RADIO TEST REPORT

Test Report No. : 13063555S-A-R2

Applicant	:	**PIONEER CORPORATION**
Type of Equipment	:	**RDS AV RECEIVER**
Model No.	:	**DMH-WC6600NEX**
FCC ID	:	**AJDK112**
Test regulation	:	**FCC Part 15 Subpart C: 2019** ***Wireless LAN & Bluetooth Low Energy part**
Test items	:	**Antenna Terminal Conducted Tests**
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 must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements.
   It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 13063555S-A-R1. 13063555S-A-R1 is replaced with this report.

Date of test: September 27 to October 16, 2019

Representative test engineer:

T. Kawakami

Takahiro Kawakami
Engineer
Consumer Technology Division

Approved by:

K. Takeyama

Kazutaka Takeyama
Engineer
Consumer Technology Division

CERTIFICATE 1266.03

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

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REVISION HISTORY

Original Test Report No.: 13063555S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13063555S-A	January 16, 2020	-	-
1	13063555S-A-R1	February 4, 2020	P.1	Modification of the applicant from: PIONEER CORPORATIONRDS AV RECEIVER to: PIONEER CORPORATION
			P.1	Addition of Test items: Antenna Terminal Conducted Tests
			P.5	Modification of the company name from: PIONEER CORPORATIONRDS AV RECEIVER to: PIONEER CORPORATION
			P.6	Modification of product description from: is a RDS AV RECEIVER to: is an RDS AV RECEIVER
			P.6	Removed from Clock frequency (ies) in the system: "Bluetooth Wi-Fi module: 32.768 kHz"
			P.7	Modification of the reference test report number from: No.13063556M-B to: No.13063556M-B-R1
2	13063555S-A-R2	February 13, 2020	P.7	Modification of the reference test report number from: No.13063556M-B-R1 to: No.13063556M-B-R2

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
SGI	Short Guard Interval
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

Company Name	:	PIONEER CORPORATION
Address	:	25-1, Yamada, Kawagoe-shi, Saitama, 350-8555, JAPAN
Telephone Number	:	+81-49-228-7681
Facsimile Number	:	+81-49-228-6172
Contact Person	:	Shigeru Yoshida

The information provided from the customer is as follows;
- Applicant, Type of Equipment, Model No., 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 (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	:	RDS AV RECEIVER
Model No.	:	DMH-WC6600NEX
Serial No.	:	Refer to SECTION 4.2
Rating	:	DC 14.4 V (DC 10.8 V to 15.1 V)
Receipt Date of Sample (Information from test lab.)	:	September 18, 2019
Country of Mass-production	:	Thailand
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: DMH-WC6600NEX (referred to as the EUT in this report) is an RDS AV RECEIVER.

General Specification

The clock frequencies used in the EUT:

Clock frequency(ies) in the system : DC-DC CONVERTER 1008 kHz / 700.5 kHz, 365.8 kHz / 413.9 kHz
FM/AM TUNER 55.467 MHz (VCO: 5.9904 GHz / 6.2208 GHz)
MAIN PROCESSER 24 MHz
SYSTEM MICRO COMPUTER 12.5 MHz
LCD BACK LIGHT 515.7 kHz / 476.6 kHz
LINE AMPLIFER 515.7 kHz / 476.6 kHz
CHIPS 26 MHz, 32.768 kHz, 10 MHz
HDMI RECEIVER 27 MHz
VIDEO DECORDER 32 MHz

Radio Specification

Radio Type	:	Transceiver	
Frequency of Operation	:	2.4 GHz:	2402 MHz - 2480 MHz (Bluetooth BDR/EDR, Bluetooth Low Energy)
			2412 MHz - 2462 MHz (IEEE 802.11b/g/n)
		5 GHz	5745 MHz (IEEE 802.11a/n-20)
			5755 MHz (IEEE 802.11n-40/ac-40)
			5775 MHz (IEEE 802.11ac-80)
Modulation	:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11g/n/a/ac)	
		FHSS (Bluetooth BDR/EDR)	
		GFSK (Bluetooth Low Energy)	
Power Supply (inner)	:	DC 3.3 V/1.8 V	
Antenna type	:	Monopole Antenna	
Antenna Gain	:	2.4 GHz:	-14.5 dBi (Bluetooth BDR/EDR, Bluetooth Low Energy)
			-11.2 dBi (IEEE 802.11b/g/n)
		5 GHz:	-13.2 dBi
Operating Temperature	:	-10 deg. C to +60 deg. C	

GNSS

Radio Type	:	Receiver
Frequency of Operation	:	GPS: 1575.42 MHz
		GLONASS: 1598.025 MHz - 1605.375 MHz
		Galileo: 1575.42 MHz.
Antenna type	:	External Antenna
Antenna Gain	:	2.0 dBi (Elevation Angle:90 deg.)
		-6.0 dBi (Elevation Angle:10 deg.)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 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 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	**FCC:** Section 15.207	N/A	N/A	- *1)
	ISED: RSS-Gen 8.8	**ISED:** 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
	ISED: -	**ISED:** 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
	ISED: RSS-Gen 6.12	**ISED:** RSS-247 5.4(d)			
Power Density	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(e)		Complied c)	Conducted
	ISED: -	**ISED:** RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	See data.	Complied d)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)
	ISED: RSS-Gen 6.13	**ISED:** 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 does not have AC power ports.
*2) For the Radiated spurious emission test, refer to test report No.13063556M-B-R2.

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)

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 stable voltage constantly to the wireless transmitter regardless of input voltage.
Instead of a new battery, DC power supply was used for the test. That does not affect the test result, 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	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.
Shonan EMC Lab.

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.98 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.75 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.12 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.06 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.24 dB
Spurious emission (Conducted) below 1GHz	0.9 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.9 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.9 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.0 dB
Bandwidth Measurement	0.07 %
Duty cycle and Time Measurement	0.262 %

3.5 Test Location

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1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	2.55 x 4.1 x 2.5	-	-

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)

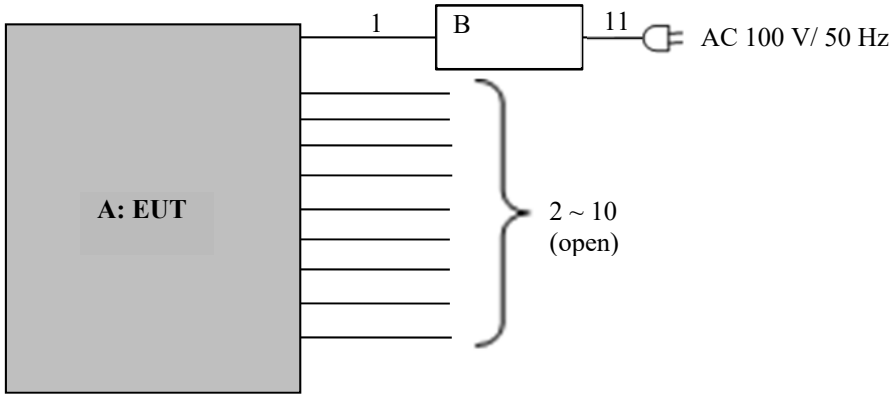
Test operating mode was determined as follows according to "Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - " of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 5 (SGI OFF), PN9
Tx (Transmitting), Bluetooth Low Energy (BT LE)	Maximum Packet Size,PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b:14 dBm 11g: 12 dBm 11n-20: 11 dBm BT LE: Fixed Software: SoC：0.0601400 SYS：7.13 *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
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	Tx 11b Tx 11g Tx 11n-20	2412 MHz 2437 MHz 2462 MHz
	Tx BT LE	2402 MHz 2440 MHz 2480 MHz
Conducted Spurious Emission	Tx 11g	2437 MHz
	Tx BT LE	2402 MHz 2440 MHz 2480 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	Remark
A	RDS AV RECEIVER	DMH-WC6600NEX	SGTM000034UC	Pioneer Corporation	EUT
B	DC Power Supply	PAN 35-10A	DE001677	Kikusui	-

List of cables used

No.	Name	Length (m)	eld		Remark
			Cable	Connector	
1	DC (+B, ACC, GND)	0.15 + 2.4	Unshielded	Unshielded	-
2	Speaker Front L	0.15	Unshielded	Unshielded	-
3	Speaker Front R	0.15	Unshielded	Unshielded	-
4	Speaker Rear L	0.15	Unshielded	Unshielded	-
5	Speaker Rear R	0.15	Unshielded	Unshielded	-
6	System Remote Control	0.15	Unshielded	Unshielded	-
7	ILL +	0.15	Unshielded	Unshielded	-
8	Reverse Gear Signal In	0.15	Unshielded	Unshielded	-
9	Parking Brake	2.0	Unshielded	Unshielded	-
10	Car Speed Signal In	0.15	Unshielded	Unshielded	-
11	AC	2.0	Unshielded	Unshielded	-

SECTION 5: 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	Enough width to display emission skirts	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: 160 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 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	10 kHz	30 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 = 10 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

