RADIO TEST REPORT

Test Report No. : 13568152S-K

Applicant	:	**KONICA MINOLTA, INC.**
Type of EUT	:	**Wireless LAN SDIO module**
Model Number of EUT	:	**SX-SDMAN2** *. The EUT was installed in the typical host device for testing.
Test regulation	:	**FCC Part 15 Subpart C: 2021**
Test item	:	**Antenna terminal conducted test**
Test Result	:	**Complied (Refer to SECTION 3.2)**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the 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.

Date of test: July 6 to 8, 2016 and January 13, 2021

Representative test engineer:
Yosuke Murakami
Engineer
Consumer Technology Division

Approved by:
Toyokazu Imamura
Leader
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.: 13568152S-K

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13568152S-K	March 1, 2021	-	-

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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

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CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	KONICA MINOLTA, INC.
Address	:	1, Sakura-machi, Hino-shi, Tokyo, Japan 191-8511
Telephone Number	:	+81-42-589-8429
Facsimile Number	:	+81-42-589-8053
Contact Person	:	Yukihiro Niekawa

The information provided from the customer is as follows;
- Applicant, Type of EUT, Model Number of EUT 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	:	Wireless LAN SDIO module
Model Number	:	SX-SDMAN2
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 3.3 V, DC 1.8 V
Receipt Date	:	June 17, 2016 and September 29, 2020
Country of Mass-production	:	Japan
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: SX-SDMAN2 (referred to as the EUT in this report) is a Wireless LAN SDIO module.

Clock frequency(ies) in the system : 26 MHz

Radio Specification

Type of radio	IEEE802.11b	IEEE802.11g	IEEE802.11a	IEEE802.11n (20 M band)	IEEE802.11n (40 M band)
Frequency of operation	2412 MHz-2462 MHz	2412 MHz-2462 MHz	5180 MHz-5240 MHz 5260 MHz-5320 MHz 5500 MHz-5700 MHz 5745 MHz-5825 MHz	2412 MHz-2462 MHz 5180 MHz-5240 MHz 5260 MHz-5320 MHz 5500 MHz-5700 MHz 5745 MHz-5825 MHz	5190 MHz-5230 MHz 5270 MHz-5310 MHz 5510 MHz-5670 MHz 5755 MHz-5795 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)		
Channel spacing	5 MHz		20 MHz	2.4 GHz band: 5 MHz 5 GHz band: 20 MHz	40 MHz
Antenna type	[Main Antenna (chain 0) /Sub Antenna (chain 1)] PIFA (Planar Inverted F Antenna)				
Antenna Gain	Main Antenna (chain 0) -1.95 dBi (2.4 GHz Band), -0.98 dBi (5 GHz Band) Sub Antenna (chain 1) -2.21 dBi (2.4 GHz Band), -1.54 dBi (5 GHz Band)				
Antenna Connector type	[Main Antenna (chain 0) /Sub Antenna (chain 1)] Connector; PCB side: U.FL, Antenna side: soldered				

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on January 12, 2021 and effective February 11, 2021

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 revisions do not affect the test result conducted before its effective date.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
6 dB 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		Complied d)	Conducted (below 30 MHz) *1)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) Radiated test result is not included in this test report.

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)
The RF Module has its own regulator.
The RF Module is constantly provided voltage through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement
The EUT has a unique coupling/antenna connector. Therefore the equipment complies with the requirement。

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.

Shonan EMC Lab.

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	1.4 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.6 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.2 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.91 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.2 dB
Spurious emission (Conducted) below 1GHz	0.87 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.96 dB
Spurious emission (Conducted) 3 GHz-18 GHz	3.0 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.2 dB
Bandwidth Measurement	0.012 %
Duty cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.95 deg.C.
Humidity_SCH-01	0.83 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.6 %
Voltage	0.86 %

3.5 Test Location

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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 / CAB identifier: JP0001)

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	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 EUT 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.

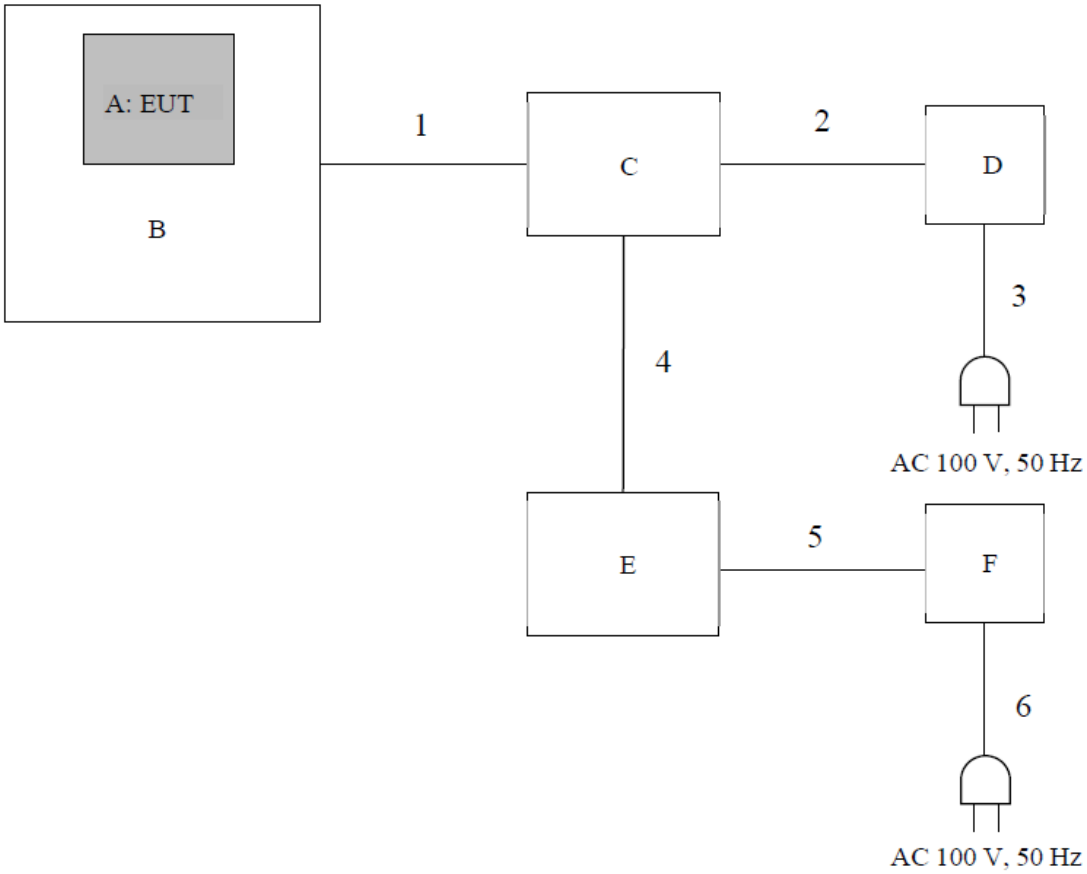
Mode	Remarks*	Power Setting (dBm)
IEEE 802.11b (11b)	11 Mbps, PN9	14
IEEE 802.11g (11g)	36 Mbps, PN9	8, 15, 11
IEEE 802.11n SISO 20 MHz BW (11n-20)	MCS 4 (Long GI) PN9	6, 14, 7
IEEE 802.11n MIMO 20 MHz BW (11n-20)	MCS 12 (Long GI) PN9	6, 14, 7
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)		
*Power of the EUT was set by the software as follows; - Software: Wireless authentication test tool Version 1.3.0.3 (Maximum Peak output power), Date: 2016.7.6, Version 1.3.0 (other than Maximum Peak output power), Date: 2017.4.18, (Storage location: Driven by connected PC) *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 Antenna	Tested frequency
Conducted Spurious Emission	11n-20 (MIMO) Tx	Sub	2437 MHz
6 dB Bandwidth Maximum Peak Output Power Power Density 99 % Occupied Bandwidth	11b Tx 11g Tx 11sn-20 (SISO) Tx	Sub	2412 MHz 2437 MHz 2462 MHz
	11n-20 (MIMO) Tx	Main + Sub	2412 MHz 2437 MHz 2462 MHz

