RADIO TEST REPORT

Test Report No.: 14337817S-A-R1

Customer	**Panasonic Automotive Systems Co., Ltd.**
Description of EUT	**AV Control Unit for In-Vehicle Infotainment**
Model Number of EUT	**AM2201**
FCC ID	**ACJ932AM2201**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied (Refer to SECTION 3)**
Issue Date	**August 17, 2022**
Remarks	**Wireless LAN (2.4 GHz band) part**

Representative test engineer	Approved by
Shiro Kobayashi Engineer	Shinichi Takano Engineer

CERTIFICATE 1266.03

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

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- The information provided from the customer for this report is identified in Section 1.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No.: 14337817S-A

This report is a revised version of 14337817S-A. 14337817S-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14337817S-A	July 27, 2022	-
1	14337817S-A-R1	August 17, 2022	P.6 Radio Specification Modulation of WLAN 5 G Deletion of DSSS

Reference: Abbreviations (Including words undescribed in this report)

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

CONTENTS **PAGE**

SECTION 1: Customer Information

Company Name	Panasonic Automotive Systems Co., Ltd. *1)
Address	4261, Ikonobe-cho, Tsuzuki-ku, Yokohama-shi, Kanagawa-ken 224-8520, Japan
Telephone Number	+81-70-3179-1127
Contact Person	Yoshinori Nagatani

*1) The Grantee name in the FCC application is “Panasonic Corporation of North America”.

The information provided from the customer is as follows;
- Customer, Description 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 and Test 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

Description	AV Control Unit for In-Vehicle Infotainment
Model Number	AM2201
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	May 19, 2022
Test Date	June 7 to 20, 2022

2.2 Product Description

General Specification

Rating	DC 13.2 V
Operating temperature	-30 deg. C to +60 deg. C

Radio Specification

Bluetooth (BR / EDR)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, π/4 DQPSK, 8 DPSK)
Antenna Type	Pattern antenna
Antenna Gain	2 dBi

WLAN (IEEE802.11b/11g/11n-20)

Equipment Type	Transceiver
Frequency of Operation	2412 MHz to 2462 MHz
Type of Modulation	DSSS, OFDM
Antenna Type	Pattern antenna
Antenna Gain	2 dBi

WLAN (IEEE802.11a/11n-20/11ac-20/11n-40/11ac-40/11ac-80)

Equipment Type	Transceiver
Frequency of Operation	5745 MHz to 5825 MHz
Type of Modulation	OFDM
Antenna Type	Pattern antenna
Antenna Gain	1st: 5 dBi, 2nd: 5 dBi

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C FCC Part 15 final revised on April 1, 2022 and effective May 2, 2022
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
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods	**FCC:** Section 15.207	-	N/A	*1)
	ISED: RSS-Gen 8.8	**ISED:** RSS-Gen 8.8			
6 dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(a)(2)	See data.	Complied a)	Conducted
	ISED: -	**ISED:** RSS-247 5.2(a)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(b)(3)		Complied b)	Conducted
	ISED: RSS-Gen 6.12	**ISED:** RSS-247 5.4(d)			
Power Density	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(e)		Complied c)	Conducted
	ISED: -	**ISED:** RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	3.1 dB 4924.00.00 MHz, AV, Hori. Mode: Tx 11b 2462 MHz	Complied# d), e)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)
	ISED: RSS-Gen 6.13	**ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.
* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

*1) The test is not applicable since the EUT does not have AC Mains.
*2) 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 6 dB Bandwidth and 99 % Occupied Bandwidth)
b) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
c) Refer to APPENDIX 1 (data of Power Density)
d) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
e) 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.

FCC Part 15.31 (e)

The equipment provides the wireless transmitter with stable power supply.
Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The equipment and its antenna comply with the requirement since the antenna is built in the equipment and it cannot be replaced by end users. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to Standard

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
99 % Occupied Bandwidth	**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 $k = 2$.

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 to 30 MHz	2.9 dB	2.9 dB	3.0 dB	2.9 dB
Radiated emission	9 kHz to 30 MHz	3.2 dB	3.1 dB	3.1 dB	-
(Measurement distance: 3 m)	30 MHz to 200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz to 1 GHz	6.0 dB	6.1 dB	6.1 dB	-
	1 GHz to 6 GHz	4.7 dB	4.7 dB	4.7 dB	-
	6 GHz to 18 GHz	5.2 dB	5.3 dB	5.3 dB	-
	18 GHz to 40 GHz	5.4 dB	5.5 dB	5.5 dB	-
Radiated emission	1 GHz to 18 GHz	5.6 dB	5.6 dB	5.6 dB	-
(Measurement distance: 1 m)	18 GHz to 40 GHz	5.8 dB	5.8 dB	5.8 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	1.2 dB
Power Measurement above 1 GHz (Peak Detector) SPM-06	2.0 dB
Power Measurement above 1 GHz (Average Detector) SPM-07	1.2 dB
Power Measurement above 1 GHz (Peak Detector) SPM-07	1.3 dB
Power Measurement above 1 GHz (Average Detector) SPM-13	1.3 dB
Power Measurement above 1 GHz (Peak Detector) SPM-13	1.3 dB
Spurious emission (Conducted) below 1 GHz	0.93 dB
Conducted emissions Power Density Measurement 1 GHz to 3 GHz	0.92 dB
Conducted emissions Power Density Measurement 3 GHz to 18 GHz	2.3 dB
Spurious emission (Conducted) 18 GHz to 26.5 GHz	2.3 dB
Spurious emission (Conducted) 26.5 GHz to 40 GHz	2.3 dB
Bandwidth Measurement	0.012 %
Duty cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.93 deg. C.
Humidity_SCH-01	4.1 %
Temperature_SCH-02	2.0 deg. C.
Humidity_SCH-02	6.6 %
Voltage	0.97 %

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 Japan
Telephone: +81 463 50 6400
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)	2 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n-20 (11n-20)	MCS 4 (Long G.I.), PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Low Channel)	
*Power of the EUT was set by the software as follows; Power Setting: Fixed Software: SI ver. 07851 (Date: 2022.05 9, Storage location: EUT memory) *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
Radiated Spurious Emission (Below 1 GHz)	Tx 11g *1)	2437 MHz
Radiated Spurious Emission (Above 1 GHz), 6 dB Bandwidth, Maximum Peak Output Power, Power Density, 99% Occupied Bandwidth	Tx 11b Tx 11g Tx 11n-20	2412 MHz 2437 MHz 2462 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test.		

4.2 Configuration and Peripherals

This page has been submitted for separate exhibit (refer to APPENDIX 4).

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, 2.0 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[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.

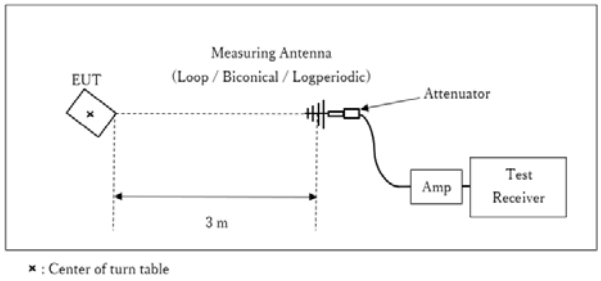
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	11.12.2.5.3 RBW: 1 MHz VBW: 1/T MHz (T: Burst length, refer to Appendix) Detector: Peak Trace mode: Max hold	RBW: 100 kHz VBW: 300 kHz

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

Figure 2: Test Setup

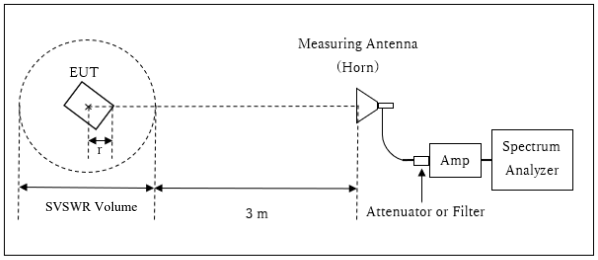
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz

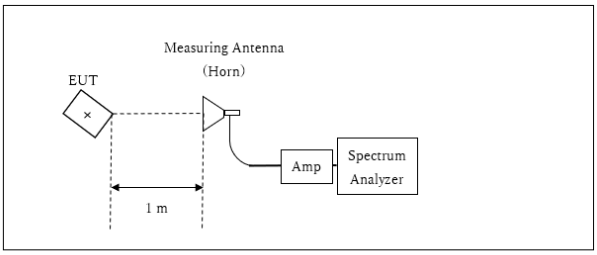


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.89 m / 3.0 m) = 2.26 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.89 m

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.11 m

10 GHz to 26.5 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.54 dB
*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of 0 deg. and 28 deg. angles of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

	Below 1 GHz	1 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz – 26.5 GHz
Horizontal	0 deg.	0 deg.	0 deg.	0 deg.
Vertical	0 deg.	0 deg.	0 deg.	0 deg.

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

Measurement Range : **30 MHz to 26.5 GHz**
Test Data : **APPENDIX**
Test Result : **Pass**

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
6 dB Bandwidth	50 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4) *5)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				

*1) Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".
*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)
*5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohmes. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 – 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

The test results and limit are rounded off to two decimals place, so some differences might be observed.
The equipment and cables were not used for factor 0 dB of the data sheets.

Test Data : APPENDIX
Test Result : Pass

APPENDIX 1: Test Data

6 dB Bandwidth and 99 % Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 20, 2022
Temperature / Humidity	24 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx

11b

Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
2412	12970.3	7.974	> 0.5000
2437	12968.4	7.893	> 0.5000
2462	12947.1	7.352	> 0.5000

