



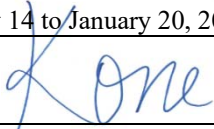
RADIO TEST REPORT

Test Report No. : 13674969H-A-R1

Applicant : Murata Manufacturing Co., Ltd.
Type of EUT : W-LAN + Bluetooth Module
Model Number of EUT : 1PJ
FCC ID : VPYLBEE5ZZ1PJ
Test regulation : FCC Part 15 Subpart C: 2021
(WLAN and Bluetooth Low Energy parts)
*For Permissive Change
Test Result : Complied (Refer to SECTION 3)
*Maximum Peak Output Power, Radiated Spurious
Emission and Conducted Spurious Emission tests only

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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.
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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 13674969H-A. 13674969H-A is replaced with this report.

Date of test: January 14 to January 20, 2021

Representative test engineer: 

Nachi Konegawa
Engineer

Approved by: 

Takayuki Shimada
Leader



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.: 13674969H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13674969H-A	March 29, 2021	-	-
1	13674969H-A-R1	May 18, 2021	P 10	Correction of transmission rate for 11n-20 in section 4.1: Operating Mode(s) 0 Mbps → MCS 0

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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	:	Murata Manufacturing Co., Ltd.
Address	:	1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	:	+81-75-955-6736
Facsimile Number	:	+81-75-955-6634
Contact Person	:	Motoo Hayashi

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	:	W-LAN + Bluetooth Module
Model Number	:	1PJ
Serial Number	:	Refer to SECTION 4.2
Rating	:	Typ. DC 3.3 V/ Min. DC 3.135 V/ Max. DC 3.465 V
Receipt Date	:	January 14, 2021
Country of Mass-production	:	China, Japan
Condition	:	Production model
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: 1PJ (referred to as the EUT in this report) is a W-LAN + Bluetooth Module.

Radio Specification

Specification of Wireless LAN (IEEE802.11b/g/a/n(HT20/40)/ac(VHT20/40/80))

Type of radio	IEEE802.11b *1)	IEEE802.11g/n (20 M band) *1)	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5720 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5710 MHz 5755 MHz - 5795 MHz	5210 MHz 5290 MHz 5530 MHz - 5690 MHz 5775 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM(IEEE802.11ac only))		
Channel spacing	5 MHz		20 MHz	40 MHz	80 MHz
Antenna type	Monopole Antenna				
Antenna Gain	2.4 GHz: 1.8 dBi 5 GHz: 2.0 dBi				

Bluetooth

	Bluetooth
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK) LE: GFSK
Channel spacing	BT: 1 MHz LE: 2 MHz
Antenna type	Monopole Antenna
Antenna Gain	1.8 dBi

*1) This test report applies to IEEE802.11b/g/n-20 (2412 MHz - 2462 MHz) and Bluetooth (LE part: 2402 MHz - 2480 MHz).

* WLAN and Bluetooth do not transmit simultaneously.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
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)	See data.	Complied a)	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	8.1 dB 4804.000 MHz, AV, Vert	Complied b), c)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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 section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6.

a) Refer to APPENDIX 1 (data of Maximum Peak Output Power)

b) Refer to APPENDIX 1 (data of Conducted Spurious Emission)

c) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

FCC Part 15.31 (e)

This EUT provides stable voltage constantly to RF Module regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The antenna is not removable from the EUT.

Therefore, the equipment complies with the antenna requirement of Section 15.203.

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 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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Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.4 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.6 dB

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	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
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 802.11b (11b)	1 Mbps, PN9
IEEE 802.11g (11g)	6 Mbps, PN9
IEEE 802.11n 20 MHz (11n-20)	MCS 0, PN9
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: 8.5 11g: 9 11n: 9.5 BT LE: minus_1dBfrom0_bdaddr_no tag33 153_minus0.3 (d9a957a8941bb09470601acc79fb579f) Software: Name: Qualcomm Radio Control Toolkit, Version : 3.0.276.0 (Date: 2020.12.23, 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) for WLAN

Test Item	Operating Mode	Tested frequency
Radiated Spurious Emission (Below 1GHz)	Tx 11n-20 *1)	2437 MHz
Radiated Spurious Emission (Above 1GHz)	Tx 11b Tx 11n-20 *2)	2412 MHz 2437 MHz 2462 MHz
Maximum Peak Output Power,	Tx 11b Tx 11g Tx 11n-20	2412 MHz 2437 MHz 2462 MHz
Conducted Spurious Emission	Tx 11n-20 *1)	2437 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power		

*The details of Operating mode(s) for BT LE

Test Item	Operating Mode	Tested frequency
Maximum Peak Output Power, Spurious Emission (Radiated) Conducted Spurious Emission	Tx BT LE	2402 MHz 2440 MHz 2480 MHz

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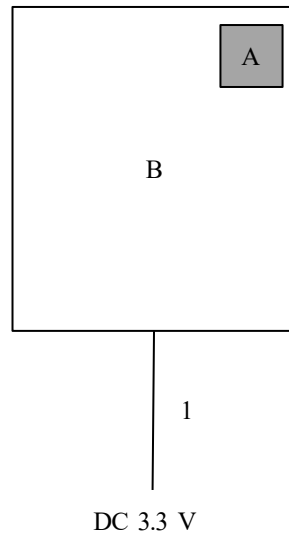
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4.2 Configuration and peripherals

Radiated Spurious Emission



* 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	W-LAN + Bluetooth Module	1PJ	3# (For WLAN) 7# (For BT LE)	Murata Manufacturing Co., Ltd.	EUT
B	Jig	JS0941	3# (For WLAN) 7# (For BT LE)	Murata Manufacturing Co., Ltd.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-

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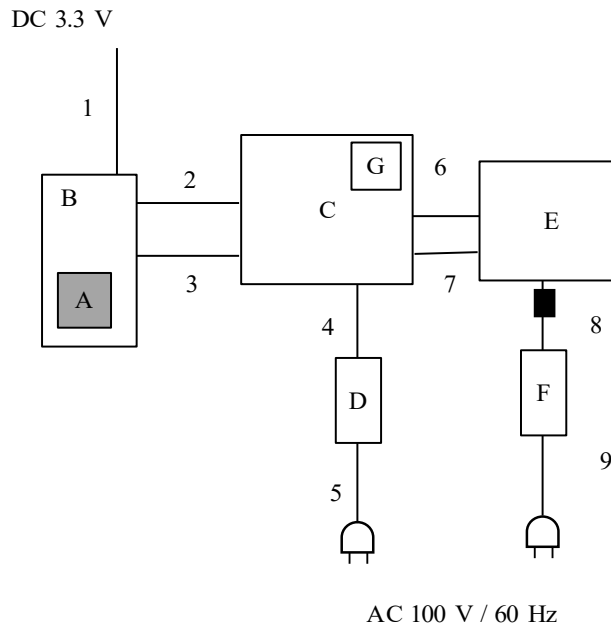
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Antenna Terminal Conducted Tests



* 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	W-LAN + Bluetooth Module	1PJ	3# (For WLAN) 7# (For BT LE)	Murata Manufacturing Co., Ltd.	EUT
B	Jig	JS0941	3# (For WLAN) 7# (For BT LE)	Murata Manufacturing Co., Ltd.	-
C	Jig	iMX6ull	TR18491580 (For WLAN) TR17112599 (For BT LE)	NXP Semiconductors	-
D	AC Adapter	ATS024T-A050	400-76027	ADAPTER TECH.	-
E	Laptop PC	CF-MX4	5FKSA17992	PANASONIC	-
F	AC Adapter	CF-AA62J2C	62J2CM2152251438SB	Panasonic	-
G	micro SD Card	110-7806 B	CERT-PL059 (For WLAN) CERT-PL054 (For BT LE)	SanDisk	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.90	Unshielded	Unshielded	-
2	Serial Cable	0.24	Unshielded	Unshielded	-
3	Serial Cable	0.26	Unshielded	Unshielded	-
4	DC Cable	1.00	Unshielded	Unshielded	-
5	AC Cable	1.00	Unshielded	Unshielded	-
6	LAN Cable	3.00	Unshielded	Unshielded	-
7	USB Cable	1.00	Shielded	Shielded	-
8	DC Cable	1.60	Unshielded	Unshielded	-
9	AC Cable	0.80	Unshielded	Unshielded	-

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SECTION 5: Radiated Spurious Emission

Test Procedure

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

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	For WLAN RBW: 1 MHz VBW: 1/T Detector: Power Averaging (RMS) For BT LE RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace : 100 trace Duty Factor was added to The results.	RBW: 100 kHz VBW: 300 kHz

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

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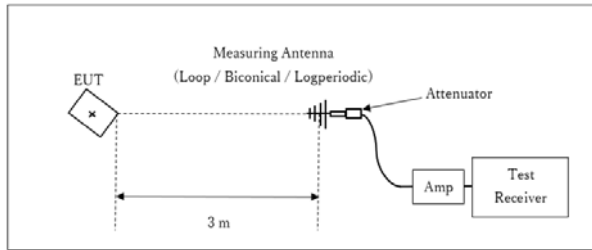
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Figure 2: Test Setup

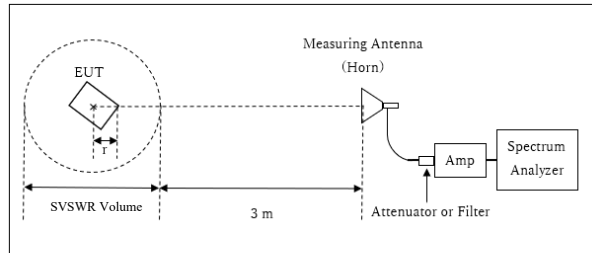
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



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

[No.3 semi anechoic chamber]

Distance Factor: $20 \times \log (3.8 \text{ m} / 3.0 \text{ m}) = 2.06 \text{ dB}$

* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.8 \text{ m}$

SVSWR Volume : 2.0 m

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

$r = 0.2 \text{ m}$

[No.2 semi anechoic chamber]

Distance Factor: $20 \times \log (3.55 \text{ m} / 3.0 \text{ m}) = 1.47 \text{ dB}$

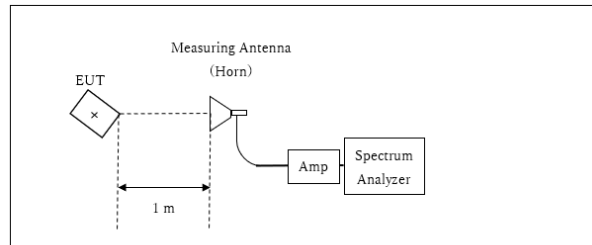
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.55 \text{ m}$

SVSWR Volume : 1.5 m

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

$r = 0.2 \text{ m}$

10 GHz – 26.5 GHz



x : Center of turn table

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 - 26.5 GHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *1)	-	Power Meter (Sensor: 50 MHz BW)
Conducted Spurious Emission *2) *3)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				
*1) Reference data							
*2) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.							
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.							
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)							
*3) 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 Ohms. 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

Maximum Peak Output Power

Report No. 13674969H
Test place Ise EMC Lab. No.6 Measurement Room
Date January 15, 2021
Temperature / Humidity 23 deg. C / 32 % RH
Engineer Kiyoshiro Okazaki
Mode Tx 11b

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	0.75	1.50	10.04	12.29	16.94	30.00	1000	17.71	1.80	14.09	25.64	36.02	4000	21.93
2437	0.79	1.50	10.04	12.33	17.10	30.00	1000	17.67	1.80	14.13	25.88	36.02	4000	21.89
2462	0.79	1.50	10.04	12.33	17.10	30.00	1000	17.67	1.80	14.13	25.88	36.02	4000	21.89

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.

