



RADIO TEST REPORT

Test Report No. : 13930662S-A-R1

Applicant : Canon Inc.
Type of EUT : Wireless Module
Model Number of EUT : WM322
FCC ID : AZD322
Test regulation : FCC Part 15 Subpart C: 2021
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.
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It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 13930662S-A. 13930662S-A is replaced with this report.

Date of test: August 16 to September 4, 2021

Representative test engineer: 
Kenichi Adachi
Engineer

Approved by: 
Toyokazu Imamura
Leader



CERTIFICATE 1266.03

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

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REVISION HISTORY

Original Test Report No.: 13930662S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13930662S-A	October 13, 2021	-	-
1	13930662S-A-R1	October 18, 2021	P.5	Correction of Clock frequency(ies) From: 996 MHz To: 38.4 MHz

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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	:	Canon Inc.
Address	:	30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, 146-8501 JAPAN
Telephone Number	:	+81-3-5482-8070
Contact Person	:	Shirata Yuichi

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 Module
Model Number	:	WM322
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 24 V (AC Adaptor), DC 22.2 V (Battery) RF block DC 3.3 V
Receipt Date	:	July 12, 2021
Country of Mass-production	:	China
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: WM322 (referred to as the EUT in this report) is a Wireless Module.

General Specification

Clock frequency(ies)	:	38.4 MHz
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Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS, OFDM
Antenna type	:	Pattern Antenna
Antenna Gain	:	3.3 dBi
Clock frequency (Maximum)	:	5 deg. C - +40 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
and 5725-5850 MHz

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	17.3 dB, 0.49580 MHz, L1	Complied a)	-
6 dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(2) ISED: RSS-247 5.2(a)	See data.	Complied b)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ISED: RSS-247 5.4(d)		Complied c)	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(e) ISED: RSS-247 5.2(b)		Complied d)	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	2.2 dB 613.315 MHz, QP, Hori. Mode: Tx 11g 2462 MHz	Complied# e), f)	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 Conducted Emission)
- b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)
- c) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
- d) Refer to APPENDIX 1 (data of Power Density)
- e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
- f) 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)

The RF Module has its own regulator.

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

FCC Part 15.203/212 Antenna requirement

The antenna is not removable from the EUT, since the antenna is printed pattern circuit. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	- a)	Conducted
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

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Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4,5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.6 dB	2.56dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	2.7 dB	2.7 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.0 dB	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-
	18 GHz-40 GHz	5.3 dB	5.3 dB	5.3 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	1.4 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.6 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.2 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.91 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.2 dB
Spurious emission (Conducted) below 1GHz	0.87 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.96 dB
Spurious emission (Conducted) 3 GHz-18 GHz	3.0 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.2 dB
Bandwidth Measurement	0.012 %
Duty cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.87 deg.C.
Humidity_SCH-01	4.3 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.6 %
Voltage	0.86 %

3.5 Test Location

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A2LA Certificate Number: 1266.03

(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

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

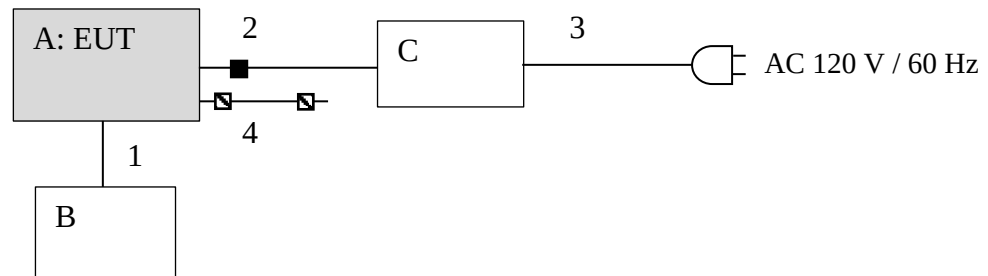
Mode	Remarks*
IEEE 802.11b (11b)	1 Mbps, PN9
IEEE 802.11g (11g)	6 Mbps, PN9
*Transmitting duty was 100 % on all tests.	
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 10 dBm Software: MFG Tool, version 01.04 (Date: 2021.7.30, Storage location: Driven by connected PC)	
*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

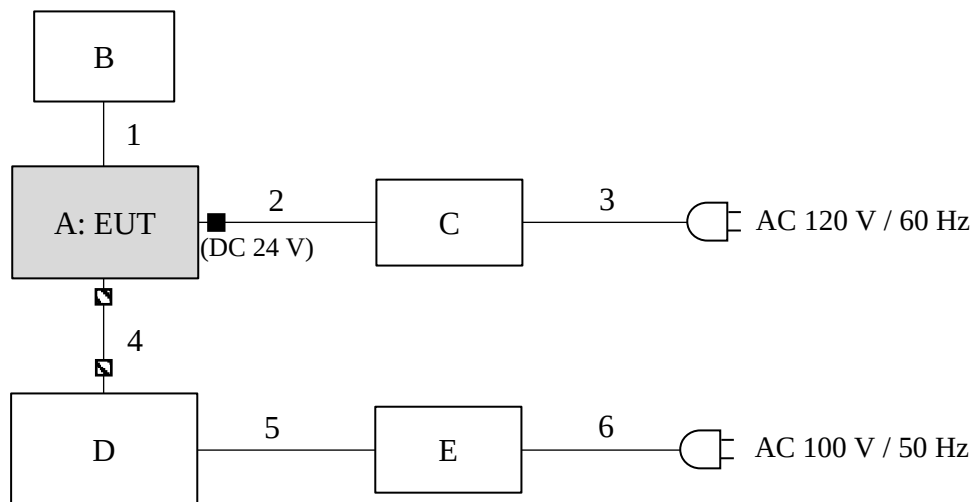
Test Item	Operating Mode	Tested frequency
Conducted Emission	Tx 11g	2462 MHz
Spurious Emission	Tx 11b Tx 11g	2412 MHz 2437 MHz 2462 MHz
6 dB Bandwidth Maximum Peak Output Power Power Density 99 % Occupied Bandwidth	Tx 11b Tx 11g	2412 MHz 2437 MHz 2462 MHz

4.2 Configuration and peripherals

For Conducted Emission test and Radiated Emission test



For Antenna Terminal Conducted test



■ : Standard Ferrite Core
 ▣ : Ferrite Core

* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

* The ferrite core attached to USB cable is not used to reduce the noise from the EUT. Therefore, that does not affect the emission level of the EUT.

*As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless Module	WM322	24 *1) 28 *2)	Canon	EUT
B	Switch board	2EE-02733AC	24 *1) 28 *2)	Canon	-
C	AC Adapter	CA-CP300 B	D1427MY00001	Canon	-
D	Laptop Computer	ThinkPad L580	PF-1LTWLZ	LENOVO	-
E	AC Adapter	ADLX45YLC2A	8SSA10E75842L1 CZ94J0D3R	LENOVO	-

*1) Used for Antenna Terminal conducted test

*2) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Cable name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.05	Unshielded	Unshielded	-
2	DC	1.5	Unshielded	Unshielded	-
3	AC	1.0	Unshielded	Unshielded	-
4	USB	1.0	Shielded	Shielded	-
5	DC	1.8	Unshielded	Unshielded	-
6	AC	0.9	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via AC Adapter in a shielded room.

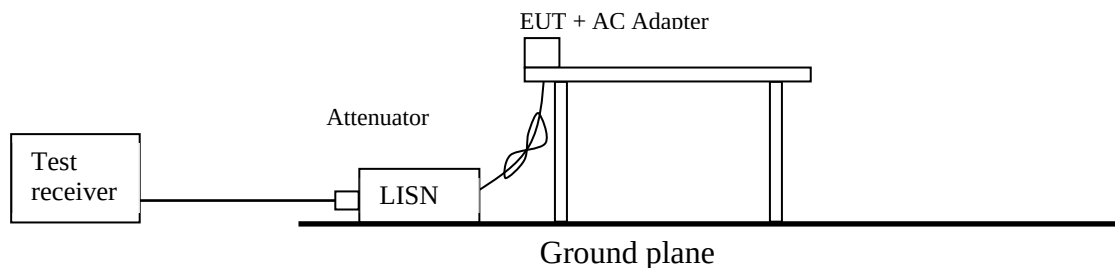
The EUT via AC adapter was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX
Test result	: Pass

Figure 1: Test Setup



SECTION 6: Radiated Spurious Emission

Test Procedure

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

[For below 1 GHz]

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

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

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

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

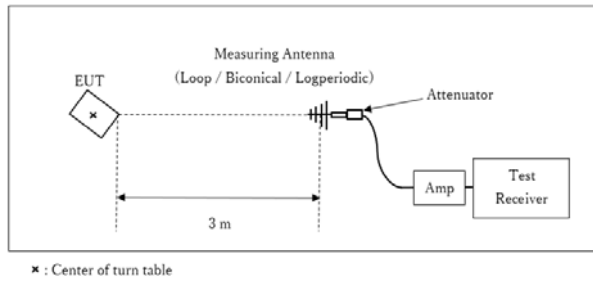
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	11.12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces	RBW: 100 kHz VBW: 300 kHz

