



RADIO TEST REPORT

Test Report No. : 12322067S-G-R2

Applicant : Canon Inc.
Type of Equipment : Communication Module
Model No. : WM601
FCC ID : AZD601
Test regulation : FCC Part 15 Subpart C: 2018
*Wireless LAN/ Bluetooth Low Energy part
Test Result : Complied (Refer to Section 3.2)

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
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6. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. 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 12322067S-G-R1. 12322067S-G-R1 is replaced with this report.

Date of test: October 15 to December 21, 2018

Representative test engineer:

Makoto Hosaka
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Approved by:

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Leader

Consumer Technology Division



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Testing
RTL02610

☐ 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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13-EM-F0429

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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	:	+81-3-5482-7283
Facsimile Number	:	+81-3-3757-8431
Contact Person	:	Tomohiro Suzuki

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No. on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the information in SECTION 2 and 4.

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Communication Module
Model No.	:	WM601
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.3 V
Receipt Date of Sample (Information from test lab.)	:	September 13, 2018
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: WM601 (referred to as the EUT in this report) is a Communication Module.

Radio Specification

WLAN (IEEE 802.11 b/g/n)

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS DBPSK / DQPSK / CCK OFDM BPSK / QPSK / 16 - QAM / 64 - QAM
Antenna type	:	Meander antenna
Antenna Gain	:	1.67 dBi
Clock frequency (Maximum)	:	37.4 MHz Crystal Oscillator embedded

Bluetooth (BR / EDR, Bluetooth LE, Version 4.2)

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS GFSK / $\pi/4$ - DQPSK / 8 - DPSK GFSK
Antenna type	:	Meander antenna
Antenna Gain	:	1.67 dBi
Clock frequency (Maximum)	:	37.4 MHz Crystal Oscillator embedded

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	14.6 dB 24.37530 MHz, AV, N, Tx 11n-20 2412 MHz	Complied a)	-
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05 ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-247 5.2(a)	See data.	Complied b)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- IC: RSS-247 5.4(d)		Complied c)	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05 ----- IC: -	FCC: Section 15.247(e) ----- IC: RSS-247 5.2(b)		Complied d)	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05 ----- IC: RSS-Gen 6.13	FCC: Section15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	2.9 dB 9608.00 MHz, AV, Hori. Tx BT LE 2402 MHz 9608.00 MHz, AV, Vert. Tx BT LE 2402 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 v05 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 Antenna requirement

The antenna is not removable from the EUT. 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	RSS-Gen 6.7	IC: -	N/A	Complied b)	Conducted

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

b) 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

EMI

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

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

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Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.5 dB	2.5 dB	2.5 dB	2.6 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.9 dB	4.8 dB	4.9 dB	-	-
	200 MHz-1 GHz	6.1 dB	6.1 dB	6.1 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 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	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

3.5 Test Location

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JAB Accreditation No. RTL02610
FCC Test Firm Registration Number: 839876

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 E.U.T. 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.

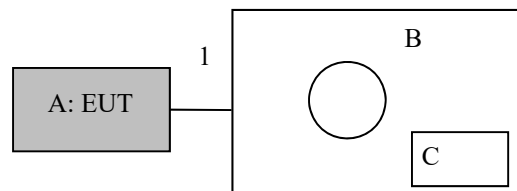
Mode	Remarks*
Tx (Transmitting), IEEE 802.11b (11b)	11 Mbps, PN9
Tx (Transmitting), IEEE 802.11g (11g)	6 Mbps, PN9
Tx (Transmitting), IEEE 802.11n 20 MHz BW (11n-20)	MCS 0, PN9
Tx (Transmitting), Bluetooth Low Energy (BT LE)	Maximum Packet Size, PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b = 8 dBm, 11g = 8 dBm, 11n-20 = 7 dBm, BT LE = 5 dBm Software: RF test ver 7.13.52.6 (WLAN) RF test ver BCM4343WA1_001.002.009.0063.0326_5p5dBm (BLE)	
*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)

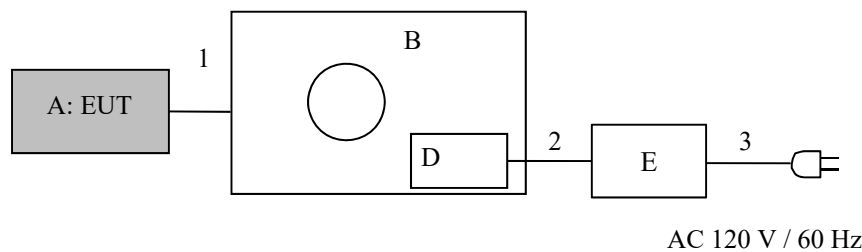
Test Item	Operating Mode	Tested frequency
Conducted Emission	Tx 11n-20	2412 MHz
	Tx BT LE	2402 MHz
		2440 MHz
		2480 MHz
Radiated Spurious Emission	Tx 11b	2412 MHz
	Tx 11g	2437 MHz
	Tx 11n-20	2462 MHz
	Tx BT LE	2402 MHz
		2440 MHz
		2480 MHz
Conducted Spurious Emission	Tx 11n-20	2412 MHz
	Tx BT LE	2402 MHz
		2440 MHz
		2480 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	Tx 11b	2412 MHz
	Tx 11g	2437 MHz
	Tx 11n-20	2462 MHz
	Tx BT LE	2402 MHz
		2440 MHz
		2480 MHz

4.2 Configuration and peripherals

Antenna Terminal conducted test and Radiated Emission test



Conducted Emission test



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication Module	WM601	2 *1) 13 *2)	Canon	EUT
B	Digital Camera	PC2328	001049000041 *1) 003049000049 *2)	Canon	-
C	Battery Pack	LP-E12	-	Canon	-
D	DC Coupler	DR-E12	-	Canon	-
E	AC Adapter	CA-PS700	-	Canon	-

*1) Used for Antenna Terminal conducted test

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

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.15	Unshielded	Unshielded	-
2	DC Cable	2.0	Unshielded	Unshielded	-
3	AC Cable	2.0	Unshielded	Unshielded	-

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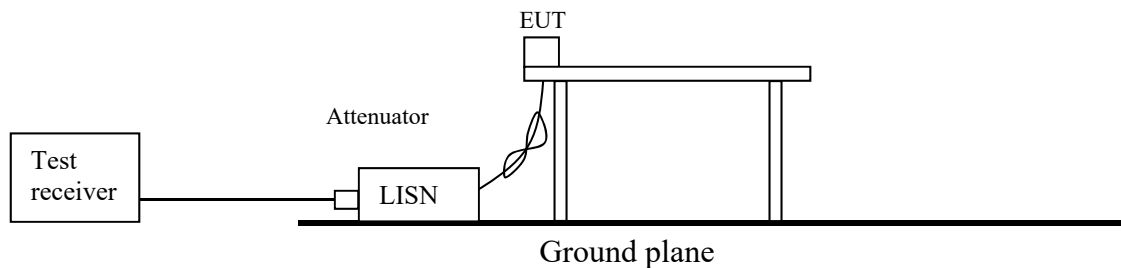
Facsimile : +81 463 50 6401

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.



For the tests on EUT with other peripherals (as a whole system)

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 in a Shielded room.

The EUT 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

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 v05".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 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 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

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(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

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	11.12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz BW: 300 kHz

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

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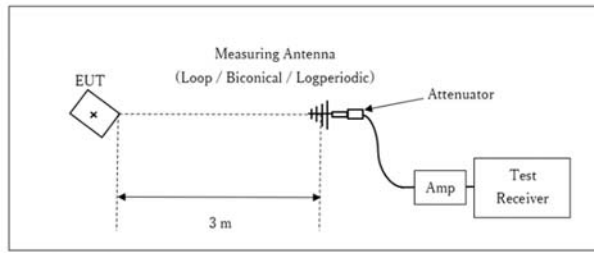
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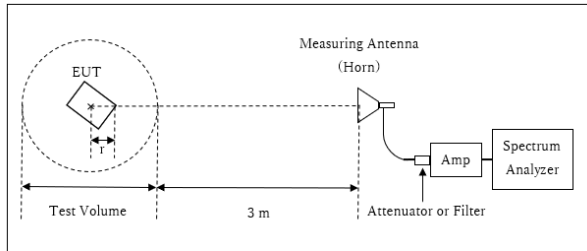
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log (3.99 \text{ m}^*/3.0 \text{ m}) = 2.48 \text{ dB}$

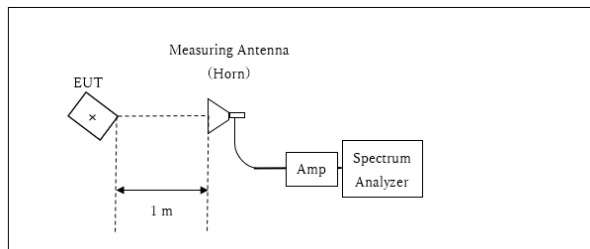
* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.99 \text{ m}$

Test Volume: 2 m

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

$r = 0.01 \text{ m}$

13 GHz - 26.5 GHz



x : Center of turn table

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

*Test Distance: 1 m

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

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz – 2.8 GHz)	Spurious (2.8 GHz – 13 GHz)	Spurious (13 GHz – 18 GHz)	Spurious (18 GHz – 26.5 GHz)
Horizontal	Y	Z	X	X	Y	X
Vertical	Z	X	Z	Z	Y	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
6dB 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 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	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 30 MHz, 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)							

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

Test data : APPENDIX

Test result : Pass

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APPENDIX 1: Test data

Conducted Emission

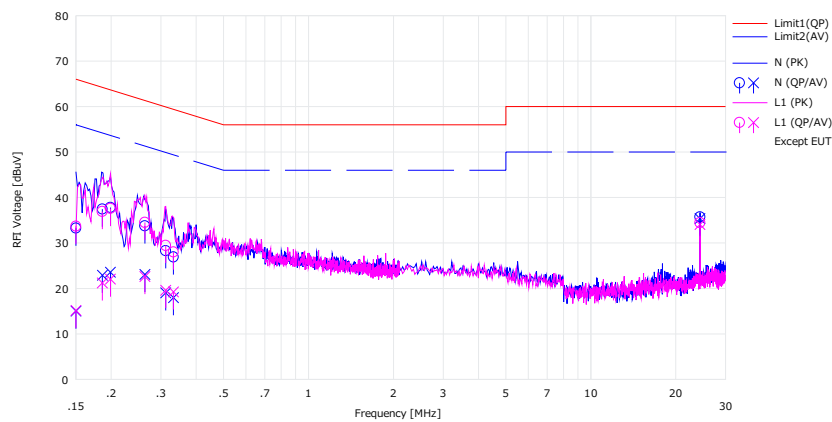
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2018/11/26

Mode : Tx_11n-20_2412 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 19 deg.C / 41 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yosuke Ishikawa



No.	Freq. [MHz]	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	20.83	2.60	9.54	2.88	33.25	15.02	66.00	56.00	32.7	40.9	N	
2	0.18612	25.00	10.46	9.56	2.88	37.44	22.90	64.20	54.20	26.7	31.3	N	
3	0.19871	25.34	11.12	9.57	2.89	37.80	23.58	63.70	53.70	25.9	30.1	N	
4	0.26328	21.29	10.64	9.57	2.89	33.75	23.10	61.30	51.30	27.5	28.2	N	
5	0.31197	15.84	6.57	9.55	2.90	28.29	19.02	59.90	49.90	31.6	30.8	N	
6	0.33235	14.44	5.51	9.56	2.90	26.90	17.97	59.40	49.40	32.5	31.4	N	
7	24.37530	22.14	21.77	9.96	3.62	35.72	35.35	60.00	50.00	24.2	14.6	N	
8	0.15000	21.26	2.74	9.54	2.88	33.68	15.16	66.00	56.00	32.3	40.8	L1	
9	0.18597	24.47	8.75	9.56	2.88	36.91	21.19	64.20	54.20	27.2	33.0	L1	
10	0.19874	25.12	9.61	9.57	2.89	37.58	22.07	63.70	53.70	26.1	31.6	L1	
11	0.26311	22.05	10.17	9.57	2.89	34.51	22.63	61.30	51.30	26.7	28.6	L1	
12	0.31186	16.98	7.14	9.55	2.90	29.43	19.59	59.90	49.90	30.4	30.3	L1	
13	0.33235	15.54	6.79	9.56	2.90	28.00	19.25	59.40	49.40	31.4	30.1	L1	
14	24.37450	20.86	20.49	9.96	3.62	34.44	34.07	60.00	50.00	25.5	15.9	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN) = SLS-01

Conducted Emission

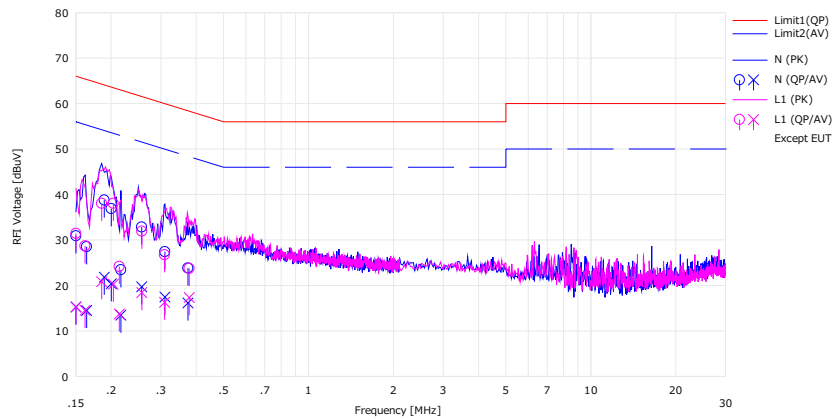
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2018/11/26

Mode : Tx BLE 2480 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 19 deg.C / 41 %RH

Limit : FCC_Part 15 Subpart C(15.207)

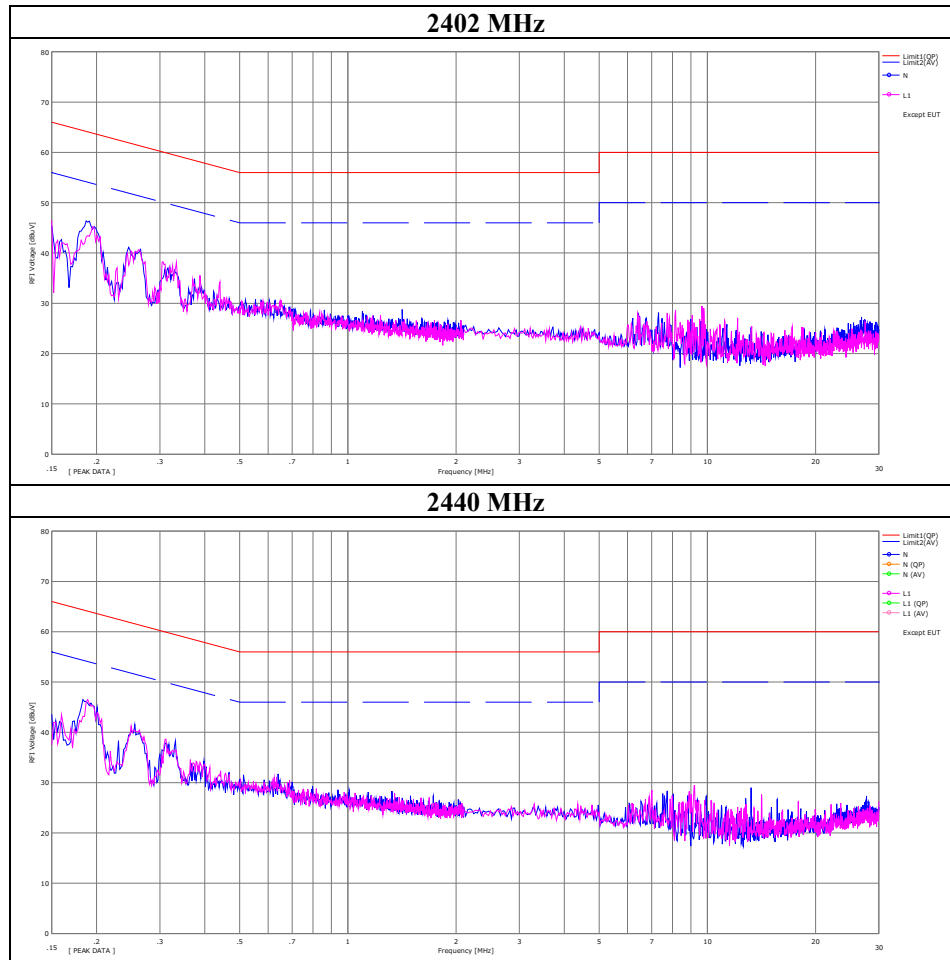
Engineer : Yosuke Ishikawa



No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		[dBP]	[dBA]			[dBP]	[dBA]	[dBP]	[dBA]	[dBP]	[dBA]		
1	0.15000	18.46	2.84	9.54	2.88	30.88	15.26	66.00	56.00	35.1	40.7	N	
2	0.16373	16.08	2.07	9.56	2.88	28.51	14.50	65.30	55.30	36.7	40.8	N	
3	0.18912	26.33	9.36	9.56	2.88	38.77	21.80	64.10	54.10	25.3	32.3	N	
4	0.20011	24.41	7.90	9.57	2.89	36.87	20.36	63.60	53.60	26.7	33.2	N	
5	0.21629	10.97	1.00	9.57	2.89	23.43	13.46	63.00	53.00	39.5	39.5	N	
6	0.25645	20.35	7.24	9.58	2.89	32.82	19.71	61.50	51.50	28.6	31.7	N	
7	0.30991	14.96	4.99	9.55	2.90	27.41	17.44	60.00	50.00	32.5	32.5	N	
8	0.37415	11.33	3.67	9.56	2.91	23.80	16.14	58.40	48.40	34.6	32.2	N	
9	0.15000	19.00	2.85	9.54	2.88	31.42	15.27	66.00	56.00	34.5	40.7	L1	
10	0.16157	16.26	2.09	9.55	2.88	28.69	14.52	65.40	55.40	36.7	40.8	L1	
11	0.18511	25.59	8.36	9.56	2.88	38.03	20.80	64.30	54.30	26.2	33.5	L1	
12	0.20360	25.58	7.78	9.57	2.89	38.04	20.24	63.50	53.50	25.4	33.2	L1	
13	0.21355	11.70	1.25	9.57	2.89	24.16	13.71	63.10	53.10	38.9	39.3	L1	
14	0.25673	19.44	5.95	9.58	2.89	31.91	18.42	61.50	51.50	29.5	33.0	L1	
15	0.30914	14.28	3.85	9.55	2.90	26.73	16.30	60.00	50.00	33.2	33.7	L1	
16	0.37800	11.25	4.86	9.57	2.91	23.73	17.34	58.30	48.30	34.5	30.9	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN) = SLS-01

Conducted Emission



UL Japan, Inc.