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Maximum Peak Output Power

Report No. 13674969H
Test place Ise EMC Lab. No.6 Measurement Room
Date January 15, 2021
Temperature / Humidity 23 deg. C / 32 % RH
Engineer Kiyoshiro Okazaki
Mode Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	4.42	1.50	10.04	15.96	39.45	30.00	1000	14.04	1.80	17.76	59.70	36.02	4000	18.26
2437	4.44	1.50	10.04	15.98	39.63	30.00	1000	14.02	1.80	17.78	59.98	36.02	4000	18.24
2462	4.27	1.50	10.04	15.81	38.11	30.00	1000	14.19	1.80	17.61	57.68	36.02	4000	18.41

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.

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Maximum Peak Output Power

Report No. 13674969H
Test place Ise EMC Lab. No.6 Measurement Room
Date January 15, 2021
Temperature / Humidity 23 deg. C / 32 % RH
Engineer Kiyoshiro Okazaki
Mode Tx 11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
[MHz]	[dBm]	[dB]	[dB]					[dB]	[dBi]					[dB]
2412	4.73	1.50	10.04	16.27	42.36	30.00	1000	13.73	1.80	18.07	64.12	36.02	4000	17.95
2437	4.84	1.50	10.04	16.38	43.45	30.00	1000	13.62	1.80	18.18	65.77	36.02	4000	17.84
2462	4.83	1.50	10.04	16.37	43.35	30.00	1000	13.63	1.80	18.17	65.61	36.02	4000	17.85

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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

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Maximum Peak Output Power

Report No. 13674969H
Test place Ise EMC Lab. No.6 Measurement Room
Date January 20, 2021
Temperature / Humidity 21 deg. C / 33 % RH
Engineer Nachi Konegawa
Mode Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-6.80	1.50	10.04	4.74	2.98	30.00	1000	25.26	1.80	6.54	4.51	36.02	4000	29.48
2440	-6.78	1.50	10.04	4.76	2.99	30.00	1000	25.24	1.80	6.56	4.53	36.02	4000	29.46
2480	-7.02	1.50	10.04	4.52	2.83	30.00	1000	25.48	1.80	6.32	4.29	36.02	4000	29.70

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.

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Average Output Power **(Reference data for RF Exposure)**

Report No.	13674969H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 15, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
2412	-2.11	1.50	10.04	9.43	8.77
2437	-2.04	1.50	10.04	9.50	8.91
2462	-2.10	1.50	10.04	9.44	8.79

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
2412	-2.16	1.50	10.04	9.38	8.67
2437	-2.24	1.50	10.04	9.30	8.51
2462	-2.29	1.50	10.04	9.25	8.41

11n-20 MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
2412	-1.93	1.50	10.04	9.61	9.14
2437	-1.91	1.50	10.04	9.63	9.18
2462	-2.01	1.50	10.04	9.53	8.97

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
2402	-7.05	1.50	10.04	4.49	2.81
2440	-6.93	1.50	10.04	4.61	2.89
2480	-7.40	1.50	10.04	4.14	2.59

Sample Calculation:

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

*The test was conducted by the use of Gate function.

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.

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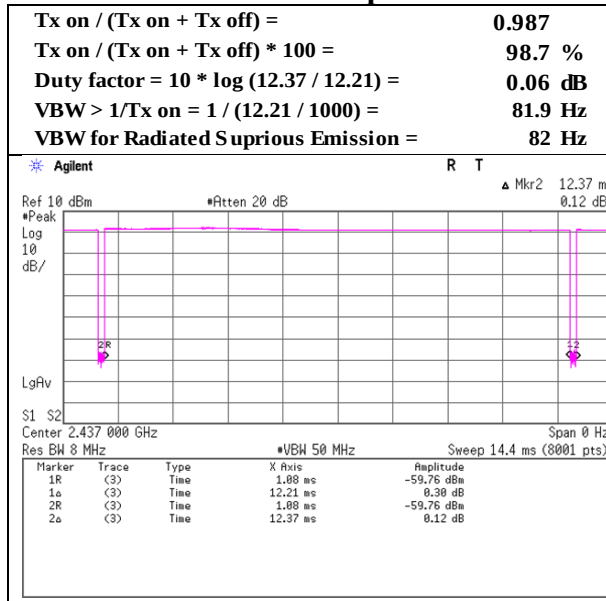
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

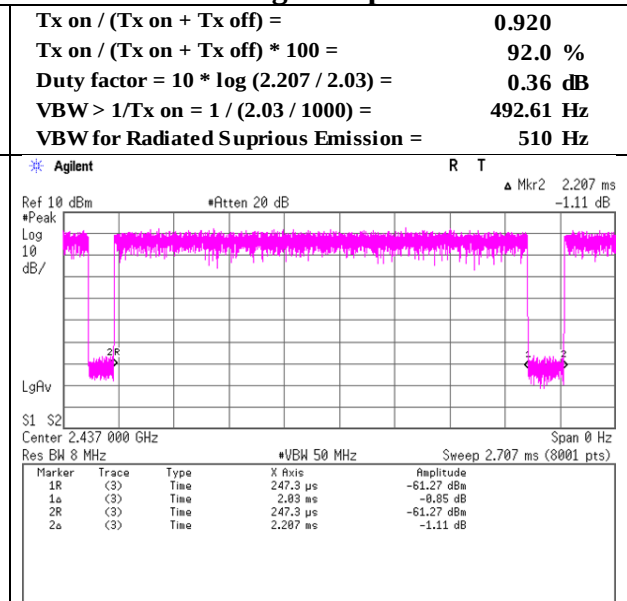
Burst rate confirmation

Report No. 13674969H
Test place Ise EMC Lab. No.6 Measurement Room
Date January 15, 2021
Temperature / Humidity 23 deg. C / 32 % RH
Engineer Kiyoshiro Okazaki
Mode Tx

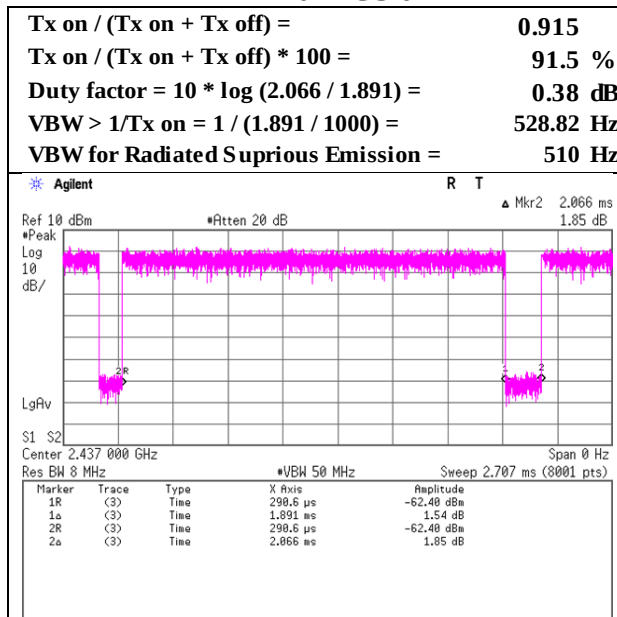
11b 1 Mbps



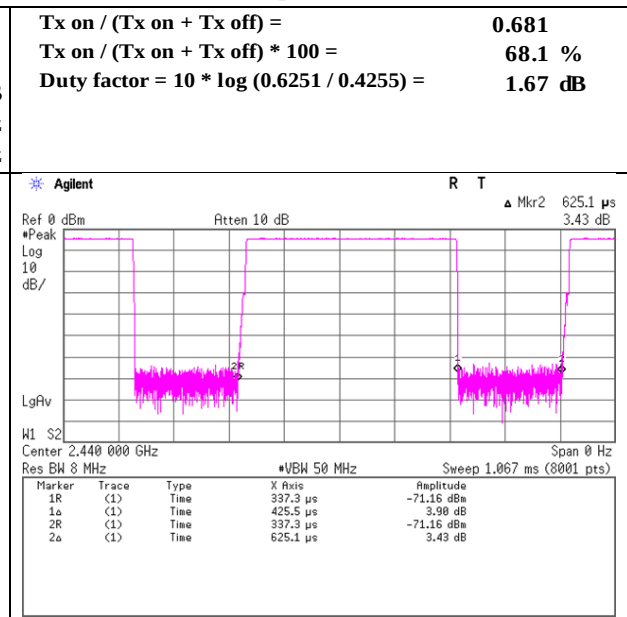
11g 6 Mbps



11n-20 MCS 0



BT LE



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

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Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	January 14, 2021	January 17, 2021	January 17, 2021
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 38 % RH	23 deg. C / 34 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)	Akihiko Maeda (10 GHz - 18 GHz)	Hiroki Numata (18 GHz - 26.5 GHz)
Mode	Tx 11b 2412 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	PK	53.4	27.5	5.2	32.7	-	53.3	73.9	20.6	
Hori.	4824.000	PK	42.1	31.7	7.3	31.7	-	49.4	73.9	24.6	Floor noise
Hori.	7236.000	PK	41.2	36.1	8.6	32.6	-	53.3	73.9	20.6	Floor noise
Hori.	9648.000	PK	42.1	38.7	9.1	33.3	-	56.6	73.9	17.3	Floor noise
Hori.	2390.000	AV	44.7	27.5	5.2	32.7	-	44.6	53.9	9.3	*1) *2)
Hori.	4824.000	AV	30.7	31.7	7.3	31.7	-	38.0	53.9	15.9	Floor noise
Hori.	7236.000	AV	32.1	36.1	8.6	32.6	-	44.2	53.9	9.7	Floor noise
Hori.	9648.000	AV	32.7	38.7	9.1	33.3	-	47.3	53.9	6.6	Floor noise
Vert.	2390.000	PK	51.1	27.5	5.2	32.7	-	51.1	73.9	22.8	
Vert.	4824.000	PK	40.2	31.7	7.3	31.7	-	47.5	73.9	26.4	Floor noise
Vert.	7236.000	PK	40.8	36.1	8.6	32.6	-	52.9	73.9	21.1	Floor noise
Vert.	9648.000	PK	42.7	38.7	9.1	33.3	-	57.2	73.9	16.7	Floor noise
Vert.	2390.000	AV	42.7	27.5	5.2	32.7	-	42.7	53.9	11.2	*1) *2)
Vert.	4824.000	AV	30.3	31.7	7.3	31.7	-	37.6	53.9	16.3	Floor noise
Vert.	7236.000	AV	32.3	36.1	8.6	32.6	-	44.4	53.9	9.5	Floor noise
Vert.	9648.000	AV	32.0	38.7	9.1	33.3	-	46.6	53.9	7.3	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 $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.06\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

*2)Noise synchronized with duty of carrier frequency.

