



RADIO TEST REPORT

Test Report No. : 13565962H-B-R3

Applicant : silex technology, Inc.
Type of EUT : Wireless LAN SDIO module
Model Number of EUT : SX-SDMAN2
FCC ID : N6C-SDMAN2
Test regulation : **FCC Part 15 Subpart E: 2021**
*WLAN (5 GHz band) part (Except for DFS test)
*For Permissive Change
Radiated Emission test only

Test Result : **Complied (Refer to SECTION 3)**

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. Ise 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 13565962H-B-R2. 13565962H-B-R2 is replaced with this report.

Date of test: November 30 and December 1, 2020

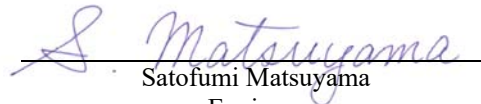
Representative test engineer:



Junya Okuno
Engineer

Consumer Technology Division

Approved by:



Satofumi Matsuyama
Engineer

Consumer Technology Division



CERTIFICATE 5107.02

- ☐ 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.: 13565962H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13565962H-B	January 21, 2021	-	-
1	13565962H-B-R1	March 24, 2021	P 6	Addition of Contents of the change from original model in Section 2.2: Product Description Bluetooth and WLAN 5 GHz (IEEE802.11a/n-20: U-NII-2C and IEEE802.11n-40) are disabled according to the customer's request.
2	13565962H-B-R2	April 21, 2021	P 6	Replacement to new sentence of contents of the change from original model in Section 2.2: Product Description
2	13565962H-B-R2	April 21, 2021	P 6	Deletion of "- 80 MHz Bandwidth (5610 MHz)" in Section 2.2: Product Description
2	13565962H-B-R2	April 21, 2021	P 7	Correction of FCC Part 15.31 (e) and FCC Part 15.203 Antenna requirement in Section 3.2. <u>FCC Part 15.31 (e)</u> The stable voltage was provided to the EUT during the tests. Therefore, this EUT complies with the requirement. <u>FCC Part 15.203 Antenna requirement</u> The EUT has an external antenna connector, but it is installed by the professionals. Therefore, the equipment complies with the antenna requirement of Section 15.203. → <u>FCC 15.31 (e)</u> The RF Module has own regulator. The RF Module is constantly provided voltage through own regulator regardless of input voltage. Therefore, this EUT complies with the requirement. <u>FCC Part 15.203/212 Antenna requirement</u> The EUT has a unique coupling/antenna connector (U.FL Alternative connector). Therefore the equipment complies with the requirement of 15.203/212.
3	13565962H-B-R3	April 27, 2021	P 6	Correction of below sentence of contents of the change from original model in Section 2.2: Product Description The test was performed only radiated emission test for WLAN 2.4 GHz (IEEE802.11b/g/n-20) and 5 GHz (IEEE802.11a/n-20: U-NII-1, U-NII-2A, U-NII-3) as the same power setting to the original report. → However, the radiated spurious emission test for WLAN 2.4 GHz (IEEE802.11b/g/n-20) and 5 GHz (IEEE802.11a/n-20: U-NII-1, U-NII-2A, U-NII-3) was performed using the same power setting to original test report, which is higher than the power setting of the host device as conservative conditions.

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Reference: Abbreviations (Including words undescribed in this report)

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

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SECTION 1: Customer information

Company Name	:	silex technology, Inc.
Address	:	2-3-1 Hikaridai, Seika-cho, Soraku-gun, Kyoto 619-0237, Japan
Telephone Number	:	+81-774-98-3878
Facsimile Number	:	+81-774-98-3758
Contact Person	:	Yoshinori Nakai

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	:	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	:	November 24, 2020
Country of Mass-production	:	Japan
Condition	:	Production model
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.

General Specification

Clock frequency(ies) in the system : 26 MHz
 Operating Temperature : -20 deg. C - +85 deg. C

Radio Specification

Radio Type : Transceiver
 Method of Frequency Generation : Synthesizer

	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n (20 M band)	IEEE802.11n (40 M band)	Bluetooth Ver.4.0 with EDR function
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz *1) 5260 MHz - 5320 MHz *1) 5500 MHz - 5700 MHz 5745 MHz - 5825 MHz *1)	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5670 MHz 5755 MHz - 5795 MHz	2402 MHz - 2480 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)		BT: FHSS (GFSK, $\pi/4$ -DQPSK, 8-DPSK) LE: GFSK
Channel spacing	5MHz		20MHz	40MHz	BT: 1MHz LE: 2MHz
Antenna type	PCB antenna				
Antenna Connector type	U.FL Alternative connector				
Antenna Gain	2.8 dBi (2.4GHz Band), 4.2 dBi (5GHz Band)				

*1) This test report applies to WLAN (5 GHz Band [5180 MHz - 5240 MHz, 5260 MHz - 5320 MHz, 5745 MHz - 5825 MHz]).

* WLAN and Bluetooth do not transmit simultaneously.

<Contents of the change from original model>

Test Report Number of original is 10748020H-C-R1 (issued by UL Japan, Inc.).

Specification was changed from the original as follows:

An antenna has been added to the EUT that only supports WLAN 2.4 GHz (IEEE802.11b/g/n-20) and 5 GHz (IEEE802.11a/n-20: U-NII-1, U-NII-2A, U-NII-3).

Host device equipped with this antenna disables Bluetooth and WLAN 5 GHz (IEEE802.11a/n-20: U-NII-2A, U-NII-2C and IEEE802.11n-40).Also, the power setting value has decreased.

However, the radiated spurious emission test for WLAN 2.4 GHz (IEEE802.11b/g/n-20) and 5 GHz (IEEE802.11a/n-20: U-NII-1, U-NII-2A, U-NII-3) was performed using the same power setting to original test report, which is higher than the power setting of the host device as conservative conditions.