11g

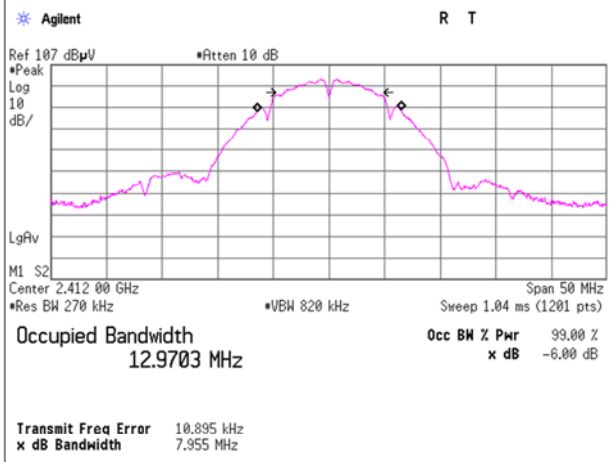
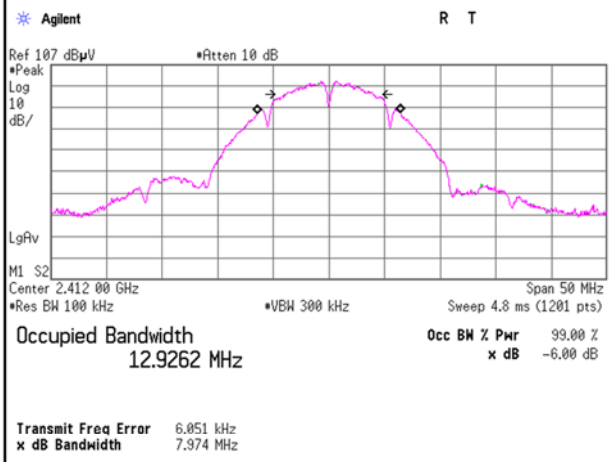
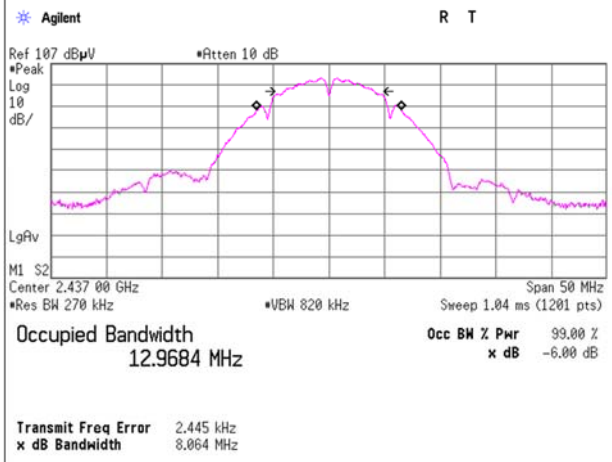
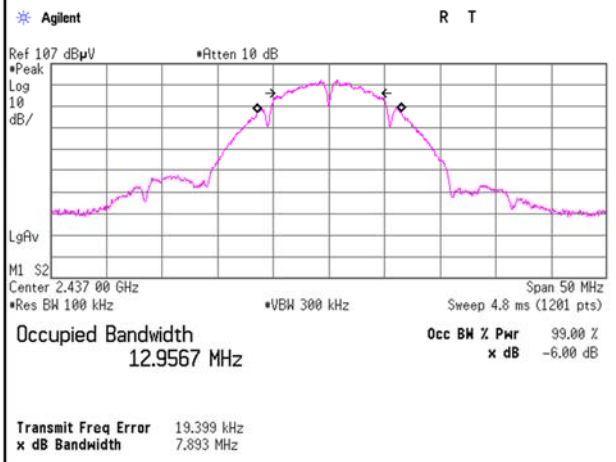
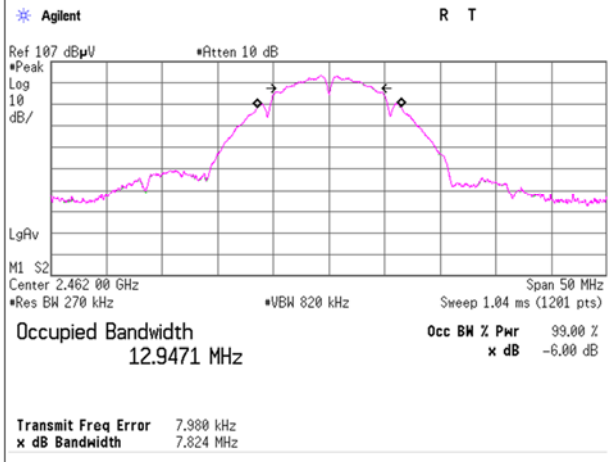
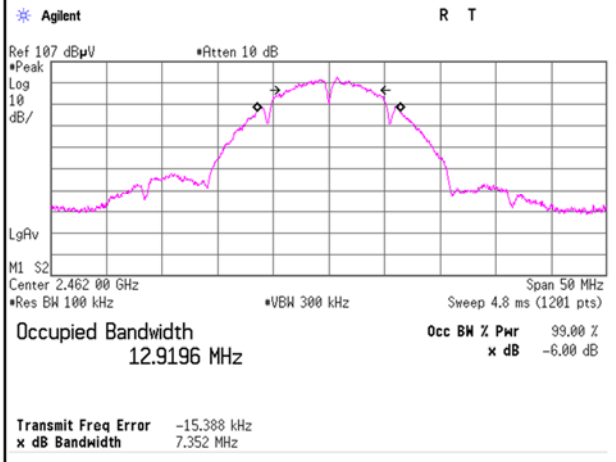
Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
2412	16868.9	16.552	> 0.5000
2437	16831.7	16.535	> 0.5000
2462	16808.3	16.534	> 0.5000

11n-20 (SISO)

Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
2412	17990.6	17.750	> 0.5000
2437	17986.2	17.771	> 0.5000
2462	17983.2	17.742	> 0.5000

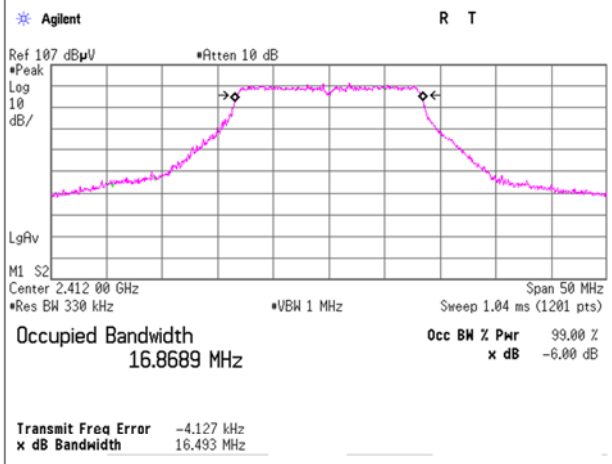
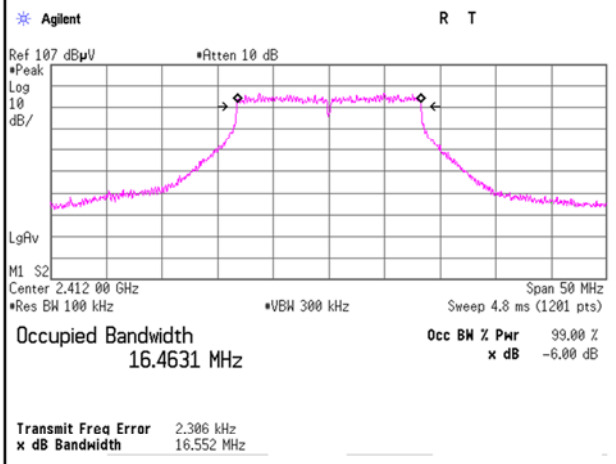
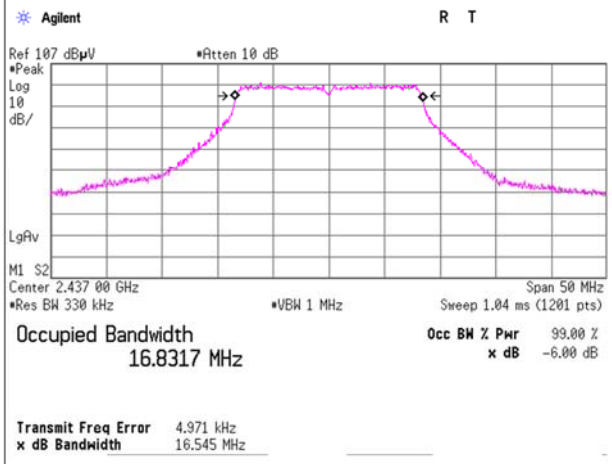
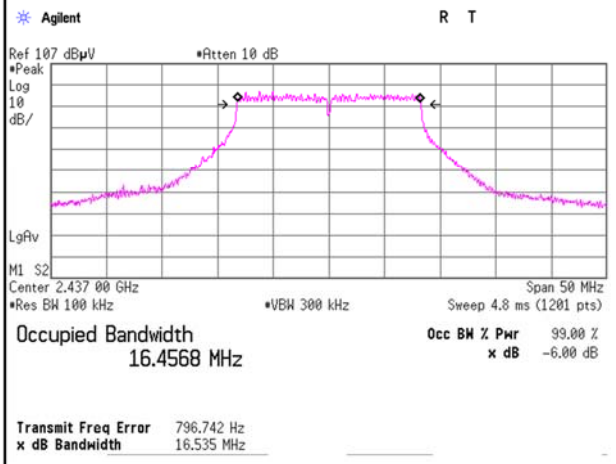
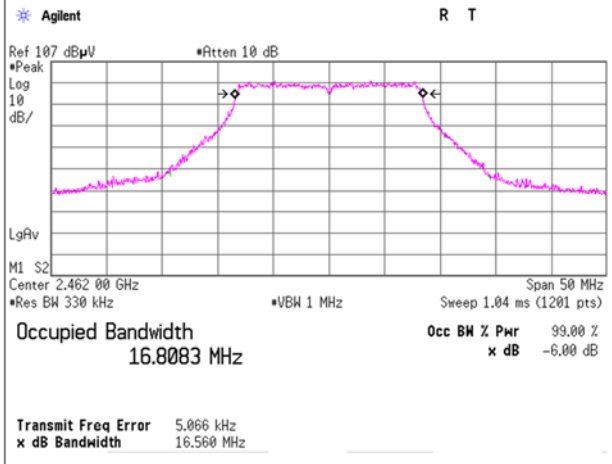
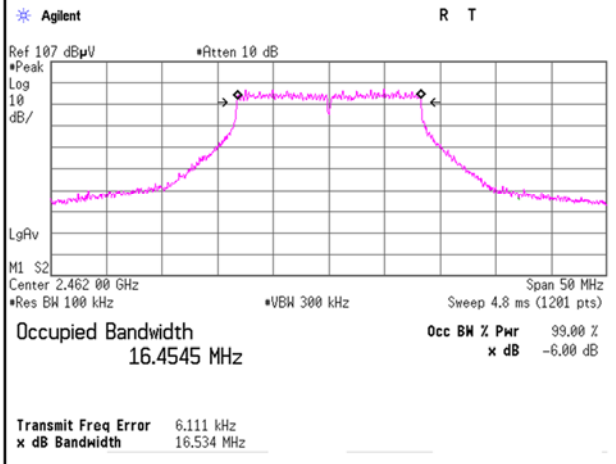
99 % Occupied Bandwidth and 6 dB Bandwidth