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

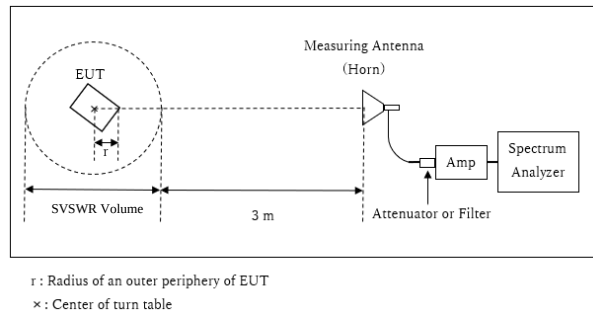
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

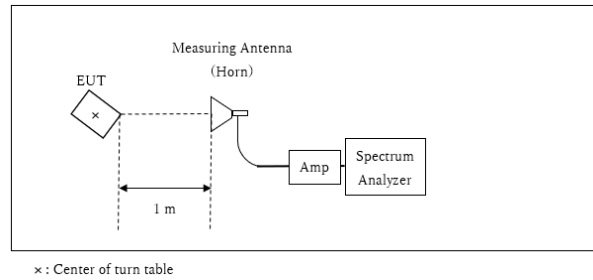
1 GHz - 10 GHz



Distance Factor: $20 \times \log (3.96 \text{ m} / 3.0 \text{ m}) = 2.42 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.96 \text{ m}$

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.04 m

10 GHz – 26.5 GHz



Distance Factor: $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$
*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.

Frequency	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz
Test					
Antenna					
Horizontal	X	X	X	X	X
Vertical	Z	Y	Y	X	X

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 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	20 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 160 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4) *5)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				

*1) Peak hold was applied as Worst-case measurement.
 *2) Reference data
 *3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".
 *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
 Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
 (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)
 *5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 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

Conducted Emission

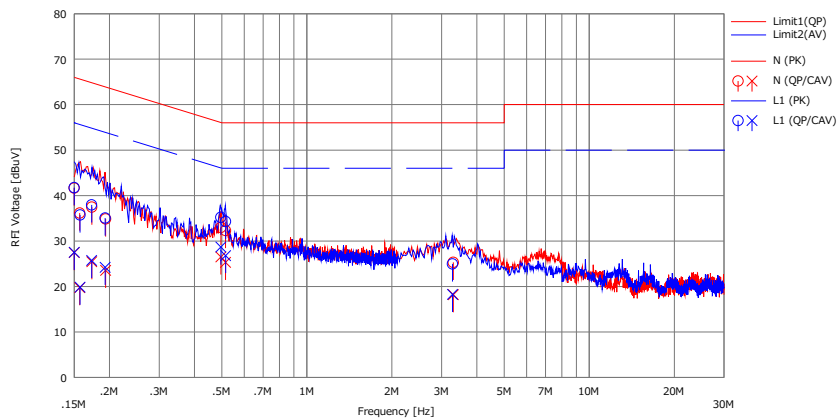
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2021/09/03

Mode : Tx 11g 2462 MHz
Power : AC 120 V / 60 Hz (AC adapter input)
Temp./Humi. : 25 deg.C / 55 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yusuke Tanikawara



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	29.20	15.00	12.45	41.65	27.45	66.00	56.00	24.3	28.5	N	
2	0.15699	23.70	7.30	12.45	36.15	19.75	65.62	55.62	29.4	35.8	N	
3	0.17314	25.00	13.00	12.46	37.46	25.46	64.81	54.81	27.3	29.3	N	
4	0.19378	22.40	11.10	12.46	34.86	23.56	63.87	53.87	29.0	30.3	N	
5	0.49597	20.50	14.00	12.50	33.00	26.50	56.07	46.07	23.0	19.5	N	
6	0.51517	19.80	12.80	12.50	32.30	25.30	56.00	46.00	23.7	20.7	N	
7	3.29949	12.60	5.50	12.70	25.30	18.20	56.00	46.00	30.7	27.8	N	
8	0.15000	29.30	15.10	12.45	41.75	27.55	66.00	56.00	24.2	28.4	L1	
9	0.15741	23.30	7.40	12.45	35.75	19.85	65.60	55.60	29.8	35.7	L1	
10	0.17292	25.50	13.30	12.45	37.95	25.75	64.82	54.82	26.8	29.0	L1	
11	0.19308	22.60	11.80	12.44	35.04	24.24	63.90	53.90	28.8	29.6	L1	
12	0.49580	22.70	16.20	12.50	35.20	28.70	56.07	46.07	20.8	17.3	L1	
13	0.51549	21.80	14.30	12.50	34.30	26.80	56.00	46.00	21.7	19.2	L1	
14	3.27914	12.30	5.60	12.67	24.97	18.27	56.00	46.00	31.0	27.7	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN) : SLS-04

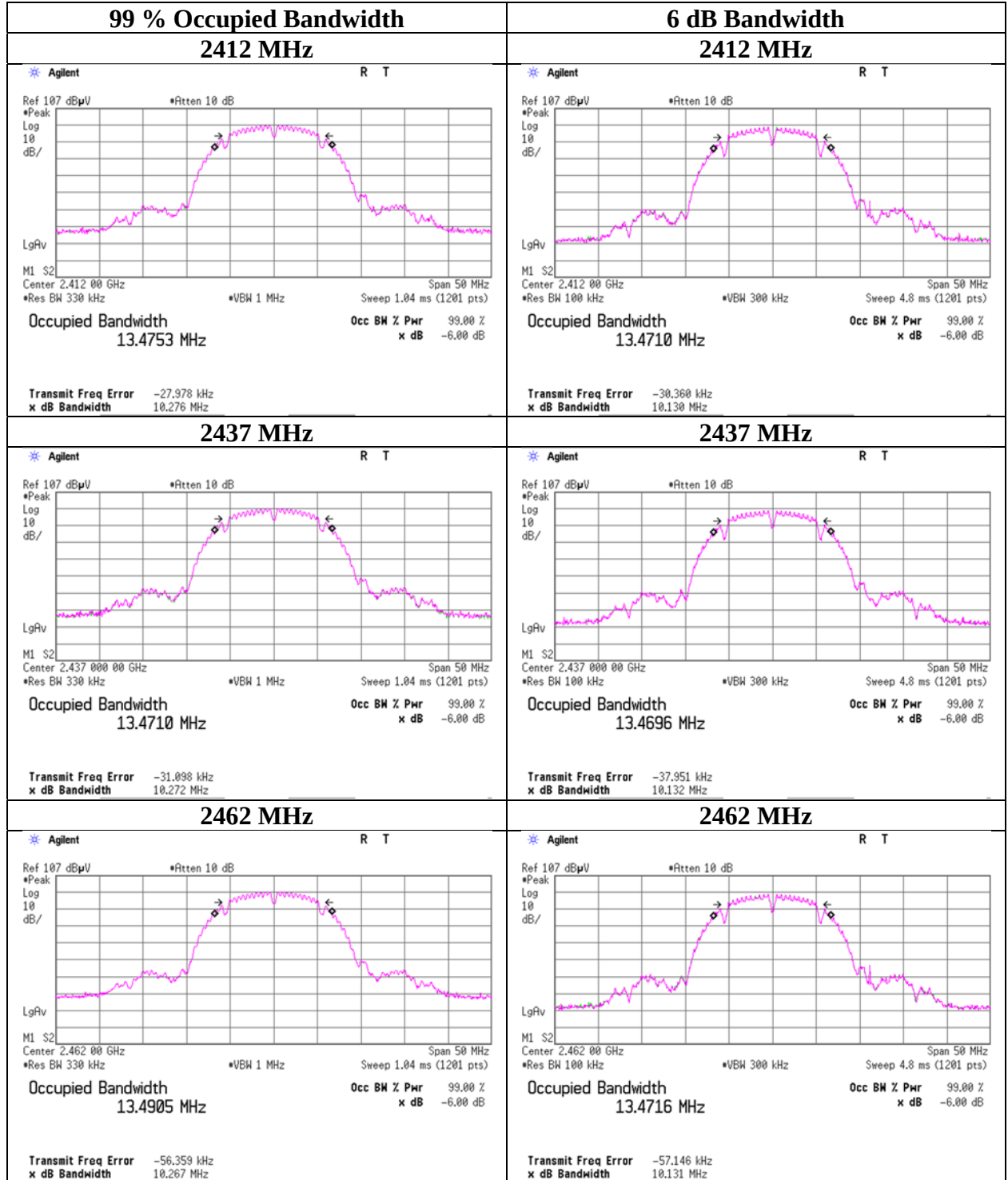
99 % Occupied Bandwidth and 6 dB Bandwidth

Report No. 13930662S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 3, 2021
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Kenichi Adachi
Mode Tx

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
11b	2412	13475.3	10.130	> 0.5000
	2437	13471.0	10.132	> 0.5000
	2462	13490.5	10.131	> 0.5000
11g	2412	16943.7	16.595	> 0.5000
	2437	16949.8	16.599	> 0.5000
	2462	16941.3	16.602	> 0.5000

99 % Occupied Bandwidth and 6 dB Bandwidth

11b



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Shonan EMC Lab.

