RADIO TEST REPORT

Test Report No. : 12745193H-A

Applicant	:	**DENSO CORPORATION**
Type of Equipment	:	**Telematics Control Unit**
Model No.	:	**OGAY17**
FCC ID	:	**HYQOGAY17**
Test regulation	:	**FCC Part 15 Subpart C: 2018**
Test Result	:	**Complied (Refer to SECTION 3.2)**

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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 covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. 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.
8. The information provided from the customer for this report is identified in SECTION 1.

Date of test: April 16 and 18, 2019

Representative test engineer:
Akihiko Maeda
Engineer
Consumer Technology Division

Approved by:
Satofumi Matsuyama
Engineer
Consumer Technology Division

NVLAP TESTING
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,
http://japan.ul.com/resources/emc_accredited/

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

REVISION HISTORY

Original Test Report No.: 12745193H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12745193H-A	May 14, 2019	-	-

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SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number	:	+81-566-61-3349
Facsimile Number	:	+81-566-25-4792
Contact Person	:	Kazuhiko Endo

The information provided from the customer is as follows;
- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment	:	Telematics Control Unit
Model No.	:	OGAY17
Serial No.	:	Refer to SECTION 4, SECTION 4.2
Rating	:	DC 13.2 V
Receipt Date of Sample (Information from test lab.)	:	April 10, 2019
Country of Mass-production	:	The United States of America
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

Model: OGAY17 (referred to as the EUT in this report) is a Telematics Control Unit.
This product is for voice and data communication via mobile telecommunication network for vehicle driver.

General Specification

Clock frequency(ies) in the system	:	CPU: 8 MHz NAD (Network access device): 19.2 MHz WLAN module: 48 MHz
Operating Temperature	:	-40 deg. C - +85 deg. C

Radio Specification

	WLAN		WWAN
	IEEE802.11b	IEEE802.11g/n	WCDMA / LTE
Radio type	Transceiver		Transceiver
Frequency of operation	2412 MHz - 2462 MHz		WCDMA Band 2 / LTE Band 2: Up Link: 1850 MHz - 1910 MHz Down Link: 1930 MHz - 1990 MHz WCDMA Band 5 / LTE Band 5: Up Link: 824 MHz - 849 MHz Down Link: 869 MHz - 894 MHz LTE Band 4: Up Link 1710 MHz - 1755 MHz Down Link: 2110 MHz - 2155 MHz LTE Band 12: Up Link 699 MHz - 716 MHz Down Link: 729 MHz - 746 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	PSK, QAM
Bandwidth	20 MHz		5 MHz (WCDMA) 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz (LTE Band 2, 4) 1.4 MHz, 3 MHz, 5 MHz, 10MHz (LTE Band 5, 12)
Channel spacing	5 MHz		200 kHz (WCDMA) 100 kHz (LTE)
Antenna type	L-type Antenna		
Antenna Connector type	-		-
Antenna Gain	1.94 dBi		-0.64 dBi (max.): 699 MHz - 716 MHz -0.42 dBi (max): 824 MHz - 849 MHz -0.07 dBi (max): 1710 MHz - 1755 MHz -0.75 dBi (max): 1850 MHz - 1910 MHz

	GNSS
	GPS
Radio type	Receiver
Frequency of operation	1575.42 MHz
Type of modulation	BPSK
Bandwidth	2.046 MHz
Channel spacing	-
Antenna type	L-type Antenna
Antenna Connector type	-
Antenna Gain	0.63 dBi (max.): 1575.42 MHz

* This test report was applied to WLAN part.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods	**FCC:** Section 15.207	-	N/A	*1)
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
6dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(a)(2)	See data.	Complied a)	Conducted
	IC: -	**IC:** RSS-247 5.2(a)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(b)(3)		Complied b)	Conducted
	IC: RSS-Gen 6.12	**IC:** RSS-247 5.4(d)			
Power Density	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(e)		Complied c)	Conducted
	IC: -	**IC:** RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	2.1 dB 2390.000 MHz, Horizontal, AV	Complied# d), e)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)
	IC: RSS-Gen 6.13	**IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.
*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6.
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)
b) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
c) Refer to APPENDIX 1 (data of Power Density)
d) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
e) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:
Complied The data of this test item has enough margin, more than the measurement uncertainty.
Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

FCC Part 15.31 (e)
This EUT provides the stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	RSS-Gen 6.7	IC: -	N/A	- a)	Conducted
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					
Symbols: Complied — The data of this test item has enough margin, more than the measurement uncertainty. Complied# — The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.					

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

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor *k*=2.
Ise EMC Lab.

Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.3 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.7 dB

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

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
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	3.1 x 5.0	-	-
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.

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

4.1 Operating Mode(s)

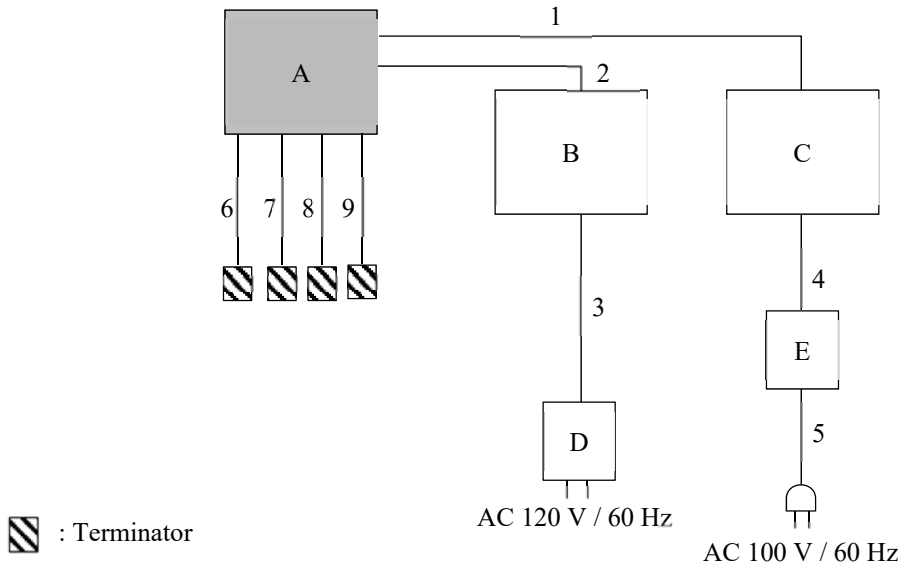
Test operating mode was determined as follows according to "Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - " of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	18 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 4, PN9
*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: 11b : 15dBm 11g : 12dBm 11n : 12dBm Software: WLAN.RMH.2.2 *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)

Test Item	Operating Mode	Tested frequency
Spurious Emission (Radiated)	11b Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
Spurious Emission (Conducted)	11b Tx	2412 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz

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	Telematics Control Unit	OGAY17	355468090008004 for *1) 355468090007972 for *2)	DENSO CORPORATION	EUT
B	Hi-bench	-	-	-	-
C	laptop PC	LATITUDE E7240	5KXBN12	DELL	-
D	AC Adapter	GF18-US1215T	HG2-073	GO FORWARD ENTERPRISE CORP.	-
E	AC Adapter	DA65NM111-00	CN-0KC6JM-48661-42N-0509-A01	DELL	-

*1) Used for Antenna Terminal conducted test
*2) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	Signal + DC Cable	0.3	Unshielded	Unshielded	-
3	DC Cable	1.6	Unshielded	Unshielded	-
4	DC Cable	1.8	Unshielded	Unshielded	-
5	AC Cable	0.9	Unshielded	Unshielded	-
6	Signal Cable	0.3	Unshielded	Unshielded	-
7	Signal Cable	0.3	Unshielded	Unshielded	-
8	Signal Cable	0.3	Unshielded	Unshielded	-
9	Signal Cable	0.3	Unshielded	Unshielded	-

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r02".

[For below 1 GHz]
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 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).
Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.
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.

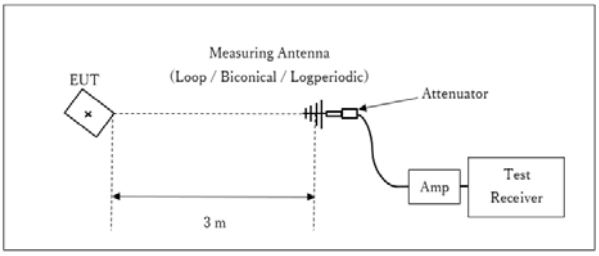
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

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	11.12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces 11.12.2.5.2 The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results.	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on ANSI C63.10-2013.

Figure 2: Test Setup

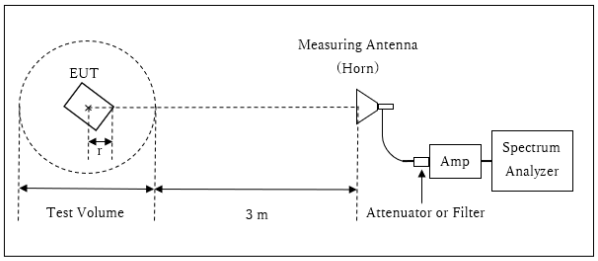
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



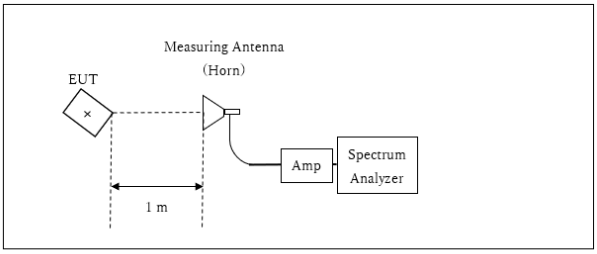
r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (4.5 m / 3.0 m) = 3.52 dB
* Test Distance: (3 + Test Volume /2) - r = 4.5 m

Test Volume : 3.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.0 m

* The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.