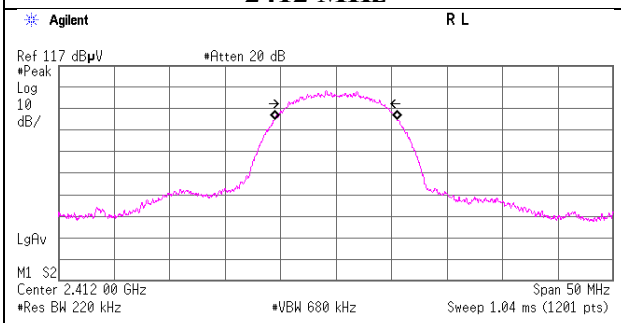
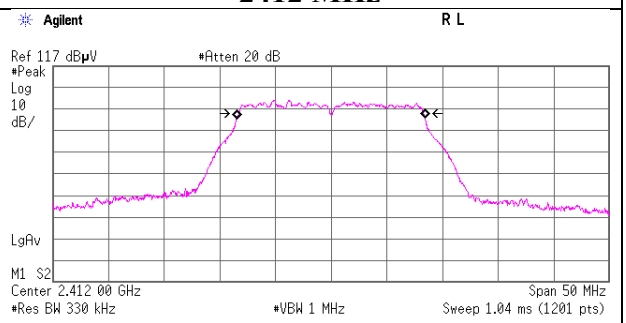
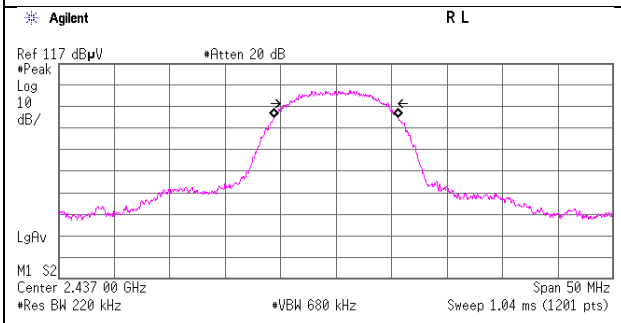
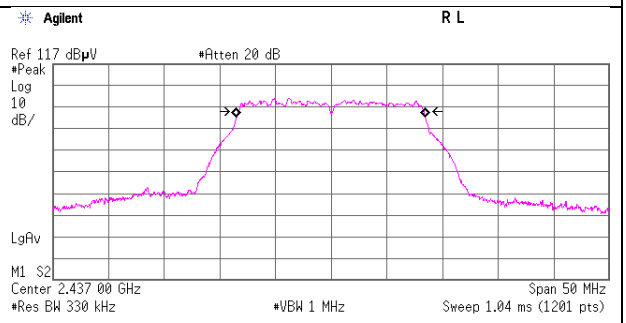
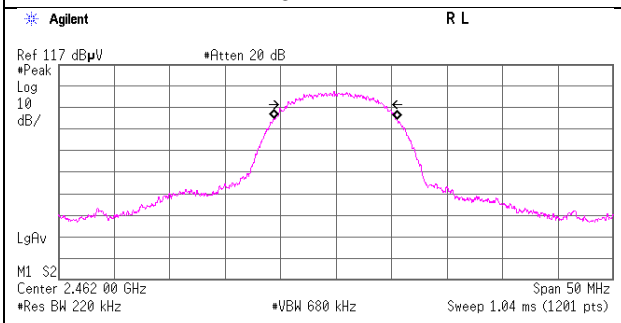
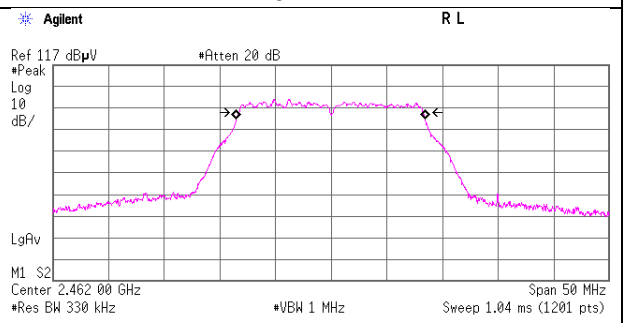
APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	13063555S-A-R2	
Test place	Shonan EMC Lab. No.1 Measurement Room	
Date	October 8, 2019	October 16, 2019
Temperature / Humidity	24deg. C / 52 % RH	25deg. C / 47 % RH
Engineer	Takahiro Kawakami	Hiromasa Sato
Mode	Tx	

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	11097.1	8.552	> 0.5000
	2437	11186.5	8.065	> 0.5000
	2462	11121.5	8.247	> 0.5000
11g	2412	16919.3	16.472	> 0.5000
	2437	16908.4	16.476	> 0.5000
	2462	16921.1	16.482	> 0.5000
11n-20	2412	18084.9	17.729	> 0.5000
	2437	18064.4	17.731	> 0.5000
	2462	18116.1	17.750	> 0.5000
BT LE	2402	1064.5	0.732	> 0.5000
	2440	1065.2	0.733	> 0.5000
	2480	1065.7	0.732	> 0.5000