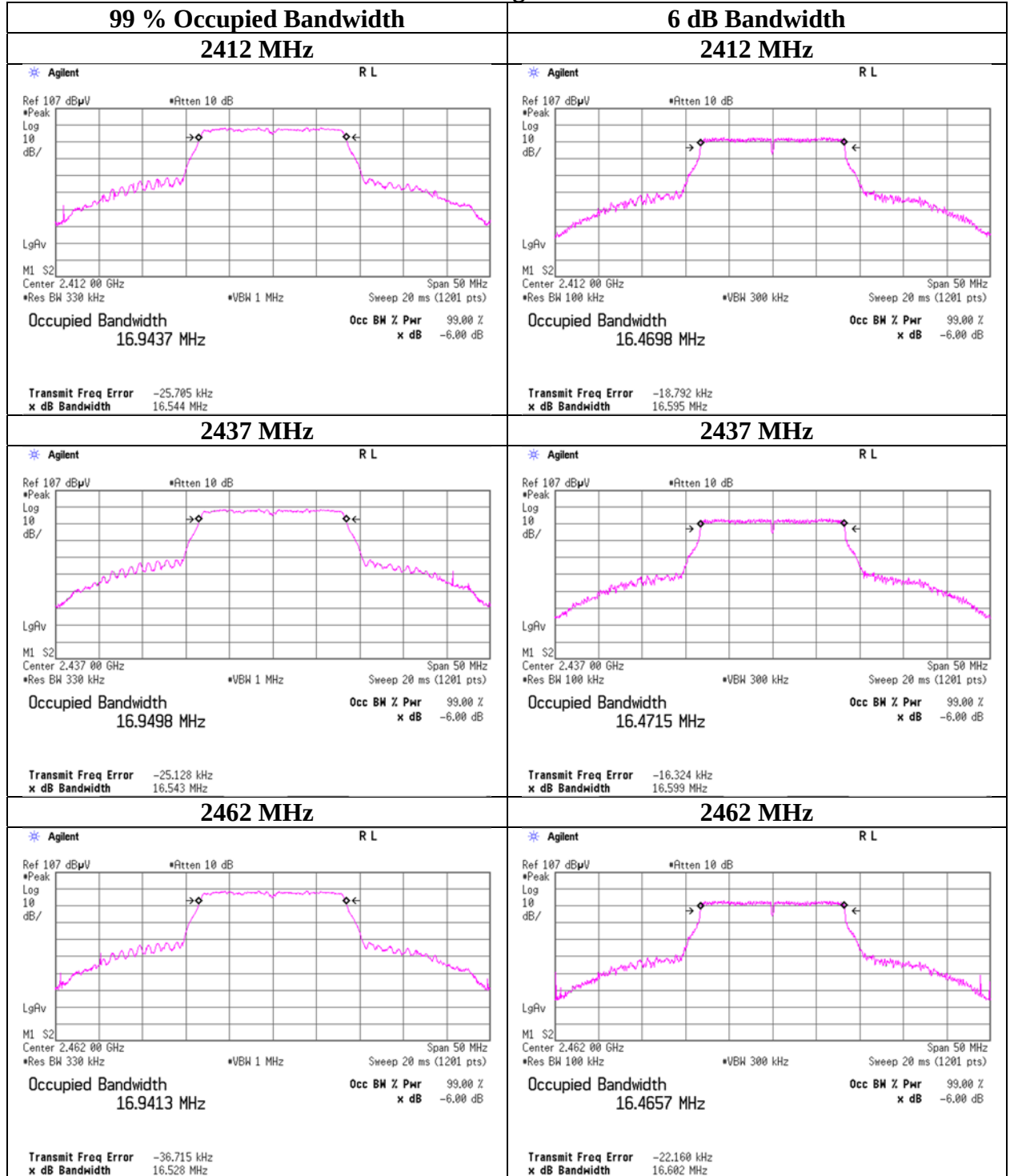
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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99 % Occupied Bandwidth and 6 dB Bandwidth

11g



UL Japan, Inc.

Shonan EMC Lab.

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Maximum Peak Output Power

Report No. 13930662S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 3, 2021
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Kenichi Adachi
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]	[dB]		[dBi]	[dBm]	[mW]	[dBm]	[mW]
2412	2.18	1.51	9.82	13.51	22.44	30.00	1000	16.49	3.30	16.81	47.97	36.02	4000	19.21
2437	2.62	1.51	9.82	13.95	24.83	30.00	1000	16.05	3.30	17.25	53.09	36.02	4000	18.77
2462	2.33	1.52	9.82	13.67	23.28	30.00	1000	16.33	3.30	16.97	49.77	36.02	4000	19.05

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.

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	2.62	*
2	2.42	
5.5	2.20	
11	2.17	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 13930662S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 3, 2021
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Kenichi Adachi
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	8.33	1.51	9.82	19.66	92.47	30.00	1000	10.34	3.30	22.96	197.70	36.02	4000	13.06	
2437	8.45	1.51	9.82	19.78	95.06	30.00	1000	10.22	3.30	23.08	203.24	36.02	4000	12.94	
2462	8.44	1.52	9.82	19.78	95.06	30.00	1000	10.22	3.30	23.08	203.24	36.02	4000	12.94	

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.

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	8.45	*
9	7.94	
12	7.42	
18	7.39	
24	8.25	
36	7.48	
48	7.92	
54	7.66	

*: Worst Rate

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

UL Japan, Inc.

Shonan EMC Lab.

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Telephone : +81 463 50 6400

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Average Output Power
(Reference data for RF Exposure)

Report No. 13930662S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 3, 2021
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Kenichi Adachi
Mode Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-0.72	1.51	9.82	10.61	11.52	0.00	10.61	11.52
2437	-0.44	1.51	9.82	10.89	12.27	0.00	10.89	12.27
2462	-0.51	1.52	9.82	10.83	12.09	0.00	10.83	12.09

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-1.91	1.51	9.82	9.42	8.75	0.00	9.42	8.75
2437	-1.82	1.51	9.82	9.51	8.93	0.00	9.51	8.93
2462	-1.82	1.52	9.82	9.52	8.96	0.00	9.52	8.96

Sample Calculation:

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

Result (Burst power average) = Time average + Duty factor

*Duty was 100 %.

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

11b, 2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	-0.44	*
2	-0.58	
5.5	-0.63	
11	-0.66	

11g, 2437MHz

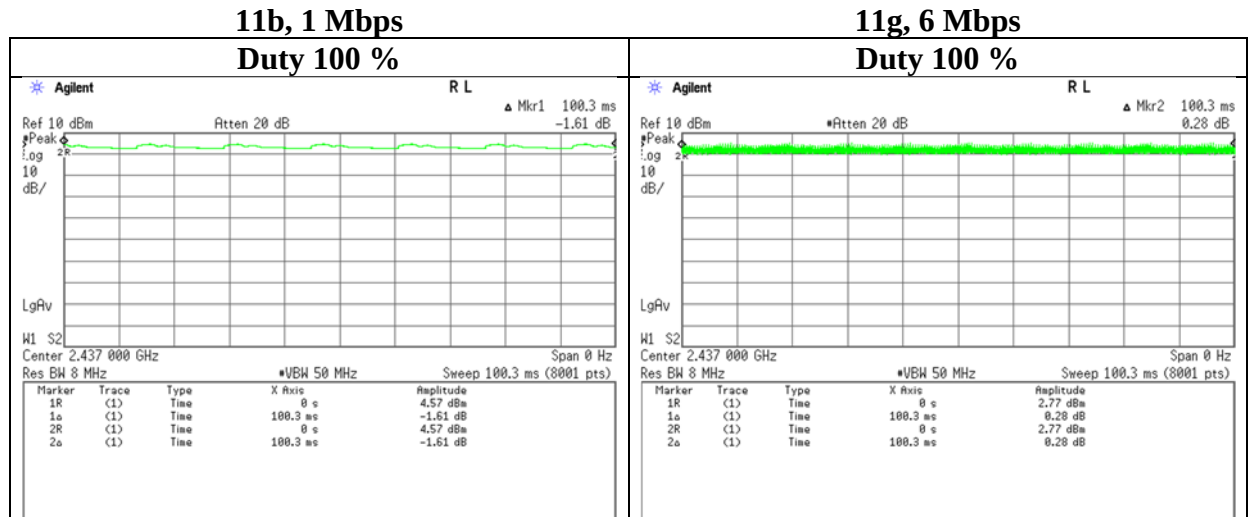
Rate	Reading	Remark
[Mbps]	[dBm]	
6	-1.82	*
9	-1.95	
12	-1.97	
18	-1.99	
24	-1.93	
36	-2.09	
48	-2.15	
54	-2.29	

*: Worst Rate

All comparizon were carried out on same frequency and measurement factors.