* See Burst rate confirmation for VBW calculation.

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	99.4	27.5	5.2	32.7	99.4	-	-	Carrier
Hori.	2400.000	PK	45.9	27.5	5.2	32.7	45.8	79.4	33.5	
Vert.	2412.000	PK	97.1	27.5	5.2	32.7	97.0	-	-	Carrier
Vert.	2400.000	PK	45.6	27.5	5.2	32.7	45.5	77.0	31.5	

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

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Ise EMC Lab.

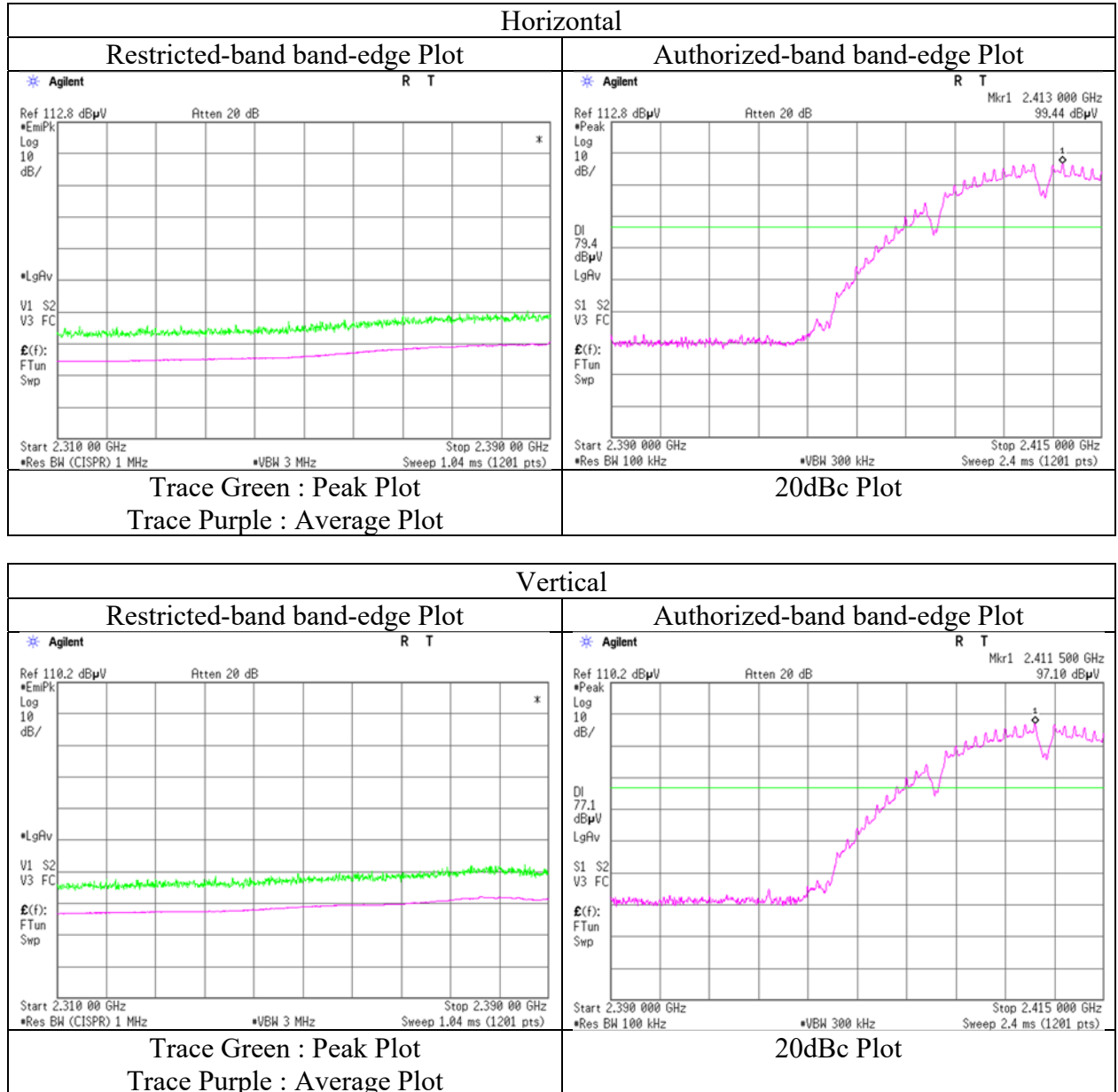
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	January 14, 2021
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Takeshi Hiyaji
	(1 GHz - 10 GHz)
Mode	Tx 11b 2412 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.

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Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	January 14, 2021	January 17, 2021	January 17, 2021
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 38 % RH	23 deg. C / 34 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)	Akihiko Maeda (10 GHz - 18 GHz)	Hiroki Numata (18 GHz - 26.5 GHz)
Mode	Tx 11b 2437 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	PK	39.8	31.5	7.3	31.6	-	46.9	73.9	27.0	Floor noise
Hori.	7311.000	PK	41.1	36.2	8.6	32.6	-	53.3	73.9	20.6	Floor noise
Hori.	9748.000	PK	42.2	39.0	9.1	33.4	-	57.0	73.9	16.9	Floor noise
Hori.	4874.000	AV	31.7	31.5	7.3	31.6	-	38.8	53.9	15.1	Floor noise
Hori.	7311.000	AV	32.0	36.2	8.6	32.6	-	44.2	53.9	9.8	Floor noise
Hori.	9748.000	AV	32.3	39.0	9.1	33.4	-	47.1	53.9	6.8	Floor noise
Vert.	4874.000	PK	40.1	31.5	7.3	31.6	-	47.2	73.9	26.7	Floor noise
Vert.	7311.000	PK	41.2	36.2	8.6	32.6	-	53.3	73.9	20.6	Floor noise
Vert.	9748.000	PK	42.4	39.0	9.1	33.4	-	57.2	73.9	16.8	Floor noise
Vert.	4874.000	AV	32.7	31.5	7.3	31.6	-	39.8	53.9	14.1	Floor noise
Vert.	7311.000	AV	33.1	36.2	8.6	32.6	-	45.3	53.9	8.6	Floor noise
Vert.	9748.000	AV	32.5	39.0	9.1	33.4	-	47.3	53.9	6.6	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.06\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

* See Burst rate confirmation for VBW calculation.

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Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	January 14, 2021	January 17, 2021	January 17, 2021
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 38 % RH	23 deg. C / 34 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)	Akihiko Maeda (10 GHz - 18 GHz)	Hiroki Numata (18 GHz - 26.5 GHz)
Mode	Tx 11b 2462 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	PK	52.2	27.3	5.2	32.7	-	52.1	73.9	21.9	
Hori.	4924.000	PK	40.0	31.4	7.3	31.6	-	47.0	73.9	26.9	Floor noise
Hori.	7386.000	PK	40.7	36.2	8.6	32.7	-	52.9	73.9	21.0	Floor noise
Hori.	9848.000	PK	41.7	38.9	9.1	33.4	-	56.3	73.9	17.6	Floor noise
Hori.	2483.500	AV	44.5	27.3	5.2	32.7	-	44.4	53.9	9.5	*1) *2)
Hori.	4924.000	AV	31.1	31.4	7.3	31.6	-	38.1	53.9	15.8	Floor noise
Hori.	7386.000	AV	31.8	36.2	8.6	32.7	-	44.0	53.9	9.9	Floor noise
Hori.	9848.000	AV	31.7	38.9	9.1	33.4	-	46.2	53.9	7.7	Floor noise
Vert.	2483.500	PK	51.3	27.3	5.2	32.7	-	51.1	73.9	22.8	
Vert.	4924.000	PK	40.0	31.4	7.3	31.6	-	47.0	73.9	26.9	Floor noise
Vert.	7386.000	PK	40.9	36.2	8.6	32.7	-	53.1	73.9	20.8	Floor noise
Vert.	9848.000	PK	42.2	38.9	9.1	33.4	-	56.8	73.9	17.1	Floor noise
Vert.	2483.500	AV	43.6	27.3	5.2	32.7	-	43.5	53.9	10.4	*1) *2)
Vert.	4924.000	AV	31.1	31.4	7.3	31.6	-	38.1	53.9	15.8	Floor noise
Vert.	7386.000	AV	32.1	36.2	8.6	32.7	-	44.3	53.9	9.6	Floor noise
Vert.	9848.000	AV	32.1	38.9	9.1	33.4	-	46.7	53.9	7.2	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 $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.06\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

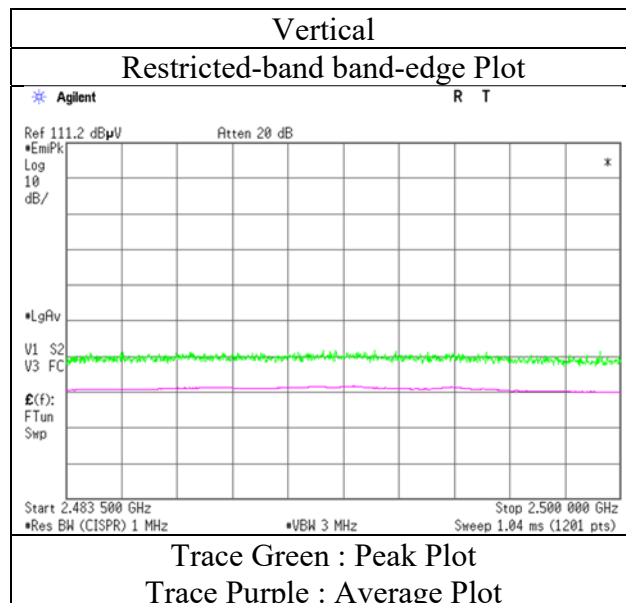
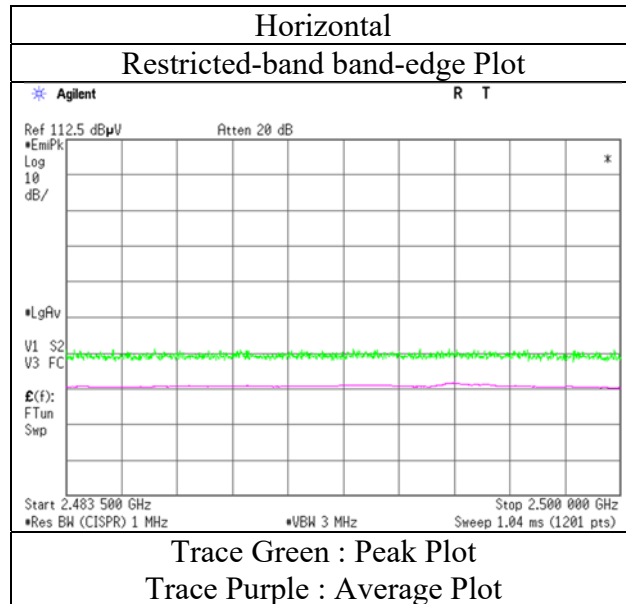
*1)Not Out of Band emission(Leakage Power)

*2)Noise synchronized with duty of carrier frequency.