*Following channels are not used in Canada.

- 20 MHz Bandwidth (5600 MHz - 5640 MHz)
- 40 MHz Bandwidth (5590 MHz - 5630 MHz)

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Spurious Emission Restricted Band Edge	FCC: ANSI C63.10-2013 KDB Publication Number 789033	FCC: 15.407 (b), 15.205 and 15.209	1.0 dB 5350.000 MHz, AV, Horizontal	Complied# a) / b)	Radiated (> 30 MHz) *1)
	ISED: -	ISED: RSS-247 6.2.1.2 6.2.2.2 6.2.3.2 6.2.4.2			

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

*1) Radiated test was selected over 30 MHz based on FCC 15.407 (b) and KDB 789033 D02 G.3.b).

a) 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 15.31 (e)

The RF Module has own regulator.

The RF Module is constantly provided voltage through own 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 (U.FL Alternative connector). Therefore the equipment complies with the requirement of 15.203/212.

3.3 Addition to standard

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

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following 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 $k=2$.
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Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
		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

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*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967

ISED Lab Company Number: 2973C / CAB identifier: JP0002

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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.

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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*
IEEE 802.11n MIMO 20MHz BW (11n-20)	MCS 11 (Long GI), PN9
*The worst condition was determined based on the test result of Maximum Conducted Output Power.	
*The power value of the EUT was set for testing as follows (setting value might be different from product specification value); Power settings: Refer to the following table - Software Name: athtestcmd - Software Version: ath6kl-v5.0 (Date: November 28, 2020, 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.	

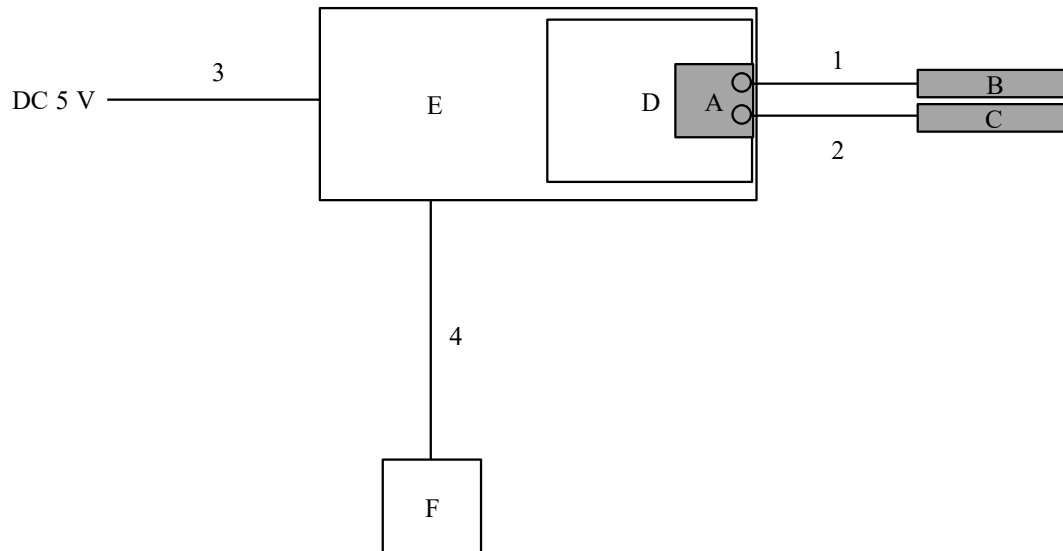
[Power setting]

	Rate		Target Power	Power Setting	
				Antenna 1	Antenna 2
11n-20	MCS11 (Long GI)	5180 MHz	10.5	13	13
		5260 MHz	10.5	13	13
		5320 MHz	10.5	13	13
		5745 MHz	10	13	13
		5785 MHz	10	13.5	13.5
		5825 MHz	10	14	14

*The details of Operating mode(s)

Test Item	Operating Mode	Tested Antenna port	Tested Frequency		
			Lower Band	Middle Band	Upper Band
Radiated Spurious Emission (Below 1GHz) *1)	11n-20 Tx	0+1	-	5320 MHz	-
Radiated Spurious Emission (Above 1GHz)	11n-20 Tx *2)	0+1	5180 MHz	5260 MHz 5320 MHz	5745 MHz 5785 MHz 5825 MHz
*1) The operating mode and tested frequency were tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11a and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest conducted 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	Wireless LAN SDIO module	SX-SDMAN2	84253F0E60CB	silex technology, Inc.	EUT
B	WiFi dual band antenna	H2B1PD1A1C	001	Unictron Technologies Corporation	EUT
C	WiFi dual band antenna	H2B1PD1A1C	001	Unictron Technologies Corporation	EUT
D	Jig	SX-582	-	silex technology, Inc.	-
E	Jig	-	-	silex technology, Inc.	-
F	Jig	-	-	silex technology, Inc.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	0.1	Shielded	Shielded	-
2	Antenna Cable	0.1	Shielded	Shielded	-
3	DC Cable	2.5	Unshielded	Unshielded	-
4	Signal Cable	1.8	Unshielded	Unshielded	-

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SECTION 5: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

< Below 1GHz >

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

< Above 1GHz >

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.

< Below 1GHz >

The result also satisfied with the general limits specified in section 15.209 (a).

< Above 1GHz >

Inside of restricted bands (Section 15.205):

Apply to limit in the Section 15.209 (a).

Outside of the restricted bands:

Apply to limit 68.2 dBuV/m, 3 m (-27 dBm e.i.r.p. *) in the Section 15.407 (b) (1) (2) (3).