11b

99 % Occupied Bandwidth	6 dB Bandwidth
2412 MHz	**2412 MHz**
	
2437 MHz	**2437 MHz**
	
2462 MHz	**2462 MHz**
	

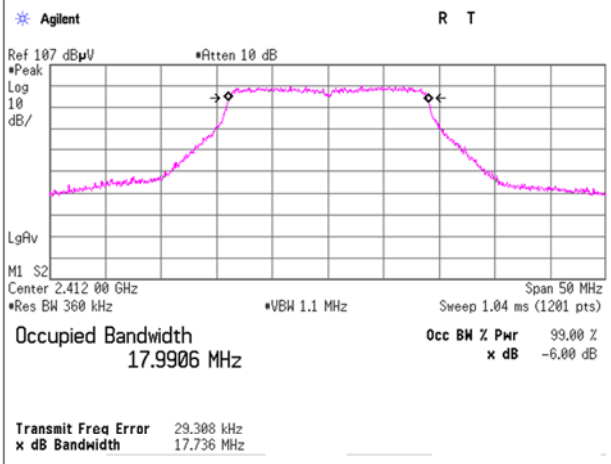
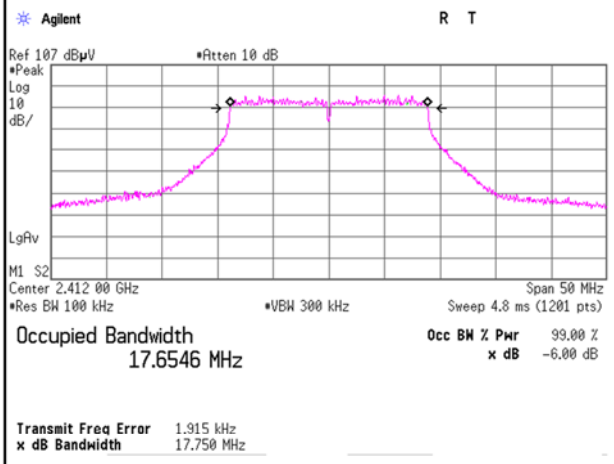
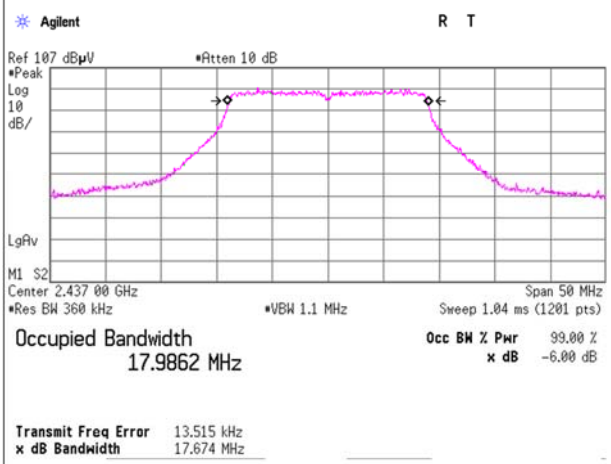
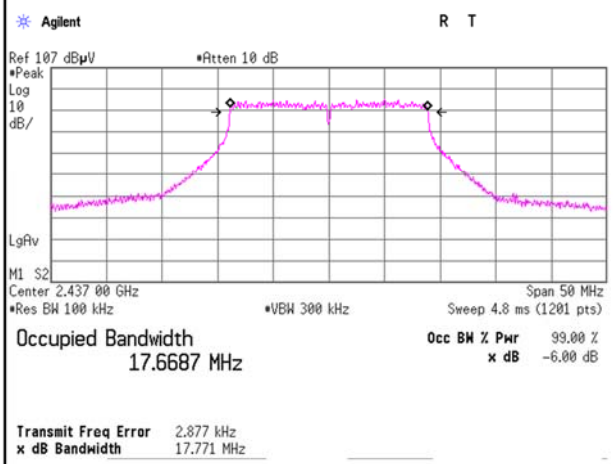
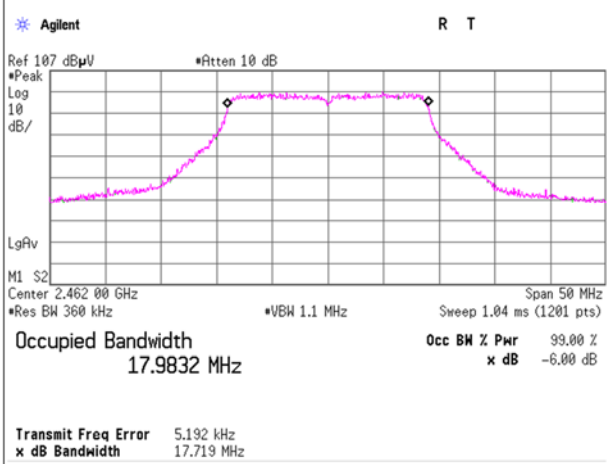
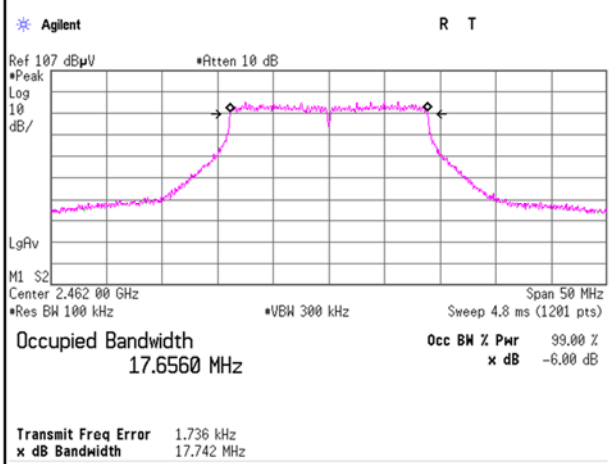
99 % Occupied Bandwidth and 6 dB Bandwidth

11g

99 % Occupied Bandwidth	6 dB Bandwidth
2412 MHz	2412 MHz
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz
	

99 % Occupied Bandwidth and 6 dB Bandwidth

11n-20 (SISO)

99 % Occupied Bandwidth	6 dB Bandwidth
2412 MHz	2412 MHz
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz
	

Maximum Peak Output Power

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 7, 2022
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Shiro Kobayashi
Mode	Tx

11b

2 Mbps (worst)

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	2.94	1.92	9.82	14.68	29.38	30.00	1000	15.32	2.00	16.68	46.56	36.02	4000	19.34
2437	3.00	1.93	9.82	14.75	29.85	30.00	1000	15.25	2.00	16.75	47.32	36.02	4000	19.27
2462	3.01	1.93	9.82	14.76	29.92	30.00	1000	15.24	2.00	16.76	47.42	36.02	4000	19.26

11g

48 Mbps (worst)

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	9.15	1.92	9.82	20.89	122.74	30.00	1000	9.11	2.00	22.89	194.54	36.02	4000	13.13
2437	9.15	1.93	9.82	20.90	123.03	30.00	1000	9.10	2.00	22.90	194.98	36.02	4000	13.12
2462	9.13	1.93	9.82	20.88	122.46	30.00	1000	9.12	2.00	22.88	194.09	36.02	4000	13.14

11n-20 (SISO)

MCS 4 (Long G.I.) (worst)

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	8.81	1.92	9.82	20.55	113.50	30.00	1000	9.45	2.00	22.55	179.89	36.02	4000	13.47
2437	8.82	1.93	9.82	20.57	114.02	30.00	1000	9.43	2.00	22.57	180.72	36.02	4000	13.45
2462	8.79	1.93	9.82	20.54	113.24	30.00	1000	9.46	2.00	22.54	179.47	36.02	4000	13.48

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

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

Maximum Peak Output Power

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 7, 2022
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Shiro Kobayashi
Mode	Tx

(Peak)

11b 2412 MHz

Rate [Mbps]	Reading [dBm]	Remark
1	2.70	
2	2.94	*
5.5	2.62	
11	2.93	

*: Worst Rate

11g 2412 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	4.49	
9	4.63	
12	4.71	
18	4.92	
24	8.89	
36	8.82	
48	9.15	*
54	8.75	

*: Worst Rate

(Long G.I.)

11n-20 2412 MHz

MCS	Reading [dBm]	Remark
0	3.57	
1	3.65	
2	3.77	
3	7.62	
4	8.81	*
5	7.65	
6	8.23	
7	7.81	

*: Worst Rate

(Short G.I.)

11n-20 2412 MHz

MCS	Reading [dBm]	Remark
0	3.70	-
1	3.63	
2	3.77	
3	7.58	
4	8.77	
5	7.63	
6	8.17	
7	8.05	

*: Worst Rate

Average Output Power
(Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 7, 2022
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Shiro Kobayashi
Mode	Tx

11b

5.5 Mbps (worst)

(*1)

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2412	0.39	1.92	9.82	12.13	16.33	0.00	12.13	16.33
2437	0.42	1.93	9.82	12.17	16.48	0.00	12.17	16.48
2462	0.42	1.93	9.82	12.17	16.48	0.00	12.17	16.48

11g

54 Mbps (worst)

(*1)

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2412	-1.27	1.92	9.82	10.47	11.14	0.00	10.47	11.14
2437	-1.32	1.93	9.82	10.43	11.04	0.00	10.43	11.04
2462	-1.17	1.93	9.82	10.58	11.43	0.00	10.58	11.43

11n-20 (SISO)

MCS 7 (Long G.I.) (worst)

(*1)

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2412	-2.30	1.92	9.82	9.44	8.79	0.00	9.44	8.79
2437	-2.12	1.93	9.82	9.63	9.18	0.00	9.63	9.18
2462	-2.33	1.93	9.82	9.42	8.75	0.00	9.42	8.75

Sample Calculation:

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

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

(*1) Power was measured with using the gate function of power meter.

Average Output Power
(Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 7, 2022
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Shiro Kobayashi
Mode	Tx

(Average)

11b 2412 MHz

Rate [Mbps]	Reading [dBm]	Remark
1	0.17	
2	0.36	
5.5	0.39	*
11	0.38	

*: Worst Rate

11g 2412 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	-1.95	
9	-1.84	
12	-1.96	
18	-1.84	
24	-1.59	
36	-1.44	
48	-1.30	
54	-1.27	*

*: Worst Rate

(Long G.I.)

11n-20 2412 MHz

MCS	Reading [dBm]	Remark
0	-2.82	
1	-2.70	
2	-2.78	
3	-2.45	
4	-2.38	
5	-2.45	
6	-2.41	
7	-2.30	*

*: Worst Rate

(Short G.I.)

11n-20 2412 MHz

MCS	Reading [dBm]	Remark
0	-2.79	-
1	-2.81	
2	-2.79	
3	-2.51	
4	-2.36	
5	-2.35	
6	-2.32	
7	-2.41	

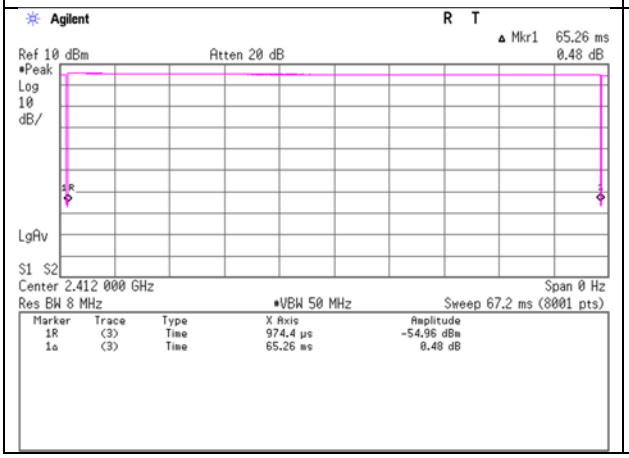
*: Worst Rate

Burst rate confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 7, 2022
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Shiro Kobayashi
Mode	Tx

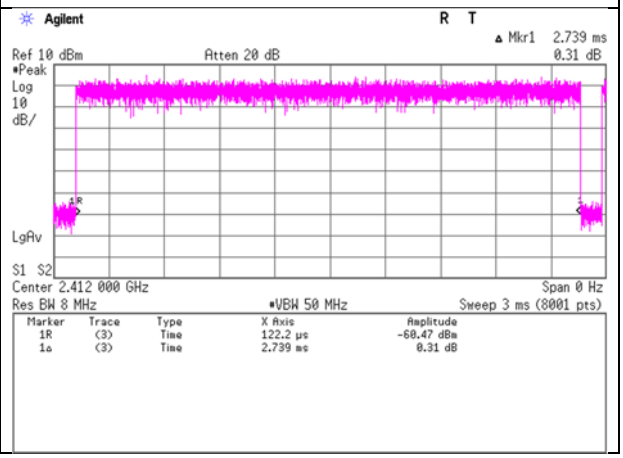
11b, 2 Mbps

VBW: 1 / (On Time) = 15.323 Hz < 18 Hz
(On Time) = 65.26 ms



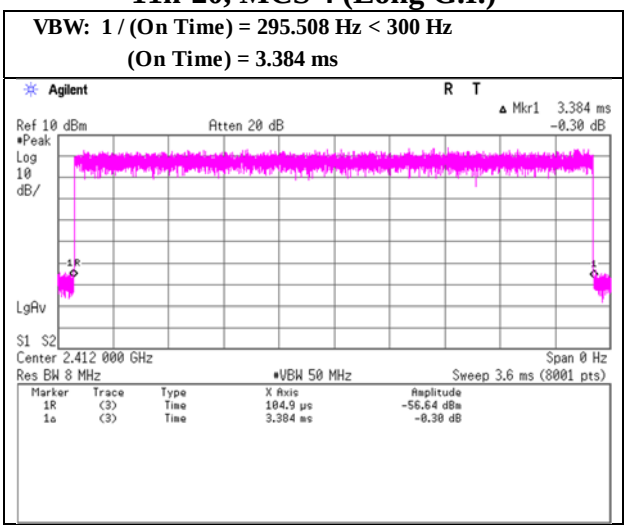
11g 48 Mbps

VBW: 1 / (On Time) = 365.097 Hz < 390 Hz
(On Time) = 2.739 ms



11n-20, MCS 4 (Long G.I.)