* See Burst rate confirmation for VBW calculation.

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	January 14, 2021
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)
Mode	Tx 11b 2462 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.

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Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	January 14, 2021	January 17, 2021	January 17, 2021
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 38 % RH	23 deg. C / 34 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)	Akihiko Maeda (10 GHz - 18 GHz)	Hiroki Numata (18 GHz - 26.5 GHz)
Mode	Tx 11n-20 2412 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	PK	53.0	27.5	5.2	32.7	-	52.9	73.9	21.0	
Hori.	4824.000	PK	41.1	31.7	7.3	31.7	-	48.3	73.9	25.6	Floor noise
Hori.	7236.000	PK	41.4	36.1	8.6	32.6	-	53.5	73.9	20.4	Floor noise
Hori.	9648.000	PK	42.8	38.7	9.1	33.3	-	57.3	73.9	16.6	Floor noise
Hori.	2390.000	AV	42.4	27.5	5.2	32.7	-	42.3	53.9	11.6	*1) *2)
Hori.	4824.000	AV	30.8	31.7	7.3	31.7	-	38.1	53.9	15.8	Floor noise
Hori.	7236.000	AV	31.7	36.1	8.6	32.6	-	43.8	53.9	10.1	Floor noise
Hori.	9648.000	AV	33.0	38.7	9.1	33.3	-	47.5	53.9	6.4	Floor noise
Vert.	2390.000	PK	51.6	27.5	5.2	32.7	-	51.5	73.9	22.4	
Vert.	4824.000	PK	41.1	31.7	7.3	31.7	-	48.4	73.9	25.5	Floor noise
Vert.	7236.000	PK	41.9	36.1	8.6	32.6	-	54.0	73.9	20.0	Floor noise
Vert.	9648.000	PK	42.7	38.7	9.1	33.3	-	57.2	73.9	16.7	Floor noise
Vert.	2390.000	AV	42.8	27.5	5.2	32.7	-	42.7	53.9	11.2	*1) *2)
Vert.	4824.000	AV	30.8	31.7	7.3	31.7	-	38.1	53.9	15.9	Floor noise
Vert.	7236.000	AV	32.0	36.1	8.6	32.6	-	44.1	53.9	9.8	Floor noise
Vert.	9648.000	AV	32.7	38.7	9.1	33.3	-	47.2	53.9	6.7	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 (3.8 m / 3.0 m) = 2.06 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

*2)Noise synchronized with duty of carrier frequency.

* See Burst rate confirmation for VBW calculation.

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	96.1	27.5	5.2	32.7	96.0	-	-	Carrier
Hori.	2400.000	PK	57.9	27.5	5.2	32.7	57.9	76.0	18.1	
Vert.	2412.000	PK	94.8	27.5	5.2	32.7	94.7	-	-	Carrier
Vert.	2400.000	PK	54.6	27.5	5.2	32.7	54.5	74.7	20.2	

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

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Ise EMC Lab.

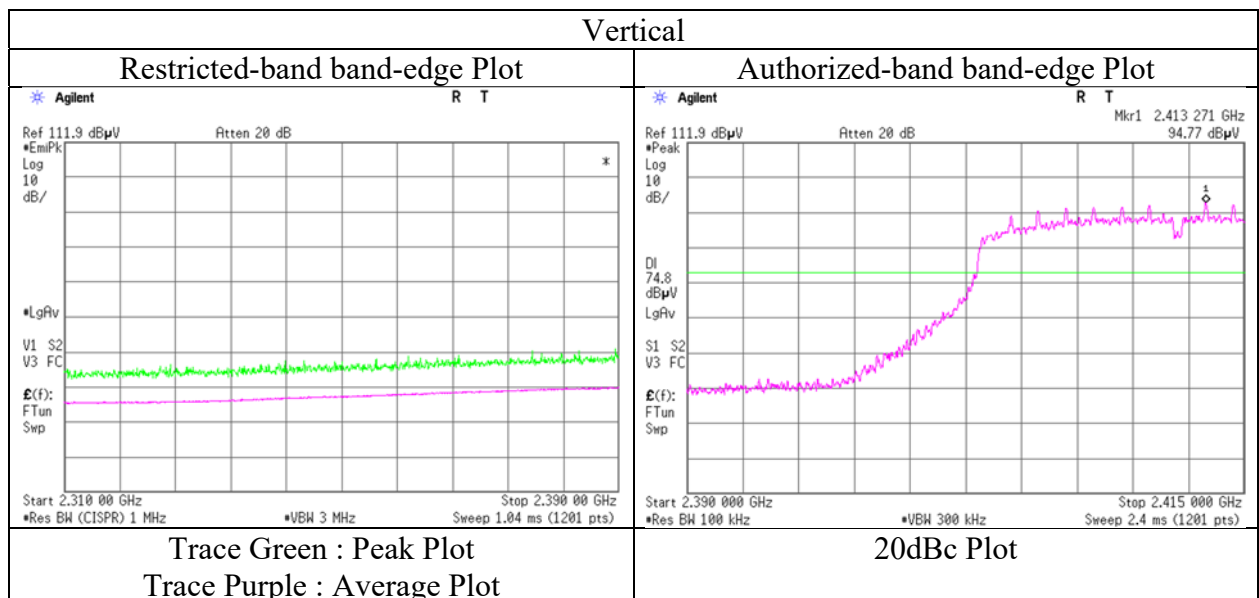
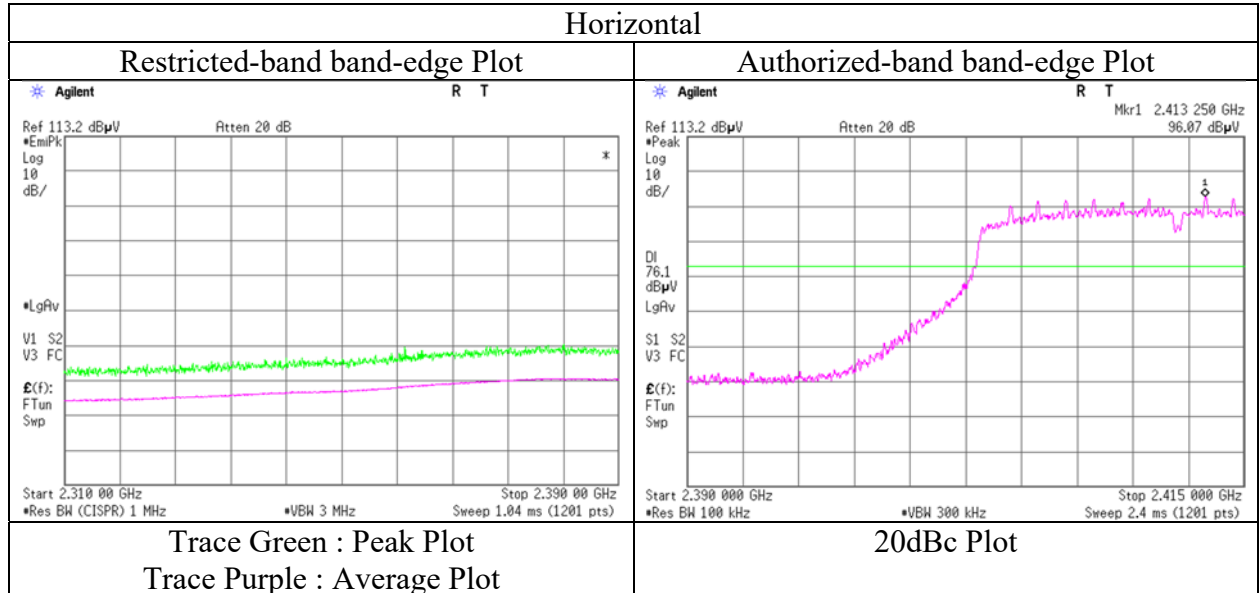
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	January 14, 2021
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)
Mode	Tx 11n-20 2412 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.