Burst rate confirmation

Report No.	13930662S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 3, 2021
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Kenichi Adachi
Mode	Tx



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

Radiated Spurious Emission

Report No. 13930662S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date September 4, 2021
Temperature / Humidity 23 deg. C / 69 % RH
Engineer Kenichi Adachi
(1 GHz - 26.5 GHz)
Mode Tx 11b 2412 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	45.29	28.58	14.19	38.72	2.42	51.76	73.9	22.1	143	148	-
Hori.	4824.000	PK	45.63	31.77	6.63	38.56	2.42	47.89	73.9	26.0	150	0	-
Hori.	7236.000	PK	45.72	37.63	8.05	39.18	2.42	54.64	73.9	19.2	150	0	-
Hori.	9648.000	PK	45.32	39.10	9.32	39.71	2.42	56.45	73.9	17.4	150	0	-
Hori.	2390.000	AV	33.55	28.58	14.19	38.72	2.42	40.02	53.9	13.8	143	148	-
Hori.	4824.000	AV	32.64	31.77	6.63	38.56	2.42	34.90	53.9	19.0	150	0	Floor noise
Hori.	7236.000	AV	33.44	37.63	8.05	39.18	2.42	42.36	53.9	11.5	150	0	Floor noise
Hori.	9648.000	AV	33.52	39.10	9.32	39.71	2.42	44.65	53.9	9.2	150	0	Floor noise
Vert.	2390.000	PK	45.24	28.58	14.19	38.72	2.42	51.71	73.9	22.1	100	101	-
Vert.	4824.000	PK	45.68	31.77	6.63	38.56	2.42	47.94	73.9	25.9	150	0	-
Vert.	7236.000	PK	45.66	37.63	8.05	39.18	2.42	54.58	73.9	19.3	150	0	-
Vert.	9648.000	PK	45.44	39.10	9.32	39.71	2.42	56.57	73.9	17.3	150	0	-
Vert.	2390.000	AV	33.51	28.58	14.19	38.72	2.42	39.98	53.9	13.9	100	101	-
Vert.	4824.000	AV	32.66	31.77	6.63	38.56	2.42	34.92	53.9	18.9	150	0	Floor noise
Vert.	7236.000	AV	33.38	37.63	8.05	39.18	2.42	42.30	53.9	11.6	150	0	Floor noise
Vert.	9648.000	AV	33.62	39.10	9.32	39.71	2.42	44.75	53.9	9.1	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.96 m / 3.0 m) = 2.42 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	92.68	28.54	14.21	38.71	2.42	99.14	-	-	Carrier
Hori.	2397.258	PK	43.72	28.57	14.20	38.72	2.42	50.19	79.1	28.9	-
Hori.	2400.000	PK	37.16	28.56	14.20	38.72	2.42	43.62	79.1	35.4	-
Vert.	2412.000	PK	91.02	28.54	14.21	38.71	2.42	97.48	-	-	Carrier
Vert.	2397.258	PK	42.43	28.57	14.20	38.72	2.42	48.90	77.4	28.5	-
Vert.	2400.000	PK	35.65	28.56	14.20	38.72	2.42	42.11	77.4	35.2	-

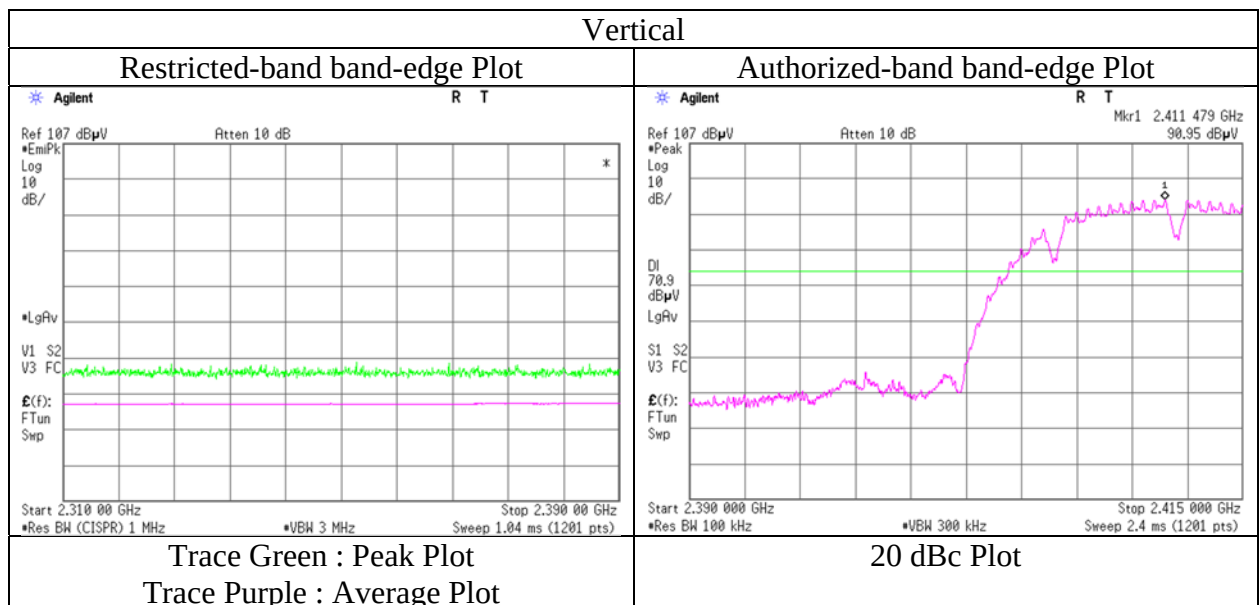
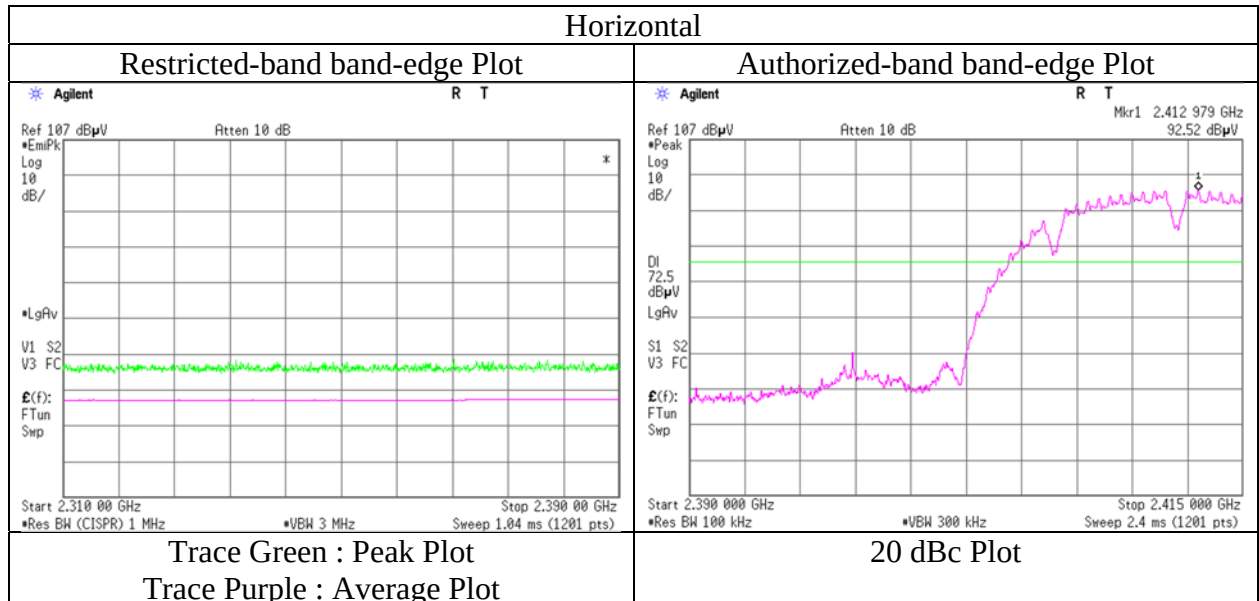
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.96 m / 3.0 m) = 2.42 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13930662S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 4, 2021
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Kenichi Adachi
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.