4.2 Configuration and peripherals

For Maximum Peak Output Power



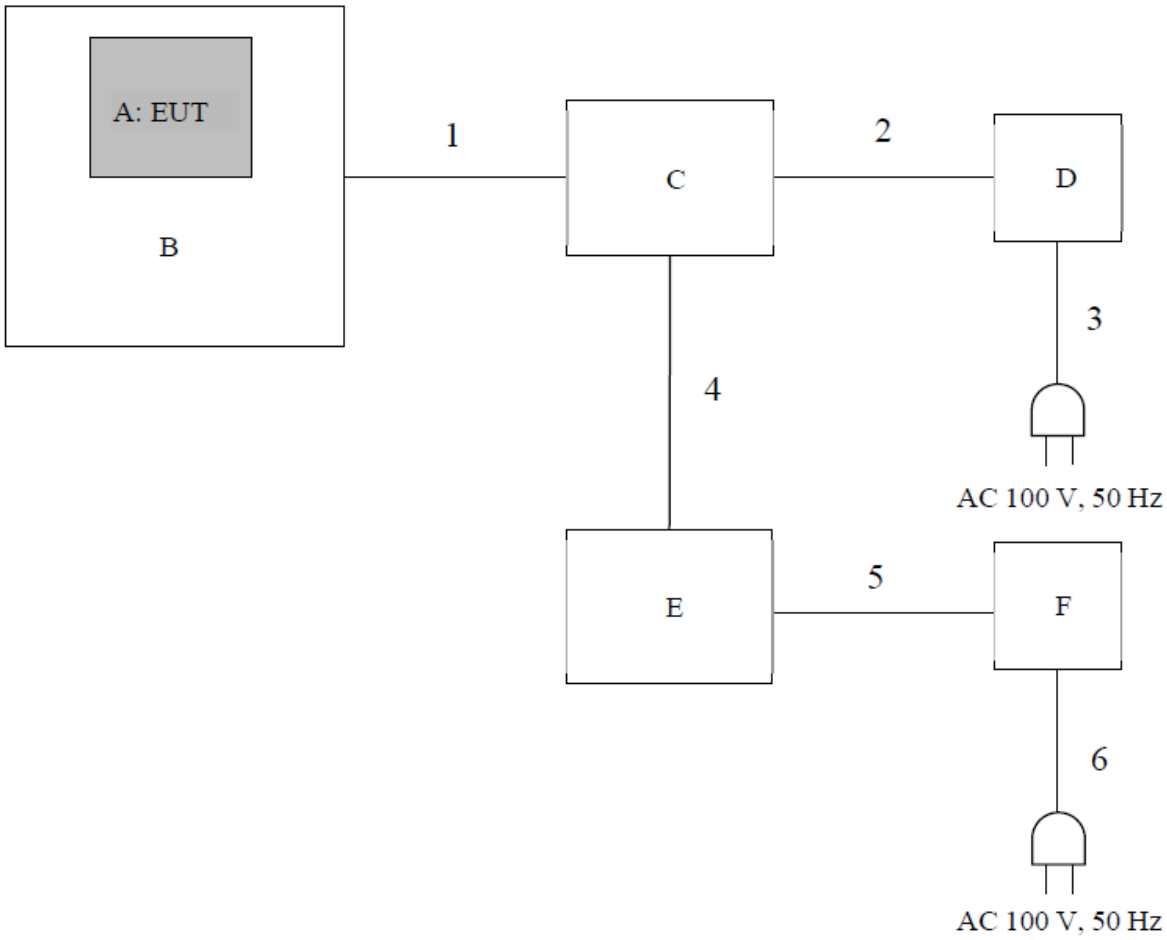
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless LAN SDIO module	SX-SDMAN2	A9YH-S002	KONICA MINOLTA Inc.	EUT
B	SKR 3000	P-75	A9YH-S002	KONICA MINOLTA Inc.	-
C	Battery Charging Unit	AeroDR	A7R9-00077	KONICA MINOLTA Inc.	-
D	AC Adapter	TR60M48	60480-0000099	ELECTRONICS CO., LTD.	-
E	Laptop Computer	dynabook Satellite B453 M	ZE127581H	TOSHIBA	-
F	AC Adapter	PA3917U-1ACA	G71C000DP410	TOSHIBA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	IO Cable	10.0	Shielded	Shielded	-
2	DC Cable	1.5	Unshielded	Unshielded	-
3	AC Cable	3.0	Unshielded	Unshielded	-
4	LAN Cable	1.0	Unshielded	Unshielded	Cat.6
5	DC Cable	0.8	Unshielded	Unshielded	-
6	AC Cable	1.7	Unshielded	Unshielded	-

For Other Antenna Terminal Conducted tests



Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless LAN SDIO module	SX-SDMAN2	A8CE-S002	KONICA MINOLTA Inc.	EUT
B	SKR 3000	P-61	A8CE-S002	KONICA MINOLTA Inc.	-
C	Battery Charging Unit	AeroDR	-	KONICA MINOLTA Inc.	-
D	AC Adapter	TR60M48	-	ELECTRONICS CO., LTD.	-
E	Laptop Computer	7666-77J	LV-B8PZ8 08/05	Lenovo	-
F	AC Adapter	92P1213	11S92P1213Z1ZD DZ92C2WU	Lenovo	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	IO Cable	10.0	Shielded	Shielded	-
2	DC Cable	1.5	Unshielded	Unshielded	-
3	AC Cable	3.0	Unshielded	Unshielded	-
4	LAN Cable	1.0	Unshielded	Unshielded	Cat.6
5	DC Cable	0.8	Unshielded	Unshielded	-
6	AC Cable	1.7	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
6 dB Bandwidth	50 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	Sample	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 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4) *5)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	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)
*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

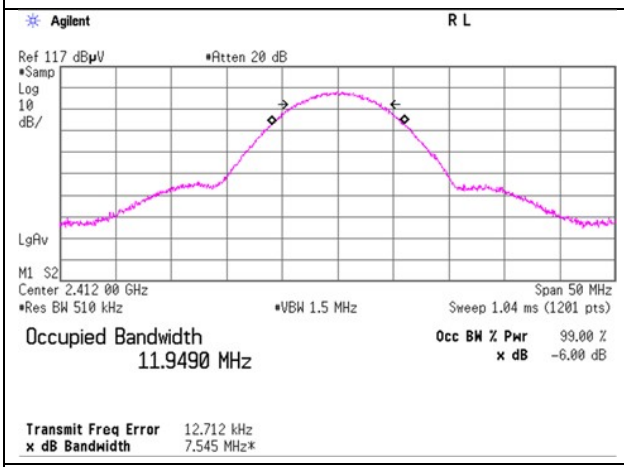
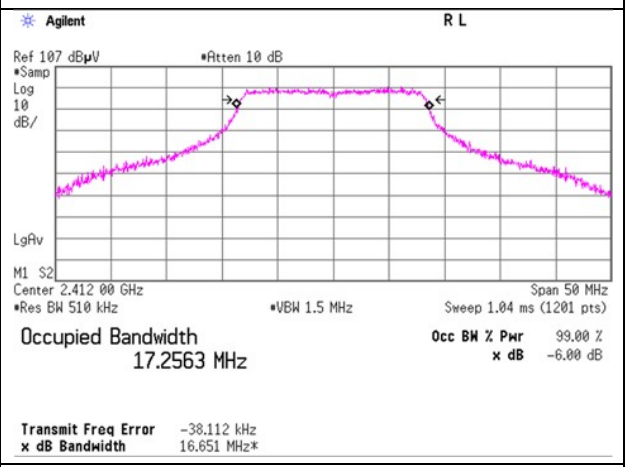
6 dB Bandwidth and 99 % Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	July 8, 2016
Temperature / Humidity	25 deg. C / 56 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	11949.0	6.955	> 0.5000
	2437	11840.0	7.436	> 0.5000
	2462	11865.8	7.456	> 0.5000
11g	2412	17256.3	16.494	> 0.5000
	2437	17436.6	16.479	> 0.5000
	2462	17319.4	16.480	> 0.5000
11n-20 (SISO)	2412	18263.4	17.661	> 0.5000
	2437	18440.5	17.715	> 0.5000
	2462	18369.1	17.686	> 0.5000
11n-20 (MIMO)	2412	18160.4	17.678	> 0.5000
	2437	18312.0	17.674	> 0.5000
	2462	18189.9	17.663	> 0.5000

* The test was carried out by worst antenna port.