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Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.2
Date	January 14, 2021	January 18, 2021	January 18, 2021
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 34 % RH	21 deg. C / 37 % RH
Engineer	Takeshi Hiyaji	Hiroki Numata	Ken Fujita
	(1 GHz - 10 GHz)	(18 GHz - 26.5 GHz)	(Below 1GHz)
Mode	Tx 11n-20 2437 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	36.115	QP	21.3	16.2	6.8	28.6	-	15.7	40.0	24.3	Floor noise
Hori.	72.298	QP	22.3	6.2	7.2	28.6	-	7.1	40.0	32.9	Floor noise
Hori.	109.090	QP	21.2	11.5	7.5	28.5	-	11.8	43.5	31.7	Floor noise
Hori.	208.160	QP	21.3	11.2	8.3	28.0	-	12.7	43.5	30.8	Floor noise
Hori.	300.802	QP	20.9	13.7	8.9	27.8	-	15.6	46.0	30.4	Floor noise
Hori.	420.368	QP	21.4	16.1	9.6	28.7	-	18.4	46.0	27.7	Floor noise
Hori.	4874.000	PK	42.2	31.5	7.3	31.6	-	49.3	73.9	24.6	Floor noise
Hori.	7311.000	PK	41.5	36.2	8.6	32.6	-	53.7	73.9	20.3	Floor noise
Hori.	9748.000	PK	41.3	39.0	9.1	33.4	-	56.0	73.9	17.9	Floor noise
Hori.	4874.000	AV	33.3	31.5	7.3	31.6	-	40.4	53.9	13.5	Floor noise
Hori.	7311.000	AV	32.3	36.2	8.6	32.6	-	44.5	53.9	9.4	Floor noise
Hori.	9748.000	AV	32.5	39.0	9.1	33.4	-	47.3	53.9	6.6	Floor noise
Vert.	36.115	QP	23.0	16.2	6.8	28.6	-	17.4	40.0	22.6	Floor noise
Vert.	72.298	QP	23.8	6.2	7.2	28.6	-	8.6	40.0	31.4	Floor noise
Vert.	109.090	QP	21.2	11.5	7.5	28.5	-	11.8	43.5	31.7	Floor noise
Vert.	208.160	QP	21.2	11.2	8.3	28.0	-	12.6	43.5	30.9	Floor noise
Vert.	300.802	QP	20.9	13.7	8.9	27.8	-	15.6	46.0	30.4	Floor noise
Vert.	420.368	QP	21.3	16.1	9.6	28.7	-	18.3	46.0	27.8	Floor noise
Vert.	4874.000	PK	41.1	31.5	7.3	31.6	-	48.2	73.9	25.7	Floor noise
Vert.	7311.000	PK	41.6	36.2	8.6	32.6	-	53.7	73.9	20.2	Floor noise
Vert.	9748.000	PK	41.4	39.0	9.1	33.4	-	56.1	73.9	17.8	Floor noise
Vert.	4874.000	AV	32.6	31.5	7.3	31.6	-	39.7	53.9	14.2	Floor noise
Vert.	7311.000	AV	32.2	36.2	8.6	32.6	-	44.3	53.9	9.6	Floor noise
Vert.	9748.000	AV	32.8	39.0	9.1	33.4	-	47.5	53.9	6.4	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.8 m / 3.0 m) = 2.06 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

* See Burst rate confirmation for VBW calculation.

Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	January 14, 2021	January 17, 2021	January 17, 2021
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 38 % RH	23 deg. C / 34 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)	Akihiko Maeda (10 GHz - 18 GHz)	Hiroki Numata (18 GHz - 26.5 GHz)
Mode	Tx 11n-20 2462 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	PK	53.2	27.3	5.2	32.7	-	53.1	73.9	20.8	
Hori.	4924.000	PK	44.4	31.4	7.3	31.6	-	51.4	73.9	22.5	Floor noise
Hori.	7386.000	PK	41.5	36.2	8.6	32.7	-	53.7	73.9	20.2	Floor noise
Hori.	9848.000	PK	42.0	38.9	9.1	33.4	-	56.5	73.9	17.4	Floor noise
Hori.	2483.500	AV	44.3	27.3	5.2	32.7	-	44.1	53.9	9.8	*1) *2)
Hori.	4924.000	AV	33.5	31.4	7.3	31.6	-	40.6	53.9	13.3	Floor noise
Hori.	7386.000	AV	31.8	36.2	8.6	32.7	-	44.0	53.9	9.9	Floor noise
Hori.	9848.000	AV	31.2	38.9	9.1	33.4	-	45.8	53.9	8.1	Floor noise
Vert.	2483.500	PK	52.9	27.3	5.2	32.7	-	52.7	73.9	21.2	
Vert.	4924.000	PK	46.1	31.4	7.3	31.6	-	53.1	73.9	20.8	Floor noise
Vert.	7386.000	PK	41.8	36.2	8.6	32.7	-	54.0	73.9	19.9	Floor noise
Vert.	9848.000	PK	41.5	38.9	9.1	33.4	-	56.1	73.9	17.8	Floor noise
Vert.	2483.500	AV	43.6	27.3	5.2	32.7	-	43.4	53.9	10.5	*1) *2)
Vert.	4924.000	AV	33.5	31.4	7.3	31.6	-	40.5	53.9	13.4	Floor noise
Vert.	7386.000	AV	31.8	36.2	8.6	32.7	-	44.0	53.9	9.9	Floor noise
Vert.	9848.000	AV	31.6	38.9	9.1	33.4	-	46.1	53.9	7.8	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.06\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

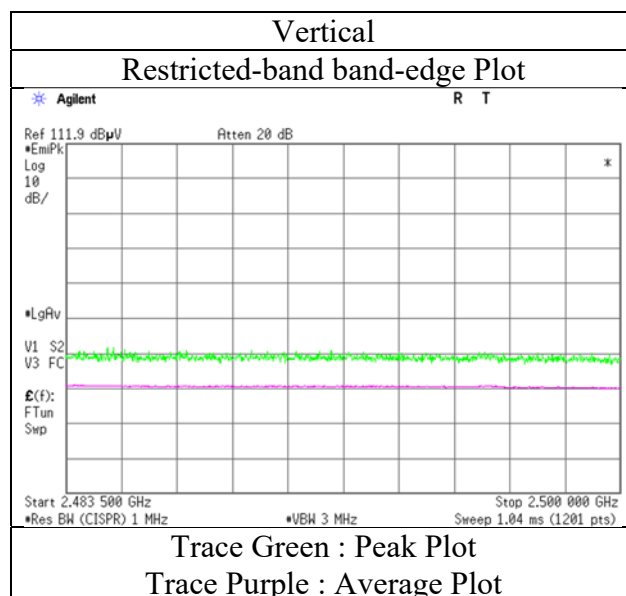
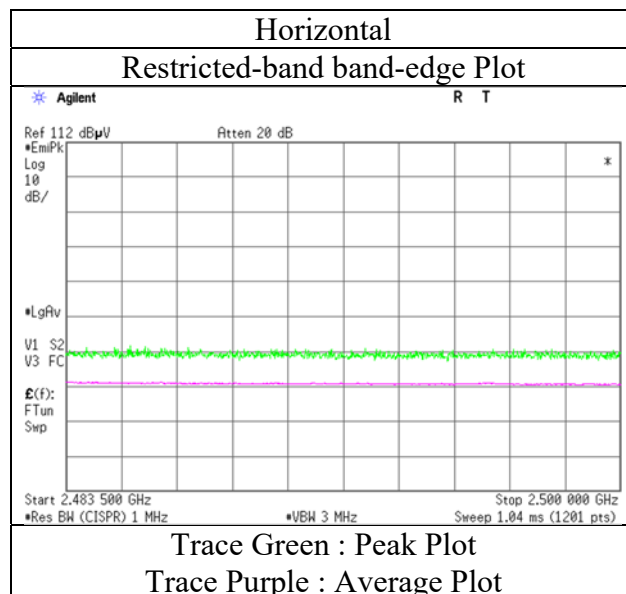
*1)Not Out of Band emission(Leakage Power)

*2)Noise synchronized with duty of carrier frequency.

* See Burst rate confirmation for VBW calculation.

Radiated Spurious Emission (Reference Plot for band-edge)

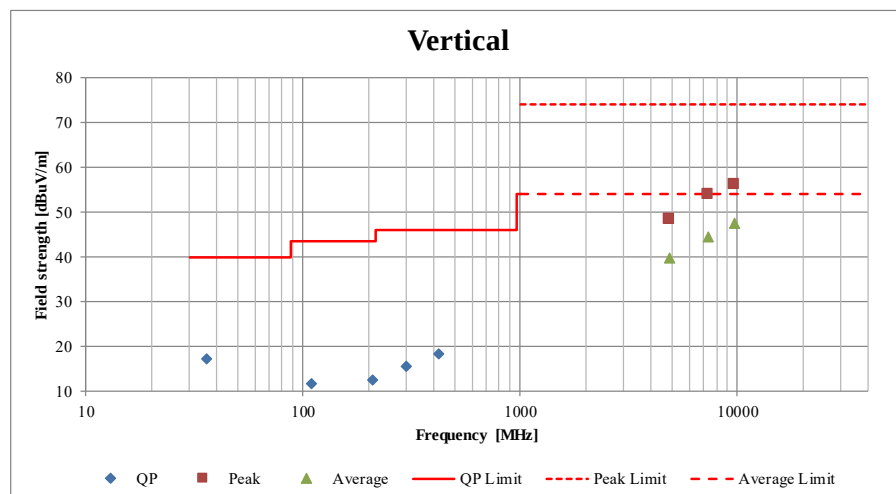
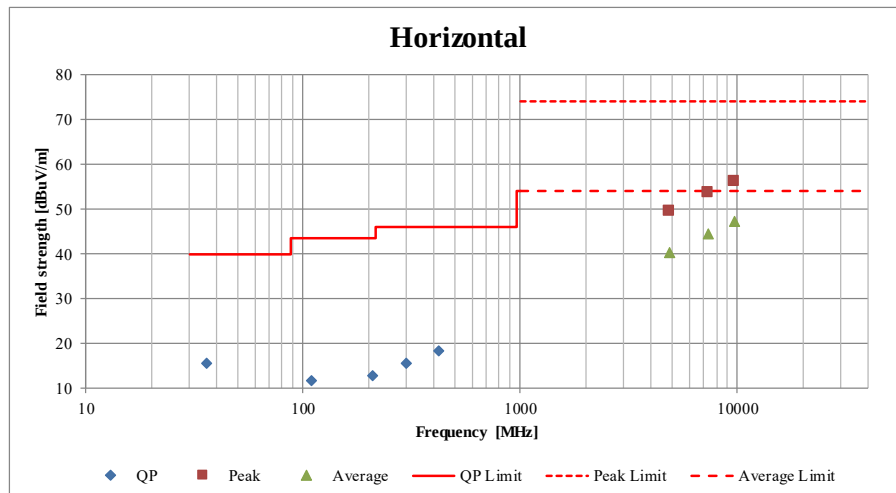
Report No. 13674969H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date January 14, 2021
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Takeshi Hiyaji
(1 GHz - 10 GHz)
Mode Tx 11n-20 2462 MHz



* 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.