Radiated Spurious Emission

Report No.	13930662S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 4, 2021
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Kenichi Adachi
	(1 GHz - 26.5 GHz)
Mode	Tx 11b 2437 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	45.74	31.77	6.65	38.58	2.42	48.00	73.9	25.9	150	0	-
Hori.	7311.000	PK	45.98	37.73	8.10	39.22	2.42	55.01	73.9	18.8	150	0	-
Hori.	9748.000	PK	46.33	39.40	9.36	39.73	2.42	57.78	73.9	16.1	150	0	-
Hori.	4874.000	AV	33.80	31.77	6.65	38.58	2.42	36.06	53.9	17.8	150	0	Floor noise
Hori.	7311.000	AV	34.09	37.73	8.10	39.22	2.42	43.12	53.9	10.7	150	0	Floor noise
Hori.	9748.000	AV	34.26	39.40	9.36	39.73	2.42	45.71	53.9	8.1	150	0	Floor noise
Vert.	4874.000	PK	45.64	31.77	6.65	38.58	2.42	47.90	73.9	26.0	150	0	-
Vert.	7311.000	PK	45.94	37.73	8.10	39.22	2.42	54.97	73.9	18.9	150	0	-
Vert.	9748.000	PK	46.27	39.40	9.36	39.73	2.42	57.72	73.9	16.1	150	0	-
Vert.	4874.000	AV	33.74	31.77	6.65	38.58	2.42	36.00	53.9	17.9	150	0	Floor noise
Vert.	7311.000	AV	34.01	37.73	8.10	39.22	2.42	43.04	53.9	10.8	150	0	Floor noise
Vert.	9748.000	AV	34.17	39.40	9.36	39.73	2.42	45.62	53.9	8.2	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.96\text{ m} / 3.0\text{ m}) = 2.42\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 13930662S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date September 4, 2021
Temperature / Humidity 23 deg. C / 69 % RH
Engineer Kenichi Adachi
(1 GHz - 26.5 GHz)
Mode Tx 11b 2462 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	45.14	28.47	14.29	38.67	2.42	51.65	73.9	22.2	144	169	-
Hori.	4924.000	PK	44.63	31.89	6.69	38.61	2.42	47.02	73.9	26.8	150	0	-
Hori.	7386.000	PK	44.49	37.82	8.13	39.25	2.42	53.61	73.9	20.2	150	0	-
Hori.	9848.000	PK	44.64	39.55	9.41	39.75	2.42	56.27	73.9	17.6	150	0	-
Hori.	2483.500	AV	32.98	28.47	14.29	38.67	2.42	39.49	53.9	14.4	144	169	-
Hori.	4924.000	AV	32.90	31.89	6.69	38.61	2.42	35.29	53.9	18.6	150	0	Floor noise
Hori.	7386.000	AV	32.60	37.82	8.13	39.25	2.42	41.72	53.9	12.1	150	0	Floor noise
Hori.	9848.000	AV	33.10	39.55	9.41	39.75	2.42	44.73	53.9	9.1	150	0	Floor noise
Vert.	2483.500	PK	44.92	28.47	14.29	38.67	2.42	51.43	73.9	22.4	100	99	-
Vert.	4924.000	PK	44.54	31.89	6.69	38.61	2.42	46.93	73.9	26.9	150	0	-
Vert.	7386.000	PK	44.42	37.82	8.13	39.25	2.42	53.54	73.9	20.3	150	0	-
Vert.	9848.000	PK	44.58	39.55	9.41	39.75	2.42	56.21	73.9	17.6	150	0	-
Vert.	2483.500	AV	32.96	28.47	14.29	38.67	2.42	39.47	53.9	14.4	100	99	-
Vert.	4924.000	AV	32.82	31.89	6.69	38.61	2.42	35.21	53.9	18.6	150	0	Floor noise
Vert.	7386.000	AV	32.54	37.82	8.13	39.25	2.42	41.66	53.9	12.2	150	0	Floor noise
Vert.	9848.000	AV	33.04	39.55	9.41	39.75	2.42	44.67	53.9	9.2	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.96 m / 3.0 m) = 2.42 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

UL Japan, Inc.

Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

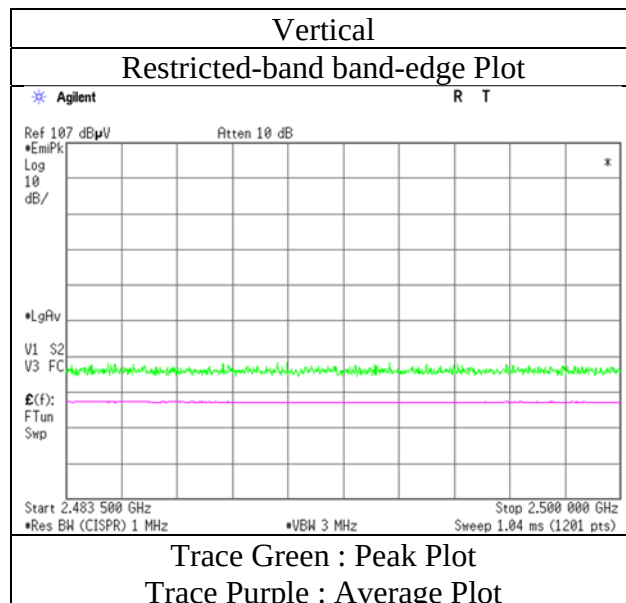
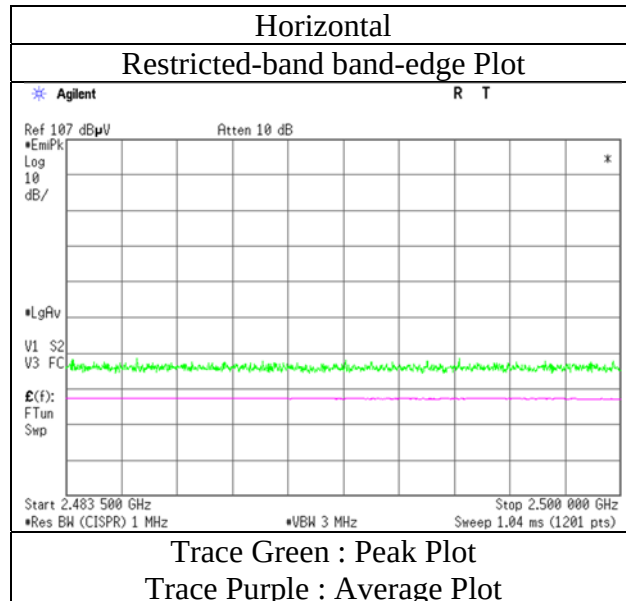
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission **(Reference Plot for band-edge)**

Report No. 13930662S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date September 4, 2021
Temperature / Humidity 23 deg. C / 69 % RH
Engineer Kenichi Adachi

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.

Radiated Spurious Emission

Report No. 13930662S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date September 4, 2021
Temperature / Humidity 23 deg. C / 69 % RH
Engineer Kenichi Adachi
(1 GHz - 26.5 GHz)
Mode Tx 11g 2412 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	47.98	28.58	14.19	38.72	2.42	54.45	73.9	19.4	143	166	-
Hori.	4824.000	PK	45.69	31.77	6.63	38.56	2.42	47.95	73.9	25.9	150	0	-
Hori.	7236.000	PK	45.78	37.63	8.05	39.18	2.42	54.70	73.9	19.2	150	0	-
Hori.	9648.000	PK	45.40	39.10	9.32	39.71	2.42	56.53	73.9	17.3	150	0	-
Hori.	2390.000	AV	36.44	28.58	14.19	38.72	2.42	42.91	53.9	10.9	143	166	-
Hori.	4824.000	AV	32.68	31.77	6.63	38.56	2.42	34.94	53.9	18.9	150	0	Floor noise
Hori.	7236.000	AV	33.49	37.63	8.05	39.18	2.42	42.41	53.9	11.4	150	0	Floor noise
Hori.	9648.000	AV	33.56	39.10	9.32	39.71	2.42	44.69	53.9	9.2	150	0	Floor noise
Vert.	2390.000	PK	47.82	28.58	14.19	38.72	2.42	54.29	73.9	19.6	100	97	-
Vert.	4824.000	PK	45.62	31.77	6.63	38.56	2.42	47.88	73.9	26.0	150	0	-
Vert.	7236.000	PK	45.74	37.63	8.05	39.18	2.42	54.66	73.9	19.2	150	0	-
Vert.	9648.000	PK	45.34	39.10	9.32	39.71	2.42	56.47	73.9	17.4	150	0	-
Vert.	2390.000	AV	35.64	28.58	14.19	38.72	2.42	42.11	53.9	11.7	100	97	-
Vert.	4824.000	AV	32.62	31.77	6.63	38.56	2.42	34.88	53.9	19.0	150	0	Floor noise
Vert.	7236.000	AV	33.38	37.63	8.05	39.18	2.42	42.30	53.9	11.6	150	0	Floor noise
Vert.	9648.000	AV	33.48	39.10	9.32	39.71	2.42	44.61	53.9	9.2	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.96 m / 3.0 m) = 2.42 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	87.26	28.54	14.21	38.71	2.42	93.72	-	-	Carrier
Hori.	2397.633	PK	50.49	28.56	14.20	38.72	2.42	56.95	73.7	16.7	-
Hori.	2400.000	PK	50.18	28.56	14.20	38.72	2.42	56.64	73.7	17.0	-
Vert.	2412.000	PK	84.58	28.54	14.21	38.71	2.42	91.04	-	-	Carrier
Vert.	2397.633	PK	47.54	28.56	14.20	38.72	2.42	54.00	71.0	17.0	-
Vert.	2400.000	PK	47.85	28.56	14.20	38.72	2.42	54.31	71.0	16.6	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.96 m / 3.0 m) = 2.42 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

UL Japan, Inc.

