RADIO TEST REPORT

Test Report No. : 13329061H-A-R1

Applicant	:	**Pioneer Corporation**
Type of EUT	:	**Car Audio with Bluetooth / WLAN**
Model Number of EUT	:	**SA211**
FCC ID	:	**AJDK114**
Test regulation	:	**FCC Part 15 Subpart C: 2020** ***WLAN part**
Test Result	:	**Complied (Refer to SECTION 3.2)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test 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 U.S. Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 13329061H-A. 13329061H-A is replaced with this report.

Date of test: May 3 to 10, 2020

Representative test engineer:
Junya Okuno
Engineer
Consumer Technology Division

Approved by:
Tsubasa Takayama
Leader
Consumer Technology Division

NVLAP® TESTING NVLAP LAB CODE 200572-0 ilac-MRA

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/

☐ This report contains data that are not covered by the NVLAP accreditation.
☒ There is no testing item of "Non-accreditation".

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

REVISION HISTORY

Original Test Report No.: 13329061H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13329061H-A	June 8, 2020	-	-
1	13329061H-A-R1	June 30, 2020	P.27	Addition of Remark *2)

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency-Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hori.	Horizontal
ICES	Interference-Causing Equipment Standard
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
ILAC	International Laboratory Accreditation Conference
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
JAB	Japan Accreditation Board
LAN	Local Area Network
LIMS	Laboratory Information Management System
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadri-Phase Shift Keying
RBW	Resolution Band Width
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

CONTENTS PAGE

SECTION 1: Customer information **5**
SECTION 2: Equipment under test (EUT) **5**
SECTION 3: Test specification, procedures & results **7**
SECTION 4: Operation of EUT during testing **11**
SECTION 5: Radiated Spurious Emission **13**
SECTION 6: Antenna Terminal Conducted Tests **15**
APPENDIX 1: Test data **16**
6 dB Bandwidth and 99 % Occupied Bandwidth 16
Maximum Peak Output Power 21
Average Output Power 24
Radiated Spurious Emission 27
Conducted Spurious Emission 38
Power Density 39
APPENDIX 2: Test instruments **42**
APPENDIX 3: Photographs of test setup **43**
Radiated Spurious Emission 43
Worst Case Position 44

SECTION 1: Customer information

Company Name	:	Pioneer Corporation
Address	:	28-8, Honkomagome 2-chome, Bunkyo-ku, Tokyo, 113-0021, Japan
Telephone Number	:	+81-49-228-7681
Facsimile Number	:	+81-49-228-6172
Contact Person	:	Yoshifumi Takahashi

The information provided from the customer is as follows;
- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT 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 (EUT)

2.1 Identification of EUT

Type	:	Car Audio with Bluetooth / WLAN
Model Number	:	SA211
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 10 V - 16 V, 10 A
Receipt Date	:	April 23, 2020
Country of Mass-production	:	Thailand
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: SA211 (referred to as the EUT in this report) is a Car Audio with Bluetooth / WLAN.

Information of the Factory

Factory Name	:	PIONEER MANUFACTURING(THAILAND) CO., LTD.
Address	:	Rojana Industrial Park, 1/31 Moo 5 Tambol Kanham, Amphur U-Thai Pranakornsriayutthaya 13210 Thailand

Radio Specification

WLAN (IEEE 802.11b/g/n-20) *1)

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS / CCK (11b) OFDM (11g/11n-20)
Antenna type	:	Custom Antenna
Antenna Gain	:	-5.67 dBi
Clock frequency (Maximum)	:	125 MHz

Bluetooth (BDR / EDR function)

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS
Antenna type	:	Custom Antenna
Antenna Gain	:	-5.38 dBi
Clock frequency (Maxmum)	:	125 MHz

*1) This test report is applies to WLAN.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C FCC Part 15 final revised on May 26, 2020 and effective July 27, 2020 except 15.258
Title	:	FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

* The revision does not affect the test result conducted before its effective date.

* The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods **ISED:** RSS-Gen 8.8	**FCC:** Section 15.207 **ISED:** RSS-Gen 8.8	N/A	N/A	*1)
6dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** -	**FCC:** Section 15.247(a)(2) **ISED:** RSS-247 5.2(a)	See data.	Complied a)	Conducted
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** RSS-Gen 6.12	**FCC:** Section 15.247(b)(3) **ISED:** RSS-247 5.4(d)		Complied b)	Conducted
Power Density	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** -	**FCC:** Section 15.247(e) **ISED:** RSS-247 5.2(b)		Complied c)	Conducted
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** RSS-Gen 6.13	**FCC:** Section15.247(d) **ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	4.4 dB 2483.500 MHz, Horizontal, AV	Complied d), e)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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 Part 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 EUT. 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	**ISED:** RSS-Gen 6.7	**ISED:** -	N/A	- a)	Conducted

a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)

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	1.4 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.6 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)	4.8 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
	(Vertical)	5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
0.5 m	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	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	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	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	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	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.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
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 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 EUT during testing

4.1 Operating Mode(s)

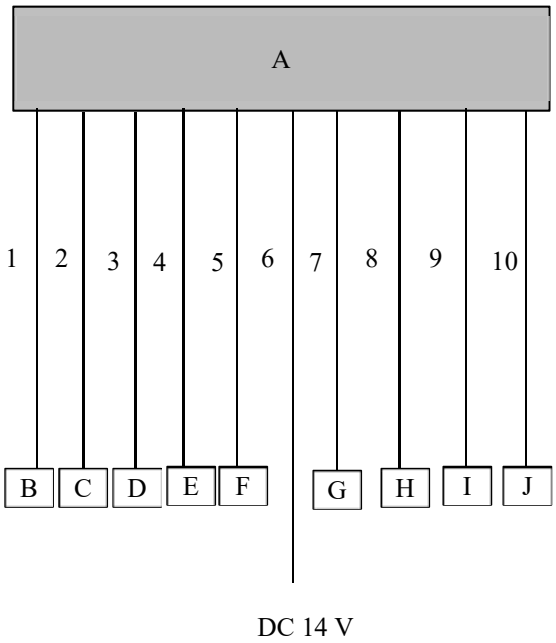
Test operating mode was determined as follows according to "Section 1 of 6 802.11 b/g/n testing - Managing Complex Regulatory Approvals - " of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	12 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 6 (Long GI), 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: 18 dBm 11g: 14 dBm 11n-20: 14 dBm Software: R.A5.00.12.25.20.00.00 (Date: May 3, 2020, Storage location: EUT memory) *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
Radiated Spurious Emission (Below 1GHz)	11n-20 Tx*1)	2462 MHz
Radiated Spurious Emission (Above 1GHz)	11b Tx 11n-20 Tx*2)	2412 MHz 2437 MHz 2462 MHz
Spurious Emission (Conducted)	11n-20 Tx	2412 MHz 2437 MHz 2462 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
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode(11n-20) that had the highest output power.		

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	Car Audio	SA211	K4TA007 for RE* K4TA006 for AT*	PIONEER CORPORATION	EUT
B	USB Memory	U202	1942QF0935MSQ1RL1L	TOSHIBA	-
C	Terminator	-	-	-	-
D	GNSS Antenna	DA15-D010	A388619	MITSUMI ELEC.	-
E	Terminator	-	-	-	-
F	Jig Board	-	-	-	-
G	Mic	39813-59S00	-	-	-
H	Dummy Speaker	-	-	-	-
I	Camera	-	-	-	-
J	Terminator	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	DAB Cable	2.0	Shielded	Shielded	-
3	GNSS Antenna Cable	2.0	Shielded	Shielded	-
4	HDMI Cable	1.2	Shielded	Shielded	-
5	Signal Cable	2.0	Unshielded	Unshielded	-
6	DC Cable	2.8	Unshielded	Unshielded	-
7	MIC Cable	2.0	Unshielded	Unshielded	-
8	Speaker Cable	2.0	Unshielded	Unshielded	-
9	Signal Cable	2.2	Unshielded	Unshielded	-
10	AM/FM Cable	2.0	Shielded	Shielded	-

*RE: Radiated Spurious Emission test, AT: Antenna Terminal Conducted Tests

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 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
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 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.

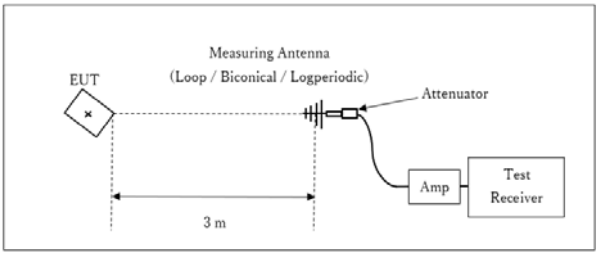
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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

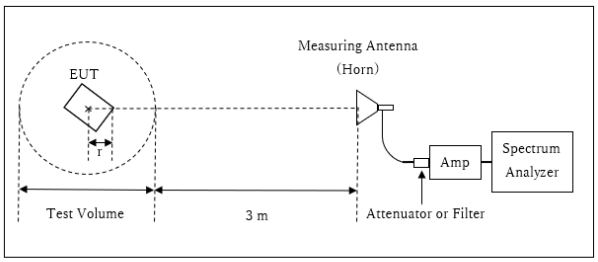
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

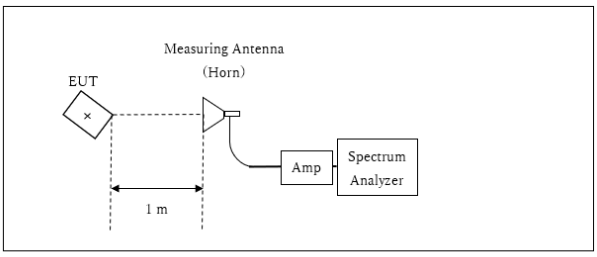


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.85 m / 3.0 m) = 2.17 dB
* Test Distance: (3 + Test Volume /2) - r = 3.85 m

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.15 m

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 0 deg. and 40 deg. as tilt angle of EUT to see the position, 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), *5)	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)
*5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohmes. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 – 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