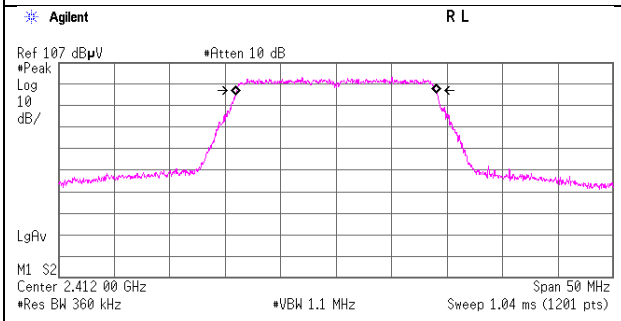
99%Occupied Bandwidth

11b	11g
2412 MHz	**2412 MHz**
	
2437 MHz	**2437 MHz**
	
2462 MHz	**2462 MHz**
	

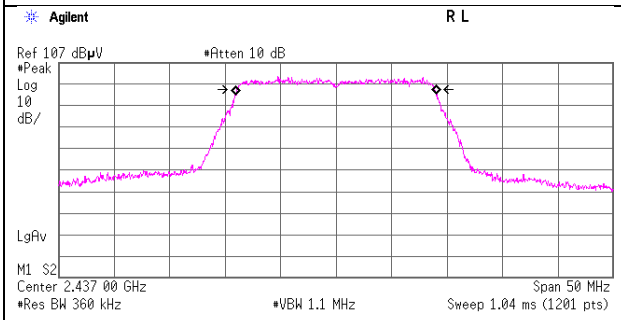
99% Occupied Bandwidth

11n-20

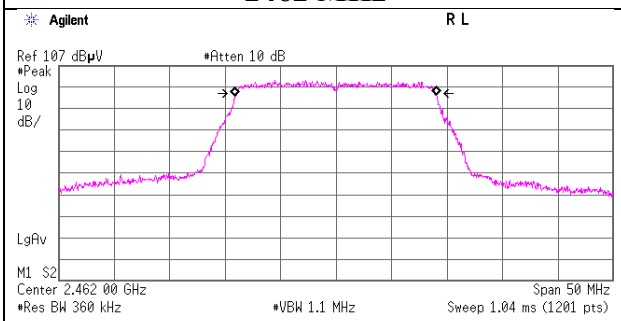
2412 MHz



2437 MHz

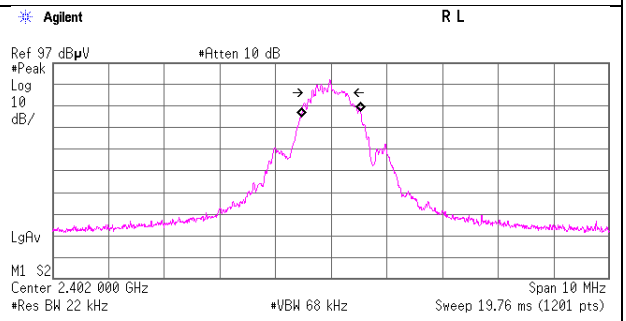


2462 MHz

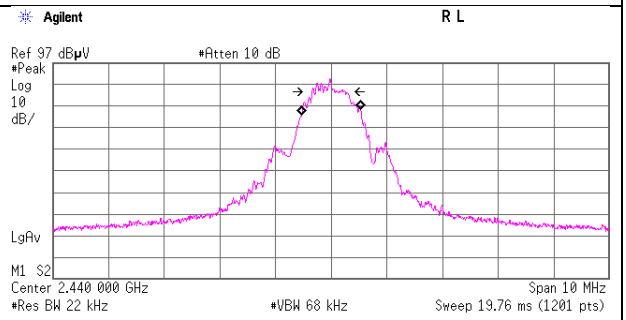


BT LE

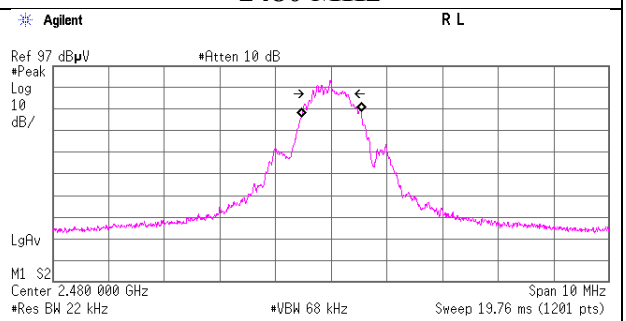
2402 MHz



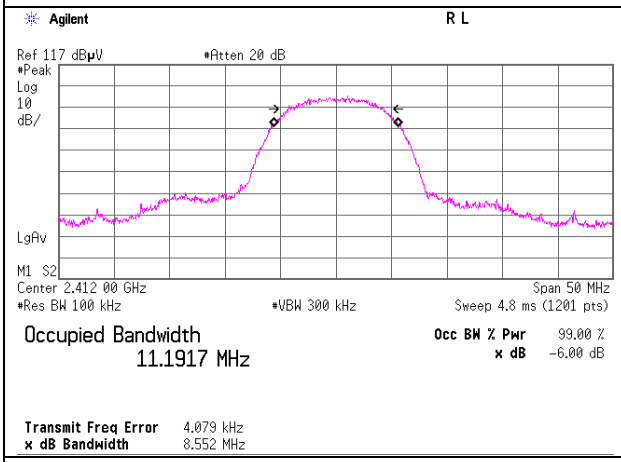
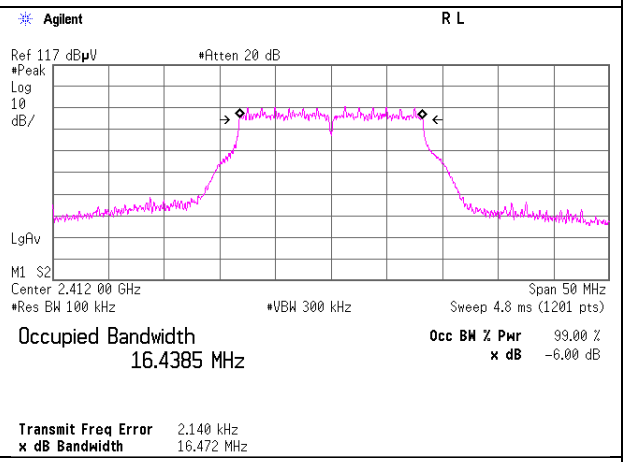
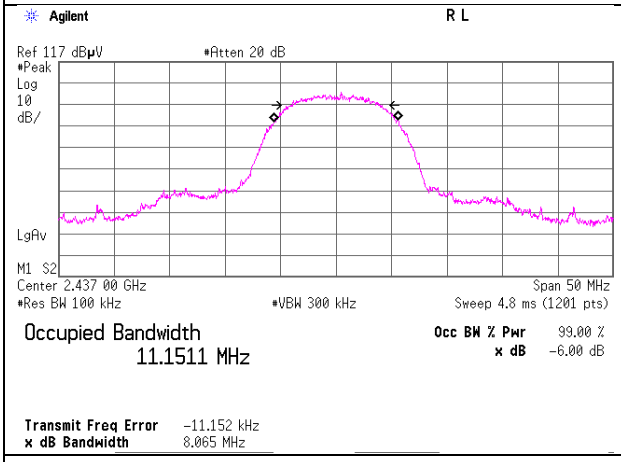
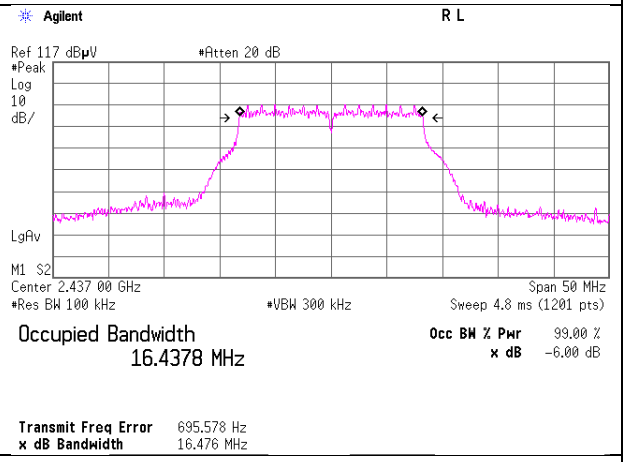
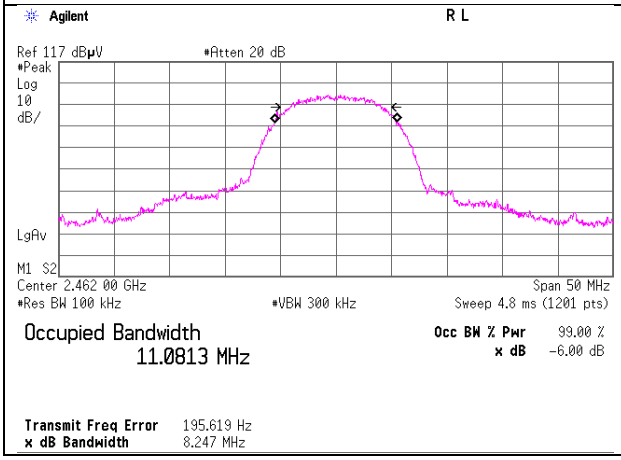
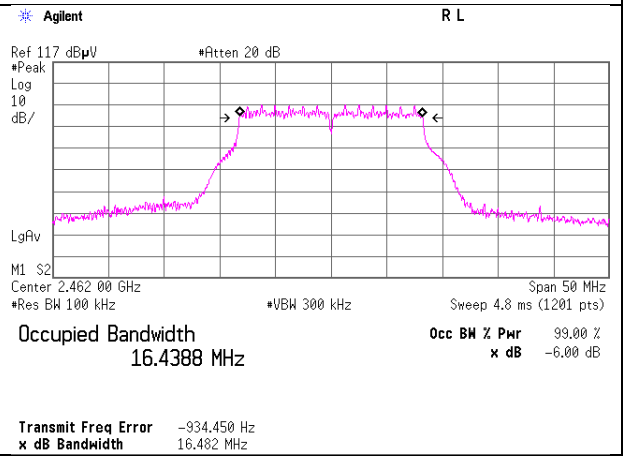
2440 MHz