99%Occupied Bandwidth

11b	11g
2412 MHz	**2412 MHz**
	
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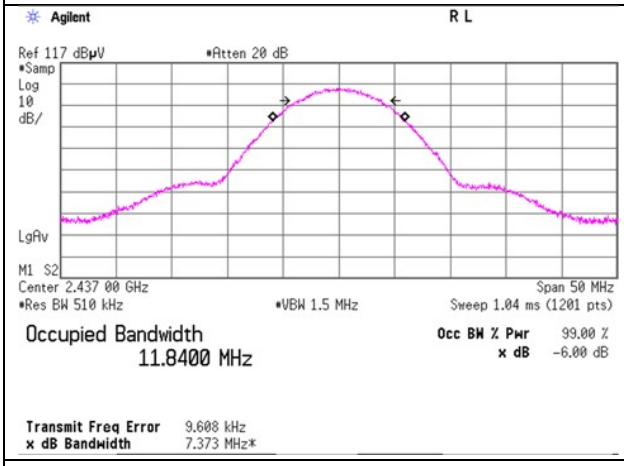	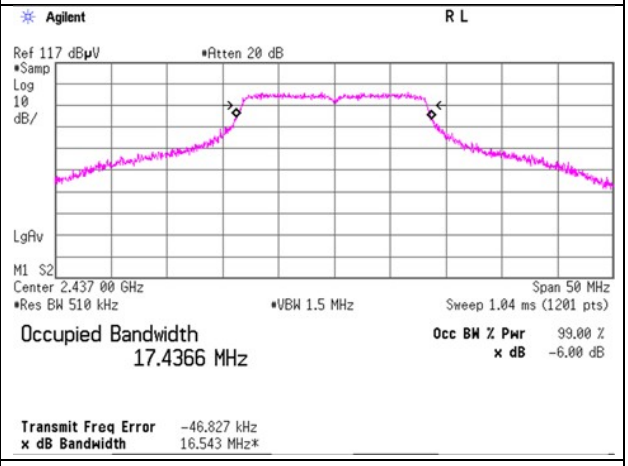
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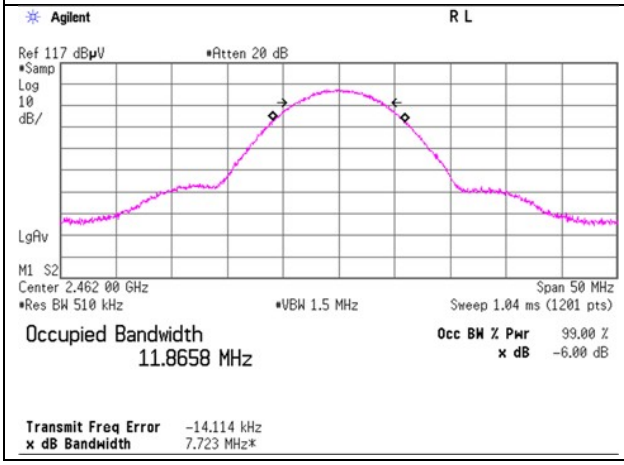
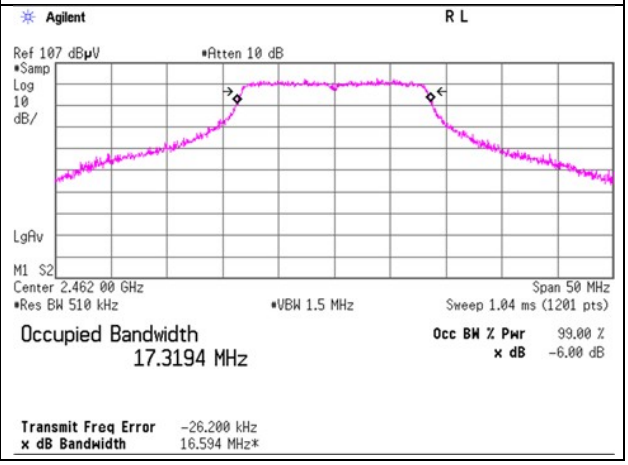
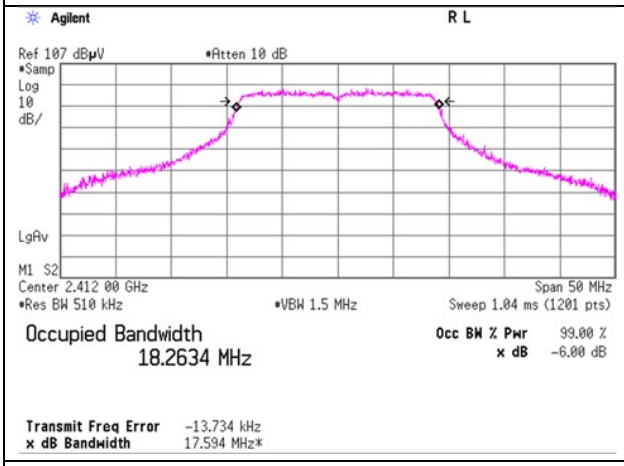
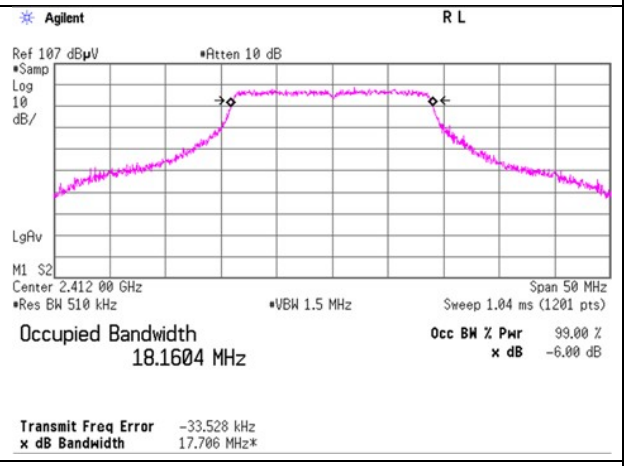
	