For W58 Bandedge

-27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge in the section 15.407(b)(4)(i).

Restricted band edge:

Apply to limit in the Section 15.209 (a).

Since this limit is severer than the limit of the inside of restricted bands.

*Electric field strength to e.i.r.p. conversion:

$$E = \frac{1000000 \sqrt{30P}}{3} \text{ (uV/m)} \quad : P \text{ is the e.i.r.p. (Watts)}$$

Test Antennas are used as below;

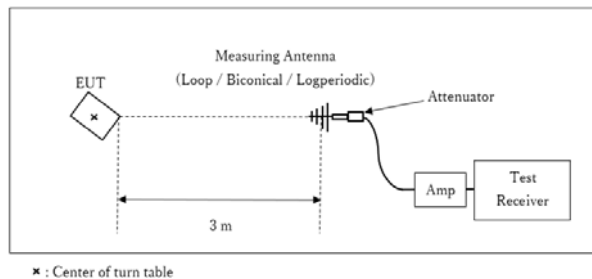
Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

Frequency	Below 1 GHz	Above 1 GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	Peak	Average
IF Bandwidth	BW: 120 kHz	RBW: 1 MHz VBW: 3 MHz	Method AD *1) RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: ≥ 100 traces If duty cycle was less than 98%, a duty factor was added to the results.

*1) The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".

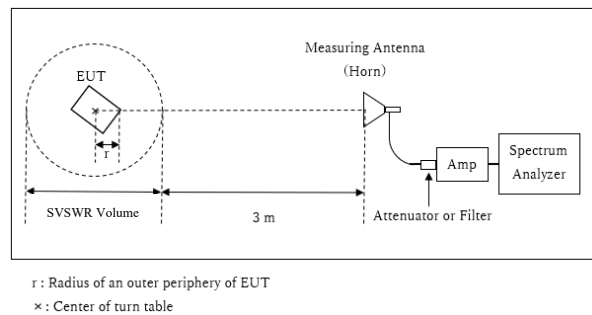
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 10 GHz



Distance Factor: $20 \times \log (3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$

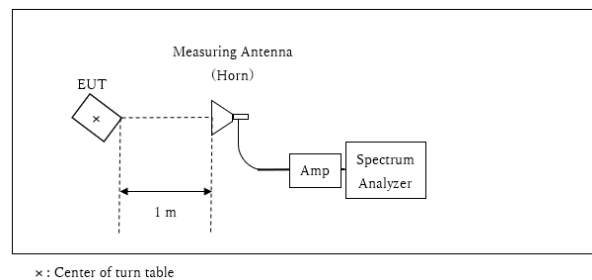
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.95 \text{ m}$

SVSWR Volume : 2.0 m

(SVSWR Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.05 \text{ m}$

10 GHz - 40 GHz



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

* Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range	: 30 MHz - 40 GHz
Test data	: APPENDIX
Test result	: Pass

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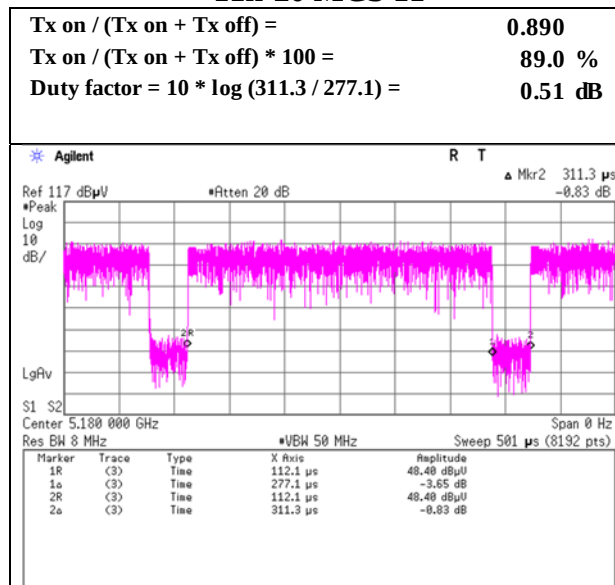
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APPENDIX 1: Test data

Burst rate confirmation

Report No.	13565962H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	November 30, 2020
Temperature / Humidity	20 deg. C / 35 % RH
Engineer	Junki Nagatomi
Mode	Tx 11n-20

11n-20 MCS 11



Radiated Spurious Emission

Report No. 13565962H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020 December 1, 2020
Temperature / Humidity 22 deg. C / 32 % RH 20 deg. C / 30 % RH
Engineer Junya Okuno Junki Nagatomi
(1 GHz - 26.5 GHz) (26.5 GHz - 40 GHz)
Mode Tx 11n-20 5180 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	5148.000	PK	53.2	32.0	6.1	31.6	-	59.6	73.9	14.3	
Hori.	5150.000	PK	53.1	32.0	6.1	31.6	-	59.5	73.9	14.4	
Hori.	6906.655	PK	46.9	34.8	6.7	32.5	-	55.9	68.2	12.3	
Hori.	10360.000	PK	48.8	40.1	-2.3	33.5	-	53.1	68.2	15.1	
Hori.	15540.000	PK	44.8	37.4	-0.8	32.5	-	48.9	73.9	25.0	Floor noise
Hori.	5148.000	AV	43.4	32.0	6.1	31.6	0.5	50.3	53.9	3.7	
Hori.	5150.000	AV	41.5	32.0	6.1	31.6	0.5	48.4	53.9	5.5	*1)
Hori.	15540.000	AV	35.6	37.4	-0.8	32.5	-	39.7	53.9	14.2	Floor noise
Vert.	5148.000	PK	53.3	32.0	6.1	31.6	-	59.7	73.9	14.2	
Vert.	5150.000	PK	53.2	32.0	6.1	31.6	-	59.6	73.9	14.3	
Vert.	6906.655	PK	47.4	34.8	6.7	32.5	-	56.4	68.2	11.8	
Vert.	10360.000	PK	54.1	40.1	-2.3	33.5	-	58.4	68.2	9.8	
Vert.	15540.000	PK	44.9	37.4	-0.8	32.5	-	49.0	73.9	24.9	Floor noise
Vert.	5148.000	AV	43.5	32.0	6.1	31.6	0.5	50.4	53.9	3.5	
Vert.	5150.000	AV	41.7	32.0	6.1	31.6	0.5	48.6	53.9	5.3	*1)
Vert.	15540.000	AV	35.7	37.4	-0.8	32.5	-	39.8	53.9	14.1	Floor noise