Shonan EMC Lab.

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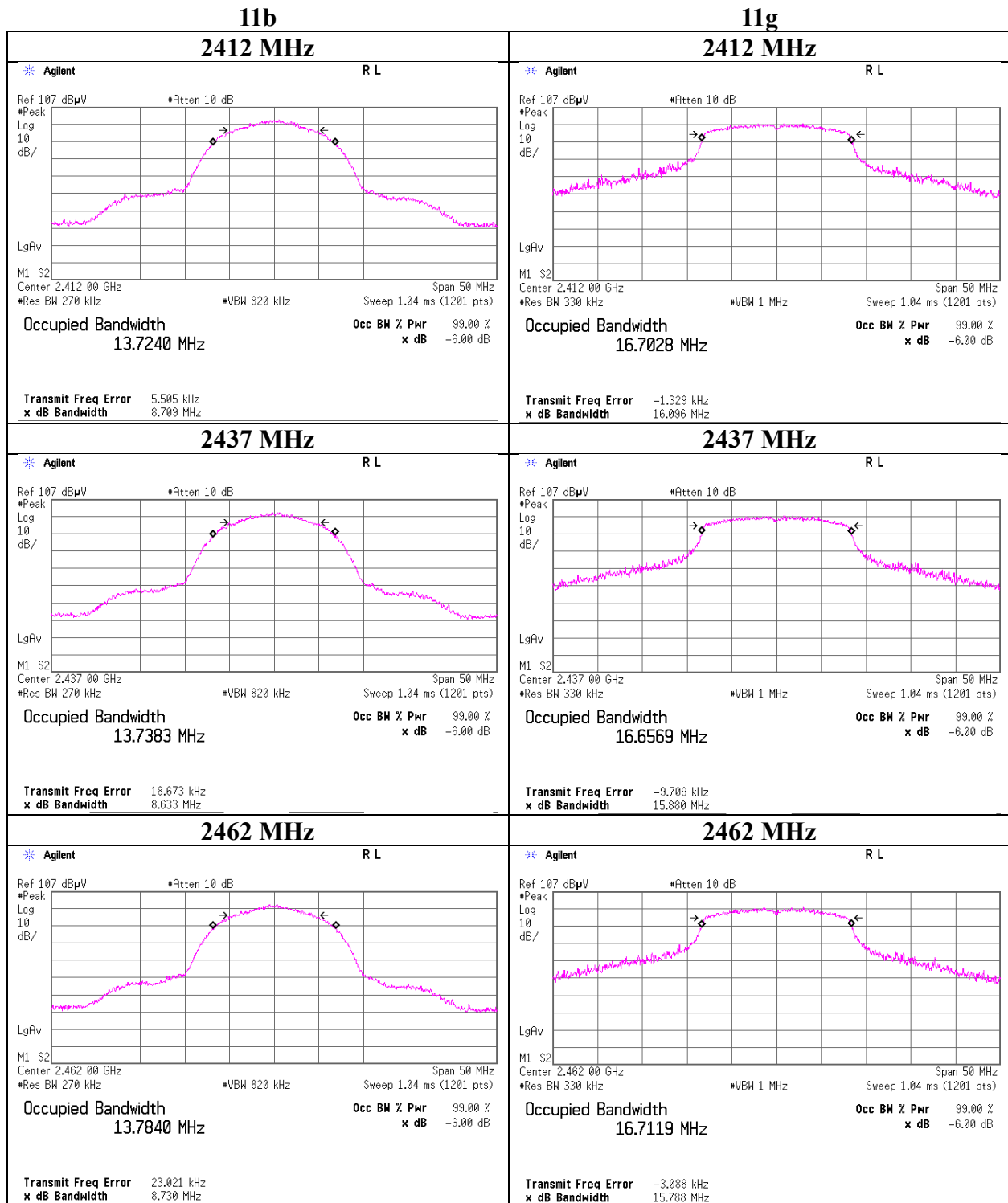
Facsimile : +81 463 50 6401

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 16, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Yosuke Ishikawa
Mode Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	13724.0	8.764	> 0.5000
	2437	13738.3	8.450	> 0.5000
	2462	13784.0	8.992	> 0.5000
11g	2412	16702.8	15.101	> 0.5000
	2437	16656.9	14.711	> 0.5000
	2462	16711.9	15.438	> 0.5000
11n-20	2412	17595.9	15.081	> 0.5000
	2437	17639.7	15.089	> 0.5000
	2462	17625.9	15.158	> 0.5000
BT LE	2402	1063.5	0.728	> 0.5000
	2440	1062.8	0.707	> 0.5000
	2480	1061.1	0.716	> 0.5000

99%Occupied Bandwidth



UL Japan, Inc.

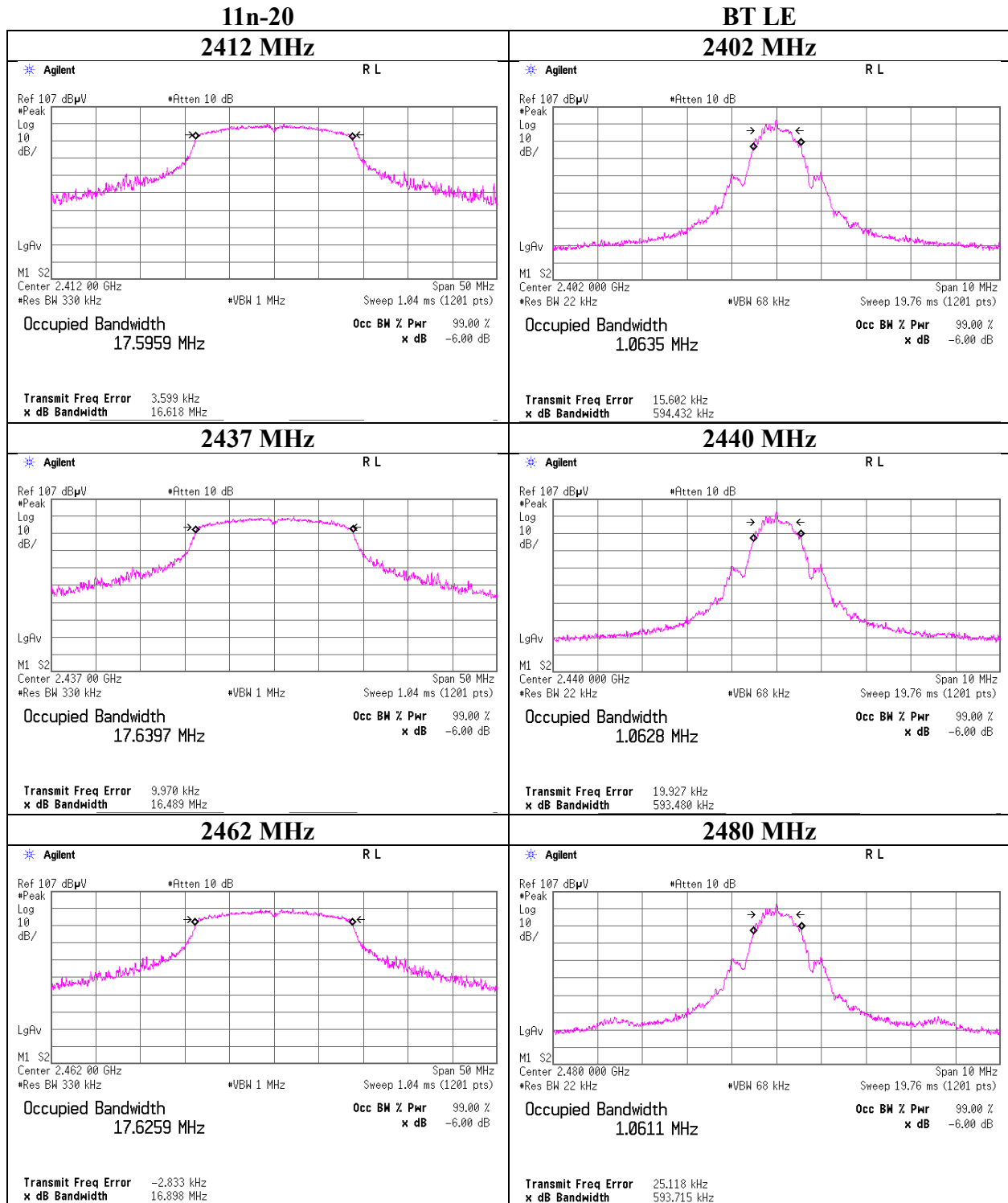
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth



UL Japan, Inc.

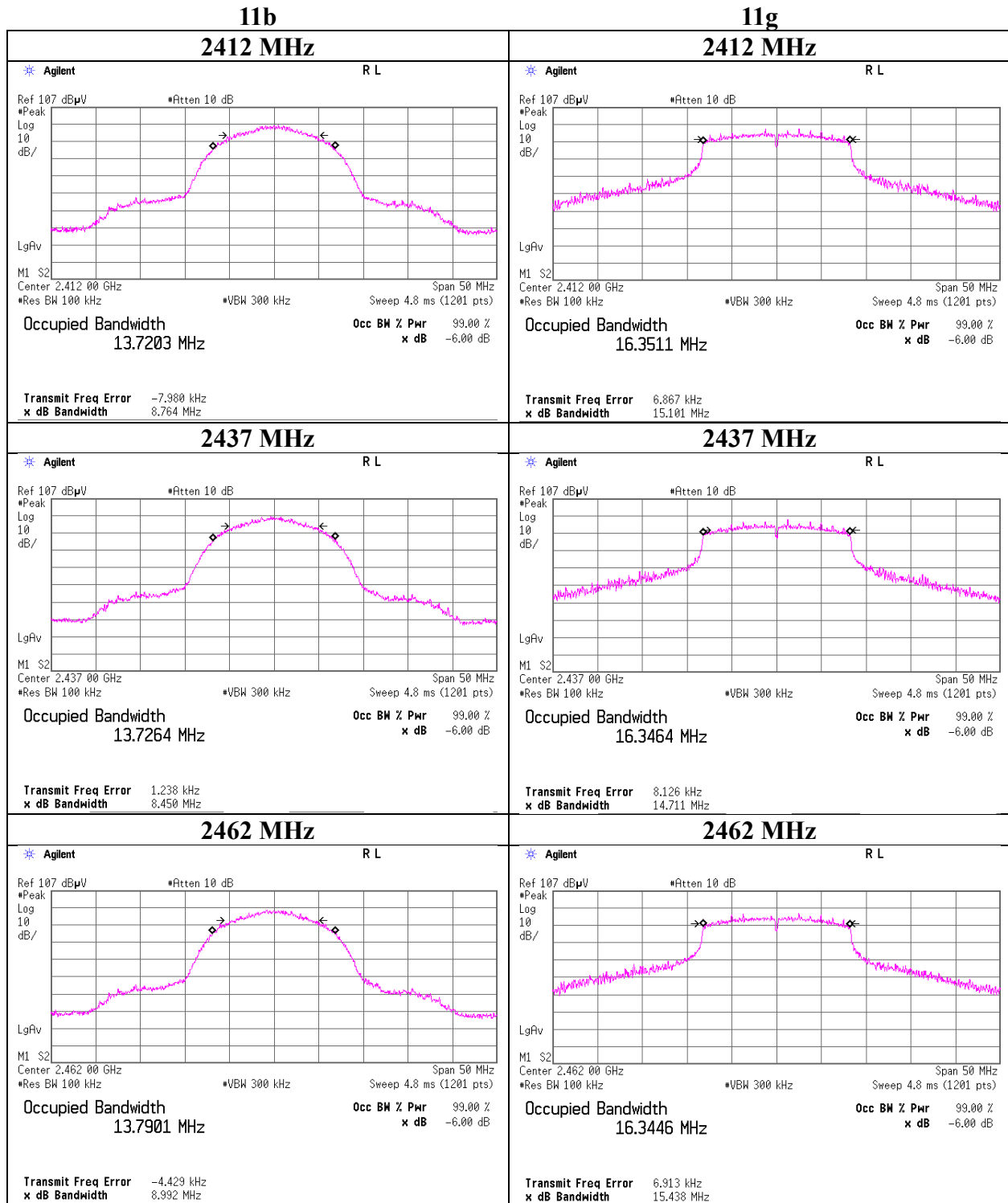
Shonan EMC Lab.

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6dB Bandwidth



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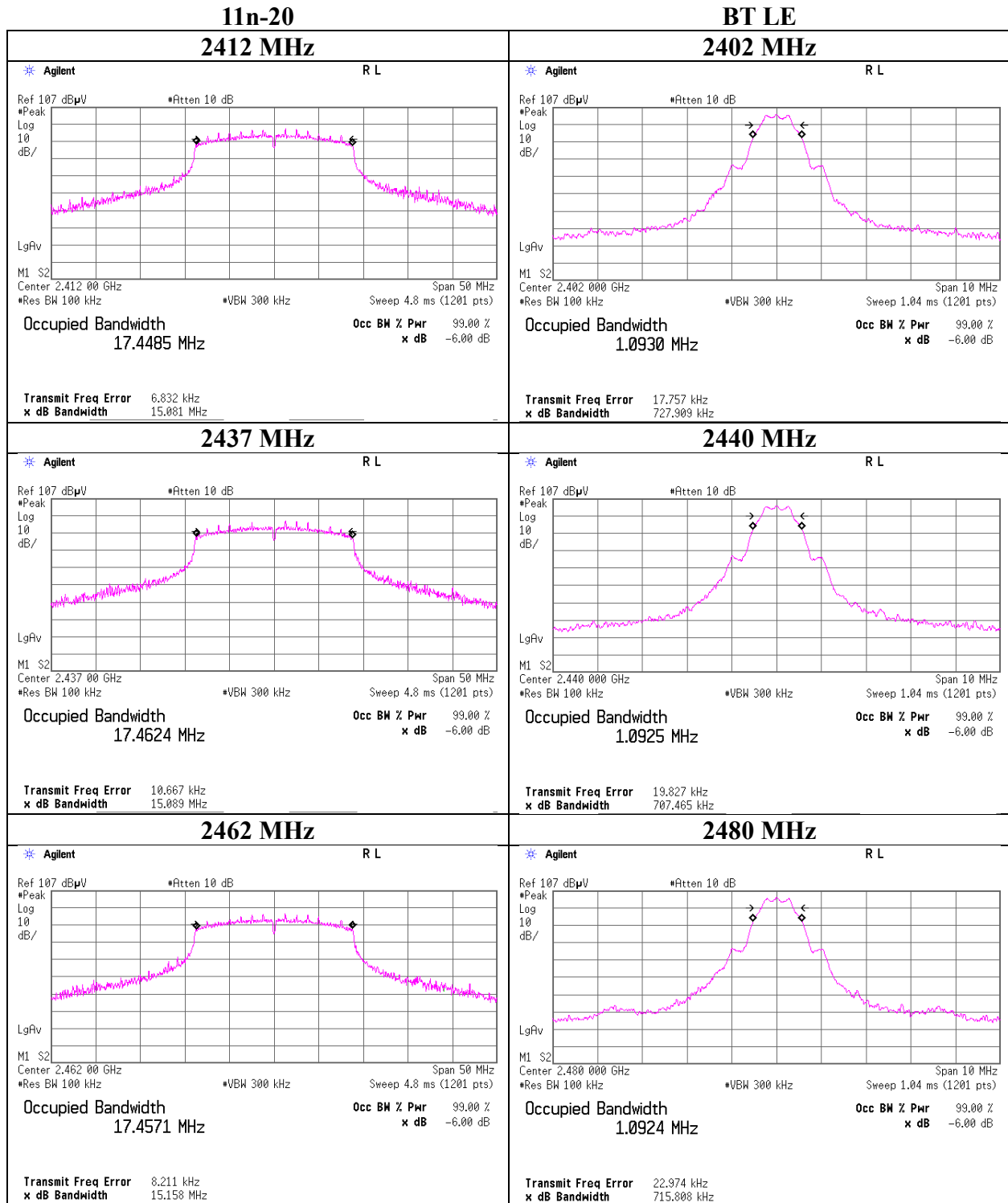
Shonan EMC Lab.