Shonan EMC Lab.

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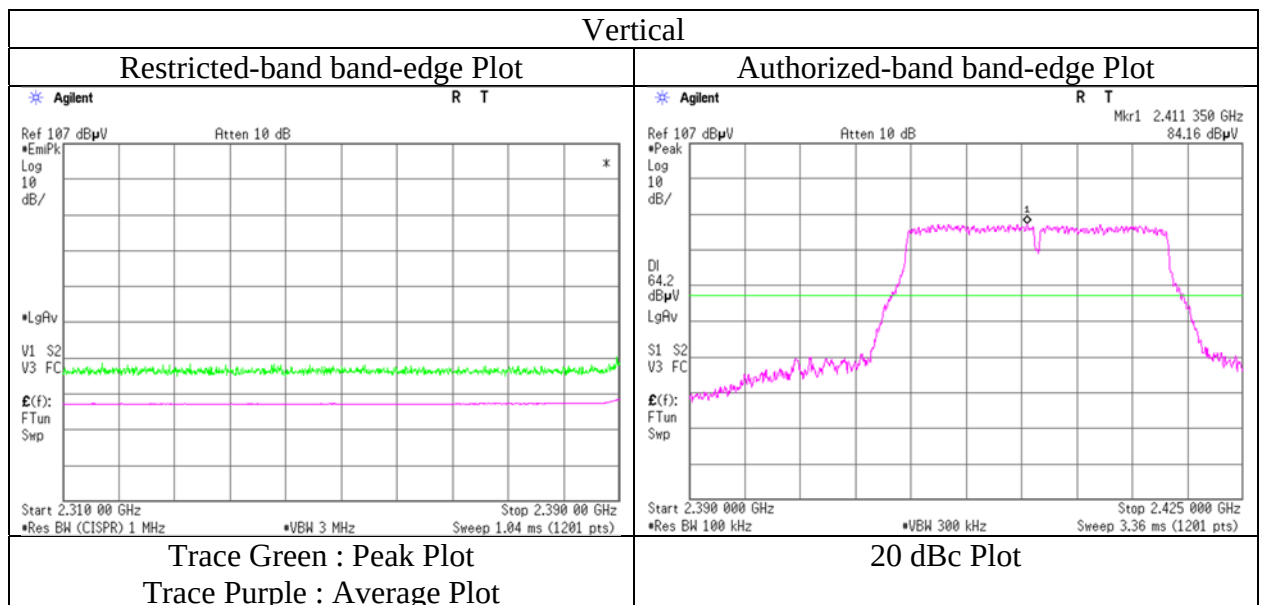
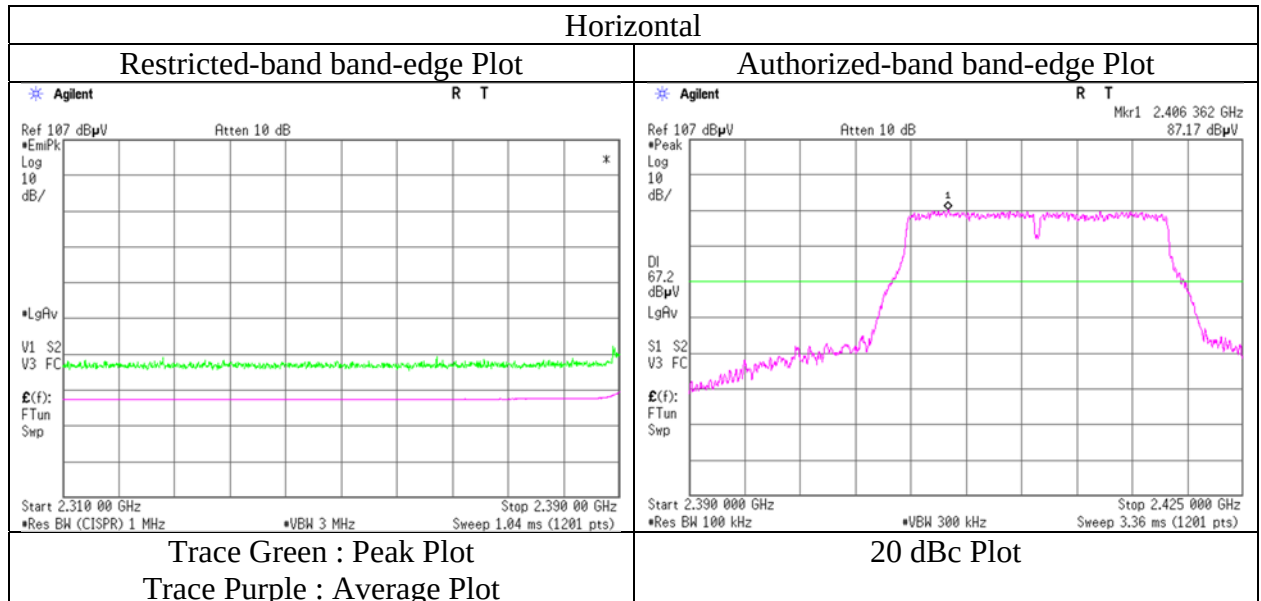
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Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13930662S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 4, 2021
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Kenichi Adachi

Mode	Tx 11g 2412 MHz
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* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 13930662S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date September 4, 2021
Temperature / Humidity 23 deg. C / 69 % RH
Engineer Kenichi Adachi
(1 GHz - 26.5 GHz)
Mode Tx 11g 2437 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	45.79	31.77	6.65	38.58	2.42	48.05	73.9	25.8	150	0	-
Hori.	7311.000	PK	46.02	37.73	8.10	39.22	2.42	55.05	73.9	18.8	150	0	-
Hori.	9748.000	PK	46.36	39.40	9.36	39.73	2.42	57.81	73.9	16.0	150	0	-
Hori.	4874.000	AV	34.12	31.77	6.65	38.58	2.42	36.38	53.9	17.5	150	0	Floor noise
Hori.	7311.000	AV	34.18	37.73	8.10	39.22	2.42	43.21	53.9	10.6	150	0	Floor noise
Hori.	9748.000	AV	34.32	39.40	9.36	39.73	2.42	45.77	53.9	8.1	150	0	Floor noise
Vert.	4874.000	PK	45.72	31.77	6.65	38.58	2.42	47.98	73.9	25.9	150	0	-
Vert.	7311.000	PK	45.98	37.73	8.10	39.22	2.42	55.01	73.9	18.8	150	0	-
Vert.	9748.000	PK	46.26	39.40	9.36	39.73	2.42	57.71	73.9	16.1	150	0	-
Vert.	4874.000	AV	34.04	31.77	6.65	38.58	2.42	36.30	53.9	17.6	150	0	Floor noise
Vert.	7311.000	AV	34.12	37.73	8.10	39.22	2.42	43.15	53.9	10.7	150	0	Floor noise
Vert.	9748.000	AV	34.25	39.40	9.36	39.73	2.42	45.70	53.9	8.2	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.96\text{ m} / 3.0\text{ m}) = 2.42\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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Radiated Spurious Emission