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

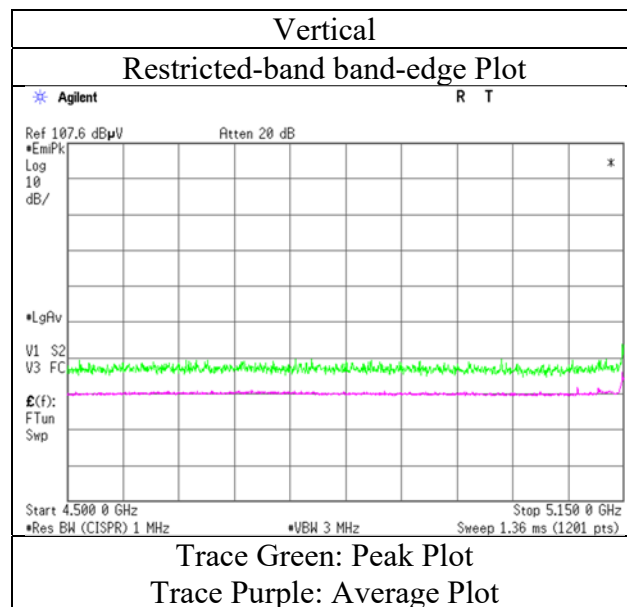
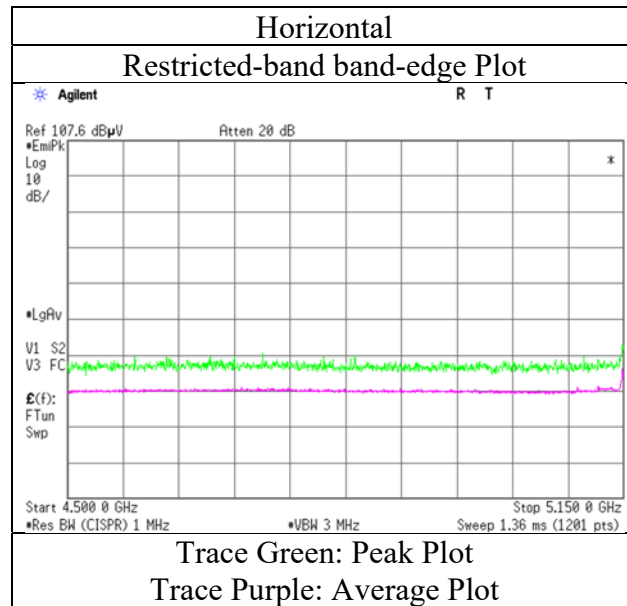
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$
10 GHz - 40 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

Radiated Spurious Emission

Report No.	13565962H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	November 30, 2020
Temperature / Humidity	22 deg. C / 32 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 5180 MHz



* 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.

