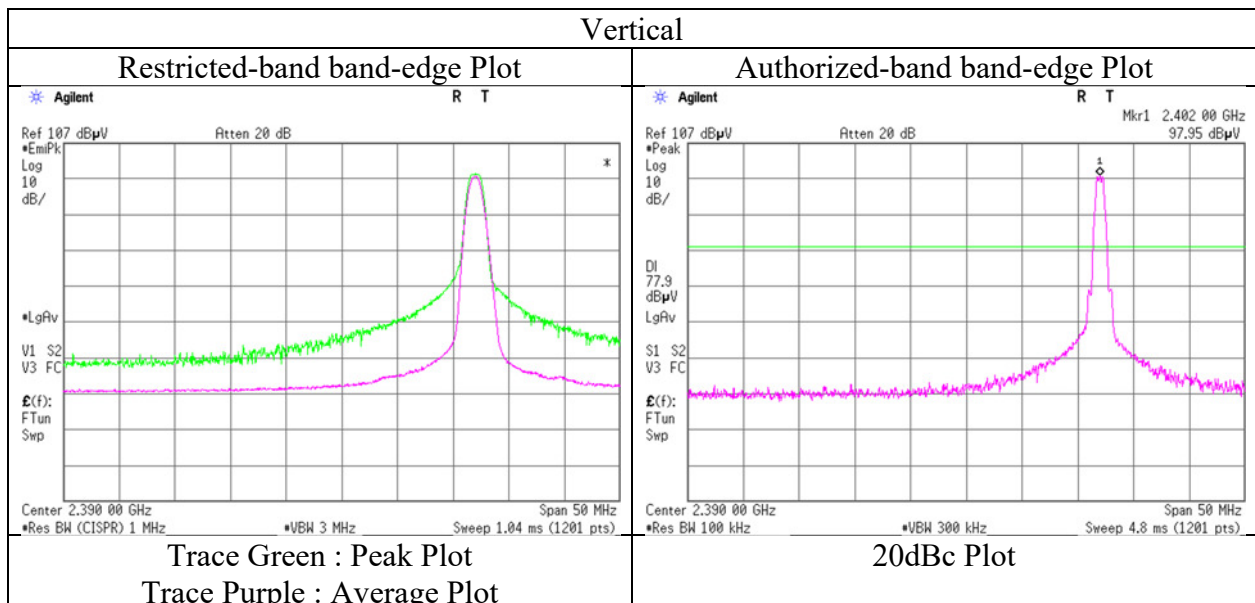
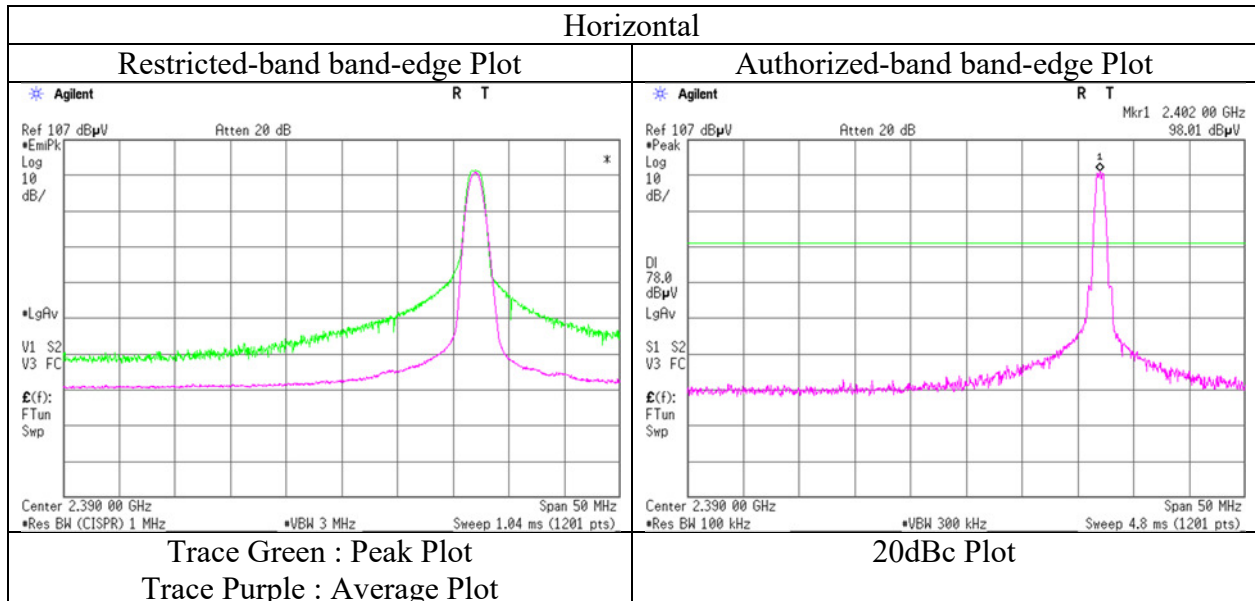
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12079930H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	December 9, 2017
Temperature / Humidity	21 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.