99% Occupied Bandwidth

11n-20 (SISO)	11n-20 (MIMO)
2412 MHz	**2412 MHz**
	
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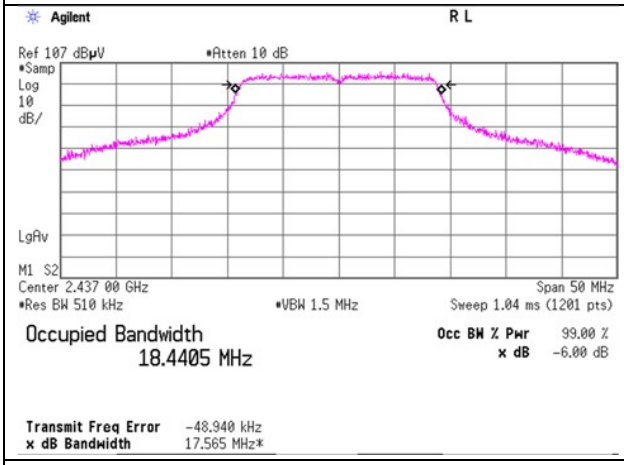
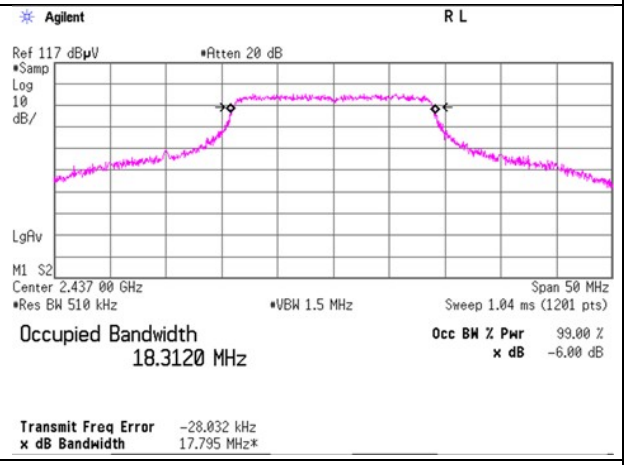
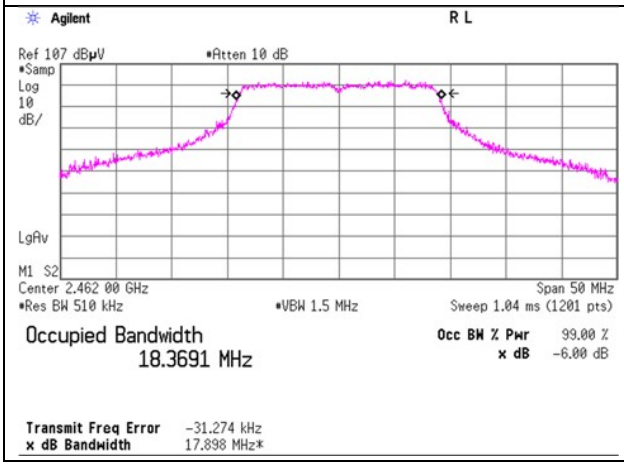
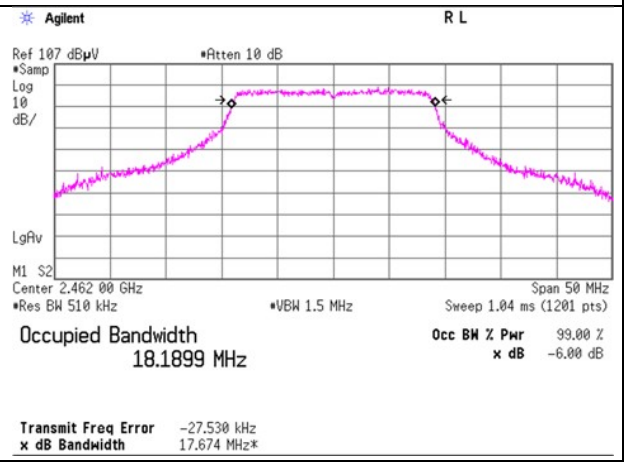
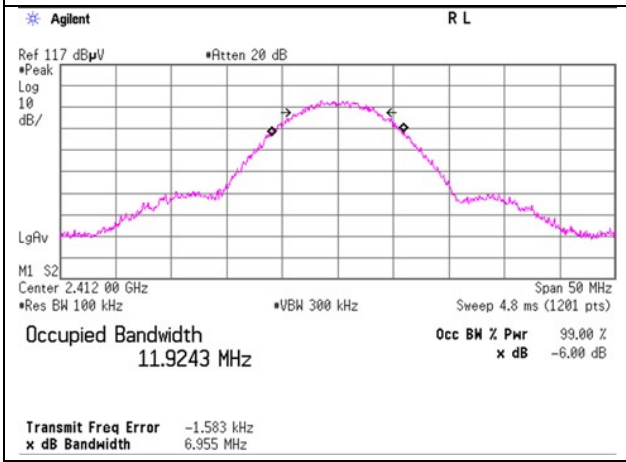
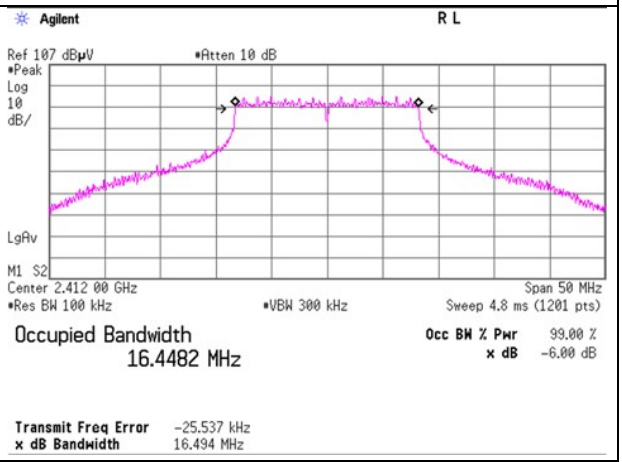
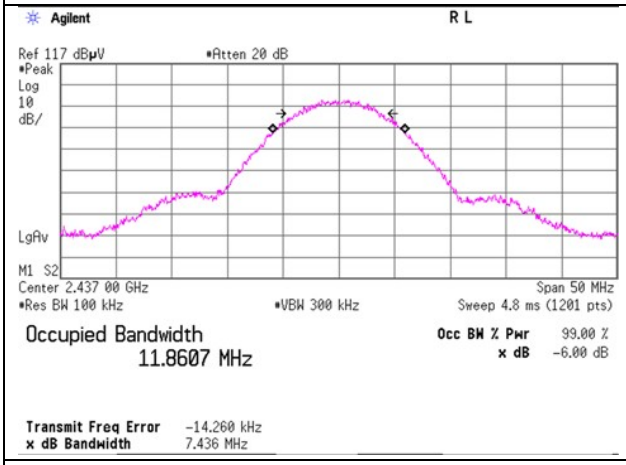
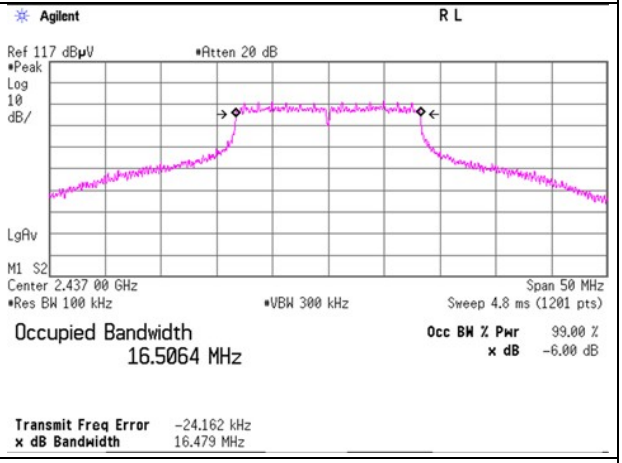
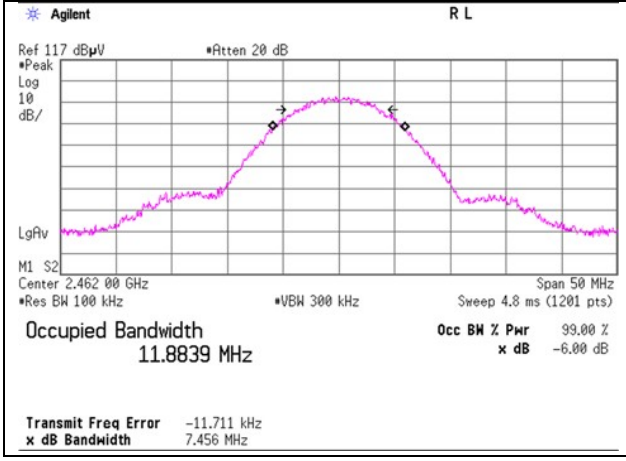
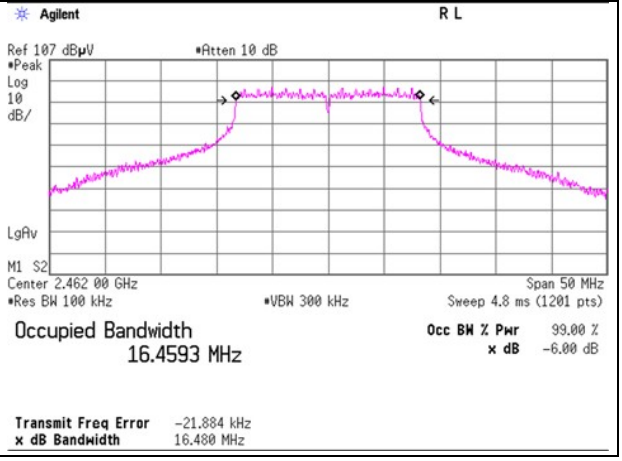
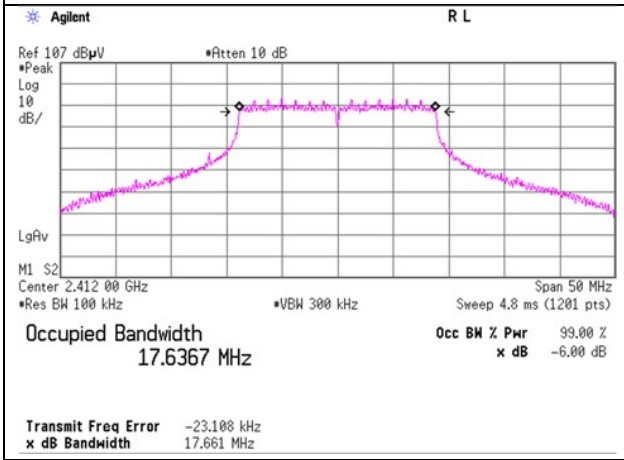
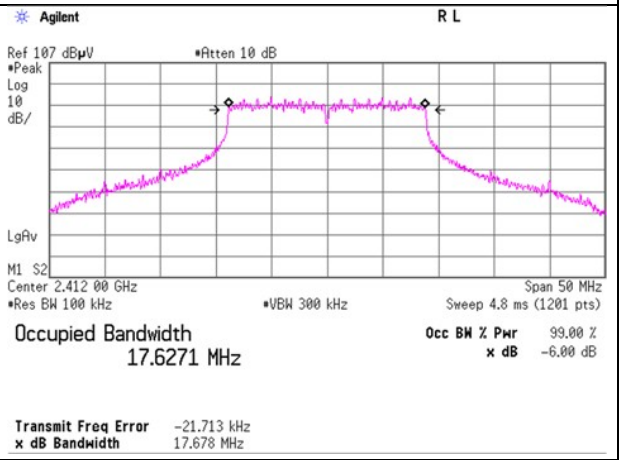
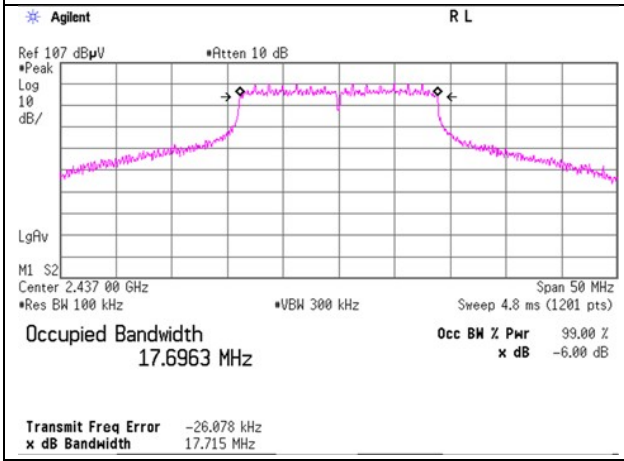
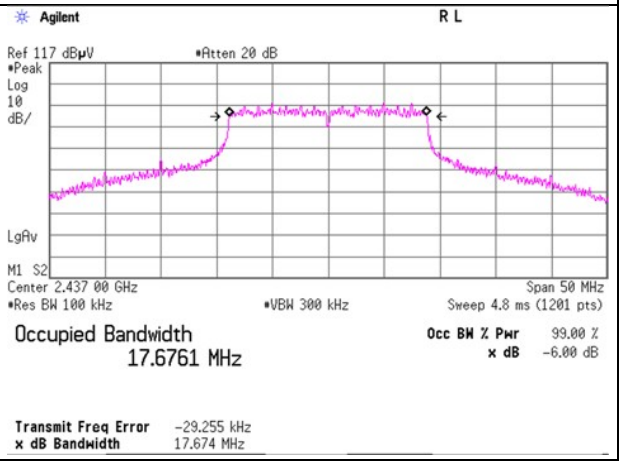
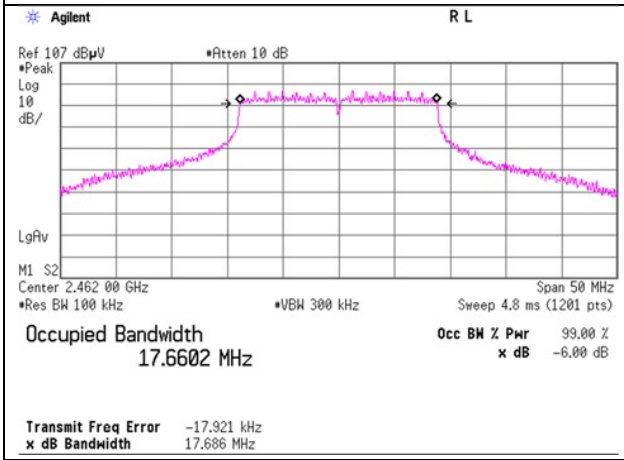
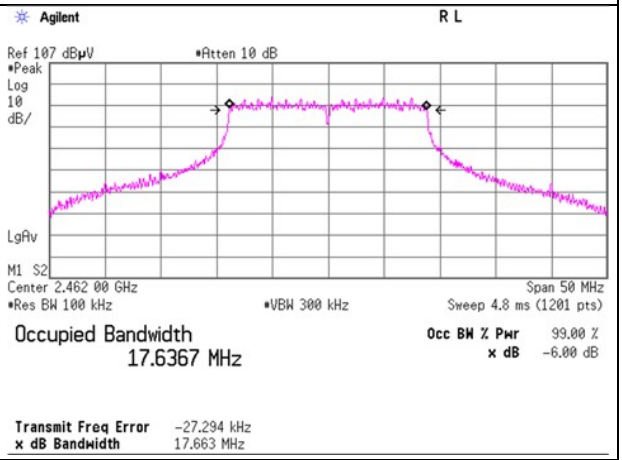
	