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

Radiated Spurious Emission

Report No. 13565962H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020 December 1, 2020
Temperature / Humidity 22 deg. C / 32 % RH 20 deg. C / 30 % RH
Engineer Junya Okuno Junki Nagatomi
(1 GHz - 26.5 GHz) (26.5 GHz - 40 GHz)
Mode Tx 11n-20 5260 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.	7013.261	PK	46.8	35.5	6.7	32.5	-	56.5	68.2	11.7	
Hori.	10520.000	PK	47.4	39.9	-2.2	33.6	-	51.6	68.2	16.6	
Hori.	15780.000	PK	44.9	37.0	-0.7	32.6	-	48.5	73.9	25.5	Floor noise
Hori.	15780.000	AV	35.7	37.0	-0.7	32.6	-	39.3	53.9	14.7	Floor noise
Vert.	7013.261	PK	47.2	35.5	6.7	32.5	-	56.9	68.2	11.3	
Vert.	10520.000	PK	52.5	39.9	-2.2	33.6	-	56.6	68.2	11.6	
Vert.	15780.000	PK	44.4	37.0	-0.7	32.6	-	48.0	73.9	26.0	Floor noise
Vert.	15780.000	AV	35.7	37.0	-0.7	32.6	-	39.3	53.9	14.6	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13565962H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	November 30, 2020	December 1, 2020	December 1, 2020
Temperature / Humidity	22 deg. C / 32 % RH	20 deg. C / 30 % RH	21 deg. C / 35 % RH
Engineer	Junya Okuno	Junki Nagatomi	Junya Okuno
	(1 GHz - 26.5 GHz)	(26.5 GHz - 40 GHz)	(Below 1 GHz)
Mode	Tx 11n-20 5320 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.	121.504	QP	36.1	13.0	8.4	32.1	-	25.4	43.5	18.2	
Hori.	135.000	QP	37.0	14.3	8.6	32.1	-	27.8	43.5	15.8	
Hori.	309.000	QP	43.0	13.6	10.1	32.0	-	34.8	46.0	11.2	
Hori.	312.000	QP	42.4	13.7	10.1	32.0	-	34.3	46.0	11.7	
Hori.	360.000	QP	40.8	15.0	10.5	32.0	-	34.4	46.0	11.7	
Hori.	617.138	QP	34.9	19.5	12.1	32.0	-	34.6	46.0	11.4	
Hori.	5350.000	PK	60.4	31.5	6.2	31.7	-	66.4	73.9	7.5	
Hori.	7093.238	PK	46.6	35.9	6.8	32.6	-	56.7	68.2	11.5	
Hori.	10640.000	PK	49.5	39.9	-2.2	33.6	-	53.6	73.9	20.3	
Hori.	15960.000	PK	44.2	37.6	-0.6	32.8	-	48.4	73.9	25.5	Floor noise
Hori.	5350.000	AV	46.4	31.5	6.2	31.7	0.5	52.9	53.9	1.0	*1)
Hori.	10640.000	AV	39.5	39.9	-2.2	33.6	0.5	44.1	53.9	9.8	
Hori.	15960.000	AV	35.3	37.6	-0.6	32.8	-	39.5	53.9	14.4	Floor noise
Vert.	39.322	QP	36.6	15.1	7.3	32.2	-	26.8	40.0	13.2	
Vert.	132.000	QP	41.3	14.0	8.5	32.1	-	31.7	43.5	11.8	
Vert.	135.000	QP	41.0	14.3	8.6	32.1	-	31.8	43.5	11.8	
Vert.	292.500	QP	41.9	13.6	10.0	32.0	-	33.5	46.0	12.5	
Vert.	300.000	QP	41.4	13.5	10.1	32.0	-	33.0	46.0	13.0	
Vert.	360.000	QP	37.4	15.0	10.5	32.0	-	31.0	46.0	15.1	
Vert.	5350.000	PK	59.7	31.5	6.2	31.7	-	65.7	73.9	8.2	
Vert.	7093.238	PK	46.5	35.9	6.8	32.6	-	56.5	68.2	11.7	
Vert.	10640.000	PK	51.5	39.9	-2.2	33.6	-	55.6	73.9	18.3	
Vert.	15960.000	PK	44.6	37.6	-0.6	32.8	-	48.8	73.9	25.2	Floor noise
Vert.	5350.000	AV	45.6	31.5	6.2	31.7	0.5	52.1	53.9	1.8	*1)
Vert.	10640.000	AV	42.0	39.9	-2.2	33.6	0.5	46.7	53.9	7.2	
Vert.	15960.000	AV	35.4	37.6	-0.6	32.8	-	39.6	53.9	14.3	Floor noise

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

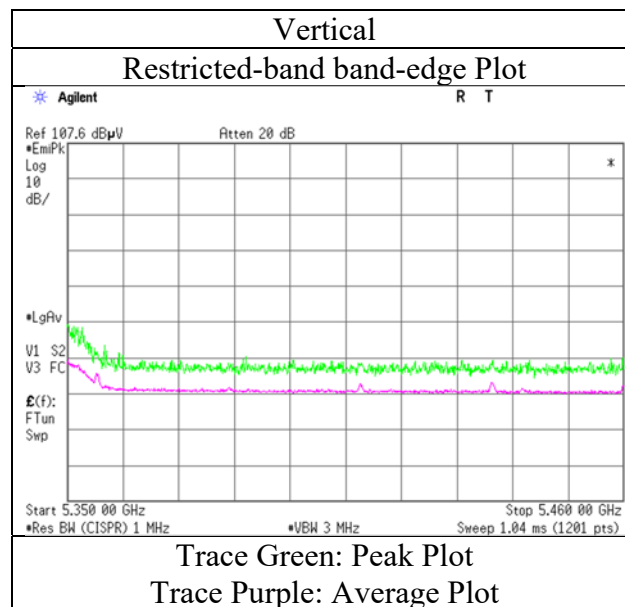
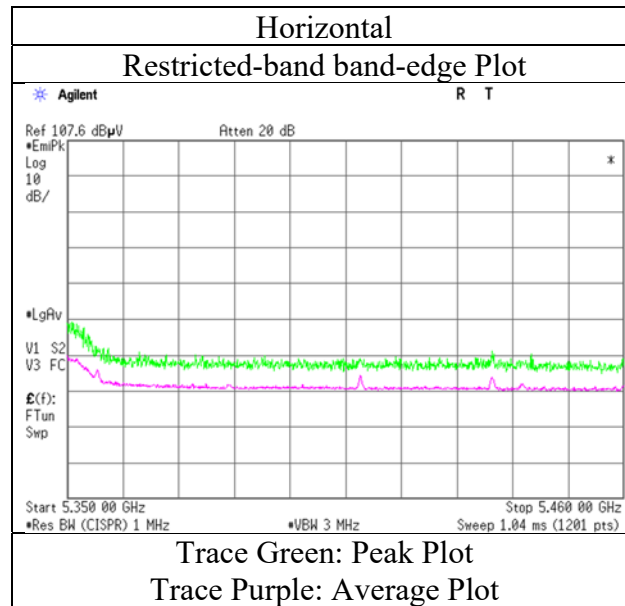
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission

Report No. 13565962H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020
Temperature / Humidity 22 deg. C / 32 % RH
Engineer Junya Okuno
(1 GHz - 10 GHz)
Mode Tx 11n-20 5320 MHz



* 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.

UL Japan, Inc.

Ise EMC Lab.