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6dB Bandwidth



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Maximum Peak Output Power

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 15, 2018
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Kazutaka Takeyama
Mode Tx 11b

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	-0.30	1.49	9.86	11.05	12.74	30.00	1000	18.95	1.67	12.72	18.71	36.02	4000	23.30
2437	-0.57	1.49	9.86	10.78	11.97	30.00	1000	19.22	1.67	12.45	17.58	36.02	4000	23.57
2462	-0.64	1.50	9.85	10.71	11.78	30.00	1000	19.29	1.67	12.38	17.30	36.02	4000	23.64

Sample Calculation:

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

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	-0.70	
2	-0.91	
5.5	-0.73	
11	-0.57	*

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 15, 2018
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Kazutaka Takeyama
Mode Tx 11g

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	5.85	1.49	9.86	17.20	52.48	30.00	1000	12.80	1.67	18.87	77.09	36.02	4000	17.15
2437	5.82	1.49	9.86	17.17	52.12	30.00	1000	12.83	1.67	18.84	76.56	36.02	4000	17.18
2462	5.60	1.50	9.85	16.95	49.55	30.00	1000	13.05	1.67	18.62	72.78	36.02	4000	17.40

Sample Calculation:

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

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	5.82	*
9	5.69	
12	5.66	
18	5.61	
24	5.70	
36	5.60	
48	5.63	
54	5.62	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 15, 2018
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Kazutaka Takeyama
Mode Tx 11n-20

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	6.00	1.49	9.86	17.35	54.33	30.00	1000	12.65	1.67	19.02	79.80	36.02	4000	17.00
2437	5.67	1.49	9.86	17.02	50.35	30.00	1000	12.98	1.67	18.69	73.96	36.02	4000	17.33
2462	5.77	1.50	9.85	17.12	51.52	30.00	1000	12.88	1.67	18.79	75.68	36.02	4000	17.23

Sample Calculation:

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

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

2437MHz

Mode	Reading	Remark
MCS	[dBm]	
0	5.67	*
1	5.65	
2	5.51	
3	5.58	
4	5.60	
5	5.47	
6	5.60	
7	5.40	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 17, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE

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]	
2402	-3.82	1.48	9.86	7.52	5.65	30.00	1000	22.48	1.67	9.19	8.30	36.02	4000	26.83
2440	-3.59	1.49	9.86	7.76	5.97	30.00	1000	22.24	1.67	9.43	8.77	36.02	4000	26.59
2480	-3.48	1.50	9.85	7.87	6.12	30.00	1000	22.13	1.67	9.54	8.99	36.02	4000	26.48

Sample Calculation:

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

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

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Average Output Power **(Reference data for SAR testing)**

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 15, 2018 October 17, 2018
Temperature / Humidity 25 deg. C / 51 % RH 25 deg. C / 46 % RH
Engineer Kazutaka Takeyama Yosuke Ishikawa
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	-3.05	1.49	9.86	8.30	6.76	0.00	8.30	6.76
2437	-3.32	1.49	9.86	8.03	6.35	0.00	8.03	6.35
2462	-3.23	1.50	9.85	8.12	6.49	0.00	8.12	6.49

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	-2.74	1.49	9.86	8.61	7.26	0.03	8.64	7.31
2437	-2.77	1.49	9.86	8.58	7.21	0.03	8.61	7.26
2462	-2.79	1.50	9.85	8.56	7.18	0.03	8.59	7.23

11n-20 MCS 0

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	-3.64	1.49	9.86	7.71	5.90	0.03	7.74	5.94
2437	-3.66	1.49	9.86	7.69	5.87	0.03	7.72	5.92
2462	-3.78	1.50	9.85	7.57	5.71	0.03	7.60	5.75

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-6.25	1.48	9.86	5.09	3.23	1.78	6.87	4.86
2440	-6.16	1.49	9.86	5.19	3.30	1.78	6.97	4.98
2480	-6.24	1.50	9.85	5.11	3.24	1.78	6.89	4.89

Sample Calculation:

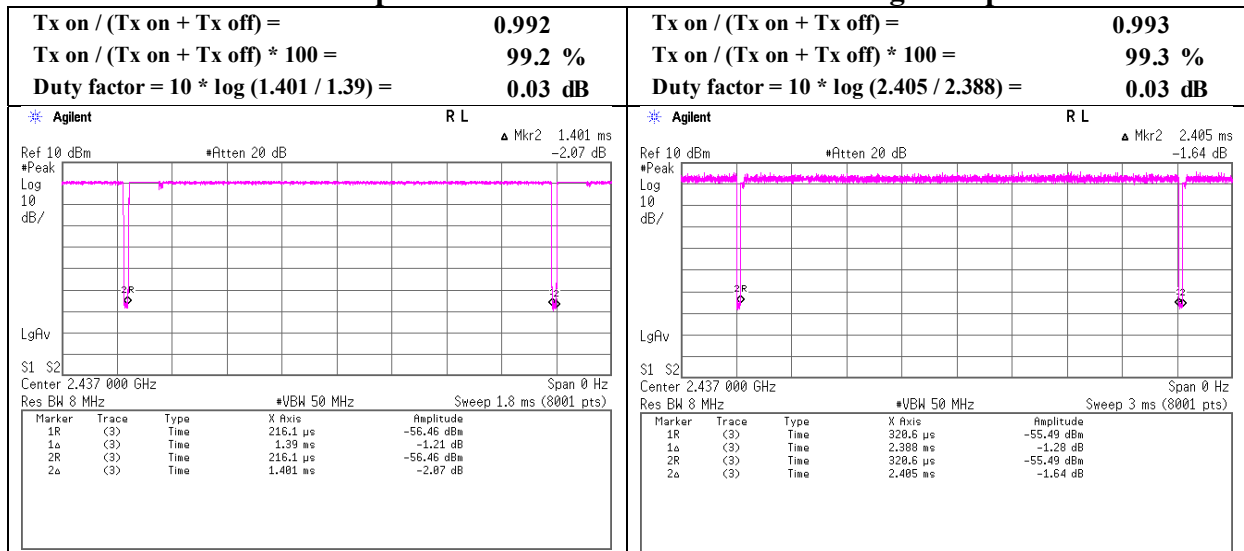
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

**The average output power was measured with the lowest order modulation and
lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.**

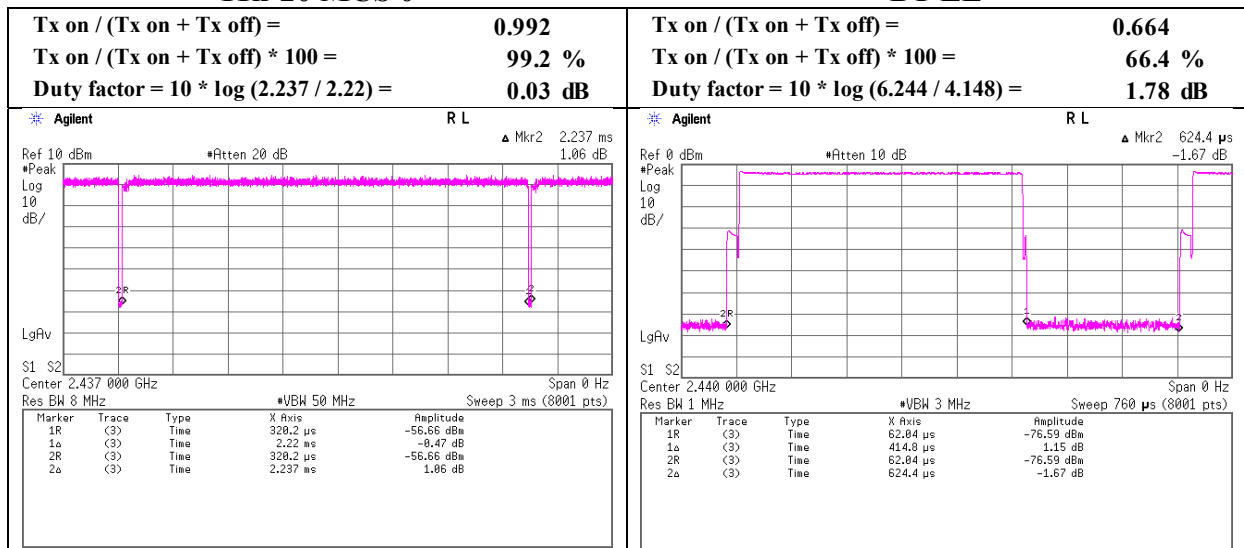
Burst rate confirmation

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 15, 2018
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Kazutaka Takeyama
Mode Tx

11b 11 Mbps



11n-20 MCS 0



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

Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	October 22, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Kazuya Noda
	(1 GHz – 2.8 GHz)	(2.8 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.	1048.120	PK	48.27	23.92	12.62	37.08	2.48	50.21	73.90	23.6	206	296	
Hori.	2390.000	PK	46.16	27.91	13.89	36.58	2.48	53.86	73.90	20.0	219	102	
Hori.	4824.000	PK	44.01	31.34	7.19	39.50	2.48	45.52	73.90	28.3	100	0	
Hori.	7236.000	PK	45.38	36.81	8.83	39.31	2.48	54.19	73.90	19.7	100	0	
Hori.	9648.000	PK	46.00	38.26	10.36	39.49	2.48	57.61	73.90	16.2	100	0	
Hori.	14472.000	PK	47.20	41.79	12.77	38.42	-9.54	53.80	73.90	20.1	136	61	
Hori.	1048.120	AV	41.68	23.92	12.62	37.08	2.48	43.62	53.90	10.2	206	296	
Hori.	2390.000	AV	35.52	27.91	13.89	36.58	2.48	43.22	53.90	10.6	219	102	
Hori.	4824.000	AV	34.41	31.34	7.19	39.50	2.48	35.92	53.90	17.9	100	0	
Hori.	7236.000	AV	34.16	36.81	8.83	39.31	2.48	42.97	53.90	10.9	100	0	
Hori.	9648.000	AV	35.00	38.26	10.36	39.49	2.48	46.61	53.90	7.2	100	0	
Hori.	14472.000	AV	39.16	41.79	12.77	38.42	-9.54	45.76	53.90	8.1	136	61	
Vert.	1048.120	PK	50.53	23.92	12.62	37.08	2.48	52.47	73.90	21.4	157	350	
Vert.	2390.000	PK	44.74	27.91	13.89	36.58	2.48	52.44	73.90	21.4	145	29	
Vert.	3617.852	PK	47.02	29.12	6.71	39.34	2.48	45.99	73.90	27.9	137	61	
Vert.	4824.000	PK	45.24	31.34	7.19	39.50	2.48	46.75	73.90	27.1	100	0	
Vert.	7236.000	PK	44.86	36.81	8.83	39.31	2.48	53.67	73.90	20.2	100	0	
Vert.	9648.000	PK	45.58	38.26	10.36	39.49	2.48	57.19	73.90	16.7	100	0	
Vert.	14472.000	PK	46.04	41.79	12.77	38.42	-9.54	52.64	73.90	21.2	136	344	
Vert.	1048.120	AV	45.13	23.92	12.62	37.08	2.48	47.07	53.90	6.8	157	350	
Vert.	2390.000	AV	34.84	27.91	13.89	36.58	2.48	42.54	53.90	11.3	145	29	
Vert.	3617.852	AV	40.34	29.12	6.71	39.34	2.48	39.31	53.90	14.5	137	61	
Vert.	4824.000	AV	35.10	31.34	7.19	39.50	2.48	36.61	53.90	17.2	100	0	
Vert.	7236.000	AV	34.67	36.81	8.83	39.31	2.48	43.48	53.90	10.4	100	0	
Vert.	9648.000	AV	36.25	38.26	10.36	39.49	2.48	47.86	53.90	6.0	100	0	
Vert.	14472.000	AV	37.91	41.79	12.77	38.42	-9.54	44.51	53.90	9.3	136	344	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

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	88.23	27.88	13.91	36.57	2.48	95.93	-	-	Carrier
Hori.	2400.000	PK	51.47	27.91	13.90	36.58	2.48	59.18	75.93	16.8	
Vert.	2412.000	PK	87.34	27.88	13.91	36.57	2.48	95.04	-	-	Carrier
Vert.	2400.000	PK	48.35	27.91	13.90	36.58	2.48	56.06	75.04	19.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

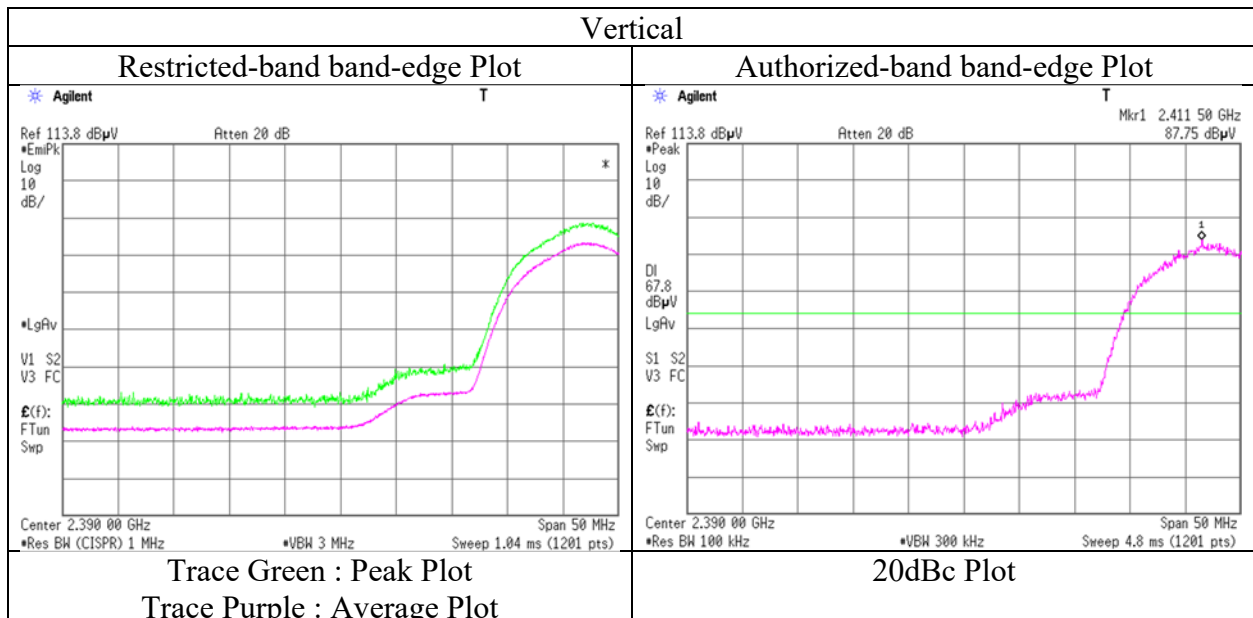
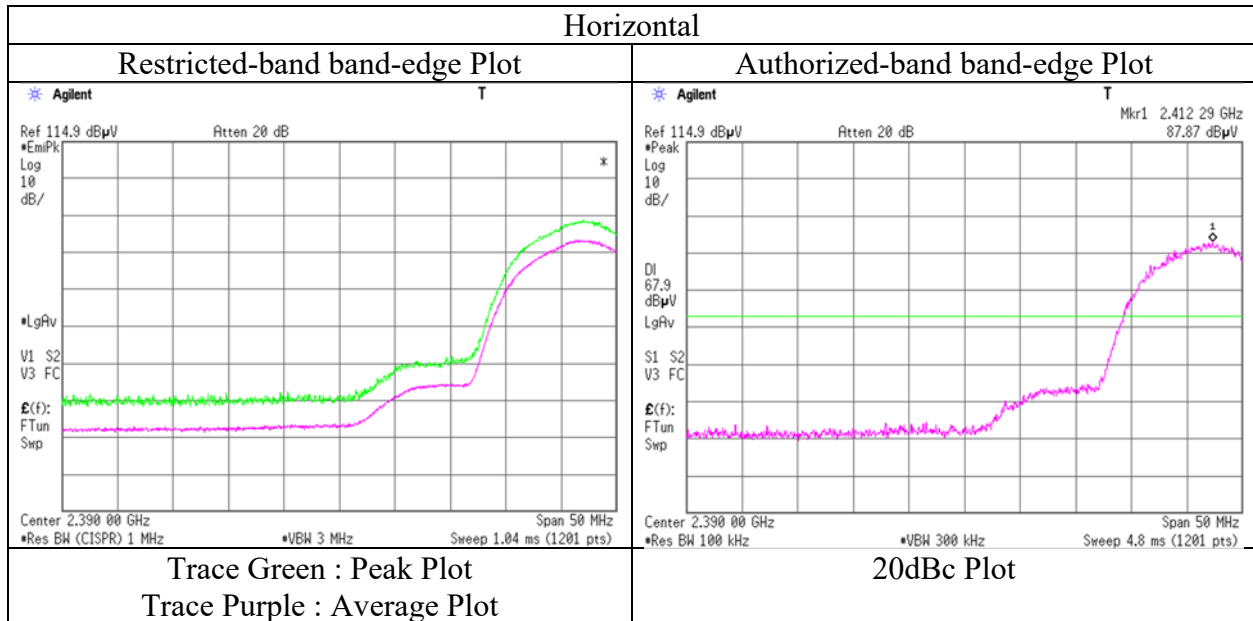
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Makoto Hosaka
	(1 GHz – 2.8 GHz)
Mode	Tx 11b 2412 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.
It is confirmed there is no emission in the range of 2310 MHz to 2390 MHz.

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Shonan EMC Lab.