2480 MHz



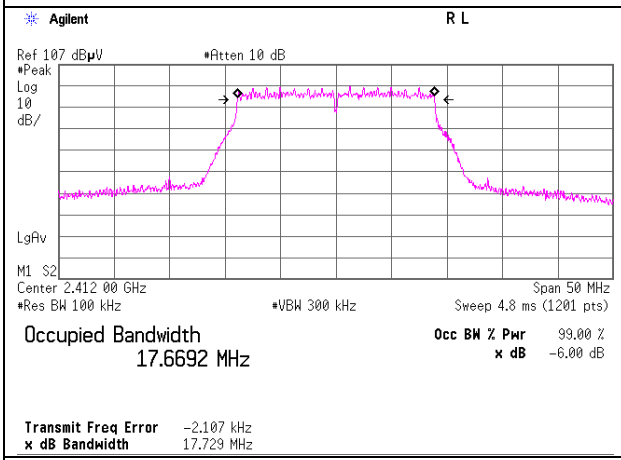
6dB Bandwidth

11b	11g
2412 MHz	**2412 MHz**
	
2437 MHz	**2437 MHz**
	
2462 MHz	**2462 MHz**
	

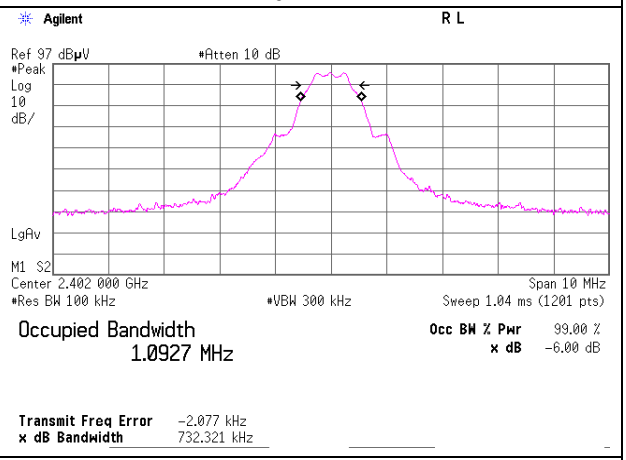
6dB Bandwidth

11n-20	BT LE

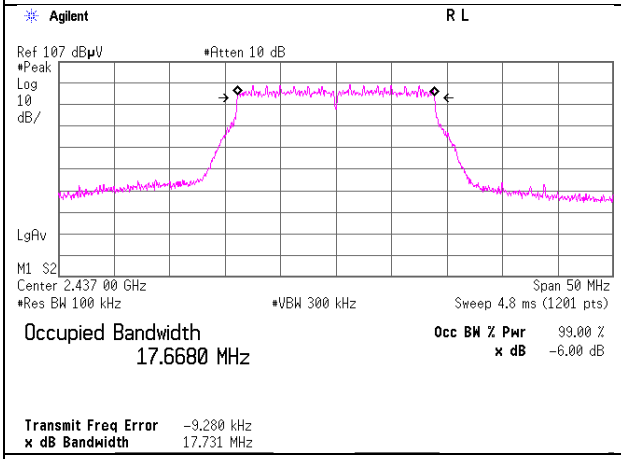
2412 MHz



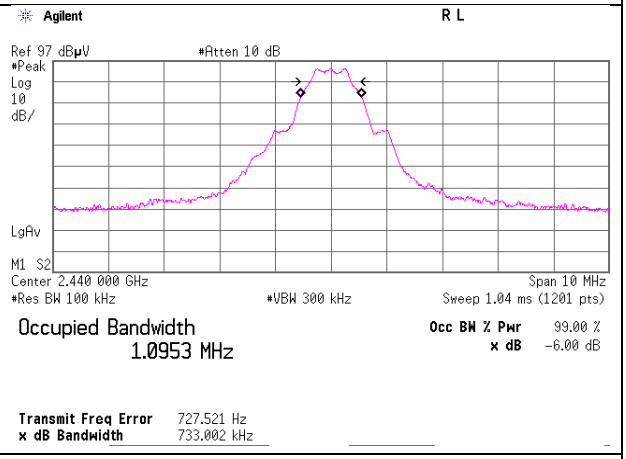
2402 MHz



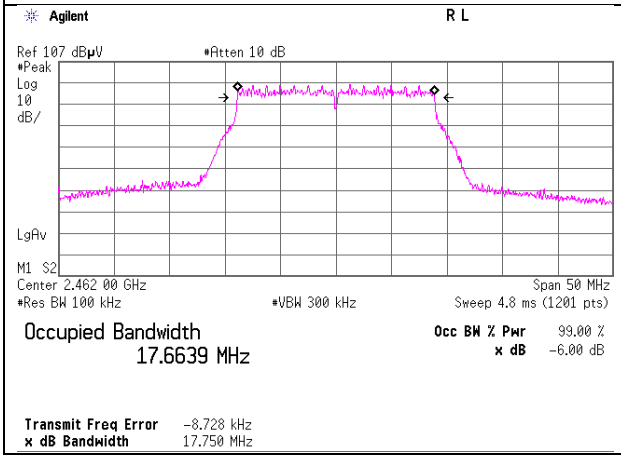
2437 MHz



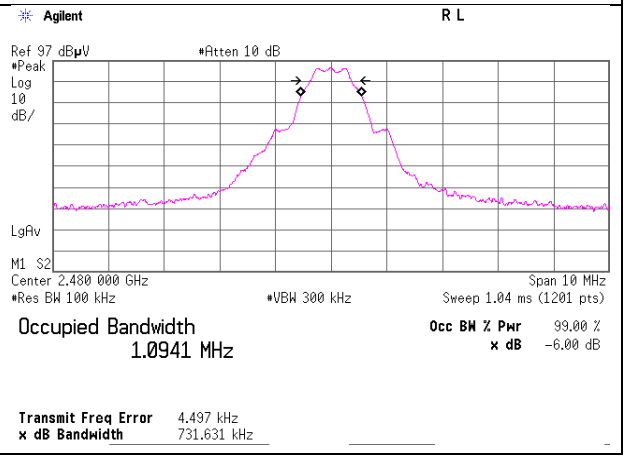
2440 MHz



2462 MHz



2480 MHz



Maximum Peak Output Power

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	September 27, 2019
Temperature / Humidity	26 deg. C / 45 % RH
Engineer	Makoto Hosaka
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	7.40	2.52	9.92	19.84	96.38	30.00	1000	10.16	-11.20	8.64	7.31	36.02	4000	27.38
2437	7.27	2.53	9.92	19.72	93.76	30.00	1000	10.28	-11.20	8.52	7.11	36.02	4000	27.50
2462	7.09	2.54	9.92	19.55	90.16	30.00	1000	10.45	-11.20	8.35	6.84	36.02	4000	27.67

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.

Rate	Reading	Remark
[Mbps]	[dBm]	
1	7.04	
2	6.98	
5.5	6.97	
11	7.27	*

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

Maximum Peak Output Power

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	September 27, 2019
Temperature / Humidity	26 deg. C / 45 % RH
Engineer	Makoto Hosaka
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	12.93	2.52	9.92	25.37	344.35	30.00	1000	4.63	-11.20	14.17	26.12	36.02	4000	21.85
2437	12.99	2.53	9.92	25.44	349.95	30.00	1000	4.56	-11.20	14.24	26.55	36.02	4000	21.78
2462	12.69	2.54	9.92	25.15	327.34	30.00	1000	4.85	-11.20	13.95	24.83	36.02	4000	22.07

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.

Rate	Reading	Remark
[Mbps]	[dBm]	
6	11.51	
9	11.11	
12	11.09	
18	11.10	
24	11.66	
36	11.47	
48	12.99	*
54	10.26	

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

Maximum Peak Output Power

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	September 27, 2019
Temperature / Humidity	26 deg. C / 45 % RH
Engineer	Makoto Hosaka
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	12.49	2.52	9.92	24.93	311.17	30.00	1000	5.07	-11.20	13.73	23.60	36.02	4000	22.29
2437	12.93	2.53	9.92	25.38	345.14	30.00	1000	4.62	-11.20	14.18	26.18	36.02	4000	21.84
2462	12.64	2.54	9.92	25.10	323.59	30.00	1000	4.90	-11.20	13.90	24.55	36.02	4000	22.12

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.

SGI:ON

MCS Number	Reading [dBm]	Remark
0	11.57	
1	11.13	
2	10.79	
3	12.04	
4	12.01	
5	12.64	
6	11.96	
7	12.12	

SGI:OFF

MCS Number	Reading [dBm]	Remark
0	11.36	
1	11.68	
2	11.51	
3	12.20	
4	11.63	
5	12.93	*
6	12.00	
7	11.68	

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

Maximum Peak Output Power

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.3 Shielded Room
Date	October 11, 2019
Temperature / Humidity	25 deg. C / 50 % RH
Engineer	Toshinori Yamada
Mode	Tx BT LE

				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]
2402	-13.02	1.24	9.82	-1.96	0.64	30.00	1000	31.96	-14.50	-16.46	0.02	36.02	4000	52.48
2440	-12.34	1.24	9.82	-1.28	0.74	30.00	1000	31.28	-14.50	-15.78	0.03	36.02	4000	51.80
2480	-12.28	1.25	9.82	-1.21	0.76	30.00	1000	31.21	-14.50	-15.71	0.03	36.02	4000	51.73

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.

Average Output Power
(Reference data for RF Exposure)

Report No.	13063555S-A-R2		
Test place	Shonan EMC Lab.		
	No.5 Shielded Room	No.5 Shielded Room	No.1 Measurement Room
Date	September 27, 2019	September 30, 2019	October 16, 2019
Temperature / Humidity	26 deg. C / 45 % RH	23 deg. C / 54 % RH	25 deg. C / 47 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Hiromasa Sato
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	3.49	2.52	9.92	15.93	39.17	0.04	15.97	39.54
2437	3.38	2.53	9.92	15.83	38.28	0.04	15.87	38.64
2462	3.20	2.54	9.92	15.66	36.81	0.04	15.70	37.15

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	1.24	2.52	9.92	13.68	23.33	0.28	13.96	24.89
2437	1.26	2.53	9.92	13.71	23.50	0.28	13.99	25.06
2462	1.05	2.54	9.92	13.51	22.44	0.28	13.79	23.93

11n-20 **MCS 0** SGI:OFF

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	0.24	2.52	9.92	12.68	18.54	0.30	12.98	19.86
2437	0.12	2.53	9.92	12.57	18.07	0.30	12.87	19.36
2462	-0.02	2.54	9.92	12.44	17.54	0.30	12.74	18.79

BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-16.05	1.24	9.82	-4.99	0.32	1.79	-3.20	0.48
2440	-15.28	1.24	9.82	-4.22	0.38	1.79	-2.43	0.57
2480	-15.14	1.25	9.82	-4.07	0.39	1.79	-2.28	0.59

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.