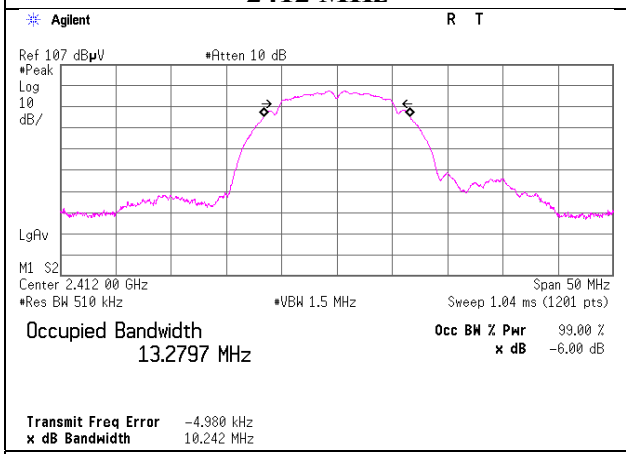
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 7, 2020
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	13279.7	10.107	> 0.5000
	2437	13298.7	10.079	> 0.5000
	2462	13305.9	9.987	> 0.5000
11g	2412	16868.6	16.427	> 0.5000
	2437	16874.5	16.425	> 0.5000
	2462	16877.8	16.425	> 0.5000
11n-20	2412	17925.7	17.661	> 0.5000
	2437	17887.0	17.656	> 0.5000
	2462	17870.9	17.677	> 0.5000