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Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	October 22, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Kazuya Noda
	(1 GHz – 2.8 GHz)	(2.8 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.	1048.120	PK	48.48	23.92	12.62	37.08	2.48	50.42	73.90	23.4	200	290	
Hori.	4874.000	PK	45.80	31.22	7.24	39.50	2.48	47.24	73.90	26.6	100	0	
Hori.	7311.000	PK	44.02	36.70	8.91	39.35	2.48	52.76	73.90	21.1	100	0	
Hori.	9748.000	PK	43.89	38.56	10.36	39.42	2.48	55.87	73.90	18.0	100	0	
Hori.	14622.000	PK	45.25	41.97	12.75	38.33	-9.54	52.10	73.90	21.8	100	0	
Hori.	1048.120	AV	41.91	23.92	12.62	37.08	2.48	43.85	53.90	10.0	200	290	
Hori.	4874.000	AV	34.53	31.22	7.24	39.50	2.48	35.97	53.90	17.9	100	0	
Hori.	7311.000	AV	35.19	36.70	8.91	39.35	2.48	43.93	53.90	9.9	100	0	
Hori.	9748.000	AV	33.75	38.56	10.36	39.42	2.48	45.73	53.90	8.1	100	0	
Hori.	14622.000	AV	37.91	41.97	12.75	38.33	-9.54	44.76	53.90	9.1	100	0	
Vert.	1048.120	PK	50.11	23.92	12.62	37.08	2.48	52.05	73.90	21.8	159	349	
Vert.	3655.810	PK	47.11	29.12	6.71	39.35	2.48	46.07	73.90	27.8	138	68	
Vert.	4874.000	PK	44.54	31.22	7.24	39.50	2.48	45.98	73.90	27.9	100	0	
Vert.	7311.000	PK	44.33	36.70	8.91	39.35	2.48	53.07	73.90	20.8	100	0	
Vert.	9748.000	PK	44.60	38.56	10.36	39.42	2.48	56.58	73.90	17.3	100	0	
Vert.	14622.000	PK	45.74	41.97	12.75	38.33	-9.54	52.59	73.90	21.3	148	58	
Vert.	1048.120	AV	45.01	23.92	12.62	37.08	2.48	46.95	53.90	6.9	159	349	
Vert.	3655.810	AV	40.64	29.12	6.71	39.35	2.48	39.60	53.90	14.3	138	68	
Vert.	4874.000	AV	34.23	31.22	7.24	39.50	2.48	35.67	53.90	18.2	100	0	
Vert.	7311.000	AV	34.23	36.70	8.91	39.35	2.48	42.97	53.90	10.9	100	0	
Vert.	9748.000	AV	33.93	38.56	10.36	39.42	2.48	45.91	53.90	7.9	100	0	
Vert.	14622.000	AV	37.05	41.97	12.75	38.33	-9.54	43.90	53.90	10.0	148	58	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	October 22, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Kazuya Noda
	(1 GHz – 2.8 GHz)	(2.8 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.	1048.120	PK	49.03	23.92	12.62	37.08	2.48	50.97	73.90	22.9	202	293	
Hori.	2483.500	PK	45.49	27.67	13.96	36.52	2.48	53.08	73.90	20.8	245	111	
Hori.	4924.000	PK	45.04	31.22	7.30	39.50	2.48	46.54	73.90	27.3	100	0	
Hori.	7386.000	PK	44.02	36.75	9.01	39.39	2.48	52.87	73.90	21.0	100	0	
Hori.	9848.000	PK	44.46	38.76	10.37	39.35	2.48	56.72	73.90	17.1	100	0	
Hori.	14622.000	PK	45.25	41.97	12.75	38.33	-9.54	52.10	73.90	21.8	100	0	
Hori.	1048.120	AV	41.81	23.92	12.62	37.08	2.48	43.75	53.90	10.1	202	293	
Hori.	2483.500	AV	35.00	27.67	13.96	36.52	2.48	42.59	53.90	11.3	245	111	
Hori.	4924.000	AV	34.47	31.22	7.30	39.50	2.48	35.97	53.90	17.9	100	0	
Hori.	7386.000	AV	33.94	36.75	9.01	39.39	2.48	42.79	53.90	11.1	100	0	
Hori.	9848.000	AV	34.50	38.76	10.37	39.35	2.48	46.76	53.90	7.1	100	0	
Hori.	14622.000	AV	37.91	41.97	12.75	38.33	-9.54	44.76	53.90	9.1	100	0	
Vert.	1048.120	PK	49.99	23.92	12.62	37.08	2.48	51.93	73.90	21.9	100	351	
Vert.	2483.500	PK	44.93	27.67	13.96	36.52	2.48	52.52	73.90	21.3	159	318	
Vert.	3693.079	PK	46.84	29.23	6.70	39.35	2.48	45.90	73.90	28.0	134	73	
Vert.	4924.000	PK	44.40	31.22	7.30	39.50	2.48	45.90	73.90	28.0	100	0	
Vert.	7386.000	PK	44.12	36.75	9.01	39.39	2.48	52.97	73.90	20.9	100	0	
Vert.	9848.000	PK	45.63	38.76	10.37	39.35	2.48	57.89	73.90	16.0	100	0	
Vert.	14622.000	PK	45.74	41.97	12.75	38.33	-9.54	52.59	73.90	21.3	148	58	
Vert.	1048.120	AV	44.92	23.92	12.62	37.08	2.48	46.86	53.90	7.0	100	351	
Vert.	2483.500	AV	34.53	27.67	13.96	36.52	2.48	42.12	53.90	11.7	159	318	
Vert.	3693.079	AV	40.56	29.23	6.70	39.35	2.48	39.62	53.90	14.2	134	73	
Vert.	4924.000	AV	34.19	31.22	7.30	39.50	2.48	35.69	53.90	18.2	100	0	
Vert.	7386.000	AV	33.56	36.75	9.01	39.39	2.48	42.41	53.90	11.4	100	0	
Vert.	9848.000	AV	34.06	38.76	10.37	39.35	2.48	46.32	53.90	7.5	100	0	
Vert.	14622.000	AV	37.05	41.97	12.75	38.33	-9.54	43.90	53.90	10.0	148	58	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

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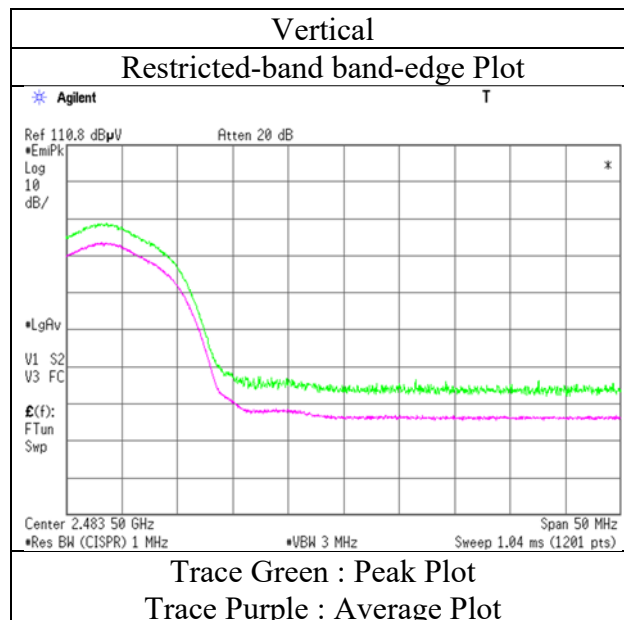
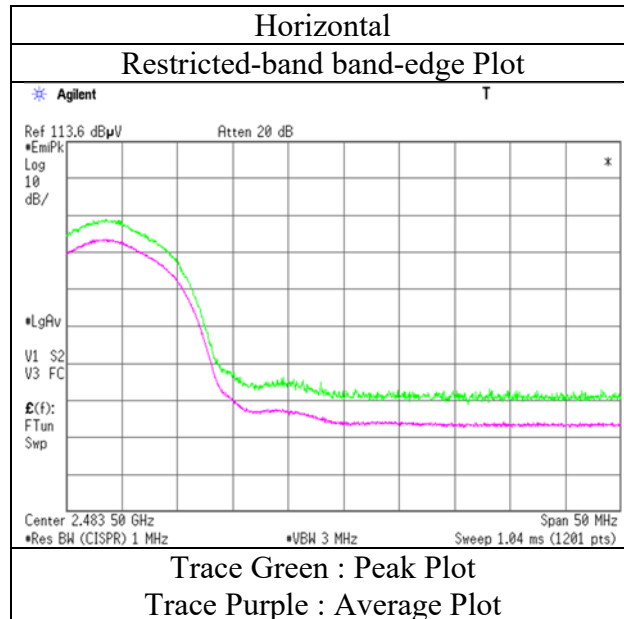
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Makoto Hosaka (1 GHz – 2.8 GHz)
Mode	Tx 11b 2462 MHz



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

Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	October 22, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Kazuya Noda
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 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.	1048.120	PK	48.90	23.92	12.62	37.08	2.48	50.84	73.90	23.0	199	292	
Hori.	2390.000	PK	57.05	27.91	13.89	36.58	2.48	64.75	73.90	9.1	220	111	
Hori.	4824.000	PK	43.89	31.34	7.19	39.50	2.48	45.40	73.90	28.5	100	0	
Hori.	7236.000	PK	45.92	36.81	8.83	39.31	2.48	54.73	73.90	19.1	100	0	
Hori.	9648.000	PK	45.75	38.26	10.36	39.49	2.48	57.36	73.90	16.5	100	0	
Hori.	14472.000	PK	48.28	43.06	11.96	38.42	-9.54	55.34	73.90	18.5	169	147	
Hori.	1048.120	AV	41.84	23.92	12.62	37.08	2.48	43.78	53.90	10.1	199	292	
Hori.	2390.000	AV	41.55	27.91	13.89	36.58	2.48	49.25	53.90	4.6	220	111	
Hori.	4824.000	AV	34.36	31.34	7.19	39.50	2.48	35.87	53.90	18.0	100	0	
Hori.	7236.000	AV	34.13	36.81	8.83	39.31	2.48	42.94	53.90	10.9	100	0	
Hori.	9648.000	AV	35.20	38.26	10.36	39.49	2.48	46.81	53.90	7.0	100	0	
Hori.	14472.000	AV	39.39	43.06	11.96	38.42	-9.54	46.45	53.90	7.4	169	147	
Vert.	1048.120	PK	49.87	23.92	12.62	37.08	2.48	51.81	73.90	22.0	161	348	
Vert.	2390.000	PK	55.42	27.91	13.89	36.58	2.48	63.12	73.90	10.7	109	334	
Vert.	3618.156	PK	47.56	29.12	6.71	39.34	2.48	46.53	73.90	27.3	149	67	
Vert.	4824.000	PK	44.54	31.34	7.19	39.50	2.48	46.05	73.90	27.8	100	0	
Vert.	7236.000	PK	45.56	36.81	8.83	39.31	2.48	54.37	73.90	19.5	100	2	
Vert.	9648.000	PK	45.14	38.26	10.36	39.49	2.48	56.75	73.90	17.1	100	0	
Vert.	14472.000	PK	48.36	43.06	11.96	38.42	-9.54	55.42	73.90	18.4	154	122	
Vert.	1048.120	AV	44.80	23.92	12.62	37.08	2.48	46.74	53.90	7.1	161	348	
Vert.	2390.000	AV	39.80	27.91	13.89	36.58	2.48	47.50	53.90	6.4	109	334	
Vert.	3618.156	AV	41.04	29.12	6.71	39.34	2.48	40.01	53.90	13.8	149	67	
Vert.	4824.000	AV	34.82	31.34	7.19	39.50	2.48	36.33	53.90	17.5	100	0	
Vert.	7236.000	AV	34.21	36.81	8.83	39.31	2.48	43.02	53.90	10.8	100	2	
Vert.	9648.000	AV	35.41	38.26	10.36	39.49	2.48	47.02	53.90	6.8	100	0	
Vert.	14472.000	AV	39.65	43.06	11.96	38.42	-9.54	46.71	53.90	7.1	154	122	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

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	86.40	27.88	13.91	36.57	2.48	94.10	-	-	Carrier
Hori.	2400.000	PK	56.15	27.91	13.90	36.58	2.48	63.86	74.10	10.2	
Vert.	2412.000	PK	85.87	27.88	13.91	36.57	2.48	93.57	-	-	Carrier
Vert.	2400.000	PK	53.41	27.91	13.90	36.58	2.48	61.12	73.57	12.5	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

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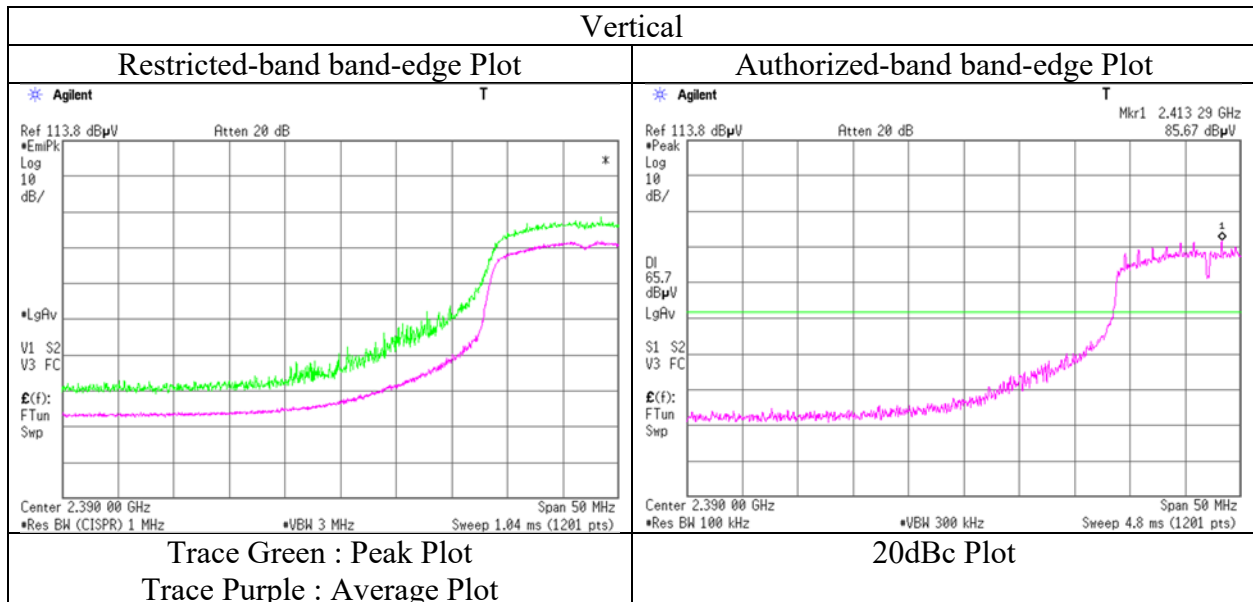
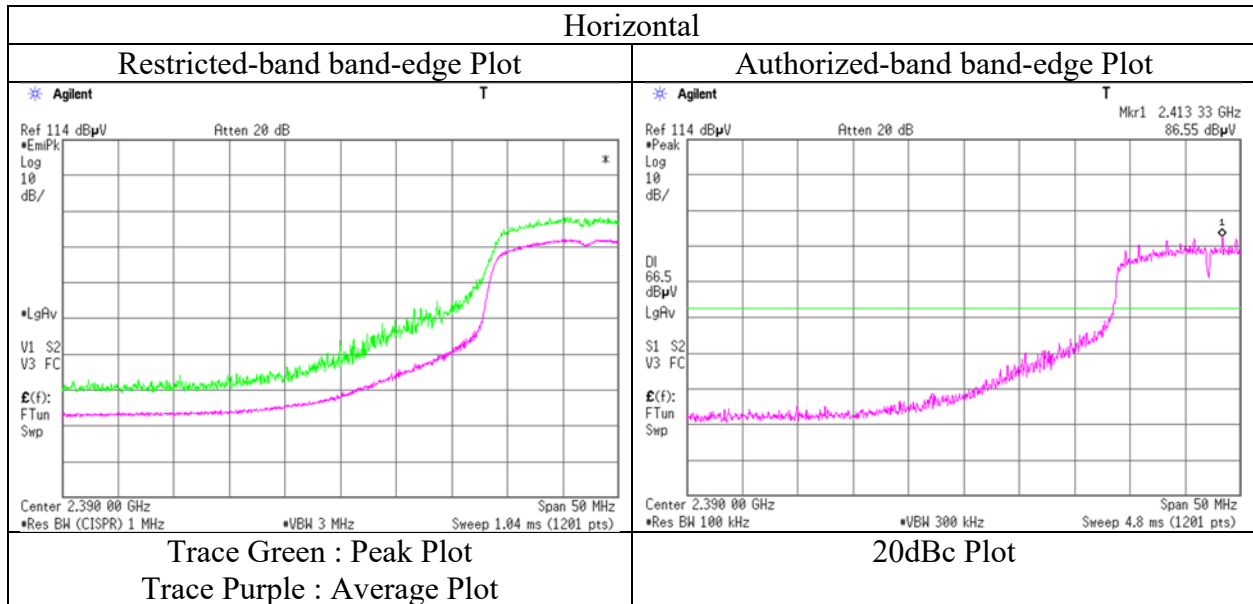
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Makoto Hosaka
	(1 GHz – 2.8 GHz)
Mode	Tx 11g 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.
It is confirmed there is no emission in the range of 2310 MHz to 2390 MHz.