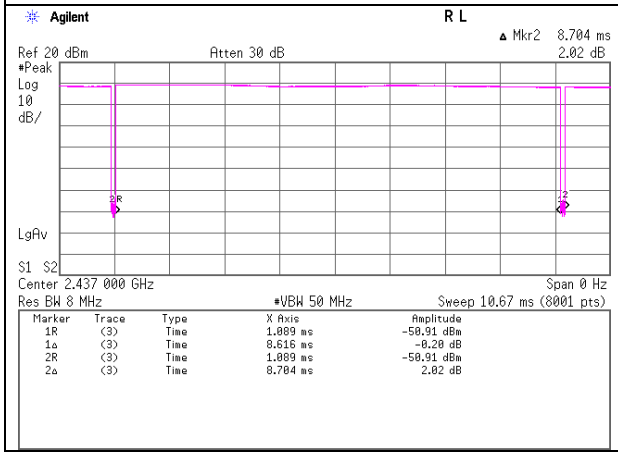
Burst rate confirmation (for average output power)

Report No.	13063555S-A-R2	
Test place	Shonan EMC Lab.	
	No.5 Shielded Room	No.1 Measurement Room
Date	September 27, 2019	October 16, 2019
Temperature / Humidity	26 deg. C / 45 % RH	25 deg. C / 47 % RH
Engineer	Makoto Hosaka	Hiromasa Sato
Mode	Tx	

Lowest Rate

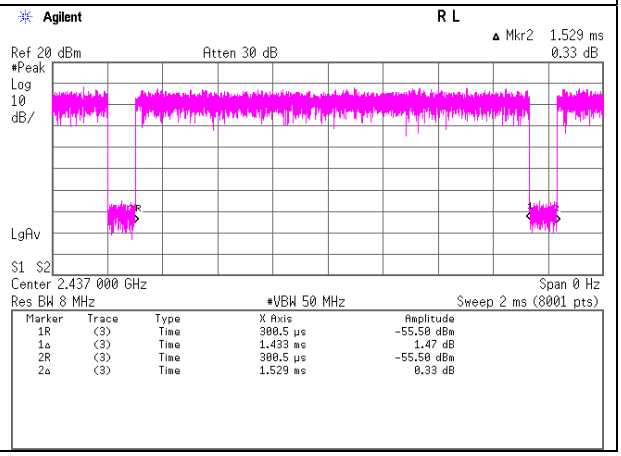
11b 1 Mbps

Tx on / (Tx on + Tx off) = 0.990
Tx on / (Tx on + Tx off) * 100 = 99.0 %
Duty factor = 10 * log (8.704 / 8.616) = 0.04 dB



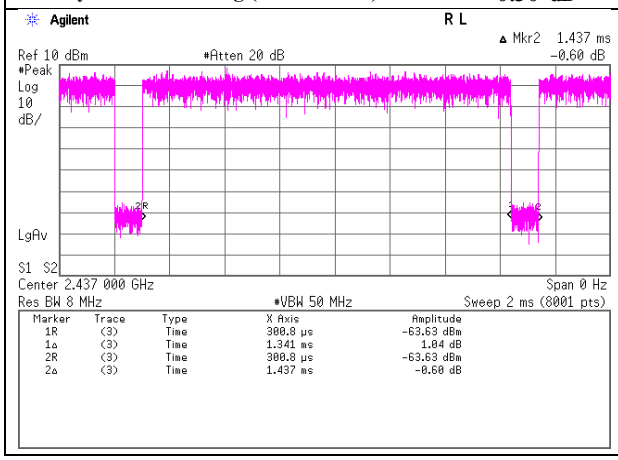
11g 6 Mbps

Tx on / (Tx on + Tx off) = 0.937
Tx on / (Tx on + Tx off) * 100 = 93.7 %
Duty factor = 10 * log (1.529 / 1.433) = 0.28 dB



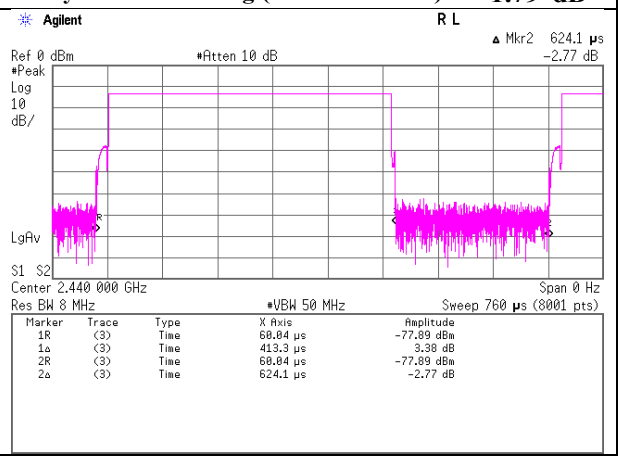
11n-20 MCS 0 (SGI:OFF)

Tx on / (Tx on + Tx off) = 0.933
Tx on / (Tx on + Tx off) * 100 = 93.3 %
Duty factor = 10 * log (1.437 / 1.341) = 0.30 dB



BT LE

Tx on / (Tx on + Tx off) = 0.662
Tx on / (Tx on + Tx off) * 100 = 66.2 %
Duty factor = 10 * log (0.6241 / 0.4133) = 1.79 dB



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

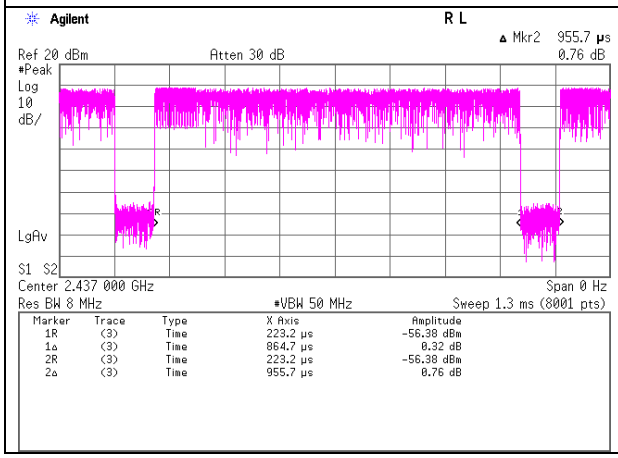
Burst rate confirmation (for radiated spurious emission)

Report No.	13063555S-A-R2	
Test place	Shonan EMC Lab.	
	No.5 Shielded Room	No.1 Measurement Room
Date	September 27, 2019	October 16, 2019
Temperature / Humidity	26 deg. C / 45 % RH	25 deg. C / 47 % RH
Engineer	Makoto Hosaka	Hiromasa Sato
Mode	Tx	

Worst Rate

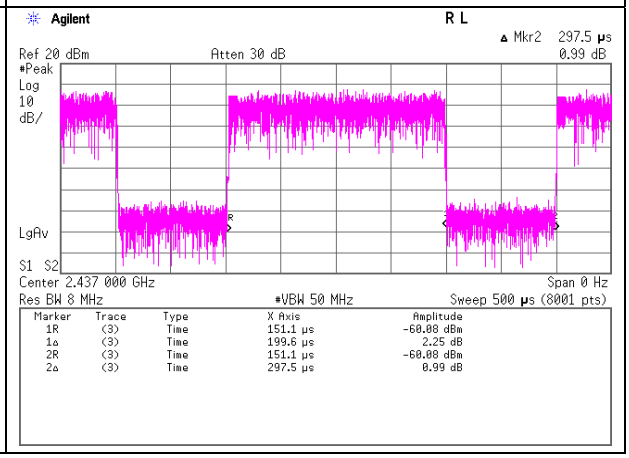
11b 11 Mbps

Tx on / (Tx on + Tx off) =	**0.905**
Tx on / (Tx on + Tx off) * 100 =	**90.5 %**
Duty factor = 20 * log (0.9557 / 0.8647) =	**0.87 dB**



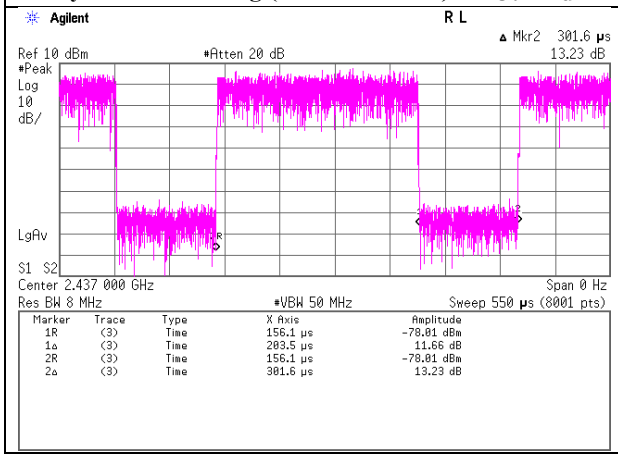
11g 48 Mbps

Tx on / (Tx on + Tx off) =	**0.671**
Tx on / (Tx on + Tx off) * 100 =	**67.1 %**
Duty factor = 20 * log (0.2975 / 0.1996) =	**3.47 dB**