2462 MHz	**2462 MHz**
	

6dB Bandwidth

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

6dB Bandwidth

11n-20 (SISO)	11n-20 (MIMO)
2412 MHz	**2412 MHz**
	
2437 MHz	**2437 MHz**
	
2462 MHz	**2462 MHz**
	

Maximum Peak Output Power

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	January 13, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yosuke Murakami
Mode	Tx

11b

Sub Antenna				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	5.73	2.21	9.88	17.82	60.53	30.00	1000	12.18	-2.21	15.61	36.39	36.02	4000	20.41
2437	5.68	2.21	9.88	17.77	59.84	30.00	1000	12.23	-2.21	15.56	35.97	36.02	4000	20.46
2462	5.19	2.21	9.88	17.28	53.46	30.00	1000	12.72	-2.21	15.07	32.14	36.02	4000	20.95

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.

11g

Sub Antenna				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	6.88	2.21	9.88	18.97	78.89	30.00	1000	11.03	-2.21	16.76	47.42	36.02	4000	19.26
2437	10.36	2.21	9.88	22.45	175.79	30.00	1000	7.55	-2.21	20.24	105.68	36.02	4000	15.78
2462	8.76	2.21	9.88	20.85	121.62	30.00	1000	9.15	-2.21	18.64	73.11	36.02	4000	17.38

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.

11n-20 (SISO)

Sub Antenna				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	5.38	2.21	9.88	17.47	55.85	30.00	1000	12.53	-2.21	15.26	33.57	36.02	4000	20.76
2437	10.11	2.21	9.88	22.20	165.96	30.00	1000	7.80	-2.21	19.99	99.77	36.02	4000	16.03
2462	5.56	2.21	9.88	17.65	58.21	30.00	1000	12.35	-2.21	15.44	34.99	36.02	4000	20.58

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.

Maximum Peak Output Power

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	January 13, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yosuke Murakami
Mode	Tx 11n-20 MIMO

Main Antenna + Sub Antenna

Freq.	Main Antenna Result	Sub Antenna Result	Conducted Power Result		Conducted Power Limit		Margin	e.i.r.p. Antenna Gain	e.i.r.p. Result		e.i.r.p. Limit		Margin
[MHz]	[mW]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	52.24	53.95	20.26	106.19	30.00	1000	9.74	-2.21	18.05	63.83	36.02	4000.00	17.97
2437	163.68	167.49	25.20	331.18	30.00	1000	4.80	-2.21	22.99	199.07	36.02	4000.00	13.03
2462	56.10	59.16	20.62	115.26	30.00	1000	9.38	-2.21	18.41	69.34	36.02	4000.00	17.61

Sample Calculation:
Result = Antenna 1 + Antenna 2
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Main Antenna

Freq.	Reading	Cable Loss	Atten. Loss	Result	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
2412	4.78	2.22	10.18	17.18	52.24
2437	9.73	2.23	10.18	22.14	163.68
2462	5.08	2.23	10.18	17.49	56.10

Sub Antenna

Freq.	Reading	Cable Loss	Atten. Loss	Result	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
2412	5.23	2.21	9.88	17.32	53.95
2437	10.15	2.21	9.88	22.24	167.49
2462	5.63	2.21	9.88	17.72	59.16

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

Average Output Power (Reference data)

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	January 13, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yosuke Murakami
Mode	Tx

11b **11 Mbps** Sub Antenna

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	2.57	2.21	9.88	14.66	29.24	0.16	14.82	30.34
2437	2.29	2.21	9.88	14.38	27.42	0.16	14.54	28.44
2462	1.99	2.21	9.88	14.08	25.59	0.16	14.24	26.55

11g **36 Mbps** Sub Antenna

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	-3.64	2.21	9.88	8.45	7.00	0.62	9.07	8.07
2437	2.61	2.21	9.88	14.70	29.51	0.62	15.32	34.04
2462	-1.55	2.21	9.88	10.54	11.32	0.62	11.16	13.06

11n-20(SISO) **MCS 4** Sub Antenna

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	-5.58	2.21	9.88	6.51	4.48	0.64	7.15	5.19
2437	1.64	2.21	9.88	13.73	23.60	0.64	14.37	27.35
2462	-5.35	2.21	9.88	6.74	4.72	0.64	7.38	5.47

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.