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Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	October 22, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka (1 GHz – 2.8 GHz)	Makoto Hosaka (2.8 GHz – 13 GHz)	Kazuya Noda (13 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.	1048.120	PK	49.23	23.92	12.62	37.08	2.48	51.17	73.90	22.7	200	294	
Hori.	4874.000	PK	44.83	31.22	7.24	39.50	2.48	46.27	73.90	27.6	123	0	
Hori.	7311.000	PK	44.44	36.70	8.91	39.35	2.48	53.18	73.90	20.7	100	0	
Hori.	9748.000	PK	44.56	38.56	10.36	39.42	2.48	56.54	73.90	17.3	100	0	
Hori.	14622.000	PK	46.84	43.39	11.96	38.33	-9.54	54.32	73.90	19.5	170	147	
Hori.	1048.120	AV	43.13	23.92	12.62	37.08	2.48	45.07	53.90	8.8	200	294	
Hori.	4874.000	AV	34.02	31.22	7.24	39.50	2.48	35.46	53.90	18.4	123	0	
Hori.	7311.000	AV	34.23	36.70	8.91	39.35	2.48	42.97	53.90	10.9	100	0	
Hori.	9748.000	AV	34.11	38.56	10.36	39.42	2.48	46.09	53.90	7.8	100	0	
Hori.	14622.000	AV	38.10	43.39	11.96	38.33	-9.54	45.58	53.90	8.3	170	147	
Vert.	1048.120	PK	49.37	23.92	12.62	37.08	2.48	51.31	73.90	22.5	156	18	
Vert.	3656.126	PK	47.01	29.12	6.71	39.35	2.48	45.97	73.90	27.9	100	0	
Vert.	4874.000	PK	45.19	31.22	7.24	39.50	2.48	46.63	73.90	27.2	100	0	
Vert.	7311.000	PK	44.41	36.70	8.91	39.35	2.48	53.15	73.90	20.7	100	0	
Vert.	9748.000	PK	45.00	38.56	10.36	39.42	2.48	56.98	73.90	16.9	100	0	
Vert.	14622.000	PK	47.81	43.39	11.96	38.33	-9.54	55.29	73.90	18.6	167	160	
Vert.	1048.120	AV	43.43	23.92	12.62	37.08	2.48	45.37	53.90	8.5	156	18	
Vert.	3656.126	AV	41.08	29.12	6.71	39.35	2.48	40.04	53.90	13.8	100	0	
Vert.	4874.000	AV	34.56	31.22	7.24	39.50	2.48	36.00	53.90	17.9	100	0	
Vert.	7311.000	AV	33.91	36.70	8.91	39.35	2.48	42.65	53.90	11.2	100	0	
Vert.	9748.000	AV	34.10	38.56	10.36	39.42	2.48	46.08	53.90	7.8	100	0	
Vert.	14622.000	AV	39.39	43.39	11.96	38.33	-9.54	46.87	53.90	7.0	167	160	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 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.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	October 22, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Kazuya Noda
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 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.	1048.120	PK	49.38	23.92	12.62	37.08	2.48	51.32	73.90	22.5	266	290	
Hori.	2483.500	PK	56.02	27.67	13.96	36.52	2.48	63.61	73.90	10.2	244	112	
Hori.	4924.000	PK	45.11	31.22	7.30	39.50	2.48	46.61	73.90	27.2	100	0	
Hori.	7386.000	PK	44.42	36.75	9.01	39.39	2.48	53.27	73.90	20.6	100	0	
Hori.	9848.000	PK	44.06	38.76	10.37	39.35	2.48	56.32	73.90	17.5	100	0	
Hori.	14772.000	PK	46.73	42.94	11.90	38.24	-9.54	53.79	73.90	20.1	169	149	
Hori.	1048.120	AV	43.43	23.92	12.62	37.08	2.48	45.37	53.90	8.5	266	290	
Hori.	2483.500	AV	40.64	27.67	13.96	36.52	2.48	48.23	53.90	5.6	244	112	
Hori.	4924.000	AV	34.28	31.22	7.30	39.50	2.48	35.78	53.90	18.1	100	0	
Hori.	7386.000	AV	33.45	36.75	9.01	39.39	2.48	42.30	53.90	11.6	100	0	
Hori.	9848.000	AV	34.39	38.76	10.37	39.35	2.48	46.65	53.90	7.2	100	0	
Hori.	14772.000	AV	38.42	42.94	11.90	38.24	-9.54	45.48	53.90	8.4	169	149	
Vert.	1048.120	PK	50.20	23.92	12.62	37.08	2.48	52.14	73.90	21.7	159	341	
Vert.	2483.500	PK	54.28	27.67	13.96	36.52	2.48	61.87	73.90	12.0	119	37	
Vert.	3692.914	PK	46.05	29.23	6.70	39.35	2.48	45.11	73.90	28.7	125	68	
Vert.	4924.000	PK	45.00	31.22	7.30	39.50	2.48	46.50	73.90	27.4	100	0	
Vert.	7386.000	PK	44.24	36.75	9.01	39.39	2.48	53.09	73.90	20.8	100	0	
Vert.	9848.000	PK	44.19	38.76	10.37	39.35	2.48	56.45	73.90	17.4	100	0	
Vert.	14772.000	PK	48.54	42.94	11.90	38.24	-9.54	55.60	73.90	18.3	163	159	
Vert.	1048.120	AV	43.43	23.92	12.62	37.08	2.48	45.37	53.90	8.5	159	341	
Vert.	2483.500	AV	39.87	27.67	13.96	36.52	2.48	47.46	53.90	6.4	119	37	
Vert.	3692.914	AV	40.26	29.23	6.70	39.35	2.48	39.32	53.90	14.5	125	68	
Vert.	4924.000	AV	34.67	31.22	7.30	39.50	2.48	36.17	53.90	17.7	100	0	
Vert.	7386.000	AV	34.23	36.75	9.01	39.39	2.48	43.08	53.90	10.8	100	0	
Vert.	9848.000	AV	34.49	38.76	10.37	39.35	2.48	46.75	53.90	7.1	100	0	
Vert.	14772.000	AV	40.17	42.94	11.90	38.24	-9.54	47.23	53.90	6.6	163	159	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

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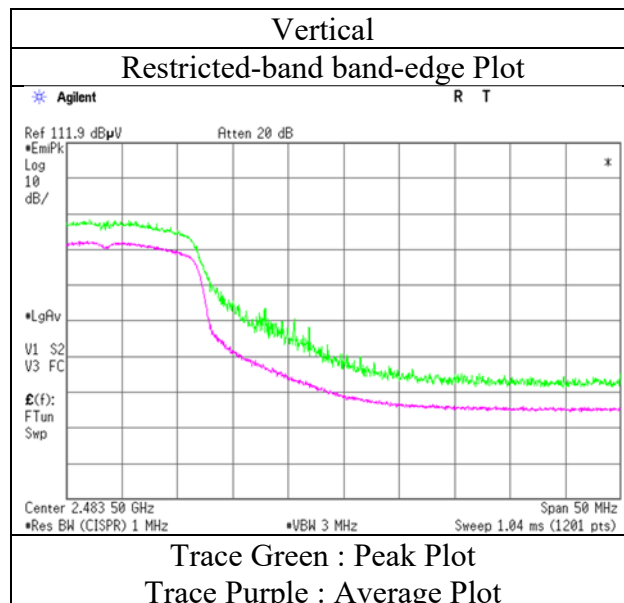
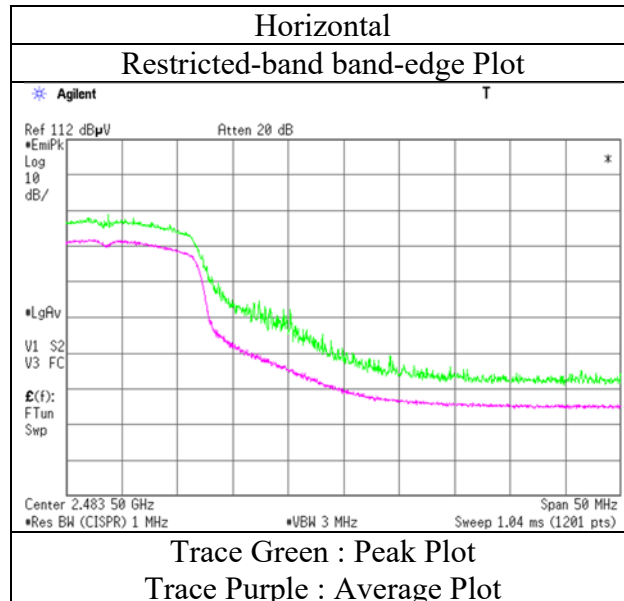
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Makoto Hosaka (1 GHz – 2.8 GHz)
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

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	December 21, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 25 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Yosuke Ishikawa	Makoto Hosaka	Kazuya Noda
	(30 MHz – 1000 MHz)	(1 GHz – 13 GHz)	(13 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.	323.998	QP	40.04	14.32	6.44	31.68	0.00	29.12	46.00	16.8	100	324	
Hori.	377.997	QP	46.31	15.14	6.88	31.66	0.00	36.67	46.00	9.3	100	150	
Hori.	431.998	QP	38.81	16.18	7.18	31.67	0.00	30.50	46.00	15.5	100	149	
Hori.	486.001	QP	39.54	17.37	7.38	31.65	0.00	32.64	46.00	13.3	217	307	
Hori.	540.000	QP	30.96	17.70	7.60	31.71	0.00	24.55	46.00	21.4	183	154	
Hori.	594.000	QP	36.78	19.07	7.82	31.65	0.00	32.02	46.00	13.9	162	304	
Hori.	702.001	QP	35.07	19.81	8.28	31.59	0.00	31.57	46.00	14.4	135	298	
Hori.	1048.136	PK	47.82	24.06	13.01	39.11	2.48	48.26	73.90	25.6	166	82	
Hori.	2390.000	PK	62.38	27.89	14.49	39.46	2.48	67.78	73.90	6.1	147	109	
Hori.	4824.000	PK	44.92	31.34	7.19	39.50	2.48	46.43	73.90	27.4	100	0	
Hori.	7236.000	PK	45.11	36.81	8.83	39.31	2.48	53.92	73.90	19.9	100	0	
Hori.	9648.000	PK	44.63	38.26	10.36	39.49	2.48	56.24	73.90	17.6	100	0	
Hori.	14472.000	PK	48.09	43.06	11.96	38.42	-9.54	55.15	73.90	18.7	167	145	
Hori.	1048.136	AV	41.57	24.06	13.01	39.11	2.48	42.01	53.90	11.8	166	82	
Hori.	2390.000	AV	43.88	27.89	14.49	39.46	2.48	49.28	53.90	4.6	147	109	
Hori.	4824.000	AV	35.21	31.34	7.19	39.50	2.48	36.72	53.90	17.1	100	0	
Hori.	7236.000	AV	34.49	36.81	8.83	39.31	2.48	43.30	53.90	10.6	100	0	
Hori.	9648.000	AV	34.00	38.26	10.36	39.49	2.48	45.61	53.90	8.2	100	0	
Hori.	14472.000	AV	39.49	43.06	11.96	38.42	-9.54	46.55	53.90	7.3	167	145	
Vert.	378.003	QP	33.79	15.14	6.88	31.66	0.00	24.15	46.00	21.8	282	237	
Vert.	486.001	QP	34.49	17.37	7.38	31.65	0.00	27.59	46.00	18.4	131	0	
Vert.	593.999	QP	29.77	19.07	7.82	31.65	0.00	25.01	46.00	20.9	100	311	
Vert.	1048.187	PK	51.03	24.06	13.01	39.11	2.48	51.47	73.90	22.4	146	0	
Vert.	2390.000	PK	62.06	27.89	14.49	39.46	2.48	67.46	73.90	6.4	121	0	
Vert.	3617.980	PK	47.99	29.12	6.71	39.34	2.48	46.96	73.90	26.9	137	67	
Vert.	4824.000	PK	44.77	31.34	7.19	39.50	2.48	46.28	73.90	27.6	100	0	
Vert.	7236.000	PK	45.28	36.81	8.83	39.31	2.48	54.09	73.90	19.8	100	0	
Vert.	9648.000	PK	46.72	38.26	10.36	39.49	2.48	58.33	73.90	15.5	100	0	
Vert.	14472.000	PK	48.33	43.06	11.96	38.42	-9.54	55.39	73.90	18.5	164	119	
Vert.	1048.187	AV	46.67	24.06	13.01	39.11	2.48	47.11	53.90	6.7	146	0	
Vert.	2390.000	AV	41.56	27.89	14.49	39.46	2.48	46.96	53.90	6.9	121	0	
Vert.	3617.980	AV	40.97	29.12	6.71	39.34	2.48	39.94	53.90	13.9	137	67	
Vert.	4824.000	AV	34.52	31.34	7.19	39.50	2.48	36.03	53.90	17.8	100	0	
Vert.	7236.000	AV	35.30	36.81	8.83	39.31	2.48	44.11	53.90	9.7	100	0	
Vert.	9648.000	AV	36.21	38.26	10.36	39.49	2.48	47.82	53.90	6.0	100	0	
Vert.	14472.000	AV	39.82	43.06	11.96	38.42	-9.54	46.88	53.90	7.0	164	119	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.99 m / 3.0 m) = 2.48 dB

13 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	86.94	27.86	14.51	39.46	2.48	92.33	-	-	Carrier
Hori.	2400.000	PK	59.94	27.89	14.50	39.46	2.48	65.35	72.33	7.0	
Vert.	2412.000	PK	85.82	27.86	14.51	39.46	2.48	91.21	-	-	Carrier
Vert.	2400.000	PK	57.34	27.89	14.50	39.46	2.48	62.75	71.21	8.5	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.99 m / 3.0 m) = 2.48 dB

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

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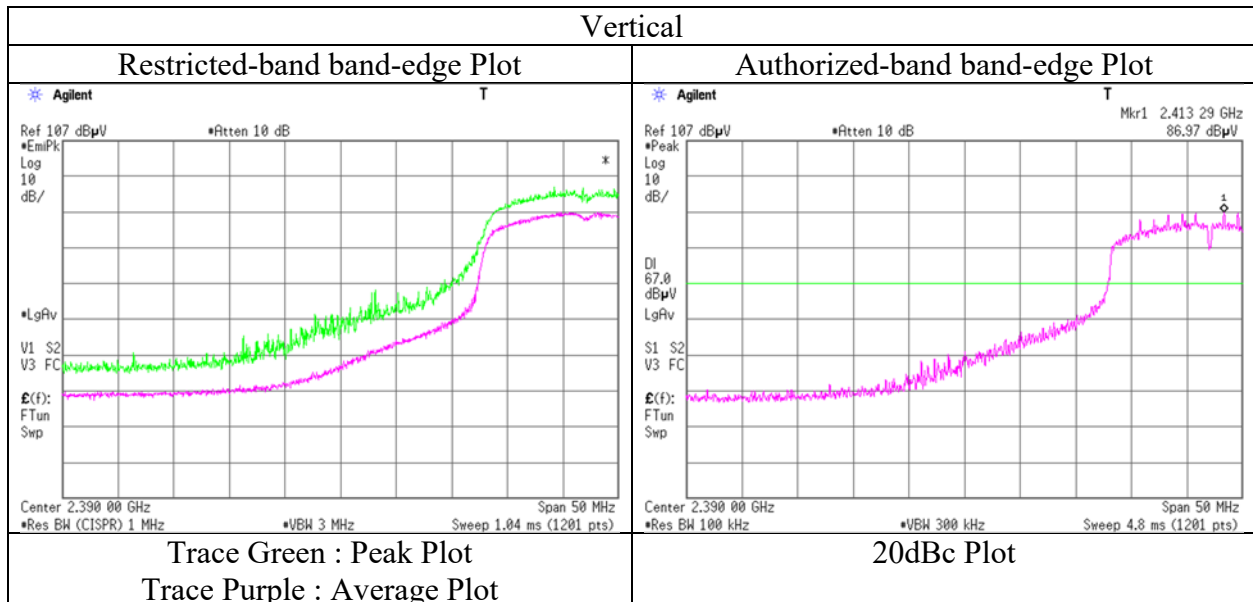
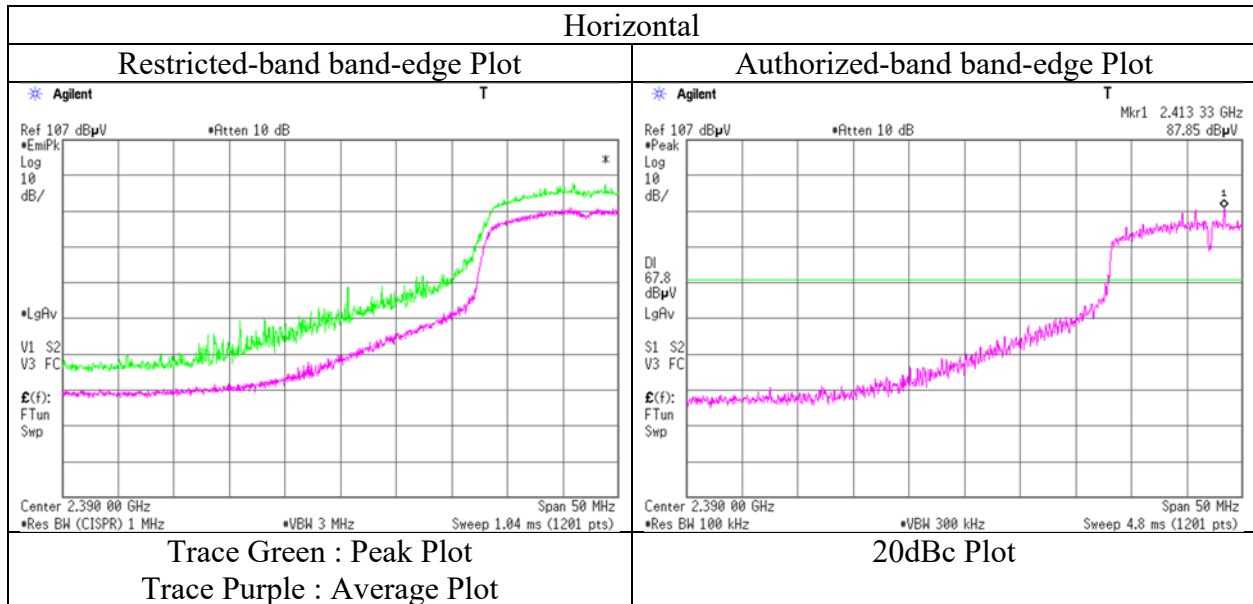
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	1
Date	October 24, 2018
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Makoto Hosaka
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2412 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.
It is confirmed there is no emission in the range of 2310 MHz to 2390 MHz.