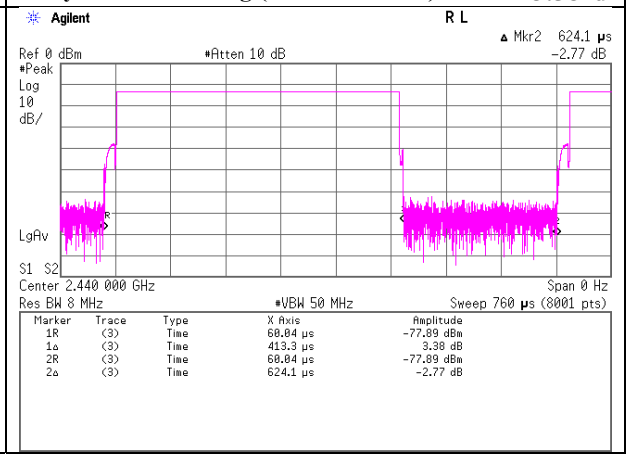
11n-20 MCS 5 (SGI:OFF)

Tx on / (Tx on + Tx off) =	**0.675**
Tx on / (Tx on + Tx off) * 100 =	**67.5 %**
Duty factor = 20 * log (0.3016 / 0.2035) =	**3.42 dB**



BT LE

Tx on / (Tx on + Tx off) =	**0.662**
Tx on / (Tx on + Tx off) * 100 =	**66.2 %**
Duty factor = 20 * log (0.6241 / 0.4133) =	**3.58 dB**

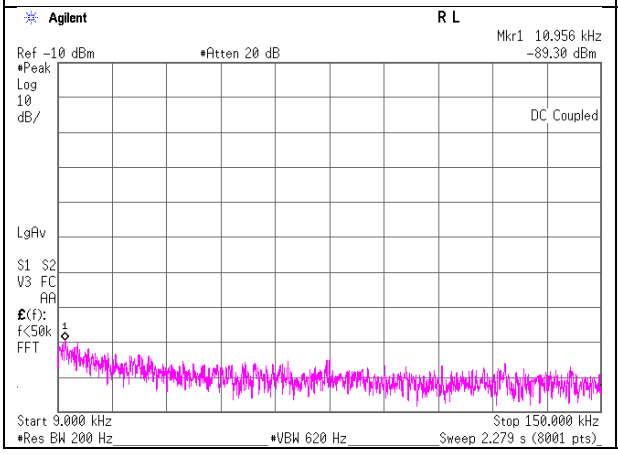


* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

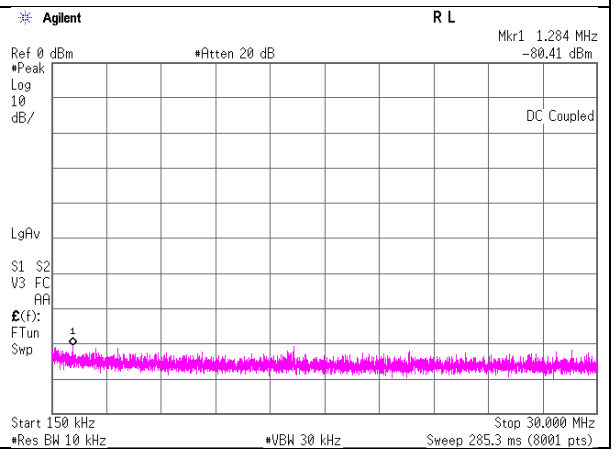
Conducted Spurious Emission

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	October 8, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx 11g 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
10.96	-89.3	0.00	9.7	2.0	1	-77.6	300	6.0	-16.3	46.8	63.1	
1284.00	-80.4	0.01	9.7	2.0	1	-68.7	30	6.0	12.6	25.4	12.8	

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)

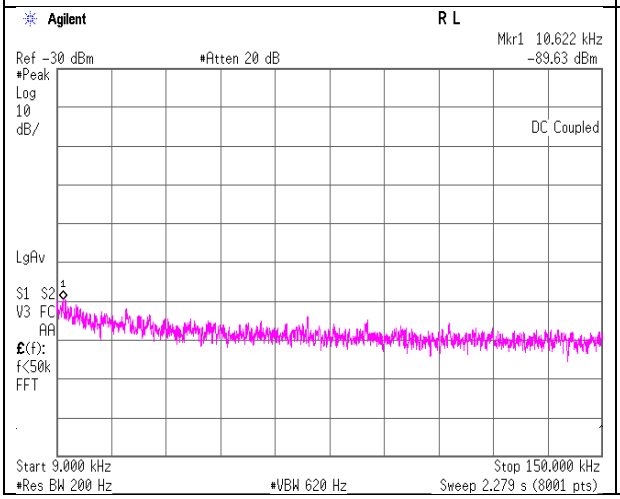
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

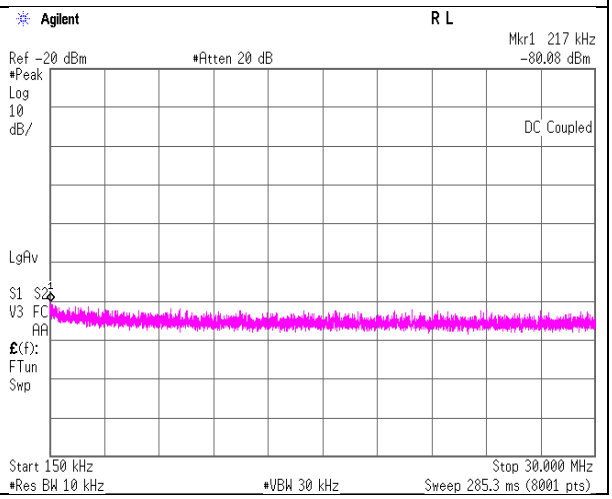
Conducted Spurious Emission

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	October 16, 2019
Temperature / Humidity	25 deg. C / 47 % RH
Engineer	Hiromasa Sato
Mode	Tx BT LE 2402 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
10.62	-89.6	0.02	9.8	2.0	1	-77.8	300	6.0	-16.6	47.0	63.6	
217.00	-80.1	0.02	9.8	2.0	1	-68.3	300	6.0	-7.0	20.8	27.8	

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)

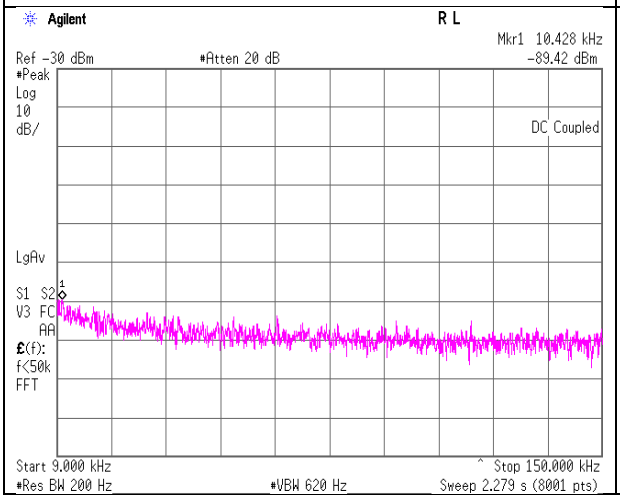
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

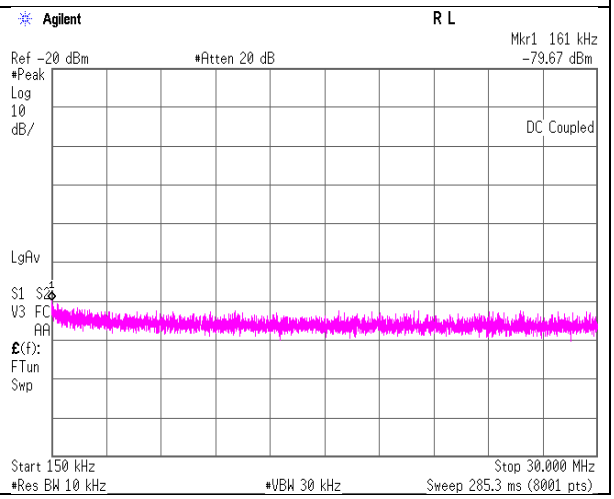
Conducted Spurious Emission

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	October 16, 2019
Temperature / Humidity	25 deg. C / 47 % RH
Engineer	Hiromasa Sato
Mode	Tx BT LE 2440 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
10.43	-89.4	0.02	9.8	2.0	1	-77.6	300	6.0	-16.3	47.2	63.5	
161.00	-79.7	0.02	9.8	2.0	1	-67.8	300	6.0	-6.6	23.4	30.0	

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)

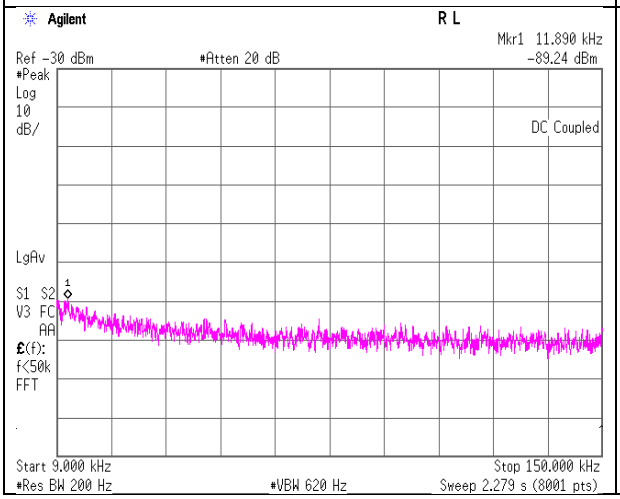
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