Report No. 13930662S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.2
Date August 16, 2021 September 4, 2021
Temperature / Humidity 23 deg. C / 68 % RH 23 deg. C / 69 % RH
Engineer Kenichi Adachi Kenichi Adachi
(30 MHz - 1 GHz) (1 GHz - 26.5 GHz)
Mode Tx 11g 2462 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	67.995	QP	32.88	6.77	7.40	31.81	0.00	15.24	40.0	24.7	400	197	-
Hori.	106.832	QP	25.98	11.41	8.18	31.80	0.00	13.77	43.5	29.7	264	344	-
Hori.	274.419	QP	54.56	13.13	6.36	31.76	0.00	42.29	46.0	3.7	109	134	-
Hori.	348.957	QP	51.94	15.03	6.88	31.77	0.00	42.08	46.0	3.9	100	268	-
Hori.	613.315	QP	47.98	19.44	8.42	32.05	0.00	43.79	46.0	2.2	149	124	-
Hori.	939.442	QP	32.66	21.91	10.06	31.12	0.00	33.51	46.0	12.4	151	294	-
Hori.	2483.500	PK	49.49	28.47	14.29	38.67	2.42	56.00	73.9	17.9	143	167	-
Hori.	4924.000	PK	45.43	31.89	6.69	38.61	2.42	47.82	73.9	26.0	150	0	-
Hori.	7386.000	PK	44.54	37.82	8.13	39.25	2.42	53.66	73.9	20.2	150	0	-
Hori.	9848.000	PK	44.72	39.55	9.41	39.75	2.42	56.35	73.9	17.5	150	0	-
Hori.	2483.500	AV	36.16	28.47	14.29	38.67	2.42	42.67	53.9	11.2	143	167	-
Hori.	4924.000	AV	33.90	31.89	6.69	38.61	2.42	36.29	53.9	17.6	150	0	Floor noise
Hori.	7386.000	AV	32.64	37.82	8.13	39.25	2.42	41.76	53.9	12.1	150	0	Floor noise
Hori.	9848.000	AV	33.14	39.55	9.41	39.75	2.42	44.77	53.9	9.1	150	0	Floor noise
Vert.	68.002	QP	47.56	6.77	7.40	31.81	0.00	29.92	40.0	10.0	100	18	-
Vert.	93.902	QP	37.78	9.01	8.35	31.80	0.00	23.34	43.5	20.1	100	329	-
Vert.	274.416	QP	50.64	13.12	6.36	31.76	0.00	38.36	46.0	7.6	219	20	-
Vert.	348.957	QP	50.44	15.03	6.88	31.77	0.00	40.58	46.0	5.4	154	32	-
Vert.	617.007	QP	41.28	19.47	8.44	32.05	0.00	37.14	46.0	8.8	169	72	-
Vert.	952.319	QP	29.06	21.99	10.11	31.01	0.00	30.15	46.0	15.8	100	92	-
Vert.	2483.500	PK	46.24	28.47	14.29	38.67	2.42	52.75	73.9	21.1	100	99	-
Vert.	4924.000	PK	44.58	31.89	6.69	38.61	2.42	46.97	73.9	26.9	150	0	-
Vert.	7386.000	PK	44.48	37.82	8.13	39.25	2.42	53.60	73.9	20.3	150	0	-
Vert.	9848.000	PK	44.64	39.55	9.41	39.75	2.42	56.27	73.9	17.6	150	0	-
Vert.	2483.500	AV	34.81	28.47	14.29	38.67	2.42	41.32	53.9	12.5	100	99	-
Vert.	4924.000	AV	32.88	31.89	6.69	38.61	2.42	35.27	53.9	18.6	150	0	Floor noise
Vert.	7386.000	AV	32.59	37.82	8.13	39.25	2.42	41.71	53.9	12.1	150	0	Floor noise
Vert.	9848.000	AV	33.08	39.55	9.41	39.75	2.42	44.71	53.9	9.1	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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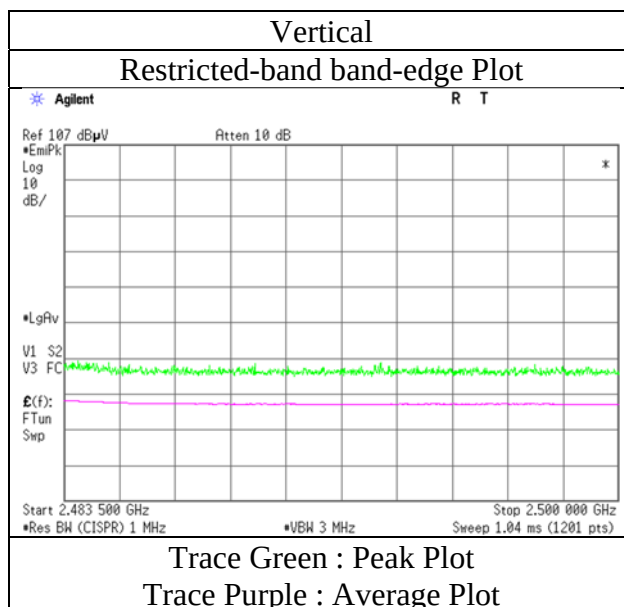
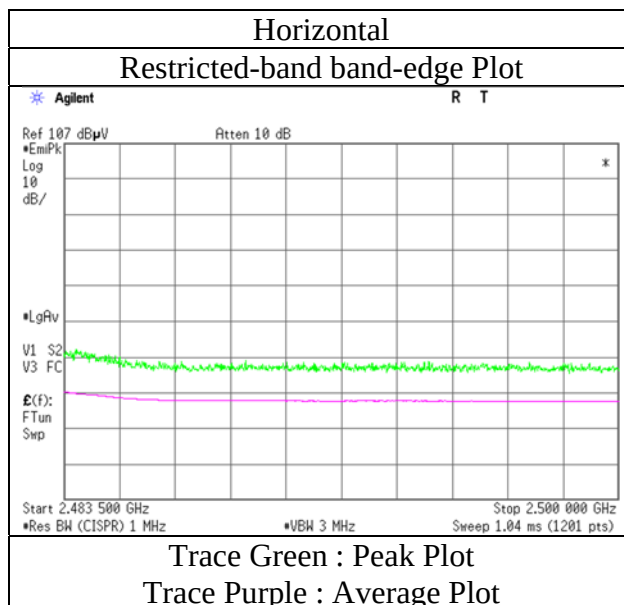
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Radiated Spurious Emission (Reference Plot for band-edge)

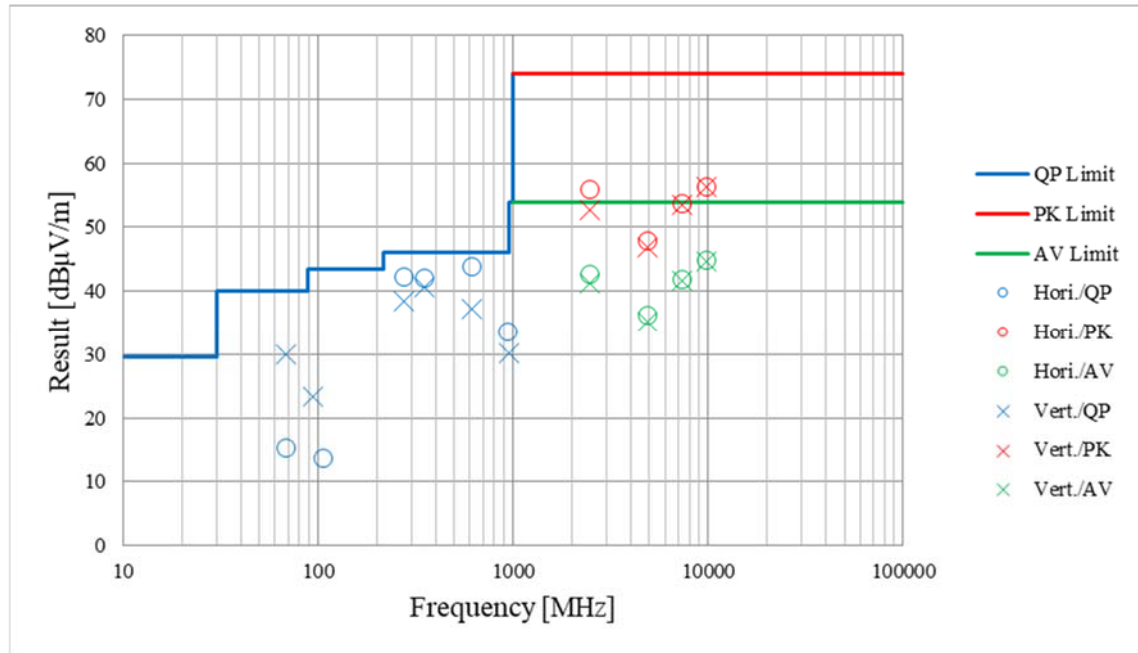
Report No.	13930662S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 4, 2021
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Kenichi Adachi
Mode	Tx 11g 2462 MHz



* 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)

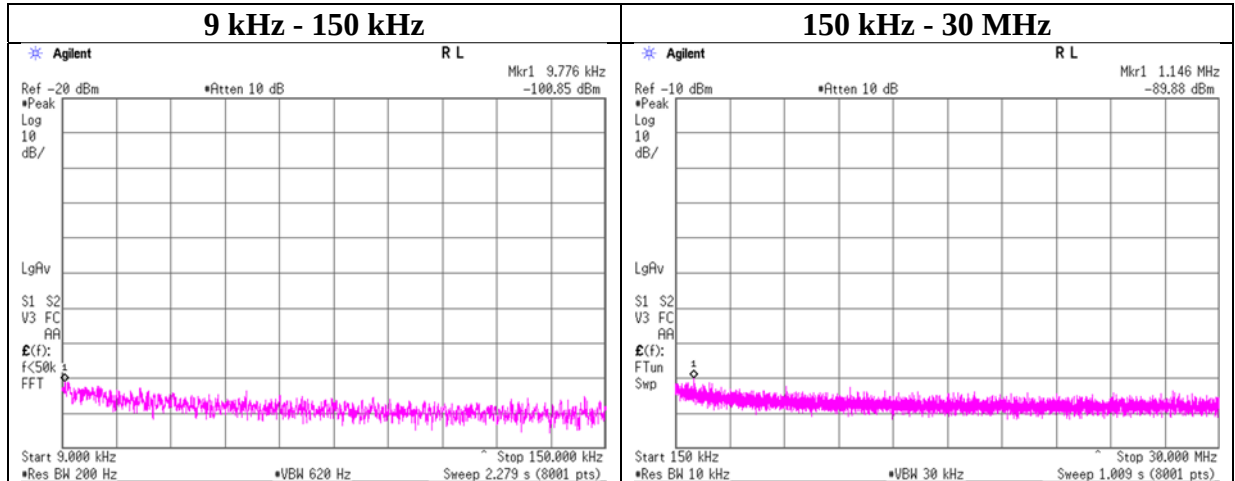
Report No.	13930662S-A-R1	No.2
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	
Date	August 16, 2021	September 4, 2021
Temperature / Humidity	23 deg. C / 68 % RH	23 deg. C / 69 % RH
Engineer	Kenichi Adachi	Kenichi Adachi
	(30 MHz - 1 GHz)	(1 GHz - 26.5 GHz)
Mode	Tx 11g 2462 MHz	