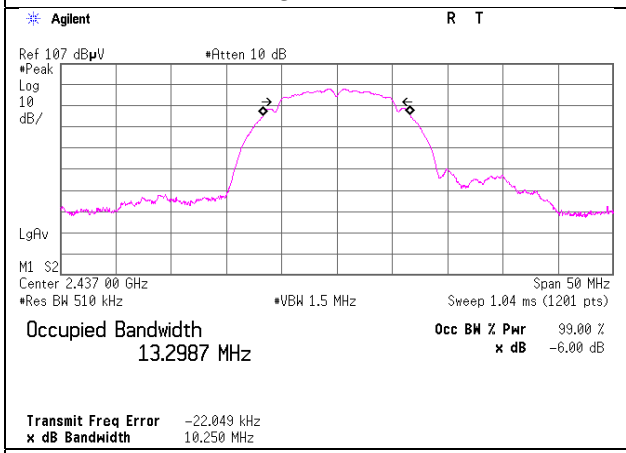
99%Occupied Bandwidth

11b

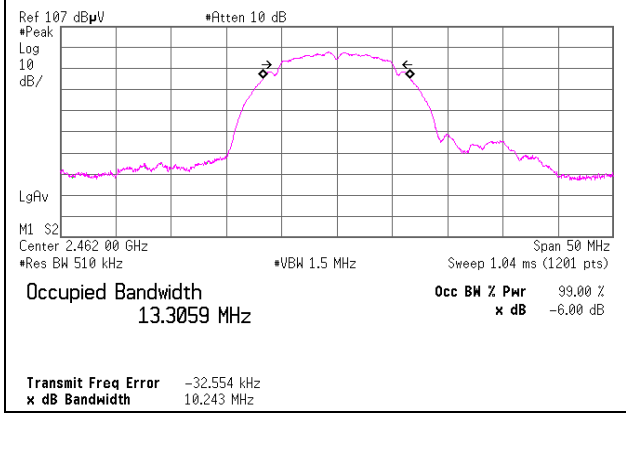
2412 MHz



2437 MHz

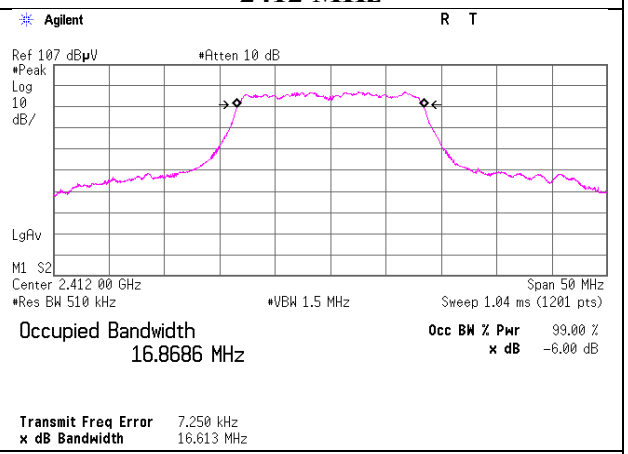


2462 MHz

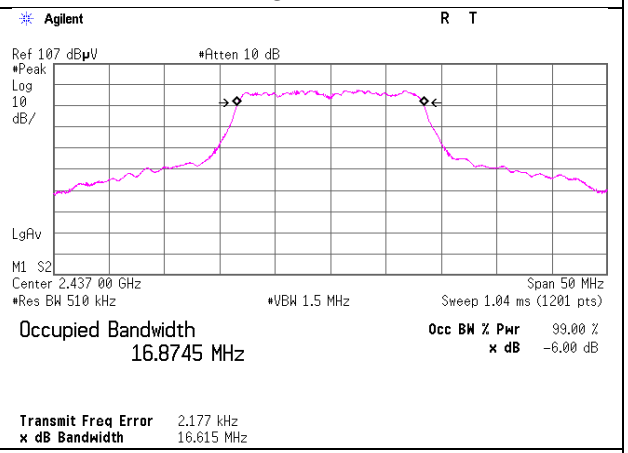


11g

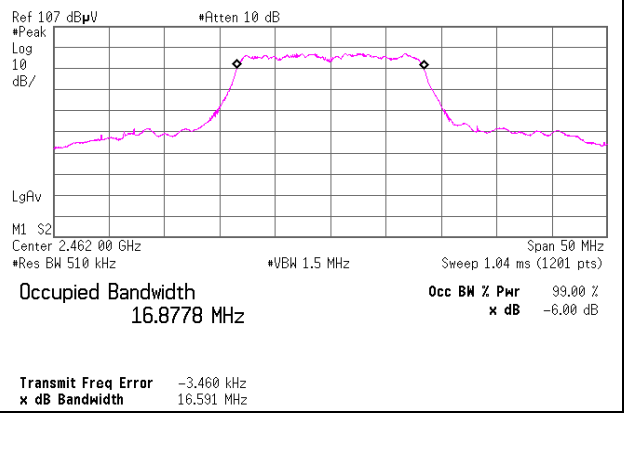
2412 MHz



2437 MHz



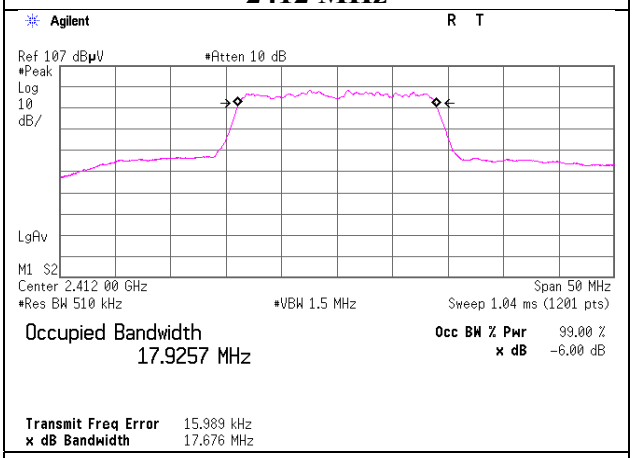
2462 MHz



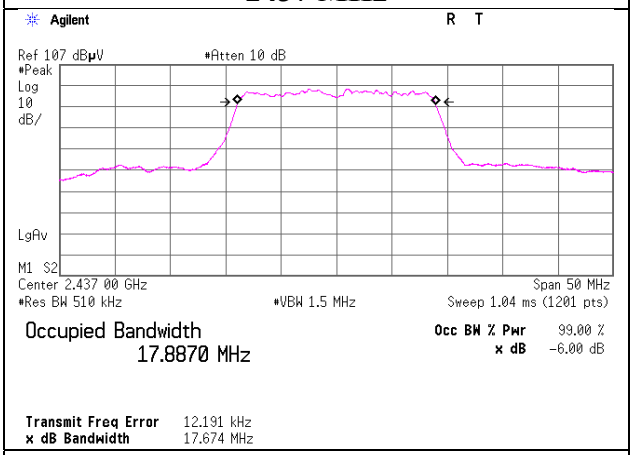
99% Occupied Bandwidth

11n-20

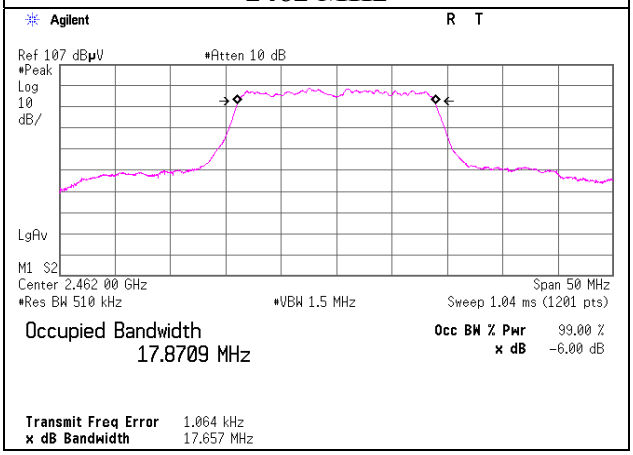
2412 MHz



2437 MHz



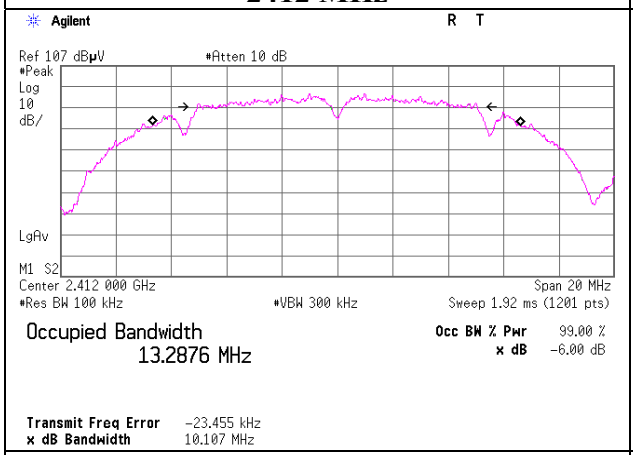
2462 MHz



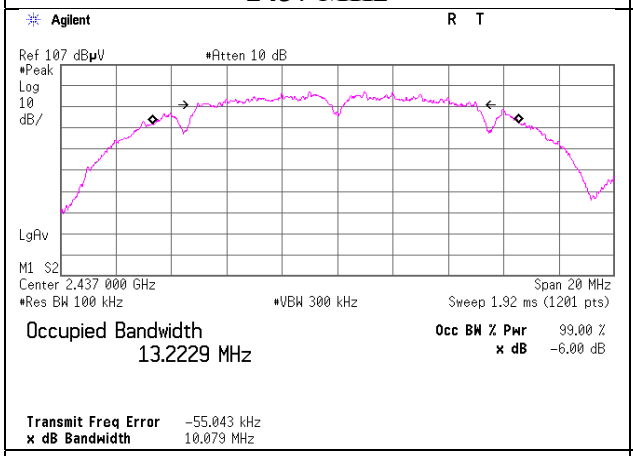
6dB Bandwidth

11b

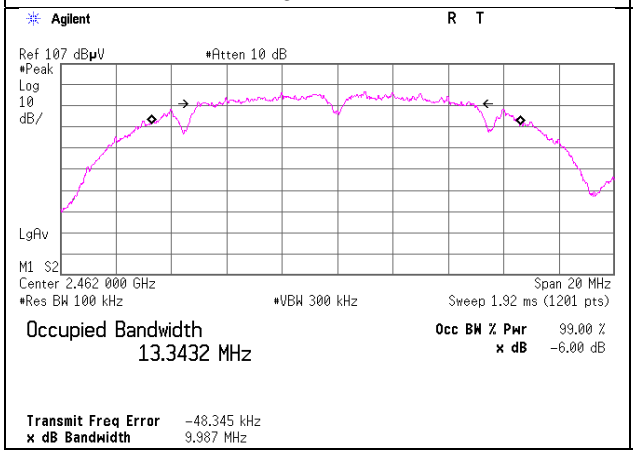
2412 MHz



2437 MHz

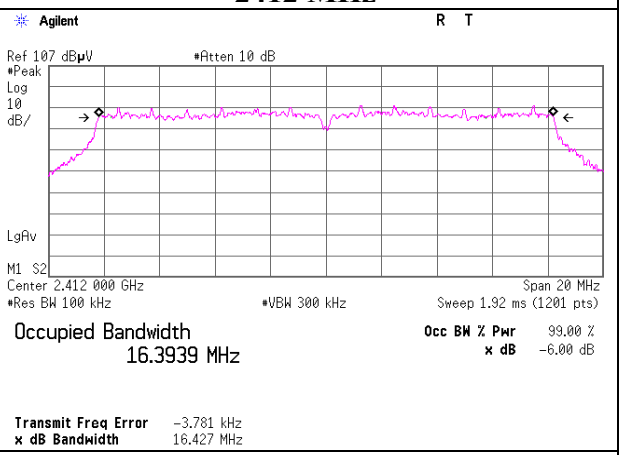


2462 MHz

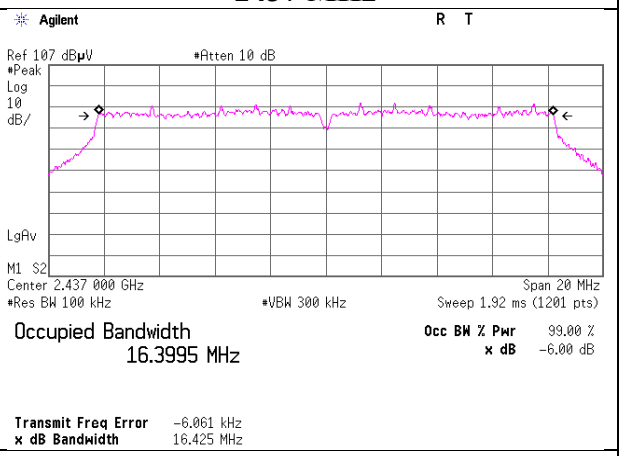


11g

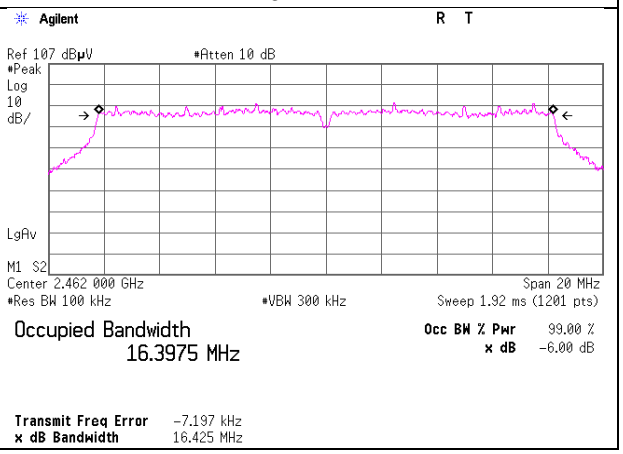
2412 MHz



2437 MHz



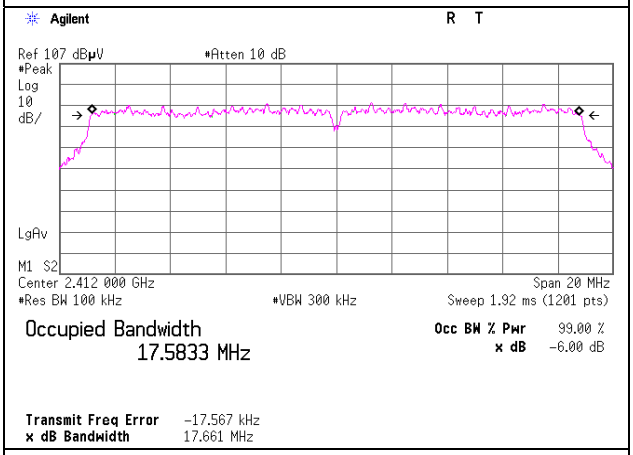
2462 MHz



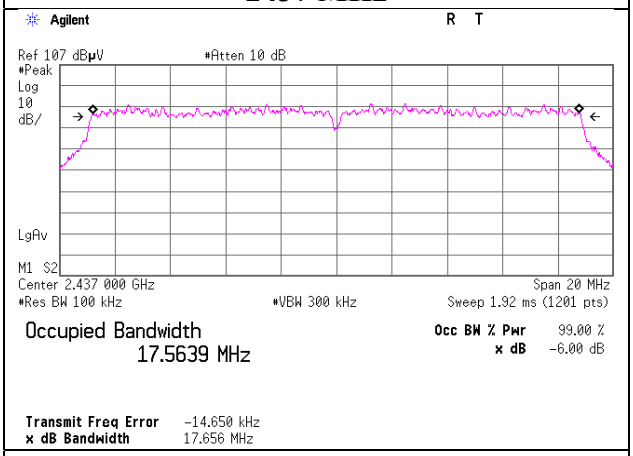
6dB Bandwidth

11n-20

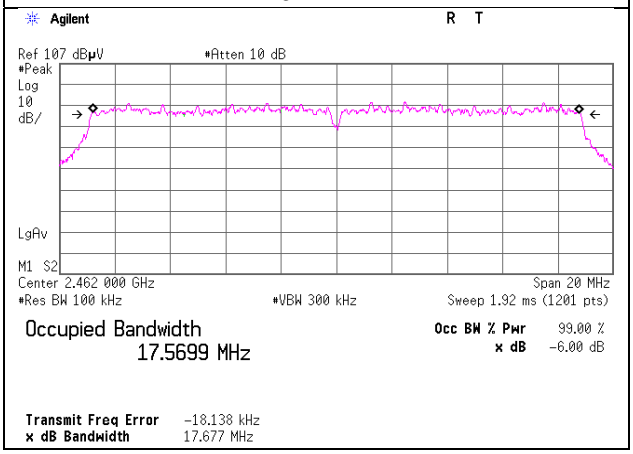
2412 MHz



2437 MHz



2462 MHz



Maximum Peak Output Power

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	May 3, 2020
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Akihiko Maeda
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	8.77	1.00	10.06	19.83	96.16	30.00	1000	10.17	-5.67	14.16	26.06	36.02	4000	21.86
2437	9.13	1.00	10.06	20.19	104.47	30.00	1000	9.81	-5.67	14.52	28.31	36.02	4000	21.50
2462	9.14	1.00	10.06	20.20	104.71	30.00	1000	9.80	-5.67	14.53	28.38	36.02	4000	21.49

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Antenna 1, 2437MHz

Rate [Mbps]	Reading [dBm]	Remark
1	8.78	
2	8.82	*
5.5	8.30	
11	8.33	

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

*Difference between worst rate check data and formal test result is due to the different test condition.

Maximum Peak Output Power

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	May 3, 2020
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Akihiko Maeda
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	13.50	1.00	10.06	24.56	285.76	30.00	1000	5.44	-5.67	18.89	77.45	36.02	4000	17.13
2437	13.64	1.00	10.06	24.70	295.12	30.00	1000	5.30	-5.67	19.03	79.98	36.02	4000	16.99
2462	13.78	1.00	10.06	24.84	304.79	30.00	1000	5.16	-5.67	19.17	82.60	36.02	4000	16.85

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Antenna 1, 2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	12.50	
9	12.49	
12	13.25	*
18	12.31	
24	12.52	
36	12.09	
48	12.03	
54	12.15	

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

*Difference between worst rate check data and formal test result is due to the different test condition.

Maximum Peak Output Power

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	May 3, 2020
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Akihiko Maeda
Mode	Tx 11n-20

Antenna 1				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	13.41	1.00	10.06	24.47	279.90	30.00	1000	5.53	-5.67	18.80	75.86	36.02	4000	17.22
2437	13.70	1.00	10.06	24.76	299.23	30.00	1000	5.24	-5.67	19.09	81.10	36.02	4000	16.93
2462	14.00	1.00	10.06	25.06	320.63	30.00	1000	4.94	-5.67	19.39	86.90	36.02	4000	16.63

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Antenna 1, 2437 MHz, Long GI

MCS Number	Reading [dBm]	Remark
0	12.75	
1	12.73	
2	12.55	
3	12.83	
4	12.54	
5	12.64	
6	13.33	*
7	12.38	

* Worst MCS

MCS Number	Reading [dBm]	GI	Remark
6	13.33	Long	*
6	13.11	Short	

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

*Difference between worst rate check data and formal test result is due to the different test condition.