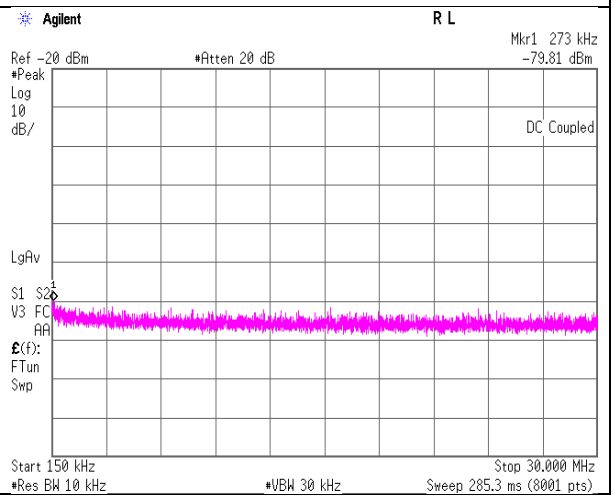
Conducted Spurious Emission

Report No.	13063555S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	October 16, 2019
Temperature / Humidity	25 deg. C / 47 % RH
Engineer	Hiromasa Sato
Mode	Tx BT LE 2480 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
11.89	-89.2	0.02	9.8	2.0	1	-77.4	300	6.0	-16.2	46.1	62.3	
273.00	-79.8	0.02	9.8	2.0	1	-68.0	300	6.0	-6.7	18.8	25.5	

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.	13063555S-A-R2	
Test place	Shonan EMC Lab. No.1 Measurement Room	
Date	October 8, 2019	October 16, 2019
Temperature / Humidity	24 deg. C / 52 % RH	25 deg. C / 47 % RH
Engineer	Takahiro Kawakami	Hiromasa Sato
Mode	Tx	

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-19.68	1.73	9.82	-8.13	8.00	16.13
2437	-19.37	1.73	9.82	-7.82	8.00	15.82
2462	-19.37	1.74	9.82	-7.81	8.00	15.81

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-25.15	1.73	9.82	-13.60	8.00	21.60
2437	-25.33	1.73	9.82	-13.78	8.00	21.78
2462	-25.42	1.74	9.82	-13.86	8.00	21.86

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-25.59	1.73	9.82	-14.04	8.00	22.04
2437	-24.91	1.73	9.82	-13.36	8.00	21.36
2462	-25.91	1.74	9.82	-14.35	8.00	22.35

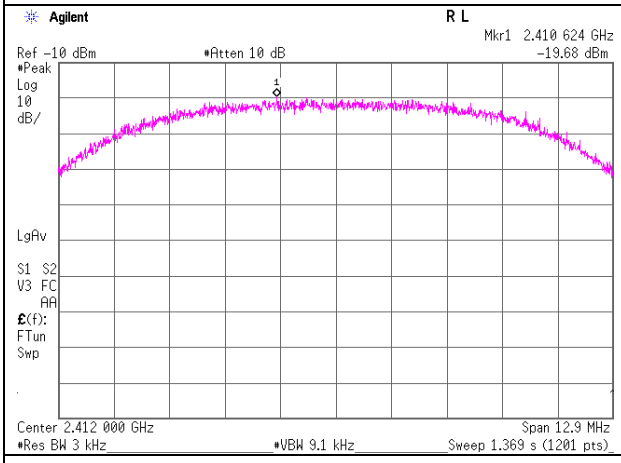
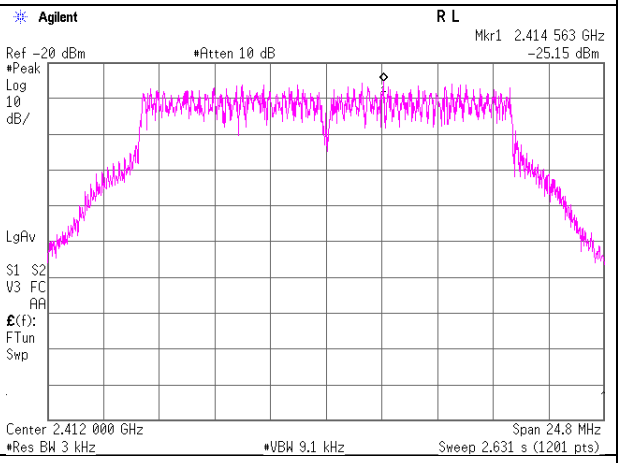
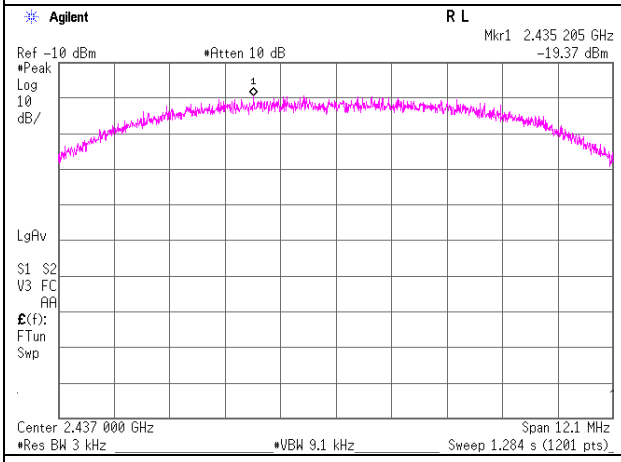
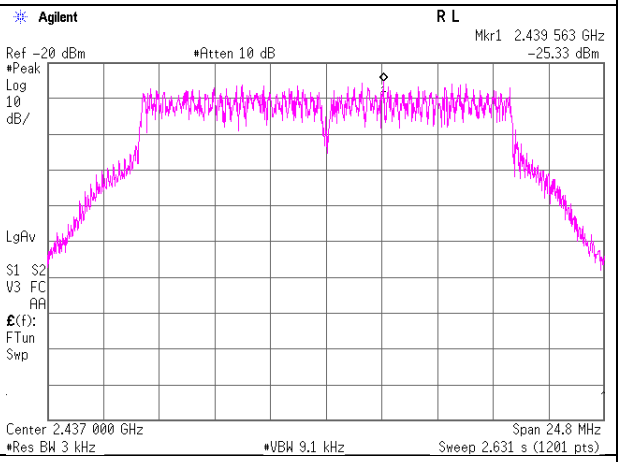
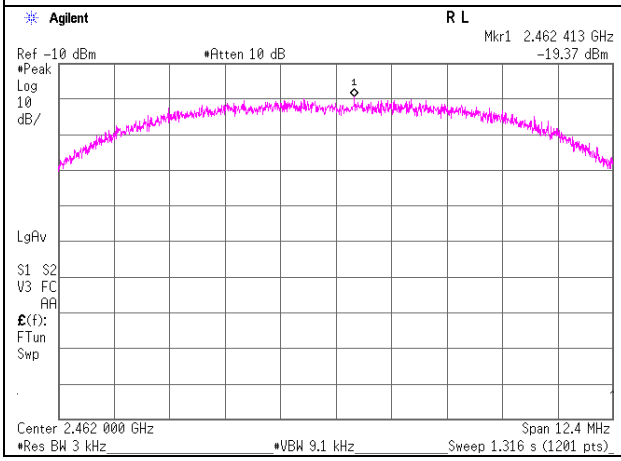
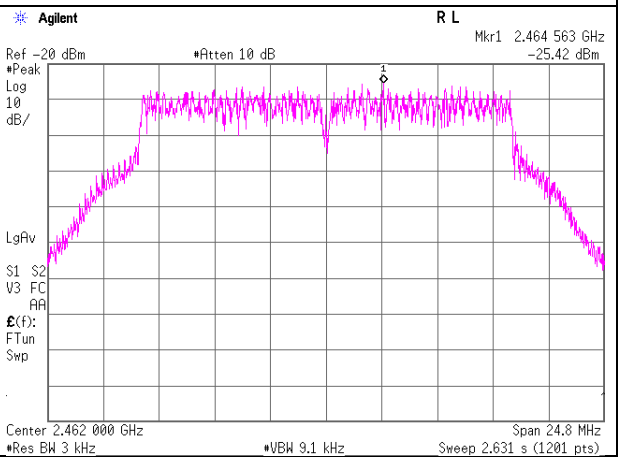
BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402	-27.73	1.32	9.89	-16.52	8.00	24.52
2440	-27.21	1.33	9.89	-15.99	8.00	23.99
2480	-27.05	1.34	9.89	-15.82	8.00	23.82

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.