Radiated Spurious Emission (Plot data, Worst case)

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.2
Date	January 14, 2021	January 18, 2021	January 18, 2021
Temperature / Humidity	22 deg. C / 40 % RH	23 deg. C / 34 % RH	21 deg. C / 37 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)	Hiroki Numata (18 GHz - 26.5 GHz)	Ken Fujita (Below 1GHz)
Mode	Tx 11n-20 2437 MHz		



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

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Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	23 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata (Below 1GHz)	Nachi Konegawa (1 GHz - 10 GHz)	Nachi Konegawa (10 GHz - 26.5 GHz)
Mode	Tx BT LE 2402 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.	55.313	QP	21.2	9.3	7.0	28.6	-	8.9	40.0	31.1	Floor noise
Hori.	75.806	QP	27.1	6.3	7.3	28.6	-	12.1	40.0	27.9	
Hori.	130.473	QP	21.8	13.6	7.7	28.4	-	14.7	43.5	28.8	Floor noise
Hori.	225.999	QP	21.8	11.2	8.4	27.9	-	13.4	46.0	32.6	Floor noise
Hori.	300.792	QP	21.8	13.7	8.9	27.8	-	16.5	46.0	29.5	Floor noise
Hori.	483.564	QP	22.2	17.4	9.8	29.1	-	20.3	46.0	25.7	Floor noise
Hori.	2390.000	PK	51.1	27.6	4.5	34.6	-	48.6	73.9	25.4	
Hori.	4804.000	PK	46.7	31.6	5.9	33.7	-	50.4	73.9	23.5	
Hori.	7206.000	PK	43.1	35.8	7.1	33.6	-	52.4	73.9	21.5	Floor noise
Hori.	9608.000	PK	42.8	38.6	8.1	34.2	-	55.2	73.9	18.7	Floor noise
Hori.	2390.000	AV	37.3	27.6	4.5	34.6	1.67	36.4	53.9	17.5	*1)
Hori.	4804.000	AV	40.3	31.6	5.9	33.7	1.67	45.7	53.9	8.2	
Hori.	7206.000	AV	33.2	35.8	7.1	33.6	-	42.5	53.9	11.4	Floor noise
Hori.	9608.000	AV	34.0	38.6	8.1	34.2	-	46.5	53.9	7.4	Floor noise
Vert.	55.313	QP	21.3	9.3	7.0	28.6	-	9.0	40.0	31.0	Floor noise
Vert.	75.806	QP	33.8	6.3	7.3	28.6	-	18.8	40.0	21.2	
Vert.	130.473	QP	20.8	13.6	7.7	28.4	-	13.7	43.5	29.8	Floor noise
Vert.	225.999	QP	21.8	11.2	8.4	27.9	-	13.4	46.0	32.6	Floor noise
Vert.	300.792	QP	21.9	13.7	8.9	27.8	-	16.6	46.0	29.4	Floor noise
Vert.	483.564	QP	22.2	17.4	9.8	29.1	-	20.3	46.0	25.7	Floor noise
Vert.	2390.000	PK	51.4	27.6	4.5	34.6	-	48.9	73.9	25.0	
Vert.	4804.000	PK	46.8	31.6	5.9	33.7	-	50.5	73.9	23.4	
Vert.	7206.000	PK	43.1	35.8	7.1	33.6	-	52.4	73.9	21.5	Floor noise
Vert.	9608.000	PK	44.0	38.6	8.1	34.2	-	56.5	73.9	17.4	Floor noise
Vert.	2390.000	AV	37.7	27.6	4.5	34.6	1.67	36.8	53.9	17.1	*1)
Vert.	4804.000	AV	40.4	31.6	5.9	33.7	1.67	45.8	53.9	8.1	
Vert.	7206.000	AV	33.3	35.8	7.1	33.6	-	42.6	53.9	11.3	Floor noise
Vert.	9608.000	AV	32.2	38.6	8.1	34.2	-	44.7	53.9	9.2	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz $20\log(3.55\text{ m} / 3.0\text{ m}) = 1.47\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	104.4	27.5	4.5	34.6	101.8	-	-	Carrier
Hori.	2400.000	PK	49.2	27.6	4.5	34.6	46.6	81.8	35.1	
Vert.	2402.000	PK	104.6	27.5	4.5	34.6	102.0	-	-	Carrier
Vert.	2400.000	PK	49.7	27.6	4.5	34.6	47.1	82.0	35.0	

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

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Ise EMC Lab.

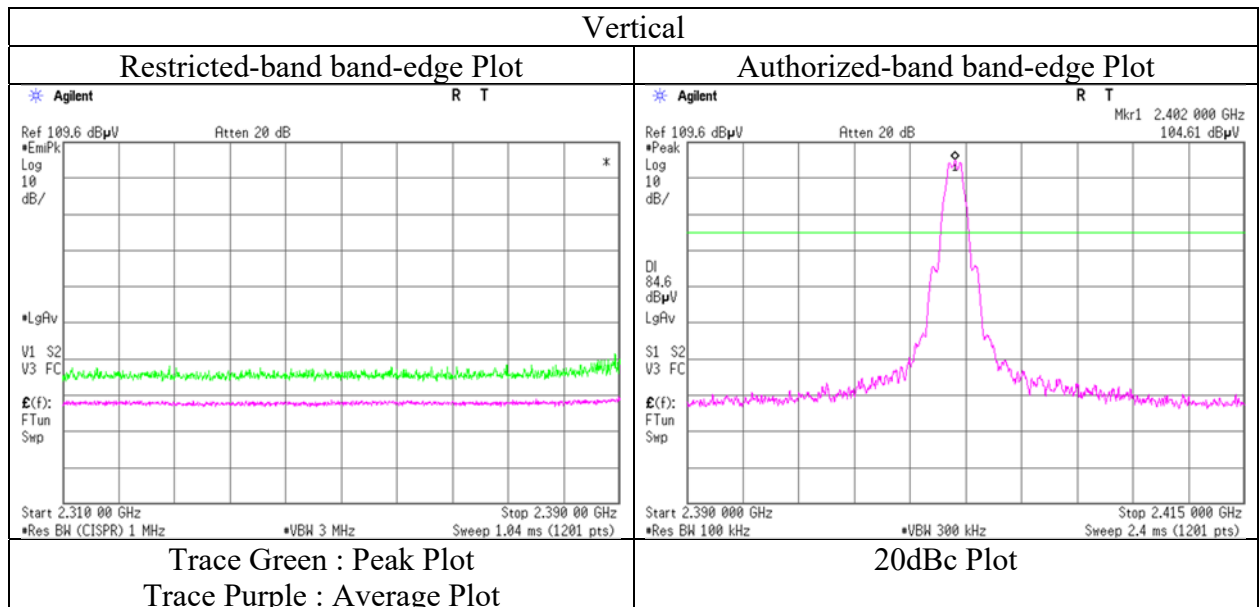
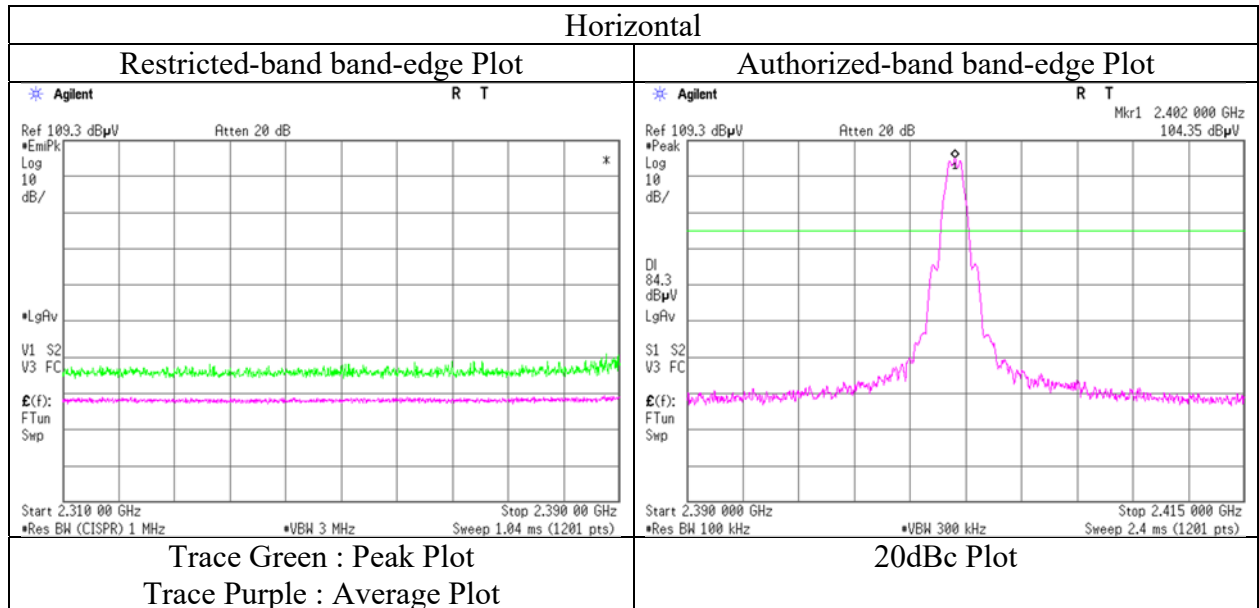
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	January 19, 2021
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Nachi Konegawa (1 GHz - 10 GHz)
Mode	Tx BT LE 2402 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.