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Radiated Spurious Emission

Report No.	12079930H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.3	No.3
Date	December 9, 2017	December 18, 2017	December 20, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Yuta Moriya (10 GHz - 26.5 GHz)	Yuta Moriya (Below 1 GHz)
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	41.640	QP	23.2	13.6	7.3	32.2	-	11.9	40.0	28.1	
Hori	94.763	QP	25.8	9.2	8.1	32.2	-	10.9	43.5	32.6	
Hori	153.336	QP	22.2	15.1	8.8	32.1	-	14.0	43.5	29.5	
Hori	385.540	QP	22.4	15.4	10.6	32.0	-	16.4	46.0	29.6	
Hori	470.321	QP	21.2	17.1	11.2	32.0	-	17.5	46.0	28.5	
Hori	845.544	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Hori	4880.000	PK	43.0	31.4	6.3	33.8	-	46.9	73.9	27.0	Floor noise
Hori	7320.000	PK	41.6	35.8	7.2	33.9	-	50.7	73.9	23.2	Floor noise
Hori	9760.000	PK	41.7	38.2	8.3	34.5	-	53.7	73.9	20.2	Floor noise
Hori	4880.000	AV	33.8	31.4	6.3	33.8	-	37.7	53.9	16.2	Floor noise
Hori	7320.000	AV	32.9	35.8	7.2	33.9	-	42.0	53.9	11.9	Floor noise
Hori	9760.000	AV	32.9	38.2	8.3	34.5	-	44.9	53.9	9.0	Floor noise
Vert	41.640	QP	23.2	13.6	7.3	32.2	-	11.9	40.0	28.1	
Vert	94.763	QP	25.7	9.2	8.1	32.2	-	10.8	43.5	32.7	
Vert	153.336	QP	22.3	15.1	8.8	32.1	-	14.1	43.5	29.4	
Vert	385.540	QP	22.3	15.4	10.6	32.0	-	16.3	46.0	29.7	
Vert	470.321	QP	21.1	17.1	11.2	32.0	-	17.4	46.0	28.6	
Vert	845.544	QP	21.3	21.3	13.2	31.2	-	24.6	46.0	21.4	
Vert	4880.000	PK	43.1	31.4	6.3	33.8	-	47.0	73.9	26.9	Floor noise
Vert	7320.000	PK	41.7	35.8	7.2	33.9	-	50.8	73.9	23.1	Floor noise
Vert	9760.000	PK	41.7	38.2	8.3	34.5	-	53.7	73.9	20.2	Floor noise
Vert	4880.000	AV	33.9	31.4	6.3	33.8	-	37.8	53.9	16.1	Floor noise
Vert	7320.000	AV	33.0	35.8	7.2	33.9	-	42.1	53.9	11.8	Floor noise
Vert	9760.000	AV	32.9	38.2	8.3	34.5	-	44.9	53.9	9.0	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 (3.75 m / 3.0 m) = 1.94 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	12079930H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.3	No.3
Date	December 9, 2017	December 18, 2017	December 20, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi	Yuta Moriya	Yuta Moriya
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(Below 1 GHz)
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	41.642	QP	23.1	13.6	7.3	32.2	-	11.8	40.0	28.2	
Hori	94.763	QP	25.9	9.2	8.1	32.2	-	11.0	43.5	32.5	
Hori	153.335	QP	22.3	15.1	8.8	32.1	-	14.1	43.5	29.4	
Hori	385.542	QP	22.3	15.4	10.6	32.0	-	16.3	46.0	29.7	
Hori	470.333	QP	21.2	17.1	11.2	32.0	-	17.5	46.0	28.5	
Hori	845.534	QP	21.1	21.3	13.2	31.2	-	24.4	46.0	21.6	
Hori	2483.500	PK	63.5	27.0	5.2	34.6	-	61.1	73.9	12.8	
Hori	4960.000	PK	41.7	31.6	6.4	33.8	-	45.9	73.9	28.0	Floor noise
Hori	7440.000	PK	41.6	35.9	7.2	34.0	-	50.7	73.9	23.2	Floor noise
Hori	9920.000	PK	42.7	38.2	8.4	34.6	-	54.7	73.9	19.2	Floor noise
Hori	2483.500	AV	46.3	27.0	5.2	34.6	2.0	45.9	53.9	8.0	*1)
Hori	4960.000	AV	33.3	31.6	6.4	33.8	-	37.5	53.9	16.4	Floor noise
Hori	7440.000	AV	32.8	35.9	7.2	34.0	-	41.9	53.9	12.0	Floor noise
Hori	9920.000	AV	33.5	38.2	8.4	34.6	-	45.5	53.9	8.4	Floor noise
Vert	41.642	QP	23.3	13.6	7.3	32.2	-	12.0	40.0	28.0	
Vert	94.763	QP	26.0	9.2	8.1	32.2	-	11.1	43.5	32.4	
Vert	153.335	QP	22.4	15.1	8.8	32.1	-	14.2	43.5	29.3	
Vert	385.542	QP	22.3	15.4	10.6	32.0	-	16.3	46.0	29.7	
Vert	470.333	QP	21.2	17.1	11.2	32.0	-	17.5	46.0	28.5	
Vert	845.534	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Vert	2483.500	PK	63.1	27.0	5.2	34.6	-	60.7	73.9	13.2	
Vert	4960.000	PK	41.5	31.6	6.4	33.8	-	45.7	73.9	28.2	Floor noise
Vert	7440.000	PK	41.7	35.9	7.2	34.0	-	50.8	73.9	23.1	Floor noise
Vert	9920.000	PK	42.6	38.2	8.4	34.6	-	54.6	73.9	19.3	Floor noise
Vert	2483.500	AV	46.1	27.0	5.2	34.6	2.0	45.7	53.9	8.2	*1)
Vert	4960.000	AV	33.1	31.6	6.4	33.8	-	37.3	53.9	16.6	Floor noise
Vert	7440.000	AV	32.7	35.9	7.2	34.0	-	41.8	53.9	12.1	Floor noise
Vert	9920.000	AV	33.3	38.2	8.4	34.6	-	45.3	53.9	8.6	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).