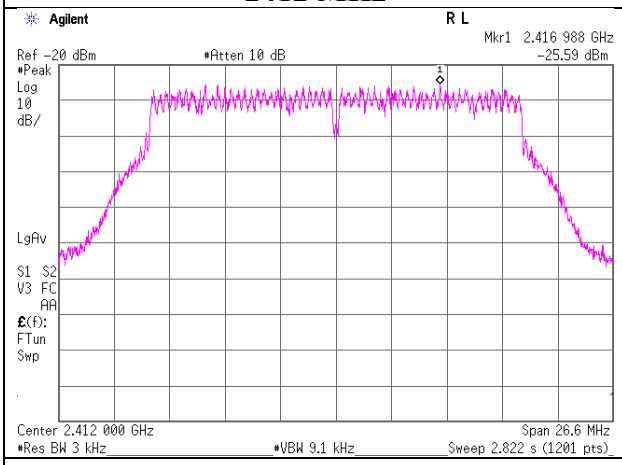
Power Density

11b	11g
2412 MHz	**2412 MHz**
	
2437 MHz	**2437 MHz**
	
2462 MHz	**2462 MHz**
	

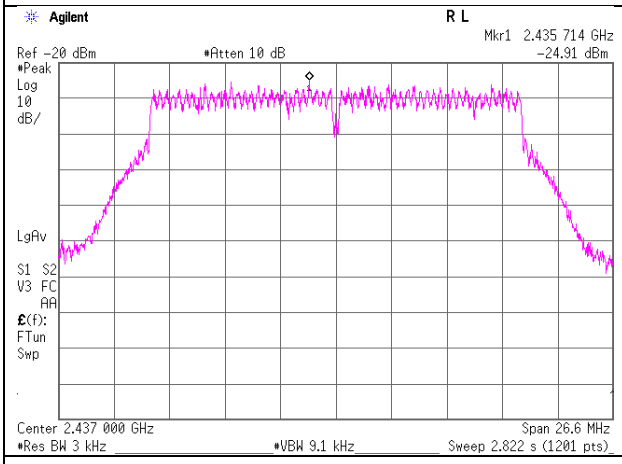
Power Density

11n-20

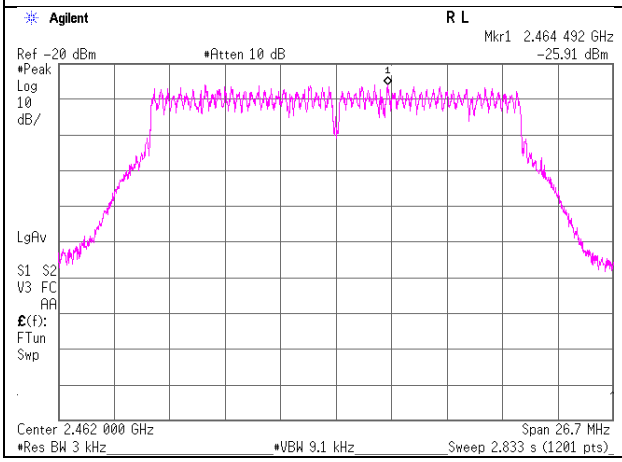
2412 MHz



2437 MHz

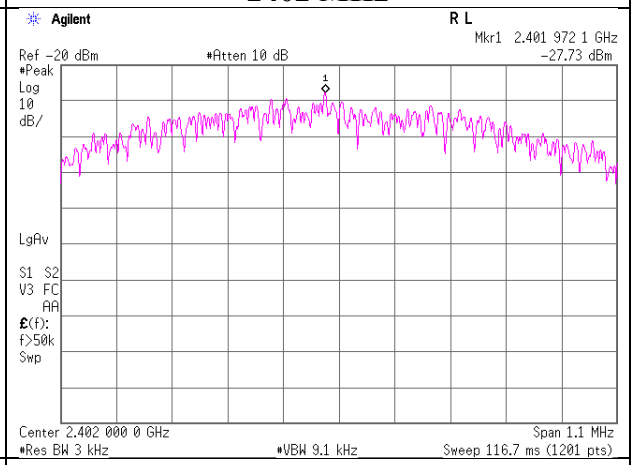


2462 MHz

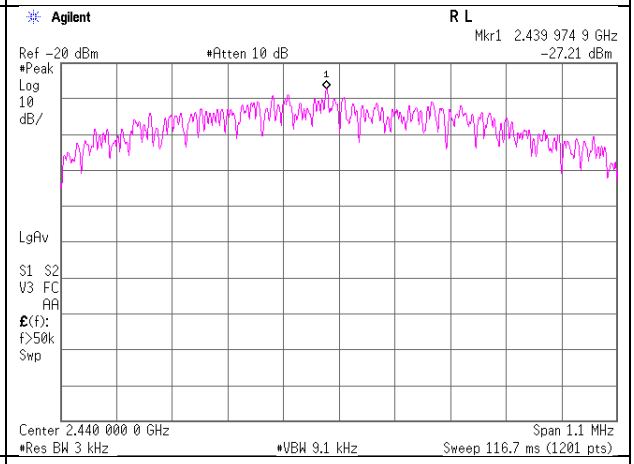


BT LE

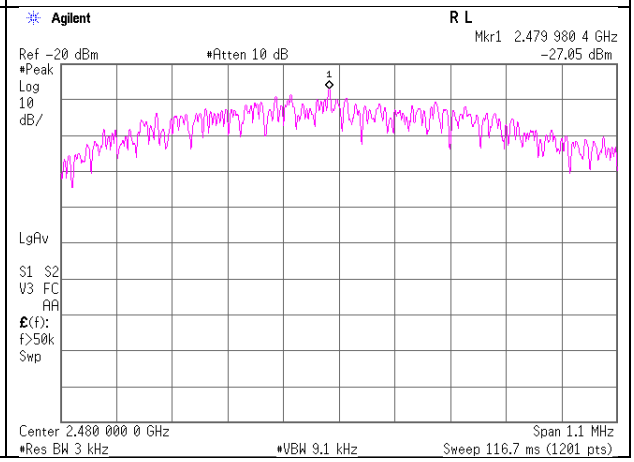
2402 MHz



2440 MHz



2480 MHz



APPENDIX 2: Test instruments

Test Instruments

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KTS-08	AT	145095	Digital Tester	SANWA	PC500	7019224	2019/4/2	2020/4/30	12
KTS-07	AT	145111	Digital Tester	SANWA	PC500	7019232	2019/10/1	2020/10/31	12
SAT10-12	AT	151609	Attenuator	Weinschel Corp.	54A-10	81601	2019/3/27	2020/3/31	12
SAT10-14	AT	154591	Attenuator	Weinschel Corp.	54A-10	81595	2019/4/16	2020/4/30	12
SAT10-16	AT	160494	Attenuator	Weinschel Corp.	54A-10	83406	2018/12/6	2019/12/30	12
SCC-G31	AT	145042	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	OCT-08-13-046	2019/4/16	2020/4/30	12
SCC-G32	AT	145183	Coaxial Cable	Junkosha	MWX241-02000KMSKMS	OCT-09-13-005	2018/11/25	2019/11/30	12
SCC-G37	AT	151614	Coaxial Cable	Junkosha	MWX241-01000KMSKMS/B	1612Q035	2018/12/25	2019/12/31	12
SCC-G39	AT	151616	Coaxial Cable	Junkosha	MWX241-01000KMSKMS/B	1612Q037	2018/12/25	2019/12/31	12
SOS-09	AT	146318	Humidity Indicator	A&D	AD-5681	4061484	2018/12/5	2019/12/31	12
SOS-13	AT	146321	Humidity Indicator	CUSTOM	CTH-202	Q.C.17	2018/12/5	2019/12/31	12
SOS-16	AT	167990	Humidity Indicator	CUSTOM	CTH-202	708Q08R	2019/1/11	2020/1/31	12
SPM-13	AT	169910	Power Meter	EMC Instruments Corporation	8990B	MY51000448	2019/3/6	2020/3/31	12
SPSS-06	AT	169911	Power sensor	EMC Instruments Corporation	N1923A	MY57270004	2019/3/6	2020/3/31	12
SRENT-09	AT	150461	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46186392	2019/1/3	2020/1/31	12
SRENT-15	AT	160899	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46185516	2019/1/21	2020/1/31	12
STM-G10	AT	171617	Terminator	Weinschel - API Technologies Corp	M1459A	92420	2019/7/4	2020/7/31	12
STM-G7	AT	171614	Terminator	Weinschel - API Technologies Corp	M1459A	88995	2019/7/4	2020/7/31	12
STM-G8	AT	171615	Terminator	Weinschel - API Technologies Corp	M1459A	88997	2019/7/4	2020/7/31	12
STS-01	AT	145792	Digital Hitester	HIOKI	3805-50	80997812	2019/10/1	2020/10/31	12
STS-02	AT	145793	Digital Hitester	HIOKI	3805-50	80997819	2019/4/2	2020/4/30	12

***Hyphens for Last Calibration Date, Calibration Due 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.
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: AT: Antenna Terminal Conducted test