Average Output Power
(Reference data for RF Exposure)

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	May 3, 2020
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Akihiko Maeda
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	5.81	1.00	10.06	16.87	48.64	0.12	16.99	50.00
2437	6.13	1.00	10.06	17.19	52.36	0.12	17.31	53.83
2462	6.15	1.00	10.06	17.21	52.60	0.12	17.33	54.08

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	2.50	1.00	10.06	13.56	22.70	0.15	13.71	23.50
2437	2.51	1.00	10.06	13.57	22.75	0.15	13.72	23.55
2462	2.55	1.00	10.06	13.61	22.96	0.15	13.76	23.77

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	2.18	1.00	10.06	13.24	21.09	0.16	13.40	21.88
2437	2.20	1.00	10.06	13.26	21.18	0.16	13.42	21.98
2462	2.44	1.00	10.06	13.50	22.39	0.16	13.66	23.23

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

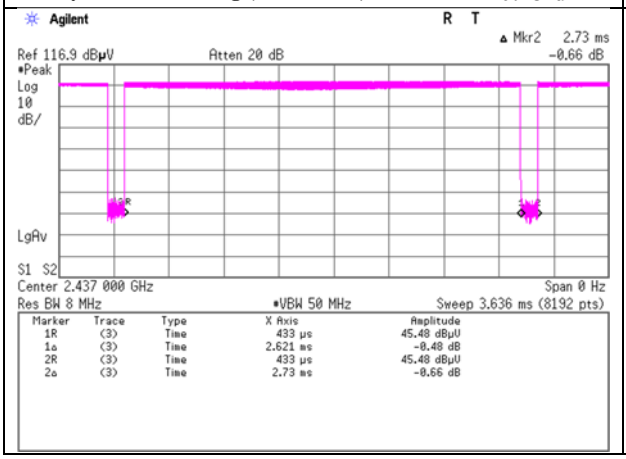
The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.

Burst rate confirmation

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx

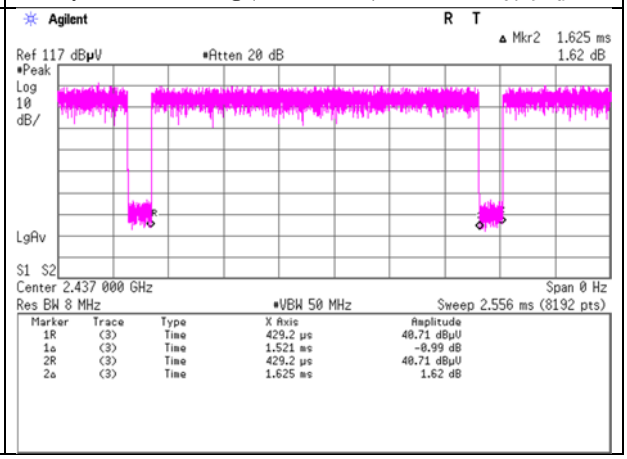
11b 2 Mbps

Tx on / (Tx on + Tx off) =	0.960
Tx on / (Tx on + Tx off) * 100 =	96.0 %
Duty factor = 10 * log (2.73 / 2.621) =	0.18 dB



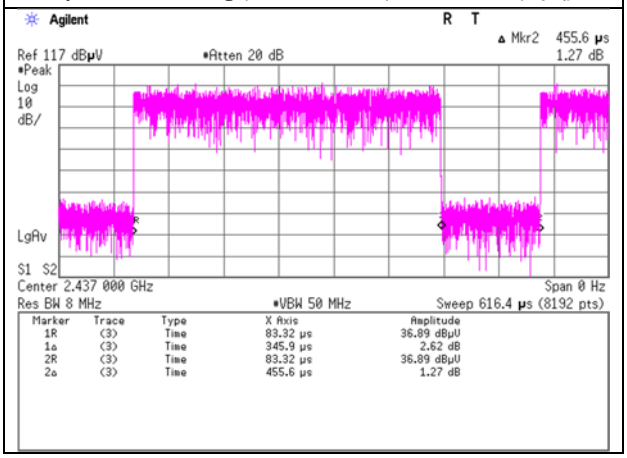
11g 12 Mbps

Tx on / (Tx on + Tx off) =	0.936
Tx on / (Tx on + Tx off) * 100 =	93.6 %
Duty factor = 10 * log (1.625 / 1.521) =	0.29 dB



11n-20 MCS 6 Long GI

Tx on / (Tx on + Tx off) =	0.759
Tx on / (Tx on + Tx off) * 100 =	75.9 %
Duty factor = 10 * log (0.4556 / 0.3459) =	1.20 dB



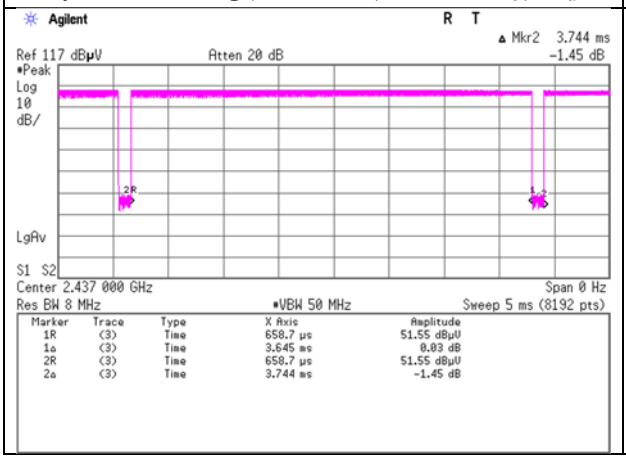
* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Burst rate confirmation

Report No.	13329061H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 15, 2020
Temperature / Humidity	22 deg. C / 47 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx

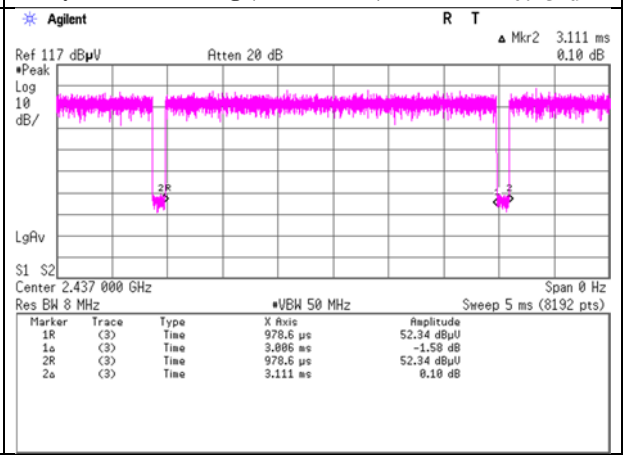
11b 1 Mbps

Tx on / (Tx on + Tx off) =	0.974
Tx on / (Tx on + Tx off) * 100 =	97.4 %
Duty factor = 10 * log (3.744 / 3.645) =	0.12 dB



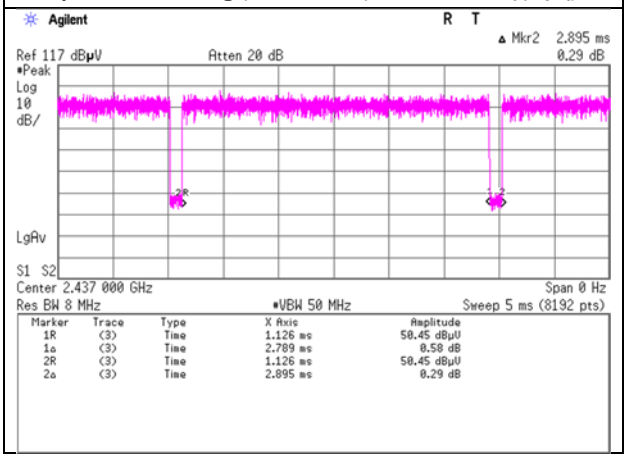
11g 6 Mbps

Tx on / (Tx on + Tx off) =	0.966
Tx on / (Tx on + Tx off) * 100 =	96.6 %
Duty factor = 10 * log (3.111 / 3.006) =	0.15 dB



11n-20 MCS 0 Long GI

Tx on / (Tx on + Tx off) =	0.963
Tx on / (Tx on + Tx off) * 100 =	96.3 %
Duty factor = 10 * log (2.895 / 2.789) =	0.16 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.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 4, 2020	May 5, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (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.	2338.658	PK	47.0	27.8	5.2	32.7	-	47.3	73.9	26.6	
Hori.	2386.383	PK	48.0	27.7	5.3	32.7	-	48.2	73.9	25.7	
Hori.	2390.000	PK	46.5	27.7	5.3	32.7	-	46.7	73.9	27.2	
Hori.	4824.000	PK	46.5	31.6	7.4	31.7	-	53.8	73.9	20.1	
Hori.	7236.000	PK	42.2	36.0	8.8	32.6	-	54.4	73.9	19.5	Floor noise
Hori.	9648.000	PK	41.2	38.6	9.3	33.3	-	55.7	73.9	18.2	Floor noise
Hori.	2338.658	AV	41.4	27.8	5.2	32.7	0.2	41.9	53.9	12.1	*2)
Hori.	2386.383	AV	42.0	27.7	5.3	32.7	0.2	42.4	53.9	11.5	*2)
Hori.	2390.000	AV	39.0	27.7	5.3	32.7	0.2	39.4	53.9	14.5	*1)
Hori.	4824.000	AV	41.0	31.6	7.4	31.7	0.2	48.5	53.9	5.4	
Hori.	7236.000	AV	34.0	36.0	8.8	32.6	-	46.2	53.9	7.7	Floor noise
Hori.	9648.000	AV	33.2	38.6	9.3	33.3	-	47.7	53.9	6.2	Floor noise
Vert.	2338.658	PK	45.6	27.8	5.2	32.7	-	45.9	73.9	28.0	
Vert.	2386.383	PK	47.1	27.7	5.3	32.7	-	47.3	73.9	26.6	
Vert.	2390.000	PK	45.6	27.7	5.3	32.7	-	45.8	73.9	28.1	
Vert.	4824.000	PK	45.2	31.6	7.4	31.7	-	52.5	73.9	21.4	
Vert.	7236.000	PK	42.8	36.0	8.8	32.6	-	55.0	73.9	18.9	Floor noise
Vert.	9648.000	PK	41.2	38.6	9.3	33.3	-	55.7	73.9	18.2	Floor noise
Vert.	2338.658	AV	39.5	27.8	5.2	32.7	0.2	40.0	53.9	14.0	*2)
Vert.	2386.383	AV	40.0	27.7	5.3	32.7	0.2	40.4	53.9	13.5	*2)
Vert.	2390.000	AV	37.3	27.7	5.3	32.7	0.2	37.7	53.9	16.2	*1)
Vert.	4824.000	AV	38.2	31.6	7.4	31.7	0.2	45.7	53.9	8.2	
Vert.	7236.000	AV	33.7	36.0	8.8	32.6	-	45.9	53.9	8.0	Floor noise
Vert.	9648.000	AV	33.2	38.6	9.3	33.3	-	47.7	53.9	6.2	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
*1) Not Out of Band emission(Leakage Power)
*2) Noise synchronized with duty of carrier frequency.