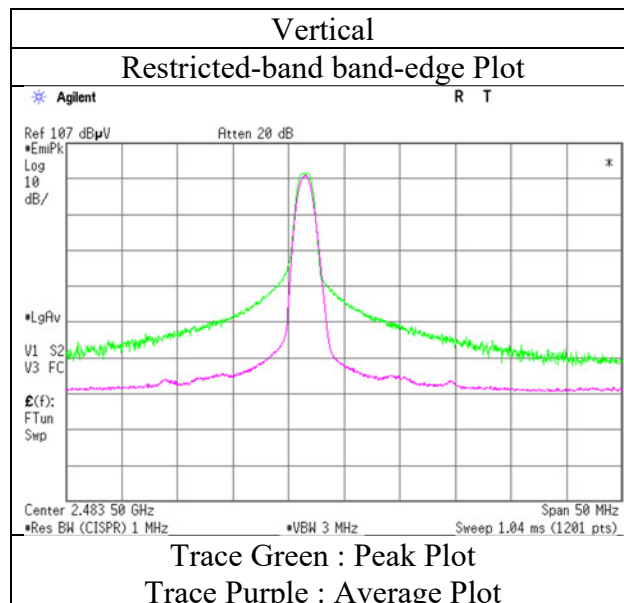
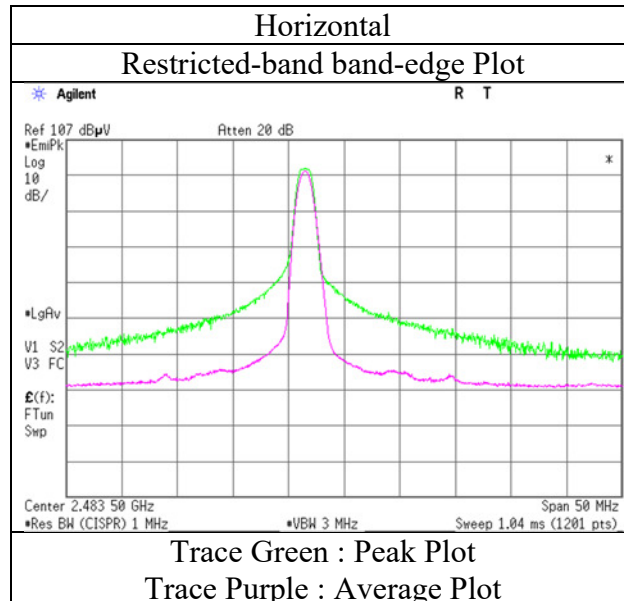
Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB

10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12079930H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	December 9, 2017
Temperature / Humidity	21 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.

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Ise EMC Lab.

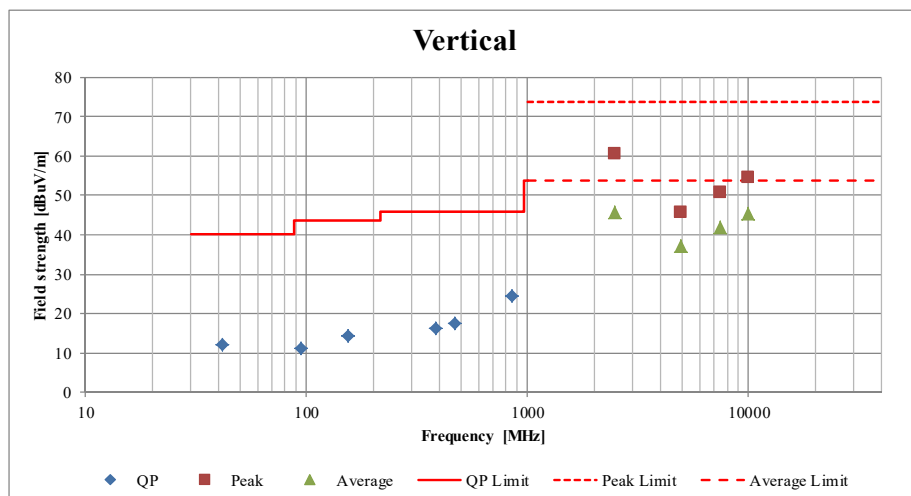
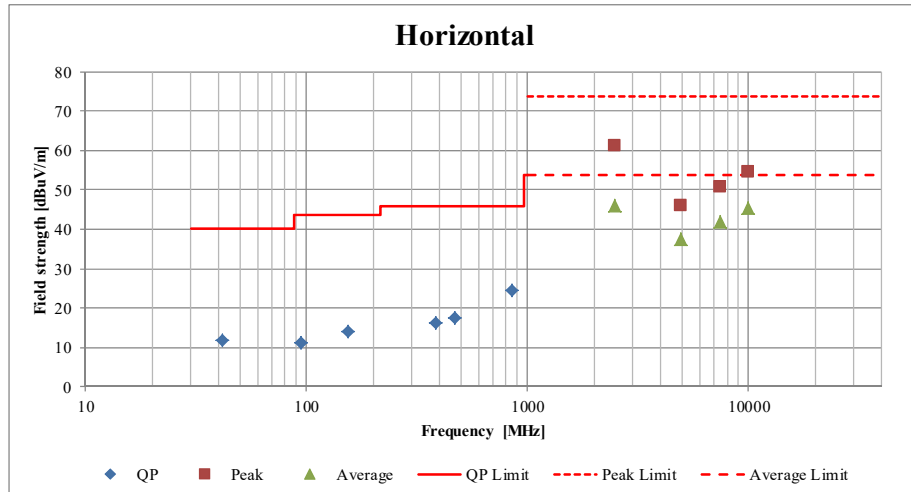
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12079930H	No.2	No.3
Test place	Ise EMC Lab.	December 9, 2017	December 18, 2017
Semi Anechoic Chamber	No.2	December 9, 2017	December 20, 2017
Date	December 9, 2017	December 18, 2017	December 20, 2017
Temperature / Humidity	21 deg. C / 30 % RH	21 deg. C / 33 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi	Yuta Moriya	Yuta Moriya
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2480 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.3 Semi Anechoic Chamber
Report No.	12079930H
Date	December 19, 2017
Temperature / Humidity	23 deg. C / 28 % RH
Engineer	Takafumi Noguchi
	(1 GHz -10 GHz)
Mode	Tx BT LE 2402 MHz and 11a 5180MHz