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Radiated Spurious Emission

Report No.	12322067S-G-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	3
Date	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka	Kazuya Noda
	(1 GHz – 13 GHz)	(13 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.	1048.175	PK	47.94	24.06	13.01	39.11	2.48	48.38	73.90	25.5	159	86	
Hori.	4874.000	PK	44.80	31.22	7.24	39.50	2.48	46.24	73.90	27.6	100	0	
Hori.	7311.000	PK	44.59	36.70	8.91	39.35	2.48	53.33	73.90	20.5	100	0	
Hori.	9748.000	PK	44.44	38.56	10.36	39.42	2.48	56.42	73.90	17.4	100	0	
Hori.	14622.000	PK	46.58	43.39	11.96	38.33	-9.54	54.06	73.90	19.8	159	143	
Hori.	1048.175	AV	41.86	24.06	13.01	39.11	2.48	42.30	53.90	11.6	159	86	
Hori.	4874.000	AV	35.43	31.22	7.24	39.50	2.48	36.87	53.90	17.0	100	0	
Hori.	7311.000	AV	35.00	36.70	8.91	39.35	2.48	43.74	53.90	10.1	100	0	
Hori.	9748.000	AV	33.72	38.56	10.36	39.42	2.48	45.70	53.90	8.2	100	0	
Hori.	14622.000	AV	37.54	43.39	11.96	38.33	-9.54	45.02	53.90	8.8	159	143	
Vert.	1048.198	PK	51.38	24.06	13.01	39.11	2.48	51.82	73.90	22.0	146	0	
Vert.	3655.892	PK	46.45	29.12	6.71	39.35	2.48	45.41	73.90	28.4	129	56	
Vert.	4874.000	PK	44.53	31.22	7.24	39.50	2.48	45.97	73.90	27.9	100	0	
Vert.	7311.000	PK	44.82	36.70	8.91	39.35	2.48	53.56	73.90	20.3	100	0	
Vert.	9748.000	PK	45.38	38.56	10.36	39.42	2.48	57.36	73.90	16.5	100	0	
Vert.	14622.000	PK	47.25	43.39	11.96	38.33	-9.54	54.73	73.90	19.1	160	161	
Vert.	1048.198	AV	47.27	24.06	13.01	39.11	2.48	47.71	53.90	6.1	146	0	
Vert.	3655.892	AV	40.39	29.12	6.71	39.35	2.48	39.35	53.90	14.5	129	56	
Vert.	4874.000	AV	34.85	31.22	7.24	39.50	2.48	36.29	53.90	17.6	100	0	
Vert.	7311.000	AV	34.13	36.70	8.91	39.35	2.48	42.87	53.90	11.0	100	0	
Vert.	9748.000	AV	33.69	38.56	10.36	39.42	2.48	45.67	53.90	8.2	100	0	
Vert.	14622.000	AV	39.86	43.39	11.96	38.33	-9.54	47.34	53.90	6.5	160	161	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 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.	12322067S-G-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	3
Date	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Makoto Hosaka	Kazuya Noda
	(1 GHz – 13 GHz)	(13 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.	1292.028	PK	46.31	25.38	13.30	39.09	2.48	48.38	73.90	25.5	126	0	
Hori.	2483.500	PK	56.37	27.64	14.59	39.46	2.48	61.62	73.90	12.2	141	63	
Hori.	4924.000	PK	45.19	31.22	7.30	39.50	2.48	46.69	73.90	27.2	150	0	
Hori.	7386.000	PK	44.53	36.75	9.01	39.39	2.48	53.38	73.90	20.5	100	0	
Hori.	9848.000	PK	44.44	38.76	10.37	39.35	2.48	56.70	73.90	17.2	100	0	
Hori.	14772.000	PK	46.68	42.94	11.90	38.24	-9.54	53.74	73.90	20.1	161	163	
Hori.	1292.028	AV	39.00	25.38	13.30	39.09	2.48	41.07	53.90	12.8	126	0	
Hori.	2483.500	AV	39.16	27.64	14.59	39.46	2.48	44.41	53.90	9.4	141	63	
Hori.	4924.000	AV	34.66	31.22	7.30	39.50	2.48	36.16	53.90	17.7	150	0	
Hori.	7386.000	AV	34.86	36.75	9.01	39.39	2.48	43.71	53.90	10.1	100	0	
Hori.	9848.000	AV	34.26	38.76	10.37	39.35	2.48	46.52	53.90	7.3	100	0	
Hori.	14772.000	AV	37.86	42.94	11.90	38.24	-9.54	44.92	53.90	8.9	161	163	
Vert.	1048.164	PK	50.61	24.06	13.01	39.11	2.48	51.05	73.90	22.8	100	0	
Vert.	2483.500	PK	55.96	27.64	14.59	39.46	2.48	61.21	73.90	12.6	133	94	
Vert.	3693.065	PK	43.72	29.23	6.70	39.35	2.48	42.78	73.90	31.1	134	56	
Vert.	4924.000	PK	44.56	31.22	7.30	39.50	2.48	46.06	73.90	27.8	100	0	
Vert.	7386.000	PK	44.13	36.75	9.01	39.39	2.48	52.98	73.90	20.9	100	0	
Vert.	9848.000	PK	44.40	38.76	10.37	39.35	2.48	56.66	73.90	17.2	100	0	
Vert.	14772.000	PK	48.19	42.94	11.90	38.24	-9.54	55.25	73.90	18.6	155	164	
Vert.	1048.164	AV	46.96	24.06	13.01	39.11	2.48	47.40	53.90	6.5	100	0	
Vert.	2483.500	AV	39.93	27.64	14.59	39.46	2.48	45.18	53.90	8.7	133	94	
Vert.	3693.065	AV	40.32	29.23	6.70	39.35	2.48	39.38	53.90	14.5	134	56	
Vert.	4924.000	AV	34.00	31.22	7.30	39.50	2.48	35.50	53.90	18.4	100	0	
Vert.	7386.000	AV	34.86	36.75	9.01	39.39	2.48	43.71	53.90	10.1	100	0	
Vert.	9848.000	AV	33.68	38.76	10.37	39.35	2.48	45.94	53.90	7.9	100	0	
Vert.	14772.000	AV	40.59	42.94	11.90	38.24	-9.54	47.65	53.90	6.2	155	164	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

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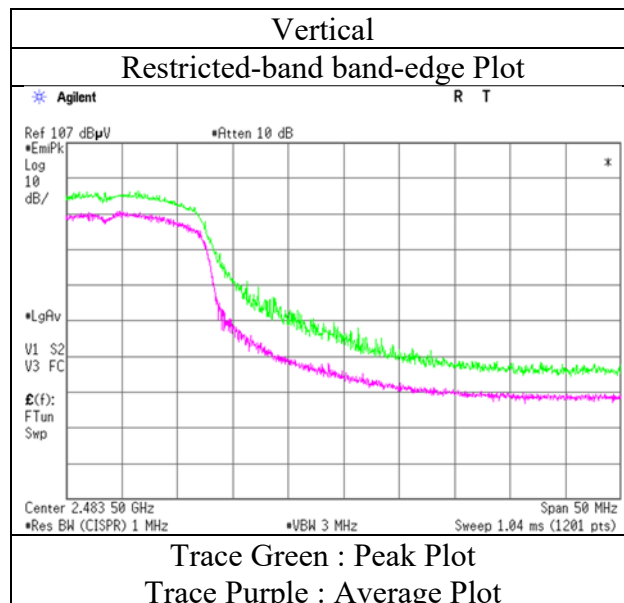
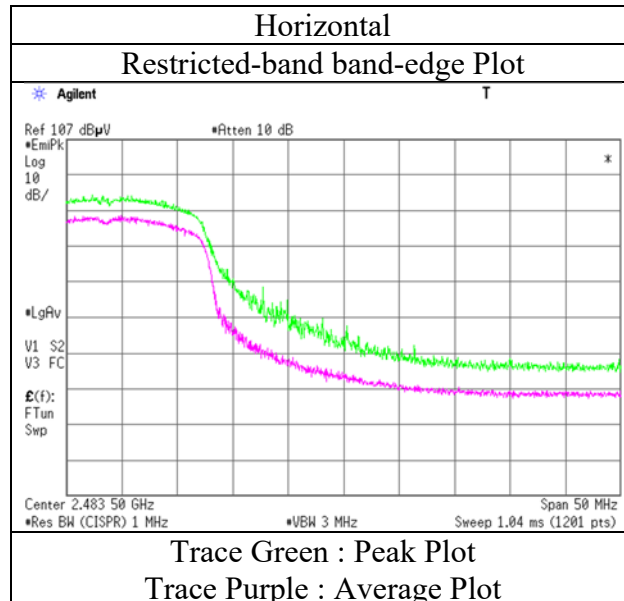
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Telephone : +81 463 50 6400

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	1
Date	October 24, 2018
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Makoto Hosaka (1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2462 MHz



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

Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	3
Date	November 20, 2018	October 22, 2018	October 27, 2018
Temperature / Humidity	23 deg. C / 36 % RH	22 deg. C / 36 % RH	24 deg. C / 48 % RH
Engineer	Shiro Kobayashi	Makoto Hosaka	Kazuya Noda
	(30 MHz – 1000 MHz)	(1 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx BT LE 2402 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.	324.001	QP	39.10	14.43	8.86	31.98	0.00	30.41	46.00	15.5	101	283	
Hori.	378.001	QP	43.32	15.17	9.15	31.96	0.00	35.68	46.00	10.3	100	104	
Hori.	432.006	QP	37.34	16.37	9.38	31.97	0.00	31.12	46.00	14.8	100	99	
Hori.	486.001	QP	37.73	17.45	9.57	31.96	0.00	32.79	46.00	13.2	204	90	
Hori.	594.001	QP	37.02	19.07	9.98	31.95	0.00	34.12	46.00	11.8	158	117	
Hori.	702.002	QP	33.98	19.88	10.40	31.87	0.00	32.39	46.00	13.6	134	248	
Hori.	2390.000	PK	44.43	27.91	13.89	36.58	2.48	52.13	73.90	21.7	221	101	
Hori.	4804.000	PK	45.17	31.31	6.51	36.88	2.48	48.59	73.90	25.3	128	138	
Hori.	7206.000	PK	45.54	36.77	7.66	37.26	2.48	55.19	73.90	18.7	100	0	
Hori.	9608.000	PK	46.18	38.11	8.64	38.47	2.48	56.94	73.90	16.9	100	0	
Vert.	323.997	QP	30.70	14.43	8.86	31.98	0.00	22.01	46.00	23.9	103	169	
Vert.	377.999	QP	34.01	15.17	9.15	31.96	0.00	26.37	46.00	19.6	293	189	
Vert.	485.997	QP	35.18	17.45	9.57	31.96	0.00	30.24	46.00	15.7	133	284	
Vert.	594.007	QP	34.22	19.07	9.98	31.95	0.00	31.32	46.00	14.6	104	262	
Vert.	2390.000	PK	43.77	27.91	13.89	36.58	2.48	51.47	73.90	22.4	108	334	
Vert.	4804.000	PK	43.95	31.31	6.51	36.88	2.48	47.37	73.90	26.5	109	356	
Vert.	7206.000	PK	45.15	36.77	7.66	37.26	2.48	54.80	73.90	19.1	100	0	
Vert.	9608.000	PK	46.19	38.11	8.64	38.47	2.48	56.95	73.90	16.9	100	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	33.85	27.91	13.89	36.58	3.60	2.48	45.15	53.90	8.8	*1)
Hori.	4804.000	AV	36.46	31.31	6.51	36.88	3.60	2.48	43.48	53.90	10.4	
Hori.	7206.000	AV	35.54	36.77	7.66	37.26	3.60	2.48	48.79	53.90	5.1	
Hori.	9608.000	AV	36.66	38.11	8.64	38.47	3.60	2.48	51.02	53.90	2.9	
Vert.	2390.000	AV	34.08	27.91	13.89	36.58	3.60	2.48	45.38	53.90	8.5	*1)
Vert.	4804.000	AV	34.44	31.31	6.51	36.88	3.60	2.48	41.46	53.90	12.4	
Vert.	7206.000	AV	35.47	36.77	7.66	37.26	3.60	2.48	48.72	53.90	5.2	
Vert.	9608.000	AV	36.69	38.11	8.64	38.47	3.60	2.48	51.05	53.90	2.9	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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.	2402.000	PK	90.80	27.90	13.90	36.57	2.48	98.51	-	-	Carrier
Hori.	2400.000	PK	41.30	27.91	13.90	36.58	2.48	49.01	78.51	29.5	
Vert.	2402.000	PK	91.13	27.90	13.90	36.57	2.48	98.84	-	-	Carrier
Vert.	2400.000	PK	41.06	27.91	13.90	36.58	2.48	48.77	78.84	30.1	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

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

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Shonan EMC Lab.

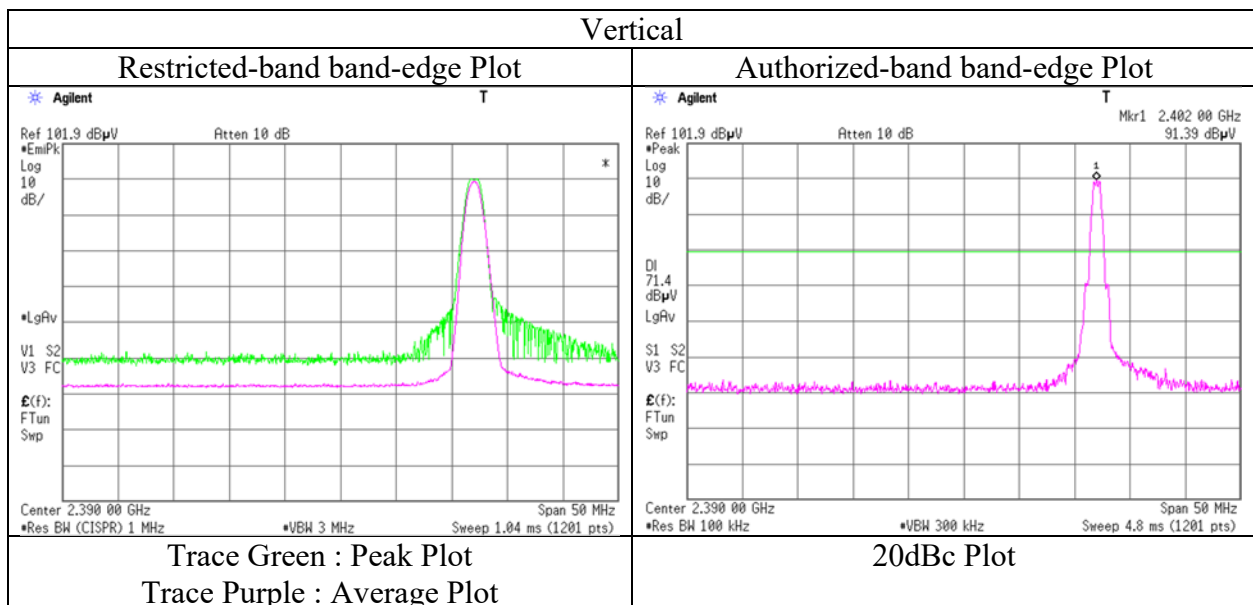
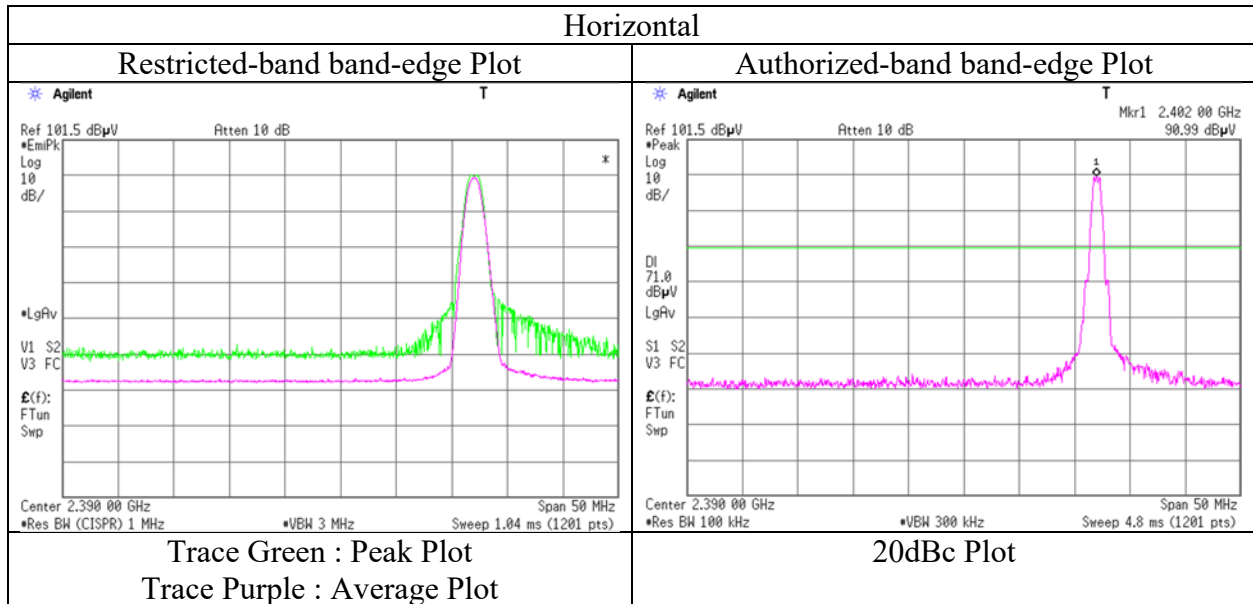
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Makoto Hosaka
	(1 GHz – 2.8 GHz)
Mode	Tx BT LE 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.
It is confirmed there is no emission in the range of 2310 MHz to 2390 MHz.

Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	3
Date	November 20, 2018	October 22, 2018	October 27, 2018
Temperature / Humidity	23 deg. C / 36 % RH	22 deg. C / 36 % RH	24 deg. C / 48 % RH
Engineer	Shiro Kobayashi	Makoto Hosaka	Kazuya Noda
	(30 MHz – 1000 MHz)	(1 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx BT LE 2440 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.	324.001	QP	38.91	14.43	8.86	31.98	0.00	30.22	46.00	15.7	100	272	
Hori.	378.001	QP	43.21	15.17	9.15	31.96	0.00	35.57	46.00	10.4	100	94	
Hori.	432.001	QP	37.38	16.37	9.38	31.97	0.00	31.16	46.00	14.8	100	91	
Hori.	486.001	QP	37.57	17.45	9.57	31.96	0.00	32.63	46.00	13.3	217	93	
Hori.	594.001	QP	36.63	19.07	9.98	31.95	0.00	33.73	46.00	12.2	157	106	
Hori.	702.001	QP	34.51	19.88	10.40	31.87	0.00	32.92	46.00	13.0	134	256	
Hori.	4880.000	PK	46.89	31.15	6.53	36.90	2.48	50.15	73.90	23.7	148	351	
Hori.	7320.000	PK	43.83	36.84	7.73	37.44	2.48	53.44	73.90	20.4	100	0	
Hori.	9760.000	PK	45.03	38.58	8.81	38.65	2.48	56.25	73.90	17.6	100	0	
Vert.	323.995	QP	32.71	14.43	8.86	31.98	0.00	24.02	46.00	21.9	122	179	
Vert.	377.998	QP	34.40	15.17	9.15	31.96	0.00	26.76	46.00	19.2	294	184	
Vert.	485.999	QP	34.01	17.45	9.57	31.96	0.00	29.07	46.00	16.9	124	283	
Vert.	593.988	QP	32.01	19.07	9.98	31.95	0.00	29.11	46.00	16.8	100	267	
Vert.	4880.000	PK	44.07	31.15	6.53	36.90	2.48	47.33	73.90	26.5	139	0	
Vert.	7320.000	PK	44.81	36.84	7.73	37.44	2.48	54.42	73.90	19.4	100	0	
Vert.	9760.000	PK	45.59	38.58	8.81	38.65	2.48	56.81	73.90	17.0	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99 \text{ m} / 3.0 \text{ m}) = 2.48 \text{ dB}$

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	39.23	31.15	6.53	36.90	3.60	2.48	46.09	53.90	7.8	
Hori.	7320.000	AV	34.63	36.84	7.73	37.44	3.60	2.48	47.84	53.90	6.1	
Hori.	9760.000	AV	35.85	38.58	8.81	38.65	3.60	2.48	50.67	53.90	3.2	
Vert.	4880.000	AV	34.70	31.15	6.53	36.90	3.60	2.48	41.56	53.90	12.3	
Vert.	7320.000	AV	34.88	36.84	7.73	37.44	3.60	2.48	48.09	53.90	5.8	
Vert.	9760.000	AV	35.61	38.58	8.81	38.65	3.60	2.48	50.43	53.90	3.5	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99 \text{ m} / 3.0 \text{ m}) = 2.48 \text{ dB}$

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

Duty factor refer to "Duty factor Calculation chart" sheet.

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Shonan EMC Lab.

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Radiated Spurious Emission

Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	3
Date	November 20, 2018	October 22, 2018	October 27, 2018
Temperature / Humidity	23 deg. C / 36 % RH	22 deg. C / 36 % RH	24 deg. C / 48 % RH
Engineer	Shiro Kobayashi	Makoto Hosaka	Kazuya Noda
	(30 MHz – 1000 MHz)	(1 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx BT LE 2480 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.	324.004	QP	39.01	14.43	8.86	31.98	0.00	30.32	46.00	15.6	100	271	
Hori.	377.989	QP	43.12	15.17	9.15	31.96	0.00	35.48	46.00	10.5	100	97	
Hori.	431.986	QP	37.42	16.37	9.38	31.97	0.00	31.20	46.00	14.8	100	88	
Hori.	485.998	QP	37.38	17.45	9.57	31.96	0.00	32.44	46.00	13.5	229	76	
Hori.	594.013	QP	36.84	19.07	9.98	31.95	0.00	33.94	46.00	12.0	159	112	
Hori.	701.993	QP	34.02	19.88	10.40	31.87	0.00	32.43	46.00	13.5	131	259	
Hori.	2483.500	PK	57.21	27.67	13.96	36.52	2.48	64.80	73.90	9.1	181	109	
Hori.	4960.000	PK	47.65	31.33	6.56	36.93	2.48	51.09	73.90	22.8	115	141	
Hori.	7440.000	PK	43.72	36.97	7.81	37.63	2.48	53.35	73.90	20.5	100	0	
Hori.	9920.000	PK	44.48	38.80	9.00	38.84	2.48	55.92	73.90	17.9	100	0	
Vert.	323.998	QP	31.00	14.43	8.86	31.98	0.00	22.31	46.00	23.6	117	178	
Vert.	378.004	QP	34.10	15.17	9.15	31.96	0.00	26.46	46.00	19.5	282	190	
Vert.	486.002	QP	34.16	17.45	9.57	31.96	0.00	29.22	46.00	16.7	131	325	
Vert.	594.006	QP	32.26	19.07	9.98	31.95	0.00	29.36	46.00	16.6	100	268	
Vert.	2483.500	PK	55.60	27.67	13.96	36.52	2.48	63.19	73.90	10.7	147	40	
Vert.	4960.000	PK	43.94	31.33	6.56	36.93	2.48	47.38	73.90	26.5	108	353	
Vert.	7440.000	PK	44.30	36.97	7.81	37.63	2.48	53.93	73.90	19.9	100	0	
Vert.	9920.000	PK	44.22	38.80	9.00	38.84	2.48	55.66	73.90	18.2	100	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	35.93	27.67	13.96	36.52	3.60	2.48	47.12	53.90	6.8	*1)
Hori.	4960.000	AV	38.67	31.33	6.56	36.93	3.60	2.48	45.71	53.90	8.2	
Hori.	7440.000	AV	34.09	36.97	7.81	37.63	3.60	2.48	47.32	53.90	6.6	
Hori.	9920.000	AV	35.06	38.80	9.00	38.84	3.60	2.48	50.10	53.90	3.8	
Vert.	2483.500	AV	35.55	27.67	13.96	36.52	3.60	2.48	46.74	53.90	7.2	*1)
Vert.	4960.000	AV	35.02	31.33	6.56	36.93	3.60	2.48	42.06	53.90	11.8	
Vert.	7440.000	AV	34.16	36.97	7.81	37.63	3.60	2.48	47.39	53.90	6.5	
Vert.	9920.000	AV	35.07	38.80	9.00	38.84	3.60	2.48	50.11	53.90	3.8	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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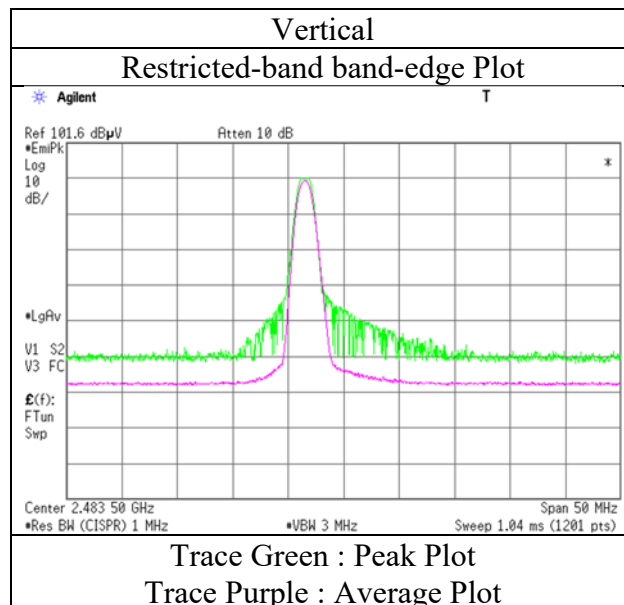
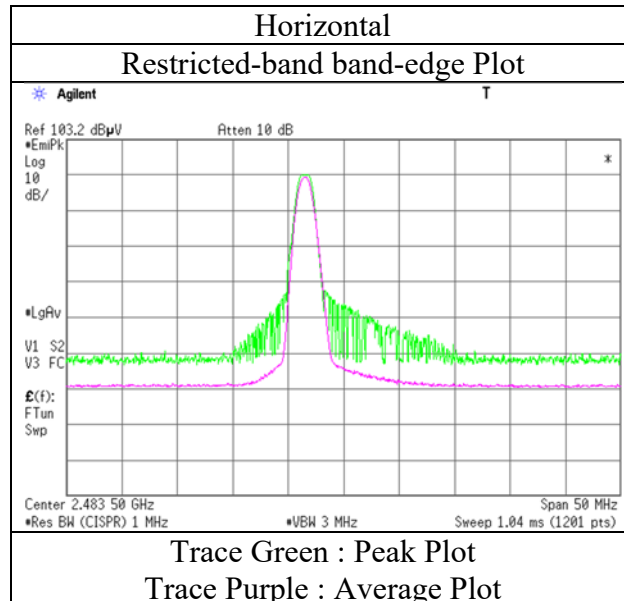
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

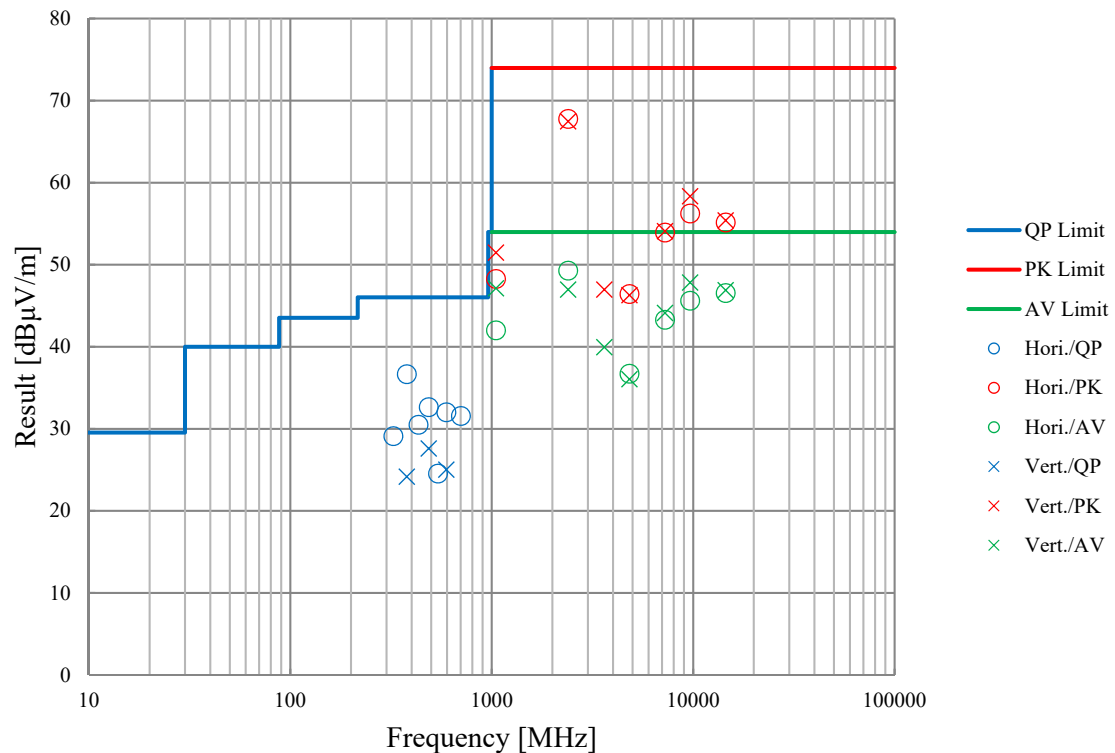
Report No.	12322067S-G-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Makoto Hosaka (1 GHz – 2.8 GHz)
Mode	Tx BT LE 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

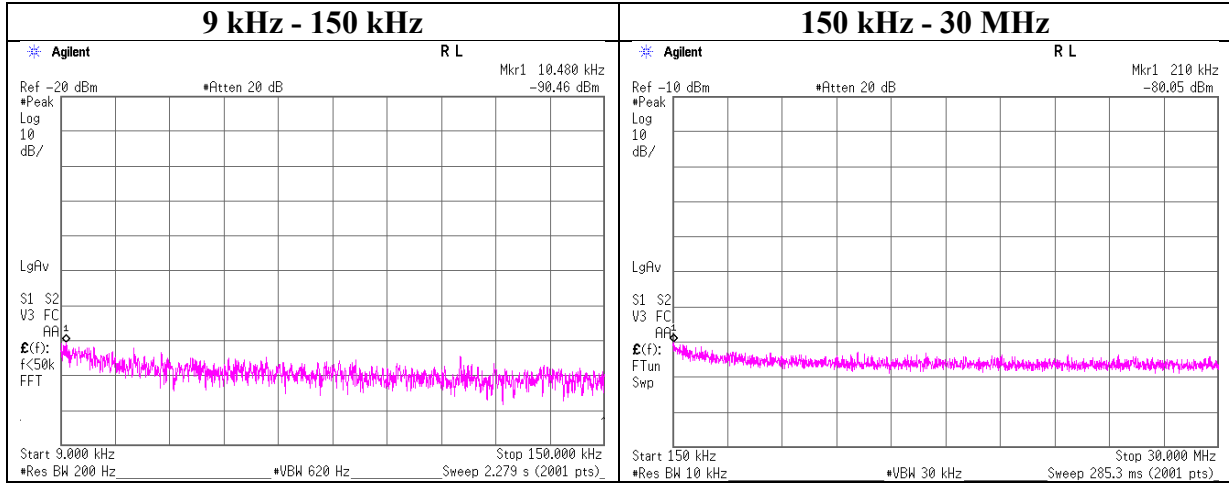
Report No.	12322067S-G-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	2	1	3
Date	December 21, 2018	October 24, 2018	October 27, 2018
Temperature / Humidity	22 deg. C / 25 % RH	22 deg. C / 35 % RH	24 deg. C / 48 % RH
Engineer	Yosuke Ishikawa	Makoto Hosaka	Kazuya Noda
	(30 MHz – 1000 MHz)	(1 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11n-20 2412 MHz		



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

Conducted Spurious Emission

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 16, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Yosuke Ishikawa
Mode Tx 11n-20 2412 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
10.48	-90.5	0.01	9.8	2.0	1	-78.6	300	6.0	-17.4	47.1	64.5	
210.00	-80.1	0.01	9.8	2.0	1	-68.2	300	6.0	-6.9	21.1	28.0	

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

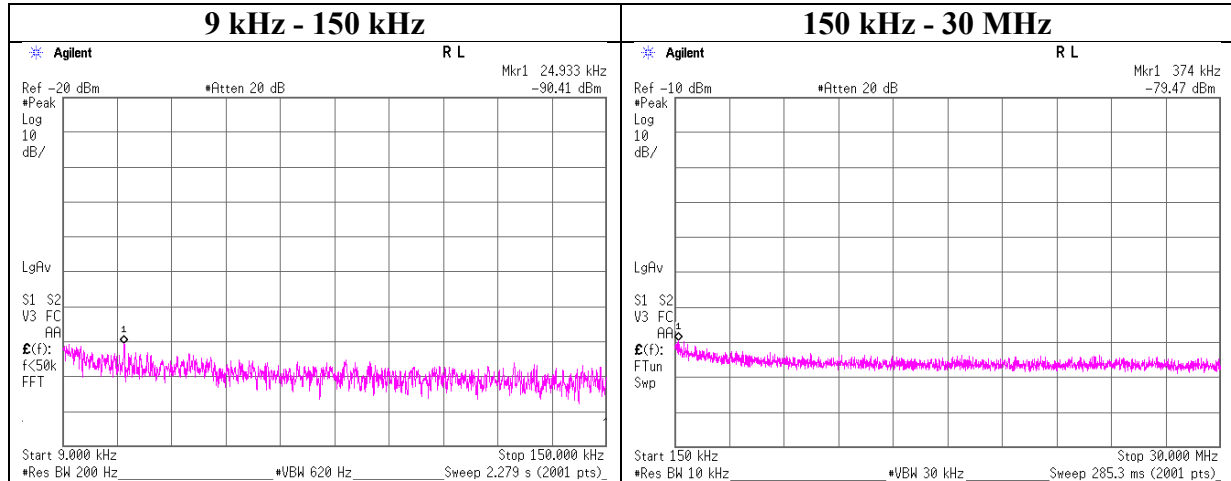
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No.	12322067S-G-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 16, 2018
Temperature / Humidity	25 deg. C / 46 % RH
Engineer	Yosuke Ishikawa
Mode	Tx BT LE 2402 MHz



Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain*	N (Number of Output)	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]		[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
24.93	-90.4	0.01	9.8	2.0	1	-78.6	300	6.0	-17.3	39.6	56.9	
374.00	-79.5	0.02	9.8	2.0	1	-67.6	300	6.0	-6.4	16.1	22.5	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Shonan EMC Lab.