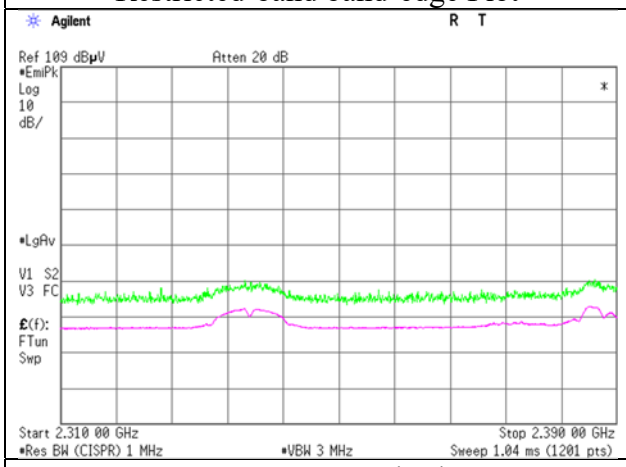
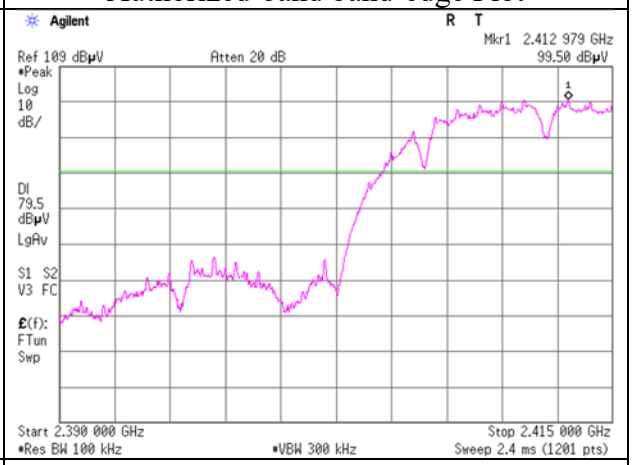
20dBc Data Sheet

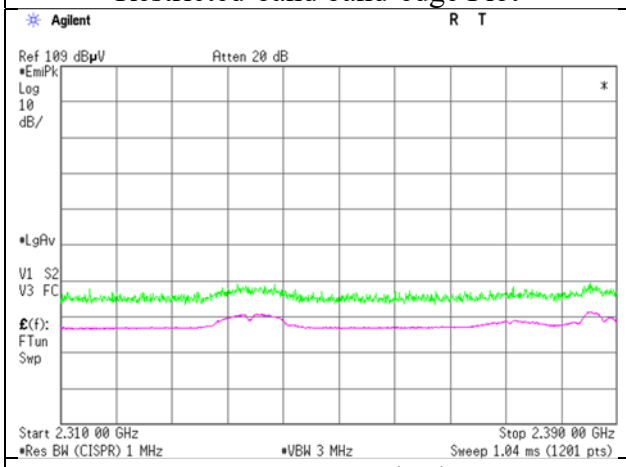
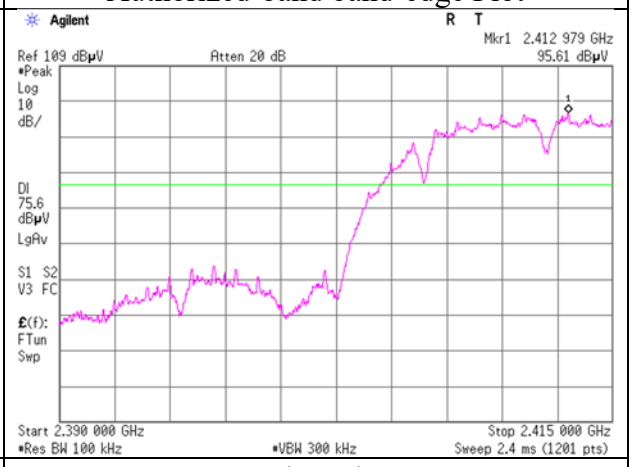
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	99.5	27.6	5.3	32.7	99.7	-	-	Carrier
Hori.	2400.000	PK	44.0	27.7	5.3	32.7	44.2	79.7	35.5	
Vert.	2412.000	PK	95.6	27.6	5.3	32.7	95.8	-	-	Carrier
Vert.	2400.000	PK	42.2	27.7	5.3	32.7	42.4	75.8	33.4	

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka (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.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 4, 2020	May 5, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (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	47.2	31.6	7.4	31.6	-	54.5	73.9	19.4	
Hori.	7311.000	PK	41.6	36.2	8.8	32.6	-	53.9	73.9	20.0	Floor noise
Hori.	9748.000	PK	42.0	38.8	9.3	33.4	-	56.7	73.9	17.2	Floor noise
Hori.	4874.000	AV	41.5	31.6	7.4	31.6	0.2	49.0	53.9	4.9	
Hori.	7311.000	AV	33.7	36.2	8.8	32.6	-	46.0	53.9	7.9	Floor noise
Hori.	9748.000	AV	32.9	38.8	9.3	33.4	-	47.6	53.9	6.3	Floor noise
Vert.	4874.000	PK	45.3	31.6	7.4	31.6	-	52.6	73.9	21.3	
Vert.	7311.000	PK	42.1	36.2	8.8	32.6	-	54.4	73.9	19.5	Floor noise
Vert.	9748.000	PK	41.5	38.8	9.3	33.4	-	56.2	73.9	17.7	Floor noise
Vert.	4874.000	AV	39.9	31.6	7.4	31.6	0.2	47.4	53.9	6.5	
Vert.	7311.000	AV	34.3	36.2	8.8	32.6	-	46.6	53.9	7.3	Floor noise
Vert.	9748.000	AV	33.0	38.8	9.3	33.4	-	47.7	53.9	6.2	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 4, 2020	May 5, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (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	46.2	27.5	5.3	32.7	-	46.3	73.9	27.6	
Hori.	4924.000	PK	45.2	31.5	7.4	31.6	-	52.5	73.9	21.4	
Hori.	7386.000	PK	42.1	36.3	8.8	32.7	-	54.5	73.9	19.4	Floor noise
Hori.	9848.000	PK	42.6	39.0	9.3	33.4	-	57.4	73.9	16.5	Floor noise
Hori.	2483.500	AV	38.2	27.5	5.3	32.7	0.2	38.5	53.9	15.4	*1)
Hori.	4924.000	AV	40.2	31.5	7.4	31.6	0.2	47.6	53.9	6.3	
Hori.	7386.000	AV	34.2	36.3	8.8	32.7	-	46.6	53.9	7.3	Floor noise
Hori.	9848.000	AV	33.0	39.0	9.3	33.4	-	47.8	53.9	6.1	Floor noise
Vert.	2483.500	PK	45.2	27.5	5.3	32.7	-	45.3	73.9	28.6	
Vert.	4924.000	PK	43.9	31.5	7.4	31.6	-	51.2	73.9	22.7	
Vert.	7386.000	PK	42.6	36.3	8.8	32.7	-	55.0	73.9	18.9	Floor noise
Vert.	9848.000	PK	41.7	39.0	9.3	33.4	-	56.5	73.9	17.4	Floor noise
Vert.	2483.500	AV	36.8	27.5	5.3	32.7	0.2	37.1	53.9	16.8	*1)
Vert.	4924.000	AV	36.7	31.5	7.4	31.6	0.2	44.1	53.9	9.8	
Vert.	7386.000	AV	34.6	36.3	8.8	32.7	-	47.0	53.9	6.9	Floor noise
Vert.	9848.000	AV	32.9	39.0	9.3	33.4	-	47.7	53.9	6.2	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

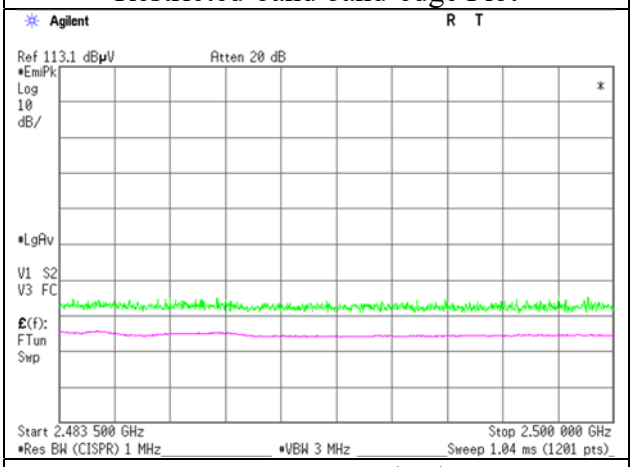
Distance factor: 1 GHz - 10 GHz 20log (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)
Mode	Tx 11b 2462 MHz