10 GHz - 26.5 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.5 dB
*Test Distance: 1 m

- 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 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	20 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 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".
*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.
The equipment and cables were not used for factor 0 dB of the data sheets.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

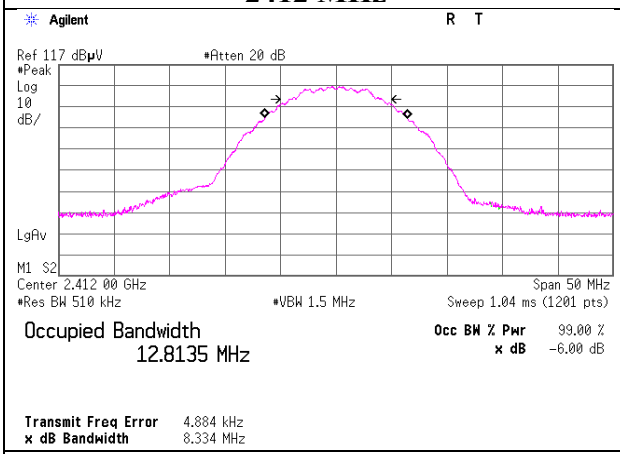
Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	12813.5	8.390	> 0.5000
	2437	12783.2	8.379	> 0.5000
	2462	12763.8	8.069	> 0.5000
11g	2412	16668.5	16.071	> 0.5000
	2437	16631.3	15.466	> 0.5000
	2462	16686.9	15.792	> 0.5000
11n-20	2412	18286.6	17.740	> 0.5000
	2437	18247.2	17.732	> 0.5000
	2462	18266.1	17.724	> 0.5000