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

Conducted Spurious Emission

Report No.	13930662S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 3, 2021
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Kenichi Adachi
Mode	Tx 11g 2462 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
9.78	-100.9	0.01	9.7	3.3	1	-87.8	300	6.0	-26.5	47.8	74.3	-
1146.00	-89.9	0.02	9.7	3.3	1	-76.8	30	6.0	4.4	26.4	22.0	-

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

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

N: Number of output

Power Density

Report No. 13930662S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 3, 2021
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Kenichi Adachi
Mode Tx

11b

Freq. [MHz]	Reading [dBm / 3 kHz]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Margin [dB]
2412	-28.80	1.51	9.82	-17.47	8.00	25.47
2437	-27.95	1.51	9.82	-16.62	8.00	24.62
2462	-28.67	1.52	9.82	-17.33	8.00	25.33

11g

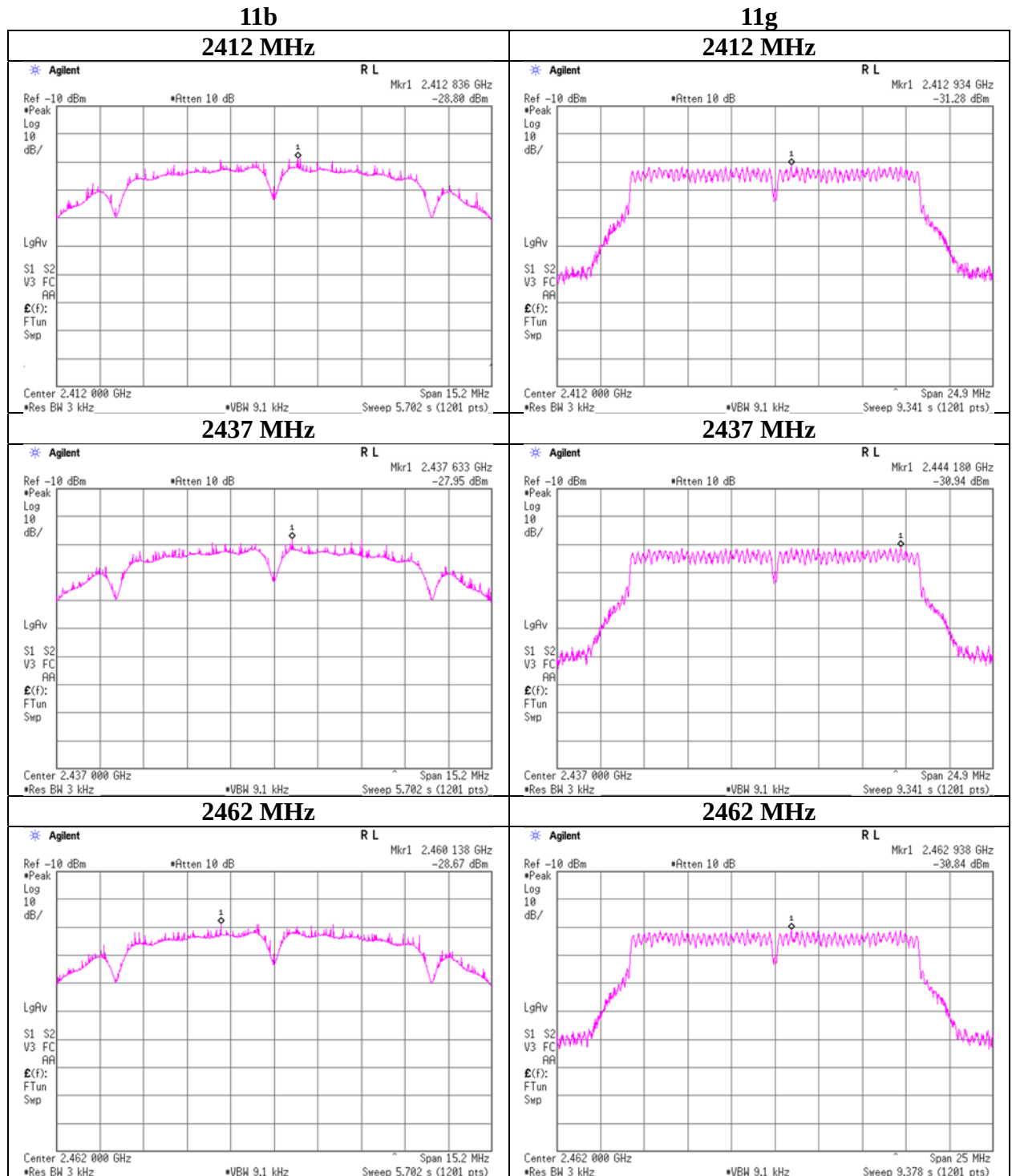
Freq. [MHz]	Reading [dBm / 3 kHz]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Margin [dB]
2412	-31.28	1.51	9.82	-19.95	8.00	27.95
2437	-30.94	1.51	9.82	-19.61	8.00	27.61
2462	-30.84	1.52	9.82	-19.50	8.00	27.50

Sample Calculation:

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

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

Power Density



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APPENDIX 2: Test instruments

Test equipment (1/2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2020/10/21	12
AT	SAT10-14	154591	Attenuator	Weinschel Corp.	54A-10	81595	2021/04/08	12
AT	SCC-G12	145040	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	2021/03/04	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
AT	SPM-13	169910	Power Meter	Keysight Technologies Inc	8990B	MY51000448	2021/01/25	12
AT	SPSS-06	169911	Power sensor	Keysight Technologies Inc	N1923A	MY57270004	2021/01/25	12
AT	SSA-03	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2021/08/09	12
CE	KAT3-12	144896	Attenuator	JFW IND. INC.	50HF-003N	-	2021/07/12	12
CE	KJM-10	146454	Measure	KOMELON	KMC-36	-	-	-
CE	SCC-B12/B13/SRSE-02	144969	Coaxial Cable&RF Selector	Suhner/Suhner/T OYO	RG223U/141PE /NS4906	-/0901-270(RF Selector)	2021/04/12	12
CE	SLS-04	145541	LISN	Rohde & Schwarz	ENV216	100514	2021/02/12	12
CE	SOS-22	191839	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2020/10/01	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,M E,PE)	-	-	-
CE,RE	STR-01	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2021/04/27	12
CE,RE	STS-02	145793	Digital Hitester	HIOKI E.E. CORPORATIO N	3805-50	80997819	2021/04/28	12
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2020/12/10	12
RE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
RE	SAEC-01(NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2021/04/30	12
RE	SAEC-02(SVSWR)	145598	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	2021/05/20	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2021/02/10	12
RE	SAF-05	145128	Pre Amplifier	Toyo Corporation	TPA0118-36	1440490	2021/05/17	12
RE	SAF-09	145008	Pre Amplifier	Toyo Corporation	HAP18-26W	18	2020/09/02	12
RE	SAJ-02	146104	Antenna Tilt Jig	Intelligent System Engineering Co., Ltd	Antenna Tilt Jig	T-S002	-	-
RE	SAT10-06	145137	Attenuator	Keysight Technologies Inc	8493C-010	74865	2020/10/05	12
RE	SAT3-12	150922	Attenuator	JFW	50HF-003N	-	2021/01/26	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032664	2021/04/10	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA /141PE/141PE/141PE/141PE/NS 4906	-/0901-269(RF Selector)	2021/04/13	12

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Shonan EMC Lab.

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Test equipment (2/2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS 4906	-/0901-269(RF Selector)	2021/04/12	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2021/03/01	12
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS /B	1612S006	2021/01/19	12
RE	SCC-G50	178573	Coaxial Cable	Huber+Suhner	SUCOFLEX_104_E	MY13407/4E	2021/03/01	12
RE	SCC-G51	178572	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	800288 /4A	2021/03/01	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2021/05/18	12
RE	SCC-G69	200009	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575617/4	2021/07/06	12
RE	SFL-18	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2021/04/08	12
RE	SHA-02	145384	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-726	2021/06/14	12
RE	SHA-04	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2021/06/14	12
RE	SHA-09	194684	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	695	2021/03/03	12
RE	SJM-20	207277	Measuring	ASKUL	-	-	-	-
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	193	2021/04/10	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
RE	SOS-21	191838	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
RE	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2021/04/13	12
RE	STS-01	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2020/10/19	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: CE: Conducted Emission test
RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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