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Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	23 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata (Below 1GHz)	Nachi Konegawa (1 GHz - 10 GHz)	Nachi Konegawa (10 GHz - 26.5 GHz)
Mode	Tx BT LE 2440 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.	42.340	QP	21.2	13.9	6.9	28.6	-	13.4	40.0	26.6	Floor noise
Hori.	75.260	QP	27.9	6.3	7.3	28.6	-	12.9	40.0	27.1	
Hori.	126.505	QP	22.1	13.3	7.7	28.4	-	14.6	43.5	28.9	Floor noise
Hori.	226.505	QP	21.5	11.2	8.4	27.9	-	13.1	46.0	32.9	Floor noise
Hori.	348.994	QP	21.9	15.0	9.2	28.1	-	18.1	46.0	27.9	Floor noise
Hori.	489.099	QP	22.4	17.7	9.8	29.1	-	20.7	46.0	25.3	Floor noise
Hori.	4880.000	PK	45.8	31.6	5.9	33.8	-	49.5	73.9	24.4	
Hori.	7320.000	PK	43.5	36.2	7.1	33.6	-	53.2	73.9	20.7	Floor noise
Hori.	9760.000	PK	42.1	38.8	8.2	34.2	-	54.8	73.9	19.1	Floor noise
Hori.	4880.000	AV	38.6	31.6	5.9	33.8	1.67	44.0	53.9	9.9	
Hori.	7320.000	AV	32.9	36.2	7.1	33.6	-	42.6	53.9	11.3	Floor noise
Hori.	9760.000	AV	34.1	38.8	8.2	34.2	-	46.8	53.9	7.1	Floor noise
Vert.	42.340	QP	21.7	13.9	6.9	28.6	-	13.9	40.0	26.1	Floor noise
Vert.	75.260	QP	33.6	6.3	7.3	28.6	-	18.6	40.0	21.4	
Vert.	126.505	QP	21.1	13.3	7.7	28.4	-	13.6	43.5	29.9	Floor noise
Vert.	226.505	QP	21.8	11.2	8.4	27.9	-	13.4	46.0	32.6	Floor noise
Vert.	348.994	QP	21.8	15.0	9.2	28.1	-	18.0	46.0	28.0	Floor noise
Vert.	489.099	QP	22.1	17.7	9.8	29.1	-	20.4	46.0	25.6	Floor noise
Vert.	4880.000	PK	45.9	31.6	5.9	33.8	-	49.6	73.9	24.3	
Vert.	7320.000	PK	42.1	36.2	7.1	33.6	-	51.8	73.9	22.1	Floor noise
Vert.	9760.000	PK	43.5	38.8	8.2	34.2	-	56.2	73.9	17.7	Floor noise
Vert.	4880.000	AV	39.5	31.6	5.9	33.8	1.67	44.8	53.9	9.1	
Vert.	7320.000	AV	32.4	36.2	7.1	33.6	-	42.1	53.9	11.8	Floor noise
Vert.	9760.000	AV	33.5	38.8	8.2	34.2	-	46.2	53.9	7.7	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 $20\log(3.55\text{ m} / 3.0\text{ m}) = 1.47\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	23 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata (Below 1GHz)	Nachi Konegawa (1 GHz - 10 GHz)	Nachi Konegawa (10 GHz - 26.5 GHz)
Mode	Tx BT LE 2480 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.	51.682	QP	21.2	10.6	7.0	28.6	-	10.2	40.0	29.8	Floor noise
Hori.	75.871	QP	27.4	6.3	7.3	28.6	-	12.4	40.0	27.6	
Hori.	128.521	QP	21.7	13.4	7.7	28.4	-	14.4	43.5	29.1	Floor noise
Hori.	247.456	QP	21.9	11.8	8.5	27.8	-	14.3	46.0	31.7	Floor noise
Hori.	302.740	QP	21.9	13.7	8.9	27.8	-	16.7	46.0	29.3	Floor noise
Hori.	483.304	QP	22.2	17.4	9.8	29.1	-	20.3	46.0	25.7	Floor noise
Hori.	2483.500	PK	59.1	27.4	4.6	34.6	-	56.4	73.9	17.5	
Hori.	4960.000	PK	46.7	31.6	5.9	33.8	-	50.4	73.9	23.5	
Hori.	7440.000	PK	42.7	36.0	7.2	33.7	-	52.2	73.9	21.7	Floor noise
Hori.	9920.000	PK	44.0	38.9	8.2	34.3	-	56.9	73.9	17.0	Floor noise
Hori.	2483.500	AV	42.8	27.4	4.6	34.6	1.67	41.8	53.9	12.1	*1)
Hori.	4960.000	AV	38.5	31.6	5.9	33.8	1.67	43.8	53.9	10.1	
Hori.	7440.000	AV	34.4	36.0	7.2	33.7	-	44.0	53.9	9.9	Floor noise
Hori.	9920.000	AV	32.7	38.9	8.2	34.3	-	45.6	53.9	8.3	Floor noise
Vert.	51.682	QP	21.4	10.6	7.0	28.6	-	10.4	40.0	29.6	Floor noise
Vert.	75.871	QP	33.6	6.3	7.3	28.6	-	18.6	40.0	21.4	
Vert.	128.521	QP	21.0	13.4	7.7	28.4	-	13.7	43.5	29.8	Floor noise
Vert.	247.456	QP	21.8	11.8	8.5	27.8	-	14.2	46.0	31.8	Floor noise
Vert.	302.740	QP	21.9	13.7	8.9	27.8	-	16.7	46.0	29.3	Floor noise
Vert.	483.304	QP	22.2	17.4	9.8	29.1	-	20.3	46.0	25.7	Floor noise
Vert.	2483.500	PK	59.2	27.4	4.6	34.6	-	56.5	73.9	17.4	
Vert.	4960.000	PK	46.1	31.6	5.9	33.8	-	49.8	73.9	24.1	
Vert.	7440.000	PK	43.5	36.0	7.2	33.7	-	53.1	73.9	20.8	Floor noise
Vert.	9920.000	PK	42.8	38.9	8.2	34.3	-	55.7	73.9	18.2	Floor noise
Vert.	2483.500	AV	44.2	27.4	4.6	34.6	1.67	43.2	53.9	10.7	*1)
Vert.	4960.000	AV	38.7	31.6	5.9	33.8	1.67	44.1	53.9	9.8	
Vert.	7440.000	AV	32.2	36.0	7.2	33.7	-	41.8	53.9	12.1	Floor noise
Vert.	9920.000	AV	33.6	38.9	8.2	34.3	-	46.5	53.9	7.4	Floor noise

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

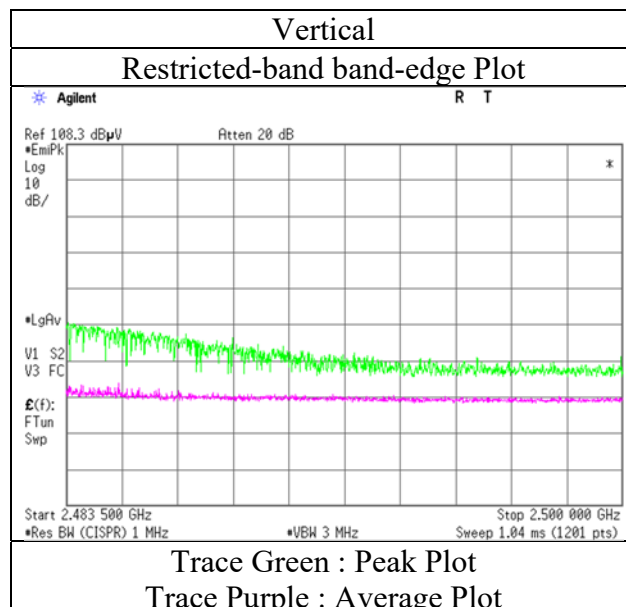
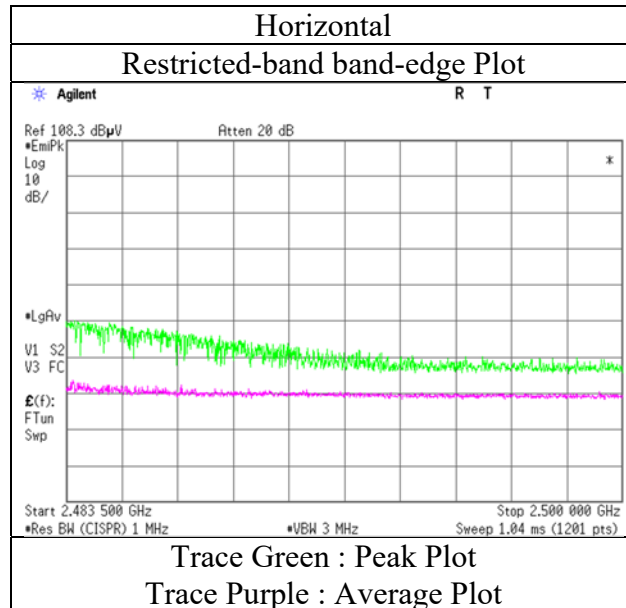
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.55\text{ m} / 3.0\text{ m}) = 1.47\text{ dB}$
10 GHz - 26.5 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 (Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	January 19, 2021
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Nachi Konegawa (1 GHz - 10 GHz)
Mode	Tx BT LE 2480 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.

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Ise EMC Lab.

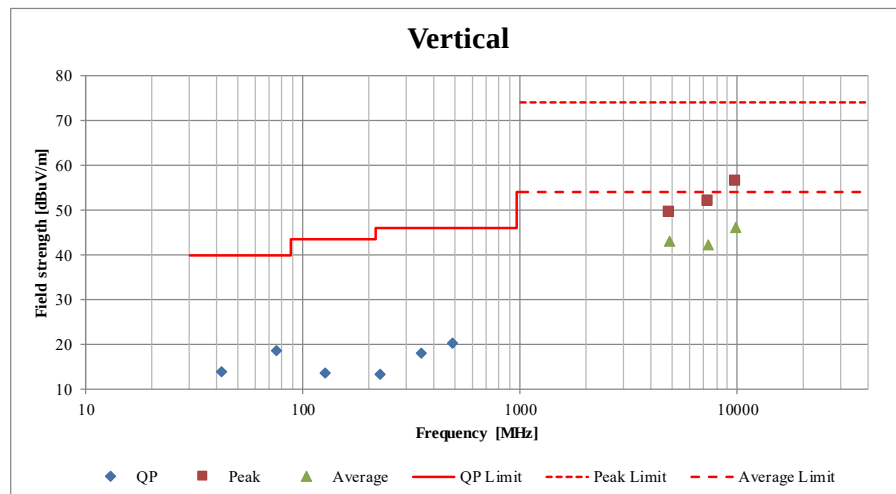
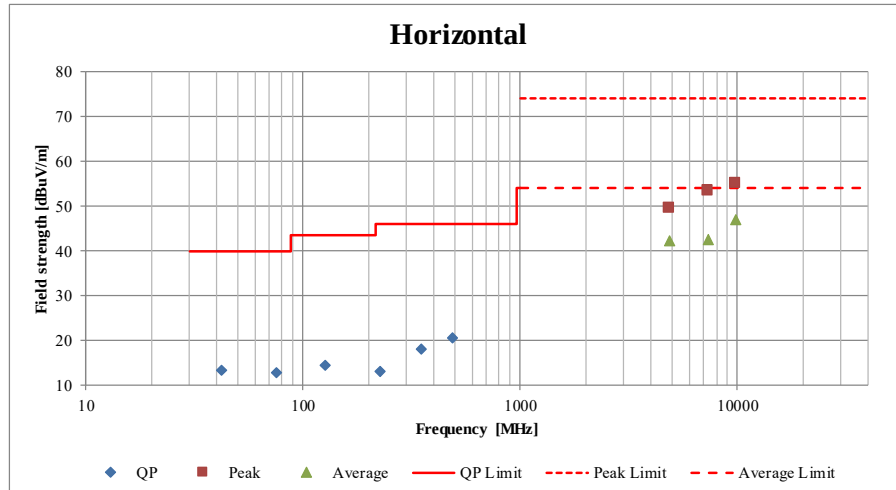
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Radiated Spurious Emission (Plot data, Worst case)