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

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Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 13565962H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020 December 1, 2020
Temperature / Humidity 20 deg. C / 35 % RH 20 deg. C / 30 % RH
Engineer Junki Nagatomi Junki Nagatomi
(1 GHz - 18 GHz) (18 GHz - 40 GHz)
Mode Tx 11n-20 5745 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.	3830.000	PK	44.6	29.6	5.6	32.0	-	47.8	73.9	26.1	
Hori.	5650.000	PK	42.0	31.7	6.3	31.8	-	48.2	68.2	20.0	
Hori.	5700.000	PK	45.9	31.8	6.3	31.8	-	52.2	105.2	53.0	
Hori.	5715.000	PK	59.0	31.9	6.3	31.8	-	65.4	109.4	44.0	
Hori.	5720.000	PK	65.4	31.9	6.3	31.8	-	71.9	110.8	38.9	
Hori.	5725.000	PK	74.2	32.0	6.3	31.8	-	80.6	122.2	41.6	
Hori.	11490.000	PK	45.5	39.7	-1.9	33.5	-	49.8	73.9	24.1	
Hori.	17235.000	PK	43.8	42.6	-0.3	32.7	-	53.4	68.2	14.8	Floor noise
Hori.	3830.000	AV	37.9	29.6	5.6	32.0	0.5	41.6	53.9	12.3	
Hori.	11490.000	AV	36.9	39.7	-1.9	33.5	0.5	41.8	53.9	12.1	
Vert.	3830.000	PK	46.5	29.6	5.6	32.0	-	49.6	73.9	24.3	
Vert.	5650.000	PK	42.7	31.7	6.3	31.8	-	48.9	68.2	19.3	
Vert.	5700.000	PK	47.4	31.8	6.3	31.8	-	53.6	105.2	51.6	
Vert.	5715.000	PK	59.3	31.9	6.3	31.8	-	65.7	109.4	43.7	
Vert.	5720.000	PK	64.7	31.9	6.3	31.8	-	71.1	110.8	39.7	
Vert.	5725.000	PK	75.0	32.0	6.3	31.8	-	81.5	122.2	40.7	
Vert.	11490.000	PK	50.2	39.7	-1.9	33.5	-	54.5	73.9	19.4	
Vert.	17235.000	PK	43.8	42.6	-0.3	32.7	-	53.5	68.2	14.7	Floor noise
Vert.	3830.000	AV	38.4	29.6	5.6	32.0	0.5	42.1	53.9	11.8	
Vert.	11490.000	AV	37.8	39.7	-1.9	33.5	0.5	42.6	53.9	11.3	

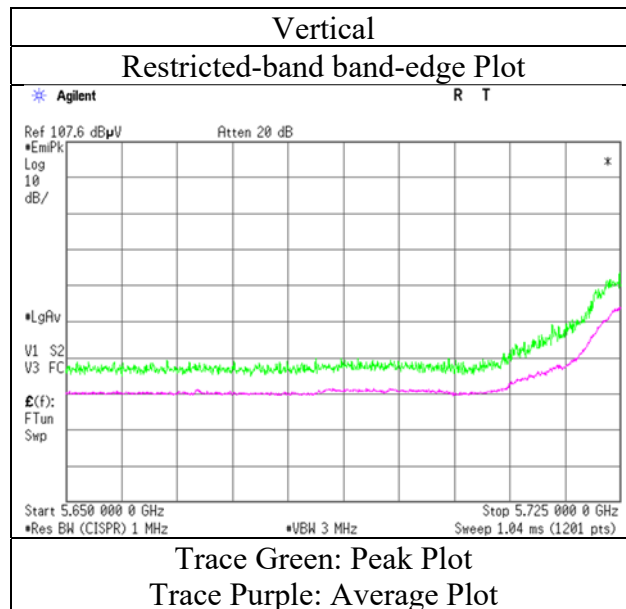
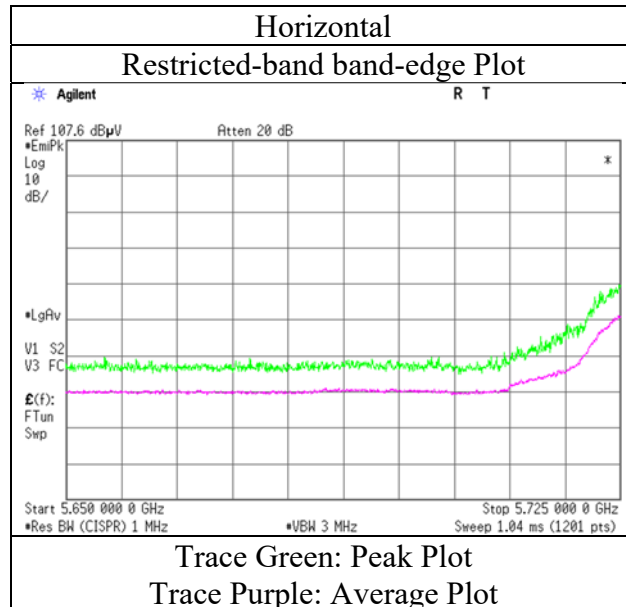
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*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 (3.95 m / 3.0 m) = 2.39 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13565962H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	November 30, 2020
Temperature / Humidity	20 deg. C / 35 % RH
Engineer	Junki Nagatomi
Mode	Tx 11n-20 5745 MHz



* 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.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

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Radiated Spurious Emission

Report No. 13565962H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020 December 1, 2020
Temperature / Humidity 20 deg. C / 35 % RH 20 deg. C / 30 % RH
Engineer Junki Nagatomi Junki Nagatomi
(1 GHz - 18 GHz) (18 GHz - 40GHz)
Mode Tx 11n-20 5785 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.	3856.810	PK	44.8	29.7	5.6	32.0	-	48.0	73.9	25.9	
Hori.	11570.000	PK	46.7	39.5	-1.8	33.4	-	51.0	73.9	23.0	
Hori.	17355.000	PK	44.2	43.7	-0.2	32.7	-	55.0	68.2	13.2	Floor noise
Hori.	3856.810	AV	37.3	29.7	5.6	32.0	0.5	41.0	53.9	12.9	
Hori.	11570.000	AV	37.1	39.5	-1.8	33.4	0.5	41.8	53.9	12.1	
Vert.	3856.810	PK	45.3	29.7	5.6	32.0	-	48.6	73.9	25.3	
Vert.	11570.000	PK	48.5	39.5	-1.8	33.4	-	52.7	73.9	21.2	
Vert.	17355.000	PK	44.6	43.7	-0.2	32.7	-	55.4	68.2	12.9	Floor noise
Vert.	3856.810	AV	38.9	29.7	5.6	32.0	0.5	42.7	53.9	11.3	
Vert.	11570.000	AV	39.1	39.5	-1.8	33.4	0.5	43.8	53.9	10.1	