VBW: 1 / (On Time) = 295.508 Hz < 300 Hz
(On Time) = 3.384 ms



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

Radiated Spurious Emission

Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 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.	2389.233	PK	51.39	28.18	14.56	41.63	2.26	54.76	73.9	19.1	192	27	-
Hori.	2390.000	PK	51.30	28.18	14.56	41.63	2.26	54.67	73.9	19.2	192	27	-
Hori.	4824.000	PK	57.35	31.57	7.27	42.86	2.26	55.59	73.9	18.3	112	300	-
Hori.	7236.000	PK	48.15	37.39	8.90	43.42	2.26	53.28	73.9	20.6	150	0	-
Hori.	9648.000	PK	49.41	38.98	10.19	43.16	2.26	57.68	73.9	16.2	127	76	-
Hori.	2389.233	AV	38.02	28.18	14.56	41.63	2.26	41.39	53.9	12.5	192	27	VBW: 18 Hz
Hori.	2390.000	AV	37.90	28.18	14.56	41.63	2.26	41.27	53.9	12.6	192	27	VBW: 18 Hz
Hori.	4824.000	AV	52.03	31.57	7.27	42.86	2.26	50.27	53.9	**3.6**	112	300	VBW: 18 Hz
Hori.	7236.000	AV	36.87	37.39	8.90	43.42	2.26	42.00	53.9	11.9	150	0	VBW: 18 Hz, Floor noise
Hori.	9648.000	AV	37.78	38.98	10.19	43.16	2.26	46.05	53.9	7.8	127	76	VBW: 18 Hz
Vert.	2385.300	PK	48.68	28.19	14.56	41.63	2.26	52.06	73.9	21.8	139	28	-
Vert.	2390.000	PK	48.84	28.18	14.56	41.63	2.26	52.21	73.9	21.6	139	28	-
Vert.	4824.000	PK	56.05	31.57	7.27	42.86	2.26	54.29	73.9	19.6	107	346	-
Vert.	7236.000	PK	48.00	37.39	8.90	43.42	2.26	53.13	73.9	20.7	150	0	-
Vert.	9648.000	PK	49.58	38.98	10.19	43.16	2.26	57.85	73.9	16.0	275	22	-
Vert.	2385.300	AV	36.67	28.19	14.56	41.63	2.26	40.05	53.9	13.8	139	28	VBW: 18 Hz
Vert.	2390.000	AV	36.53	28.18	14.56	41.63	2.26	39.90	53.9	14.0	139	28	VBW: 18 Hz
Vert.	4824.000	AV	49.76	31.57	7.27	42.86	2.26	48.00	53.9	5.9	107	346	VBW: 18 Hz
Vert.	7236.000	AV	36.50	37.39	8.90	43.42	2.26	41.63	53.9	12.2	150	0	VBW: 18 Hz, Floor noise
Vert.	9648.000	AV	38.71	38.98	10.19	43.16	2.26	46.98	53.9	6.9	275	22	VBW: 18 Hz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

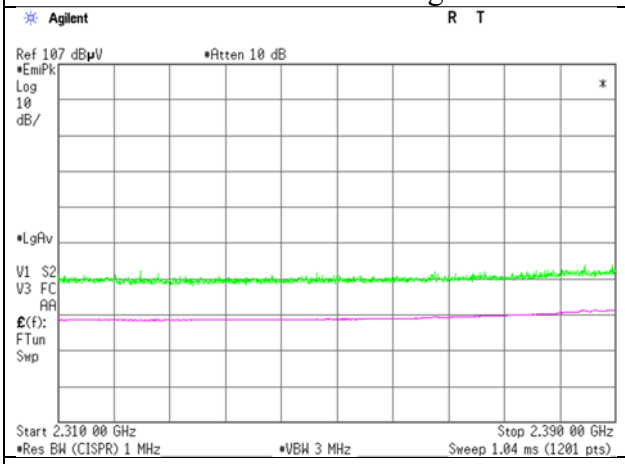
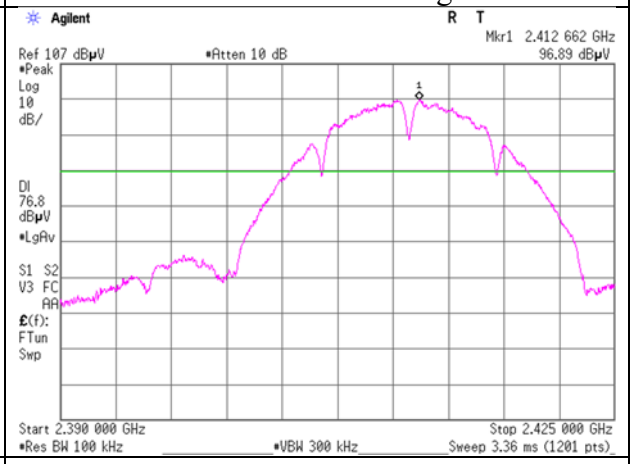
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

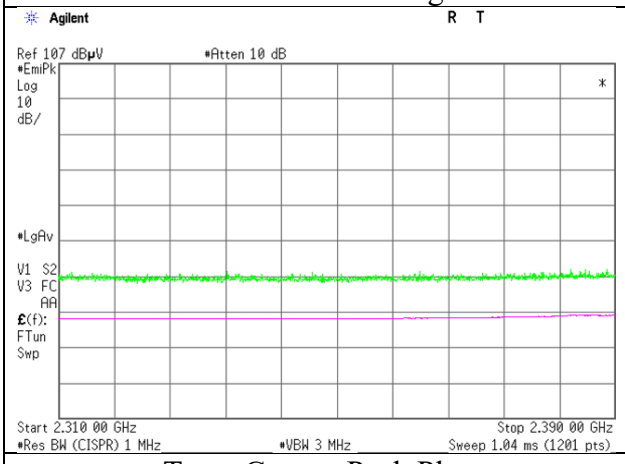
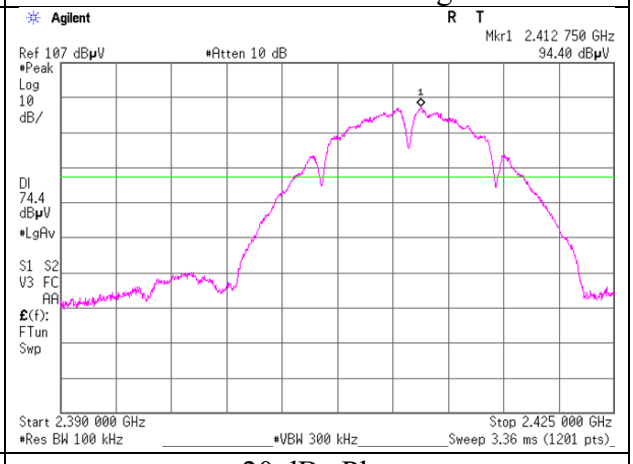
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	97.13	28.15	14.59	41.64	2.26	100.49	-	-	Carrier
Hori.	2398.325	PK	53.60	28.17	14.58	41.64	2.26	56.97	80.4	23.4	-
Hori.	2400.000	PK	47.44	28.17	14.58	41.64	2.26	50.81	80.4	29.5	-
Vert.	2412.000	PK	94.48	28.15	14.59	41.64	2.26	97.84	-	-	Carrier
Vert.	2398.308	PK	48.09	28.17	14.58	41.64	2.26	51.46	77.8	26.3	-
Vert.	2400.000	PK	42.26	28.17	14.58	41.64	2.26	45.63	77.8	32.1	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	June 11, 2022
Temperature / Humidity	25 deg.C, 52 %RH
Engineer	Miku Ikudome (1 GHz -2.8 GHz)
Mode	Tx 11b 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20 dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20 dBc Plot

* 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

Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 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	57.68	31.63	7.30	42.84	2.26	56.03	73.9	17.8	108	306	-
Hori.	7311.000	PK	48.48	37.45	8.96	43.51	2.26	53.64	73.9	20.2	150	0	-
Hori.	9748.000	PK	50.11	39.17	10.22	43.04	2.26	58.72	73.9	15.1	296	40	-
Hori.	4874.000	AV	52.07	31.63	7.30	42.84	2.26	50.42	53.9	**3.4**	108	306	VBW: 18 Hz
Hori.	7311.000	AV	36.48	37.45	8.96	43.51	2.26	41.64	53.9	12.2	150	0	VBW: 18 Hz, Floor noise
Hori.	9748.000	AV	39.87	39.17	10.22	43.04	2.26	48.48	53.9	5.4	296	40	VBW: 18 Hz
Vert.	4874.000	PK	54.52	31.63	7.30	42.84	2.26	52.87	73.9	21.0	338	343	-
Vert.	7311.000	PK	48.51	37.45	8.96	43.51	2.26	53.67	73.9	20.2	150	0	-
Vert.	9748.000	PK	49.67	39.17	10.22	43.04	2.26	58.28	73.9	15.6	279	21	-
Vert.	4874.000	AV	46.98	31.63	7.30	42.84	2.26	45.33	53.9	8.5	338	343	VBW: 18 Hz
Vert.	7311.000	AV	36.48	37.45	8.96	43.51	2.26	41.64	53.9	12.2	150	0	VBW: 18 Hz, Floor noise
Vert.	9748.000	AV	38.83	39.17	10.22	43.04	2.26	47.44	53.9	6.4	279	21	VBW: 18 Hz

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

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

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

Radiated Spurious Emission

Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 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	51.11	28.08	14.68	41.68	2.26	54.45	73.9	19.4	183	15	-
Hori.	2484.036	PK	52.46	28.08	14.68	41.68	2.26	55.80	73.9	18.1	183	15	-
Hori.	4924.000	PK	57.81	31.71	7.32	42.81	2.26	56.29	73.9	17.6	102	305	-
Hori.	7386.000	PK	48.22	37.56	9.01	43.59	2.26	53.46	73.9	20.4	150	0	-
Hori.	9848.000	PK	48.77	39.15	10.27	42.91	2.26	57.54	73.9	16.3	176	78	-
Hori.	2483.500	AV	39.77	28.08	14.68	41.68	2.26	43.11	53.9	10.7	183	15	VBW: 18 Hz
Hori.	2484.036	AV	40.46	28.08	14.68	41.68	2.26	43.80	53.9	10.1	183	15	VBW: 18 Hz
Hori.	4924.000	AV	52.23	31.71	7.32	42.81	2.26	50.71	53.9	**3.1**	102	305	VBW: 18 Hz
Hori.	7386.000	AV	36.39	37.56	9.01	43.59	2.26	41.63	53.9	12.2	150	0	VBW: 18 Hz, Floor noise
Hori.	9848.000	AV	36.90	39.15	10.27	42.91	2.26	45.67	53.9	8.2	176	78	VBW: 18 Hz
Vert.	2483.500	PK	48.33	28.08	14.68	41.68	2.26	51.67	73.9	22.2	148	24	-
Vert.	4924.000	PK	52.92	31.71	7.32	42.81	2.26	51.40	73.9	22.5	148	309	-
Vert.	7386.000	PK	48.20	37.56	9.01	43.59	2.26	53.44	73.9	20.4	150	0	-
Vert.	9848.000	PK	48.99	39.15	10.27	42.91	2.26	57.76	73.9	16.1	113	202	-
Vert.	2483.500	AV	36.30	28.08	14.68	41.68	2.26	39.64	53.9	14.2	148	24	VBW: 18 Hz
Vert.	4924.000	AV	44.02	31.71	7.32	42.81	2.26	42.50	53.9	11.4	148	309	VBW: 18 Hz
Vert.	7386.000	AV	36.41	37.56	9.01	43.59	2.26	41.65	53.9	12.2	150	0	VBW: 18 Hz, Floor noise
Vert.	9848.000	AV	37.42	39.15	10.27	42.91	2.26	46.19	53.9	7.7	113	202	VBW: 18 Hz