Horizontal

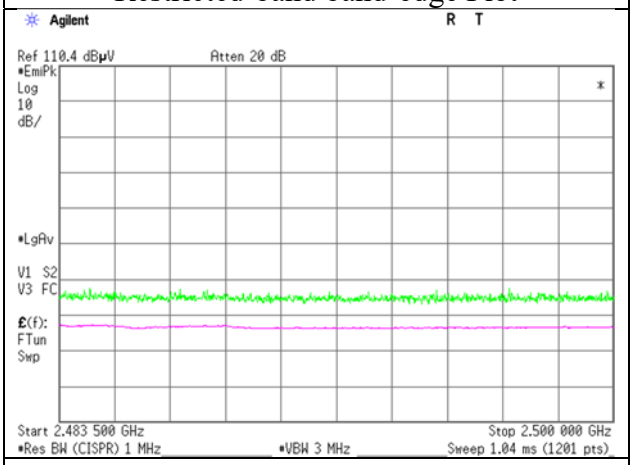
Restricted-band band-edge Plot



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.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 4, 2020	May 5, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (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	60.0	27.7	5.3	32.7	-	60.2	73.9	13.7	
Hori.	4824.000	PK	41.1	31.6	7.4	31.7	-	48.4	73.9	25.5	Floor noise
Hori.	7236.000	PK	42.1	36.0	8.8	32.6	-	54.3	73.9	19.6	Floor noise
Hori.	9648.000	PK	43.2	38.6	9.3	33.3	-	57.7	73.9	16.2	Floor noise
Hori.	2390.000	AV	46.0	27.7	5.3	32.7	1.2	47.4	53.9	6.5	*1)
Hori.	4824.000	AV	33.2	31.6	7.4	31.7	-	40.5	53.9	13.4	Floor noise
Hori.	7236.000	AV	33.6	36.0	8.8	32.6	-	45.8	53.9	8.1	Floor noise
Hori.	9648.000	AV	33.3	38.6	9.3	33.3	-	47.8	53.9	6.1	Floor noise
Vert.	2390.000	PK	55.7	27.7	5.3	32.7	-	55.9	73.9	18.0	
Vert.	4824.000	PK	41.7	31.6	7.4	31.7	-	49.0	73.9	24.9	Floor noise
Vert.	7236.000	PK	42.4	36.0	8.8	32.6	-	54.6	73.9	19.3	Floor noise
Vert.	9648.000	PK	41.5	38.6	9.3	33.3	-	56.0	73.9	17.9	Floor noise
Vert.	2390.000	AV	42.1	27.7	5.3	32.7	1.2	43.5	53.9	10.4	*1)
Vert.	4824.000	AV	32.7	31.6	7.4	31.7	-	40.0	53.9	13.9	Floor noise
Vert.	7236.000	AV	33.9	36.0	8.8	32.6	-	46.1	53.9	7.8	Floor noise
Vert.	9648.000	AV	33.3	38.6	9.3	33.3	-	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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
*1) Not Out of Band emission(Leakage Power)

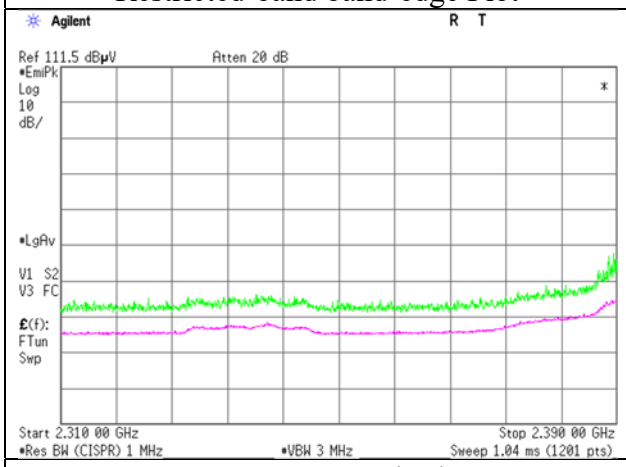
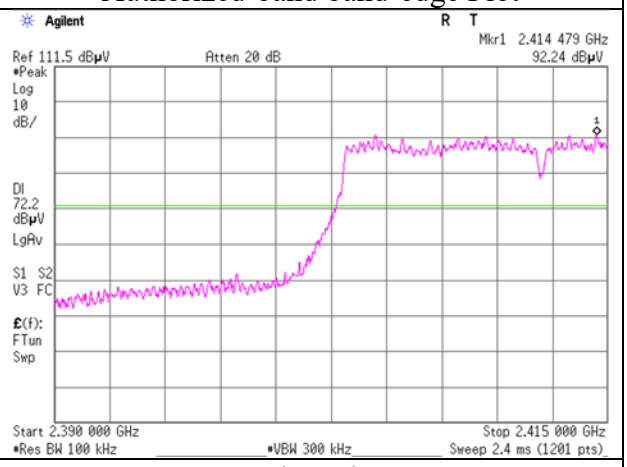
20dBc Data Sheet

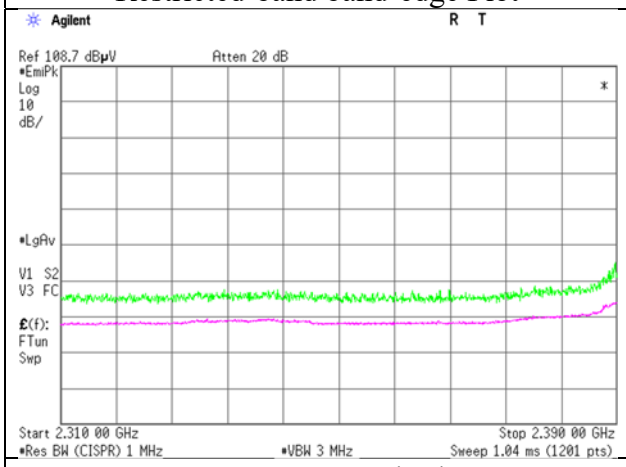
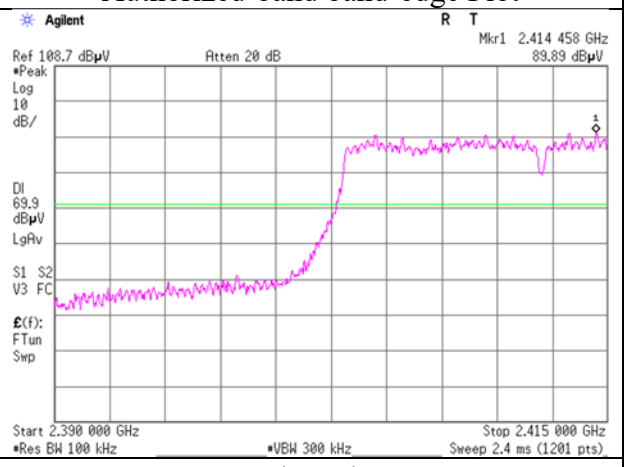
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	92.2	27.6	5.3	32.7	92.4	-	-	Carrier
Hori.	2400.000	PK	51.4	27.7	5.3	32.7	51.6	72.4	20.8	
Vert.	2412.000	PK	89.9	27.6	5.3	32.7	90.1	-	-	Carrier
Vert.	2400.000	PK	48.7	27.7	5.3	32.7	48.9	70.1	21.2	

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka (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.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 4, 2020	May 5, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (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.	4874.000	PK	40.9	31.6	7.4	31.6	-	48.2	73.9	25.7	Floor noise
Hori.	7311.000	PK	41.8	36.2	8.8	32.6	-	54.1	73.9	19.8	Floor noise
Hori.	9748.000	PK	41.9	38.8	9.3	33.4	-	56.6	73.9	17.3	Floor noise
Hori.	4874.000	AV	32.1	31.6	7.4	31.6	-	39.4	53.9	14.5	Floor noise
Hori.	7311.000	AV	33.3	36.2	8.8	32.6	-	45.6	53.9	8.3	Floor noise
Hori.	9748.000	AV	33.2	38.8	9.3	33.4	-	47.9	53.9	6.0	Floor noise
Vert.	4874.000	PK	40.4	31.6	7.4	31.6	-	47.7	73.9	26.2	Floor noise
Vert.	7311.000	PK	42.1	36.2	8.8	32.6	-	54.4	73.9	19.5	Floor noise
Vert.	9748.000	PK	40.8	38.8	9.3	33.4	-	55.5	73.9	18.4	Floor noise
Vert.	4874.000	AV	32.2	31.6	7.4	31.6	-	39.5	53.9	14.4	Floor noise
Vert.	7311.000	AV	33.5	36.2	8.8	32.6	-	45.8	53.9	8.1	Floor noise
Vert.	9748.000	AV	33.1	38.8	9.3	33.4	-	47.8	53.9	6.1	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 20log (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13329061H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	May 4, 2020	May 5, 2020	May 10, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (10 GHz - 26.5 GHz)	Junya Okuno (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.	196.610	QP	32.7	16.7	9.1	32.0	-	26.4	43.5	17.1	
Hori.	208.895	QP	38.5	11.2	9.2	32.0	-	26.9	43.5	16.7	
Hori.	221.182	QP	41.8	11.1	9.3	32.0	-	30.2	46.0	15.8	
Hori.	233.472	QP	39.1	11.3	9.4	32.0	-	27.8	46.0	18.2	
Hori.	276.480	QP	33.9	13.2	9.8	32.0	-	24.9	46.0	21.2	
Hori.	294.910	QP	33.2	13.4	9.9	32.0	-	24.6	46.0	21.4	
Hori.	2483.500	PK	63.9	27.5	5.3	32.7	-	64.0	73.9	9.9	
Hori.	4924.000	PK	42.0	31.5	7.4	31.6	-	49.3	73.9	24.6	Floor noise
Hori.	7386.000	PK	42.3	36.3	8.8	32.7	-	54.7	73.9	19.2	Floor noise
Hori.	9848.000	PK	41.2	39.0	9.3	33.4	-	56.0	73.9	17.9	Floor noise
Hori.	2483.500	AV	48.2	27.5	5.3	32.7	1.2	49.5	53.9	4.4	*1)
Hori.	4924.000	AV	32.1	31.5	7.4	31.6	-	39.4	53.9	14.5	Floor noise
Hori.	7386.000	AV	33.8	36.3	8.8	32.7	-	46.2	53.9	7.7	Floor noise
Hori.	9848.000	AV	33.0	39.0	9.3	33.4	-	47.8	53.9	6.1	Floor noise
Vert.	196.610	QP	36.0	16.7	9.1	32.0	-	29.7	43.5	13.8	
Vert.	227.320	QP	39.7	11.1	9.4	32.0	-	28.2	46.0	17.8	
Vert.	233.473	QP	41.3	11.3	9.4	32.0	-	30.0	46.0	16.0	
Vert.	236.541	QP	38.1	11.4	9.4	32.0	-	26.9	46.0	19.1	
Vert.	245.753	QP	38.3	11.7	9.5	32.0	-	27.5	46.0	18.5	
Vert.	294.910	QP	37.0	13.4	9.9	32.0	-	28.4	46.0	17.6	
Vert.	2483.500	PK	62.0	27.5	5.3	32.7	-	62.1	73.9	11.8	
Vert.	4924.000	PK	43.8	31.5	7.4	31.6	-	51.1	73.9	22.8	Floor noise
Vert.	7386.000	PK	42.6	36.3	8.8	32.7	-	55.0	73.9	18.9	Floor noise
Vert.	9848.000	PK	42.0	39.0	9.3	33.4	-	56.8	73.9	17.1	Floor noise
Vert.	2483.500	AV	48.1	27.5	5.3	32.7	1.2	49.4	53.9	4.5	*1)
Vert.	4924.000	AV	32.1	31.5	7.4	31.6	-	39.4	53.9	14.5	Floor noise
Vert.	7386.000	AV	33.5	36.3	8.8	32.7	-	45.9	53.9	8.0	Floor noise
Vert.	9848.000	AV	33.0	39.0	9.3	33.4	-	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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