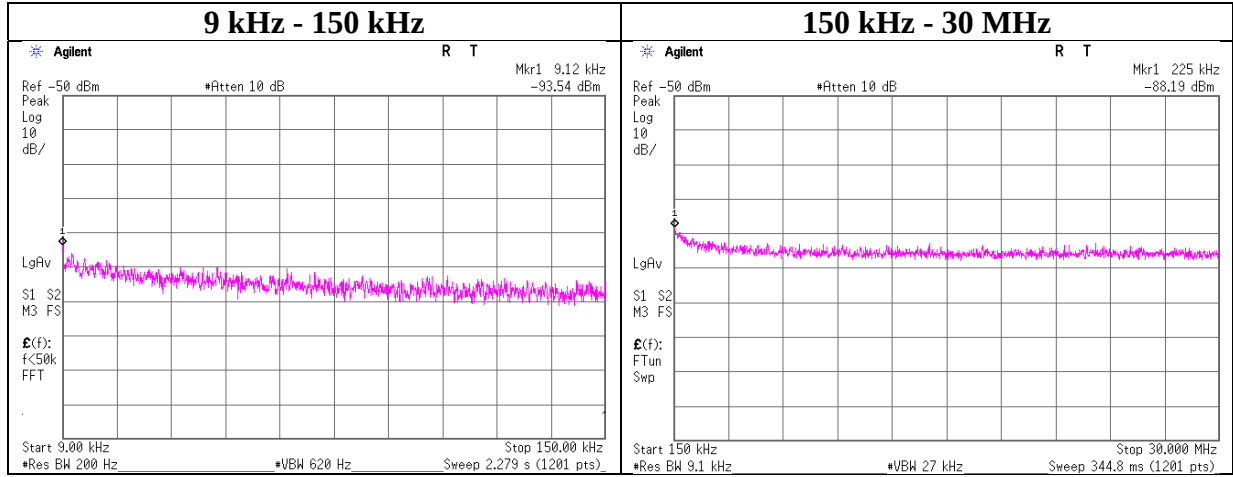
Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	23 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata (Below 1GHz)	Nachi Konegawa (1 GHz - 10 GHz)	Nachi Konegawa (10 GHz - 26.5 GHz)
Mode	Tx BT LE 2440 MHz		



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

Conducted Spurious Emission

Report No.	13674969H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 15, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx 11n-20 2437 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
9.12	-93.54	1.5	10.04	2	1	-80.0	300	6.0	-18.7	48.4	67.1	
225.00	-88.19	1.5	10.04	2	1	-74.7	300	6.0	-13.4	20.5	33.9	

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

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

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.

UL Japan, Inc.

Ise EMC Lab.

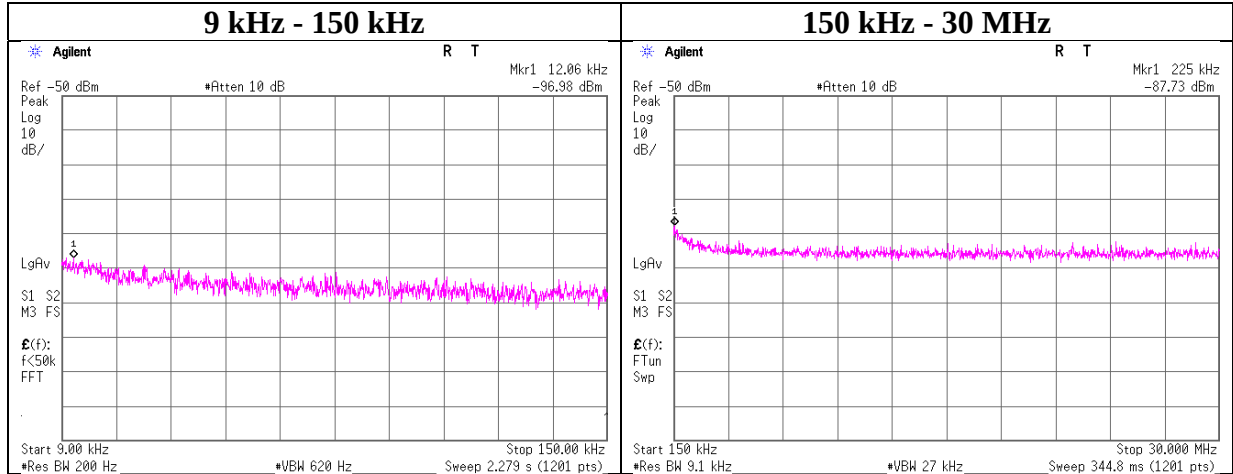
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Conducted Spurious Emission

Report No.	13674969H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 15, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx BT LE 2402 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
12.06	-96.98	1.5	10.04	2	1	-83.4	300	6.0	-22.2	45.9	68.1	
225.00	-87.73	1.5	10.04	2	1	-74.2	300	6.0	-12.9	20.5	33.4	

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

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

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.

UL Japan, Inc.

Ise EMC Lab.

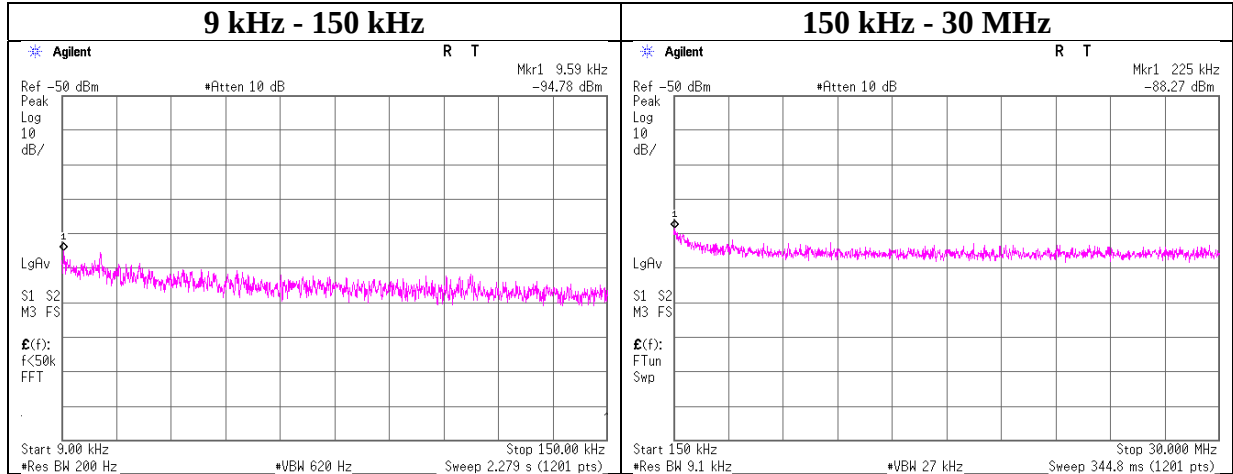
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Conducted Spurious Emission

Report No.	13674969H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 15, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx BT LE 2440 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
9.59	-94.78	1.5	10.04	2	1	-81.2	300	6.0	-20.0	47.9	67.9	
225.00	-88.27	1.5	10.04	2	1	-74.7	300	6.0	-13.5	20.5	34.0	

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

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

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.

UL Japan, Inc.

Ise EMC Lab.

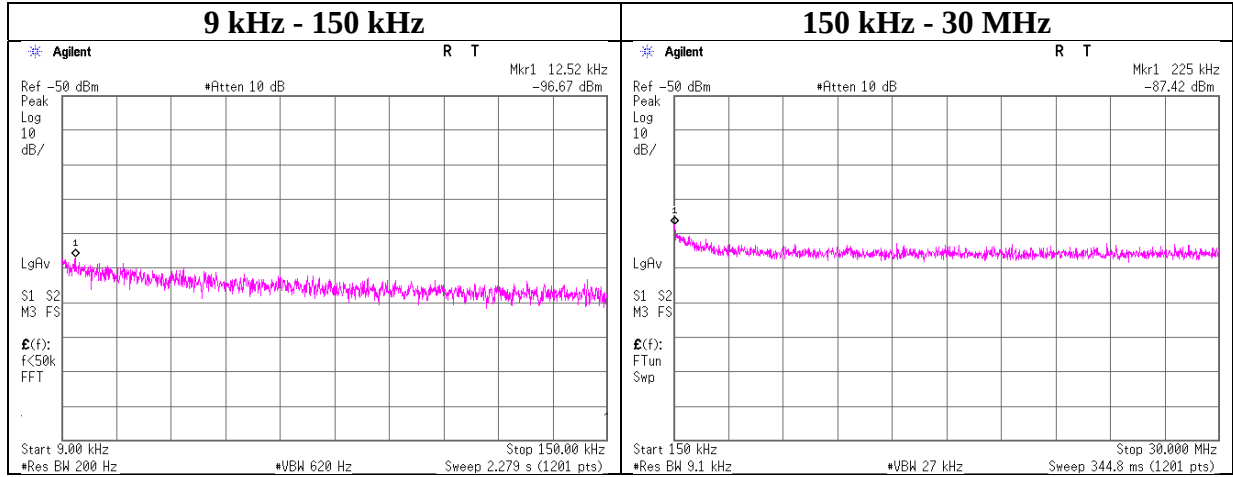
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Conducted Spurious Emission

Report No.	13674969H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 15, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx BT LE 2480 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
12.52	-96.67	1.5	10.04	2	1	-83.1	300	6.0	-21.9	45.6	67.5	
225.00	-87.42	1.5	10.04	2	1	-73.9	300	6.0	-12.6	20.5	33.1	

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

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

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.

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APPENDIX 2: Test instruments

Test equipment (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/15/2021	12
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/07/2021	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-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)/1902S579(5m)	03/02/2020	12
RE	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/09/2020	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/23/2020	12
AT	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	12/18/2020	12
AT	MPM-16	141812	Power Meter	Keysight Technologies Inc	8990B	MY51000271	08/20/2020	12
AT	MPSE-22	141842	Power sensor	Keysight Technologies Inc	N1923A	MY54070003	08/20/2020	12
AT	MAT-58	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/07/2020	12
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/15/2021	12
AT	MMM-12	141547	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	60500120	02/03/2020	12
AT	MJM-24	142225	Measure	ASKUL	-	-	-	-
AT	MPM-12	141809	Power Meter	ANRITSU	ML2495A	825002	05/07/2020	12
AT	MPSE-17	141830	Power sensor	ANRITSU	MA2411B	738285	05/07/2020	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170306	05/21/2020	12
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/04/2020	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/18/2020	12
RE	MCC-12	141317	Coaxial Cable	UL Japan Inc.	-	-	09/25/2020	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/10/2020	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103B+BBA9106	8031	07/29/2020	12
RE	MLA-21	141265	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-190	07/29/2020	12
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/13/2020	12
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/26/2020	24
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/06/2020	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/18/2020	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/01/2019	24
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	01/12/2021	12
RE	MHF-26	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/23/2020	12

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Test equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MCC-216	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 537073/126E(5 m)	02/18/2020	12
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	254	09/14/2020	12
RE	MHA-02	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/15/2020	12
RE	MAT-58	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/07/2020	12
RE	MPSE-22	141842	Power sensor	Keysight Technologies Inc	N1923A	MY54070003	08/20/2020	12
RE	MPM-16	141812	Power Meter	Keysight Technologies Inc	8990B	MY51000271	08/20/2020	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 test

AT: Antenna Terminal Conducted test

UL Japan, Inc.

Ise EMC Lab.

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