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

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

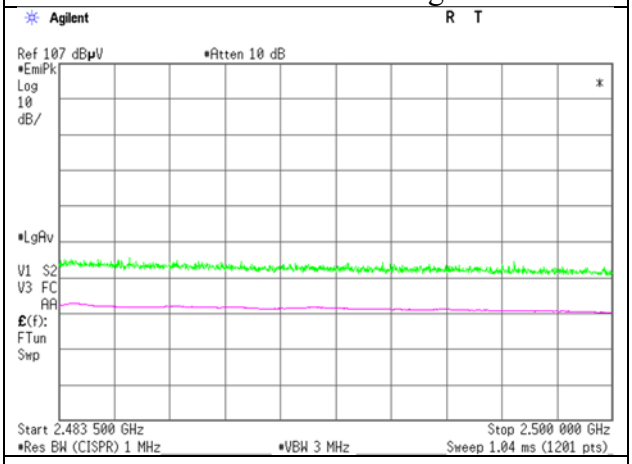
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	June 11, 2022
Temperature / Humidity	25 deg.C, 52 %RH
Engineer	Miku Ikudome
	(1 GHz -2.8 GHz)
Mode	Tx 11b 2462 MHz

Horizontal

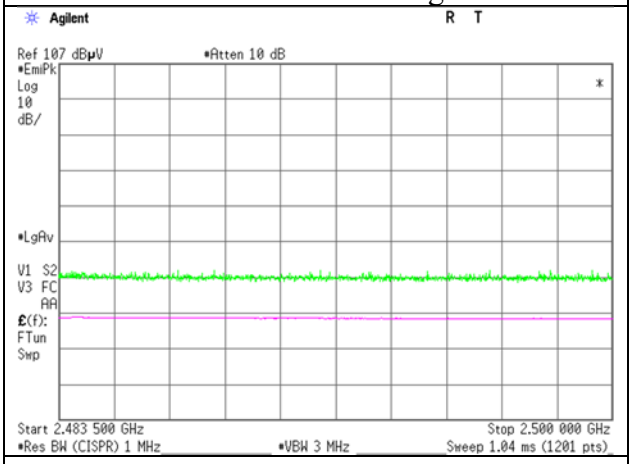
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

* 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

Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 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	54.42	28.18	14.56	41.63	2.26	57.79	73.9	16.1	119	26	-
Hori.	4824.000	PK	52.48	31.57	7.27	42.86	2.26	50.72	73.9	23.1	100	307	-
Hori.	7236.000	PK	48.27	37.39	8.90	43.42	2.26	53.40	73.9	20.5	150	0	-
Hori.	9648.000	PK	50.38	38.98	10.19	43.16	2.26	58.65	73.9	15.2	291	40	-
Hori.	2390.000	AV	41.78	28.18	14.56	41.63	2.26	45.15	53.9	8.7	119	26	VBW: 390 Hz
Hori.	4824.000	AV	46.43	31.57	7.27	42.86	2.26	44.67	53.9	9.2	100	307	VBW: 390 Hz
Hori.	7236.000	AV	37.03	37.39	8.90	43.42	2.26	42.16	53.9	11.7	150	0	VBW: 390 Hz, Floor noise
Hori.	9648.000	AV	41.00	38.98	10.19	43.16	2.26	49.27	53.9	**4.6**	291	40	VBW: 390 Hz
Vert.	2390.000	PK	50.01	28.18	14.56	41.63	2.26	53.38	73.9	20.5	135	29	-
Vert.	4824.000	PK	52.90	31.57	7.27	42.86	2.26	51.14	73.9	22.7	115	338	-
Vert.	7236.000	PK	48.07	37.39	8.90	43.42	2.26	53.20	73.9	20.7	150	0	-
Vert.	9648.000	PK	49.49	38.98	10.19	43.16	2.26	57.76	73.9	16.1	274	20	-
Vert.	2390.000	AV	38.37	28.18	14.56	41.63	2.26	41.74	53.9	12.1	135	29	VBW: 390 Hz
Vert.	4824.000	AV	45.31	31.57	7.27	42.86	2.26	43.55	53.9	10.3	115	338	VBW: 390 Hz
Vert.	7236.000	AV	36.99	37.39	8.90	43.42	2.26	42.12	53.9	11.7	150	0	VBW: 390 Hz, Floor noise
Vert.	9648.000	AV	39.71	38.98	10.19	43.16	2.26	47.98	53.9	5.9	274	20	VBW: 390 Hz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

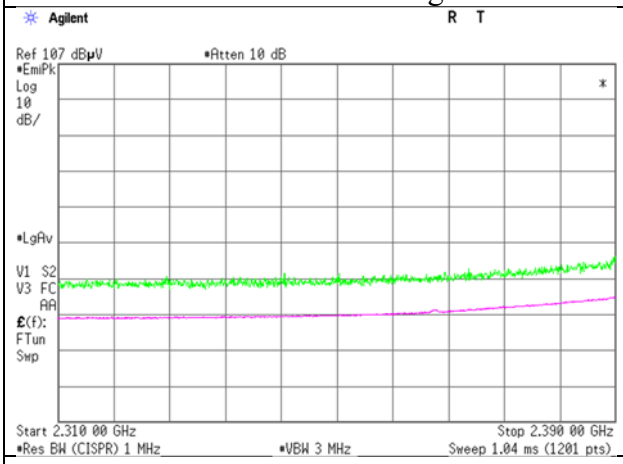
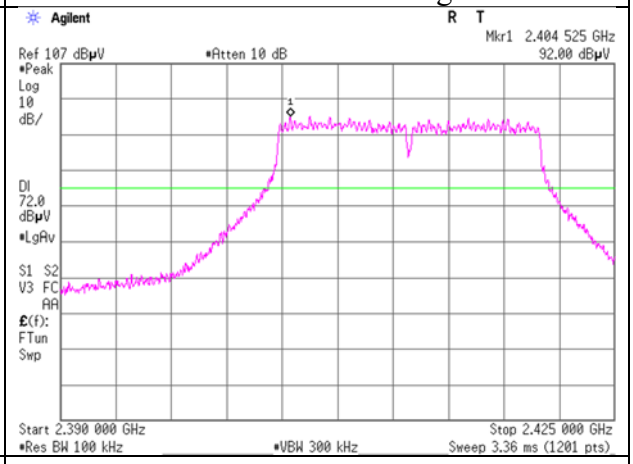
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

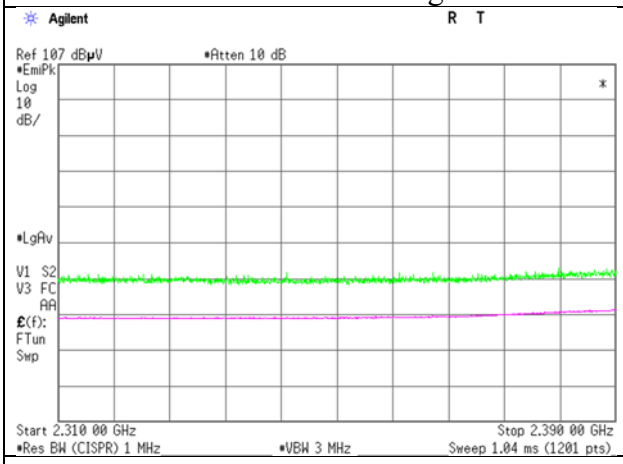
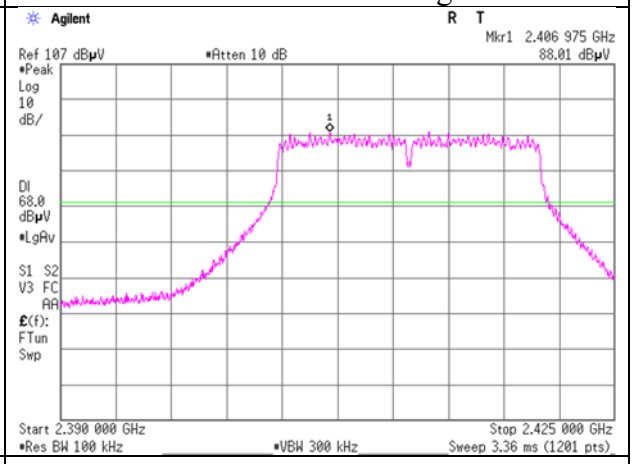
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	92.00	28.15	14.59	41.64	2.26	95.36	-	-	Carrier
Hori.	2400.000	PK	57.66	28.17	14.58	41.64	2.26	61.03	75.3	14.2	-
Vert.	2412.000	PK	88.10	28.15	14.59	41.64	2.26	91.46	-	-	Carrier
Vert.	2400.000	PK	52.02	28.17	14.58	41.64	2.26	55.39	71.4	16.0	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	June 11, 2022
Temperature / Humidity	25 deg.C, 52 %RH
Engineer	Miku Ikudome
	(1 GHz -2.8 GHz)
Mode	Tx 11g 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20 dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20 dBc Plot

* 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

Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	1	3	3	3	3
Date	June 19, 2022	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	22 deg.C, 59 %RH	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Yasumasa Owaki	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(30 MHz -1 GHz)	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 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.	54.000	QP	49.10	9.90	7.45	31.83	0.00	34.62	40.0	5.3	377	221	-
Hori.	60.000	QP	46.80	8.22	7.27	31.83	0.00	30.46	40.0	9.5	360	207	-
Hori.	84.000	QP	51.10	7.05	8.42	31.82	0.00	34.75	40.0	5.2	224	122	-
Hori.	96.000	QP	46.00	9.47	8.32	31.81	0.00	31.98	43.5	11.5	341	324	-
Hori.	216.000	QP	52.60	11.21	5.95	31.77	0.00	37.99	43.5	5.5	161	188	-
Hori.	4874.000	PK	53.24	31.63	7.30	42.84	2.26	51.59	73.9	22.3	106	307	-
Hori.	7311.000	PK	48.84	37.45	8.96	43.51	2.26	54.00	73.9	19.9	150	0	-
Hori.	9748.000	PK	49.26	39.17	10.22	43.04	2.26	57.87	73.9	16.0	212	41	-
Hori.	4874.000	AV	46.18	31.63	7.30	42.84	2.26	44.53	53.9	9.3	106	307	VBW: 390 Hz
Hori.	7311.000	AV	36.89	37.45	8.96	43.51	2.26	42.05	53.9	11.8	150	0	VBW: 390 Hz, Floor noise
Hori.	9748.000	AV	38.77	39.17	10.22	43.04	2.26	47.38	53.9	6.5	212	41	VBW: 390 Hz
Vert.	42.000	QP	43.50	14.16	7.32	31.83	0.00	33.15	40.0	6.8	100	8	-
Vert.	54.000	QP	49.40	9.90	7.45	31.83	0.00	34.92	40.0	**5.0**	100	320	-
Vert.	84.000	QP	48.70	7.05	8.42	31.82	0.00	32.35	40.0	7.6	134	298	-
Vert.	87.000	QP	45.80	7.68	8.42	31.82	0.00	30.08	40.0	9.9	108	293	-
Vert.	4874.000	PK	52.10	31.63	7.30	42.84	2.26	50.45	73.9	23.4	146	339	-
Vert.	7311.000	PK	49.36	37.45	8.96	43.51	2.26	54.52	73.9	19.3	150	0	-
Vert.	9748.000	PK	49.09	39.17	10.22	43.04	2.26	57.70	73.9	16.2	278	22	-
Vert.	4874.000	AV	42.11	31.63	7.30	42.84	2.26	40.46	53.9	13.4	146	339	VBW: 390 Hz
Vert.	7311.000	AV	36.84	37.45	8.96	43.51	2.26	42.00	53.9	11.9	150	0	VBW: 390 Hz, Floor noise
Vert.	9748.000	AV	39.45	39.17	10.22	43.04	2.26	48.06	53.9	5.8	278	22	VBW: 390 Hz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission

Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 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.	2483.500	PK	55.12	28.08	14.68	41.68	2.26	58.46	73.9	15.4	127	20	-
Hori.	4924.000	PK	52.74	31.71	7.32	42.81	2.26	51.22	73.9	22.6	103	307	-
Hori.	7386.000	PK	47.81	37.56	9.01	43.59	2.26	53.05	73.9	20.8	150	0	-
Hori.	9848.000	PK	48.76	39.15	10.27	42.91	2.26	57.53	73.9	16.3	196	79	-
Hori.	2483.500	AV	43.08	28.08	14.68	41.68	2.26	46.42	53.9	7.4	127	20	VBW: 390 Hz
Hori.	4924.000	AV	45.43	31.71	7.32	42.81	2.26	43.91	53.9	9.9	103	307	VBW: 390 Hz
Hori.	7386.000	AV	36.89	37.56	9.01	43.59	2.26	42.13	53.9	11.7	150	0	VBW: 390 Hz, Floor noise
Hori.	9848.000	AV	37.64	39.15	10.27	42.91	2.26	46.41	53.9	7.4	196	79	VBW: 390 Hz
Vert.	2483.500	PK	49.49	28.08	14.68	41.68	2.26	52.83	73.9	21.0	149	25	-
Vert.	4924.000	PK	50.36	31.71	7.32	42.81	2.26	48.84	73.9	25.0	148	309	-
Vert.	7386.000	PK	47.91	37.56	9.01	43.59	2.26	53.15	73.9	20.7	150	0	-
Vert.	9848.000	PK	49.28	39.15	10.27	42.91	2.26	58.05	73.9	15.8	100	315	-
Vert.	2483.500	AV	36.86	28.08	14.68	41.68	2.26	40.20	53.9	13.7	149	25	VBW: 390 Hz
Vert.	4924.000	AV	40.46	31.71	7.32	42.81	2.26	38.94	53.9	14.9	148	309	VBW: 390 Hz
Vert.	7386.000	AV	36.79	37.56	9.01	43.59	2.26	42.03	53.9	11.8	150	0	VBW: 390 Hz, Floor noise
Vert.	9848.000	AV	38.48	39.15	10.27	42.91	2.26	47.25	53.9	**6.6**	100	315	VBW: 390 Hz

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

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

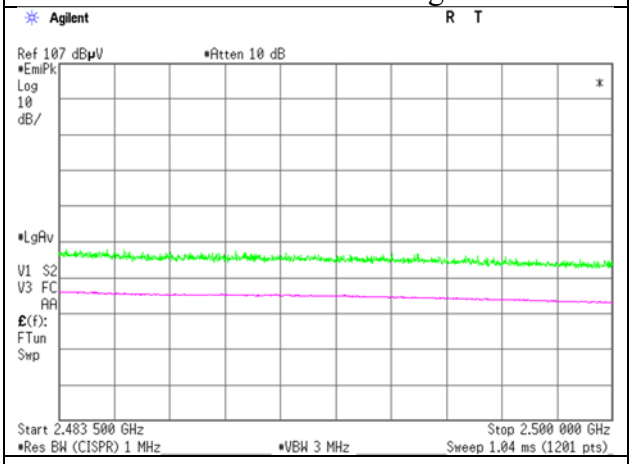
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	June 11, 2022
Temperature / Humidity	25 deg.C, 52 %RH
Engineer	Miku Ikudome
	(1 GHz -2.8 GHz)
Mode	Tx 11g 2462 MHz

Horizontal

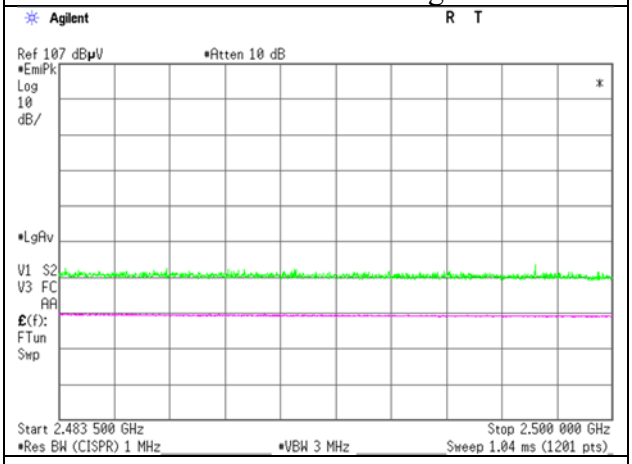
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

* 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

Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx 11n-20 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	53.18	28.18	14.56	41.63	2.26	56.55	73.9	17.3	123	14	-
Hori.	4824.000	PK	53.50	31.57	7.27	42.86	2.26	51.74	73.9	22.1	100	308	-
Hori.	7236.000	PK	48.86	37.39	8.90	43.42	2.26	53.99	73.9	19.9	150	0	-
Hori.	9648.000	PK	50.52	38.98	10.19	43.16	2.26	58.79	73.9	15.1	265	40	-
Hori.	2390.000	AV	42.16	28.18	14.56	41.63	2.26	45.53	53.9	8.3	123	14	VBW: 300 Hz
Hori.	4824.000	AV	46.52	31.57	7.27	42.86	2.26	44.76	53.9	9.1	100	308	VBW: 300 Hz
Hori.	7236.000	AV	36.80	37.39	8.90	43.42	2.26	41.93	53.9	11.9	150	0	VBW: 300 Hz, Floor noise
Hori.	9648.000	AV	40.56	38.98	10.19	43.16	2.26	48.83	53.9	**5.0**	265	40	VBW: 300 Hz
Vert.	2390.000	PK	49.31	28.18	14.56	41.63	2.26	52.68	73.9	21.2	154	19	-
Vert.	4824.000	PK	53.33	31.57	7.27	42.86	2.26	51.57	73.9	22.3	103	337	-
Vert.	7236.000	PK	48.35	37.39	8.90	43.42	2.26	53.48	73.9	20.4	150	0	-
Vert.	9648.000	PK	49.72	38.98	10.19	43.16	2.26	57.99	73.9	15.9	272	20	-
Vert.	2390.000	AV	37.53	28.18	14.56	41.63	2.26	40.90	53.9	13.0	154	19	VBW: 300 Hz
Vert.	4824.000	AV	45.46	31.57	7.27	42.86	2.26	43.70	53.9	10.2	103	337	VBW: 300 Hz
Vert.	7236.000	AV	37.04	37.39	8.90	43.42	2.26	42.17	53.9	11.7	150	0	VBW: 300 Hz, Floor noise
Vert.	9648.000	AV	39.69	38.98	10.19	43.16	2.26	47.96	53.9	5.9	272	20	VBW: 300 Hz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

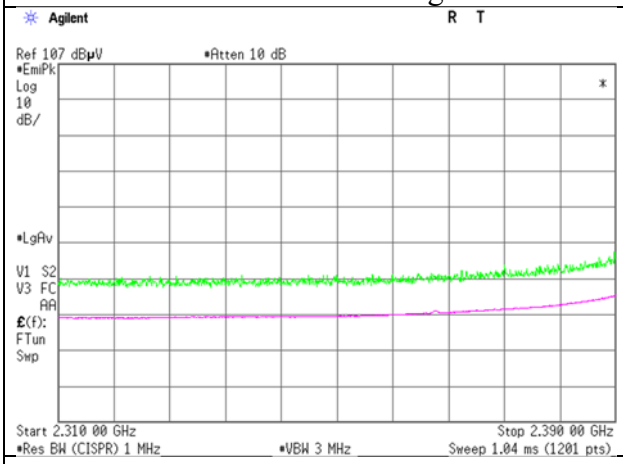
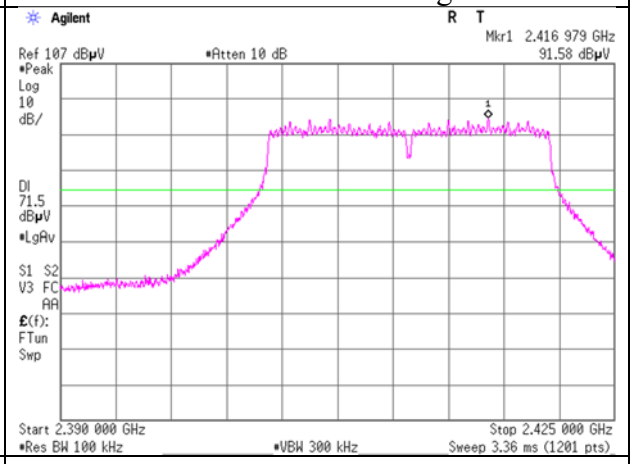
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

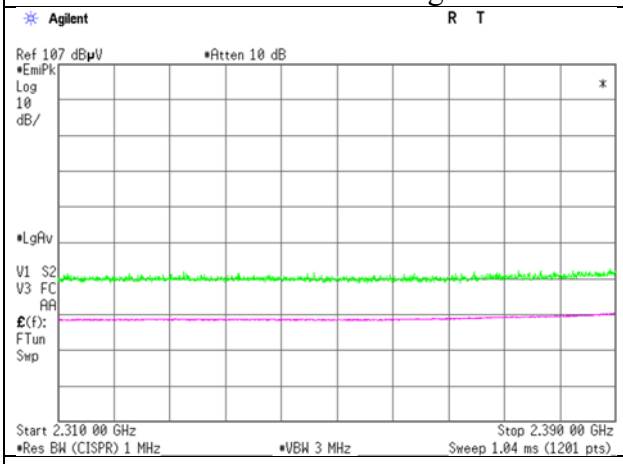
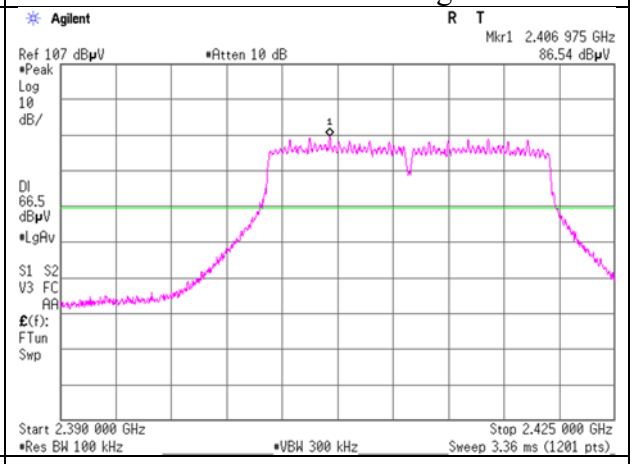
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	91.55	28.15	14.59	41.64	2.26	94.91	-	-	Carrier
Hori.	2400.000	PK	57.94	28.17	14.58	41.64	2.26	61.31	74.9	13.5	-
Vert.	2412.000	PK	86.54	28.15	14.59	41.64	2.26	89.90	-	-	Carrier
Vert.	2400.000	PK	52.66	28.17	14.58	41.64	2.26	56.03	69.9	13.8	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	June 11, 2022
Temperature / Humidity	25 deg.C, 52 %RH
Engineer	Miku Ikudome
	(1 GHz -2.8 GHz)
Mode	Tx 11n-20 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20 dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20 dBc Plot

* 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

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	June 11, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Kouki Yamada	Hiromasa Sato
	(1 GHz -10 GHz)	(10 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx 11n-20 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	53.11	31.63	7.30	42.84	2.26	51.46	73.9	22.4	162	302	-
Hori.	7311.000	PK	47.25	37.45	8.96	43.51	2.26	52.41	73.9	21.4	150	0	-
Hori.	9748.000	PK	49.75	39.17	10.22	43.04	2.26	58.36	73.9	15.5	265	36	-
Hori.	4874.000	AV	45.92	31.63	7.30	42.84	2.26	44.27	53.9	9.6	162	302	VBW: 300 Hz
Hori.	7311.000	AV	36.84	37.45	8.96	43.51	2.26	42.00	53.9	11.9	150	0	VBW: 300 Hz, Floor noise
Hori.	9748.000	AV	40.74	39.17	10.22	43.04	2.26	49.35	53.9	**4.5**	265	36	VBW: 300 Hz
Vert.	4874.000	PK	51.25	31.63	7.30	42.84	2.26	49.60	73.9	24.3	134	338	-
Vert.	7311.000	PK	47.19	37.45	8.96	43.51	2.26	52.35	73.9	21.5	150	0	-
Vert.	9748.000	PK	49.71	39.17	10.22	43.04	2.26	58.32	73.9	15.5	254	22	-
Vert.	4874.000	AV	41.64	31.63	7.30	42.84	2.26	39.99	53.9	13.9	134	338	VBW: 300 Hz
Vert.	7311.000	AV	36.76	37.45	8.96	43.51	2.26	41.92	53.9	11.9	150	0	VBW: 300 Hz, Floor noise
Vert.	9748.000	AV	38.98	39.17	10.22	43.04	2.26	47.59	53.9	6.3	254	22	VBW: 300 Hz