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	50.5	27.7	6.7	32.4	-	52.5	73.9	21.4	
Hori	2775.616	PK	49.8	28.5	7.0	32.3	-	53.0	73.9	20.9	
Hori	2390.000	AV	35.3	27.7	6.7	32.4	2.0	39.3	53.9	14.6	*1)
Hori	2775.616	AV	41.5	28.5	7.0	32.3	2.0	46.7	53.9	7.2	
Vert	2390.000	PK	50.0	27.7	6.7	32.4	-	52.0	73.9	21.9	
Vert	2775.616	PK	50.1	28.5	7.0	32.3	-	53.3	73.9	20.6	
Vert	2390.000	AV	34.9	27.7	6.7	32.4	2.0	38.9	53.9	15.0	*1)
Vert	2775.616	AV	41.7	28.5	7.0	32.3	2.0	46.9	53.9	7.0	

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

*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	2402.000	PK	94.3	27.7	6.8	32.4	96.4	-	-	Carrier
Hori	2400.000	PK	49.3	27.7	6.8	32.4	51.4	76.4	25.0	
Vert	2402.000	PK	93.8	27.7	6.8	32.4	95.9	-	-	Carrier
Vert	2400.000	PK	48.9	27.7	6.8	32.4	51.0	75.9	24.9	