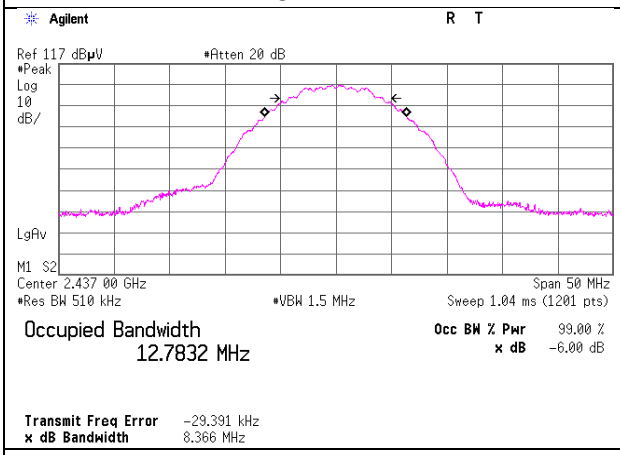
99%Occupied Bandwidth

11b

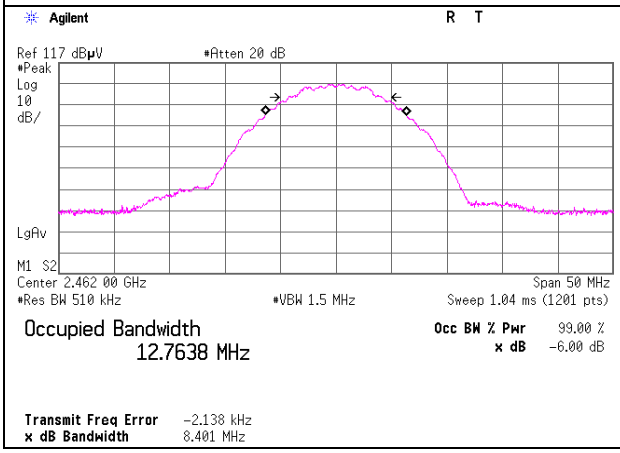
2412 MHz



2437 MHz

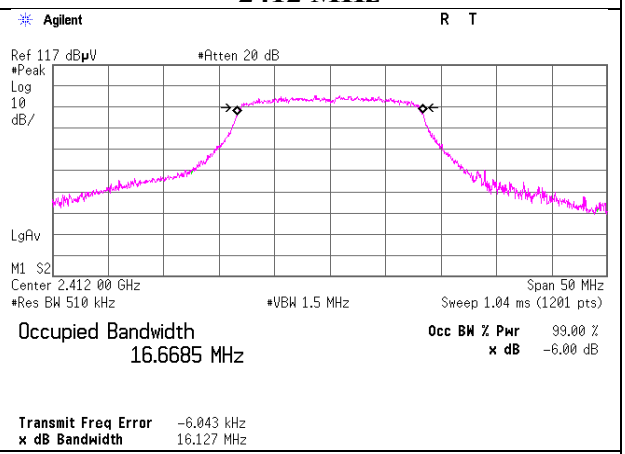


2462 MHz

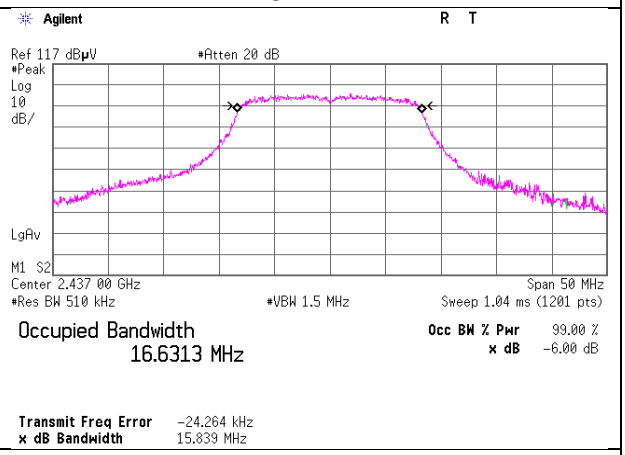


11g

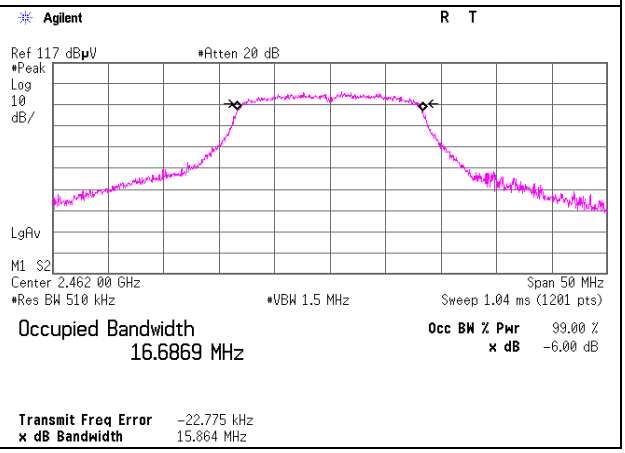
2412 MHz



2437 MHz



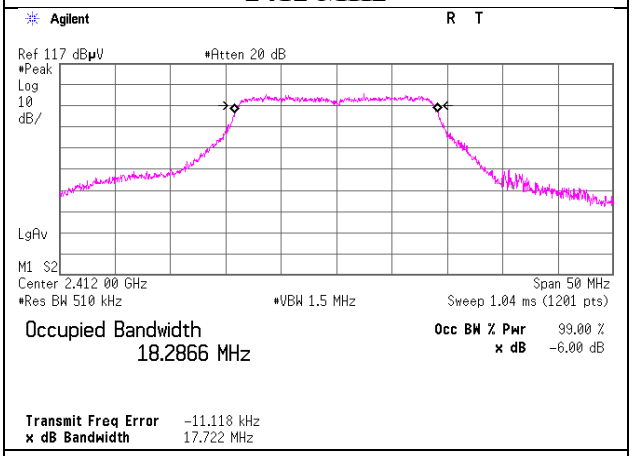
2462 MHz



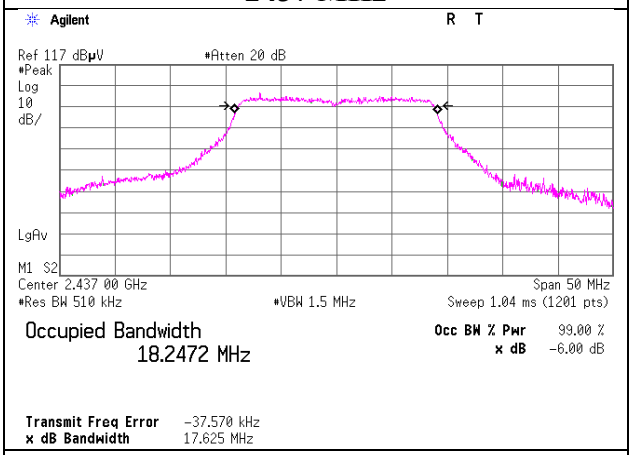
99% Occupied Bandwidth

11n-20

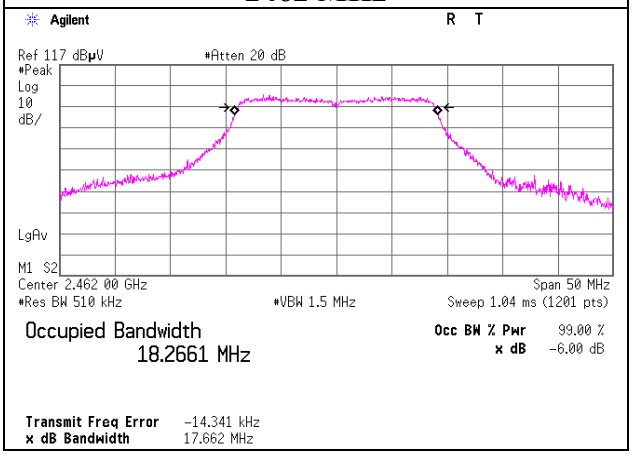
2412 MHz



2437 MHz



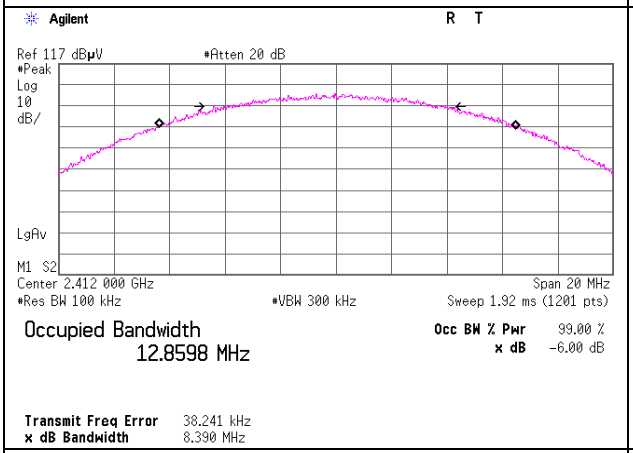
2462 MHz



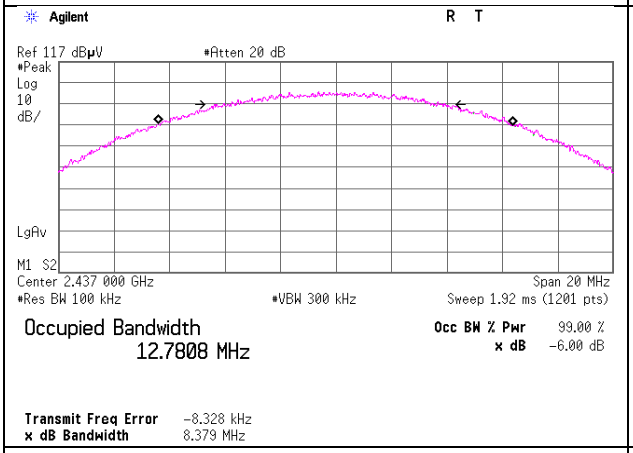
6dB Bandwidth

11b

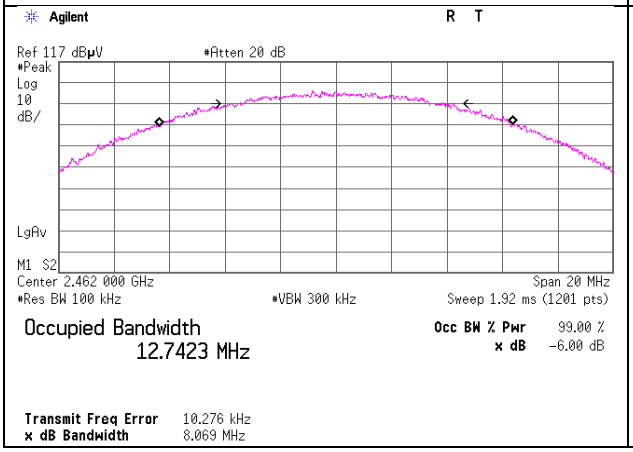
2412 MHz



2437 MHz

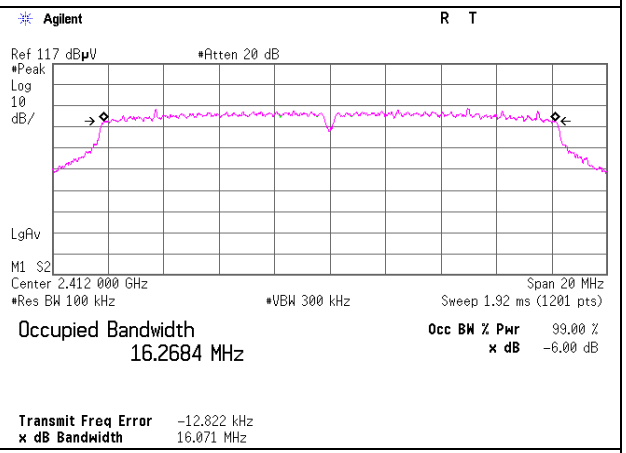


2462 MHz

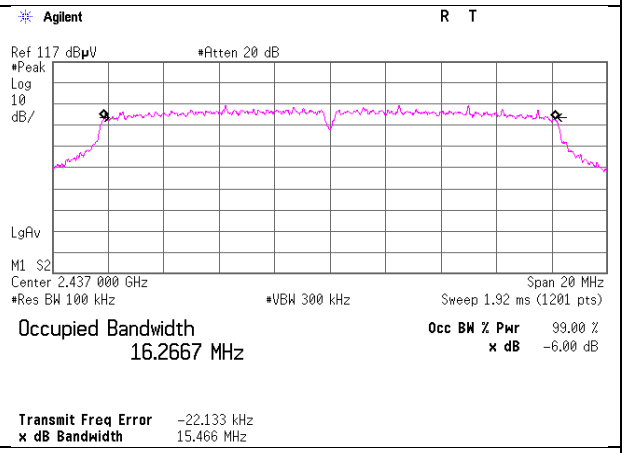


11g

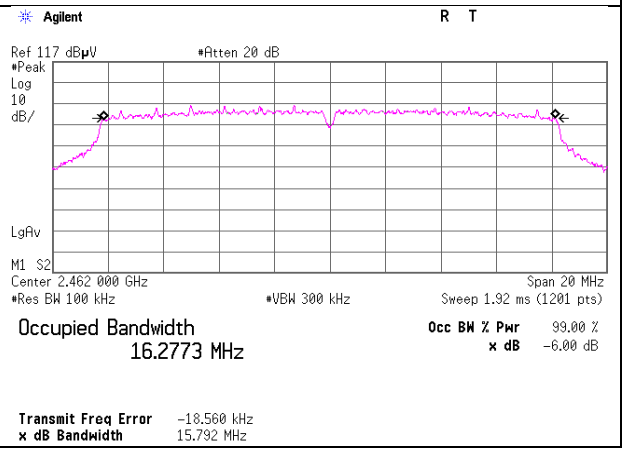
2412 MHz



2437 MHz



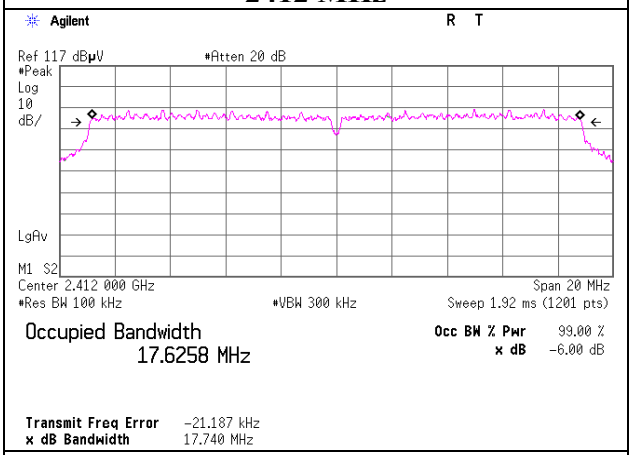
2462 MHz



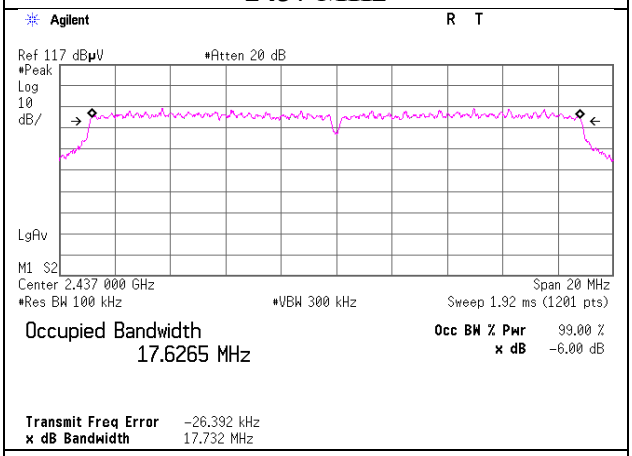
6dB Bandwidth

11n-20

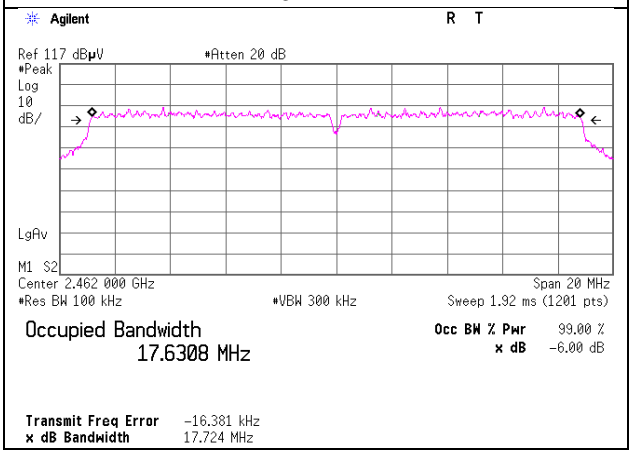
2412 MHz



2437 MHz



2462 MHz



Maximum Peak Output Power

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx 11b

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	6.02	1.03	10.06	17.11	51.40	30.00	1000	12.89	1.94	19.05	80.35	36.02	4000	16.97
2437	6.15	1.04	10.06	17.25	53.09	30.00	1000	12.75	1.94	19.19	82.99	36.02	4000	16.83
2462	6.12	1.04	10.06	17.22	52.72	30.00	1000	12.78	1.94	19.16	82.41	36.02	4000	16.86

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain
*The equipment and cables were not used for factor 0 dB of the data sheets.

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
1	5.82	
2	5.80	
5.5	5.80	
11	6.15	*

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.

Maximum Peak Output Power

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx 11g

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	10.30	1.03	10.06	21.39	137.72	30.00	1000	8.61	1.94	23.33	215.28	36.02	4000	12.69
2437	10.59	1.04	10.06	21.69	147.57	30.00	1000	8.31	1.94	23.63	230.67	36.02	4000	12.39
2462	10.73	1.04	10.06	21.83	152.41	30.00	1000	8.17	1.94	23.77	238.23	36.02	4000	12.25

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain
*The equipment and cables were not used for factor 0 dB of the data sheets.

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	10.16	
9	10.15	
12	10.25	
18	10.59	*
24	10.44	
36	10.35	
48	10.55	
54	10.29	

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.

Maximum Peak Output Power

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx 11n-20

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	10.41	1.03	10.06	21.50	141.25	30.00	1000	8.50	1.94	23.44	220.80	36.02	4000	12.58
2437	10.77	1.04	10.06	21.87	153.82	30.00	1000	8.13	1.94	23.81	240.44	36.02	4000	12.21
2462	10.64	1.04	10.06	21.74	149.28	30.00	1000	8.26	1.94	23.68	233.35	36.02	4000	12.34

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain
*The equipment and cables were not used for factor 0 dB of the data sheets.