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 (3.95 m / 3.0 m) = 2.39 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 13565962H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020 December 1, 2020
Temperature / Humidity 20 deg. C / 35 % RH 20 deg. C / 30 % RH
Engineer Junki Nagatomi Junki Nagatomi
(1 GHz - 18 GHz) (18 GHz - 40 GHz)
Mode Tx 11n-20 5825 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.	3883.700	PK	44.3	29.7	5.6	32.0	-	47.7	73.9	26.2	
Hori.	5850.000	PK	59.5	32.3	6.4	31.8	-	66.3	122.2	55.9	
Hori.	5855.000	PK	54.7	32.3	6.4	31.8	-	61.5	110.8	49.3	
Hori.	5860.000	PK	50.3	32.3	6.4	31.8	-	57.1	109.4	52.3	
Hori.	5875.000	PK	43.0	32.3	6.4	31.8	-	49.9	105.2	55.3	
Hori.	5925.000	PK	41.2	32.4	6.4	31.9	-	48.1	68.2	20.1	
Hori.	11650.000	PK	47.1	39.2	-1.8	33.4	-	51.1	73.9	22.8	
Hori.	17475.000	PK	43.4	44.6	-0.3	32.7	-	55.1	68.2	13.2	Floor noise
Hori.	3883.700	AV	37.3	29.7	5.6	32.0	0.5	41.1	53.9	12.8	
Hori.	11650.000	AV	37.6	39.2	-1.8	33.4	0.5	42.1	53.9	11.9	
Vert.	3883.700	PK	45.0	29.7	5.6	32.0	-	48.3	73.9	25.6	
Vert.	5850.000	PK	61.2	32.3	6.4	31.8	-	68.0	122.2	54.2	
Vert.	5855.000	PK	56.0	32.3	6.4	31.8	-	62.8	110.8	48.0	
Vert.	5860.000	PK	52.4	32.3	6.4	31.8	-	59.2	109.4	50.2	
Vert.	5875.000	PK	42.4	32.3	6.4	31.8	-	49.3	105.2	55.9	
Vert.	5925.000	PK	41.0	32.4	6.4	31.9	-	47.9	68.2	20.3	
Vert.	11650.000	PK	47.5	39.2	-1.8	33.4	-	51.4	73.9	22.5	
Vert.	17475.000	PK	44.3	44.6	-0.3	32.7	-	56.0	68.2	12.2	Floor noise
Vert.	3883.700	AV	37.8	29.7	5.6	32.0	0.5	41.6	53.9	12.3	
Vert.	11650.000	AV	37.5	39.2	-1.8	33.4	0.5	41.9	53.9	12.0	

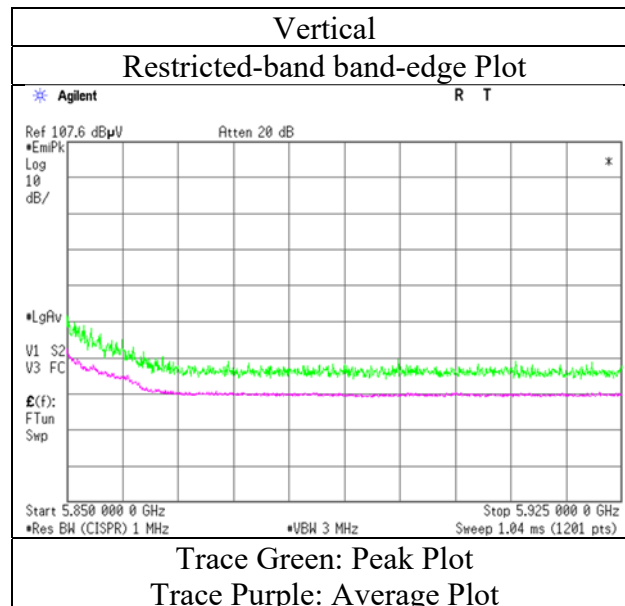
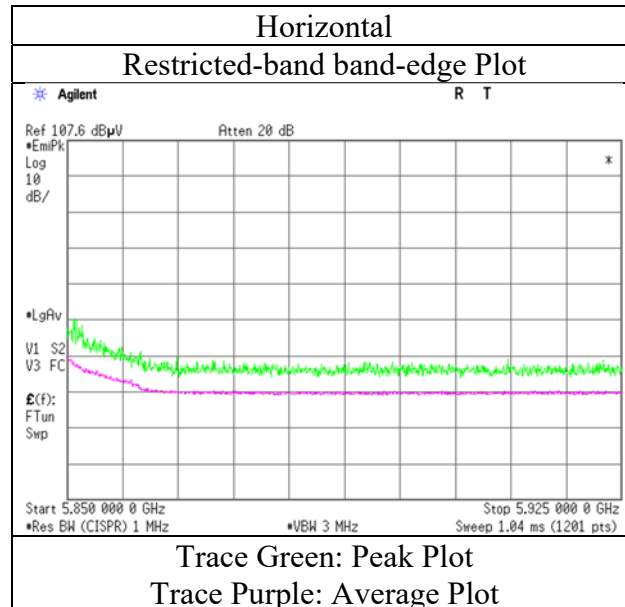
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13565962H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	November 30, 2020
Temperature / Humidity	20 deg. C / 35 % RH
Engineer	Junki Nagatomi
Mode	Tx 11n-20 5825 MHz



* 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.