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

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

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

Radiated Spurious Emission

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	June 11, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	25 deg.C, 52 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Miku Ikudome	Kouki Yamada	Hiromasa Sato
	(1 GHz -10 GHz)	(10 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx 11n-20 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	55.32	28.08	14.68	41.68	2.26	58.66	73.9	15.2	127	16	-
Hori.	4924.000	PK	53.61	31.71	7.32	42.81	2.26	52.09	73.9	21.8	118	303	-
Hori.	7386.000	PK	49.92	37.56	9.01	43.59	2.26	55.16	73.9	18.7	150	0	-
Hori.	9848.000	PK	49.89	39.15	10.27	42.91	2.26	58.66	73.9	15.2	100	70	-
Hori.	2483.500	AV	43.35	28.08	14.68	41.68	2.26	46.69	53.9	7.2	127	16	VBW: 300 Hz
Hori.	4924.000	AV	45.29	31.71	7.32	42.81	2.26	43.77	53.9	10.1	118	303	VBW: 300 Hz
Hori.	7386.000	AV	36.74	37.56	9.01	43.59	2.26	41.98	53.9	11.9	150	0	VBW: 300 Hz, Floor noise
Hori.	9848.000	AV	37.92	39.15	10.27	42.91	2.26	46.69	53.9	7.2	100	70	VBW: 300 Hz
Vert.	2483.500	PK	49.01	28.08	14.68	41.68	2.26	52.35	73.9	21.5	147	26	-
Vert.	4924.000	PK	52.34	31.71	7.32	42.81	2.26	50.82	73.9	23.0	105	331	-
Vert.	7386.000	PK	49.00	37.56	9.01	43.59	2.26	54.24	73.9	19.6	150	0	-
Vert.	9848.000	PK	50.32	39.15	10.27	42.91	2.26	59.09	73.9	14.8	216	304	-
Vert.	2483.500	AV	37.33	28.08	14.68	41.68	2.26	40.67	53.9	13.2	147	26	VBW: 300 Hz
Vert.	4924.000	AV	40.50	31.71	7.32	42.81	2.26	38.98	53.9	14.9	105	331	VBW: 300 Hz
Vert.	7386.000	AV	36.69	37.56	9.01	43.59	2.26	41.93	53.9	11.9	150	0	VBW: 300 Hz, Floor noise
Vert.	9848.000	AV	38.48	39.15	10.27	42.91	2.26	47.25	53.9	**6.6**	216	304	VBW: 300 Hz

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

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

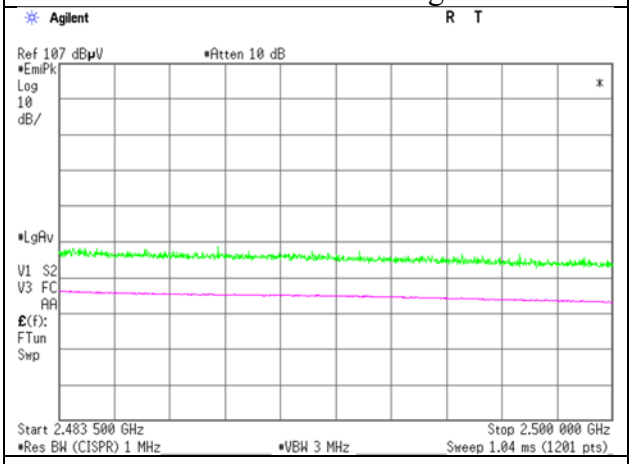
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	June 11, 2022
Temperature / Humidity	25 deg.C, 52 %RH
Engineer	Miku Ikudome
	(1 GHz -10 GHz)
Mode	Tx 11n-20 2462 MHz

Horizontal

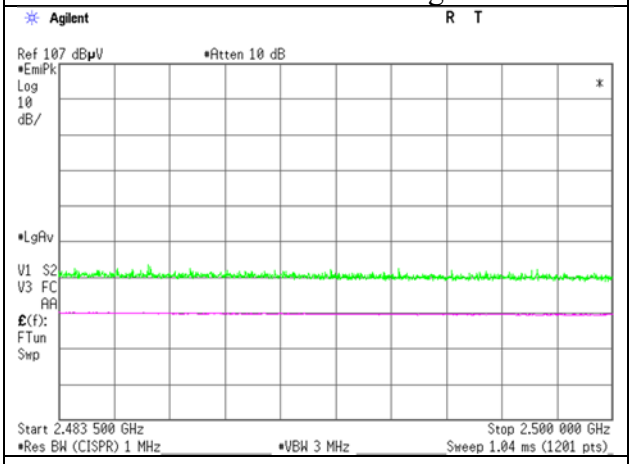
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

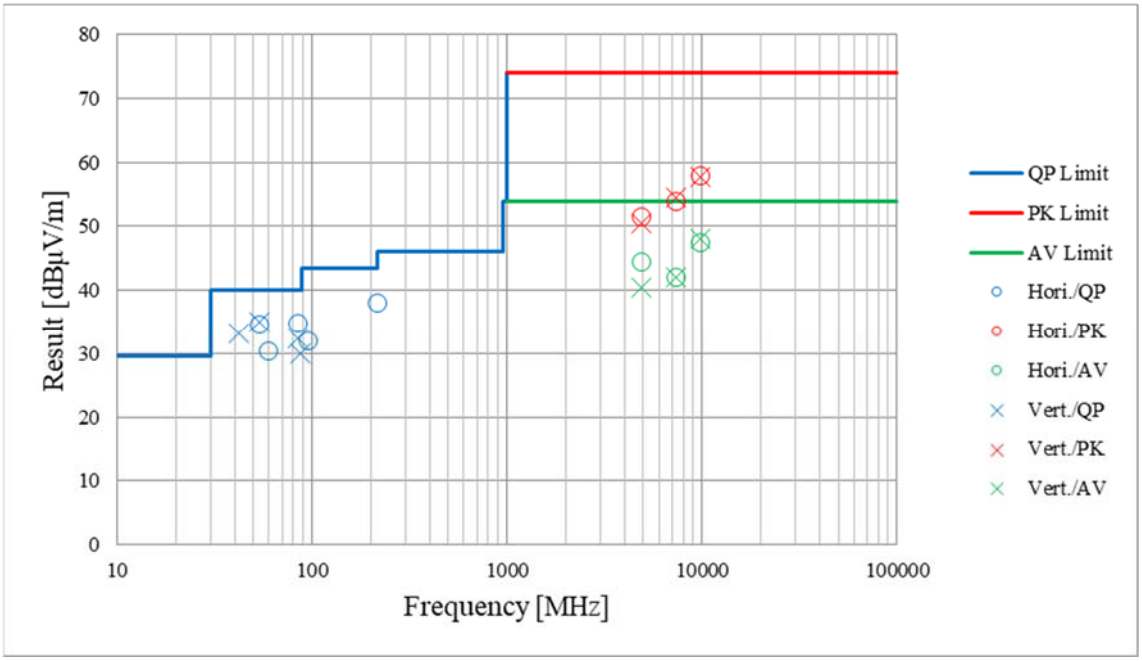


Trace Green : Peak Plot
Trace Purple : Average Plot

* 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 mode for Maximum Peak Output Power)

Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	1	3	3	3	3
Date	June 19, 2022	June 11, 2022	June 10, 2022	June 16, 2022	June 17, 2022
Temperature / Humidity	22 deg.C, 59 %RH	25 deg.C, 52 %RH	24 deg.C, 48 %RH	25 deg.C, 41 %RH	23 deg.C, 50 %RH
Engineer	Yasumasa Owaki	Miku Ikudome	Yosuke Murakami	Kouki Yamada	Hiromasa Sato
	(30 MHz -1 GHz)	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx 11g 2437 MHz				



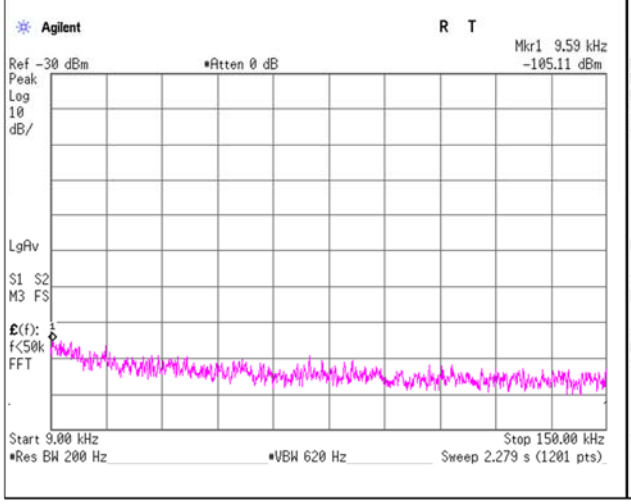
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

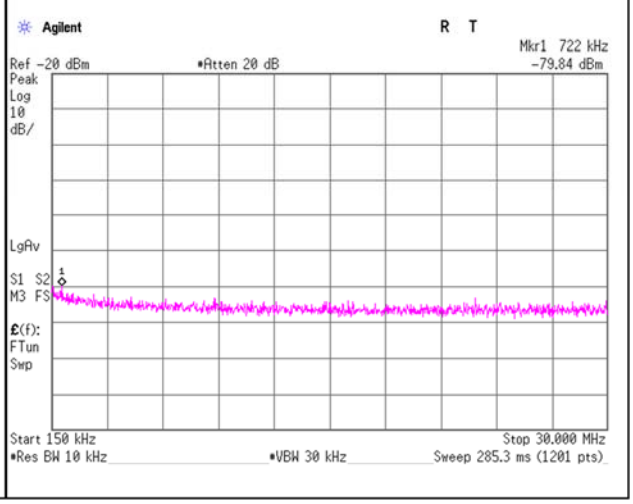
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 20, 2022
Temperature / Humidity	24 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx 11g, 2437 MHz (worst power mode)

Tx, 2437 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain * [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.59	-105.1	1.1	9.7	2.0	1.0	-92.3	300	6.0	-31.0	47.9	78.9	-
722.00	-79.8	1.1	9.7	2.0	1.0	-67.0	30	6.0	14.3	30.4	16.1	-

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

Power Density

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	June 20, 2022
Temperature / Humidity	24 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx

11b

Frequency [MHz]	Measured Frequency [MHz]	Reading [dBm/3 kHz]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm/3 kHz]	Limit [dBm/3 kHz]	Margin [dB]
2412	2412.838	-20.58	1.92	9.82	-8.84	8.00	16.84
2437	2437.898	-20.47	1.93	9.82	-8.72	8.00	16.72
2462	2462.898	-20.67	1.93	9.82	-8.92	8.00	16.92

11g

Frequency [MHz]	Measured Frequency [MHz]	Reading [dBm/3 kHz]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm/3 kHz]	Limit [dBm/3 kHz]	Margin [dB]
2412	2416.088	-26.43	1.92	9.82	-14.69	8.00	22.69
2437	2441.088	-26.37	1.93	9.82	-14.62	8.00	22.62
2462	2465.465	-27.34	1.93	9.82	-15.59	8.00	23.59