2437 MHz

Rate [MCS]	Reading [dBm]	Remark
0	10.60	
1	10.29	
2	10.36	
3	10.21	
4	10.77	*
5	10.18	
6	10.45	
7	10.33	

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.

Average Output Power
(Reference data for RF Exposure)

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx

11b **1 Mbps**

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2412	3.22	1.03	10.06	14.31	26.98	0.00	14.31	26.98
2437	3.25	1.04	10.06	14.35	27.23	0.00	14.35	27.23
2462	3.28	1.04	10.06	14.38	27.42	0.00	14.38	27.42

11g **6 Mbps**

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2412	0.29	1.03	10.06	11.38	13.74	0.02	11.40	13.80
2437	0.43	1.04	10.06	11.53	14.22	0.02	11.55	14.29
2462	0.38	1.04	10.06	11.48	14.06	0.02	11.50	14.13

11n-20 **MCS 0**

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2412	0.17	1.03	10.06	11.26	13.37	0.04	11.30	13.49
2437	0.27	1.04	10.06	11.37	13.71	0.04	11.41	13.84
2462	0.22	1.04	10.06	11.32	13.55	0.04	11.36	13.68

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

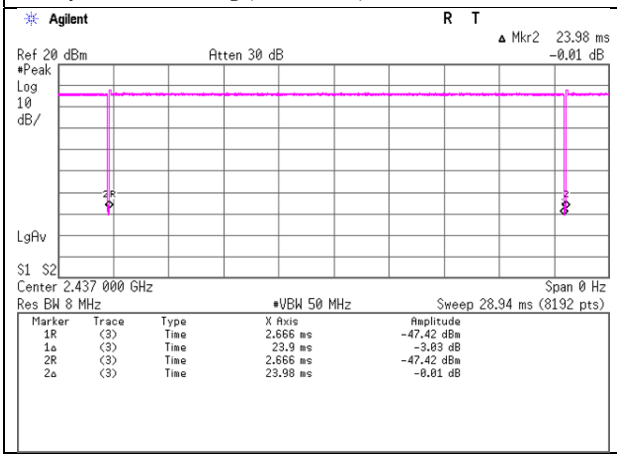
The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.

Burst rate confirmation

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx

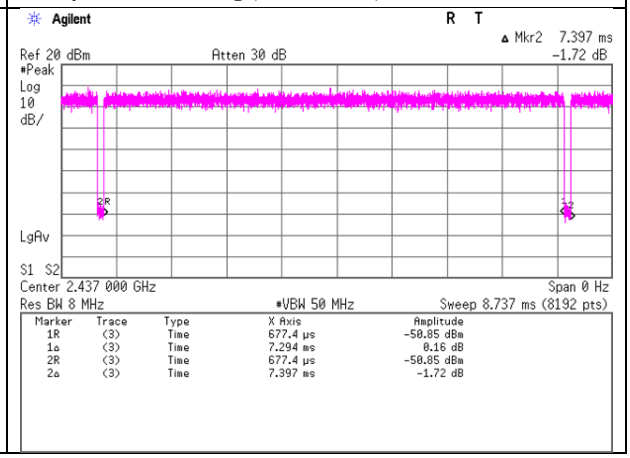
11b 11 Mbps

Tx on / (Tx on + Tx off) =	**0.997**
Tx on / (Tx on + Tx off) * 100 =	**99.7 %**
Duty factor = 10 * log (23.98 / 23.9) =	**0.01 dB**



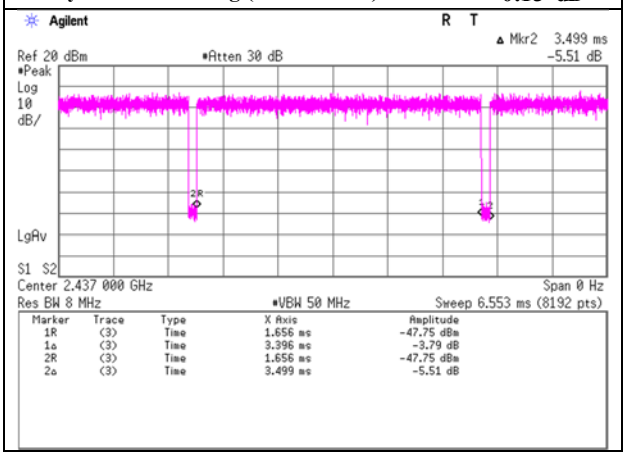
11g 18 Mbps

Tx on / (Tx on + Tx off) =	**0.986**
Tx on / (Tx on + Tx off) * 100 =	**98.6 %**
Duty factor = 10 * log (7.397 / 7.294) =	**0.06 dB**



11n-20 MCS 4

Tx on / (Tx on + Tx off) =	**0.971**
Tx on / (Tx on + Tx off) * 100 =	**97.1 %**
Duty factor = 10 * log (3.499 / 3.396) =	**0.13 dB**



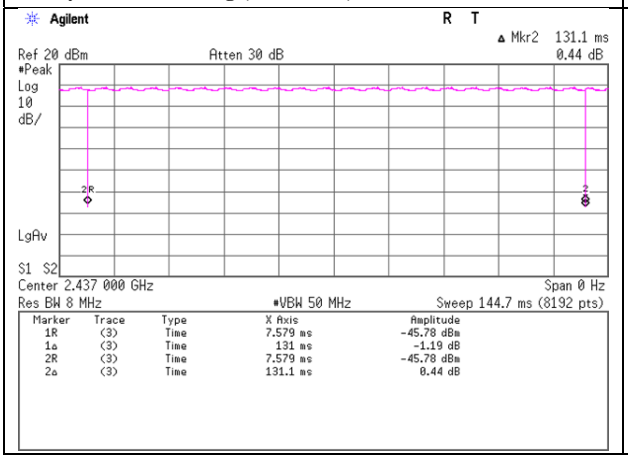
* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Burst rate confirmation

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx

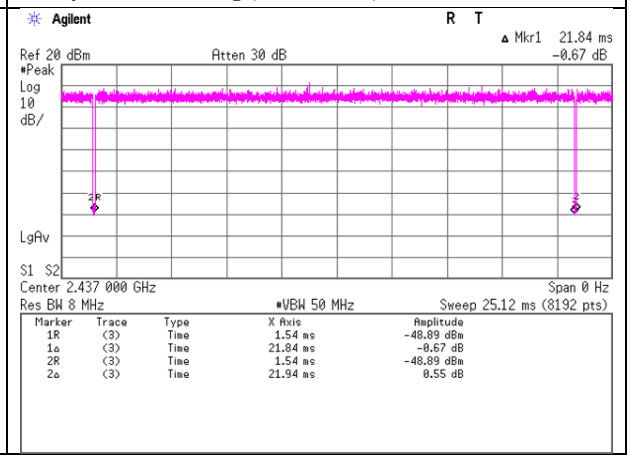
11b 1 Mbps

Tx on / (Tx on + Tx off) =	0.999
Tx on / (Tx on + Tx off) * 100 =	99.9 %
Duty factor = 10 * log (131.1 / 131) =	0.00 dB



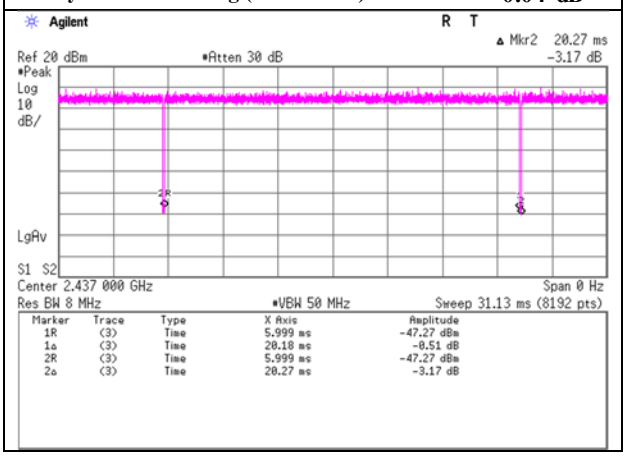
11g 6 Mbps

Tx on / (Tx on + Tx off) =	0.995
Tx on / (Tx on + Tx off) * 100 =	99.5 %
Duty factor = 10 * log (21.94 / 21.84) =	0.02 dB



11n-20 MCS 0

Tx on / (Tx on + Tx off) =	0.992
Tx on / (Tx on + Tx off) * 100 =	99.2 %
Duty factor = 10 * log (20.27 / 20.1) =	0.04 dB



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Report No.	12745193H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	April 18, 2019	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Akihiko Maeda (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	47.0	27.8	6.6	32.8	-	48.6	73.9	25.3	
Hori.	4824.000	PK	41.1	31.7	8.7	31.8	-	49.7	73.9	24.2	Floor noise
Hori.	7236.000	PK	43.1	35.9	9.9	32.7	-	56.2	73.9	17.7	Floor noise
Hori.	9648.000	PK	43.7	38.7	10.5	33.3	-	59.6	73.9	14.3	Floor noise
Hori.	2390.000	AV	38.0	27.8	6.6	32.8	-	39.6	53.9	14.3	
Hori.	4824.000	AV	30.2	31.7	8.7	31.8	-	38.8	53.9	15.1	Floor noise
Hori.	7236.000	AV	30.8	35.9	9.9	32.7	-	43.9	53.9	10.0	Floor noise
Hori.	9648.000	AV	31.2	38.7	10.5	33.3	-	47.1	53.9	6.8	Floor noise
Vert.	2390.000	PK	45.2	27.8	6.6	32.8	-	46.9	73.9	27.0	
Vert.	4824.000	PK	41.0	31.7	8.7	31.8	-	49.6	73.9	24.3	Floor noise
Vert.	7236.000	PK	43.1	35.9	9.9	32.7	-	56.2	73.9	17.7	Floor noise
Vert.	9648.000	PK	43.4	38.7	10.5	33.3	-	59.3	73.9	14.6	Floor noise
Vert.	2390.000	AV	37.2	27.8	6.6	32.8	-	38.8	53.9	15.1	
Vert.	4824.000	AV	30.1	31.7	8.7	31.8	-	38.7	53.9	15.2	Floor noise
Vert.	7236.000	AV	31.0	35.9	9.9	32.7	-	44.1	53.9	9.8	Floor noise
Vert.	9648.000	AV	31.2	38.7	10.5	33.3	-	47.1	53.9	6.8	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 (4.5 m / 3.0 m) = 3.52 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