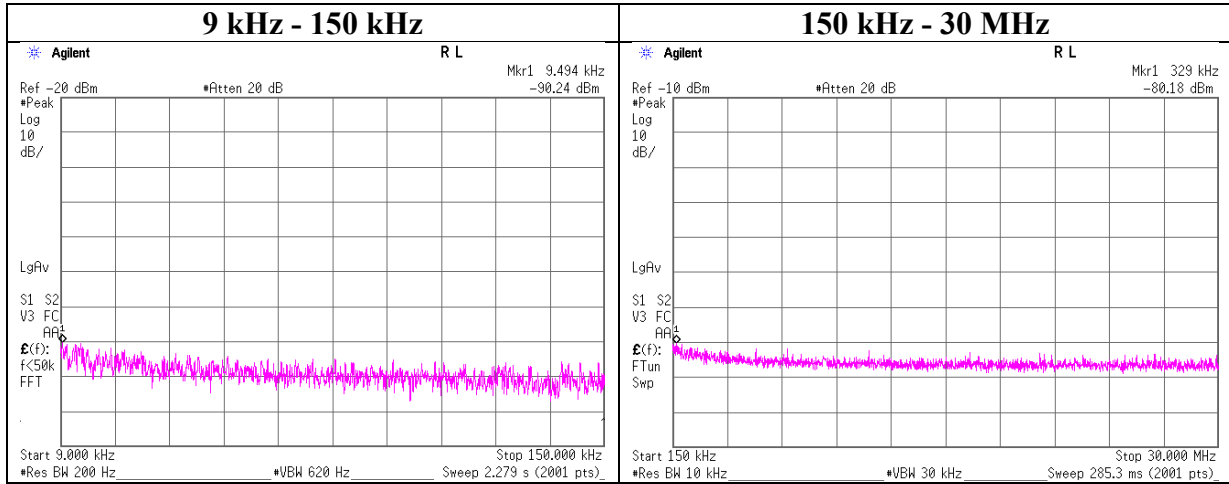
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Conducted Spurious Emission

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 16, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.49	-90.2	0.01	9.8	2.0	1	-78.4	300	6.0	-17.1	48.0	65.1	
329.00	-80.2	0.02	9.8	2.0	1	-68.3	300	6.0	-7.1	17.2	24.3	

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

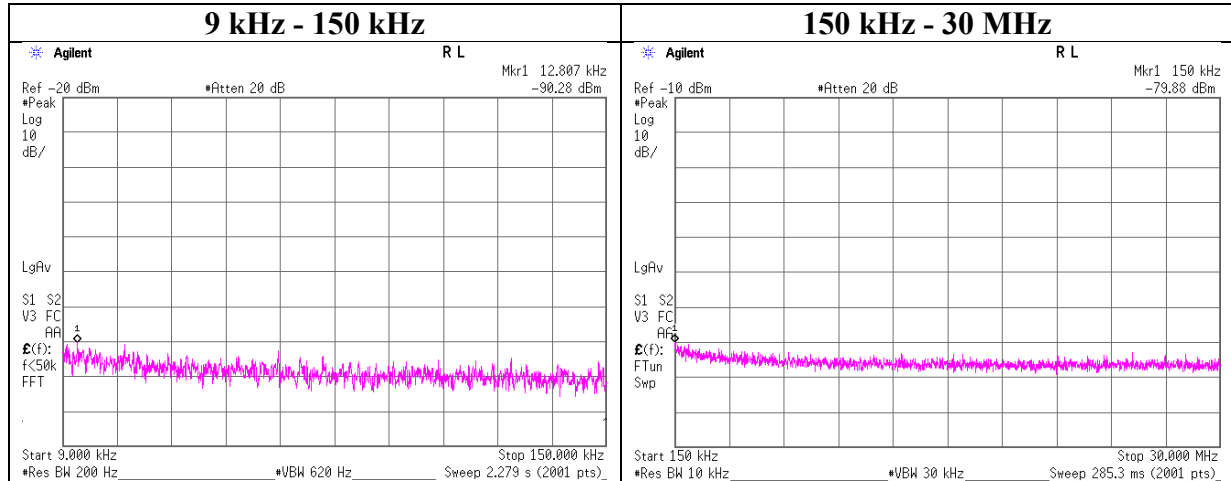
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 16, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
12.81	-90.3	0.01	9.8	2.0	1	-78.4	300	6.0	-17.2	45.4	62.6	
150.00	-79.9	0.01	9.8	2.0	1	-68.0	300	6.0	-6.8	24.0	30.8	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Report No. 12322067S-G-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 16, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Yosuke Ishikawa
Mode Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-24.48	1.49	9.86	-13.13	8.00	21.13
2437.00	-24.76	1.49	9.86	-13.41	8.00	21.41
2462.00	-25.55	1.50	9.85	-14.20	8.00	22.20

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-25.59	1.49	9.86	-14.24	8.00	22.24
2437.00	-25.51	1.49	9.86	-14.16	8.00	22.16
2462.00	-26.78	1.50	9.85	-15.43	8.00	23.43

11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-27.68	1.49	9.86	-16.33	8.00	24.33
2437.00	-26.72	1.49	9.86	-15.37	8.00	23.37
2462.00	-27.13	1.50	9.85	-15.78	8.00	23.78

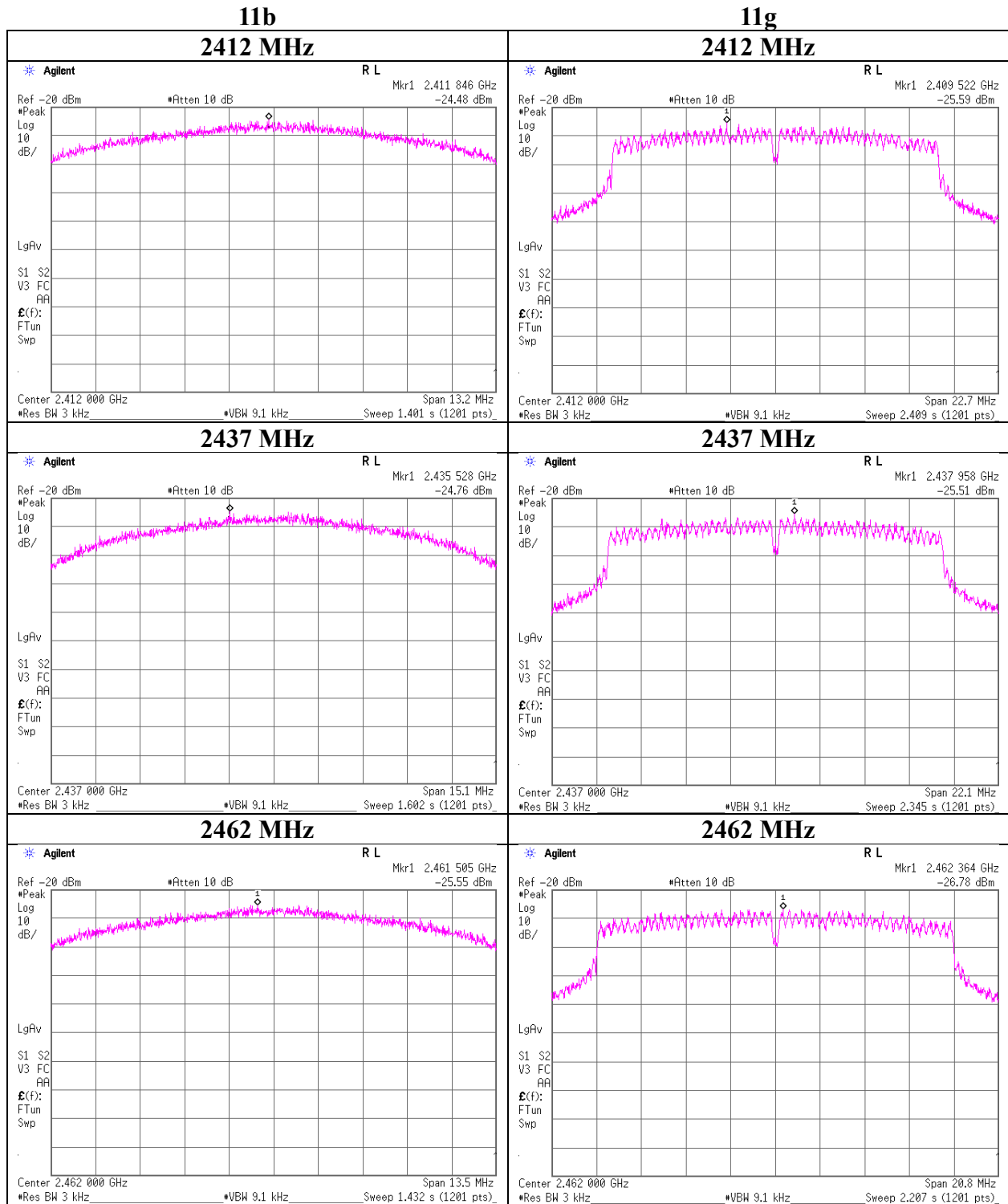
BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-17.81	1.48	9.86	-6.47	8.00	14.47
2440.00	-17.68	1.49	9.86	-6.33	8.00	14.33
2480.00	-17.67	1.50	9.85	-6.32	8.00	14.32

Sample Calculation:

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

Power Density



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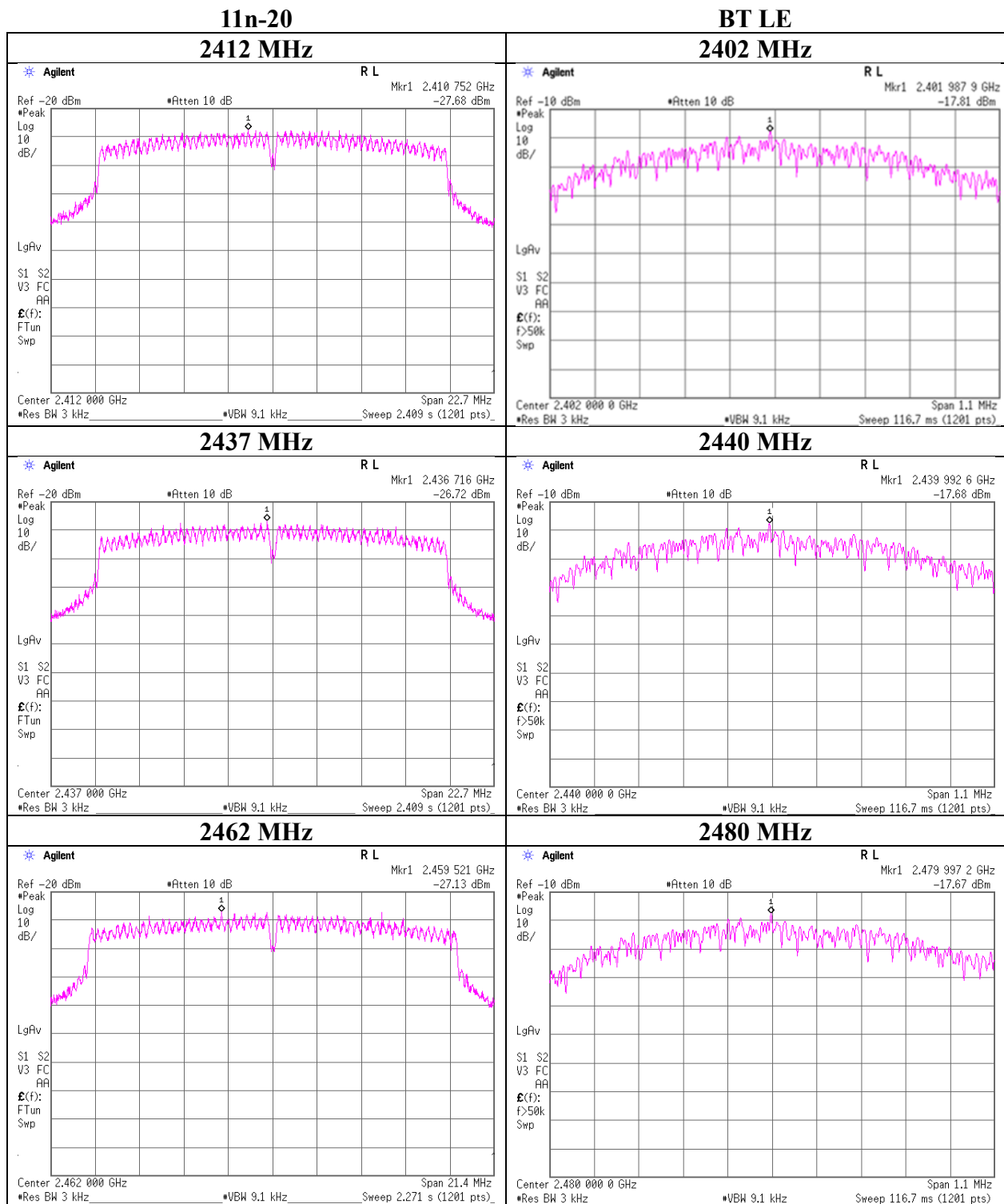
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Power Density



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APPENDIX 2: Test instruments

Test Instruments (1/3)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SAT10-12	AT	151609	Attenuator	Weinschel Corp.	54A-10	81601	2018/3/22	2019/3/31	12
SAT10-16	AT	160494	Attenuator	Weinschel Corp.	54A-10	83406	2017/12/8	2018/12/31	12
SCC-G13	AT	145166	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	2018/3/19	2019/3/31	12
SCC-G14	AT	145175	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	2018/3/19	2019/3/31	12
SOS-09	AT	146318	Humidity Indicator	A&D	AD-5681	4061484	2018/12/5	2019/12/31	12
SPM-07	AT	146247	Power Meter	AGILENT	8990B	MY5100272	2018/7/13	2019/7/31	12
SPSS-04	AT	146310	Power sensor	AGILENT	N1923A	MY5326009	2018/7/13	2019/7/31	12
SRENT-15	AT	160899	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46185516	2017/12/26	2018/12/31	12
SSA-03	AT	145801	Spectrum Analyzer	AGILENT	E4448A	MY48250152	2018/8/30	2019/8/31	12
COTS-SEM I-1	CE,RE	144865	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,M F)	-	-	-	-
KJM-09	CE	145929	Measure	KOMELON	KMC-36	-	-	-	-
SAT3-10	CE	144960	Attenuator	JFW	50HF-003N	-	2018/8/23	2019/8/31	12
SAT3-13	CE	150923	Attenuator	JFW	50HF-003N	-	2018/2/22	2019/2/28	12
SCC-A12/A 13/SRSE-01	CE	144966	Coaxial Cable&RF Selector	Suhner/Suhner/ TOYO	RG223U/141 PE/NS4906	-/0901-269(RF Selector)	2018/4/9	2019/4/30	12
SCC-C6/C7 /C8/C10/SR SE-03	CE	145034	Coaxial Cable&RF Selector	Suhner/Fujikura /Suhner/Suhner/ TOYO	141PE/12DSF A/141PE/141 PE/NS4906	-/0901-271(RF Selector)	2018/4/9	2019/4/30	12
SLS-01	CE	145538	LISN	Rohde & Schwarz	ENV216	100511	2018/2/26	2019/2/28	12
SLS-05	CE	145542	LISN	Rohde & Schwarz	ENV216	100516	2018/2/26	2019/2/28	12
SOS-16	CE	167990	Humidity Indicator	CUSTOM	CTH-202	708Q08R	2018/3/27	2019/3/31	12
STM-05	CE	145762	Terminator	TME	CT-01 BP	-	2017/12/14	2018/12/31	12
STR-01	CE	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2018/4/13	2019/4/30	12
STS-01	CE	145792	Digital Hitester	HIOKI	3805-50	80997812	2018/10/16	2019/10/31	12
KJM-02	RE	146432	Measure	TAJIMA	GL19-55	-	-	-	-
KSA-08	RE	145089	Spectrum Analyzer	AGILENT	E4446A	MY46180525	2018/10/7	2019/10/31	12
SAEC-01(S VSWR)	RE	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SV SWR)	1	2018/7/19	2019/7/31	12
SAEC-02(NSA)	RE	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NS A)	2	2018/5/31	2019/5/31	12
SAEC-02(S VSWR)	RE	145598	Semi-Anechoic Chamber	TDK	SAEC-02(SV SWR)	2	2018/7/15	2019/7/31	12
SAEC-03(NSA)	RE	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NS A)	3	2018/6/2	2019/6/30	12
SAF-02	RE	145004	Pre Amplifier	SONOMA	310N	290212	2018/2/16	2019/2/28	12
SAF-03	RE	145126	Pre Amplifier	SONOMA	310N	290213	2018/2/16	2019/2/28	12
SAF-04	RE	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2018/6/26	2019/6/30	12
SAF-05	RE	145128	Pre Amplifier	Toyo Corporation	TPA0118-36	1440490	2018/2/15	2019/2/28	12
SAF-08	RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2018/3/27	2019/3/31	12

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Test Instruments (2/3)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SAT10-05	RE	145136	Attenuator(above 1GHz)	AGILENT	8493C-010	74864	2018/11/25	2019/11/30	12
SAT3-11	RE	150921	Attenuator	JFW	50HF-003N	-	2018/2/22	2019/2/28	12
SAT6-02	RE	145045	Attenuator	JFW	50HF-006N	-	2018/2/16	2019/2/28	12
SAT6-13	RE	167094	Attenuator	JFW	50HF-006N	-	2018/2/9	2019/2/28	12
SBA-02	RE	145022	Biconical Antenna	Schwarzbeck	BBA9106	91032665	2018/6/5	2019/6/30	12
SBA-03	RE	145023	Biconical Antenna	Schwarzbeck	BBA9106	91032666	2018/6/17	2019/6/30	12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	RE	144975	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-270(RF Selector)	2018/4/9	2019/4/30	12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	RE	144976	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-270(RF Selector)	2018/4/7	2019/4/30	12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	RE	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-271(RF Selector)	2018/4/9	2019/4/30	12
SCC-G05	RE	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2018/1/29	2019/1/31	12
SCC-G06	RE	145173	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	2018/6/1	2019/6/30	12
SCC-G22	RE	145180	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	2018/5/11	2019/5/31	12
SCC-G23	RE	145168	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	2018/5/11	2019/5/31	12
SCC-G33	RE	145184	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	2018/4/20	2019/4/30	12
SCC-G40	RE	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2018/1/29	2019/1/31	12
SCC-G41	RE	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2018/1/29	2019/1/31	12
SCC-G43	RE	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104 E	SN MY 13406/4E	2018/7/10	2019/7/31	12
SCC-G44	RE	168300	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800070/4A	2018/3/28	2019/3/31	12
SCC-G45	RE	168301	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102 E	800137/2EA	2018/3/28	2019/3/31	12
SFL-02	RE	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2018/11/16	2019/11/30	12
SFL-18	RE	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2018/4/20	2019/4/30	12
SHA-01	RE	145383	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	2018/7/23	2019/7/31	12
SHA-02	RE	145384	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	2018/7/23	2019/7/31	12
SHA-03	RE	145501	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	2018/7/23	2019/7/31	12
SHA-04	RE	145512	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	2018/7/23	2019/7/31	12
SJM-09	RE	145336	Measure	PROMART	SEN1935	-	-	-	-

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Test Instruments (3/3)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SLA-06	RE	145528	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	2018/6/5	2019/6/30	12
SLA-07	RE	145529	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	2018/6/17	2019/6/30	12
SOS-03	RE	146317	Humidity Indicator	A&D	AD-5681	4063325	2018/10/25	2019/10/31	12
SOS-05	RE	146293	Humidity Indicator	A&D	AD-5681	4062518	2018/10/25	2019/10/31	12
SOS-06	RE	146294	Humidity Indicator	A&D	AD-5681	4062118	2018/12/5	2019/12/31	12
SSA-02	RE	145800	Spectrum Analyzer	AGILENT	E4448A	MY48250106	2018/3/5	2019/3/31	12
STR-07	RE	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2018/9/26	2019/9/30	12
STS-03	RE	146210	Digital Hitester	HIOKI	3805-50	80997823	2018/10/16	2019/10/31	12
STS-02	RE	145793	Digital Hitester	HIOKI	3805-50	80997819	2018/3/8	2019/3/31	12

*Hyphens for Last Calibration Date, Calibration Due 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.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test item: CE: Conducted Emission test
RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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