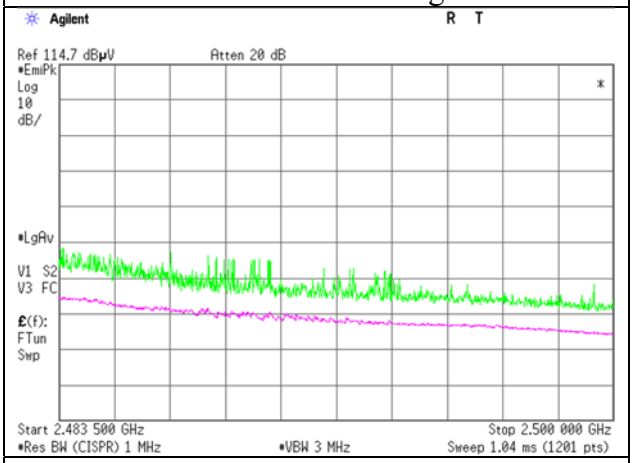
*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)
Mode	Tx 11n-20 2462 MHz

Horizontal

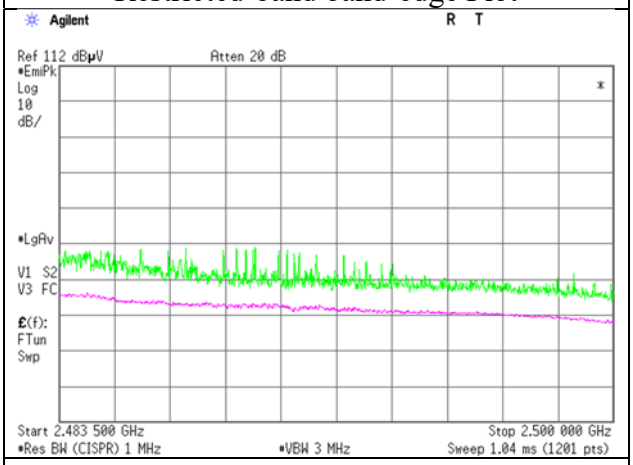
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

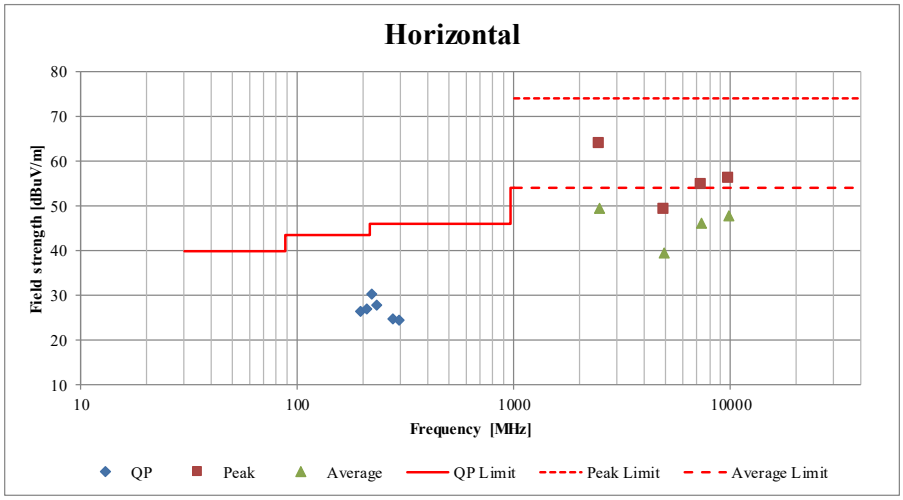


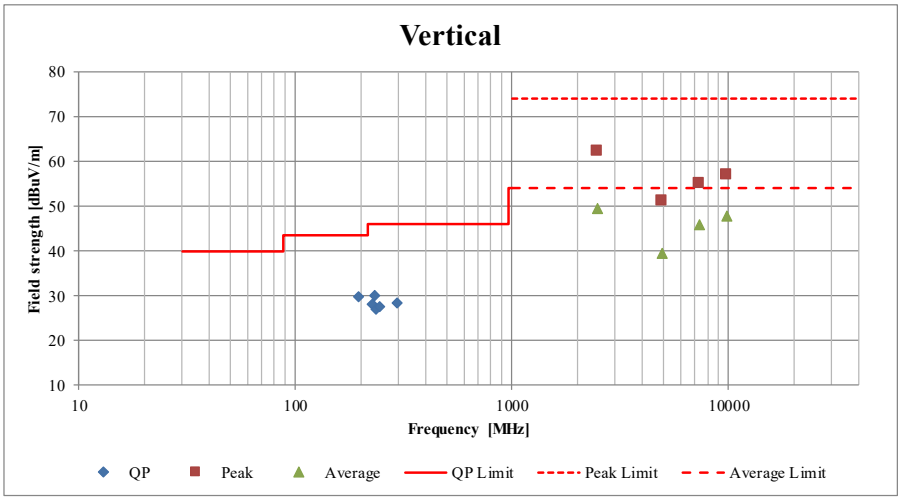
Trace Green : Peak Plot
Trace Purple : Average Plot

* 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.	13329061H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	May 4, 2020	May 5, 2020	May 10, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (10 GHz - 26.5 GHz)	Junya Okuno (Below 1 GHz)
Mode	Tx 11n-20 2462 MHz		



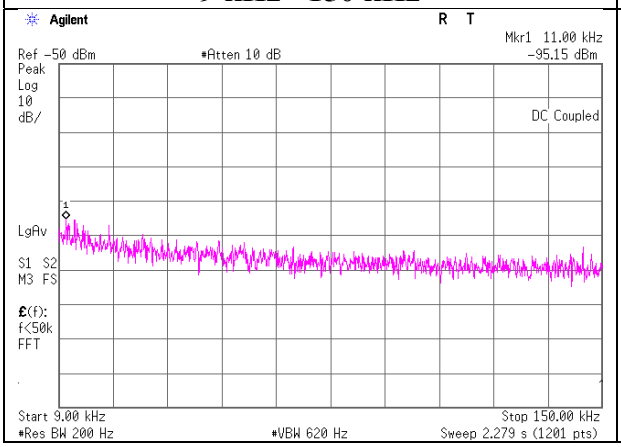


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

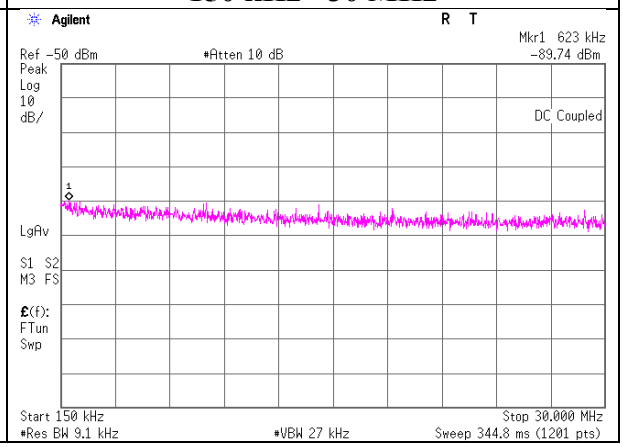
Conducted Spurious Emission

Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 7, 2020
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx 11n-20 2462 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
11.00	-95.2	1.07	9.9	2.0	1	-82.2	300	6.0	-21.0	46.7	67.7	
623.00	-89.7	1.71	9.9	2.0	1	-76.1	30	6.0	5.1	31.7	26.6	

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 ANSI C63.10 since antenna gain was less than 2.0 dBi.