20dBc Data Sheet

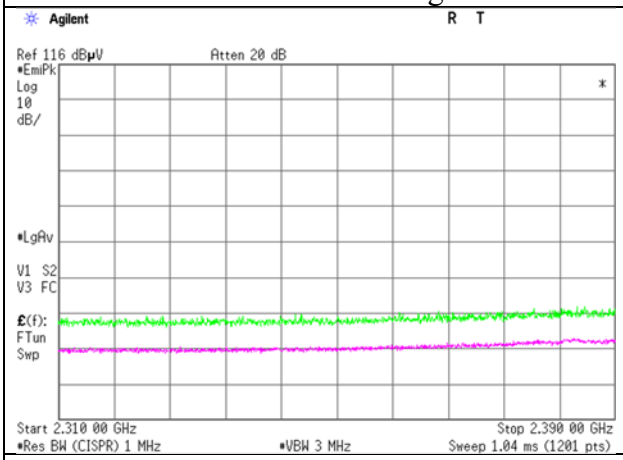
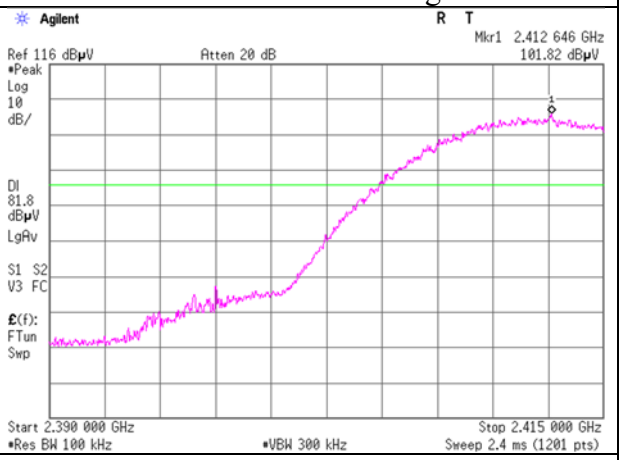
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	101.8	27.7	6.6	32.7	103.3	-	-	Carrier
Hori.	2400.000	PK	52.1	27.8	6.6	32.7	53.7	83.3	29.6	
Vert.	2412.000	PK	100.9	27.7	6.6	32.7	102.4	-	-	Carrier
Vert.	2400.000	PK	50.1	27.8	6.6	32.7	51.7	82.4	30.7	

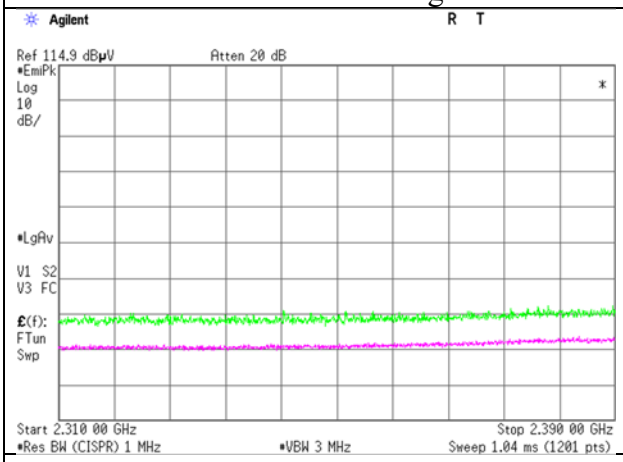
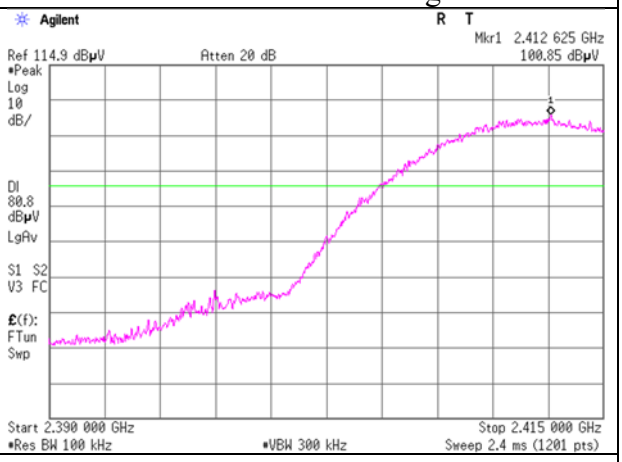
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.52 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12745193H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)
Mode	Tx 11b 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12745193H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	April 18, 2019	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Akihiko Maeda (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	41.1	31.7	8.7	31.8	-	49.8	73.9	24.1	Floor noise
Hori.	7311.000	PK	42.0	36.3	9.9	32.7	-	55.5	73.9	18.4	Floor noise
Hori.	9748.000	PK	42.1	39.0	10.5	33.4	-	58.2	73.9	15.7	Floor noise
Hori.	4874.000	AV	30.3	31.7	8.7	31.8	-	38.9	53.9	15.0	Floor noise
Hori.	7311.000	AV	30.7	36.3	9.9	32.7	-	44.2	53.9	9.7	Floor noise
Hori.	9748.000	AV	31.4	39.0	10.5	33.4	-	47.5	53.9	6.4	Floor noise
Vert.	4874.000	PK	41.0	31.7	8.7	31.8	-	49.6	73.9	24.3	Floor noise
Vert.	7311.000	PK	41.7	36.3	9.9	32.7	-	55.2	73.9	18.7	Floor noise
Vert.	9748.000	PK	42.5	39.0	10.5	33.4	-	58.7	73.9	15.2	Floor noise
Vert.	4874.000	AV	30.2	31.7	8.7	31.8	-	38.8	53.9	15.1	Floor noise
Vert.	7311.000	AV	30.9	36.3	9.9	32.7	-	44.4	53.9	9.5	Floor noise
Vert.	9748.000	AV	31.3	39.0	10.5	33.4	-	47.4	53.9	6.5	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 (4.5 m / 3.0 m) = 3.52 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	12745193H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	April 18, 2019	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Akihiko Maeda (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	50.6	27.5	6.6	32.7	-	52.0	73.9	21.9	
Hori.	4924.000	PK	40.5	31.8	8.7	31.8	-	49.2	73.9	24.7	Floor noise
Hori.	7386.000	PK	41.8	36.7	9.9	32.7	-	55.7	73.9	18.2	Floor noise
Hori.	9848.000	PK	42.3	39.1	10.4	33.4	-	58.4	73.9	15.5	Floor noise
Hori.	2483.500	AV	43.0	27.5	6.6	32.7	-	44.4	53.9	9.5	
Hori.	4924.000	AV	30.0	31.8	8.7	31.8	-	38.7	53.9	15.2	Floor noise
Hori.	7386.000	AV	31.0	36.7	9.9	32.7	-	44.9	53.9	9.1	Floor noise
Hori.	9848.000	AV	31.4	39.1	10.4	33.4	-	47.6	53.9	6.3	Floor noise
Vert.	2483.500	PK	51.6	27.5	6.6	32.7	-	53.0	73.9	20.9	
Vert.	4924.000	PK	40.9	31.8	8.7	31.8	-	49.6	73.9	24.3	Floor noise
Vert.	7386.000	PK	42.2	36.7	9.9	32.7	-	56.1	73.9	17.8	Floor noise
Vert.	9848.000	PK	42.5	39.1	10.4	33.4	-	58.6	73.9	15.3	Floor noise
Vert.	2483.500	AV	42.8	27.5	6.6	32.7	-	44.2	53.9	9.7	
Vert.	4924.000	AV	30.1	31.8	8.7	31.8	-	38.8	53.9	15.1	Floor noise
Vert.	7386.000	AV	30.8	36.7	9.9	32.7	-	44.7	53.9	9.2	Floor noise
Vert.	9848.000	AV	31.4	39.1	10.4	33.4	-	47.5	53.9	6.4	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).

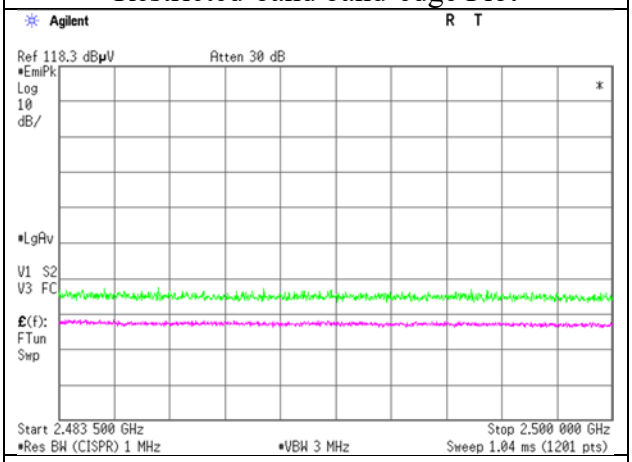
Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.52 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12745193H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)
Mode	Tx 11b 2462 MHz