Average Output Power
(Reference data)

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	January 13, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yosuke Murakami
Mode	Tx

Main Antenna + Sub Antenna

Freq.	Main Ant Result	Sub Ant Result	Result		Limit		Margin
[MHz]	[mW]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412.0	5.74	5.82	10.63	11.56	30.00	1000	19.37
2437.0	27.10	31.70	17.69	58.80	30.00	1000	12.31
2462.0	5.92	6.01	10.77	11.93	30.00	1000	19.23

Main Antenna

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	-5.89	2.22	10.18	6.51	4.48	1.08	7.59	5.74
2437.0	0.84	2.23	10.18	13.25	21.13	1.08	14.33	27.10
2462.0	-5.77	2.23	10.18	6.64	4.61	1.08	7.72	5.92

Sub Antenna

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	-5.52	2.21	9.88	6.57	4.54	1.08	7.65	5.82
2437.0	1.84	2.21	9.88	13.93	24.72	1.08	15.01	31.70
2462.0	-5.38	2.21	9.88	6.71	4.69	1.08	7.79	6.01

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

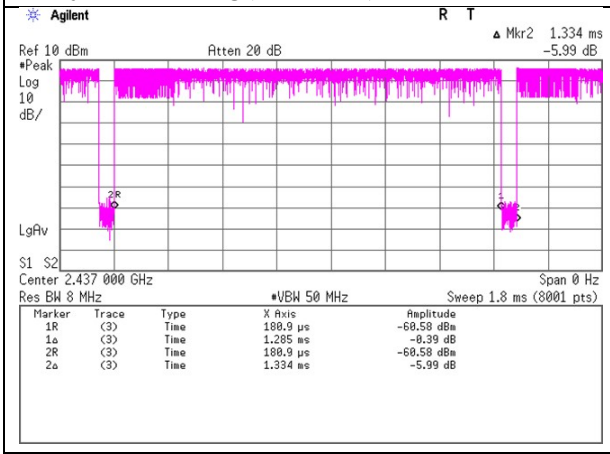
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	January 13, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yosuke Murakami
Mode	Tx

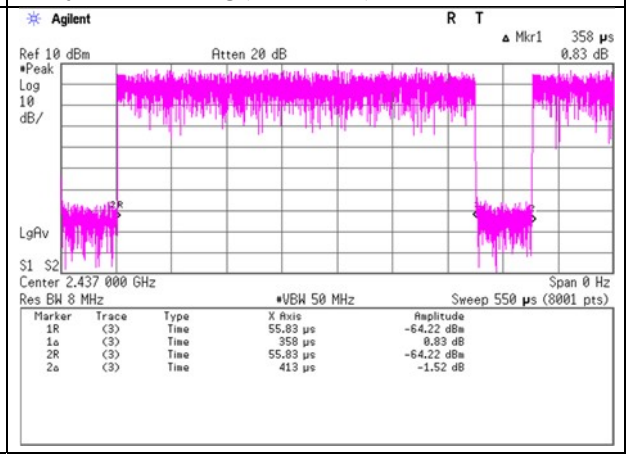
11b 11 Mbps

Tx on / (Tx on + Tx off) =	**0.963**
Tx on / (Tx on + Tx off) * 100 =	**96.3 %**
Duty factor = 10 * log (1.334 / 1.285) =	**0.16 dB**



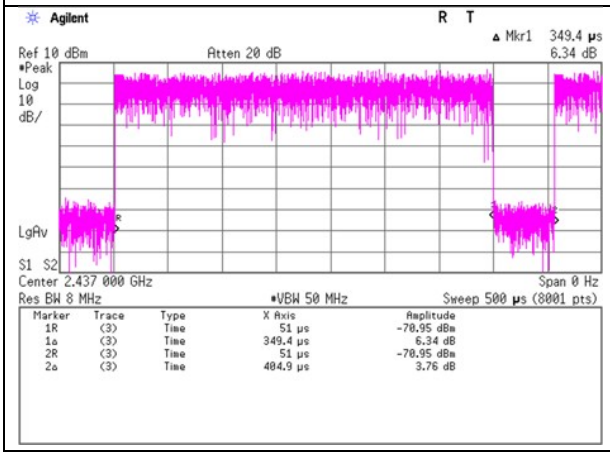
11g 36 Mbps

Tx on / (Tx on + Tx off) =	**0.867**
Tx on / (Tx on + Tx off) * 100 =	**86.7 %**
Duty factor = 10 * log (0.413 / 0.358) =	**0.62 dB**



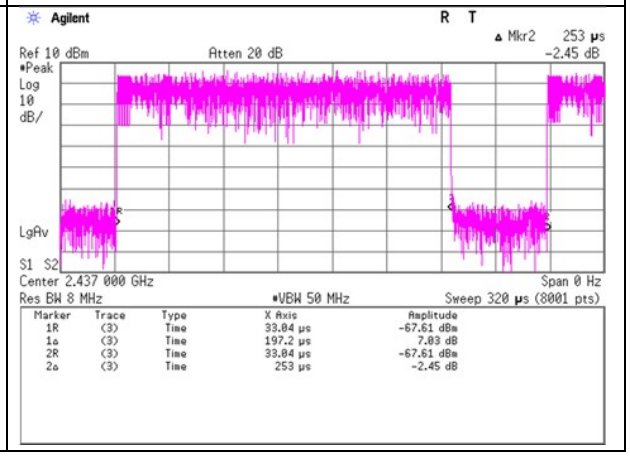
11n-20 (SISO) MCS 4

Tx on / (Tx on + Tx off) =	**0.863**
Tx on / (Tx on + Tx off) * 100 =	**86.3 %**
Duty factor = 10 * log (0.4049 / 0.3494) =	**0.64 dB**



11n-20 (MIMO) MCS 12

Tx on / (Tx on + Tx off) =	**0.779**
Tx on / (Tx on + Tx off) * 100 =	**77.9 %**
Duty factor = 10 * log (0.253 / 0.1972) =	**1.08 dB**

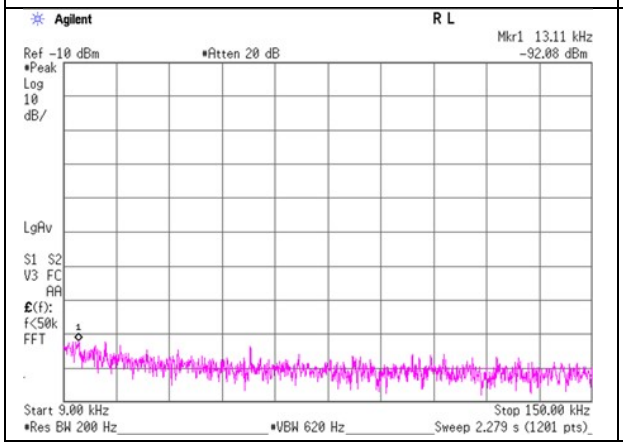


Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

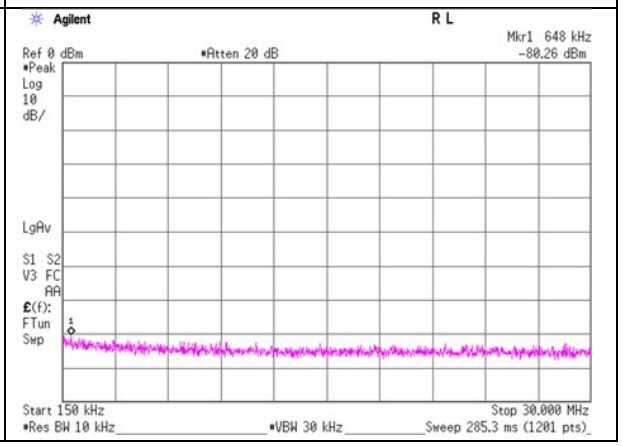
Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	July 8, 2016
Temperature / Humidity	25 deg. C / 56 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx 11n-20 (MIMO) 2437 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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
13.11	-92.1	0.01	9.8	2.0	2	-77.2	300	6.0	-16.0	45.2	61.2	
648.00	-80.3	0.02	9.8	2.0	2	-65.4	30	6.0	15.9	31.3	15.4	

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

EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

*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

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	July 8, 2016
Temperature / Humidity	25 deg. C / 56 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx

11b Sub antenna

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-21.35	3.42	9.92	-8.01	8.00	16.01
2437.00	-21.52	3.42	9.92	-8.18	8.00	16.18
2462.00	-21.85	3.43	9.92	-8.50	8.00	16.50

11g Sub antenna

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-29.26	3.42	9.92	-15.92	8.00	23.92
2437.00	-23.12	3.42	9.92	-9.78	8.00	17.78
2462.00	-26.13	3.43	9.92	-12.78	8.00	20.78