Power Density

Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 7, 2020
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-26.76	1.28	19.97	-5.51	8.00	13.51
2437	-26.94	1.28	19.97	-5.69	8.00	13.69
2462	-26.81	1.28	19.97	-5.56	8.00	13.56

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-35.17	1.28	19.97	-13.92	8.00	21.92
2437	-33.86	1.28	19.97	-12.61	8.00	20.61
2462	-34.66	1.28	19.97	-13.41	8.00	21.41

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-32.88	1.28	19.97	-11.63	8.00	19.63
2437	-33.01	1.28	19.97	-11.76	8.00	19.76
2462	-32.61	1.28	19.97	-11.36	8.00	19.36

Sample Calculation:

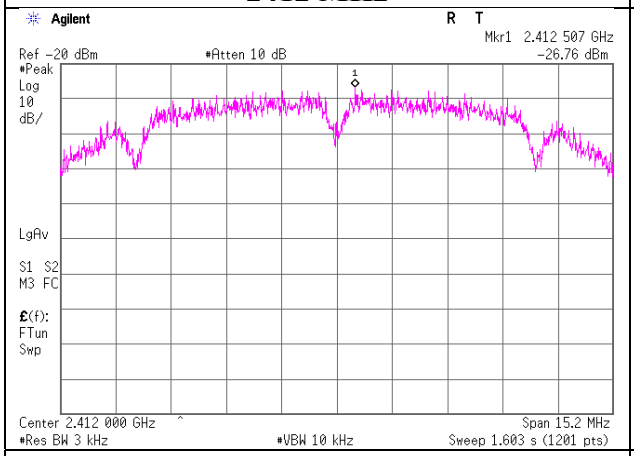
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

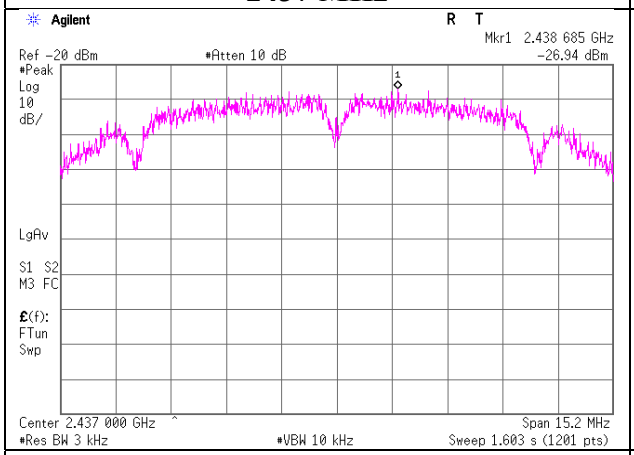
Power Density

11b

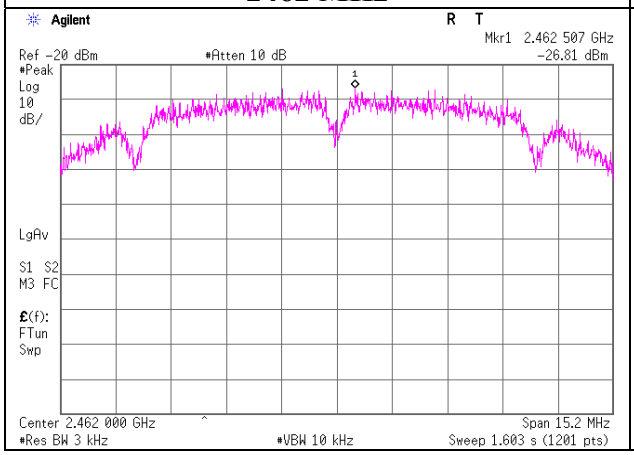
2412 MHz



2437 MHz

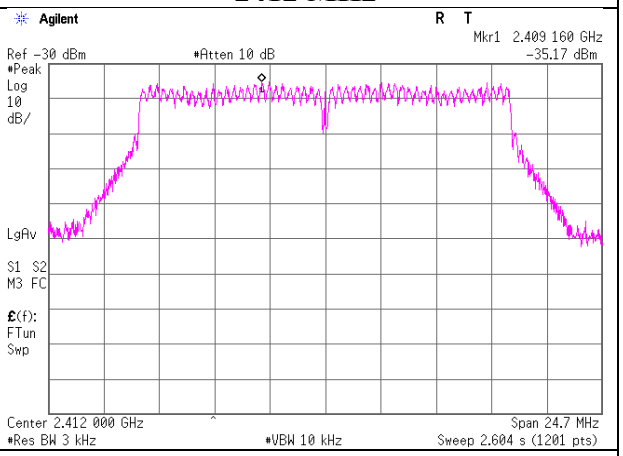


2462 MHz

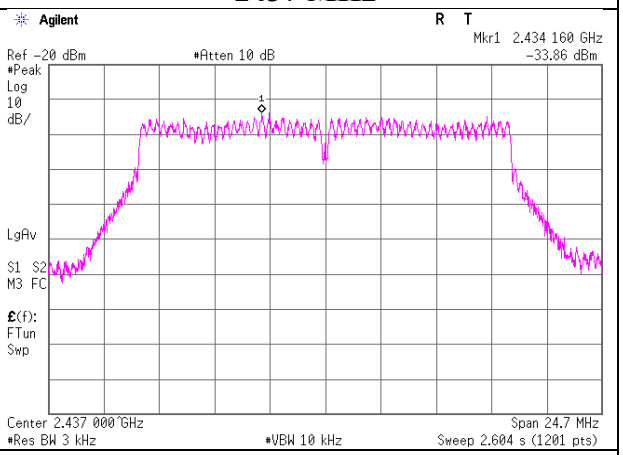


11g

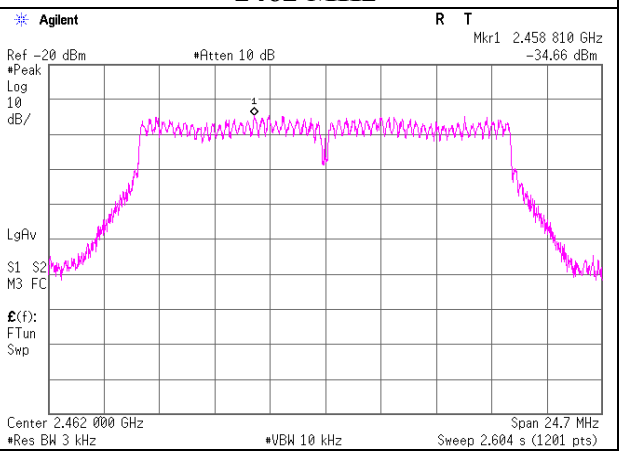
2412 MHz



2437 MHz



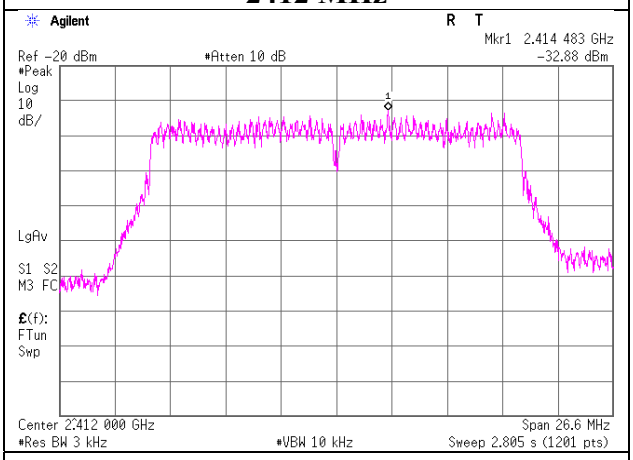
2462 MHz



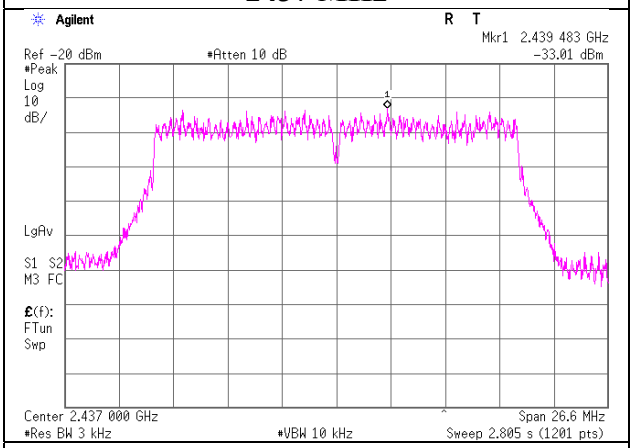
Power Density

11n-20

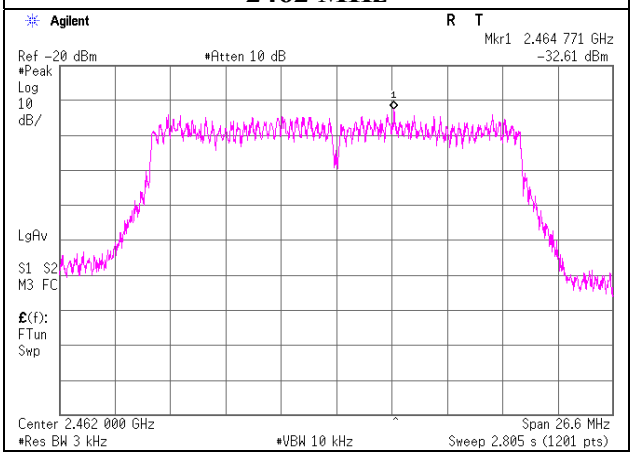
2412 MHz



2437 MHz



2462 MHz



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT/RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM	CTH-201	1301	01/07/2020	12
AT/RE	MMM-08	141532	DIGITAL HiTESTER	Hioki	3805	51201197	01/06/2020	12
AT	MPM-12	141809	Power Meter	ANRITSU	ML2495A	825002	05/07/2020	12
AT	MPSE-17	141830	Power sensor	ANRITSU	MA2411B	738285	05/07/2020	12
AT	MAT-56	141214	Attenuator(10dB)	Suhner	6810.19.A	-	-	-
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	24
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ	TEPTO-DV	-	-	-
RE	MAEC-03-SVSWR	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/08/2019	24
RE	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	258	09/26/2019	12
RE	MPA-11	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	03/24/2020	12
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/ 1902S579(5m)	03/02/2020	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170306	10/08/2019	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/11/2019	12
RE	MSA-10	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	08/07/2019	12
AT	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	12
AT	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	01/06/2020	12
AT	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
AT	MSA-15	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	10/09/2019	12
AT	MCC-178	141227	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S305	03/18/2020	12
AT	MAT-21	141174	Attenuator(20dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-120	901247	01/07/2020	12
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/04/2020	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/07/2019	12
RE	MAT-95	142314	Attenuator	Pasternack	PE7390-6	D/C 1504	06/11/2019	12
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1915	08/24/2019	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/02/2019	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-191	08/24/2019	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/10/2020	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/02/2019	12

***Hyphens for Last Calibration Date and Cal Int (month) 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.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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