Horizontal

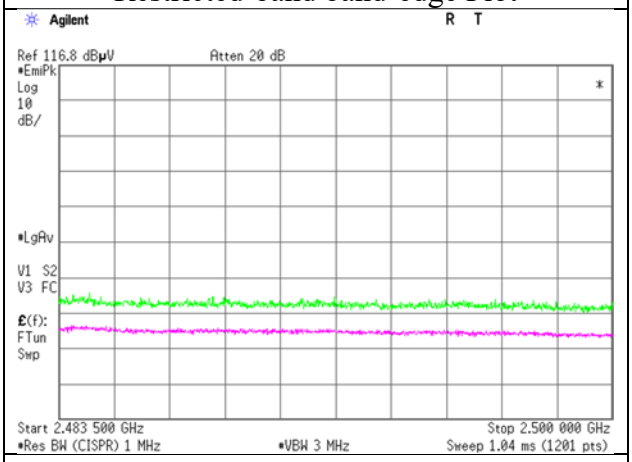
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12745193H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	April 18, 2019	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Akihiko Maeda (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	61.6	27.8	6.6	32.8	-	63.2	73.9	10.7	
Hori.	4824.000	PK	41.0	31.7	8.7	31.8	-	49.6	73.9	24.3	Floor noise
Hori.	7236.000	PK	42.9	35.9	9.9	32.7	-	56.0	73.9	17.9	Floor noise
Hori.	9648.000	PK	43.7	38.7	10.5	33.3	-	59.5	73.9	14.4	Floor noise
Hori.	2390.000	AV	50.1	27.8	6.6	32.8	0.1	51.8	53.9	2.1	*1)
Hori.	4824.000	AV	30.3	31.7	8.7	31.8	-	38.8	53.9	15.1	Floor noise
Hori.	7236.000	AV	30.9	35.9	9.9	32.7	-	44.0	53.9	9.9	Floor noise
Hori.	9648.000	AV	31.6	38.7	10.5	33.3	-	47.5	53.9	6.4	Floor noise
Vert.	2390.000	PK	59.6	27.8	6.6	32.8	-	61.2	73.9	12.7	
Vert.	4824.000	PK	41.2	31.7	8.7	31.8	-	49.7	73.9	24.2	Floor noise
Vert.	7236.000	PK	41.7	35.9	9.9	32.7	-	54.9	73.9	19.1	Floor noise
Vert.	9648.000	PK	42.6	38.7	10.5	33.3	-	58.4	73.9	15.5	Floor noise
Vert.	2390.000	AV	48.7	27.8	6.6	32.8	0.1	50.4	53.9	3.5	*1)
Vert.	4824.000	AV	30.5	31.7	8.7	31.8	-	39.0	53.9	14.9	Floor noise
Vert.	7236.000	AV	30.9	35.9	9.9	32.7	-	44.1	53.9	9.9	Floor noise
Vert.	9648.000	AV	31.1	38.7	10.5	33.3	-	46.9	53.9	7.0	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) = 3.52 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

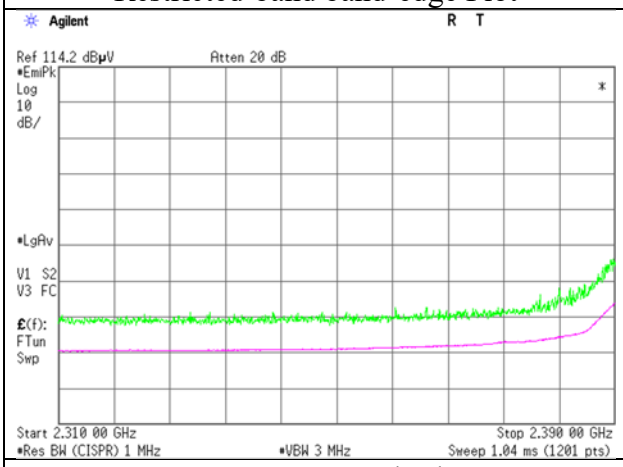
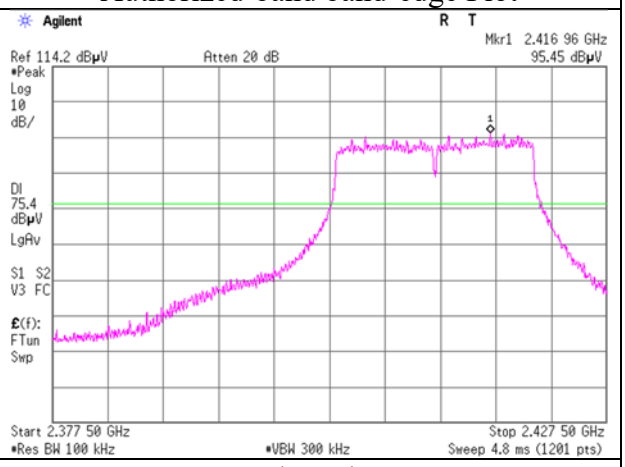
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	95.5	27.7	6.6	32.7	97.0	-	-	Carrier
Hori.	2400.000	PK	62.4	27.8	6.6	32.7	64.0	77.0	13.0	
Vert.	2412.000	PK	93.6	27.7	6.6	32.7	95.1	-	-	Carrier
Vert.	2400.000	PK	61.1	27.8	6.6	32.7	62.7	75.1	12.4	

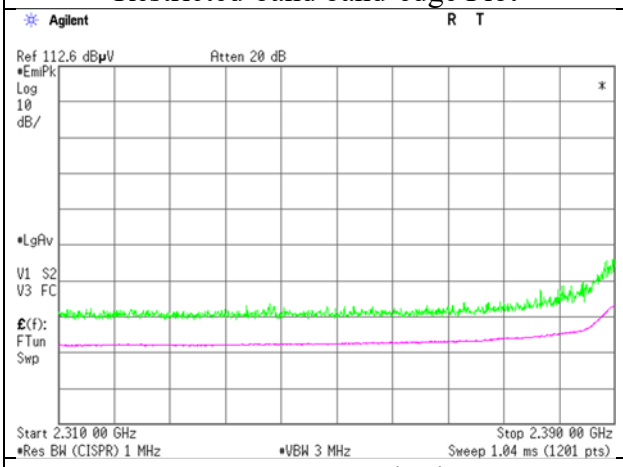
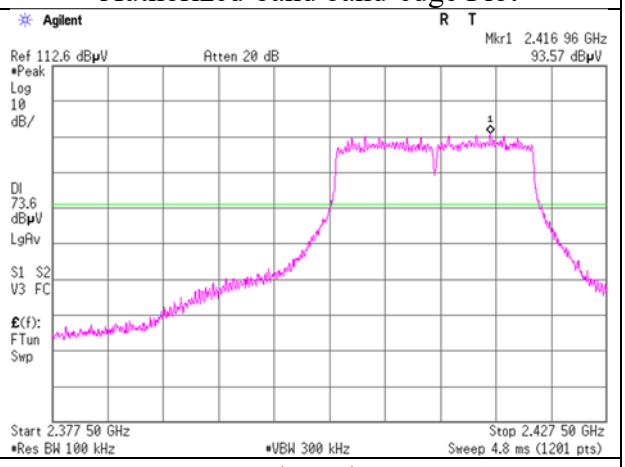
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.52 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12745193H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)
Mode	Tx 11n-20 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12745193H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	April 18, 2019	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Akihiko Maeda (10 GHz - 26.5 GHz) (Blow 1 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.	84.276	QP	37.8	7.5	8.0	32.2	-	21.1	40.0	18.9	
Hori.	120.635	QP	31.8	12.9	8.4	32.1	-	21.1	43.5	22.5	
Hori.	229.376	QP	37.9	11.3	9.5	32.0	-	26.7	46.0	19.3	
Hori.	242.072	QP	36.8	11.6	9.6	32.0	-	26.0	46.0	20.0	
Hori.	268.311	QP	40.1	12.6	9.8	32.0	-	30.6	46.0	15.4	
Hori.	464.978	QP	22.5	16.8	11.2	32.0	-	18.6	46.0	27.4	
Hori.	4874.000	PK	41.5	31.7	8.7	31.8	-	50.2	73.9	23.7	Floor noise
Hori.	7311.000	PK	42.3	36.3	9.9	32.7	-	55.8	73.9	18.2	Floor noise
Hori.	9748.000	PK	42.5	39.0	10.5	33.4	-	58.6	73.9	15.3	Floor noise
Hori.	4874.000	AV	30.2	31.7	8.7	31.8	-	38.8	53.9	15.1	Floor noise
Hori.	7311.000	AV	30.7	36.3	9.9	32.7	-	44.2	53.9	9.7	Floor noise
Hori.	9748.000	AV	31.3	39.0	10.5	33.4	-	47.4	53.9	6.5	Floor noise
Vert.	46.878	QP	44.4	12.4	7.5	32.2	-	32.1	40.0	7.9	
Vert.	87.879	QP	41.4	8.1	8.1	32.2	-	25.4	40.0	14.6	
Vert.	105.046	QP	41.0	11.0	8.3	32.1	-	28.2	43.5	15.4	
Vert.	198.833	QP	32.8	16.7	9.2	32.0	-	26.7	43.5	16.8	
Vert.	229.376	QP	37.3	11.3	9.5	32.0	-	26.1	46.0	19.9	
Vert.	327.680	QP	35.8	14.4	10.3	31.9	-	28.6	46.0	17.4	
Vert.	4874.000	PK	40.7	31.7	8.7	31.8	-	49.3	73.9	24.6	Floor noise
Vert.	7311.000	PK	41.7	36.3	9.9	32.7	-	55.2	73.9	18.7	Floor noise
Vert.	9748.000	PK	42.0	39.0	10.5	33.4	-	58.1	73.9	15.8	Floor noise
Vert.	4874.000	AV	30.3	31.7	8.7	31.8	-	38.9	53.9	15.0	Floor noise
Vert.	7311.000	AV	31.0	36.3	9.9	32.7	-	44.5	53.9	9.4	Floor noise
Vert.	9748.000	AV	31.1	39.0	10.5	33.4	-	47.3	53.9	6.6	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 (4.5 m / 3.0 m) = 3.52 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	12745193H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 18, 2019
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Akihiko Maeda (30 MHz - 26.5 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	54.5	27.5	6.6	32.7	-	55.9	73.9	18.0	
Hori.	4924.000	PK	40.5	31.8	8.7	31.8	-	49.2	73.9	24.7	Floor noise
Hori.	7386.000	PK	41.8	36.7	9.9	32.7	-	55.7	73.9	18.2	Floor noise
Hori.	9848.000	PK	42.3	39.1	10.4	33.4	-	58.4	73.9	15.5	Floor noise
Hori.	2483.500	AV	43.2	27.5	6.6	32.7	0.1	44.8	53.9	9.1	*1)
Hori.	4924.000	AV	30.0	31.8	8.7	31.8	-	38.7	53.9	15.2	Floor noise
Hori.	7386.000	AV	31.0	36.7	9.9	32.7	-	44.9	53.9	9.1	Floor noise
Hori.	9848.000	AV	31.4	39.1	10.4	33.4	-	47.6	53.9	6.3	Floor noise
Vert.	2483.500	PK	52.5	27.5	6.6	32.7	-	53.9	73.9	20.0	
Vert.	4924.000	PK	40.9	31.8	8.7	31.8	-	49.6	73.9	24.3	Floor noise
Vert.	7386.000	PK	42.2	36.7	9.9	32.7	-	56.1	73.9	17.8	Floor noise
Vert.	9848.000	PK	42.5	39.1	10.4	33.4	-	58.6	73.9	15.3	Floor noise
Vert.	2483.500	AV	42.7	27.5	6.6	32.7	0.1	44.2	53.9	9.7	*1)
Vert.	4924.000	AV	30.1	31.8	8.7	31.8	-	38.8	53.9	15.1	Floor noise
Vert.	7386.000	AV	30.8	36.7	9.9	32.7	-	44.7	53.9	9.2	Floor noise
Vert.	9848.000	AV	31.4	39.1	10.4	33.4	-	47.5	53.9	6.4	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) = 3.52 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