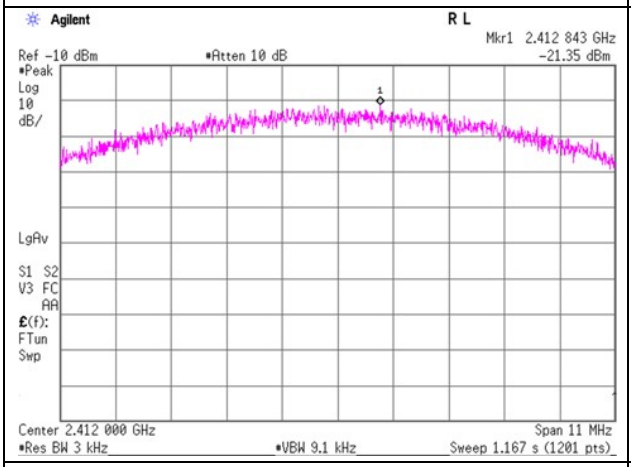
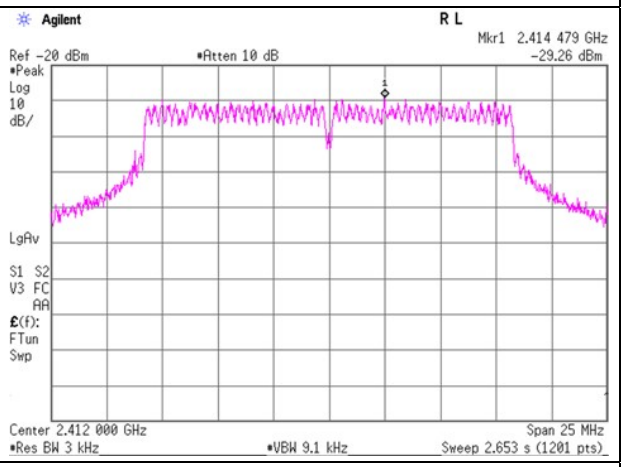
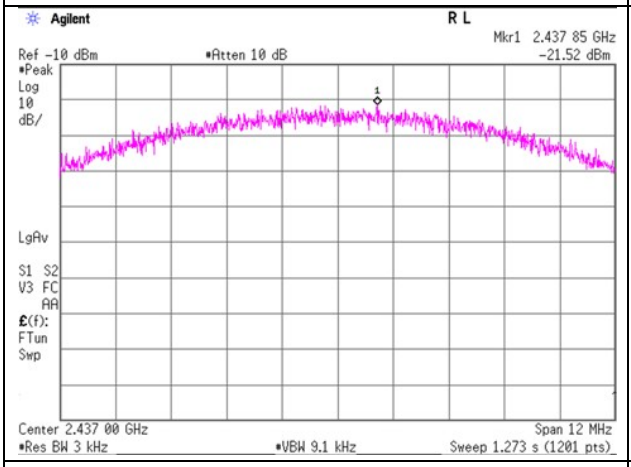
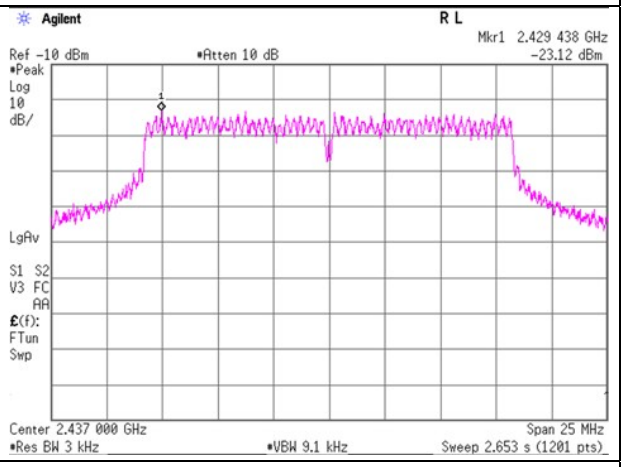
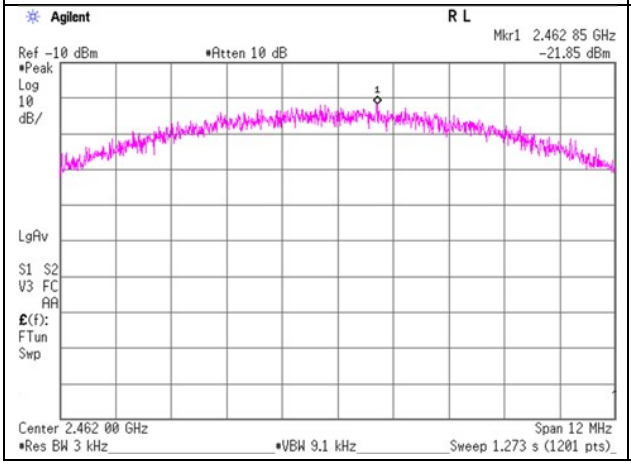
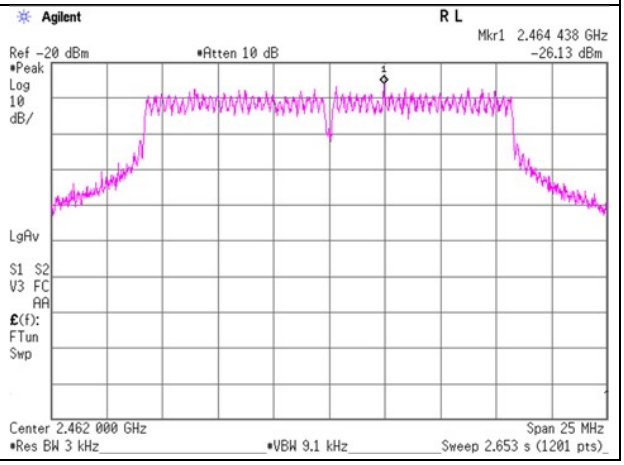
11n-20 (SISO) Sub antenna

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-32.12	3.42	9.92	-18.78	8.00	26.78
2437.00	-22.14	3.42	9.92	-8.80	8.00	16.80
2462.00	-26.97	3.43	9.92	-13.62	8.00	21.62

Sample Calculation:

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

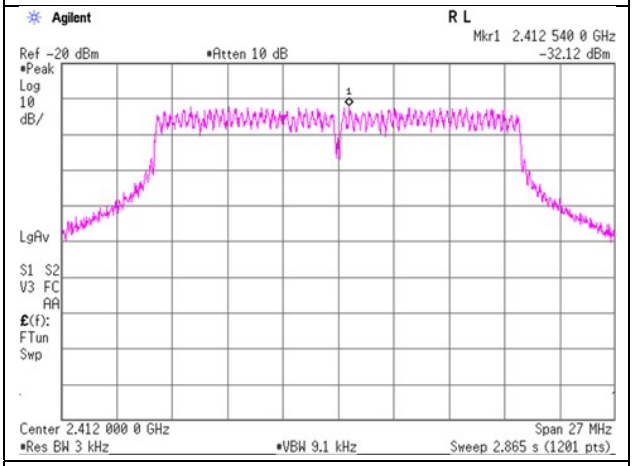
Power Density

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

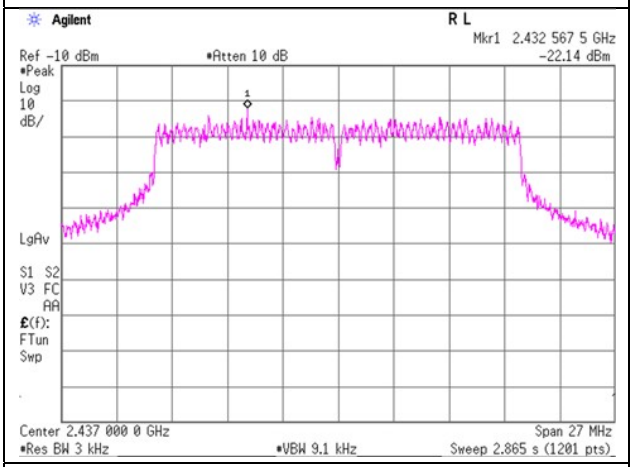
Power Density

11n-20 (SISO)

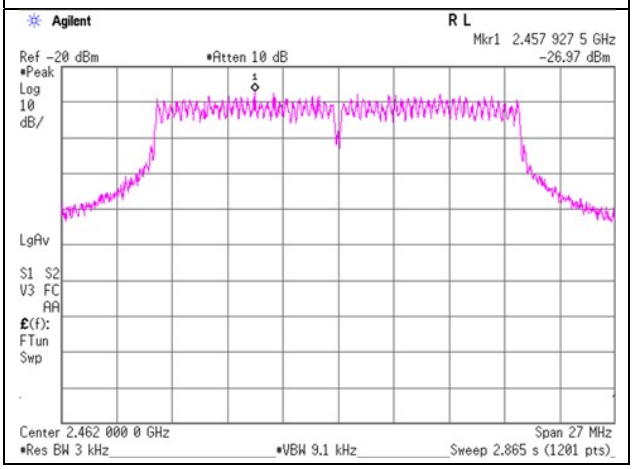
2412 MHz



2437 MHz



2462 MHz



Power Density

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	January 13, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yosuke Murakami
Mode	Tx

Main antenna + Sub antenna

Freq. [MHz]	Main Result [mW]	Sub Result [mW]	Result [dBm]	Result [mW]	Limit [dBm]	Margin [dB]
2412.00	0.01	0.02	-15.08	0.03	8.00	23.08
2437.00	0.07	0.08	-8.36	0.15	8.00	16.36
2462.00	0.01	0.02	-14.45	0.04	8.00	22.45