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

Radiated Spurious Emission

Test place : Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 12079930H
Date : December 18, 2017 December 19, 2017 December 19, 2017 December 20, 2017
Temperature / Humidity : 23 deg. C / 28 % RH 22 deg. C / 31 % RH 23 deg. C / 28 % RH 23 deg. C / 26 % RH
Engineer : Takafumi Noguchi Yuta Moriya Takafumi Noguchi Takafumi Noguchi
: (10 GHz - 18 GHz) (18 GHz - 26.5 GHz) (1 GHz - 10 GHz) (Below 1 GHz)
Mode : Tx BT LE 2440 MHz and 11a 5180 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	53.316	QP	21.8	9.5	7.5	32.2	-	6.6	40.0	33.4	
Hori	67.539	QP	22.6	6.4	7.7	32.2	-	4.5	40.0	35.5	
Hori	95.915	QP	25.8	9.4	8.1	32.2	-	11.1	43.5	32.4	
Hori	249.998	QP	26.2	11.8	9.6	32.0	-	15.6	46.0	30.4	
Hori	470.338	QP	21.3	17.1	11.2	32.0	-	17.6	46.0	28.4	
Hori	845.928	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Hori	2737.538	PK	51.5	28.5	7.0	32.3	-	54.7	73.9	19.2	
Hori	4880.000	PK	40.1	31.9	8.0	31.4	-	48.6	73.9	25.3	Floor noise
Hori	7320.000	PK	40.3	36.2	8.9	32.2	-	53.2	73.9	20.7	Floor noise
Hori	9760.000	PK	41.2	38.7	10.1	33.0	-	57.0	73.9	16.9	Floor noise
Hori	2737.538	AV	43.3	28.5	7.0	32.3	2.0	48.5	53.9	5.4	
Hori	4880.000	AV	31.7	31.9	8.0	31.4	-	40.2	53.9	13.7	Floor noise
Hori	7320.000	AV	31.9	36.2	8.9	32.2	-	44.8	53.9	9.1	Floor noise
Hori	9760.000	AV	32.0	38.7	10.1	33.0	-	47.8	53.9	6.1	Floor noise
Vert	53.316	QP	28.8	9.5	7.5	32.2	-	13.6	40.0	26.4	
Vert	67.539	QP	29.4	6.4	7.7	32.2	-	11.3	40.0	28.7	
Vert	95.915	QP	24.9	9.4	8.1	32.2	-	10.2	43.5	33.3	
Vert	249.998	QP	31.3	11.8	9.6	32.0	-	20.7	46.0	25.3	
Vert	470.338	QP	21.3	17.1	11.2	32.0	-	17.6	46.0	28.4	
Vert	845.928	QP	21.2	21.3	13.2	31.2	-	24.5	46.0	21.5	
Vert	2737.538	PK	50.8	28.5	7.0	32.3	-	54.0	73.9	19.9	
Vert	4880.000	PK	40.1	31.9	8.0	31.4	-	48.6	73.9	25.3	Floor noise
Vert	7320.000	PK	40.5	36.2	8.9	32.2	-	53.4	73.9	20.5	Floor noise
Vert	9760.000	PK	41.2	38.7	10.1	33.0	-	57.0	73.9	16.9	Floor noise
Vert	2737.538	AV	42.5	28.5	7.0	32.3	2.0	47.7	53.9	6.2	
Vert	4880.000	AV	31.7	31.9	8.0	31.4	-	40.2	53.9	13.7	Floor noise
Vert	7320.000	AV	32.0	36.2	8.9	32.2	-	44.9	53.9	9.0	Floor noise
Vert	9760.000	AV	32.0	38.7	10.1	33.0	-	47.8	53.9	6.1	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. No.2 Semi Anechoic Chamber
Report No.	12079930H
Date	December 19, 2017
Temperature / Humidity	23 deg. C / 28 % RH
Engineer	Takafumi Noguchi
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz and 11a 5180 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	61.0	27.8	6.8	32.4	-	63.2	73.9	10.7	
Hori	2697.658	PK	50.9	28.4	6.9	32.3	-	53.9	73.9	20.0	
Hori	2483.500	AV	43.6	27.8	6.8	32.4	2.0	47.8	53.9	6.1	*1)
Hori	2697.658	AV	42.4	28.4	6.9	32.3	2.0	47.4	53.9	6.5	
Vert	2483.500	PK	59.9	27.8	6.8	32.4	-	62.1	73.9	11.8	
Vert	2697.658	PK	51.9	28.4	6.9	32.3	-	54.9	73.9	19.0	
Vert	2483.500	AV	42.7	27.8	6.8	32.4	2.0	46.9	53.9	7.0	*1)
Vert	2697.658	AV	43.0	28.4	6.9	32.3	2.0	48.0	53.9	5.9	

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).

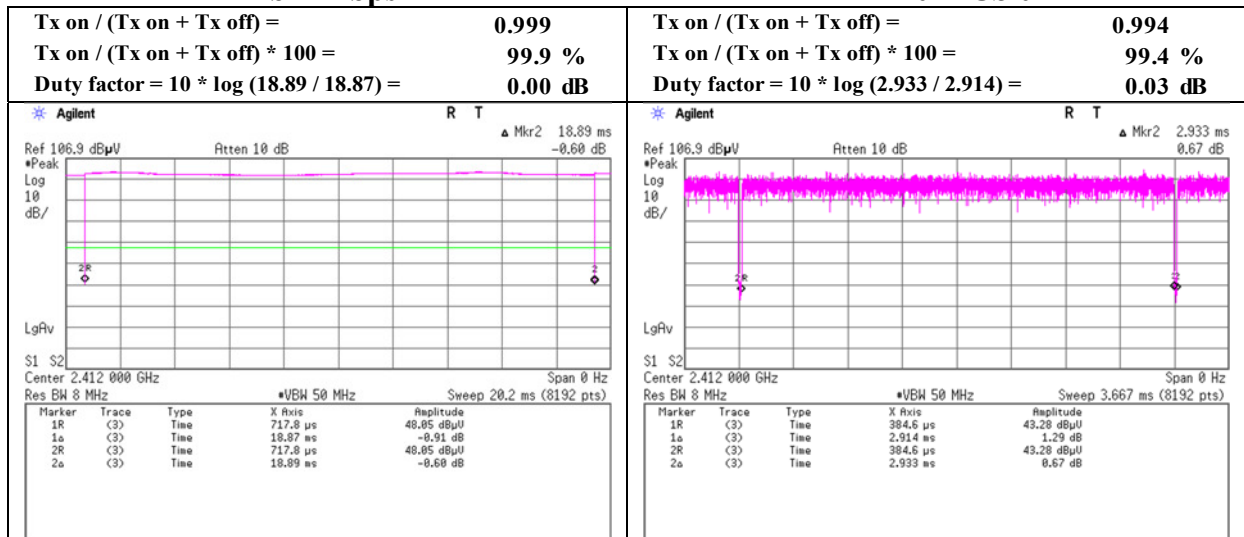
Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB

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

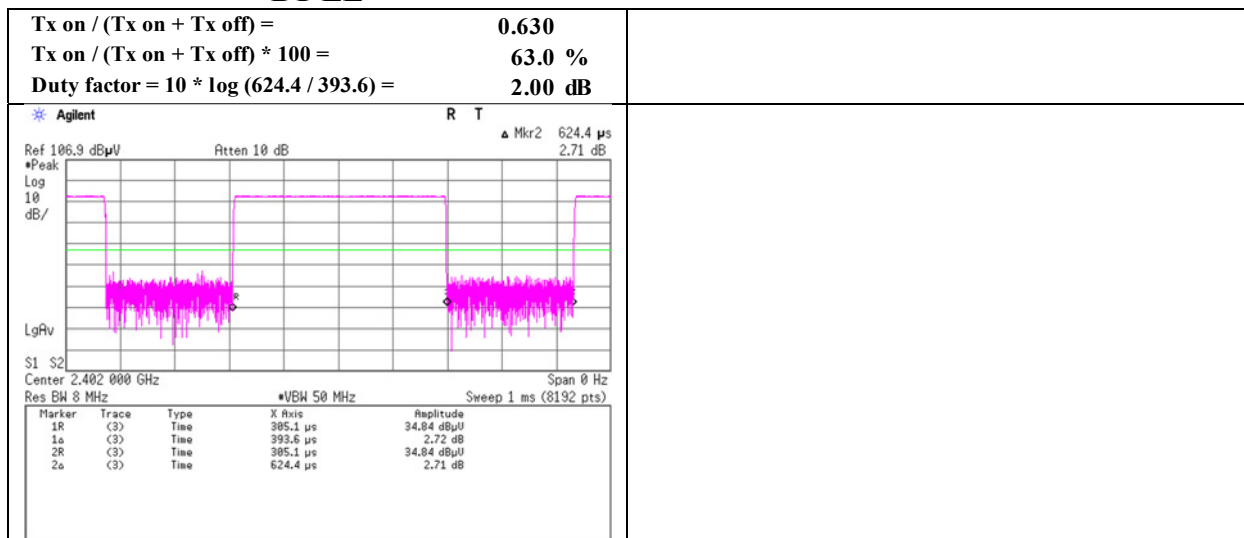
Burst rate confirmation

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	12079930H
Date	December 9, 2017
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takafumi Noguchi
Mode	Tx

11b 1 Mbps



BT LE



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2017/08/31 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/12/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2017/11/07 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2017/02/24 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2017/08/04 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2017/01/16 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2017/08/07 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2017/09/11 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2017/05/30 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2017/10/31 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2017/01/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2017/08/22 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2017/05/22 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2017/05/29 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2017/03/21 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2017/05/14 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2017/01/19 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2017/09/22 * 12
MCC-177	Microwave Cable	Junkosha	MMX221-00500D MSDMS	1502S304	RE	2017/03/13 * 12
MHF-22	High Pass Filter 7-20GHz	TOKIMEC	TF37NCCB	602	RE	2017/01/13 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2017/08/22 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2017/10/02 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2017/01/26 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2017/07/12 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2017/12/14 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 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 test

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