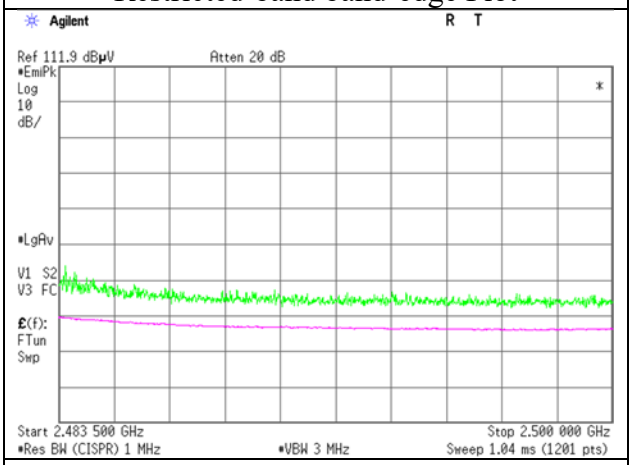
*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12745193H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 18, 2019
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Akihiko Maeda (1 GHz - 10 GHz)
Mode	Tx 11g 2462 MHz

Horizontal

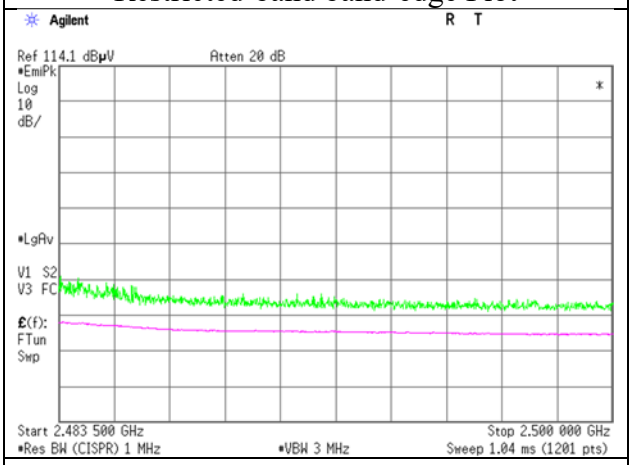
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

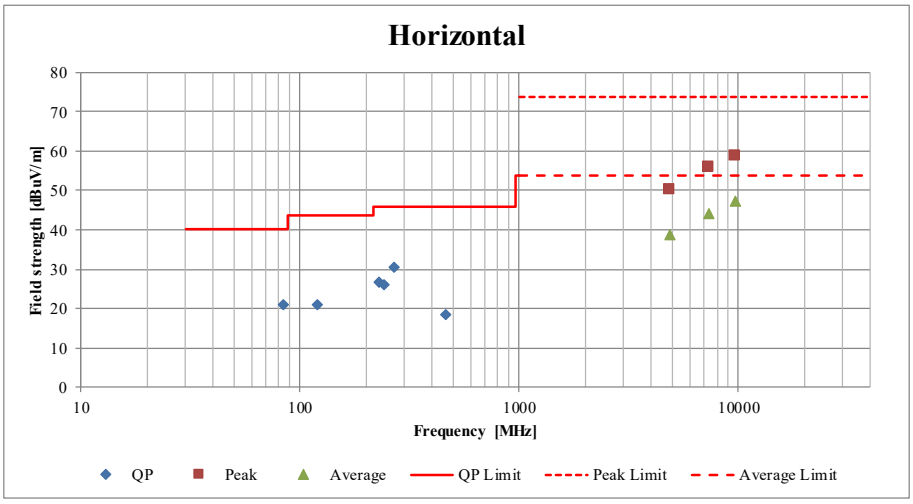


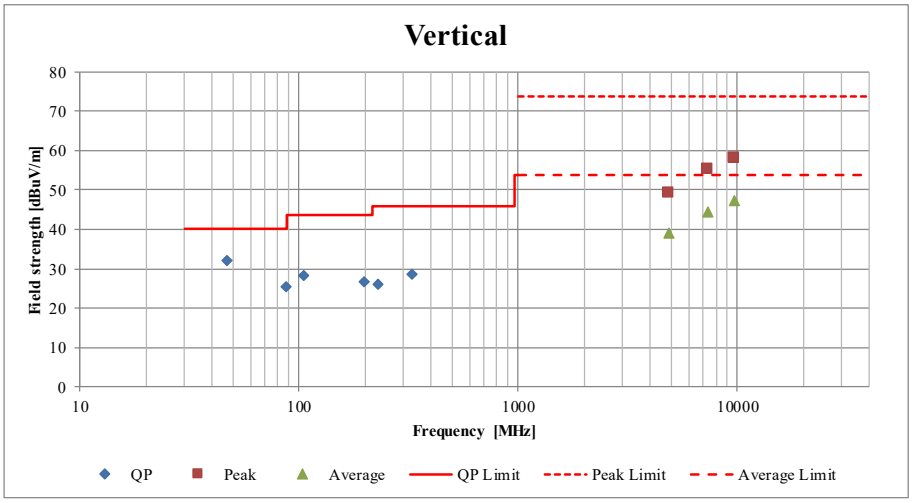
Trace Green : Peak Plot
Trace Purple : Average Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12745193H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	April 18, 2019	April 18, 2019
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 40 % RH
Engineer	Takafumi Noguchi (1 GHz - 10 GHz)	Akihiko Maeda (10 GHz - 26.5 GHz) (Blow 1 GHz)
Mode	Tx 11n-20 2437 MHz	



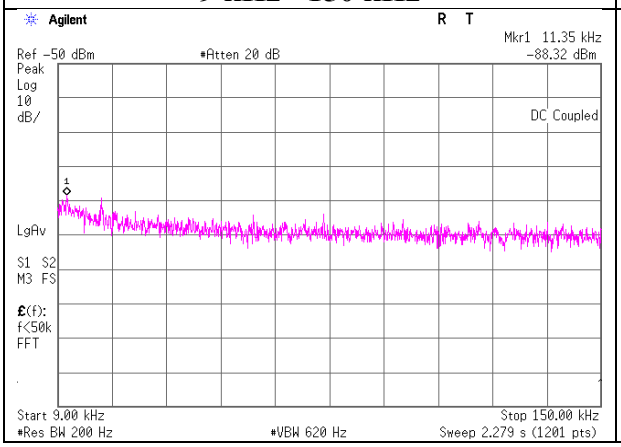


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

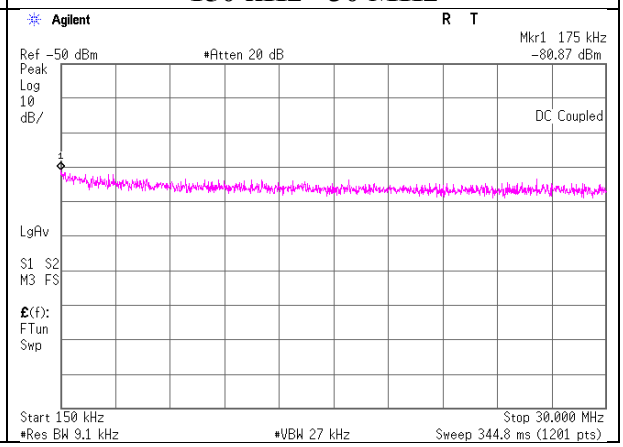
Conducted Spurious Emission

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx 11n-20 2437 MHz

9 kHz - 150 kHz



150 kHz - 30 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	-88.3	1.03	10.1	2.0	1	-75.2	300	6.0	-14.0	46.5	60.5	
175.00	-80.9	1.04	10.1	2.0	1	-67.8	300	6.0	-6.5	22.7	29.2	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-18.17	1.03	10.06	-7.08	8.00	15.08
2437.00	-19.05	1.04	10.06	-7.95	8.00	15.95
2462.00	-18.12	1.04	10.06	-7.02	8.00	15.02

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.55	1.03	10.06	-13.46	8.00	21.46
2437.00	-24.24	1.04	10.06	-13.14	8.00	21.14
2462.00	-23.60	1.04	10.06	-12.50	8.00	20.50

Sample Calculation:

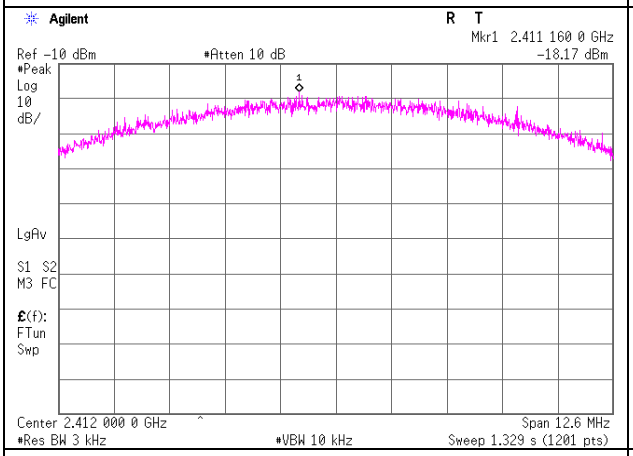
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