Sample Calculation:
Result = Main antenna + Sub antenna

Main antenna

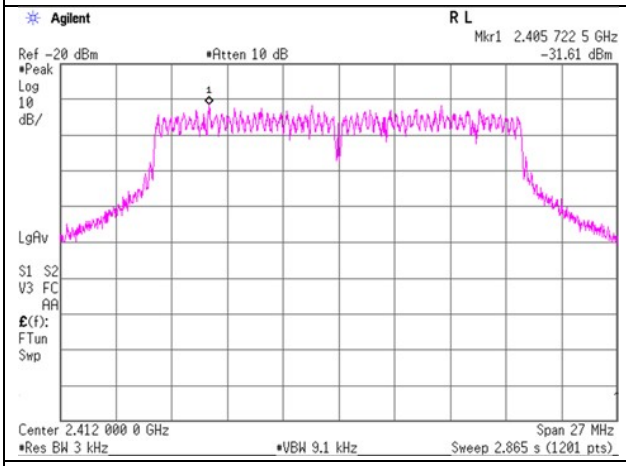
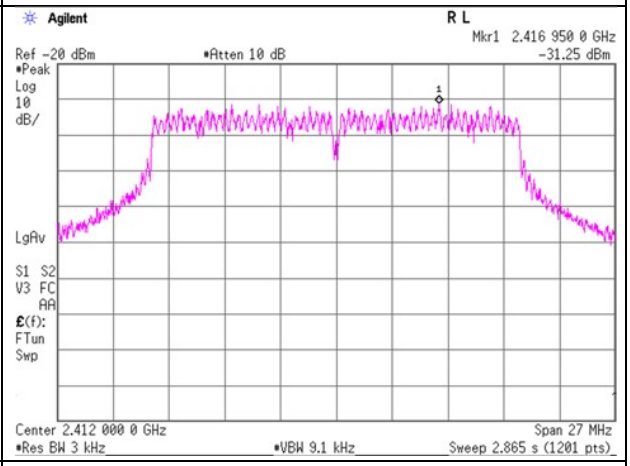
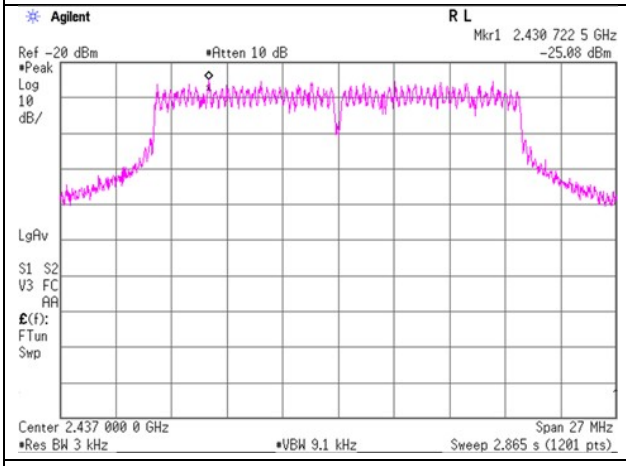
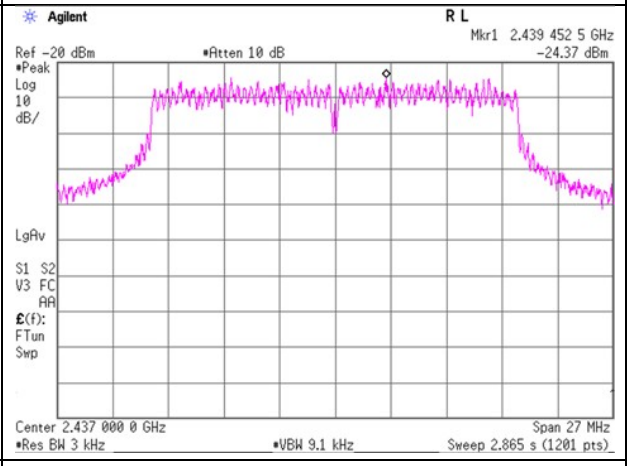
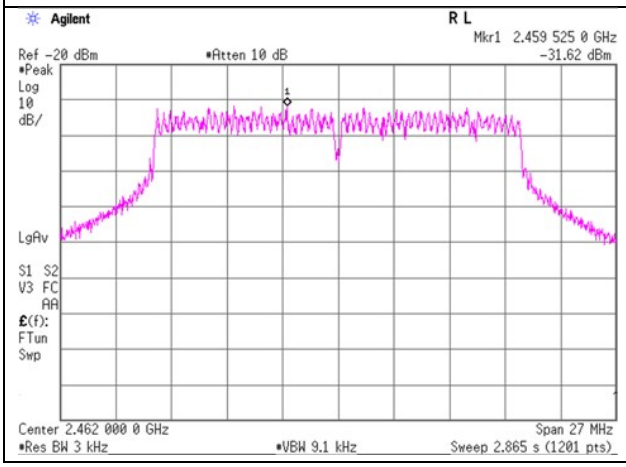
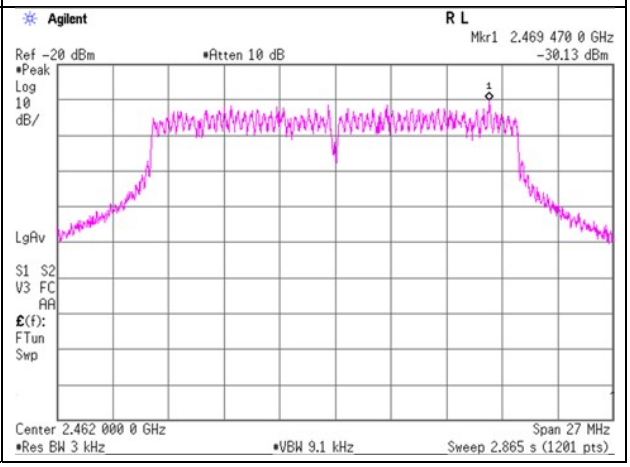
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [mW]	Limit [dBm]	Margin [dB]
2412.00	-31.61	3.42	9.92	-18.27	0.01	8.00	26.27
2437.00	-25.08	3.42	9.92	-11.74	0.07	8.00	19.74
2462.00	-31.62	3.43	9.92	-18.27	0.01	8.00	26.27

Sub antenna

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [mW]	Limit [dBm]	Margin [dB]
2412.00	-31.25	3.42	9.92	-17.91	0.02	8.00	25.91
2437.00	-24.37	3.42	9.92	-11.03	0.08	8.00	19.03
2462.00	-30.13	3.43	9.92	-16.78	0.02	8.00	24.78

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

Power Density

11n-20 (MIMO) Main antenna	11n-20 (MIMO) Sub antenna
2412 MHz	2412 MHz
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz
	

APPENDIX 2: Test instruments

Test equipment

For Maximum Peak Output Power measurement

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2020/10/21	12
AT	SAT10-15	160493	Attenuator	Weinschel Corp.	54A-10	83406	2020/12/21	12
AT	SAT10-16	160494	Attenuator	Weinschel Corp.	54A-10	83420	2020/12/21	12
AT	SCC-G11	145174	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	2020/03/02	12
AT	SCC-G60	196941	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102	803093/2	2020/03/10	12
AT	SCC-G67	196949	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102	803480/2	2020/03/10	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2020/09/29	12
AT	SPM-07	146247	Power Meter	Keysight Technologies Inc	8990B	MY5100272	2020/05/27	12
AT	SPSS-04	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2020/05/27	12
AT	SPSS-05	146311	Power sensor	Keysight Technologies Inc	N1923A	MY5349008	2020/05/27	12
AT	SRENT-22	202830	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250036	2020/11/24	12

For Other Antenna Terminal Conducted tests

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	SSA-02	-	Spectrum Analyzer	Agilent	E4448A	MY48250106	2016/03/23	12
AT	SPM-07	-	Power Meter	Agilent	8990B	MY5100272	2016/04/04	12
AT	SPSS-04	-	Power sensor	Agilent	N1923A	MY5326009	2016/04/04	12
AT	SOS-09	-	Humidity Indicator	A&D	AD-5681	4061484	2015/12/07	12
AT	SCC-G13	-	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	2016/03/23	12
AT	SAT10-10	-	Attenuator	Weinschel Corp.	54A-10	37584	2016/04/18	12
AT	STM-G4	-	Terminator	Weinschel	M1459A	U6592	2015/07/14	12
AT	KSA-08	-	Spectrum Analyzer	Agilent	E4446A	MY46180525	2016/03/28	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: AT: Antenna Terminal Conducted test