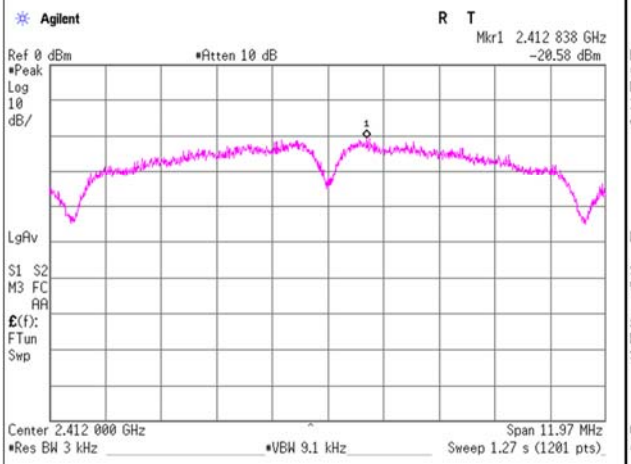
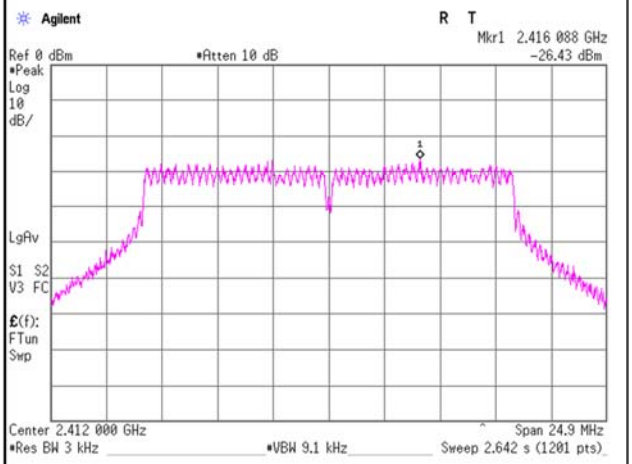
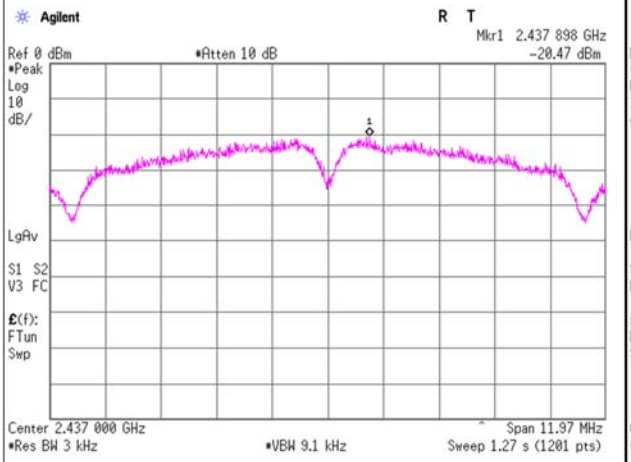
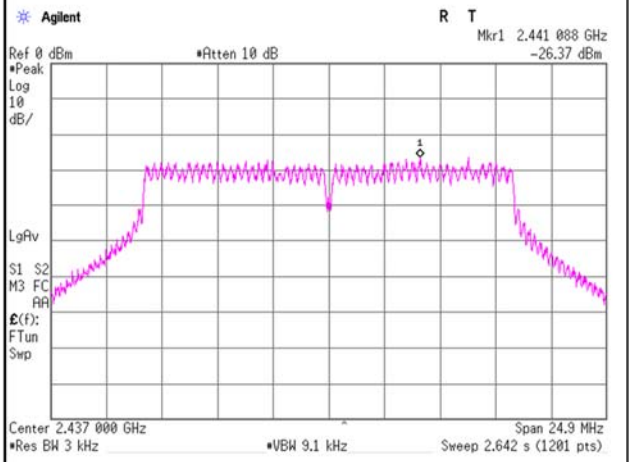
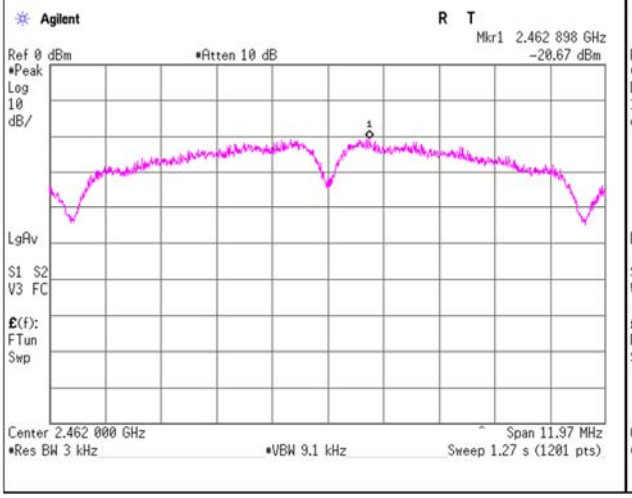
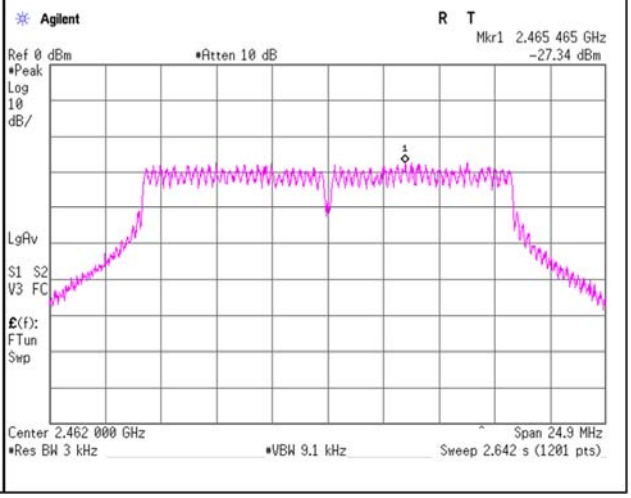
11n-20 (SISO)

Frequency [MHz]	Measured Frequency [MHz]	Reading [dBm/3 kHz]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm/3 kHz]	Limit [dBm/3 kHz]	Margin [dB]
2412	2418.319	-27.94	1.92	9.82	-16.20	8.00	24.20
2437	2441.984	-27.70	1.93	9.82	-15.95	8.00	23.95
2462	2466.984	-27.65	1.93	9.82	-15.90	8.00	23.90

Sample Calculation:

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

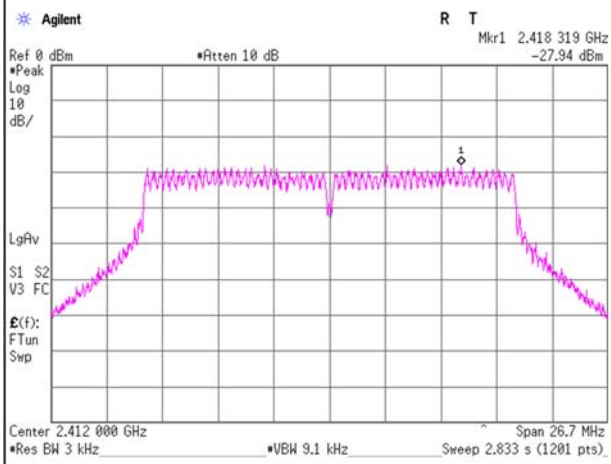
Power Density

11b, 2 Mbps	11g, 48 Mbps
2412 MHz	2412 MHz
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz
	

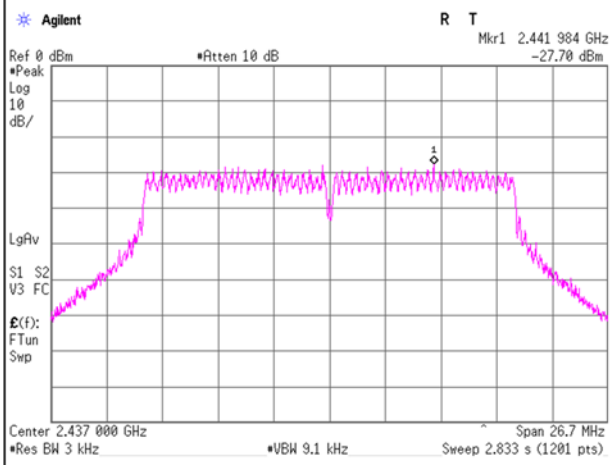
Power Density

11n-20 (SISO), MCS 4(Long G.I.)

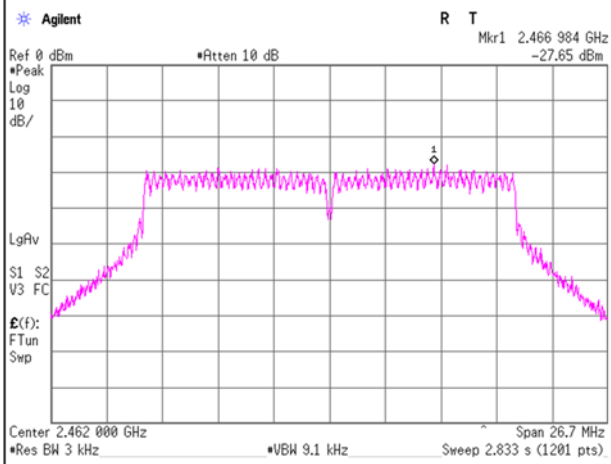
2412 MHz



2437 MHz



2462 MHz



APPENDIX 2: Test Instruments

Test Equipment (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2021/09/14	12
AT	SAT10-14	154591	Attenuator	Weinschel Corp.	54A-10	81595	2022/04/01	12
AT	SCC-G12	145040	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	2022/03/02	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
AT	SPM-06	146267	Power Meter	Anritsu Corporation	ML2495A	850009	2022/05/24	12
AT	SPSS-03	146309	Power sensor	Anritsu Corporation	MA2411B	917063	2022/05/24	12
AT	SSA-03	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2021/08/09	12
AT	STM-G11	204923	Terminator	Weinschel - API Technologies Corp	M1459A	110101	2022/02/21	12
RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3 (RE,CE,ME,PE)	-	-	-
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2021/12/10	12
RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
RE	KSA-08	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2021/10/13	12
RE	SAEC-01 (NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2022/04/11	12
RE	SAEC-03 (NSA)	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2022/04/15	12
RE	SAEC-03 (SVSWR)	145566	Semi-Anechoic Chamber	TDK	SAEC-03 (SVSWR)	3	2022/05/18	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2022/02/24	12
RE	SAF-06	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2022/02/04	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2022/03/03	12
RE	SAT10-05	145136	Attenuator	Keysight Technologies Inc	8493C-010	74864	2021/10/07	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2021/08/16	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032664	2022/04/16	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269 (RF Selector)	2022/04/20	12

Test Equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269 (RF Selector)	2022/04/20	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2022/03/03	12
RE	SCC-G40	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2022/01/06	12
RE	SCC-G43	156380	Coaxial Cable	Huber+Suhner	SUCOFLEX_104_E	SN MY 13406/4E	2022/05/20	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2022/05/12	12
RE	SCC-G58	183047	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	800287/4A	2022/05/20	12
RE	SCC-G70	200010	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575618/4	2021/07/06	12
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2021/10/07	12
RE	SHA-03	145501	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-739	2022/03/16	12
RE	SHA-04	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2022/06/06	12
RE	SHA-10	194685	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	711	2022/03/16	12
RE	SJM-22	207279	Measuring Tool, Tape Measure	ASKUL	-	-	-	-
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	193	2022/04/16	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
RE	SOS-23	191840	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
RE	STR-08	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2022/03/02	12
RE	STS-01	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2021/09/14	12
RE	STS-03	146210	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997823	2021/09/14	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
AT: Antenna Terminal Conducted