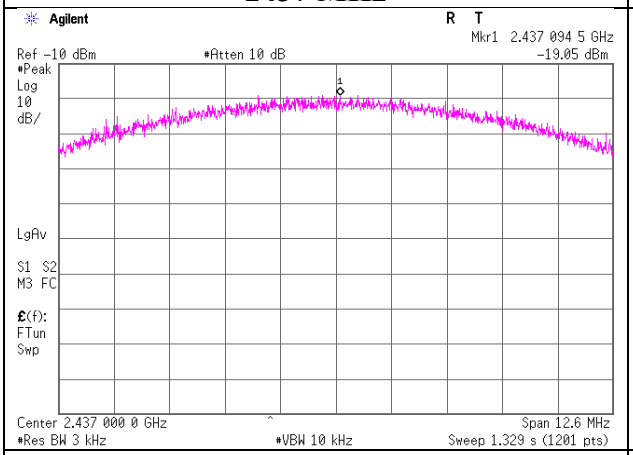
Power Density

11b

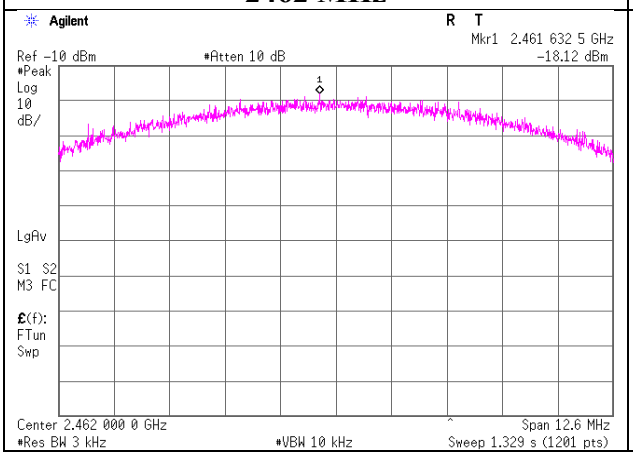
2412 MHz



2437 MHz

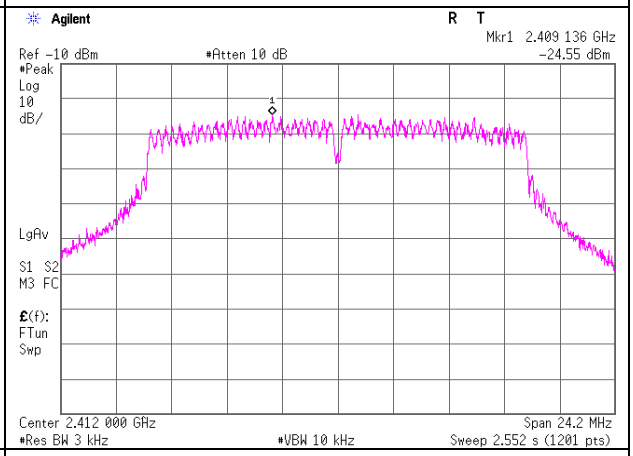


2462 MHz

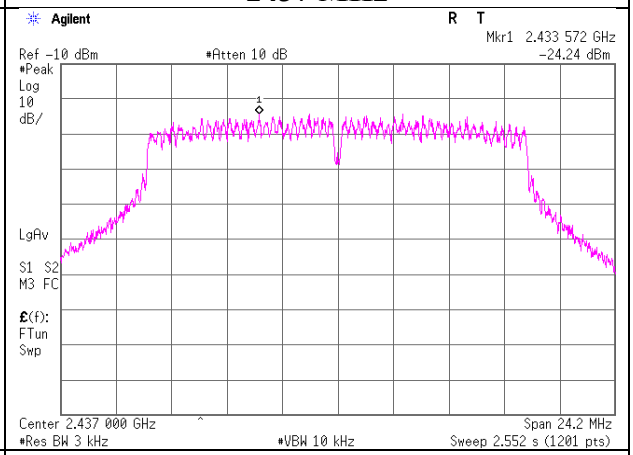


11g

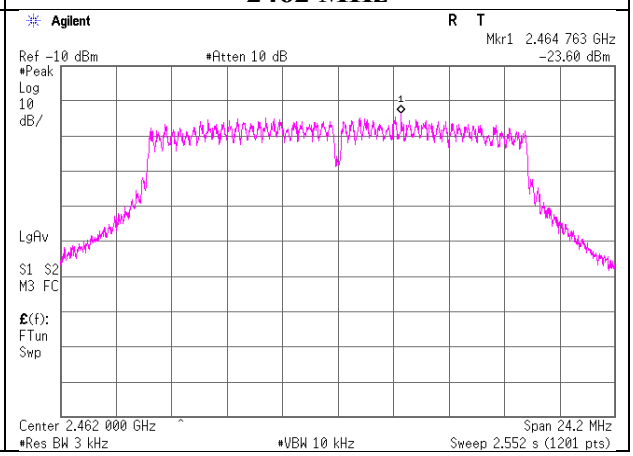
2412 MHz



2437 MHz



2462 MHz



Power Density

Report No.	12745193H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 16, 2019
Temperature / Humidity	26 deg. C / 23 % RH
Engineer	Takumi Shimada
Mode	Tx

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-25.51	1.03	10.06	-14.42	8.00	22.42
2437.00	-24.78	1.04	10.06	-13.68	8.00	21.68
2462.00	-25.23	1.04	10.06	-14.13	8.00	22.13

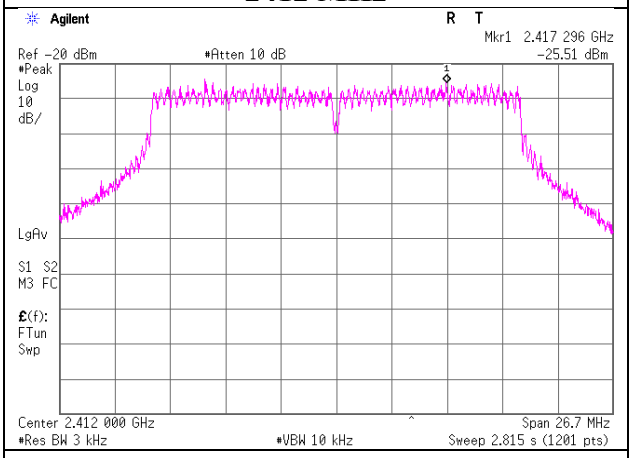
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

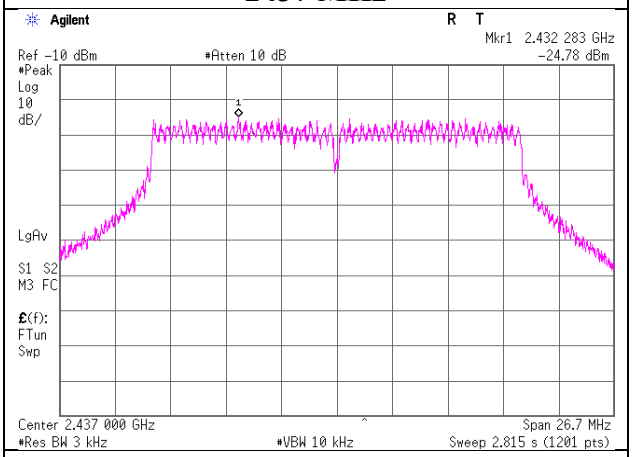
Power Density

11n-20 Antenna 1

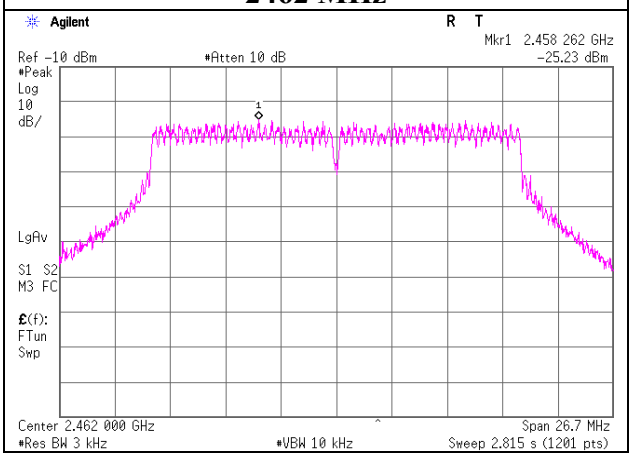
2412 MHz



2437 MHz



2462 MHz



APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
AT	141855	Spectrum Analyzer	AGILENT	E4440A	MY46187750	11/09/2018	11/30/2019	12
AT	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	01/11/2019	01/31/2020	12
AT	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/06/2018	12/31/2019	12
AT	141224	Microwave Cable	Junkosha	MWX221	1409S496	03/05/2019	03/31/2020	12
AT	141830	Power sensor	ANRITSU	MA2411B	438285	05/21/2018	05/31/2019	
AT	141809	Power Meter	ANRITSU	ML2495A	825002	05/21/2018	05/31/2019	12
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/19/2018	09/30/2019	12
RE	141580	MicroWave System Amplifier	AGILENT	83017A	MY39500779	03/05/2019	03/31/2020	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	06/07/2018	06/30/2019	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/05/2019	03/31/2020	12
RE	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/06/2018	04/30/2019	12
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/29/2019	01/31/2020	12
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/20/2018	12/31/2019	12
RE	141885	Spectrum Analyzer	AGILENT	E4448A	US44300523	11/07/2018	11/30/2019	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/08/2019	02/29/2020	12
RE	141323	Coaxial cable	UL Japan	-	-	07/03/2018	07/31/2019	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	03/25/2019	03/31/2020	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	06/04/2018	06/30/2019	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/06/2018	08/31/2019	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24

***Hyphens for Last Calibration Date, Calibration Due Date and Cal Int are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

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**
AT: Antenna Terminal Conducted test