UL Japan, Inc.

Ise EMC Lab.

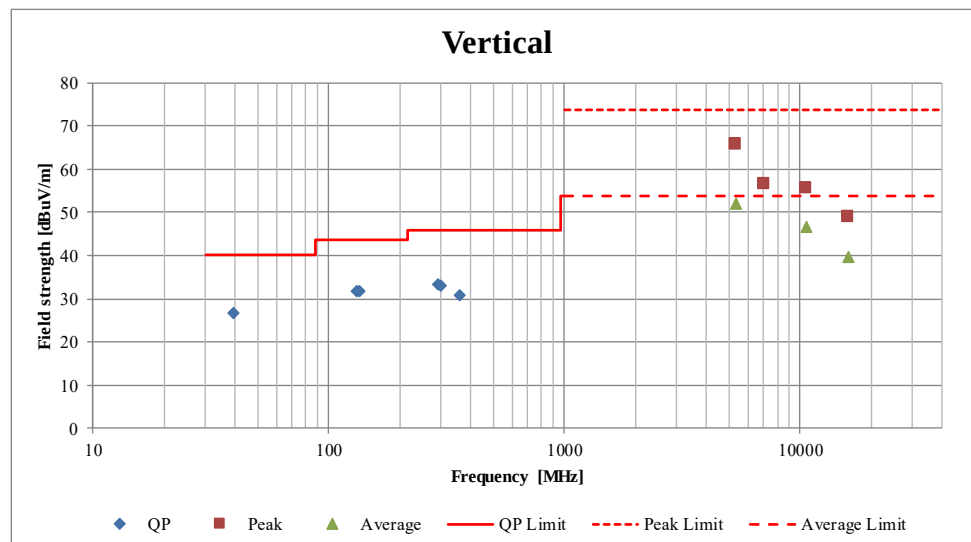
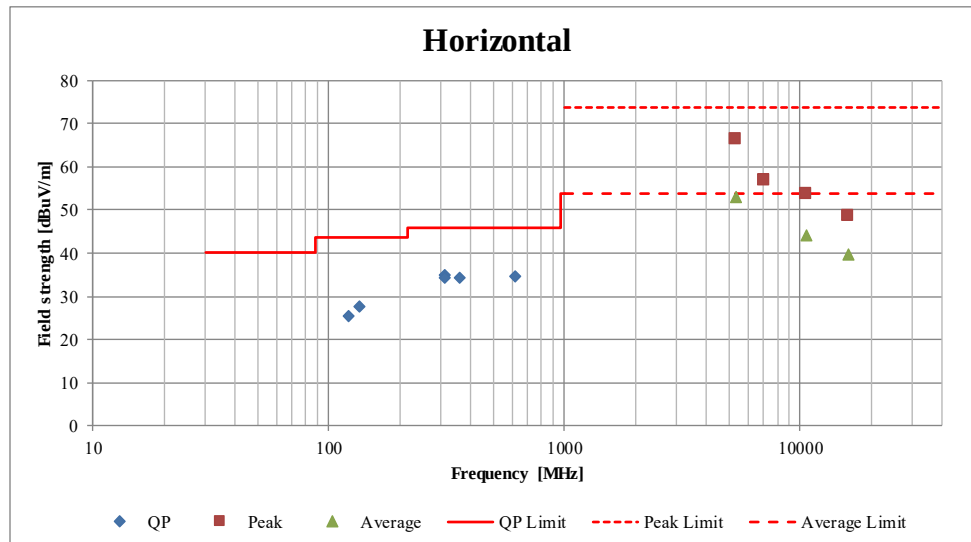
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

Report No.	13565962H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	November 30, 2020	December 1, 2020	December 1, 2020
Temperature / Humidity	22 deg. C / 32 % RH	20 deg. C / 30 % RH	21 deg. C / 35 % RH
Engineer	Junya Okuno	Junki Nagatomi	Junya Okuno
	(1 GHz - 26.5 GHz)	(26.5 GHz - 40 GHz)	(Below 1 GHz)
Mode	Tx 11n-20 5320 MHz		



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

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/07/2020	12
RE	MMM-08	141532	DIGITAL HiTESTER	Hioki	3805	51201197	01/06/2020	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-ME MI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	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	10/01/2020	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)/1902 S579(5m)	03/02/2020	12
RE	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/09/2020	12
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MHF-22	141293	High Pass Filter 7-20GHz	TOKIMEC	TF37NCCB	602	01/06/2020	12
RE	MCC-177	141226	Microwave Cable	Junkosha	MMX221-00500DMS DMS	1502S304	03/18/2020	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170306	05/21/2020	12
RE	MPA-22	141588	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-33-8P / AMF-4F-2600400-33-8P	1871355 /1871328	09/07/2020	12
RE	MHA-29	141517	Horn Antenna 26.5-40GHz	ETS LINDGREN	3160-10	152399	08/03/2020	12
RE	MCC-224	160324	Coaxial Cable	Huber+Suhner	SUCOFLEX 102A	MY009/2A	11/17/2020	12
RE	MAT-95	142314	Attenuator	Pasternack	PE7390-6	D/C 1504	06/17/2020	12
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1915	08/13/2020	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/06/2020	12
RE	MLA-22	141266	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-191	08/13/2020	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	08/18/2020	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

UL Japan, Inc.

Ise EMC Lab.

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